# Multicomponent drift gas mixtures for the SHiP Muon Magnetic Spectrometer

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# Content

# SHiP experiment

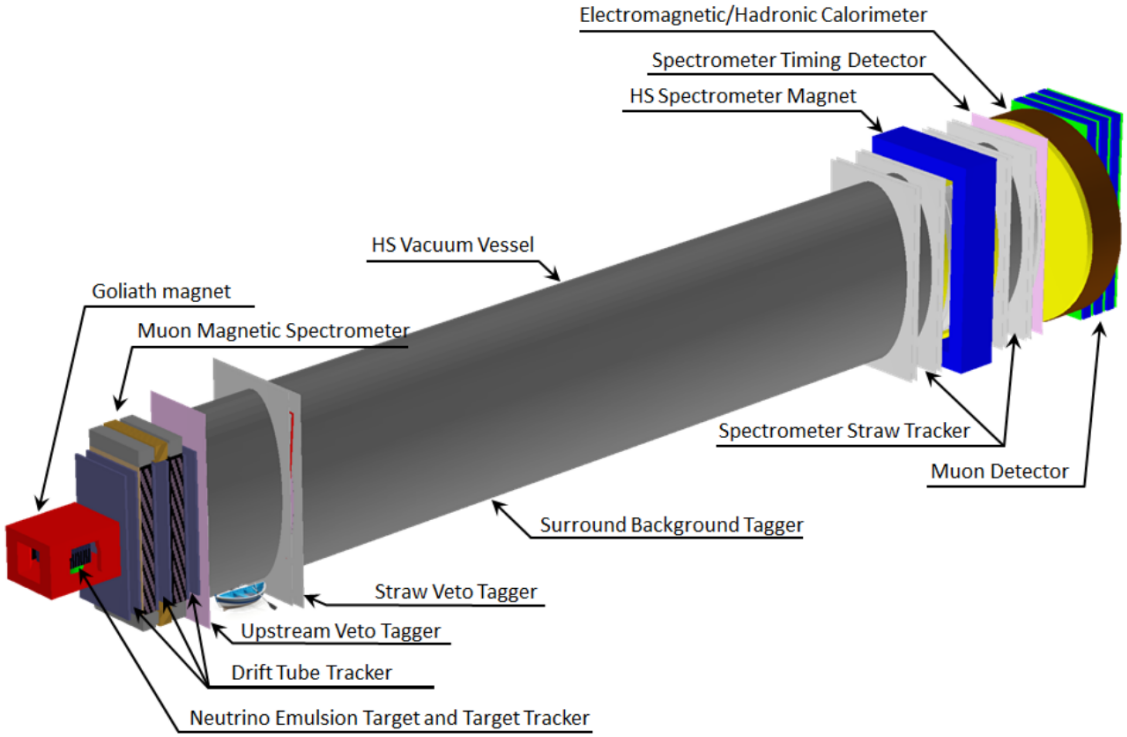


Figure: SHiP detector layout [1]

