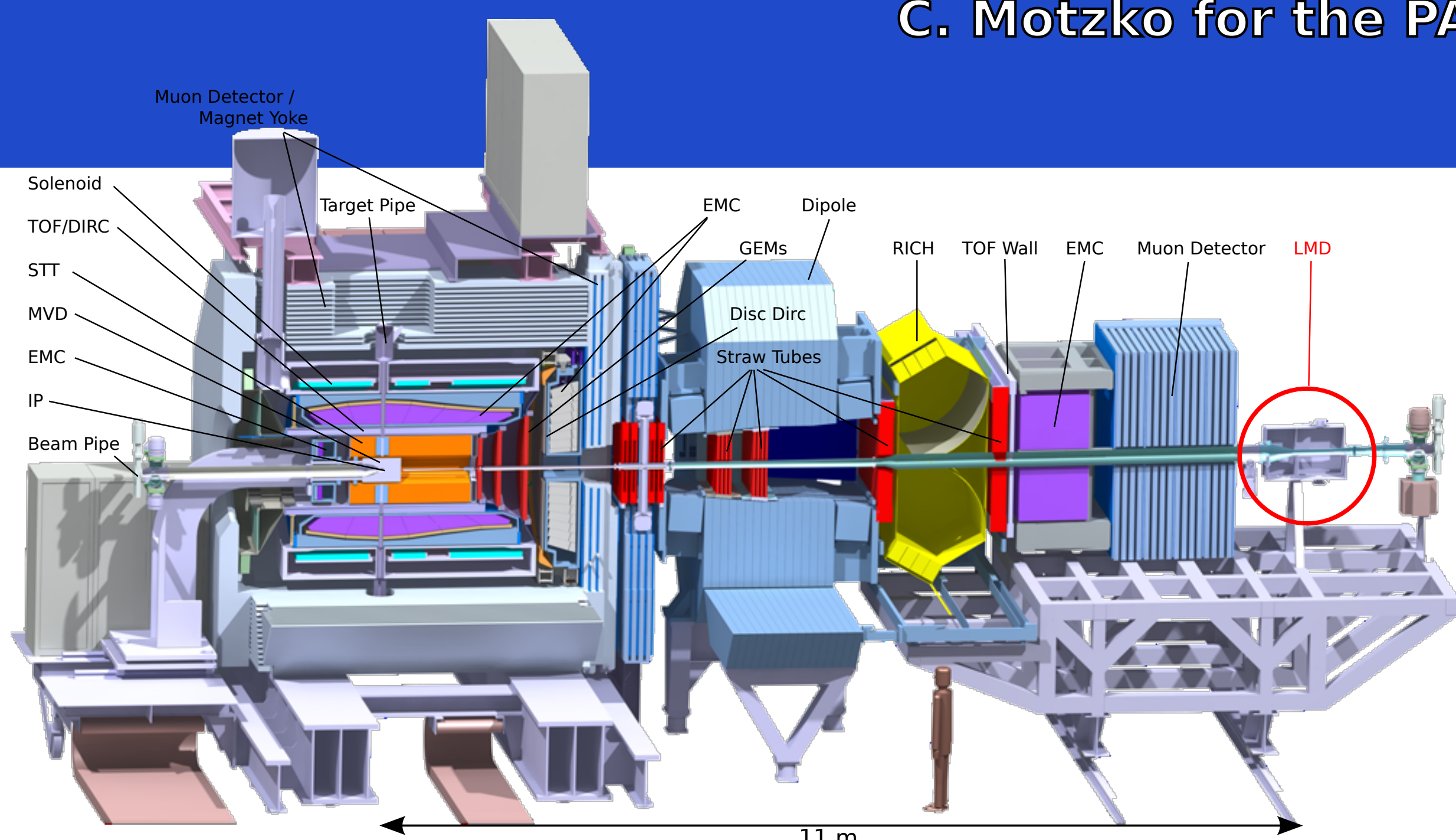


High Voltage Monolithic Active Pixel Sensors for the PANDA Luminosity Detector

C. Motzko for the PANDA Luminosity Group



Luminosity determination at PANDA

Measurement by normalization to the elastic antiproton proton cross section at very small scattering angles ($\Theta = 3 - 8$ mrad)

