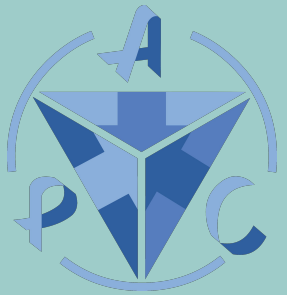
Tau slow studies in PDHD

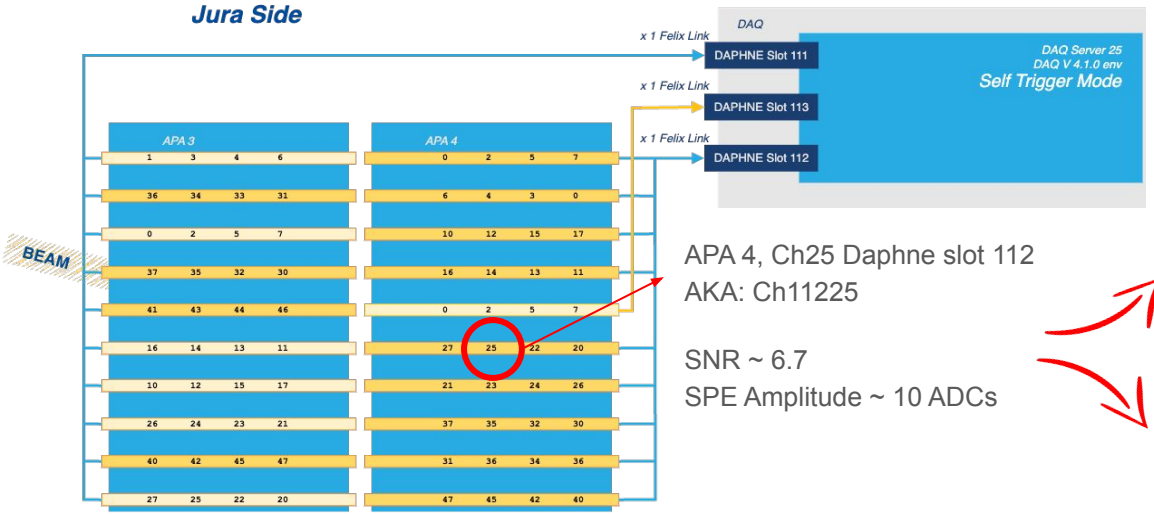
Henrique Souza

With huge thanks to Anselmo C., Laura Perez, Federico G., Manuel A., Renan de A., Julio U., and …

14/10/2024



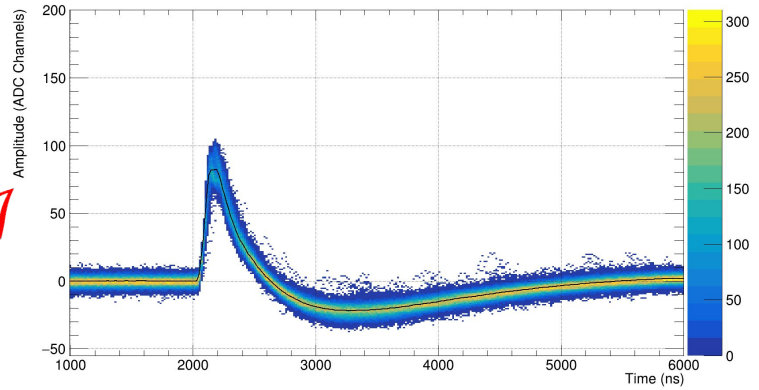
Summary of what has been presented



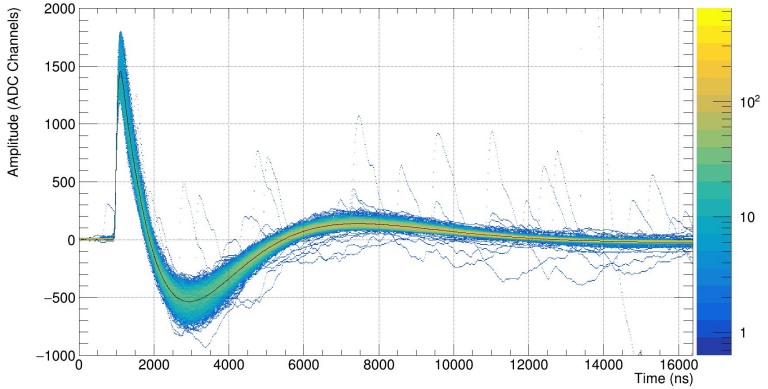
APA 4, Ch25 Daphne slot 112
AKA: Ch11225

