Work ongoing on hadron analysis

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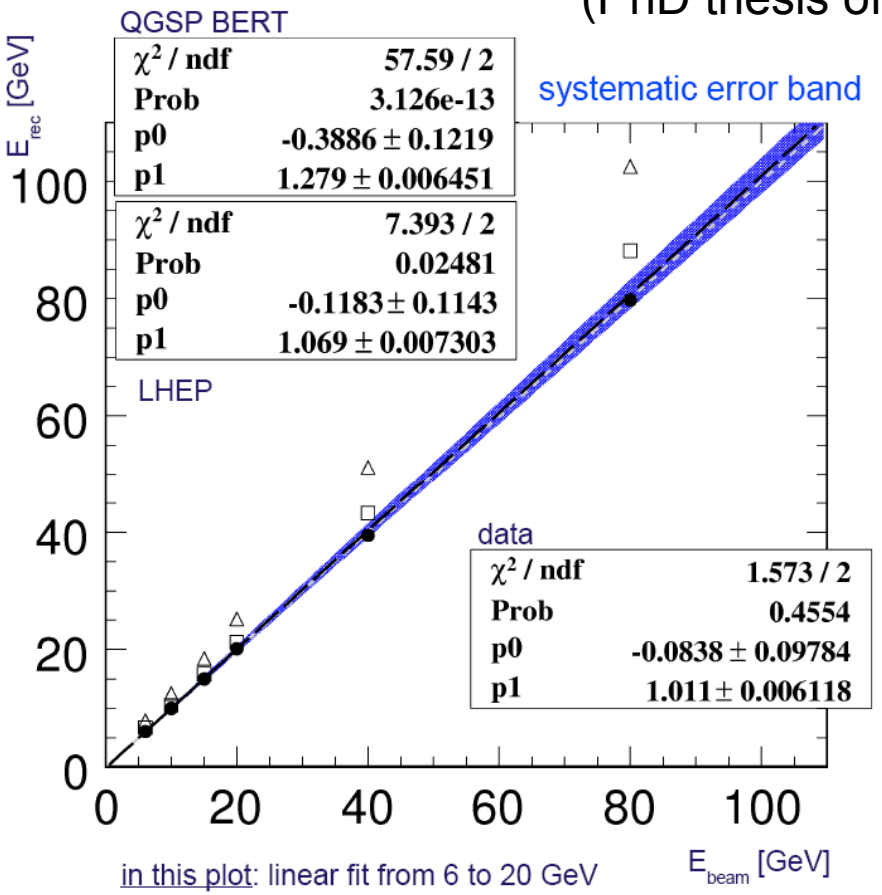
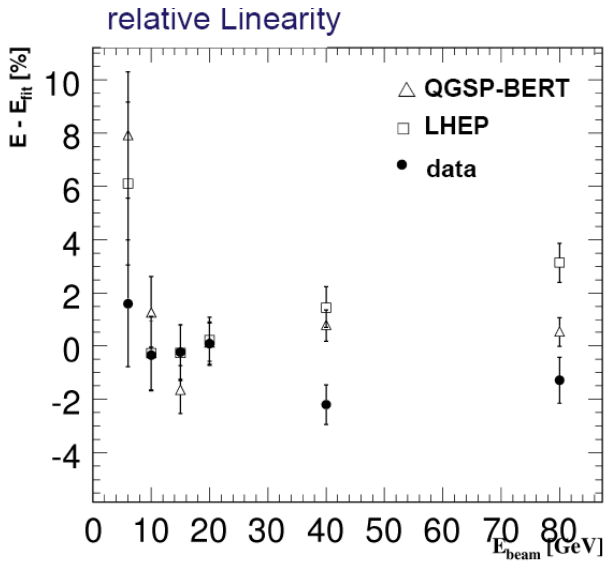
comparison to MC models

(PhD thesis of Oliver Wendt)





Status from last meeting:

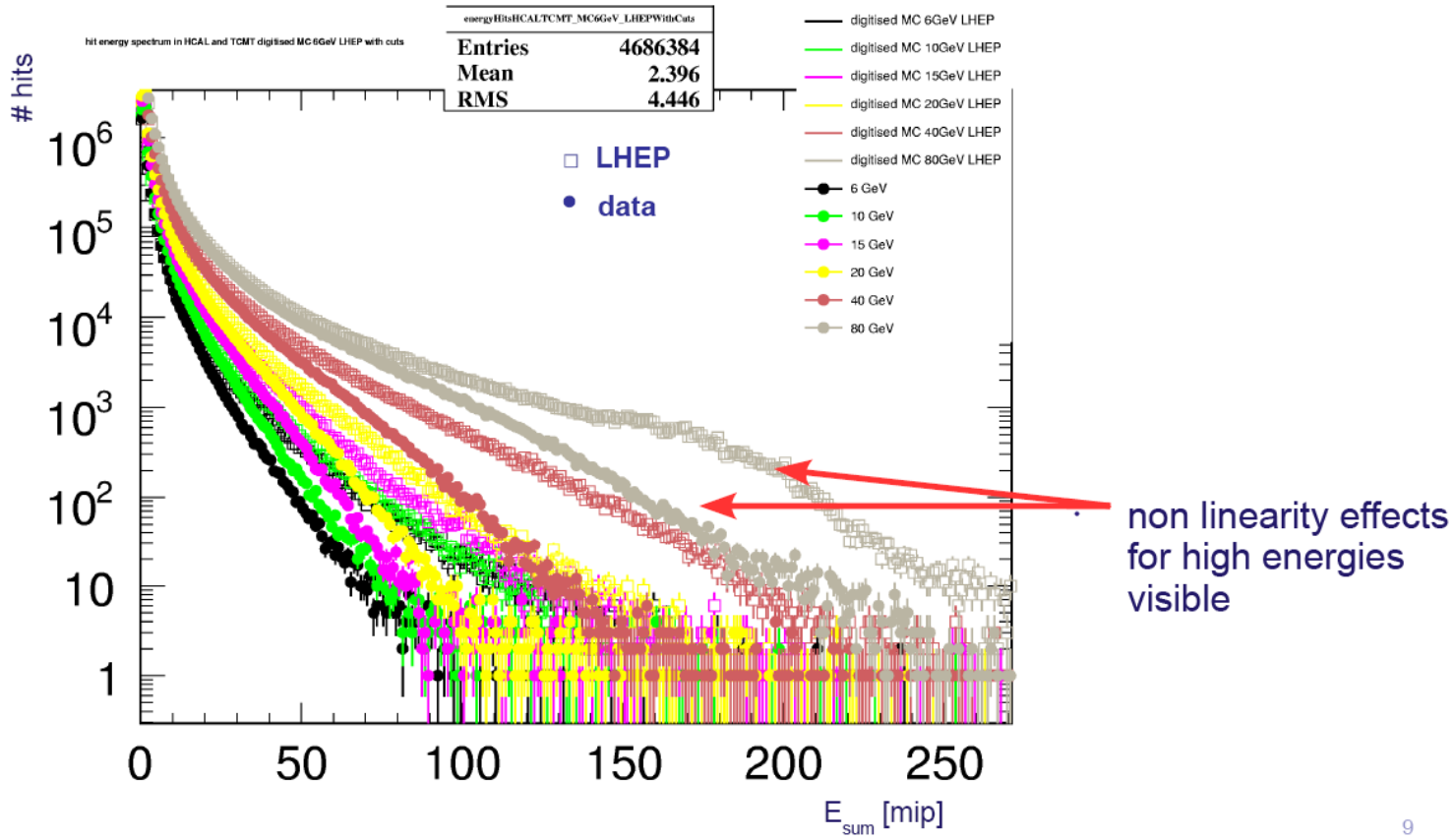
- 6-80 GeV pi+/pi- sample analysed
- difference in absolute scale data/models
- data correction not final

Update:

- test effect of Birks law on MC models
- compare digitized to true MC
- comparison pi+ / pi- sample (not yet finished)

