

Admission to 2° PhD year of Technologies for Fundamental Research in Physics and Astrophysics

Michele Rignanese
curriculum: Electronics

12/09/2024



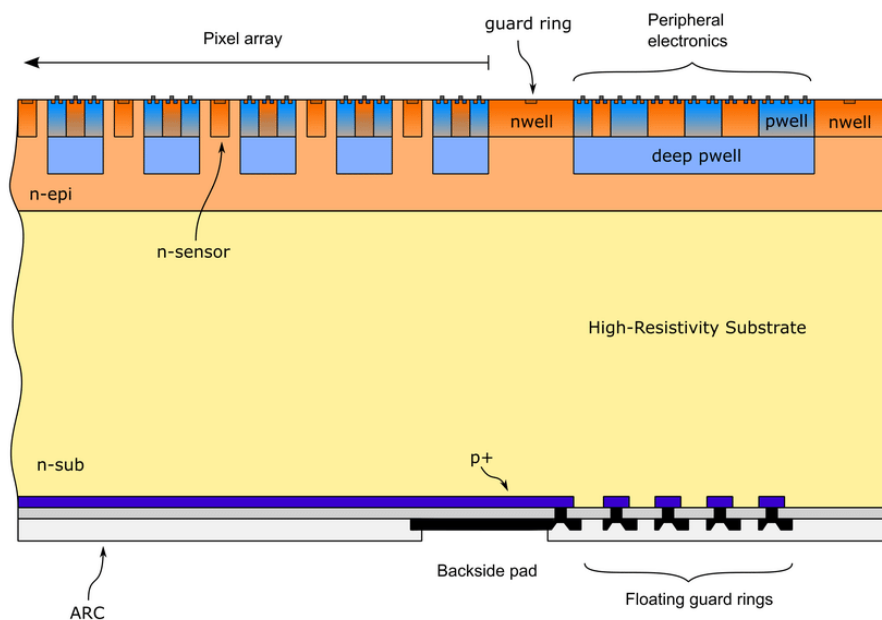
UNIVERSITÀ
DEGLI STUDI
DI PADOVA



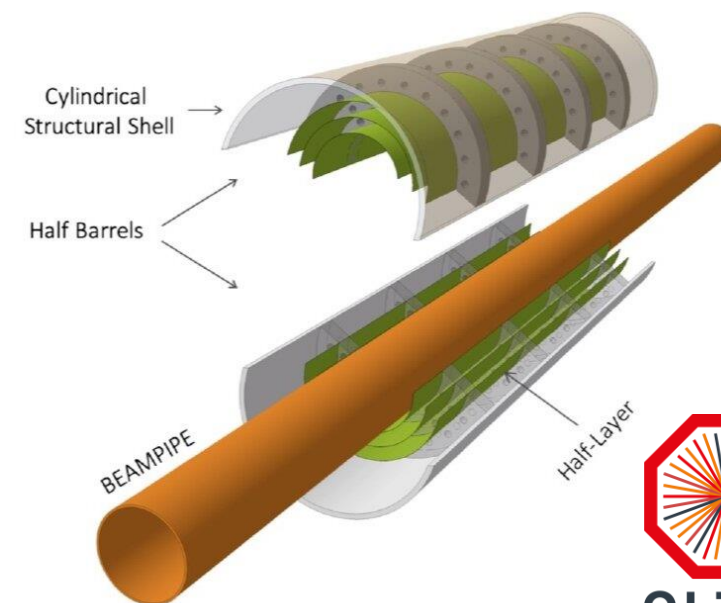
Dipartimento
di Fisica
e Astronomia
Galileo Galilei

RESEARCH TOPICS: PhD OBJECTIVES

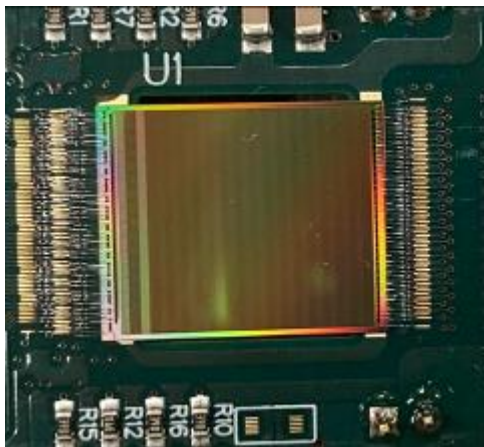
PhD general topic: development and characterization of novel CMOS **M**onolithic **A**ctive **P**ixel **S**ensors (MAPS) in 65 nm technology, exploiting stitching to realize single-die, ultra-large area sensors.



