# CoGeNT: dark matter or background?



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Christopher McCabe

with Celine Boehm
and Jonathan Davis

arXiv:1405.0495

DMUK, IPPP, Durham University – 9th June 2014

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# ~~dark matter or~~ background



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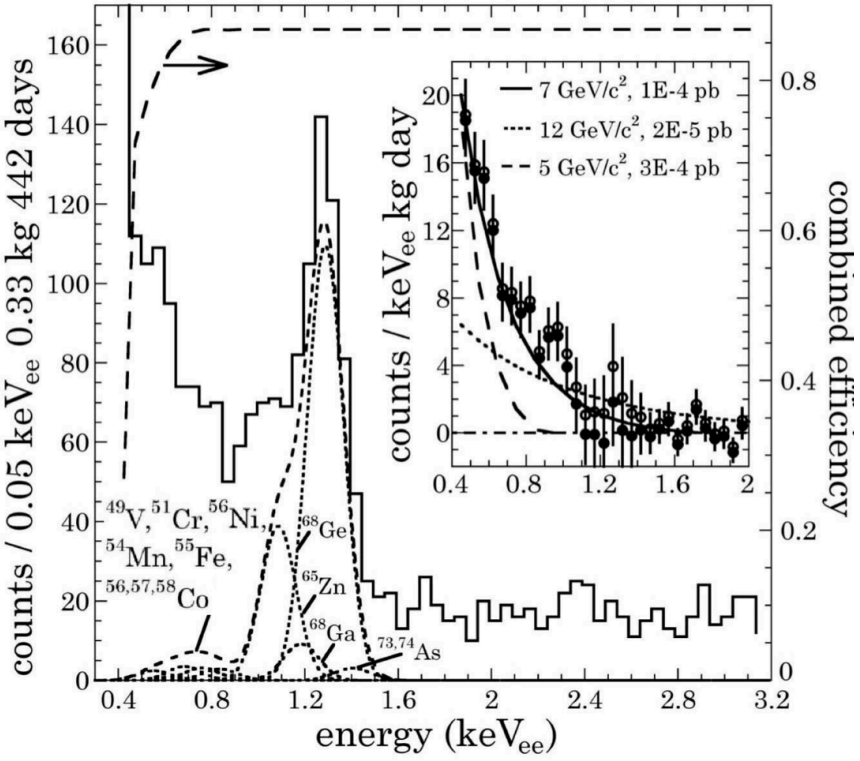
# Summary

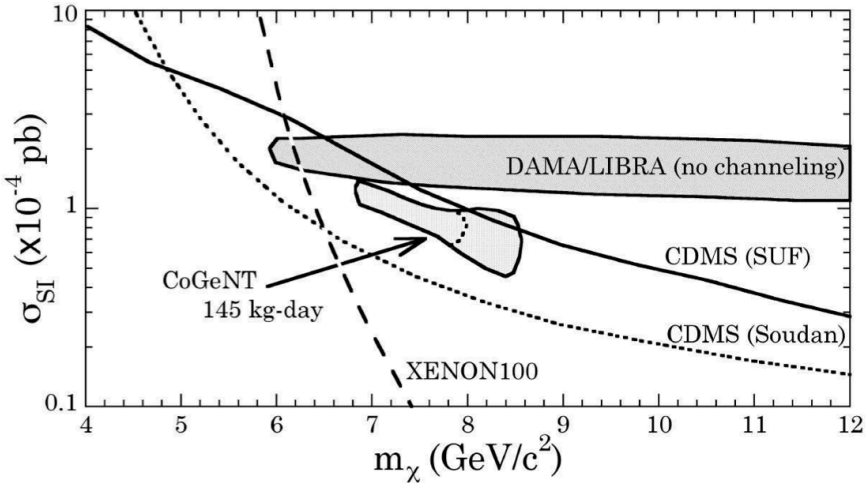
- Surface events can account for the all of the CoGeNT events

# Evidence for low mass DM?

CoGeNT:
1002.4703, 1106.0650,
1208.5737, 1401.3295

- Low-threshold Ge detector
- 2010: low-energy 'irreducible excess' (600+ citations)
- Excess still there in results from 2010-present day

