



Results from dE/dx measurements of electrons at LAL

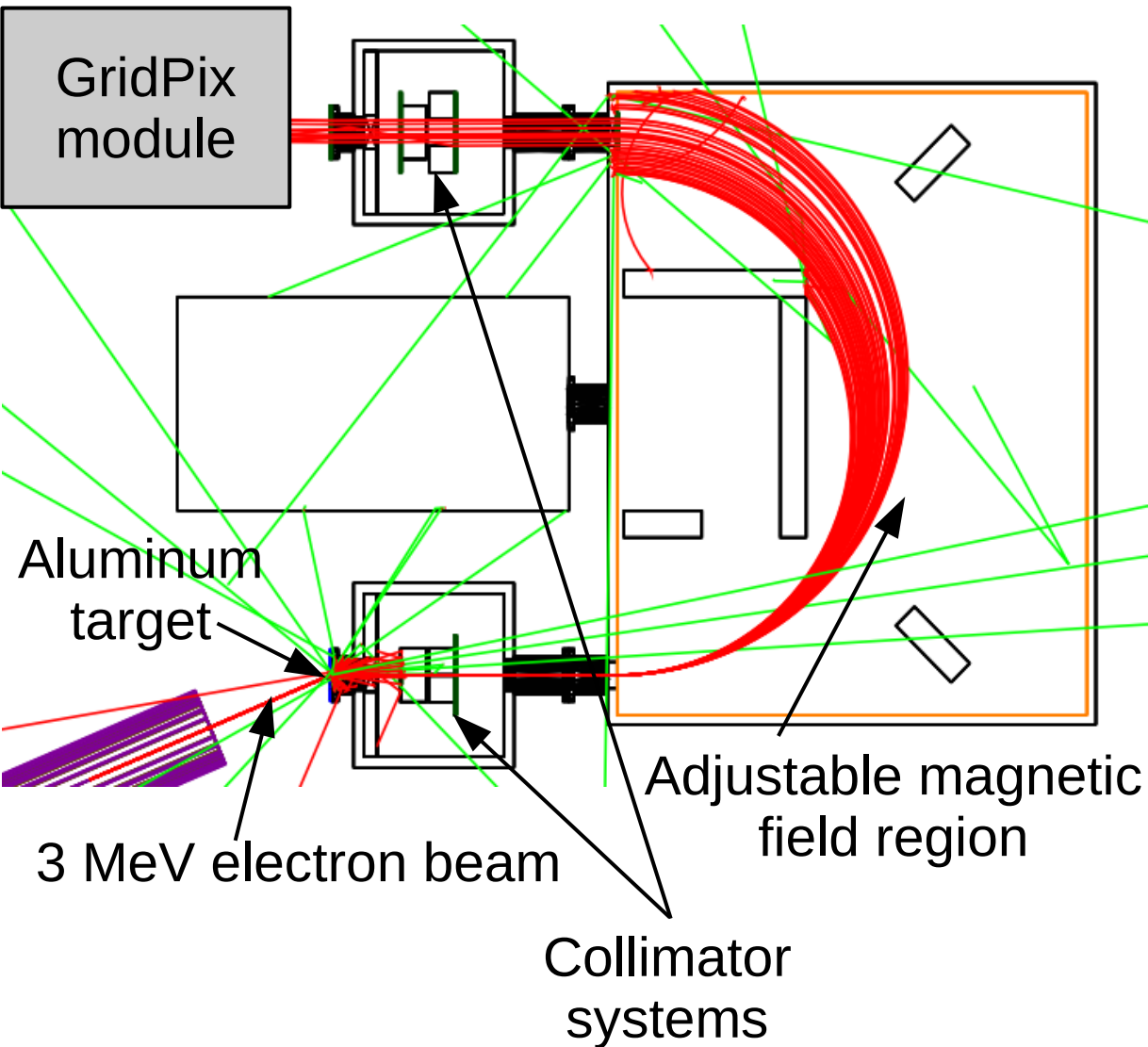
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LCTPC Collaboration Meeting
29 November 2017 to 1 December 2017, DESY

Agenda

- 1) Experimental setup
- 2) Track reconstruction
- 3) Analysis
- 4) Bethe-Bloch curve
- 5) Comparison with simulation

