# Current status of PhD studies

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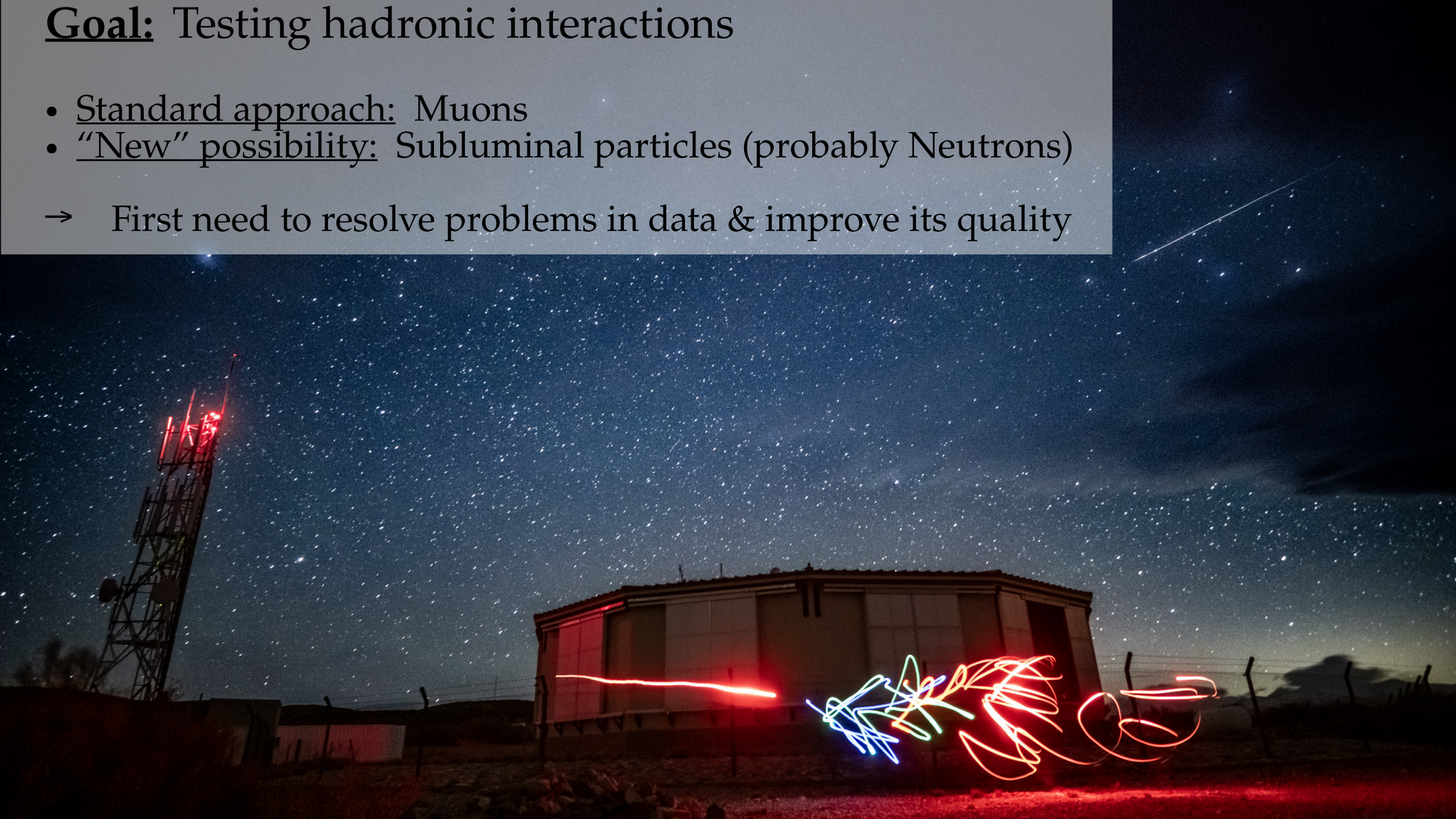
Annual meeting of DDAp and HIRSAP – 2023