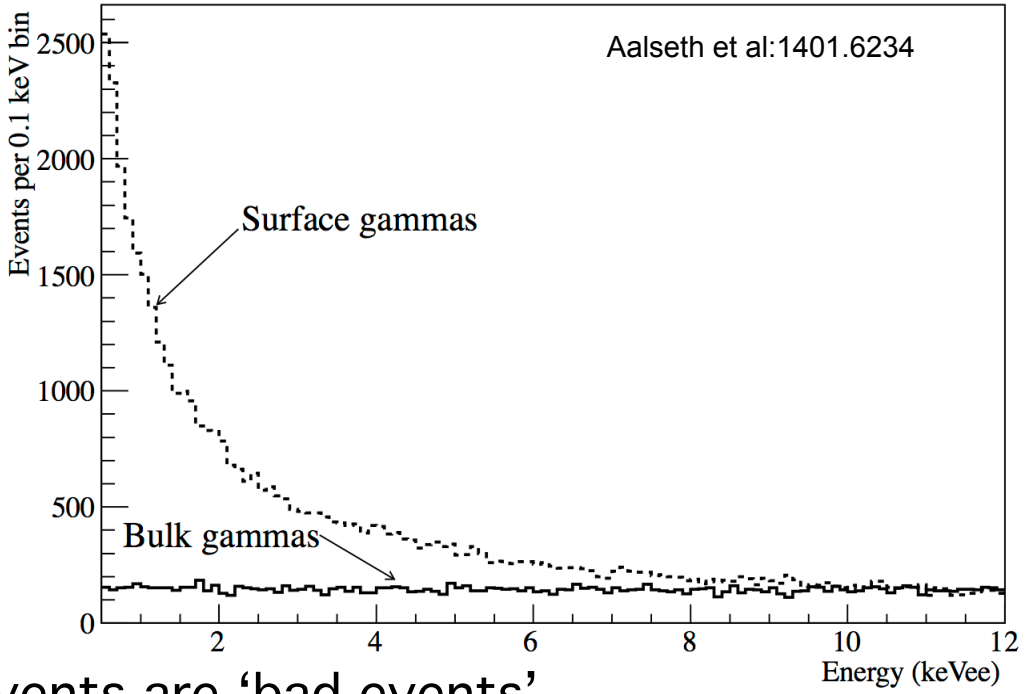



CoGeNT: 1106.0650

# Surface and bulk events

- CoGeNT measures
  - Bulk events – 'good events'
  - Surface events – partial energy (charge) collection

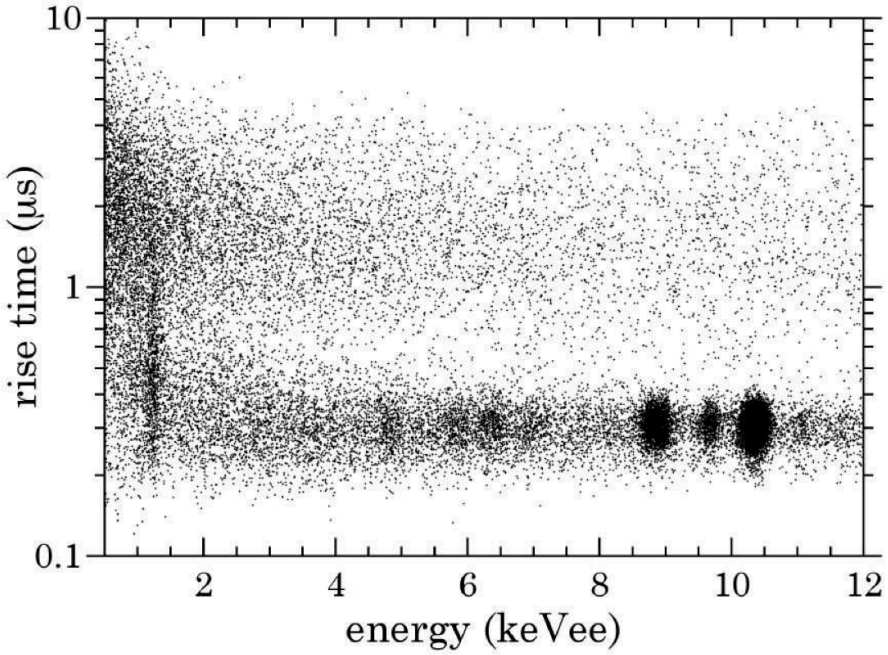



- Surface events are 'bad events'
  - give rise to a low energy excess: looks like dark matter

