

MIRAM ESA Project 4000122160/17/UK/ND

MIRAM Miniaturized Radiation Monitor ACQP TPX3 ASIC

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*Start-up of the Medipix Collaboration/IEAP CTU Prague



ADVACAM
Imaging the Unseen
* www.advacam.com

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MIRAM ACQP TPX3 Bread Board

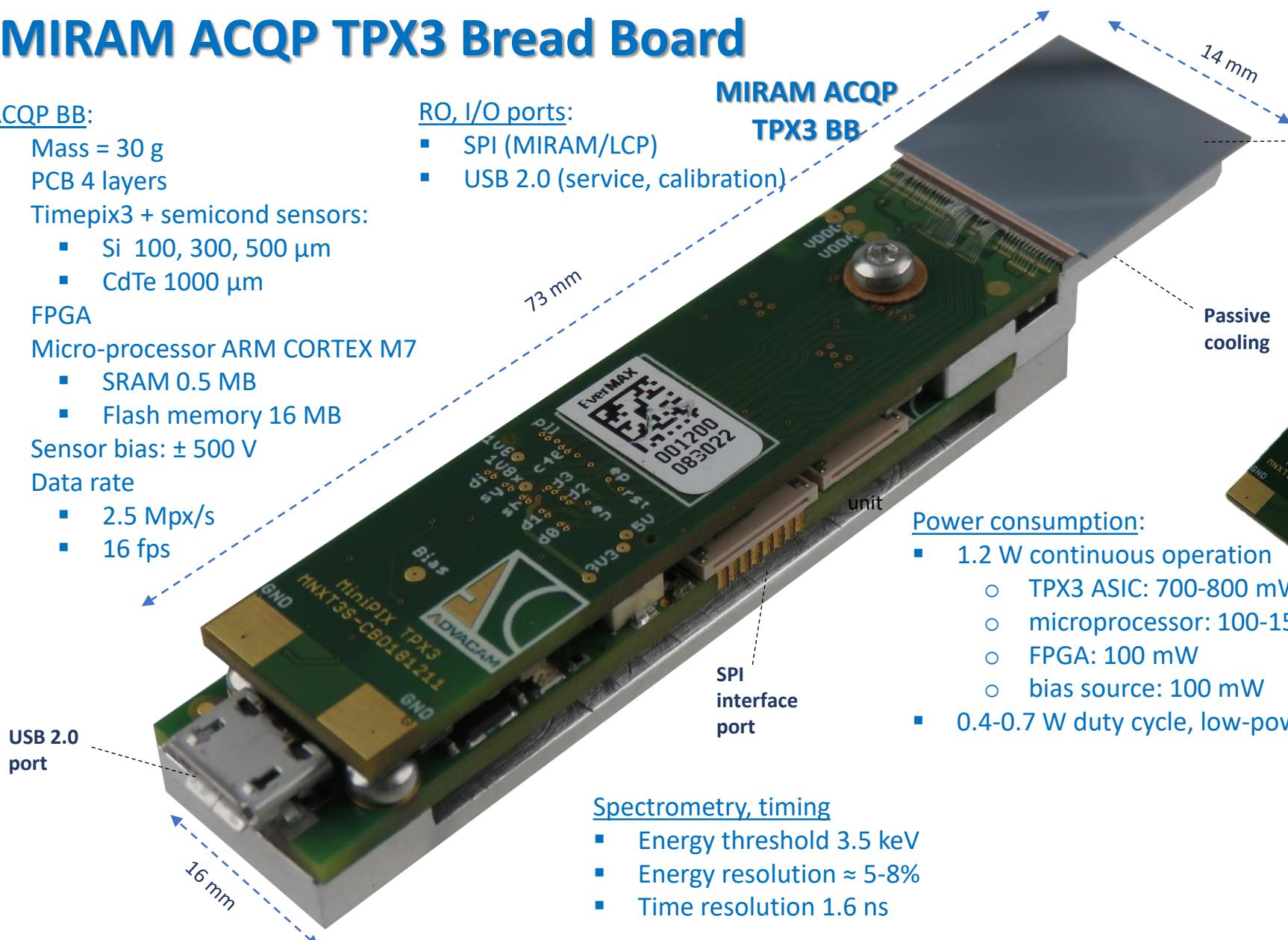
ACQP BB:

- Mass = 30 g
- PCB 4 layers
- Timepix3 + semicond sensors:
 - Si 100, 300, 500 μm
 - CdTe 1000 μm
- FPGA
- Micro-processor ARM CORTEX M7
 - SRAM 0.5 MB
 - Flash memory 16 MB
- Sensor bias: ± 500 V
- Data rate
 - 2.5 Mpx/s
 - 16 fps

