

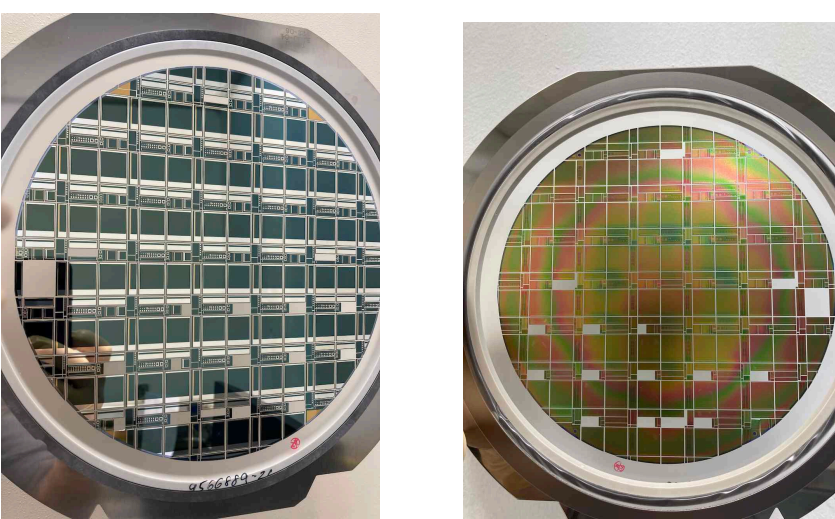
Caratterizzazione e progettazione di sensori monolitici CMOS fully-depleted per tracciatori, timing e X-ray imaging

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ARCADIA DMAPS R&D at INFN

Advanced Readout CMOS Architectures with Depleted Integrated sensor Arrays

ARCADIA



Fully Depleted Monolithic Active Pixel CMOS sensor technology platform allowing for:

- Active sensor thickness in the range $50\text{ }\mu\text{m}$ to $500\text{ }\mu\text{m}$;
- Operation in full depletion with fast charge collection by drift, small collecting electrode for optimal signal-to-noise ratio;
- Scalable readout architecture with ultra-low power capability ($O(10\text{ mW}/\text{cm}^2)$);
- Compatibility with standard CMOS fabrication processes
- Technology: LF11 is 110nm CMOS node (quad-well, both PMOS and NMOS), high-resistivity bulk
- Custom patterned backside, patented process developed in collaboration with LFoundry

ARCADIA Main Demonstrator Chip



Top Padframe

Auxiliary supply, IR Drop Measure

Matrix

512x512 pixels, Double Column arrangement

End of Sector (x16)

Reads and Configures 512x32 pixels

Sector Biasing (x16)

