Geant4 Hadronic Group
Work Plan for 2019

1st version, 16 January 2019

String models (1/3)

- Study of **fast** particle production in hadronic interactions
  - Analysis of small-angle particle production in proton and pion nuclear interactions in FTF and QGS
    - HARP data (p/pi) at 3 - 15 GeV/c, Allaby data (19.2 GeV/c), data at 24 GeV/c, NA61/SHINE data on p+C interactions at 31 GeV/c, last Protvino data on p+C interactions at 31 GeV/c, Cronin data
  - V. Uzhinsky
- Study of **slow** particle production in hadronic interactions
  - Revision of the statistical multi-fragmentation model of Geant4, and analysis of nuclear multi-fragmentation data
  - V. Uzhinsky
- Extension of the string models (FTF and QGS) to **charmed & bottom hadrons**
  - V. Uzhinksy

String models (2/3)

- Re-thinking of the string fragmentation treatment for low-mass strings, and of antiproton annihilation in Geant4
  - V. Uzhinsky
- Development, fine-tuning and validation of FTF for antiproton – nucleus interactions from rest to hundred GeV
  - A. Galoyan
- Validation of FTF model for nucleus – nucleus interactions
  - A. Galoyan
- Collect experimental data on charm hadron production in hadron-nucleus interactions for future validation
  - A. Galoyan
- Introduce fusion of quark-gluon strings for FTF and QGS
  - A. Galoyan

String models (3/3)

- Investigation of physics effects of using Fortran EPOS with Geant4 for hadron interactions at very high energy
  - A. Ribon
- Hadronic shower effects of **FTF** and **QGS**
  - A. Ribon
- Code improvements of **FTF** and **QGS**
  - A. Ribon

- *HIJING... ???*
  - *K. Abdel-Wagel*

Intra-nuclear Cascade models

- **Bertini** (BERT) model
  - Maintenance and user-support
    - M. Kelsey, *Dennis Wright ???*
  - *???*
    - *Dennis Wright*
- **Binary** (BIC) model
  - Development of a coalescence model
    - G. Folger
  - Code review and maintenance
    - G. Folger
- **INCL++** model
  - Upgrades and maintenance
    - J-C. David, D. Mancusi

Precompound / De-Excitation models

- Include the gamma de-excitation chain into FermiBreakUp
  - V. Ivanchenko
- Release of the new GEM model
  - V. Ivanchenko

- *???*
  - *J.M. Quesada*

Radioactive Decay model

- Beta-delayed particle emission
  - L. Sarmiento
- Superheavy elements
  - L. Sarmiento

- *???*
  - *L. Desorgher*
- *???*
  - *Dennis Wright*

ParticleHP model

- Validation & Maintenance of ParticleHP
  - A. Bhattacharyya, H. Kumawat (BARC)
  - *Dennis Wright (SLAC) ???*
  - *P. Arce, E. Mendoza & D. Cano (CIEMAT) ???*

NCrystal model

(Model for ~meV neutron scattering in both poly- and single-crystals)

- *???*
  - *X. Cai & T. Kittelmann*

LEND model

(Low Energy Neutron Data , General Interaction Data interface)

- Complete, test, and release new version of LEND/GIDI : LLNL low energy nuclear data interface and data
  - Douglas Wright, *J. Verbeke ???*
- Maintenance and support of physics lists using LEND with LLNL fission model
  - Douglas Wright, *J. Verbeke ???*

Elastic models

- Introduce a new model with delta-resonance elastic scattering for pions
  - V. Ivanchenko
- Improvement and validation of the diffuse elastic model
  - V. Grichine

Other models

- Muonic atoms
  - K. Lynch, *K. Genser ???*
- Neutrino- (electron-, gamma-) nucleus final-state models
  - V. Grichine
- *Low-energy, entry-channel models: SMF and BLOB ???*
  - *Semiclassical one-body approaches to solve the Boltzmann-Langevin equation*
  - *C. Mancini (GeNIALE project)*

Cross Sections

- Improve hadronic cross sections (more accurate treatment of elastic, use of TOTEM data for pp)
  - V. Ivanchenko
- Extension of Glauber-Gribov nuclear cross sections for **heavy projectiles**: hyperons, charmed and bottom hadrons
  - V. Grichine

Validation & Testing

- *???*

- *FNAL Team: K.Genser, R.Hatcher, Sunanda B., H.Wenzel, J.Yarba*

Other Validation activities

- Validation of cascade models using the **n_TOF** evaluated neutron flux, obtained at EAR1 and EAR2
  - M. Cortes Giraldo

- Validation and maintenance of **TARC** (test15)
  - A. Howard, A. Bhattacharyya

Hadronic Framework

- Investigate possible simplifications of the hadronic framework
  - Starting with some design ideas considered in the context of GeantV physics...
  - A. Ribon *et al.*