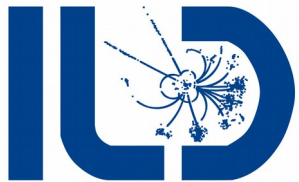


dE/dx-Check for new 250 GeV-Production

Uli Einhaus

ILD Software and Analysis Meeting

08.04.2020



HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES



- Took files:

/pnfs/desy.de/ilc/prod/ilc/mc-opt/ild/dst-merged/1-calib/single/ILD_I5_o1_v02_nobg/v02-01/

/rv02-01.sv02-01.mILD_I5_o1_v02_nobg.E1-calib.I110081.Ps_pm11_prnd.e0.p0.n001.d_dstm_14703_0.slcio

rv02-01.sv02-01.mILD_I5_o1_v02_nobg.E1-calib.I110082.Ps_pm13_prnd.e0.p0.n001.d_dstm_14703_0.slcio

rv02-01.sv02-01.mILD_I5_o1_v02_nobg.E1-calib.I110083.Ps_pm211_prnd.e0.p0.n001.d_dstm_14703_0.slcio

rv02-01.sv02-01.mILD_I5_o1_v02_nobg.E1-calib.I110084.Ps_pm321_prnd.e0.p0.n001.d_dstm_14703_0.slcio

rv02-01.sv02-01.mILD_I5_o1_v02_nobg.E1-calib.I110085.Ps_pm2212_prnd.e0.p0.n001.d_dstm_14703_0.slcio

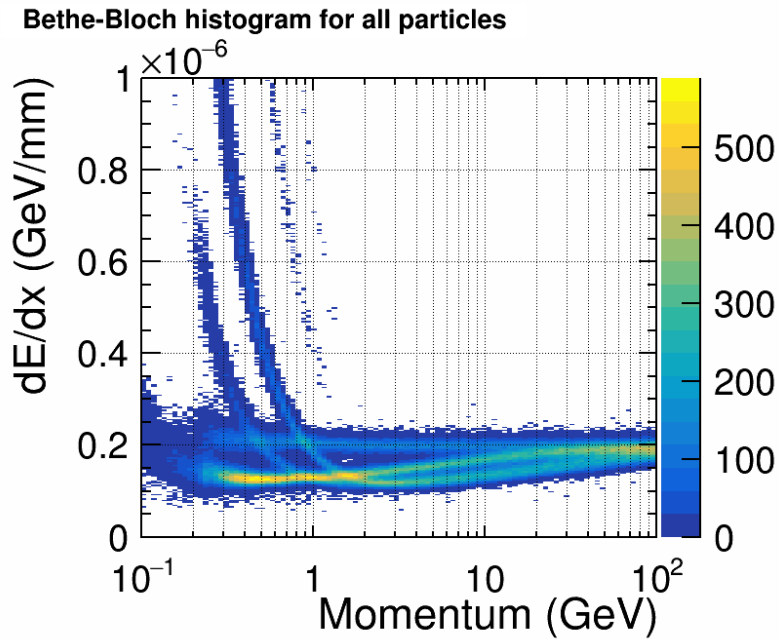
- Ran dEdxAnalyserProcessor, made plots from root-output-file
- Result: Looks basically alright, no big issues, but extracted dE/dx-resolution is worse than before
- Compared to previous large production:

/pnfs/desy.de/ilc/prod/ilc/mc-opt-3/ild/dst-merged/1-calib/single/ILD_I5_o1_v02_nobg/v02-00-01

