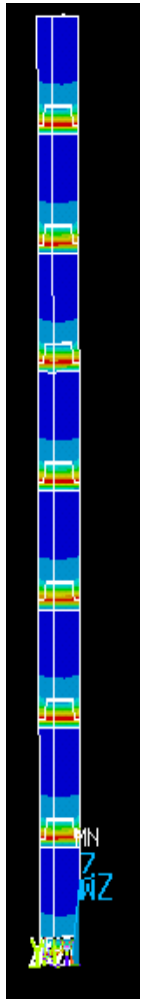
FTM simulations

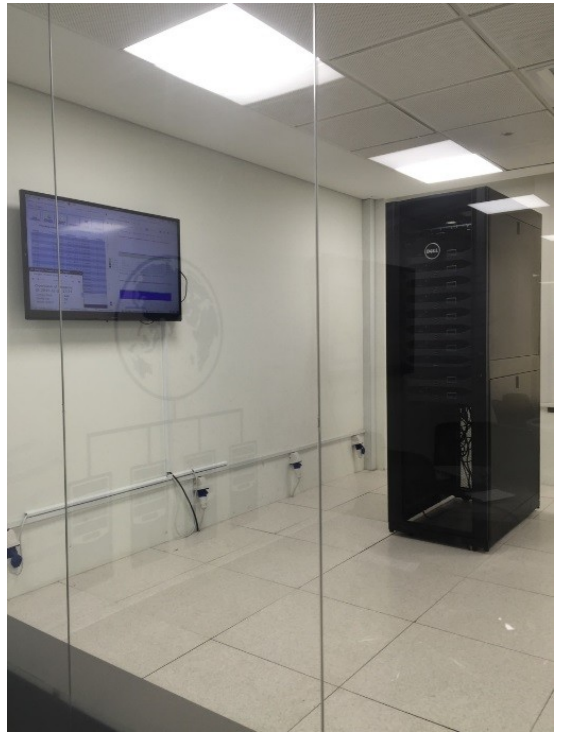
Yasser Maghrbi
American University of the Middle East, Kuwait

