



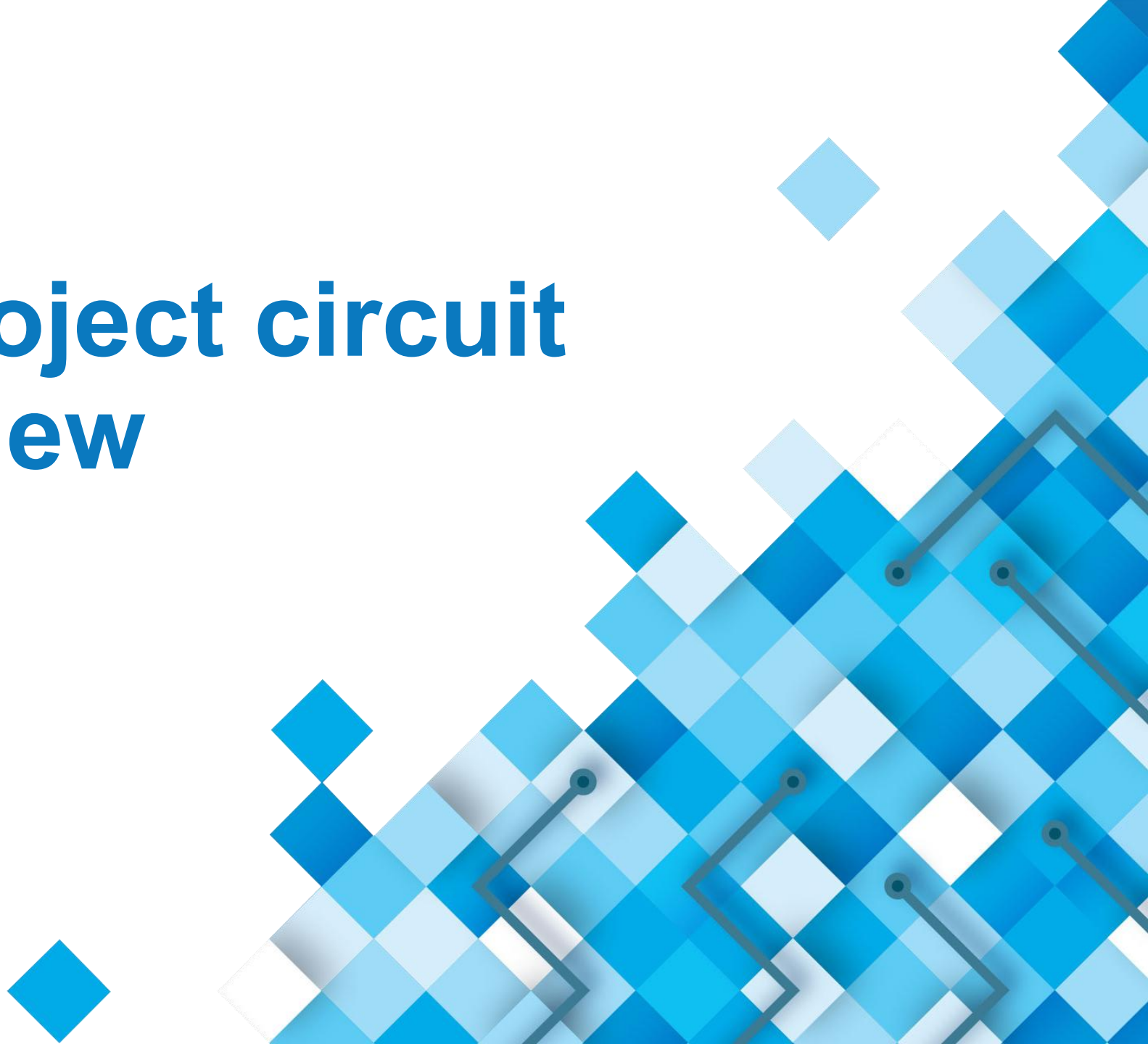
**FACULTY OF
NUCLEAR SCIENCES
AND PHYSICAL
ENGINEERING
CTU IN PRAGUE**

OCTOPUS project circuit design overview

9/9/2026

Lukáš Kvasnička

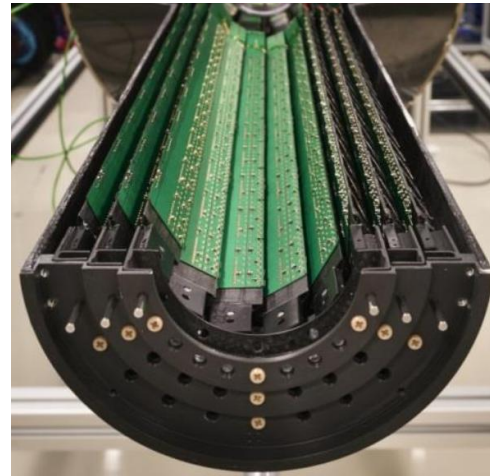
kvasnlu1@cvut.cz



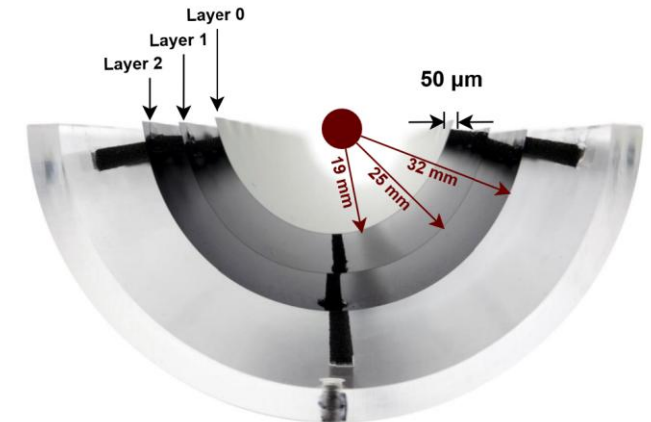
Technology comparison

	Towerjazz 180 nm	TPSCo 65 nm
Wafer size	200 mm wafer	300 mm wafer (27×9 cm ² sensor)
Metal backend	Aluminum	Copper (lower sheet resistance)
Thickness	50 μm	30 μm (well flexible)
Power supply	1.8 V	1.2 V
Pixel pitch for detection systems	~28 μm (Alpide)	Targeting 10 μm