# Characterising the events

CoGeNT:1208.5737

- Events are characterised by the rise time




surface events

bulk events

# Characterising the events

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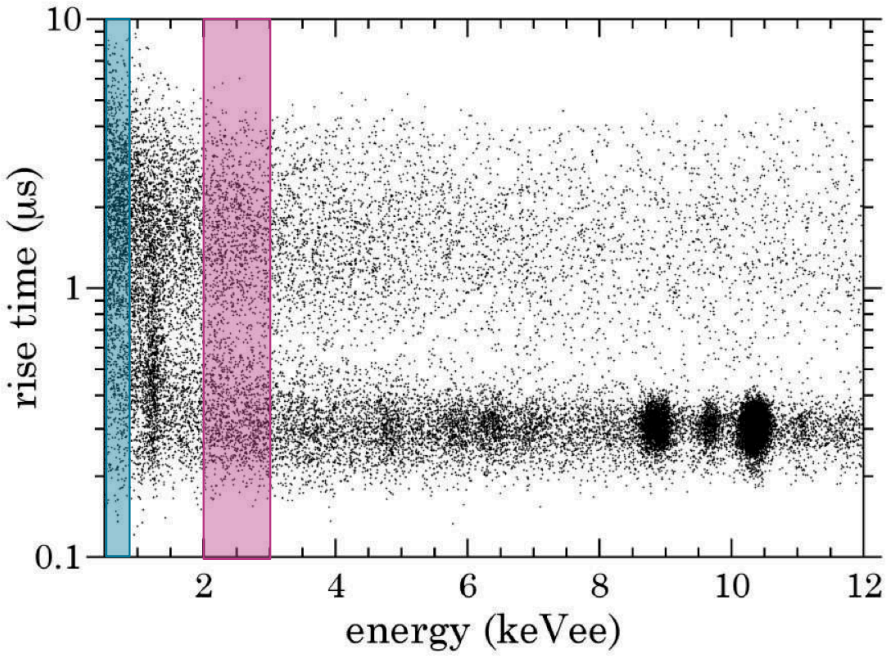
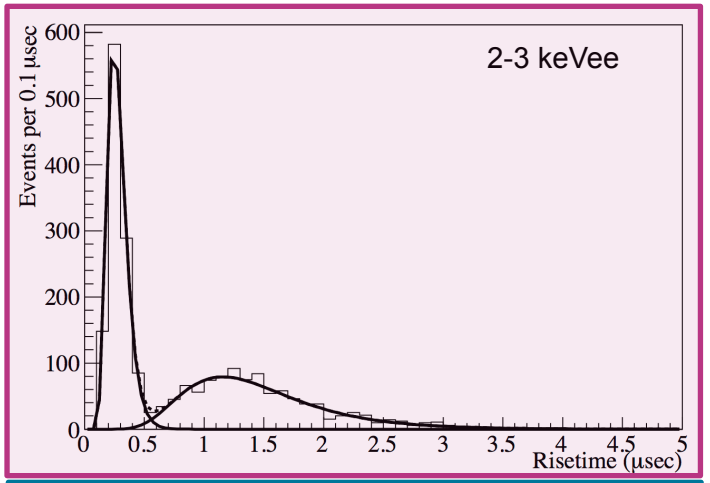
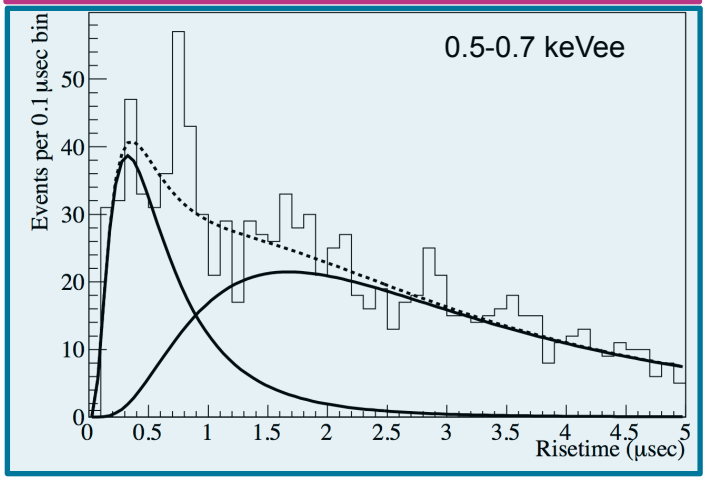


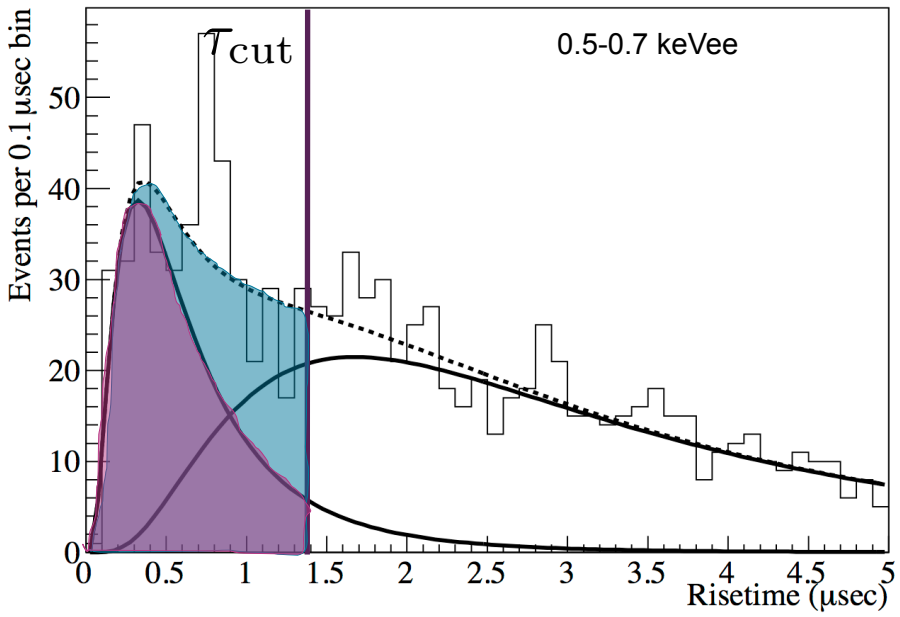

Difficult to separate at low energies:

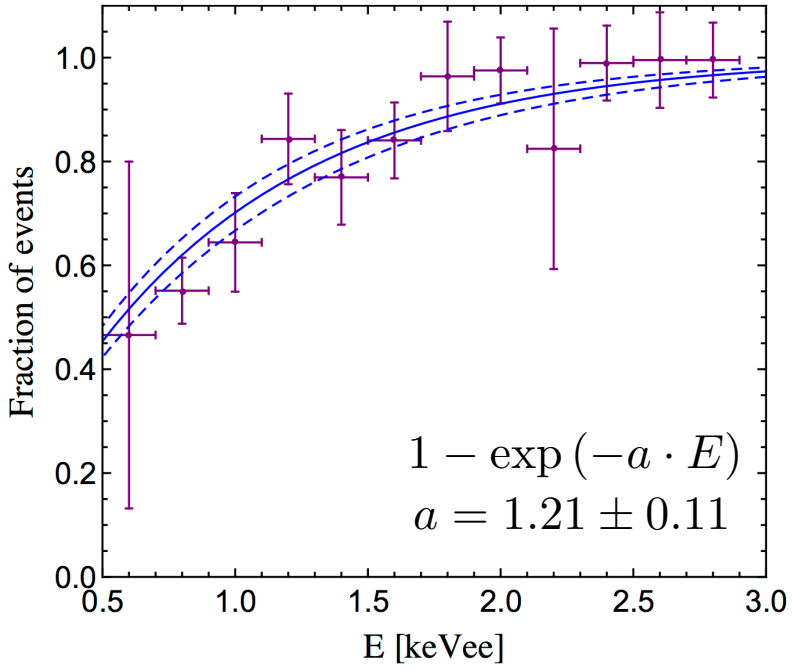
# Correcting the spectrum

CoGeNT:1208.5737

- At each energy can calculate the fraction of bulk events:

$$\text{fraction} = \frac{\text{bulk events}}{\text{total events}}$$



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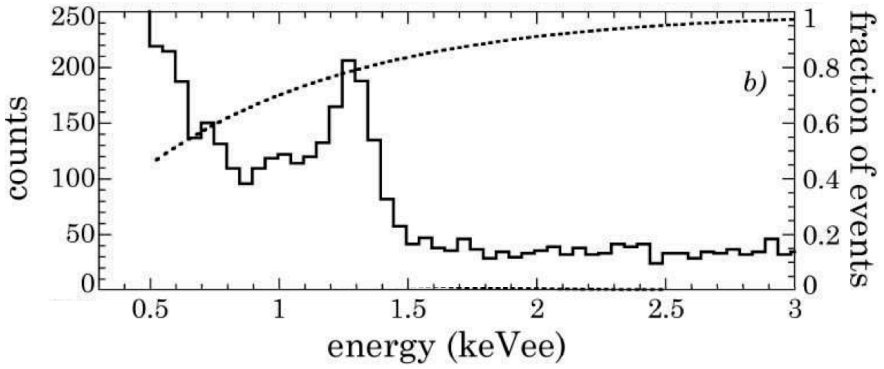
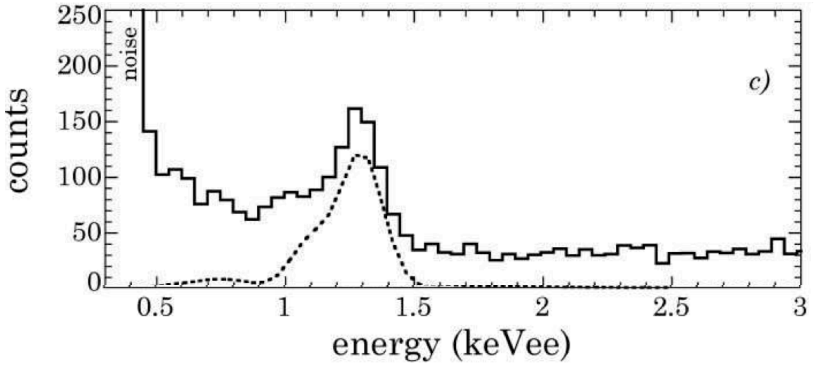
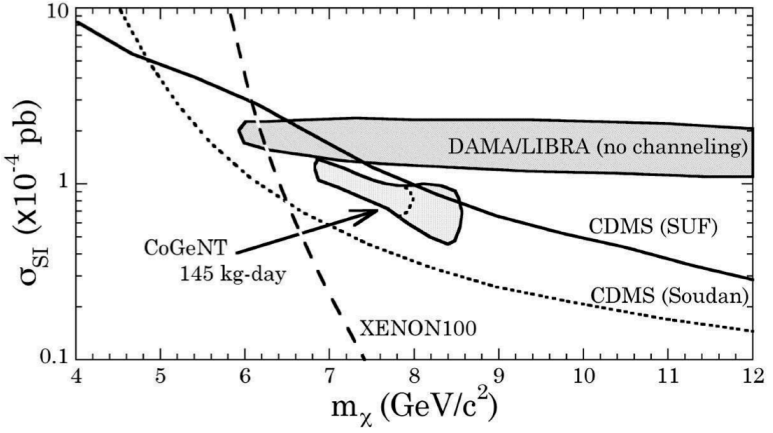
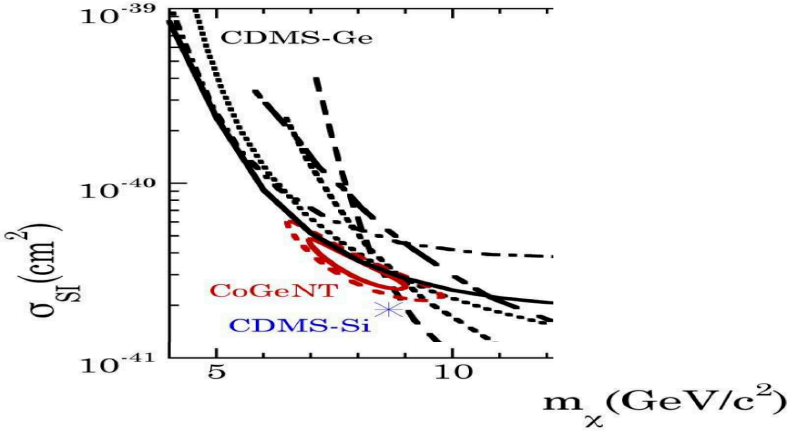
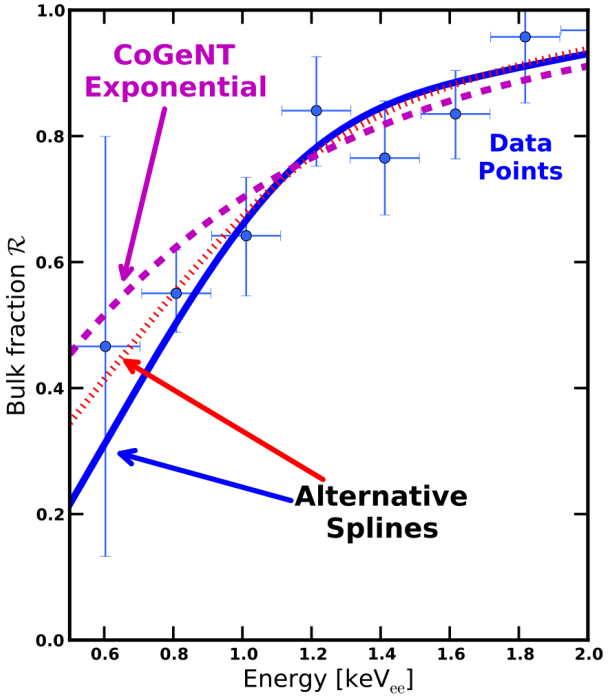


