

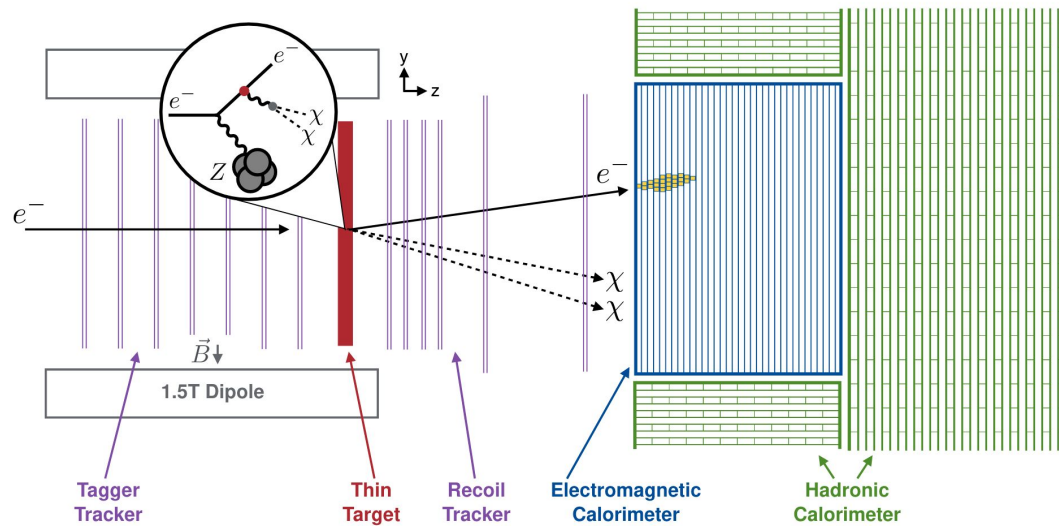
Some tales from the detector simulation tomes