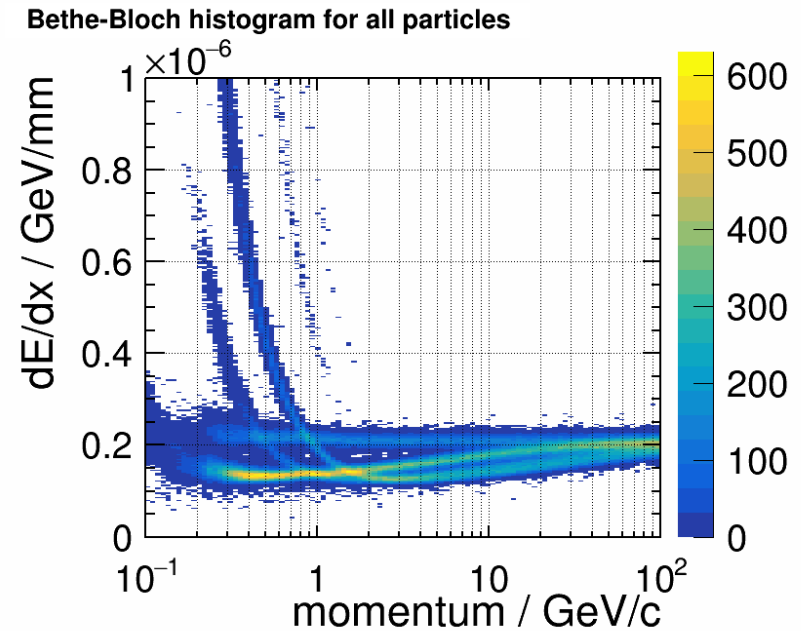


Beth-Bloch-Curves

New test production

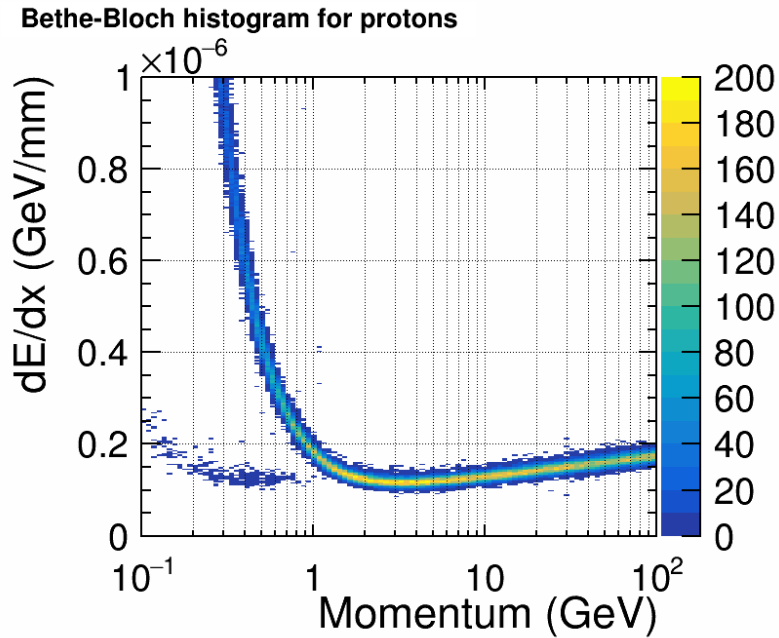


Previous production

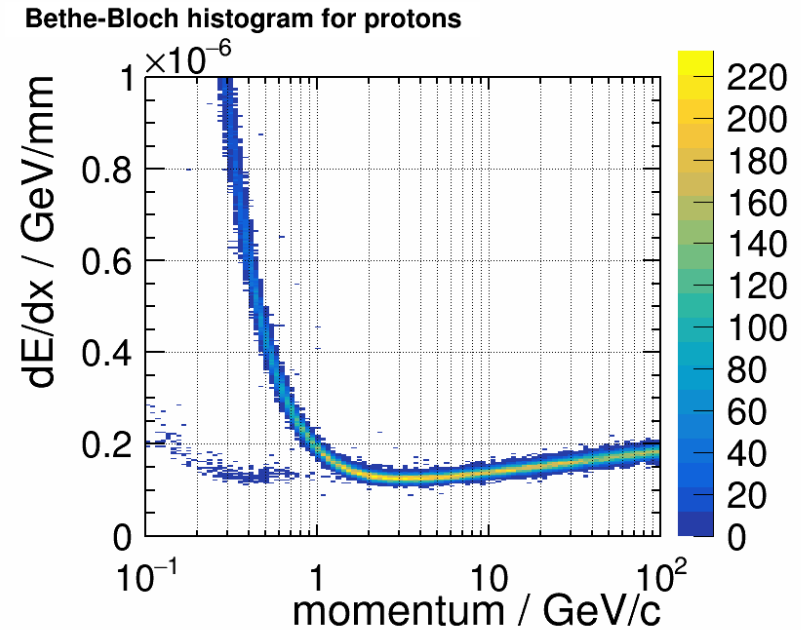


Beth-Bloch-Curves

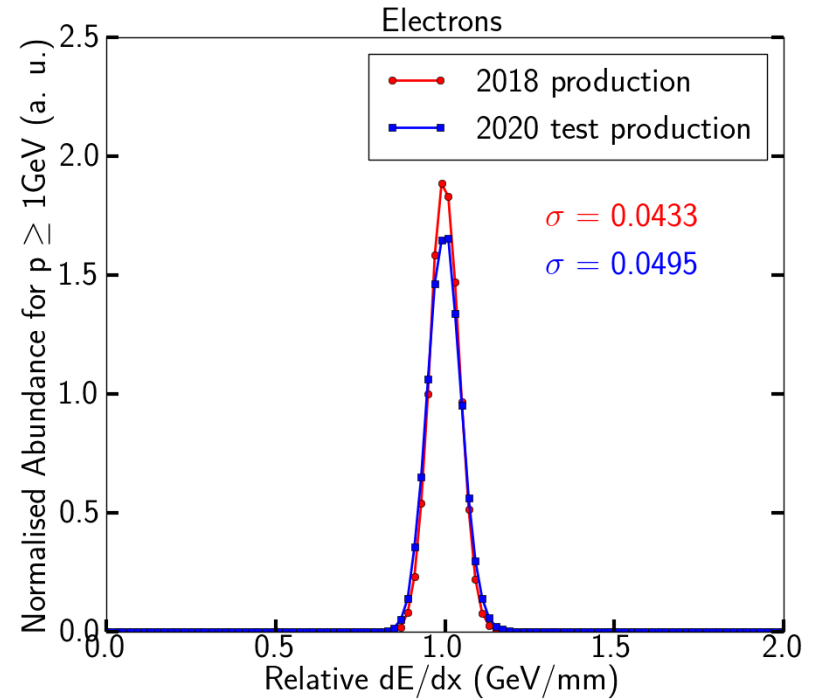
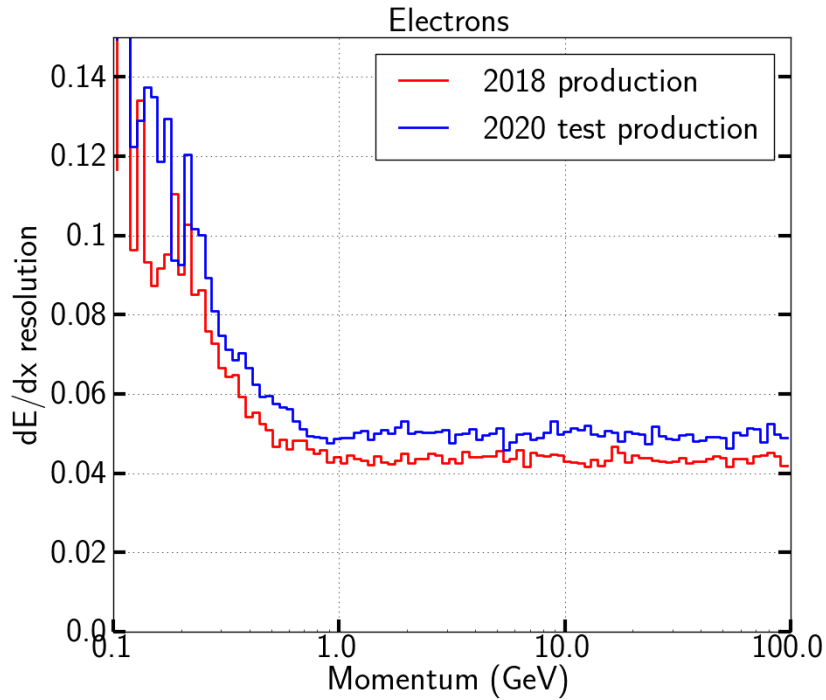
New test production