**Goal:** Testing hadronic interactions

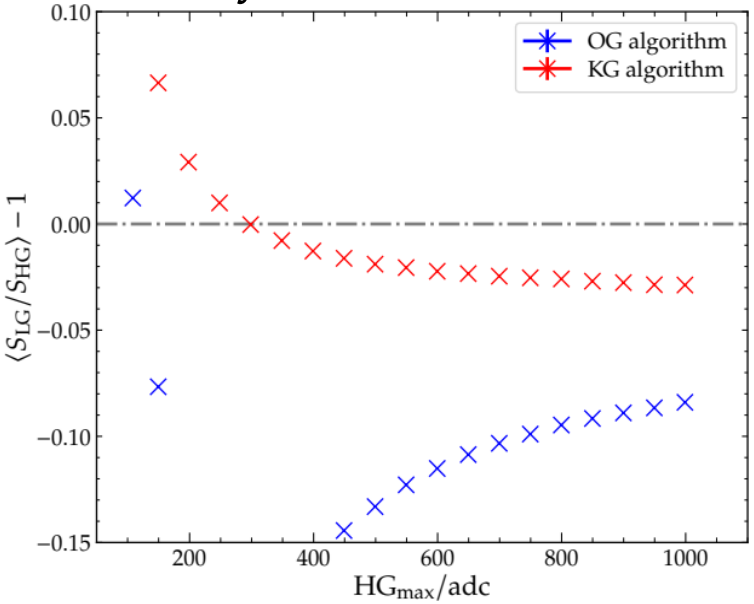
- Standard approach: Muons
- "New" possibility: Subluminal particles (probably Neutrons)

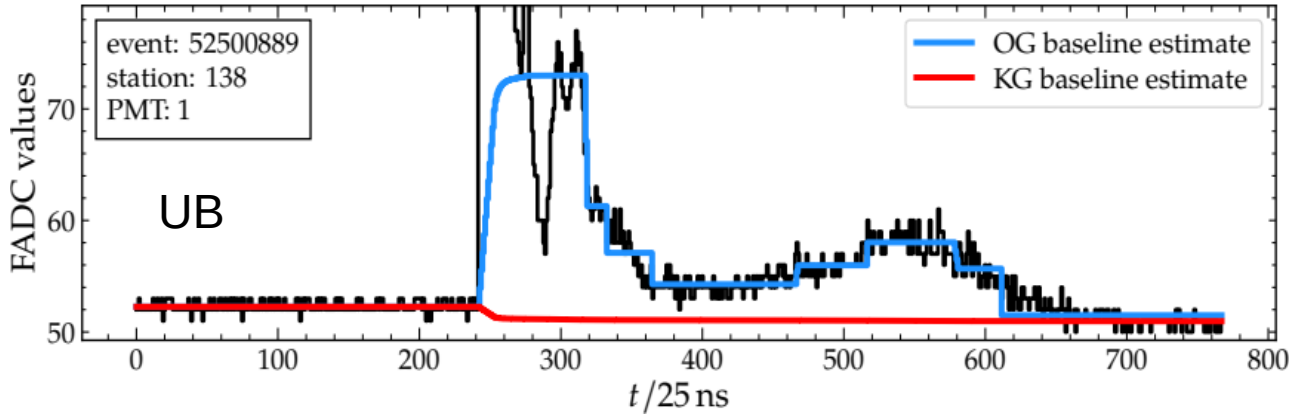
→ First need to resolve problems in data & improve its quality