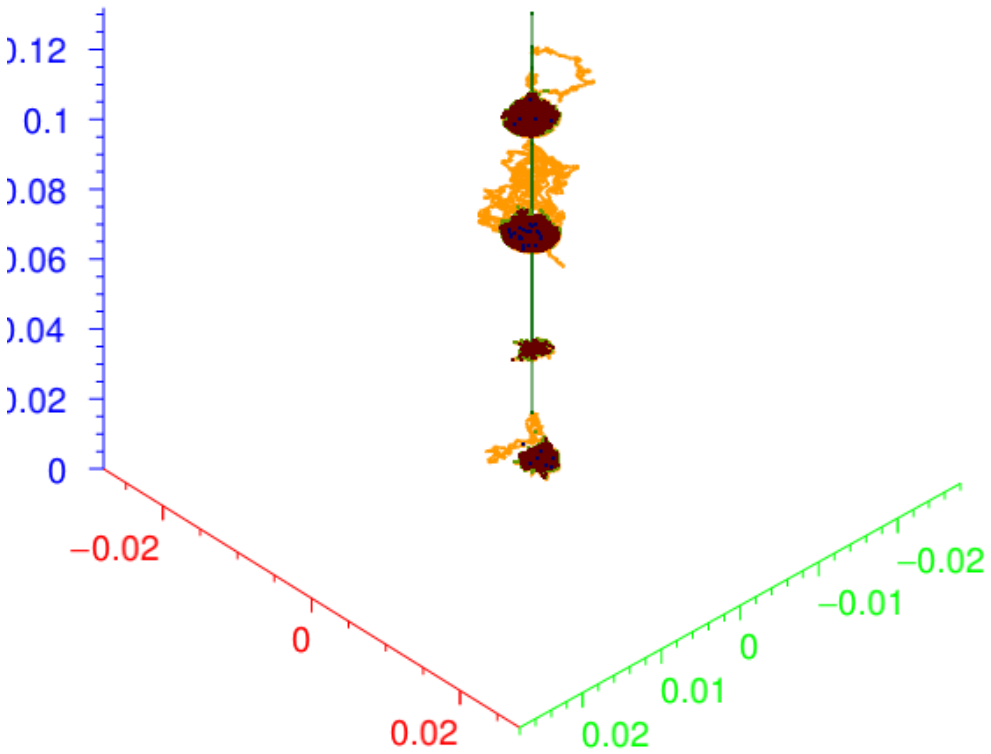
5/2/2018

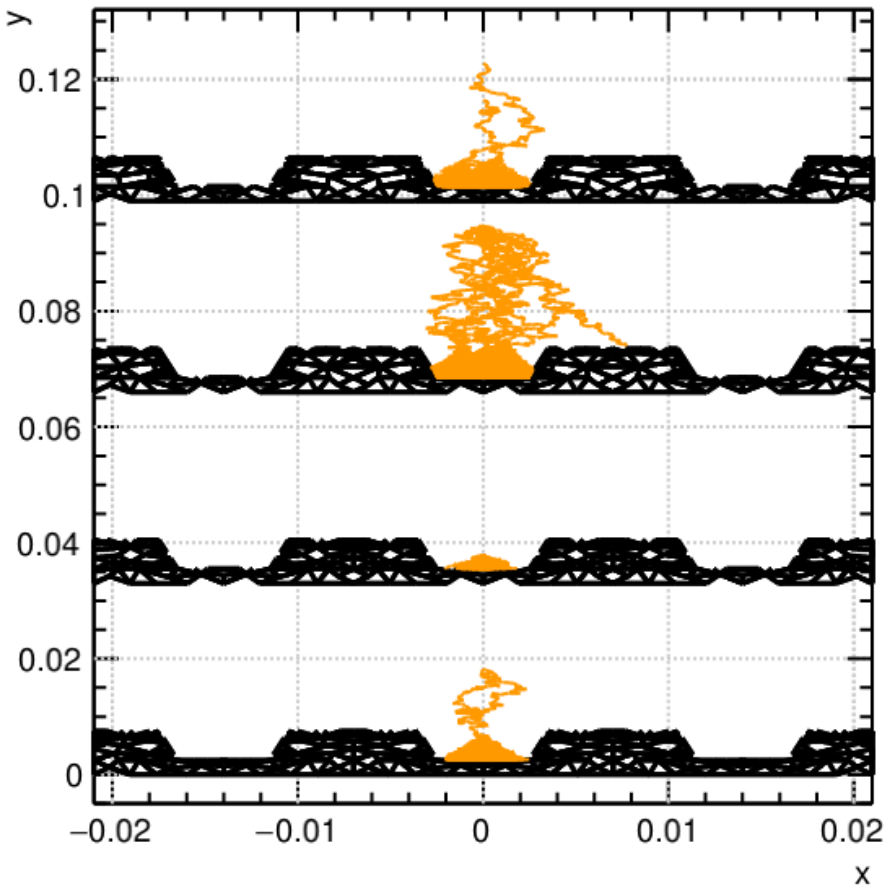


8 layers FTM with ANSYS

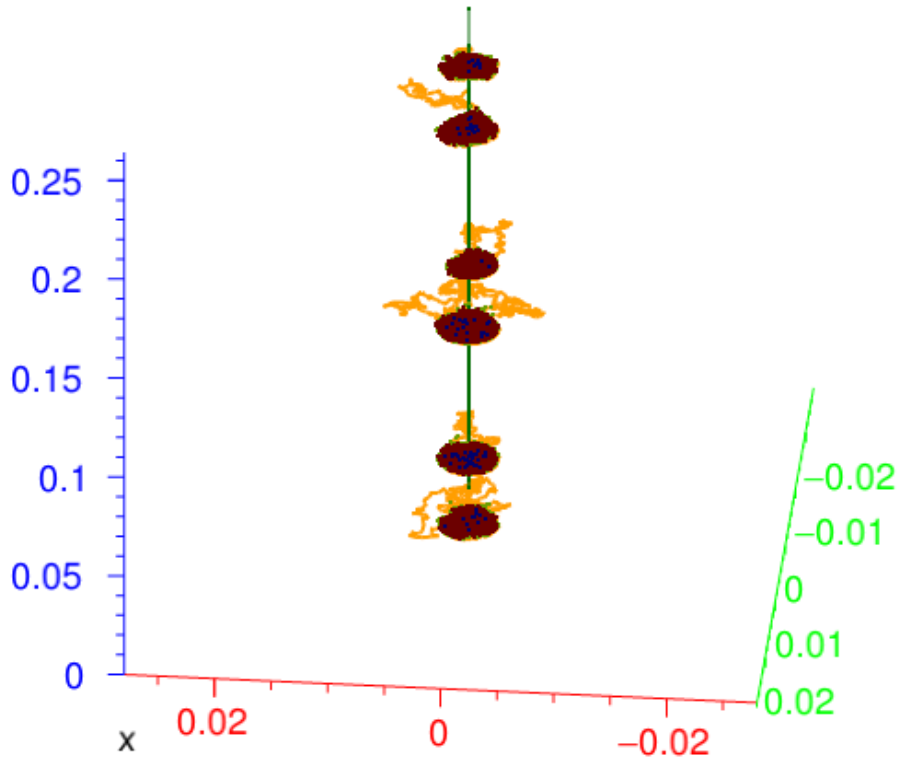
- SORMA conference June 11-14, paper in NIM A.
- Results to be presented: gain, time resolution and collection efficiency, with scan on drift field and test of different gas mixtures.
- Analysis for 1, 2, 4, 8, 12, 16 layers. We can go higher but issues with ANSYS: for 12 layers and more, the code should be manually written (Area numbering issue).
- Initial parameters: 3 kV/cm drift field, 100 kV/cm amp field
- Calculations are done using AUM HPC, 1 track (150 GeV/c muon) per CPU.
- AUM HPC: Dell PowerEdge R730 Intel Xeon E5-2698 v3 2.3GHz, 640 CPU, Aggregate memory 1.28 TB, Total storage: 20 TB, GPU accelerator: NVidia Tesla K40C 12GB, Mellanox 40 Gbps InfiniBand Interconnection.
- For Ar:CO2 (70:30), 1000 tracks are simulated in ~ 6 hours (penning at 0.57) for 16 layers.
- The calculation takes much longer time in Ar:iC4H10 (90:10).
-