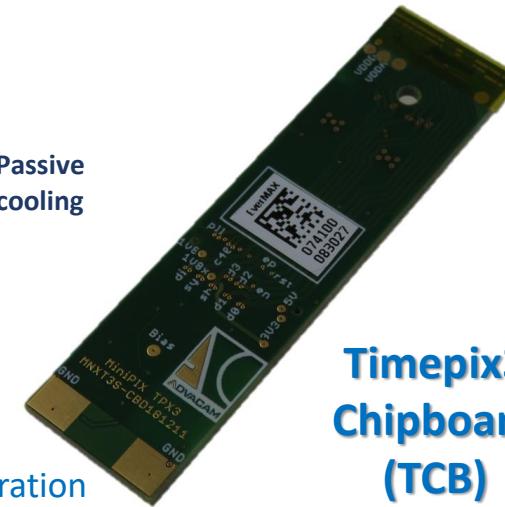
RO, I/O ports:

- SPI (MIRAM/LCP)
- USB 2.0 (service, calibration)

**MIRAM ACQP
TPX3 BB**



TPX3 ASIC
Si 500 μm



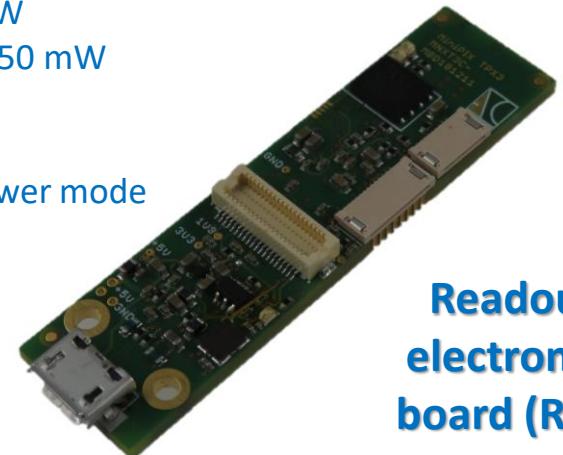
**Timepix3
Chipboard
(TCB)**



ACQP BB TPX3
500 μm Si

Power consumption:

- 1.2 W continuous operation
 - TPX3 ASIC: 700-800 mW
 - microprocessor: 100-150 mW
 - FPGA: 100 mW
 - bias source: 100 mW
- 0.4-0.7 W duty cycle, low-power mode



**Readout
electronics
board (REB)**

Spectrometry, timing

- Energy threshold 3.5 keV
- Energy resolution \approx 5-8%
- Time resolution 1.6 ns

C. Granja, J. Jakubek, et al., *Directional response Timepix detector to Energetic Charged Particles*,
Wed 14 Nov 2018, 10:20 am

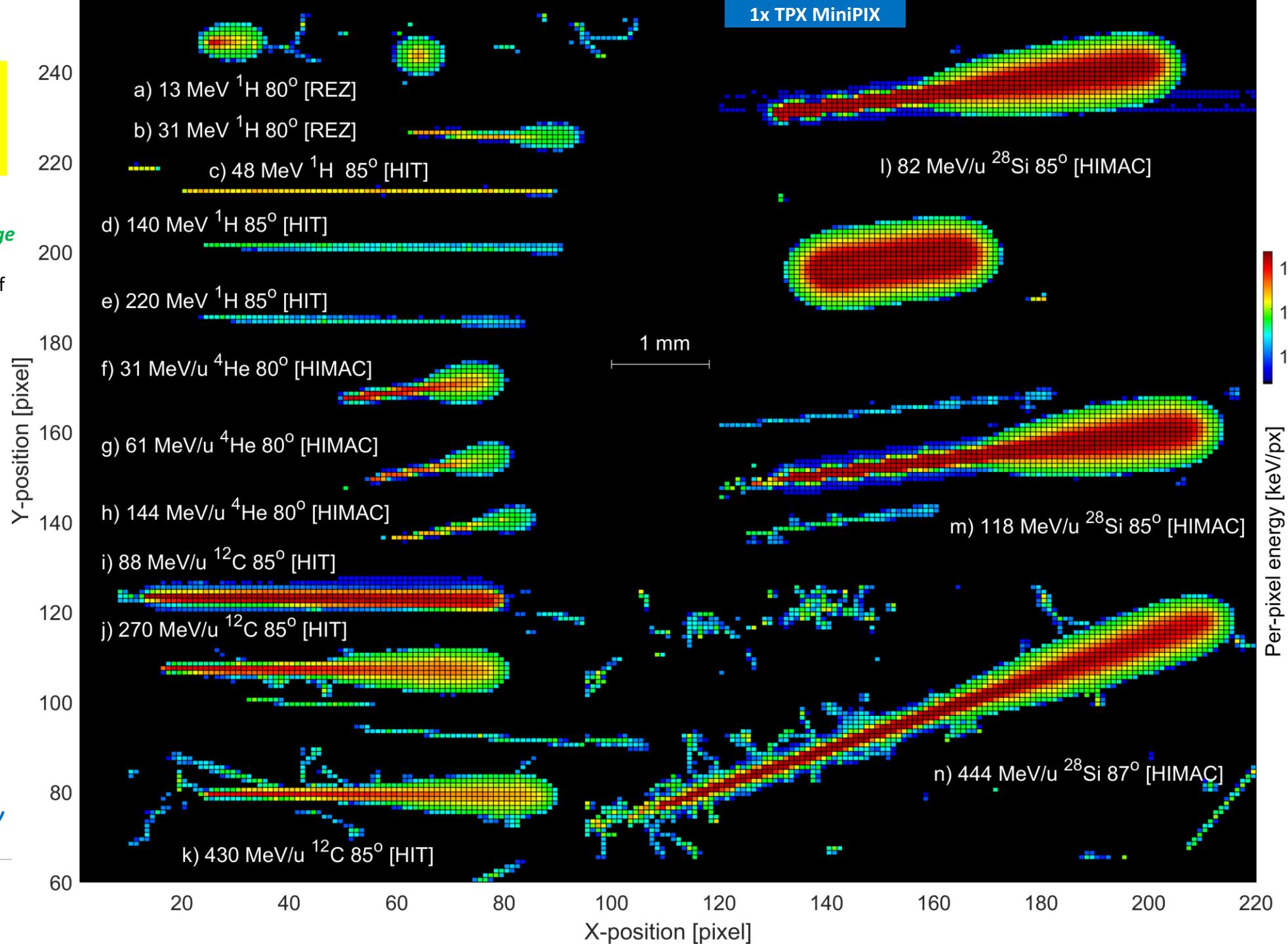
C. Granja, J. Jakubek, et al., *Dynamic range and resolving power of the Timepix detector to Heavy Charged Particles*, J. of Instrum. JINST 13 (2018) C11003

