Xenon doping analysis in pDUNE

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15/05/2020
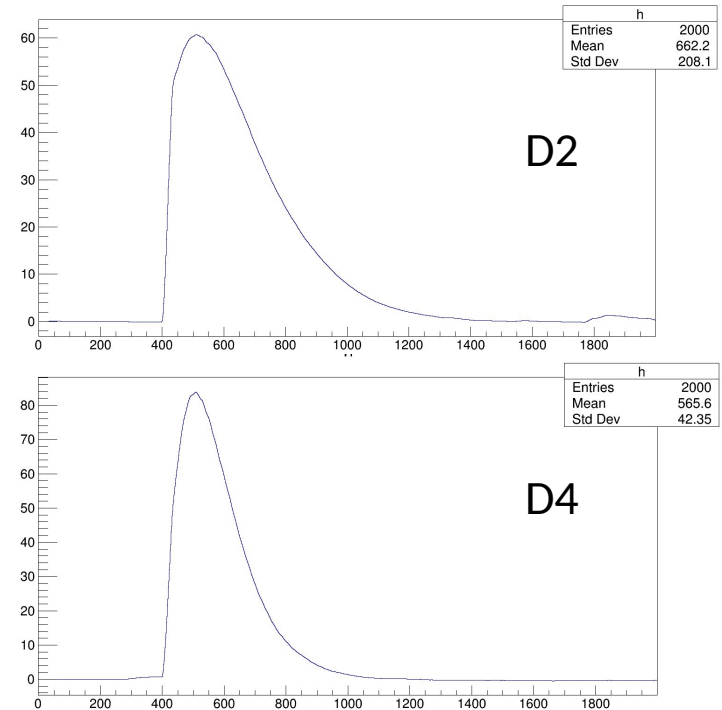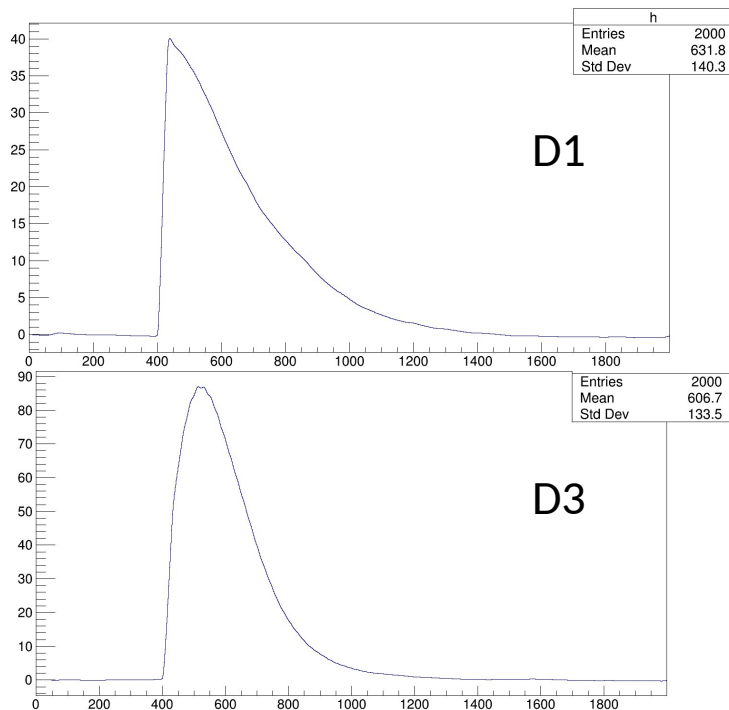
Data-sets

- Data collected with standalone SSP

- External trigger

- Time period: 12/02 to 13/05

- 4 doping steps:

