

Electromagnetic standard Developments and Improvements for Release 9.1

Geant4 Technical Forum

7 November 2007

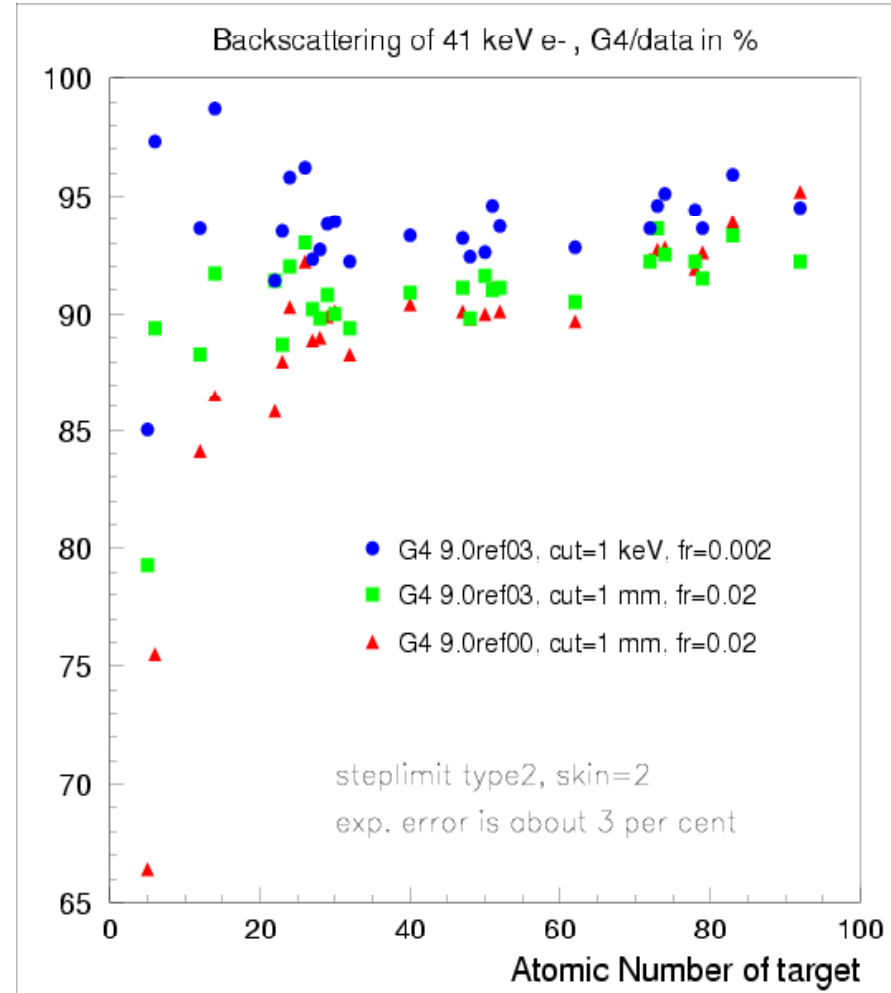
V.Ivanchenko for EM group

Materials and General EM Interfaces

- **Materials:**
 - Clear separation between materials/elements constructed from NIST DB and from scratch
 - Allows to have natural and depleted elements in the same setup
 - Allows construct gases from list of elements
 - Fixed memory leak at the end of run
- **General interfaces:**
 - Fixed SelectRandomAtom method for gamma incident
 - Fixed memory leak – proper deletion of tables at the end of run
 - Fixed problem with cross section happens when electrons moved from vacuum to solid material

Multiple scattering upgrade (L.Urban)

- Multiple scattering:
 - Further update of G4SafetyHelper class and its interaction with G4Navigator
 - Navigation in parallel geometry
 - Upgrade of Urban multiple scattering model to achieve better stability of simulation results for different step limitations
 - Different msc tails for e , μ , hadrons



Other developments and Fixes

- Single scattering
 - Improved single Coulomb scattering model
 - Nuclear size effect and scattering of atomic electrons are taken into account; results are competitive with msc ofr precision but not for CPU
 - Vanderbilt single scattering model for ions may be released
- Fixed muon bremsstrahlung – wrong shape of energy distribution near the end of the spectrum (NA49 request)
- Ionisation:
 - Fixed G4mpIonisation and provided example/exotic/monopole
 - New process G4ionGasIonisation for ions in low-density media
 - Updated ion fluctuation model – improved Bragg peak for ^{12}C
- G4Cerenkov – become discrete PostStep process (fixed problem of lateral displacement by msc or other processes)
- XTR models – cleanup, fixed memory leak
- Polarisation library updated
 - Polarized photo-electric effect added
- May be released:
 - Helper class to provided list of single ionisations at the step
 - Separate scoring of non-ionizing energy deposit

Hadronic Improvements for Release 9.1 and Other Developments

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D.H. Wright for hadronic group

Precompound/De-excitation

- **G4PreCompound model**

- improvements of the exciton model based on a study of the literature
 - improved probability calculations
 - corrected units in Pauli-blocking calculation
 - making number of charged particles decrease when exciton number decreases
- several bug fixes

