Simple benchmarks status

First results on pion absorption (in flight)

Witek Pokorski

Outline

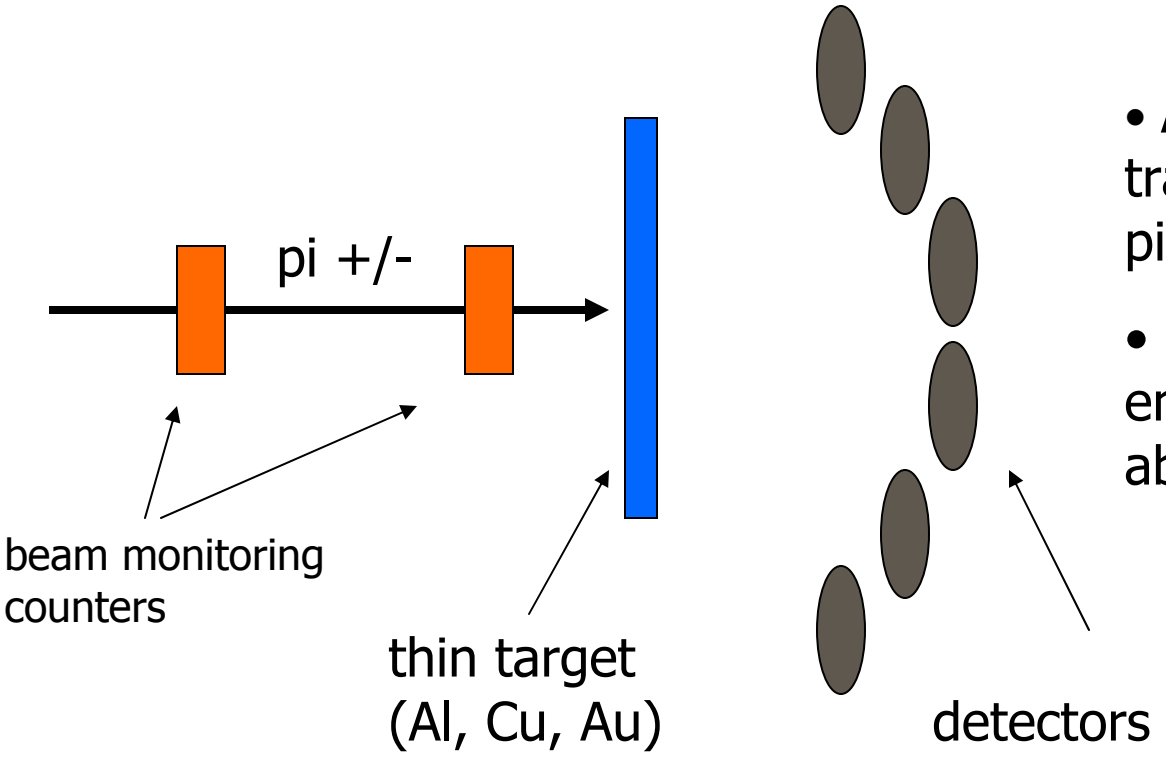
- reminder on the work done so far
- pion absorption – experiments
- pion absorption – simulation
- pion absorption plots
- summary and plans

Reminder on work done so far

- Jurg Beringer working on the project until end of 2003
  - double differential cross-section benchmark completed
    (reusing G4 benchmark application developed by I.Gonzalez from Alice)
  - work published in LCG note (draft ready – final corrections)
  - results also available on the web page:
    - http://lcgapp.cern.ch/project/simu/validation/benchmarks/neutron/index.html
  - preliminary work for the next benchmark – pion absorption (in flight)

Pion absorption – experiments

- very little experimental data available!
  - K. Nakai at al., PRL 44, 1446 (1980)
  - D. Ashery et al, PR C23, 2173 (1991)

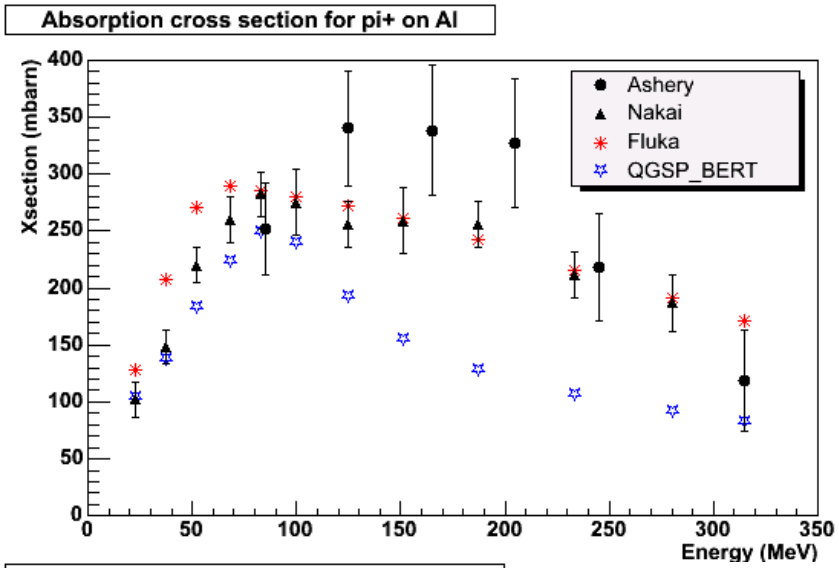


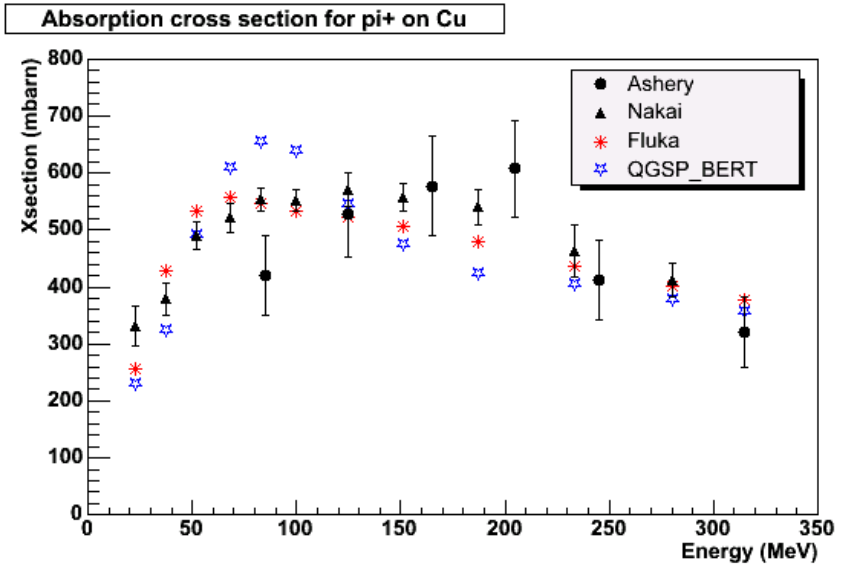
- Ashery – look for transmitted (not absorbed) pions
- Nakai – look for gammas emitted after pion absorption