Generates I/V biases for 512x32 pixels

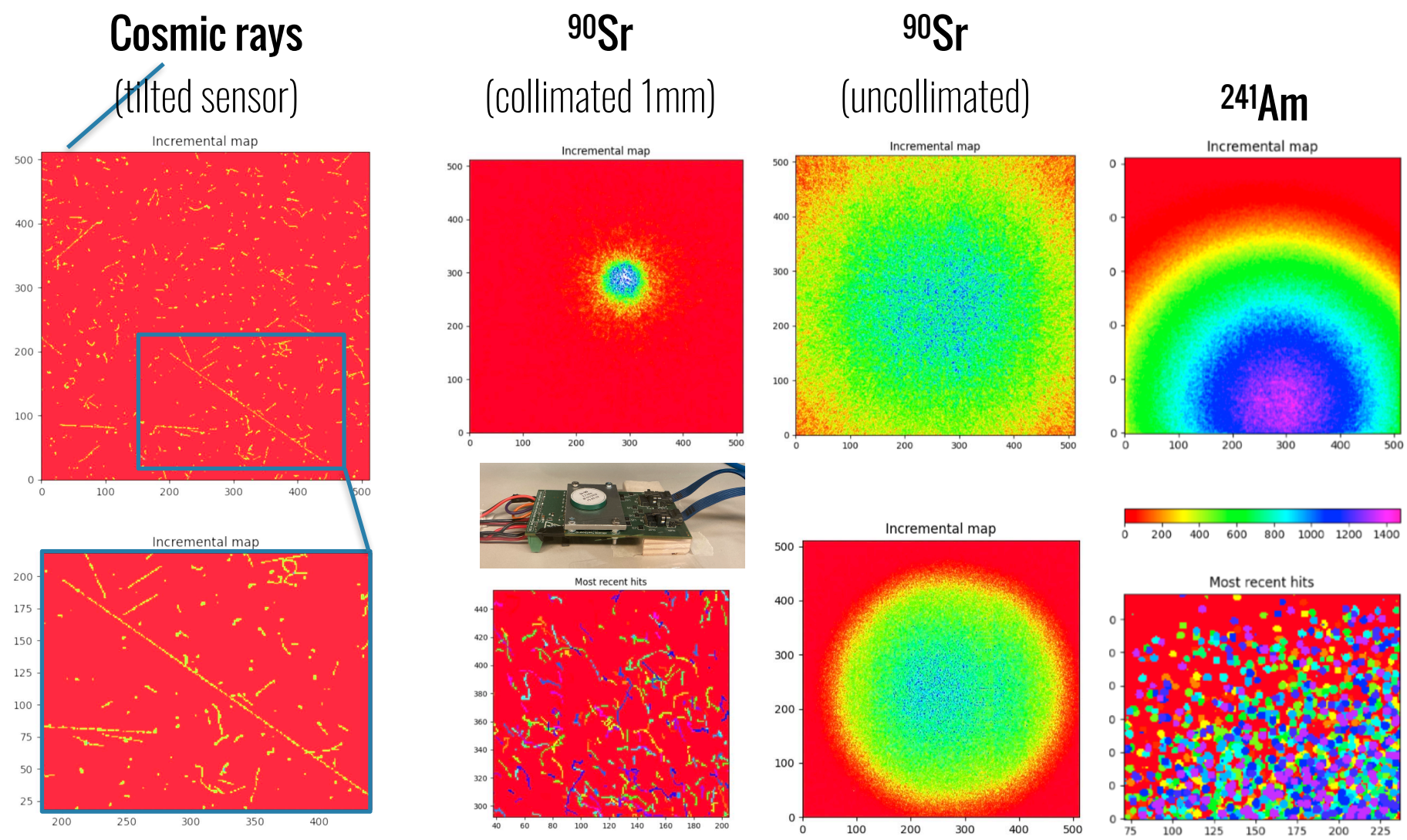
Periphery

SPI, Configuration, 8b10b enc, Serializers