MiniPIX-Timepix + Heavy charged particles: protons, ions

Quantum imaging detection and track visualization of energetic protons, alpha particles, ions



Light ion U-120 cyclotron, Rez-Prague
Synchrotron HIT, Heidelberg, Germany
Synchrotron, HIMAC, Chiba, Japan



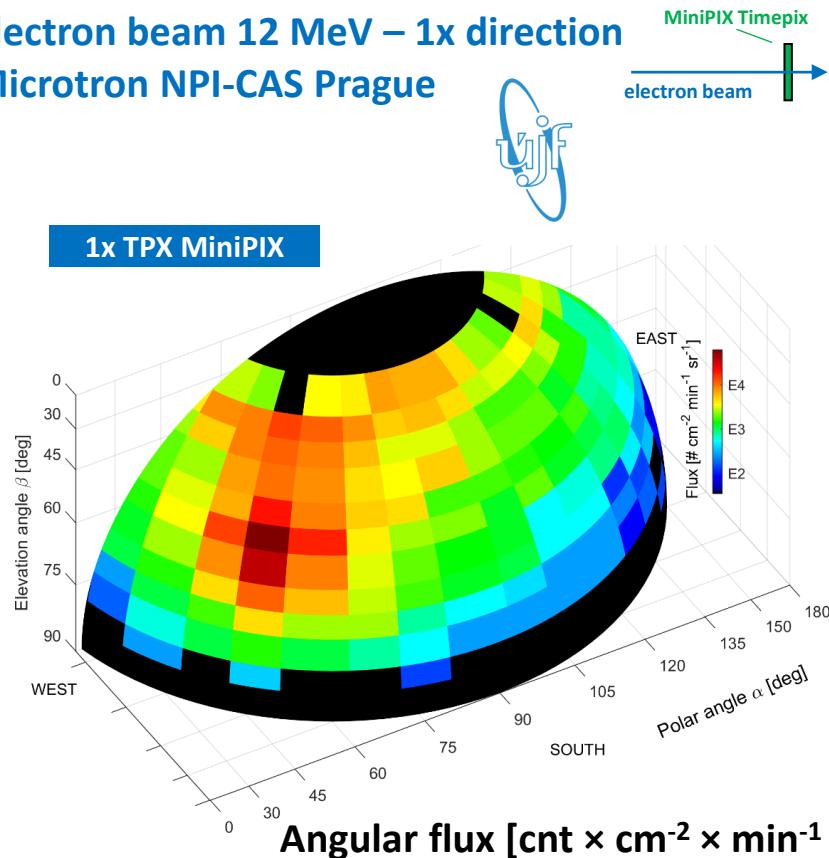
Angular distributions of energetic light charged particles

Single layer TPX + MiniPIX-Timepix camera + 1D angular distributions + wide FoV sky map



Angular distribution of a 12 MeV electrons beam incident at $\beta = 60^\circ$ and $\alpha = 45^\circ$. By single layer MiniPIX-Timepix camera.

Electron beam 12 MeV – 1x direction
Microtron NPI-CAS Prague



Angular distribution of a 31 MeV proton beam along the (a) elevation and (b) polar angles for four incident geometries (collected separately) by a single layer MiniPIX-Timepix camera (sensor 300 μm silicon).

Proton beam 31 MeV – 4x directions
Cyclotron NPI-CAS Prague Rez