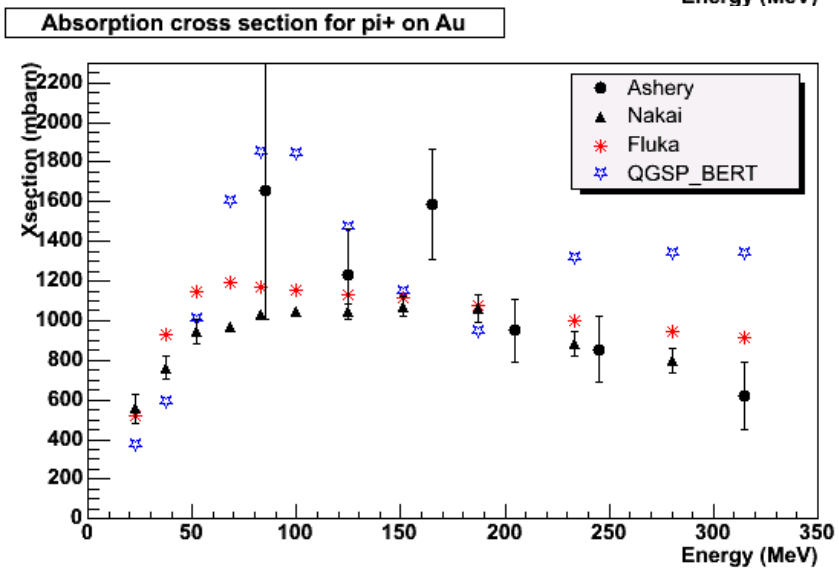
Pion absorption – simulation

- based on the G4 application developed by Isidro (Alice)
- simulating the real setup (thin target) would be very time consuming due to low probability of interaction
- 'fake' thin target experiment simulated by
  - switching on only inelastic scattering process
  - geometry consisting of huge (infinite) block of material
  - propagating particles until the process occurs and looking at the secondaries produced
- using Geant4.6.0 with QGSO_BERT
- similar approach for Fluka – using 'bypass' provided by Alfredo
- using Fluka2003.1

