

# **Avalanche Pixelated Detectors for Time Resolved Experiments**

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Diamond Light Source

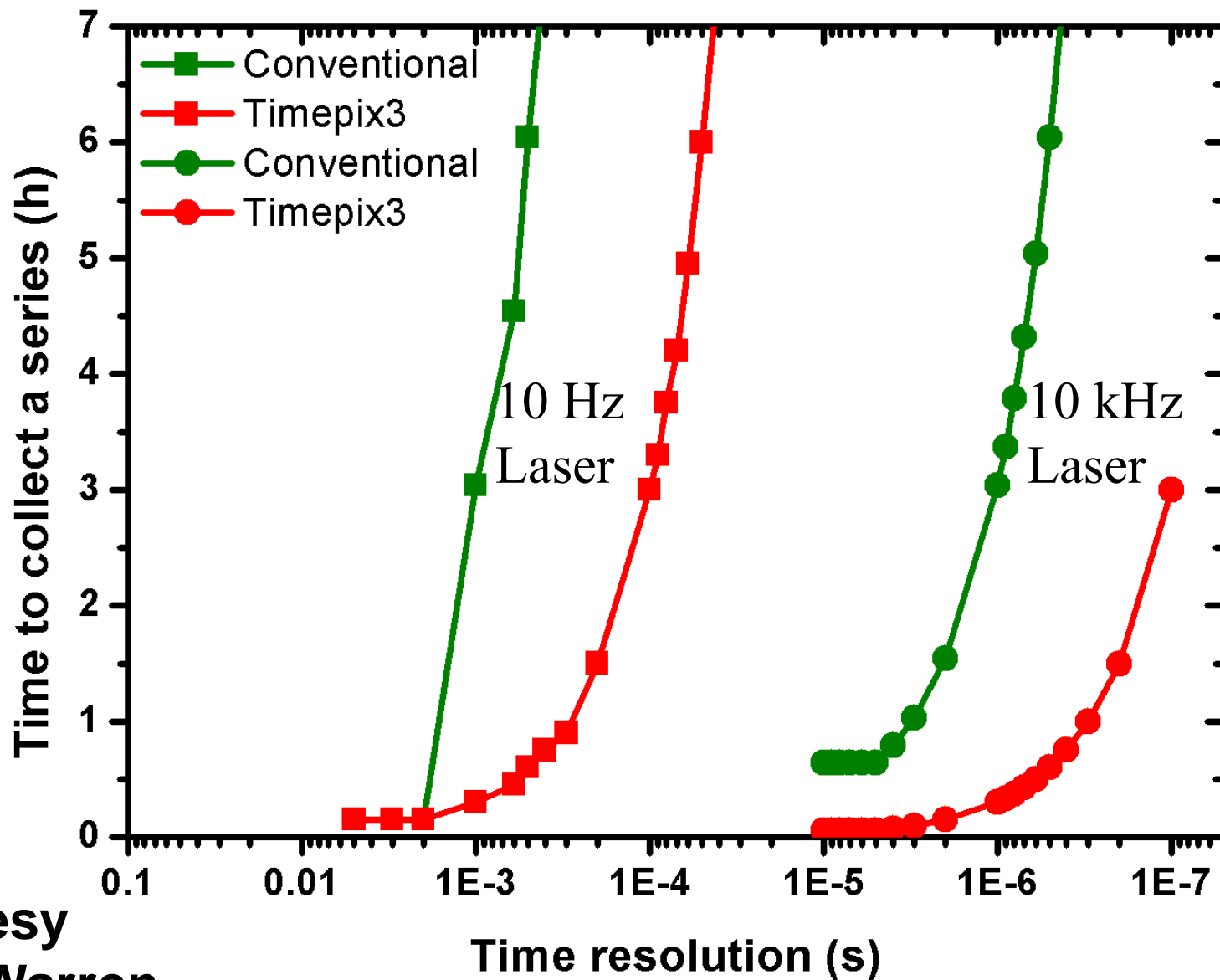
# **Techniques requiring time resolving detectors**

- **Crystallography**
- **Powder diffraction**
- **Small angle scattering**
- **Spectroscopy**
- **...**

