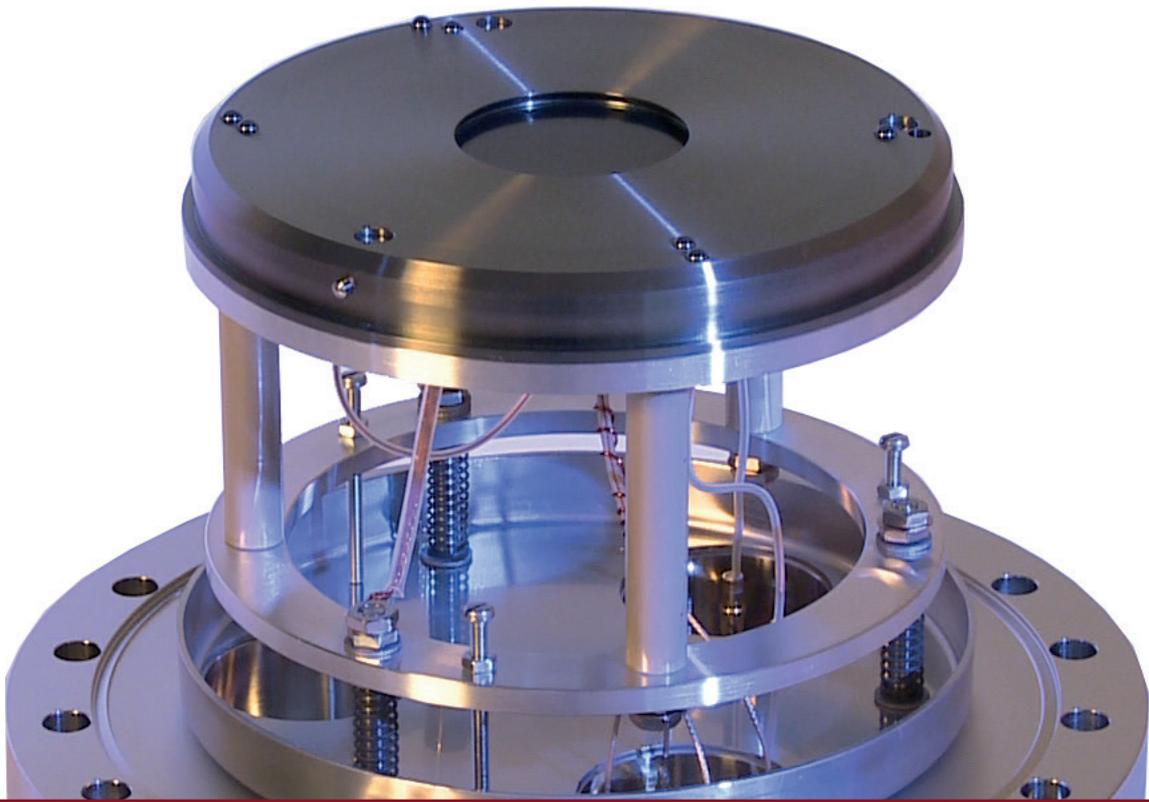


# Delayline Detectors

Imaging Detection of Electrons, Ions & Photons  
with Picosecond Time Resolution

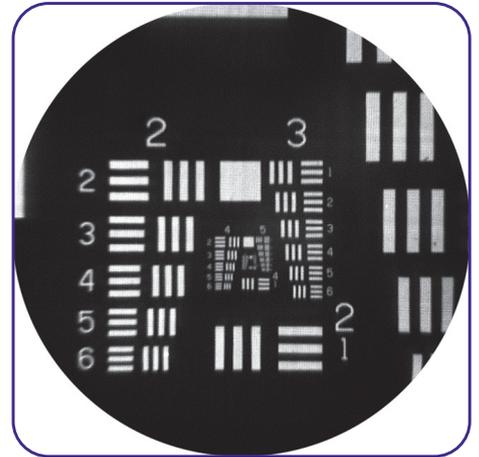


# 3D Detector Systems

## - Imaging Detectors with Time Resolution -

Boost your particle analysis to a new level of high speed measurement. Delayline Detectors are superior particle imagers with excellent temporal resolution, very fast sampling (up to several 10MHz), and 1D/2D/3D histogramming on the fly.

Anyone who aims for permanent, dead time free data streaming will largely benefit from the use of our multidimensional detector layouts.