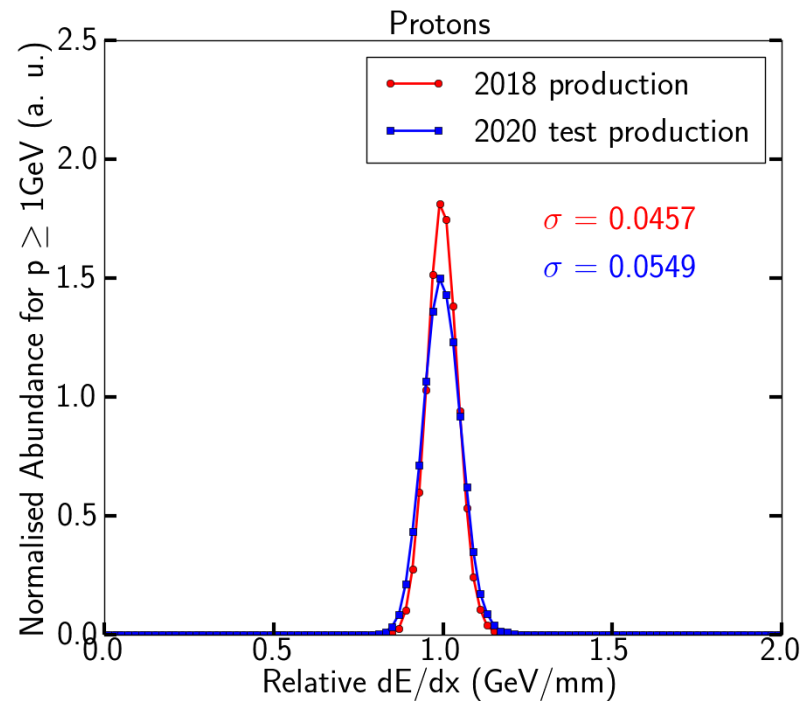
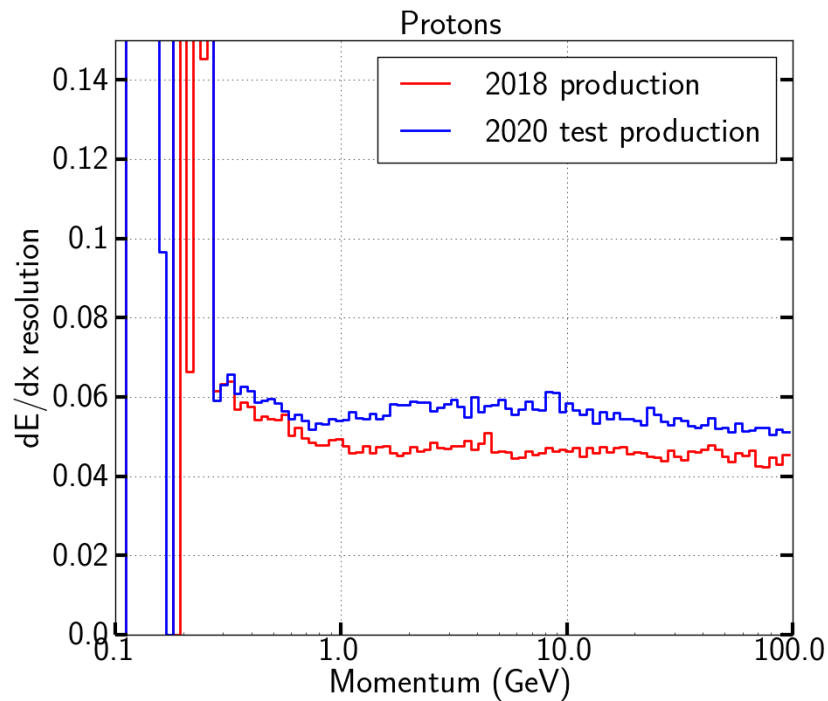
Previous production



