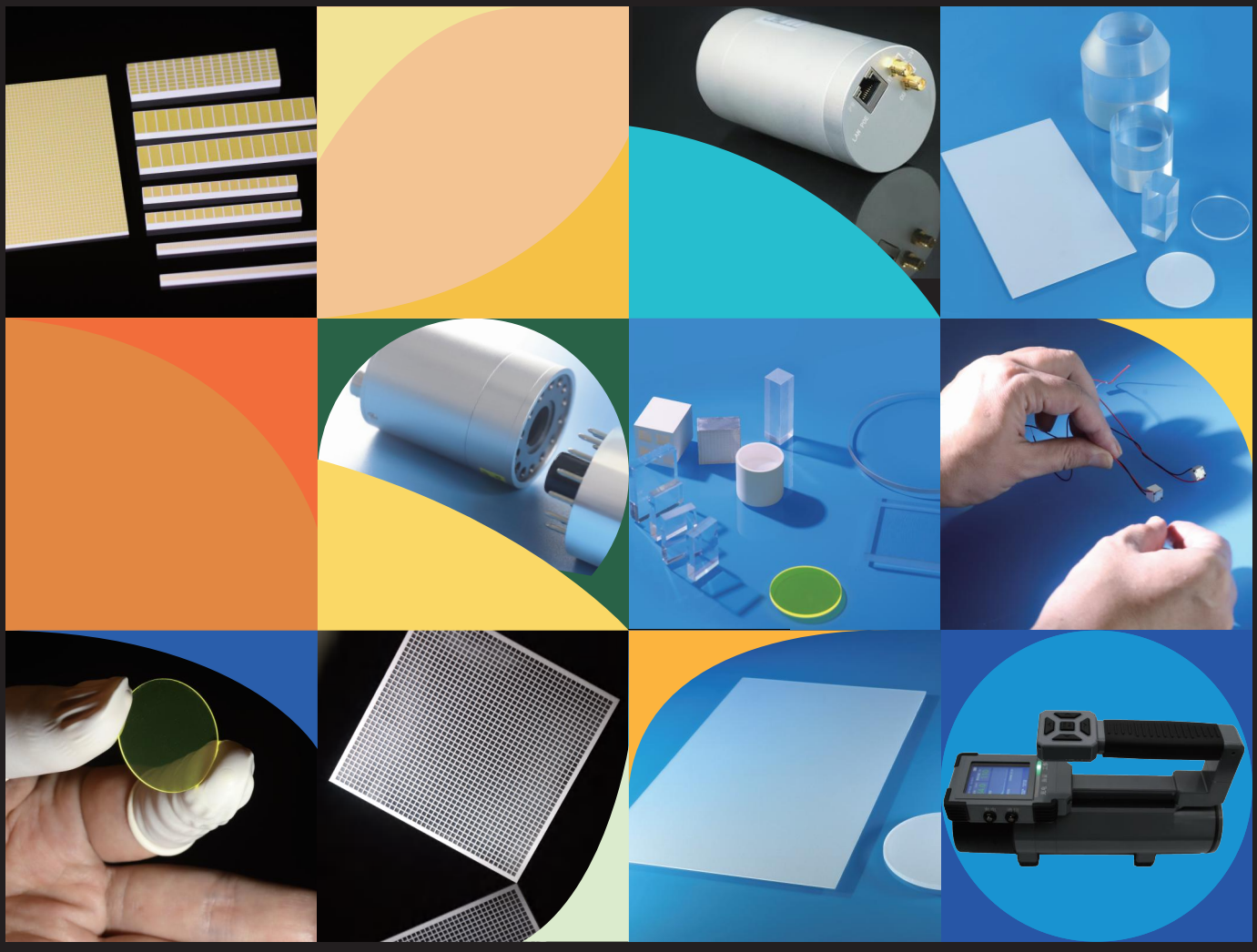
Shalom EO

Scintillators



Hangzhou Shalom Electro-optics Technology Co., Ltd.

Quality You Can See, Expertise You Can Trust.

Applications

Shalom EO's scintillators are used in:

- Nuclear Energy
- Petroleum Well-Logging
- Nuclear Medicine
- Safety Inspection
- High Energy Physics
- Cosmic ray research
- Scanning Electron Microscope
- Industrial NDT

Security scanning equipment

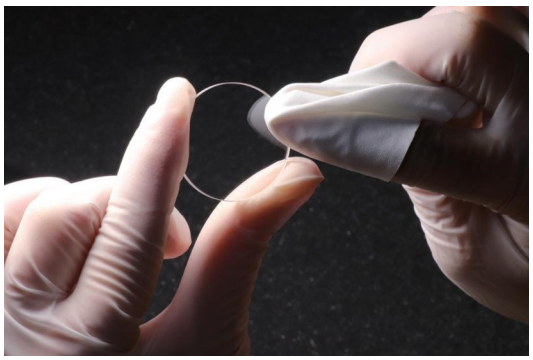
Nuclear medical equipment

Oilfield Well-logging

Nuclear power plant

Aerospace

Environmental Radiation Monitoring



ISO9001 CERTIFICATION

QUALITY MANAGEMENT SYSTEM CERTIFICATION

Hangzhou Shalom Electro-optics Technology Co., Ltd.

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Beijing Zhongmaozhilian International Certification Co Ltd.

About Us

Founded in 2011 and headquartered in Hangzhou, China, Hangzhou Shalom Electro-optics Technology Co., Ltd. (Shalom EO) supplies scintillator materials, components, and detector solutions for research and industrial applications worldwide.

Our scintillator portfolio covers a wide range of products, including inorganic and plastic scintillation materials, scintillator screens, pixelated scintillator arrays, detector assemblies, and related components. Standard products and customized solutions are available to support applications such as medical imaging, industrial inspection, oil and gas logging, security scanning, radiation monitoring, nuclear instrumentation, and scientific research.

With experience serving universities, research institutes, system integrators, and industrial customers, Shalom EO supports projects ranging from small-volume R&D requirements to customized component and detector development. Our engineering-oriented team works closely with customers to understand application requirements, evaluate technical options, and support product development and upgrades.

Engineering Support & Quality Assurance
Shalom EO combines technical consultation, flexible customization, and structured quality control to support customers throughout the sourcing and development process.
Our ISO 9001-certified quality management system, together with in-house testing capabilities and cooperation with qualified third-party laboratories, enables us to provide relevant inspection and performance data according to product and project requirements.

Key capabilities include:

- **Broad selection of standard and customized scintillator products**
- **Engineering-oriented sales and technical support**
- **Flexible support for small-batch, R&D, and customized projects**
- **Scintillator testing capabilities, including energy resolution and temperature-stability evaluation for applicable products**
- **ISO 9001 quality management system**
- **12-month product warranty**

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Scintillation Crystal Materials

Shalom EO specializes in providing a wide range of inorganic and plastic scintillation materials. The applications of our products vary depending on the material and design across a diverse range of fields: medical imaging, nuclear energy, mining, security, physics research, and space observation.

Shalom EO's Capabilities in Scintillation Materials

Materials	LYSO(Ce), YAG(Ce), GAGG(Ce), BGO, NaI(Tl), CsI(Tl), GOS(Pr)/ GOS(Tb), $LaBr_3$(Ce), $CeBr_3$, LuAG(Ce), $CdWO_4$ and more
	Plastic Scintillators Equivalent to Luxium and Eljen products.
Various Form Factors	Boules, blanks, polished crystals, crystals with reflective coating, encapsulated blocks, thin screens, pixelated arrays, detectors, etc.
Large-Size Crystal Growth	NaI(Tl): Maximum ingot 950×950×250 mm ▪ $LaBr_3$(Ce): Max. Φ76.2×200 mm ▪ $CeBr_3$: Max. Φ76×150 mm ▪ YAG(Ce): Max. Φ101.6 mm ▪ LYSO(Ce): Max. Φ110×200 mm

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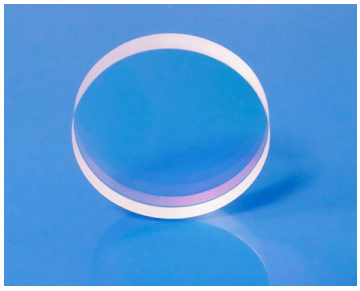
LYSO(Ce) Scintillator Crystal

- **High Light Output and Short Decay Time**
- **High Energy Resolution**
- **High Density and Anti-radiation**
- **Stable Chemical and Physical Properties**
- **Maximum Size: Φ105mm x 200mm**
- **LYSO(Ce) Bulk Crystals, LYSO(Ce) Screens, and LYSO(Ce) Scintillator Arrays are available**



Cerium-doped silicate yttrium lutetium, Ce: LYSO or LYSO (Ce) crystal, in short, is a cerium-doped and lutetium-based scintillation crystal. LYSO (Ce) crystal is a new type of scintillation material that has excellent properties: high density, short decay time, high light output, and anti-radiation. LYSO (Ce) crystal is also a reliable scintillation material with stable chemical and physical properties. LYSO(Ce) is ideal for applications that require higher throughput, better timing, and energy resolution, including time-of-flight Positron Emission Tomography (PET) scanning machines. Gamma-ray detectors based on Cerium-doped LYSO hold broad prospects in fields like Nuclear Medical Imaging, High Energy Physics, Nuclear Physics, etc. Shalom EO offers custom LYSO(Ce) blanks, polished components, scintillation screens, and LYSO(Ce) arrays upon the customer's request. Our LYSO scintillation crystals are grown by the Czochralski method; the largest diameter of 105mm and a maximum length of 200mm crystals are available.

Applications:

Positron emission tomography (PET)
Medical X-ray CT
High-energy physics
Nuclear medicine
Nuclear radiation scanner
Geological prospecting
Radiation detector
Radiation Monitoring Systems
Gamma pulse spectroscopy

Basic Properties:

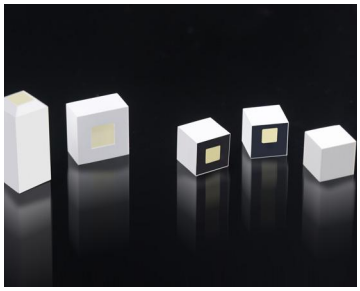
Melting Point (°C)	2050	Density (g/cm^3)	7.2
Hygroscopic	None	Hardness (Mohs)	5.8
Wavelength of Emission Peak(nm)	428nm	Refractive Index @ Emission Peak	1.82
Decay Time (ns)	<42	Energy Resolution (%)	8%-10%
Light Yield (Photons/MeV)	≥32000	Anti-radiation (rad)	>10^6
Effective Atomic Number	66	Radiation Length (cm)	1.10

Specifications:

Growth Method	Czochralski	Items	Both LYSO(Ce) crystals and LYSO (Ce) arrays are available
Maximum Dimension	ø105 mm x 200 mm		

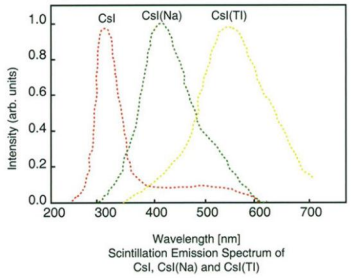
CsI Scintillation Crystal

- **Fast decay time: 16ns**
- **Emission peak at 315nm**
- **Lower light output than CsI(Tl) and CsI(Na)**
- **Grown using the Bridgman method, maximum size diameter 90mm x 300mm length and above**
- **High stopping power**
- **CsI one-dimensional line arrays, CsI two-dimensional plane arrays, CsI(Tl), and CsI(Na) also available**



CsI (Cesium Iodide) Scintillation Crystal, as one of the CsI scintillator class, is a scintillator material with a light emission spectrum located between the UV and the visible wavelength region, and the emission peak of unactivated CsI scintillator sits around 310-420nm, depending on the radiation interaction and excitation source. The light yield is moderate compared to doped CsI such as CsI(Tl) or CsI(Na), but still sufficient for certain detection applications.
The most distinct advantage of a pure, undoped CsI crystal compared to its doped siblings CsI(Tl) and CsI(Na) is its capabilities in fast timing applications attributed to its exceptionally small decay time. Besides, undoped CsI scintillation crystals exhibit a unique combination of fast and slow luminescence components. Its emission is composed of fast intrinsic luminescence (10ns) peaked around 305nm and a slow component (100-4000 ns) around 350-600nm. The 10ns fast component makes pure CsI an excellent choice for time-sensitive measurements.
Also, as a dense material with a high atomic number, CsI crystal offers high stopping power, which, in addition to the fast-timing characteristics and good radiation hardness, makes CsI a great choice for high-energy physical experiments.
The weakness of undoped CsI relative to Tl-doped CsI or Na-doped CsI is that the light output of pure CsI crystal is lower than CsI(Tl) and CsI(Na), so pure CsI is selected when timing resolution is prioritized over light yield. Another flaw of pure CsI is that its emission spectrum might not match as well with the photodetectors.
CsI crystal is a soft and malleable material with no cleavage plane, which contributes to its robust characteristics, excellent for well-logging, space research, or other applications where severe shock conditions are encountered. Pure CsI is also much less hygroscopic than CsI(Tl) (however, it can still benefit from protective coating or encapsulation).

Shalom EO supplies custom CsI Scintillation Crystals with a maximum size of D 90mm x T 300mm length and above; this page highlights our undoped CsI, whereas we also provide CsI(Tl)/Thallium doped CsI and CsI(Na)/Sodium doped CsI. The CsI(Tl) can be grown up to a size of 400mm x 400mm x 100mm. Shalom EO's undoped CsI crystals feature premium scintillation properties with an emission peak at 315nm wavelength, high stopping power, and fast timing edge. The CsI crystals have a decay time of 16ns, optimized for specialist applications of high-energy, nuclear, space, and medical physics requiring precise timing.
In Shalom EO, we engage the eco-conscious Bridgman Method to grow the CsI in bulk scales. Our industrial expertise and manufacturing prowess allow us to produce crystals in custom shapes and dimensions, tailored to meet your specific requirements, and we uphold quality assurance at each phase of manufacturing. Crystals of custom shapes and dimensions, reflectors are available, and compatible electronics or photodetectors (PMTs, SiPMs, or PD) can be integrated. We also provide CsI one-dimensional line arrays and CsI two-dimensional plane arrays.



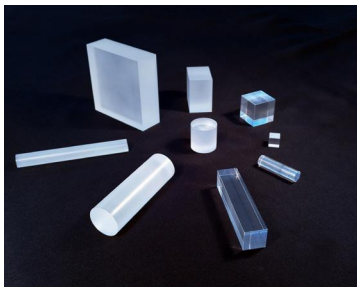
Scintillation Emission Spectrum of CsI, CsI(Na) and CsI(Tl)

Basic Properties:

Density(g/cm^3)	4.51	Melting Point (°C)	621
Cleavage Plane	None	Hardness(Mohs)	2
Hygroscopic	Slightly	Refractive Index at Emission Peak	1.95
Emission Peak Wavelength (nm)	315	Lower Wavelength Cutoff (nm)	260
Decay Time (ns)	16	Light Yield (photons/Mev/γ)	2×10^3
Thermal Expansion Coefficient (K-1)	49×10^{-6}	Photoelectron Yield (% of NaI(Tl)) (γ-rays)	4~6
Afterglow (after 20ms) (%)	2×10^3		

CsI(Tl) Scintillator Crystal

- **Maximum size reaching 400mm x 400mm x 100 mm**
- **We can provide CsI(Tl) in many special shapes and designs, such as CsI(Tl) with a hole bore in the center/well-shaped CsI(Tl), CsI(Tl) scintillators with single or multiple**
- **windows Superiorly high light output, 52 photons keV average**
- **Good γ-ray stopping power and radiation hardness**
- **Emission peak at 550nm, matches well with photodiodes**
- **Robust physical properties**
- **Low afterglow CsI(Tl) available. and besides the CsI(Tl) bulk crystals, we also provide CsI(Tl) Scintillation Screens, and CsI(Tl) Scintillator Arrays are available**



CsI(Tl), or thallium-doped cesium iodide, is a widely used alkali-halide scintillator featuring high light output, strong gamma- and X-ray stopping power, and good compatibility with photodiodes and SiPMs. It is suitable for applications including medical imaging, radiation detection, well logging, security inspection, industrial NDT, and high-energy physics.

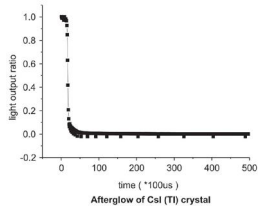
CsI(Tl) offers a high light yield of approximately 54 photons/keV. Its broad emission spectrum extends from approximately 350–700 nm, with a peak near 550 nm, providing a good spectral match with silicon photodiodes. This makes CsI(Tl) well suited for compact detector designs without the high-voltage supply typically required by PMTs.

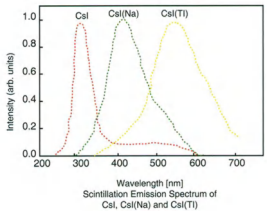
Due to its relatively slow scintillation response, with a typical decay time of around 1 μs, CsI(Tl) is more suitable for applications where light output and energy resolution are prioritized over high counting speed. Its multiple decay components can also support pulse-shape discrimination in selected particle-detection applications.

CsI(Tl) also offers good radiation hardness and relatively low hygroscopicity, contributing to stable performance in demanding environments.

Shalom EO supplies a wide range of CsI-based scintillator products, including: CsI(Tl) crystal blanks and polished crystals, encapsulated CsI(Tl) scintillators, CsI(Tl) pixelated arrays, CsI(Tl) array + photodiode assemblies, Undoped CsI, CsI(Na), and low-afterglow CsI(Tl)

Customized options are available for dimensions, shapes, reflectors, packaging, detector coupling, and integrated electronics. CsI(Tl) crystals can be fabricated up to 400 × 400 × 100 mm, depending on specification and application requirements.

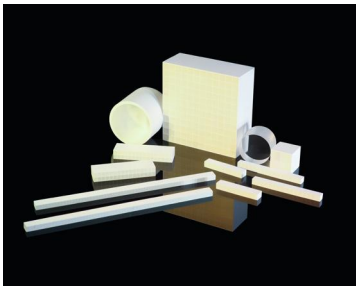




Basic Properties:

Density(g/cm^3)	4.51	Melting Point (°C)	621
Cleavage Plane	None	Hardness(Mohs)	2
Hygroscopic	Slightly	Refractive Index at Emission Peak	1.79
Emission Peak Wavelength (nm)	550	Lower Wavelength Cutoff (nm)	320
Decay Time (ns)	1000	Light Yield (photons/Mev/γ)	52~56×10^3
Thermal Expansion Coefficient (K-1)	54×10^{-6}	Photoelectron Yield (% of NaI(Tl)) (γ-rays)	45
Afterglow (after 20ms) (%)	<0.5 (for normal CsI(Tl))		

CsI(Tl) Scintillator Crystal (Low Afterglow)

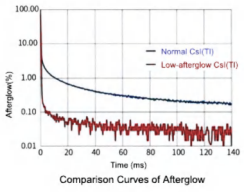


- **High light yield**
- **Rugged and robust, durable against mechanical shock**
- **A low afterglow version (0.05~0.39% @20ms, the value could be tailored upon request)**
- **Applications: Nuclear Radiation Detection, Security and Industrial Inspection, Medical CT, etc.**
- **CsI(Tl) Bulk Crystals, CsI(Tl) Scintillation Screens, and CsI(Tl) Scintillator Arrays are available**

CsI(Tl) or Thallium-activated Cesium Iodide crystals are among the brightest scintillator materials. Its emission peak sits at 550nm within the broad emission spectrum of 350-700nm, which matches well with photodiode readouts. And because photodiodes can be used, the sizes of the scintillator detectors can be reduced, with the additional advantage that one might not need to use high-voltage supplies. Furthermore, photodiodes are less affected by magnetic fields. CsI(Tl) has a high light output of 54 photons/Kev, leading to a photoelectron yield to gamma radiation that amounts to 45% of the value of Na(I), making it one of the brightest scintillators ever known. CsI(Tl) is also well suited for detecting heavy charged particles utilizing particle pulse analysis technique, as the ratio of its multiple decay time components is variant to the ionization capacity. CsI(Tl) has a naturally larger photoabsorption cross-section compared to many other scintillator materials. This property, in combination with its high radiation hardness and good stopping power, makes it great for applications like gamma spectroscopy and imaging.

Physically, CsI(Tl) is robust and has excellent mechanical properties because it has no cleavage plane, contributing to its reliable strength under various conditions. CsI(Tl) can be utilized in medical applications such as jaw and head scanning, security X-radiation inspection, well-logging, space research, etc. However, it is worth noting that CsI(Tl) is a slow scintillator, which limits its potential when fast speed is critical.
Afterglow is defined as the fraction of scintillation light that persists for a specific time after the excitation source has stopped. In most applications, afterglow is undesirable because it can interfere with the detector's performance. For example, in X-ray scanning, afterglow can retard the decay of illumination, leading to image blurring and reduced clarity. Low afterglow CsI(Tl) inherit high light yield from normal CsI(Tl) while restraining the afterglow phenomenon with high effectiveness, enhancing the image quality.

Shalom EO offers custom Low Afterglow CsI(Tl) scintillators; the products highlight a low afterglow of 0.05~0.39% @20ms; we could tailor the value of afterglow upon your request. The products are available as CsI(Tl) blanks, polished crystals, encapsulated scintillators, CsI(Tl) arrays, CsI(Tl) array +PD assemblies, and 2-dimensional arrays upon customer's request. Our CsI(Tl) scintillation crystals and CsI(Tl) arrays feature excellent radiation hardness, high light output, and reliable robustness. Our CsI(Tl) crystals could be applied in diverse fields, including nuclear radiation detection, high-energy physics, security X-radiation scanning machines, Industrial inspection, and medical equipment of Computerized Tomographic (CT) Scanning.



Comparison Curves of Afterglow

Basic Properties:

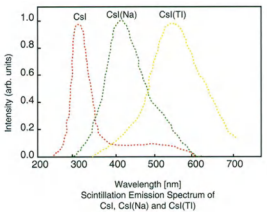
Density(g/cm^3)	4.51	Melting Point (K)	894
Cleavage Plane	None	Hardness(Mohs)	2
Hygroscopic	Slightly	Refractive Index at Emission Peak	1.79
Emission Peak Wavelength (nm)	550	Lower Wavelength Cutoff (nm)	320
Decay Time (ns)	1000	Light Yield (% of NaI(Tl))	40
Afterglow(%@20ms)	0.05~0.39		

CsI(Na) Scintillator Crystal

- **Emission peak at 420nm, which matches well with Photomultiplier Tubes**
- **(PMTs) Maximum size: 100x100x400mm**
- **High Light Output, mechanical and temperature stability**
- **High Density contributing to high stopping power for γ-rays**
- **Encapsulated CsI(Na) and complementary PMTs available**
- **Applications: Well Logging, Space Research, and Other Harsh Environmental Applications**

Sodium-doped Cesium Iodide, or CsI(Na) is one of the CsI scintillator variants. CsI(Na) has a broad emission spectrum, with an emission peak wavelength of 420nm, which is well matched to the spectral sensitivities of the bialkali photomultiplier (PMT). CsI(Na) is also a bright scintillator with a high light output just a bit lower than CsI(Tl) and a luminescence efficiency comparable to Na(I), while CsI(Na) exhibits a decay time of around 0.63 μs, faster than CsI(Tl), allowing for better timing applications. CsI(Na) has a high density (4.51 g/cm³) and effective atomic number (54), providing strong stopping power for gamma rays and X-rays. The distinct feature of CsI(Na) is that it has good thermal and mechanical robustness; CsI(Na) can remain very stable to temperature changes and is therefore excellent for applications in harsh environments, like well-logging, space research, etc. The drawback of CsI(Na) is that the light output of CsI(Na) drops drastically at lower energies. This can limit its effectiveness in detecting low-energy X-rays or soft gamma rays, which require alternative scintillators like CsI(Tl) or others optimized for such ranges. CsI(Na) is also more prone to absorbing moisture than CsI(Tl), this calls for the need for careful encapsulation.

Shalom EO offers CsI(Na) custom scintillator crystals; polished and encapsulated CsI(Na) crystals are available. Shalom EO's CsI(Na) crystals provide high deliver exceptional performance in applications like oil well logging, geophysical and borehole logging. Complementary Photomultiplier Tubes (PMT) could be installed if requested.