Imaging of a UV-irradiated USAF 1951 type mask with a 40mm DLD



Delayline Detector DLD4040 R2.55 with 40mm active area

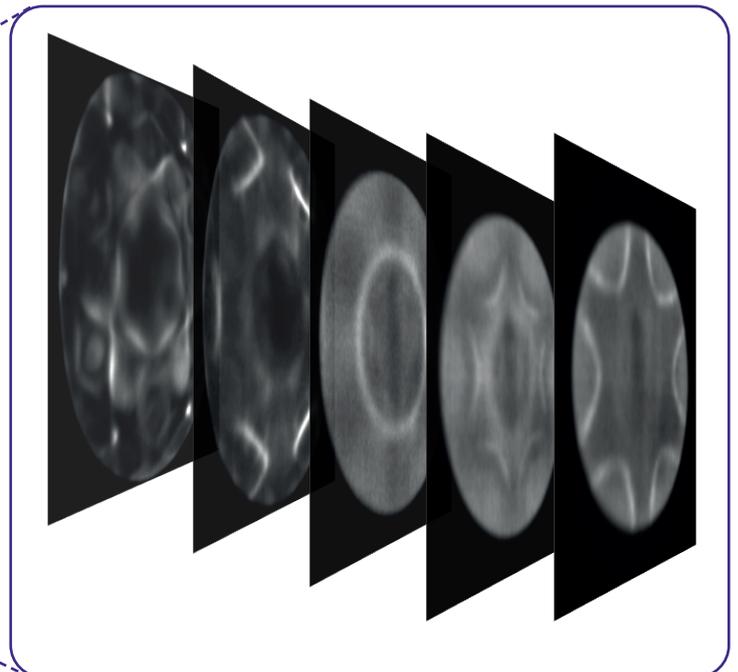
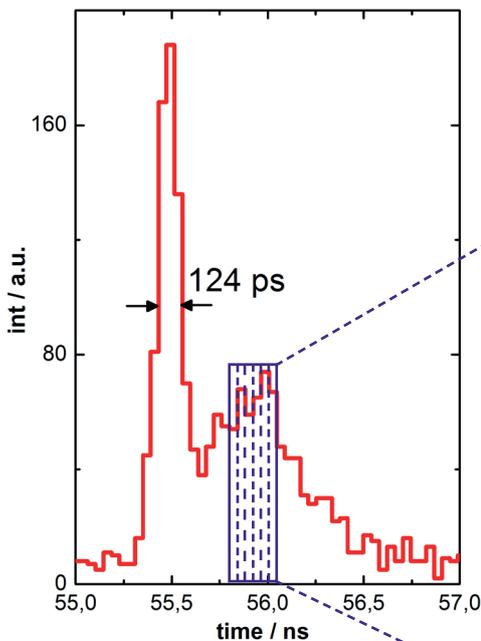
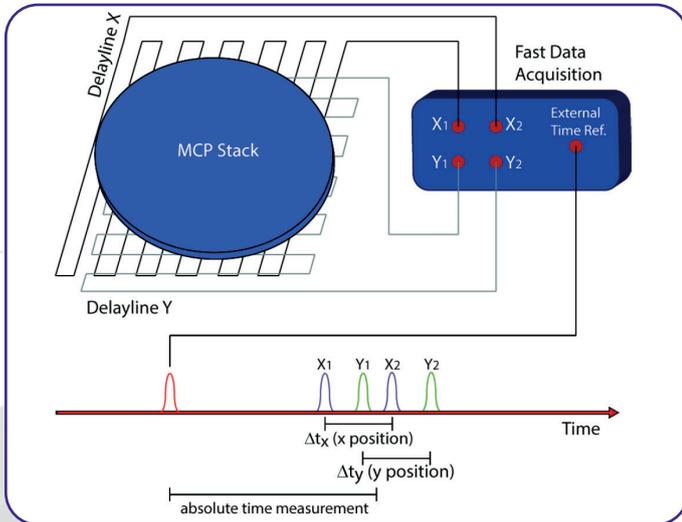


Image time slices measured with a DLD

# Delayline Readout of MCPs - The Technical Approach -



Microchannel-Plate (MCP) detectors provide the highest performance in imaging of electrons, ions, neutrons and photons.

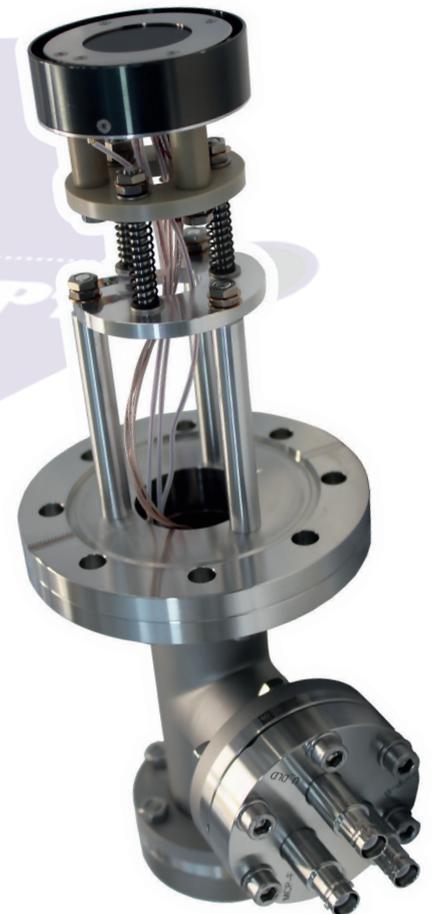
In case the application requires single event analysis, the Delayline readout of MCPs is by far the best choice as the Delayline Detector (DLD) enables true single event counting with excellent signal-to-noise ratio and the highest time resolution.