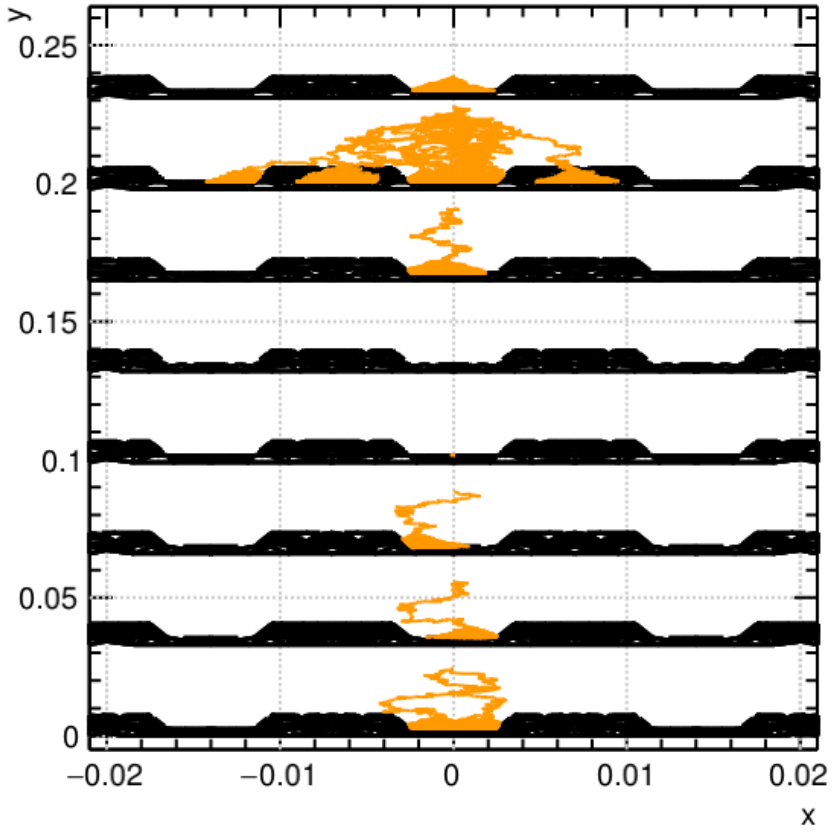




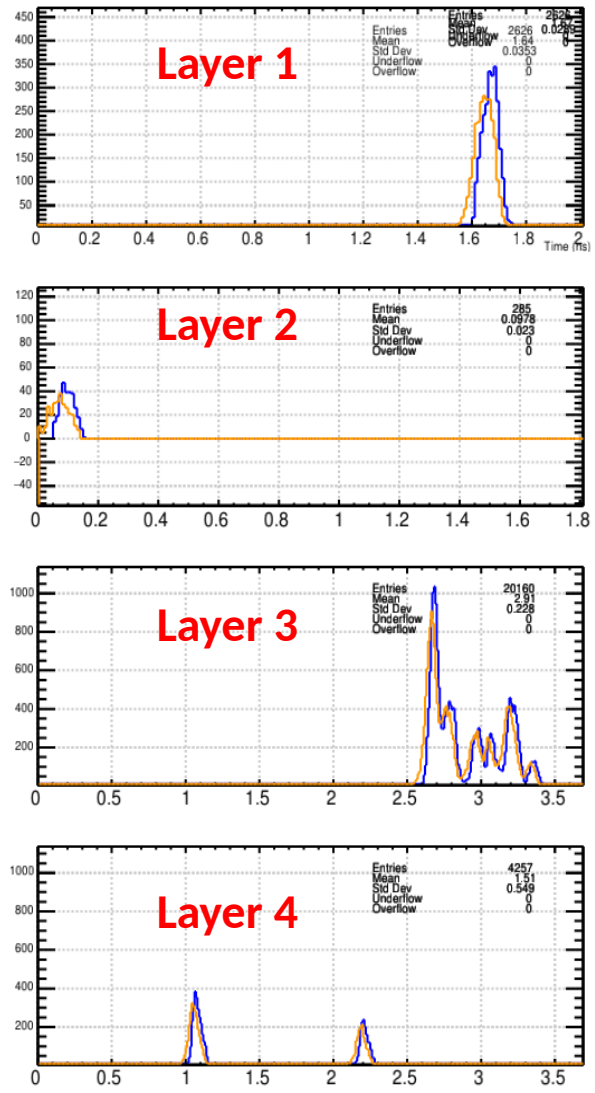


150 GeV/c muon track in 4-layer FTM using HEED in Garfield++



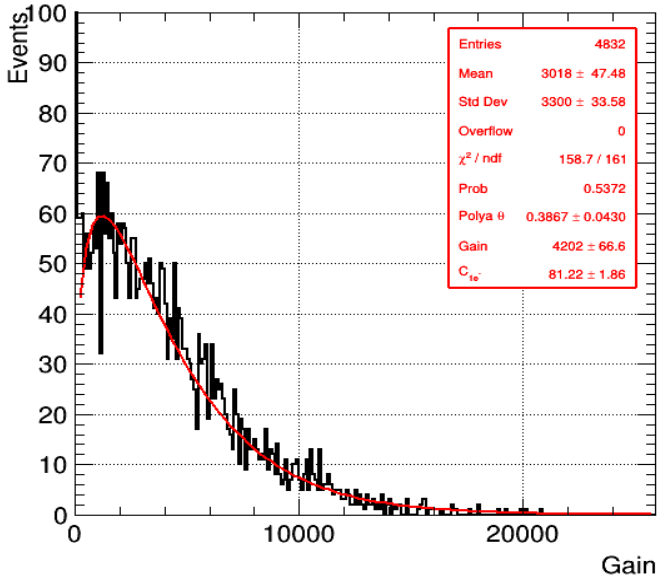


150 GeV/c muon in 8-layer FTM

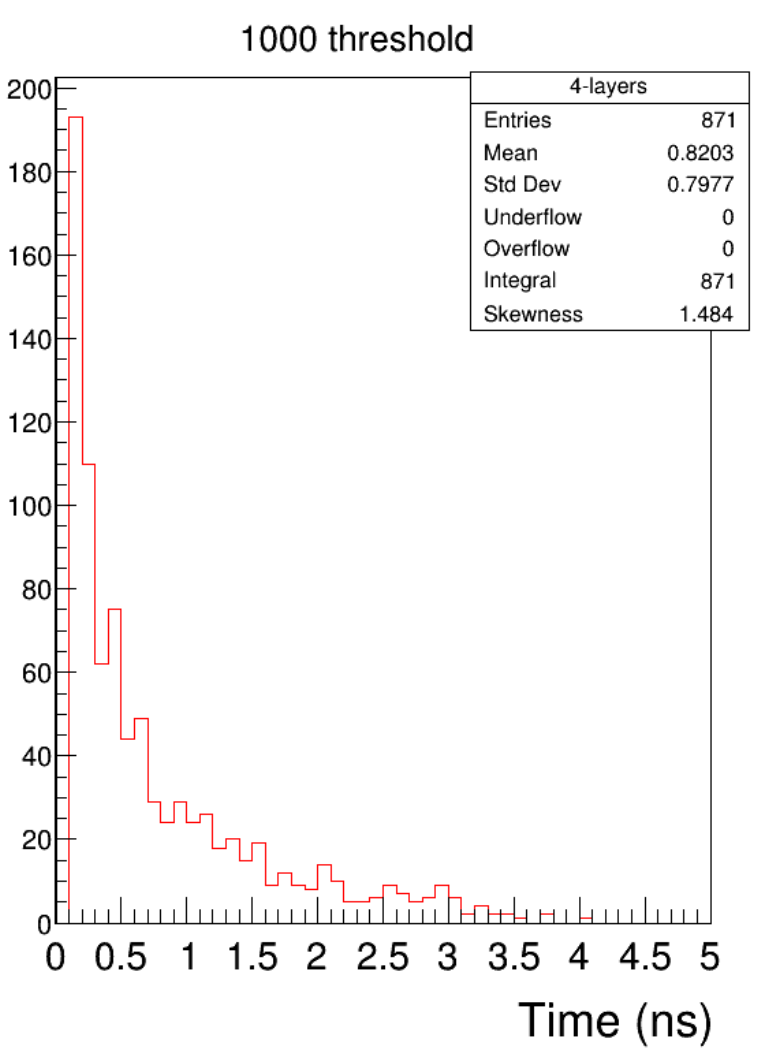


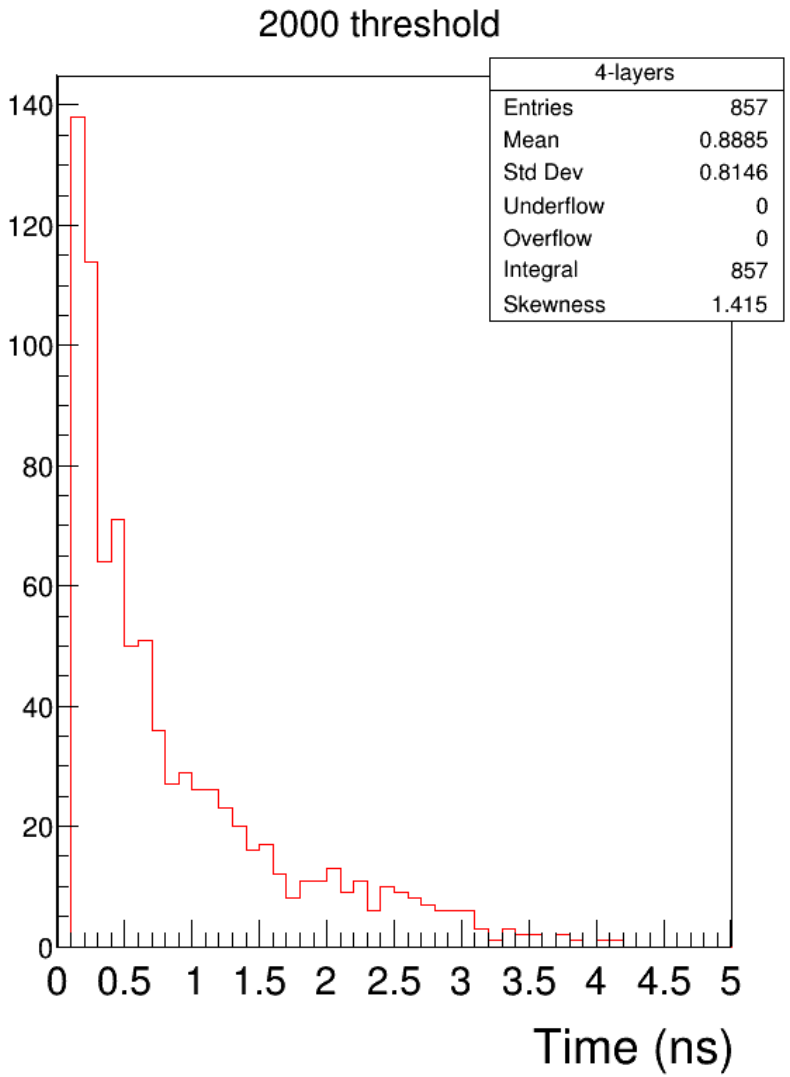
Procedure

