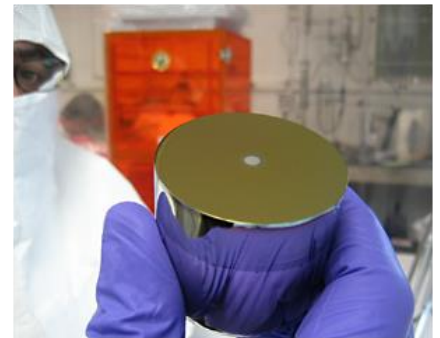# A maximum likelihood analysis of the CoGeNT public dataset

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Work in progress with: Matt Bellis, Juan Collar, and Nicole Fields

Our Analysis

- The CoGeNT collaboration has released more than 3 years of data including the spectrum and time variation of the nuclear candidate events in their germanium detector.
- We perform an unbinned, maximum likelihood fit to the data, accounting for known backgrounds and systematic effects to search for dark matter interactions with the detector.
- Background and possible signals are characterized by two dimension probability distribution functions that account for energy and possible temporal variation.
  - Additionally, we utilize the pulse rise time to model the "surface events" which are a known contamination of the bulk events where a dark matter signal should appear.
- We test several possible dark matter velocity distributions including the standard halo model employed by most direct detection experiments as well as more directional streams.
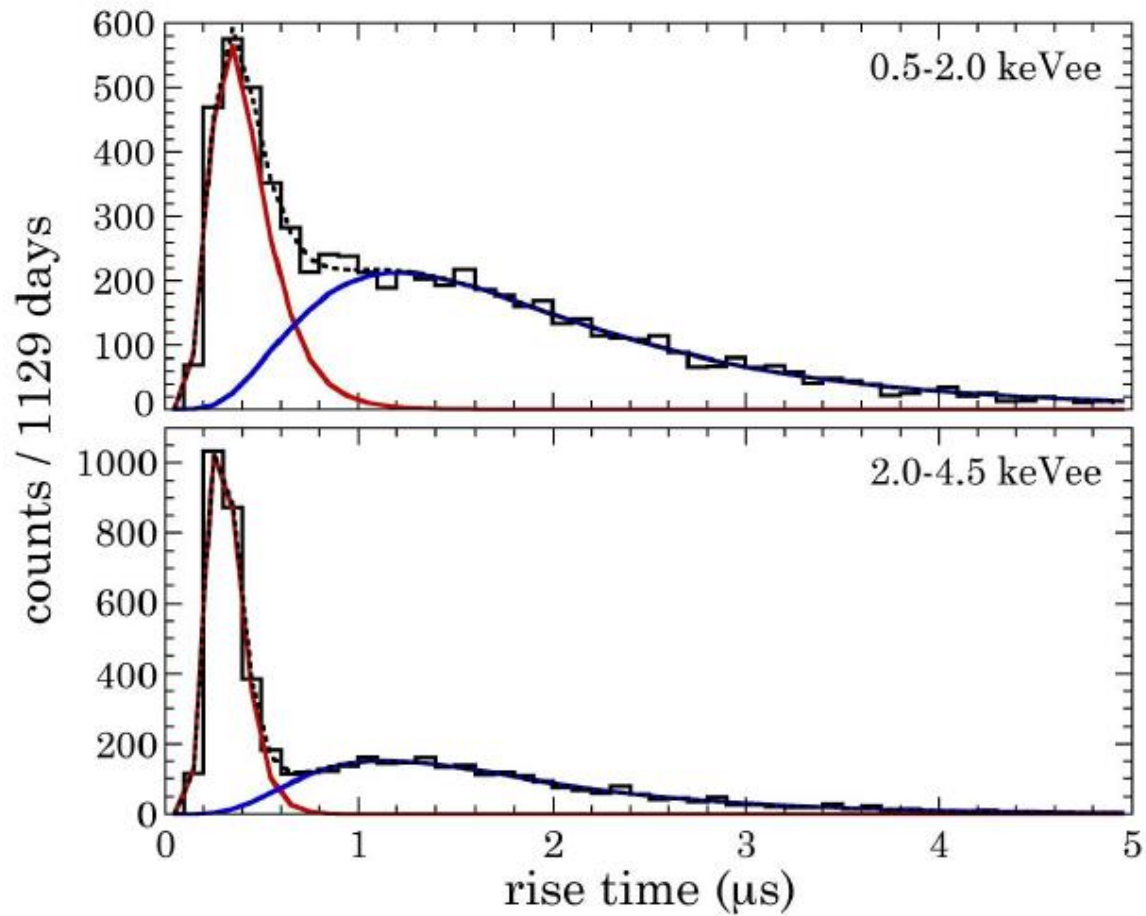
A Simple Detector Schematic
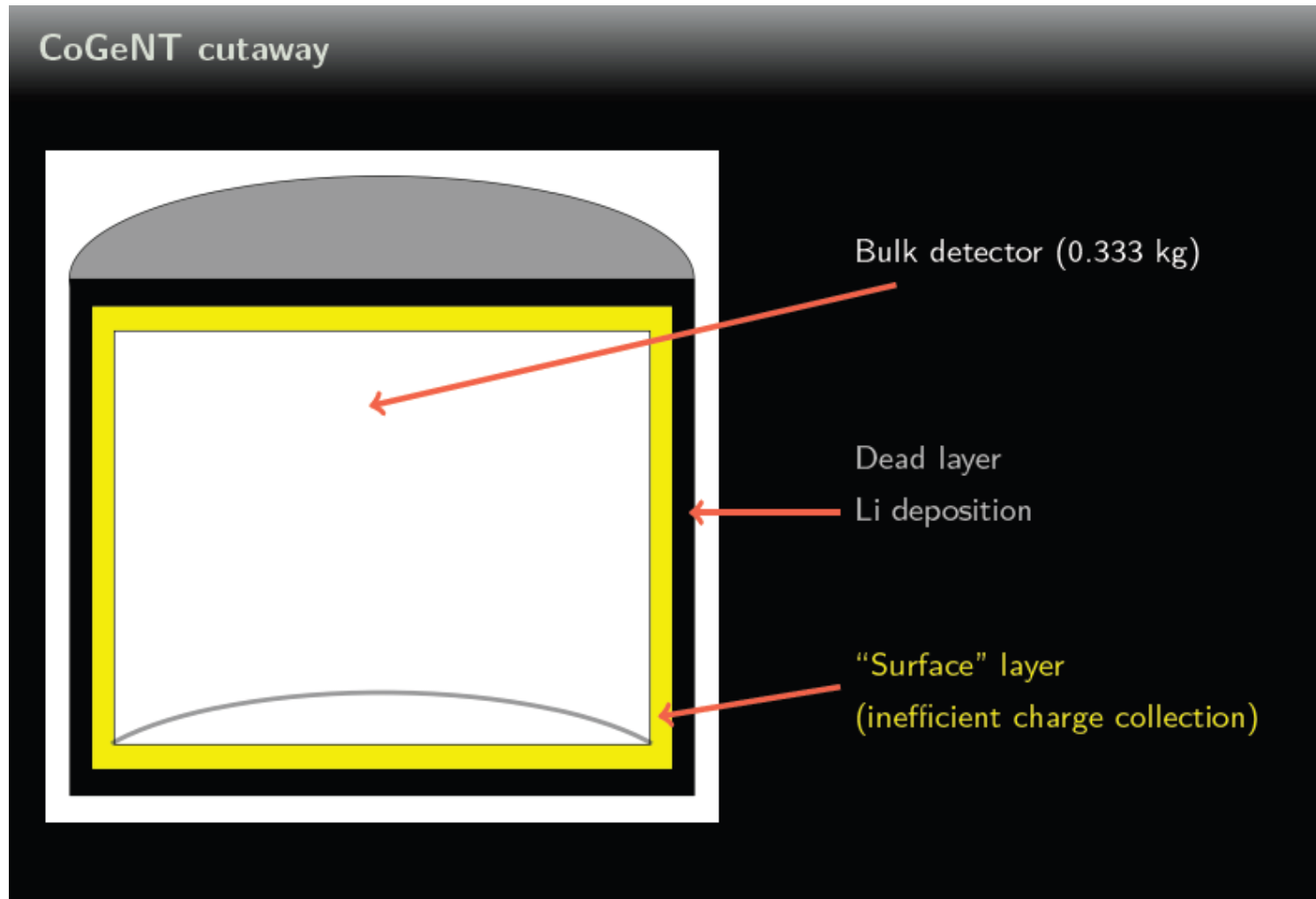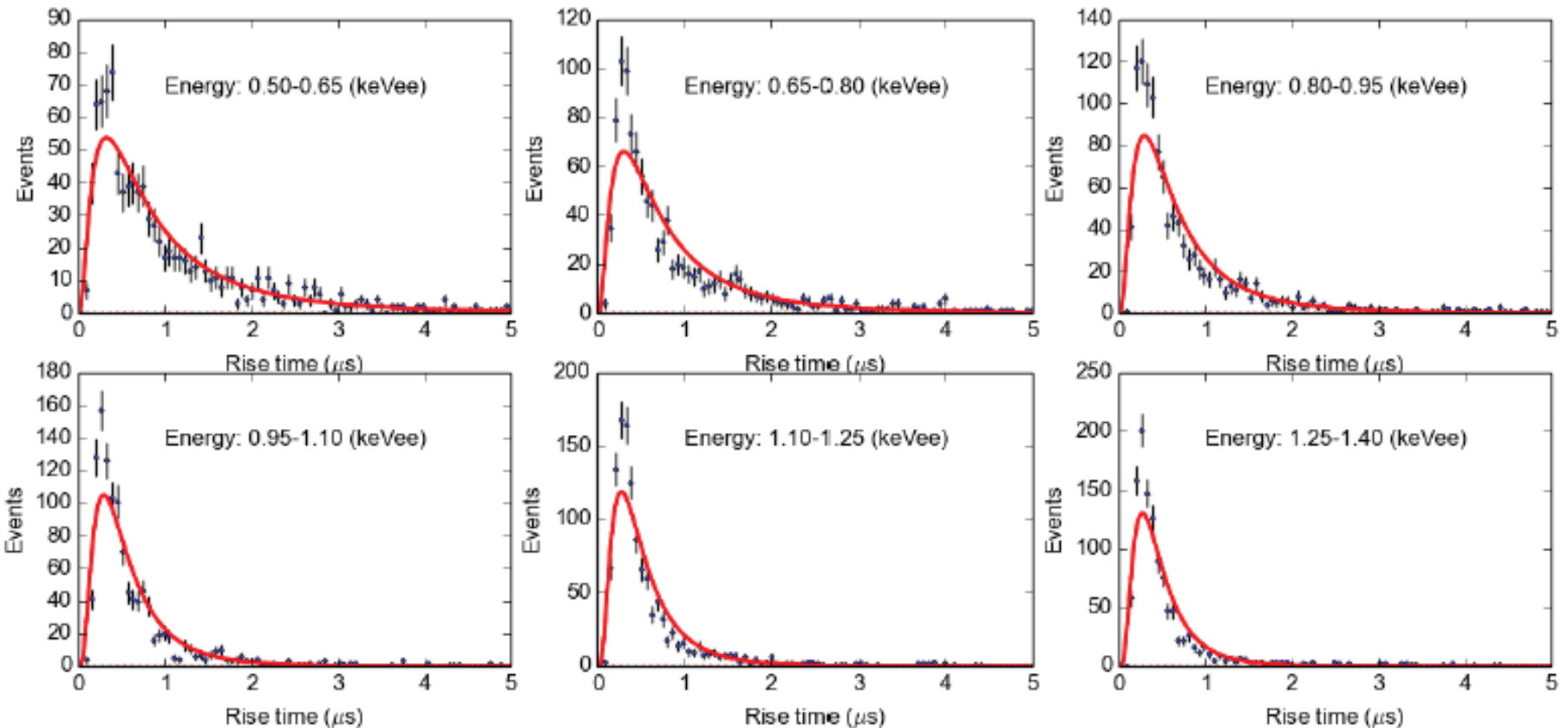