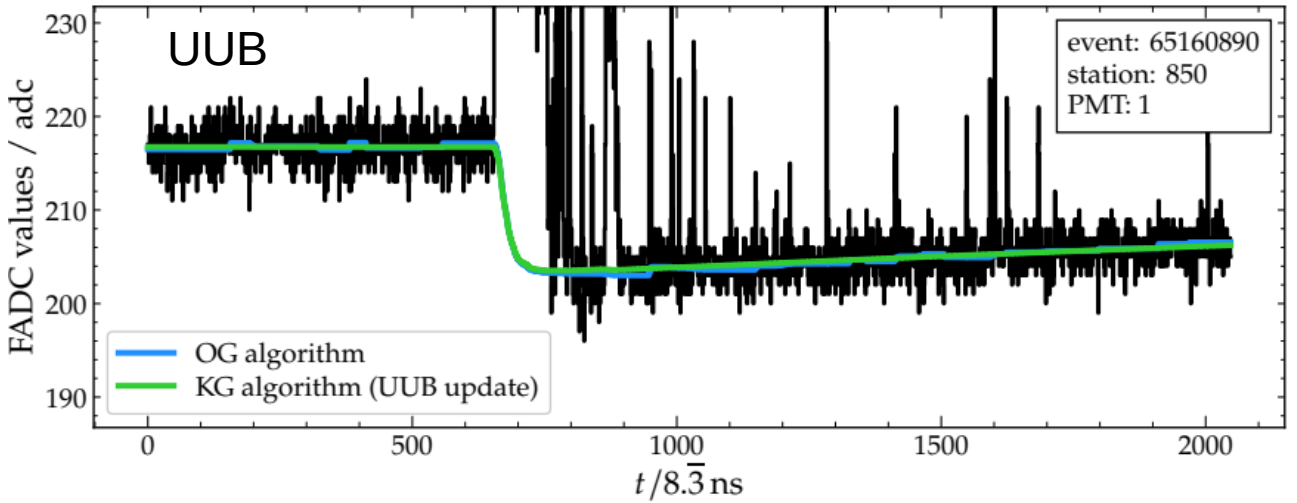


# Updated baseline algorithm

- Resolving LG/HG systematics
- Updated **baseline algorithm** to create physically motivated baseline
- Determined **decay time** of recovery UUB undershoot



## Improving quality of data

Done

- Rework of baseline algorithm for UB and UUB
- Correction of residual gain ratio bias
  → Significant reduction of systematic error in signals

## Muon deficit

On hold

- For now: analysis with simplifying assumptions to probe impact of changes to signals
- maybe return to this after neutron analysis
- possibility of improving muon signal resolution with shielding

## Subluminal Pulses

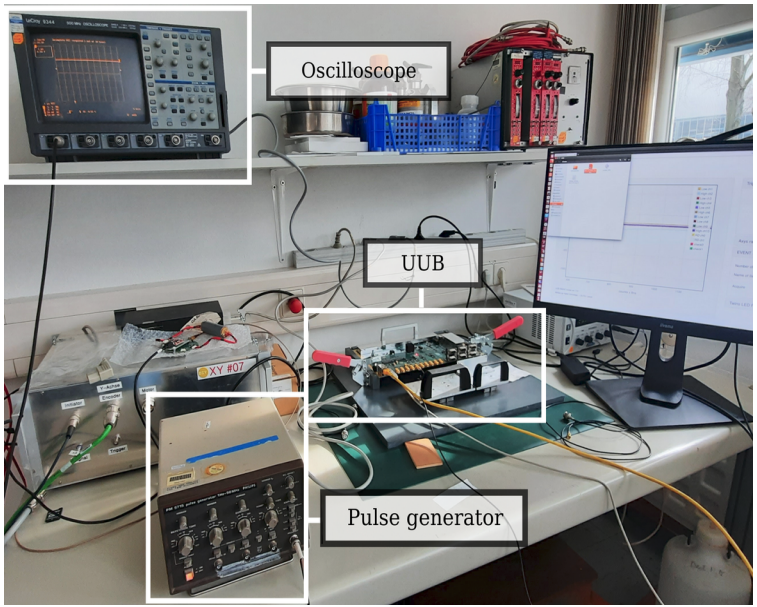
Ongoing

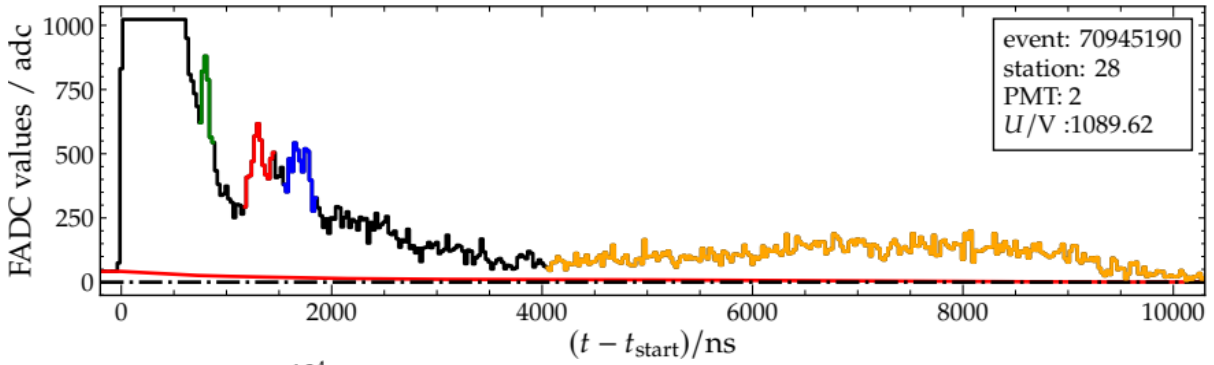
- Extensive analysis of late pulses in WCD
- Verification that Afterpulsing plays significant role for WCD
- Characterization of subluminal pulses (possibly late neutrons) in SSD traces