Scintillation Emission Spectrum of CsI, CsI(Na) and CsI(Tl)

Basic Properties:

Density(g/cm³)	4.51	Melting Point (°C)	621
Cleavage Plane	None	Hardness(Mohs)	2
Hygroscopic	Yes	Refractive Index at Emission Peak	1.84
Emission Peak Wavelength (nm)	420	Lower Wavelength Cutoff (nm)	300
Decay Time (ns)	630	Light Yield (photons/Mev/γ)	$38\sim44\times10^{3}$
Thermal Expansion Coefficient (K-1)	49×10^{-6}	Photoelectron Yield (% of NaI(Tl)) (γ-rays)	85
Afterglow (after 20ms) (%)	0.5~5.0		

YAG(Ce) Scintillator Crystal

- **High light yield (8000Ph/MeV), fast decay time (70ns)**
- **Good Mechanical Properties and Thermal Conductivity**
- **Maximum diameter: up to 4 inches**
- **Coating Optional: Al, Ag, Au, and Protective SiO2 Layer**
- **Applications: SEM, Ultra-thin imaging Screens, Electron Imaging, Beta Ray and X-ray Counter, Ion Beam Imaging**
- **Thin Ce: YAG Screens are also available: minimum thickness 0.01mm with substrates, 0.05mm freestanding**

Ce: YAG scintillation crystal has distinguished characteristics such as high light output (8000Ph/MeV) and fast decay time (70ns). Also, with the emission peak positioned at 530nm, YAG(Ce) can be well-matched to CCD sensors. YAG(Ce) scintillators find prominence in various applications like Scanning Electron Microscope (SEM), electronic imaging, beta-particle, X-radiation counters, and imaging. It has outstanding thermal and mechanical characteristics, making it excellent for manufacturing ultra-thin screens of 0.01mm. The fact that YAG(Ce) crystals feature high endurance to high-energy electrons or ions contributes to their wide usage in high-energy radiation detection. Besides, Ce: YAG also has the advantage of rich availability in large sizes; all these merits, in combination, make Ce-doped YAG scintillation crystal a representative inorganic scintillation crystal material. The growth and annealing processes of Ce:YAG crystals determine the practical properties of the crystal.

Shalom EO offers custom YAG(Ce) single scintillation crystals grown using the Czochralski method. A broad selectable range of dimensions (maximum diameter 4") can be tailored upon custom request. Optional metal coating of Aluminum and silver with a SiO2 protective layer is offered. Ultra-thin YAG(Ce) Screens of 0.05mm free sanding and 0.01mm with substrates are also procurable in Shalom EO.

Applications:
· Scanning electron microscope(SEM)
· Ultra-thin imaging screens
· Electron imaging
· Beta, X-ray counter
· Ion beam imaging

Physical and Chemical Properties:

Crystal Structure	Cubic	Lattice Constant	12.01 Å
Melting Point	1970°C	Mohs Hardness	8.5
Density	4.56±0.04g/cm^3	Specific Heat	0.59J/g.cm^3@0-20°C
Elastic Modulus	310GPa	Young's Modulus	3.17×10^{4}kg/mm^2
Poisson's Ratio	0.3	Tensile Strength	0.13~0.26GPa
Thermal Expansion	[100]:8.2×10^{-6}/°C@ 0~250°C [110]:7.7×10^{-6}/°C@0~250°C [111]:7.8×10^{-6}/°C@0~250°C	Thermo-optic Coefficient (dn/dT)	7.3×10^{-6}/°C
Thermal Conductivity	14W/m/K@20°C 10.5W/m/K@100°C	Thermal Shock Resistance	790W/m
Solubility	Insoluble in water, slightly soluble in acids.		

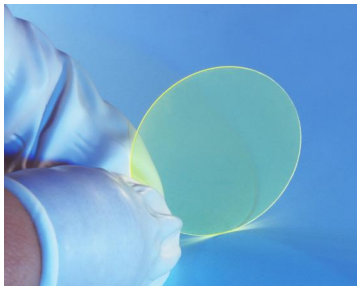
Scintillation Properties:

Emission Peak (nm)	530	Light Output (Photons/MeV)	8000
Effective Atomic Number (Zeff)	35	Decay Time (ns)	70
Quality Factor (LR/t)	138.5		

Growth Method	Czochralski	Formula	$Y_3Al_5O_{12}$ (cerium content 0,1–0,2 % ат.)
Maximum Dimension	Max. Diameter 4"	Crystal Structure	Single Crystal
Metal Coating	Al, Au, Ag, etc.	Protective Coating	SiO_2

GAGG(Ce) Scintillator Crystal

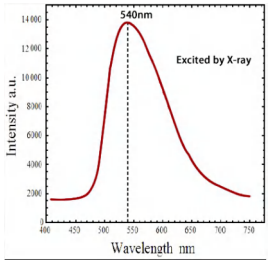
- **Non- Hygroscopic**
- **High Light Output**
- **High Energy Resolution**
- **Ultra-thin Ce: GAGG scintillation screen: minimum thickness 0.05mm free-standing, 0.01mm with substrates. learn more in our GAGG Scintillation Screen catalog.**
- **GAGG(Ce) Pixelated Scintillators are also accessible**



GAGG(Ce) - Gadolinium Aluminum Gallium Garnet ($Gd_3Al_2Ga_3O_{12}$) doped with Ce is a newly developed scintillator material. GAGG(Ce) is one of the brightest scintillators with an emission peak at 540nm, which matches well with Photo Diodes (PD) and Silicon Photon Multiplier (SiPM). GAGG(Ce) has excellent radiation resistance, durability against moisture, and mechanical ruggedness, making them well-fit for a broad range of applications. Furthermore, GAGG(Ce) scintillation crystals have good non-self-radiant radiation resolution.

Shalom EO offers custom bulk GAGG(Ce) scintillators. Our GAGG series scintillation products are the ideal option for Time-of-Flight Positron Emission Tomography (TOF-PET), Positron Emission Mammography (PEM), Single Photon Emission Computed Tomography (SPECT), Computed Tomography (CT), X-radiation and gamma-radiation detection in nuclear, space, industrial, and medical fields. GAGG(Ce) Scintillation Arrays (minimum thickness 0.05mm free-standing, 0.01mm with substrates) and GAGG(Ce) Scintillation Arrays are also available in Shalom EO.

Applications:
· Nuclear medicine: ToF-PET, PEM, SPECT, CT
· Radiation detector
· Oil detection equipment
· Security check equipment
· High-energy experiments

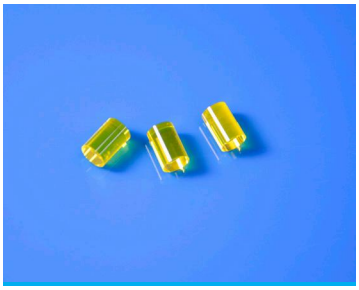


Basic Properties:

Emission Peak Wavelength	540nm	Density (g/cm^3)	6.63
Hygroscopicity	No	Melting Point (ºC)	2105
Hardness (Mhos)	8.0	Decay Time (ns)	90
Light Yield (Photon/MeV)	54000	Refractive Index	1.9
Radiation Resistance (rad)	10^5	Energy Resolution	6%
Effective Atomic Number	54		

Growth Method	Czochralski	Maximum Dimension	Ø 100 mm x 150 mm
Available Items	Single crystal and arrays		

LuAG(Ce) Scintillator Crystal



- **High Density and Fast Decay Time**
- **Peak Emission Wavelength Matching Well to PD**
- **High Chemical and Mechanical Resistance**
- **Main Applications: PET Scanners, High Energy Physics, High Spatial Resolution Imaging Screens**
- **Bulk Ce: LuAG Crystals and Thin Ce: LuAG Screens available**

Cerium-doped Lutetium Aluminum Garnet or LuAG(Ce) scintillation crystal is a relatively dense and fast scintillation material. Its density of 6.75 g/cm^3 is about 94% of the density of BGO (7.13 g/cm^3). Its decay time is much faster (70 ns) than that of BGO (300 ns). These good properties make it fit for time-dependent and coincidence-scintillating detection. The wavelength of scintillation emission for LuAG(Ce) is about 535 nm, ideal for Photo Diode (PD) and avalanche diode readout. The LuAG(Ce) crystal material is mechanically and chemically stable and can be machined into various shapes and dimensions, including prisms, spheres, and ultra-thin plates/sheets. Like Ce: YAG, Ce: LuAG could be used for imaging screens, but compared with the former, Ce: LuAG has higher densities, which makes its screens thinner and higher in spatial resolution.

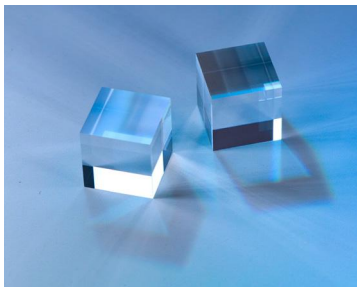
Shalom EO offers LuAG(Ce) scintillation crystals, and LuAG(Ce) thin screens are widely used in Positron Emission Tomography (PET) Scanners, high-energy gamma and charged particle detection, and high spatial resolution imaging screens for gamma, X, beta, and UV rays detection.

Basic Properties:

Crystals Structure	Cubic	Hygroscopic	None
Cleavage Plane	None	Density(g/cm^3)	6.75
Hardness (Mohs)	8.5	Refractive Index at Peak Emission	1.84
Emission Peak (nm)	535	Decay Time (ns)	70
Light Output (%NaI(Tl))	20	Light Yield @300K (photons/MeV)	20000

BGO Scintillator Crystal

- **Bismuth Germanate Crystal**
- **Non-hygroscopic and Mechanical Ruggedness**
- **High Density and High Radiation Hardness**
- **Maximum Diameter: 200mm**
- **Both bulk crystals and BGO Scintillation Arrays are available**
- **Main applications: Positron emission tomography (PET), High Energy Physics, Nuclear Medicine, Geological Prospecting, and Gamma Pulse Spectroscopes**



Bismuth Germanate (BGO) Crystal is one of the most common oxide scintillation materials. BGO is a high Z material (a material with a high atomic number), and the atomic number of bismuth is 83, which implies that BGO is an efficient radiation absorber, particularly for gamma radiation. Given the high Z value of the material, the photo fraction for gamma absorption is high. As a result, impressive peak-to-total ratios are obtained.
Shalom EO offers BGO bulk crystals with custom specifications. The scintillators are used in high-energy physics (scintillators for electromagnetic calorimeters and detecting assemblies of accelerators), spectrometers of gamma-radiation, and positron tomography. Besides, Shalom EO also provides Pixelated BGO Scintillation Arrays.

Applications:

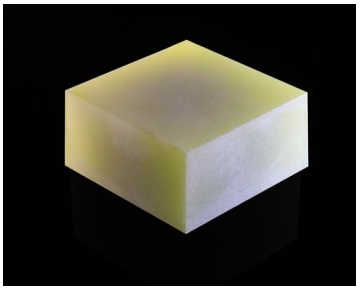
· Positron emission tomography (PET)
· High-energy physics
· Nuclear medicine
· Geological prospecting
· Gamma pulse spectroscopy

Basic Properties:

Density (g/cm^3)	7.13	Melting Point (K)	1323
Effective Atomic Number	74	Hardness	5
Refractive Index	2.15	Decay Constant	317ns
Radiation Length	1.1cm	Wavelength of Peak Emission	480nm
Light Yield	8500 (Photon/MeV)	Hygroscopic	No

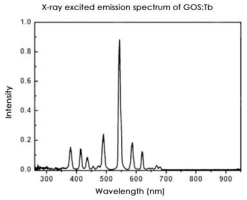
Growth Method	Bridgman	Formula	$Bi_4Ge_3O_{12}$
Maximum Diameter	200mm	Available Items	Single crystal and arrays

GOS Ceramics (GOS:Pr, GOS:Tb)



- **Two kinds of materials GOS: Pr, and GOS: Tb Scintillation are available**
- **High light output and low afterglow**
- **Environmental friendliness**
- **Applications: CT scanners, radiation detection, security devices, and non-destructive testing**
- **GOS Scintillation Thin Films are also available**

GOS Ceramics, or Gadolinium Oxysulfide ceramics, are primarily composed of the chemical compound Gadolinium Oxysulfide (Gd_2O_2S), GOS Ceramics belong to a hexagonal system structure (space group: P3− ml; lattice parameters: a = b = 0.3851 nm and c = 0.6664 nm) with trigonal symmetry. Gadolinium oxysulfide (GOS) is an excellent scintillation material because of its high density (7.43 g/cm^3) and adequate atomic number of Gd. These characteristics lead to an increased interaction potential for X-ray radiation. Solid-state Gd_2O_2S (GOS) also exhibits promising chemical and physical characteristics, such as a high melting point (2070 ◦C), a high X-ray attenuation coefficient (~52 cm−1 at 70 keV), a wide band gap (4.6–4.8 eV), favorable chemical durability, low phonon energy, low crystal symmetry, and low toxicity, which make it a promising host material for luminescence and scintillation applications.
GOS: Tb finds prominence as a scintillator for X-ray imaging. It emits wavelengths between 382nm and 622nm, with the emission peak positioned at 545nm. GOS: Tb sub-micro phosphors synthesized by the homogeneous precipitation method are promising as a new green-emitting material to be applied to the high-resolution digital X-ray imaging field. It is also an excellent green phosphor in projection CRTs.
GOS:Pr exhibits unique luminescent properties. The Pr3+-activated GOS ceramic is an effective ceramic scintillation material for high-quality imaging applications owing to its high X-ray conversion efficiency, strong stopping power for the incident X-ray, short lifetime, fast afterglow, high chemical stability, and good emission, matching the high sensitivity of silicon photodiodes.
Shalom EO offers GOS: Pr and GOS: Tb Scintillation Materials. Our Pr-doped GOS and Tb-doped GOS feature high light output, low afterglow, and environmental friendliness. We have developed an advanced production line with leading-edge capabilities. Besides, we also offer GOS scintillation thin films and GOS pixelated arrays.



GOS:Pr Scintillator:Basic Properties:

Density(g/cm^3)	7.280	Refractive Index	2.2
Molecular Formula	Gd_2O_2S	Relative Molecular Mass	378
Melting Point	2070°C	Crystal Structure	Hexagonal Crystal System
Zeff	61.1		

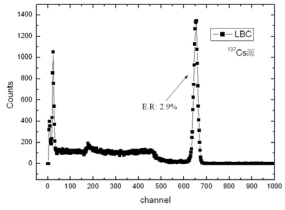
Comparison of GOS Ceramic Scintillators with CsI(Tl) Scintillators

Material	CsI(Tl)	GOS:Tb	GOS:Pr
Peak Wavelength	560	550	510
Morphology	Cubic	Polycrystalline Ceramic	Polycrystalline ceramic
Transparency	Transparent	Translucent	Translucent
Light Yield Photons/MeV	59000	46500	27000
Decay Time/ns	1000	600000	3000
Afterglow/@3ms	≤1%	≤0.1%	≤0.05%
Atomic Coefficient	54	60	60
Density/g-cm^3	4.51	7.34	7.34
Hygroscopicity	Slightly	No	No
Irradiation Damage	/	12%(1Mrad)	6%(1Mrad)

$LaBr_3$(Ce) Scintillator Crystal

- **High light output**
- **Excellent energy resolution**
- **Fast decay time and High count rate capabilities**
- **Excellent radiation hardness**
- **Maximum Dimensions: ϕ 100 mm x 300 mm**
- **Double Optical Window Structure Available**
- **Main applications: High-energy physics, Nuclear radiation detection, Well logging**

Cesium-doped lanthanum bromide, LaBr3 (Ce) scintillator is a new-generation nuclear radiation detection scintillation material. LaBr3 (Ce) scintillator crystals have many outstanding performances: high energy resolution, high time resolution, high light output, suitable energy non-linearity, short decay time, etc. They are widely used in environmental monitoring, oil well logging, nuclear medicine, high-energy physics, security, counter-terrorism, and radionuclide identification.
Shalom EO offers standard and custom encapsulated LaBr3 (Ce) scintillation crystals to custom requirements. Our unique crystal growing technique makes the maximum crystal dimension of Dia100 mm x 300 mm available. Photomultiplier Tubes (PMT) and electronic modules could be assembled with LaBr3 (Ce) scintillators if required. To check our standard Ce-doped LaBr3, please move to the Modules or Types tab.



Basic Properties:

Melting Point (ºC)	1116	Density (g/cm^3)	5.2
Hygroscopic	Yes	Wavelength of Emission Max. (nm)	380
Refractive Index @ Emission Max.	1.9	Decay Time (ns)	25
Energy Resolution (%)	<3.5	Light Yield (photons/MeV)	63000
Cleavage Plane	<100>		

Specifications:

Formula	$LaBr_3(Ce)$	Maximum Dimension	Ø100mm x 300mm
Available Items	Single crystals with Aluminum housing and optical window		

Modules or Types:

Shalom EO can provide standard LaBr3 (Ce) scintillation crystals with the following specifications. The LaBr3 (Ce) scintillator can be optionally supplied with photomultiplier tubes (PMT). Custom Cesium-doped Lanthanum Bromide is also accessible upon request.

Code	Scintillator	Crystal Size	Housing	Windows	PMT
5111-01	$LaBr_3(Ce)$	D1"x1"	Aluminum	Optical Glass	No PMT
5111-02	$LaBr_3(Ce)$	D1"x1"	Aluminum	Optical Glass	With PMT
5111-03	$LaBr_3(Ce)$	D1.5"x1.5"	Aluminum	Optical Glass	No PMT
5111-04	$LaBr_3(Ce)$	D1.5"x1.5"	Aluminum	Optical Glass	With PMT
5111-05	$LaBr_3(Ce)$	D2"x2"	Aluminum	Optical Glass	No PMT
5111-06	$LaBr_3(Ce)$	D2"x2"	Aluminum	Optical Glass	With PMT
5111-07	$LaBr_3(Ce)$	D3"x3"	Aluminum	Optical Glass	No PMT
5111-08	$LaBr_3(Ce)$	D3"x3"	Aluminum	Optical Glass	With PMT

$LaCl_3$(Ce) Scintillator Crystal

- **High light output and good energy resolution**
- **Fast decay time and High count rate capabilities**
- **Maximum Dimension: Dia75 mm x 75 mm**
- **Single/Double Optical Window Structure available**
- **Detectors could also be assembled with PMT/electronic modules**
- **Applications: High energy physics, Nuclear radiation detection, Well logging**

Cerium-doped Lanthanum Chloride or $LaCl_3$(Ce) Scintillator Crystals belong to hexagonal crystalline systems. The light output of $LaCl_3$(Ce) crystals is similar to the NaI(Tl) scintillators. Still, their decay time is 28ns, which is only 1/10 of NaI(Tl) scintillators, and the energy resolution of $LaCl_3$(Ce) is 1/2~2/3 of NaI(Tl) crystals, and it also has good mechanical properties. In addition, $LaCl_3$:Ce crystals have excellent temperature performance and a good consistency of energy resolution within a wide temperature range.

Shalom EO offers custom $LaCl_3$(Ce) scintillator crystals on custom requirements, with a maximum dimension of Dia 75 mm x 75 mm. The $LaCl_3$(Ce) crystals would often be encapsulated in an aluminum housing with one or two optical windows.

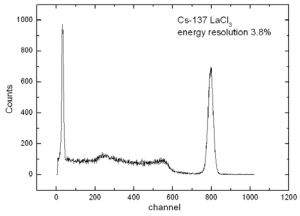
Photomultiplier tubes (PMT) and electronic modules could be integrated with the scintillation detector.

Applications:

· High-energy physics

· Nuclear radiation detection

· Petroleum well-logging



Basic Properties:

Melting Point (°C)	1135	Density (g/cm^3)	3.85
Hygroscopic	Yes	Wavelength of Emission Max. (nm)	350
Decay Time (ns)	<28	Energy Resolution (%)	3.5~4
Light Yield (photons/MeV)	40000	Cleavage Plane	<100>
Refractive Index @ Emission Max.	1.9		

Formula	$LaCl_3$(Ce)	Maximum Dimension	Ø 75 mm x 75 mm
Available Items	Single crystals with Aluminum housing and optical window		

$CeBr_3$ Scintillator Crystal

- **High light output and Excellent energy resolution,**
- **Low background**
- **Fast decay time and High count rate capabilities,**
- **Excellent radiation hardness**
- **Maximum crystal size: ϕ 50 mm x 50 mm**
- **Main applications: High energy physics, Nuclear radiation detection, Well logging**

Cerium Bromide $CeBr_3$ scintillator crystals are newly developed scintillators, $CeBr_3$ has many excellent properties, including low background, high energy resolution, high light output (6000 photons/MeV), high energy non-linearity, short decay time (20ns) and excellent time resolution (<4.5%@662keV), $CeBr_3$ crystals have a broad application prospect in environment monitoring, petroleum well logging, nuclear medicine, high-energy physics, security, counter-terrorism, nuclear identifications.

Shalom EO offers custom Cerium Bromide or $CeBr_3$ scintillators according to the customer's request; the maximum size of ϕ 50 mm x 50 mm is available, and the detector with a photomultiplier tube (PMT) and electronic modules is available upon request.

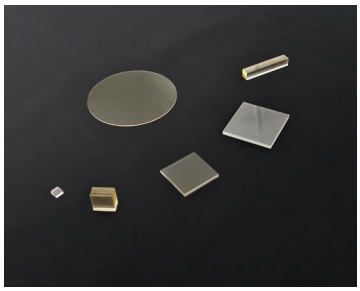
Basic Properties:

Melting Point (ºC)	722	Density (g/cm^3)	5.1
Hygroscopic	Yes	Wavelength of Emission Max.(nm)	360~385
Decay Time (ns)	<20	Energy Resolution (%)	4~5
Light Yield (photons/MeV)	60000		

Formula	$CeBr_3$	Maximum Dimension	⌀ 50 mm x 50 mm
Available Items	Single crystals with Aluminum housing and optical window		

$CdWO_4$ Scintillator Crystal

- **Low afterglow**
- **High density and High-Z scintillator**
- **Relatively high light yield and High Radiation Hardness**
- **Bulk crystal and $CdWO_4$ 1-Dimensional/2-Dimensional Arrays offered**

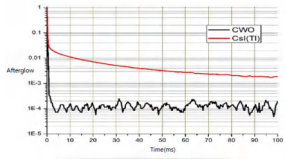


$CdWO_4$-Cadmium tungstate scintillation crystal is characterized by high density, high atomic number, and relatively high light yield with meager decay time. When subjected to X-ray irradiation, the after-glow of $CdWO_4$ is typically less than 0.1% at 3ms, and $CdWO_4$ scintillators also demonstrate excellent resistance to radiation. $CdWO_4$ is a popular scintillation crystal for X-ray Computed Tomography (CT) and X-ray security scanning inspection.

Shalom EO offers custom $CdWO_4$ crystals upon customers' requests. Linear one-dimensional and two-dimensional $CdWO_4$ Scintillation Arrays are also available. The latter might even be coupled with silicon photodiodes if you require it.

Applications

Security inspection
X-ray CT
High energy physics
Nuclear medicine



Basic Properties:

Melting Point (°C)	1598	Density (g/cm^3)	7.9
Hygroscopic	None	Hardness (ns)	4~4.5
Wavelength of Emission Max. (nm)	475	Refractive Index @ Emission Max	2.2~2.3
Decay Time (ns)	14000	Light Yield (photons/MeV)	12000~15000
Photoelectron Yield (% of NaI(Tl)) (for γ-rays)	30~50	Afterglow(%@3ms)	<0.1
Radiation Length(cm)	1.06		

Abilities:

Growth Method	Bridgman	Maximum Dimension	ø 80 mm x 200 mm
Available Items	Single crystal and 1D array or 2D array	Inhomogeneity between pixels in array	<15%

YSO(Ce) Scintillator Crystal

- **High density of 4.5g/cm³**
- **High anti-radiation hardness**
- **Short decay time**
- **Maximum Dimensions: φ 80mm × 160mm**
- **YSO(Ce) crystals and YSO(Ce) Pixelated Arrays offered**
- **Applications: Security industry, Semiconductor, Photo optic application, Positron emission tomography (PET), Nuclear medicine**

Cerium-doped silicate Yttrium YSO(Ce) belongs to a monoclinic rare earth orthosilicate crystal with a peak emission wavelength of 420nm. YSO(Ce) scintillators have a similar decay time to LYSO(Ce) (50-70ns), but it has no background (Lutetium), which is critical for precise detection fields. YSO(Ce) crystal has a high density of 4.5g/cm³and high radiation resistance, good mechanical properties, and is non-deliquescent. YSO(Ce) scintillator crystals are used in high-energy, nuclear, and space physics, industrial NDT, nuclear medicine, Positron emission tomography (PET), and industrial Non-Destructive Test (NDT) applications.