Slide from Matt Bellis' April, 2014 APS Talk

Rise times are different for the two types of events
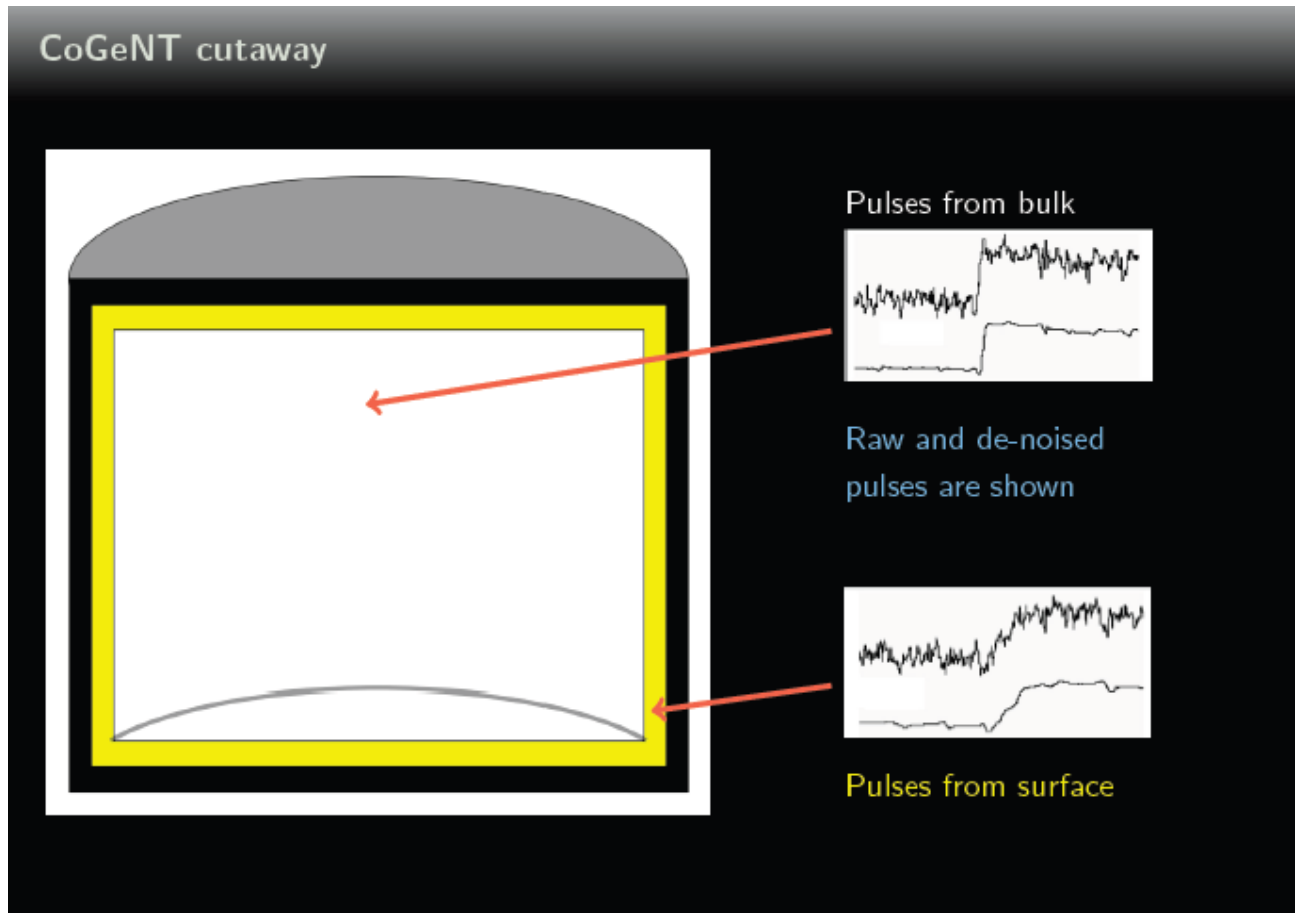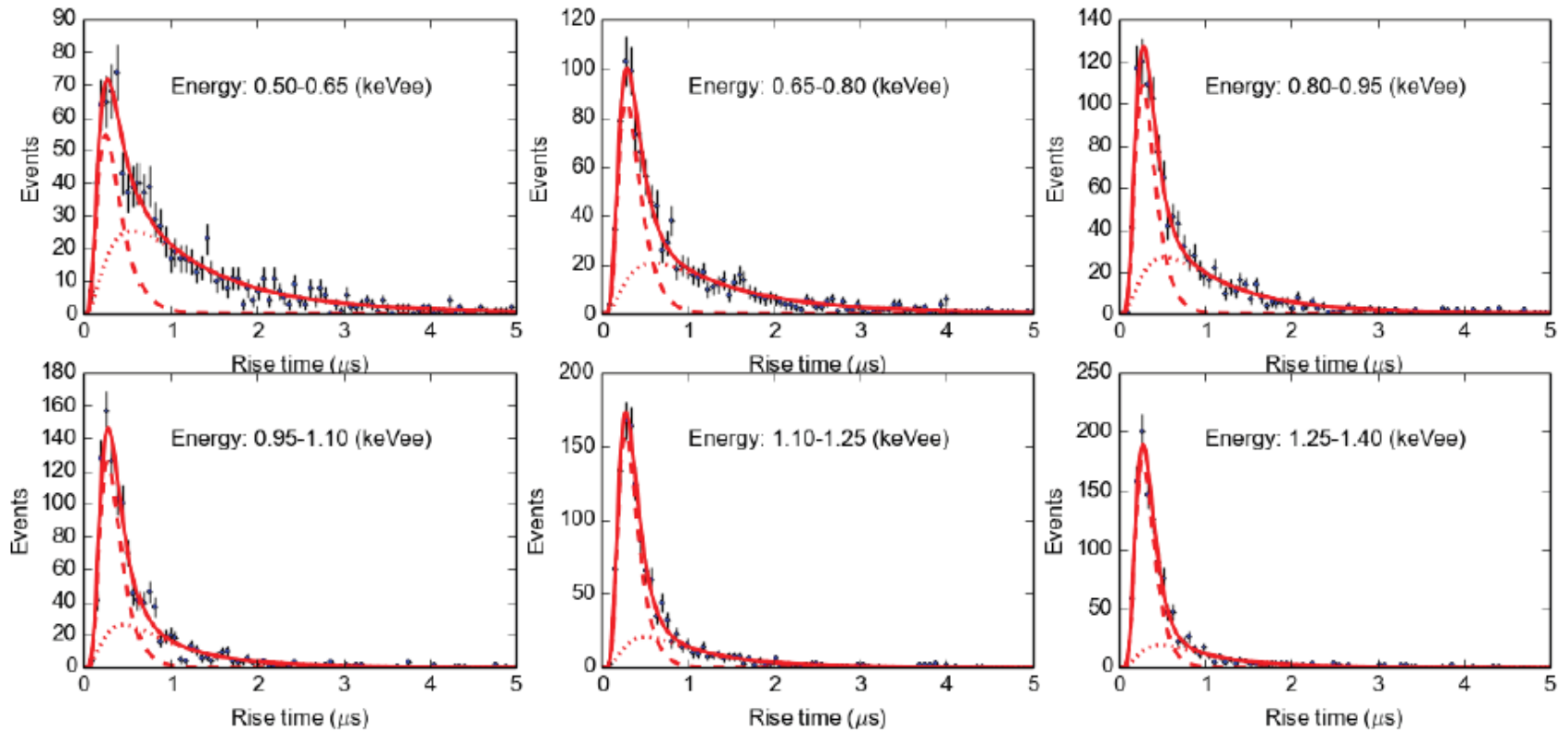
Actual Data