SNR ~ 6.7
SPE Amplitude ~ 10 ADCs

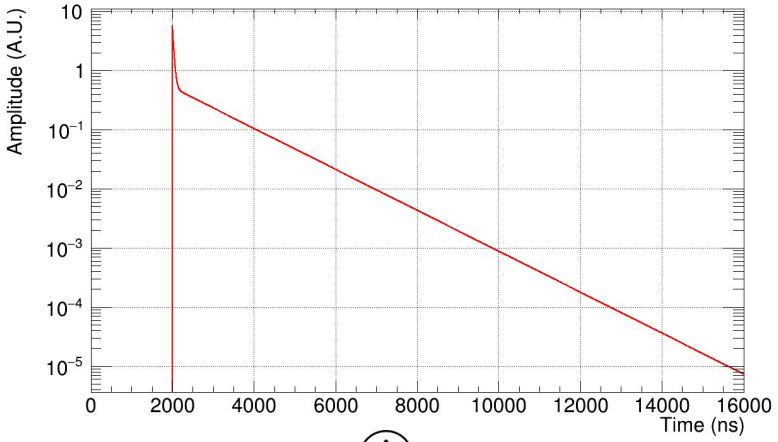
Template selection



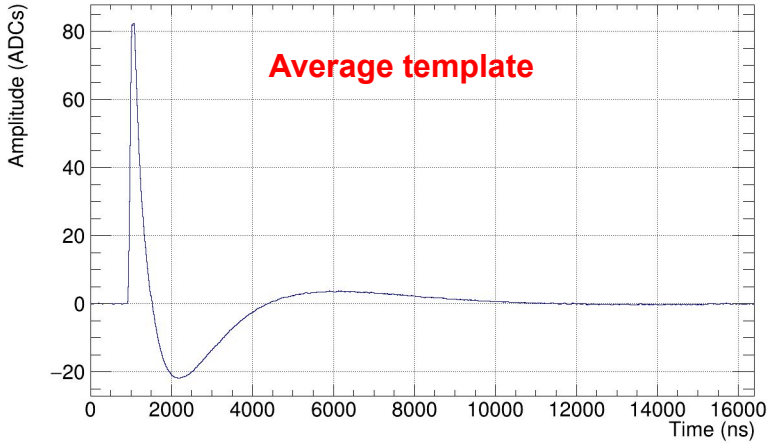
Response selection



Summary of what has been presented



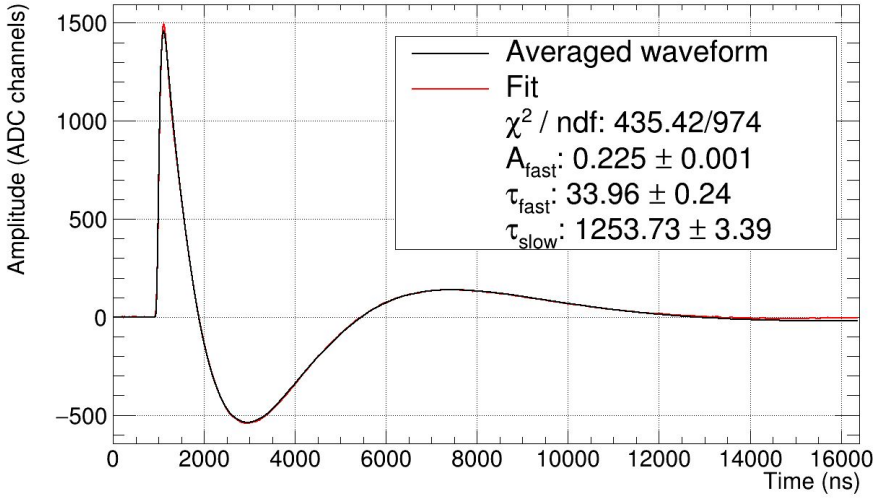
$$\circledast$$



$$=$$

$$L(t) = \frac{A_f}{\tau_f} \times e^{-t/\tau_f} + \frac{1-A_f}{\tau_s} \times e^{-t/\tau_s}$$

$$R(t) = SPE(t) \circledast L(t)$$



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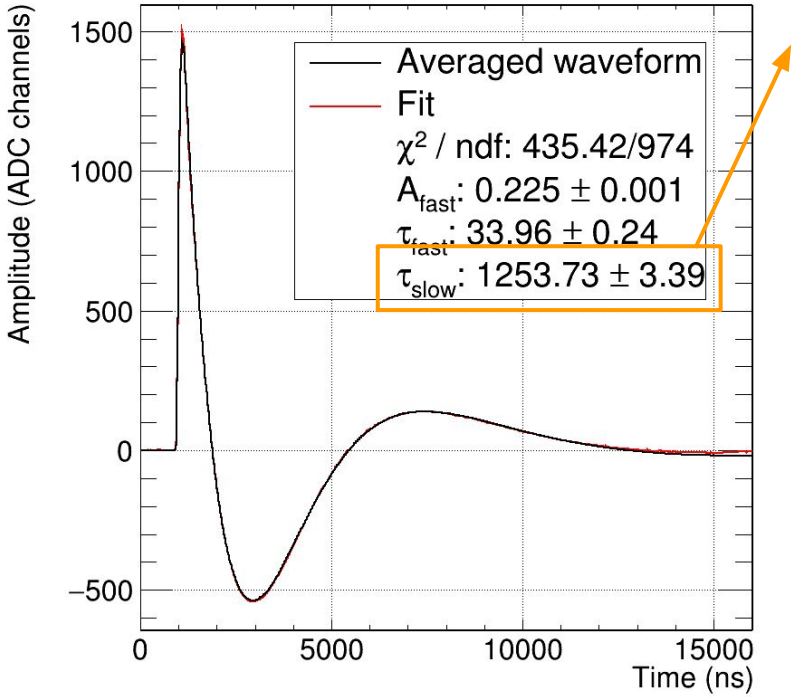
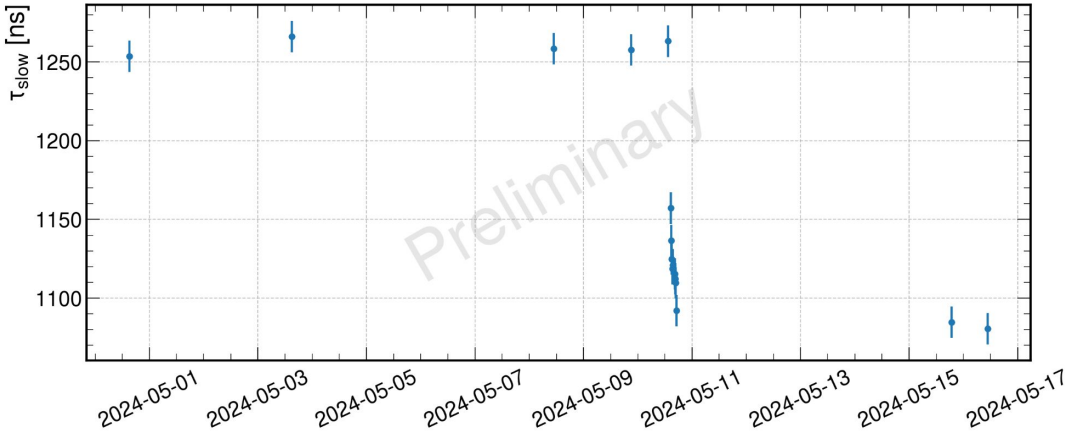