Experimental setup



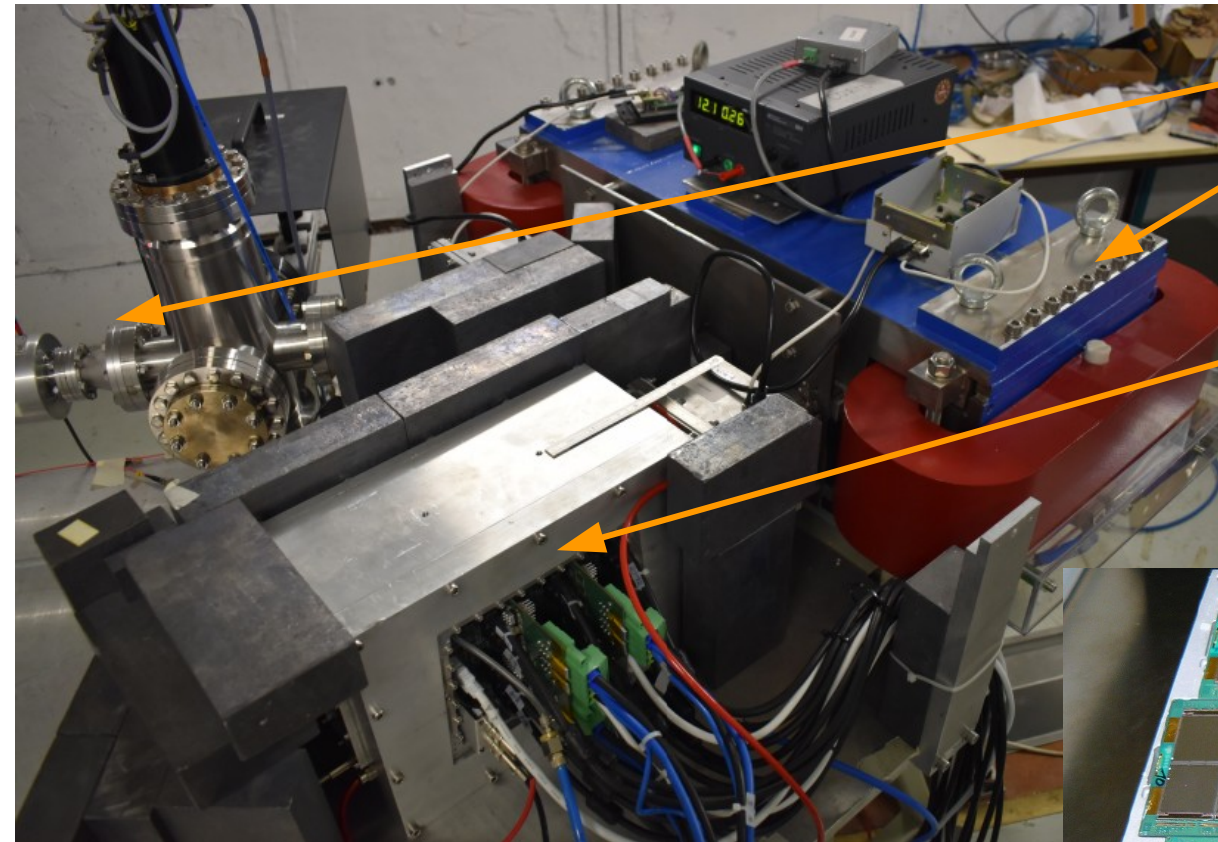
le@tech

- Low Energy Electron
TECHnique

Motivation for the test beam:

- Measure the dE/dx for electrons of up to 3 MeV kinetic energy
- Study the LEETECH capability as a gaseous detectors testing tool

