

Hadronic Physics Requirements for the Electron-Ion Collider

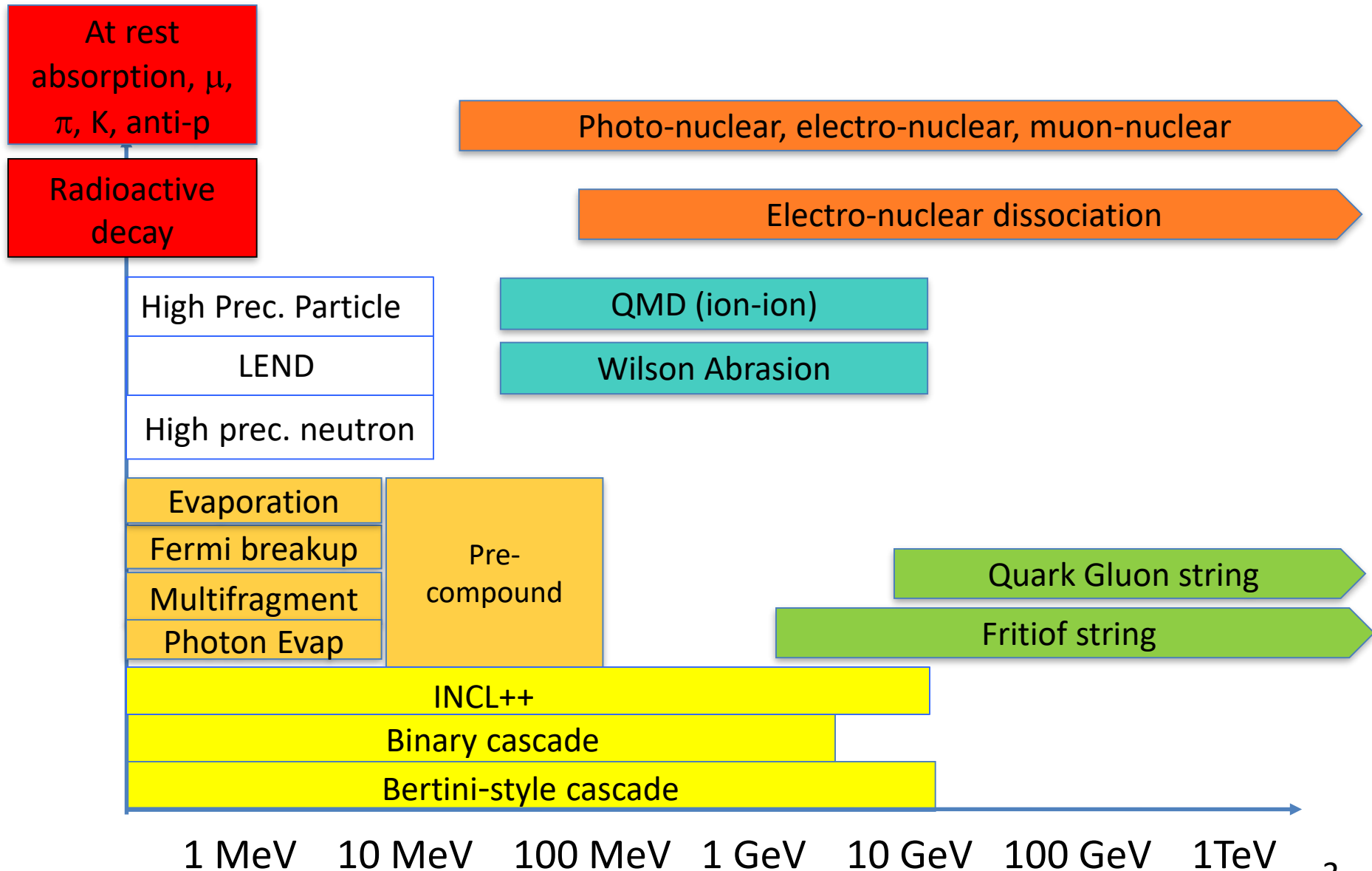
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18 May 2018

Outline

- Hadronic physics models for the EIC energy range
- Physics lists
- Validation

Partial Hadronic Model Inventory



Hadronic Physics Models

- Energy range driven by calorimetry
 - ~ 100 MeV to 10 GeV
- Bertini cascade covers all energies up to 20 GeV
 - $p, n, \pi, K, \Lambda, \Sigma, \gamma$
 - has its own precompound and evaporation model
- G4Precompound model could be used below 200 MeV
 - for p, n
 - more precise but slower than Bertini

Hadronic Physics Models

- Fritiof (FTF) model probably not necessary at these energies
 - unless anti-protons, anti-neutrons important
- Neutrons
 - Low energy neutrons can be important in calorimetry
 - Also in background studies
 - In the past we used High Precision neutron models → now moved to LEND models
- Probably don't need electro-nuclear, but maybe photo-nuclear

Physics Lists

- Two options available now:
 - FTFP_BERT - Bertini cascade up to 12 GeV, FTF above 3 GeV
 - Shielding – very similar to FTFP_BERT, except uses high precision neutron models and ion-ion collision models
- Tailoring to EIC
 - FTFP_BERT optimized for high energy calorimetry
 - Shielding optimized for penetration studies
 - FTF model probably not too important for EIC → rely more on Bertini (up to 15 GeV)
 - Bertini has option to use G4Precompound for better precision below 200 MeV

Physics Lists

- Questions impacting physics list choices
 - Are low energy neutrons important?
 - How about ion-ion collisions?
 - Photo-nuclear?
 - What is the granularity of the detector?
- Choices can be configurable (but not too configurable)
 - Physics models
 - Cross sections
 - Need to be sure validated physics list remains stable

Validation and Testing

- If custom EIC physics list required it must be validated against
 - test beam data
 - thin-target data (lots exist)
- Testing
 - Model-level
 - Process-level
 - Physics-list-level