

## Background

InnospeXion has developed, produced and installed a number of shutter systems for X-ray beam closure, since 2002. In 2014, we developed a very fast shutter with opening or closing time less than 10 ms. In 2017, the ultrafast shutter with an opening or closing time less than 1 ms, was developed. Shutters are available up to 300 kVp X-ray radiation. Neutron shutters can be developed relative to specifications (tailored versions).

The need for these shutter systems are typically for quality control of the response time and other conformity parameters in the manufacturing of X-ray scanning detectors.

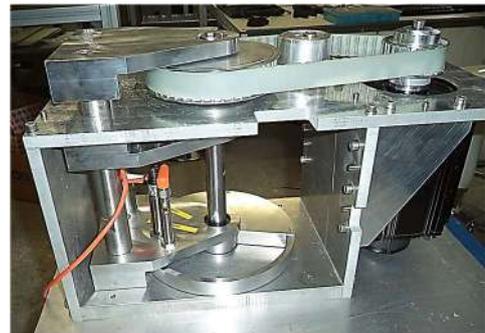
InnospeXion has provided the shutter systems integrated with X-ray cabinet, X-ray source, and mechanics for the positioning of detector boards for measurement, as well as PLC-based control system and user interfaces.



*InnospeXion may provide the shutter system integrated with tailored X-ray cabinet, high stability X-ray source, control system, user interface, and mechanical mounting parts*

## Basic description

The shutter is driven by a dedicated servo motor and moves a lead disc (optionally a Boron containing disc for neutron usage) with a mass of 800 g to open/close a window of 6 x 9 cm. The shutter is fitted with numerous laser sensors to enable that access door can be opened with the beam on. The shutter is entirely controlled from the PLC. The PLC may be externally controlled from a PC or other control hardware. The shutter is designed for mounting close to the X-ray source window, but can be configured for use in e.g. a neutron or other X-ray source beam configuration. The electro-mechanical assembly is made of aluminum, and measures approximately 300 x 300 x 200 mm.



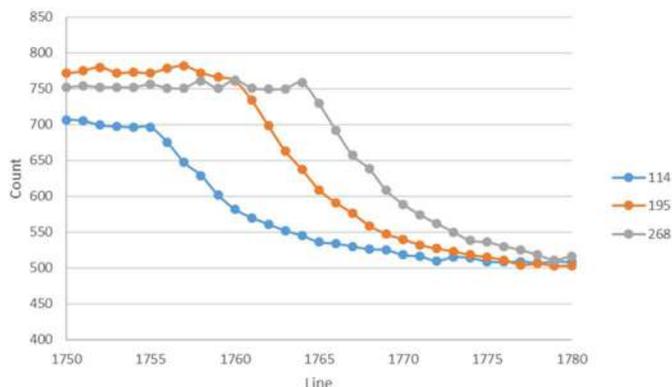
## Control and interface

The shutter is integrated with a safety system, controlled and monitored from a PLC. All control is automatically performed through Udp protocol. Writing to and reading from PLC addresses is accordingly through a DLL. Manual control of the shutter is possible through the PLC control human interface.



## Shutter speed validation

The shutter speed has been validated during the design phase, and confirmed by positioning of fast read out radiation sensitive area detectors in the beam. By profiling, the shutter movement can be traced, which has confirmed an opening or closing speed less than 1 ms. Opening time may be as long as requested.



*Closing time measurements at different positions across the beam. Closing is e.g. computed as  $(1764 - 1755) * 0.1 \text{ms} = 0.9 \text{ms}$ , and is the same for all positions*

## Robustness and radiation shielding

InnospeXion have provided shutter solutions for over 15 years, for industrial 24/7 applications. The shutter electronics and mechanics have been confirmed to be durable, long lasting, safe, and robust. Maintenance and inspection must however be conducted at regular intervals, depending on usage. Bearings and drive belts must be renewed at least annually, and safety components (laser sensors and mechanical contacts) must be inspected at weekly intervals. Radiation shielding of electronics (servo motor) and sensors is necessary in high flux applications where these electrical components may be exposed to radiation.

## Other information

The standard shutter for X-ray radiation (140 kVp) has a delivery time of 6-8 weeks. Tailored versions have delivery times from 8 to 16 weeks, depending on required radiation, design changes needed, special control requests, etc. The shutter may optionally be installed relative to the radiation source. Complete cabinets with integrated X-ray source according to specification may prove cost effective. These complete shutter systems are relevant for industrial usage, in particular. Shutter systems are supplied according to InnospeXion general terms of supply and are warranted for one year from the shipment date.

## Further information

Contact CEO Joergen Rheinlaender, +45 4640 9070, [jr@innospexion.dk](mailto:jr@innospexion.dk).

You are welcome at our new premises: Bjernedevej 25-27, Bjernede, Sorø, Denmark (next to the E20 motorway).



*InnospeXion has moved to larger and more adequate buildings*