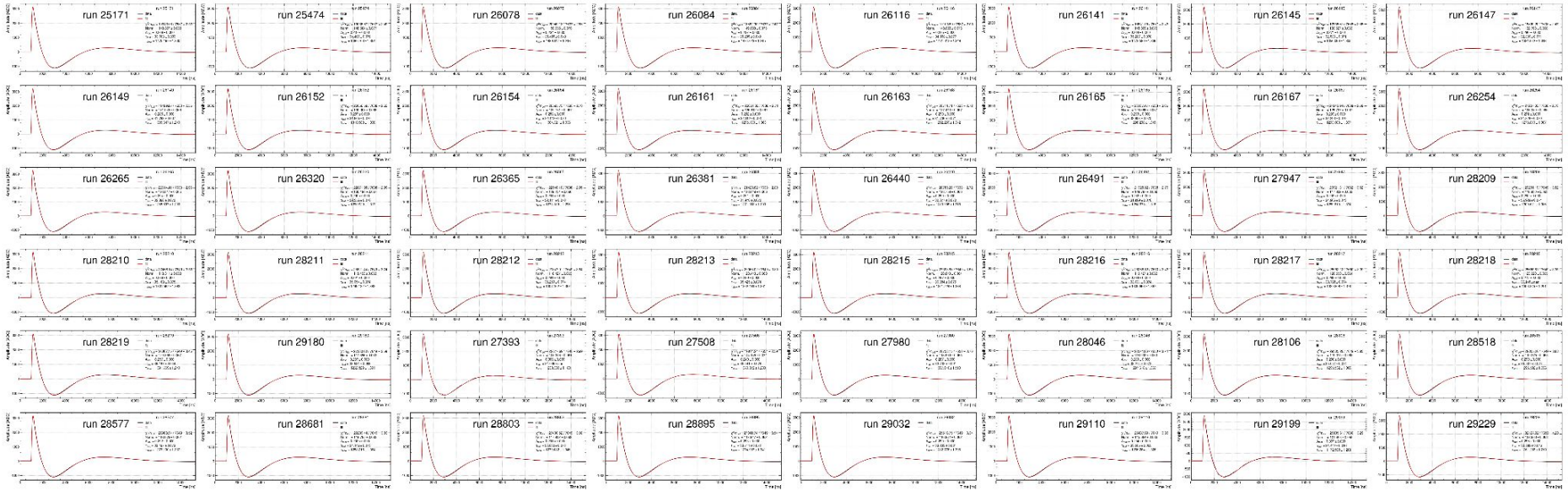


Presented in the September 2024 CM

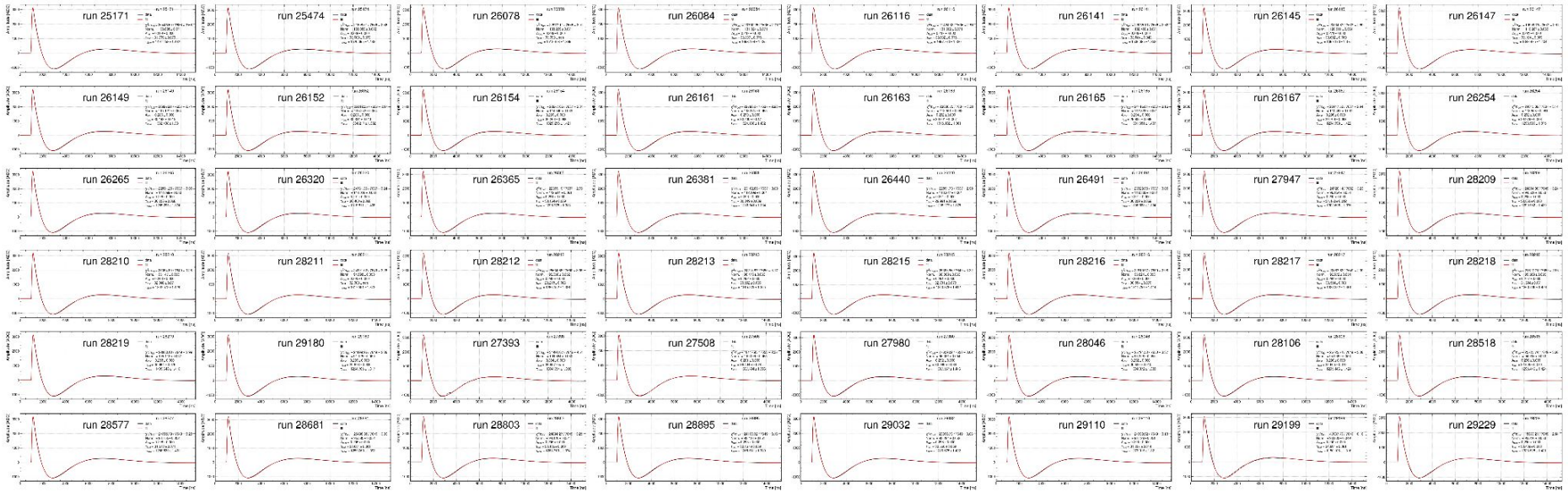
What changed

- **More channels**
  - Channel (112)27 and (111)14 added to the analysis (2 HPK, 1 FBK)
- **More runs and more hdf5 files (increasing number of events)**
  - Beam runs (without beam) also included
  - Increased the number of waveforms readed
- **Better template and response**
  - **Less aggressive cuts:** Increased number of waveforms allowed to decrease selection
  - **Creation of a unique template over several runs**
    - Splitted in two periods due to O.V changes in the SiPMs
- **Better fitting:**
  - Scanning different offsets and finding minimal chi2
- What caused most of the changes in results:
  - Accepting signals from 240 - 500 p.e. (instead of 120 to 180)
  - Less cut in the template selection and creation of unique template merging runs