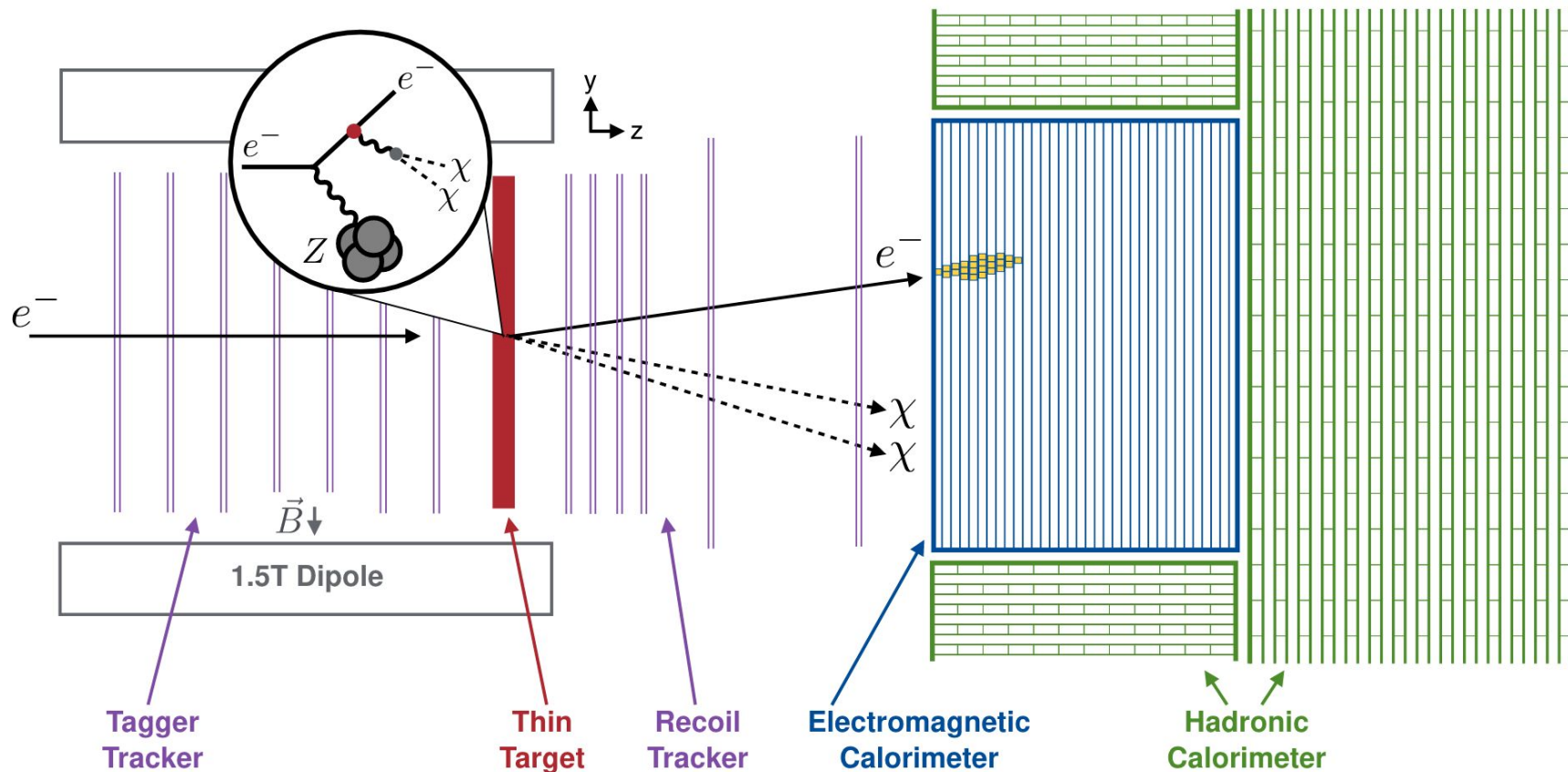
And other things I do
PhD Day 2023

Background



- Software/physics
- Too high energy for nuclear, too low for HEP
- LDMX & Geant4





Details: [Photon-rejection Power of the Light Dark Matter eXperiment in an 8 GeV Beam](#)

Two topics

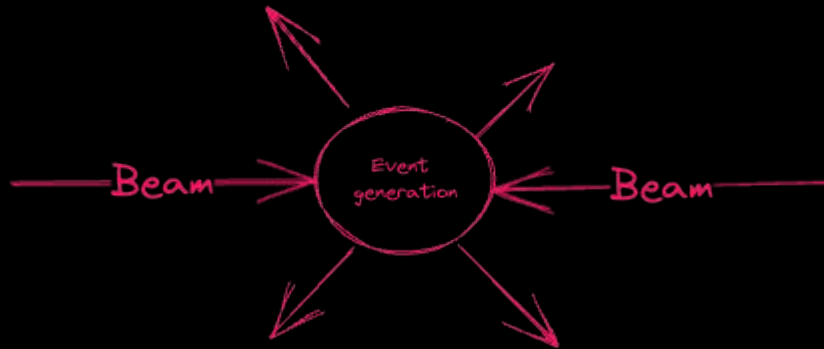
- Signal:
The story of the factorization of HEP simulations or Pythia8 & Geant4
- Background:
Curious things that photons can do to nuclei or everything is an intranuclear cascade

Part I: Signal

What does a HEP simulation look like?

