SFT Group Meeting

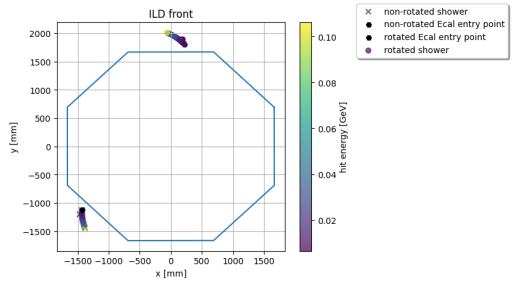
Status Update #5

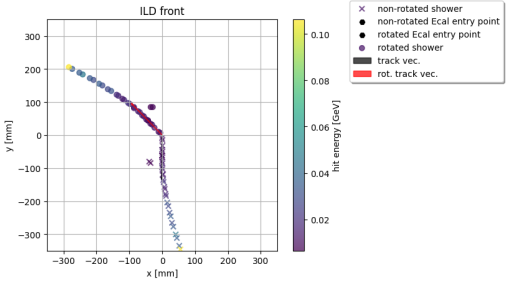
Konrad Helms

22nd June 2023

What am I doing?

- Regression: TOF estimation using ML techniques based on ECal hits
- data: 4D point cloud: (x,y,z,e) ➡️ $N \times 4$ points, $N = \#$ hits
- remark: N **will** differ for different pfos





15 June - 22 June

- generated new dataset with X pfos
- finished dataset transformation: rotation, translation - checked everything thoroughly

Event #	PFO #	PFO In event #	PDG	trk length (mm)	trk p (GeV)	trk pT (GeV)	trk px (GeV)	trk py (GeV)	trk pz (GeV)	theta (rad)	trk Ecal x (mm)	trk Ecal y (mm)	trk Ecal z (mm)	true TOF (ns)	N hits	Hit #	true hit time (ns)	hit time 50ps (ns)	hit energy (GeV)	hit layer
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.775828	-603.657654	-712.213135	-2411.799805	12.998178	11.0	0.0	13.036542	13.030875	0.020942	0.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.776259	-603.657654	-712.213135	-2411.799805	12.998178	11.0	1.0	13.056417	12.992281	0.008795	1.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.780479	-603.657654	-712.213135	-2411.799805	12.998178	11.0	2.0	13.107572	13.057655	0.013894	2.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.781849	-603.657654	-712.213135	-2411.799805	12.998178	11.0	3.0	13.217596	13.266463	0.188474	2.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.782273	-603.657654	-712.213135	-2411.799805	12.998178	11.0	4.0	13.124200	13.199738	0.202033	3.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.785953	-603.657654	-712.213135	-2411.799805	12.998178	11.0	5.0	13.225193	13.213037	0.056208	4.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.787573	-603.657654	-712.213135	-2411.799805	12.998178	11.0	6.0	13.267866	13.241030	0.069604	5.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.786113	-603.657654	-712.213135	-2411.799805	12.998178	11.0	7.0	13.191255	13.218976	0.021942	4.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.789114	-603.657654	-712.213135	-2411.799805	12.998178	11.0	8.0	13.215720	13.100756	0.029463	5.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.837490	-603.657654	-712.213135	-2411.799805	12.998178	11.0	9.0	96.903122	96.924886	0.008203	25.0
28.0	7.0	1.0	211.0	3848.54	0.866131	0.675316	-0.073503	0.671304	-0.542338	2.792218	-603.657654	-712.213135	-2411.799805	12.998178	11.0	10.0	73.077576	73.018060	0.008266	22.0

- maybe backscattering?!

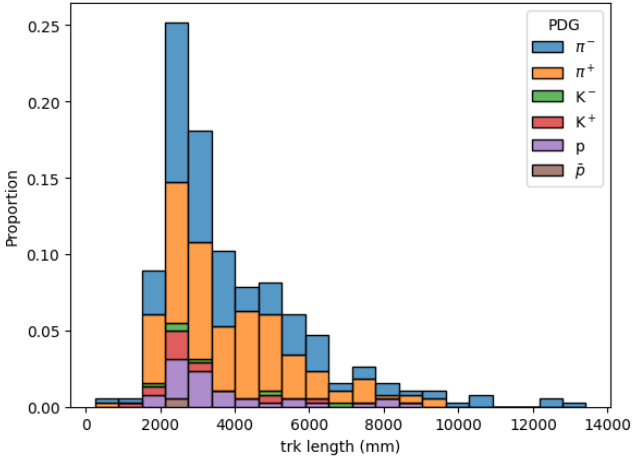
15 June - 22 June

- agenda:
  1. cut away the unwanted pfos, even if some of them make it into the training dataset ✅
     - ➡️ effect on training most likely minimal, if even noticeable
  2. work on PointNet++ implementation
- pfo selection: see next slides

15 June - 22 June

PFO Selection #1

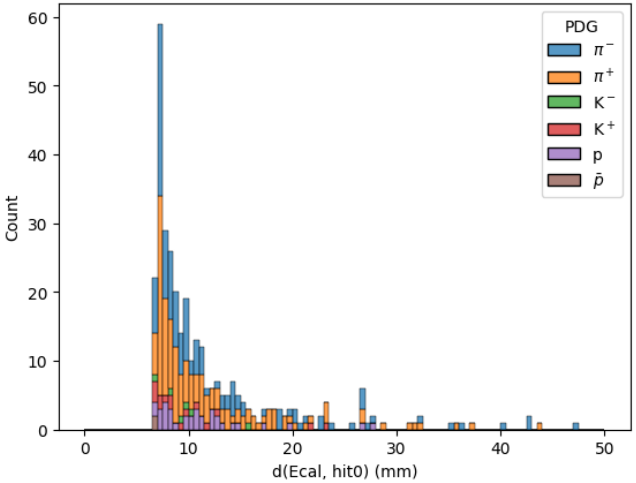
track length cut: 1800 mm $\leq$ track length $\leq$ 8000 mm