Shalom EO offers custom YSO(Ce) scintillation crystals according to customers' requests. Our YSO(Ce) scintillator crystals feature a maximum crystal size is φ 80mm × 160mm. Besides, YSO(Ce) Scintillation Arrays are also available.

Applications:

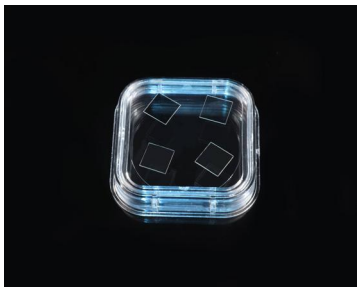
· High-energy physics, nuclear and space physics
· Security Industry
· Industrial NDT
· Positron emission tomography (PET)
· Nuclear medicine

Basic Properties:

Density(g/cm^3)	4.50	Melting Point (K)	2273
Refractive Index	1.8	Emission Peak (nm)	420
Decay Time (ns)	50-70	Light Yield (photons/Mev)	10000
Effective Atomic Number(z)	39	Hygroscopic	None
Cleavage Plane	None		

YAP(Ce) Scintillator Crystal

- **Fast decay time of 40ns**
- **High light output**
- **Maximum Dimensions: φ 50mm × 160mm**
- **Applications: Scanning electron microscope (SEM), Ultra-thin imaging screens, Electron imaging, Gamma and X-radiation counter, X-radiation imaging**
- **YAP(Ce) bulk crystals and YAP(Ce) thin screens are both offered**



Cerium-doped yttrium aluminum (Ce: YAP) crystals are a fast scintillating material, with a decay time of 40ns. The YAP(Ce) crystal is mechanically robust and chemically inert, making it suitable for high-precision processing during the fabrication procedure. An aluminum film could be deposited on the entrance surface to avoid light sensitivity. YAP(Ce) is well suited for imaging applications due to its ultra-low-energy secondary X-ray emissions. Ce: YAP detectors are widely used in gamma and X-ray counting, electron microscopy, electron and X-ray imaging screens, and computer tomography (CT) systems.
Shalom EO offers the YAP(Ce) single crystals upon the customer's requirement; the maximum size available is ø 50 mm x 160 mm, and it is grown by the Czochralski method with a cerium concentration of 0.2~1.2at%. Besides the general cylindrical or rectangular-shaped YAP(Ce) crystals, Shalom EO also provides the YAP(Ce) thin screen for soft X-ray high-resolution imaging applications.

Application Notes:

· Scanning electron microscope(SEM)
· Ultra-thin imaging screens
· Electron imaging
· Gamma, X-ray counter
· X-ray imaging

Basic Properties:

Density (g/cm^3)	5.4	Melting Point (°C)	1875
Refractive Index at Peak Emission	1.95	Emission Peak (nm)	370
Emission Spectral Range (nm)	325-425	Decay Time (ns)	40
Light Yield (photons/MeV)	18000	Radiation Length (cm)	2.7
Hygroscopic	None	Cleavage Plane	None

Growth Method	Czochralski	Formula	$YAlO_3$ (cerium content: 0.2~1.2 at%)
Maximum Dimension	ø 50 mm x 160 mm	Available Items	Single crystal
Metal Coating	Al, Au, Ag etc.	Protective Coating	SiO_2

RGBS Scintillator Crystal

- **High density and non-hygroscopic**
- **High light output**
- **Short decay time and low background radiation**
- **Stable chemical and physical properties**

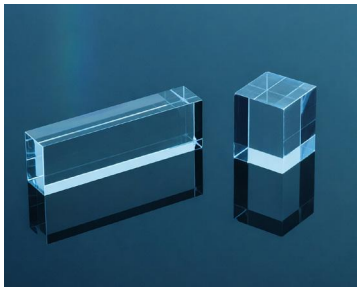
Shalom EO offers the newly developed scintillator materials RGBS. With high density, high light output, low background radiation, and short decay time, RGBS is a suitable scintillation material with excellent properties: stable chemical and physical properties, non-hygroscopic and non-cleavability, and easy processing. This nicely expands the range of applications as follows.

Applications:

· Nuclear Radiation Scanner
· Nuclear Medicine Imaging
· Nondestructive Testing(NDT) and Industrial Computed Tomography(CT)
· Environmental Radiation Detection
· Baggage Safety Inspection

Density(g/cm^3)	6.63	Light Yield(% of NaI(Tl))	130
Emission Peak Wavelength(nm)	520	Decay Time(ns)	90
Refractive Index(@550nm)	1.9	Energy Resolution(% of 137Cs)	6
Afterglow(%@20ms)	≤0.03	Irradiation Hardness(rads)	10^5
Hardness(Mohs)	8.0	Effective Atomic Number	54
Crystal Structure	Cubic	Hygroscopic	None
Cleave Plane	None		

CaF_2(Eu) Scintillator Crystal



- **Relatively high light output**
- **High thermal and mechanical shock resistance**
- **High light collection efficiency**
- **Chemically Inert and Non-hygroscopic**
- **Small background radiation**
- **Maximum size: φ 80x120mm**

CaF_2(Eu) crystals have sound transmission in a wide wavelength range from 0.13 to 10μm. It has a relatively high light output, low background radiation, high thermal and mechanical shock resistance, excellent chemical stability, and good machinability. CaF_2(Eu) is suitable for detecting soft gamma-rays of several hundred keV and charged particles, as it has a very low vapor pressure and is well-suited for use in a vacuum environment. Two issues should be considered when using CaF_2(Eu): first, CaF_2(Eu) has a low density and low z, which results in a soft light output for gamma-ray detection. Second, CaF_2(Eu) has a sharp absorption at 400nm, which is within the emission spectrum, which means CaF_2(Eu) crystals would absorb a part of the emission light.

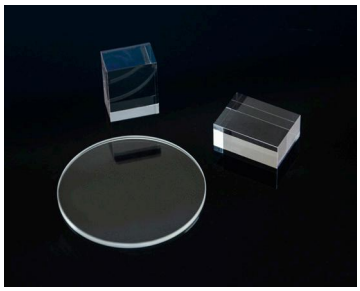
Shalom EO offers polished CaF_2(Eu) scintillators upon your request; our CaF_2(Eu) is used in nuclear medicine as phoswiches with NaI(Tl) to separate alpha, beta, and gamma rays.

Basic Properties:

Density (g/cm^3)	3.18	Melting Point (°C)	1360
Cleavage Plane	<111>	Hardness (Mohs)	4
Refractive Index	1.47	Emission Peak(nm)	435
Decay Time(ns)	940	Growth method	Bridgman

BaF_2 Scintillator Crystal

- **Sub-nanosecond decay time**
- **Low absorption at the emission wavelength**
- **Slightly hygroscopic**
- **Maximum size: φ120mm x 200mm**
- **Applications: Positron Lifetime Studies, Time of Flight measurements, Positron Emission Tomography (PET), High Energy Physics**



Barium fluoride (BaF_2) is a fast inorganic scintillation material characterized by two principal emission components: A fast VUV component, with emission peaks around 195 and 220 nm and a decay time of approximately 0.6–0.8 ns. A slow component, with an emission maximum around 310 nm and a decay time of approximately 630 ns

The sub-nanosecond fast component makes BaF_2 particularly suitable for applications requiring excellent timing resolution and high counting rates, including time-of-flight (TOF) measurements, high-energy physics experiments, coincidence detection, and fast radiation diagnostics.

BaF_2 offers a density of approximately 4.88 g/cm³ and good transparency in the ultraviolet region. Its fast VUV emission requires photosensors and optical coupling materials with suitable UV sensitivity and transmission.

BaF_2 is relatively resistant to moisture; however, prolonged exposure to humid conditions or condensation should be avoided to protect the crystal surface.

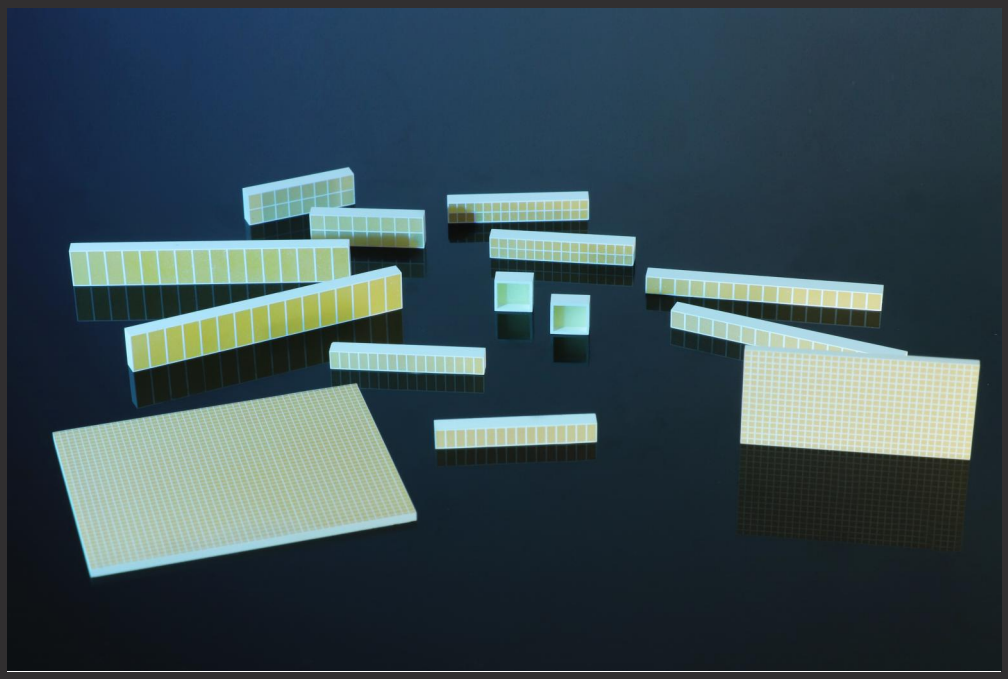
Shalom EO supplies custom BaF_2 scintillation crystals according to customer specifications, with dimensions available up to Ø120 mm × 200 mm. Optional processing and integration include: Optical polishing / Protective coatings / Customized dimensions and geometries / Detector coupling / Complete scintillation detector assemblies

With its sub-nanosecond scintillation response, BaF_2 is an important material for advanced radiation detection systems where fast timing performance is required.

Basic Properties:

Density(g/cm³)	4.88	Melting Point (K)	1627
Cleavage Plane	<111>	Hardness(Mohs)	3
Hygroscopic	Slightly	Refractive Index	1.54(220nm)
Emission Peak (nm)	310/220	Lower Wavelength Cutoff (nm)	135
Decay Time (ns)	630(slow)/0.6-0.8(fast)	Light Yield (photons/Mev)	10000 (slow), 1800 (fast)
Photoelectron Yield (% of NaI(Tl))	16(slow)/3(fast)	Growth Method	Bridgman

Pixelated Scintillation Arrays and Modules



Pixelated scintillator arrays consist of individually segmented scintillator elements arranged in one- or two-dimensional configurations. Each scintillator pixel converts incoming ionizing radiation into light, while the coupled photodetector converts the emitted light into an electrical signal.

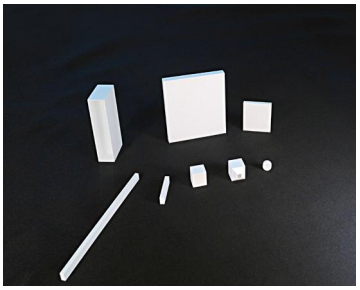
By resolving the location and intensity of radiation interactions across the array, these detectors provide position-sensitive and high-resolution radiation detection for applications such as medical imaging, security inspection, industrial imaging, high-energy physics, and radiation monitoring.

One-dimensional and two-dimensional scintillator arrays can be coupled with silicon photodiodes (PDs) or silicon photomultipliers (SiPMs) to form compact detector modules. Typical applications include Computed Tomography (CT), Positron Emission Tomography (PET), X-ray baggage and cargo inspection, industrial X-ray imaging, and scientific instrumentation.

Available Configurations	• 1D / 2D Pixelated Scintillator Arrays • Scintillator Array + Silicon Photodiode Array • Scintillator Array + SiPM Array • Scintillator Array + Photodetector + Readout / DAQ Electronics
Available Scintillator Materials	• CsI(Tl) • LYSO(Ce) • BGO • GOS(Tb) • GOS(Pr)
Pixel Structure Specifications	• Minimum Pixel Size: 0.3 × 0.3 mm • Minimum Inter-pixel Gap: 0.07 mm

2

CsI(Tl) Scintillator Array



- **High light output, great stopping power, and mechanical robustness**
- **Peak emission wavelength at 550nm well matched with Si photodiode readout**
- **Low afterglow versions (afterglow 0.05~0.39%@20ms) available; custom afterglow values also accessible**
- **CsI(Tl) Scintillation Crystals also available in Shalom EO**

Thallium-doped cesium iodide, CsI(Tl), is a high-light-output scintillator with an emission peak near 550 nm and a broad emission spectrum of approximately 350–700 nm. Its emission matches well with the spectral sensitivity of silicon photodiodes, making CsI(Tl) particularly suitable for compact photodiode-based detector systems without the high-voltage supply required by conventional PMTs.

CsI(Tl) also offers a relatively high effective atomic number and strong X-ray and gamma-ray stopping power, making it widely used in radiation imaging and detection applications.

In pixelated scintillator arrays, individual CsI(Tl) pixels are arranged in one- or two-dimensional configurations and optically separated by reflective materials. The reflector structure helps reduce optical crosstalk and confine scintillation light within each pixel, improving position resolution and enabling accurate localization of radiation events.

Shalom EO supplies 1D and 2D CsI(Tl) pixelated arrays for applications such as medical and security X-ray imaging. Arrays can also be coupled with silicon photodiode arrays according to customer requirements.

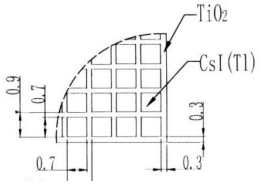
For applications requiring reduced afterglow, low-afterglow CsI(Tl) is also available. Typical afterglow values can reach approximately 0.05–0.39% at 20 ms, depending on crystal composition, growth conditions, and measurement conditions. Customized afterglow performance can be provided according to project requirements.

Applications

· Medical X-ray Computed Tomography (CT)
· Security and baggage X-ray inspection
· Industrial X-ray and non-destructive testing
· Radiation monitoring and isotope detection
· High-energy physics and calorimetry
· Position-sensitive radiation detection

Drawing:

The figure below illustrates the design of a CsI(Tl) pixelated array, consisting of CsI(Tl) pixels and TiO_2 reflectors.



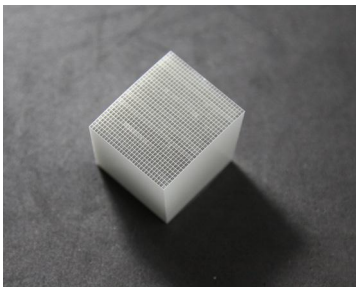
Single Pixel Size	customized	Minimum Pixel Size	0.3×0.3mm
1 Dimensional / Linear Arrays	1×8, 1×16, 1×32, 1×64, 1×128... pixels	2-Dimensional Arrays	6×10, 12×18, 24×36..... pixels, etc.
Afterglow	0.6%(max) after 100ms (Other afterglow available upon request)	Reflector	TiO_2, $BaSO_4$, ESR, etc
Reflector Thickness	Customized		

Basic Properties:

Density(g/cm^3)	4.51	Melting Point (°C)	621
Cleavage Plane	None	Hardness(Mohs)	2
Hygroscopic	Slightly	Refractive Index at Emission Peak	1.79
Emission Peak Wavelength (nm)	550	Lower Wavelength Cutoff (nm)	320
Decay Time (ns)	1000	Light Yield (photons/Mev/γ)	52~56×103
Thermal Expansion Coefficient (K-1)	54×10-6	Photoelectron Yield (% of NaI(Tl)) (γ-rays)	45
Afterglow (after 20ms) (%)	<0.5 (for normal CsI(Tl))		

LYSO(Ce) Scintillator Array

- **High light output**
- **High density and Fast**
- **Customized Array and Pixel size**
- **The gap between each pixel: minimum 0.05 mm**
- **Pixel Light Uniformity in Arrays: <10% or customized**
- **Minimum pixel or crystal element size: 0.3mm x 0.3mm**
- **Applications: Positron emission tomography (PET), Medical X-ray Computed Tomography (CT), High-energy physics, Nuclear medicine, Nuclear radiation scanner**

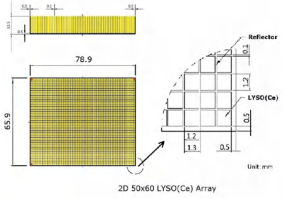


Cerium-doped Lutetium Yttrium Silicate scintillation crystal, LYSO(Ce), is an ideal generation scintillator crystal. LYSO scintillator has the advantages of high light output and density, quick decay time, and excellent energy resolution. These properties make LYSO an ideal candidate for various ray detection applications in nuclear physics and medicine, requiring higher timing resolution and superior energy resolution. It is suitable for applications that require high throughput, good timing, and energy resolution, such as time-of-flight Positron Emission Tomography (PET). PET applications have traditionally used arrays of BGO. But LYSO crystals thoroughly beat BGO on density, energy resolution, and timing.

Shalom EO offers LYSO(Ce) pixelated scintillators and crystal arrays featuring high geometric precision and homogeneous light output, which makes the LYSO scintillation arrays one of the most popular scintillators used for PET applications, including PET for human diagnosis, animal diagnosis, and specific organs like the brain and breast. We are capable of offering large LYSO(Ce) pixelated arrays with a pixel size as small as 0.3×0.3mm, which contributes to superior imaging resolution. Furthermore, for PET equipment requiring higher resolutions, single layers of scintillation arrays could be stacked into multilayer scintillation arrays to enhance the resolution.

Applications:

· Positron Emission Tomography (PET)
· Medical X-ray Computed Tomography (CT)
· High-energy physics
· Nuclear medicine
· Nuclear radiation scanners



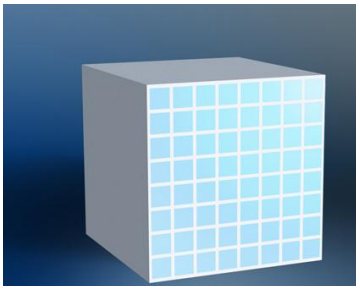
Array Size	Custom	Pixel Size	Custom, minimum 0.3×0.3mm
The Gap between Each Pixel	≥0.05 mm	Reflector/Separator	Barium Sulfate($BaSO_4$), TiO_2, Vikuiti ESR film etc.
Pixel Light Uniformity in Arrays	<10% or customized		

Basic Properties:

Melting Point (°C)	2050	Density (g/cm^3)	7.2
Hygroscopic	None	Hardness (Mohs)	5.8
Wavelength of Emission Peak(nm)	428nm	Refractive Index @ Emission Peak	1.82
Decay Time (ns)	<42	Energy Resolution (%)	8%-10%
Light Yield (Photons/MeV)	≥32000	Anti-radiation (rad)	>10^6
Effective Atomic Number	66	Radiation Length (cm)	1.10

$LaBr_3$(Ce) Scintillation Array

- **Minimum pixel size 1mm x 1mm $LaBr_3$(Ce) array**
- **available Fast decay time (typical 16-25ns)**
- **Suitable energy non-linearity**
- **Exceptional energy resolution and high light output**



$LaBr_3$(Ce) pixelated scintillation arrays consist of many cubic $LaBr_3$(lanthanum bromide) crystals arranged in linear or 2-dimensional metrics, and the optical reflectors in between the crystals. Cerium-doped Lanthanum bromide crystal, simplified as $LaBr_3$(Ce), with high light output, exceptional energy resolution and fast decay time (typically 16-25ns) characteristic, have high potential for gamma spectrometer, and radiation imaging applications that require high time resolution, for example, medical imaging TOF - PET (Time of Flight-Positron Emission Tomography), an advanced PET imaging technique that improves image quality by measuring the difference in arrival times of two photons produced during positron annihilation.

This is how a $LaBr_3$(Ce) pixelated array works: Each small crystal is defined as a "pixel". When a high-energy particle collides with the pixel, the LaBr3crystal captures the particle and absorbs its energy; then the crystal is stimulated and emits fluorescence. Due to the optical reflectors, the light is mostly restricted to the pixel where the event occurred, and the downstream photodetector (such as silicon photodiodes) can distinguish which pixel generated the scintillation event, allowing the host computer to form a visual image.

Due to the strong deliquescent and hygroscopic nature of the Ce-doped LaBr3crystal, manufacturing small-sized $LaBr_3$(Ce) crystals, including producing $LaBr_3$(Ce) scintillation arrays requiring a small pixel size, is practically challenging and technically demanding. Shalom EO is capable of producing minimum pixel size 1mm x 1mm $LaBr_3$(Ce) scintillation arrays; other custom pixel sizes, pixel numbers, and reflector materials/thickness are available upon request.

The advantages of $LaBr_3$(Ce) crystals:

1. High light-yield, around 63000 photons/MeV, twice that of NaI(Tl), and fast decay time, 16-25ns, support TOF systems and fast-timing experiments in nuclear physics
2. Exceptional energy resolution, <3.5%, much superior to NaI(Tl), but the actual energy resolution of the crystal relates to the uniformity of the crystal grown
3. High stopping power, effective for detecting gamma rays
4. Room temperature operation is not required; compared to HPGe, it can operate at room temperature, resulting in a simpler and lower-cost system.

The application note:

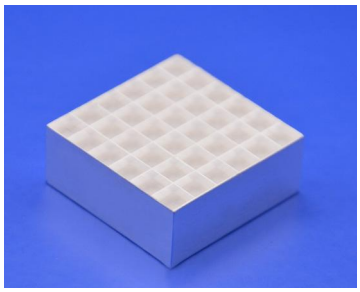
Avoid sudden temperature and humidity changes

Avoid prolonged exposure after opening; do not power on or disassemble in humid environments, and avoid rapid temperature changes that could cause internal condensation.

Basic Properties of $LaBr_3$(Ce:

Melting Point (°C)	1116	Density (g/cm^3)	5.2
Hygroscopic	Yes	Wavelength of Emission Max. (nm)	380
Refractive Index @ Emission Max.	1.9	Decay Time (ns)	25
Energy Resolution (%)	<3.5	Light Yield (photons/MeV)	63000
Cleavage Plane	<100>	Min. pixel size	1mm x 1mm $LaBr_3$(Ce) arrays available

BGO Scintillator Arrays



- **Non-hygroscopic and mechanically rugged**
- **Good radiation hardness**
- **High density and atomic number, nearly complete absence of afterglow**
- **Minimum pixel or crystal element size: 0.3mm x 0.3mm**
- **Main applications: High Energy Physics (HEP), Small-sized tomography devices, gamma-radiation monitoring, Security control, radiation isotope identification devices, non-destructive testing, well-logging**
- **Could be assembled as Multilayer Scintillation Arrays**

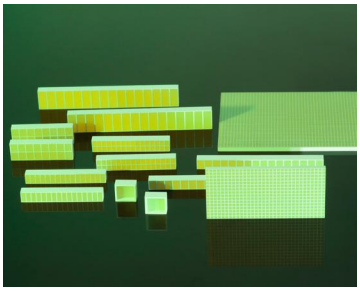
Bismuth germanate Bi4Ge3O12 (BGO) is a common heavy oxide scintillator material. BGO has a high atomic number of 74 and a high density (7.13 g/cm^3). The luminescence spectrum of BGO scintillators has a maximum in the visible spectral range at 480 nm. Among the advantages of BGO, one should note its non-hygroscopicity and mechanical and radiation stability. BGO Scintillators are stable under radiation doses of up to 103 rad. Another essential benefit of BGO crystals is a nearly complete absence of afterglow. The decay time of the main scintillation component of BGO at room temperature is 300 ns. All the above advantages of BGO crystals make it an attractive candidate in high-energy physics and for compact tomographic devices and active protection from background radiation.

Shalom EO offers Pixelated BGO Scintillation Arrays with custom pixel element sizes and designs. Shalom EO's pixelated BGO scintillators are excellent for Positron Emission Tomography (PET), Computed Tomography (CT), industrial Non-Destructive Testing (NDT), and other research applications. Our single-layer BGO array series could also be integrated into multi-layer scintillation arrays, further enhancing the resolution of Positron Emission Tomography (PET).