Delayline readouts are superior among all time resolving MCP readout systems because they deliver time slice images with time windowing down to below 100ps with highest intensity linearity.

Operation principle of a DLD. Charge cloud coupling from an MCP stack into an anode structure delayline arrangement enables the measurement of impact position and time by determining the arrival times of the pulses at the ends of the delaylines.

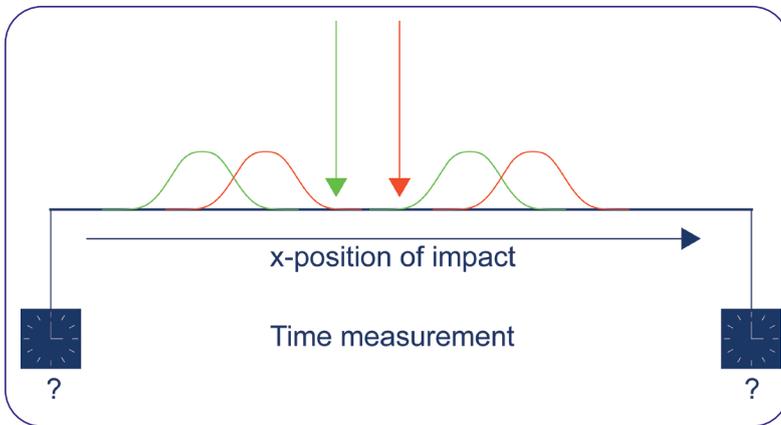
## Key Features

Active Diameters	10mm - 120mm
Lateral Resolution	down to 50µm
Imaging Countrate (Permanent Random)	> 5 million counts/s
Imaging Countrate (Special Layouts)	> 20 million counts/s
Max. Burst Rate	up to 100 million counts/s equivalent
Multi-Hit Designs	>= 4 hits
High Voltage Floating Capability	up to 10kV
Time Bin Resolution	6.8ps
Typical Time Resolution (Position Integrated)	< 200ps
Start Repetition Rate	max. 9MHz
Standard Coms	USB 3.0 & GBit LAN



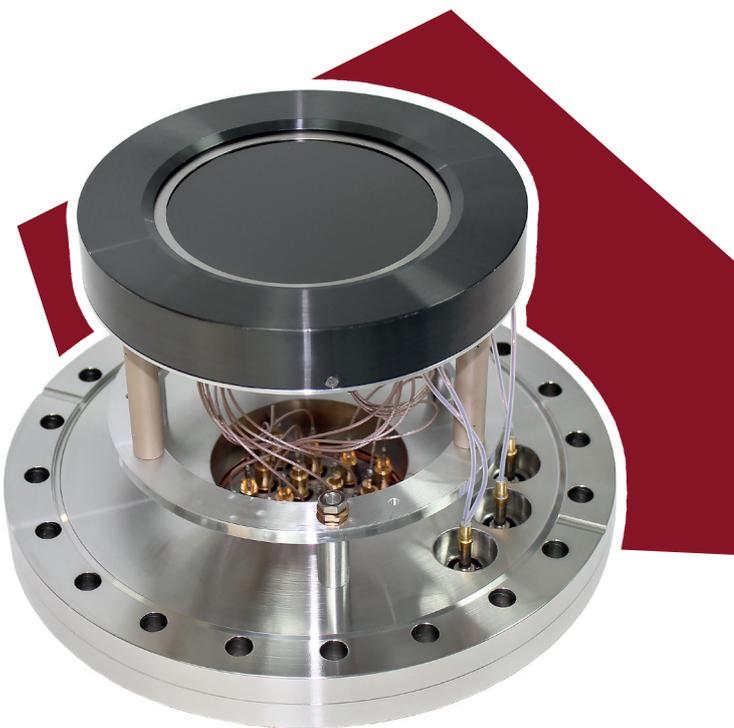
Customer specific solution of a Delayline Detector design