  - 1 ppm

  - 3.3 ppm

  - 11 ppm

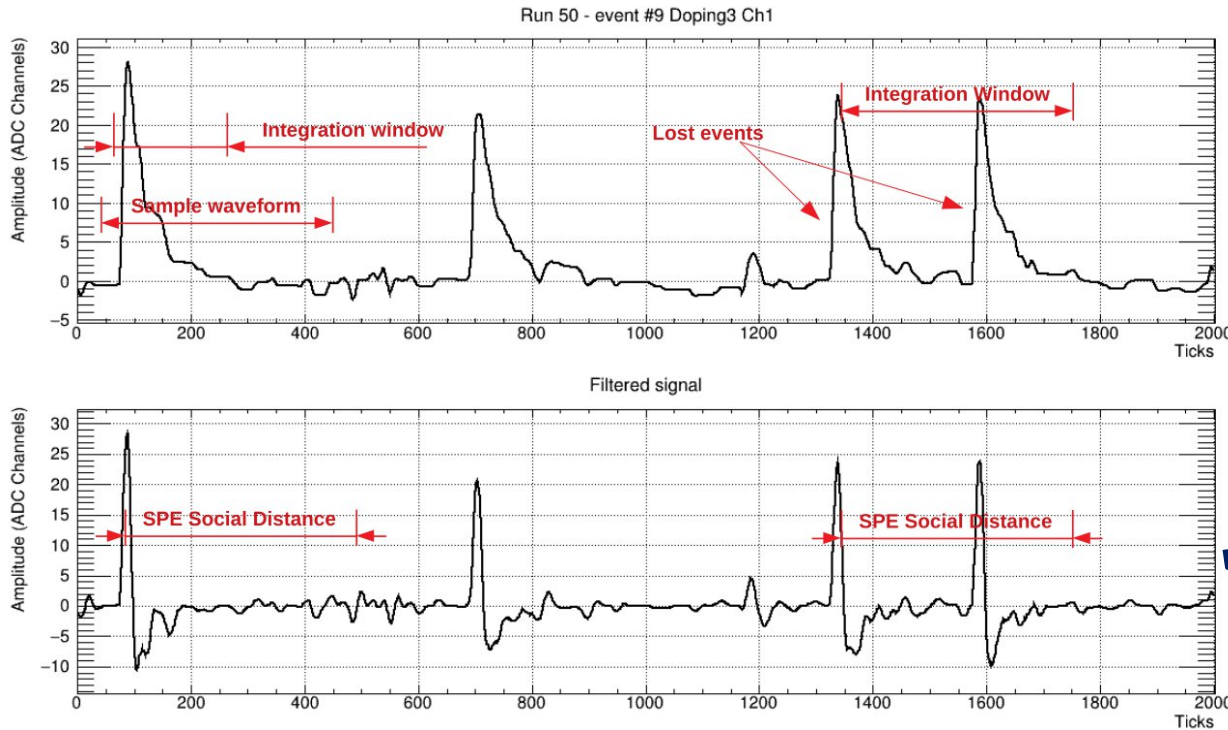 - 15 ppm

Average waveforms

- Waveform filtered with a moving average

- Baseline subtraction event by event

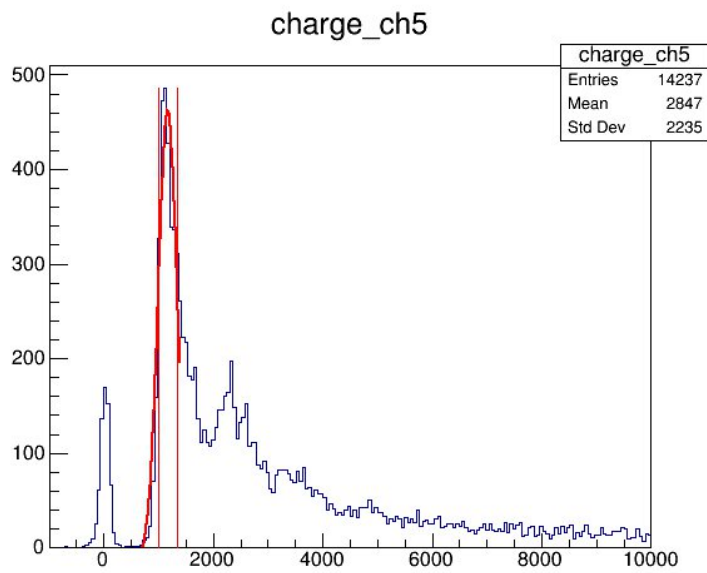- Average of all waveforms channel by channel
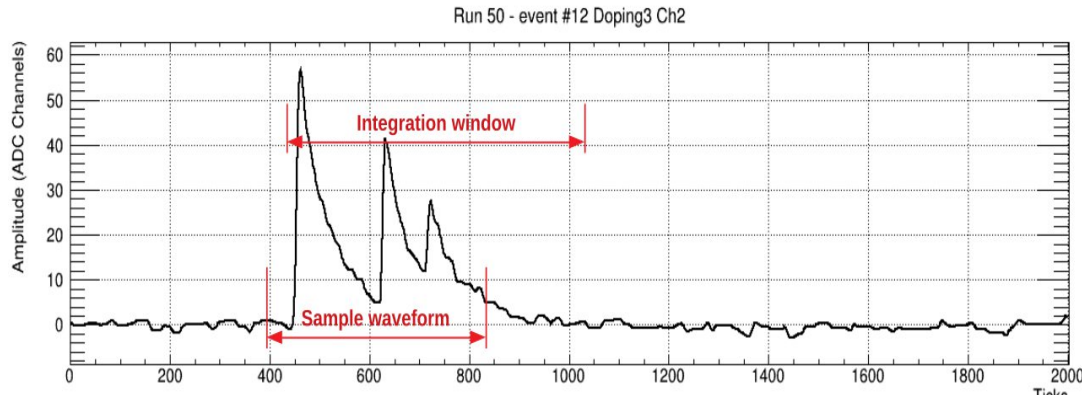
SPE evaluation