Basic Properties:

Density (g/cm^3)	7.13	Melting Point (K)	1323
Effective Atomic Number	74	Hardness	5
Refractive Index	2.15	Decay Constant	317ns
Radiation Length	1.1cm	Wavelength of Peak Emission	480nm
Light Yield	8500 (Photon/MeV)	Hygroscopic	No

GAGG(Ce) Scintillation Array



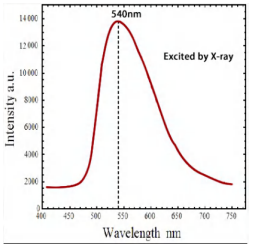
- **Good matching for photodiode and avalanche diode readout**
- **Best light output in all series of oxide crystals and short decay time**
- **No self-radiation and non-hygroscopic**
- **High density (LuAG: Ce, GAGG: Ce) and very high light yields (GAGG: Ce)**
- **Customized sizes or specifications available upon your request**
- **Minimum pixel or crystal element size: 0.3mm x 0.3mm**
- **Applications: Positron Emission Tomography (PET), PEM, SPECT, and CT SPECT scan systems, Neutron sensors, Oil detection, security inspection, Geophysics**

GAGG(Ce) - Gadolinium Aluminum Gallium Garnet ($Gd_3Al_2Ga_3O_{12}$) doped with Ce is a newly developed scintillator material. GAGG(Ce) is one of the brightest scintillators with an emission peak at 540nm, which matches well with Photodiodes (PD) and Silicon Photon Multiplier (SiPM). GAGG(Ce) features excellent stability under exposure to radiation, high ruggedness, and is well fit for a broad range of applications. Furthermore, GAGG(Ce) scintillation crystals have good energy resolution and high density; it is non-self-radiant and non-deliquescent.

Shalom EO offers a series of GAGG(Ce) Scintillation Arrays with custom dimensions and pixel sizes. Our GAGG series scintillator products have been widely applied in Time-of-Flight Positron Emission Tomography (TOF-PET), Positron Emission Mammography (PEM), Single Photon Emission Computed Tomography (SPECT), Computed Tomography (CT), X-radiation and gamma detection applications in nuclear, space, industrial, and medical fields. Besides, Bulk GAGG(Ce) Scintillators and GAGG (Ce) Scintillator Screens are also available.

Curves:

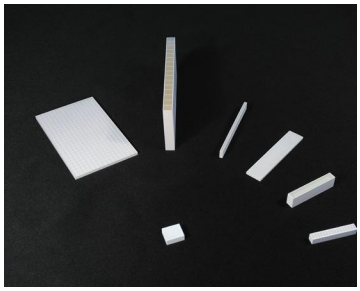
Emission Spectrum of GAGG(Ce) Scintillators:



Basic Properties:

Emission Peak Wavelength	540nm	Density (g/cm^3)	6.63
Hygroscopicity	No	Melting Point (ºC)	2105
Hardness (Mhos)	8.0	Decay Time (ns)	90
Light Yield (Photon/MeV)	54000	Refractive Index (nm)	1.9
Radiation Resistance (rad)	10^5	Energy Resolution	6%
Effective Atomic Number	54		

$CdWO_4$ Scintillator Array

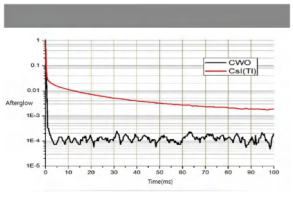


- **Low afterglow and high-density, high-Z scintillator**
- **Relatively High light yield and High resistance to energy radiation damage**
- **Suitable for low activity counting applications**
- **Linear Arrays of 8, 16, 32, 64...elements and 2-Dimensional Arrays of 6×10, 12×18, 24×36...elements available**
- **Minimum pixel or crystal element size: 0.3mm x 0.3mm**
- **Application Notes: Security inspection, X-ray CT, High-energy physics, Nuclear medicine**

Cadmium tungstate ($CdWO_4$) is a high-z (large atomic number) scintillator with a decent high light yield and extremely low afterglow. The afterglow at 3ms is less than 0.1%. The emission maximum is at 475nm, and the total light output is 12 to 15 photons/keV. The photoelectron yield relative to NaI(Tl) on a bialkali PMT is 30 to 50%. The massive nuclei of $CdWO_4$ mean high stopping power and make it an efficient absorber, particularly for high-energy X-radiation. It takes only 3mm to stop up to 150 keV photons. The low afterglow of $CdWO_4$ scintillators is of great importance for fast inspection, for instance, in cargo containers.

$CdWO_4$ is ideal for high-energy physics due to its high tolerance to high-power radiation.

Shalom EO offers custom $CdWO_4$ arrays according to customer request; our CWO scintillation arrays are commonly used in X-radiation Computerized Tomography (CT) equipment, security cargo inspections, high-energy physics, and nuclear medicine applications. Besides, Bulk $CdWO_4$ Scintillator Crystals are available at Shalom EO as well.



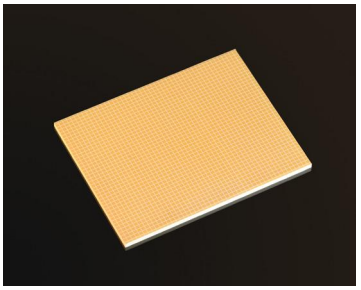
Single Pixels Size	customized	Linear Array	8, 16, 32, 64... pixels
2-Dimensional Array	6×10, 12×18, 24×36....pixels	Light Output	12,000-15,000 Photons/MeV
Afterglow	0.1%(max) after 3ms	Reflector	TiO2, BaSO4, ESR ect.

Basic Properties:

Melting Point (°C)	1598	Density (g/cm^3)	7.9
Hygroscopic	None	Hardness(ns)	4-4.5
Wavelength of Emission Max.(nm)	475	Refractive Index of Emission Max	2.2-2.3
Decay Time(ns)	14000	Photoelectron Yield (% of NaI(Tl)) (for γ-rays)	30-50
Afterglow(%@3ms)	<0.1	Radiation Length(cm)	1.06

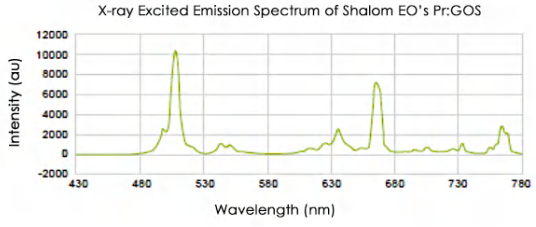
GOS:Pr Scintillator Arrays

- **High light output and high density, very machinable**
- **Low afterglow of less than 0.1% at 3 ms and excellent moisture Resistance, good chemical stability**
- **Well matched with the spectral sensitivity of silicon photodiodes (Si PD)**
- **Emission peak wavelength at 512nm**
- **Minimum pixel or crystal element size: 0.3mm x 0.3mm**
- **Applications: Computerized Tomography (CT) Scanners, security devices, and non-destructive testing systems**

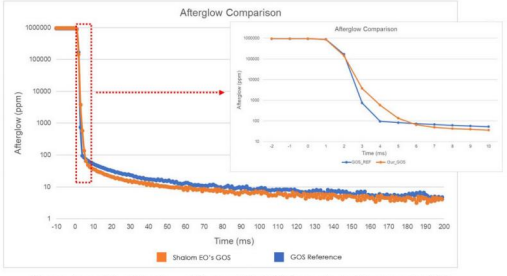


Praseodymium-doped gadolinium oxysulfide, GOS:Pr (Gd_2O_2S:Pr), is a ceramic scintillator featuring high density, low afterglow, good chemical stability, and good machinability. Its emission peak around 512 nm provides a good spectral match with silicon photodiodes, making GOS:Pr particularly suitable for X-ray imaging applications. Shalom EO supplies 1D and 2D GOS:Pr scintillator arrays, as well as arrays coupled with silicon photodiode (SiPD) detectors. Customized pixel dimensions, array formats, reflector structures, and detector coupling are available according to application requirements.

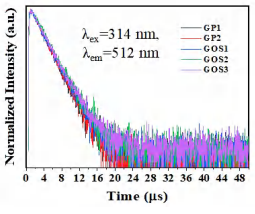
1.The X-ray Excited Emission Spectrum of Shalom EO's GOS:Pr

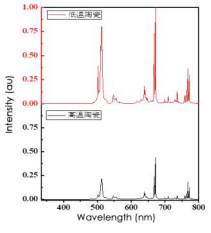


2.The Afterglow Comparison between Shalom EO's GOS:Pr and Other Commercial GOS Ceramics



Comparison of The Afterglow of Shalom EO's GOS Ceramic and Commercial GOS



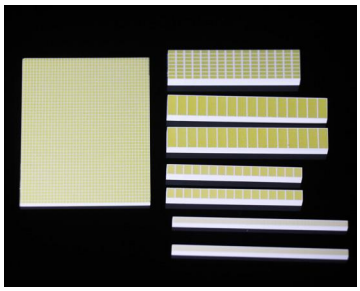


Basic Properties:

Density(g/cm^3)	7.280	Refractive Index	2.2
Molecular Formula	Gd_2O_2S	Relative Molecular Mass	378
Melting Point	2070°C	Crystal Structure	Hexagonal Crystal System
Zeff	61.1		

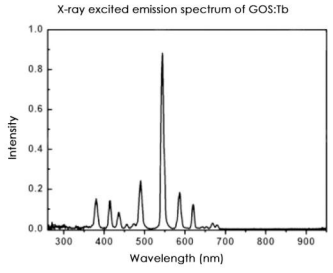
GOS:Tb Scintillator Array

- **High light output and low after-glow**
- **Ideal for pairing with detectors operating at 25- 130 kV**
- **Ultrahigh neutron capture cross-section of Gd**
- **High spatial resolution**
- **Applications: CT scanners, radiation detection, security devices, and non-destructive testing**



GOS ceramic (Gd_2O_2S) belongs to a hexagonal system structure. Among numerous inorganic scintillators, gadolinium oxysulfide (Gd_2O_2S, GOS) based materials are quite attractive for their high density (7.34 g/cm^3), wide band gap (4.6 eV), and high radiation resistance. Tb (terbium) activated GOS ceramic scintillator features high light output, no harmful content to the environment, and low after-glow. The emission peak wavelength is positioned at 550nm; it is typically paired with low-energy detectors operating at 25- 130 kV and could be used for various purposes such as CT scanners, radiation detection, security devices, and non-destructive testing.
Recently, with the rapid development of neutron detection technology, GOS: Tb scintillator has shown excellent prospects due to its ultrahigh neutron capture cross-section of Gd, high spatial resolution, and good coupling with a CCD camera (GOS has a powder-like structure; it could be coupled with sensors of any pixel size).

1.The X-ray Excited Emission Spectrum of Shalom EO's GOS:Tb



Basic Properties:

Comparison of GOS Ceramic Scintillators with CsI(Tl) Scintillators

Material	CsI(Tl)	GOS:Tb	GOS:Pr
Peak Wavelength	560	550	510
Morphology	Cubic	Polycrystalline Ceramic	Polycrystalline Ceramic
Transparency	Transparent	Translucent	Translucent
Light Output/MeV	59000	46500	27000
Decay Time/ns	1	600	3
Afterglow/@3ms	≤1%	≤0.1%	≤0.05%
Atomic Coefficient	54	60	60
Density/g-cm^3	4.51	7.34	7.34
Hygroscopicity	Slightly	No	No
Irradiation Damage	/	12% (1 Mrad)	6% (1 Mrad)

GOS Ceramic Thin Film

- **Consisting of a GOS ceramic scintillation layer sandwiched between a PET substrate and a PET protective layer**
- **Ideal for use in combination with scintillation arrays made of other materials to realize dual-energy X-ray detection**
- **Two types available: high light output and low afterglow**
- **Good match with TFT, CCD, and PD chips**
- **Application: medical imaging, baggage inspection, non-destructive testing**

A GOS Scintillation Thin Film is a thin sheet consisting of a scintillation layer of GOS ceramics, a PET substrate layer, and a protective PET layer on top. Gadolinium Oxysulfide (GOS) ceramic, chemical formula Gd_2O_2S, is an excellent scintillation material that offers high light yield, large density, and low afterglow. The GOS ceramic thin films are often used in combination with scintillation arrays made of other scintillator materials (e.g., thallium-doped cesium iodide scintillator arrays) to realize dual-energy X-ray detection utilizing two distinct energy levels of X-rays, where the GOS thin films are stacked together with the scintillation arrays and filters. The GOS thin films are optimized to absorb and convert lower-energy X-rays, and the other constituent scintillator arrays are optimized to detect higher-energy X-rays.

Shalom EO offers a series of GOS scintillator products, including GOS scintillation crystals (terbium-activated GOS and praseodymium-activated GOS), pixelated GOS scintillation arrays, and GOS scintillator thin films, which are specified on this page.

We can provide standard and custom GOS thin films of different sizes and thicknesses tailored to meet your needs. The GOS ceramic scintillation thin films we provide can be coupled with TFT, CCD, and PD chips.

The standard GOS scintillation thin films are available in two types:

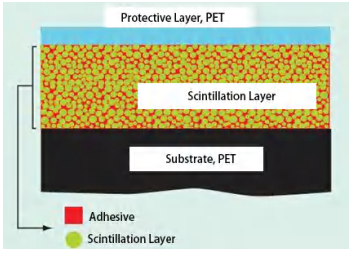
1. High light output type thin film made of GOS: Pr. This type of GOS thin film Shalom EO offers is brighter and more sensitive to the incoming radiation (i.e., produces more light per unit dose), which implies that the detectors attached to the thin film receive more intense light signals, leading to a higher signal-to-noise ratio when forming the image. This high light output type GOS thin film is suitable for low dose rate X-ray imaging.
2. Low afterglow type made of GOS: Tb. This type of GOS thin film has lower afterglow, which means it produces less ghosting, an advantage for applications that require high-speed dynamic imaging, real-time imaging, and high frame rates, such as high-frame-rate X-ray imaging, industrial online real-time detection, and dynamic digital radiography.

The manufacturing technique of GOS ceramic scintillation thin films

(as in the case of producing GOS: Tb thin films) is as follows:

1. Using the coprecipitation method to produce the mixed powder of Gd_2O_3 and Tb_2O_3;
2. High-temperature sulfurization sintering forms GdSO grains;
3. Add adhesives, press the material into pieces, and bind the pieces together with the PET substrates;
4. Stick a protective layer onto the light-emitting surface;
5. Obtain Gd_2OS_2:Tb thin films; the emission peak is 550nm.

Figure 1. The diagram showing the structure of Shalom EO's GOS scintillation thin films



1. Specifications of high light output type GOS:Tb Thin Films:

Code		SSF-GOSTb-001	SSF-GOSTb-002	SSF-GOSTb-003
Structure	Protective Layer	6μm	6μm	6μm
	Scintillation Layer	68 (mg/cm² ±10%)	100 (mg/cm² ±10%)	145 (mg/cm² ±10%)
	Substrate	250μm	250μm	188μm
	Total Thickness	406μm	464μm	507μm
Light Output	Relative Light Output (%) (*See explanation 1)	80%	100%	145%
Light Emission Wavelength		550nm	550nm	550nm
MTF	MTF (2 Lp/mm)	0.35	0.25	0.1
	Relative MTF (*See explanation 2)	140%	100%	40%

*Explanation 1: The relative light output percentages specified in the table are calculated by setting the light output of SSF-GOSTb-002 as 100%, and then calculating the percentage values of SSF-GOSTb-001 and SSF-GOSTb-003 relative to SSF-GOSTb-002

*Explanation 2: The relative light output percentages specified in the table are calculated by setting the MTF of SSF-GOSTb-002 as 100%, and then calculating the percentage values of SSF-GOSTb-001 and SSF-GOSTb-003 relative to SSF-GOSTb-002

Code		SSF-GOSPr-001	SSF-GOSPr-002	SSF-GOSPr-003
Structure	Scintillation Layer	80 (mg/cm² ±10%)	180 (mg/cm² ±10%)	300 (mg/cm² ±10%)
	Total Thickness	430μm	645μm	830μm
Light Output	Relative Light Output (%) (*See explanation 3)	100%	125%	147%
Light Emission Wavelength		512nm	512nm	512nm
After Glow	% @10ms	0.008	0.008	0.114
	% @30ms	0.005	0.005	0.028
	% @100ms	0.002	0.002	0.006
Transparency		Not transparent	Not transparent	Not transparent
Deliquescent		No	No	No

*Explanation 3: The relative light output percentages specified in the table are calculated by setting the MTF of SSF-GOSPr-002 as 100%, and then calculating the percentage values of SSF-GOSPr-001 and SSF-GOSPr-003 relative to SSF-GOSPr-002

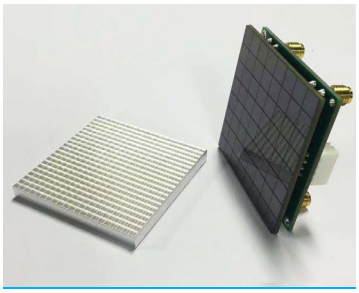
Modules or Types:
Below are the standard GOS thin films that Shalom EO supplies.

For the specifications of these modules, please check the specification tab

Code	Type	Material of The Scintillation Layer	Total Film Thickness	Thickness of The Scintillation Layer
SSF-GOSTb-001	High light output	GOS:Tb	406μm	68mg/cm²
SSF-GOSTb-002	High light output	GOS:Tb	464μm	100mg/cm²
SSF-GOSTb-003	High light output	GOS:Tb	507μm	145mg/cm²
SSF-GOSPr-001	Low Afterglow	GOS:Pr	430μm	80mg/cm²
SSF-GOSPr-002	Low Afterglow	GOS:Pr	645μm	180mg/cm²
SSF-GOSPr-003	Low Afterglow	GOS:Pr	830μm	300mg/cm²

YSO(Ce) Scintillation Array

- **High density and good energy resolution**
- **Low after-glow and fast decay time**
- **Good matching for PMT readout**
- **Minimum pixel or crystal element size: 0.3mm x 0.3mm**

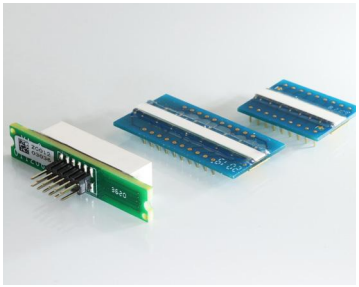


Y_2SiO_5:Ce (YSO: Ce) or cerium-doped silicate yttrium is a bright and fast light scintillator with an emission peak at 420 nm. It is easy to match with PMT and SiPM readouts. YSO(Ce) has a similar decay time to LYSO(Ce) (50-70ns) but less background radiation attributed to the absence of lutecium. Mechanical processing of YSO: Ce scintillators is easier compared to other silicates. YSO(Ce) is often made into a pixelated array and multi-layer arrays for nuclear medicine Positron Emission Tomography (PET) applications.
Shalom EO offers custom YSO(Ce) scintillation crystal arrays according to your request; our LYSO(Ce) arrays are widely used in the Radiation Detection, Security industries, Semiconductors, photo optics, Positron Emission Tomography (PET), and Nuclear medicine. Bulk YSO(Ce) Crystals are also available.

Basic Properties:

Density(g/cm^3)	4.50	Melting Point (K)	2273
Refractive Index	1.8	Emission Peak (nm)	420
Decay Time (ns)	50-70	Light Output (photons/Mev)	10000
Effective Atomic Number(z)	39	Hygroscopic	None
Cleavage Plane	None		

Scintillation Detection Arrays (Coupled with Si PDs)



- **Linear Scintillation Array + Monocrystalline Si Photodiode Array + Mounting Board**
- **Element size: width 1.4mm, height 2.5nm, with an element pitch of 1.575nm**
- **Modules of 16 elements, 64 elements, and 128 elements are available**
- **Wide spectral range of 350-1100nm (responsivity peak at 950nm)**
- **A variety of scintillator materials including CsI(Tl), GOS ceramic, $CdWO_4$, or other custom choices**
- **Dual-energy inspection is enabled when combining a CsI(Tl) detector for high energy and a GOS detector for low energy**

This product is a portfolio of linear Scintillation Detection Arrays; all the modules are coupled with 16-element, 64-element, or even 128-element Front-Side-illumination (FSI) monocrystalline Si photodiodes as the photo readout devices. The detector modules exhibit reliability and versatility for diverse applications that involve non-destructive X-ray inspection (e.g., baggage inspection, portal security, food inspection, etc.). Various scintillation materials, such as CsI(Tl), GOS ceramic screens, $CdWO_4$, etc., could be incorporated. Compared to PMTs, photodiode readouts are advantageous in terms of low cost, excellent electrical current linearity, long life span, and high quantum efficiency (also known as responsivity). Shalom EO's scintillation detection arrays feature ultra-low dark current, high response speed, low terminal capacitance, and the photosensitivity spectrum extensively stretches from 350-1100nm, peaking approximately at 950nm. Additionally, this module is compact and lightweight, allowing easy integration, and it only requires a low maximum reverse voltage of <10V; the photosensitivity of the diode elements is impressively homogeneous.

Two standard scintillation materials are optional: the CsI(Tl) scintillation detector performs extremely high light output for high-energy inspection, and the GOS ceramic scintillation detector is for low-energy inspections. The scintillation pixels of one array are separated by a reflector with a wide assortment of selective materials (e.g., MgO_2, TiO_2, ESR, BaSO4 White Plastic, White Epoxy, etc.) to avert optical crosstalk. A dual-energy X-ray imaging sensor could be obtained by combining one high-energy detector and one low-energy detector at the upper and lower stages. Furthermore, long-size line detectors are formed when aligning multiple detection arrays in a row.

About the specifications, the element size is 1.4mm in width x 2.5mm in height; the element pitch is 1.575mm, apt for compact security inspection systems. CsI(Tl) arrays are mounted on 25.4mm x 10.2mm boards, and GOS arrays are mounted on 25.4mm x 20mm boards. Other customized specifications could also be tailored upon request.

Versions that are integrated with data readout electronics are also available in Shalom EO.

Typical Applications:

Non-destructive X-Ray Inspection

Security Check

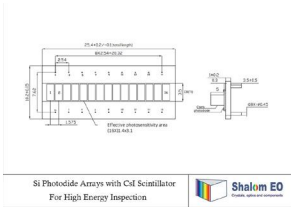
Food Inspection

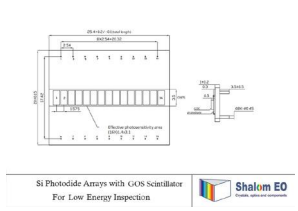
Thickness measurement

Industrial Process control

Mineral Detection

Waste Sorting





Properties of Scintillators:

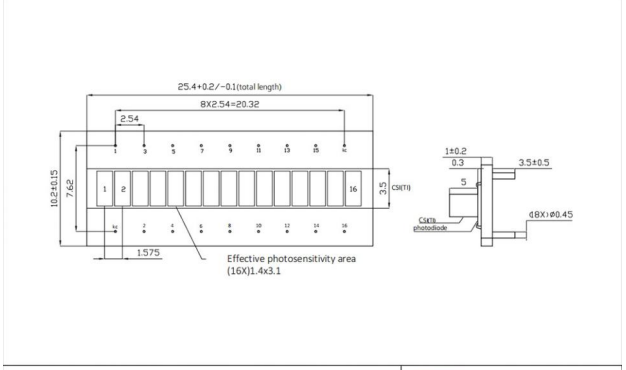
Material	GOS ceramic (Gd_2O_2S:Pr)	CsI (Tl)(Cesium Iodide)
Peak Emission Wavelength	512nm	550nm
Decay Time	3000ns	1000ns
Refractive Index	2.2	1.79
Afterglow	0.01% @20ms	<1% @20ms
Density	7.34 g/cm^3	4.51 g/cm^3
Non-uniformity of Sensitivity	+/- 15%	+/- 15%

Operating Conditions:

Reverse Voltage	5V, 10V	
Temperature	Operating	0-60°C
	Storage and Transport	-20-70°C
Humidity	Operating	30-90%RH (No dew condensation)
	Storage and Transport	40-95%RH (No dew condensation)
Atmospheric Pressure	Operating, Storage and Transport	700-1000mbar

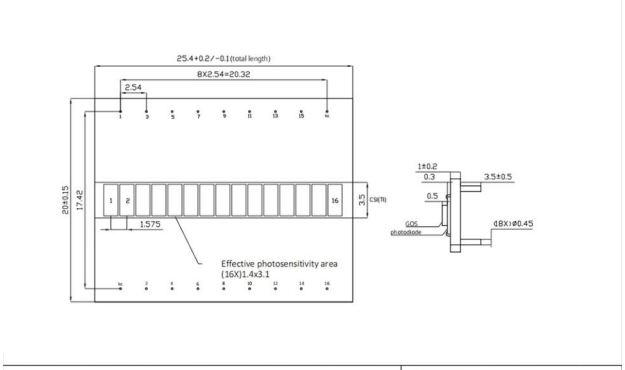
Product list

Code	Element Pitch	Number of Elements
SA-PD16A-16-1.575	1.575mm	1×16
SA-PD6404A-16-1.575	1.575mm	1×16
SA-PD6404-16-2.5	2.5mm	1×16



Si Photodide Arrays with CsI Scintillator
For High Energy Inspection

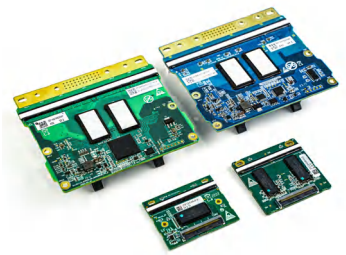
Shalom EO
Crystals, optics and components



Si Photodide Arrays with GOS Scintillator
For Low Energy Inspection

Shalom EO
Crystals, optics and components

Linear Si Photodiode Array X-Ray Detector Boards



- **Based on Linear Si PD scintillation detection chips, supporting both single-energy and dual-energy X-ray detection**
- **Numerous channels with custom pixel pitch and dimensions**
- **Common applications: security screening, non-destructive inspection, food testing, ore sensing, etc.**
- **Customization for your specific application**

Shalom EO offers a series of custom-tailored Detector Boards for X-Ray Imaging Systems. The products are X-radiation sensor chips consisting of linear Si photodiode arrays coupled with scintillators, integrated on data acquisition boards designed for X-ray line scanning. These modules feature high responsivities and short integration time, optimized NEP (noise equivalent power), etc., combined with a robust architecture of high radiation resistance to ensure a long lifetime under X-ray flux and strengthened interfaces. The detector boards are suitable for applications in various fields associated with X-ray imaging and inspection, including baggage inspection, security screening, food testing, the mineral industry, etc. No matter where your interest lies, Shalom EO could tailor the linear diode arrays (LDA) for incorporation into your systems to help you produce complete X-ray imaging solutions.