Experimental setup



Beam pipe

Dipole magnet

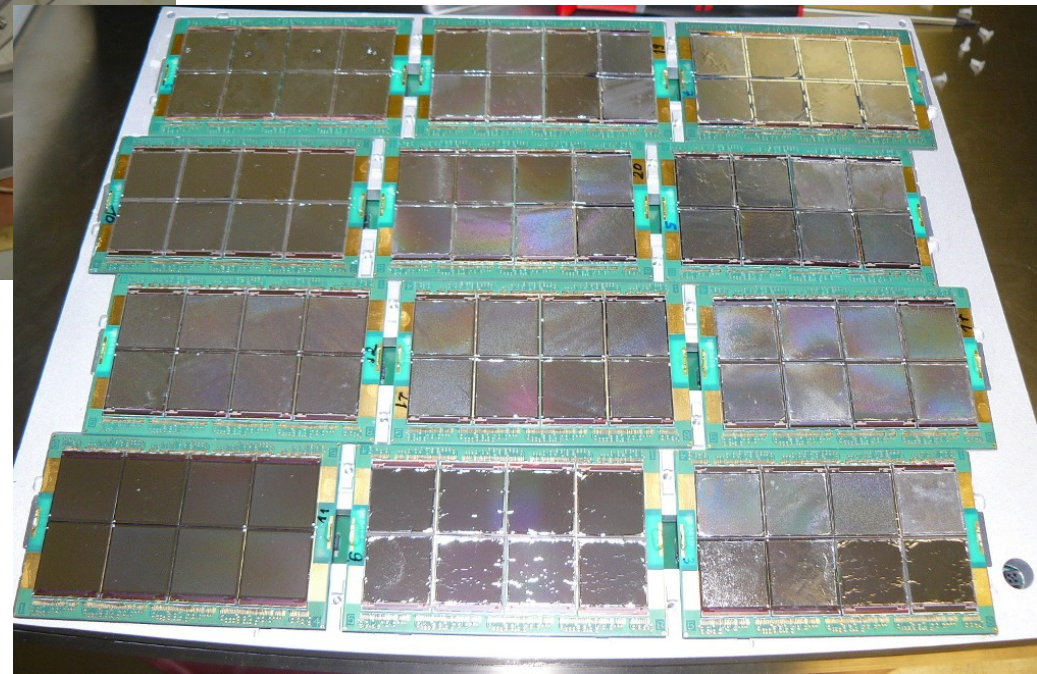
Lead shielding

GridPix module

96-chips GridPix module

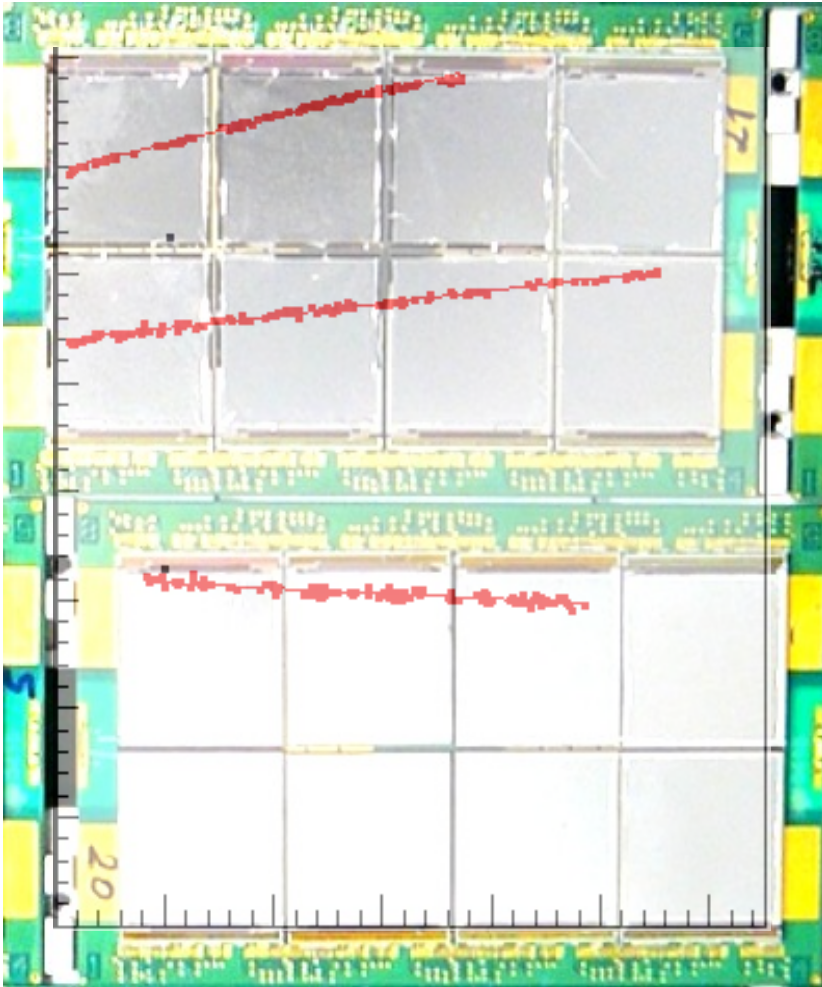
Gas mixtures used:

- He/ $i\text{C}_4\text{H}_{10}$ 80/20
- He/ CF_4 / $i\text{C}_4\text{H}_{10}$ 89/6/5