- Peak finder

- Computing SPE distribution

- Select 1 PE events
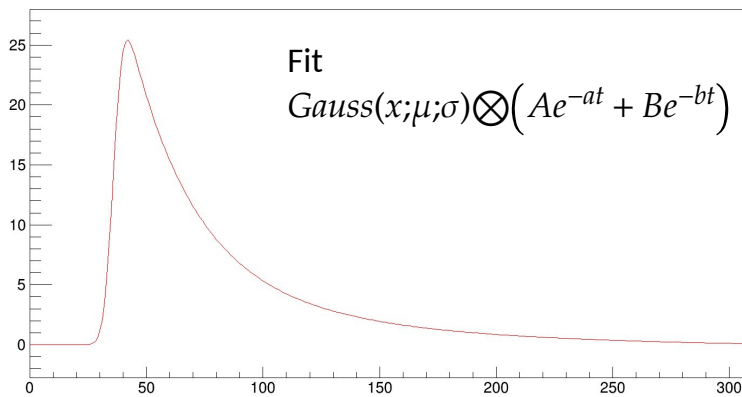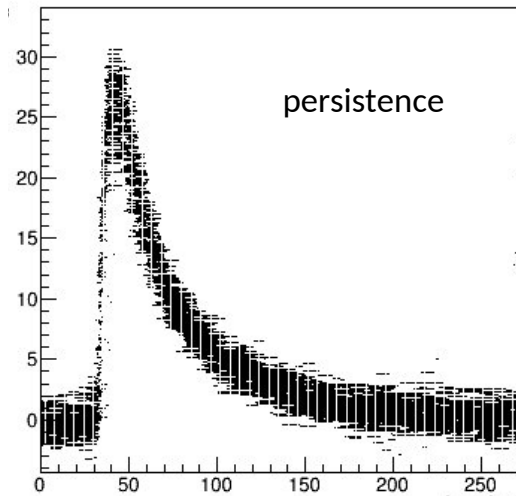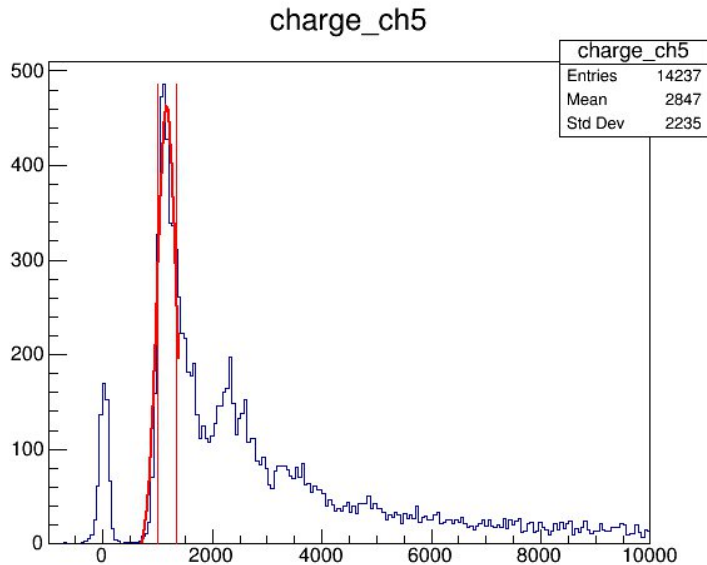
- Align and average

