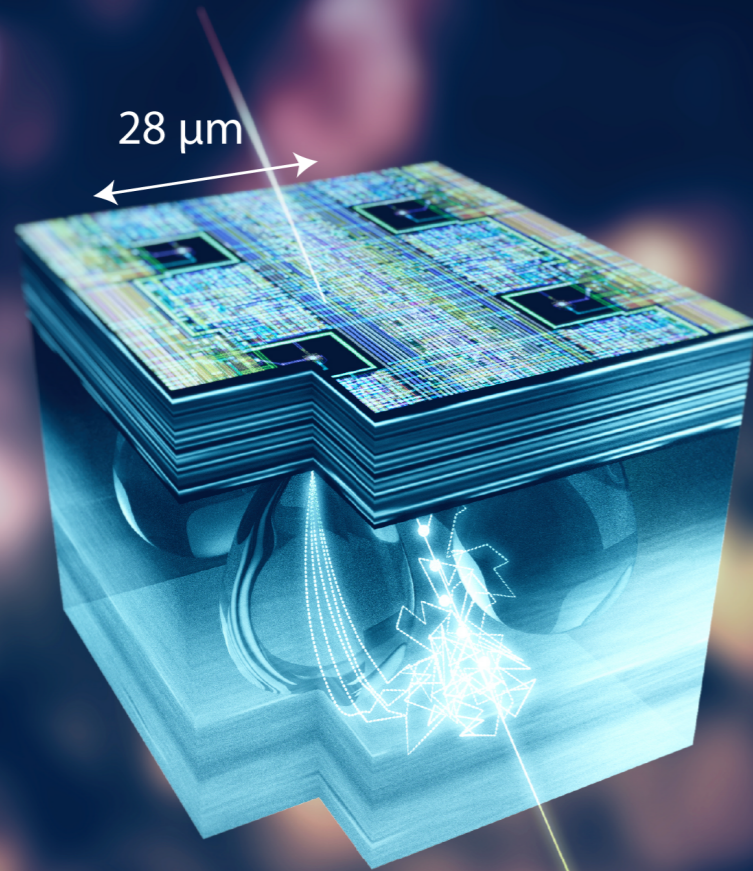


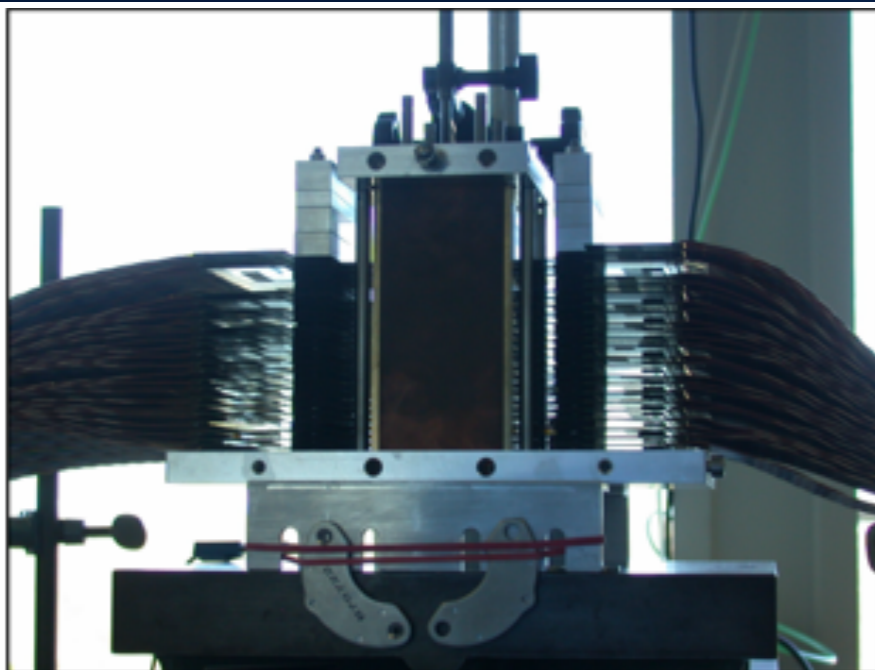
# ALPIDE sensor and FoCal R&D



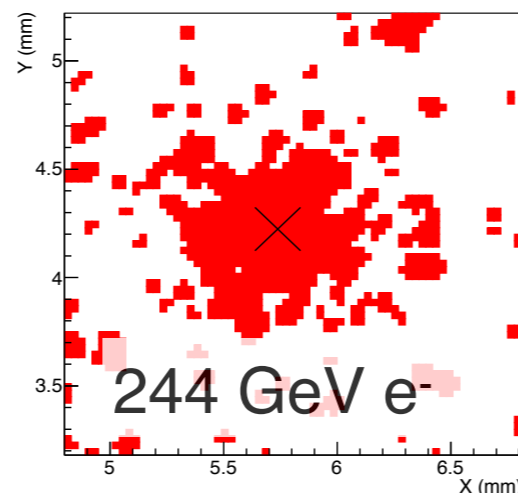
Current Alpide CMOS sensor used in ALICE ITS upgrade

Candidate sensor for digital pixel calorimeter

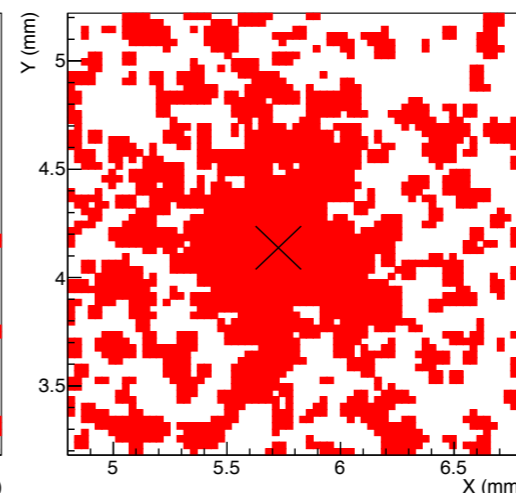
Proof of principle demonstrated  
need advanced Alpide sensor



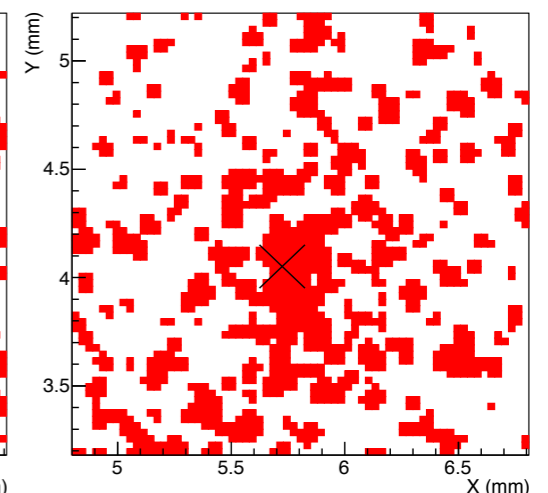
layer 4



layer 8



layer 12



# Future Applications of Alpid CMOS Sensors

- calorimeter-capable CMOS
  - FoCal
  - electron ID from pre-shower
  - a new tracking calorimeter concept for a revolution in particle flow
  - detector for proton CT
- requires additional R&D of digital part: higher bandwidth, data reduction, ...
- new generation of fully depleted CMOS sensor being developed at CERN
  - expect time of flight  $< 30$  ps

