

iXmini

Portable miniature X-ray source as a non-radioactive detector calibrant



Incoatec offers the iXmini, a portable miniature X-ray source for detector calibration. It comprises an X-ray tube with an Fe or Cu anode. The iXmini can be used for performing reliable flat field calibrations, making fluorescent metal foils and calibrants based on radioactive isotopes obsolete in your lab. With the iXmini, this calibration can now be done autonomously, even when there is no other X-ray source available, e.g. during downtime periods at synchrotrons. It's also a simple and easy-to-use source for the regular checks of your radiation detection systems.

iXmini features and benefits:

- Non-radioactive calibrant
- No special storage or handling permit needed as required for radioactive sources
- Simple and safe operation
- Operation in low level vacuum possible (down to 10^{-2} - 10^{-3} mbar)
- Small footprint with a size of 103 x 120 x 89.5 mm³
- Integrated HV generator and safety controller
- Two independent safety lines for integration in an interlock system
- Maximum power of 100 mW with operating parameters 4-10 kV and 2-10 μ A
- Four pre-defined operation modes selectable through a control knob

The portable source iXmini contains a miniature X-ray tube with Fe ($K\alpha = 6.4 \text{ keV}$) or Cu anode ($K\alpha = 8.04 \text{ keV}$). Its main purpose is the detector calibration without the need for a radioactive calibrant or an additional fluorescence foil.



iXmini specifications

Dimension	103 x 120 x 89.5 mm
Weight	ca 1500 g
Supply voltage	DC 24.0 V +/-1V
X-ray tube	metal ceramic, transmission anode
Target material	Iron (Fe) or Copper (Cu) 150 nm on Beryllium window
Typical operational voltage	4.0 – 10.0 kV (anode to cathode)
Maximum power	100 mW

System integration

The iXmini is an open X-ray emitter, which immediately generates radiation, as soon as 24 V DC are switched on, and both interlock lines are closed.

Requirements

The iXmini requires an external 24 V DC power supply which should be fused with 1 A. It does not require any additional cooling.

Power setting

The iXmini offers four pre-defined operating modes with different power settings, which can be selected by a control knob at the top of the iXmini. The intensity of the X-rays emitted will depend on the selected operation values.

X-ray shutter

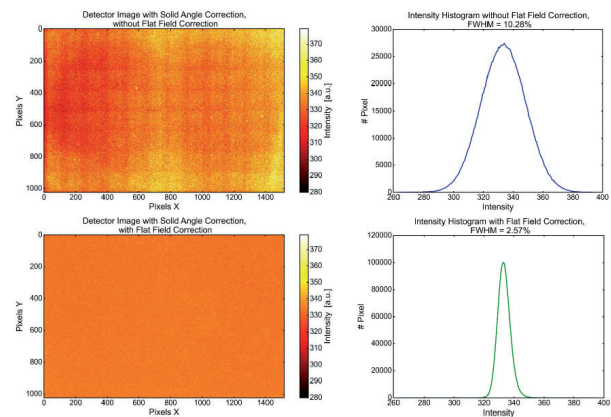
The shutter of the iXmini is manually opened before the power supply is turned on and the interlock is closed and manually closed after the power supply is turned off.

Warning lights

The iXmini has two warning lights, displaying the status "X-RAY ON" and "BEAM ON". During ramp-up, these lights will flash. When reaching full operation power, both lights will shine continuously.

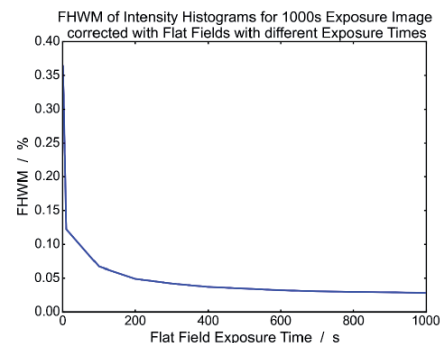
Flat Field Calibration of a CMOS Detector

The iXmini was used for applying flat field calibration of a CMOS detector. The iXmini was operated at 10 kV and 10 μA , using a Cu anode. For the flat field correction, an image with an exposure time of 1000 s was acquired.



Comparison of two 1000 s images, one without flat field correction (top) and one with flat field correction applied (bottom), together with the corresponding intensity variation over the whole image. As can be seen from the histograms, the homogeneity in the intensity distribution is improved significantly by applying the flat field correction.

Further, a set of flat field images was recorded with different exposure times in order to identify the minimum exposure time required for a good correction. The evaluation of this experiment shows that a reasonably good correction can already be achieved with a 600 s exposure time.



Improvement of the intensity homogeneity in dependence of the exposure time of the actual flat field image used for the correction. Reasonable statistics for the flat field correction are already obtained after about 10 min.