MAPS are used in HEP experiments for tracking applications for example



RESEARCH ACTIVITIES: ARCADIA

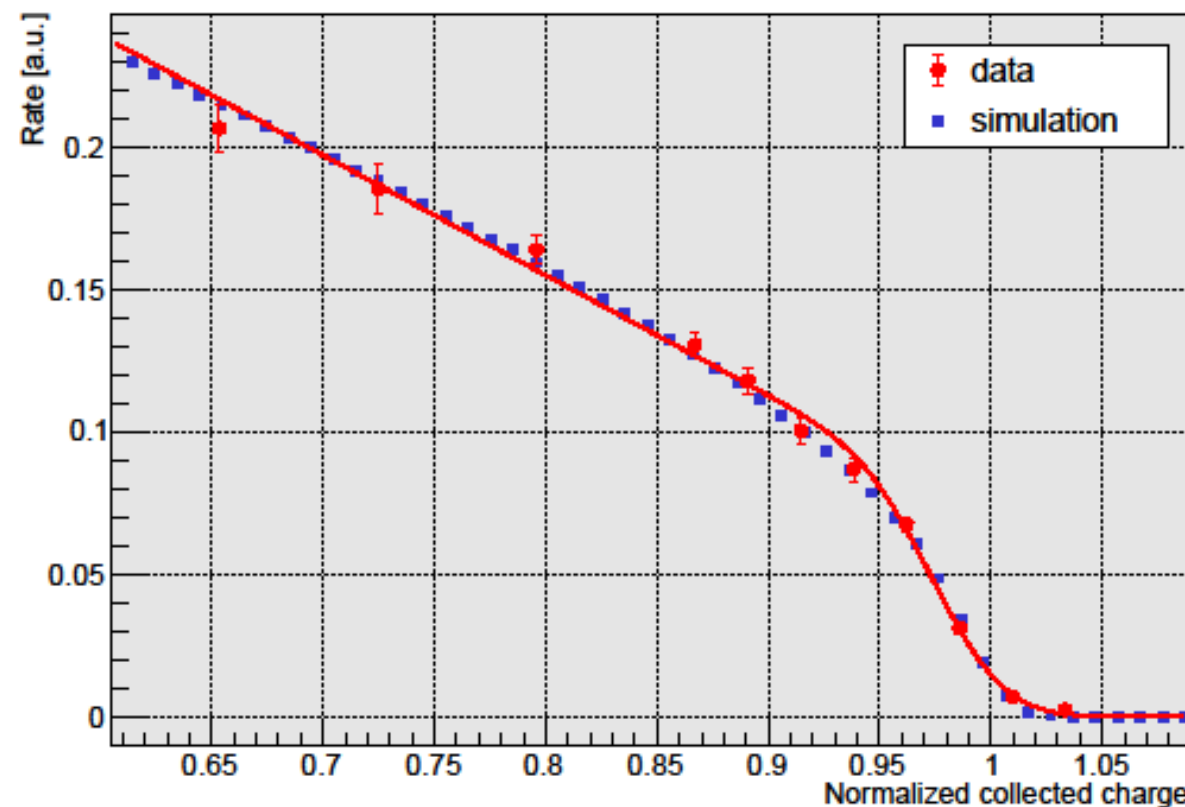


ARCADIA chip: an array made by 512x512 pixels

Alternative way: S-curve measurements using a **monochromatic** X-ray source (^{55}Fe) instead of test pulses