- Proposed beam dump experiment (SPS beam)
- Search for Hidden Particles

# Test setup

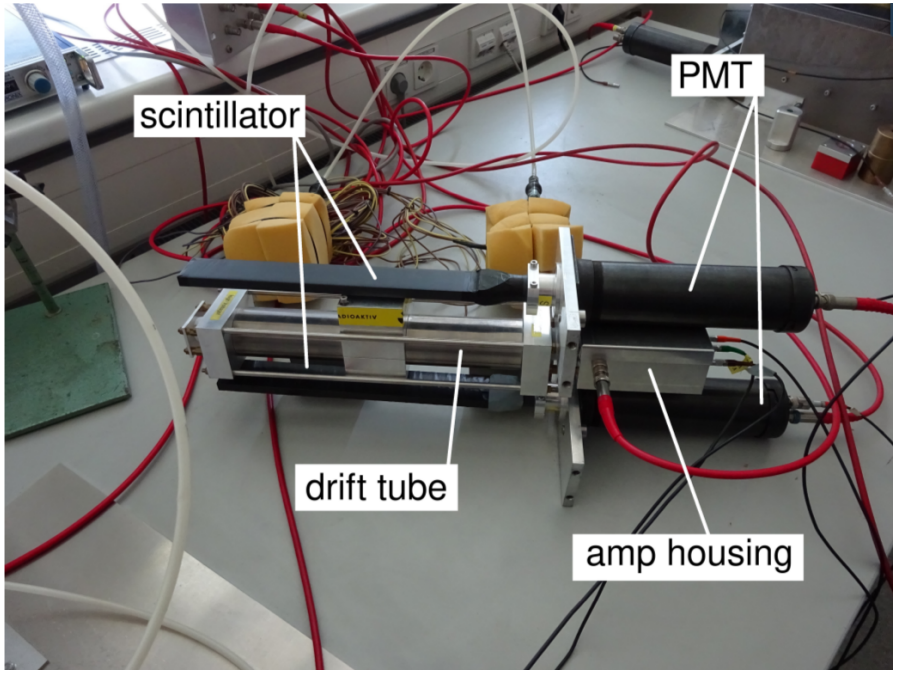


Figure: Photo of the experimental setup

- shortened tube from OPERA mass production
  - $L = 30\,\text{cm}$
  - $r \approx 1.8\,\text{cm}$
- gas at atmospheric pressure
- FADC readout