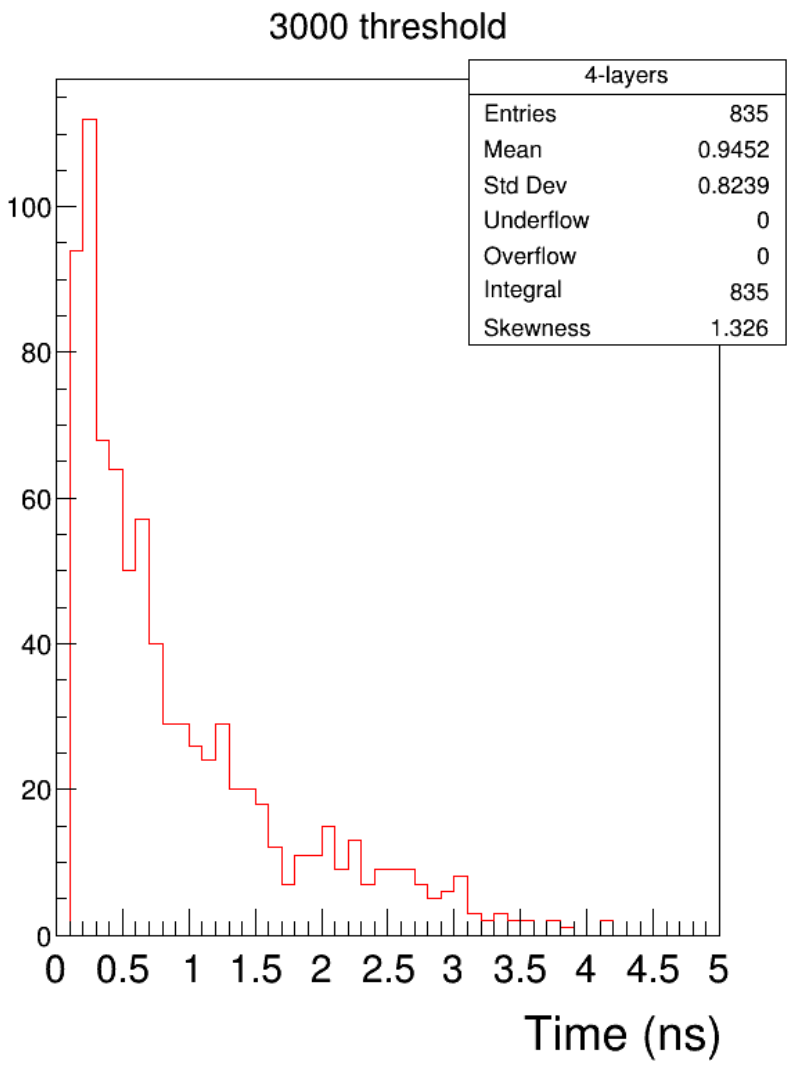
- The gain is given by the total number of electrons created in the avalanche.
- Record the endpoints of the electrons.
- If the Z position of an electron endpoint falls in the PCB of one of the layers, the timing is recorded in a 1D histogram.
- For each track, for each layer, the value of the fastest electron is recorded if above a certain threshold (1000, 2000 or 3000 e).
- If the threshold is not reached, the charge integration is reset and the next peak is considered.
- For each track, the smallest value of all layers is recorded
- The time resolution of the detector is given by the standard deviation of the obtained distribution
-