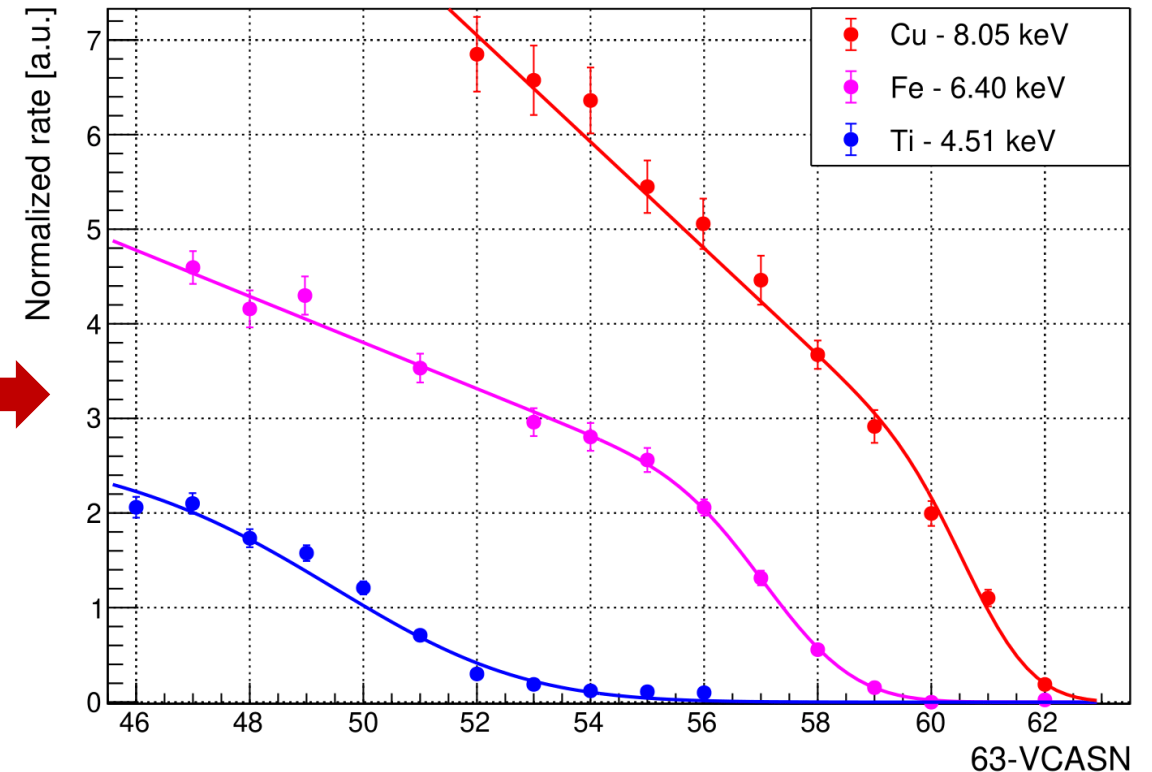
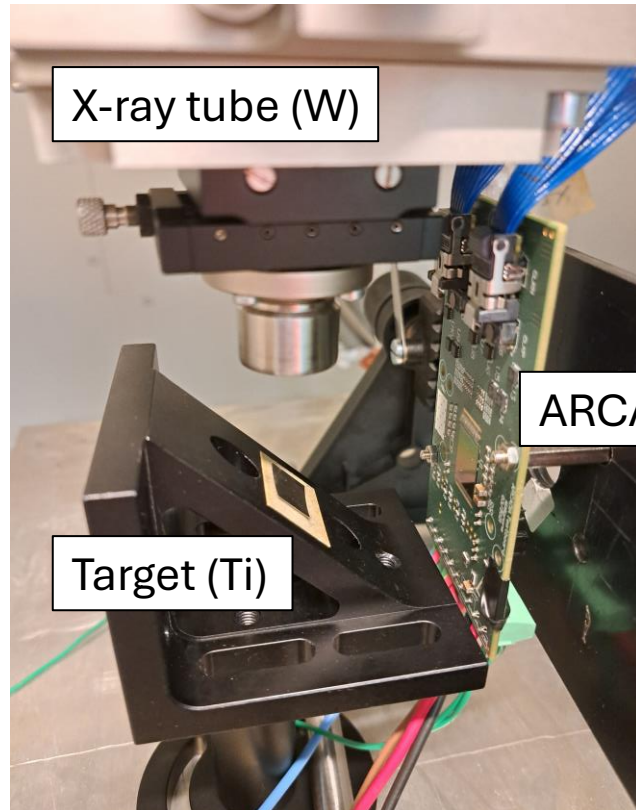
First measurements:
calibration of pixel thresholds
using test pulses

Value of injected charge is
different from what expected



RESEARCH ACTIVITIES: ARCADIA

Fluorescence: extract an almost monochromatic X-ray beam using a target



Parallel activity: electrical measurements (IV, CV, ...) on passive test structures with the same technology of the ARCADIA sensor.