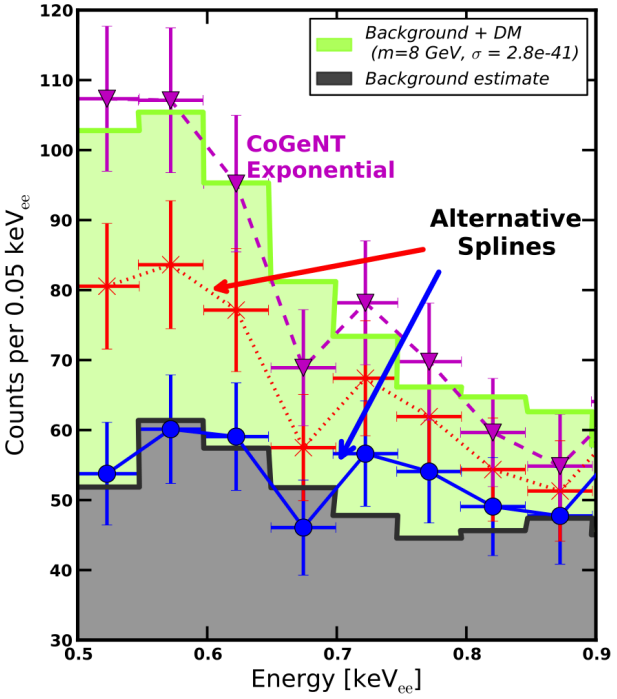



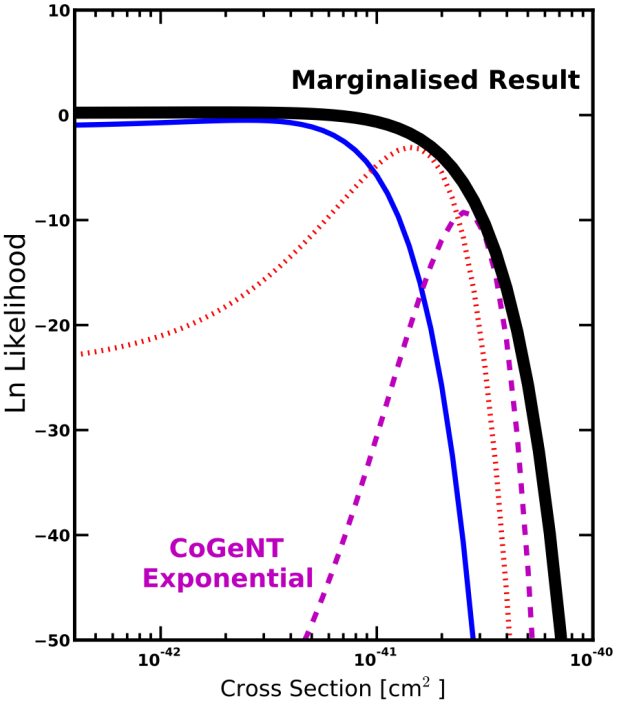



# A closer look...




- Fit bulk fraction with cubic splines
- Marginalised result shows no preference for non-zero cross-section

