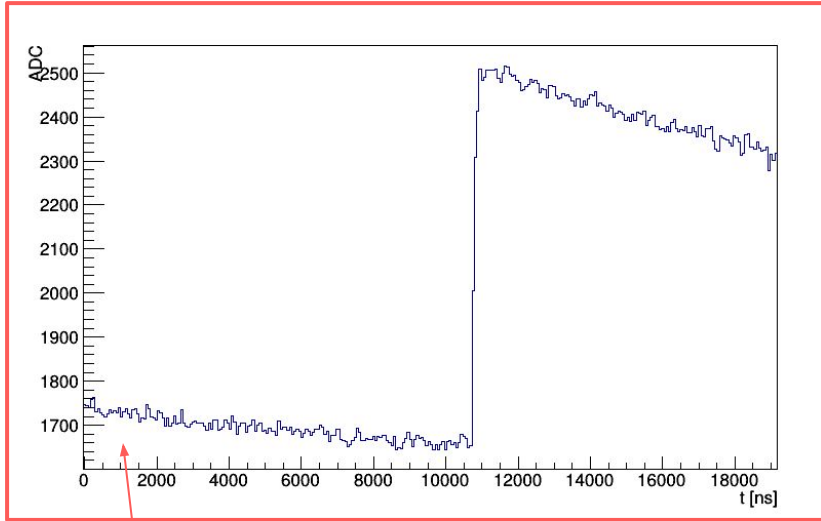# Pile up in LLAMA data

Elisabetta Bossio - 1 Feb 2022
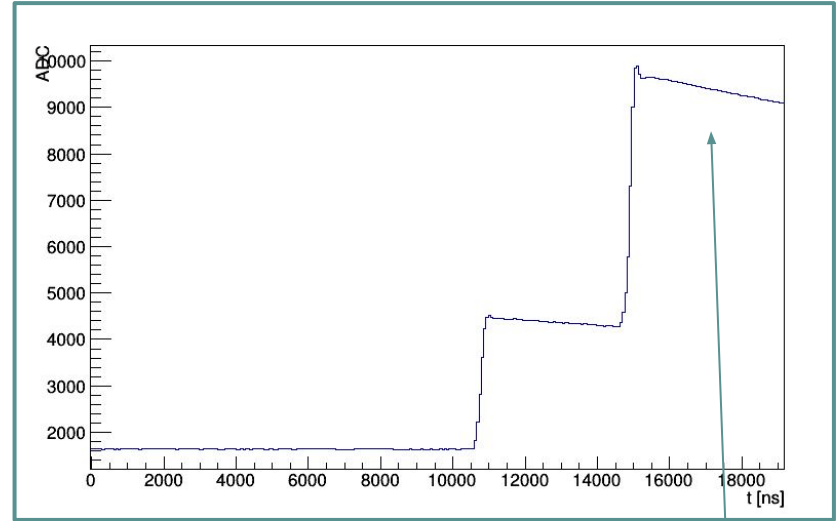
# We observe two types of pile up

**Pre-trace pile up**
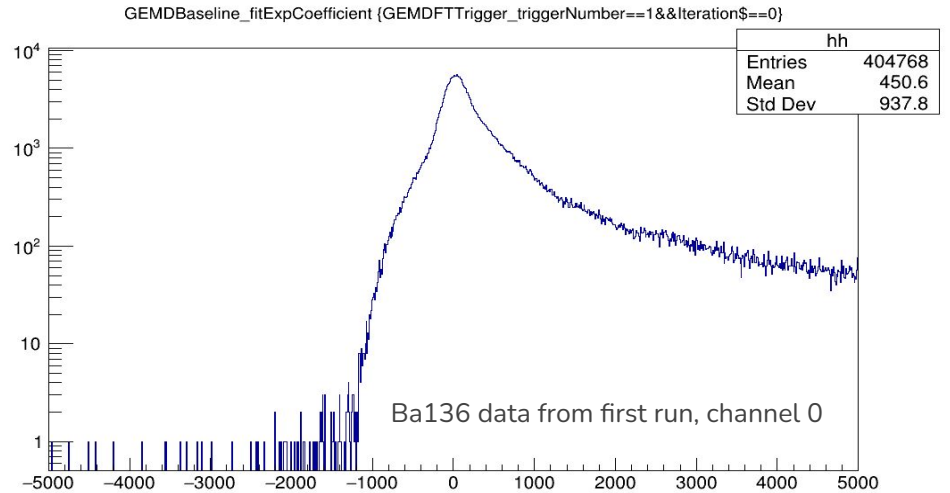
**In-trace pile up**

# Pre-trace pile up

Evaluate the slope of the **baseline\***

(\*between 0 and 8 us)



GEMDBaseline_fitExpCoefficient {GEMDFTTrigger_triggerNumber==1&&Iteration$==0}

| hh | |
|---|---|
| Entries | 404768 |
| Mean | 450.6 |
| Std Dev | 937.8 |

Ba136 data from first run, channel 0

# Pre-trace pile up

Evaluate the slope of the **baseline***
(*between 0 and 8 us)