**goal**

Find a drift gas mixture that is fast and has a *more* linear *rt*-relation

# Raw FADC data

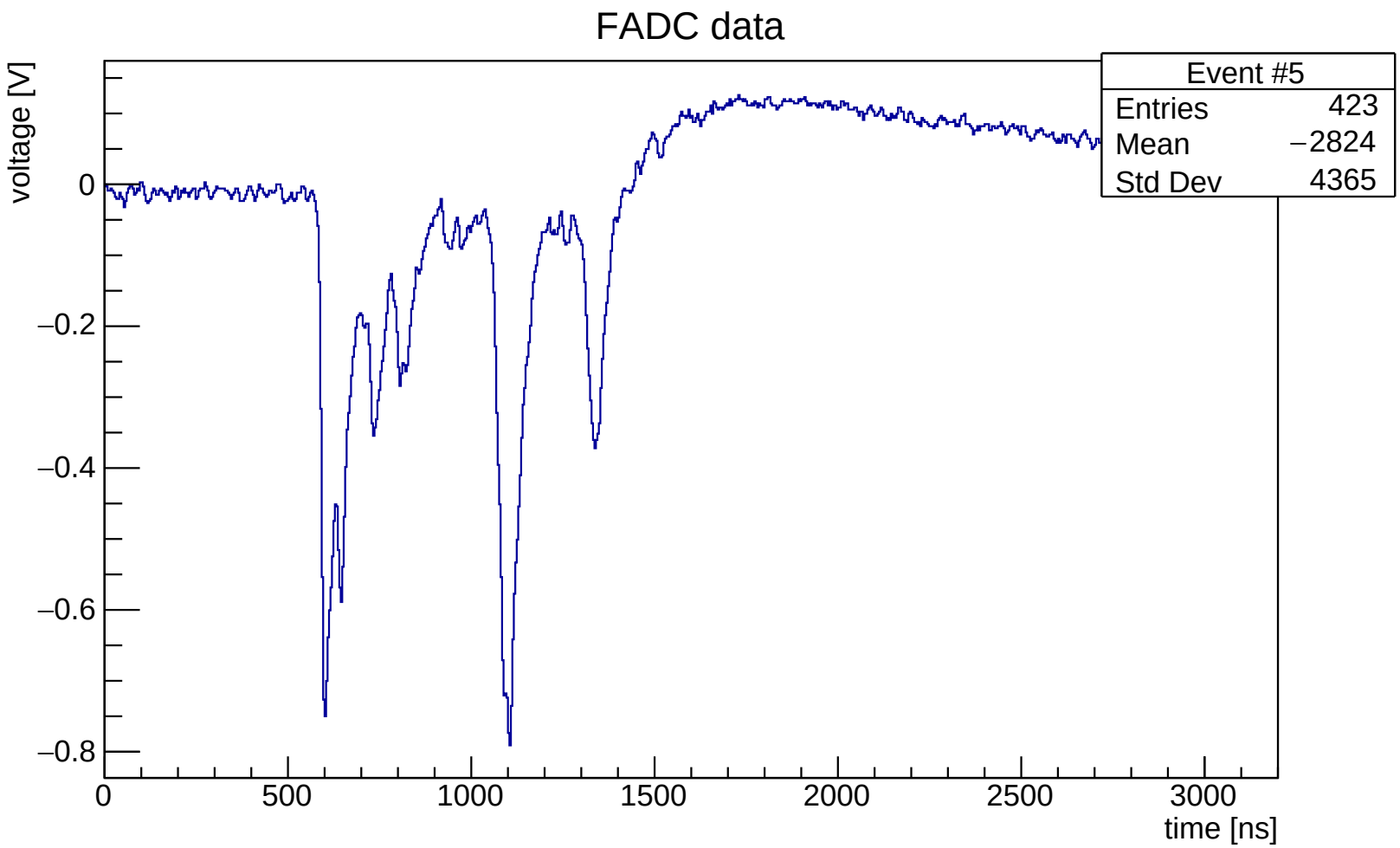


Figure: Voltage pulse for Ar:$CO_2$ 80:20

# Raw FADC data

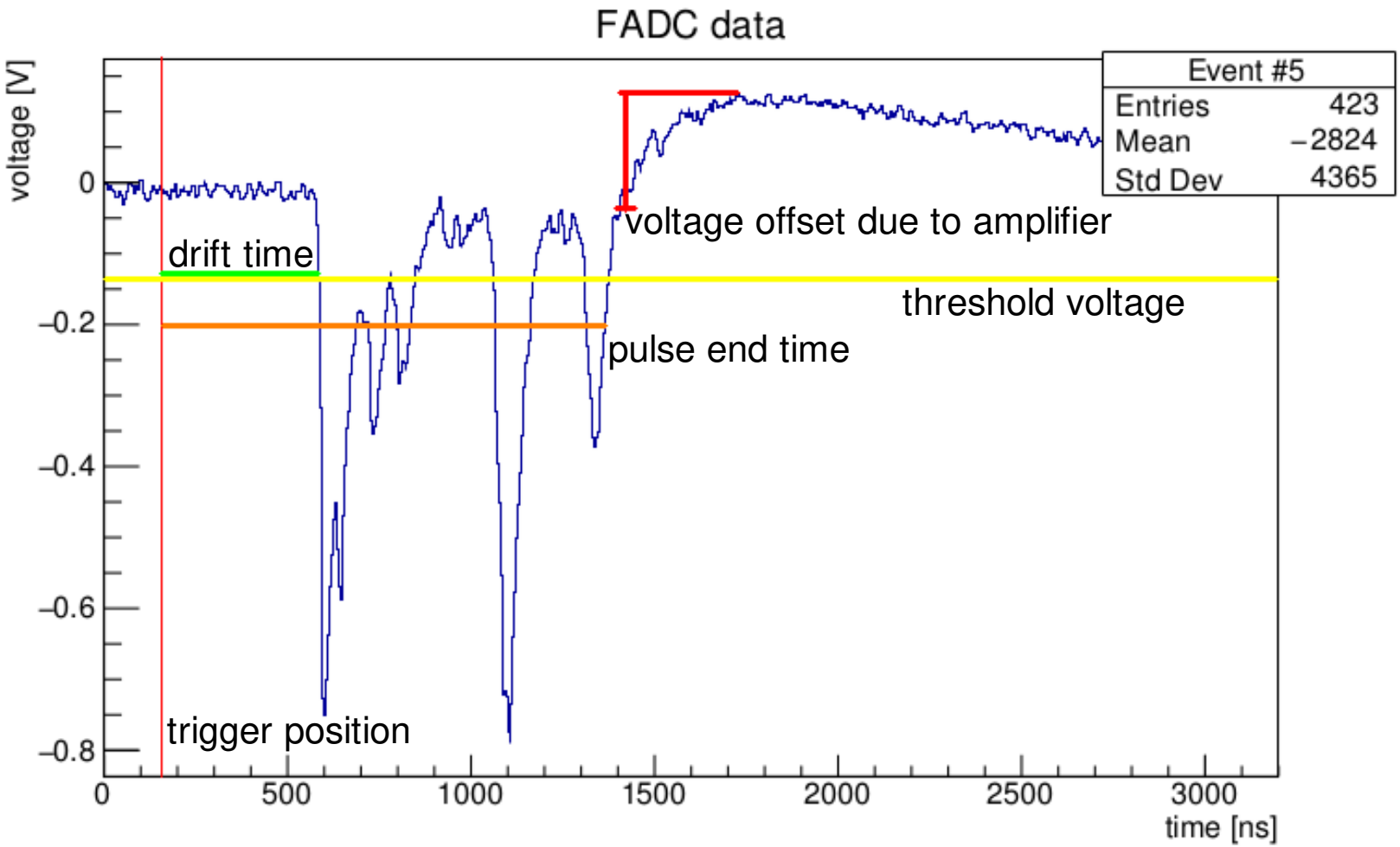


Figure: Voltage pulse for Ar:$CO_2$ 80:20