SPE evaluation - Peak finder

Run 50 - event #9 Doping3 Ch1

Filtered signal

Delay-line shaping: the acquired waveform is shifted by Δt and subtracted

SPE evaluation - distribution

Run 50 - event #12 Doping3 Ch2
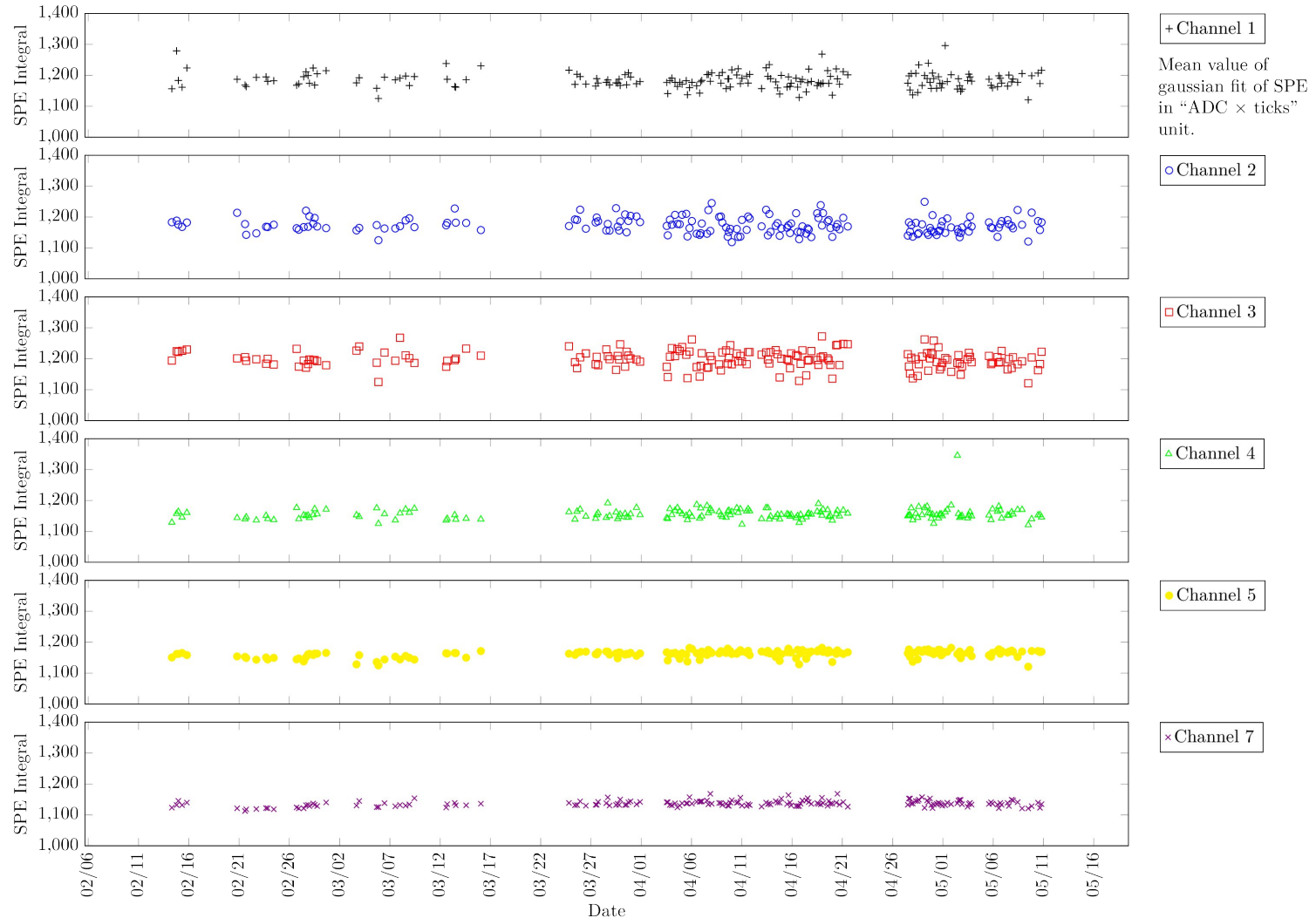

charge_ch5

- Integrate together events that are not isolated

- If an event is isolated integrate for "200 ticks"

