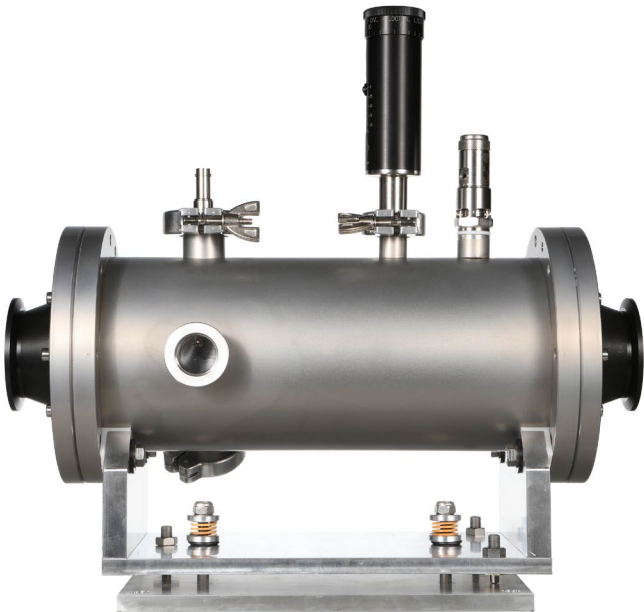


X-Ray Ionisation Chambers System

Based on three variable Gap Parallel Plate Ionisation Chambers



Highlights

Feature	Benefit
Adjustable electrode gap	Allows changing the transition time of charge carriers within the ionisation chamber. Small gaps at constant bias decrease the charge collection time and therefore increase the time resolution, which is of interest for fast EXAFS /XANES
Double-sided aluminised Kapton foils 1 mil (25.4 µm) + 400 nm Al as entrance / exit window	Low x-ray absorption while pressure resistant (up to 2.5 bars / 36 psi)
The PPIC is equipped with two electrically isolating KF endcaps manufactured in PIK	Allows attaching the system to the vacuum pipes of the beamline to minimise airgaps and reduces electromagnetic pick-up through ground loops
The PPIC comprises five half nipple KF25 vacuum flanges	Providing gas filling and resealing capability and low and high voltage electrical feedthroughs.
The readout electrode with a length of 300 mm is confined by a guard ring.	To avoid leakage currents flowing from the high-voltage electrode, and thus ensure low-noise operations
Female BNC connectors	Allows the connection of low-voltage electrodes
SHV connectors	Suitable for high voltage use
SSHV connectors	Suitable for high voltage
Rigid and adjustable (manual three-point adjustment) stands	Allows height adjustments from 10 mm to 30 mm
Frisch grid (optional)	Suppresses the current signal dependency from the vertical beam position and substantially increases the read out speed of the PPIC

Applications

The variable gap parallel plate ionisation chamber (PPIC) is specifically designed for synchrotron radiation based transmission x-ray absorption spectroscopy, and in particular for EXAFS and XANES.

How Does It Work?

The IC consists of two parallel stainless-steel electrodes, which are colinear to the x-ray beam direction and whose vertical gap can be adjusted manually utilising an UHV linear translator. Such a feature is unique for this type of ionisation chamber.

The electrodes and associated mechanics are accommodated in a cylindrical stainless steel vacuum / pressure vessel confined by two stainless steel flanges, that can be evacuated and subsequently filled with an appropriate conversion gas.

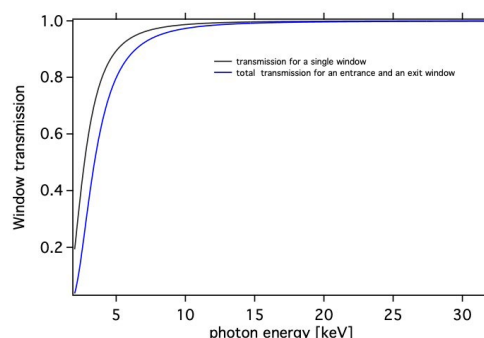
X-rays, which enter the PPIC through its entrance window (1 mil aluminised Kapton foil), travel between the two electrodes at a distance y_0 and will generate ions and electrons in the conversion gas, which drift in the electric field to the respective electrodes thereby generating a measurable photon induced current ΔI , which is given by:

$$\Delta I = \frac{N \cdot e \cdot E_\gamma \cdot y_0 \cdot P}{R \cdot C \cdot d \cdot w_{ion} \cdot P_0}$$

where N is the number of interacting photons of the energy E_γ , e is the electron charge magnitude, R the input impedance of the readout electronics, C is the effective capacity of the parallel plates, d the gap, P and P_0 are the gas pressure in the vessel and the atmospheric pressure (1 bar, 730 torr), respectively, and w_{ion} is the energy required to generate an electron ion couple. The latter is dependent on the conversion gas and typically ranges between 20 eV and 40 eV. Any contamination within the chamber may result in recombination of the charge carriers and will reduce this photocurrent. Since the readout current is directly coupled to the beam position y_0 , stable beam conditions are needed to not falsify the results. To avoid such entanglement between beam intensity (N) and the beam position (y_0), the PPIC can be equipped with a Frisch Grid.

The front and back end flanges accommodate an upstream and a downstream aperture (50 mm (h) x 10 mm (v)) placed symmetrically about the centre axis of the vessel. The vessel

is sealed by double-sided aluminised one mil (25.4 μm) thick Kapton foils (standard), serving as the entrance and exit window for the x-rays. The thickness of the Al layer is 200 nm. Thus the window thickness of each PPIC will be 50.8 μm (plus 400nm Al) or subsequently 152.4 μm (plus 1.2 μm Al) for a system comprising three PPICs. The aluminium cover on the Kapton surfaces serves to avoid the electrostatic charge of the Kapton insulator, which would cause radiation induced distortion of the electric field within the parallel plates.



The x-ray transmission through a single window and a couple of windows (thus an entrance and an exit window) versus the photon is depicted in the figure above.

Available Options

- Frisch grid – a perforated third electrode, which is mounted between the high voltage electrode and the readout electrode.
- The read-out electrode can be separated into two segments to provide some horizontal x-ray beam position sensitivity.

Accessories

The PPIC works best in combination with high voltage power supplies and data acquisition systems developed by Elettra for this device.

In particular the following electrometers are suggested:

- AH401B (works with positive charges, thus the collection of ions, and requires a positive HV)
- AH501B (works with both electrons and positive charges and requires a HV)
- XPi (like the AH401B, the XPi works with positive charges and provides an integrated variable HV power supply up to 2000V)

As for stand-alone HV power supplies, we suggest using the HV-Flex system. Moreover, HV Splitters and HV Low Pass Filters are also available.

See the single product brochures for details.

Specifications

Body material	Stainless steel
Body length	340 mm
Flange diameter	100 mm
Height	380 mm – 400 mm depending on the adjustment of the rigid stand
Window aperture	50 mm (h) x 10 mm (v)
Window material	Double-sided aluminised Kapton foil
Window thickness	1 mil (25.4 μm)
Electrode length	300 mm
Electrode gap	10 – 30 mm
Operating voltage	Up to 3000 V
Working pressure	0.3 – 2.0 bar absolute



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