# OPERA gas mixture

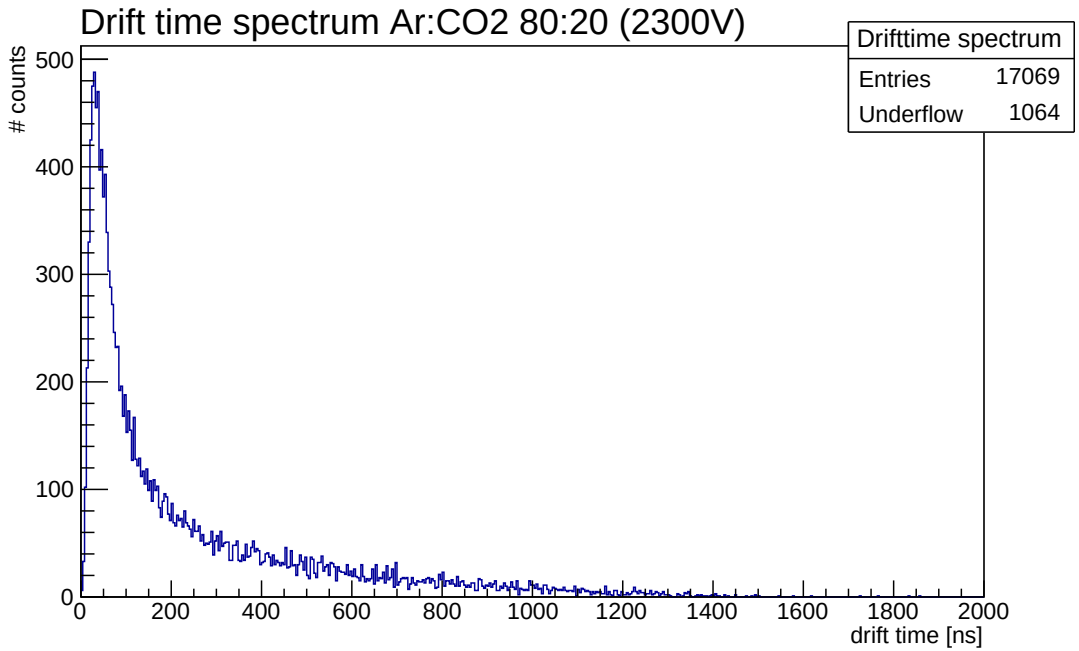


Figure: Drift time spectrum for Ar:$CO_2$ 80:20

- Reproduction of known results from OPERA with FADC readout
- Maximum drift time around 1.5 $\mu$s
- Edge effects present for all gases, remain comparable

