

2012 Hadronic Group Work Plan

25 January 2012
updated 1 March 2012

Outline

- High priority for 2012
- Model development
- Validation and Testing
- Cross sections
- Code Review

High Priorities for 2012

- Reproduce observed shower shape parameters
 - resolution, length, width
- Develop more physical way of merging/integrating models
 - vs. energy/angular distribution/multiplicity
 - physics list improvements
- Code review to improve:
 - CPU/memory performance
 - multi-threaded performance

Model Development (1)

- Completion of low energy charged particle models
 - using CIEMAT-translated databases
 - Pedro Arce (February 2012)
- Fast (CPU) neutron capture model/data
 - Anything left to be done here, validation?
 - Vladimir Ivantchenko, Tatsumi Koi
- Improvement of LEND/GIDI
 - Tatsumi Koi, Bret Beck

Model Development (2)

- Radioactive decay
 - clean-up
 - speed-up
 - add spontaneous fission channel
 - Dennis Wright (March 2012)
 - re-design
 - Dennis Wright, Laurent DeSorgher (December 2012)

Model Development (3)

- Photo-nuclear, electro-nuclear, muon-nuclear
 - use direct gamma interaction in Bertini for cascade energies
 - study possible improvements to low energy gamma interactions
 - re-examine handling of high energy gammas
 - Dennis Wright (June 2012)
 - examine using Binary cascade as alternative to CHIPS or Bertini
 - examine gamma-nuclear cross sections (there are two - which is best?)
 - Witold Pokorski (June 2012)

Model Development (4)

- Precompound/de-excitation
 - improve CPU performance, code clean-up
 - Vladimir Ivantchenko (December 2012)
 - add coalescence mode to precompound
 - Jose Manuel Quesada, Anton Ivantchenko, Migule Cortes
 - add alternate Fermi breakup model, improve multi-fragmentation model
 - Jose Manuel Quesada, Miguel Cortes (June 2012)
 - add correlations in gamma decay chains to photon evaporation model
 - Jason Detwiler (June 2012)
 - add alternate photon evaporation model
 - Vladimir Ivantchenko (March 2012)

Model Development (5)

- Bertini cascade
 - improve re-scattering interface
 - Mike Kelsey (June 2012)
 - 5% CPU increase
 - Mike Kelsey (June 2012)
 - investigate use for capture models
 - Mike Kelsey, Julia Yarba (December 2012)
 - complete direct interaction of gammas
 - Dennis Wright (January 2012)

Model Development (6)

- INCL/ABLA
 - Integrate remaining INCL++ features, extend to light ion reactions bug fixes
 - Davide Mancusi, Pekka Kaitaniemi, Alain Boudard (September 2012)
 - Eventually remove old INCL from QGSP_INCLXX
 - Davide Mancusi (December 2012)
 - improve ABLA and other de-excitation code
 - Alain Boudard (September 2012)

Model Development (7)

- Binary cascade
 - software review, improvement
 - study and add coalescence model
 - Gunter Folger (June 2012)

Model Development (8)

- Transition region and shower shapes
 - study transition from cascade to high energy models (more physical coupling of models)
 - find ways to better reproduce resolution, shower length and width (empirical or theoretical)
 - Vladimir Uzhinsky, Mike Kelsey, Andrea Dotti, Alberto Ribon, Dennis Wright (December 2012)

Model Development (9)

- Fritiof (FTF)
 - improve anti-nucleus nucleus interactions (parameter tuning, validation, smooth transition to Reggeon cascade, documentation)
 - Vladimir Uzhinsky, Aida Galoyan (April 2012)
 - improve nucleus-nucleus interactions: add projectile residual in final particle list, reggeon cascading in target and projectile ($A > 11$), de-excitation of projectile residual, validation, documentation
 - Vladimir Uzhinsky, Aida Galoyan (July 2012)
 - Improve elastic nucleus-nucleus and antinucleus-nucleus scattering, including real part of scattering amplitude and correct treatment of Coulomb interactions
 - Aida Galoyan (June 2012)

Model Development (10)

- Fritiof (FTF)
 - Review and software improvement
 - Gunter Folger, Alberto Ribon (June 2012)

Model Development (11)

- QGS
 - model improvements, including addition of Reggeon cascade, review of cross section calculation, update of model parameters, check of fragmentation functions
 - Vladimir Uzhinsky (December 2012)

Model Development (12)

- CHIPS
 - development and maintenance
 - Mikhail Kossov

Model Development (13)

- Elastic scattering
 - replace G4HadronElastic with G4WHadronElastic, then rename to G4HadronElastic
 - Vladimir Ivantchenko, Gunter Folger, Tatsumi Koi, Dennis Wright (December 2012)
 - continued development of coherent elastic
 - Nikolai Starkov

