Geant4 Basics

Brian Mong - Laurentian University

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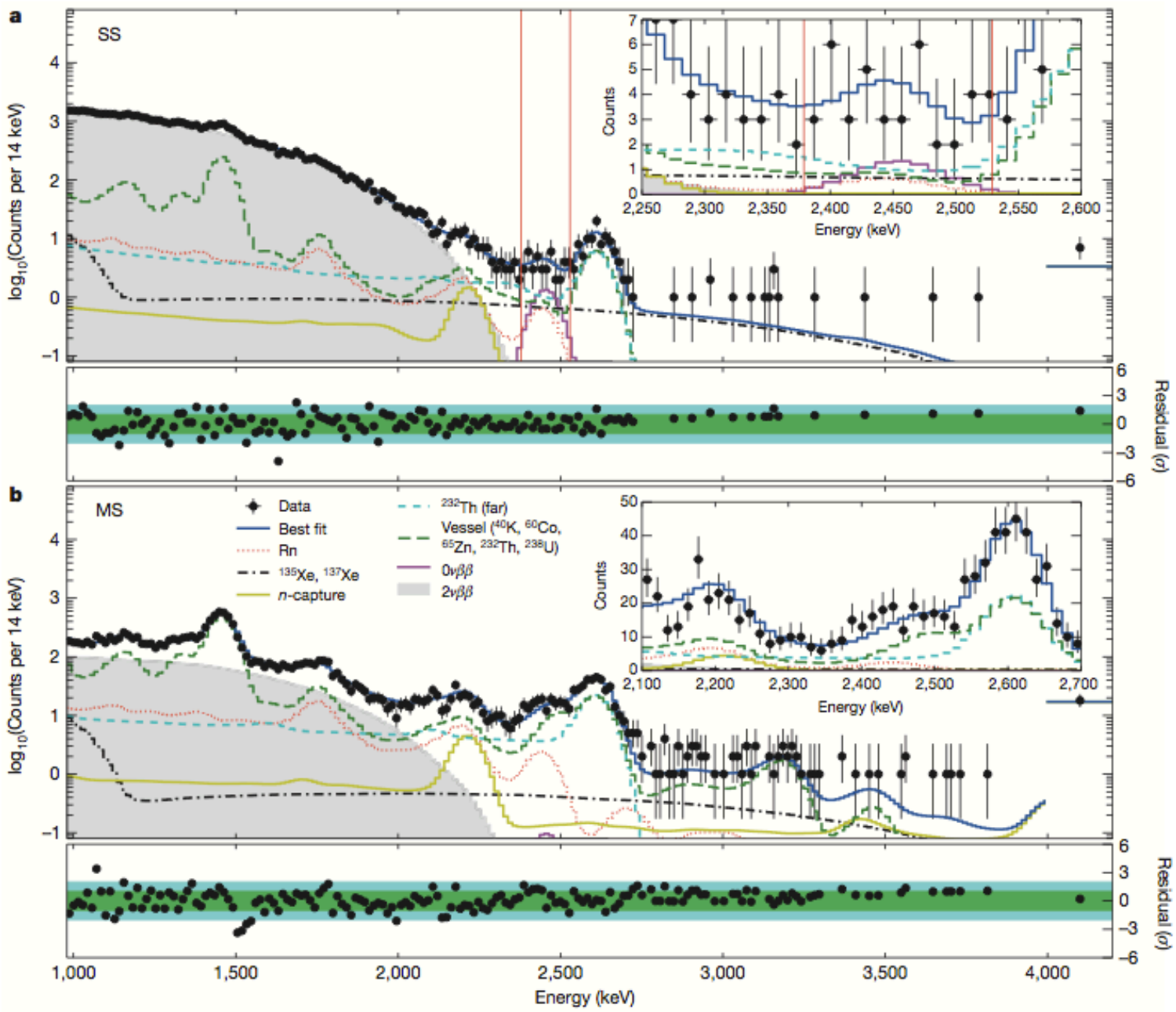
Why do we use Geant4

- Often experimental data does not perfectly categorize into signal and noise (background)
  - Monte Carlo is used to predict the signal shapes of backgrounds and signals
  - These form a set of PDFs (probability density functions) that are fit to the data
  - Example next slide
- Sometimes you want to predict the performance of a detector before it is built

EXO-200 neutrinoless double beta decay search



So what is Geant4?

- Basically a set of C++ libraries that help
  - Setup experiment/detector geometry
    - solids / materials / fields
  - Define physics processes
    - Must select physics that is important in experiment
  - Generate particles
    - Radioactive decays, particle beams, etc
  - Propagate/track particles in experiment
    - uses physics process that were defined
  - Output hits / energy deposits / etc
  - Visualize particle tracks and geometry

And Now What?

- Since Geant4 is basically only a set of libraries each usage case is different
- In EXO-200: Geant4 is only one module in our simulations/reconstruction code.
  - MC hits are fed into a signal generator
  - These signals are reconstructed the same way our data is reconstructed
  - The whole framework is written in C++
- There is no standard implementation but Geant4 does come with many examples…