

Introduction and news

LCG Physics Validation Meeting
1 December 2010



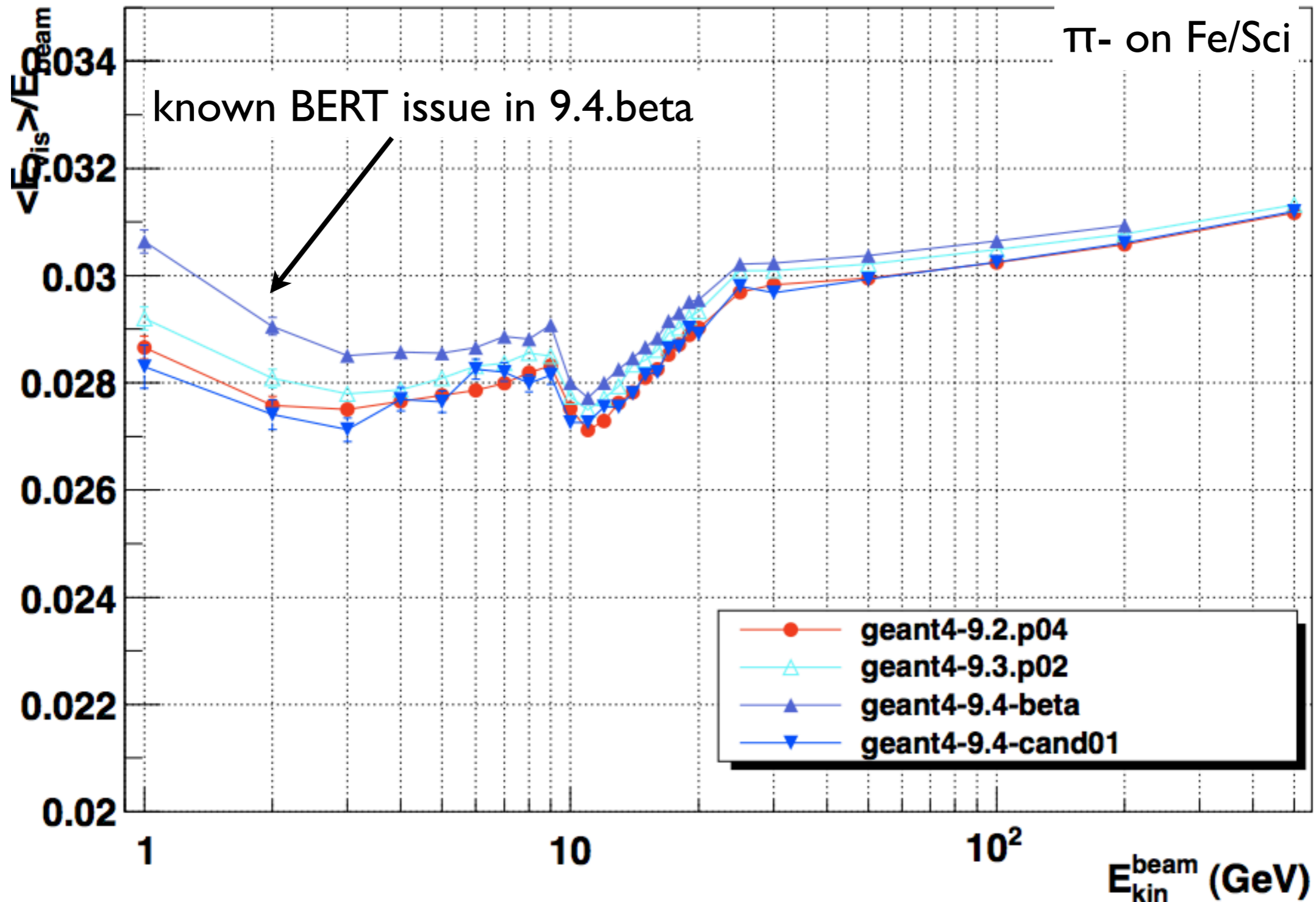
Towards 9.4

- Geant4 version 9.4 **expected before Christmas** break
- Currently ongoing validation on thin target data, simplified setups, full CMS TB setup
- We **do not expect major differences** for LHC “production physics lists”: QGSP_BERT*, LHEP
- We **do expect improvements** for FTF based physics lists. Indication that CHIPS is improved (TBC)
- We **do expect changes** for “experimental” ones: FTFP_BERT_CHIPS, FTFP_BERT, QGSP_FTFP_BERT