ITS2 half-barrel

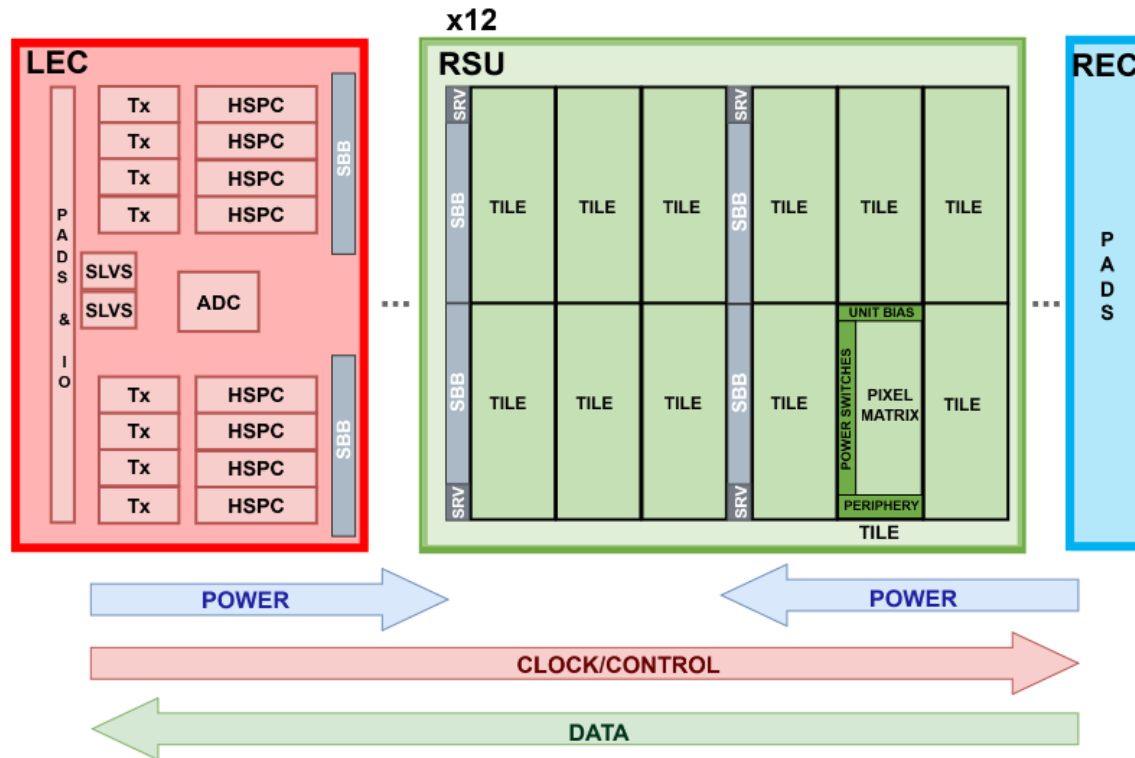


mechanical model of the ITS3 half-barrel



• MOSAIX characteristics

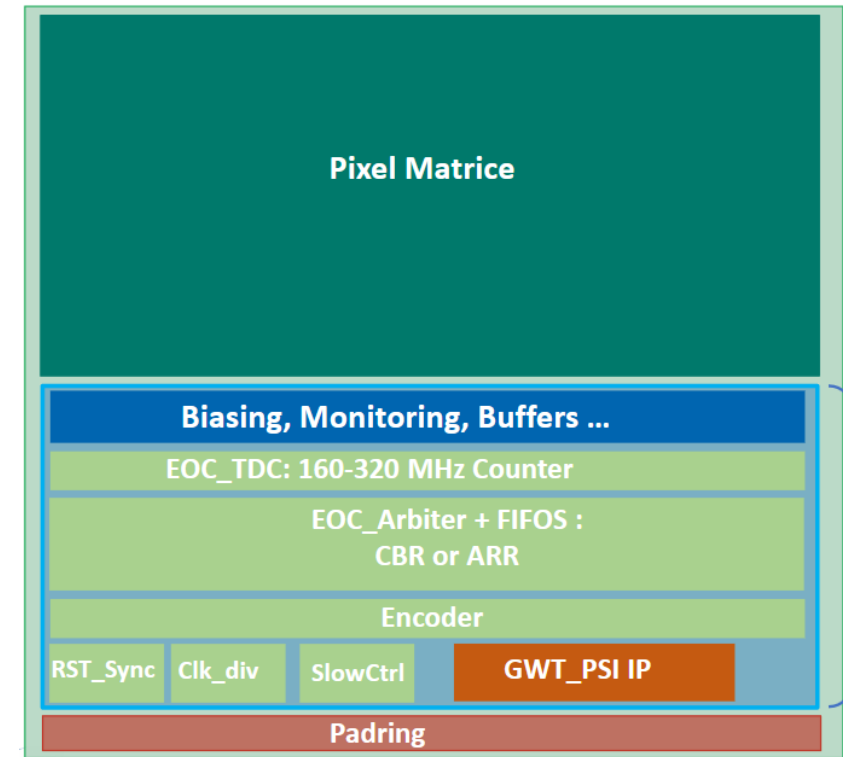
- ALICE ITS3
- $\sim 22 \mu\text{m}$ pixel pitch
- $40 \text{ mW}/\text{cm}^2$ power consumption
- 40 ns time resolution



MOSAIX chip diagram (not to scale)