*In the beginning there
was the event generator...*

Initial state ->
Primary particles & vertices



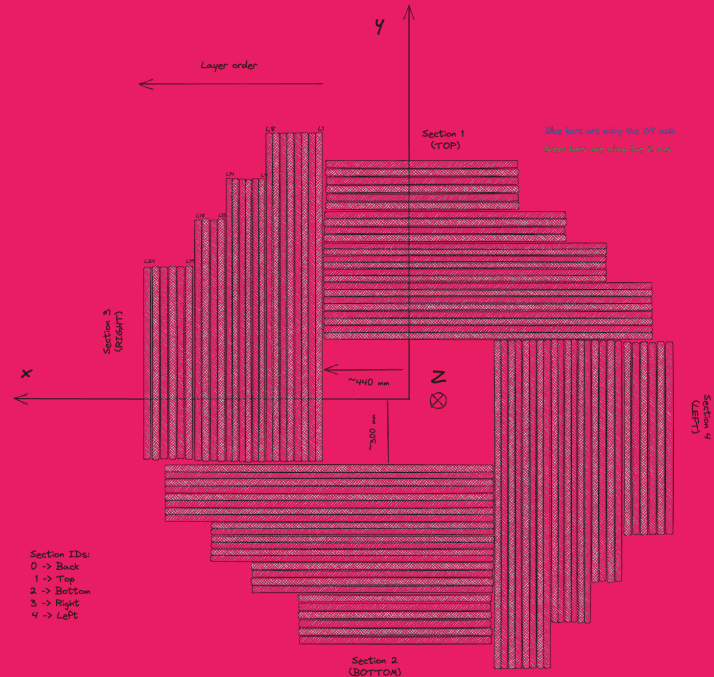
But everything changed when the
detector simulation nation attacked

I'm very sorry for that reference



GEANT4
A SIMULATION TOOLKIT

- Geometries
- Tracking
- Boring physics ?



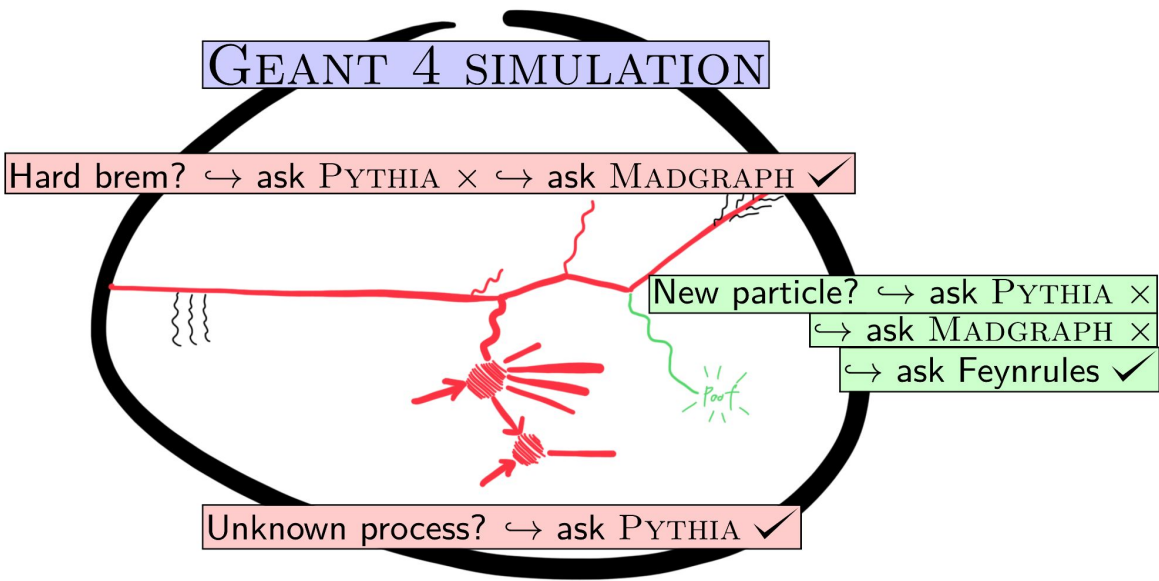
And never shall the two meet

Why not both?