Absorption Xsection for pi+

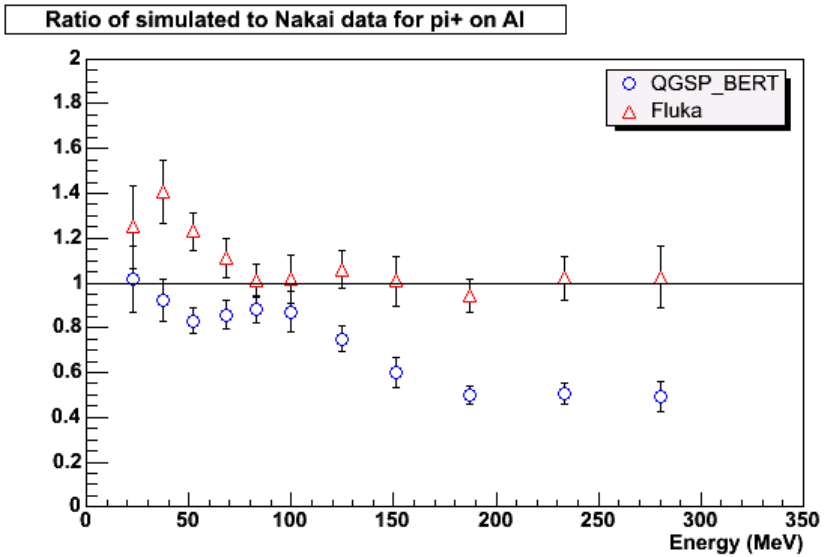


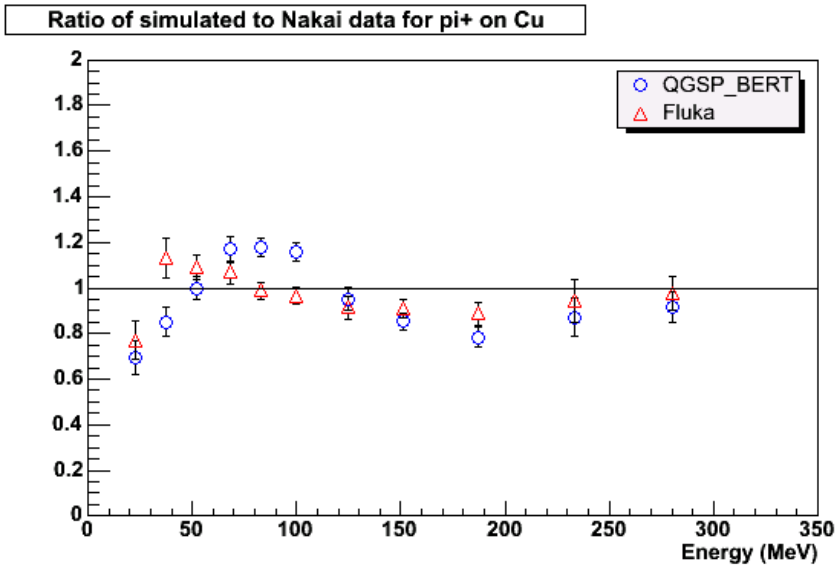


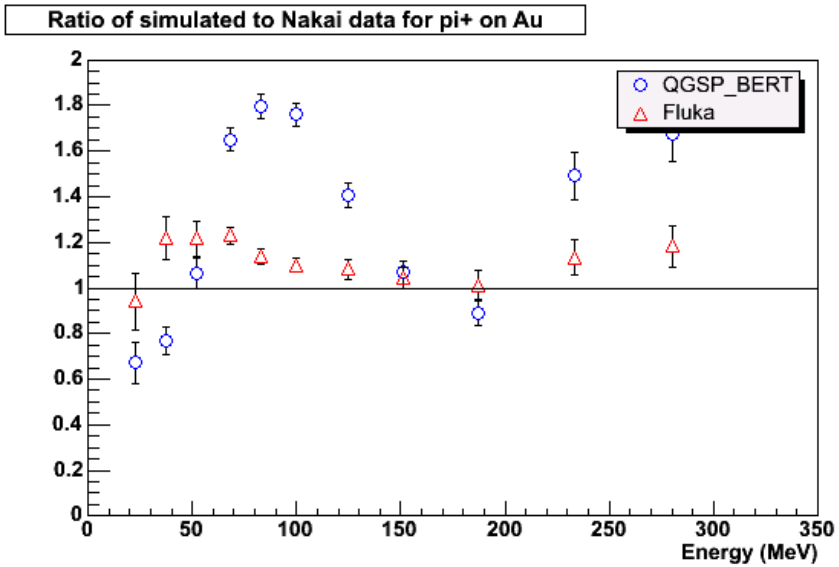


- in all cases Fluka seems to be closer to experimental data
- for heavier materials QGSP_BERT plot seems to have some 'unnatural' shape

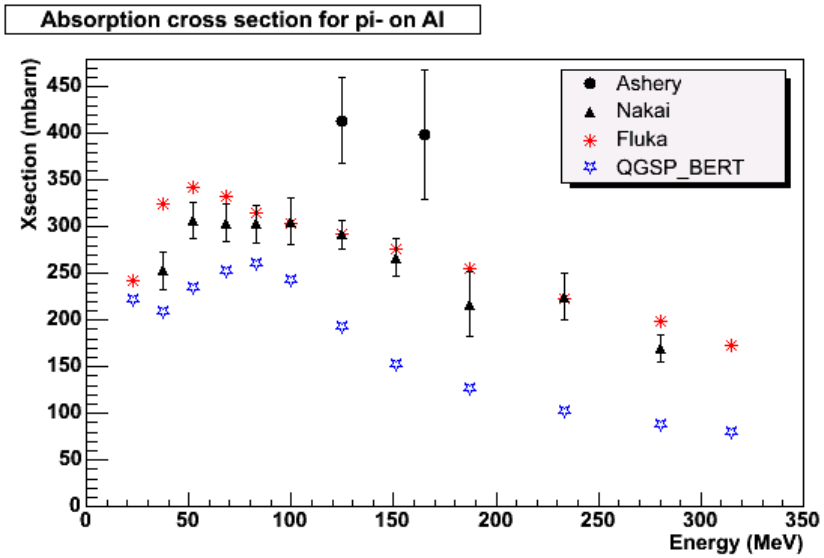
Ratio for pi+

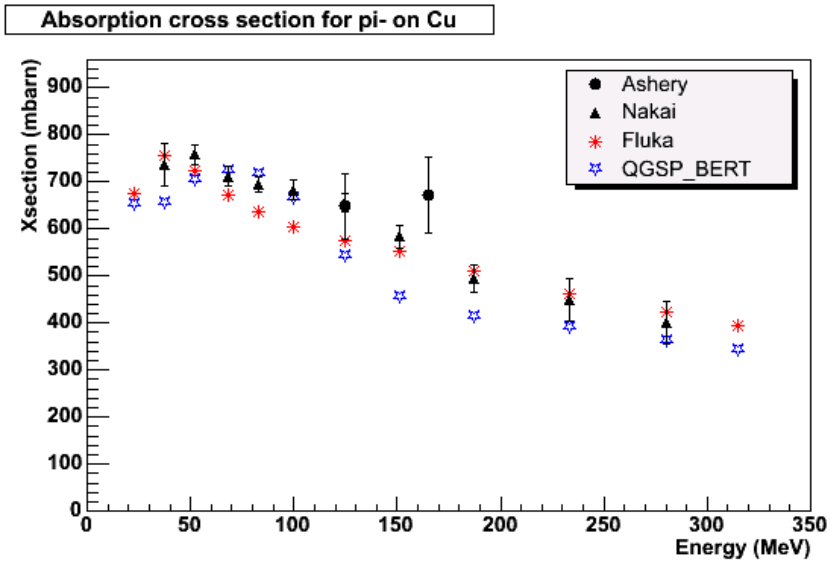

Ratio of simulated to Nakai data for pi+ on Al
QGSP_BERT
Fluka
Energy (MeV)

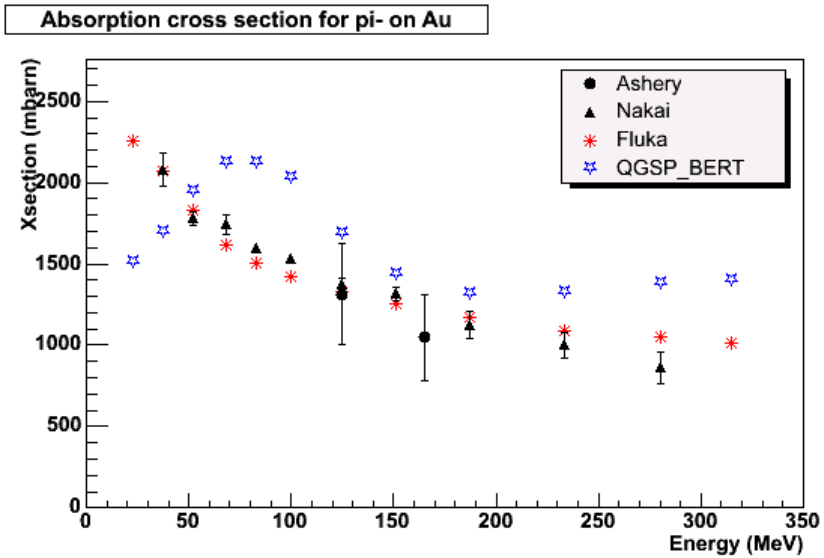

Ratio of simulated to Nakai data for pi+ on Cu
QGSP_BERT
Fluka
Energy (MeV)


Ratio of simulated to Nakai data for pi+ on Au
QGSP_BERT
Fluka
Energy (MeV)