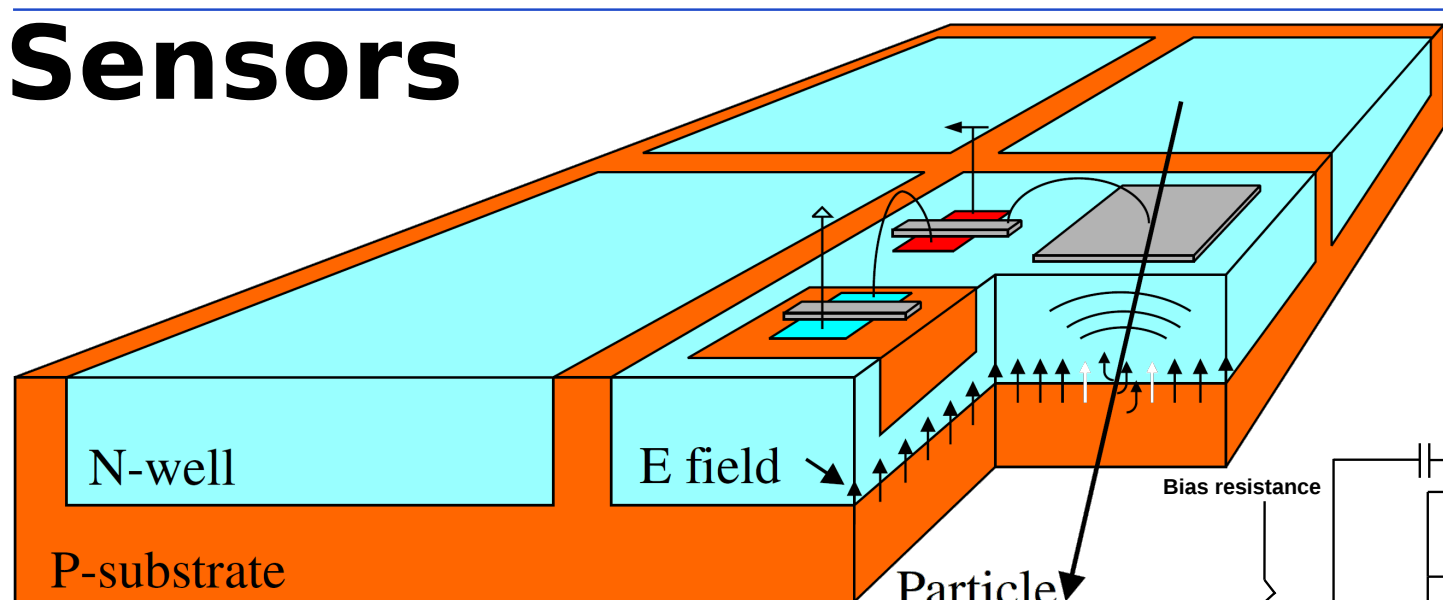
Reconstruction of tracks via 4 detector planes

Backtracking to interaction point through complex magnetic fields

Requirements

- High angular resolution
- Low material budget
- Measurement at smallest angle
- Minimal distortion of the beam