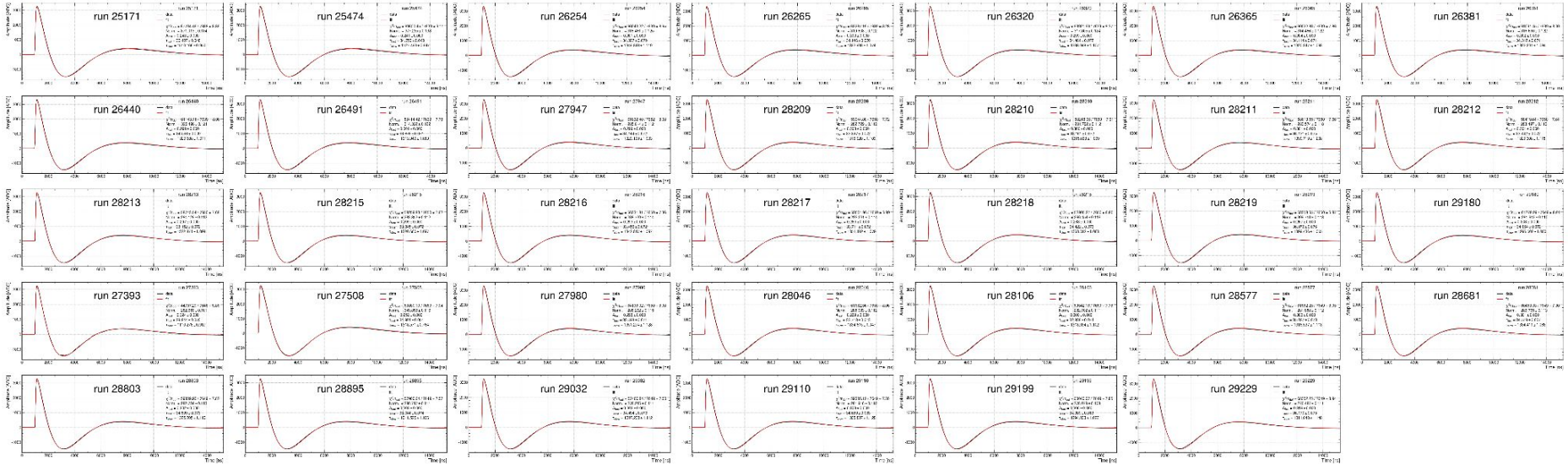
Results over 48 runs - Ch. 11225



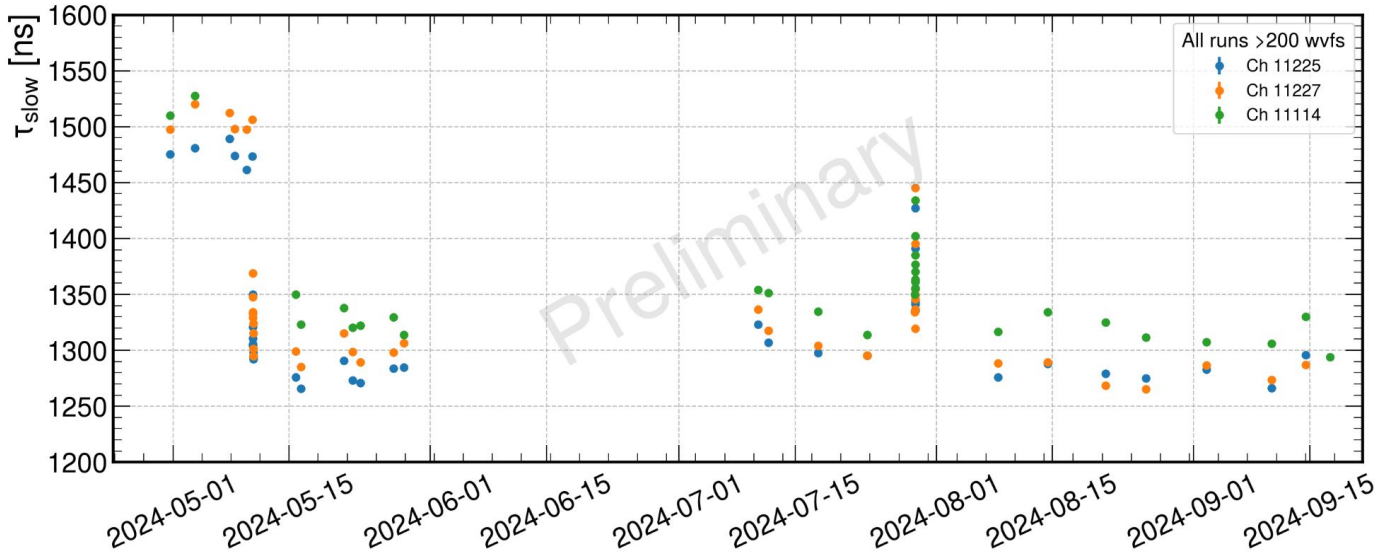
Results over 48 runs - Ch. 11227

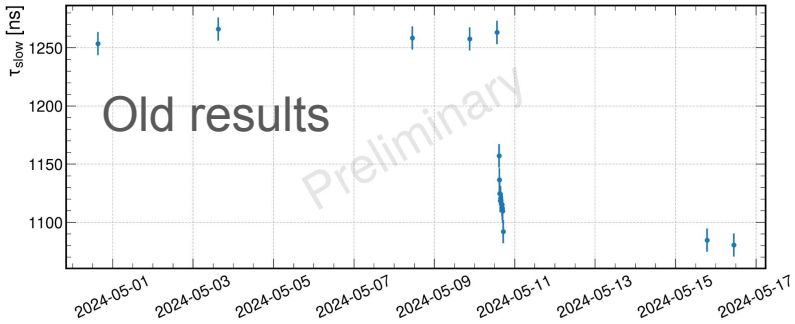


Results over 34 runs - Ch. 11114