- Event generation isn't (always) independent of beam & target
 - Upstream effects for fixed target experiments
 - What happened before my interaction?
- Detector simulation contains multiple event generators
 - Different constraints
- So combine them
 - Allow Pythia8's physics to be used anywhere inside Geant4

Dark bremsstrahlung with Pythia8

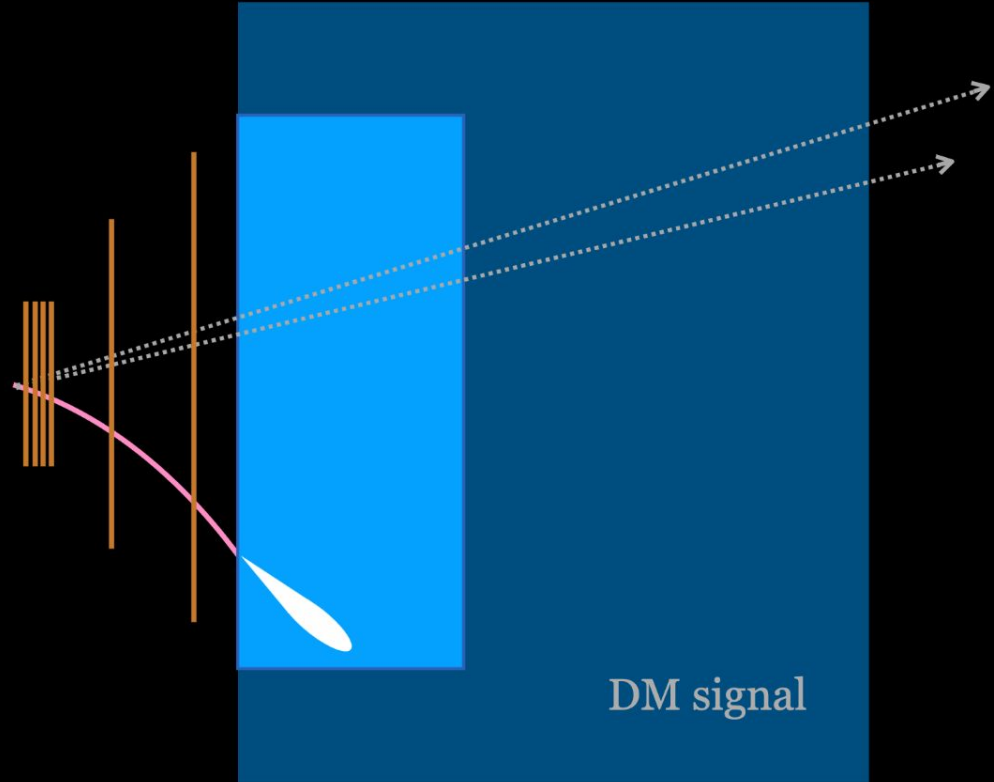
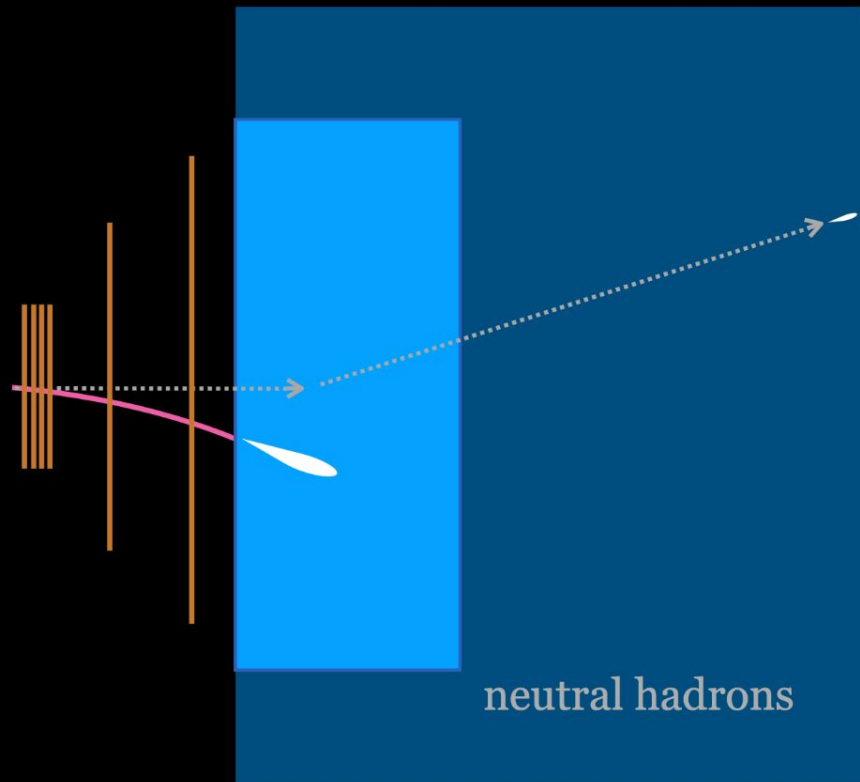
- Collaboration with Taylor Gray (Chalmers) and Leif Gellersen
- Based on Stefan Prestel's work with DIRE/Pythia8
- Generate electron scattering from nucleus based on nuclear form factors with MadGraph
- Dark photon emission from parton shower
 - Correct emission pattern based on MEC from MadGraph