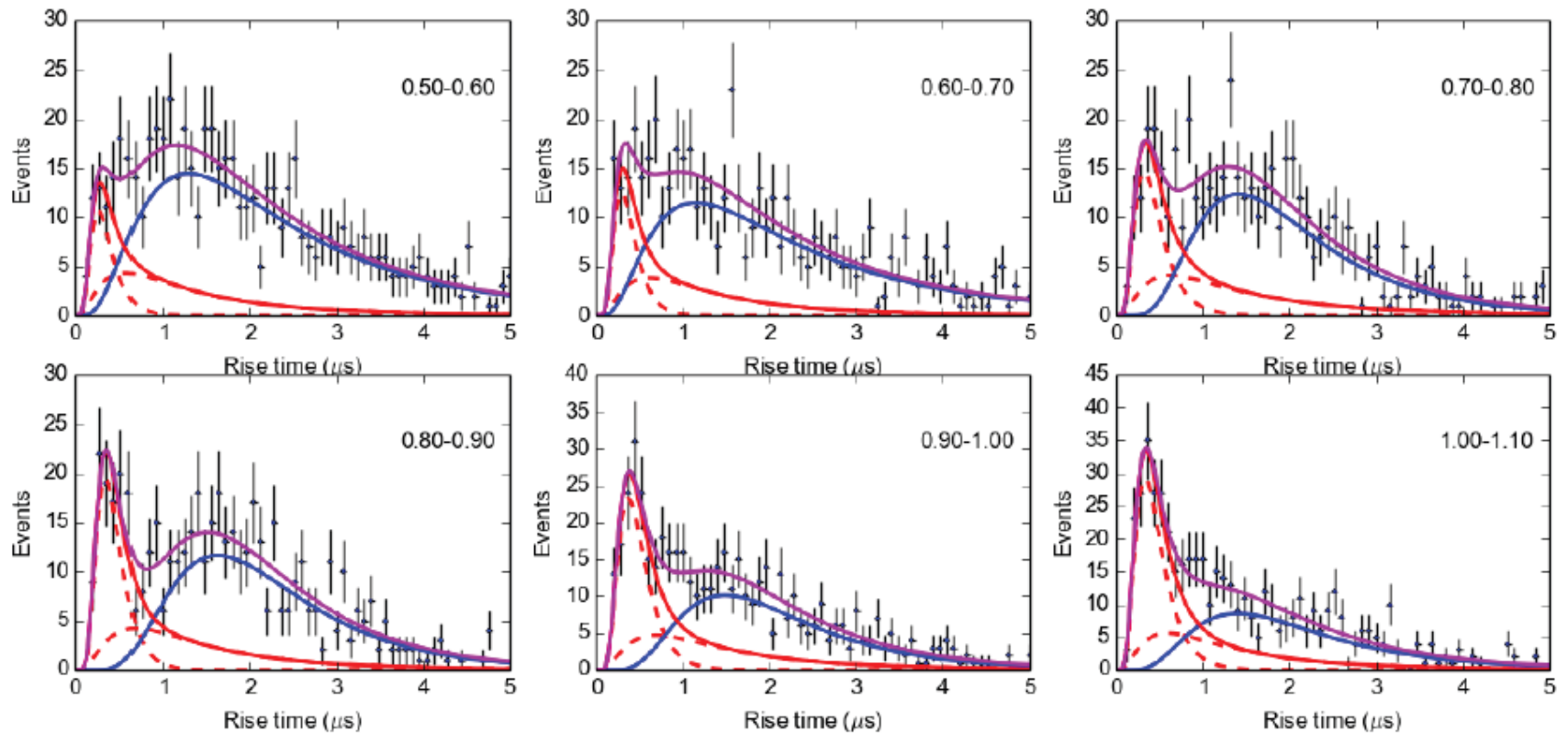# Simulated data for the fast pulses with actual detector noise
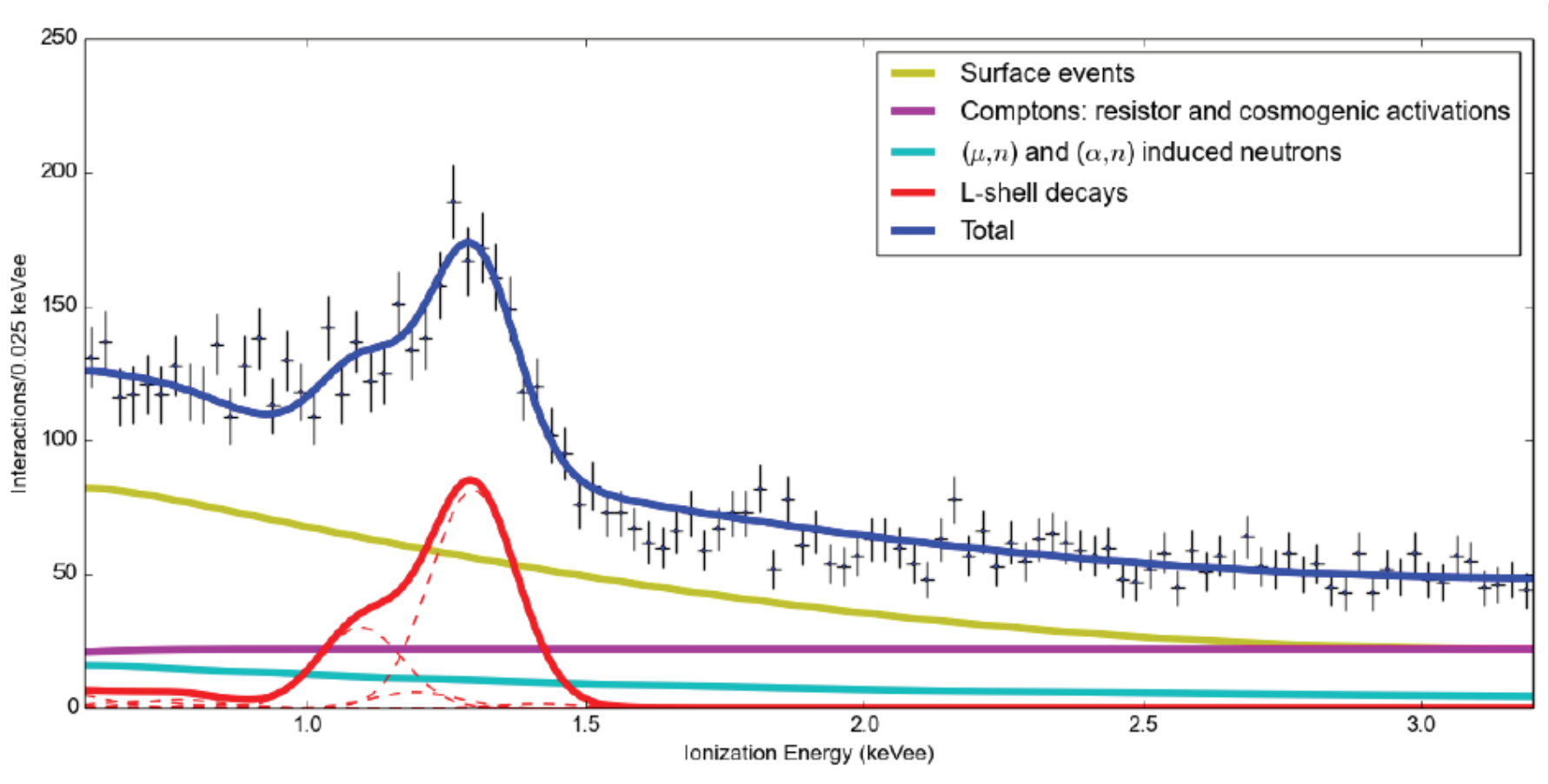