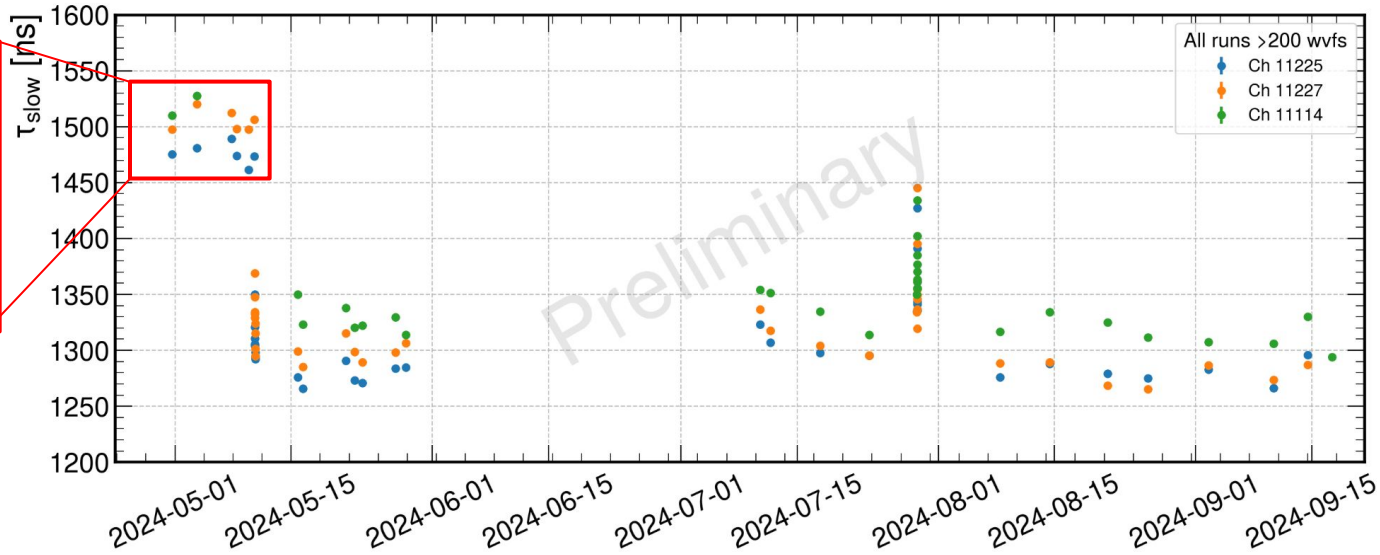
Result over time

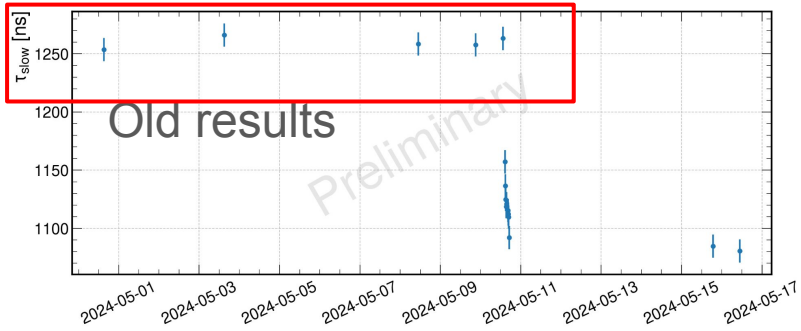




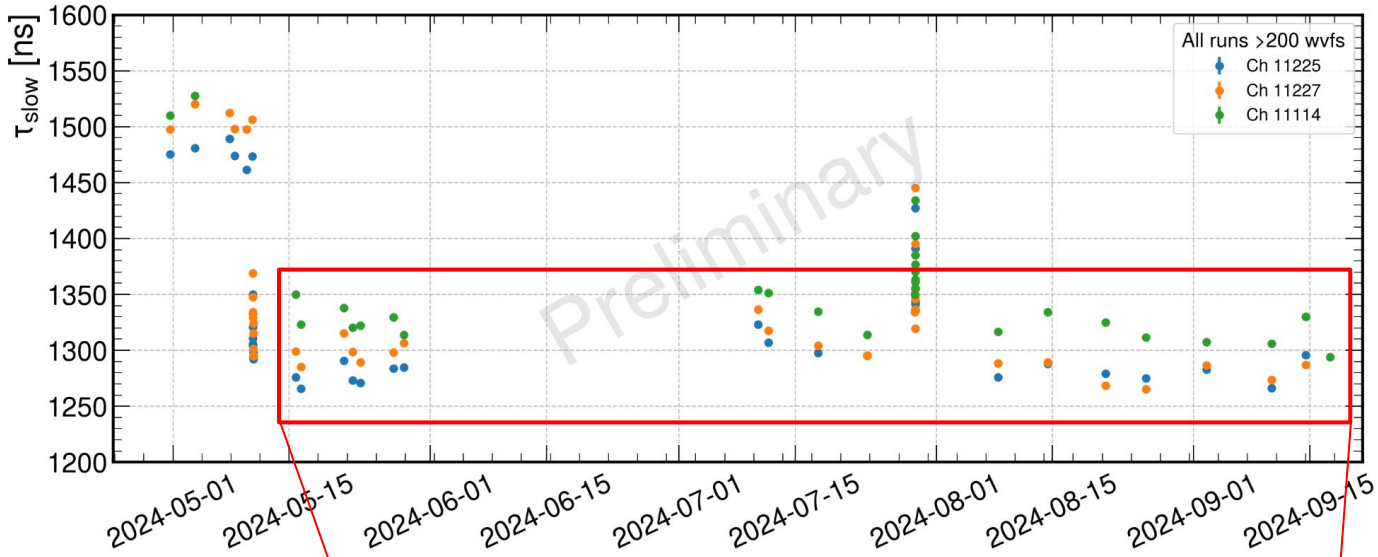
Result over time

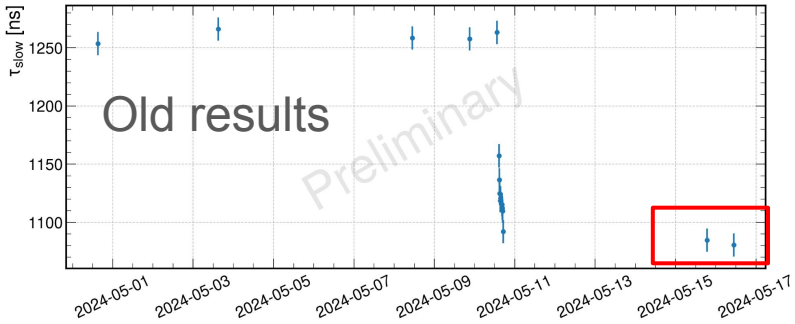
Values of tau slow does not indicate a substantial nitrogen contamination:
0.48 ± 0.04 ppm





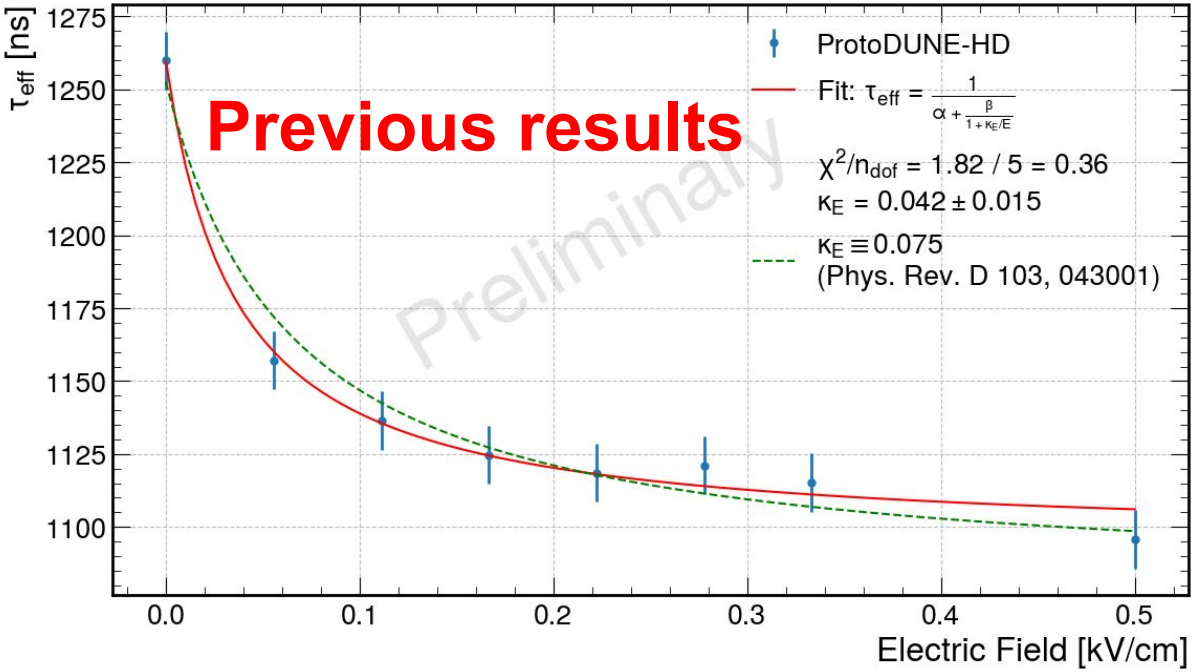
Result over time





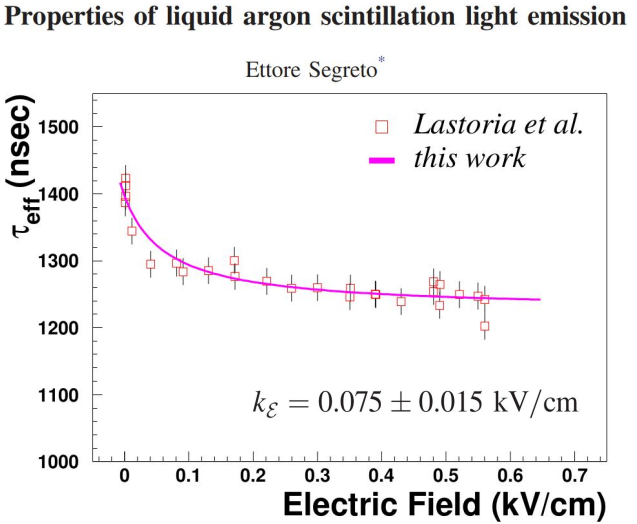
More data during beam runs, showing no degradation over time

Dependence with Efield ?



