

Brief Update on my Thesis

Gregor Brodbek

Data Simulation

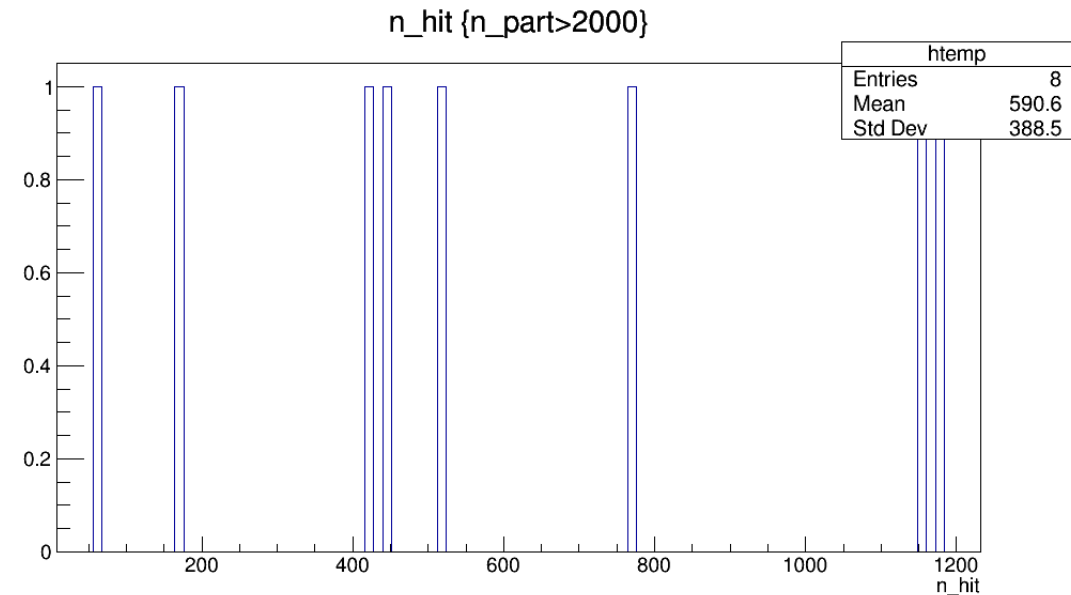
- Created signal and background samples using Dolores' workflow
 - 1. simulate events using Pythia8
 - 2. run CLD full simulation
 - 3. run reconstruction
 - 4. produce the flat tree
- 100 files with 1000 events each created for both tau decay signals and background samples

Verifying the Data

- What variables are simulated/saved
- Any errors/bugs in the process
 - Some weird events with way too many particles ($> 12\ 000$)
 - Always the same events in each file (145, 349, 463)

For the rest of the slides:

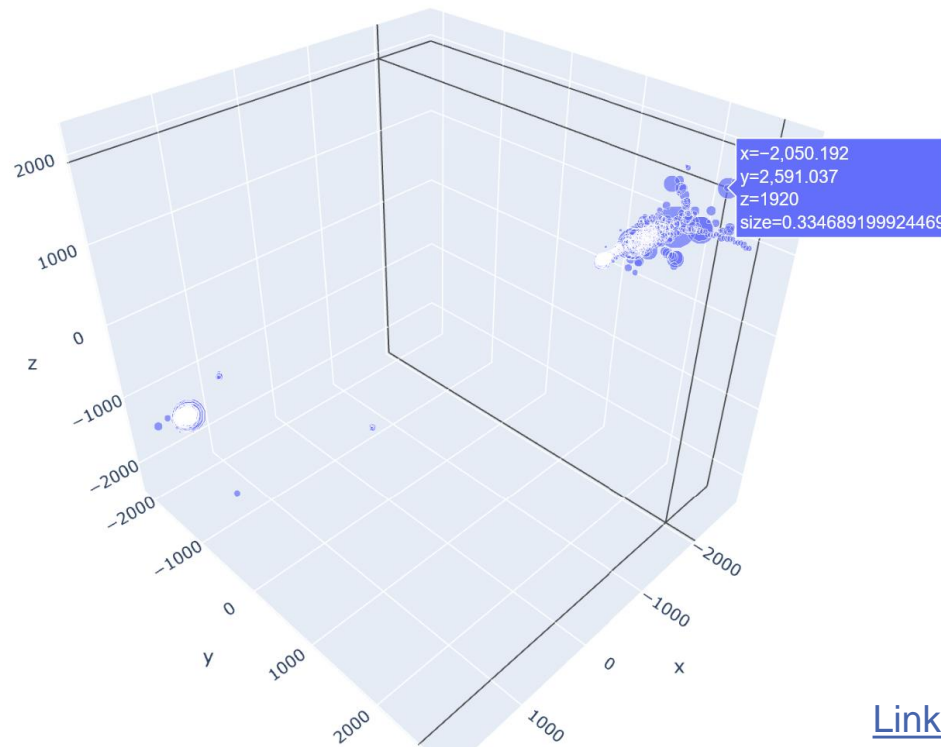
All events with < 200 particles are referred to as „normal events“ and events with > 5000 events as „weird events“



