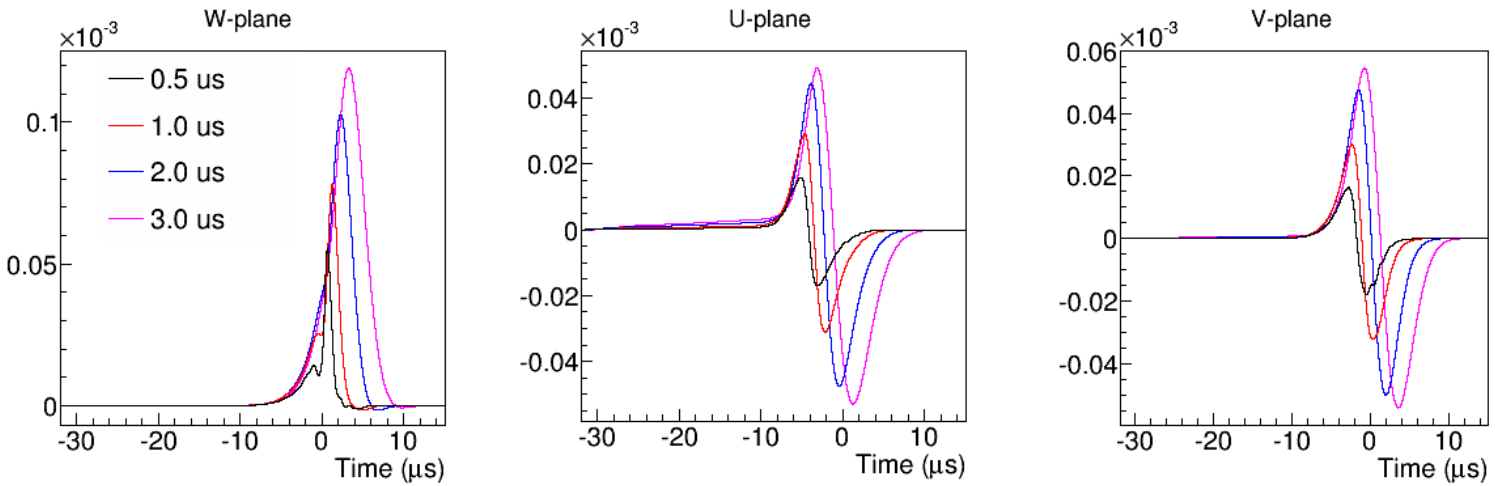
Two Important Issues for DUNE Data Rate Estimations

^{39}Ar event size, data rates, and zero suppression threshold.

$\sim$GeV event size estimation

Zero Suppression Threshold and ^{39}Ar Event Size

- Endpoint 565 keV, ∼25% above **ZS threshold of 500 keV** (LBNE DocDB 3018)
- 1.0 Hz/kg ^{39}Ar decay (ICARUS ^{39}Ar/^{42}Ar NIM paper)
- ^{39}Ar event size: **100 samples** (10μs/waveform * 2 samples/μs * 5 wires) (1 collection wire, 2 each from induction planes). Prior estimate was 24 samples.



Need **at least** 10μs to capture waveform of point ionization because of **electronics shaping time**.
(data from DocDB 10651, plot by Xin Qian)

- ^{39}Ar total = **53 PB/year!** In-spill = **159 TB/year**. Just with-beam-ν activity = **79 GB/year**.
- **Can we simply raise zero-suppression threshold to 0.6 MeV???**

Size of ∼GeV events: 10MB → 2.5MB → 0.1MB

- Initial estimate (T.Junk) using LArSoft `raw::RawDigit/fADC`: 10MB/event uncompressed (UC), zero-suppressed (ZS)
- I confirm the estimate but find some unneeded bits:
  - duplicate counts for number of samples/channel.
  - `pedestal`, `sigma` and `compression` integers on **all** channels/readouts.
- If I ignore these: **2.5MB/event** (UC, ZS).
  - With ROOT **compression**: ∼**0.1MB/event** (at ∼10GeV)
- Still bloated: 100 MeV is still 2.45MB/event!
  First principles, expect MIP: ∼20 kByte/GeV (UC, ZS).
  - More than ∼2MB/event is empty-channel overhead
  - However, it's quite compressible (×25)

For now, we take **2.5MB/event** (UC, ZS), **0.1MB/event** (comp+ZS).

Etc

- See CDR's `annex-rate.pdf` for some details.
  - All parameters in `cdr/data/parameters.xls` and `cdr/python/parameters.py`.
  - Please locate bugs!
  - Fixes get automatically rolled into `annex-rate.pdf` and S&C CDR chapter.
- Not all these updates got in to CDR release "v6" for the editorial team review.
- If we can avoid the empty-channel overhead bloat, expect further reduction in the ∼GeV scale event sizes.

→ We need to rework SPCP run plan in light of this improved data size estimate!