# Timepix3

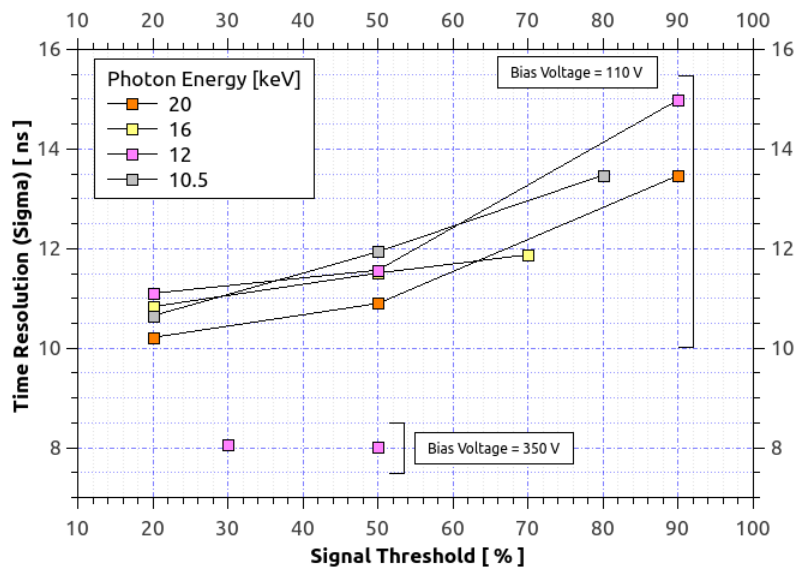
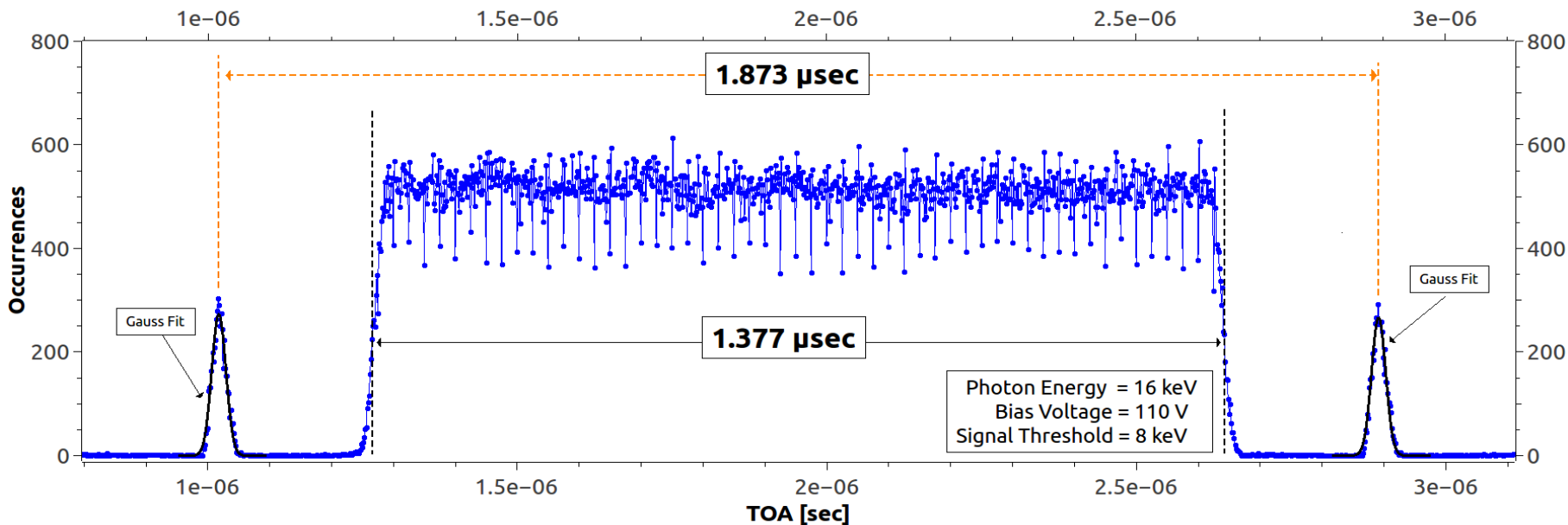
- **Time stamp per pixel 1.56ns resolution**
- **Data-driven Zero-suppressed Sparse readout**
- **Pixel size 55  $\mu\text{m}$  x 55  $\mu\text{m}$**
- **Pixel matrix array 256 x 256**

# Small molecule crystallography



Courtesy  
Mark Warren

# Hystogram of ToAs



Best achieved resolution:

**8 ns** (sigma)

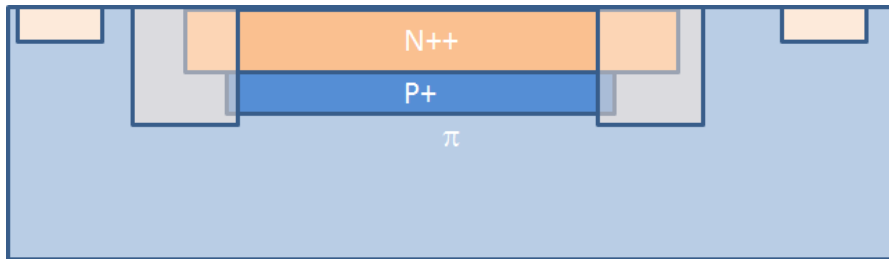
Measurements taken in  
Hybrid and Low-Alpha  
modes

# Limitations

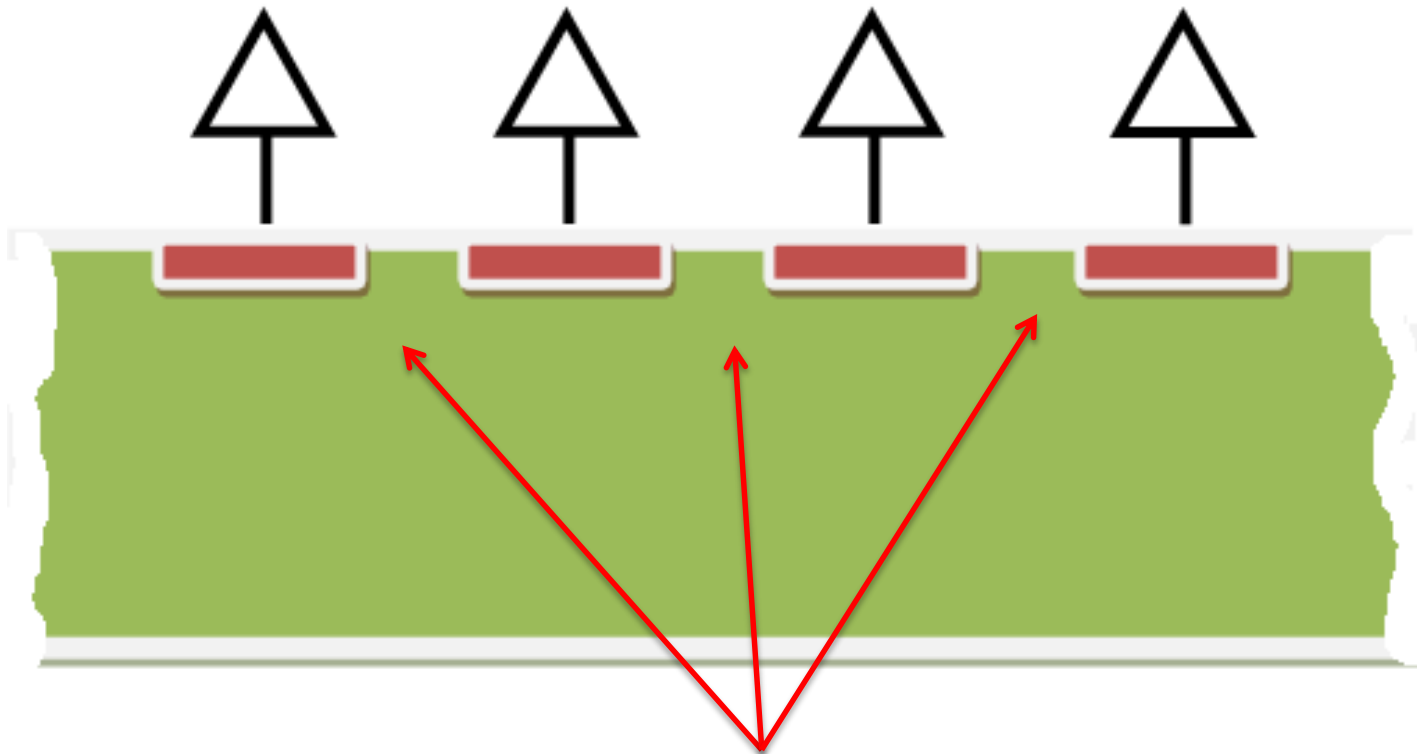
- **DEAD TIME: Time Over Threshold + 475ns**
- **MAX GLOBAL COUNTING RATE: 80 Mhits/s/chip**