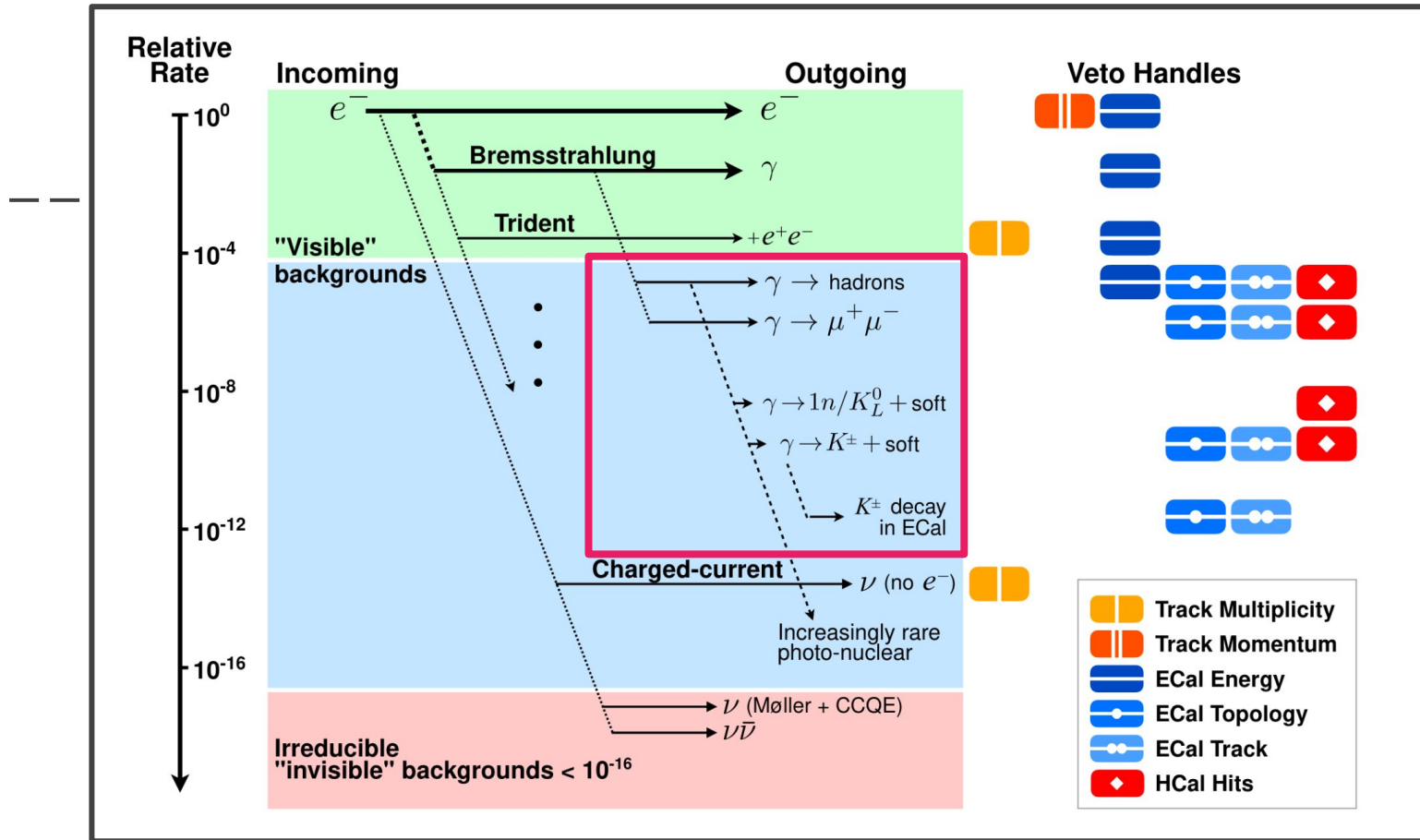


And now for something slightly different

Part II: Background

[Cartoon from LKs 2023](#)
[Fysikdagarna talk](#)