15 June - 22 June

PFO Selection #3

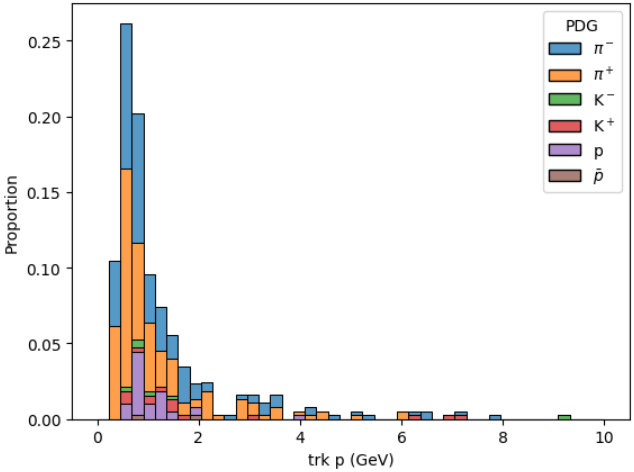
distance between Ecal surface and very first hit cut:
d(Ecal surface, hit #0) $\leq$ 30 mm



15 June - 22 June

PFO Selection #4

PFO/track momentum cut:
$p \leq 10\,\text{GeV}$

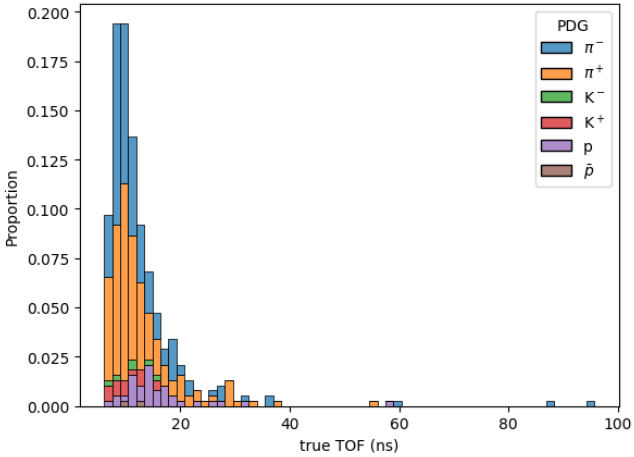


15 June - 22 June

PFO Selection #5

true TOF cut:

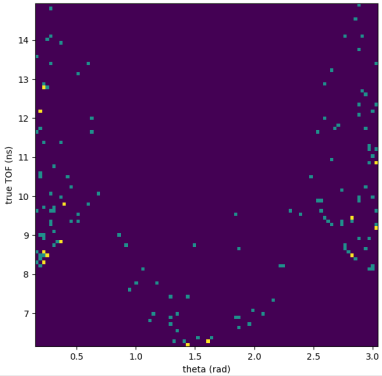
$0\,\text{ns} \leq \text{true TOF} \leq 27\,\text{ns}$

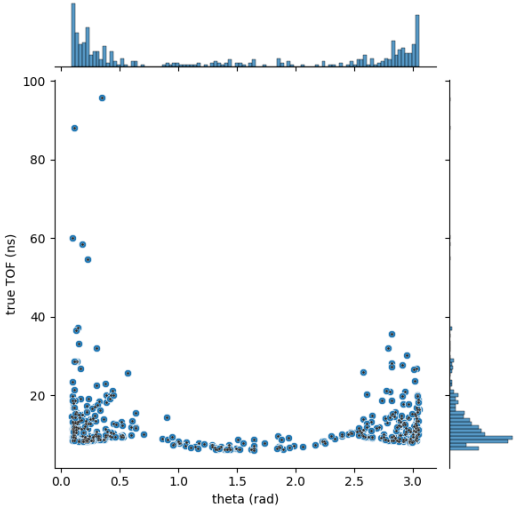


15 June - 22 June

PFO Selection #2

LumiCal cut: necessary?!





15 June - 22 June

PFO Selection #6

true hit time difference cut (potentially avoid hits from backscattering):
$|\mathrm{d}(\text{true hit time } i, \text{true hit time } i+1)| \leq 0.5\,\mathrm{ns}$
hit ordering:
hits ordered by distance to the Ecal surface

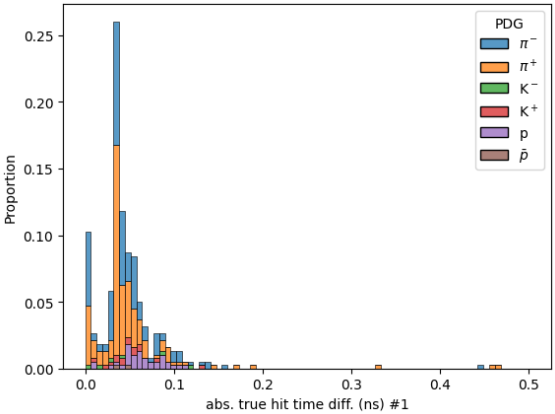


Figure: Exemplary distribution.

15 June - 22 June

PFO Selection Results and Outlook

PFO Selection Results:

- after selection: $\simeq$ 47% of pfos kept

Outlook:

- work on PointNet++ implementation

Cheers from Göttingen ☀️