3d Plots of the Simulated Events

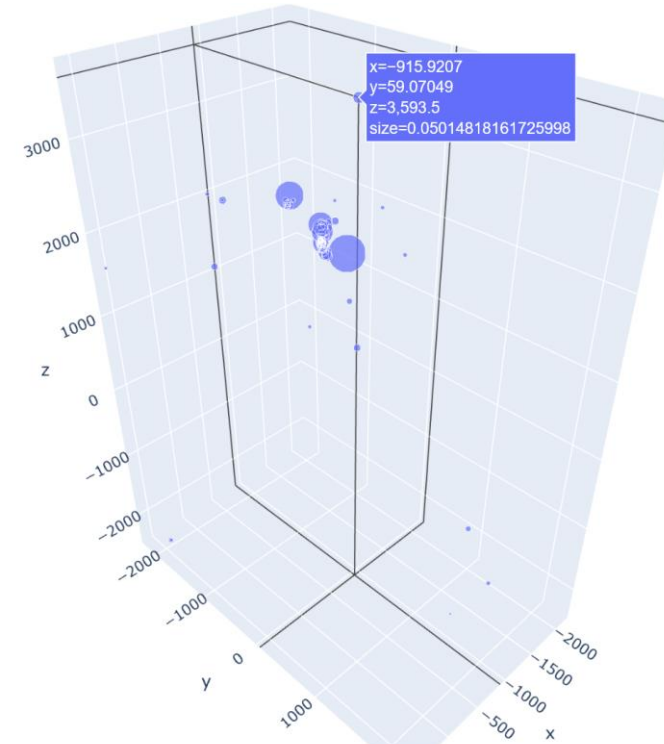
Normal Event

Hits: 1484
Particles: 44



Weird Event