# Details of our complete analysis

- CoGeNT released full dataset for public analysis. We investigated:

- Frequentist and Bayesian analysis
- Different models for the bulk and surface populations
- Various rise time cuts
- Different background models
- Different bin sizes

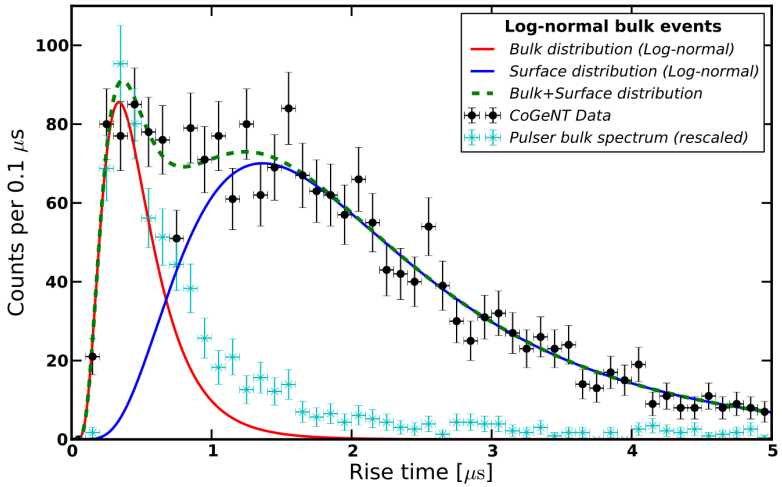
- All cases give similar results: $\lesssim 1\sigma$ preference for DM

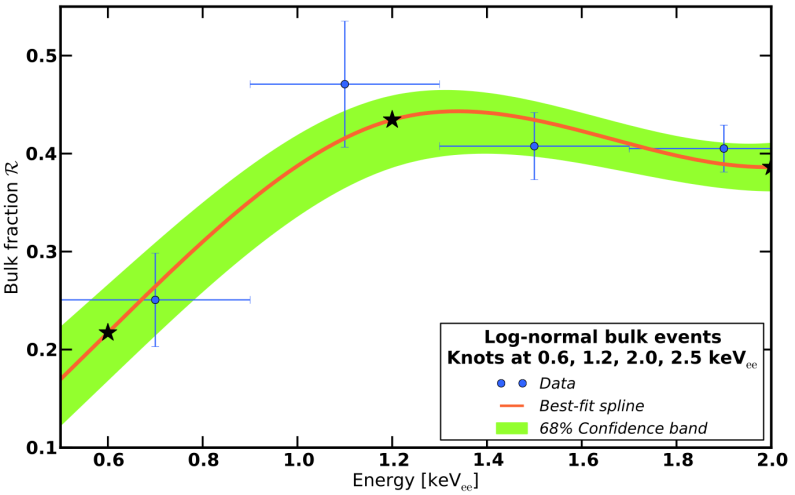
# Summary

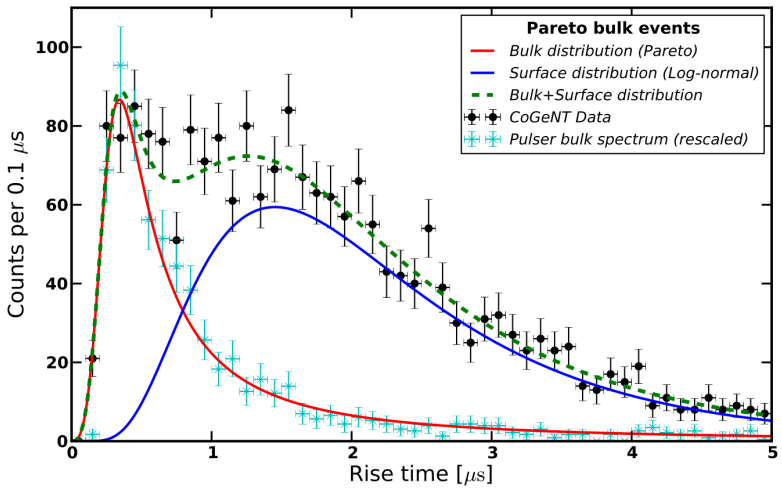
- Surface events can account for the all of the CoGeNT events

