



Some **quick updates** on neutron BIB

MAIA weekly meeting

26 August 2025

John (JP) Dervan

Northeastern University

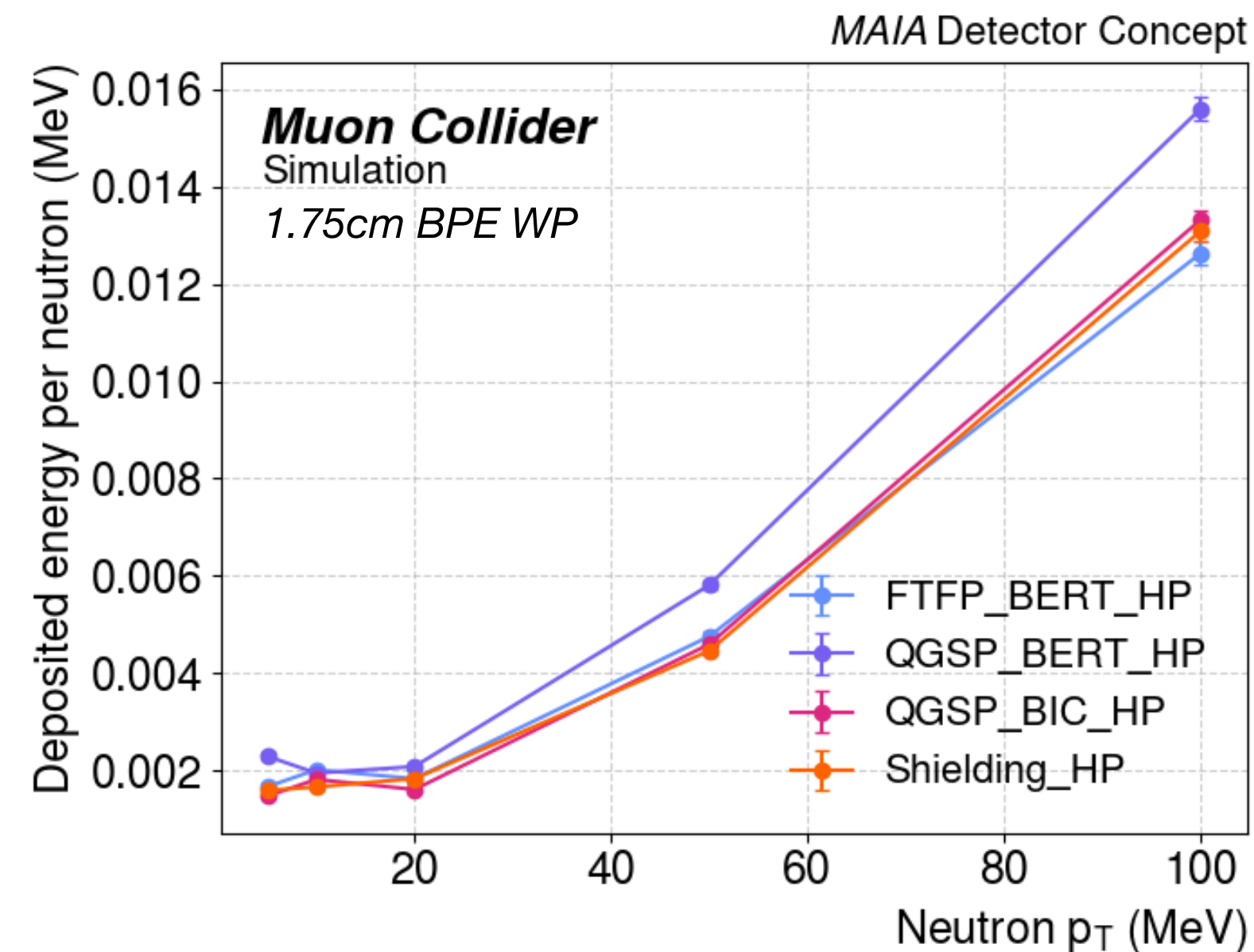
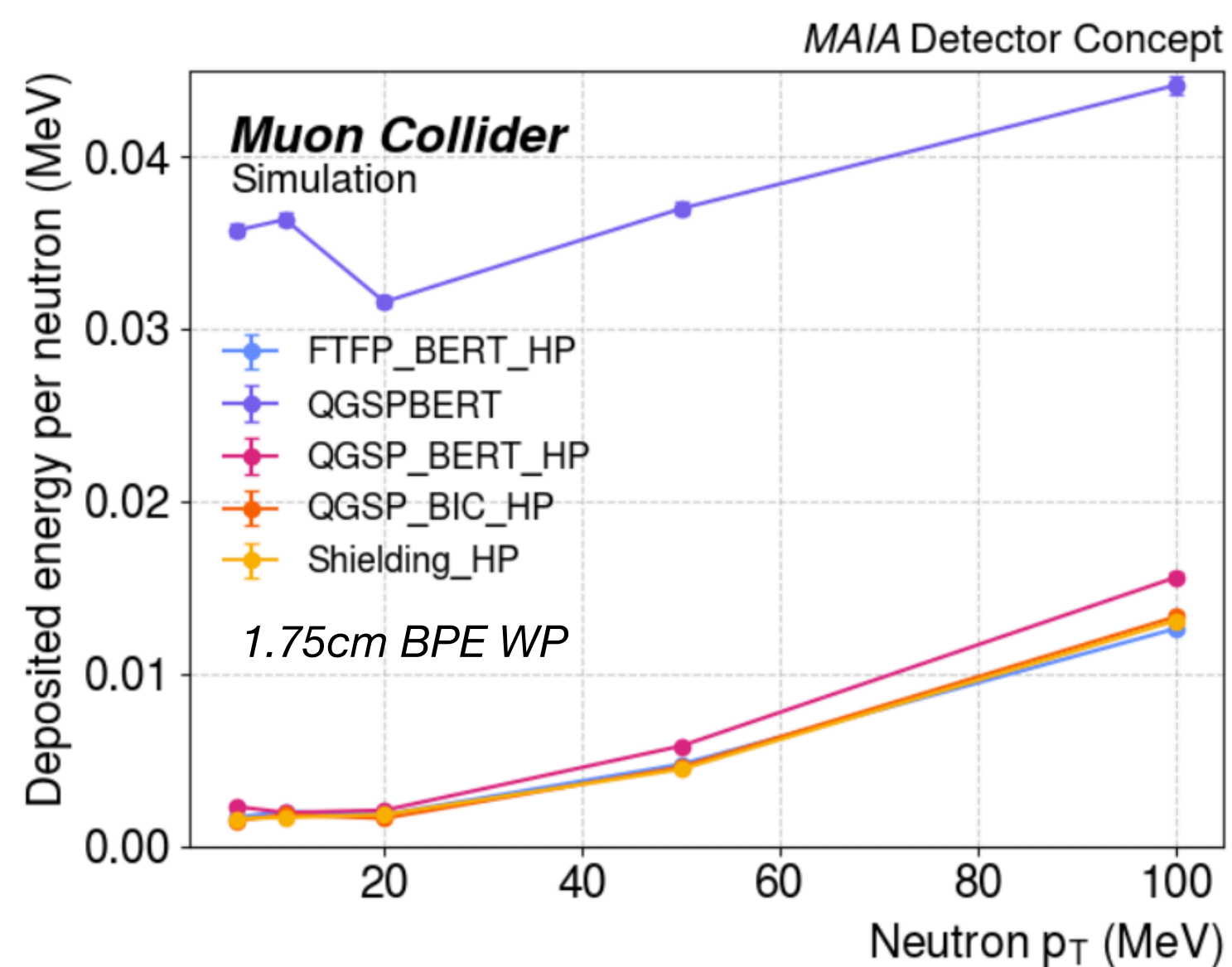