Remaining SiPM non-linearity

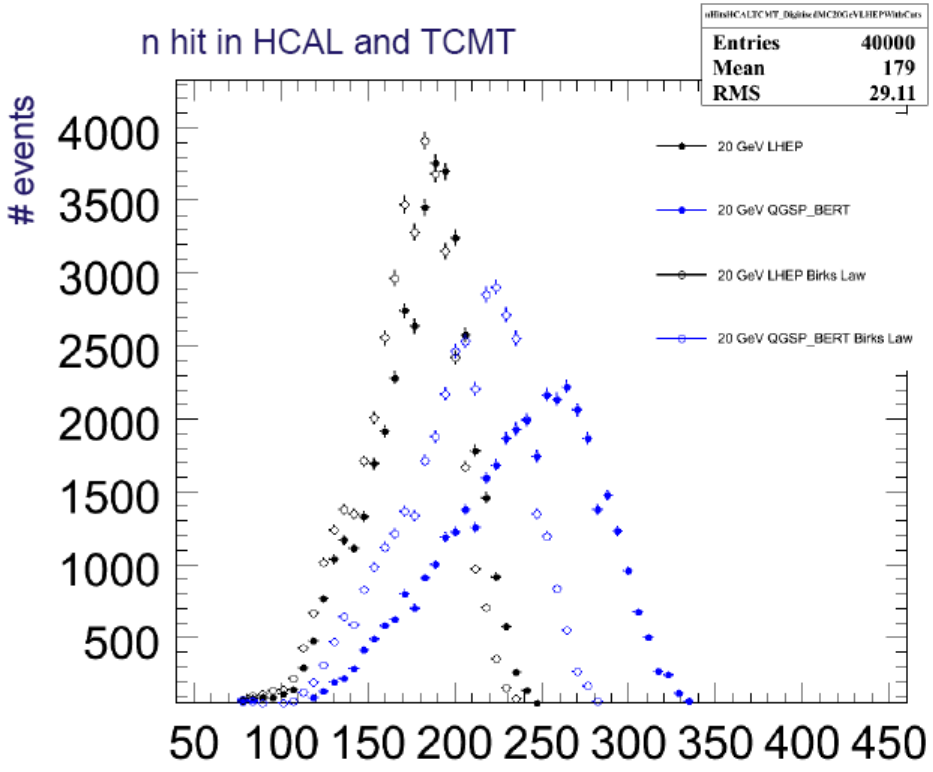
effect of SiPM non-linearity visible at high energy in hit energy spectrum
non-final calibration procedure:
➔rescaling of response function by 20% missing (see EM analysis)
➔this will improve absolute scale agreement with models

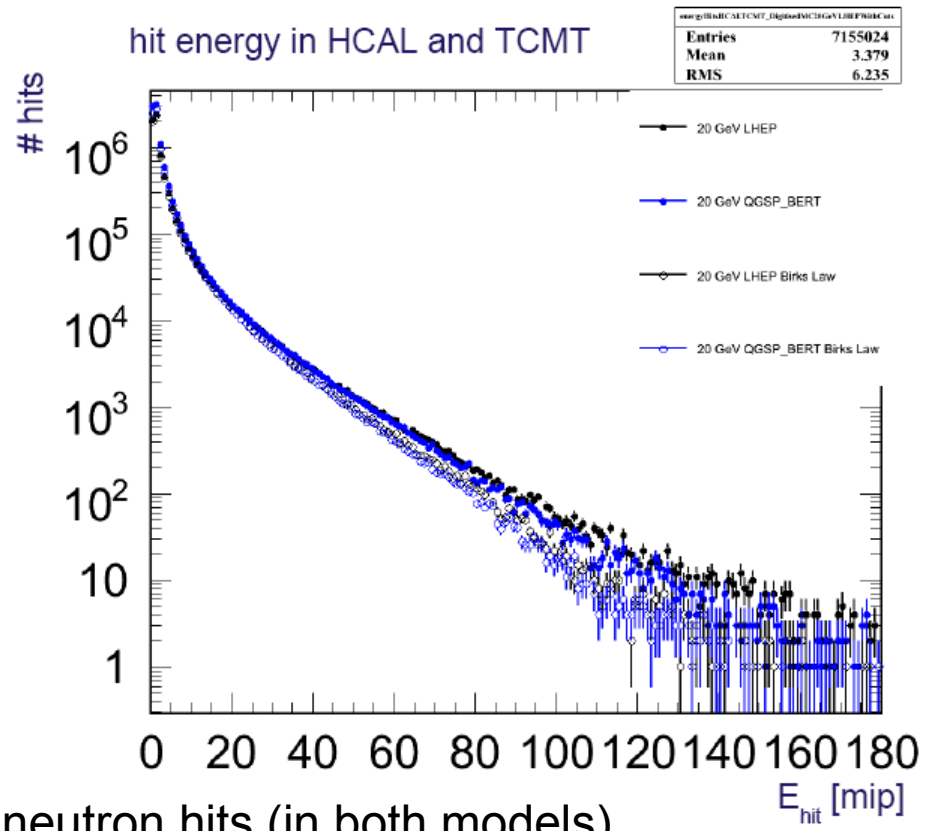


Birks law

saturation effect in scintillator at high ionization density (recoil protons)

- running Mokka 06-05-p02 with Geant4.9.2.BETA01 and digitisation
- π^-, 20 GeV, two digitised Monte Carlos (LHEP and QGSP BERT)