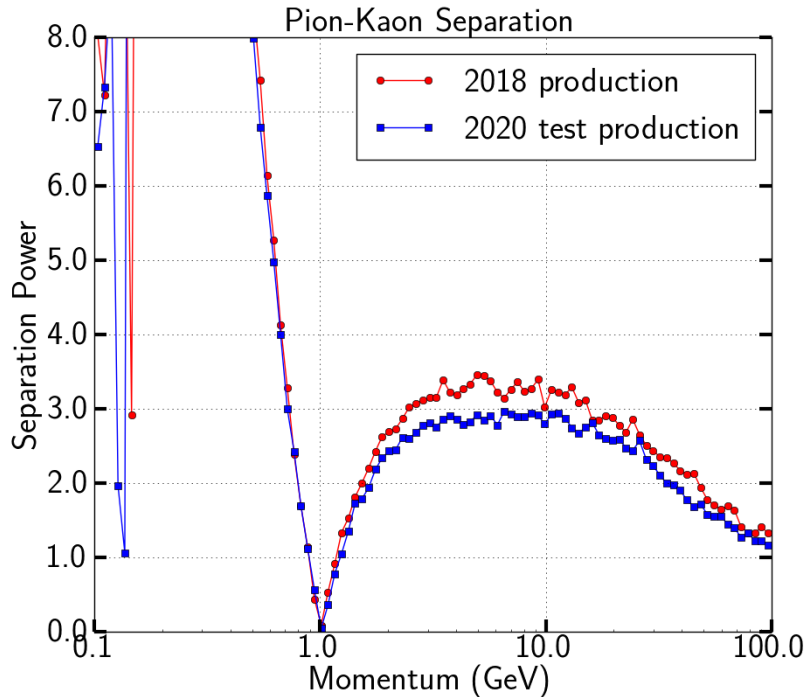
dE/dx Resolution - Electrons



dE/dx Resolution - Protons



Separation Power: Pion/Kaon

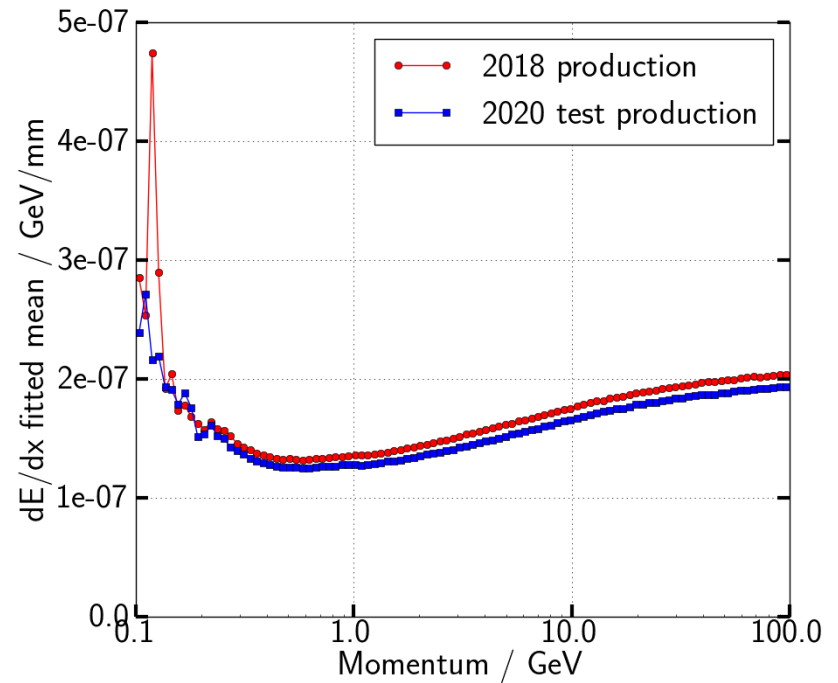
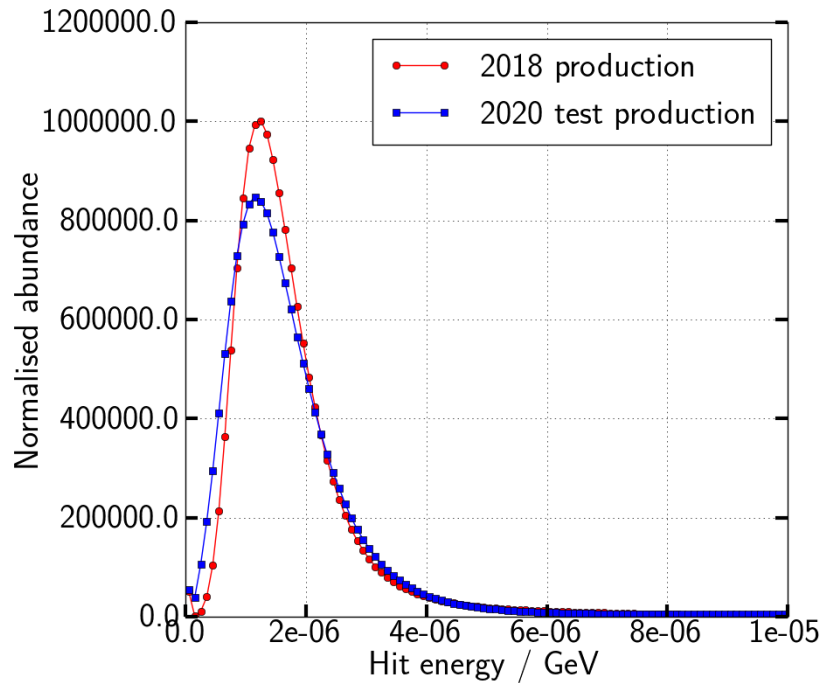