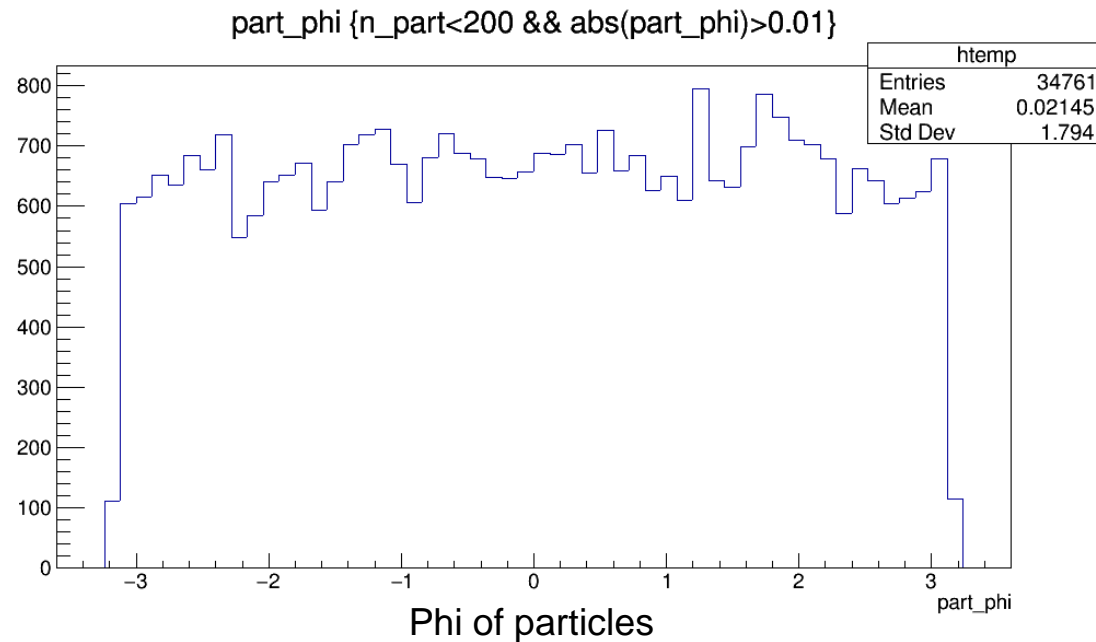
Hits: 82
Particles: 10185



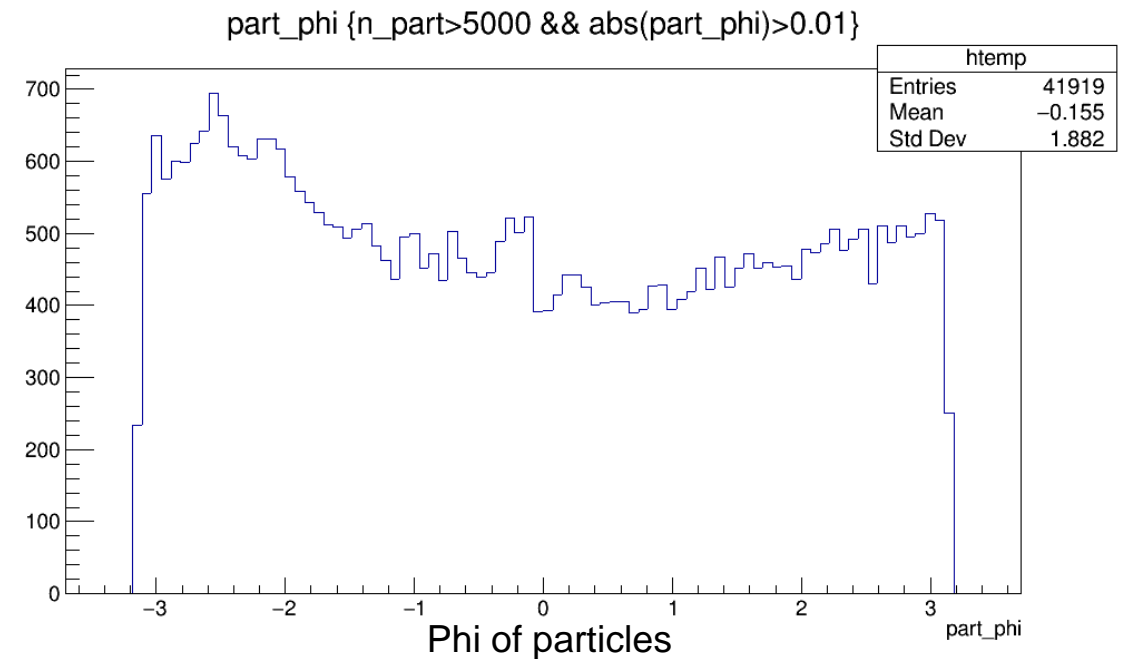
[Link to the 3d plots](#)

