
HARP-CDP group results of Geant4 validation

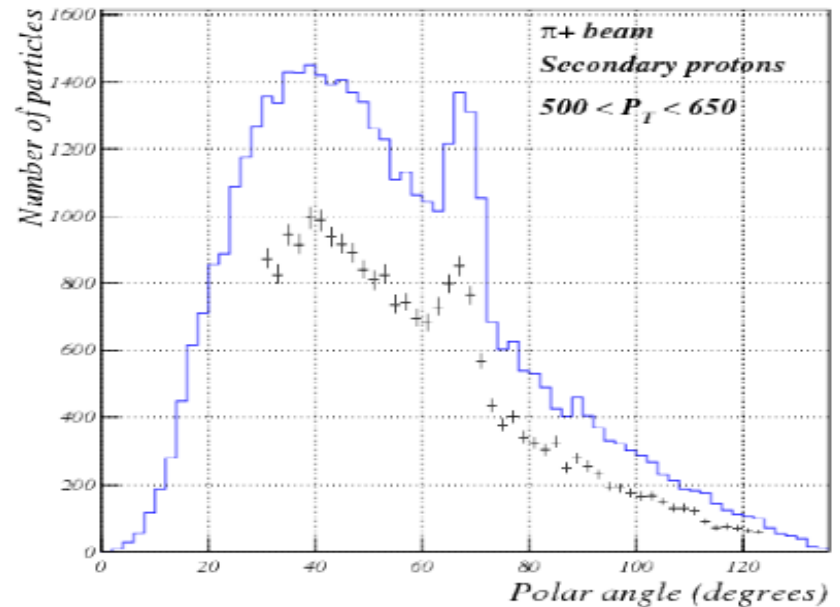
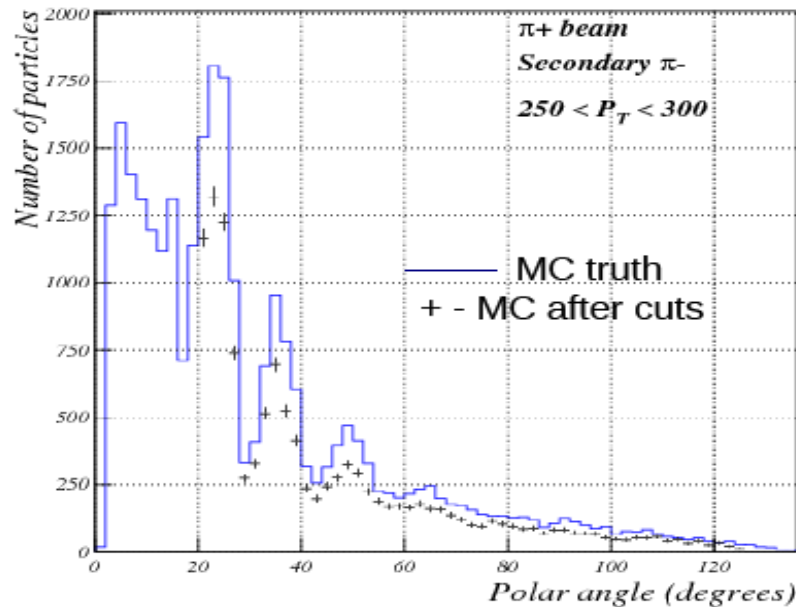
G.Folger, V.Ivanchenko, V.Uzhinskiy
for Geant4 hadronic working group
2 July 2008

HARP-CDP group results

- Results of Geant4 simulation are presented for p and π^\pm beams of 8 and 8.9 GeV/c in Be target
 - LHEP, LHEP_PRECO_HP, QGSC, QGS_BIC, QGSP, QGSP_BERT, QGSP_BIC, QBBC, FTFC, FTFP, FTFP_BERT Physics Lists were used
 - G4 9.1, 9.1p02 were exercised
 - The two problems were reported of unphysical structure of the secondary particle spectra
 - Acceptance corrections and normalization of the data was not done

A.Zhemchugov, Physics validation meeting, 18 June 2008

Acceptance and migration



We consider the effect of acceptance correction and migration small enough, and compare data with MC truth directly

Kinematic region with unambiguous particle identification is chosen

A.Zhemchugov, Physics validation meeting, 18 June 2008

Summary

- Geant4 predictions on hadron production by protons and pions at 8.9 GeV/c has been compared with experimental data
- Significant disagreements in shape of polar angle distributions have been found for all standard physics lists
- Major problems are
 - an unphysical peak for secondary protons near 70°
 - an unphysical diffraction-like pattern for secondary pions
- Situation partially improved in the recent version 4.9.1p02