• OCTOPUS final characteristics

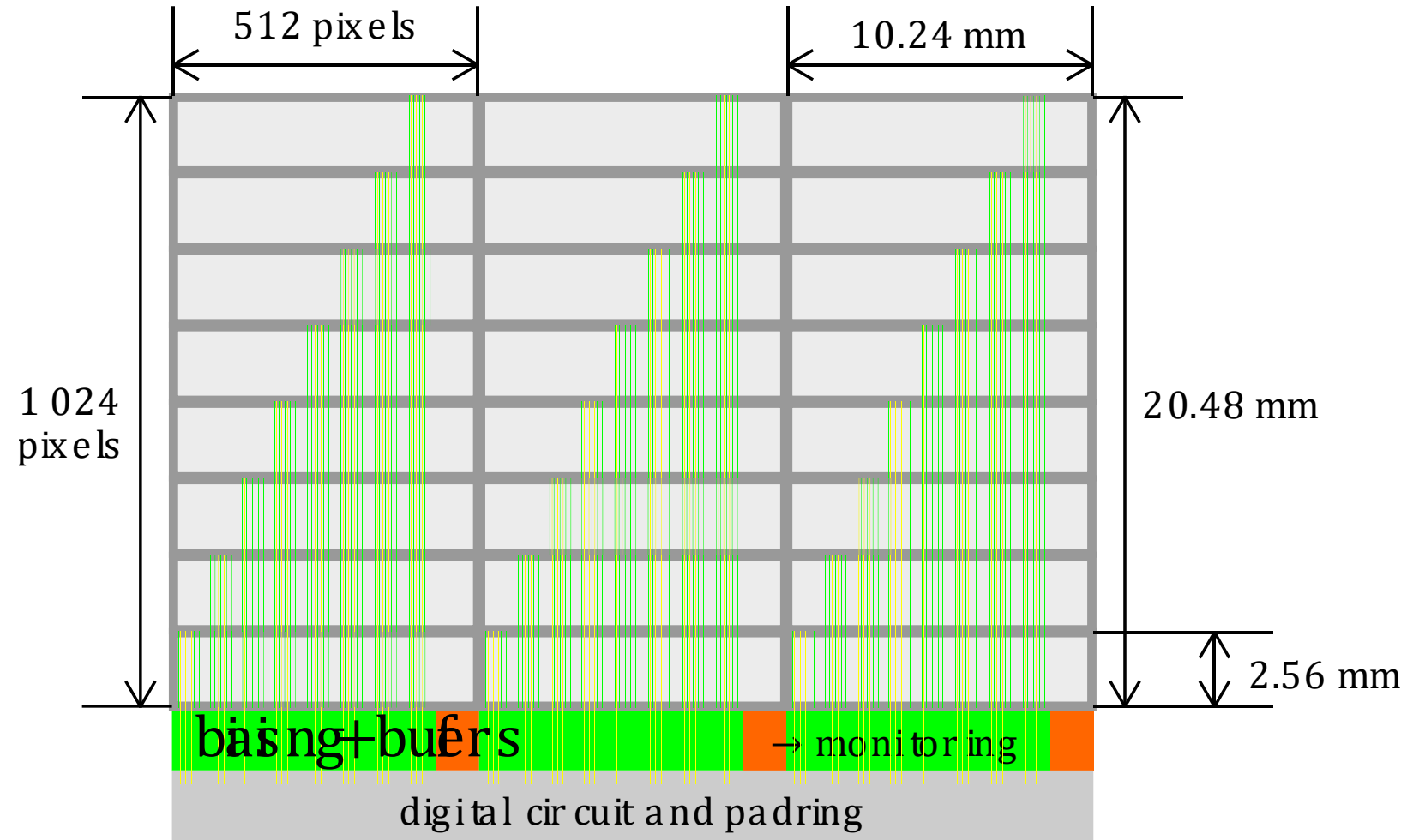
- Future lepton colliders
- $< 15 \mu\text{m}$ pixel pitch
- $< 50 \text{ mW}/\text{cm}^2$ power consumption
- 5 ns time resolution



OCTOPUS chip diagram (not to scale)