Each detector board produces End-Of-Scan pulses, which accommodate the aligning of individual boards into a continuous row of detector boards.

Compared to direct X-ray detection approaches, such as CCD-based detectors, the detector modules using scintillators have the advantages of a wider detectable energy range and being able to scan objects in large areas.

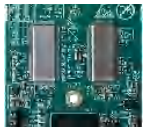
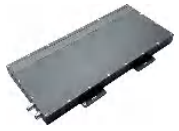
One layer or two layers of linearly pixelated crystalline/amorphous silicon photodiodes are coupled with scintillators on top of them. The double-layer versions allow Dual-energy Inspection, where the low-energy X-ray and high-energy X-ray are separated by the copper filter between two layers, with pixel element numbers available like 1×8, 1×16, 1×32, 1×64, 1×128, and customized pixel dimension/pitch; all the elements are integrated simultaneously. One could also select the scintillator materials for the X-ray detectors according to specific applications. In this case, Shalom EO recommends CsI(Tl), GOS ceramic, or $CdWO_4$, since their spectrum of high light output matches well with the sensitive spectrum of the PDs. The scintillator X-radiation detector boards use an ROIC (readout integrated circuit) that is optimized for the specific requirements of the X-ray diode array. The printed circuit board (PCB) for the linear diode arrays is designed with components on both sides, maximizing space efficiencies and allowing for a more compact design. This allows for better signal processing, higher efficiencies, and better control over performance. A tightly integrated design reduces the number of interconnections, minimizing potential failure points and improving overall reliability. The detector boards support a large number of cards per single data transmission link, and multiple links can be combined, ensuring flexible operations for different scanning widths. Dedicated software provides real-time monitoring of the system, allows users to adjust operational parameters, and supports self-diagnosis for maintenance and troubleshooting. Besides, the Si PD array X-ray detector board is compatible with both Windows and Linux operating systems, ensuring easy integration into different workflows.

TAll the specifications could be customized upon requests

Capabilities of Shalom EO:

· Silicon Photo Diode Array Detectors of 1×8, 1×16, 1×32, 1×64, 1×128, etc. pixels are available

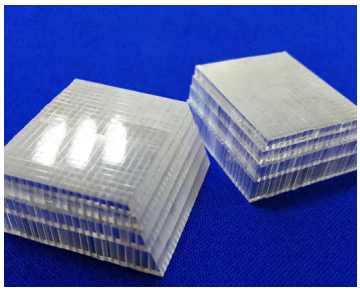
· Scintillator Matetials: CsI(Tl), GOS ceramic, or $CdWO_4$

Product	SAB-6404A3	SAB-6404S3		SAB-12804	SAB-12808	SAB-LD	
Model	6404A3-CG16	6404S3-CG16	6404S3-CG25	12804S-0G04	12808DV-JG08	LD04	LD08
							
PD type	c-si	c-si	c-si	c-si	c-si	c-si	c-si
Scintillator type	GOS+CSI	GOS+CSI	GOS+CSI	GOS	GOS+GOS	GOS	GOS
Pixel pitch	1.575mm	1.575mm	2.5mm	0.4mm	0.8mm	0.4mm	0.8mm
Energy range	30~160kV	30~320kV	30~320kV	40~160kV	40~160kV	40~160kV	40~160kV
ADC	16	16	16	16	16	16	16
Min int. time	200us	200us	200us	200us	200us	200us	200us
Speed	0.8m/s	3.0m/s	5.5m/s	2m/s	3m/s	2m/s	3m/s
Max cards	40	40	40	40&120 2link&8link core	40&120 40&120	/	/
Signal trans.	GigE	GigE	GigE	GigE	GigE	GigE	GigE
Detection width	102mm	102mm	160.4mm	51.2mm	102mm	51.2*X	51.2*X

Product	SAB-6404A3	SAB-6404S3		SAB-12804	SAB-12808	SAB-LD*	
Model	6404A3-CG16	6404S3-CG16	6404S3-CG25	12804S-0G04	12808DV-JG08	LD04	LD08
Baggage Inspection	√	√	√		√		
High speed baggage		√			√		
Car Inspection		√	√				
Cargo Inspection							
Security CT							
Food Inspection				√	√	√	√
Mineral Sorting		√		√	√		

Multilayer Scintillation Arrays

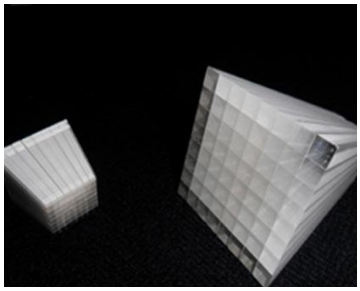
- **Based on BGO or LYSO(Ce)**
- **Customized multilayer arrays with up to 4~5 layers available**
- **Applied to improve the resolution of PET (Positron Emission Tomography)**
- **Additional Light Guides could be integrated if required**



Multilayer Scintillation Arrays enhance PET (Positron Emission Tomography) resolution, employing commonly used scintillation crystals like BGO and LYSO(Ce) within their construction. Occasionally, light guides are integrated to optimize performance. Crucial specifications for these arrays encompass precise pixel sizes, gap measurements, and overall array dimensions. Shalom EO specializes in crafting highly precise, customized multilayer arrays. Our expertise allows us to produce multilayer scintillation arrays with up to 4 to 5 layers configurations.

Light Guide for Scintillator Array

- **Light guides made from BK7 optical glass available for different requirements**
- **BK7 glass specifications: Index of refraction:1.51630, Dispersion: 0.00806, Abbe number: 64.06**
- **Compliant with Shalom EO's Multilayer Scintillation Arrays and various Single-layer Scintillation Arrays**



Light guides are compatible with Multilayer Scintillation Arrays and various single-layer scintillation arrays. They are designed to optimize the transmission and collection of photons, enhancing the performance of imaging systems. Customization options for the light guides include adjustments in length, diameter, shape, and other parameters to ensure optimal transmission of light signals.

As an ideal complement to Multilayer Scintillation Arrays, these light guides play a crucial role in imaging technologies like Positron Emission Tomography (PET), aiding in improving resolution, sensitivity, and overall image quality. Whether integrated within multilayer arrays or used in conjunction with single-layer arrays, these BK7 glass light guides effectively enhance the overall performance of radiation detection systems.

Shalom EO provides customized light guides made from BK7 optical glass to meet diverse requirements.

Specifications:

We use various kinds of optical glass to manufacture light guide materials, such as BK7 glass.

· Index of refraction:1.51630

· Dispersion: 0.00806

· Abbe number: 64.06

The components of BK7 glass are stated as follows:

· SiO_2=69.13%

· $B2O_3$=10.75%

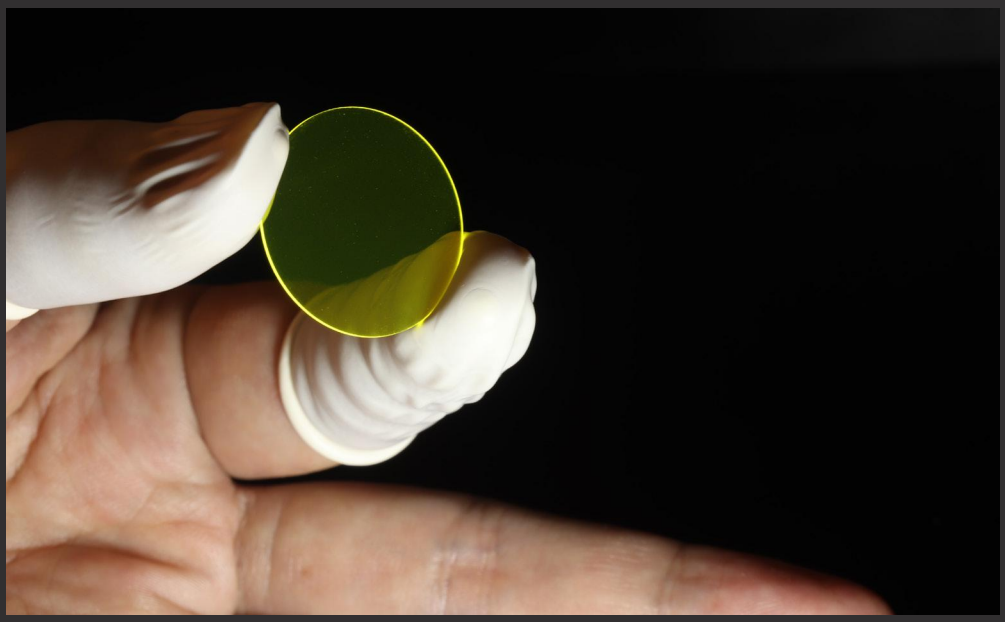
· BaO=3.07%

· Na_2O=10.40%

· K2O=6.29%

· As_2O_3=0.36%

Scintillation Screens



High-resolution scintillation screens for X-ray and particle imaging Scintillation screens convert X-rays, charged particles, and other high-energy radiation into visible light, enabling precise visualization of radiation intensity and distribution. They are widely used in medical imaging, industrial non-destructive testing, scientific instrumentation, and high-resolution radiation imaging.

For demanding applications such as SEM, proton radiography, soft X-ray imaging, and VUV/XUV imaging, ultra-thin single-crystal scintillation screens provide high spatial resolution with excellent image quality. Key performance advantages include:

· High light output
· Excellent optical homogeneity
· Superior surface flatness
· Low surface roughness
· Ultra-thin configurations for high-resolution imaging

Shalom EO offers scintillation screens based on YAG, YAP, GAGG, and LuAG single crystals. YAG and LuAG are particularly well suited for low-energy X-ray and particle imaging, combining high imaging performance with reliable material properties.

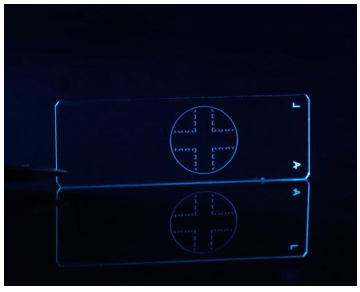
Available Configurations

· Substrate-supported screens: thickness down to 0.01 mm
· Self-supporting screens: thickness down to 0.05 mm
· Maximum diagonal size: up to 4 inches
· Custom dimensions and configurations available

3

Customized Scintillation Screen

- **For high spatial resolution applications**
- **Maximum diameter 4 inches**
- **Minimum 0.05mm for free-standing screens**
- **Minimum 0.01mm for screens with Fused Silica (FS) substrates**
- **Aluminum Coating Available**
- **Scintillation Materials including YAG(Ce), GAGG(Ce), LuAG(Ce), LYSO(Ce), YAP(Ce) and CsI(Tl)**
- **Applications: Detection of proton beams, Electron beams, Soft X-rays, UV light, VUV, and XUV radiation**



Customized Scintillation Screens refer to tailored or specially designed scintillation screens personalized to meet specific requirements or preferences. These screens are crafted to precise specifications, accommodating unique sizes, shapes, compositions, or performance characteristics based on the customer's specific needs. The customization aspect ensures that the scintillation screens are optimized for particular applications, such as medical imaging, security checks, or scientific research, allowing for enhanced sensitivity, tailored dimensions, or specialized configurations to achieve optimal performance in diverse applications

The thin, flat scintillation crystals can be used as the scintillation screens directly, which have extraordinarily high spatial resolutions. Scintillation thin screens are used to detect proton beams, electron beams, low-energy X-rays (or soft X-rays), Ultraviolet (UV) light, Deep Ultraviolet (DUV) light, Vacuum Ultraviolet (VUV), and Extreme Ultraviolet (EUV or XUV) radiation; they are widely used in Scanning Electron Microscope (SEM), high-resolution soft X-ray detection, and Ultraviolet laser systems. Shalom EO provides a variety of scintillation screens made from scintillation crystals: LuAG(Ce), YAG(Ce), YAP(Ce), GAGG(Ce), LYSO(Ce), and CsI(Tl), etc., The scintillator screen could be free-standing or installed in an aluminum mount, and to get a thin screen down to 10 or 20 micros, fused silica or optical glass substrate would be bonded to the scintillation screens.

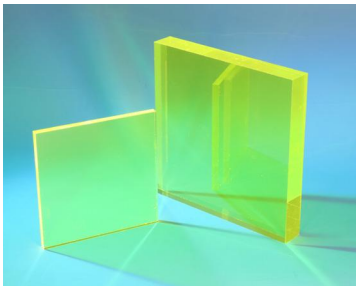
Material Available: YAG(Ce), GAGG(Ce), LuAG(Ce), LYSO(Ce), YAP(Ce) and CsI(Tl) crystals.
Tips on materials selection
Regarding imaging screens for general purposes, select: YAG:Ce, LuAG:Ce and YAP:Ce.
For scintillation imaging dealing with lower energy, select: YAG:Ce and LuAG:Ce

Capabilities:
Note: We can supply custom scintillation screens with a maximum diameter of 4 inches. The following table is only a list of our thickness capabilities at corresponding diameter ranges, and does not indicate the diameter limit that we can provide.

Type	Diameter	Minimum Thickness
Free Standing	70-100mm	Down to 100μm
Free Standing	Up to 60mm	Down to 50μm
Edge Mounted Screen(with ring support)	70- 100mm	Down to 100μm
Edge Mounted Screen(with ring support)	15-60mm	Down to 50μm
Edge Mounted Screen(with ring support)	Up to 10mm	Down to 40μm
Substrates Mounted Screen(bonded to substrates)	70-100mm	Down to 70μm
Substrates Mounted Screen(bonded to substrates)	35-60mm	Down to 40μm
Substrates Mounted Screen(bonded to substrates)	20-30mm	Down to 30μm
Substrates Mounted screen(bonded to substrate)	15-20mm	Down to 20μm
Substrates Mounted screen(bonded to substrate)	Up to 10mm	Down to 10μm

YAG(Ce) Scintillation Screen

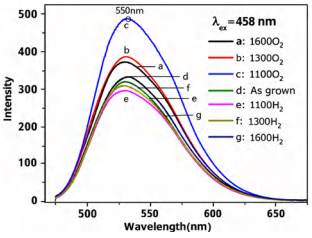
- **Minimum thickness 0.05mm for free-standing screen**
- **Minimum thickness 0.01mm for substrate-mounted screen**
- **High light output**
- **Maximum diameter 4"**
- **For high spatial resolution detection, SEM, soft X-ray imaging, UV light, VUV, XUV radiation detection**
- **Custom size, thickness, and Al coating available**



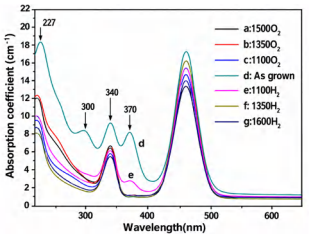
Ce:YAG scintillation crystal has distinguished characteristics such as high light output (8000Ph/MeV) and fast decay time (70ns). Also, with the emission peak positioned at 530nm, YAG(Ce) can be well-matched to CCD sensors. YAG(Ce) scintillators find prominence in various applications like Scanning Electron Microscope (SEM), electronic imaging, beta-particle, X-radiation counters, and imaging. It has outstanding thermal and mechanical characteristics, making it excellent for manufacturing ultra-thin screens of 0.01mm. The fact that YAG(Ce) crystals feature high endurance to high-energy electrons or ions contributes to their wide usage in high-energy radiation detection. Besides, Ce: YAG also has the advantage of rich availability in large sizes; all the merits in combination make Ce-doped YAG scintillation crystal a representative inorganic scintillation crystal material.
The thin, flat Ce:YAG scintillation crystals can be used directly as scintillation screens with extraordinarily high spatial resolutions. Scintillation thin screens are used to detect proton beams, electron beams, low-energy X-rays (or soft X-rays), Ultraviolet (UV) light, Deep Ultra-Violet (DUV) light, Vacuum Ultra-Violet (VUV), and Extreme Ultra-Violet (EUV or XUV) radiation. Ce:YAG is broadly utilized in Scanning Electron Microscopes (SEM), high-resolution soft X-ray detection, and Ultraviolet laser systems.
Shalom EO offers stocked and custom YAG(Ce) thin scintillator screens and plates; they could be provided in forms including free-standing crystals, installation in aluminum holders, and bonding to ultraviolet fused silica substrates. The minimum thicknesses are 0.05mm for free-standing screens and 0.01mm for screens with FS substrates. We are capable of offering large-size YAG(Ce) scintillator screens with diameters up to 4 inches. Furthermore, Bulk YAG(Ce) Crystals are also available.

Curves:

1. The emission wavelength spectrum of YAG(Ce) scintillator



2. The absorption spectrum of YAG(Ce) scintillator



Physical and Chemical Properties:

Crystal Structure	Cubic	Lattice Constant	12.01 Å
Melting Point	1970°C	Mohs Hardness	8.5
Density	4.56±0.04g/cm^3	Specific Heat	0.59J/g.cm^3@0-20°C
Elastic Modulus	310GPa	Young's Modulus	3.17×10^{4}Kg/mm^2
Poisson's Ratio	0.3	Tensile Strength	0.13~0.26GPa
Thermal Expansion	[100]:8.2×10-^6/°C@ 0~250°C	Thermo-optic Coefficient(dn/dT)	7.3×10^{-6}/°C
	[110]:7.7×10^-6/°C@0~250°C		
	[111]:7.8×10^-6/°C@0~250°C		
Thermal Conductivity	14W/m/K@20°C	Thermal Shock Resistance	790W/m
	10.5W/m/K@100°C		
Solubility	Insoluble in water, slightly soluble in acids.		

Scintillation Properties:

Emission Peak (nm)	530	Light Output (Photons/MeV)	8000
Effective Atomic Number (Zeff)	35	Decay Time (ns)	70
Quality Factor (LR/t)	138.5		

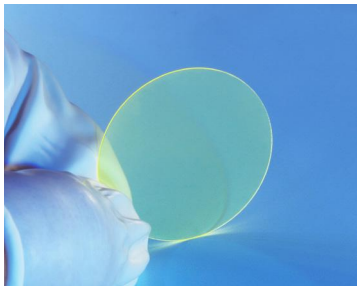
Materials	Ce-doped YAG single crystals	Size or Diameter Tolerance	+/-0.1mm
Surface Quality	60/40 S/D	Coating	Aluminum (optional)

Product list

Code	Size	Thickness	Surface Finish	Substrates or Mount
532-001	Φ10mm	0.01mm	DSP	UVFS Substrate
532-002	Φ5.0mm	0.05mm	DSP	Mounted
532-003	5.0×5.0mm	0.1mm	DSP	None
532-004	Φ10mm	0.1mm	DSP	None
532-005	10.0×10.0mm	0.1mm	DSP	None
532-006	Φ12.7mm	0.1mm	DSP	None
532-007	20.0×20.0mm	0.1mm	DSP	None
532-008	Φ25.4mm	0.1mm	DSP	None
532-009	Φ50.8mm	0.1mm	DSP	None
532-010	Φ100mm	0.1mm	DSP	None

GAGG(Ce) Scintillation Screen

- **High light output and High energy resolution**
- **Fast decay time, High density, Non-self-radiation, and Non-hygroscopic**
- **Maximum diameter 4 inches**
- **Minimum thickness 0.05mm for free-standing crystal**
- **Minimum thickness 0.01mm for FS substrate-mounted screen**
- **Custom size and thickness and Al coating are available**
- **Applications: SEM, high resolution, soft X-radiation detection, UV, VUV, EUV light radiation detection**



GAGG(Ce) - Gadolinium Aluminum Gallium Garnet ($Gd_3Al_2Ga_3O_{12}$) doped with Ce is a newly developed scintillator material. GAGG(Ce) scintillator crystals are one of the brightest scintillators with an emission peak at 540nm, which means an excellent match to Photo Diodes (PD) and Silicon Photon Multiplier (SiPM). GAGG(Ce) has good radiation hardness and is physically rugged and well-suited for various applications. Furthermore, GAGG(Ce) scintillators have high resolution and stopping power. GAGG(Ce) is also non-self-radiant and non-deliquescent.

The thin, flat GAGG:Ce scintillation screens can be used directly as scintillation screens with extraordinarily high spatial resolutions. Scintillation thin screens are used to detect proton beams, electron beams, low-energy X-rays (or soft X-rays), Ultraviolet (UV) light, Deep Ultraviolet (DUV) light, Vacuum Ultraviolet (VUV), and Extreme Ultraviolet (EUV or XUV) radiation; they are widely used in Scanning Electron Microscope (SEM), high-resolution soft X-radiation detection, and Ultraviolet laser systems.

Shalom EO offers stocked and custom GAGG(Ce) thin scintillation screens and plates; they can be provided in the forms of free-standing crystals, installation in aluminum holders, and bonding to ultraviolet fused silica substrates. The minimum thicknesses are 0.05mm for free-standing GAGG(Ce) crystals, and 0.01mm for FS substrate is available. We are capable of offering large-size GAGG(Ce) scintillation screens up to a diameter of 4". Furthermore, bulk GAGG(Ce) crystals are also accessible in Shalom EO.