- Worsened resolution and consequently separation power
- Possible reason: Geant4 version was changed
- Check hit-level properties

3

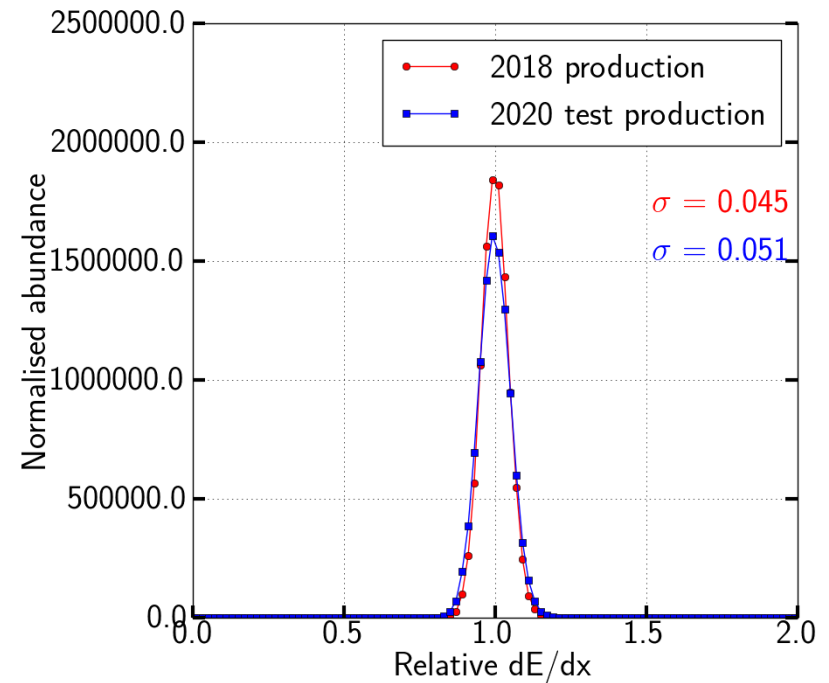
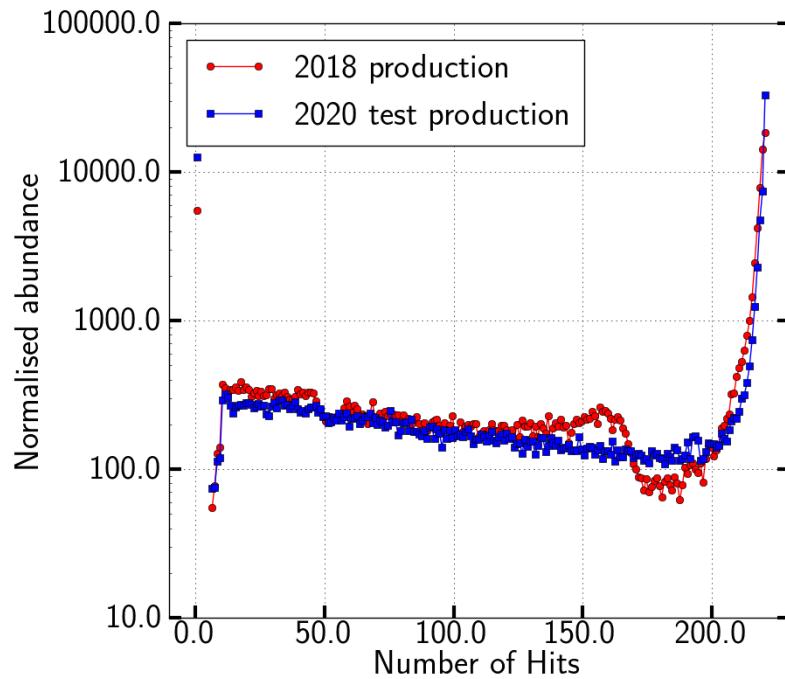
Shift in Hit Energy Landau and Beth-Bloch Level