Analog front-end

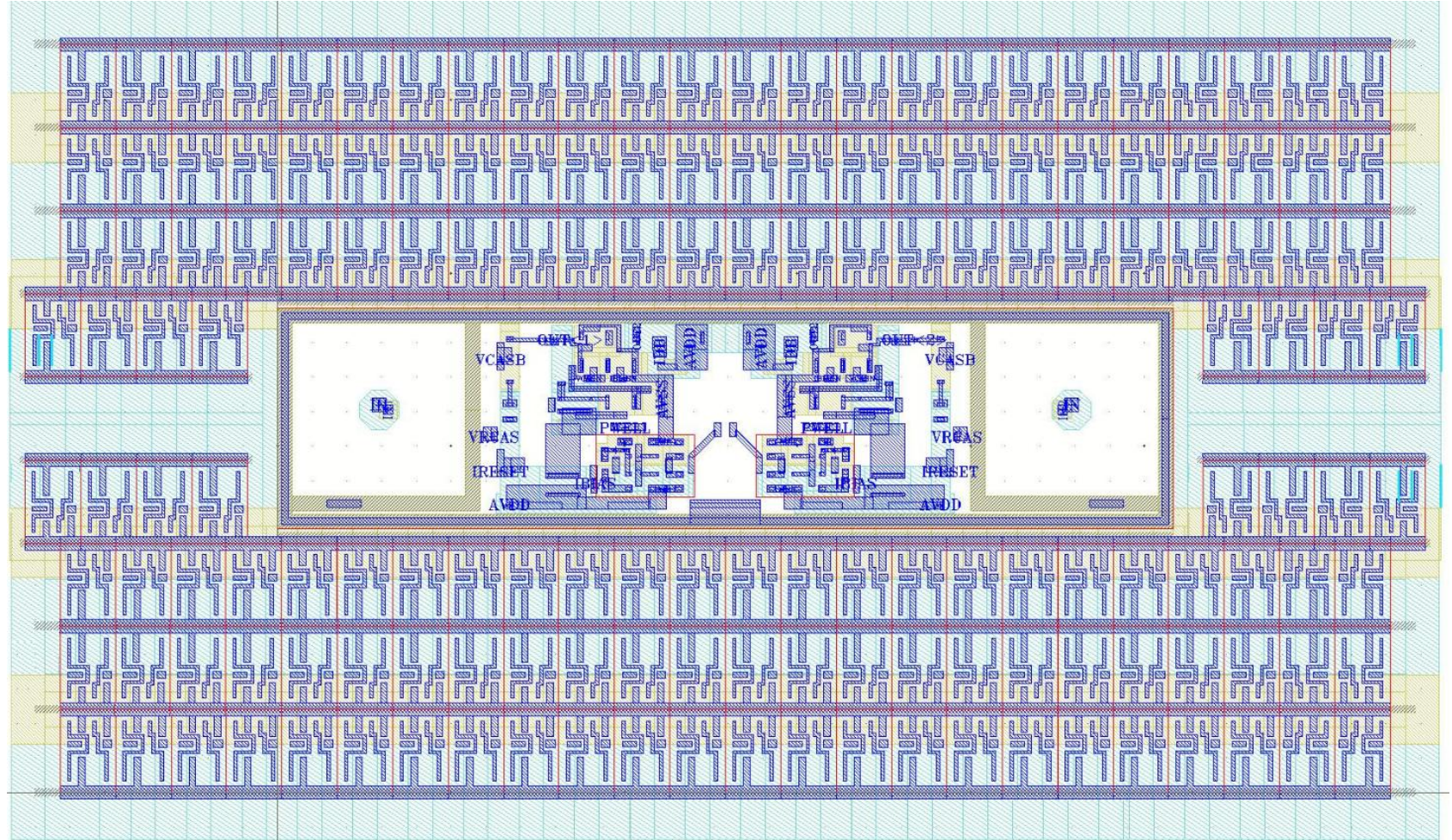
- 1024×512 pixel unit
- Unit is biased separately due to voltage drop
- Number of units may change



Block-diagram of analog front-end (not to scale)