We can select "good" events
= no pile up
|Baseline slope| < 200



GEMDBaseline_fitExpCoefficient {GEMDFTTrigger_triggerNumber==1&&Iteration$==0}

| hh | |
|---|---|
| Entries | 404768 |
| Mean | 450.6 |
| Std Dev | 937.8 |

Ba136 data from first run, channel 0
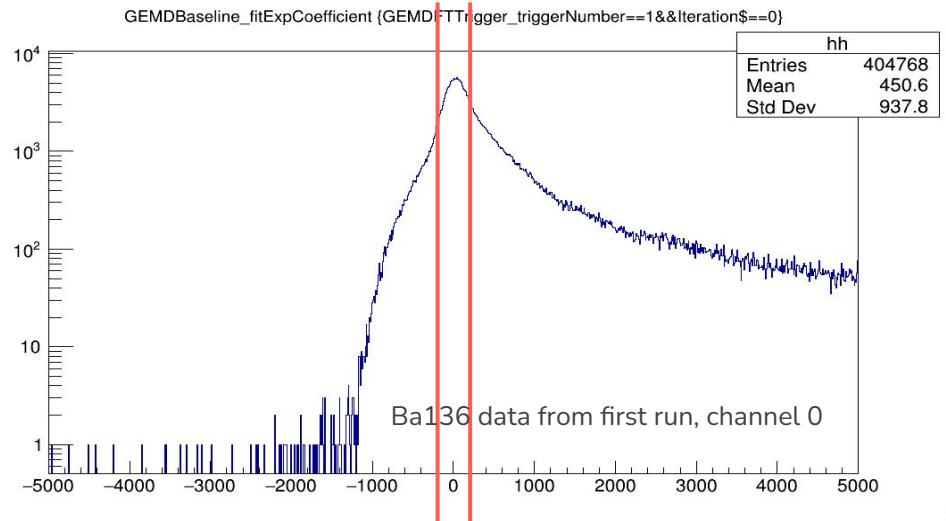
# How much pre-trace pile up?

- Select events with only 1 trigger = allEvents
- Tag events with |baselineSlope| < 200* = goodEvents
- PileUp fraction = 1 - goodEvents/allEvents





*like in previous slide
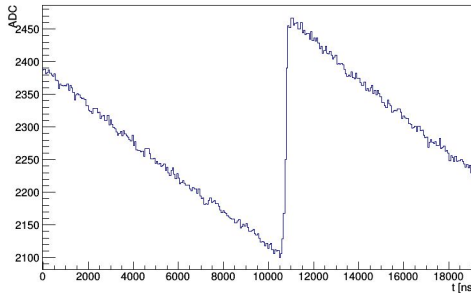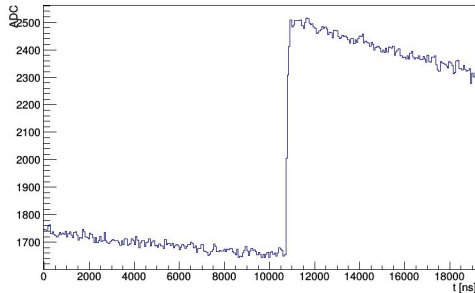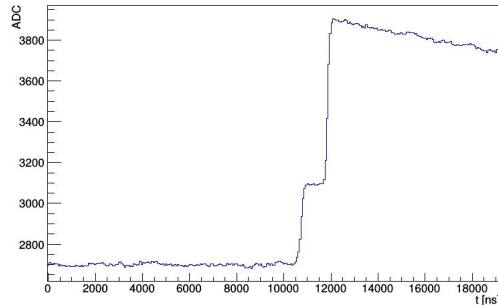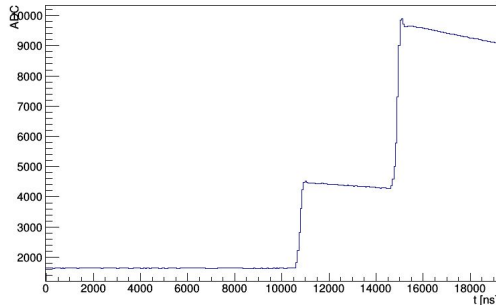
| channel | PileUp fraction |
|---------|-----------------|
| ch0 | 58% |
| ch1 | 41% |
| ch2 | 50% |
| ch3 | 38% |
| ch4 | 66% |
| ch5 | 39% |
| ch6 | 58% |
| ch7 | 57% |

# How much in-trace pile up?

- Select events with triggerNumber not 0 -> allEvents
- Select events with triggerNumber > 1 -> pileupEvents
- PileUp fraction = pileupEvents / allEvents

| channel | PileUp fraction |
|---------|-----------------|
| ch0 | 2.7% |
| ch1 | 2.0% |
| ch2 | 2.7% |
| ch3 | 2.5% |
| ch4 | 10% |
| ch5 | 2.0% |
| ch6 | 4.7% |
| ch7 | 4.6% |

# Strategy

- We want to recover events with **pre-trace pile up**, restoring the baseline to be flat
  - Not a problem for energy resolution -> the trapezoidal filter already does this step
  - Needed for precise trigger determination
  - More than 50% of the statistic
- We will cut the **in-trace pile up**
  - Energy reconstruction would need to be adapted to separate the two (or more) events in the trace, worse energy resolution
  - Not big lost ~5% of the statistic