

Hyperion

Event Based Detector 3D Ion/Electron Imaging

Hyperion captures ion and electron events continuously, combining picosecond timing, noise-free, multi-hit detection, and high-rate readout, with efficient data acquisition for VMI, TOF, and mass spectrometry experiments.

Technology

Hyperion is an event-based ion/electron-imaging detector that records the position, arrival time, and signal intensity of every hit. Powered by Timepix technology, each pixel operates independently and outputs simultaneous Time of Arrival (ToA) and Time over Threshold (ToT) data. With 1.56 ns (TPX3) and 195 ps (TPX4) timing, zero readout dead time, and sustained high-rate acquisition, Hyperion enables 3D momentum imaging, coincidence and covariance analysis, and clearer mass spectra across a broad m/z range.

General Features

- Event-driven readout for continuous, frame-free acquisition
- Simultaneous ToA (timing) and ToT (intensity) per pixel
- Down to ~195 ps time bin resolution; 260 ps external TDC timestamps
- 5 ps RMS with Pico TDC
- High-speed interface for sustained data streaming



Specifications

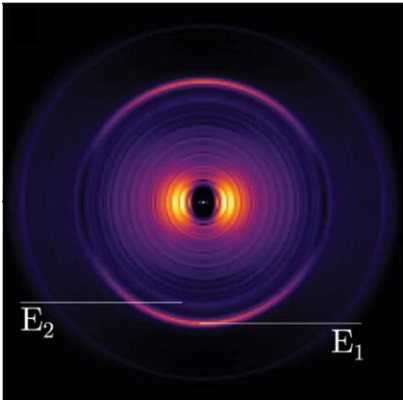
Parameter	Timepix3		Timepix4
Pixel Matrix	256x256	512x512	512x448
Bandwidth (Mhits/s)	80	320	1200
Active Area (mm ²)	14 x 14	28 x 28	30 x 24
Pixel Pitch (μm ²)	55	55	55
Time Resolution	~ 1.56 ns		~ 195 ps
TDC	~ 260 ps	~ 5 ps	~ 260 ps
Event Packet Size	48-bit		64-bit
Energy Measurement	Time over Threshold		
Readout Mode	Data Driven		
Sensor Options	Silicon		

Applications

- * **Velocity Map Imaging (VMI)**
3D ion and electron momentum distributions
- * **Time-of-Flight (TOF) experiments**
Detector-to-laser synchronization with 5 ps TDC timestamps
- * **Coincidence and covariance imaging**
Multi-particle events without frame overlap
- * **Mass spectrometry imaging**
High-SNR ion images across a broad m/z range
- * **Reaction dynamics**
Continuous high-rate acquisition without empty-frame data

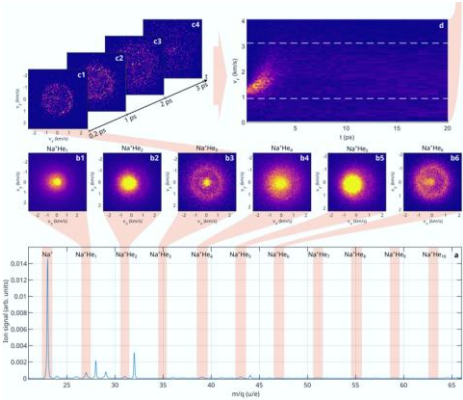
Photo-electron Spectroscopy

Single-Shot image of He(1s) photoelectrons with a repetition rate of 1 MHz.
H. Bromberger *et al.* J. Phys. B (2022)



Reaction Dynamics

Laser induced Columb Explosion Imaging
H. Alberchtsen *et al.*, Phys. Rev A (2023)



Fast Mass Microscopy

Mass Spectrometry Imaging of a Gigapixel Image in 34 Minutes
Körber *et al.*, Anal. Chem. (2022)