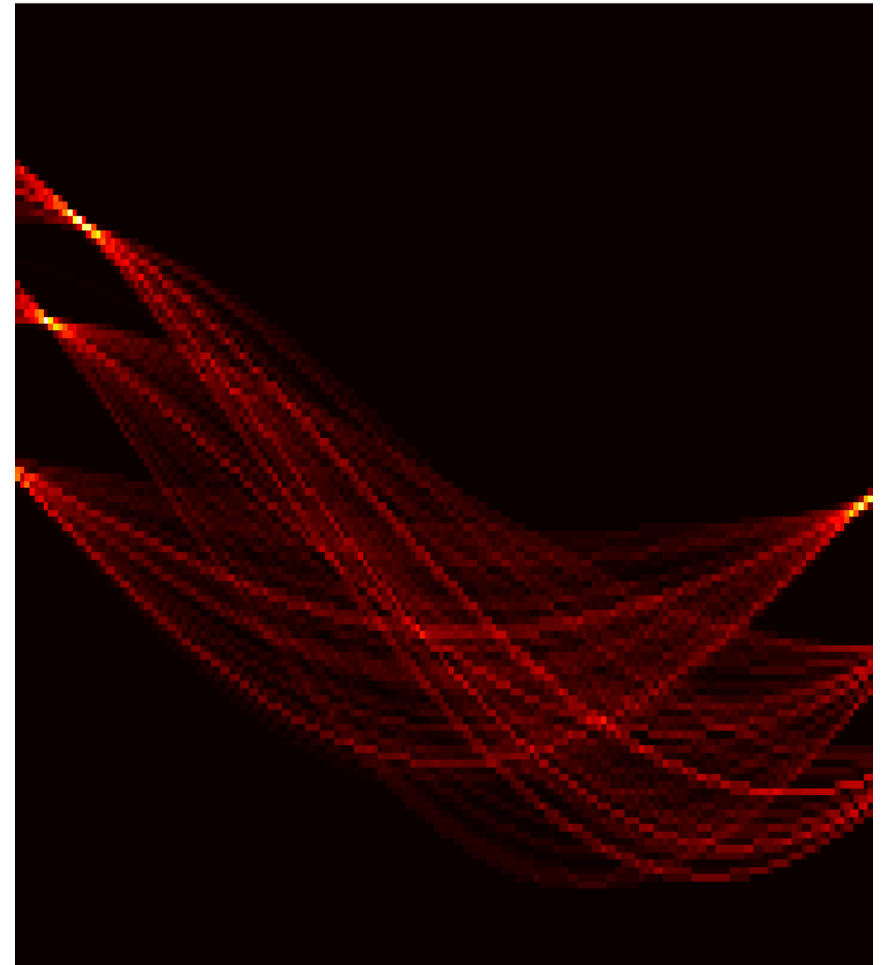


Track reconstruction

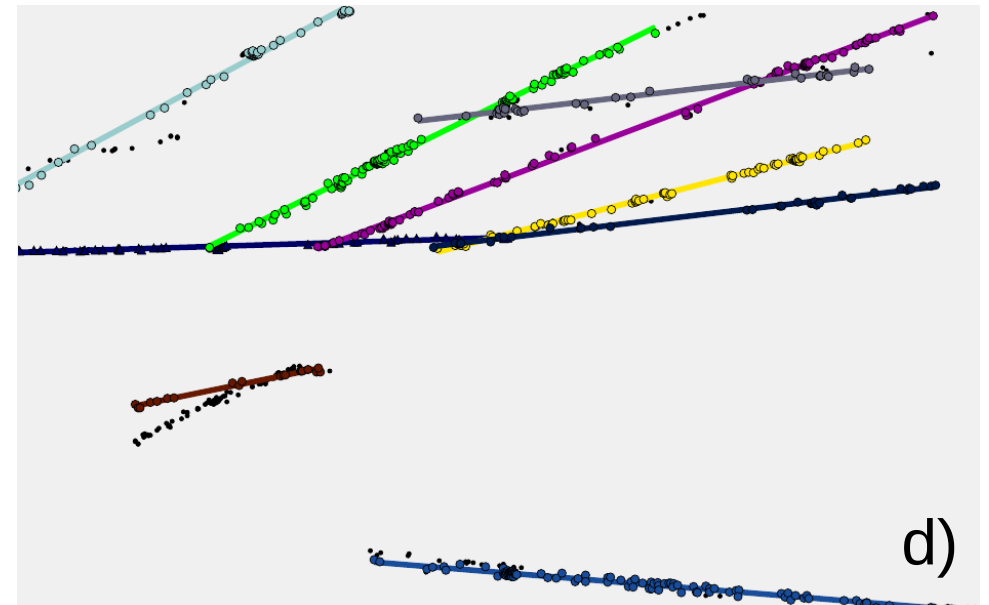
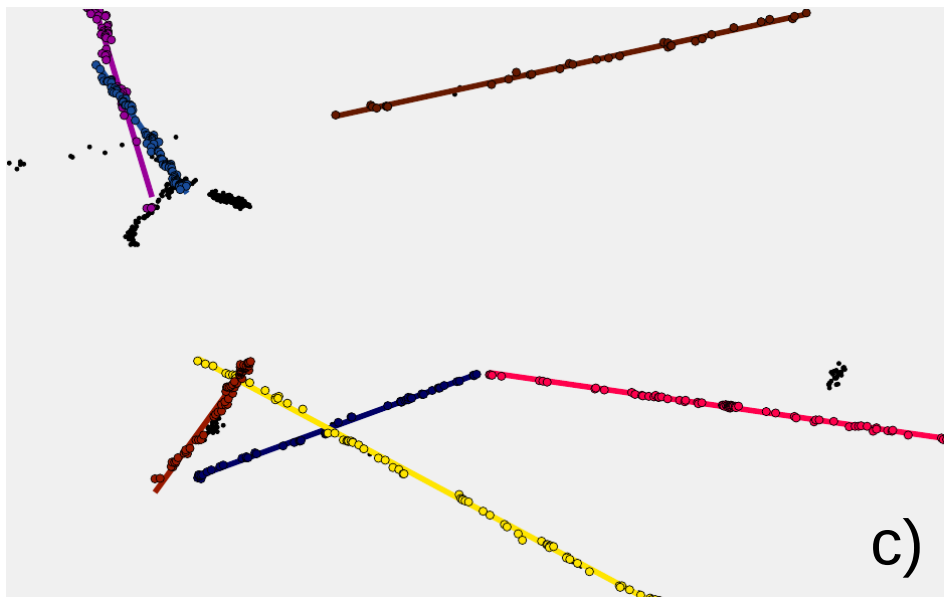