Basic Properties:

Emission Peak Wavelength	540nm	Density (g/cm^3)	6.63
Hygroscopicity	No	Melting Point (ºC)	2105
Hardness (Mhos)	8.0	Decay Time (ns)	90
Light Yield (Photon/MeV)	54000	Refractive Index (nm)	1.9
Radiation Resistance (rad)	105	Energy Resolution	6%
Effective Atomic Number	54		

Materials	Ce-doped GAGG single crystals	Size or Diameter Tolerance	+/-0.1mm
Surface Quality	60/40 S/D (option: 10/5 S/D, 20/10 S/D)	Coating	Aluminum (optional)

Product list

Code	Size	Thickness	Surface Finish	Coating	Substrates or Mount
533-001	Φ10mm	0.01mm	DSP	None	UVFS Substrate
533-002	Φ5mm	0.05mm	DSP	None	Mount
533-003	Φ10mm	0.1mm	DSP	None	None
533-004	10×10mm	0.1mm	DSP	None	None
533-005	Φ12.7mm	0.1mm	DSP	None	None
533-006	20×20mm	0.1mm	DSP	None	None
533-007	Φ25.4mm	0.1mm	DSP	None	None
533-008	40×40mm	0.1mm	DSP	None	None
533-009	Φ60mm	0.1mm	DSP	None	None

Encapsulated NaI(Tl) Scintillation Crystals and Detectors

Thallium-activated sodium iodide (NaI(Tl)) is one of the most widely used and well-established scintillator materials, renowned for its high light yield and efficiency in detecting ionizing radiation. Thanks to these properties, NaI(Tl) is extensively used in:

- Nuclear physics
- Gamma-ray identification (RIID) for nuclear power plants
- Geological exploration (including the oil and gas industry)
- Mineral composition analysis
- Astrophysical research
- Medical diagnostics and industrial safety

Growth of large-sized crystals:	We achieve sizes of 950×950×250 mm for NaI(Tl) ingots. Other typical sizes: 4"x4"x16" (4 L), 2"x4"x16" (2 L), 4"x4"x8" (2 L), Φ76.2×220 mm (1 L), Φ5"x5" (1.6 L).
Various types and designs:	**1) Encapsulated crystals of various shapes:** · Shock-resistant (Rugged) · cylindrical and rectangular · "well-type" (well-type) for increasing detection efficiency · with side holes for specific assembly schemes · flat/thin NaI(Tl) disks with a beryllium (Be) window **2) Ready-made detector modules, which include:** · NaI(Tl) scintillator, · photomultiplier tube (PMT) is outsourced electronic signal processing units and optical windows on demand
Shock-resistant NaI(Tl) for well logging:	Designed specifically for geophysical well investigations. Titanium alloy housing + operating temperature up to 175°C to withstand high pressure and heating.

4

Cylindrical NaI(Tl) Crystal Encapsulated

- **Energy resolution options: 6.5-9.0% (Cs137,662keV)**
- **Large light output**
- **Maximum size: φ150mm x 400mm**
- **Aluminum housing and optical glass windows**
- **Stocked and custom modules offered**
- **NaI(Tl) integrated with PMT detectors available**

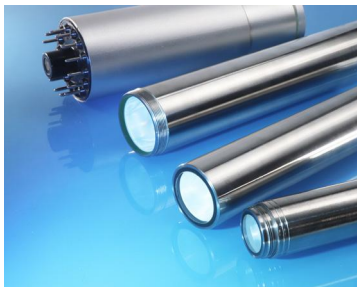
Sodium Iodide crystal doped with Thallium (or NaI(Tl) crystals) has a very high scintillation or luminescence efficiency and a good energy resolution, NaI(Tl) scintillators have the largest light-out and an emission range well matched to photomultipliers with bialkali photocathodes at high efficiency, and in combination with their easy availability of variety size and geometries and low cost, NaI(Tl) scintillators have become the most widely used scintillators. NaI(Tl) crystals are a highly hygroscopic material; they must be put in a hermetically sealed housing when used.
Shalom EO offers off-the-shelf and custom cylindrical NaI(Tl) scintillators and detectors. The NaI(Tl) crystals are made into cylinders and encapsulated in aluminum or steel housings with optical windows, which would couple to Photomultiplier Tubes (PMT), and NaI(Tl) crystals could be integrated with PMT and electronics if required. Our cylindrical NaI(Tl) crystals have been widely applied in scintillation measurements or spectrometer detectors for ordinary GAMMA rays.

Density(g/cm^3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness(Mohs)	2
Hygroscopic	yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)	250
Light Yield (photons/KeV)	38		

Product LIst

Code	Material	Crystal Size	Housing	Windows
541-001	NaI(Tl)	Φ25mmx25mm	Aluminium	Optical Glass
541-002	NaI(Tl)	Φ25mmx40mm	Aluminium	Optical Glass
541-003	NaI(Tl)	Φ25mmx50mm	Aluminium	Optical Glass
541-004	NaI(Tl)	Φ25mmx100mm	Aluminium	Optical Glass
541-005	NaI(Tl)	Φ50mmx50mm	Aluminium	Optical Glass
541-006	NaI(Tl)	Φ63mmx63mm	Aluminium	Optical Glass
541-007	NaI(Tl)	Φ75mmx75mm	Aluminium	Optical Glass
541-008	NaI(Tl)	Φ76mmx200mm	Aluminium	Optical Glass
541-010	NaI(Tl)	Φ76.2mmx220mm (1L)	Aluminum	Optical Glass
541-009	NaI(Tl)	Φ100mmx55mm	Aluminium	Optical Glass
541-011	NaI(Tl)	D5"x5" (1.6L)	Aluminum	Optical Glass

Rugged NaI(Tl) Detector for Well Logging



- **Large light output**
- **Rugged detectors fit for harsh environment in Well-logging**
- **Wide Operation Temperature Range of 25°C to 17°C**
- **Anti-shock and anti-vibration design**
- **Titanium alloy as housing and Sapphire as optical windows**
- **off-the-shelf and custom NaI(Tl) scintillator detectors available**

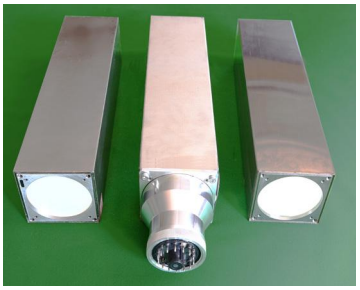
Sodium Iodide crystals doped with Thallium (or NaI(Tl) crystals) have a very high scintillation or luminescence efficiency and a good energy resolution, NaI(Tl) scintillators has the largest light-out and an emission range well matched to photomultipliers with bialkali photocathodes at a high efficiency, and combination with its easy availability of variety size and geometries and low cost, NaI(Tl) scintillators has become most widely used scintillators. NaI(Tl) crystals is a kind of highly hygroscopic materials, it must be put in a hermetically sealed housing in using.
Well-logging is done in a harsh environment of high temperature, high pressure, and high humidity; the energy spectrum of gamma rays needs to be measured in well-logging. Shalom EO select the high quality temperature resist NaI(Tl) crystals as the scintillators, uses titanium alloy as housing and Sapphire as optical windows to make rugged well-logging NaI(Tl) scintillators, and combined with anti-shock and vibration design, our encapsulated well-logging NaI(Tl) crystals have a good reflects from well-logging equipment customers.

Operation Temperature Range	25°C to 175°C	Vibration	<20g @ 20-1000Hz
Shock	<400g@1ms		

NaI(Tl) Crystals Properties:

Density(g/cm3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness(Mohs)	2
Hygroscopic	yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)	250
Light Yield (photons/KeV)	38		

Rectangular NaI(Tl) Crystals and Detectors



- **High light output and large emission range**
- **Aluminum or distilled steel housing and optical glass windows**
- **Stocked and custom modules available**
- **NaI(Tl) crystals integrated with PMT detectors are available**
- **Main Applications: scintillation measurements and scintillation spectrometer detectors for ordinary GAMMA ray**

Sodium Iodide crystals doped with Thallium (or NaI(Tl) crystals) have a very high scintillation or luminescence efficiency and a good energy resolution. NaI(Tl) scintillators have the largest light output and an emission range well matched to photomultipliers with bialkali photocathodes at high efficiency, and, combined with their easy availability of variety size and geometries and low cost, NaI(Tl) scintillators have become the most widely used scintillators. NaI(Tl) crystals are highly hygroscopic materials; they must be put in a hermetically sealed housing in use.

The rectangular-shaped NaI(Tl) scintillator is a common type of gamma-ray detector. Its NaI(Tl) crystal is rectangular-shaped and encapsulated in aluminum or steel cases with an optical window for Photomultiplier Tube (PMT) coupling. The Photomultiplier Tube (PMT) could be integrated into NaI(Tl) crystals if it is required. Rectangular-shaped NaI(Tl) scintillators are widely used in scintillation measurements or scintillation spectrometer detectors for ordinary GAMMA rays. Shalom EO offers stocked standard rectangular NaI(Tl) scintillation crystals and detectors with fast delivery, and we also offer customized NaI(Tl) crystals upon customers' request.

Density(g/cm^3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness(Mohs)	2
Hygroscopic	yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)	250
Light Yield (photons/KeV)	38		

Product List

Code	Material	Crystal Size	Housing	Windows
543-001	NaI(Tl)	54×54×50mm	Aluminium	Optical Glass
543-002	NaI(Tl)	50×100×400mm	Aluminium	Optical Glass
543-003	NaI(Tl)	4"x4"x8"(2L)	Aluminum	Optical Glass
543-004	NaI(Tl)	4"x4"x16"(4L)	Aluminum	Optical Glass

Well-Type NaI(Tl) Crystals and Detectors

- **High light output**
- **High detection efficiency, especially for detecting low-level radiation**
- **Encapsulated in Aluminium housing**
- **NaI(Tl) crystals integrated with PMT available**
- **Main Applications: gamma-ray detecting systems in radiation medicine, gamma cameras in measuring environmental radiation, including from nuclear reactors**

Sodium Iodide crystals doped with Thallium (or NaI(Tl) crystals) have a very high scintillation or luminescence efficiency and a good energy resolution. NaI(Tl) scintillators has the largest light output and an emission range well matched to photomultipliers with bialkali photocathodes at a high efficiency, and, combined with their easy availability of variety size and geometries and low cost, NaI(Tl) scintillators have become the most widely used scintillators. NaI(Tl) crystals is a kind of highly hygroscopic materials, it must be put in a hermetical sealing housing in using. The well-type NaI(Tl) scintillator is a gamma ray detector with a cylindrical part (or a well) that is fabricated concentrically in a cylindrical NaI(Tl) crystal; then the well-type NaI(Tl) crystal is encapsulated in an aluminium housing. For measurement, the specimen can be placed in the well, and the emitted scintillation light is collected through the optical window at the top. This well-shaped design is especially useful for detection of low-level radiation. Shalom EO offers customized well-type NaI(Tl) scintillation crystals upon the customer's request, and the Photomultiplier Tube (PMT) and electronics could be integrated if required.

Basic Properties:

Density(g/cm^3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness(Mohs)	2
Hygroscopic	yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)	250
Light Yield (photons/KeV)	38		

Side-hole Type NaI(Tl) Crystals and Detectors

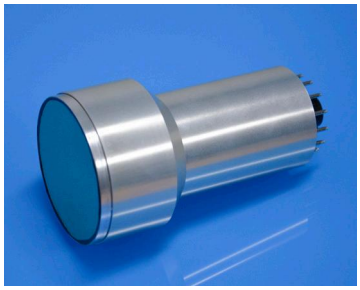
- **High light output**
- **High detection efficiency and Low background radiation**
- **Encapsulated in aluminum housing**
- **NaI(Tl) integrated with PMT detectors available**
- **Main Applications: GAMMA ray detecting systems in radiation medicine, gamma cameras in measuring environmental radiation including from nuclear reactors, nuclear physics, high energy physics and out-of-space research**

Sodium Iodide crystals doped with Thallium (or NaI(Tl) crystals) have a very high scintillation or luminescence efficiency and a good energy resolution. NaI(Tl) scintillators have the largest light output and an emission range well matched to photomultipliers with bialkali photocathodes at a high efficiency, and, combined with their easy availability of variety size and geometries and low cost, NaI(Tl) scintillators have become the most widely used scintillators. NaI(Tl) crystals is a kind of highly hygroscopic materials, it must be put in a hermetical sealing housing in using.

Side-hole type NaI(Tl) crystals have a side hole passing vertically through the axis of the cylinder of NaI(Tl) crystals, and then it is encapsulated in an aluminum housing. The measured specimen could be put inside the hole, and emitted light from the scintillating NaI(Tl) crystals could be obtained from an optical window mounted on the top surface. Shalom EO offers customized side-hole type NaI(Tl) scintillators upon customer's request; the Photomultiplier Tube (PMT) and electronic modules could be integrated with side-hole type NaI(Tl) crystals if it is required.

Density(g/cm^3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness(Mohs)	2
Hygroscopic	yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)	250
Light Yield (photons/KeV)	38		

Thin Disk Type NaI(Tl) Crystals and Detectors



- **Housed in aluminum rings**
- **Beryllium or aluminum foil entrance windows**
- **NaI(Tl) thin crystals integrated with PMT detectors available**
- **Main Applications: soft X-ray and γ-ray detection at low energy levels**

Sodium Iodide crystals doped with Thallium (or NaI(Tl) crystals) have a very high scintillation or luminescence efficiency and a good energy resolution. NaI(Tl) scintillators have the largest light output and an emission range well matched to photomultipliers with bialkali photocathodes at a high efficiency, and, combined with their easy availability of variety size and geometries and low cost, NaI(Tl) scintillators have become the most widely used scintillators. NaI(Tl) crystals is a kind of highly hygroscopic materials, it must be put in a hermetical sealing housing for use.

The NaI(Tl) crystal is cut into a thin disk and polished, then it is encapsulated in an aluminum ring. Beryllium or aluminum foil is often used as the entrance window, and thin disk or plate NaI(Tl) crystals are usually used in detection of soft X-rays with low energy levels. Shalom EO supplies the customized thin NaI(Tl) scintillators upon customer's request; the Photomultiplier Tube (PMT) and electronic modules could be integrated with thin disk or plate type NaI(Tl) crystals if it is required.

Density(g/cm^3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness(Mohs)	2
Hygroscopic	yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)	250
Light Yield (photons/KeV)	38		

Scintillation Detector Assemblies & Accessories

A scintillation detector typically combines a scintillator material with a photodetector such as a photomultiplier tube (PMT), silicon photodiode (SiPD), or silicon photomultiplier (SiPM) to convert incident X-rays, gamma rays, or energetic particles into measurable electrical signals.
Depending on the application, a complete detector assembly may also integrate a voltage divider, preamplifier, high-voltage (HV) module, signal-processing electronics, connectors, housing, and light guides, providing a compact and application-ready detection solution.
Scintillation detector assemblies are widely used in:

- X-ray and gamma-ray detection
- Radiation monitoring and spectroscopy
- Medical imaging
- High-energy and nuclear physics
- Geophysical and well-logging applications
- Nuclear power and radiation safety systems

Flexible Detector Configurations
Shalom EO offers scintillation detector assemblies based on NaI(Tl), CsI(Tl), CsI(Na), LYSO(Ce), BGO, $LaBr_3$(Ce), $LaCl_3$(Ce), and plastic scintillators.
Detector modules can be configured with different combinations of:

- Scintillator crystals or plastic scintillators
- PMTs, SiPDs, or SiPMs
- High-voltage modules
- Preamplifiers and signal-processing electronics
- Light guides
- Mechanical housings and connectors

PMTs from selected third-party manufacturers can also be integrated according to customer requirements.
Both standard detector modules and customized assemblies are available to support different detector geometries, interfaces, electronics, and system-level requirements.
In addition to complete detector assemblies, Shalom EO also supplies PMTs, plastic scintillator surface contamination monitors, multichannel analyzers (MCAs), and radionuclide identification devices (RIIDs).
From individual detector components to complete integrated assemblies, Shalom EO provides flexible configurations for research, instrumentation, and radiation detection applications.

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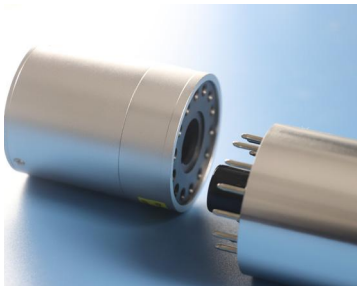
Scintillation Detectors (Scintillators + PMT)



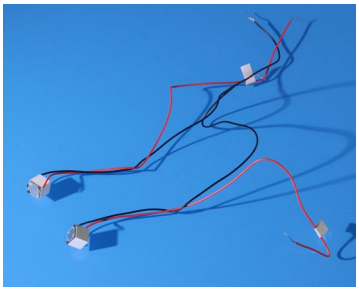
- **Aluminum or stainless steel housing, optical glass windows**
- **PMT manufactured by Beijing Hamamatsu, ET, or other suppliers**
- **Off-the-shelf modules and customized detectors available upon request**
- **Based on various scintillation materials: NaI(Tl), CsI(Tl), CsI(Na), LYSO(Ce), BGO, $LaBr_3$(Ce), $LaCl_3$(Ce), $CeBr_3$ and plastic scintillators**
- **Main Applications: X-radiation and gamma detections**

This series of Scintillation Detector Assemblies consists of scintillators, photomultiplier tubes, and hermetic housings made from aluminum or stainless steel. The most often incorporated scintillator material is NaI(Tl), but other scintillators include CsI(Tl), LYSO(Ce), BGO, $LaBr_3$(Ce), $LaCl_3$(Ce), $CeBr_3$, and plastic scintillators are available. PMTs can be sourced from Beijing Hamamatsu, ET, or other suppliers according to your requirements. Besides a collection of standard-design scintillation detectors and probe modules, Shalom EO will provide customized detectors upon your request.

Code	Crystal Size	Module	PMT	Housing	Windows
551-001	D25×25mm	NaI(Tl)+PMT	Beijing Hamamatsu CR125	Aluminium	Optical Glass
551-002	D25×50mm	NaI(Tl)+PMT	Beijing Hamamatsu CR125	Aluminium	Optical Glass
551-003	D25×100mm	NaI(Tl)+PMT	Beijing Hamamatsu CR125	Aluminium	Optical Glass
551-004	D30×50mm	NaI(Tl)+PMT	Beijing Hamamatsu CR105-05	Aluminium	Optical Glass
551-005	D50×50mm	NaI(Tl)+PMT	Beijing Hamamatsu CR105-05	Aluminium	Optical Glass
551-006	D75×75mm	NaI(Tl)+PMT	Beijing Hamamatsu CR160	Aluminium	Optical Glass

SiPM Photomultiplier Scintillator Detectors

- **Custom modules available; different types of scintillation crystals can be**
- **selected Compact size**
- **Immune to magnetic fields**
- **Solid-state, thus more rugged than PMT**
- **Much lower voltage supplies are required than for PMTs**
- **Applications: medical imaging (PET/SPECT), high-energy physics**



SiPM scintillation detectors combine scintillator materials with silicon photomultipliers (SiPMs) to provide compact, low-voltage, and highly integrated solutions for radiation detection.

Compared with conventional PMT-based detectors, SiPM detectors offer several key advantages:

· Compact and lightweight design

· Low operating voltage

· High resistance to vibration and shock

· Excellent performance in magnetic-field environments

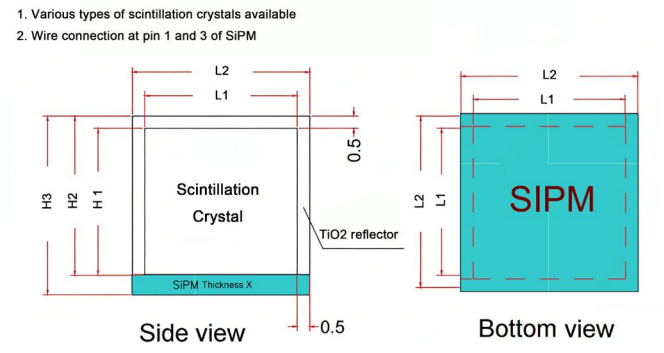
· Flexible integration with single SiPMs or SiPM arrays

· Optional temperature-compensated bias and preamplifier circuits

Shalom EO provides standard and customized SiPM scintillation detector assemblies with flexible configurations of scintillators, SiPMs, electronics, housings, and interfaces. Available scintillator materials include NaI(Tl), CsI(Tl), CsI(Na), LYSO(Ce), BGO, GAGG(Ce), $LaBr_3$(Ce), and plastic scintillators. Typical applications include PET and SPECT imaging, portable radiation detectors, radiation monitoring, nuclear physics experiments, industrial measurement, and compact multi-channel detection systems. For applications requiring large sensitive areas or extremely low dark noise, PMT-based detectors may still be preferred.

Shalom EO supports custom detector geometries, small-batch production, and application-specific detector integration.

Shalom EO's SiPM photomultiplier scintillator detector:



Scintillation Detectors (Scintillators+PMT+Electronics)

- **Aluminum or stainless steel housing**
- **PMT made by Beijing Hamamatsu, ET, or others**
- **Package with Voltage Divider, Preamplifier, High Voltage Module (HV), and Connectors available upon requests**
- **Various scintillators options: NaI(Tl), CsI(Tl), CsI(Na), LYSO(Ce), BGO, $LaCl_3$(Ce), $LaBr_3$(Ce), $CeBr_3$ and plastic scintillators**
- **Main Applications: X-ray and gamma detections**

This series of Scintillation Detector Assemblies consists of scintillators, photomultiplier tubes, and hermetic housings made from aluminum or stainless steel. A broad range of scintillation materials, including NaI(Tl), CsI(Tl), LYSO(Ce), BGO, $LaBr_3$(Ce), $LaCl_3$(Ce), $CeBr_3$, and plastic scintillators, are all available. PMTs can be sourced from Beijing Hamamatsu, ET, or other suppliers according to your requirements. Besides a collection of standard-design scintillation detectors and probe modules, Shalom EO will provide customized detectors upon your request.

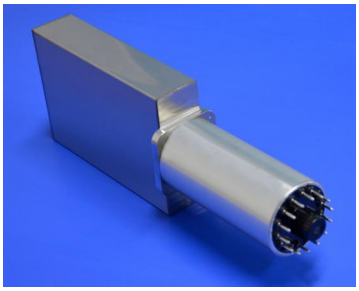
Custom Electronic Module for Detector Assembliescs

- **Compatible with various kinds of Scintillators, PMTs, and Scintillator + PMT detector modules**
- **Various Module options, including PMT, Voltage Divider, Preamplifier, high-voltage modules, and Connectors**
- **Unique Designs for individual requirements available**
- **A Guarantee period of 12 months for all modules**

Shalom EO offers the electronics module for your scintillator + PMT detectors, Voltage Divider, Preamplifier, high-voltage modules, and output connectors, available upon your request. Our experts and engineers will well understand your needs and offer you an optimal scheme in electronics design. All electronic modules are guaranteed for 12 months.

Plastic Scintillation Detector Assemblies

- **Custom Plastic Scintillation Detector Assemblies**
- **Optional Configurations: Light Guides, PMT, Electronics, Light-tight Wrapping, etc. Large Light Yield and Fast Response**
- **Ideal for Gross Gamma Counting, Nuclear Detection, Alpha/Beta Particle Detection, etc.**
- **Large-Dimension Plastic Scintillators in Various Shapes Incorporated**



Plastic Scintillation detectors, based on plastic scintillators, feature large light yield, short scintillation time constants, and fast response, in addition to high radiation resistance and stable chemical/mechanical properties. The detectors are optimized for fast-timing detection of Gamma/X-ray radiation, alpha/beta particles, neutrons, nuclear mass measurement, etc.

Shalom EO offers a series of Custom Plastic Scintillation detector assemblies for radiation detection. The Plastic Scintillators could be integrated with various accessories and radiation-collecting components, including light guides, photomultiplier tubes (PMT), light-tight wrappings, radiation-entrance windows, and electronics. The plastic scintillators incorporated into our detectors have the merit of being available in large dimensions and shape variations; hence, the detectors are adept at applications involving gross gamma counting such as vehicle portal monitors for contamination detection and nuclear safeguard instruments.

The configurations and electronics for the photomultiplier tubes are optional according to your requests, where the detectors could be furnished with voltage dividers, internal high-voltage modules, preamplifiers, etc. The other specifications of the plastic scintillation assemblies are all customizable.

PMMA Light Guides for Scintillators

- **Made of PMMA Imported from German**
- **Immunities to Yellowing for Long-term Usage**
- **Custom Specifications Tailored for Your Scintillation Detectors**
- **Various Forms for Different Cross-sections: Fish-tail, Tapered-cone, Rectangular, Flat Bar, etc.**
- **Compliant with PMT, SIPM, or Other Readout Components**

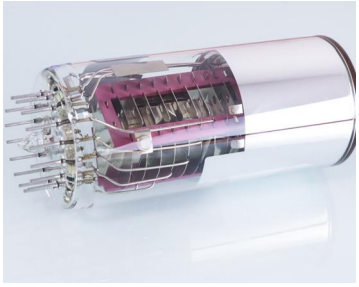
Light Guides are essential components for transmitting light from the scintillator media and the light collection device (Photomultiplier Tube/PMT or Silicon Photomultipliers/SIPM) in scintillation detectors. There are often two circumstances in which a light guide is utilized: One is when the area of the scintillator is greater than the area of the phototubes, and another is when the cross-sectional shape of the scintillator differs from that of the phototubes.

PMMA cast sheet is a common plastic material for manufacturing scintillation light guides. The term PMMA is the abbreviation of Polymethyl Methacrylate, and the material is also known as acrylic plastic; in a commercial context, it is sold under the name Lucite, Perspex, Plexiglas, etc.