- If events are close integrate from first peak to last peak + "200 ticks"

- Histogram of results

- Fit 1 PE with a gaussian

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SPE evaluation - selection

charge_ch5

charge_ch5	
Entries	14237
Mean	2847
Std Dev	2235

persistence

Fit
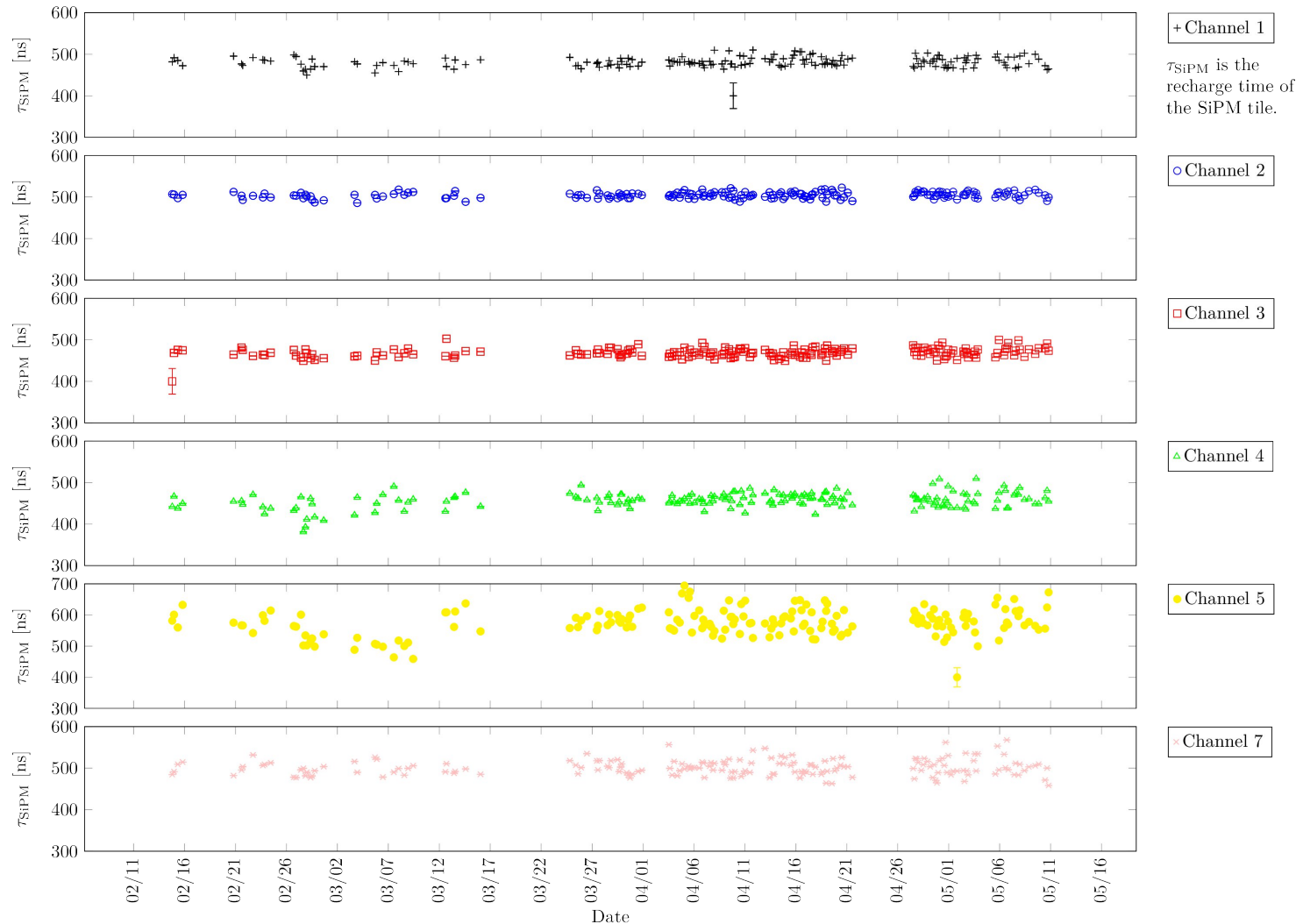$$Gauss(x;\mu;\sigma) \otimes \left(Ae^{-at} + Be^{-bt} \right)$$