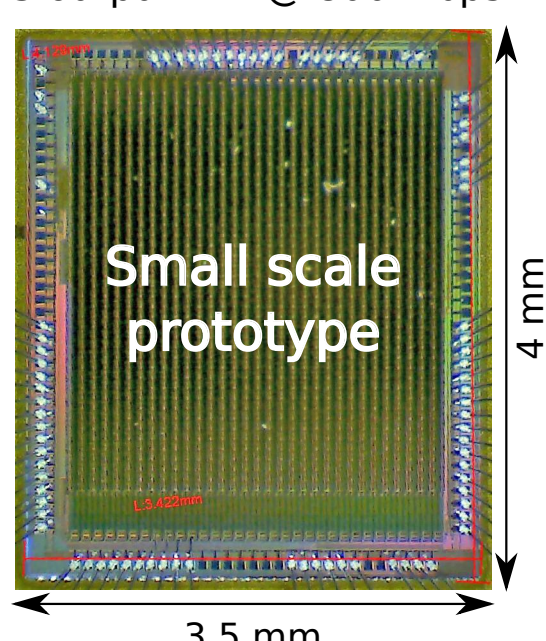
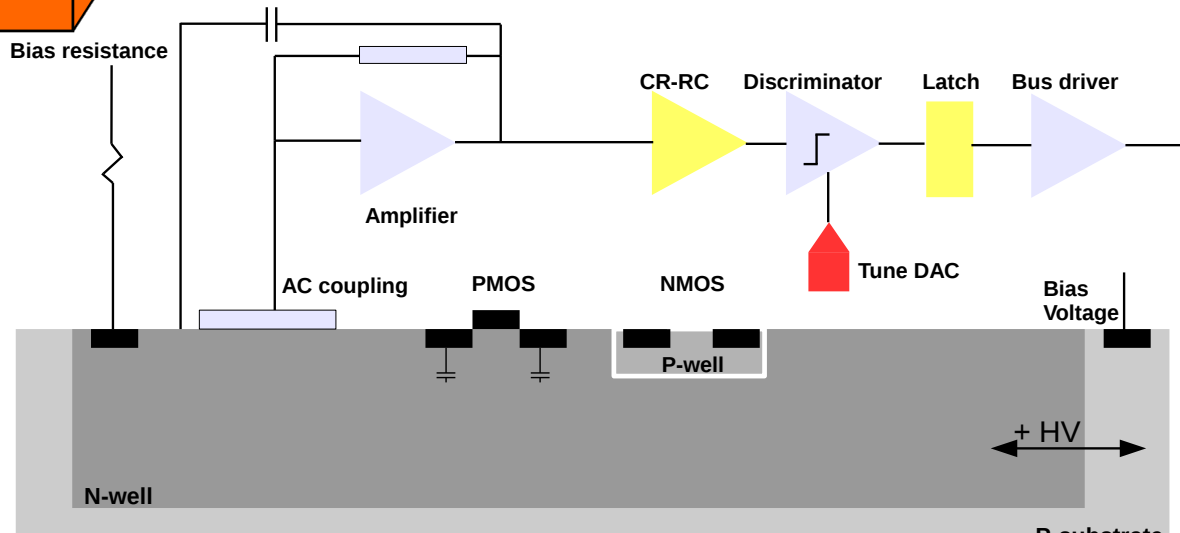
Sensors



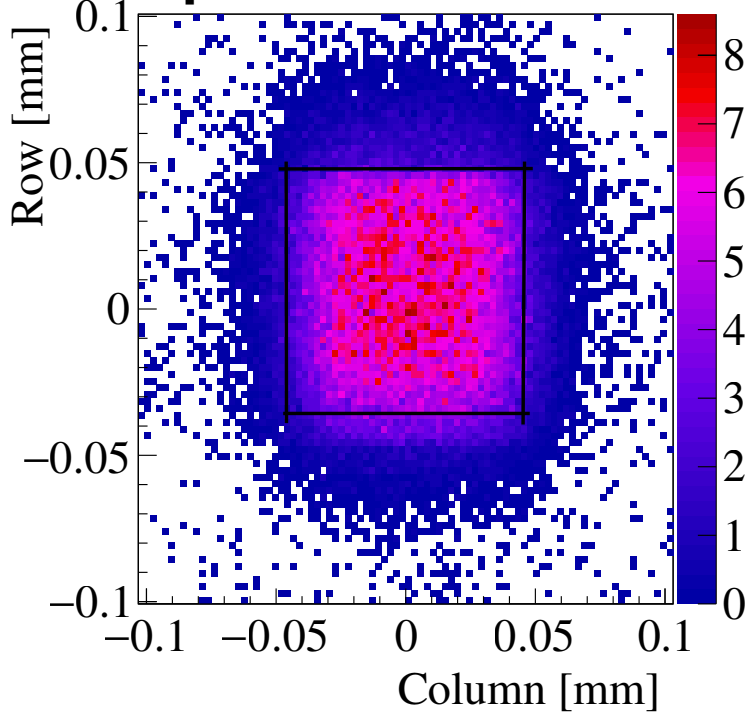
High Voltage Monolithic Active Pixel Sensor

- Industrial HV-CMOS standard (180 nm)
- 2x2 cm², thinned to 50 μ m
- Pixel size: 80 μ m x 80 μ m
- ~50 V bias voltage for
- Fast charge collection (< 1ns)
- Enhanced depletion zone (~10 μ m)

In pixel amplification
Analog and digital readout integrated:
- Each hit converted on-chip into pixel address and time-stamp
- Zero suppressed data sent through LVDS output link @ 800 Mbps