# Drift time spectra overlay

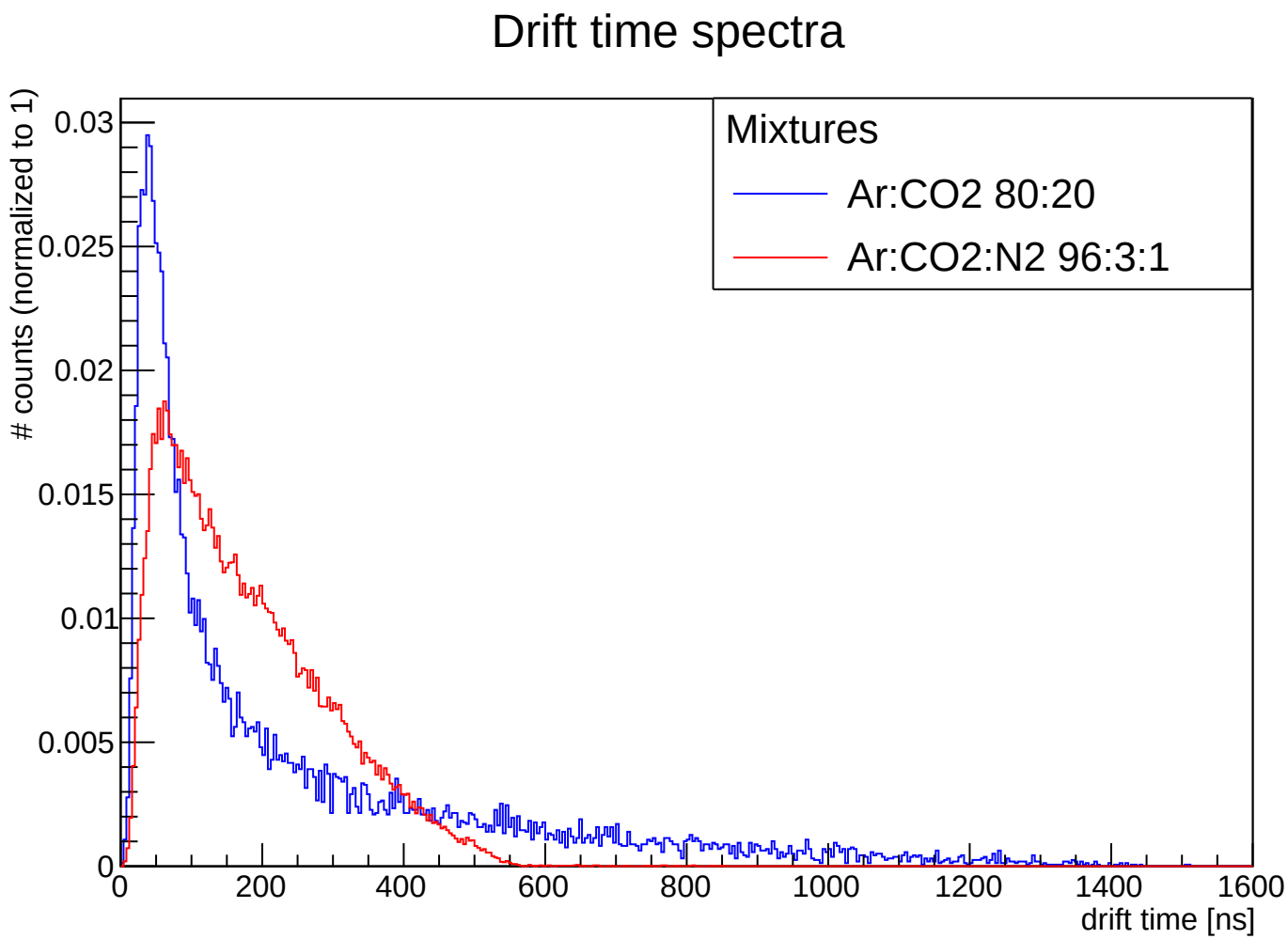


Figure: Normalized drift time spectra

# *rt*-relations for Ar:$CO_2$ 80:20 and Ar:$CO_2$:$N_2$ 96:3:1

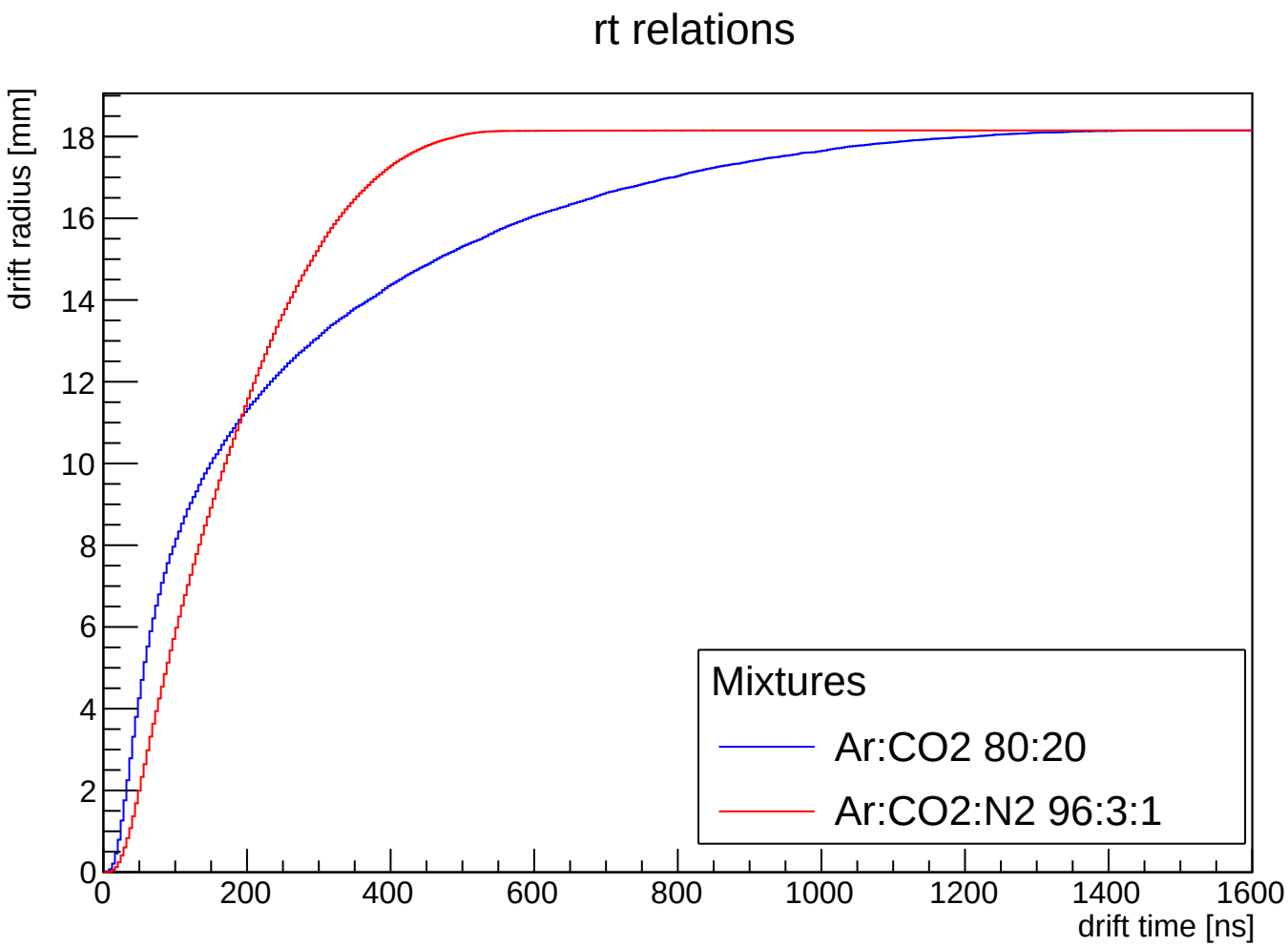


Figure: overlay of the *rt*-relations

# Ar:$CO_2$:$N_2$ 96:3:1 pulse shape

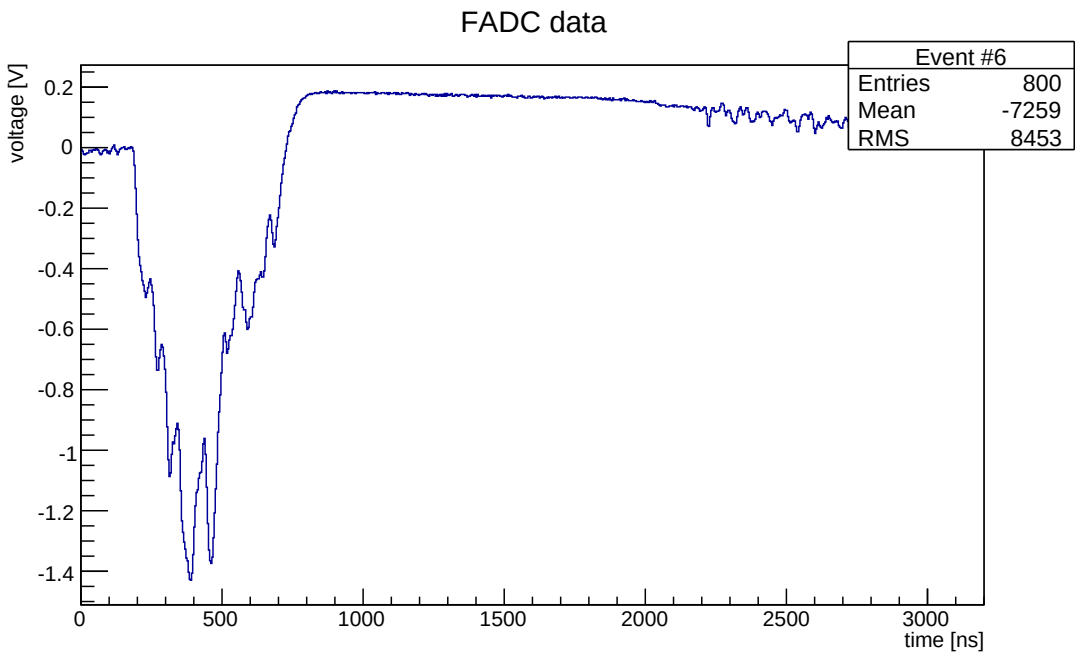


Figure: Voltage pulse for Ar:$CO_2$:$N_2$ 96:3:1

- signals of individual pulses overlap

$\Rightarrow$ possible to determine time of pulse end

  - correlated with time of particle transition

# Summary and outlook

## Summary

- reduction of maximum drift time of about 40%
- significantly more linear *rt*-relation

## Outlook

- spatial resolution
- dependence on high voltage

# Thanks

Thank you for attending

# Bibliography


SHiP Collaboration.
A facility to Search for Hidden Particles (SHiP) at the CERN SPS.
Technical proposal, CERN, April 2015.
arXiv:1504.04956v1.