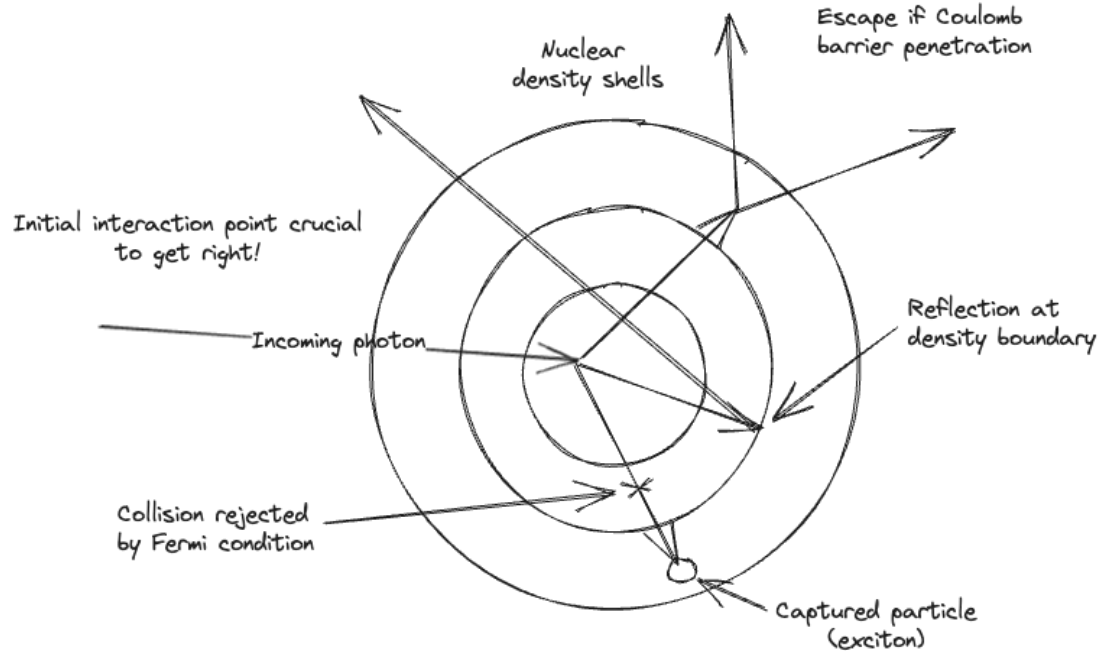




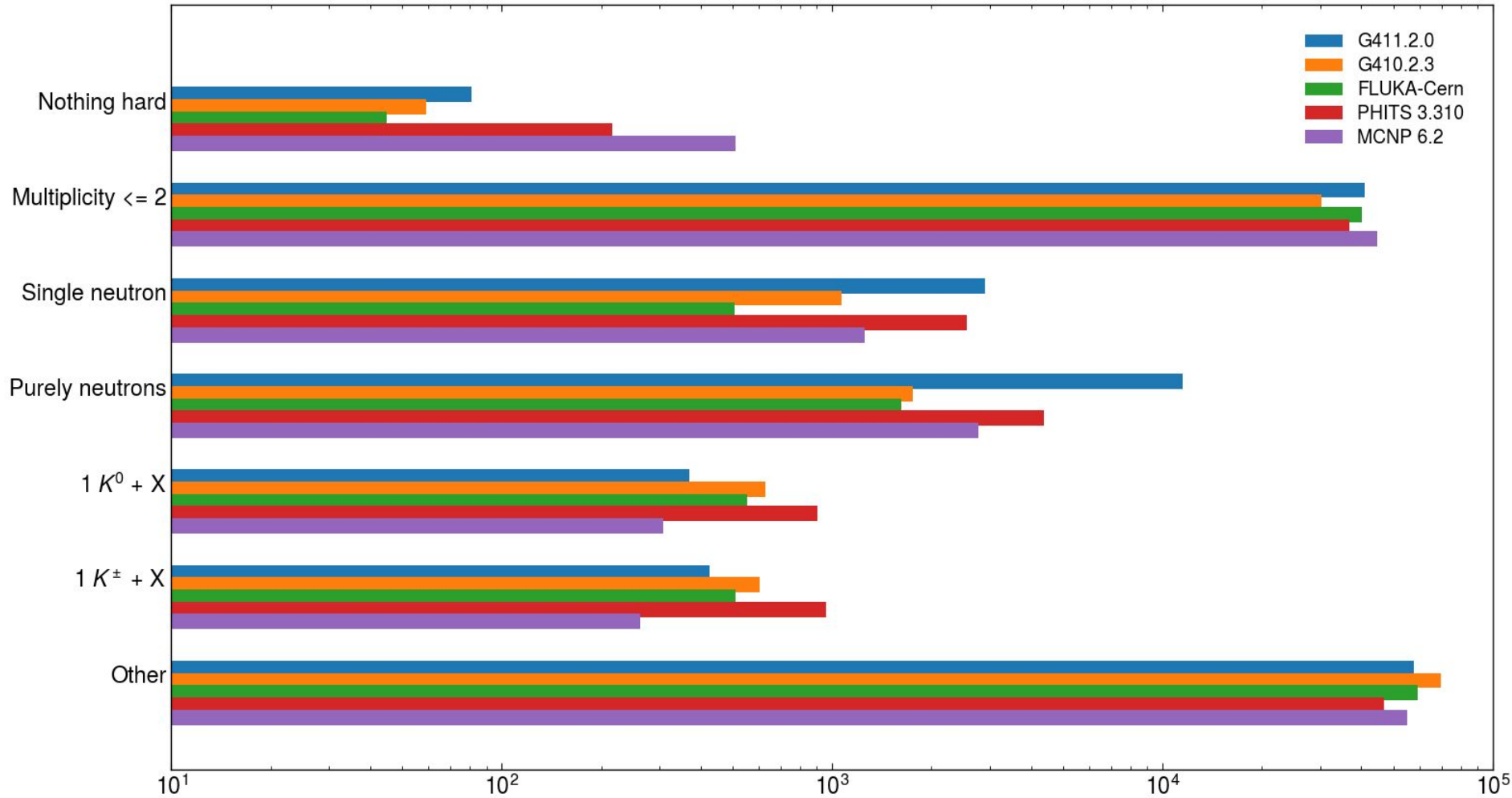
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Cascade stage in Geant4's Bertini cascade