Absorption Xsection for pi-

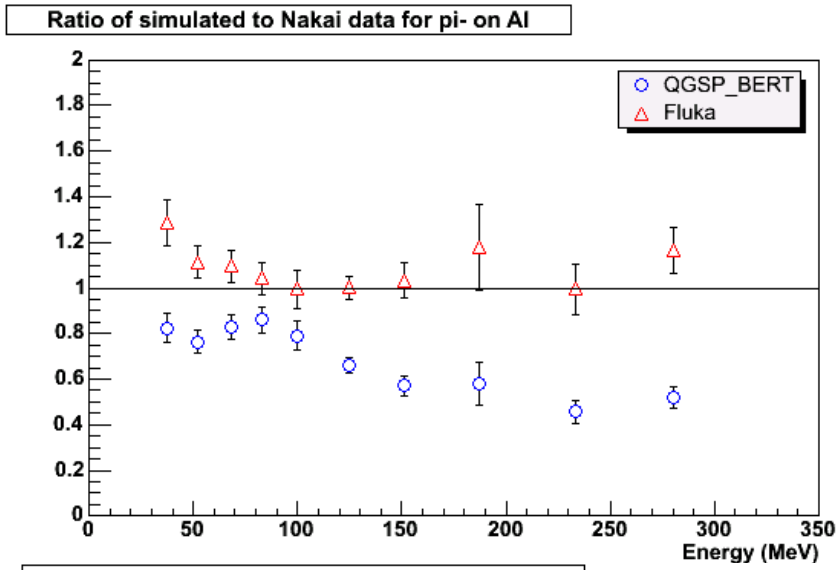


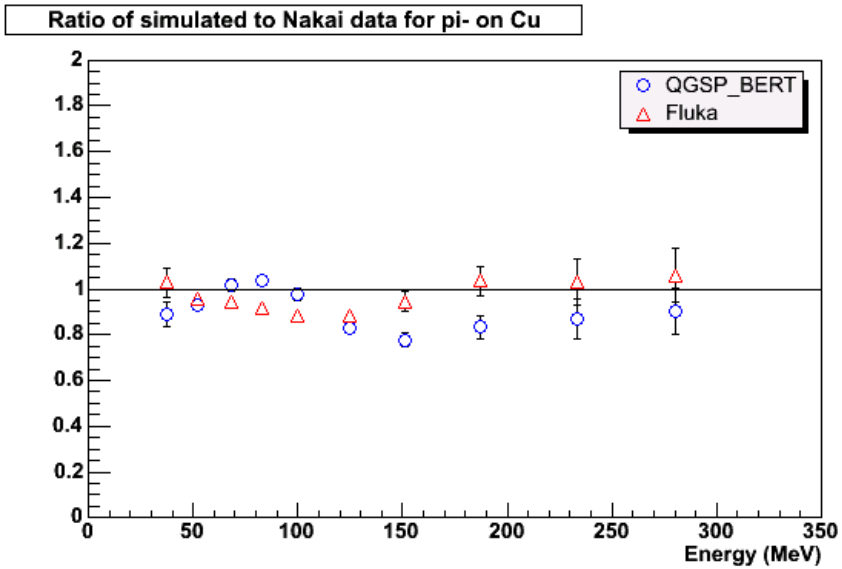


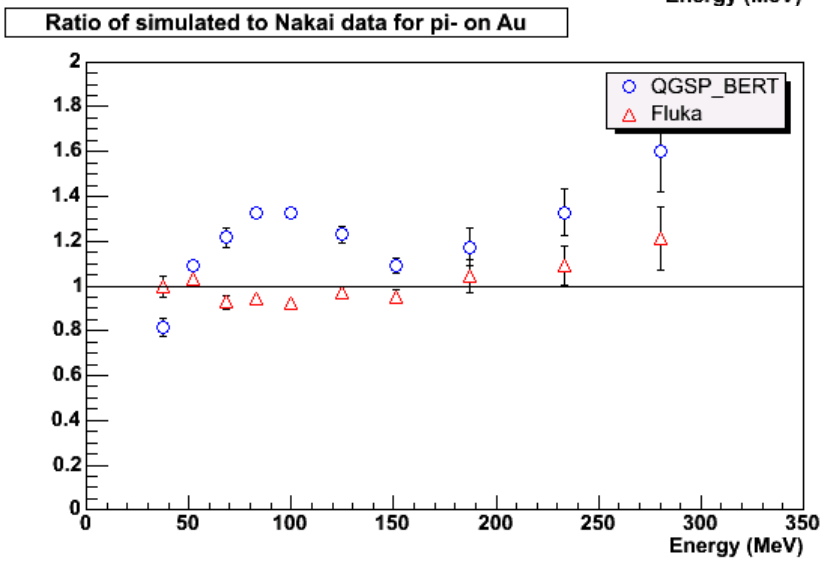


- same remarks as for pi+
- for heavy material (Au) the shape of the QGSP_BERT quite different

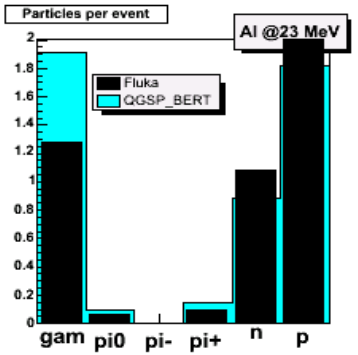
Ratio for pi-

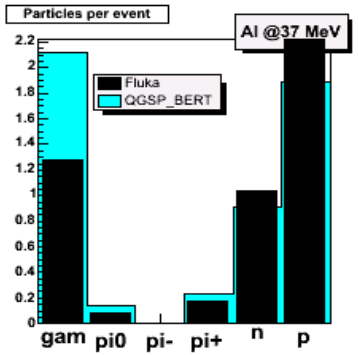

Ratio of simulated to Nakai data for pi- on Al
QGSP_BERT
Fluka
Energy (MeV)

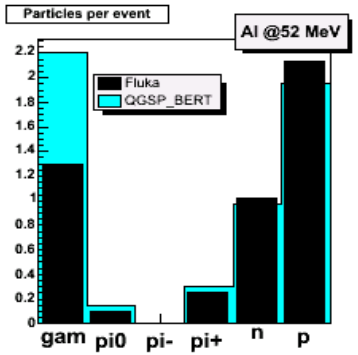

Ratio of simulated to Nakai data for pi- on Cu
QGSP_BERT
Fluka
Energy (MeV)