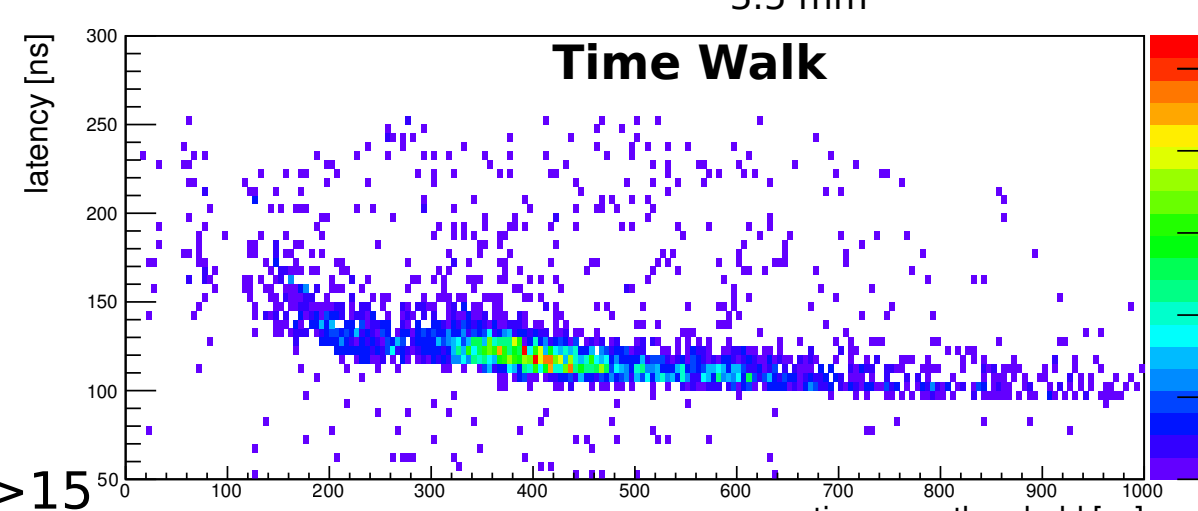


Spatial Resolution



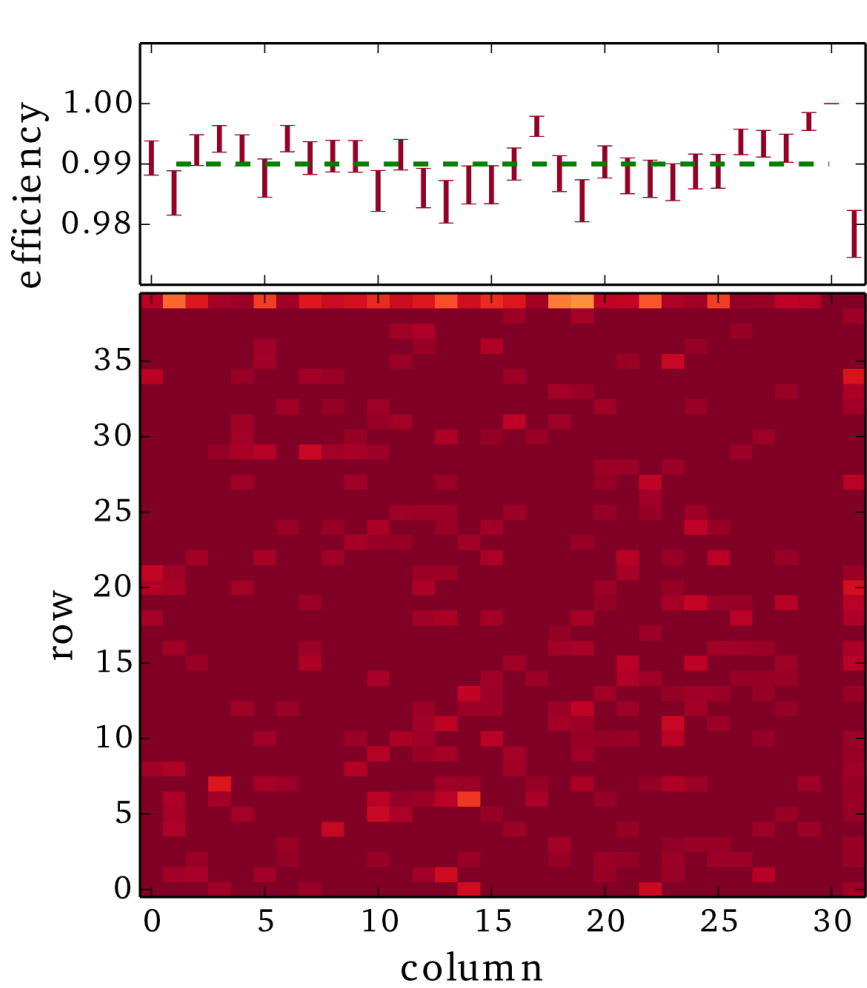
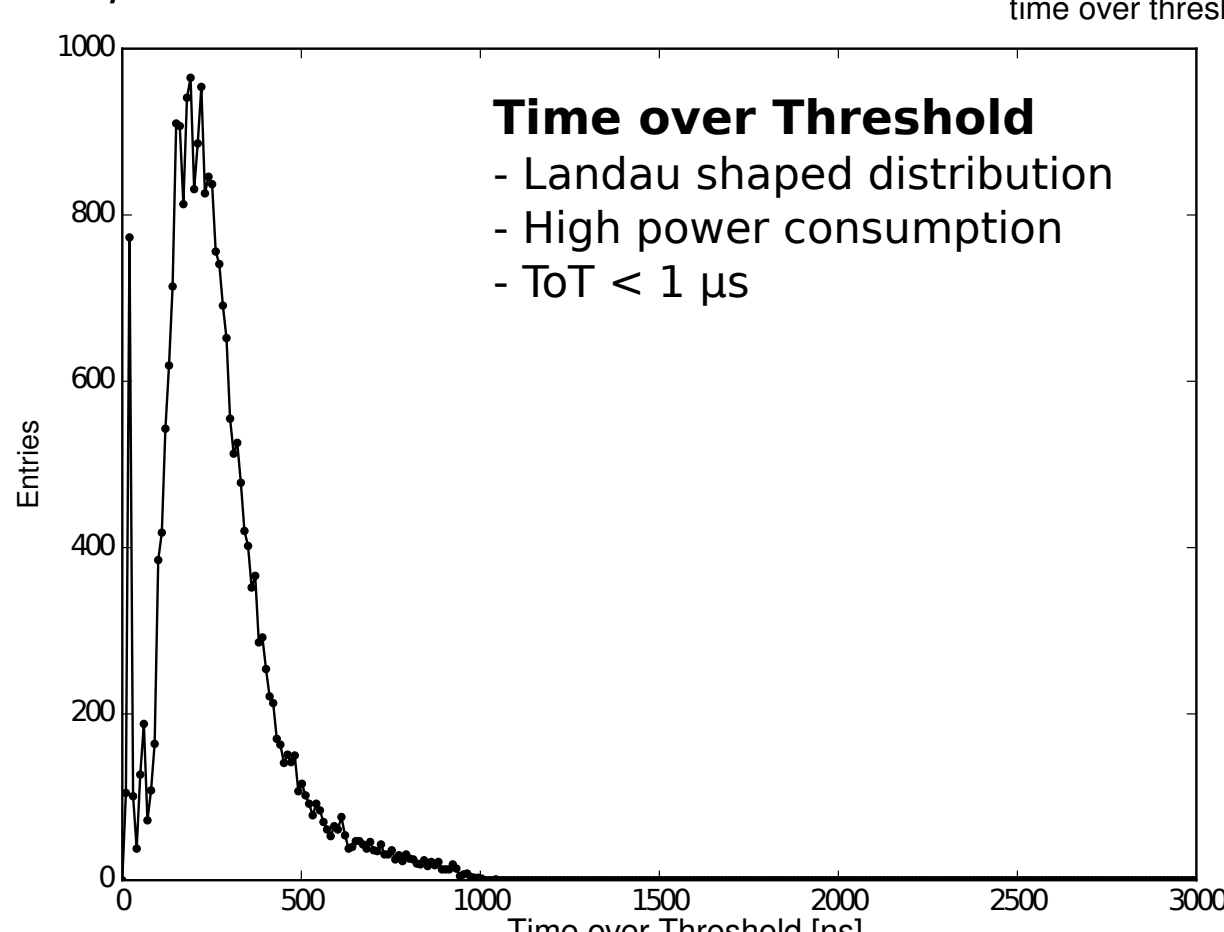
Performance

- Prototype performance studies at MAMI 1 GeV electron beam and at DESY 5 GeV electron beam
- Electron detection efficiency >99%
- Hit resolution given by pixel cell size
- Time resolution: 7 ns
- Laboratory measurements give S/N >15