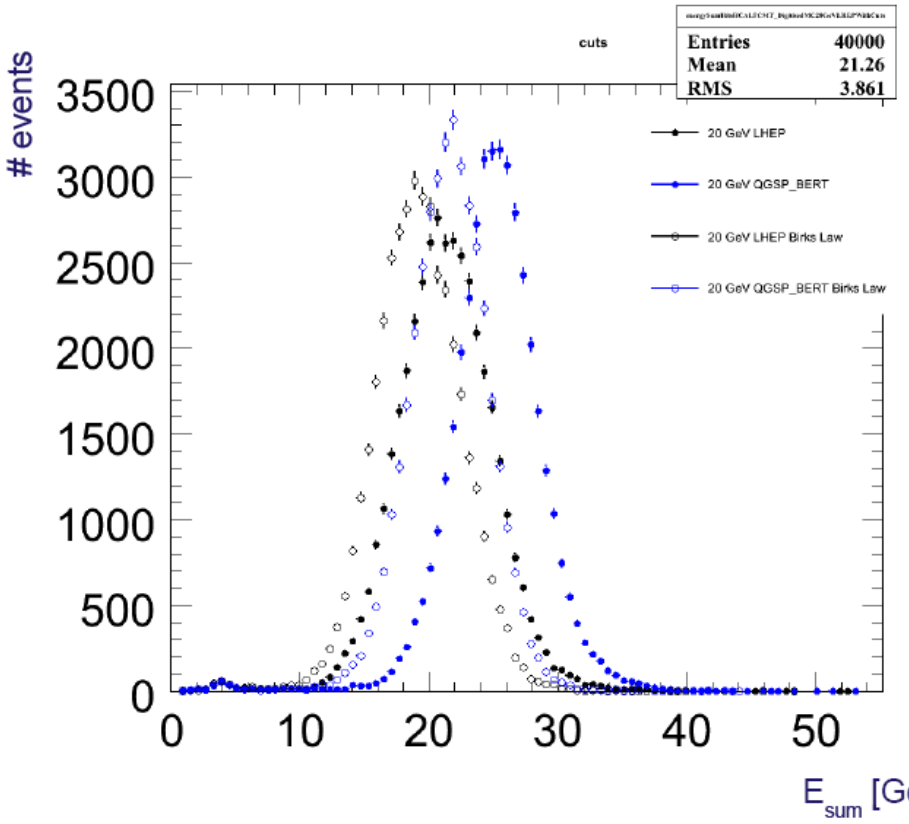


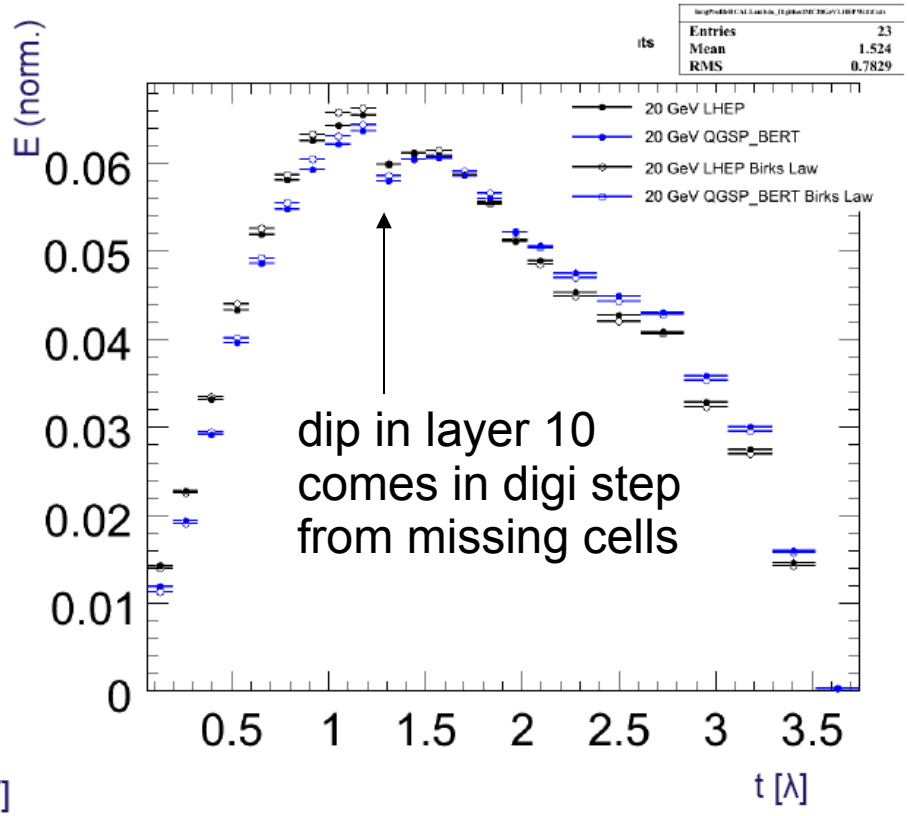
- using Birks law decreases number of neutron hits (in both models)
- stronger effect in QGSP_BERT which has largest number of neutrons
- less discrepancy between models with Birks law switch on

➔ Birks law must become the default of our simulation !!