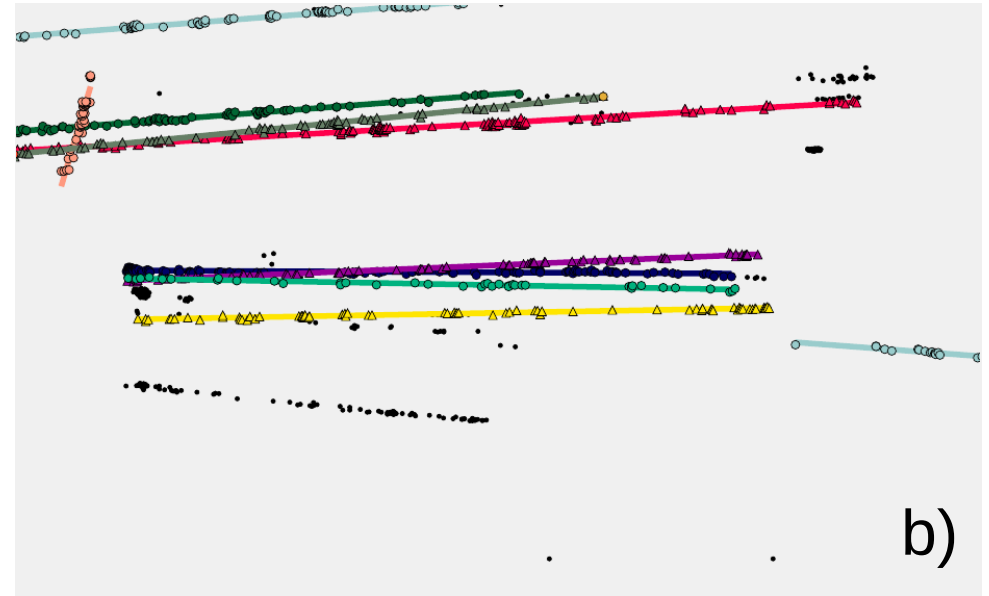
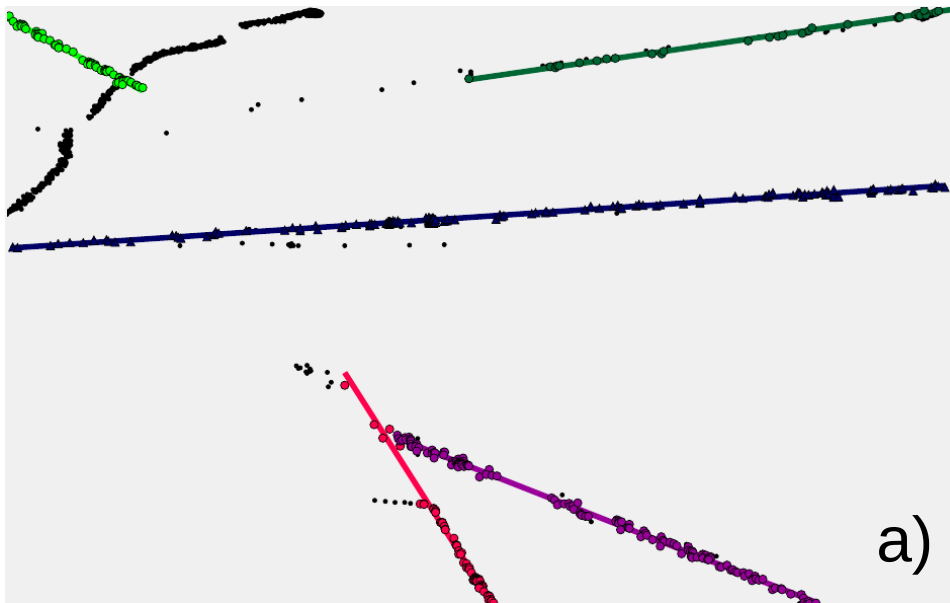
Reconstructed event



Hough transform
(histogram maxima indicate tracks)