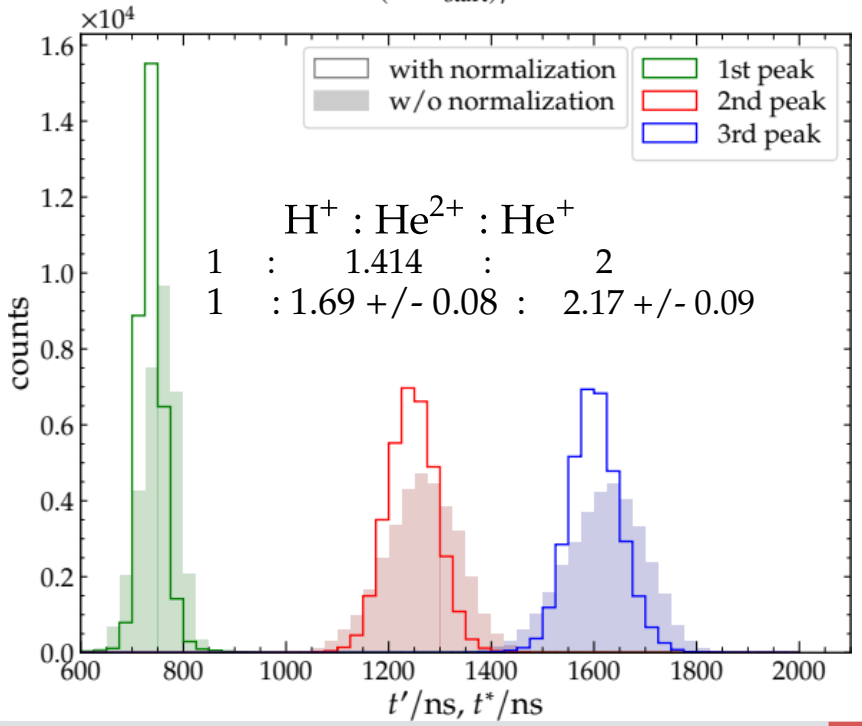
# Afterpulsing

- Analysis of **peak structures** in saturated traces
- **Lab measurements** to rule out electronics as cause