High-precision neutron simulations



A caveat for QGSP_BERT_HP

- Changes made to HP for QGSP_BERT_HP are preliminary as of late '24/early'25 [1]—more mature models should be used
- Models [2] like FTFP_BERT_HP, QGSP_BIC_HP, and Shielding_HP use well-validated HP model
- But compared to the baseline QGSP_BERT, we're still *on the right track*



Other things to think about

- Best practices for benchmarking computation time with each of these models?
- Boron-10 enrichment for shielding → any trade-offs by using $^{10}\text{B}_4\text{C}$?

[1] [Geant4 forum: ncapture cross section in QGSP_BERT_HP](#)

[2] [Physics List Guide, Rel. 11.3 Sec. 2.3.6](#)

Backup: some Geant4 physics models



- **BertiniCascade:**
 - ▶ **Intranuclear cascade model** simulating incoming **hadron/γ cascade** through successive 2-body collisions with **nucleons** before remnant de-excites via pre-equilibrium, evaporation, fission, or γ-emission
- **FTFP** (Fritiof string + PreCompound model):
 - ▶ **HE string model** where incoming hadron/nucleus excites ≥ 1 quark-gluon strings in target nucleus
 - ▶ Strings fragment to produce **secondaries** → leftover nucleus passed to **PreCompound** model → pre-equilibrium emission, evap., fission, γ emission + Fermi breakup
- **QGSP** (Quark-Gluon String + PreCompound)
 - ▶ Describes **hadron-/γ-nucleus** collisions as exchanges of **color strings** between partons
 - ▶ Strings fragment into secondaries while excited remnant is de-excited by **PreCompound**
- **nRadCapture** (Neutron Radiative Capture):
 - ▶ Neutron absorbed by nucleus → model forms excited **compound nucleus** → de-excites with γ cascade generated by **Photon Evaporation** package → deliver ≥ 1 HE γ + residual nucleus
- **PreCompound:**
 - ▶ Simulates **pre-equilibrium** phase of nuclear de-excitation.
 - ▶ Handles fast emission of **neutrons, protons, & light ions** between nuclear excitation by hadronic collision and evaporation/thermal equilibrium