Birks law II

- running Mokka 06-05-p02 with Geant4.9.2.BETA01 and digitisation
- π^-, 20 GeV, two digitised Monte Carlos (LHEP and QGSP BERT)

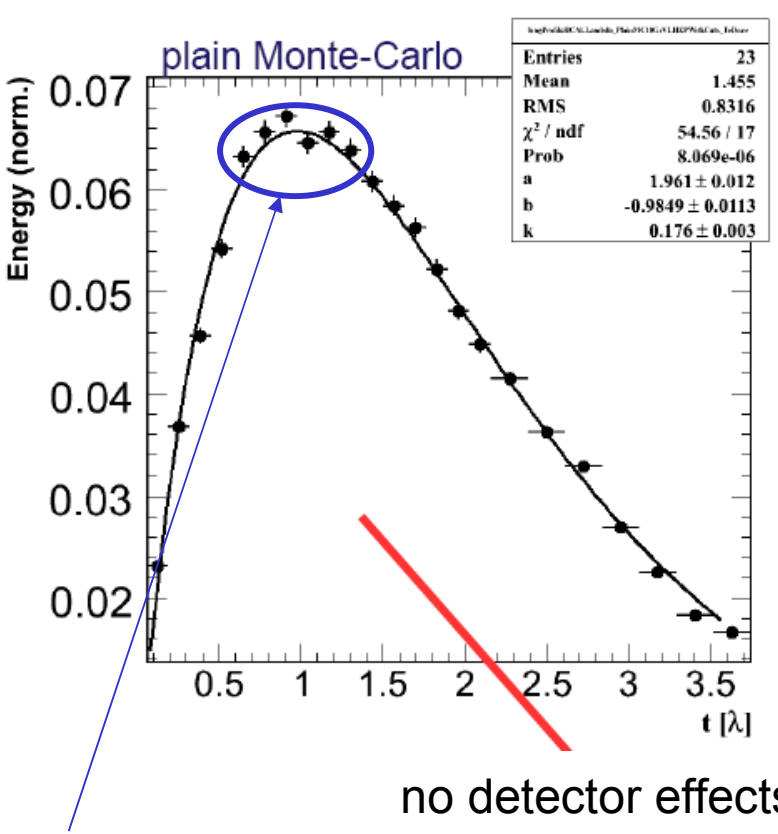


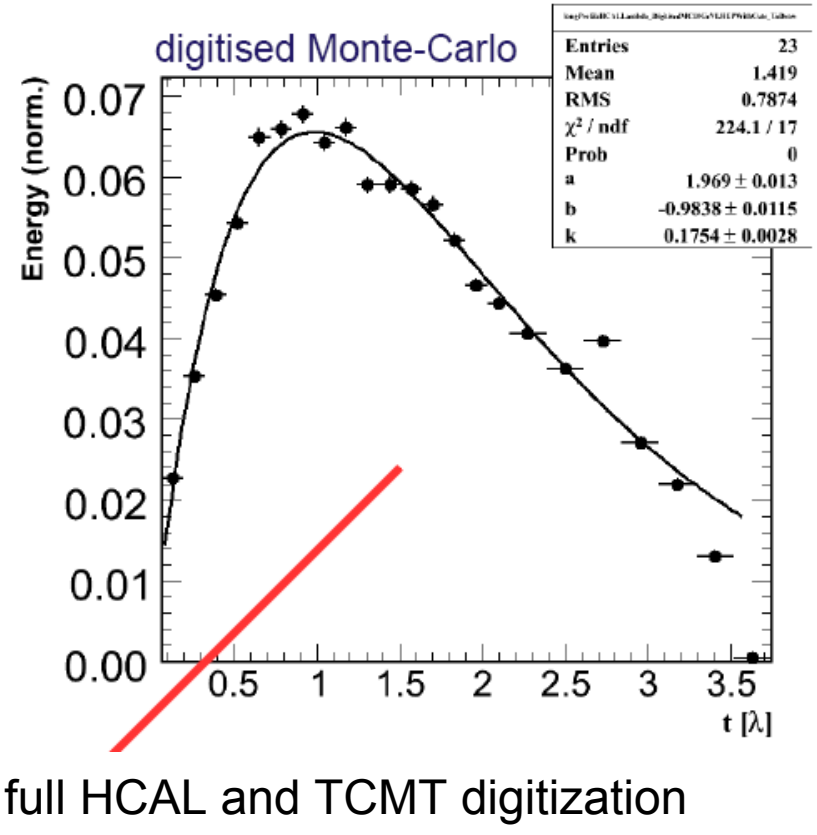


- using Birks law decreases also total energy sum ➔ better agreement with data
- small effect on the longitudinal shower shape