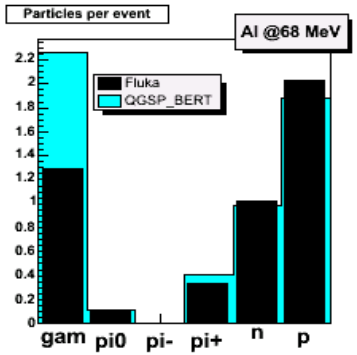

Ratio of simulated to Nakai data for pi- on Au
QGSP_BERT
Fluka
Energy (MeV)

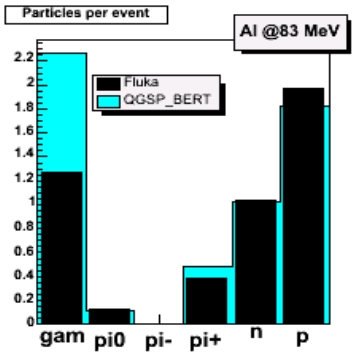
Particle spectra for pi+ on Al

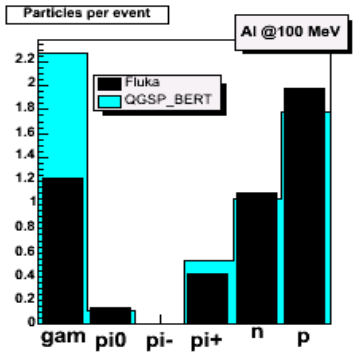


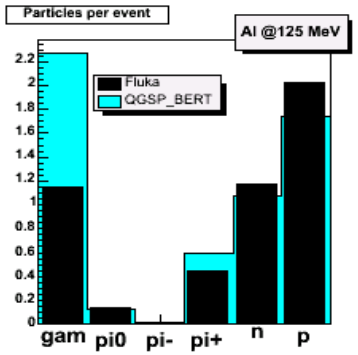


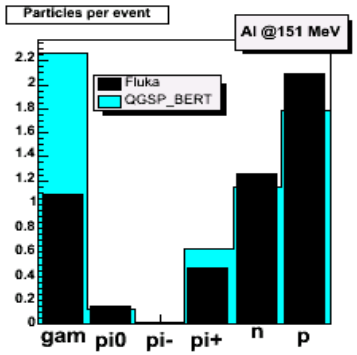


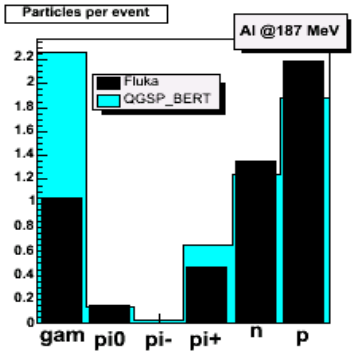


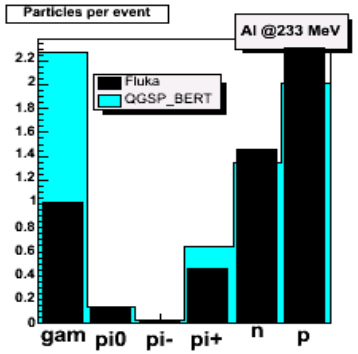


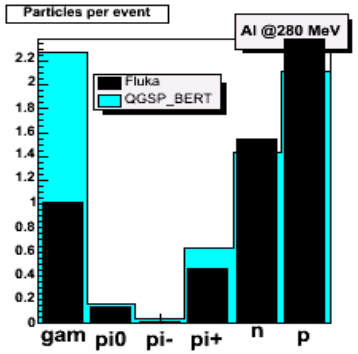


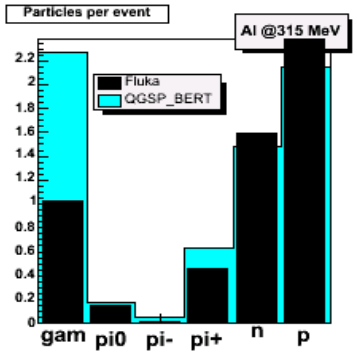




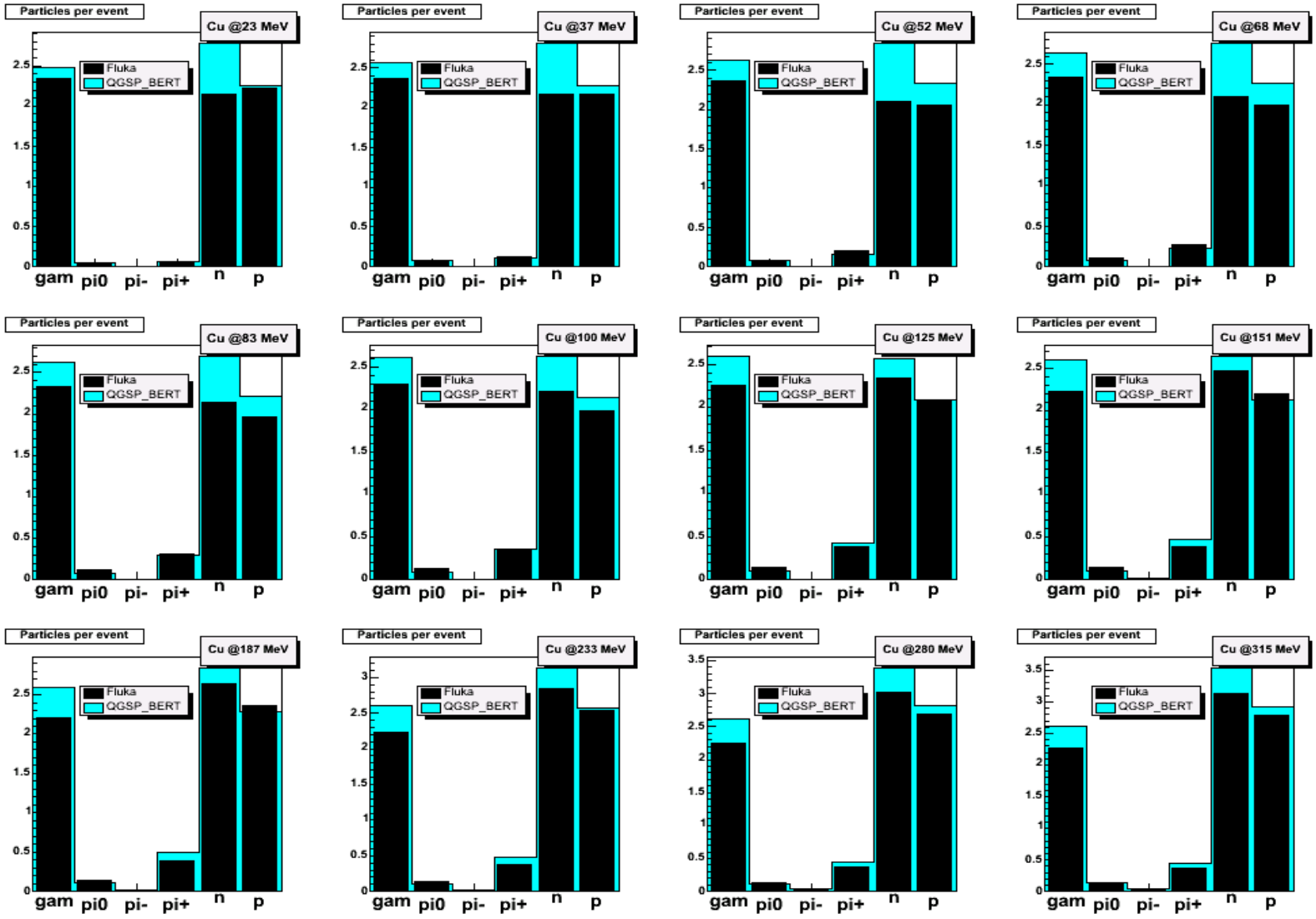