- Select waveforms with integral in $[1PE - \sigma, 1PE + \sigma]$
- Select waveforms with the peak in the first 400 ticks and in the last 600 ticks of the acquisition window.
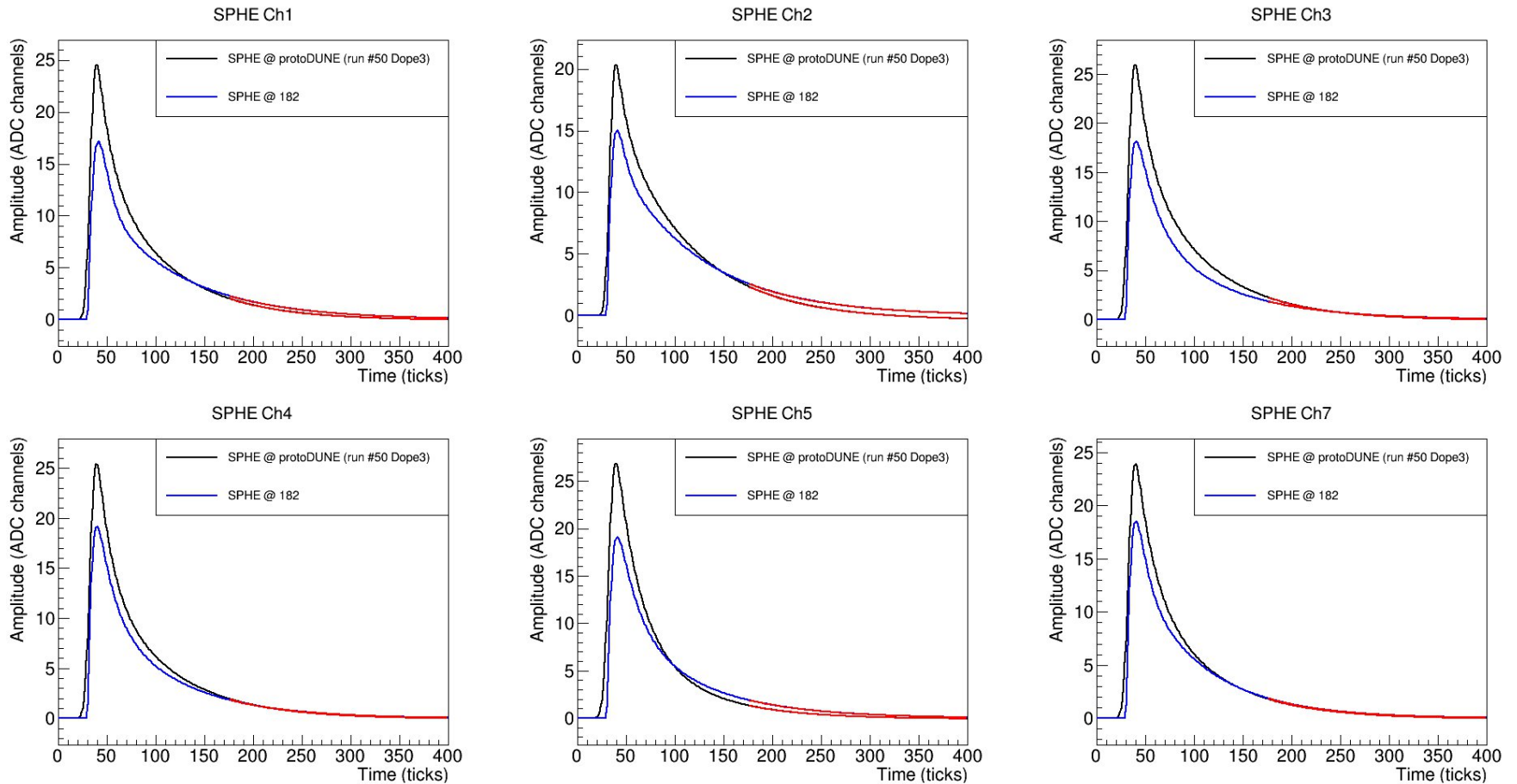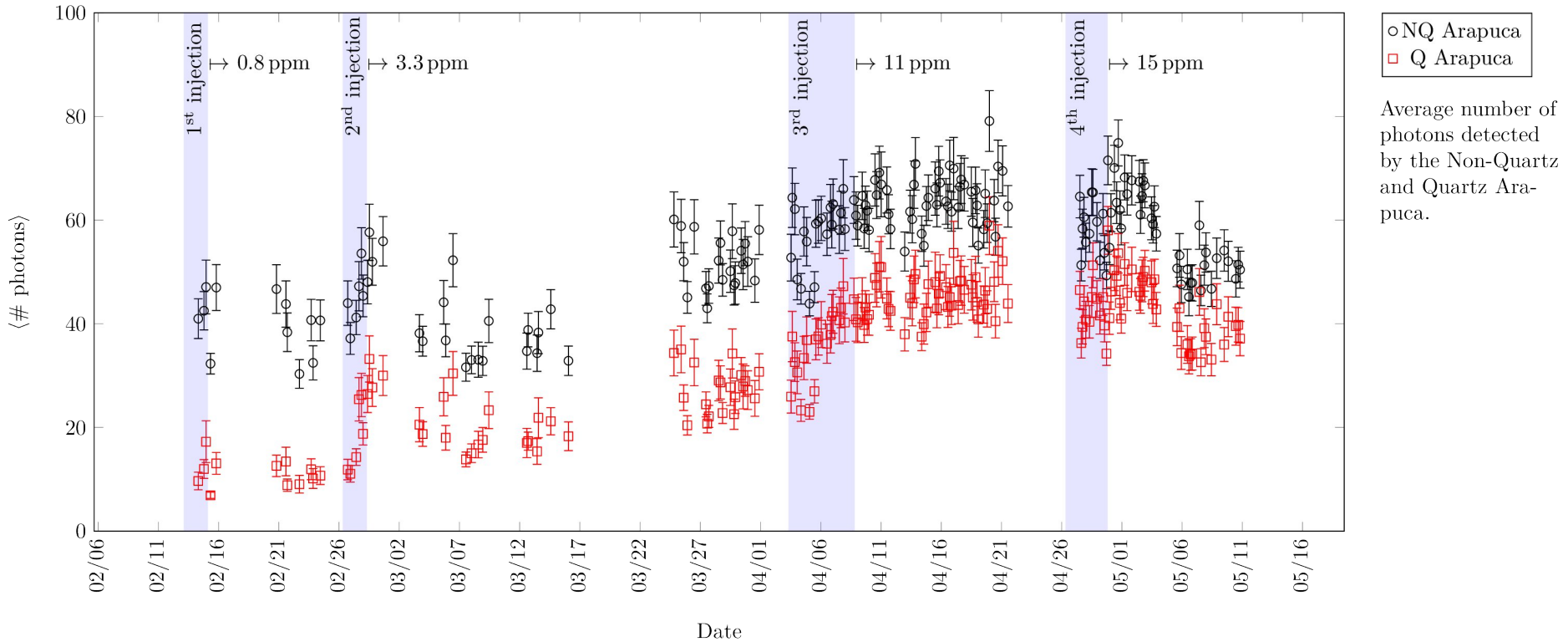- Fit the average waveform
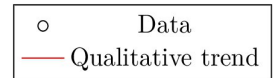
INFN MILANO