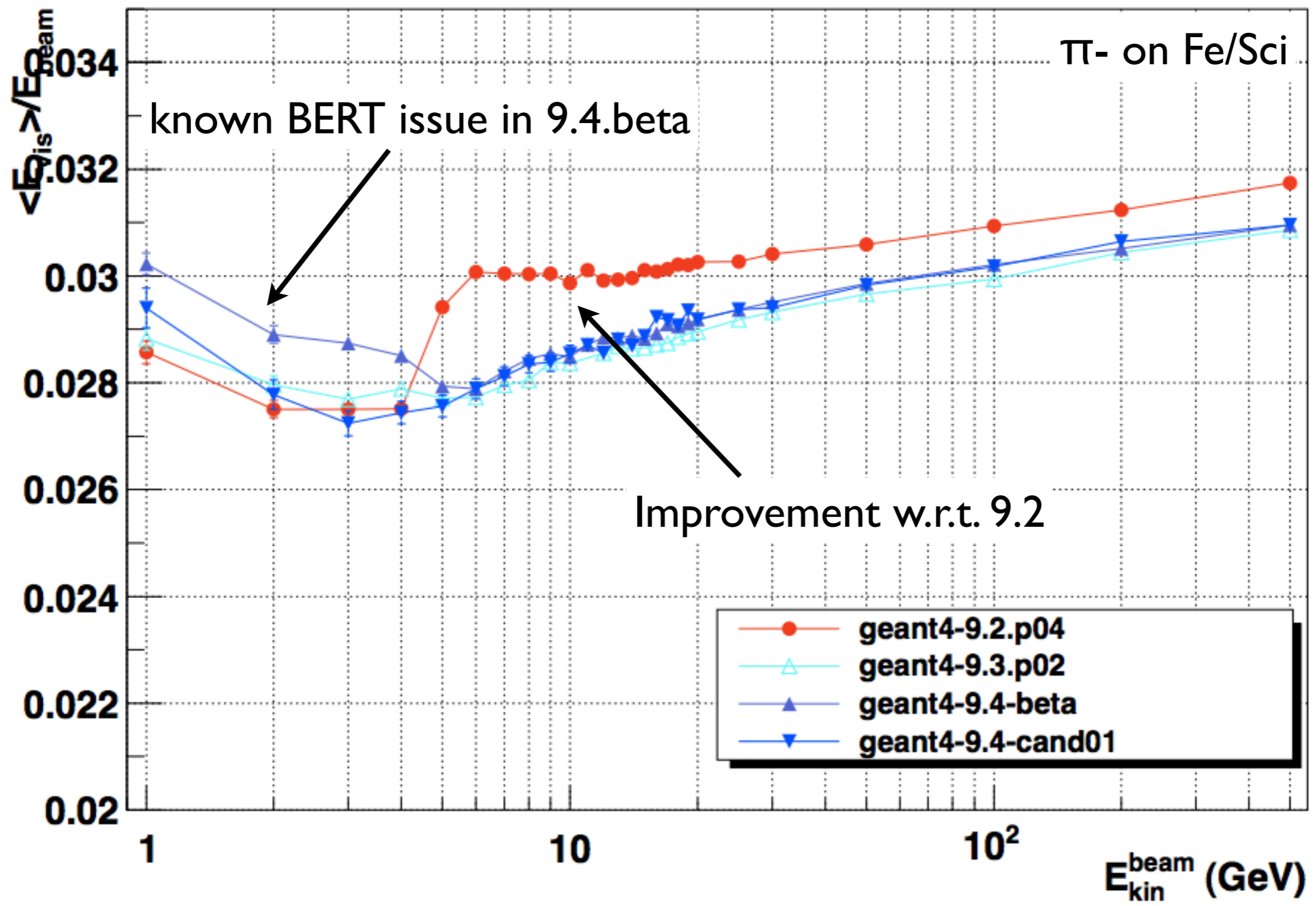
Major changes

- First implementation of anti-ions simulation (anti-p, anti-d, anti-t, anti-He): see contributions
- Improved handling of anti-nucleons, hyperons, kaons (using CHIPS cross-section and **final state generator**) in QGSP_BERT_CHIPS; FTFP_BERT, QGSP_FTFP_BERT (for kaons only cross-sections)
- Relativistic rise of cross-sections using Glauber-Gibrov (affects high energy)

