Hadronic Group
Work Plan for 2013

4th version, 21 February 2013

Model development (1)

STRING MODELS

- Documentation of FTF
  - V. Uzhinsky (1)
- Improve the excitation energies of nuclear residuals in FTF and how these are passed to Precompound
  - A. Galoyan (else A. Ribon) (1)
- Creation of FTF and QGS validation/tuning tests, based on ROOT (from V. Uzhinsky's private tests)
  - A. Galoyan (else A. Ribon) (1)
- Validation of FTF for nucleus-nucleus interactions
  - K. Abdel-Wagel & V. Uzhinksy (2)

Model development (2)

- Validation of FTF for anti-proton and light anti-nucleus inelastic and elastic interactions
  - A. Galoyan (else postponed) (1)
- Code improvement of FTF
  - A. Ribon (with advices and help by Gunter) (1)
- Tuning of FTF with more parameters changed simultaneously, with and without Bertini rescattering
  - A. Ribon (2)
- Validation and improvements of QGS
  - Extension to lower energy with Reggeon Cascade
  - Study of diffraction dissociation
  - V. Uzhinksy (1)

Model development (3)

BERTINI MODEL

- Install new two-body angular distributions for gamma-N, using tabulated cos(theta) distributions at energy bins
  - M. Kelsey & D. Wright (1)
- Evaluate gamma-N "forced first interaction" with new angular distributions
  - M. Kelsey & D. Wright (1)
- Generate new two-body angular distributions for pi-N and N-N (using the same technique as for gamma-N above)
  - contingent upon the success of gamma-N (see first bullet), and on the CPU time required for the new sampling method
  - M. Kelsey & D. Wright (1)
- Implement at-rest mu- capture
  - D. Wright (1)

Model development (4)

- Re-evaluate nucleon-nucleon performance with in-medium cross-sections, improved angular distributions, and physically-motivated nuclear model parameters
  - M. Kelsey & D. Wright (1)
- Validate final-state nucleon clustering for light-ion production, and enable by default
  - M. Kelsey & D. Wright (2)
- Extend kaon and hyperon final-state tables to 32 GeV (same as pi-N) and 9-body final states
  - M. Kelsey & D. Wright (2 or next year)
- Investigate redesign of secondary propagation using a smooth 1D nuclear potential, with stepwise curved trajectories
  - M. Kelsey & D. Wright (2 or next year)

Model development (5)
DE-EXCITATION MODELS

- Introduction of production and transportation of isomers
  - Needs corresponding changes in base hadronic classes
  - Needs update of photo-evaporation model
    - including modifications needed for gamma decay angular correlations (ongoing work by Jason Detwiler)
  - Needs to use RadioactiveDecay
    - its CPU impact should be carefully considered
  - V. Ivanchenko, J.M. Quesada, D. Wright (1)
- Refinements of de-excitation models and code optimization
  - V. Ivanchenko & J.M. Quesada (1 & 2)
- Correlated neutron gamma emission in fission
  - In spontaneous-, neutron-induced- and photo-fission
  - J. Verbeke (1 & 2)

Model development (6)

HP MODEL

- New Data Processing by NJOY2012
  - T. Koi (1)
- Compression of neutron data libraries
  - T. Koi (1)
- G4MT-related updates
  - T. Koi (1,2)
- Fission Fragment Model
  - T. Koi & B. Wendt (1,2)
- Merging neutron_hp and particle_hp
  - P. Arce , D. Cano , T. Koi (2)

Model development (7)

- Systematic check of neutron_hp & particle_hp and try to speed up neutron transportation
  - P. Arce
- Work on data libraries
  - Maintenance of IAEA GEANT4 neutron data libraries website
  - Creation and validation of new neutron data libraries (ENDF/B-VII.1, JEFF 3.2 and others)
  - Creation of the new TENDL2012 incident charged particle (including protons) data library
  - E. Mendoza & D. Cano
- Validation of the libraries with the most recent G4 releases
  - Perform about 400 simulations per library (all individual isotopes) with both G4 and MCNPX
  - E. Mendoza & D. Cano

Model development (8)

- Implementation/modification of new models for the secondary particle production in neutron induced reactions
  - E. Mendoza & D. Cano
- Investigate the differences of the thermal treatment implemented in both MCNPX and G4
  - E. Mendoza & D. Cano

Model development (9)

BINARY MODEL

- Add coalescence to BIC
  - G. Folger (1)
- Investigate BIC for pi- stopping at rest and gamma-nuclear
  - W. Pokorski (2)