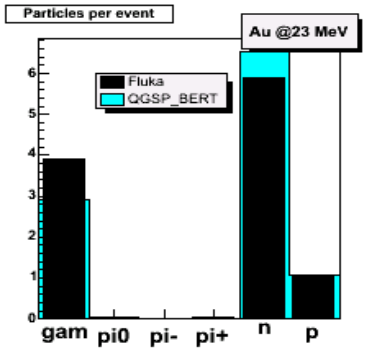


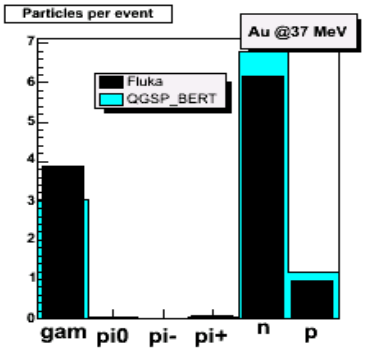


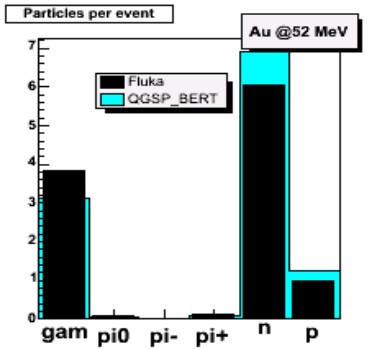
Particle spectra for pi+ on Cu

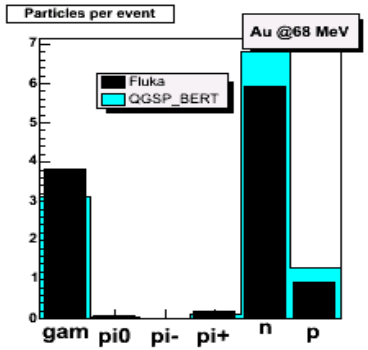


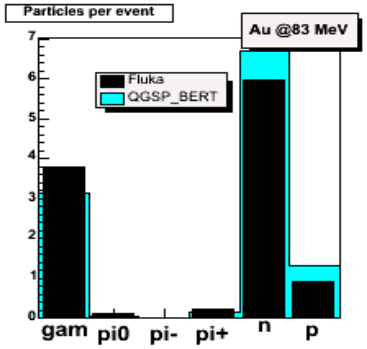
Particle spectra for pi+ on Au

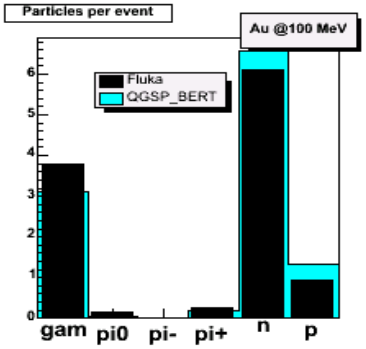


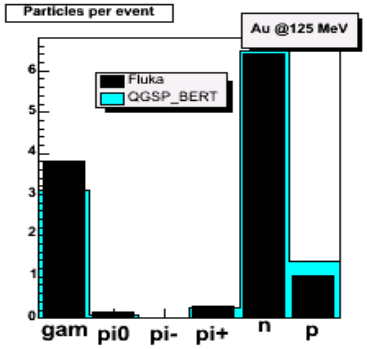


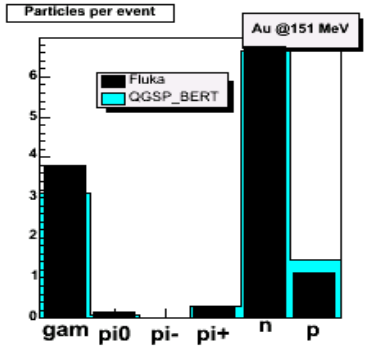


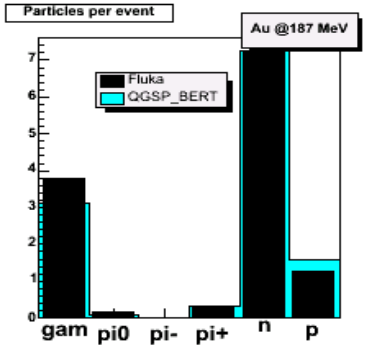


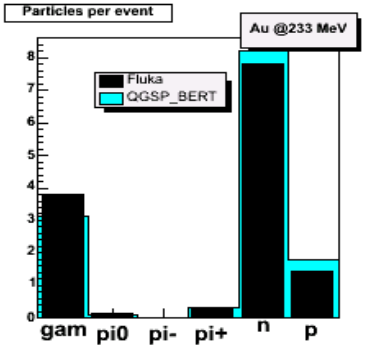


