Report from a Seconded Researcher MidTerm Review of SENSE

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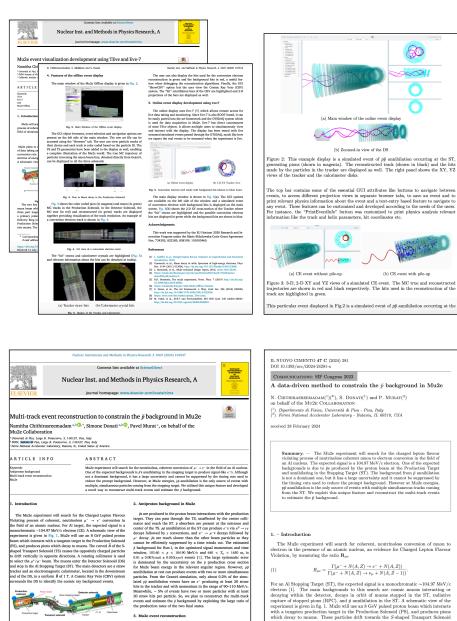
Introduction

- I joined University of Pisa, INFN Pisa in April 2021 for my PhD research under the *Grant Agreement* no.858199 of the European Union Horizon 2020 Programme, Marie Skłodowska-Curie Actions (MSCA), Innovative Training Networks as a part of the INTENSE project.
- I work on the Mu2e experiment. It will look for the charged lepton flavour violating process of neutrinoless muon to electron conversion in the field of an aluminium nucleus.
- My doctoral thesis is entitled "A data-driven method to estimate the antiproton background in Mu2e".
- I joined the ICARUS experiment in September 2022. I am studying the track splitting and stitching efficiency at the cathode using CRT-PMT match.
- I plan to submit my thesis by March 2025 and further continue as a Post-doc at the University of Pisa, working on the ICARUS experiment.



PhD research

- In Mu2e, developed the event display; worked on track reco algorithms; installation of electronics on the straw tracker panels (one of the main Mu2e detectors).
- One of the backgrounds in Mu2e is antiprotons annihilating in the stopping target to produce signallike electron.
- Not a dominant background but 100% systematic uncertainty due to the uncertainty in the \bar{p} production cross section for the Mu2e proton beam energy.
- We have developed a novel way to reconstruct multi-track events (a unique signature of \bar{p} annihilation) and estimate the \bar{p} background in-situ.
- This work was presented in various conferences like ICHEP 2024, Pisa Meeting on Advanced Detectors, International Workshop on Tau Lepton Physics, SIF, APS April Meeting, ACAT etc.



The Mulle event rec tr. From MC studies, about 90% of the bits in an

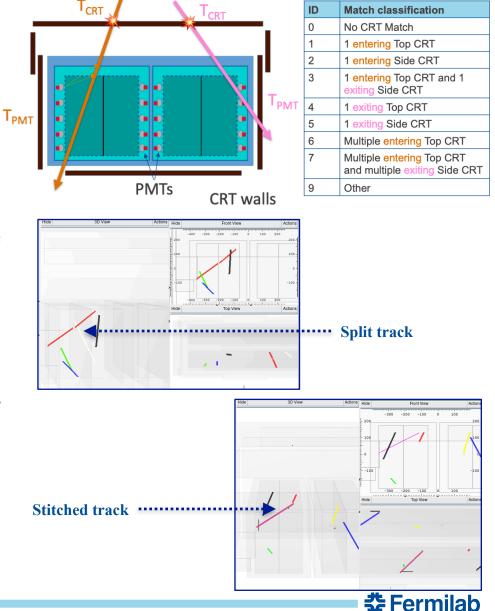
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(TS). The curved magnetic field of the TS causes the oppositely charged particles to

Track Splitting in ICARUS (SENSE Secondments)

- Bends in the cathode can result in track misalignment and thus track splitting.
- In this study we use events with a cosmic muon entering from the Top CRT, crossing the cathode, producing a PMT flash, then exiting out the Side CRT.
- We have a CRT-PMT matching algorithm and we specifically select events with a Flash Classification = 3.
- The goal is to understand the track misalignment at the cathode and evaluate the track stitching efficiency of the reconstruction algorithm.



Future

- Submit the thesis by March 2025.
- Continue working on neutrino physics as part of the ICARUS collaboration.
- Be present at Fermilab for hands-on work on the ICARUS detector and perform relevant analyses.