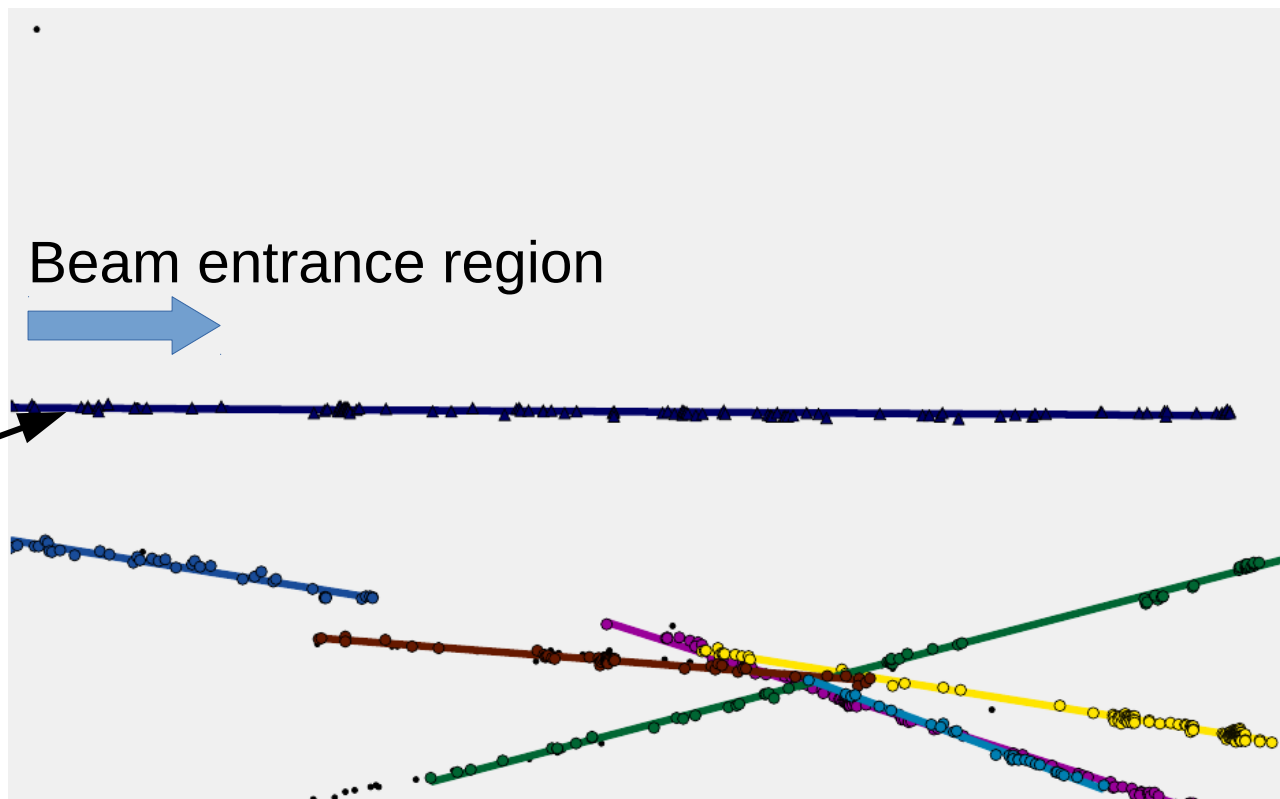
Track reconstruction



Track analysis

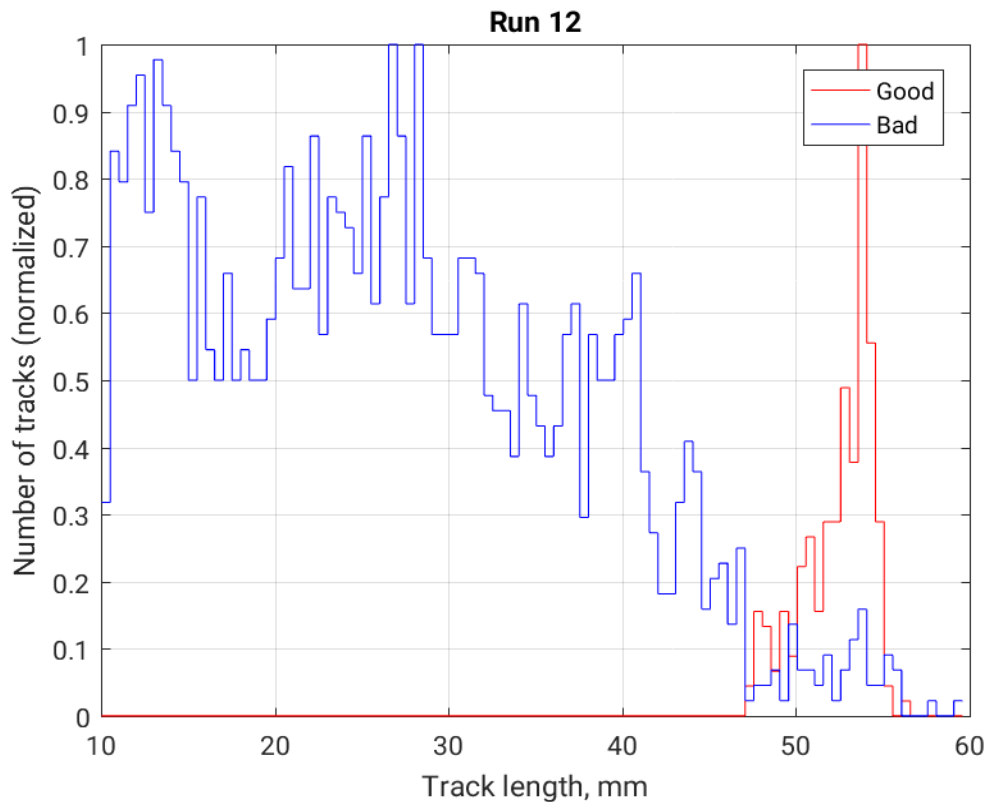
- A pivot run containing 1000 events was analyzed.
- Good tracks were selected manually (a mouse click on the track, not too much time).
- Different markers (▲) for good tracks are automatically set.
- Histograms of various track parameters were plotted for good and bad tracks.
- Derived cuts are fixed and automatically applied to further reconstruction results.