Pions



Number of Hits and Resolution

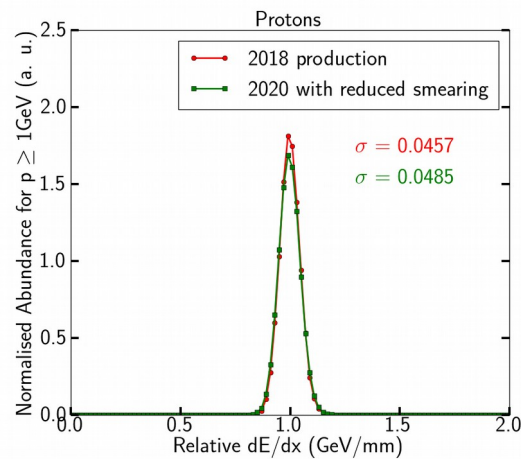
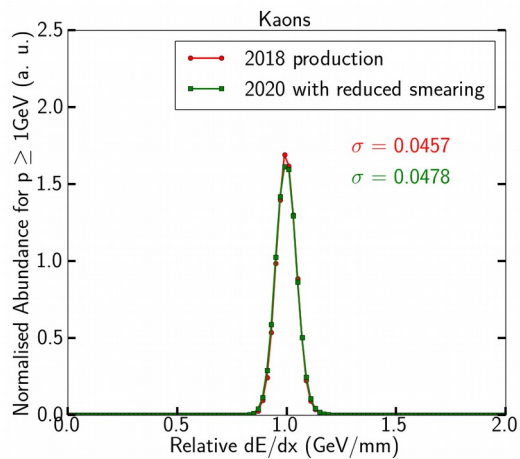
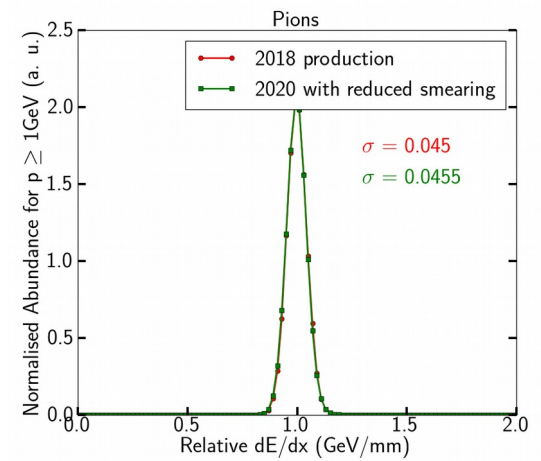
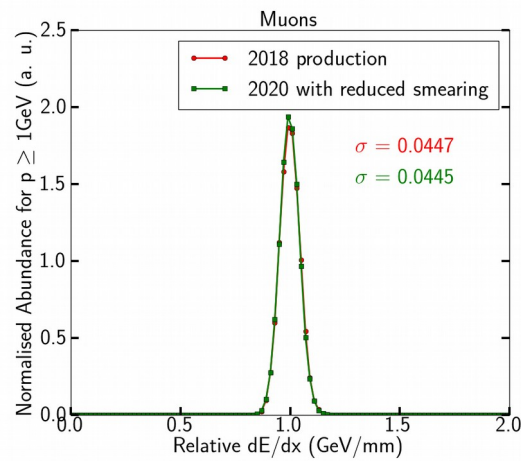
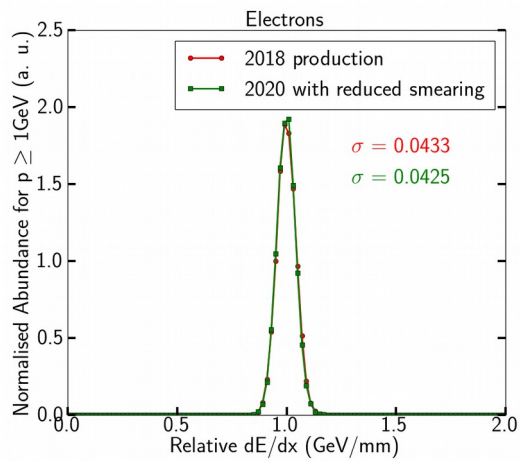
Pions