Digitized / true MC

π^-, 10 GeV, plain and digitised Monte Carlo, LHEP, longitudinal profile





no detector effects

full HCAL and TCMT digitization

not understood deep in layer 8 in true MC, not observed in data

idea: use ratio digi/true MC to extract layer-wise correction factors (ongoing)

Shower leakage analysis

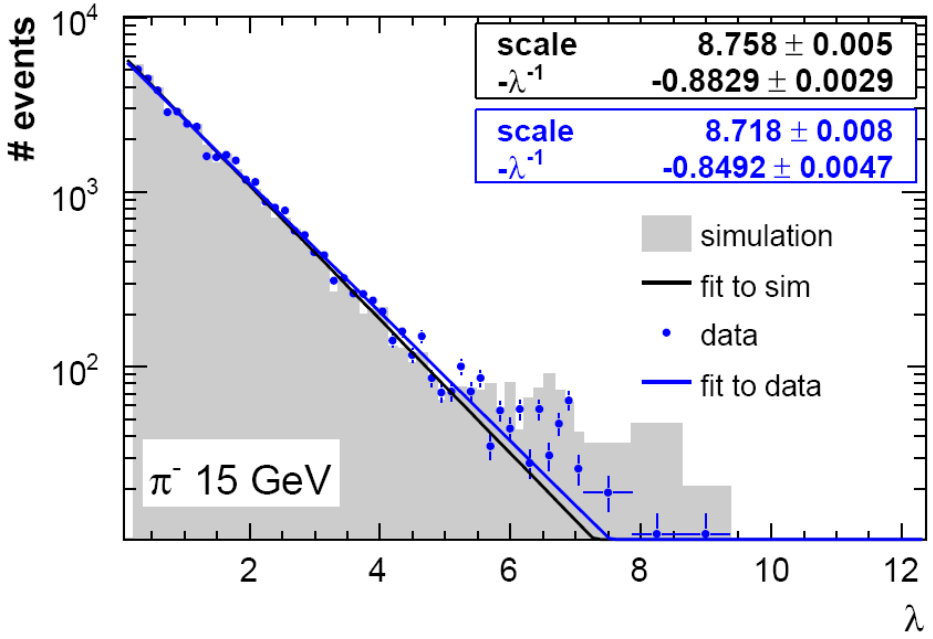
(PhD thesis of Beni Lutz)

Update:
analysis procedure unchanged ➔ determination of shower starting point in HCAL
extraction of shower leakage from HCAL vs shower starting point

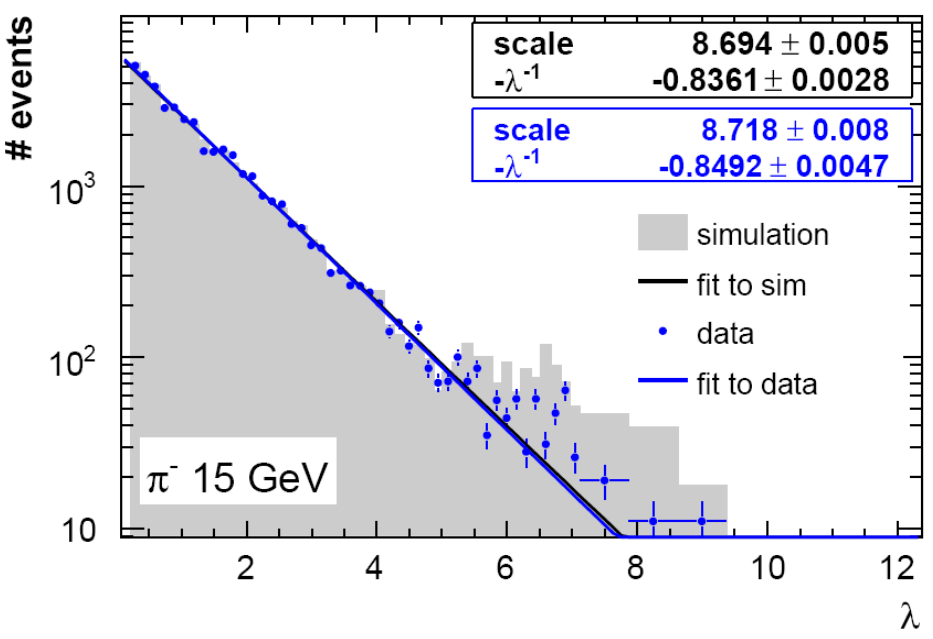
now available comparison with MC models (LHEP and QGSP_BERT)

no Birks law included

LHEP



QGSP_BERT



determination of interaction length consistent between data and MCs

$\lambda_{pion} > \lambda_{proton}$ expected ➔ from data $\lambda_{pion} = 0.85\ \lambda_{proton}$