→ Peaks in WCD are afterpulsing effects



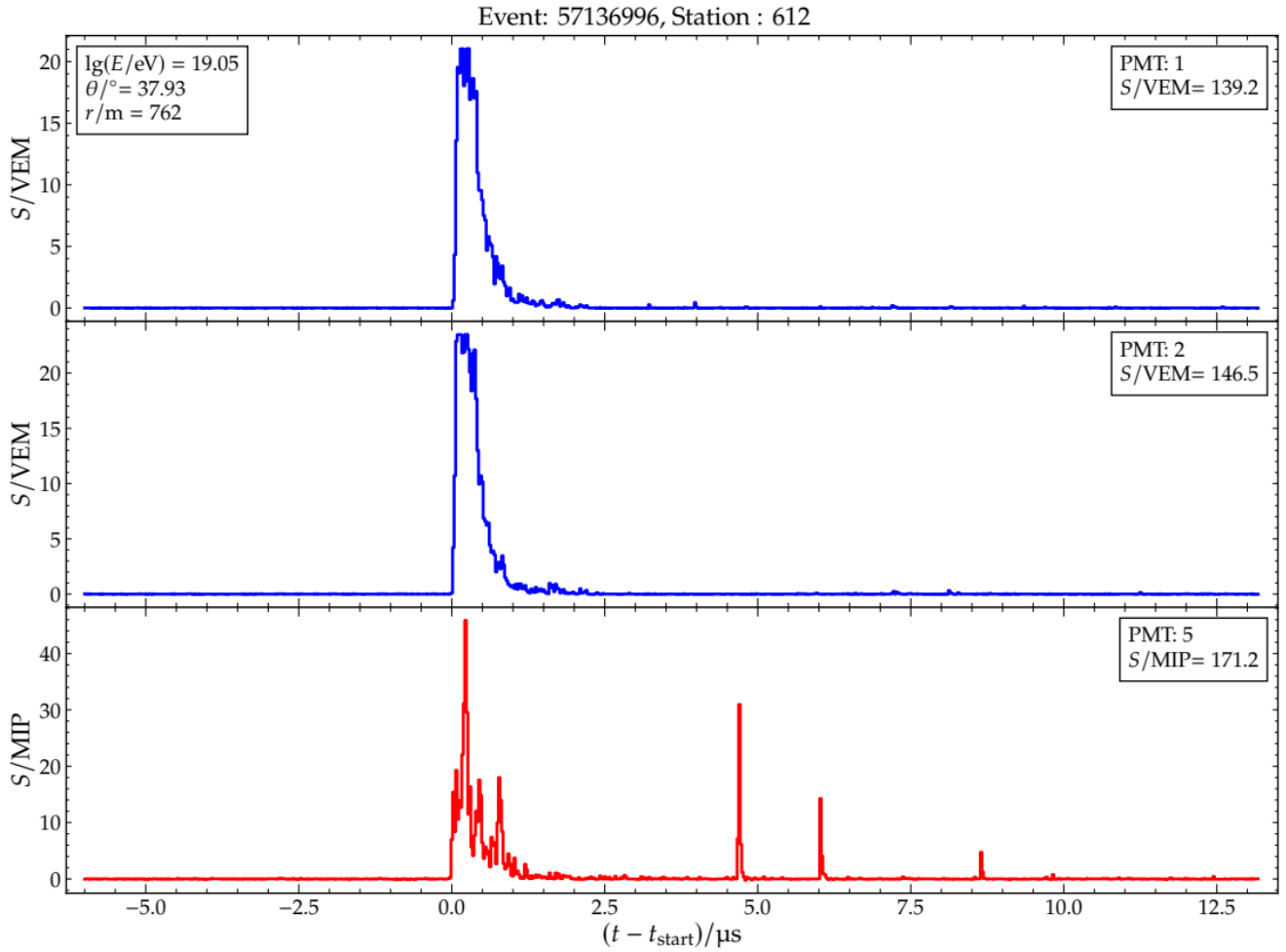



# Late pulses

- **SSD** traces contain late pulses
- **Characterization** of the late pulses
- Rule out detector effects, e.g. **afterpulses** (APs)
- Subluminal pulses (SLPs), e.g. **neutons**?

→ Get **energy spectrum** and **LDF**

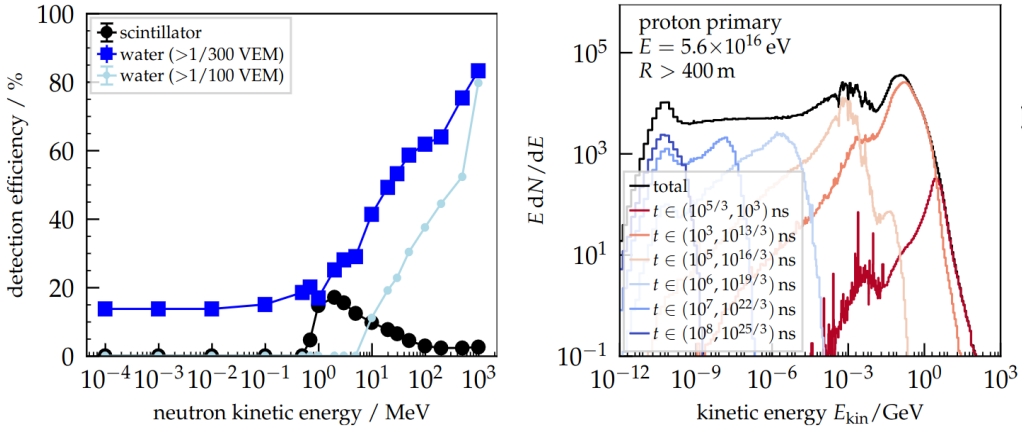


# Towards energy spectrum: Charge of late pulses

- Histogram the signal of single pulses that arrive past 5µs as first step towards **energy spectrum**