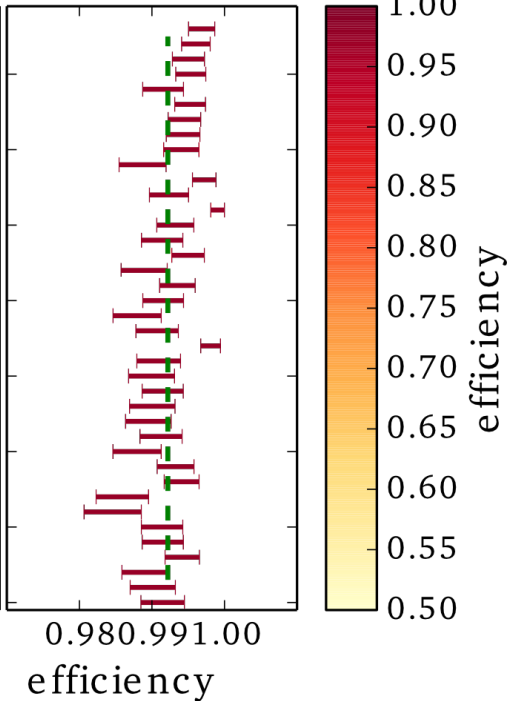


Time over Threshold

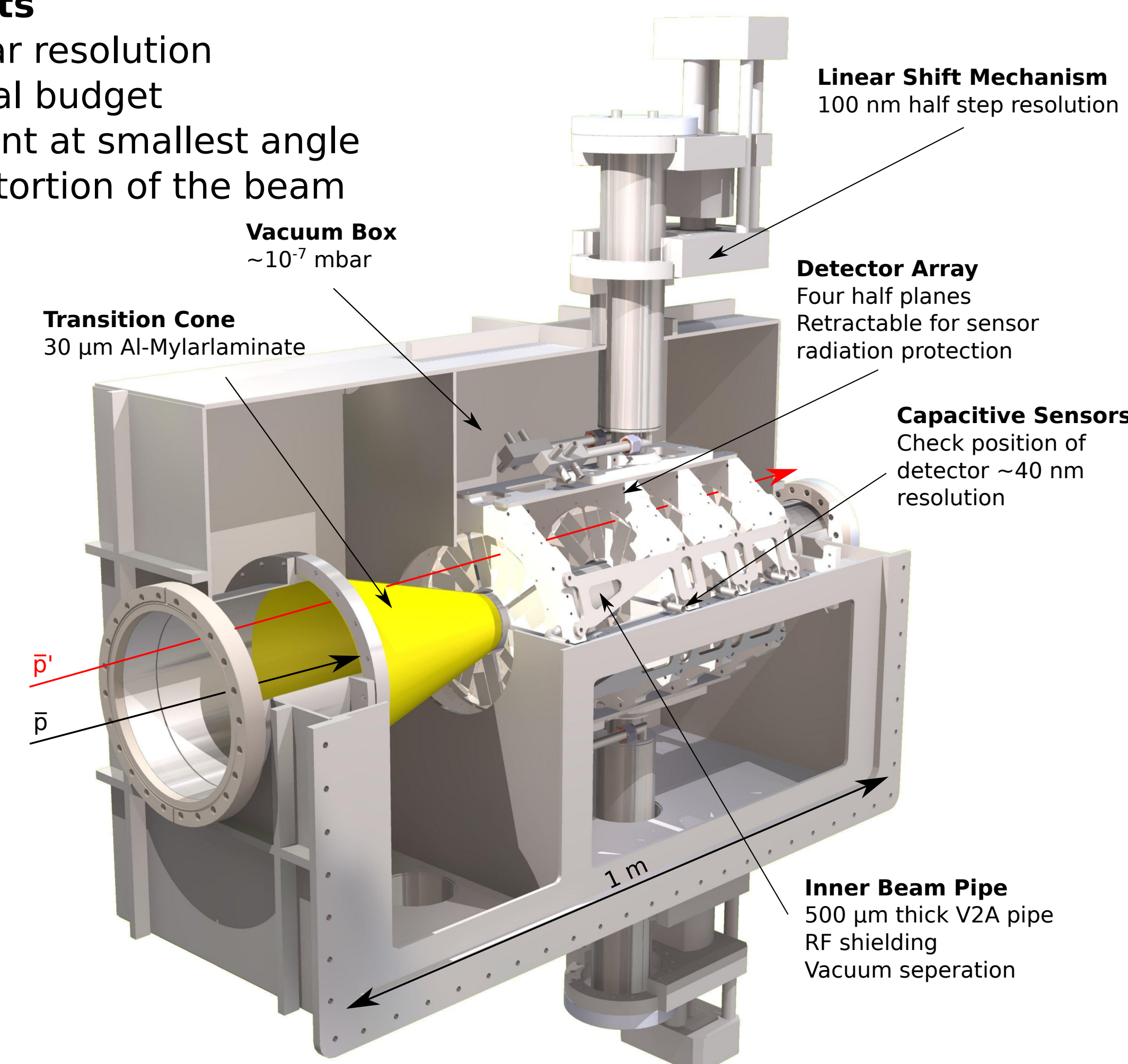