Some Comparisons: Phi

Normal Events

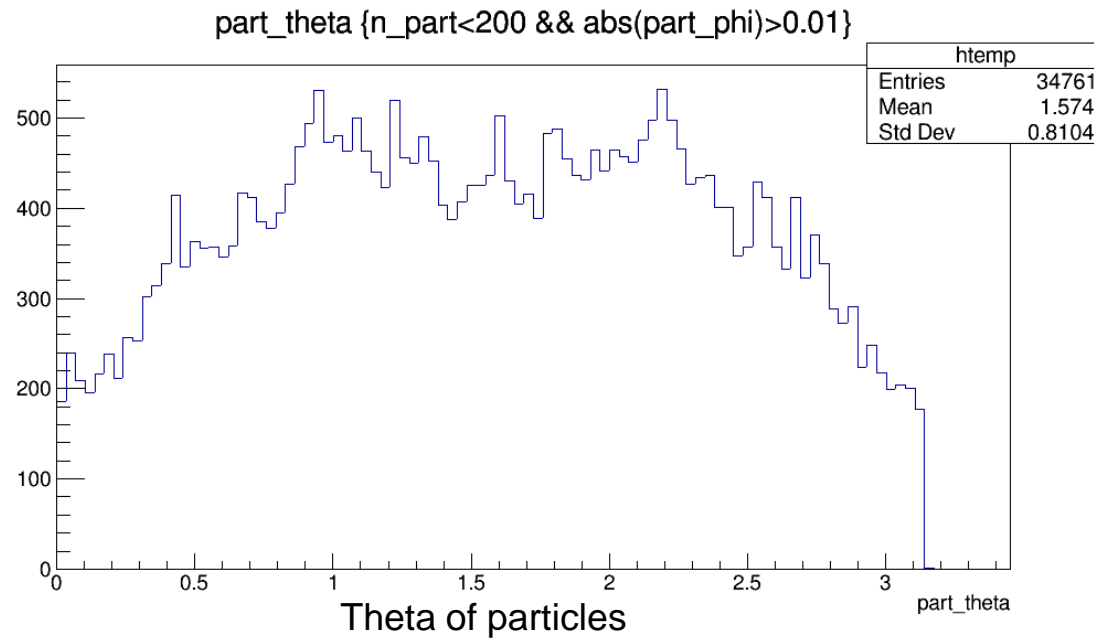


Weird Events

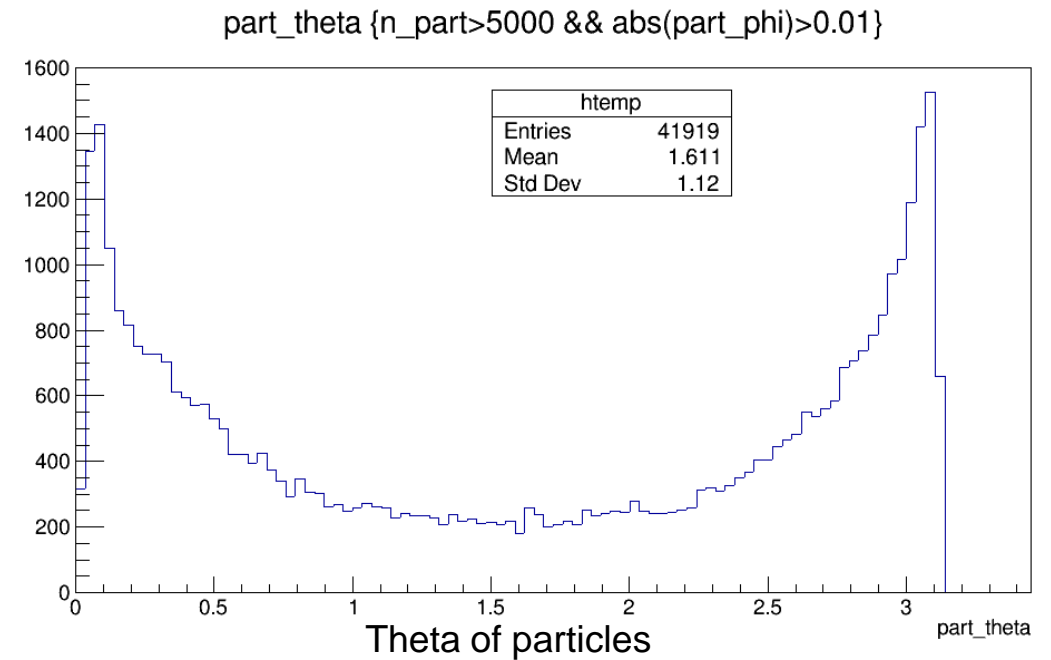


Some Comparisons: Theta

Normal Events



Weird Events

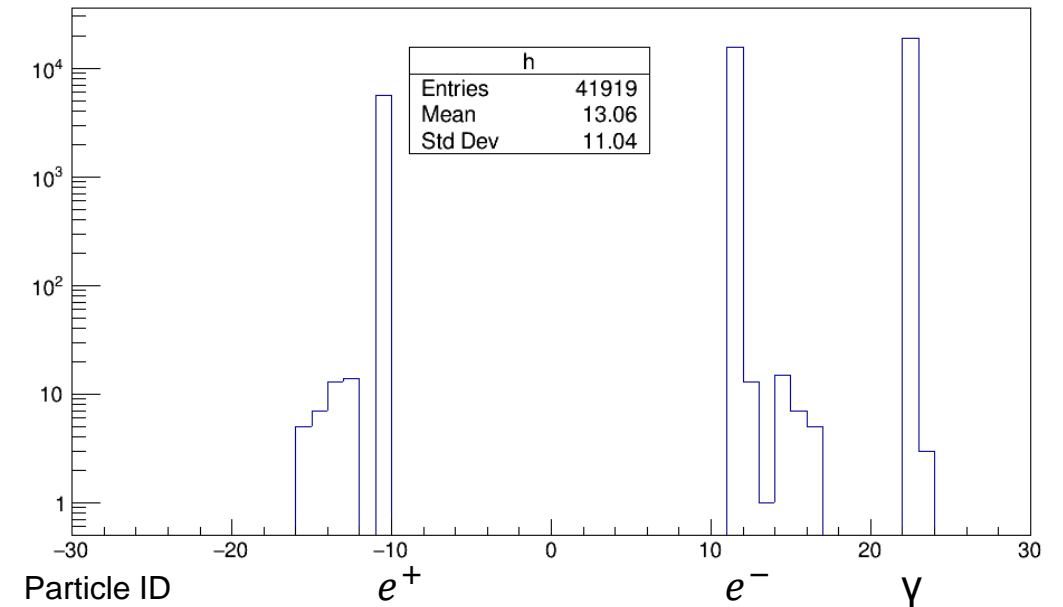


Investigating the Weird Events