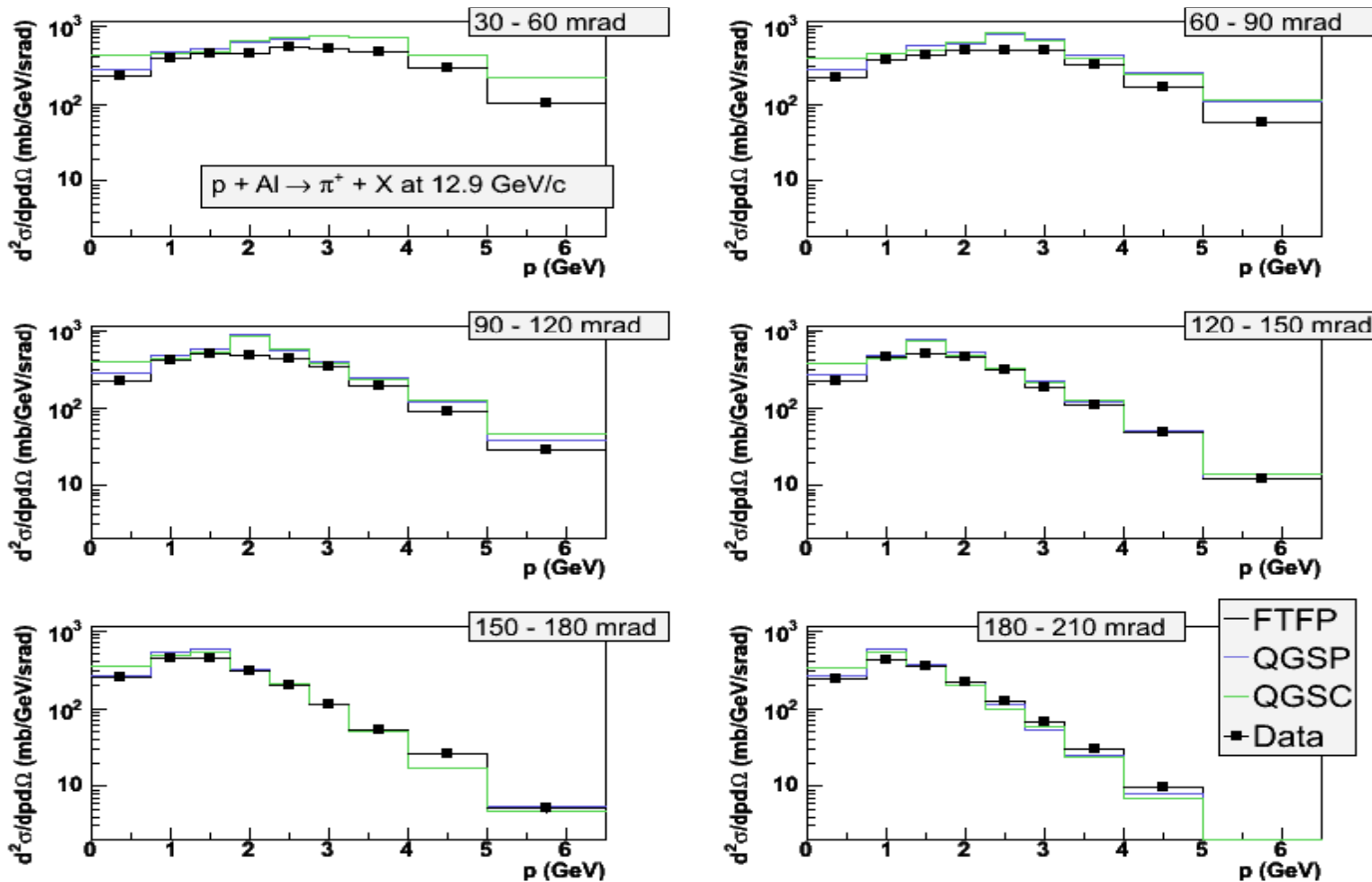
- **Evaporation**

- supplied missing calculation of factor used to calculate evaporation probabilities
 - particles affected: p, n, d, t, 3He, alpha
- suppressed warning message when no gamma level exists
 - user must now set flag

Other Model Fixes and Improvements

- Bertini cascade
 - a crude Coulomb barrier will be available for testing (but not in release)
 - fix of angular distribution for $E > 2.3$ GeV also planned
- LEP
 - fix of several bugs in charge exchange code, based on comparison with GHEISHA Fortran
- CHIPS
 - corrected t-distribution in G4QuasiElasticRatios
 - added neutral currents for ν interactions (see talk of M.Kossov)
 - single diffraction (target only) included

Fixes in QGSC – pion production validation



New Model Development

- **Liege INCL cascade/ABLA de-excitation**
 - translation from Fortran to C++ complete
 - alpha version of code now available
 - much testing and validation still required
 - will provide an alternative to Binary, Bertini cascades
- **QMD-style nucleus-nucleus collision model**
 - development version now does collisions up to 300 MeV/n
 - next stage, few GeV/n collisions, ready by Summer 2008
- **High Precision Neutron alternative model**
 - based on LLNL neutron database
 - development version for elastic reactions now running faster than HPNeutron model

Validation

- **Hadronic shower shapes**
 - new physics lists tested (FTFP_BERT) for longer, wider showers
 - more work to come on improved FTF model may help lengthen showers
- **Model verification**
 - new models included in test30
 - INCL, RPG
 - verifications from 22 MeV to 3 GeV
 - additional tests completed at 4, 6, 9, 10 GeV/c comparing to (p,p) , (p,π) cross sections
 - testing FTFP, FTFC, QGSP, QGSC, Bertini, Binary models for possible use at lower energies