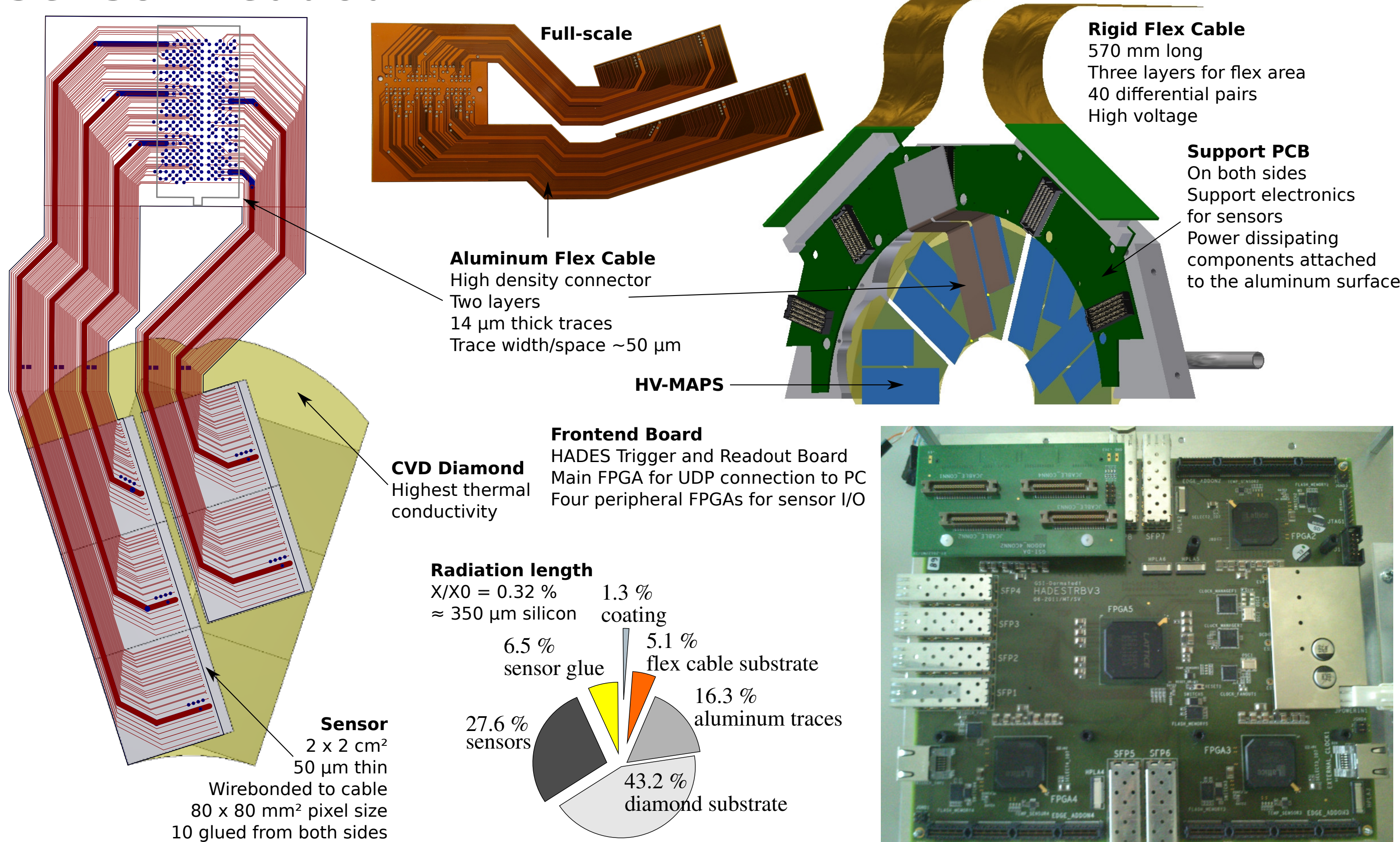
- Landau shaped distribution
- High power consumption
- ToT < 1 μ s



