



UV Laser Calibration System: A probe to Determine Electric Field Distortion inside Liquid Argon Time Projection Chambers

Midterm Review Meeting- INTENSE
24 June 2022

Supervisor:

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Self Introduction:

- Born on 6th November, at Kasaragod, India.
 - BSc in Physics (August 2014 - May 2017)
Government College Kasaragod, Kannur University, India.
 - MSc in Physics (August 2017 - May 2019)
Central University of Karnataka, India
- Master's Thesis - " Study of Matter-antimatter asymmetry through leptogenesis"
Indian Institute of Technology (IIT), Guwahati
- Started as Marie Curie Early stage researcher/ PhD Student
University of Bern, Switzerland in March 2021.

Bekal Fort, Kasaragod



Lauterbrunnen, Switzerland

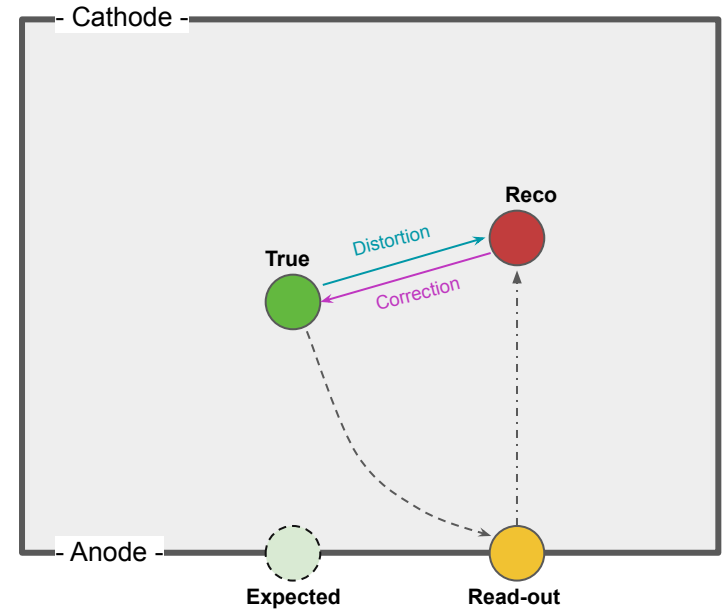


Workshops, Schools and Courses:

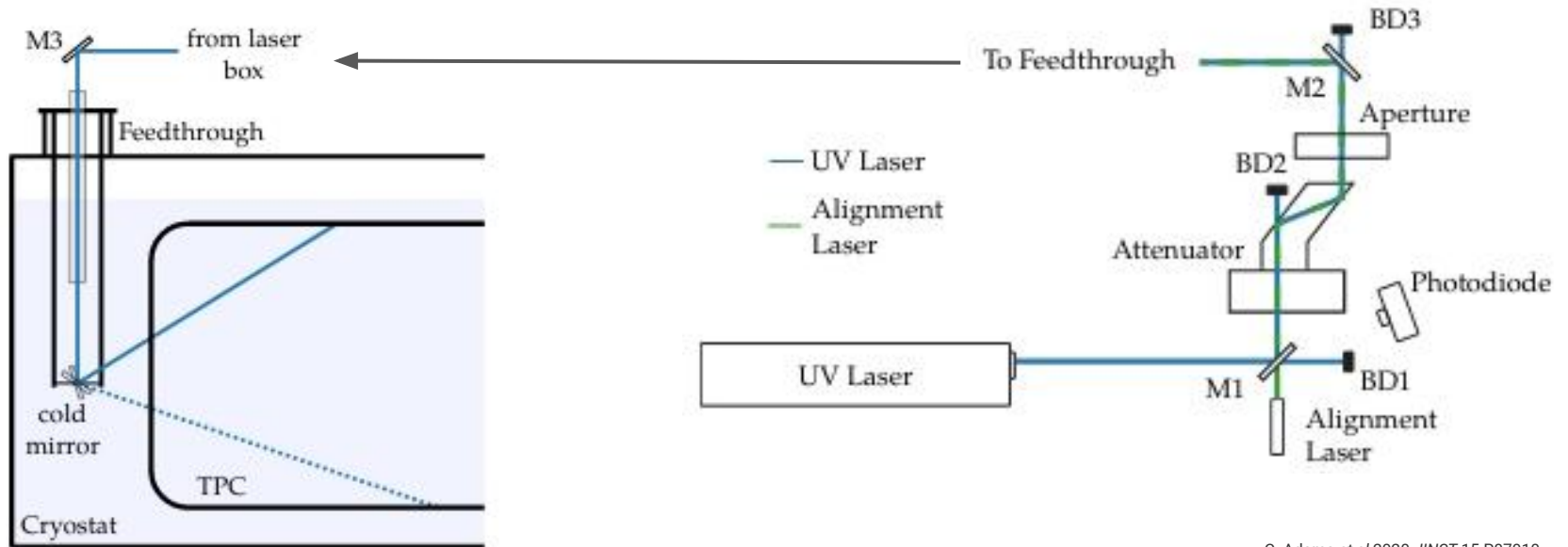
- PyHEP 2021 Workshop (virtual)
05 July 2021- 09 July 2021.
- Fermilab - C++ / Standard Template Library course by Glenn Downing (virtual)
17 August 2021 - 14 September 2021
- 2021 SBN Calibration Workshop (virtual)
27 September 2021 - 01 October 2021.
- International Workshop on Cosmic-Ray Muography 2021 (virtual)
24 November 2021 - 26 November 2021
- Bern Winter School on Machine Learning, Murren
31 January 2022 - 04 February 2022
Worked on a mini ML project named “ Finding Muons in LArTPC”
- KSETA Short Course : Introduction to Machine Learning and Deep Learning (Virtual)
KSETA Short Course: Neutrino mass phenomenology
05 October 2021 - 15 October 2021.