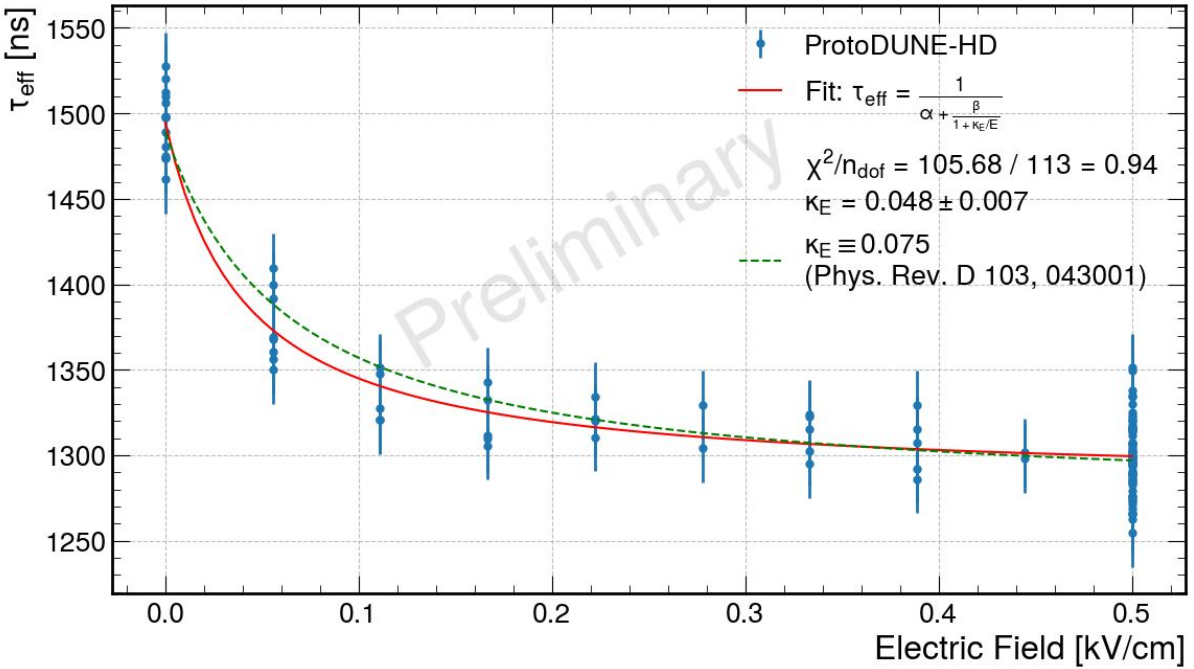
$$\tau_{\text{eff}} = \frac{1}{\alpha + \frac{\beta}{1+k_E/E}}$$

$$\alpha = 1/\tau_{\text{eff}}(0)$$



However, the paper: **P. Agnes et al 2021 JINST 16 P11026** saw no correlation of tau slow with the electric field.

Dependence with Efield ?

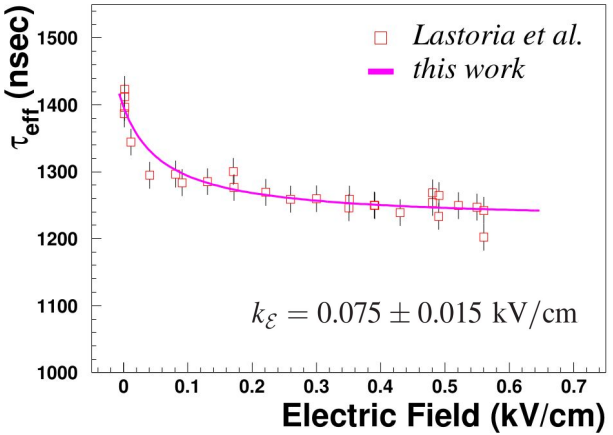


$$\tau_{\text{eff}} = \frac{1}{\alpha + \frac{\beta}{1+k_E/E}}$$

$$\alpha = 1/\tau_{\text{eff}}(0)$$

Properties of liquid argon scintillation light emission

Ettore Segreto*



Need to find the proper way to insert all data together

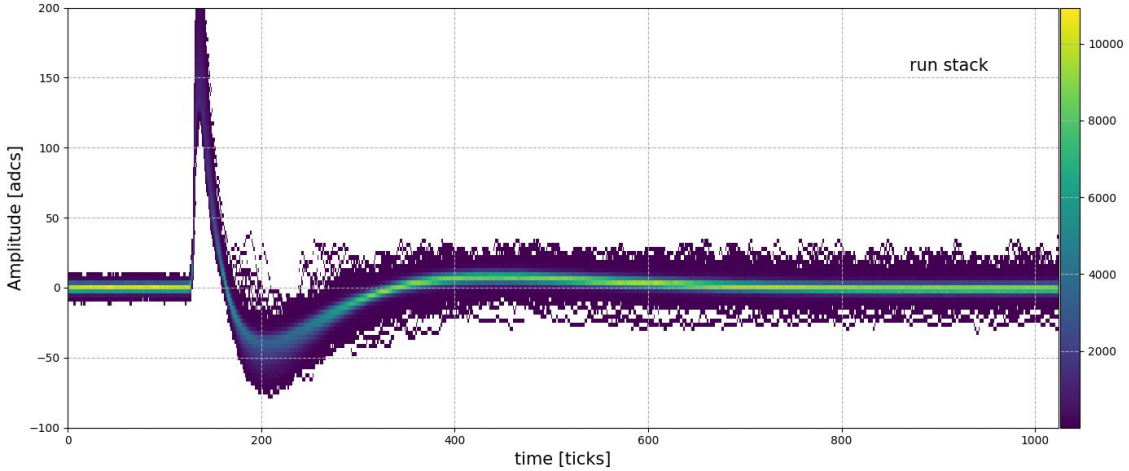
Note: the paper **P. Agnes et al 2021 JINST 16 P11026** saw no correlation of tau slow with the electric field.