- Mainly electrons, positrons and photons are created

Particles in the weird events

part_pid {n_part>5000 && abs(part_phi)>0.01}

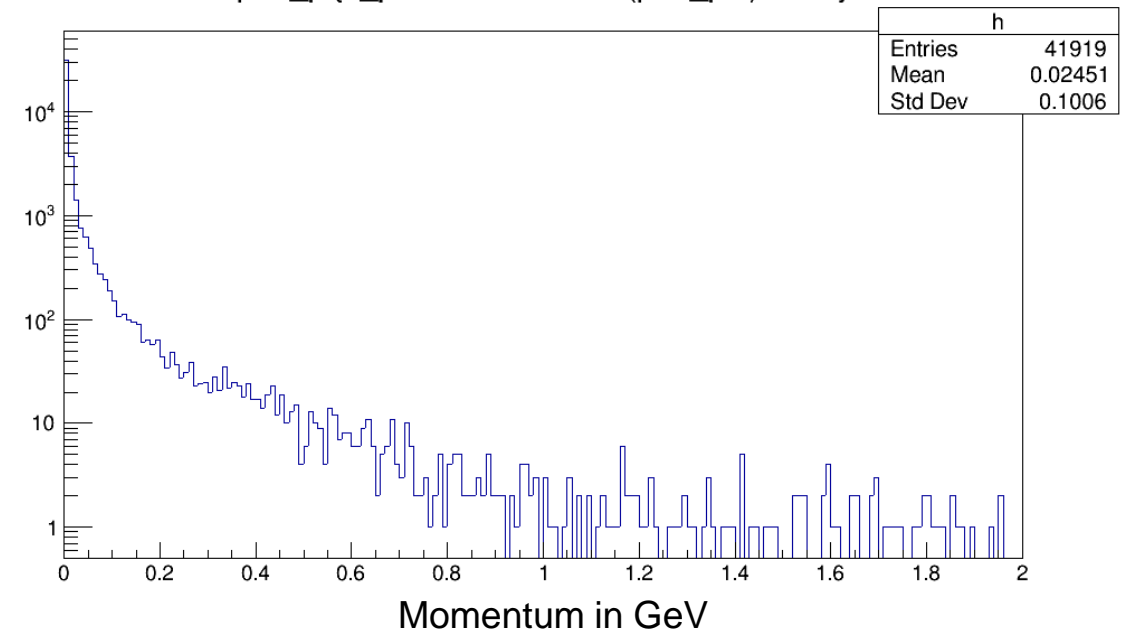


Investigating the Weird Events

- Mainly electrons, positrons and photons are created
- And have momentum lower than 2 GeV