Geant4 hadronic group clarification

- We appreciate HARP-CDP group comparisons
- Thanks to their work problems were identified:
 - Absence of Fermi-motion in implementation of the quasi-elastic scattering
 - Problem of scattering in the Bertini Cascade
 - Problem of scattering in the LHEP (GHEISHA parameterization)

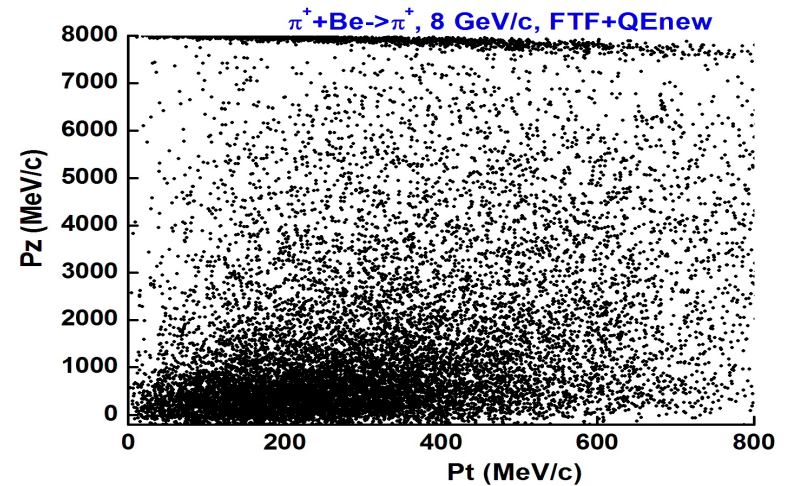
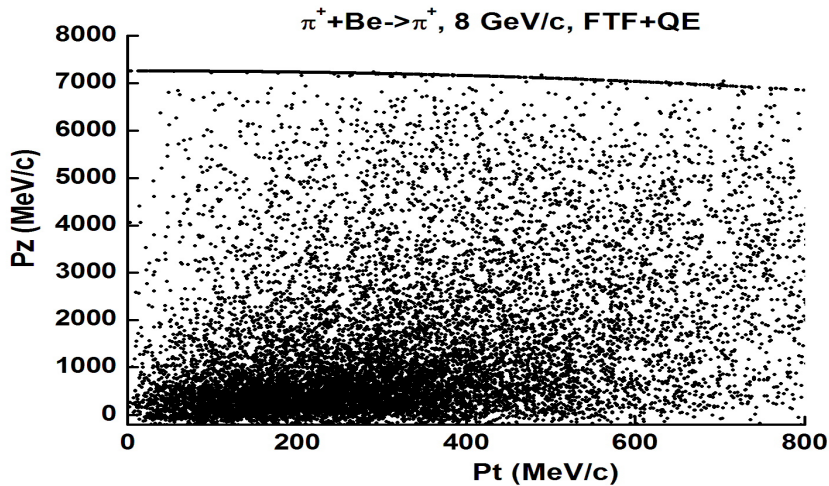
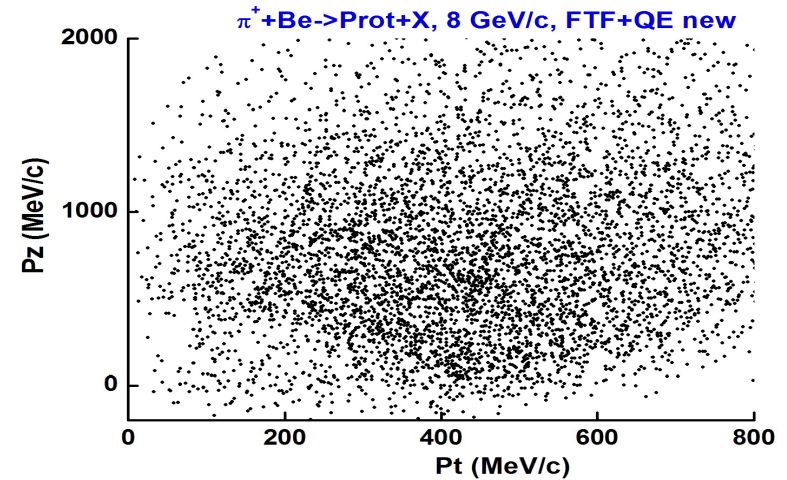
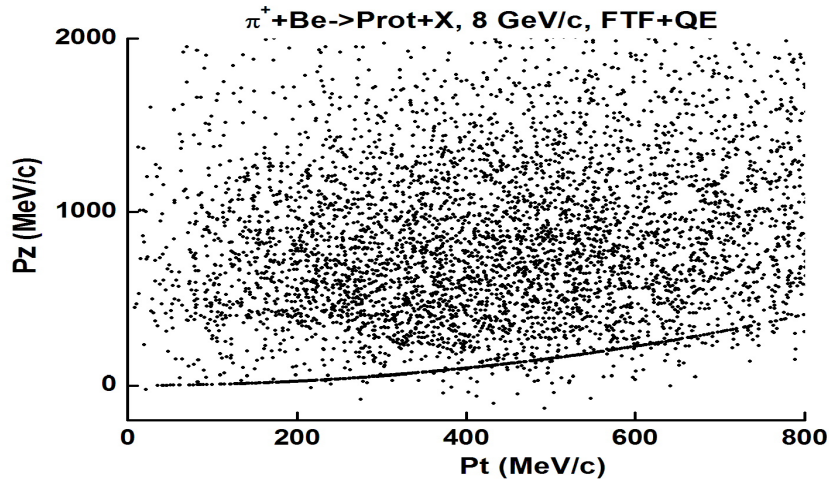
Physics Lists versus Hadronic Models for 8-9 GeV proton and pion beams