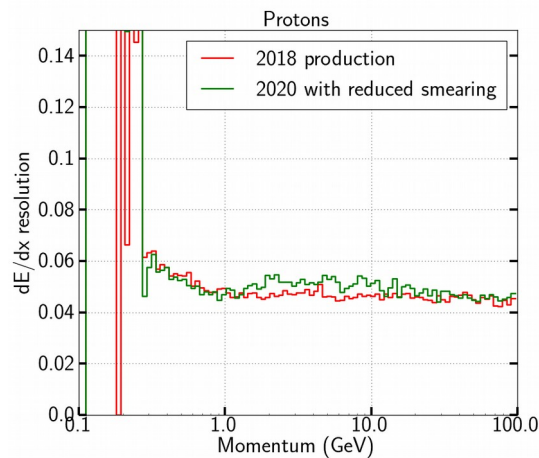
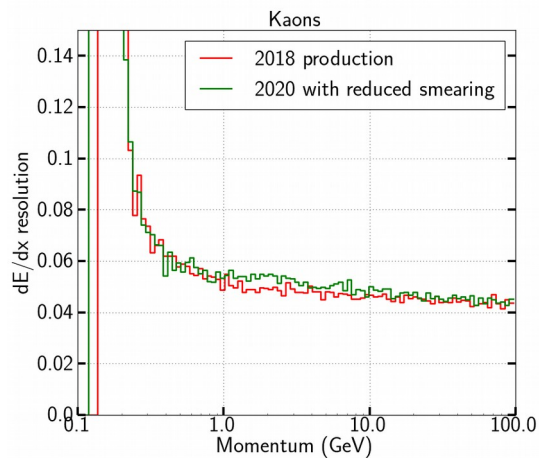
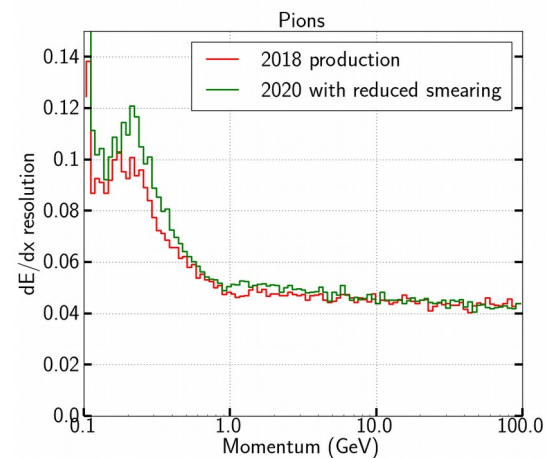
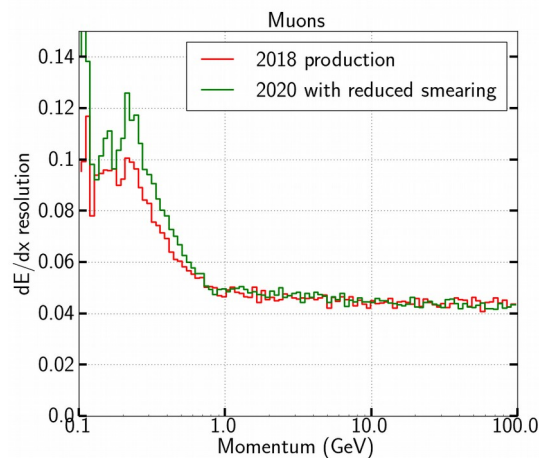
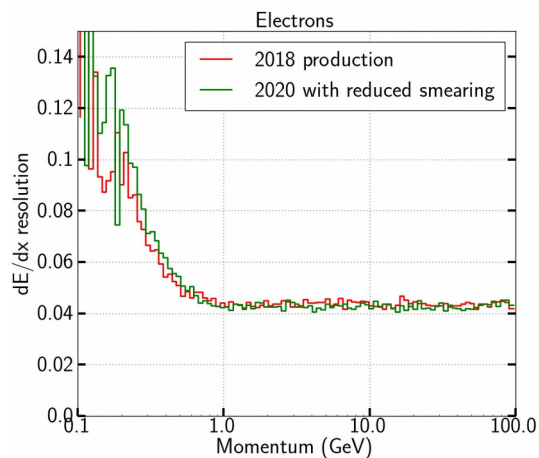
- Resulting resolution is part 'intrinsic' width of geant4 ionisation and additional Gaussian smearing by the Compute_dEdxProcessor
- **2018 production:** intrinsic 2.8 % vs. smearing 3.5 % (Pions)
- **2020 test production:** intrinsic 3.8 % → smearing 2.4 %

- Re-reconstructed single particle files with smearing factor of 0.024 and checked the results

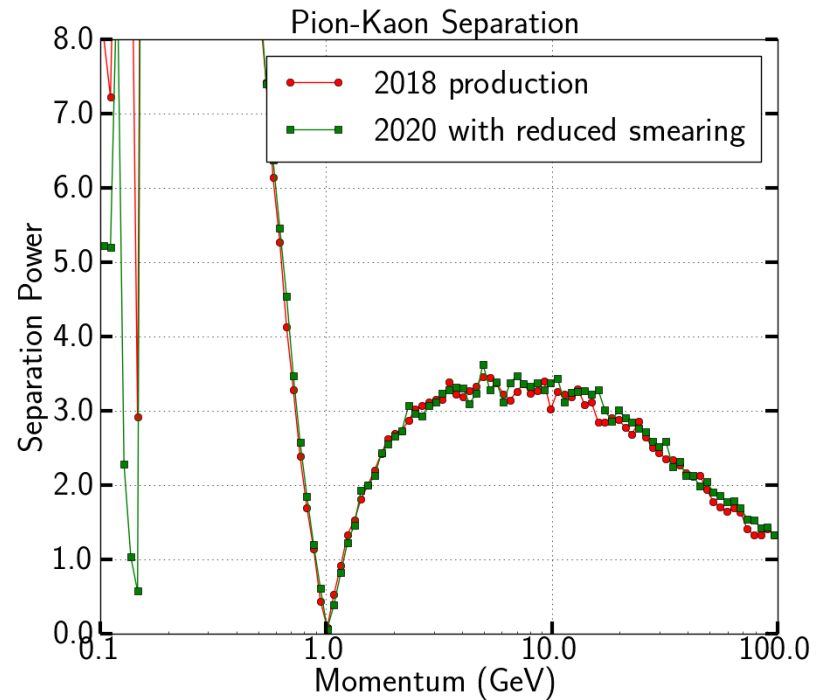
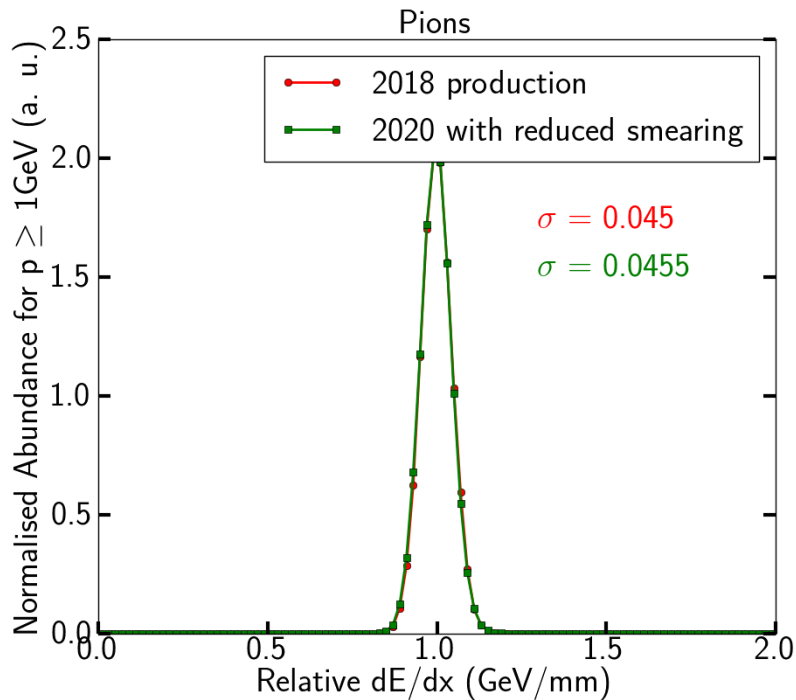
dE/dx Resolution after Smearing Correction