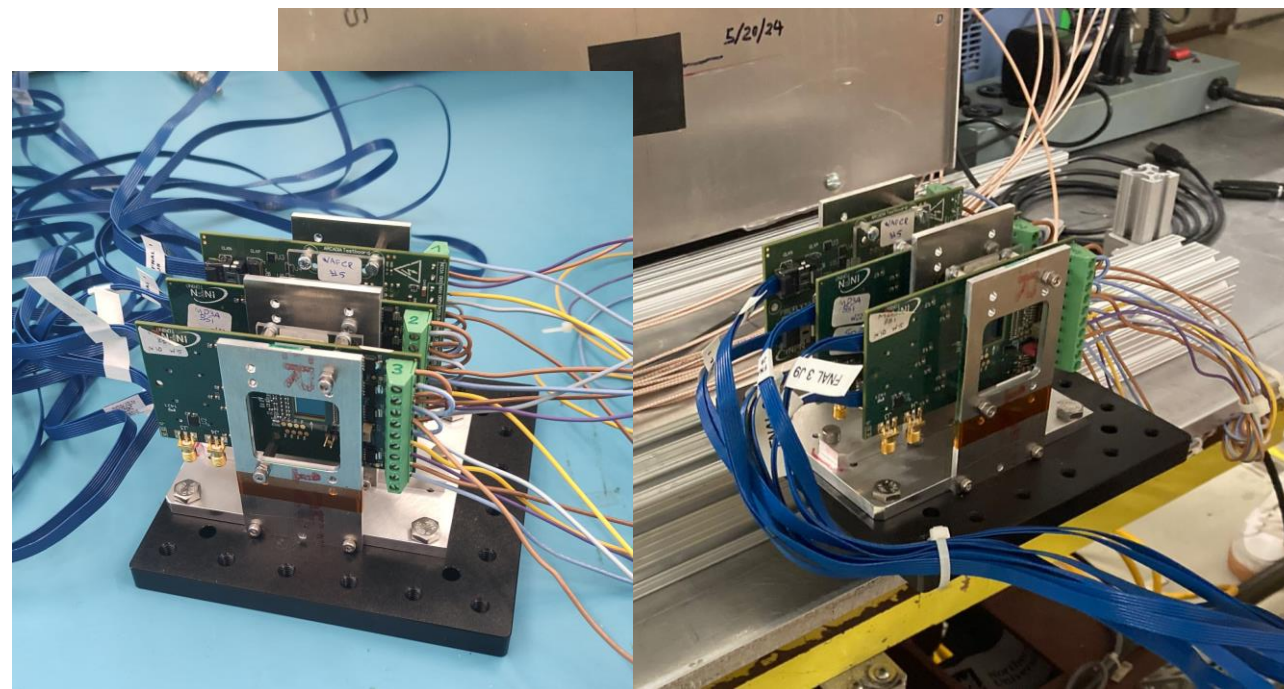
RESEARCH ACTIVITIES: ARCADIA

Further characterization of ARCADIA:
test beam at FNAL with 120 GeV
proton beam

- Commissioning of the telescope
- Developing the acquisition software to control 3 devices
- Testing with cosmic rays

Scans done during the test beam:

- over different threshold values
- varying Front-End Board parameters
- varying bias voltage