Momentum of particles from weird events

part_p {n_part>5000 && abs(part_phi)>0.01}

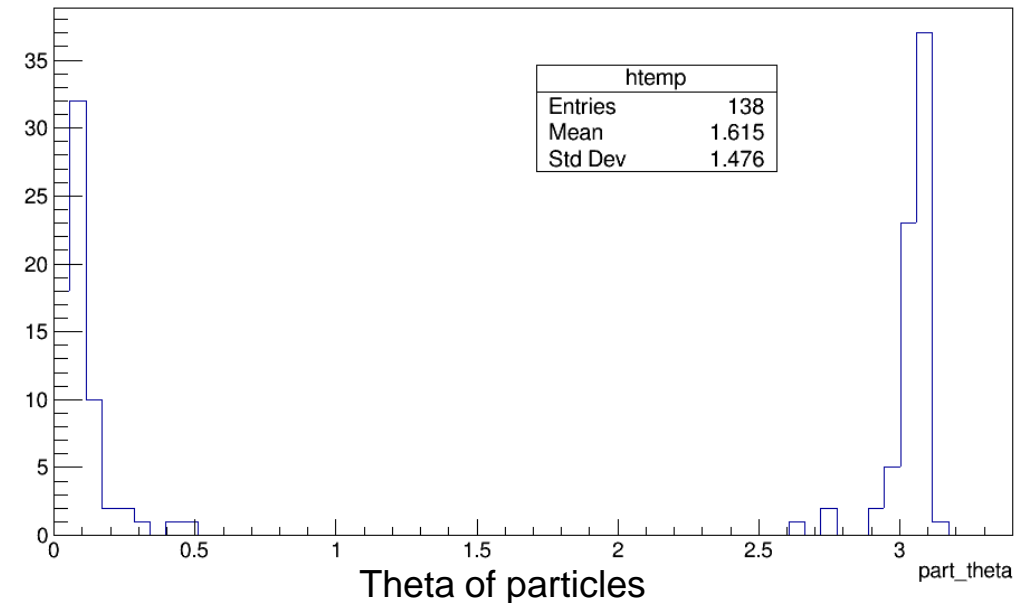


Investigating the Weird Events

- Mainly electrons, positrons and photons are created
- And have momentum lower than 2 GeV
- Theta of the „normal“ particles ($p > 2$ GeV) in these events is still unusual

Theta of „normal“ particles from weird events

part_theta {n_part>5000 && abs(part_phi)>0.01 && part_p>2}

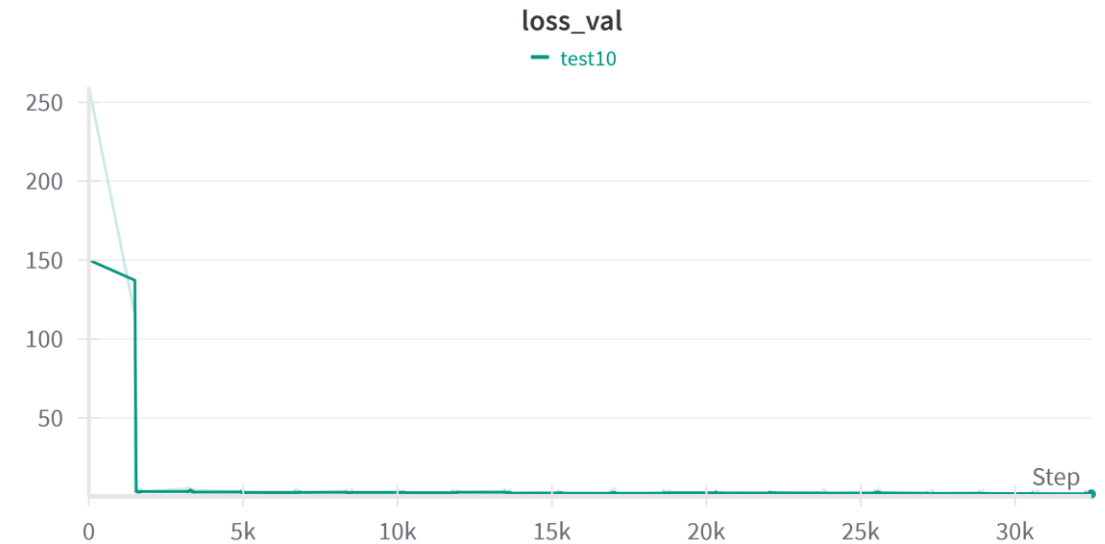
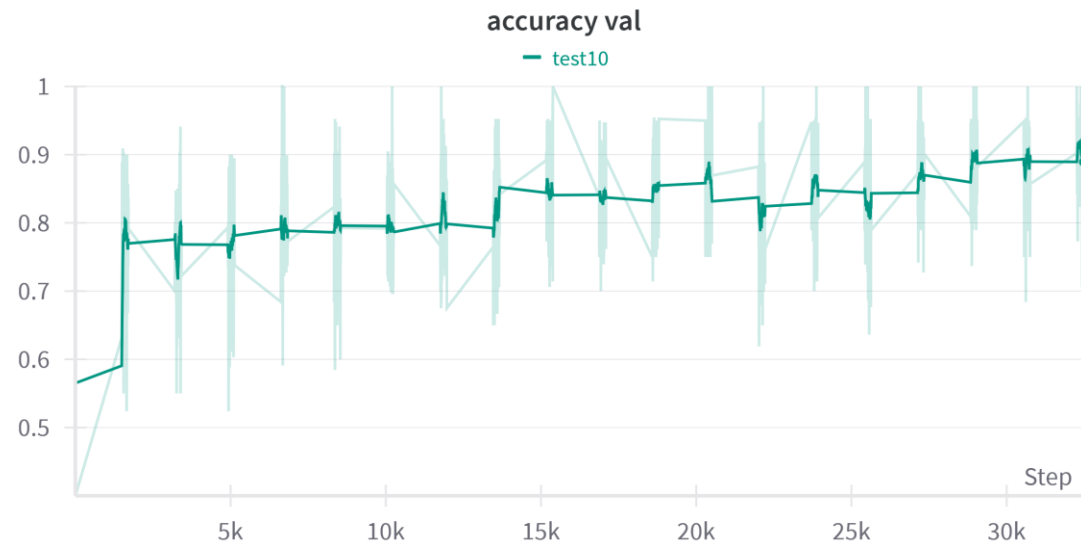