Pixel

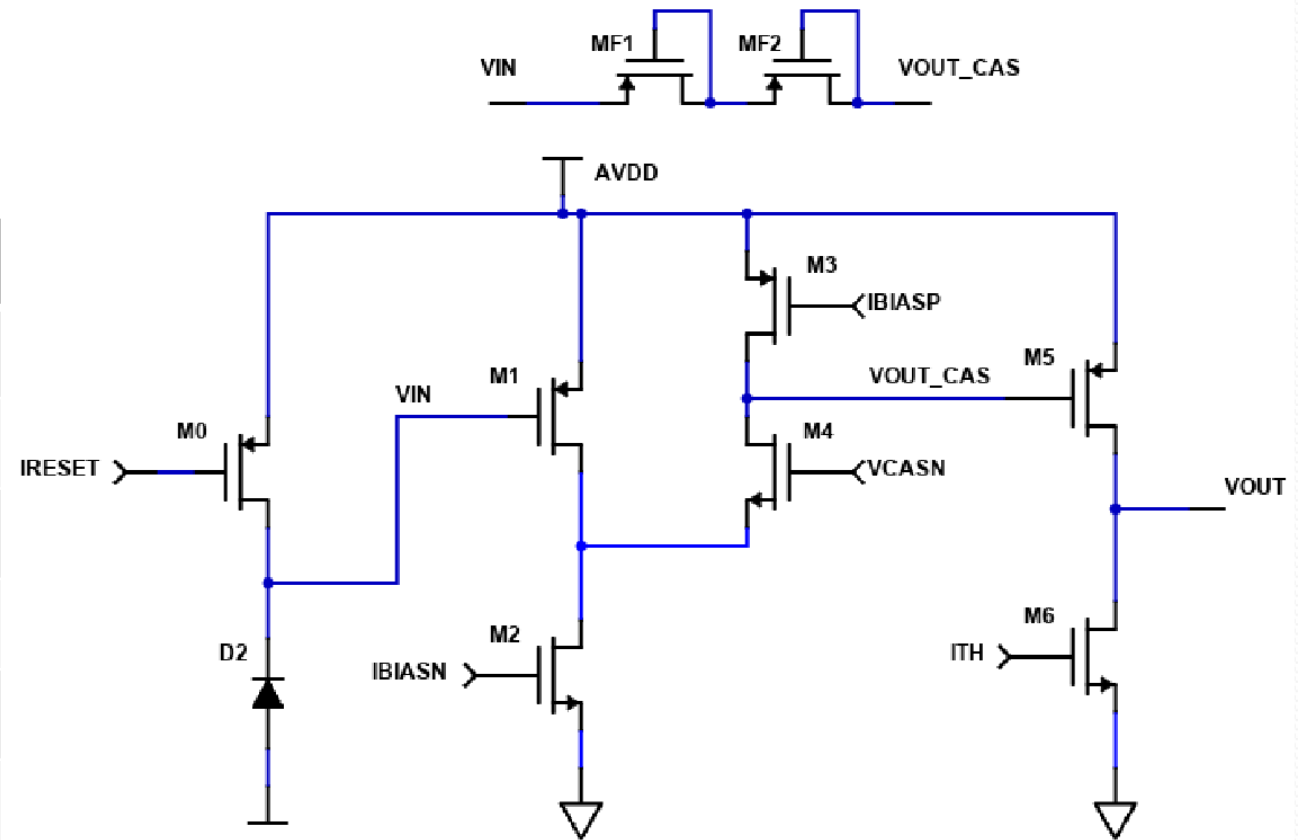
- Double pixel with surrounding digital circuit
- Pixel pitch $\sim 20\text{ }\mu\text{m}$
- modified pixel from other TPSCo 65 nm projects