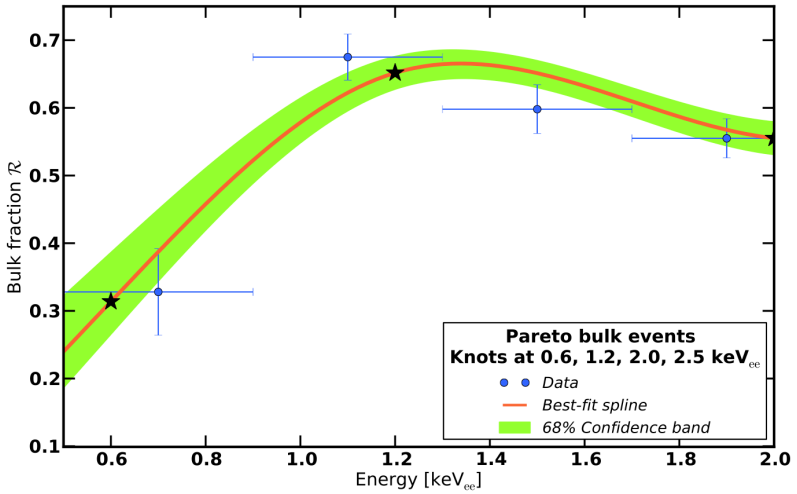
backup

# Log-normal vs Pareto



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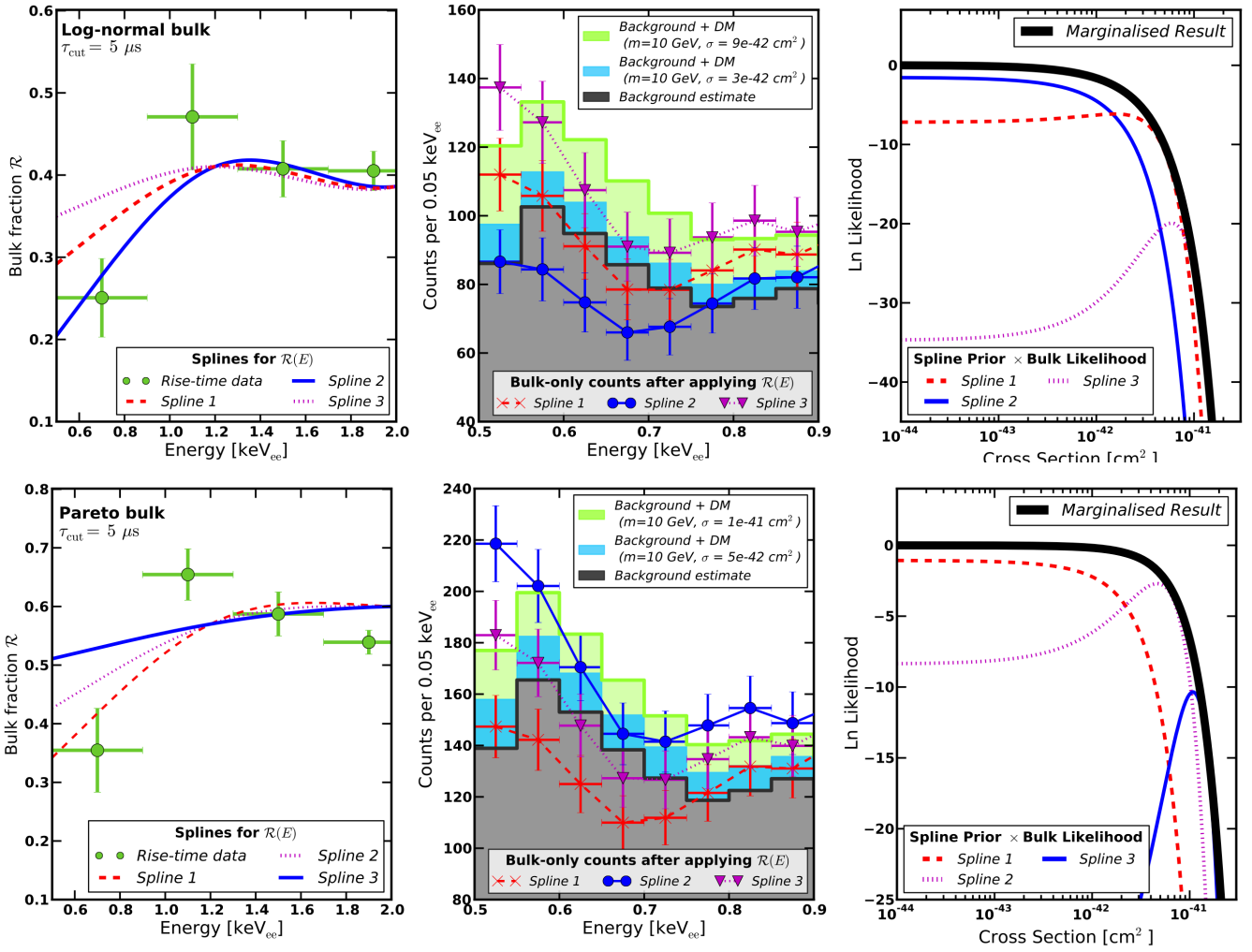
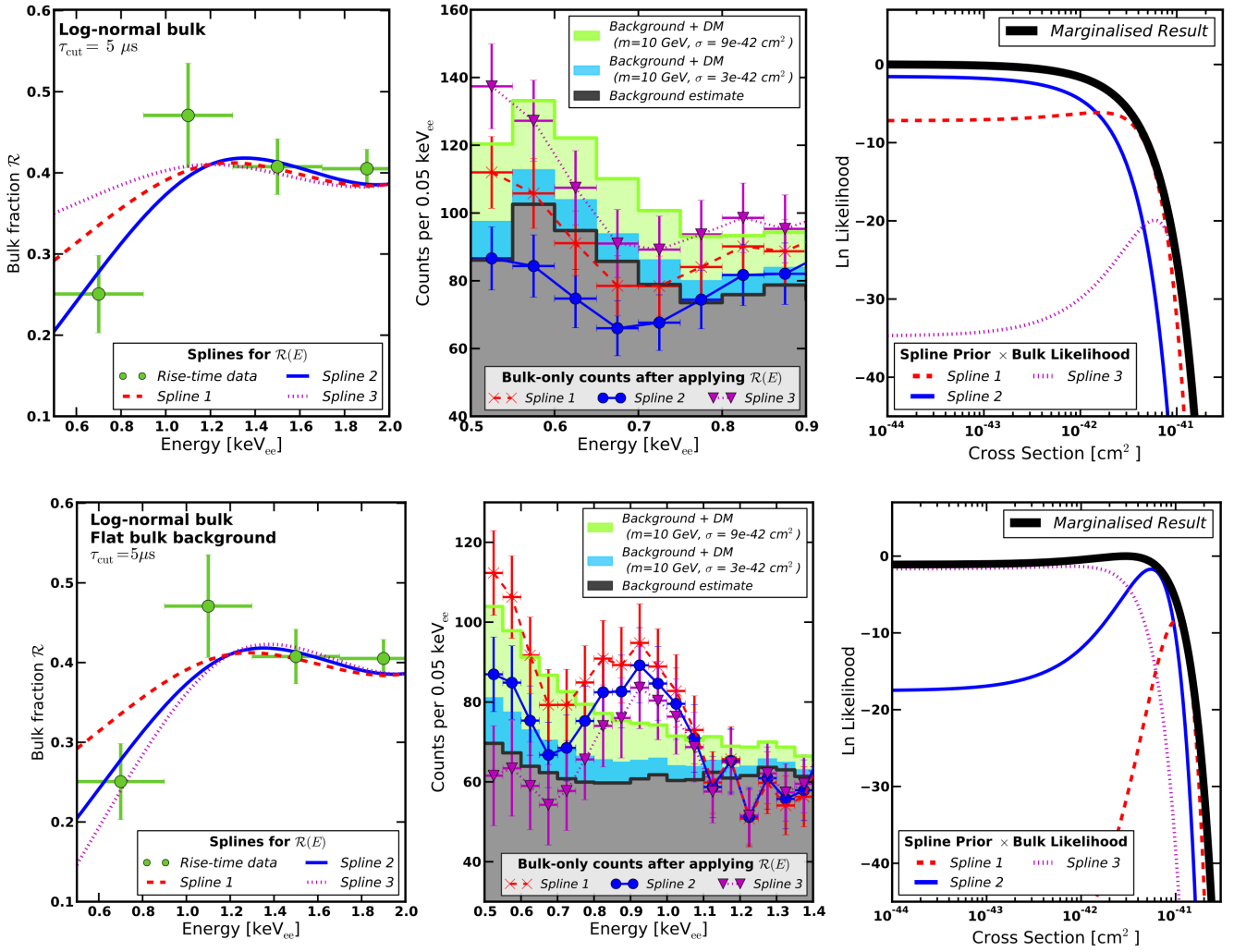


