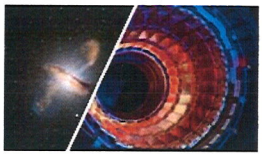

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UNIVERSITÀ DEGLI STUDI DI PADOVA

PhD course of National Interest in Technologies for Fundamental Research in Physics and Astrophysics

Annual report

Name and surname: Michele Rignanese
Cycle and a.a.: 39th cycle 2024-2025
Supervisor: Piero Giubilato

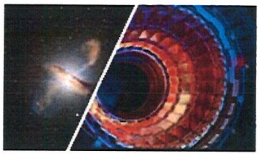
- **Research activity carried out during the year**

During my second year of PhD, I continued the characterization and analysis work within both the ARCADIA project and the ALICE collaboration for the ITS3 upgrade. In the first part of my second year (November–December 2024), I focused on the analysis of the data collected during the test beam performed at the CERN PS with the babyMOSS telescope. In this test campaign we studied the spatial resolution and efficiency of three babyMOSS prototypes: one non-irradiated sensor and two irradiated sensors. I was responsible for the analysis of the data and the comparison of the performance of the different devices. Within the ARCADIA project, the main activity has been the analysis of data collected during the Fermilab test beam (June–July 2024). The goal of this study was to assess the performance of the device in terms of spatial resolution and tracking efficiency. In parallel with this work, I also completed laboratory measurements started during the first year, to have a more complete characterization of the chip. These measurements include: threshold scans with test pulses and ^{55}Fe source, and measurements with monochromatic fluorescence X-rays, to calibrate the chip energy response. The combination of laboratory and test beam measurements provides a comprehensive picture of the sensor performance, and two papers are currently being written. For my third year of PhD, I will continue working on both the ALICE ITS3 and ARCADIA project. For the first one, I already started to contribute to the development of the DAQ software of the test system for the MOSAIX chip, which will be the final prototype for the ITS3 upgrade. As service work for the collaboration, I will also do data analysis to estimate ITS2 performances by looking at the shape and size of clusters produced by tracks in the layers of the ALICE Inner

Tracking System. On the ARCADIA side instead, I plan to develop a telescope based on multiple tracking planes, extending the two-plane setup used in the Fermilab test beam. The aim of this upgrade is to develop a tracking system based on standard tools of data acquisition and analysis that can be used for test beam characterization of ARCADIA chips as well as a wide range of other pixel, strip, or other detectors.

- **List of attended courses and passed exams**
  - Embedded Design with FPGA: exam done in the first year
  - Machine Learning for Physics: exam done on May 14th, 2025
  - Efficient Scientific Computing school: school attended in Bertinoro with final examination
  - Design of readout integrated circuits for particle detectors: I attended the course, and I plan to do the exam by the end of the second year

- **List of attended conferences, workshops and schools, with mention of the presented talks**
  - ALICE Italia meeting in Brescia 16-18 December 2024. I presented a talk on the results of the PS test beam with babyMOSS chip: *Results of test beam campaign on baby-MOSS with MOSS-RAISER telescope at CERN PS*
  - Workshop on Electronics for physics experiments and applications in Torino 5-7 March 2025. Presented a poster on *Laboratory and test beam characterization of ARCADIA MAPS*
  - ISOTDAQ school in Vilnius 17-26 June 2025: international school on trigger and data acquisition systems
  - ELMA Workshop on "Energy loss measurements with MAPS" in Trieste 10-11 September 2025
  - (Future conference) 111° Congresso Nazionale SIF, 22-26 September 2025. Oral presentation on *Characterization of stitched prototypes chip for the ALICE ITS3 upgrade*



- (Future conference) IEEE NSS MIC RTSD in Yokohama, 1-8 November 2025. Oral presentation on *Fully Depleted MAPS in 110nm CIS technology for particle tracking and X-ray detection*

- **List of published papers/proceedings**

- **Thesis title (even temporary)** Temporary title: CAP: CMOS – Advanced Pixels

Date: 03/09/2025 **Signature** Michele Ryzanese

Seen, the supervisor