

**INTENSE: particle physics experiments at the high intensity frontier,
from new physics to spin-offs.**

A cooperative Europe – United States – Japan effort



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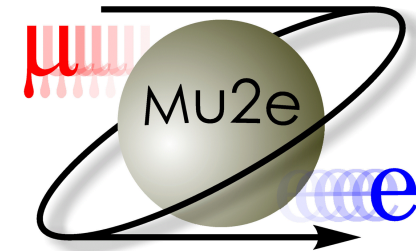
INTENSE Midterm Review Meeting



About me

- Master's degree in Theoretical Physics at University of Pavia with a thesis on hadron physics.
- Ph.D. in Applied Physics at University of Genova with a thesis on superconducting magnets.
- First postdoc at the INFN Section of Cagliari on LHCb experiment.
- Second postdoc at University of Pisa on Mu2e experiment.

Mu2e Software Simulation Framework



- The Mu2e offline software is a collection of code and scripts for simulation, calibration, reconstruction, analysis and event display. This collection includes all code necessary for the experiment, from the device firmware to analysis software.
- It also includes code to characterize the quality of results delivered by the reconstruction code when it is run on simulated events and on experimental data, once they will be available.
- For these studies, Mu2e has developed several software packages, simpler codes permitted a fast start to many critical studies but did not have all the features needed for development of hit based reconstruction code.
- These software packages are based on the *art* (Event-Processing Framework).

Art: Event-Processing Framework



- *art* is an event-processing framework, written in C++ 11, developed and supported by the Fermilab.
- The *art* framework is used to build physics programs by loading physics algorithms, provided as plug-in modules. Each experiment or user group may write and manage its own modules.
- *art* also provides infrastructure for common tasks, such as reading input, writing output, provenance tracking, database access and run-time configuration.
- Mu2e users use *art* as an external package. They provide executable code to *art* in pieces called *art modules* that are dynamically loaded as plugins and that operate on event data.

Secondments:
July 21st – August 6th, September 10th – 23rd, 2022

- Our scope was to develop a data-driven method for antiproton background measurement.
- My task was to simulate the conversion electrons (CEs) by using the Mu2e software framework.
- The software offers two different procedures to simulate the generation, digitization and reconstruction of the conversion electrons.
- As a cross-check, the two procedures should give the same results.
- With the help of an expert at Fermilab, I identified two bugs that carried to simulate CEs with different kinematics.

Secondments:
November 30th – December 13rd, 2022

- My next task is to simulate all background of the experiment, so that it could be added to the antiproton simulations.
- However, I discovered another bug in the code that causes fluctuations in the simulation results.
- I am planning to work with an expert at Fermilab to identify the origin of the problem.