

# **Geant4 Hadronic Group Work Plan for 2018**

1<sup>st</sup> version, 24 January 2018

# String models (1/3)

- Finalizing **FTF** model description of NA61/SHINE data on  $\pi^-$  C interactions at 158 and 350 GeV/c
  - V. Uzhinsky
- Tuning of **FTF** parameters for K+P and K+A interactions
  - V. Uzhinsky
- Further tuning and improvement of **QGS**
  - V. Uzhinsky
- Study potential extensions of **QGS** :
  - gamma, electron and neutrino interactions;
  - inclusion of hard processes
  - V. Uzhinsky
- Documentation of **QGS**
  - V. Uzhinsky

# String models (2/3)

- Validation of **FTF** for nucleus-nucleus interactions and extension of the validation test-suite for string models (test22) with high-energy nucleus-nucleus data
  - A. Galoyan & V. Uzhinsky
- Tuning and validation of **FTF** model for strange meson and hyperon production in antiproton interactions
  - A. Galoyan
- Study of exp. data on charm particle production in proton and antiproton interactions with protons and nuclei. Implementation of charm particle production in **FTF** model
  - A. Galoyan & V. Uzhinsky
- Further improvements and validation of HIJING for p-Pb and Pb-Pb collisions at LHC
  - K. Abdel-Wagel

# String models (3/3)

- Hadronic shower effects of **FTF** and **QGS**
  - A. Ribon
- Code improvements of **FTF** and **QGS**
  - A. Ribon
- Interfacing Fortran EPOS with Geant4
  - T. Pierog & A. Ribon

# Intra-nuclear Cascade models

- **Bertini (BERT) model**
  - Maintenance and user-support
    - Dennis Wright & M. Kelsey
- **Binary (BIC) model**
  - Maintenance and code review
    - G. Folger
- **INCL++ model**
  - Completion of strangeness physics in INCL
    - J-C. David & J. Hirtz
  - Upgrades & maintenance
    - J-C. David, J. Hirtz, D. Mancusi, J.L. Rodriguez Sanchez
  - Hypernuclei production in ABLA++
    - J-C David & J.L. Rodriguez Sanchez

# Precompound / De-Excitation models

- Complete the new GEM (Generalized Evaporation Model) model
  - V. Ivanchenko
- Modification of FBU (Fermi Break Up) model with addition of gamma transition channels
  - V. Ivanchenko
- Improvement of the parameterisation of the probabilities of evaporation
  - V. Ivanchenko
- Maintenance and improvement of pre-equilibrium and de-excitation models
  - V. Ivanchenko & J. M. Quesada

# ParticleHP model

- Maintenance of ParticleHP
  - P. Arce, E. Mendoza & D. Cano Ott
- Maintenance and update of the IAEA Geant4 neutron data libraries website (including JEFF-3.3 and ENDF/B-VIII)
  - E. Mendoza & D. Cano Ott
- Maintenance of the Fission Fragment module
  - B. Wendt

# LEND model

(Low Energy Neutron Data , General Interaction Data interface)

- Development for neutron- and gamma-induced reactions
  - J. Verbeke
- New version of LEND/GIDI
  - Douglas Wright
- Maintenance and support of physics lists for LEND
  - J. Verbeke & Douglas Wright



# NCrystal model

(Model for  $\sim$ meV neutron scattering in both poly- and single-crystals)

- Paper to describe the physics of the model in detail
  - X. Cai & T. Kittelmann
- Improved integration of NCrystal in Geant4
  - X. Cai & T. Kittelmann

# Radioactive Decay model

- More correct partial K, L1, L2, L3, M1-M5 electron capture probability; implementation of electron capture from N shell
  - L. Desorgher
- Maintenance of the RDM & PhotoEvaporation data-sets
  - L. Desorgher
- RDM biasing improvements
  - L. Desorgher
- Beta-delayed neutron emission
  - L. Sarmiento
- Extension to Super Heavy Elements (SHE)
  - L. Sarmiento

# Elastic models

- R&D hadronic elastic scattering
  - V. Grichine
- Review of hadron elastic models
  - W. Pokorski
- Convert TARC into test15 to be run in nightlies
  - A. Bhattacharyya & A. Howard

# Other models

- **Muonic atom**
  - K. Lynch & K. Genser
- **Low-energy, entry-channel models: SMF and BLOB**
  - Semiclassical one-body approaches to solve the Boltzmann-Langevin equation
  - C. Mancini (GeNIALE project)
- **Nuclear Coulomb excitation model**
  - M. Taylor
- **Neutrino interactions:**
  - R&D for neutrino-nucleus final state generator, V. Grichine
  - Inserting neutrino physics in Geant4 framework, V. Grichine

# Cross Sections

- New version of G4NEUTRONXS data set
  - V. Ivanchenko
- R&D hadronic cross sections
  - V. Grichine

# Validation & Testing

- Composition, monitoring and validation of physics lists for the Intensity Frontier (IF)
- Maintenance, and periodic execution of Test19, Test23, Test47, Test48, Test75
- Hadronic validation with BNL and MIPs data, and with the new high-granularity CMS test-beam
- Physics highlights release page
- Development of the infrastructure for studying sensitivity of MC predictions to the variations of the model parameters
- Possible integration of interfaces of Geant4 hadronic models to be used by GENIE neutrino interaction code
- FNAL Team: K.Genser, R.Hatcher, Sunanda B., H.Wenzel, J.Yarba

# Other Validation activities

- Transforming test-beam simulations from the experiments (e.g. ATLAS and CALICE) as Geant4 stand-alone applications useful for hadronic physics validation
  - K. Nikolics & W. Pokorski
- Validation of cascade models with the n\_TOF evaluated neutron flux
  - M. Cortes Giraldo
- Validation of low-energy models
  - P. Cirrone & C. Mancini

# Hadronic Framework

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