One Log-Normal is not good fit

Two Log Normals fit much better

Use data to define the PDF's in Energy
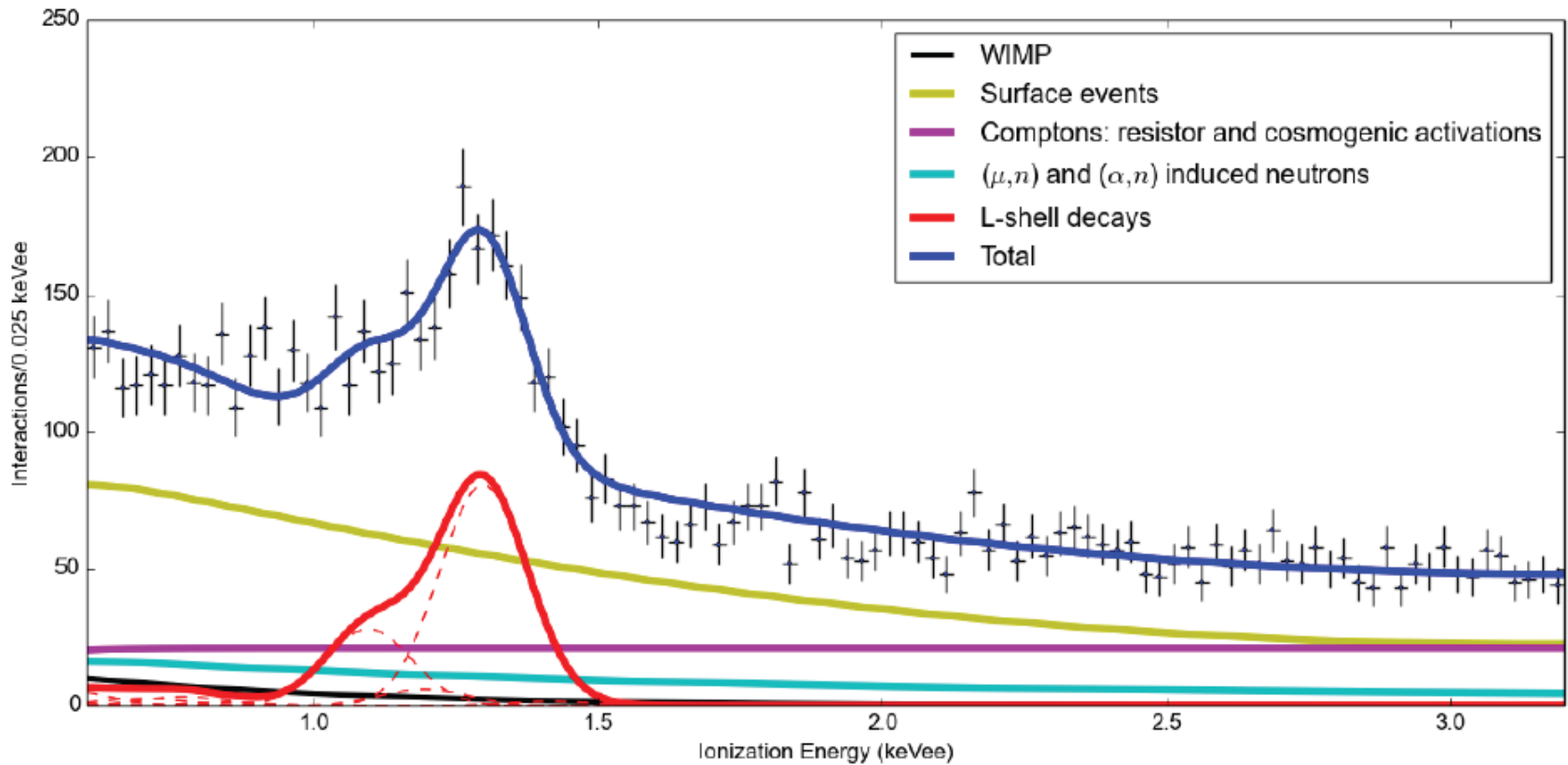
Background Only Fit to the Data

