

# Some ideas on the future of Geant4 hadronic physics

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# String Models

- Consolidate **FTF**
  - Code structure
  - Tuning
- Improve and extend **QGS**
  - Useful to provide an alternative to FTF for hadronic showers
  - Naturally valid to higher energies than FTF
- Higher energy (  $>\sim 1 \text{ TeV}$  ) applications:
  - **Accelerators, cosmic rays**
  - Final-state model: QGS leading candidate
    - while FTF would required extensive improvements
  - Cross sections: main problem for very high energy cosmic rays

# Hadronic Cross Sections

- The most important for the **CPU performance** of G4 hadronics
  - Continue to review them and make them more efficient
- **Validation suite** for hadronic cross sections
  - Useful for us to see exactly what we have
    - What is changed from version to version
    - How do we compare with data (when available)
  - Required also by users, in particular LHCb

# Hadron Elastic

- Need to review cross sections and final-state models that we have in Geant4 for hadron – nucleus and nucleus – nucleus elastic
- Particular important for hadronic showers in scintillator-based calorimeter is **neutron – proton elastic scattering**
  - Review and validate with data

# Nuclear Physics

- Geant4 is progressing steadily on low-energy hadronic models, becoming more and more attractive to the nuclear physics community...
  - Should “nuclear physics” in Geant4 be a subgroup of “hadronic physics”, or become, at some point, a new Working Group?
  - In any case, how do we (hadronic group) interact with them?
    - They are certainly not interested in string models, and hadronic showers
    - But we have common subjects: precompound, evaporation, low-energy neutrons, radioactive decay, etc...

# Studies of radiation effects

- Fluka, MCNPX, MARS, etc. are the common codes used for radiation studies
- Geant4 has proved now to be mature enough to be useful also in this domain
  - Extensive comparisons of HP with MCNP made by Emilio *et al.*
  - ATLAS cavern background studies made recently by Tatsumi *et al.*
- Do we need anything else?
  - e.g. more biasing capabilities?
- Likely, the most important thing to boost this domain is to have one or few people who can dedicate to it...