Alternative front-end

- Improving the design
- Intermediate step

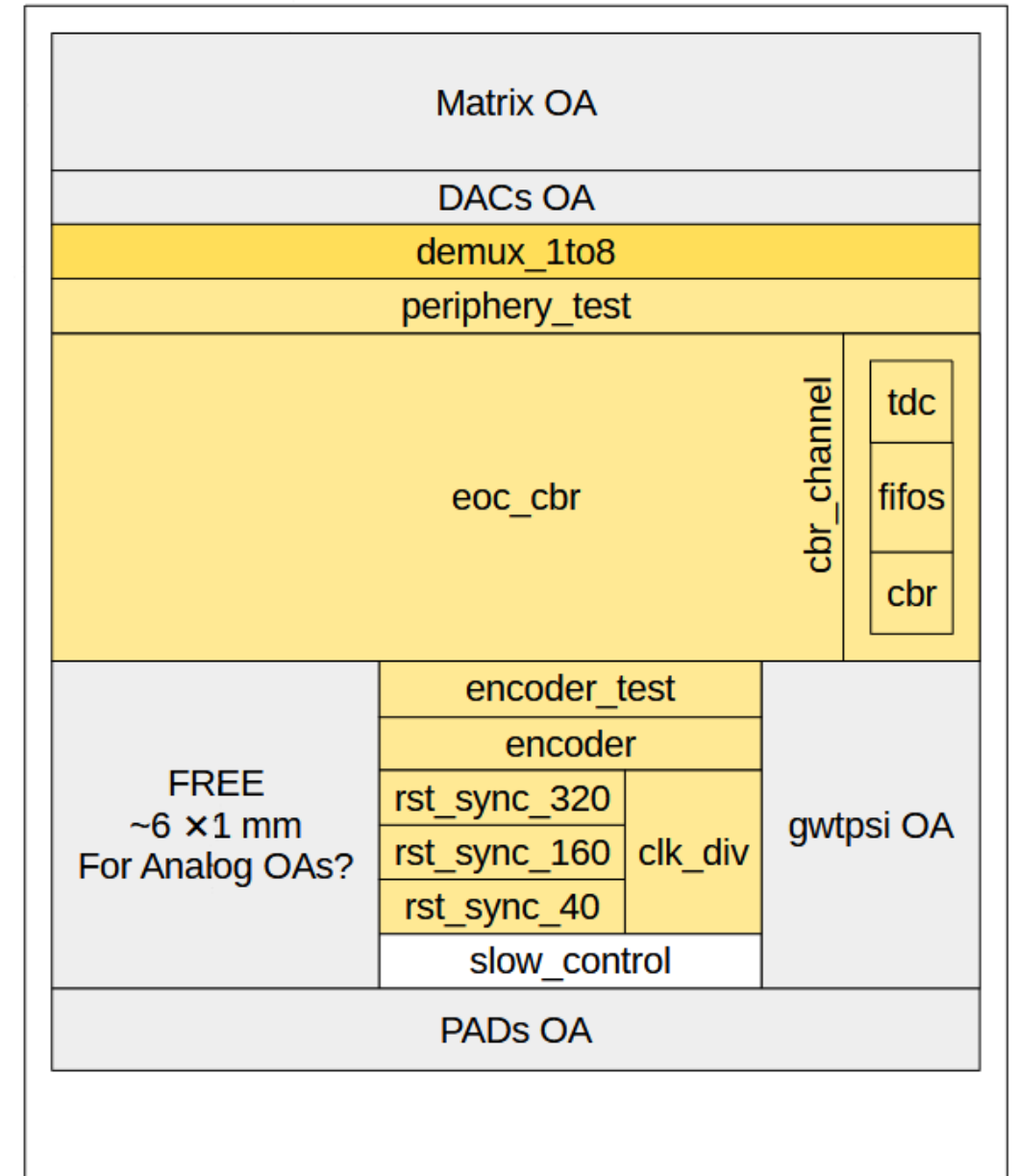
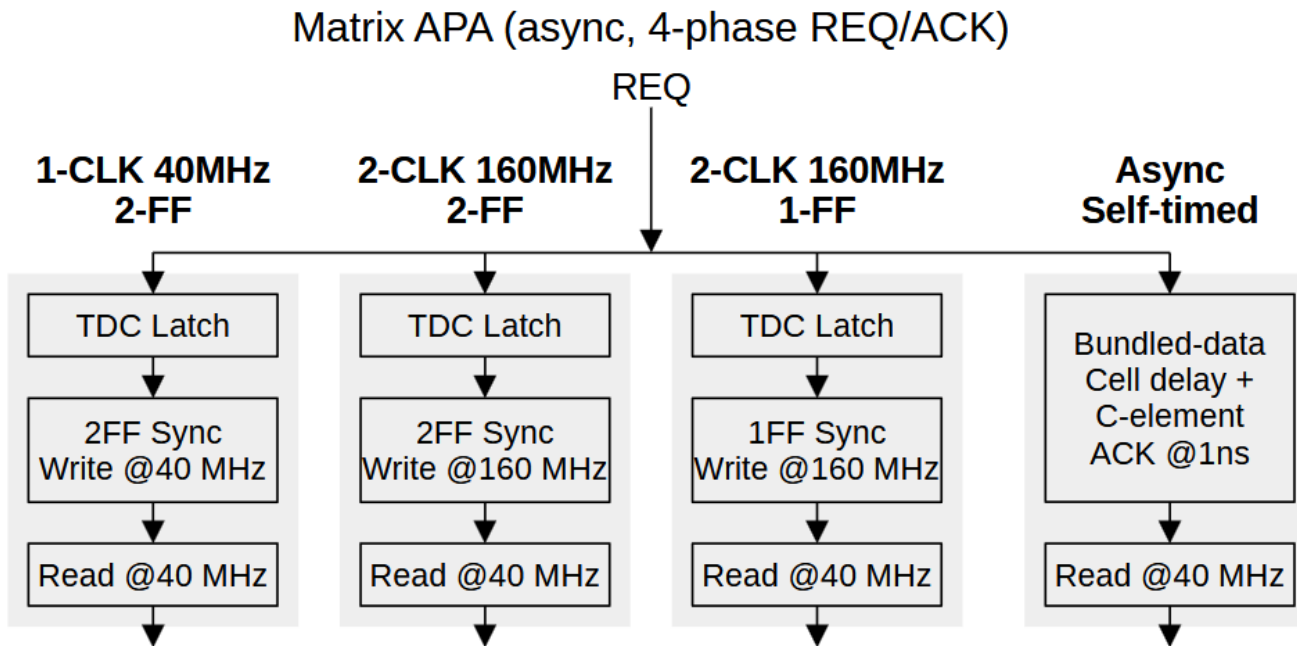
Parameter	Value
Pixel pitch	~20 μm
Power density	~30 mW/cm ²
Minimum threshold	100 e-
Max hit rate	75 MHz/cm ²
Total ionizing dose	30 Mrad/year
Non-ionizing energy loss	1 MeV neq/year