Model development (10)

INCL++ MODEL

- Perform some tuning in the INCL++ nucleus-nucleus sector
  - D. Mancusi (1)
- Set up a suite of physics tests for INCL++
  - D. Mancusi (1)
- Get ABLA++ up and running again and bring it back to the main Geant4 source tree
  - D. Mancusi (1)
- Start the development of the high-energy (up to 12 GeV) extension of INCL++
  - A. Boudard, D. Mancusi (2)

Model development (11)

CHIPS QUASI-ELASTIC MODEL

- Code improvement of Chips-extracted quasi-elastic
  - Not needed in the case that the improved version of QGS includes its own version of quasi-elastic
  - W. Pokorski (2)

Model development (12)

ELASTIC MODEL

- Combine electromagnetic & hadronic elastic scattering for hadrons and ions
  - Validate the existing model G4DiffuseElastic with proton-nucleus elastic data
    - in collaboration with electromagnetic working group
  - Test and look for validation data for the ion-ion elastic model G4NuclNuclDiffuseElastic, and provide corresponding physics builder
  - V. Ivanchenko & V. Grichine (2)

Cross Sections

- Design and code improvements of hadronic cross sections
  - W. Pokorski (1)
- Complete test suite for hadronic cross sections (with data)
  - V. Grichine & W. Pokorski (1)
- Validation of pion-nucleus cross sections
  - V. Grichine (else postponed) (1)
- Validation of kaon- and hyperon-nucleus cross sections
  - V. Grichine (else postponed) (2)
- Updates and new cross sections from SAID
  - A. Afanaciev, W. Briscoe, I. Strakovsky (1 & 2)

Code/Design Review

- Review of the use of static members in hadronic classes for multi-threaded Geant4
  - Identify classes which have (many or large) static data members and find out the 'invariant' part, i.e. read-only after initialization or during event loop
  - Many people (1)
- Design improvement of hadronics
  - While reviewing the hadronic classes for G4 MT, identify areas of Geant4 hadronics which need design improvements
  - Make a plan to address these design improvements
  - Implement (at least some of) these design improvements
  - Many people (1 & 2)

Validation & Testing (1)

- Regression test for multiplicities
  - W. Pokorski (1)
- Extension and improvement of the model-level tests aimed to link microscopic interactions to hadronic shower observables
  - A. Ribon (1)
- Improve software and physics robustness of physics models
  - Consider light target nuclei
  - Energy-momentum checks
  - Improve tests to check the output, or perform regression, not simply “run to the end without crashing”
  - Several people
- Improvements of public examples and tests (+ architecture of PhysicsConstructors)
  - M. Maire (1 & 2)

Validation & Testing (2)

- Port testing suite SimplifiedCalorimeter to MT
  - A. Dotti (1)
- Add new HIJING interface (and re-code UrQMD one) in Hadr02
  - A. Dotti (1)
- Add new CTest-based testing to validation suite to check physics output automatically
  - A. Dotti, to be followed by all others (2)
- Update and improvements of tests: test45, test45ion, HadrXS, Hadr02, test35. Run hadronic validation testing suite regularly and submit results to FNAL DB
  - A. Ivanchenko (1 & 2)

Validation & Testing (3)

FNAL Team: D. Elvira, K. Genser, H. Wenzel, J. Yarba

- Validation framework development (1 & 2)
- Muon stopping and capture development (1 & 2)
- Validation of muon stopping and capture, Test48 (1 & 2)
- Development, maintenance, and periodic execution of Test47, Test48 (1 & 2)
- Development of Test19 validation package (intermediate to high energy 20-30 to 120 GeV) (1 & 2)
- Development of Test75 (photon/electro-nuclear) (1 & 2)
- Physics highlights release page (1 & 2)

Physics Lists

- Improvements in design, implementation and documentation of physics lists
  - Many people (1 & 2)
- Remove LEP/HEP
  - Replace LEP with FTF in QGS-based physics lists. Then, if QGS is extended to lower energies, FTF can be removed
  - A. Ribon (1)
- Fix remaining non-reproducibility of G4
  - neutron HP and QBBC
  - A. Ribon (2)
- Investigation of calorimeter effects of Bertini rescattering, and Bertini + Precompound
  - A. Ribon (2)

Man power

- Total man-power contribution to Geant4 hadronics:

2012 : 10.00 FTE

2013 : 9.29 FTE