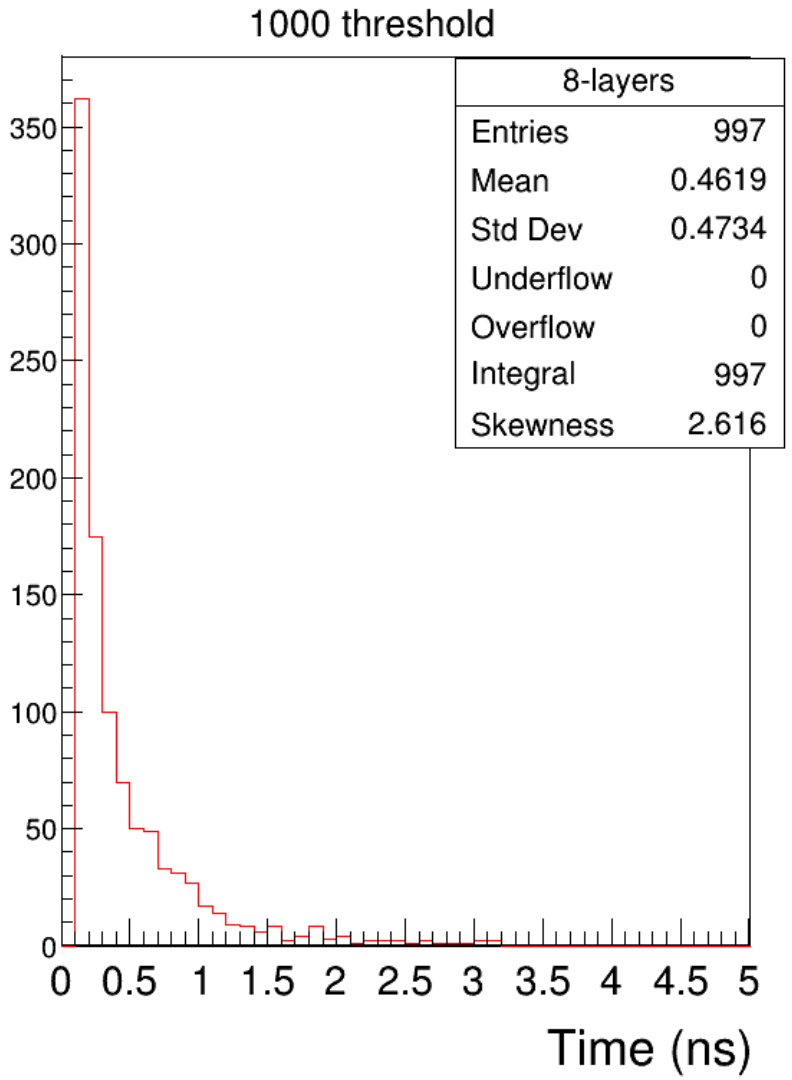
Orange: Amplification time, Blue: endpoint time