exciting times ahead for CMOS sensors

# A new experiment based on a “all-silicon” detector



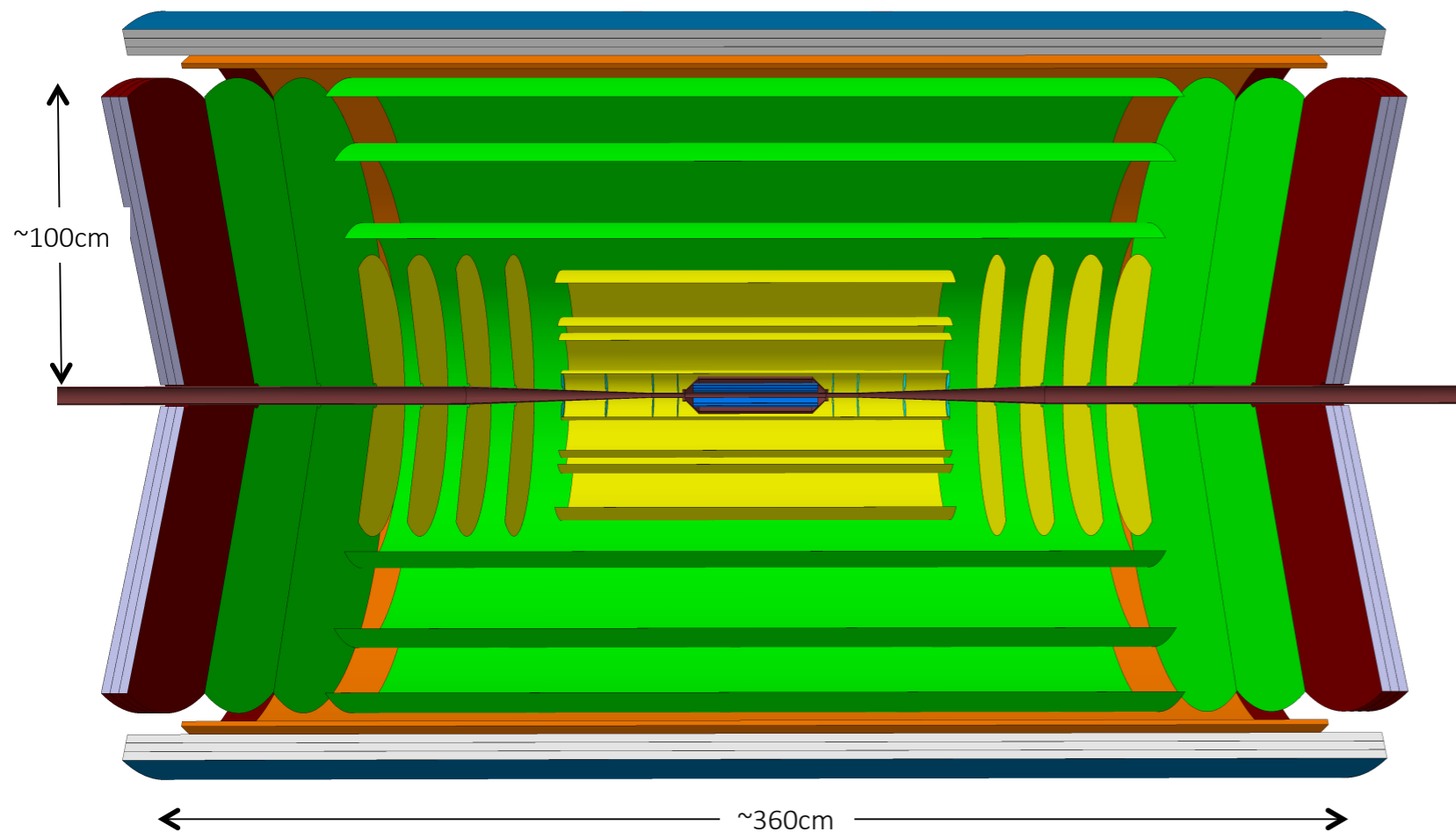
ALICE

Tracker: ~10 tracking barrel layers (blue, yellow and green) based on CMOS sensors

Hadron ID: TOF with outer silicon layers (orange)

Electron ID: pre-shower (outermost blue layer)

Extended rapidity coverage: **up to 8 rapidity units**  
**+ FoCal**



## Preliminary studies

### Magnetic Field

- $B = 0.5$  or  $1$  T

### Spatial resolution

- Innermost 3 layers:  $\sigma \sim 1\mu\text{m}$
- Outer layers:  $\sigma \sim 5\mu\text{m}$

### Time Measurement

Outermost layer integrates high precision time measurement  
( $\sigma_t < 30\text{ps}$ )

# Contribution to a Calorimeter-Alpide

- UU/Nikhef currently pioneering digital calorimetry
- Nikhef has significant contribution to Alpide development and ITS construction
- requires similar investment to ALICE ITS to stay in a leading position and profit from head start (from late 2019/early 2020)
  - design contribution to CMOS sensor periphery (bandwidth, data reduction)
  - contribution to modified readout board (FPGA-based)
  - assembly, testing etc, to be discussed (similar scale to ITS desirable)