DUNE

SPE - Charge stability

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SPE - Recharge time stability

SPE 182 vs pDUNE
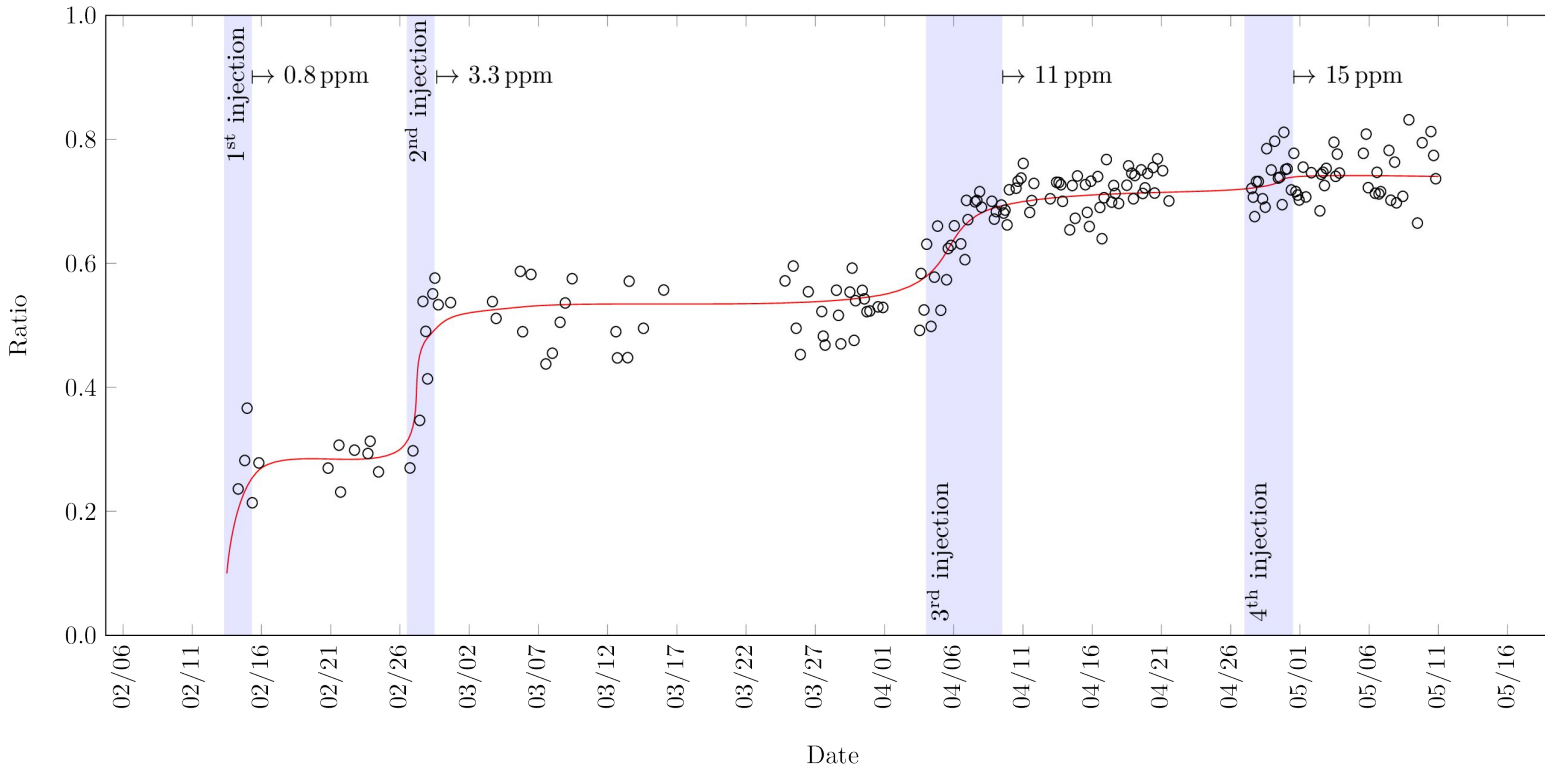
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Collected light

Average number of photons detected by the Non-Quartz and Quartz Arapuca.

Light ratio

Deconvolution

Ch 2 (NQ)

Ch 5 (NQ)
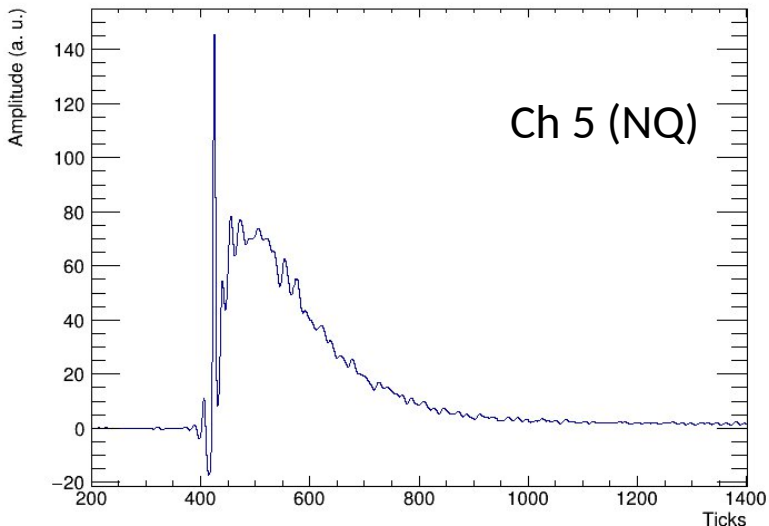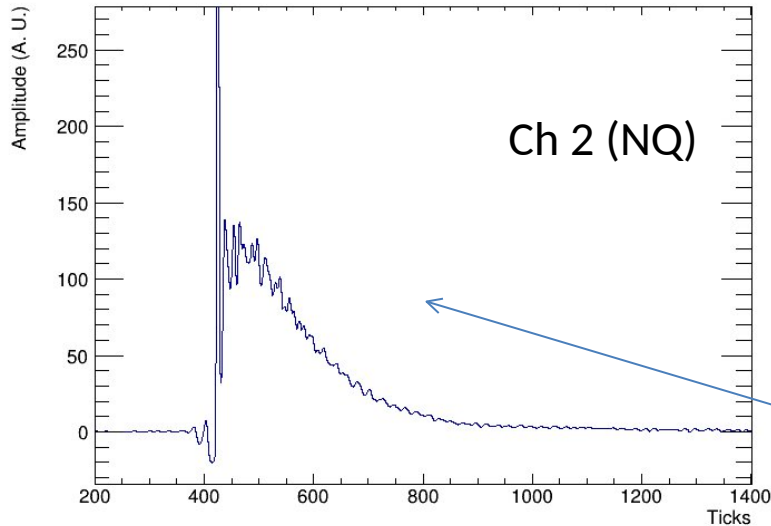
- Usin the fitted function to deconvolute