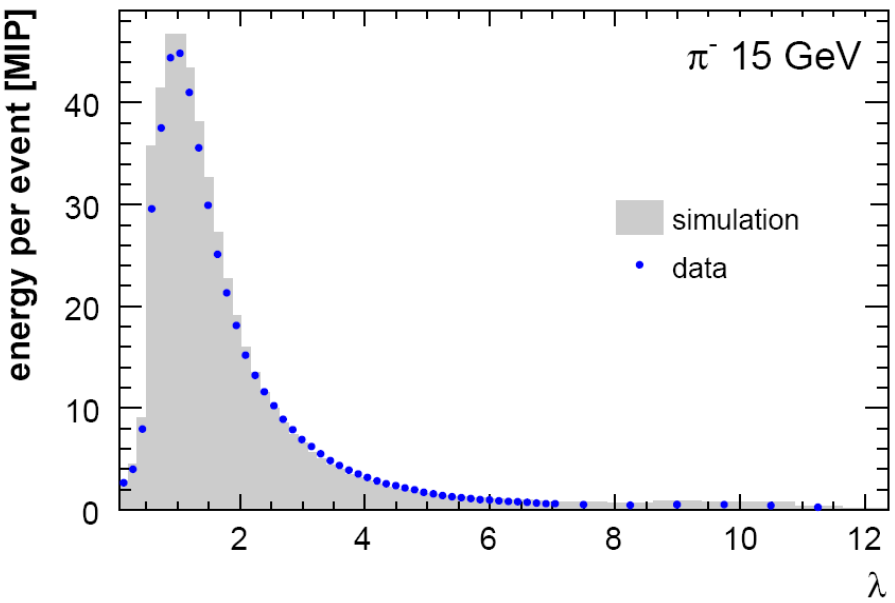
Longitudinal shower shape

longitudinal shower shape shifted to shower start point event by event

➔the shower maximum is approx. at ~1 λ

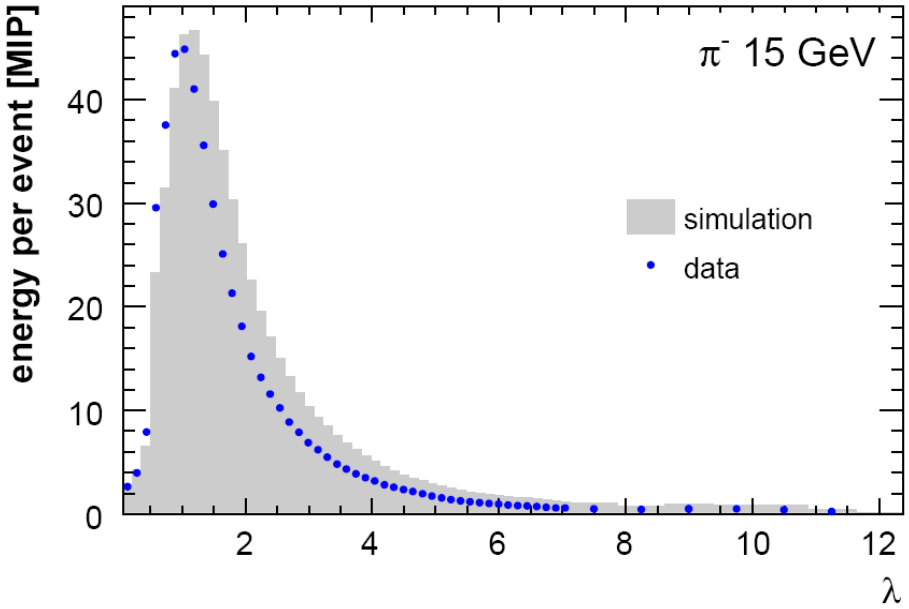
➔more direct comparison with MC physics

LHEP



QGSP_BERT

no Birks law included



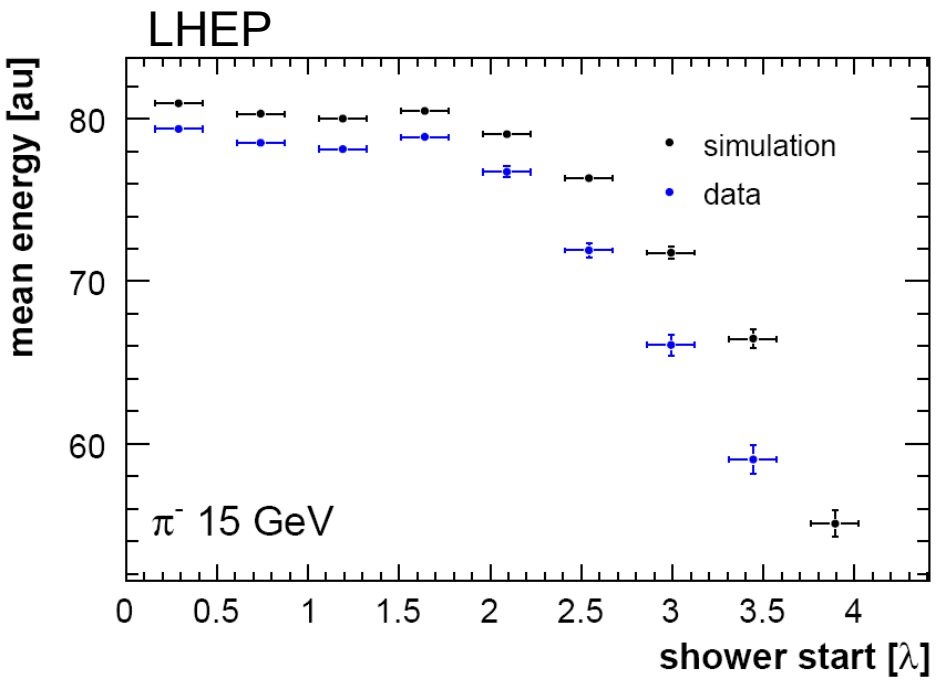
•QGSP_BERT later shower max. and longer shower

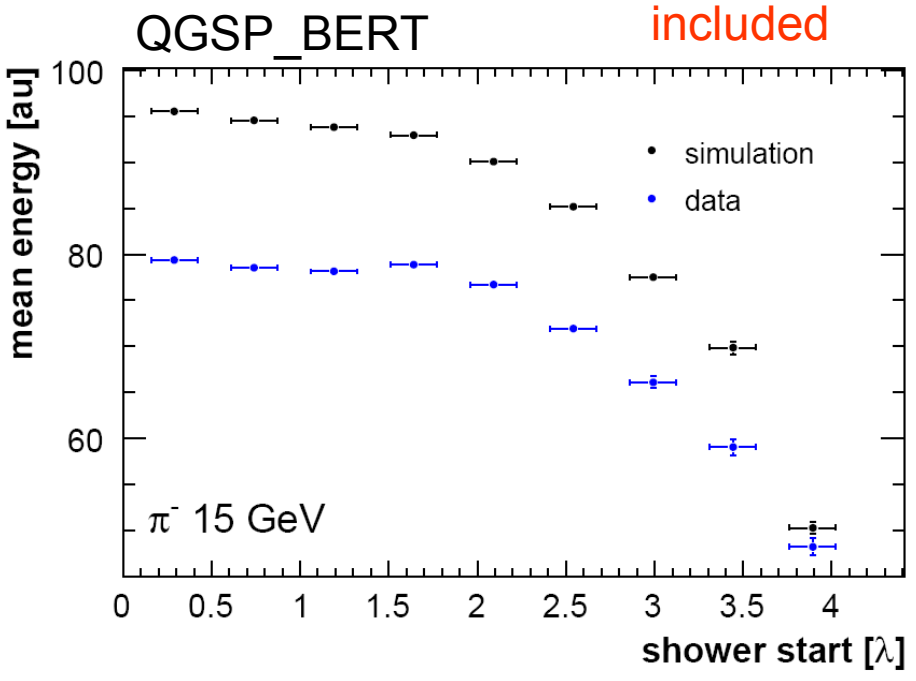
•data favour a short shower shape as in LHEP

Shower leakage

Determination of total energy in HCAL as a function of shower starting point

➔ for showers started after 2 λleakage becomes significant





no Birks law included

- LHEP reproduces the kink after 2 λseen in data
- QGSP_BERT has more smooth decrease
- QGSP_BERT gives more energy than LHEP (consistent with Oliver analysis)

Conclusion

- both hadron analyses are well ongoing
- new calibration results from EM analysis still have to be ported to hadron analysis

- consistent result in the comparison to two MC models
- 170 M MC events generated in ~ 1 month ➔ considerable computation effort (thanks to Munich support)
- Birks law has to become standard in our MC production