Selection criteria

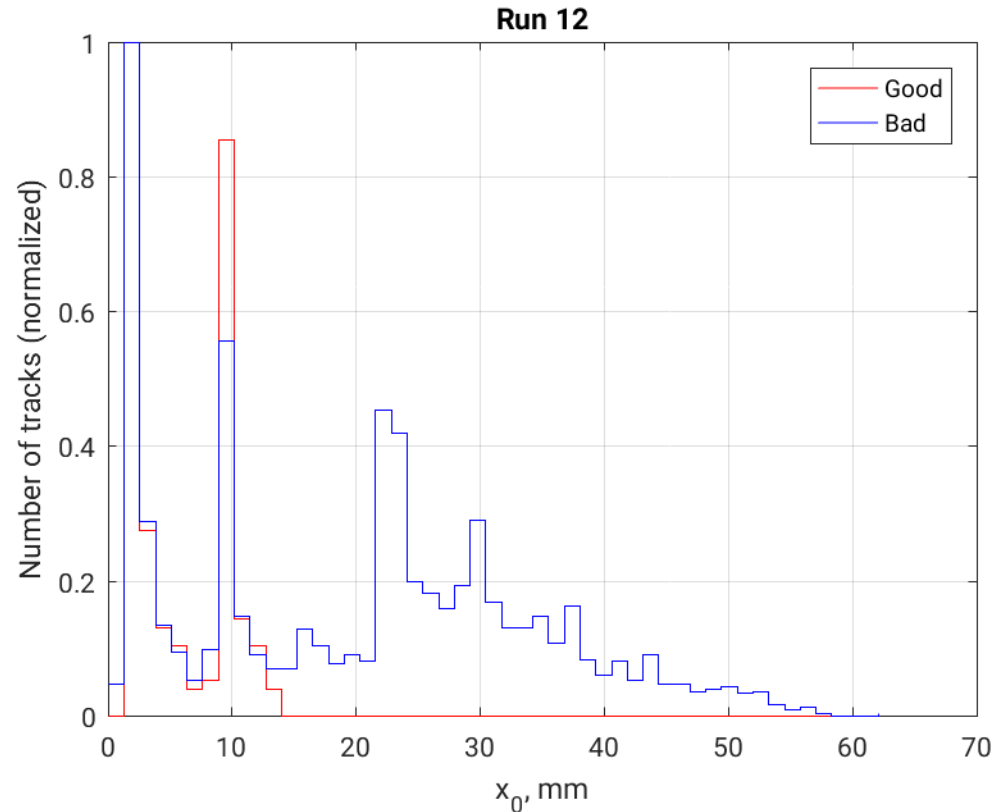


Track analysis

Track parameter plots from manual selection



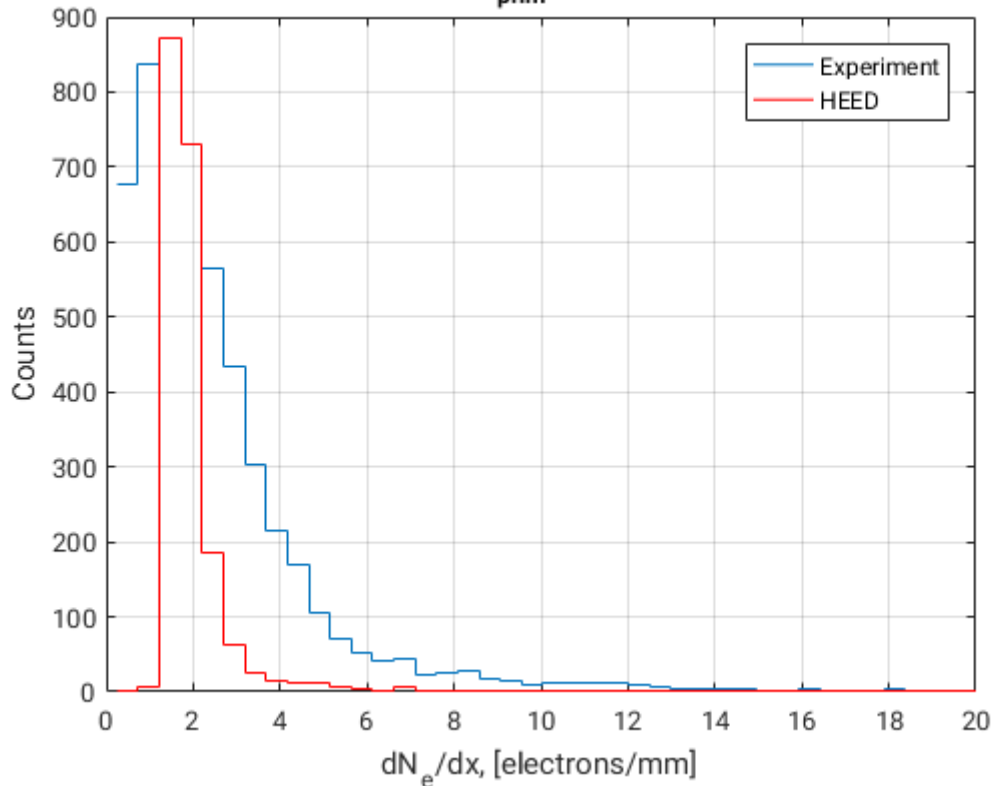
Only long tracks passing through the whole octoboard are considered.