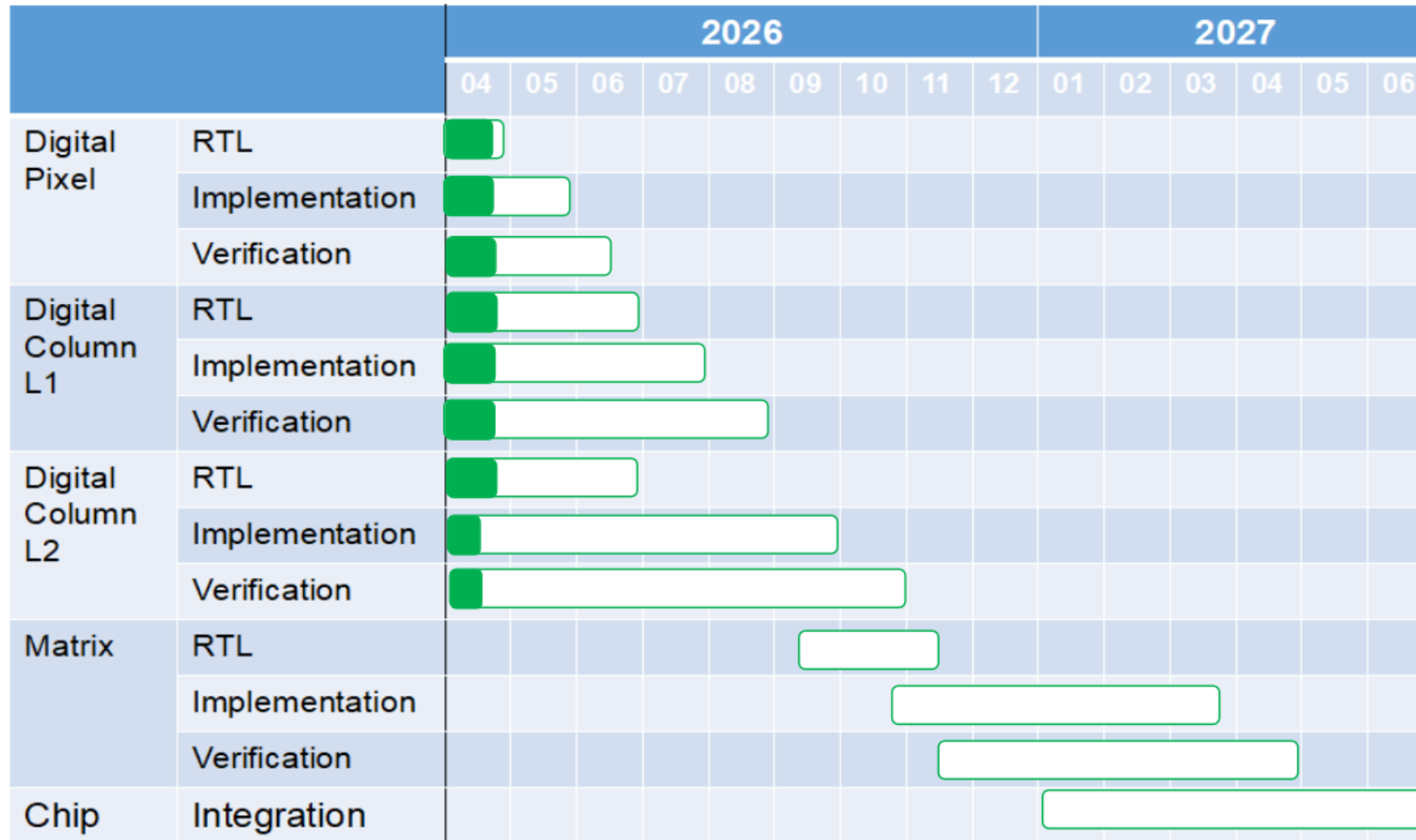
Alternative front-end schematic

Digital circuit

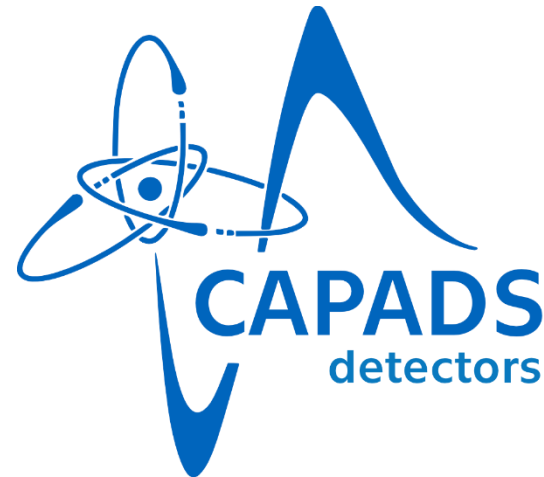
- Cooperation with MANTA project
- Implementation at RTL level



Present and future development



Thank you for your attention!



<https://capads.fjfi.cvut.cz>