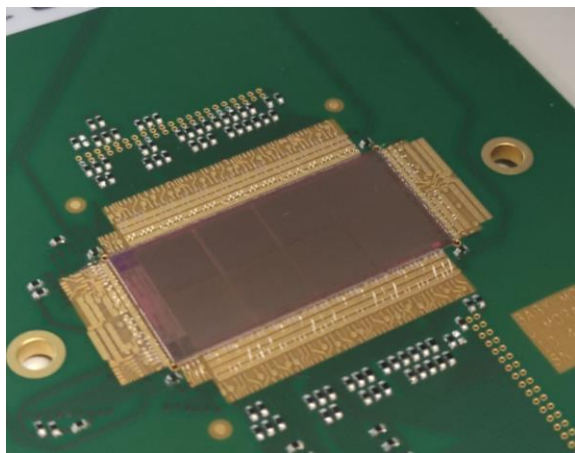


Data analysis: on going

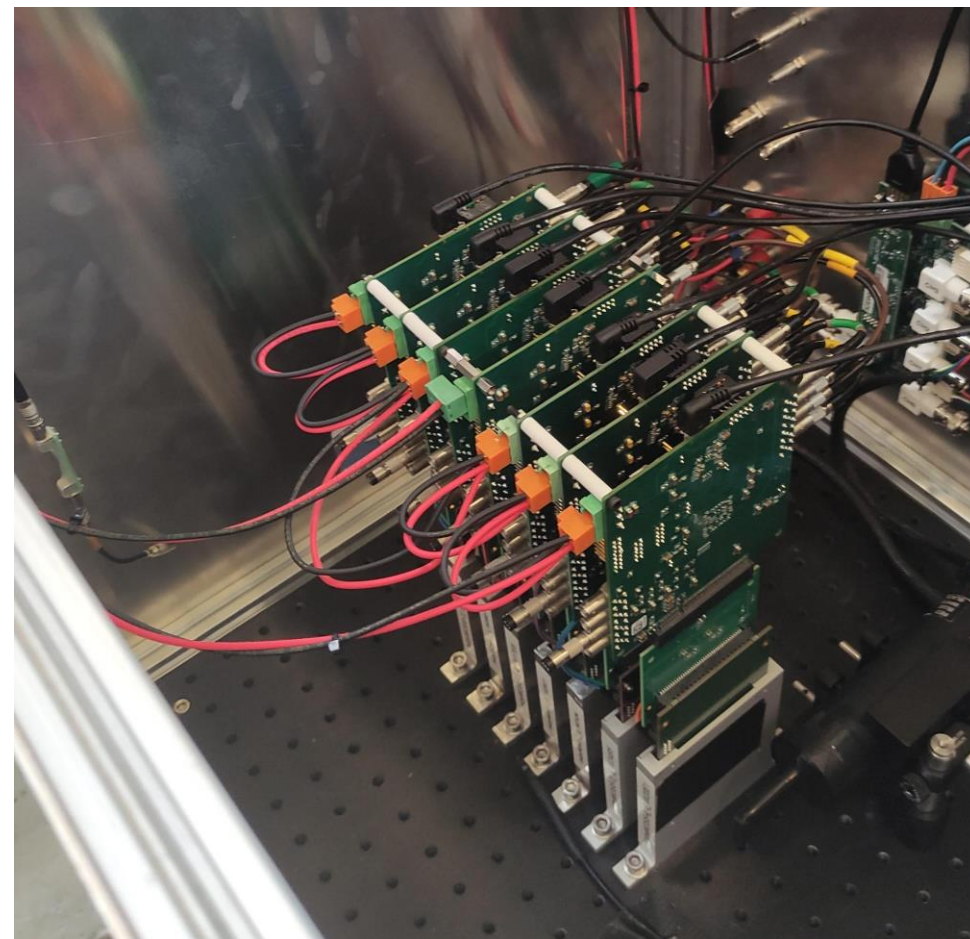
RESEARCH ACTIVITIES: ALICE BABY-MOSS

ALICE collaboration planned an upgrade of its Inner Tracking System (ITS3) using **stitched sensors**

Participation to lab activities and test beam at PS at CERN



Baby-MOSS bonded on carrier board. It is constituted by two stitched half-unit



Telescope with 6 reference baby-MOSS(s)



PLANNED ACTIVITIES FOR 2° YEAR

- Data analysis of the ARCADIA test beam did in July at Fermilab
- Further test beams to complete ARCADIA characterization, depending on the results of the data analysis
- Data analysis of baby-MOSS test beam since ALICE collaboration planned to do a summary of characterization measurements by the beginning of October
- Learn in depth how baby-MOSS works, so that I can actively participate to the development and characterization of the final chip that will be used for ITS3 upgrade



EXAMS AND SCHOOLS

First year: exams and schools

- Embedded design with FPGA: exam passed on June 11th. This course is taken from UniPD Information engineering PhD school
- Machine Learning for Physics: I have attended the lectures
- Applied superconductivity: quantum phenomena and quantum systems
- ESC Efficient Scientific Computing School from October 14th to October 24th

Second year: exams and schools

- Design of readout integrated circuits for particle detectors
- ISOTDAQ – International School of Trigger and Data Acquisition