# Segmented Anodes - For Improved Multi-Hit Detection -

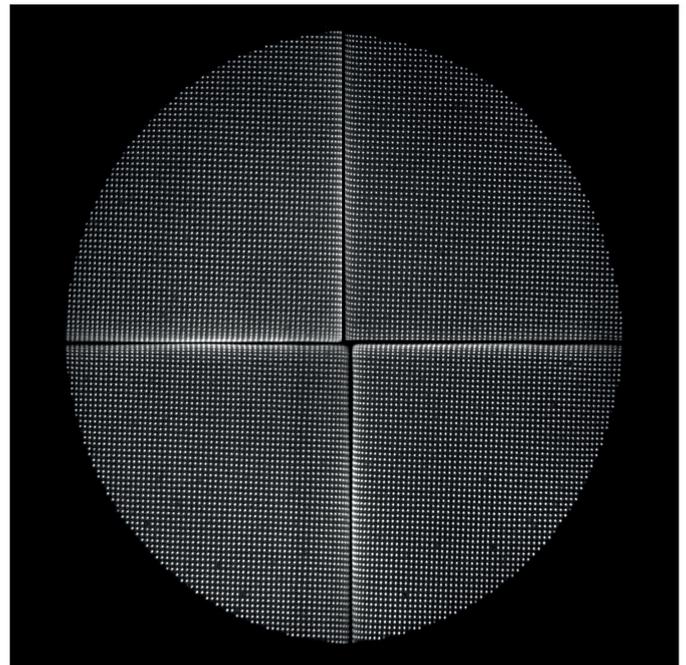


Delayline Detectors feature only a limited Multi-Hit capability due to their event-counting working principle. Two events at the same position and the same time cannot be clearly distinguished.

Therefore Surface Concept provides different types of segmented Delayline Detector anodes (like in 4 quadrants, 8 segments or customer specific segmentation) to improve the **Multi-Hit capability**.



4-fold segmented DLD with 80mm active area



Detector image of a shadow mask recorded with a 4-fold segmented DLD showing the segmentation of the detector anode

## Multi-Hit Concepts

Extensive Multi-Hit capability for novel applications like Free-Electron-Laser science is reached with the **Multi-Line Delayline Detector** by massive parallel segmentation of anodes perpendicular to the image plane with up to **256 single delaylines** which increases the number of detectable Multi-Hits to several tens.

# Delayline Detector Package - Accompanying Readout Electronics -

Our Delayline Detectors do not come as pure vacuum heads but as a complete detector package with accompanying readout electronics of analogue pre-amplifier and constant-fraction discriminator unit (ACU) and time-to-digital converter (TDC) adjusted among each other for the best possible performance of the detector. The package also contains our GUI demo software for detector readout and data saving and additionally on request a high voltage power supply with floating capability.



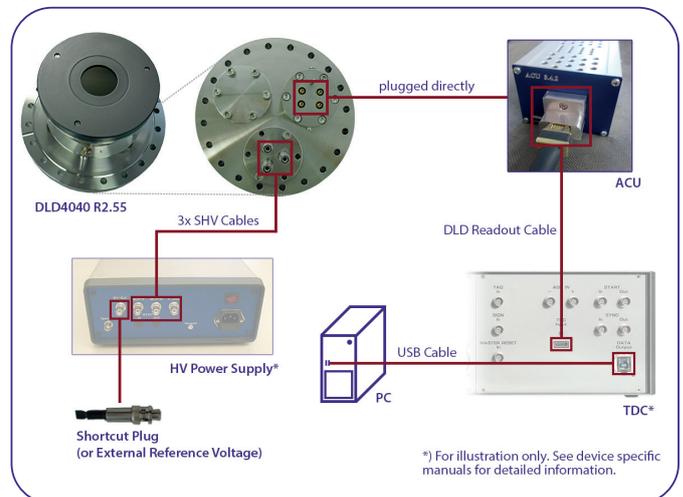
4-channel pre-amplifier and constant-fraction discriminator unit (ACU)



4-channel time-to-digital converter (TDC) with extended I/Os for advanced measurement applications



4-channel time-to-digital converter (TDC) with standard I/Os and integrated High Voltage Power Supply



Cabling scheme of a Delayline Detector package.

# Applications

- Time-of-Flight Analysis of Electrons and Ions (ToF)
- Time Correlated or Coincidence Photon and Particle Imaging
- Gated Imaging for X-Ray and Electron Spectroscopy
- True Counting Imaging with large Areas up to 120mm Detection Size
- Electron Energy and Time-of-Flight Analyzers (XPS, UPS, EELS)
- Time-of-Flight Photoemission Electron Microscopy (ToF PEEM)
- Medium Energy Ion Scattering with Time-of-Flight Analysis (MEIS ToF)
- Atom Probe Tomography / Microscopy (APT, 3D-AP)
- X-Ray Absorption / Emission Spectroscopy (XAS, XES)
- X-Ray Picosecond Imaging by Means of Time Gating for Contrast Enhancement
- Fluorescence Lifetime Imaging (FLIM, FLIM-FRET)



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..... **CONCEPT**