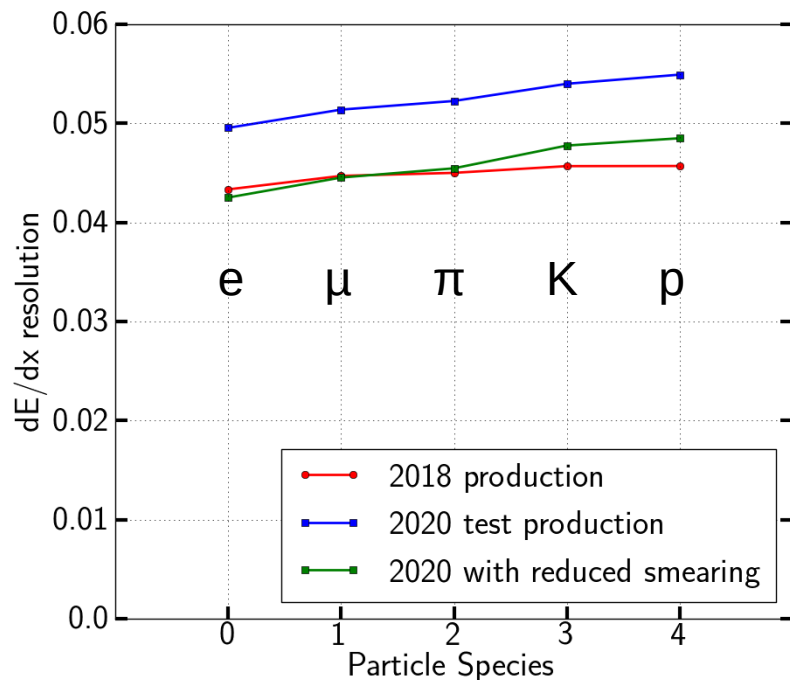
dE/dx Resolution vs. Momentum after Smearing Correction



Pion-Kaon Separation Power after Smearing Correction



Comparison of dE/dx Resolution



- Overall, the correction returned the resolution to previous levels.
- But: difference in resolution values of different species (worse with growing mass) were enhanced.
- We need to decide which particle should be at 4.5 % resolution and adapt the smearing factor accordingly. Testbeams are done with electrons.

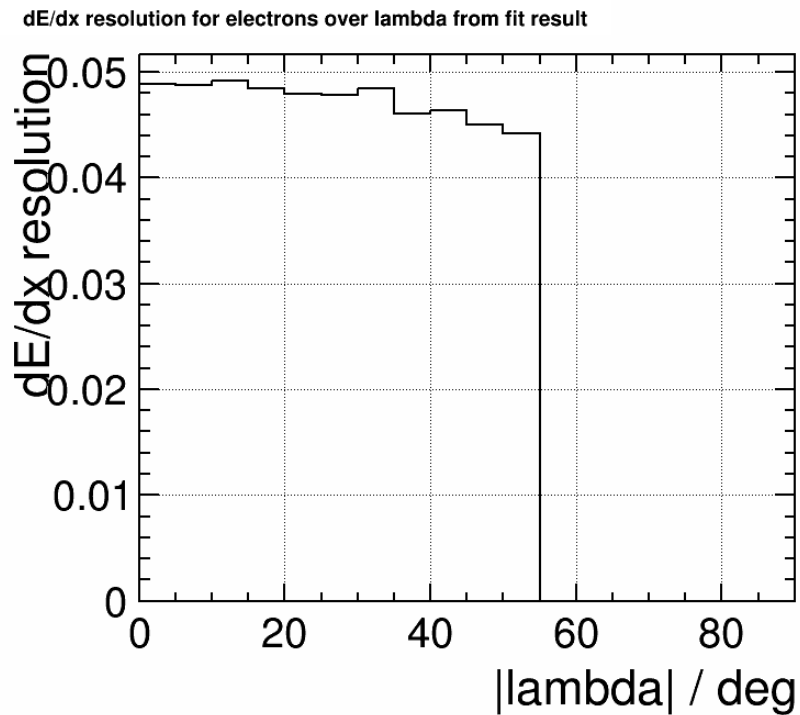
Regarding Further Changes

- Better dE/dx -resolution can be implemented by reducing the smearing factor further.
- Drift length-dependent algorithms, like cluster counting, can in principle be implemented into the smearing factor, but needs some work and a dedicated parametrisation from measurements or simulation.
- The smearing factor is applied at the end of TrackingReco, a re-reconstruction would need to start at least there (so far done by entirely re-running MarlinStdReco).



Angular Distribution

New test production



Previous production