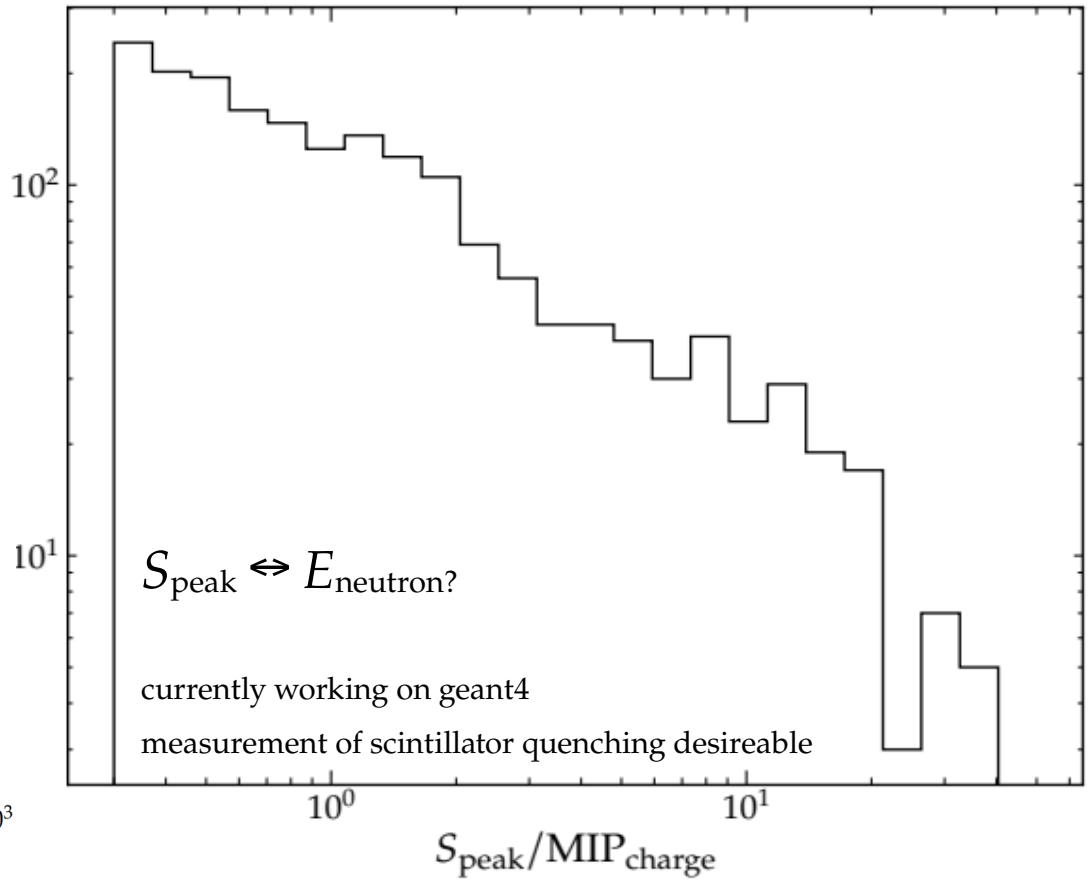
- Neutron **simulations** needed to get an energy spectrum from neutron signals

- Full **time-distribution** of late pulses **unknown**







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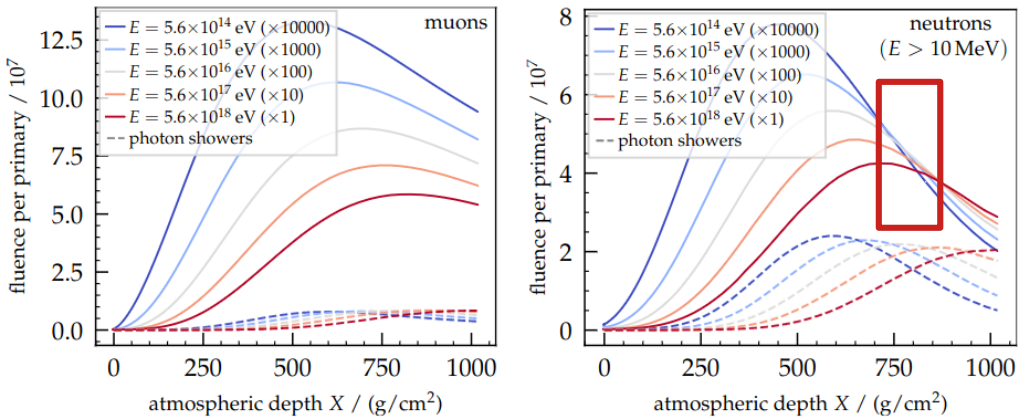
# Towards neutron LDF: Frequency of pulses