Model	Physics Lists	Problem	Fixed
LEP (GHEISHA)	LHEP family, QGSP, QGSC, QGSP_BIC(π^\pm)	Diff. structure	
QGS	QBBC	QE peak + shape(?)	QE
FTF	FTFP, FTFC, FTF_BERT	QE peak + shape(?)	QE
Binary	QGSP_BIC (protons)	Shape(?)	
Bertini	QGSP_BERT	QE peak + shape(?)	

Old

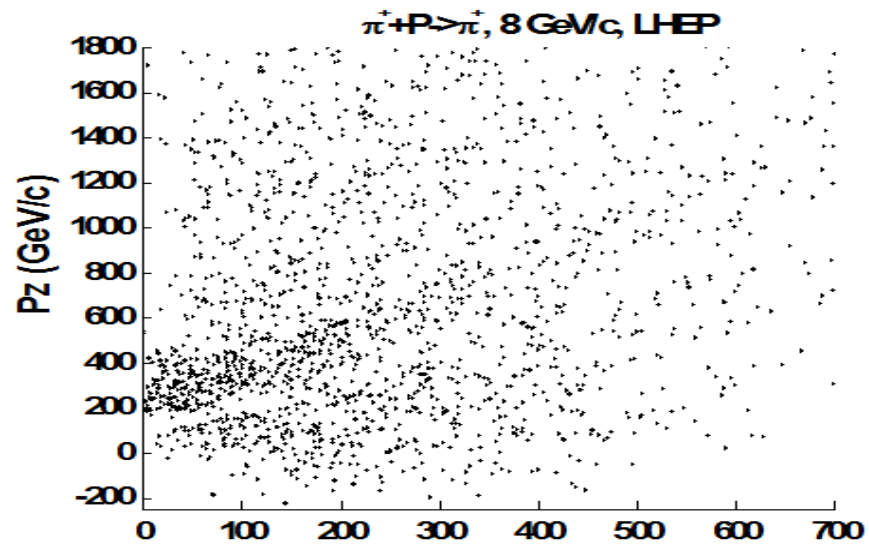
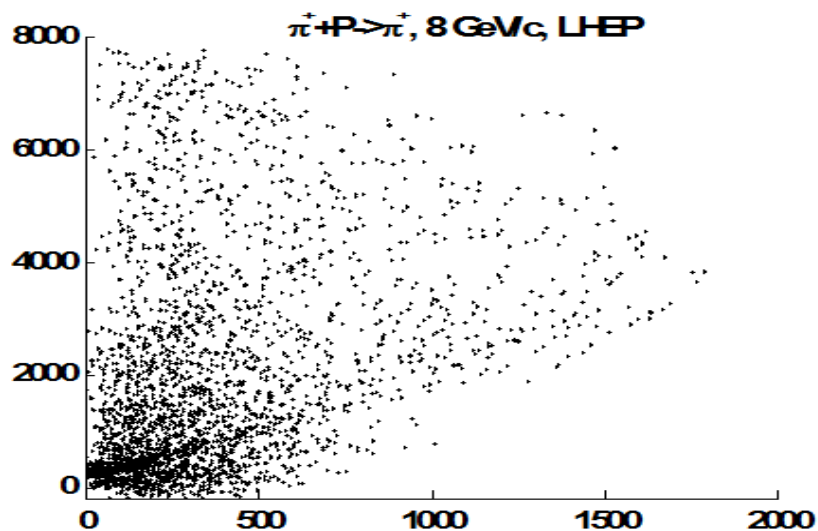
V.Uzhinskiy, June 2008