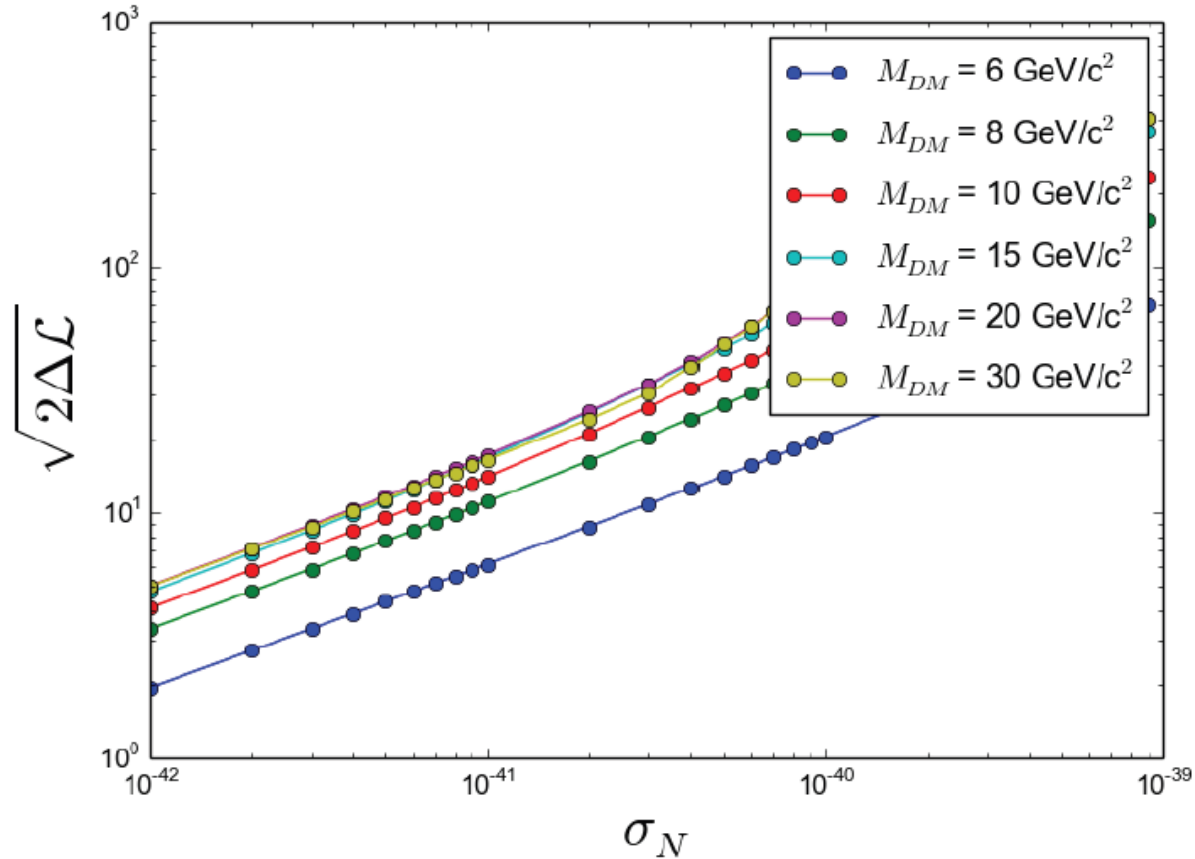Background model is good fit to the data
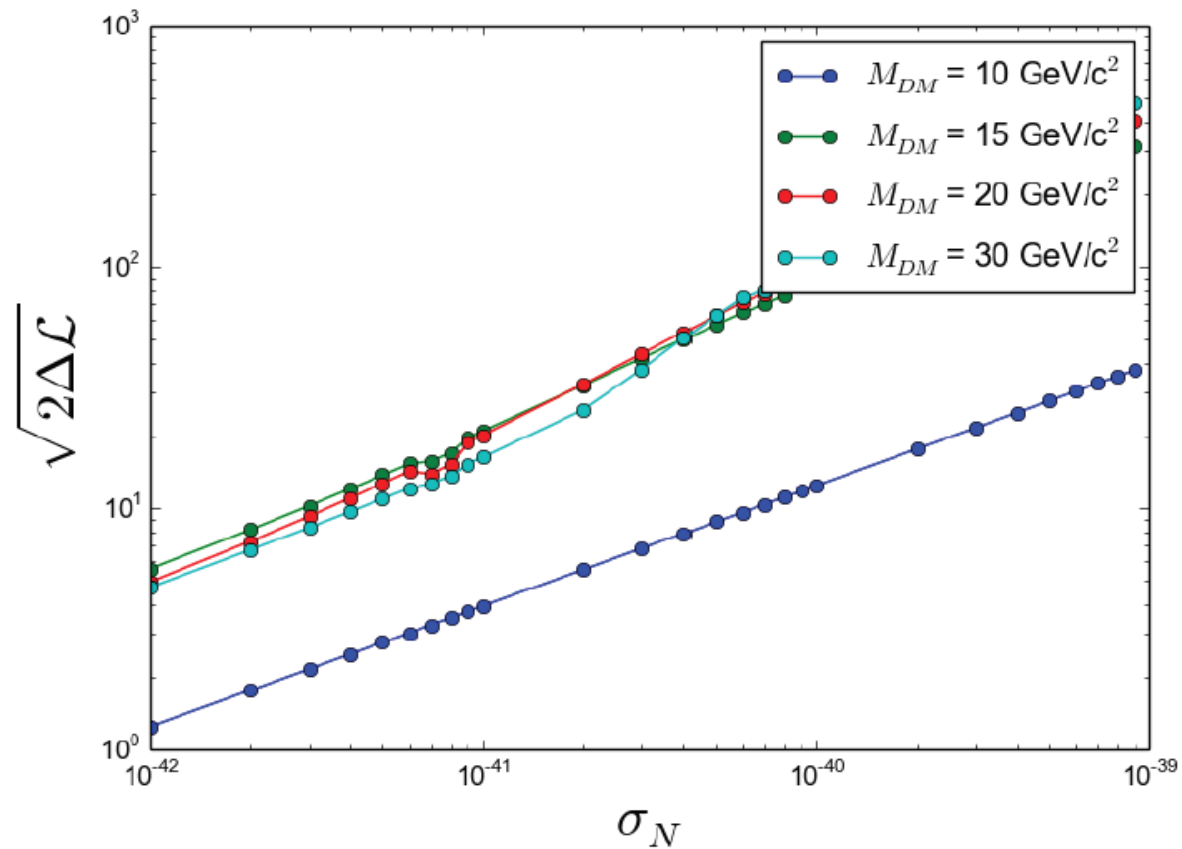
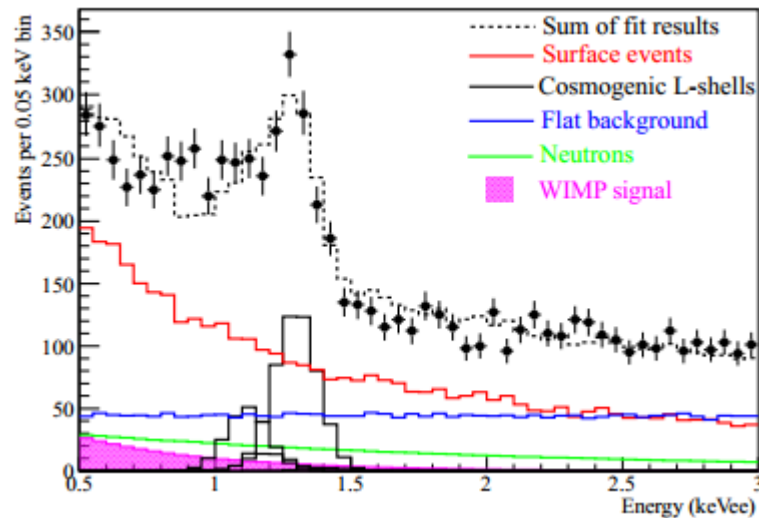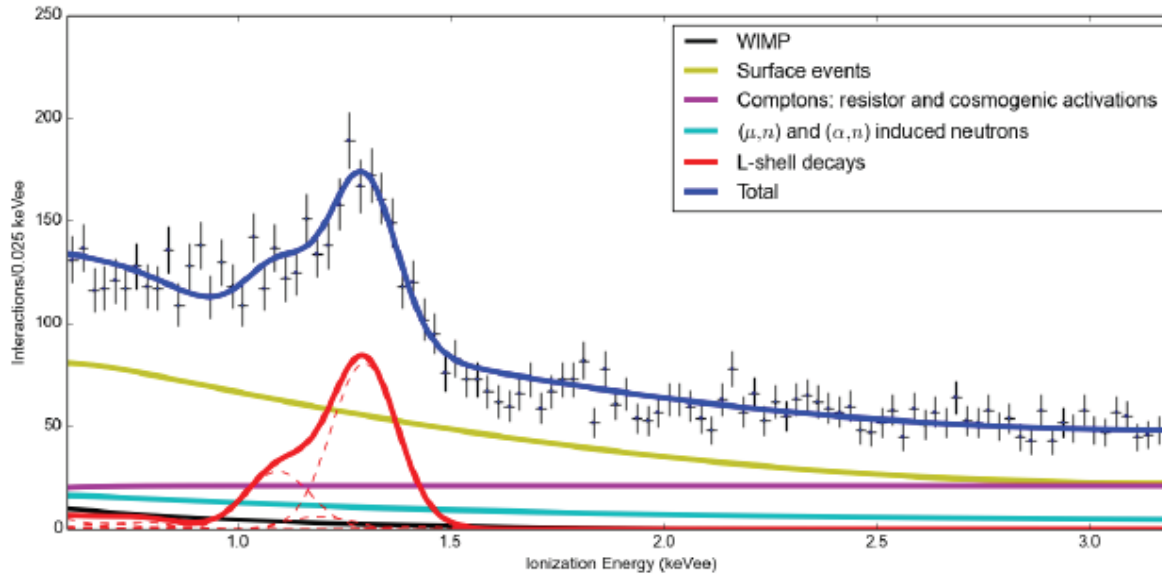# Now Include a WIMP Signal

Does the fit improve?

Including a WIMP with a Standard Halo

A Sagittarius-like Stream

Our Results versus Collaboration-(Collar and Fields)

arXiv: 1401.623

Conclusions

- We perform an unbinned, maximum likelihood fit to the public CoGeNT data using extensive studies to separate bulk and surface events

- We find a good fit to the data with our background model
  - The likelihood gets worse when including a WIMP component either as a standard halo or Sagittarius like stream

- Still to come
  - Try to understand the different conclusions with the likelihood analysis performed by Collaboration – (Collar and Fields)
  - Look at more exotic signals (such as axion-like particles scattering from electrons)
  - Set upper limits on the cross section