Conclusion Weird Events

- High amount of particles is caused by a lot of low-momentum electrons and photons
- Removing these particles still leaves unexpected plots for theta
- Still unclear, why it's always the same events, that have so many particles
- Leads to the conclusion, that a bug/coding issue leads to these events

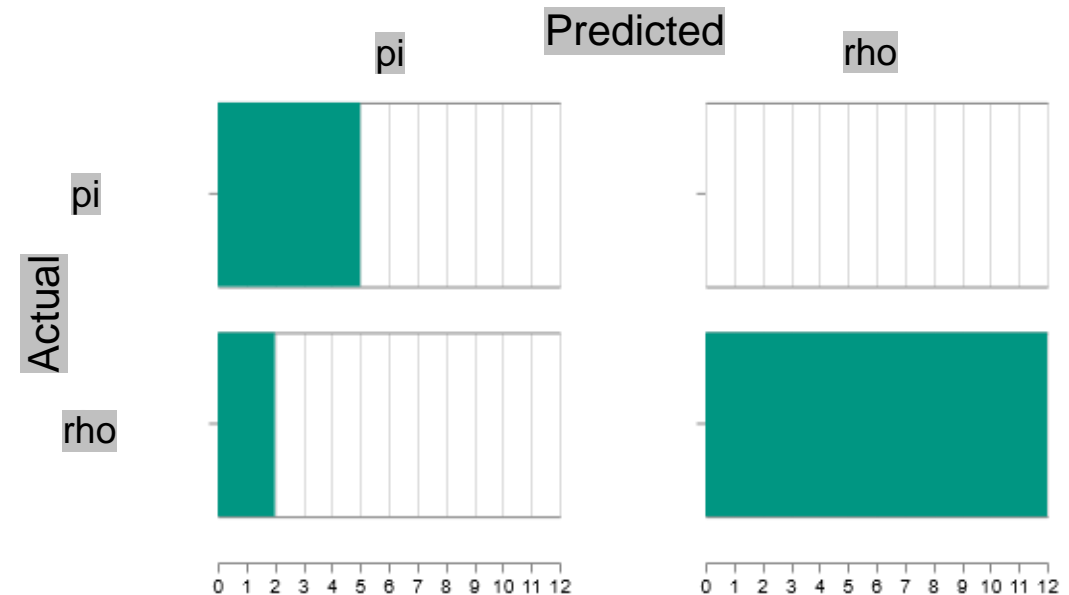
Running the Training Script

Accuracy and loss of a test run with 10 files for 10 epochs



Running the Training Script

- But what exactly is getting trained?
- Currently, distinction between rho and pi
- We want a distinction between several tau decay modes



Next Steps

- Adapt the model/training to our objective
 - To distinguish between the decay modes of the tau and from background
- Change the model parameters
- Change the true labels used for training to the labels of the decay modes we want to determine
- Need to add the needed labels to the data in the treemaker