Shalom EO offers Custom PMMA Light Guides for Scintillators; all the specifications and parameters can be tailored to optimize your scintillation detectors. Various forms of light guides are available, including fish-tail light guides for a transition from thin rectangular ends to round cross-sections, tapered-cone light guides for coupling of square-to-round ends, or round-to-round cross-sections, with other additional options encompassing rectangular light guides, flat bar light guides, or other custom shapes. Smooth surfaces or reflectors are engaged to exploit total internal reflection. The light guides ensure efficient and uniform transmission, being compatible with PMT, SIPM, or other readout sensors. The cast PMMA material is imported from Germany, featuring high optical transmission, exceptional resistance to UV exposure, high thermal tolerance, and immunity to yellowing for long-term usage. Our PMMA Light Guide Series, used in combination with our Plastic Scintillation Detectors are excellent radiation detection instrument for Gamma detection, nuclear monitoring, and alpha/beta particle detection.

Substrate Material	PMMA	Density	1.19 g/cm^3
Refractive Index	1.49	Fabrication Technique	Cast
Working Temperature	-40 ~ 55°C		

Photomultiplier (PMT) Tubes



- **Designed for scintillators, PMT tubes contain a borosilicate glass optical window, Bialkali photocathode, dynode stages, anodes, pin base, and**
- **vacuum envelope Spectral response range (290-650nm), QE peak wavelength 380nm, matching well with scintillators**
- **High luminous sensitivity and blue sensitivity**
- **Two standard PMT series: SPMT-F021 featuring high gain and collection efficiencies, SPMT-T013 featuring low noise and fast response**

A photomultiplier tube (PMT) is a highly sensitive light detector that converts weak optical signals into amplified electrical signals. With high gain, large active areas, and excellent sensitivity to low light levels, PMTs are widely used with scintillators in radiation detection and spectroscopy systems.

Shalom EO offers standard and customized PMTs optimized for scintillation detectors. Our standard models feature borosilicate glass windows, bialkali photocathodes, multi-stage dynode structures, and spectral response well matched to blue and visible scintillation light.

The standard spectral range covers approximately 290–650 nm, with peak quantum efficiency around 380 nm.

SPMT-F021 Series

The SPMT-F021 series features high gain and high collection efficiency, with active cathode areas starting from Ø46 mm. Its box-and-grid dynode structure supports efficient electron collection and is suitable for applications such as:

· Scintillation counters

· High-energy physics

· Radiation detection systems

SPMT-T013 Series

The SPMT-T013 series is designed for fast response and low noise, with a typical rise time of 1.9 ns and typical dark current of 2 nA.

Available with box-focused or linear-focused dynode structures, it is suitable for:

· Scintillation counters

· Radiation measurement

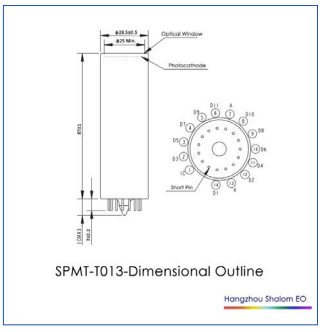
· General-purpose detector systems

Shalom EO supports both standard PMT supply and customized configurations for different scintillator materials and detector requirements.

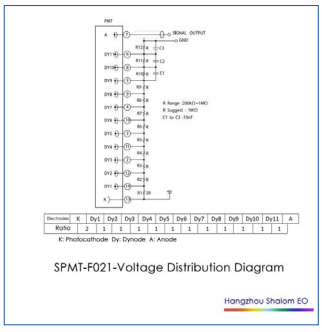
General Specifications:

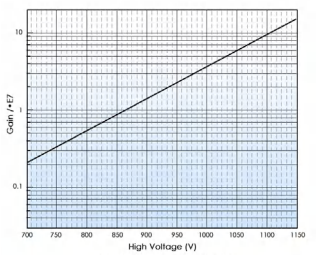
Optical window	Borosilicate glass optical windows	Operating temperature range	-30°C~50°C
Photocathode	Bialkali photocathode	Storage temperature range	-50°C~50°C
Design Structure	Box and grid/Box-focuses/linear focused		

Code	Wavelength	Diameter	Length	Photocathode Active Area	Cathode Luminous Sensitivity	Cathode Blue Sensitivity	Gain
SPMT-T013-A	290-650nm, QE Peak 380nm	28.5±0.5mm (Tube Diameter)	Max. 97±1mm	Round, Min. Dia 25mm	Typ. 80μA/lm	Typ. 11μA/lmf, Min. 9μA/lmf	Typ. 7×10^6
SPMT-T013-B	290-650nm, QE Peak 380nm	28.5±0.5mm (Tube Diameter)	Max. 97±1mm	Round, Min. Dia 25mm	Typ. 80μA/lm	Typ. 11μA/lmf, Min. 9μA/lmf	Typ. 7×10^6
SPMT-T013-C	290-650nm, QE Peak 380nm	28.5±0.5mm (Tube Diameter)	Max. 97±1mm	Round, Min. Dia 25mm	Typ. 80μA/lm	Typ. 11μA/lmf, Min. 9μA/lmf	Typ. 7×10^6
SPMT-F021-A	290-650nm, QE Peak 380nm	51±0.5mm (Tube Diameter)	Max. 147mm	Round, Min. Dia 46mm	Min. 60μA/lm	Min. 10.5μA/lmf	Typ. 2.5×10^7
SPMT-F021-B	290-650nm, QE Peak 380nm	51±0.5mm (Tube Diameter)	Max. 147mm	Round, Min. Dia 46mm	Min. 60μA/lm	Min. 9μA/lmf	Typ. 1.6×10^7
SPMT-F021-C	290-650nm, QE Peak 380nm	51±0.5mm (Tube Diameter)	Max. 147mm	Round, Min. Dia 46mm	Min. 60μA/lm	Min. 7μA/lmf	Typ. 1×10^7

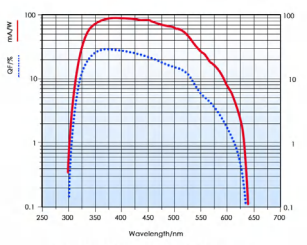


SPMT-T013-Dimensional Outline

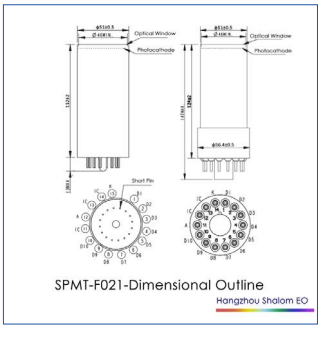

SPMT-F021-Voltage Distribution Diagram



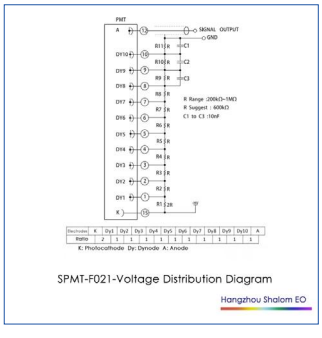
SPMT-T013-Typical Gain

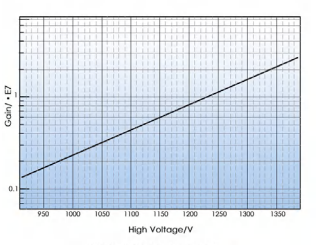


SPMT-T013-Typical Spetral Response

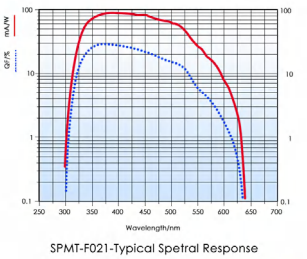


SPMT-F021-Dimensional Outline


SPMT-F021-Voltage Distribution Diagram



SPMT-F021-Typical Gain



SPMT-F021-Typical Spetral Response

Plastic Scintillators

Shalom EO plastic scintillators are available in the form of blocks, plates, rods/cylinders, sheets, ZnS(Ag)-coated products, rings, arrays, integrated detectors, and radiation contamination monitors.
Plastic scintillators are particularly suitable for applications requiring fast decay time and large detection areas. Typical applications include portable radiation monitors, surface contamination monitors, and hand-and-foot contamination monitors.
Flexible configurations are available, including PMTs, light guides, electronics, and light-tight housings, allowing the detector design to be adapted to different application requirements.

SP101	Equivalent to EJ-212 and BC-400	Gamma-ray, X-ray, and muon detection
SP102	Equivalent to EJ-212 and BC-400	Beta-particle detection
SP121	Equivalent to EJ-444	Alpha and beta detection; suitable for hand-and-foot contamination monitors
SP122	—	Low-energy gamma-ray detection
SP123	Equivalent to EJ-442	Alpha-particle detection
Surface Contamination Monitoring Module	Based on plastic scintillator SP121	
Module Configuration	SP121 + PMT + Mylar (PET) films + steel protective mesh + housing and electronics	
Detection Capability	Alpha detection, beta detection, and dual Alpha + Beta detection	

Plastic Scintillators SP101 (Equal to EJ212, BC400)

- **Equivalent to Eljen's EJ212 or Luxium's BC400**
- **Polystyrene-based and High Mechanical Strength**
- **Good Vibration and Humidity Resistance**
- **Various Shapes and Large Dimensions are available**
- **Short Decay Time of 2.4ns**
- **Assemblies of SP101 with a light guide, PMT, Si PD, and Electric Module installations are available**
- **Thin Plastic Scintillator Screens Available**
- **Aluminum Coating Available**
- **Applications: Isotope gauge, Vehicle radiation detection, Environmental radiation monitoring, Anti-Compton detector**

Organic or plastic scintillators have high transparency, excellent durability, and good resistance to vibration, impact, and humidity. They also have extremely high anti-radiation properties. Plastic scintillators feature low cost and broad availability in large dimensions and various shapes. Plastic scintillators have a short decay time and high light output. For its excellent properties, plastic scintillators have been widely used in X-ray and Gamma detection.

Shalom EO offers the plastic scintillator SP101 (Equivalent to EJ212 and BC400), a polystyrene-based material produced by thermal polymerization of styrene monomer, POPOP, and p-terphenyl. SP101 is a fast scintillator with a decay time of 2.4 ns; it has a good light yield, which is 20%-30% of NaI(Tl) and 64% of anthracene crystals, and a peak emission wavelength of 423nm.

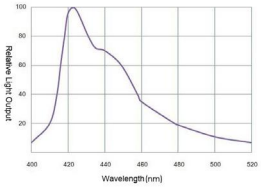
Shalom EO offers custom plastic SP101 scintillators in various shapes, such as plates, disks, blocks, rods, cylinders, cubes, and rings, and with optional reflector materials and packing design.

General Specifications:

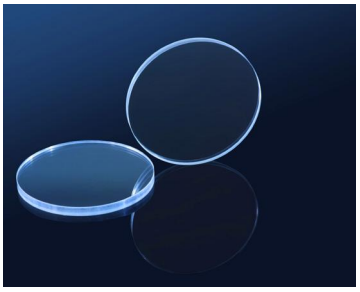
Base Materials	Polystyrene	Density (g/cm^3)	1.02
Softening Temperature (°C)	75	Operating Temperature (°C)	-40~55
Wavelength of Emission Max. (nm)	423	Refractive index @ Emission Max	1.58
Decay Time (ns)	2.4	Light Yield (% of NaI(Tl))	20 ~ 30
Light Yield (% of Anthracene Crystal)	64		

Modules or Types:

Standard or typical plastic scintillators SP101 (Equal to EJ212)
50×500×1200mm
50×50×1000mm
50×50×1500mm
50×50×2000mm
Dia.50×1000mm
Dia.50×1500mm
Dia.50×2000mm



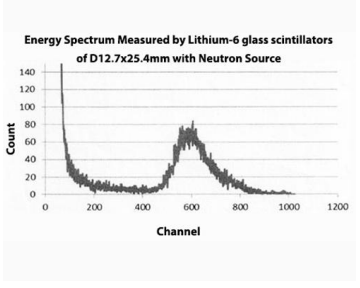
Lithium Glass Scintillators SG101 for Neutron Detection



- **High detection efficiency for Thermal Neutron Detection**
- **Short Decay Time and good thermal properties**
- **Excellent (n,γ) gamma-ray discrimination properties**
- **Various Shapes available**
- **Applications in nuclear power plants, nuclear waste treatment facilities, environmental radiation monitoring systems, etc.**

SG101 is a kind of Lithium-6-doped glass (Li-6 glass) scintillator used in thermal neutron detection. It has high efficiency for thermal neutron detection, with short decay time, excellent (n,γ) gamma-ray discrimination, and good thermal properties. Li-6 glass is often made into cylindrical or rectangular shapes in applications.

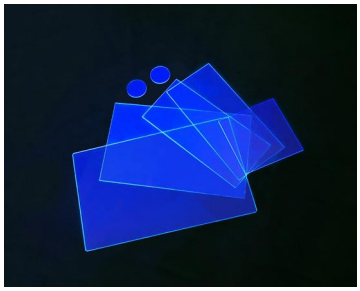
Shalom EO offers custom Li-6-doped glass scintillators according to customers' requests. Our lithium glass scintillators are used in nuclear power plants, nuclear waste treatment facilities, environmental radiation monitoring systems, etc., which would monitor environmental neutron radiation accurately. Li-6 glass scintillators are also used in neutron flight time experiments, well-logging, nondestructive tests, and neutron photography applications.



Specifications:

Density (g/cm^3)	2.3	Li-6 Doping	7.5-11.2wt%
Light Output (relative to NaI(Tl))	12%	Measuring Range	thermal neutron
Scintillation Decay Time (ns)	53	Emission Peak Wavelength (nm)	416
Energy Resolution for Thermal Neutron	≦ 28%	Operating Temperature Range	-150°C ~ 200°C

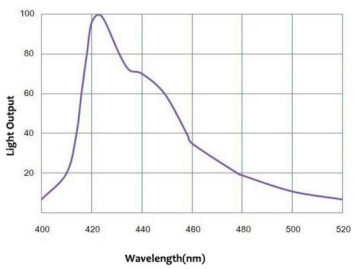
Plastic Scintillators SP102 for Beta Ray Detection



- **High detection efficiency for Beta-Ray detection Polystyrene-based,**
- **Excellent uniformity and no deformation Short Decay Time of 2.4ns**
- **Thickness range of 0.25- 1.0 mm and various shapes available Different**
- **doping composition from SP101**
- **Equal to Eljen's EJ212 and Luxium's BC400**

Plastic scintillator SP102 is made from the same kind of materials as plastic scintillator SP101, but the doping composition is different from that of SP101. SP102 series plastic scintillators are developed for Beta-Ray (or β-ray) detection; the thickness is often in the range of 0.25~1.0 mm. A small thickness could decrease the light output generated by gamma rays (or γ-rays). Plastic scintillators SP102 have high detection efficiency, excellent uniformity, and no deformation.
Shalom EO offers the custom plastic scintillator SP102 upon the customer's request.

Curve: Light Emission Spectrum

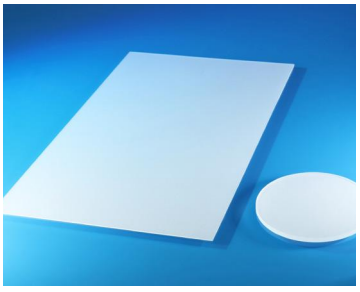


Specifications:

Substrate Materials	Polystyrene	Density (g/cm^3)	1.023
Refractive Index	1.58	Light Yield (% of Anthracene Crystal)	64
Emission Peak Wavelength (nm)	423	Decay Time (ns)	2.4
Softening Temperature (°C)	75	Operation Temperature Range (°C)	-40 ~ 55
Measuring Range	50keV ~ 3MeV		

Plastic Scintillators SP121 (Equal to EJ444) for Alpha Ray & Beta Ray Detection

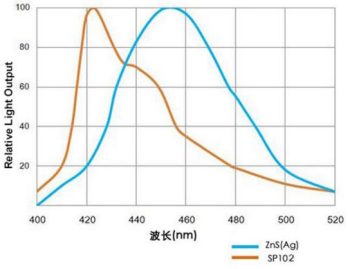
- **Equivalent to Eljen EJ444**
- **Fit for both alpha-ray and beta-ray detection**
- **Polystyrene Based and surface coated with ZnS(Ag) layer on SP102 Good**
- **uniformity and excellent homogeneity**
- **Various shapes available**
- **ZnS(Ag) layers with a standard thickness of 4.5mg/cm^2 and other designed thicknesses optional**



Shalom EO has developed the SP121 (Equal to EJ444) series plastic scintillators, which are suitable for both α-ray and β-ray detection. The plastic scintillator SP121 consists of a ZnS(Ag) layer coated on the surface of our plastic scintillator SP102 , with the ZnS(Ag) layer thickness typically being 4.5mg/cm^2. The plastic scintillator SP102 is for β-ray detection with a peak emission wavelength of 423nm, and the ZnS(Ag) layer is for α-ray detection with peak emission at 450nm. The thickness of the ZnS(Ag) layer is meticulously designed to obtain exactly the desired α-ray absorption.

Advanced and sophisticated processing is used to realize the ZnS(Ag) coating, which makes the final scintillators have excellent homogeneity and uniformity.

Curve: Light Emission Spectrum

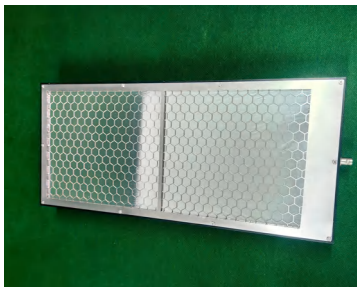


Specifications:

	SP102	ZnS(Ag)
Materials	Polystyrene	ZnS(Ag)
Density(g/cm^3)	1.023	4.1
Refractive Index	1.58	
Light Yield (% of Anthracene Crystals)	64	280
Emission Peak Wavelength (nm)	423	450
Decay Time (ns)	2.4	200
Operation Temperature Range（°C）	-40~55	-40~55
Thickness of Coated Layer（mg/cm^2）		4.5

Plastic Scintillator Detector for Surface Radiation Contamination

- **Consists of a plastic scintillator, PMT, Mylar PET films, steel mesh, aluminum housing, and a flexible design of electronic modules**
- **Plastic scintillator SP121 (equal to EJ444) optimized for alpha/beta surface radiation detection and measurement**
- **Three detection modes: α-radiation detection, β-radiation detection, α and β radiation detection**
- **Multiple formats of digital output signals compatible with various data acquisition and digital processing modules**
- **Optical cavity structure or PMMA lightguides**
- **Applications: portable radiation detector probes, hand and foot monitors, floor contamination monitors**



Surface radiation contamination refers to the presence of radioactive materials on surfaces, such as equipment, floors, walls, clothing, or skin. This contamination occurs when radioactive particles or substances settle onto a surface, either through direct contact, airborne deposition, or liquid spills. Unlike radiation exposure, which results from being near a radiation source, surface contamination involves actual radioactive material (e.g., alpha-, beta-, and gamma-emitting radionuclides) being present on the surface, which can pose ongoing hazards if not properly contained or removed. Surface contamination is often measured and quantified as radiation rate (i.e., the amount of radiation coming from a source (or in an area) during a period) or radiation dose (i.e., the amount of radiation that is absorbed).

Plastic scintillator is advantageous for radiation dosimetry, particularly in medical applications like radiotherapy, small field dosimetry, and IMRT QA. While plastic scintillators offer excellent tissue equivalencies, miniaturized sizes, and energy independence in the MV Range, challenges such as low signal-to-noise ratio and material degradation are being actively addressed to improve their long-term performance.

Shalom EO offers a custom surface contamination plastic scintillator detector series that recognizes and measures sources that emit alpha and/or beta particle radiations. Our plastic scintillator detector series is a core constituent element optimized for alpha/beta radiation detection devices.Shalom EO's plastic scintillator surface radiation contamination detectors are developed based on the SP121 (which is equivalent to EJ444) plastic scintillator, in addition to photomultiplier tubes, electronic modules, Mylar polyester films, steel mesh, and an aluminum housing. The ionizing radiation generates light pulses from the scintillators, and the light signals are multiplied and converted into photoelectron currents at the output anode of the photomultiplier tubes; the current is then transformed into readable voltage pulses. The electronic modules can be a flexible combination of voltage divider, high voltage unit, preamplifier, and digitization unit, allowing further integration.

Utilizing α and/or β radiation detection and monitoring techniques with its sensitive scintillator, wide radiation measurement range, and adaptable electronics module design, Shalom EO's plastic scintillation surface contamination detector series is well-suited for incorporation into surface contamination detectors for detecting alpha and/or beta radioactive contaminants. The scintillation detector and measurement modules are excellent for a wide range of applications, including portable radiation detector probes, hand and foot monitors, and floor contamination monitors.

Three detection modes are available for our scintillation radiation contamination detectors: detection of alpha particles, detection of beta particles, and a combination of two scintillators allowing simultaneous alpha and beta detection. The scintillator can be manufactured in different geometries and sizes based on the user's specific requirements. Standard construction for optical transmission is an optical cavity structure, whereas a polymethyl methacrylate (PMMA) light guide can also be used to improve the efficiency of light collection and enhance signal light transmission. Our scintillation plastic detectors also support diverse output signal formats, ensuring compatibility with different data acquisition and processing modules and accommodating various application scenarios.

Specifications:

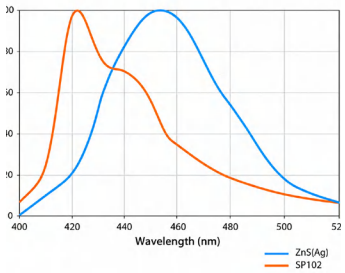
Scintillator Material	SP121 Plastic Scintillator	Detection	Alpha; Beta; Alpha+Bata
Amplifier	Multi-stage voltage amplification	Pulse Screening	Voltage screening + hardware anti-compliance
Output of Preamplifier	Tailed pulse or Quasi-Gaussian pulse	Detector optical window	2 layers 3μm Mylar
Housing	Aluminum housing	Working conditions	Temperature: -25°C~50°C;Humudity: <95%

Plastic Scintillators SP122 for Low-Energy Gamma Ray Detection

- **Fit for low energy γ-ray detection(γ-ray as low as 40KeV)**
- **Polystyrene SP101 Based and surface coated with ZnS(Ag) layer on SP101**
- **Good uniformity and excellent homogeneity**
- **Various shapes and sizes available**
- **ZnS(Ag) coatings with a standard thickness of 8-10mg/cm² and custom thicknesses optional**

SP122 series plastic scintillators are developed by Shalom EO for low-energy γ-ray detection. The substrate of SP122 is our plastic scintillator SP101; a ZnS(Ag) layer is coated on the surface of the plastic scintillator SP101, and the usual thickness of the ZnS(Ag) layer is 8-10mg/cm². Advanced and sophisticated processing is used to make the ZnS(Ag) coating; the final plastic scintillators obtained have excellent homogeneity and uniformity. SP122 can detect γ-rays with energy as low as 40KeV.

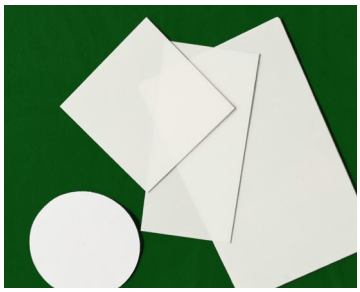
Curve: Light Emission Spectrum



	Parameters	
	SPO01	ZnS(Ag)
Substrate Materials	Polystyrene	ZnS(Ag)
Density(g/cm³)	1.023	4.1
Refractive Index	1.58	
Light Output (related to anthracene crystals)	64%	280%
Emission Peak Wavelength (nm)	423	450
Decay Time (ns)	2.4	200
Operation Temperature Range（°C）	-40~55	-40~55
Thickness of Coated Layer（mg/cm²）		8~10

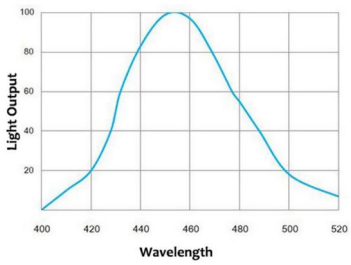
Plastic scintillators SP123 (Equal to EJ442) for Alpha Ray Detection

- **Equivalent to Eljen EJ442**
- **Fit for α-ray detection**
- **Based on PMMA substrates and surfaces deposited with ZnS(Ag) coatings**
- **Excellent homogeneity and uniformity**
- **Various shapes and large dimensions up to 1000mm x 1000mm available**
- **ZnS(Ag) layers with a standard thickness of 4.5mg/cm^2 and other designed thicknesses optional**



Shalom EO offers the SP123 (Equal to EJ442) series plastic scintillators, which are used for α-ray detection. The SP123 plastic scintillators consist of a ZnS(Ag) coating deposited on the surface of Poly Methyl Methacrylate (PMMA) plastic materials, where ZnS(Ag) is used as the scintillation material, with a peak emission at 450nm. The usual thickness of ZnS(Ag) is 4.5mg/cm^2 and the common thickness of PMMA is between 0.1mm to 10mm. SP123plastic scintillators can be made into a large area; sizes up to 1000x1000mm are available. Advanced and sophisticated processing is used to make the ZnS(Ag) coating, which makes the final scintillators have excellent homogeneity and uniformity.