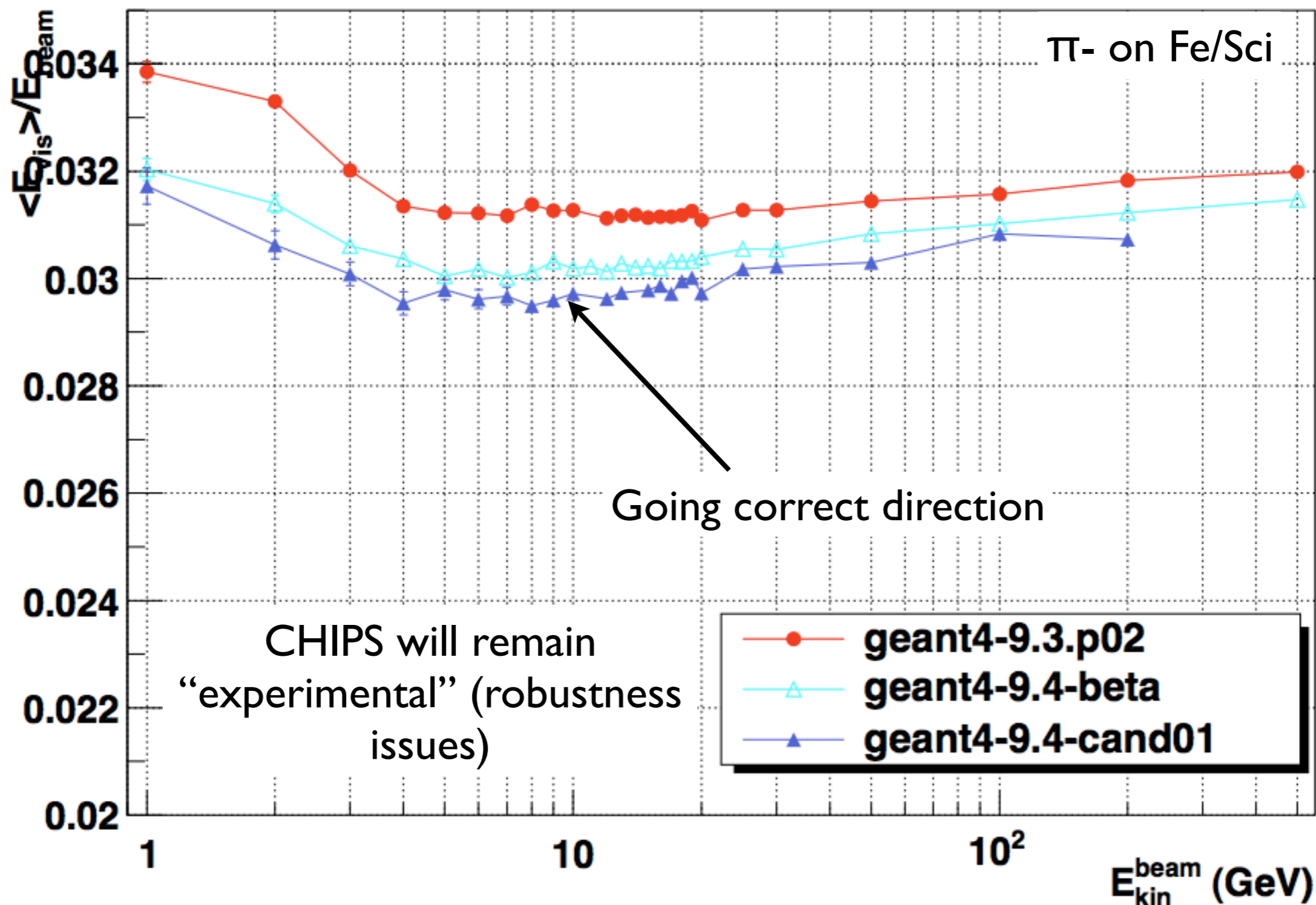
QGSP_BERT stability



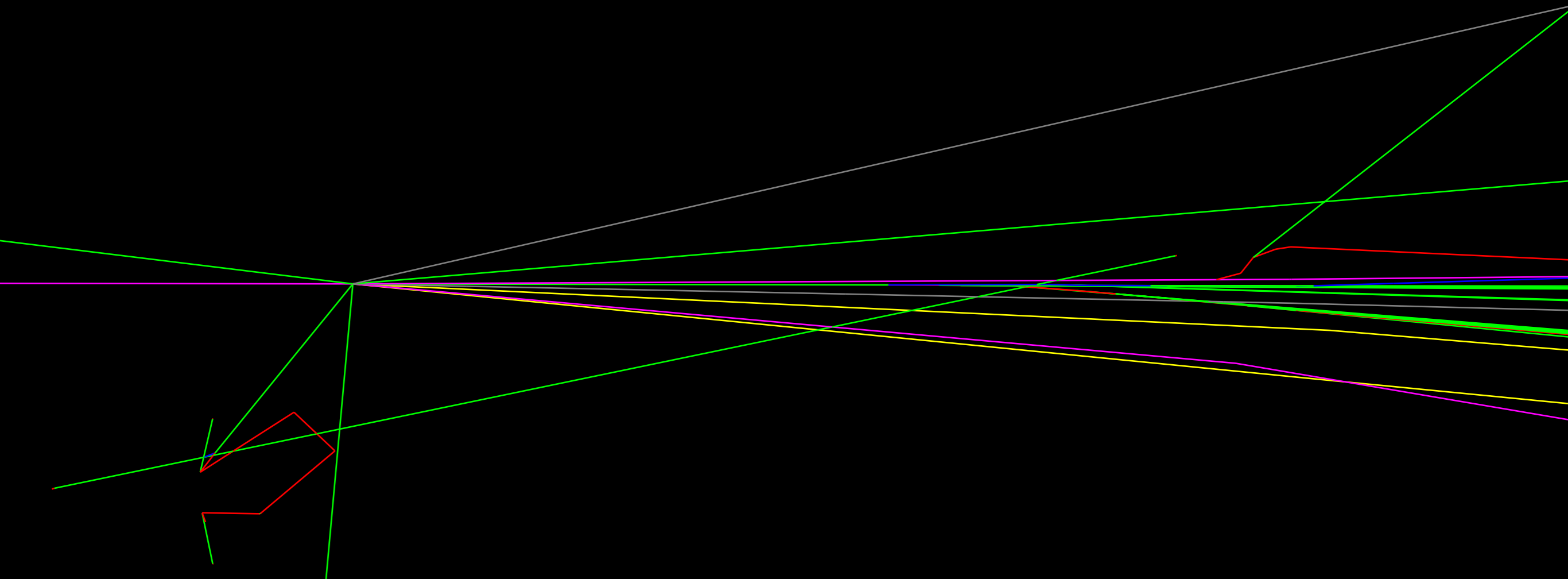
FTFP_BERT improvements



CHIPS improvements



Features planned for 9.4



Geometry

- [Review of navigation verbosity & control at step number – Implementation of precise `ComputeSafety()` in
- [navigation
- [Extension of divisions to allow for gaps in replicated daughters
- [Q/A review to code and addressing open issues

Materials and Particles

- [Addition of extra data for ion stopping powers
- [Review of atomic shell energies
- [Introduction of variable density

- [Update properties of particles to PDG 2010
- [Review implementation of static tables and
- [treatment of ions for thread-safety

Em Physics: standard

- [Extend capability of helper classes
- [Establish more effective sampling of displacement in Urban multiple-scattering
- [Updated Bremsstrahlung model for e^{\pm} for energies $E < 1 \text{ GeV}$
- [Development of Doppler broadening parameterisation

Em Physics: Low Energy

- [Penelope 2008 e+/- processes
- [Pair production in the electron electric field (*)
- [Radiative correction for pair production in the nuclear field (*)
- [Reimplementation of anti-proton model of ionisation

(*) Not confirmed

Hadronic Physics

- Implementation of fast neutron capture model
- ENDL neutron database alternative models (*)
- Improved break-up method in de-excitation
- Complete migration to integer Z and A interface