New

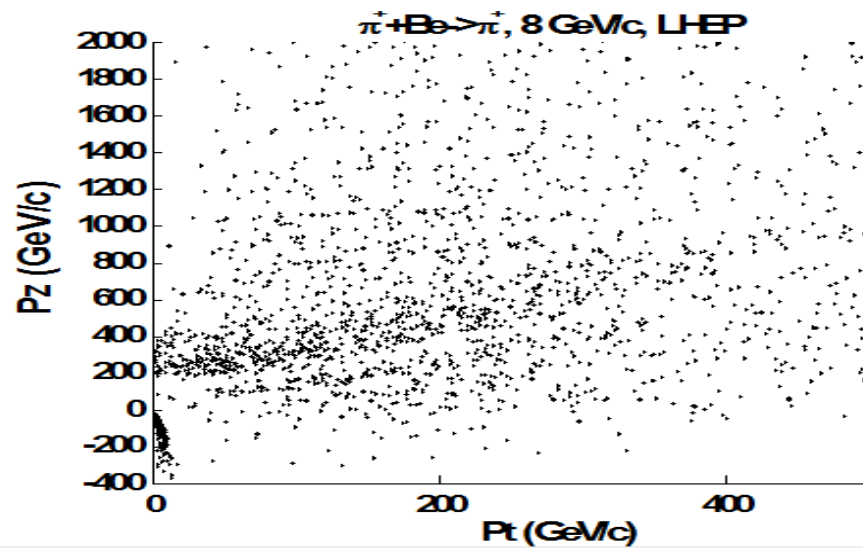
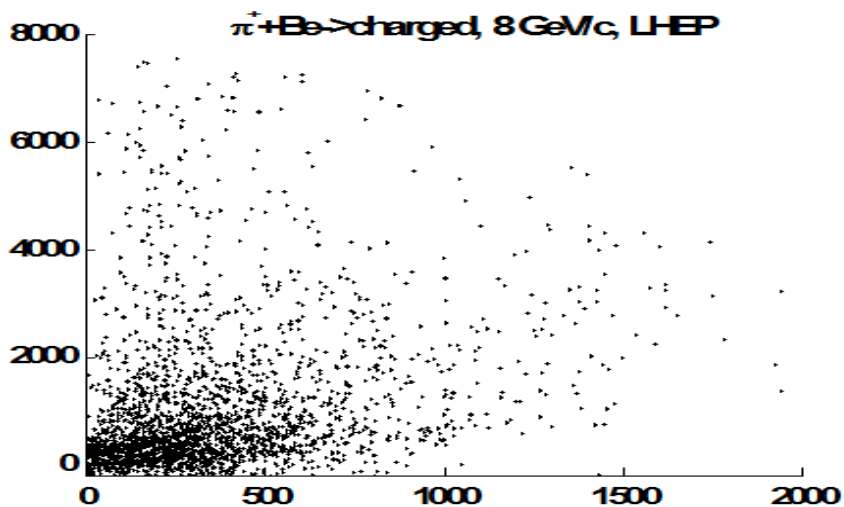


Corresponding HARP exp. data are not published.

A correct simulation of quasi-elastic scattering is very important



The structure is presented in hN-interactions. It is natural that it is in hBe-interactions too! LHEP must be improved.



Geant4 hadronic group actions

- Quasi-elastic scattering have been fixed with g4 9.1p02
 - Fix was introduced to FTF and QGS models
- The Bertini cascade model is under investigation
- LEP model will be under investigation
 - LHEP based Physics Lists usually provide bad comparison results for thin target experiments
 - GHEISHA was optimized for calorimeter simulation
 - LHEP is kept unchanged as a reference results for LHC calorimetry

Optimal Physics List for 8-9 GeV/c beam in Beryllium Target

- FTF model was revised significantly and the upgrade provided with g4 9.2beta (V.Uzhinskiy)
 - Hadron/nucleon data were used for optimization
 - FTF_BIC approach was proved
 - QGS model is planned to be tuned (December 2008)
- Physics Lists for moderate energies with g4 9.2:
 - FTF_BIC, QBBC
- Main Physics List for LHC QGSP_BERT needs some attention
- Beyond g4 9.2 :
 - LEP model is planned to be substituted by the new RPG model
 - Binary and Bertini cascades may be tuned to extend their applicability range from 3-5 GeV to 10 GeV