- Using Gold algorithm do perform deconvolution

- Fit from 500 to 1400 with $Ae^{-at} + B$ to get slow time constant of distribution (Ar + Xe)

Slow time constant - Ar + Xe

τ_s is the slow time constant of Ar+Xe distribution.
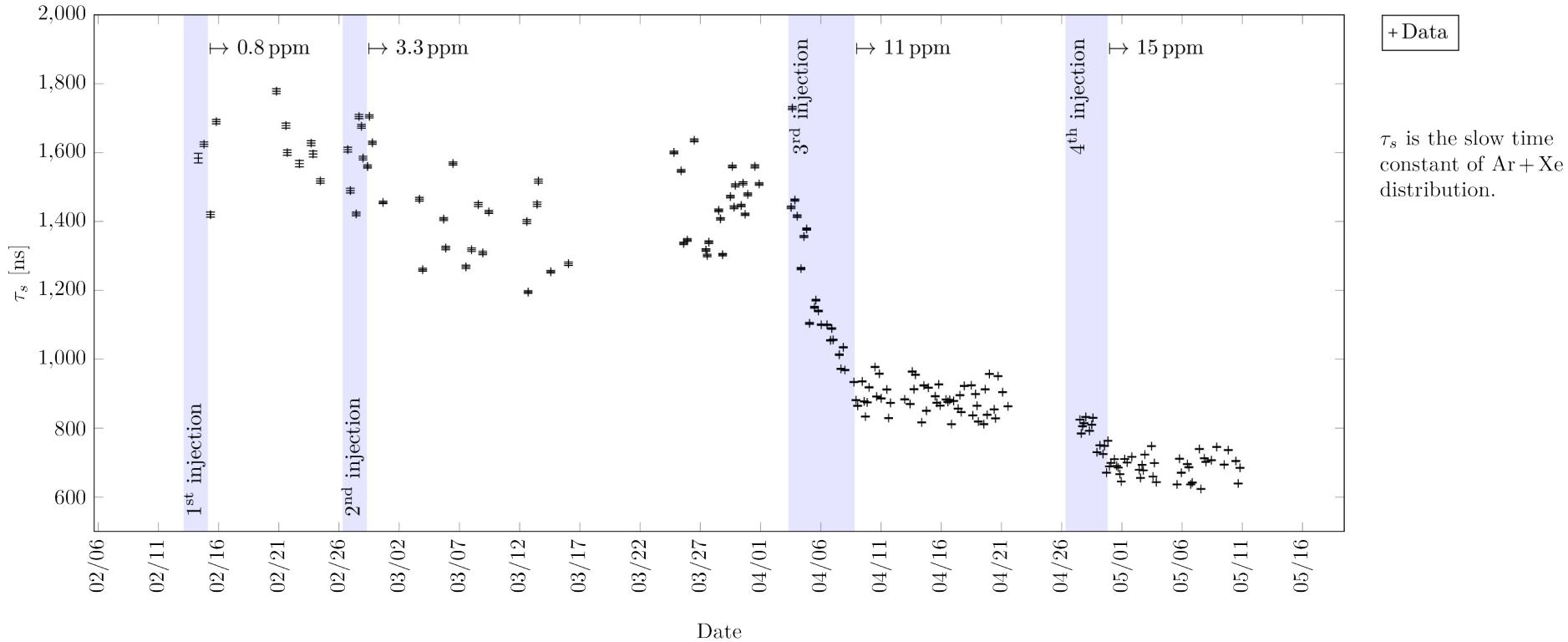
Conclusions

- We computed the Single Photon response for each run
- We checked its stability over time
- We performed deconvolution of signals
- We computed the light ratio and the time constant for Ar+Xe distribution

Further developments:
- Improve SPE selection and Gain computation
- Better error estimation
- Improve deconvolution
- Any suggestion?

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