New Model Development Projects

- Review, improve EM dissociation
 - Vladimir Uzhinsky (2013)
- Investigate high pt production models
 - Vladimir Uzhinsky (2013)
- Study flow effects in nucleus-nucleus scattering
 - Vladimir Uzhinsky (2013)
- New muon stopping and capture model
 - Krzysztof Genser, Julia Yarba, Daniel Elvira (June 2012)
- Use Vanderbilt biasing scheme to replace hadronic cross section biasing
 - Dennis Wright (December 2012)

Cross Sections

- Continue cross section re-design
 - Gunter Folger, Tastumi Koi, Vladimir Ivantchenko, Dennis Wright (December 2012)
- Cross section validation
 - Anton Ivantchenko (June 2012)
- Cross section development
 - complete the parameterization of elastic cross sections for p , $pbar$, π , K on p , calculate Glauber cross sections for p , $pbar$, π , K on A , and nucleus-nucleus
 - Vladimir Grichine, Aida Galoyan (May-June 2012)

Validation and Testing (1)

- Continuing validation effort
 - test30, test35, IAEA validation
 - Anton Ivantchenko, Vladimir Ivantchenko, Alex Howard
 - medium energy validation (test47: validation vs. ITEP data up to 7.5 GeV)
 - Julia Yarba
 - Stopping and at-rest validation (test48)
 - Julia Yarba, Krzysztof Genser
 - calorimeter validations and shower studies with various physics lists (especially in transition region)
 - Alberto Ribon, Andrea Dotti
 - Grid validation
 - Alberto Ribon, Andrea Dotti

Validation and Testing (2)

- Continuing validation effort
 - improvements in hadronic validation suite (increased automation)
 - Hans Wenzel, Julia Yarba (June 2012)
 - rerun shielding tests for SATIF-11
 - Tastumi Koi (March 2012)
 - INCL/ABLA
 - Pekka Kaitaniemi, Alain Boudard, Davide Mancusi (December 2012)
 - comparison to MIPS and BNL data between 10 and 100 GeV
 - Sunanda Banerjee

Validation and Testing (3)

- **New validation projects**
 - radioactive decay validation suite
 - **Dennis Wright, Laurent DeSorgher (2013)**
 - expansion of high energy validation suite
 - **Gunter Folger (2013)**
 - QGS validation (and check fragmentation functions)
 - **Vladimir Uzhinsky (August 2012)**
 - FTF validation for pi/K-nucleus and nucleus-nucleus
 - **Vladimir Uzhinsky (June 2012)**
 - ion-ion
 - **Anton Ivantchenko, Tatsumi Koi (December 2012)**

Validation and Testing (4)

- **New validation projects**
 - ENDL/GIDI validation and documentation
 - **Tatsumi Koi, Bret Beck (June 2012)**
 - CIEMAT translated database testing
 - **Daniel Cano Ott, Tatsumi Koi (June 2012)**
 - Validate Bertini-Precompound interface
 - **Mike Kelsey (March 2012)**
 - Testing diffuse elastic and nucleus-nucleus elastic models within a physics list
 - **Vladimir Grichine (June 2012)**

Validation and Testing (5)

- New testing projects
 - more testing and checking of energy/momentum conservation
 - Gunter Folger (June 2012)
 - study/evaluate the movement of E/p checking out of G4HadronicProcess and into separate class
 - Dennis Wright, Gunter Folger (June 2012)

Code Review (1)

- Examine ways to improve multi-threaded performance
 - enforce const-ness, etc.
 - All (December 2012)
- Review GEM code to look for improvements
 - Anton Ivantchenko, Vladimir Ivantchenko (June 2012)
- Code speed-up
 - evaluate possible savings by reduction of number of virtual classes (flatten hadronic framework)
 - Gunter Folger, Dennis Wright, Vladimir Ivantchenko (December 2012)
- Code clean-up
 - remove isotope production infrastructure from processes, move to LEP models
 - Dennis Wright (January 2012)

Code Review (2)

- **Reproducibility**
 - improve “strong” reproducibility: recover same results when run is stopped and re-started as when run goes continuously to completion
 - examine random seed handling
 - **Alberto Ribon (June 2012)**
- **Re-visit error handling/diagnostics (restore whiteboard functionality?)**
 - **Dennis Wright (2013)**

Code Review (3)

- move some hadronic code to global: G4Clebsch, new 6-j and 9-j code, new code for Legendre polynomials
 - Jason Detwiler (June 2012)
- review Bertini code to recover 5% CPU loss
 - Mike Kelsey (June 2012)
- quasi-elastic code has been extracted from CHIPS, but needs re-engineering to enable easier/more consistent use
 - Witold Pokorski (June 2012)
- standardize model implementation to avoid code duplication and enforce toolkit nature of models
 - Witold Pokorski (2013)