



Product name: Opal™
El-Mul PN: 1100-O-0000

Opal is a multi-segment detector for scanning transmission electron microscopes (STEM). The detector is a segmented diode, with option to include up to 16 segments. Segmentation may include BF, ABF, ADF and HAADF, all on one plane and in the same detector, thus maximizing utility and reducing hardware costs.

Exact segmentation geometry may be defined by the customer, providing maximal flexibility in adapting the design to the user's experimental needs. Potential applications include DPC, imaging of light elements, imaging of strain, Z-contrast, tomography and others. To enhance SNR the detector includes an in-vacuum preamplifier for every segment and respectively up to 16 analog output channels.

The Opal detector is intended for high energy STEM applications (60-300keV).

Product Description

The Opal detector comprises a segmented, PIN silicon diode sensor, a preamplifier for each segment and a retraction mechanism.

The sensor is sensitive to high electron energies (60-300keV). Sensor's segmentation can be adapted and defined for each individual detector according to the customer's needs. The detector supports up to 16 segments, with or without a central (BF) segment and almost any annular and angular design.



Illustration of possible geometries

The detector is sensitive to single electrons, even in the outer-most segments.

Pre-amplifiers are assembled on a PCB, close to the sensor in order to reduce parasitic noise. The number of pre-amplifiers and output channels is defined according to the number of segments in the diode.

Sensor and pre-amplifiers are positioned on a pneumatic retraction mechanism. For systems in which another detector or camera are installed opposite the Opal detector, an additional pneumatic module is available to prevent simultaneous insertion and protect both detectors from collision.

The mechanical interface is designed to fit the Gatan 806 port (other interfaces are possible).

Cables between the detector and the customer's electrical interface can be provided upon request.

Functional Specifications

| Parameter | Value | Units | Comment |
|-----------------------------------|-------|-------|---|
| Sensor max. outer diameter | 32 | mm | Inner segmentation may be defined by user before ordering |
| Sensor min. central hole diameter | 0.2 | mm | If applicable |
| Diode gain | >0.20 | A/W | for 60-300 keV electrons energy range |
| Pre-Amplifier Gain | <200 | kΩ | Maximum gain to comply with bandwidth requirements |
| Detector leakage current | 10 | nA | per segment |
| Bandwidth | 1 | MHz | |
| Pre-Amplifier noise RMS | <1 | mV | At 1 MHz with Rf=200 kΩ |
| Cross talk | <2 | % | |
| Output impedance | 50 | Ω | |
| Max. sensor bias | 100 | V | Typical: 40V |
| Pre-amp supply voltage | ±6 | V | |

System Operating Parameters

The Opal detector is designed to operate under system's operating parameters as detailed in the table below.

| Parameter | Value | Units |
|----------------------|---------|-------|
| Primary Beam current | 10-2000 | pA |
| Primary Beam energy | 60-300 | keV |
| Operating vacuum | < 5E-6 | Torr |
| Maximal temperature | 70 | °C |

Environment, Health & Safety

- The Opal detector contains shields that prevent emission of high energy radiation outside the vacuum chamber
- The Opal detector is RoHS compliant