# Pulse integrals

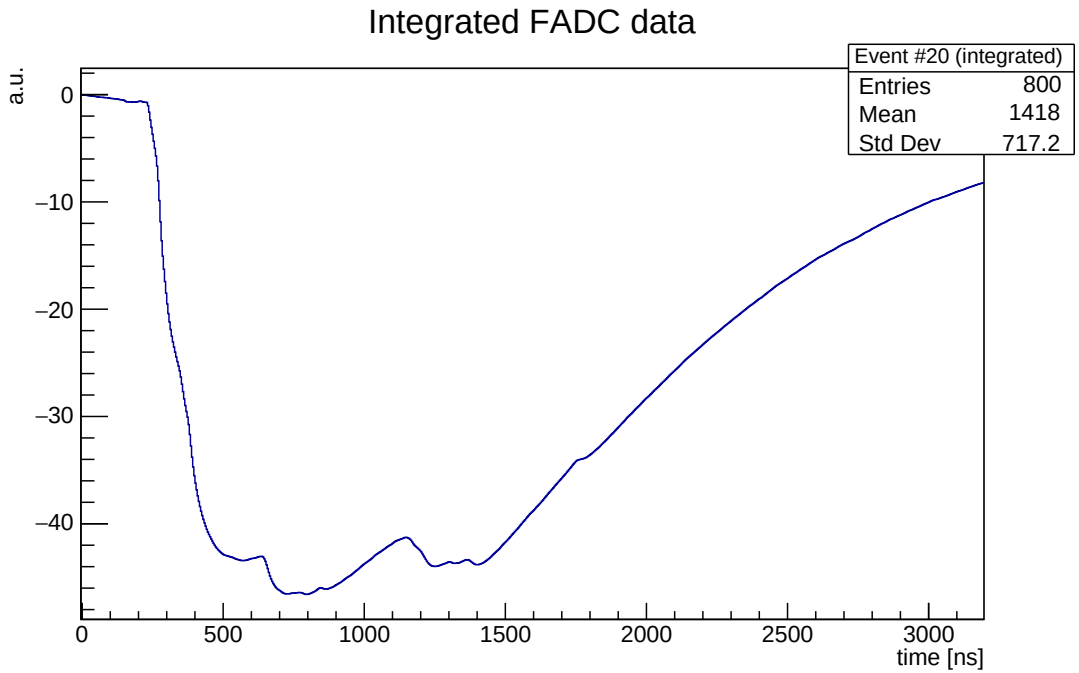


Figure: Pulse integral for Ar:$CO_2$ 80:20

# Integral minimum distribution

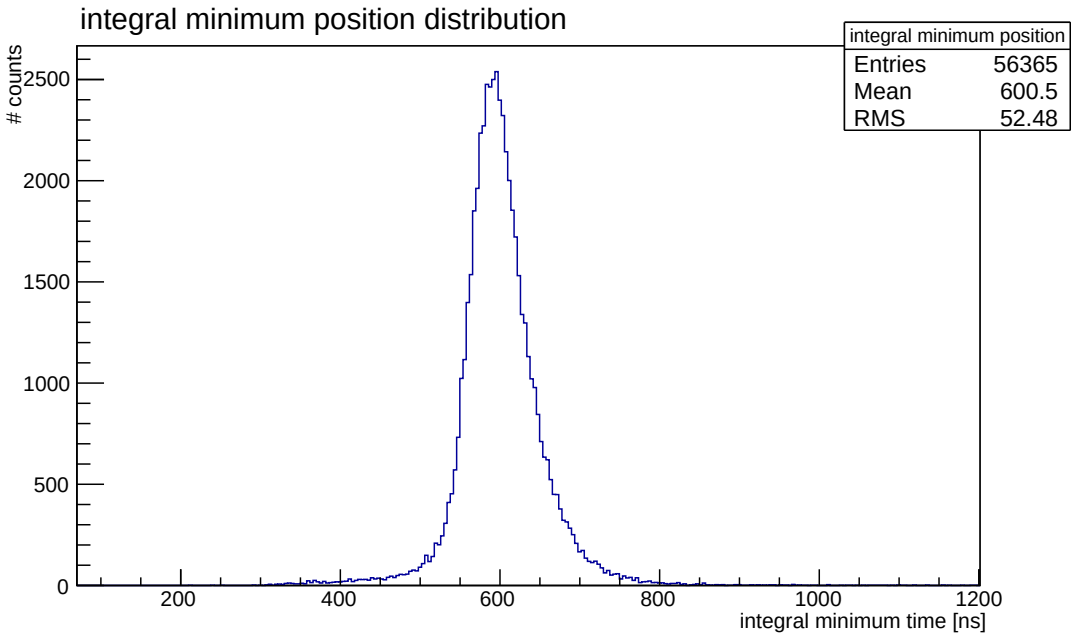


Figure: Integral minimum distribution