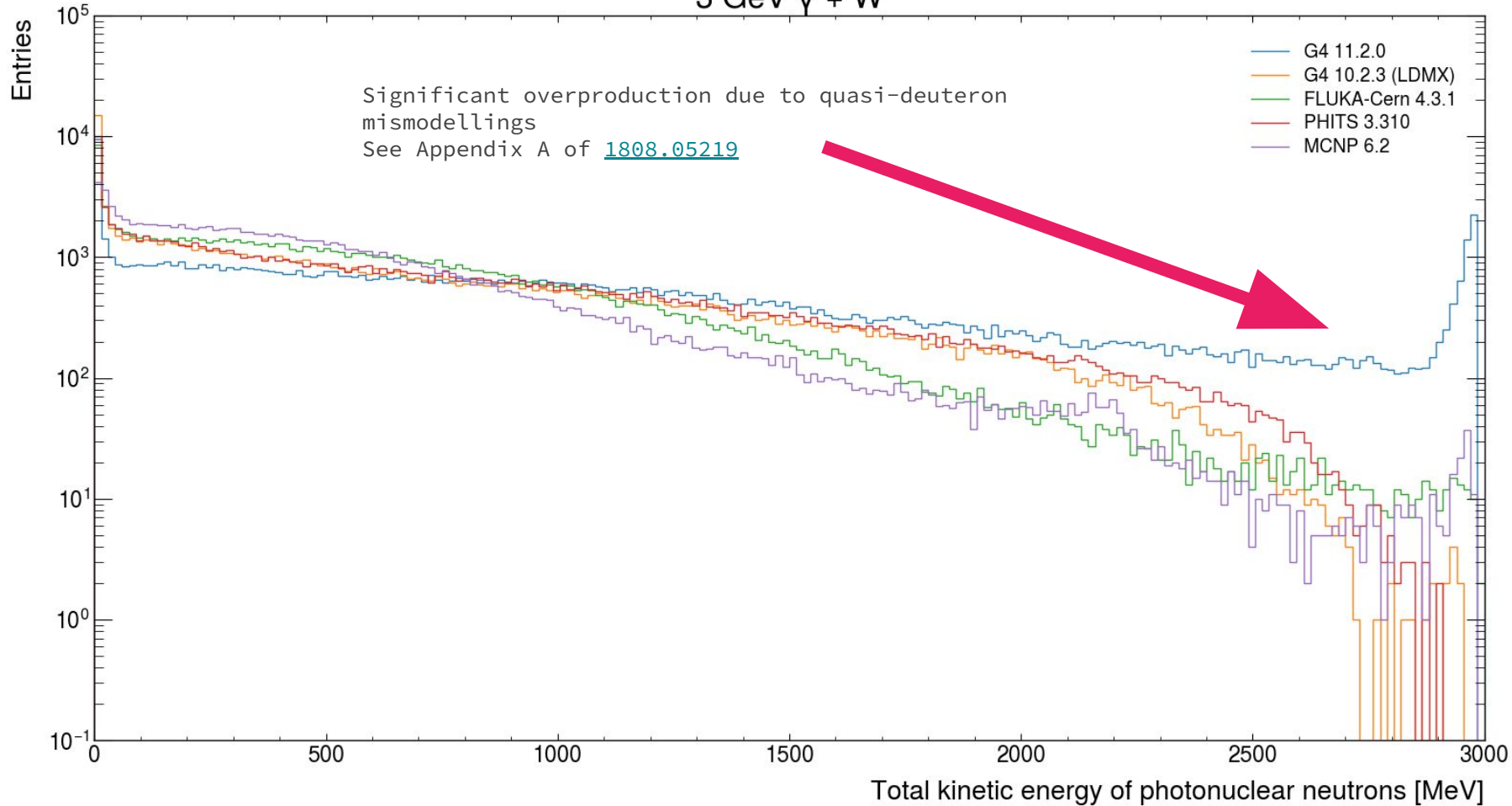
- ~few GeV photonuclear generally treated as intranuclear cascade
- Only difference from hadronic interaction is initial collision
- Do competing simulation tools give similar predictions?



LDMX Simulation Internal



3 GeV γ + W



Things you should know about me

It's alright, I'll be fine

If you got this reference, my condolences