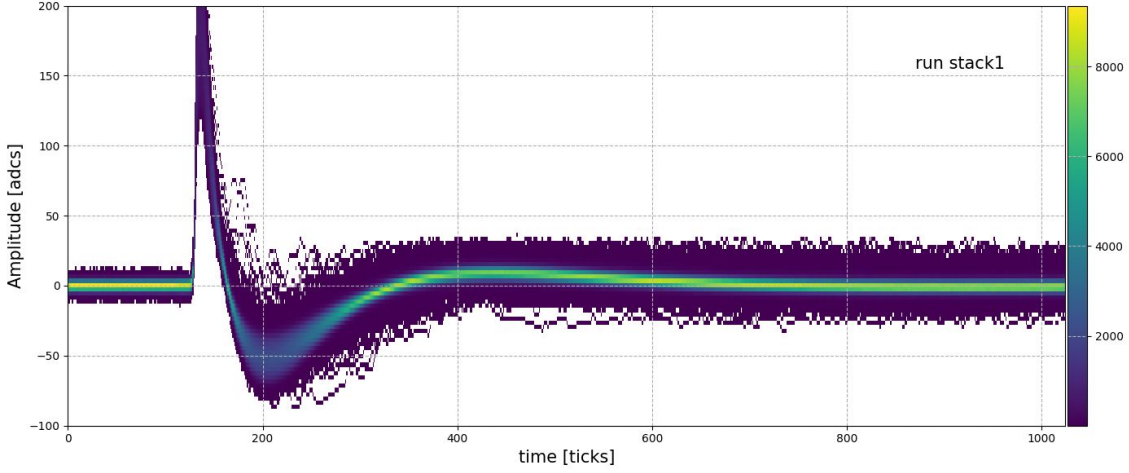
Conclusions

- Increasing number of events helped to get better template and responses
- Number of beam runs can be increased, but need time
- Main outcomes:
  - **Higher tau slow found:**
    - Caused mostly because of selection over bigger events (from 120-180 to 240 - 500)
  - **Two other channels added:**
    - Results are consistent given the fluctuation in each channel
- **To be understood:**
  - **What is the uncertainty of the fit?**
  - **Why different channels have different bias:**
    - Leaded by template or response?
  - **Why we have different values after tuning of OV?**
    - **NOT presented here**
- **PR to add analysis in WAFFLES done**

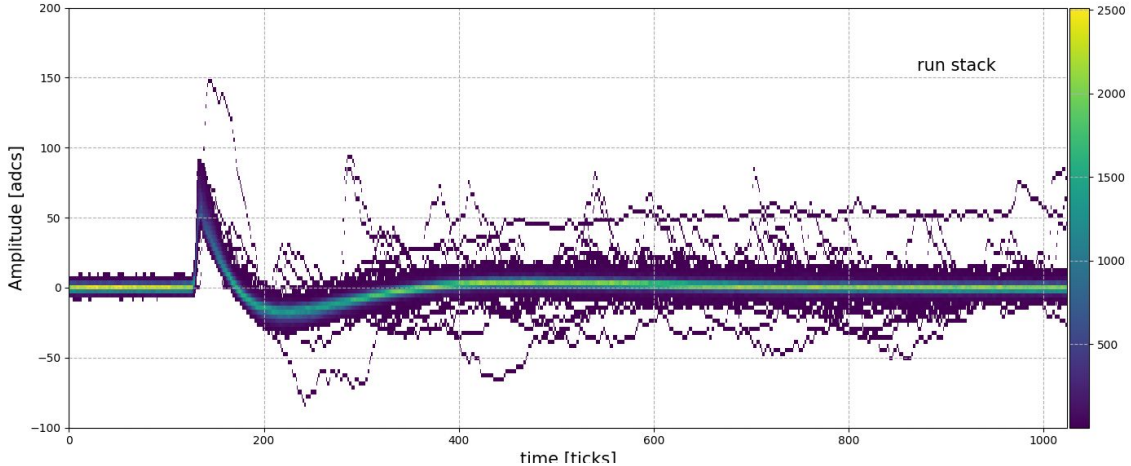
Backup

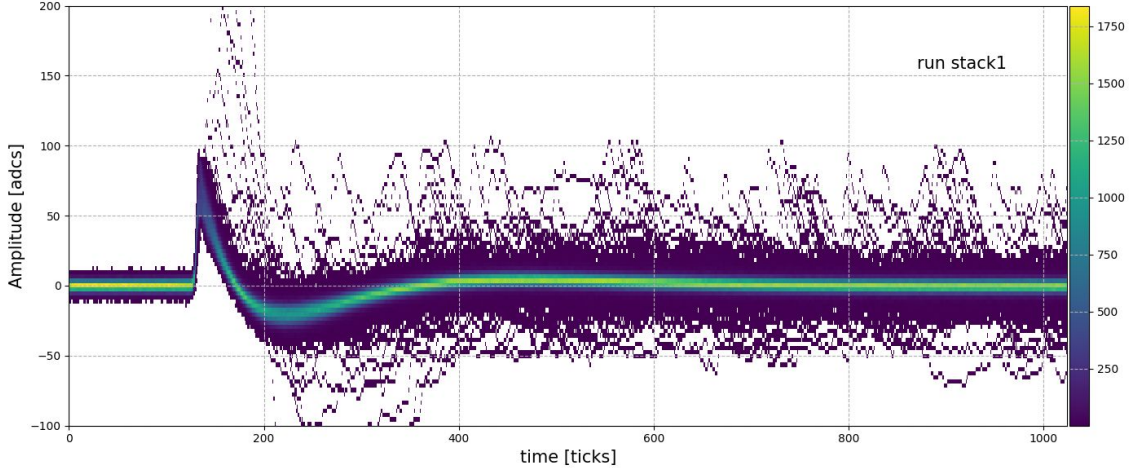
Backup


run stack
Amplitude [adcs]
time [ticks]
200
150
100
50
0
−50
−100
0
200
400
600
800
1000
10000
8000
6000
4000
2000


run stack1
Amplitude [adcs]
time [ticks]
200
150
100
50
0
−50
−100
0
200
400
600
800
1000
8000
6000
4000
2000

Backup


run stack
Amplitude [adcs]
time [ticks]


run stack1
Amplitude [adcs]
time [ticks]