- Complete interface from Bertini cascade to pre-compound and optimised fixes for energy/momentum conservation
- Interface of INCL to pre-compound & carbon ions in INCL/ABLA
- Integral elastic cross sections for coherent elastic model
- Extension of FTF model to nucleus-nucleus collisions
- Development of ion-ion model for elastic scattering
- Development of integral nucleus-nucleus cross-sections

(*) Not confirmed

More features

— [**Scoring**

- [Full revision of scorers to accept user-defined unit
- [Cylindrical and spherical meshes for command-based scoring

— [**UI & Environments**

- [Support for Python 3.0 in G4Py

— [**Visualization**

- [Support of dynamic loading for visualization drivers
- [Improved visualization tools for regular voxel geometries
- [Support filtering of geometry according to attributes
- [Integrated visualization of field lines

— [**Advanced Examples**

- [Introduction of DICOM images for Medical-Linac and Hadrontherapy examples
- [New examples: GammaKnife (simulation of a real 'radio-surgery' apparatus); IORT (*) (simulation of a real apparatus for Intra Operative Radio Therapy); Cexmc (Charge exchange Monte Carlo)

(*) Not confirmed

More features

— [**Configuration**

- [New optional configuration & installation system based on CMake
- [First prototype thread-safe/multi-core kernel
 - [Alternative code tree based on 9.4 series
- [Complete list of planned developments for 2010 at:
- [http://geant4.cern.ch/support/planned_features.shtml