# Avalanche Pixelated Sensors Hi-Res Silicon

Structures fabricated by  
Micron Semiconductor and  
Glasgow University



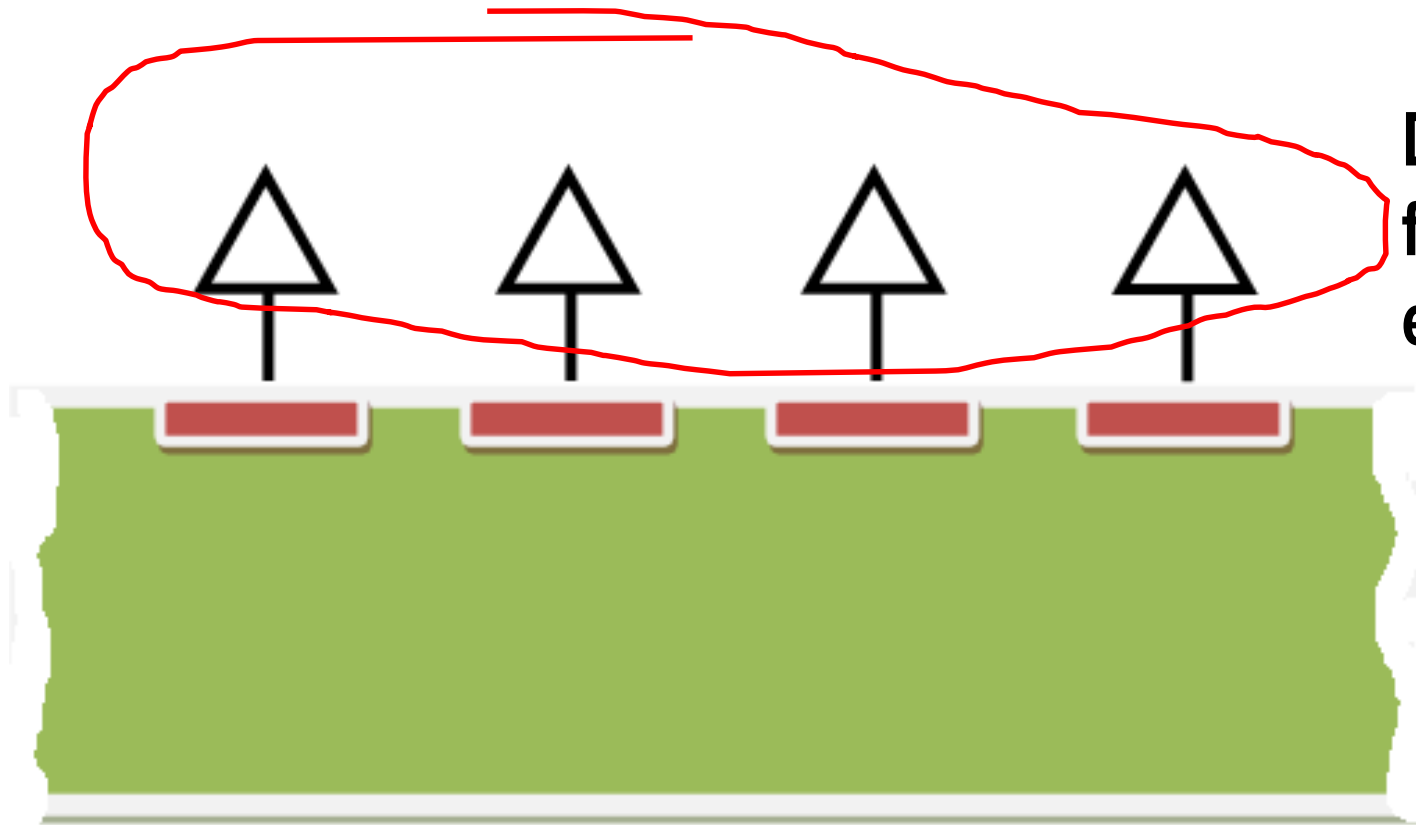
# Issues to be addressed



**Uniformity of gain**



# Issues to be addressed



**Dedicated  
front-end  
electronics**

# **Mini-Attract Project**

- **Development of front-end electronics with 55 micron pitch dedicated to Avalanche Detectors**
- **Development of Avalanche Pixelated Sensors suitable to build large area detectors**

# Possible Attract Project

- **Full detector system development**
  - **Avalanche sensor**
  - **ASIC (4-side buttable with high performance digital section)**
  - **Interconnections (board-level optical interconnections)**
  - **DAQ**

# Potential Impact

- **Enhancement of hybrid detector technology**
- **Much more efficient Time Resolved Experiments**
- **Effective operation in 1 keV – 4 keV range**