Bottom Padframe

Stacked Power and Signal pads

ARCADIA-MD3: charged particles

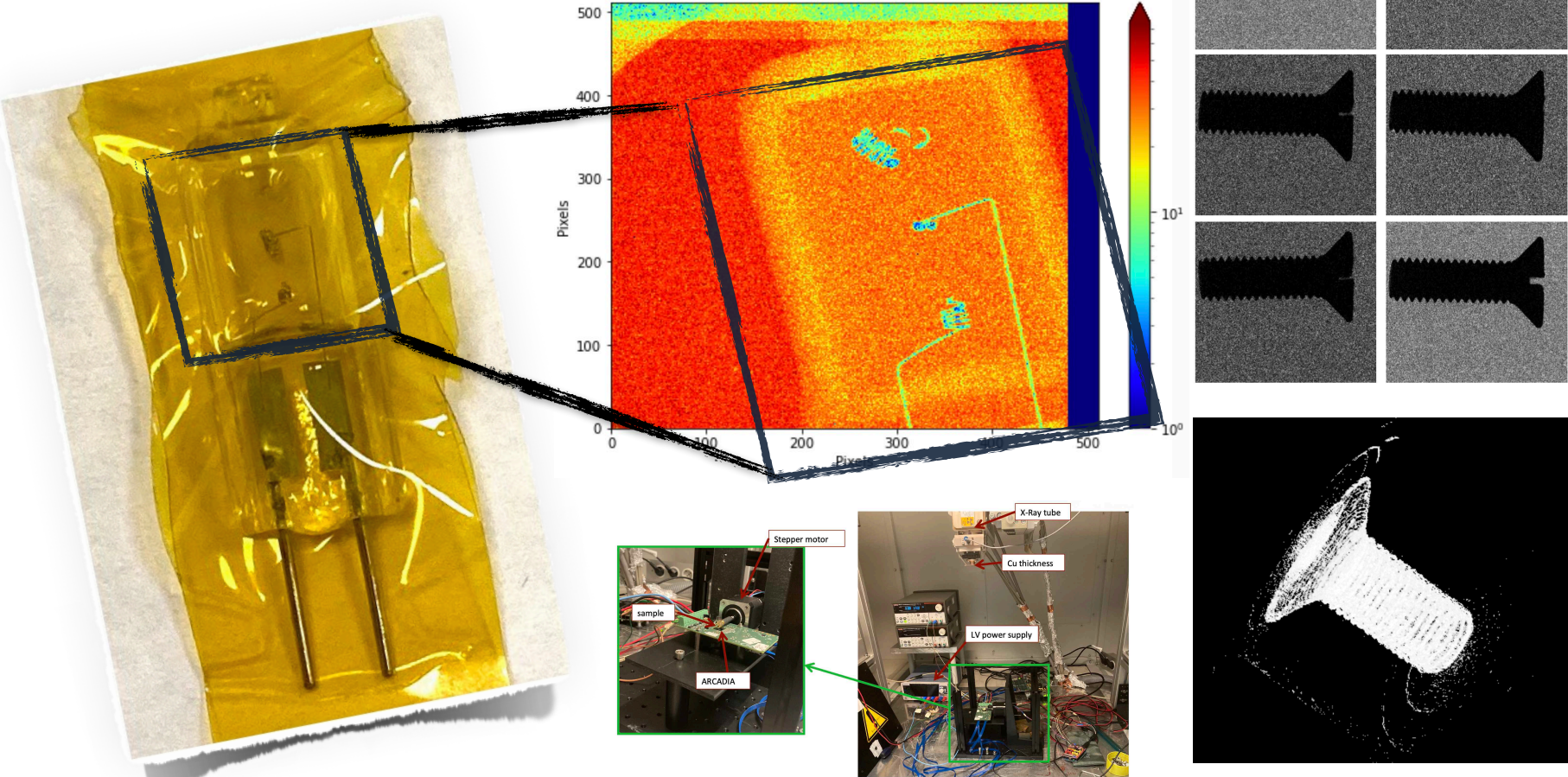


Proposte di Tesi:

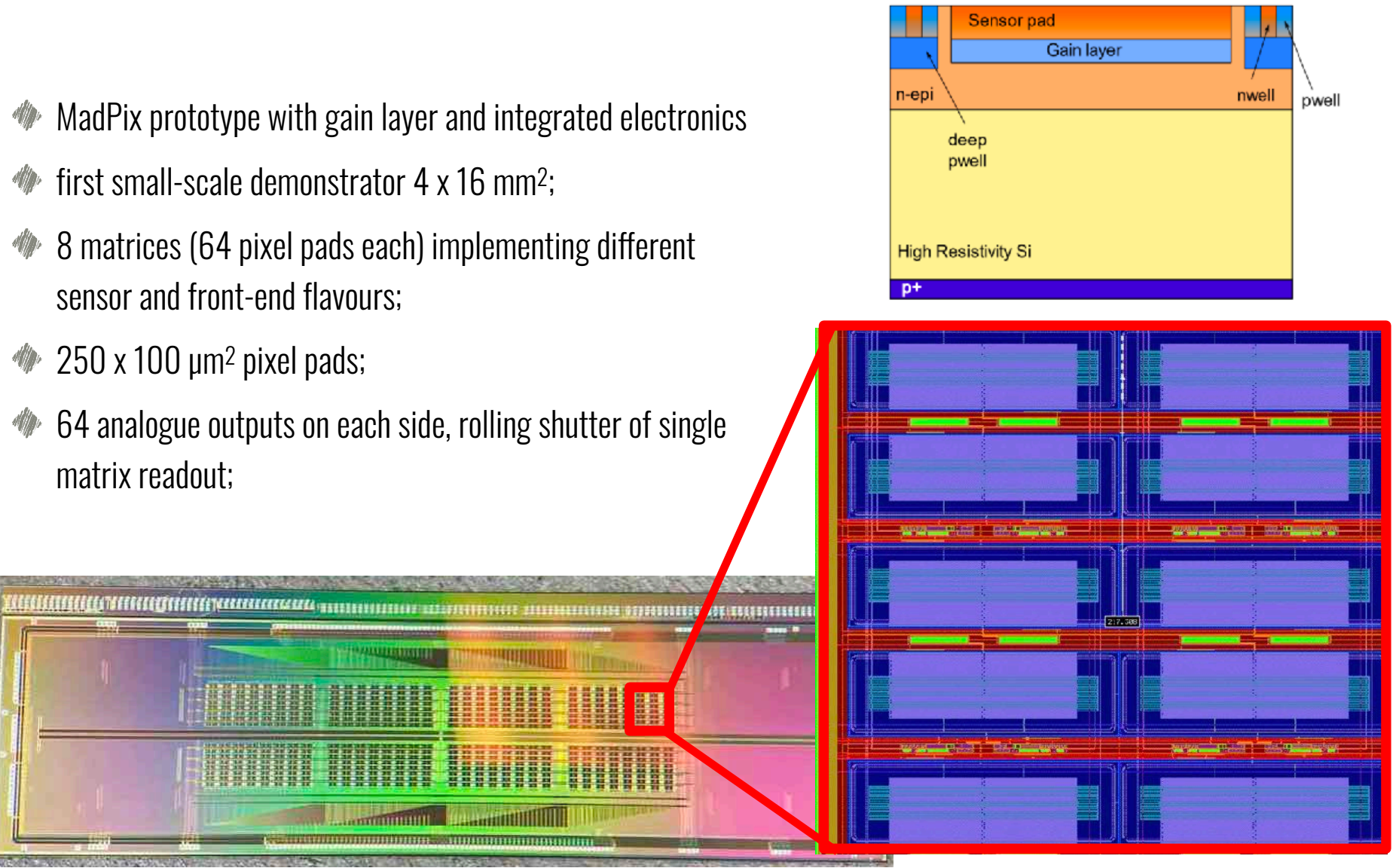
- caratterizzazione sensore FD-MAPS di ARCADIA (MD3) con sorgenti radioattive e laser, preparazione setup e partecipazione a test-beam, installazione telescopio multi-plane per acquisizione dati con raggi cosmici.
- simulazioni front-end analogico e back-end digitale con CAD/EDA tools per sviluppo di microelettronica in tecnologia CMOS.

ARCADIA-MD3: X-ray tube and CT

- X-ray setup (2 mA, 40 kV) with W tube (8.40 keV and 9.67 keV)
- Radiography samples and CT reconstruction (stepper motor, 1.8 deg)