The need of an UV Laser Calibration System:

- Electric field distortion inside TPC due to space charge effect.
- Discrepancies between true and reconstructed points.
- Reduces track and energy reconstruction efficiencies of the detector and introduces additional systematic uncertainties



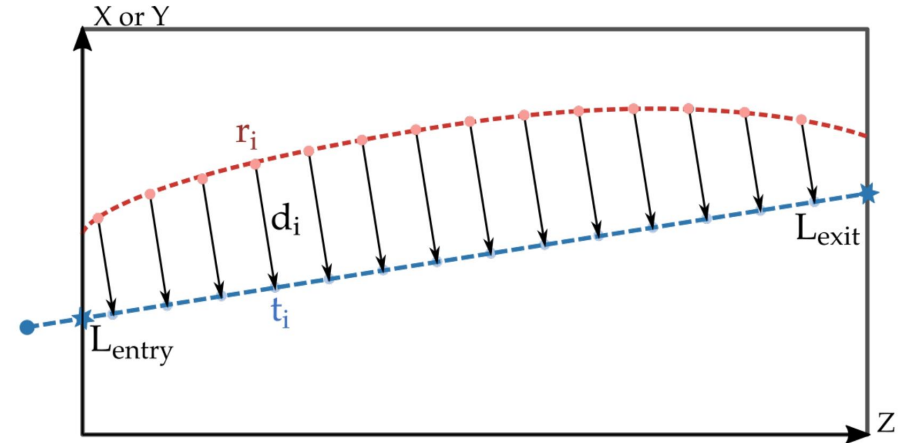
Schematic representation of MicroBooNE UV laser calibration set up



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Spatial displacement maps:

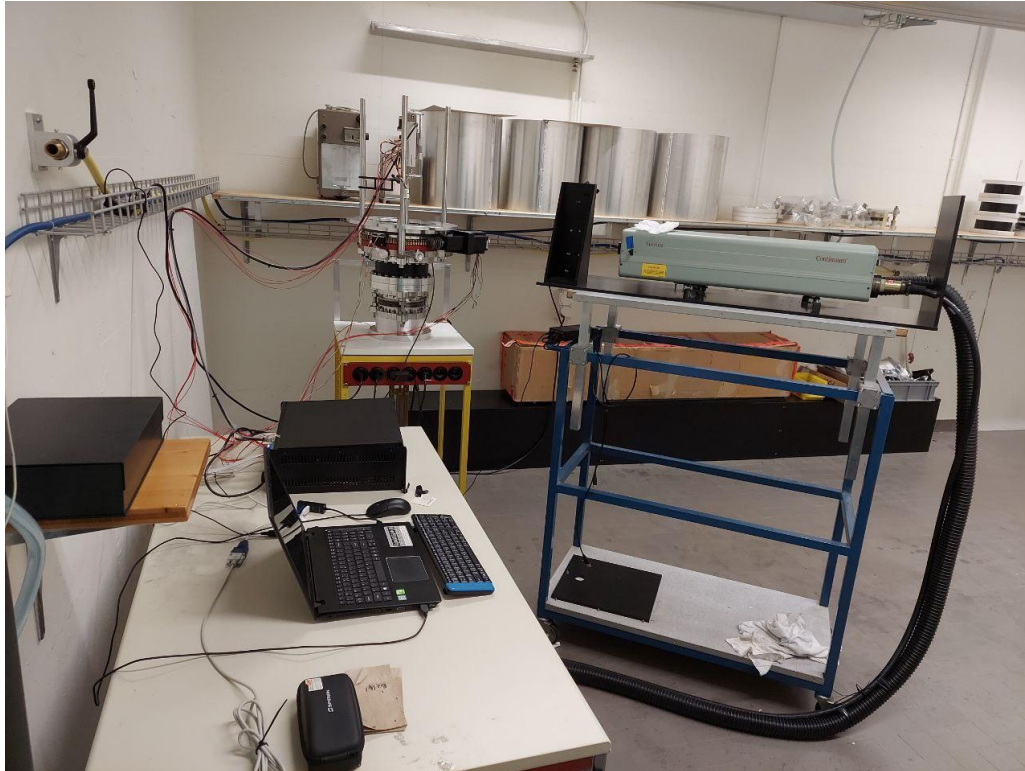
- **Correction Map:** Based on reco spatial coordinates
Gives expected true points, given by the reco points.
- **Distortion map:** Based on True spatial coordinates.
Gives expected reco points, given true points.