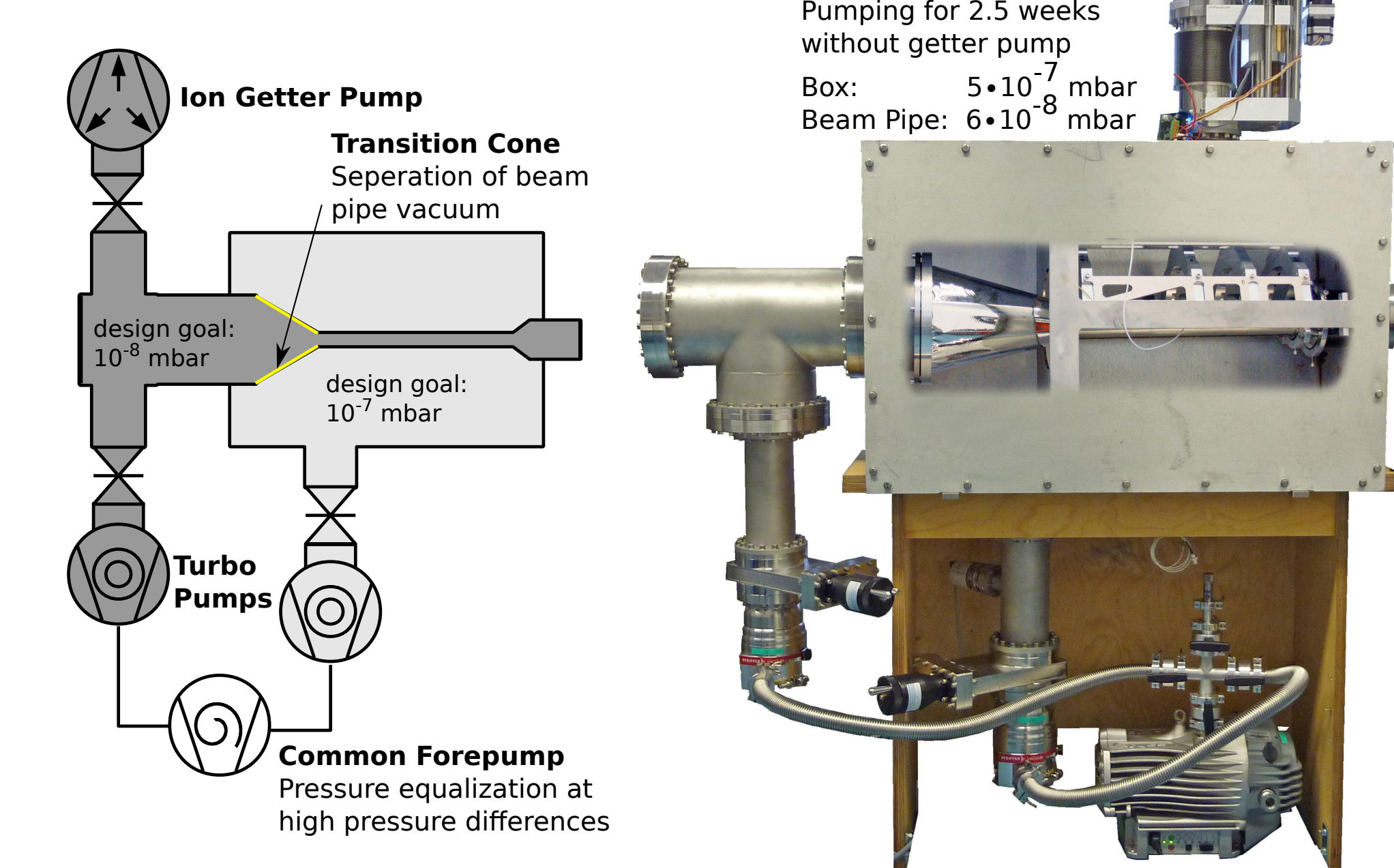
Efficiency



Sensor Readout



Vacuum



Cooling