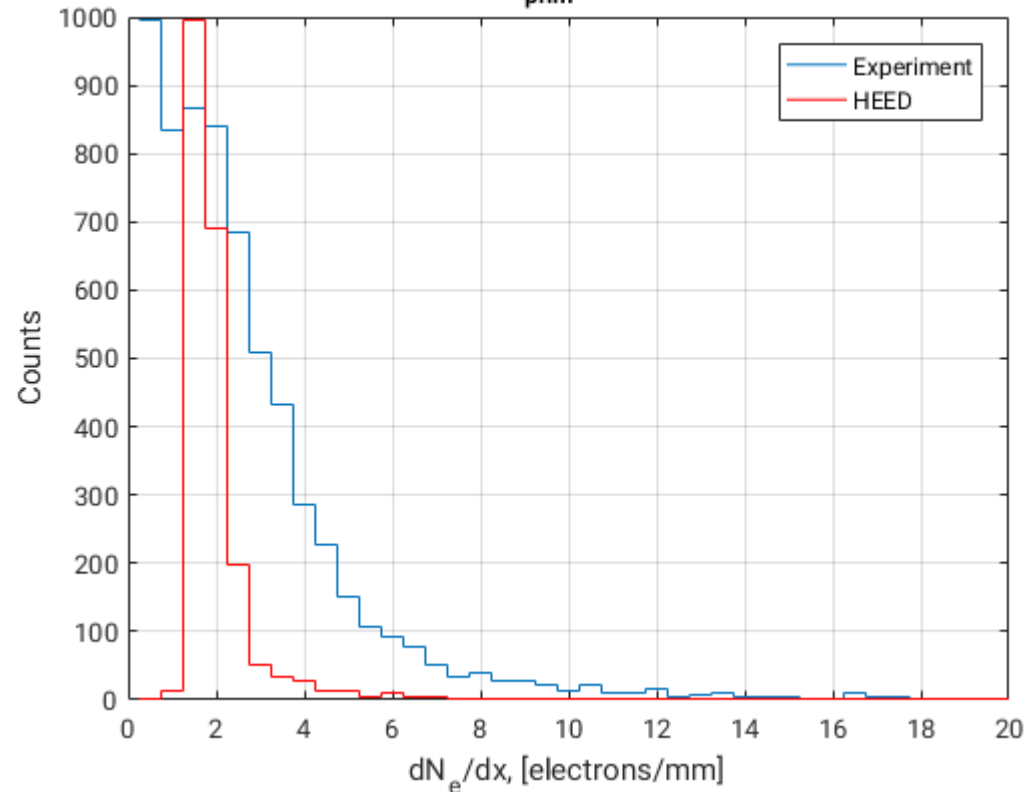
Peaks corresponds to octoboard entrance coordinates. Tracks starting from the middle of the octoboard are discarded.

dE/dx distributions

Run 15, $E_{\text{prim}} = 2.76 \text{ MeV}$



Run 22, $E_{\text{prim}} = 1.95 \text{ MeV}$



Degrad and Heed results are in 5% agreement, giving the mean of 2.1 primary ionizations per mm in He/isoButane 80/20 gas mixture.

Experimental distributions are wider than simulation results, though the track reconstruction looks acceptable.

Summary

- First analysis of LAL test beam results is performed and dE/dx of low energy electrons is obtained.
- Track reconstruction and selection looks good, even for complex events with overlapping and scattered tracks
- Obtained dE/dx distribution mean values agrees with Heed simulation, but the shape is not reproduced.

To be studied

- Study the reasons of wide dE/dx distributions.
- Introduce the GridPix module dead regions to the analysis and extend the track reconstruction to the whole module.
- Reproduce the Bethe-Bloch curve.
- Study the dE/dx resolution.