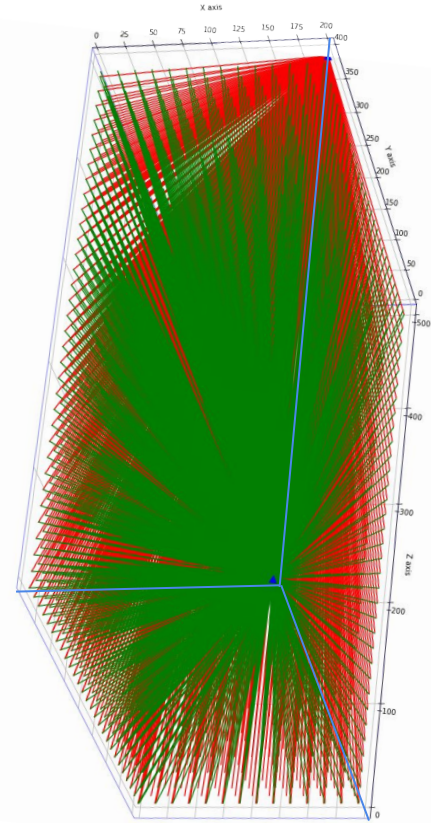
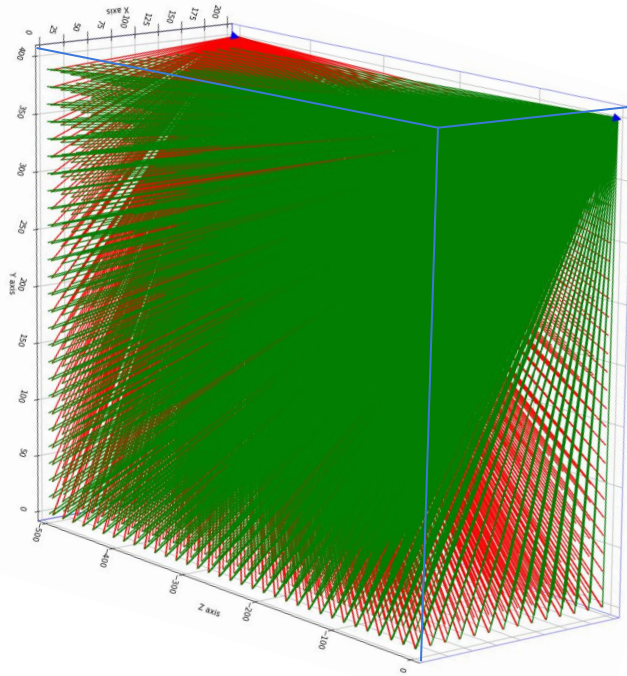
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- The vectors from the reconstructed track points (red) to their closest point on the true track (blue) are the **correction vectors**.
- The vectors starting from the true track (blue) to the reconstructed track points (red) are the **distortion vectors**
- This forces the displacement vectors to be perpendicular to the corresponding true laser tracks.

Laser test facility at LHEP:



Expected laser tracks in a SBND TPC.



Future:

- Simulation with Diffusion, SCE
- Reconstruction and correction maps
- Cable production, Transportation.
- Laser System Installation at Fermilab.