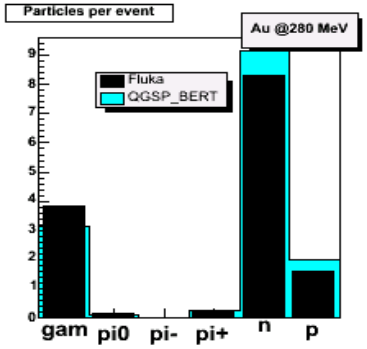


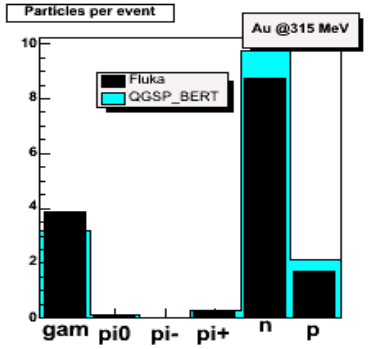




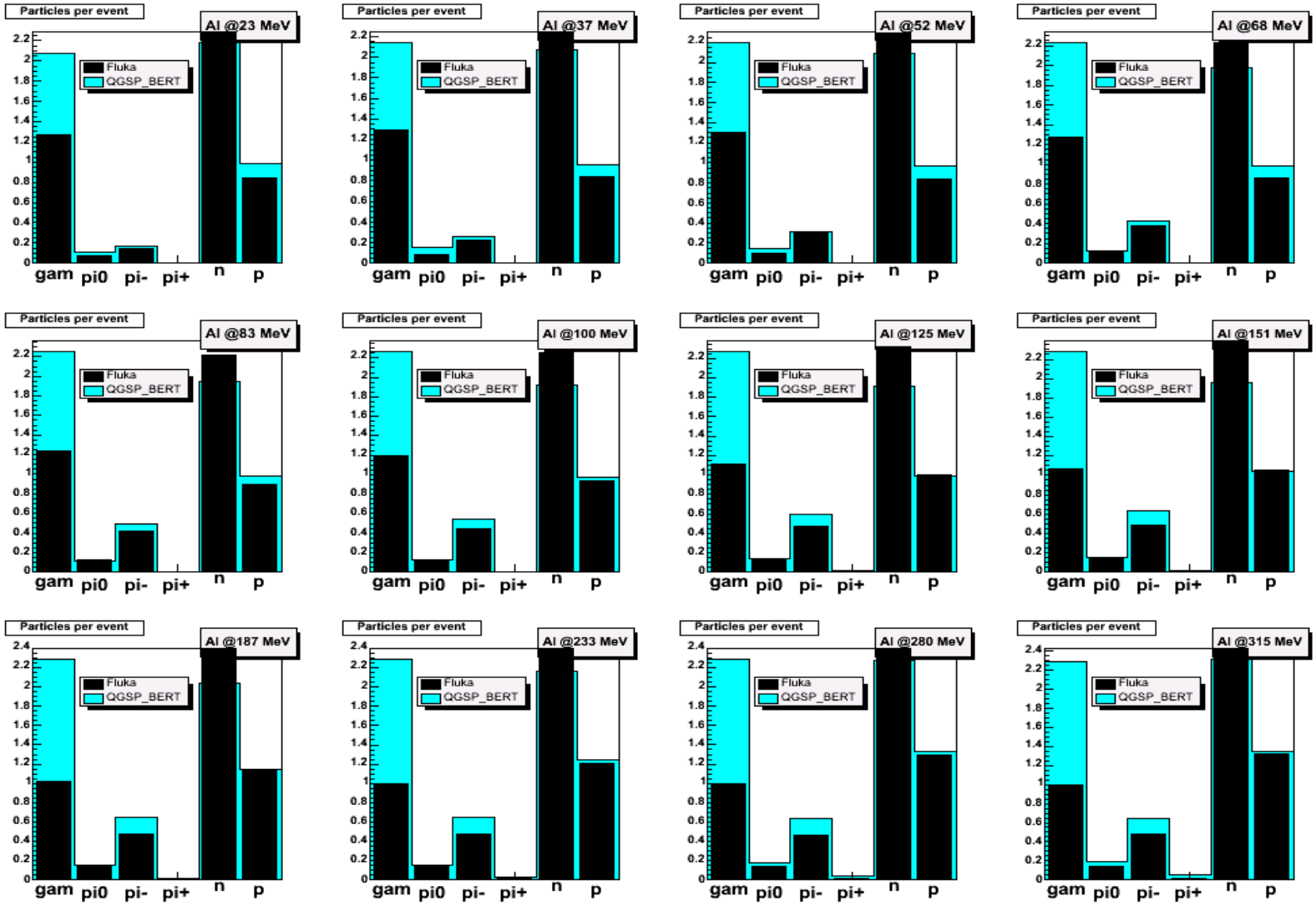




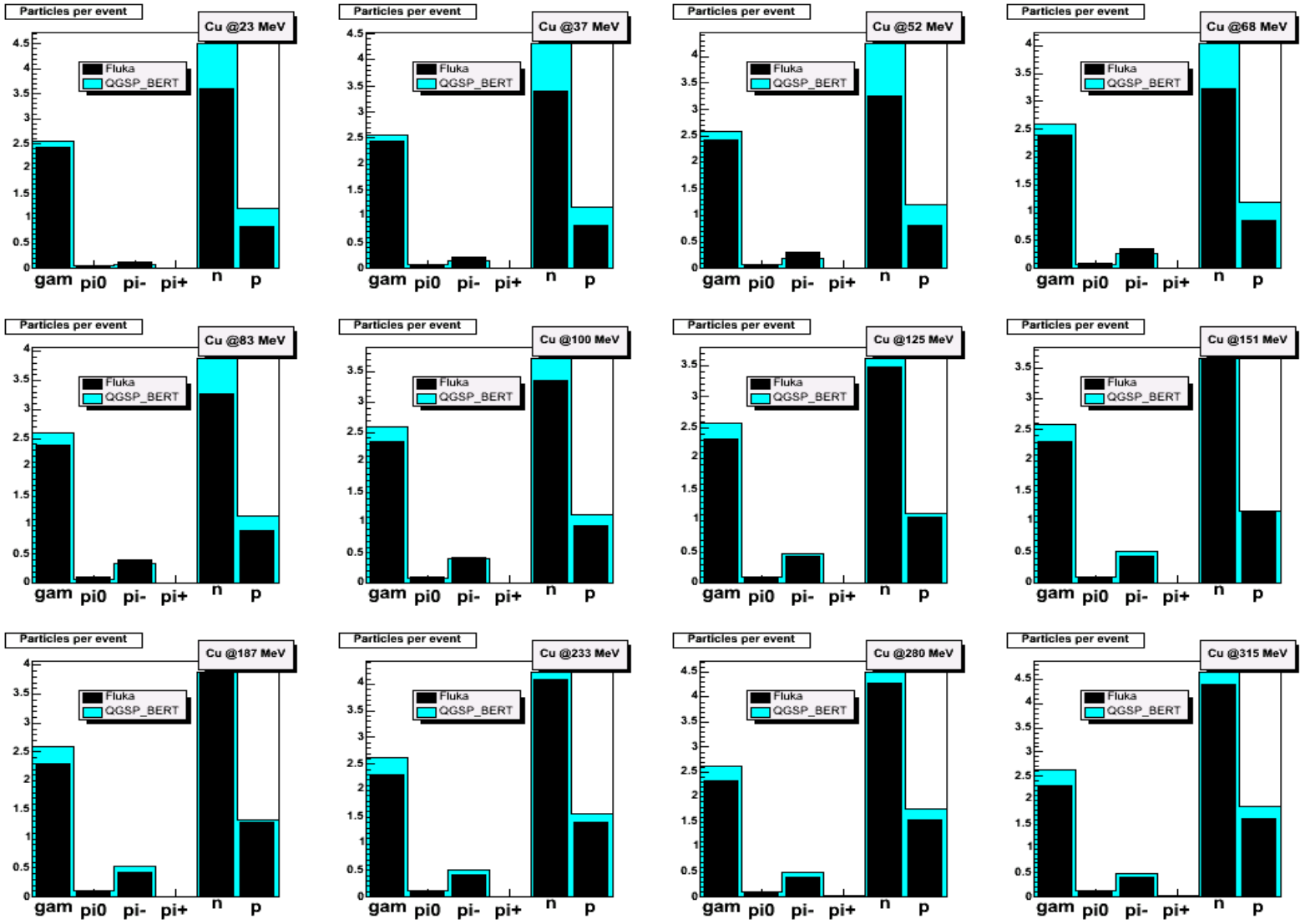




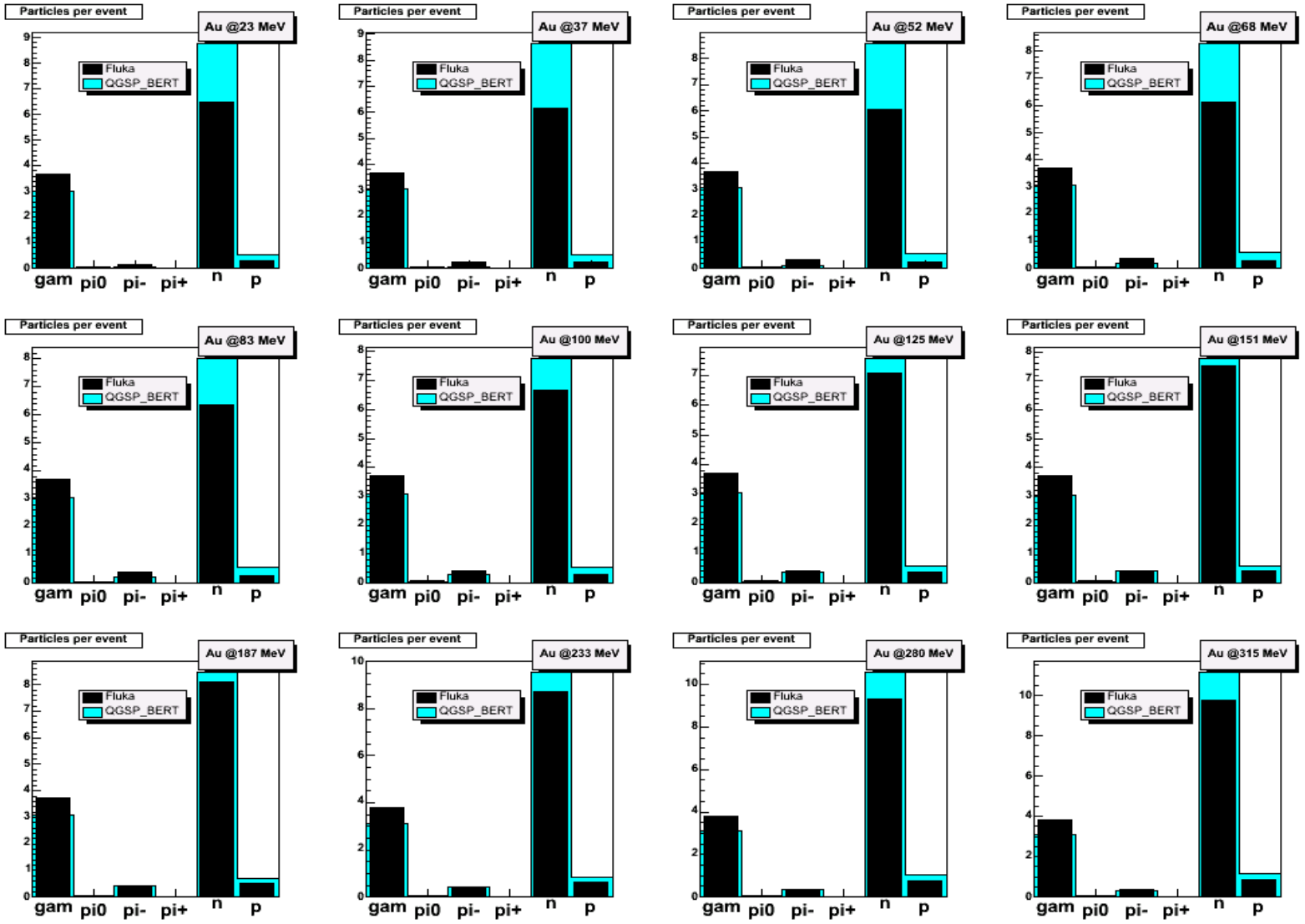
Particle spectra for pi- on Al



Particle spectra for pi- on Cu



Particle spectra for pi- on Au



Summary and plans(1/2)

- first results show reasonable agreement between simulation and experimental data
- Fluka seems to be a bit better than G4 with QGSP_BERT, but hard to judge because of big uncertainties in the experimental data
- some 'unnatural lack of smoothness' in QGSP_BERT – should probably be investigated
- looking forward to redo the benchmark with QGSP_BIC (and any other adequate physics list)

Summary and plans (2/2)

- simple benchmarks provide new insight into G4 and FLUKA, complementary to other validation studies
- plan for the future benchmarks under discussion now
  - any suggestions welcome
  - would be useful to have experiments to come up with list of processes/benchmarks particularly relevant for their subdetectors