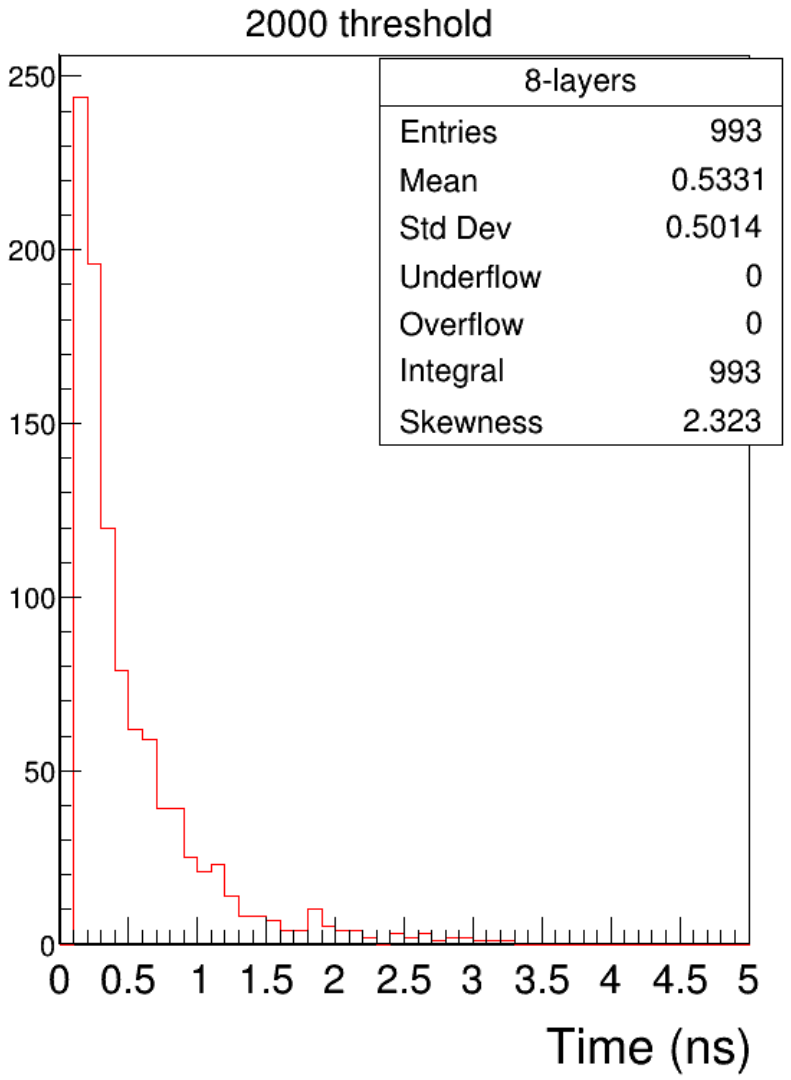


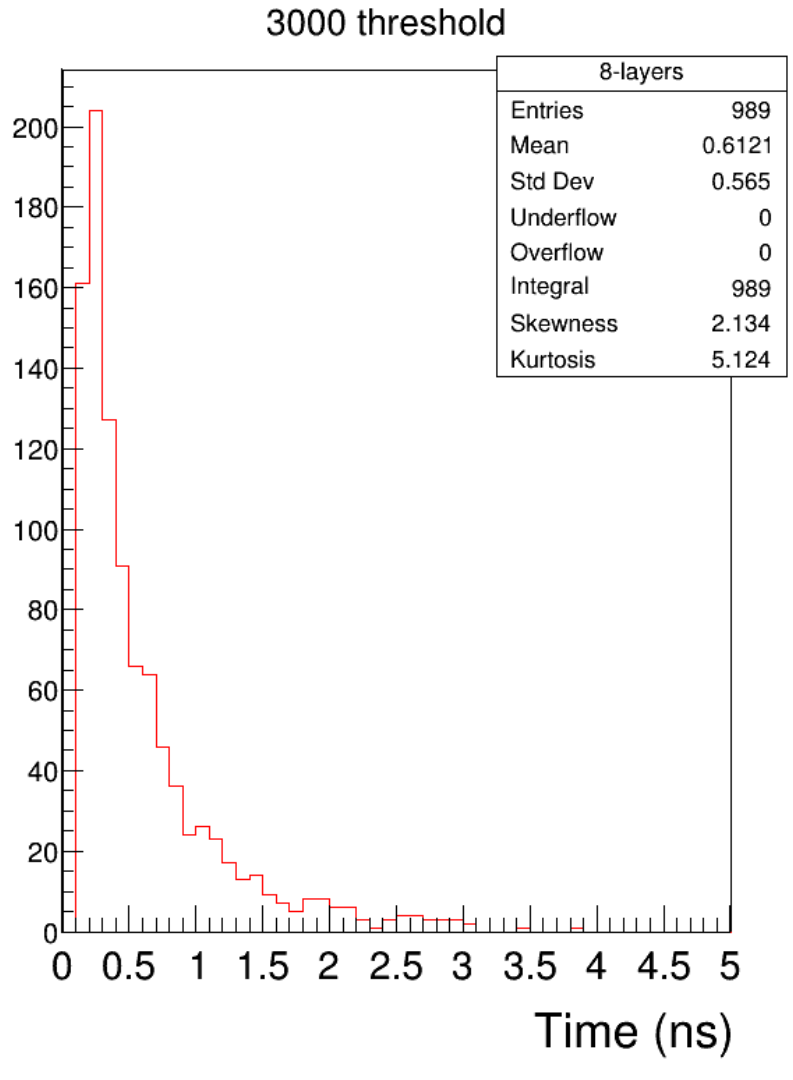




150 GeV/c muon in 4-layer FTM – 1000 simulated downstream tracks – ArCO2 70:30



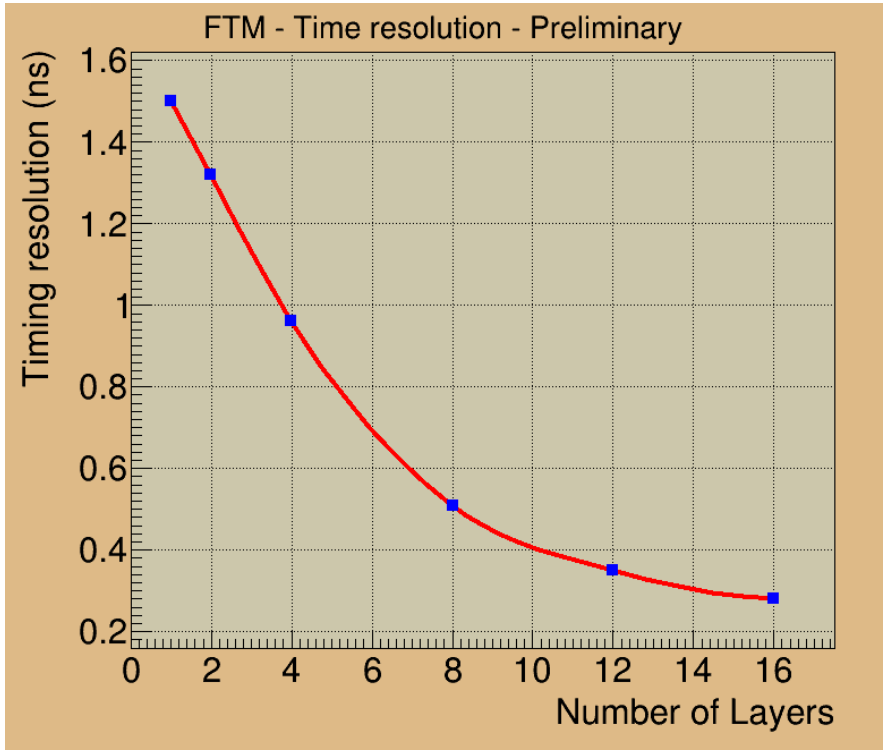




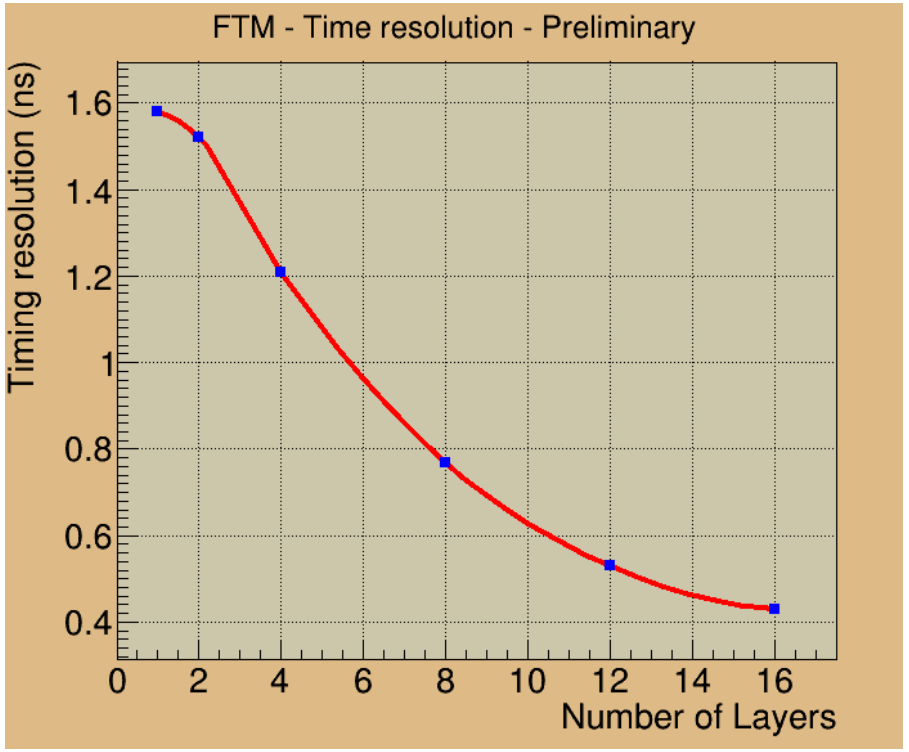
150 GeV/c muon in 8-layer FTM – 1000 simulated downstream tracks – Ar:CO2 70:30

Preliminary

1000 e threshold

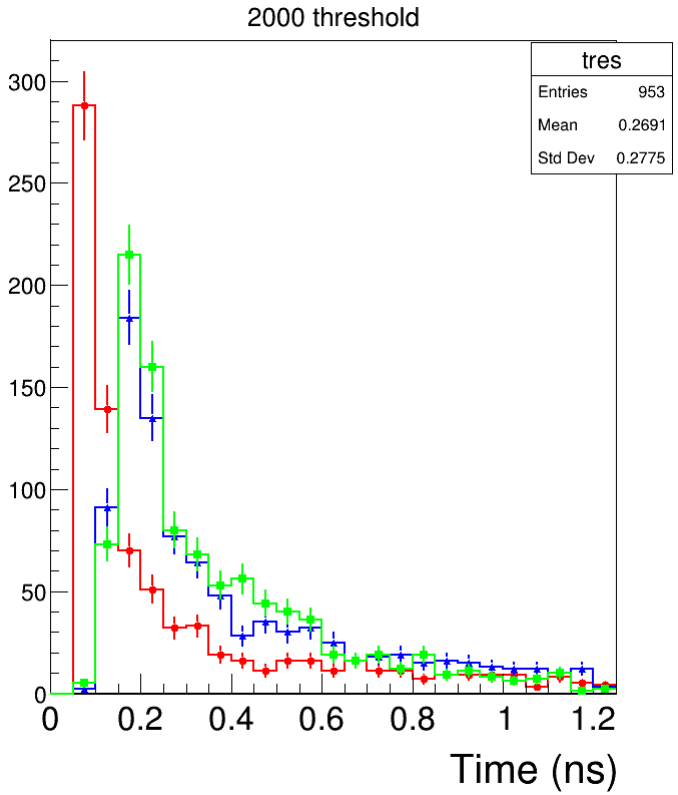


3000 e threshold



Summary and outlook

- Preliminary results for the conference seem reasonable
- First draft of the paper to be ready in ~ 2 weeks
- Number of layers?
- Should we do a collection efficiency study first to fix the value of the drift field?
- Simulations will continue after the paper (guidance needed)
- Later on, we would be very interested to participate in experimental efforts, also involving students if possible
- In addition, electrical engineering faculty at AUM with good experience in rad-hard electronics
-



Ar:iC4H10 (90:10)
Ar:CO2:CF4 (45:15:40)
Ar:CO2 (45:15:40)

Amp. field to be adjusted to have similar gains