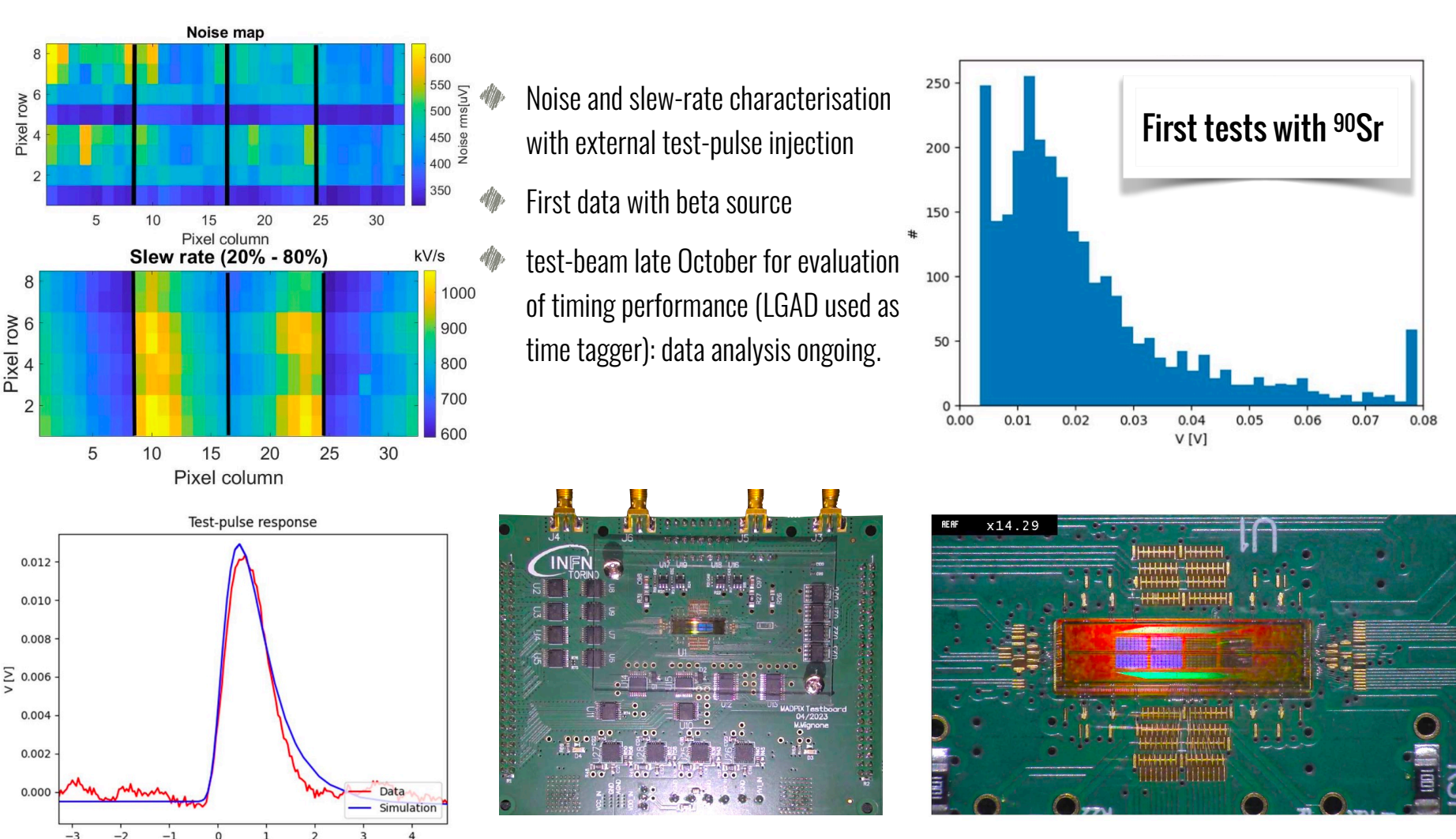
MadPix CMOS LGAD multi-pixel prototype



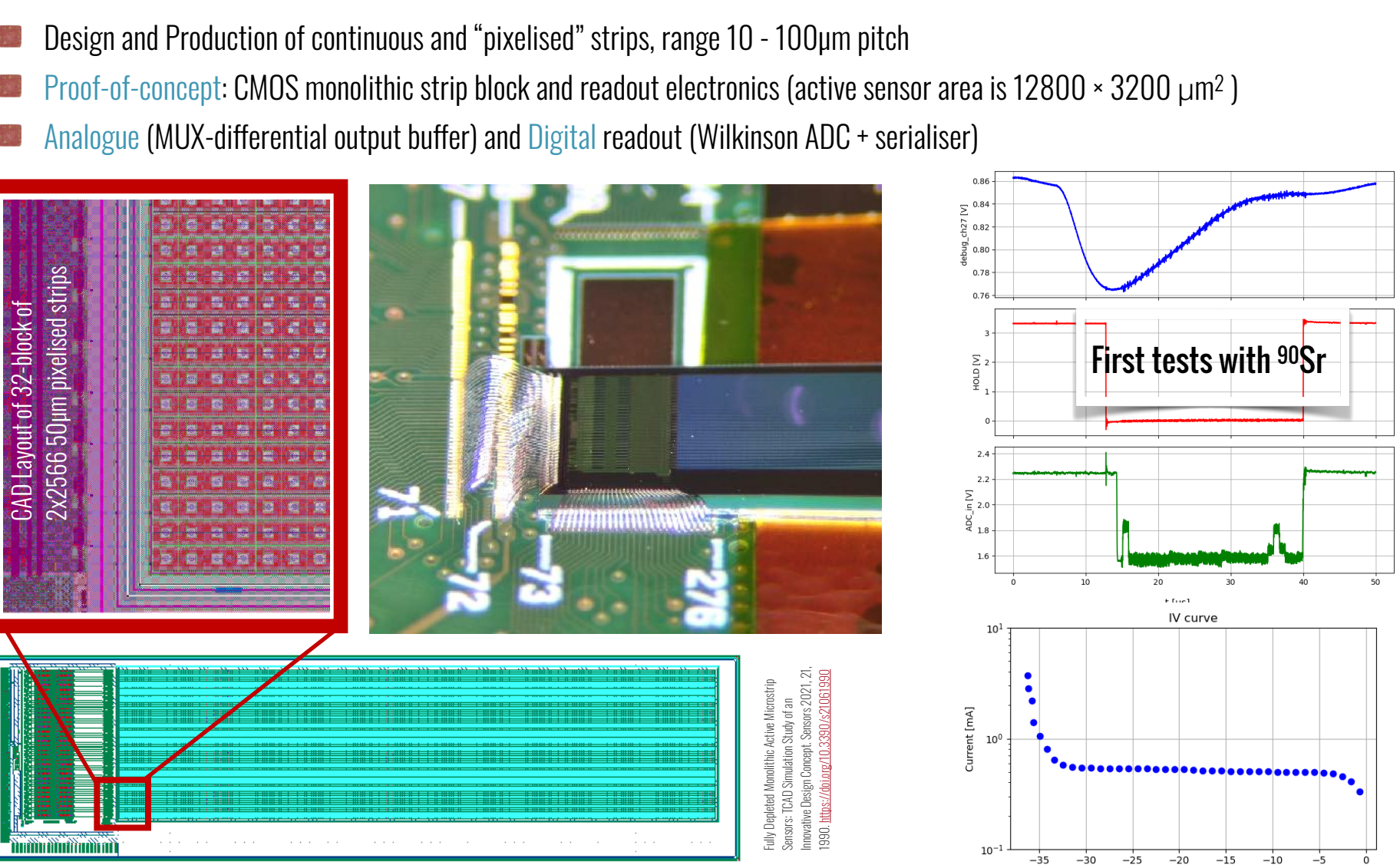
Proposte di Tesi:

- caratterizzazione dimostratore Monolithic CMOS LGAD con sorgenti radioattive e laser, preparazione setup e partecipazione a test-beam. Analisi dati test-beam.
- simulazione, progettazione e ottimizzazione sensori con guadagno per timing con tools TCAD e Montecarlo.

MadPix CMOS LGAD multi-pixel prototype: tests



FD Monolithic Active Microstrips



Proposte di Tesi:

- caratterizzazione dimostratore Monolithic Active Microstrips con sorgenti radioattive e laser, preparazione setup, sviluppo DAQ e partecipazione a test-beam.
- simulazione front-end analogico e ADCs con CAD/EDA tools per sviluppo di microelettronica in tecnologia CMOS

FD Monolithic Active Microstrips

- preAmp: CSA + TP injection circuit
- Slow Shaper branch for charge measurement with externally controlled S&H circuit
- Analogue readout (MUX-differential output buffer) and Digital readout (Wilkinson ADC and serialiser)
- Trigger output: Fast Shaper branch providing a fast-OR output
- ASTRA FastOR signal provides trigger to the FPGA
- FPGA sends HOLD signal and then start readout of analogue MUX