- Count average amount of candidate (or background) **peaks per trace**
- Account for **search-window** size & **normalize** by detector area
- Roughly **linear scaling** with energy expected at Auger depth

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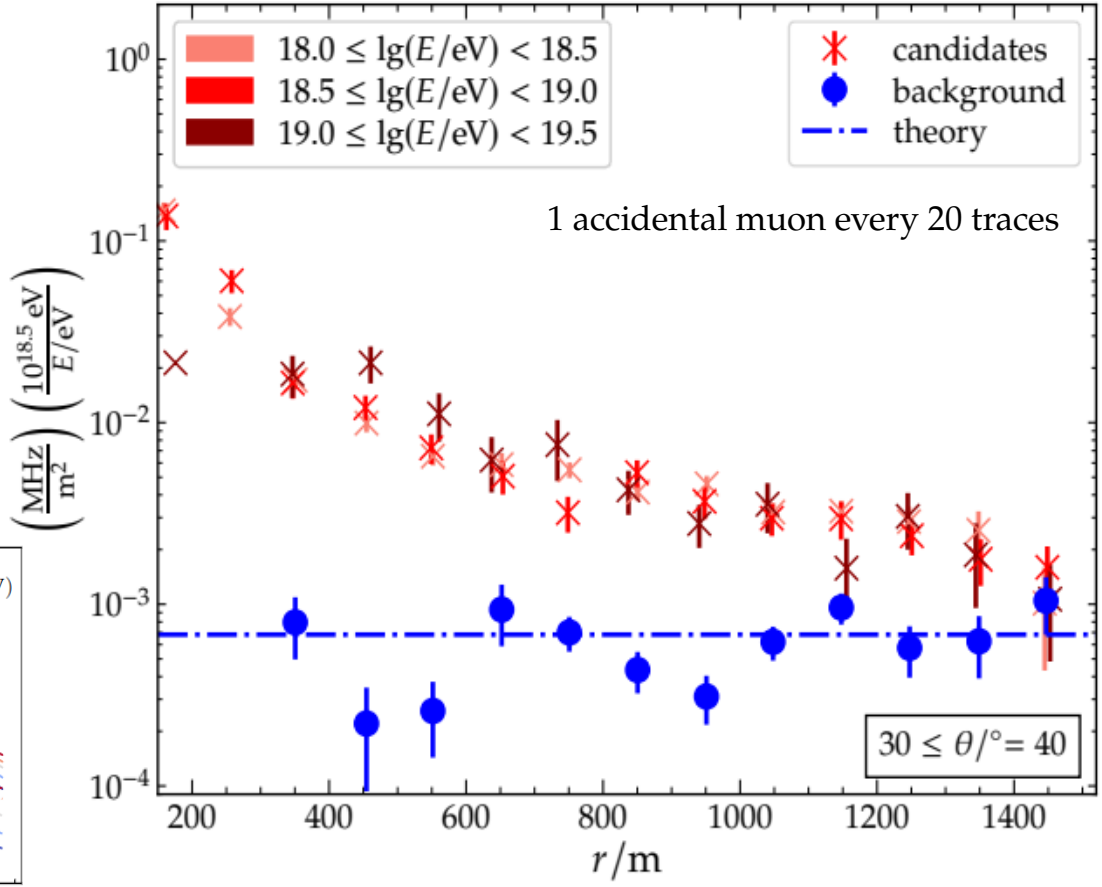


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# Zonda wind

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**Zonda wind** (Spanish: *viento zonda*) is a regional term for the foehn wind that often occurs on the eastern slope of the Andes, in Argentina.