# Varying the background



# Evidence for modulation?

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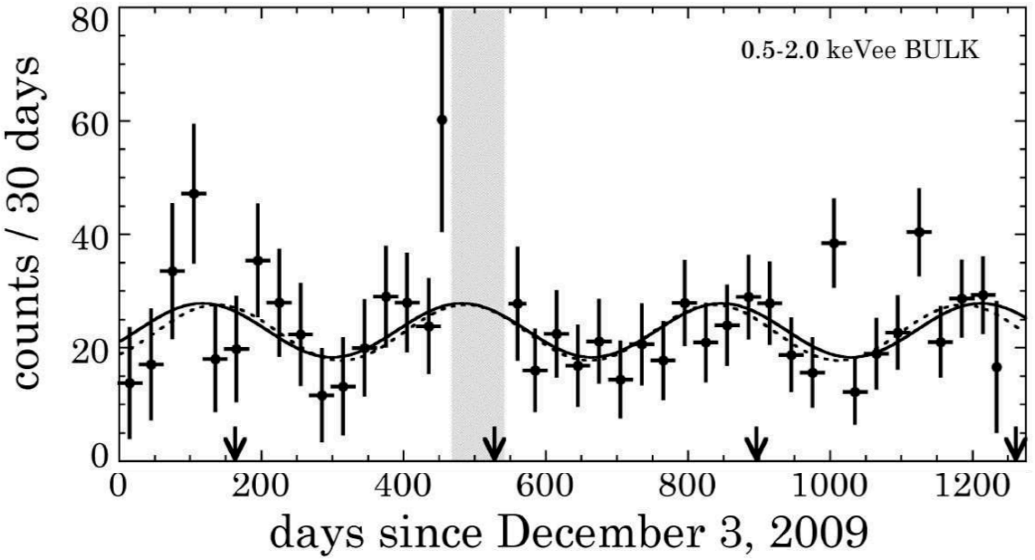
- Weak evidence for modulation $\sim 2.2\sigma$




- Not consistent with standard halo model
- Astrophysics free methods (eg Herrero-Garcia, 1112.1627) show that the modulation isn't compatible with the low energy excess