Curves: Light Emission Spectrum

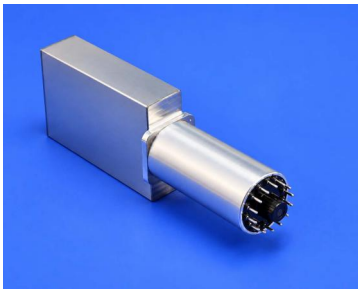


Specification:

	PMMA	ZnS(Ag)
Substrate Materials	PMMA	ZnS(Ag)
Density（g/cm^3）	1.19	4.1
Light Yield (% of Anthracene Crystal)		280
Emission Peak Wavelength (nm)		450
Decay Time (ns)		200
Operation Temperature Range）°C）	-40~55	-40~55
Thickness of Painting Layer（mg/cm^2）		4.5

Plastic Scintillation Detector

- **Custom Plastic Scintillation Detector Assemblies**
- **Optional Configurations: Light Guides, PMT, SiPM, Electronics, Light-tight Wrapping, etc.**
- **Large Light Yield and Fast Response**
- **Ideal for Muon Particle Detection, Gross Gamma Counting, Nuclear Detection, Alpha/Beta Particle Detection, etc.**
- **Large-Dimension Plastic Scintillators in Various Shapes (such as rectangular, cylinder, triangle shaped)Incorporated**



Plastic Scintillation detectors, based on plastic scintillators, feature large light yield, short scintillation time constants, and fast response, in addition to high radiation resistance and stable chemical/mechanical properties. The detectors are optimized for fast-timing detection of Gamma/X-ray radiation, alpha/beta particles, neutrons, nuclear mass measurement, etc.

Shalom EO offers a series of Custom Plastic Scintillation detector assemblies for radiation detection. The Plastic Scintillators could be integrated with various accessories and radiation-collecting components, including light guides, photomultiplier tubes (PMT), light-tight wrappings, radiation-entrance windows, and electronics. The plastic scintillators incorporated into our detectors have the merit of being available in large dimensions and shape variations; hence, the detectors are adept at applications involving gross gamma counting, such as vehicle portal monitors for contamination detection and nuclear safeguard instruments.

The configurations and electronics for the photomultiplier tubes are optional according to your requests, where the detectors could be furnished with voltage dividers, internal high voltage modules, preamplifiers, etc. The other specifications of the plastic scintillation assemblies are all customizable.

Technical Specifications

Products can be manufactured according to individual customer requirements.

PMMA Light Guides for Plastic Scintillation Detectors

- **Immunity to Yellowing for Long-term Usage**
- **Custom Specifications Tailored for Your Scintillation Detectors**
- **Various Forms for Different Cross-sections: Fish-tail, Tapered-cone, Rectangular, Flat Bar, etc.**
- **Compliant with PMT, SIPM, or Other Readout Components**
- **Matches with Shalom EO's Scintillation Detectors**

Light Guides are essential components for transmitting light from the scintillator media and the light collection device (Photomultiplier Tube/PMT or Silicon Photomultipliers/SIPM) in scintillation detectors. There are often two circumstances in which a light guide is utilized: One is when the area of the scintillator is greater than the area of the phototubes, and another is when the cross-sectional shape of the scintillator differs from that of the phototubes.

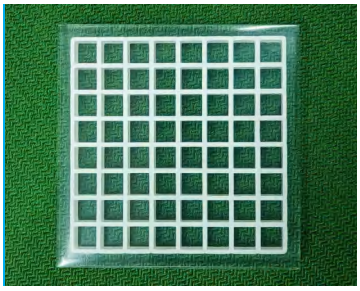
PMMA cast sheet is a common plastic material for manufacturing scintillation light guides. The term PMMA is the abbreviation for Polymethyl Methacrylate, and the material is also known as acrylic plastic; in a commercial context, it is sold under the name Lucite, Perspex, Plexiglas, etc.

Shalom EO offers Custom PMMA Light Guides for Scintillators; all the specifications and parameters can be tailored to optimize your scintillation detectors. Various forms of light guides are available, including fish-tail light guides for a transition from thin rectangular ends to round cross-sections, tapered-cone light guides for coupling of square-to-round ends, or round-to-round cross-sections, with other additional options encompassing rectangular light guides, flat bar light guides, or other custom shapes. Smooth surfaces or reflectors are engaged to exploit total internal reflection. The light guides ensure efficient and uniform transmission, being compatible with PMT, SIPM, or other readout sensors. The cast PMMA material is imported from Germany, featuring high optical transmission, exceptional resistance to UV exposure, high thermal tolerance, and immunity to yellowing for long-term usage. Our PMMA Light Guide Series, used in combination with our Plastic Scintillation Detectors are excellent radiation detection instrument for Gamma detection, nuclear monitoring, and alpha/beta particle detection.

Substrate Material	PMMA	Density	1.19 g/cm^3
Refractive Index	1.49	Fabrication Technique	Cast
Working Temperature	-40 ~ 55ºC		

Plastic Scintillator Arrays & Plastic Scintillator Fiber Arrays

- **Custom plastic scintillator arrays and custom plastic scintillator fiber arrays are available**
- **Plastic scintillator arrays made of our SP101 plastic scintillator material, equal to EJ212 and BC400**
- **Plastic scintillator fiber arrays are delivered with the end faces of the fibers flat and mirrorpolished**
- **Capabilities for plastic scintillator arrays: min. pixel size 3x3mm, min. spacing 6mm**
- **Capabilities for plastic scintillator arrays: pixel size range 0.25 mm~1 mm**



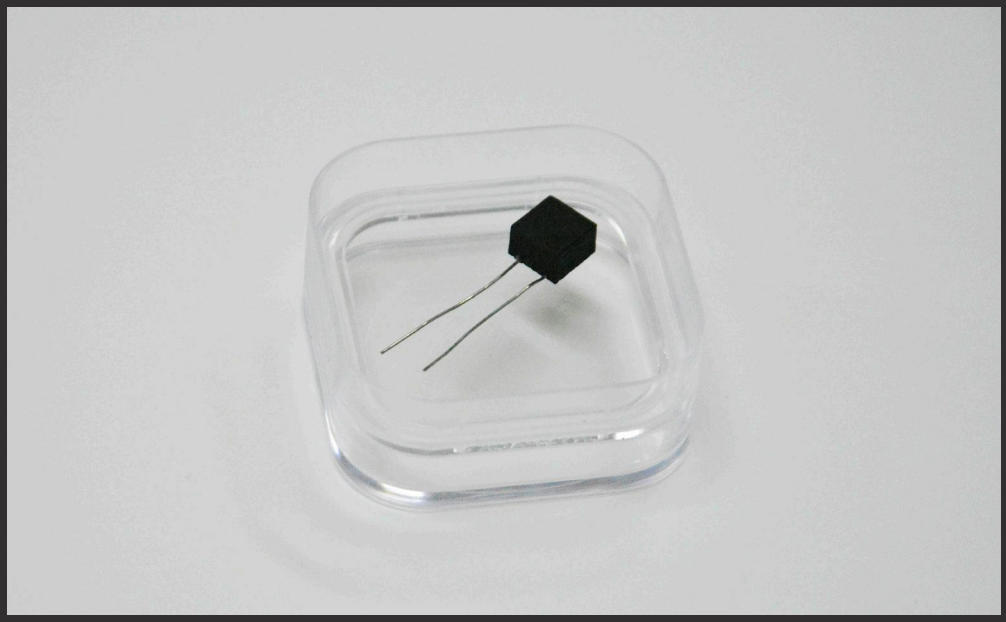
Plastic scintillators are solid solutions of luminophores (or luminescent additives, which are the active ingredients that produce visible light when radiation hits them) in a transparent polystyrene (PST) plastic base (which holds the luminophores). Plastic scintillators have the features of a fast response time, making them excellent for high-speed measurement. Also, plastic scintillators are lightweight and low cost; the light output of plastic scintillators is not as high as NaI(Tl), but sufficient for certain applications. Plastic scintillation arrays are assemblies of multiple plastic scintillator elements arranged in a grid or matrix. Each separate scintillator unit (called a pixel) in the array emits light when it interacts with ionizing radiation (such as gamma rays, beta particles, or neutrons) and offers spatial discrimination of the signals. Plastic scintillator arrays are especially useful for detecting radiation when spatial resolution or position-sensitive detection is important.

Plastic scintillator fibers (PSF) are thin, flexible optical fibers made from plastic scintillator material. A plastic scintillation fiber consists of a core made of plastic scintillator material doped with luminophores; the core is where the scintillation (light emission) happens; and a cladding made of materials with a lower refractive index that surrounds the core, the cladding ensures total internal reflection, guiding the emitted light along the fiber toward a detector. Plastic scintillator fiber arrays are structured arrangements of scintillating fibers. Each fiber acts as a miniature, individual light guide, and the entire array can provide detailed information on the position, timing, and intensity of incoming radiation.

Shalom EO provides SPA101 series plastic scintillator arrays and SFA100 series plastic scintillator fiber arrays.
Shalom EO's SPA101 plastic scintillator arrays are custom plastic scintillator arrays developed based on our SP101 plastic scintillator, which is equivalent to EJ212 and BC400, optimized for the detection of gamma-rays, x-rays, and muons. Our flexible production capabilities allow the customization of the product specifications, including the number of scintillator pixel units, where the minimum pixel size is down to 3×3 mm, and the minimum distance between adjacent pixels is 0.5mm. About the thickness, when a single pixel is smaller than 6×6 mm, the thickness is typically between 2mm and 5mm; beyond this limit, it is not easy to realize.
Shalom EO's SFA100 plastic scintillator fiber arrays are custom plastic scintillator products composed of plastic scintillation fibers. The plastic scintillator fiber array can be constructed by any numbers of scintillator units according to the user's request, where the pixel size is down to diameter 0.25mm and up to 1mm, with the spacing between scintillation fibers typically being 0.5mm. The thinnest thickness for the plastic scintillator fiber is 10mm. About the finishing, the end faces of the scintillator fibers are all flat and mirror polished.

Density (g/cm^3)	3.67	Melting Point (K)	924
Cleavage Plane	<100>	Hardness (Mohs)	2
Hygroscopic	Yes	Refractive Index at Emission Peak	1.85
Emission Peak Wavelength (nm)	415	Decay Time (ns)s	250
Light Yield (photons/keV)	38		

CZT Detectors



CZT (Cadmium Zinc Telluride) detectors, based on single-crystal CdZnTe, are semiconductor radiation detectors designed for high-efficiency X-ray and gamma-ray detection with excellent energy resolution.

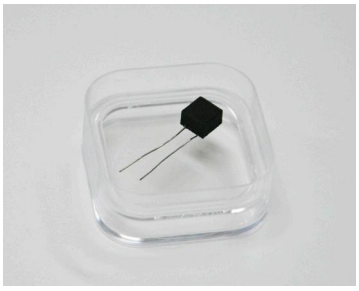
Unlike conventional scintillation detectors, CZT detectors directly convert incident radiation into electrical signals, eliminating the need for scintillators and additional optoelectronic conversion devices such as photomultiplier tubes. This enables compact detector designs, fast response, and low electronic noise.

With their high atomic number and high density, CZT detectors provide efficient absorption of high-energy photons. They also offer excellent energy resolution at room temperature, without the cryogenic cooling required by some semiconductor detector technologies. In addition to X-rays and gamma rays, CZT can be used for direct detection of alpha and beta particles in suitable detector configurations.

Combining room-temperature operation, high detection efficiency, good energy resolution, fast response, and compact size, CZT detectors are well suited for applications including medical imaging, nuclear physics, radiation monitoring, security inspection, and nuclear spectroscopy.

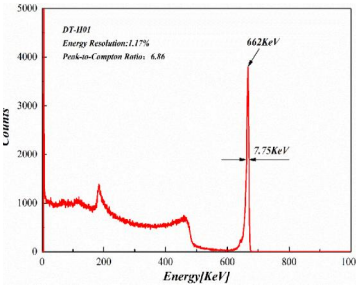
CZT (CdZnTe) Hemispherical Detectors (CZT-HM01 Series)

- **Fit for X-ray and medium-high energy gamma ray detection**
- **Special electrode (AU) design**
- **Operating at room temperature and High energy resolution**
- **Short response time and Stability for long period operations**
- **Main applications: space probes, industrial inspections, nuclear science and technology, homeland security, environment detections**



CdZnTe hemispherical detectors, or CZT half-spherical probes, are specially electrode-designed detectors. By the special design, which is based on potential theory, the "sensitive area" of the CZT detectors is hemispherical, and then the influence of the hole on the signal can be reduced, which makes the CdZnTe hemispherical detectors can measure high-energy rays with high energy resolution; the energy resolution is better than 3% for the 137 cs @ 662 keV gamma rays.

Shalom EO provides the CZT-HM01 series CZT (CdZnTe) hemispherical detectors, which can be used for X-ray and medium- to high-energy gamma-ray detection. With excellent energy resolution, this detector is widely applied in nuclear science and technology, homeland security, environmental detection, space probes, and industrial inspection, etc.



Materials	CdZnTe		
Density	5.8 g/cm³		
Volume Resistivity	5.8 g/cm³		
Electrode	Au		
Size	5.0(±0.1)×5.0(±0.1)mm²	10.0(±0.1) ×10.0 (±0.1)mm²	15.0(±0.1) ×15.0 (±0.1)mm²
Thickness Tolerance	2.5(±0.05)mm	5.0(±0.05)mm	7.5(±0.05)mm
Storage Temperature	10°C-40°C		
Storage Humidity	20%-80%		
Operating Temperature	0°C-40°C(standard), -20-40°C(Tailor-made)		
Energy Range	10KeV(beryllium window)-3MeV		
Energy Resolution(22°C)	<3%@662KeV		

CZT (CdZnTe) Hemispherical Detectors (CZTDT-01C1 Series)

- **Energy Range 10KeV-3.0MeV (Model Selection Available), Energy Resolution <2.0%137Cs, 662V (Model Selection Available)**
- **Simple operation and ease of use**
- **High Energy Resolution, Optimized for accurate energy measurements**
- **Compact Design: Small size with lightweight construction for easy handling**
- **Stable operations at room temperatures**
- **Low Power Consumption**

ΓCadmium Zinc Telluride (CdZnTe, CZT) is a semiconductor material known for its high energy resolution, high atomic number, and room-temperature operation. Unlike conventional NaI(Tl) scintillation detectors coupled with PMTs, CZT detectors directly convert incident radiation into electrical signals, enabling compact and efficient detector systems.

Shalom EO's CZTDT-01C1 High-Energy Resolution CZT Hemispherical Detector is designed for precise X-ray and gamma-ray spectroscopy. It combines a hemispherical CZT crystal with a low-noise charge-sensitive preamplifier, providing stable signal acquisition and high-resolution energy measurement.

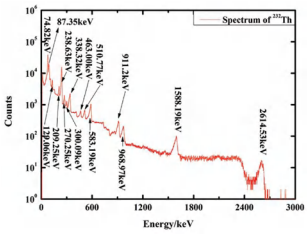
Multiple CZT crystal dimensions are available to meet different detection requirements. The compact design and low power consumption make the CZTDT-01C1 suitable for both laboratory and field applications.

Applications:

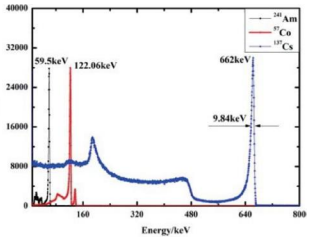
· Radiation monitoring and public safety
· Environmental radiation measurement
· Nuclear science and spectroscopy
· Medical radiation detection
· Industrial inspection

Graphs:
The CZTDT-01C1 detector highlights outstanding spectral performance, precisely discriminating between different radiation sources. Its energy spectrum analysis capabilities include isotopes such as 241Am, 57Co, 137Cs, and 232Th. The graphs below demonstrate the outstanding performance of Shalom EO's CZTDT-01C1 high-energy resolution CZT (CdZnTe) Hemispherical Detectors to deliver clear and high-resolution detection results across a wide range of energy levels.

1. The energy spectrum of CZTDT-01C1 CZT (CdZnTe) Hemispherical Detectors under 232TH



2. The energy spectrum of CZTDT-01C1 CZT (CdZnTe) Hemispherical Detectors under 241Am, 57Co, 137Cs



Power Consumption	0.4W	Power Supply	±12V
Output Impedance	50Ω	Operating Temperature	0°C to 40°C (for standard products) -20°C to +40°C (for custom products)
Energy Resolution	<2% @ 137Cs, 662 keV	Energy Range	10 keV (integrated with Be windows) to 3 MeV
Integral Nonlinearity	10 keV to 1.3 MeV <0.5%; 10 keV to 3 MeV <1.0%	Operating Environment	Non-condensing: 0°C to 40°C (<4% humidity) Adjustable conditions: -20°C to +0°C (<5% humidity)
High Voltage Input	DC+800V@5×5×2.5mm CZT DC+900V@10×10×5mm CZT	Crystal	10x10x5mm/5x5x2.5mm Hemispherical CZT
Signal Output	Exponential Decay Signal, Tr < 150 ns	Connection	5-Core Connector
Peak Drift Under Different Temperatures	<4%@0°C~40°C <5%@-20°C~0°C	Peak Drift over 8h	<1%
Size	ϕ30 × 57 mm	Weight	≤60g

RIID Radiation Detectors & Multi-channel Analyzers

Handheld Gamma Spectrometers (RIID)

Shalom EO's handheld Radioisotope Identification Devices (RIID) are based on NaI(Tl) or $LaBr_3$(Ce) scintillation detectors, combined with Geiger-Müller (GM) counters for radiation monitoring. Designed for field use, these compact instruments support gamma dose-rate measurement, radioactive source search, and rapid isotope identification. They are suitable for applications in nuclear facilities, radiation safety, emergency response, security inspection, and research laboratories.

Multichannel Analyzers (MCA)

Shalom EO's base-mounted Multichannel Analyzer (MCA) is compatible with 14-pin PMT sockets, including the E687-14W. It provides up to 4096 channels for gamma spectroscopy and supports Power over Ethernet (PoE) for simplified power and data transmission.

The integrated software features automatic spectrum stabilization, while the available API supports secondary development and system integration, making the MCA suitable for both standalone detector systems and customized radiation measurement platforms.

Handheld Radioisotope Identifier

- **NaI(Tl) or $LaBr_3$(Ce) detector options**
- **High-resolution gamma spectroscopy**
- **Dose-rate measurement up to 1 Sv/h**
- **Automatic energy calibration and real-time spectrum**
- **stabilization Editable radionuclide library**
- **Audio and visual alarms**
- **Large-capacity spectrum data storage**
- **Rugged IP65 enclosure**

Shalom EO's Handheld Radioisotope Identifier (RIID) integrates gamma spectroscopy, dose-rate measurement, radioactive source search, and isotope identification in a single portable instrument. The system is available with NaI(Tl) or $LaBr_3$(Ce) scintillation detectors coupled with SiPMs for gamma-spectrum analysis, together with a Geiger-Müller (GM) tube for monitoring and alarming at high dose rates.

The RIID performs real-time gamma-ray spectroscopic analysis to identify characteristic energy peaks from different radionuclides. Advanced digital filtering algorithms improve the effective energy resolution and help distinguish closely spaced or overlapping peaks. At 662 keV, the energy resolution can reach approximately ≤6% for NaI(Tl) and ≤2% for $LaBr_3$(Ce).

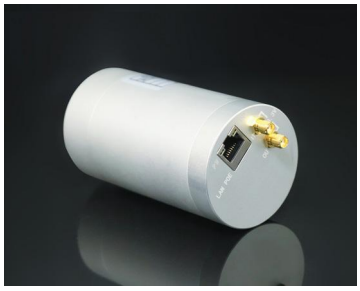
For isotope identification, the system incorporates a pre-programmed radionuclide library covering 4 categories and 16 isotopes, while allowing users to edit and expand the library for specific applications. Unknown nuclides can trigger audio and visual alarms. Automatic energy calibration and real-time adaptive spectrum stabilization help maintain stable performance during long-term operation and changing environmental conditions.

Designed for field operation, the handheld RIID features a compact housing, IP65 protection, battery-powered operation, and a continuous working time of at least 8 hours. Monitoring data and full-spectrum records can be stored in the device and transferred to a computer for further analysis and report generation.

Detector	NaI(Tl) or $LaBr_3$(Ce) + SiPM; GM tube	Data Storage	≥10,000 full-spectrum records
Energy Resolution @ 662 keV	≤6% NaI(Tl); ≤2% $LaBr_3$(Ce)	Communication	RS-232 / USB 2.0 / Ethernet / Wi-Fi
Energy Range	25 keV–3 MeV	Continuous Operation	≥8 h
Dose Rate Range	0.1 μSv/h–1 Sv/h	Protection	IP65
MCA Channels	1024 / 2048 / 4096	Operating Temperature	−40 to 55°C
Isotope Identification	≥4 categories, 16 isotopes	Crystal Size	1.5" × 1.5"
Identification Time	≤30 s*	Weight	≤2.5 kg

Tube Base Multi Channel Analyzer (MCA)

- **Integrated PMT base, high-voltage module, preamplifier, and MCA**
- **Compatible with NaI(Tl), $LaBr_3$(Ce), $CeBr_3$, and SrI_2 detectors**
- **Compatible with E687-14W 14-pin PMT base**
- **1024 / 2048 / 4096 channels**
- **FPGA-based digital signal processing**
- **Ethernet with PoE**
- **Built-in oscilloscope for real-time monitoring**
- **Automatic spectrum stabilization**
- **Software API for system integration and secondary development**
- **Support for waveform, gamma-spectrum, and activity analysis**



Shalom EO's Tube Base Multichannel Analyzer (MCA) is designed for scintillation detector systems and integrates a PMT base, high-voltage module, preamplifier, multichannel pulse analyzer, Ethernet interface, and dedicated software in a compact unit. It is compatible with NaI(Tl), $LaBr_3$(Ce), $CeBr_3$, and SrI_2 scintillation detectors, as well as the E687-14W 14-pin PMT base.

The MCA supports 1024, 2048, or 4096 channels for gamma spectroscopy and employs FPGA-based digital signal processing, including digital trapezoidal shaping, fast shaping, pile-up rejection, and automatic baseline recovery. These functions help improve signal quality and support accurate pulse-height analysis for energy-spectrum measurement.

An RJ45 Ethernet interface with Power over Ethernet (PoE) enables power supply and digital data transmission through a single cable. Acquired pulse data can be transferred to PC software for waveform analysis, gamma-spectrum analysis, and activity calculation, simplifying detector system integration and remote operation.

The accompanying software supports energy-spectrum acquisition and analysis, nuclide analysis, automatic spectrum stabilization, parameter configuration, and automated measurement. A software API is also available for secondary development, multi-unit integration, and customized detector systems.

Communication mode	Ethernet (PoE)	Trapezium parameter adjustment range	Rising edge: 50ns~5us; Flat top: 50ns~5us
Applicability	E687-14W 14-pin tube base photomultiplier	Gain control	0.25~10
Power consumption	<2w	Integral nonlinearity	<±0.05%
HV range	0~±1250V	Differential nonlinearity	<±0.1%
Conversion gain	1024/2048/4096 channels can be set	Maximum input pulse frequency	200kcps
ADC resolution	12Bit	Maximum channel capacity	Nmax = 2^32 -1
ADC sampling frequency	20/40/65/80MHz	Operating ambient temperature	-40°C~60°C
Signal processing mode	Digital trapezoidal forming	Storage ambient temperature	-40°C~70°C
Forming time	150ns~15us	Overall dimensions	Φ67 m x 110 mm
Mass	250g		

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