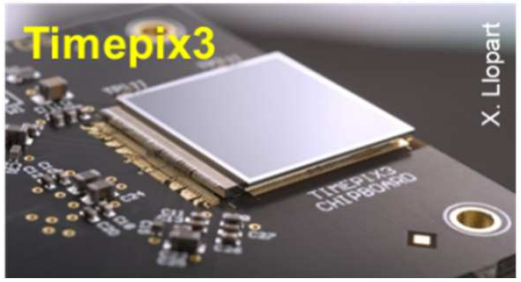
Detector R&D for the TauFV Experiment at the CERN Beam Dump Facility

Interest in TauFV Experiment in the community

Timepix4

- Optimize Timepix4 chip for TauFV
- DAQ development



			Timepix3 (2013)	Timepix4 (2019)
Technology			130nm – 8 metal	65nm – 10 metal
Pixel Size			55 x 55 µm	55 x 55 µm
Pixel arrangement			3-side buttable 256 x 256	4-side buttable 512 x 448
Sensitive area			1.98 cm^2	**6.94 cm^2**
Readout Modes	Data driven (Tracking)	Mode	TOT and TOA	
		Event Packet	48-bit	64-bit
		Max rate	$0.43x10^6$ hits/mm^2/s	**$3.58x10^6$ hits/mm^2/s**
		Max Pix rate	1.3 KHz/pixel	**10.8 KHz/pixel**
	Frame based (Imaging)	Mode	PC (10-bit) and iTOT (14-bit)	CRW: PC (8 or 16-bit)
		Frame	Zero-suppressed (with pixel addr)	Full Frame (without pixel addr)
		Max count rate	~0.82 x 10^9 hits/mm^2/s	~5 x 10^9 hits/mm^2/s
TOT energy resolution			< 2KeV	**< 1Kev**
TOA binning resolution			1.56ns	**195ps**
TOA dynamic range			409.6 µs (14-bits @ 40MHz)	**1.6384 ms** (16-bits @ 40MHz)
Readout bandwidth			≤5.12Gb (8x SLVS@640 Mbps)	**≤163.84 Gbps** (16x @10.24 Gbps)
Target global minimum threshold			<500 e^-	<500 e^-

X. Llopart

ASIC Development

Development of

- rad-hard detectors with thin layers
- small pixels
- picosecond timing

Development of new readout ASIC: **PicoPix**

- 28 nm technology
- 2 cm^2 sensitive area
- 50 ps time resolution
- 600 Gb/s readout

	VeloPix (2016)	Timepix4 (imminent)	PicoPix ? (2025)
Technology	130 nm	65 nm	28 nm
Pixel Size	55 x 55 µm	55 x 55 µm	55 x 55 µm
Pixel arrangement	3-side buttable 256 x 256	4-side buttable 512 x 448	4-side buttable 256 x 256
Sensitive area	1.98 cm^2	6.94 cm^2	1.98 cm^2
Event packet	24 bit	64-bit	32-bit
Max rate	~400 Mhits/cm^2/s	178.8 Mhits/cm^2/s	~12000 Mhits/cm^2/s
Best time resolution	25 ns	~200ps	~50 ps
Readout bandwidth	19.2 Gb/s	81.92 Gb/s	~600 Gb/s

G. Wilkinson

Synergies with non-particle physics research fields (e.g. photon science, material science)

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