IDEA Test Beam 2018
Drift chamber

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RD_FA collaboration
5 Dec. 2018

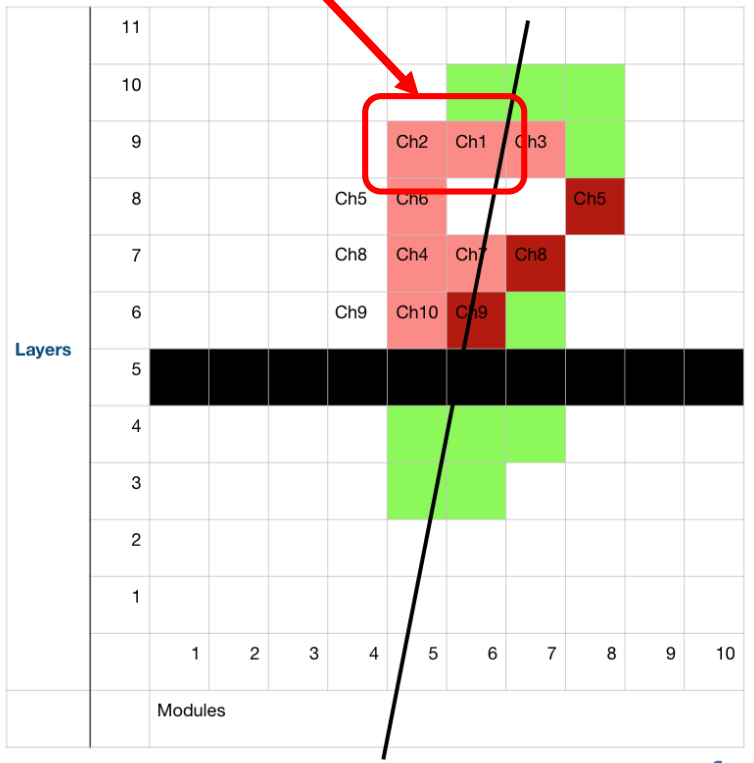
Noise Identification

- We need to identify the coherent noise between the channels.
- We take two channels in the same layer beside each other “Ch1 & Ch2”
- Build new wave form by subtracting these two wave forms.

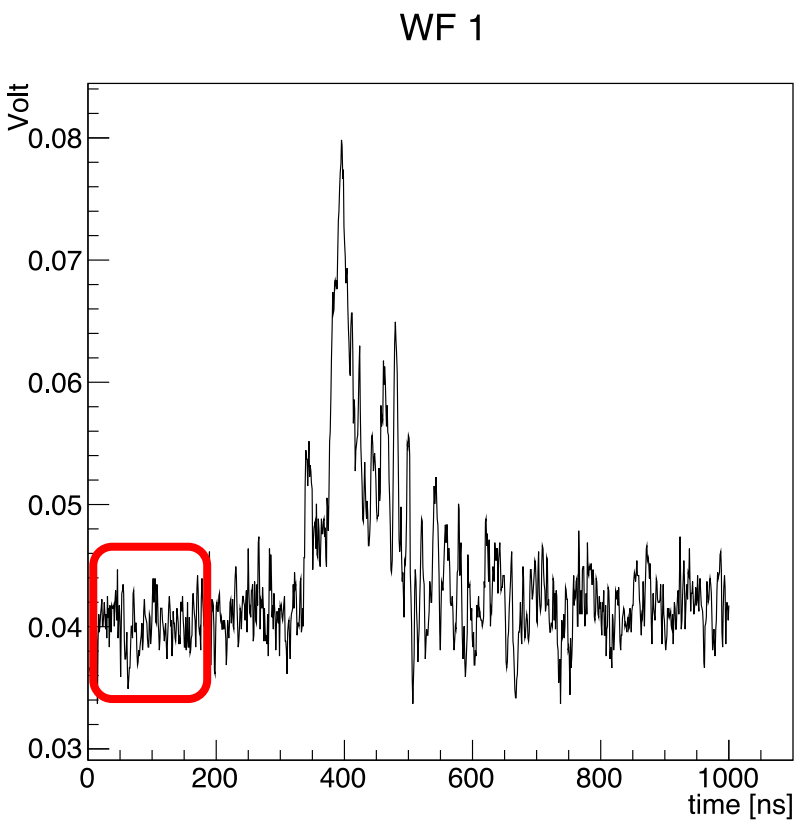
$$WF_{new} = WF_1 - (Divide) * WF_2$$

Where:

$$Divide = \frac{(sum\ volt\ first\ 100\ bins)\ ch1}{(sum\ volt\ first\ 100\ bins)\ ch2}$$



➢ Run 126 ➢ Event 6 ➢ Ch1 & Ch2



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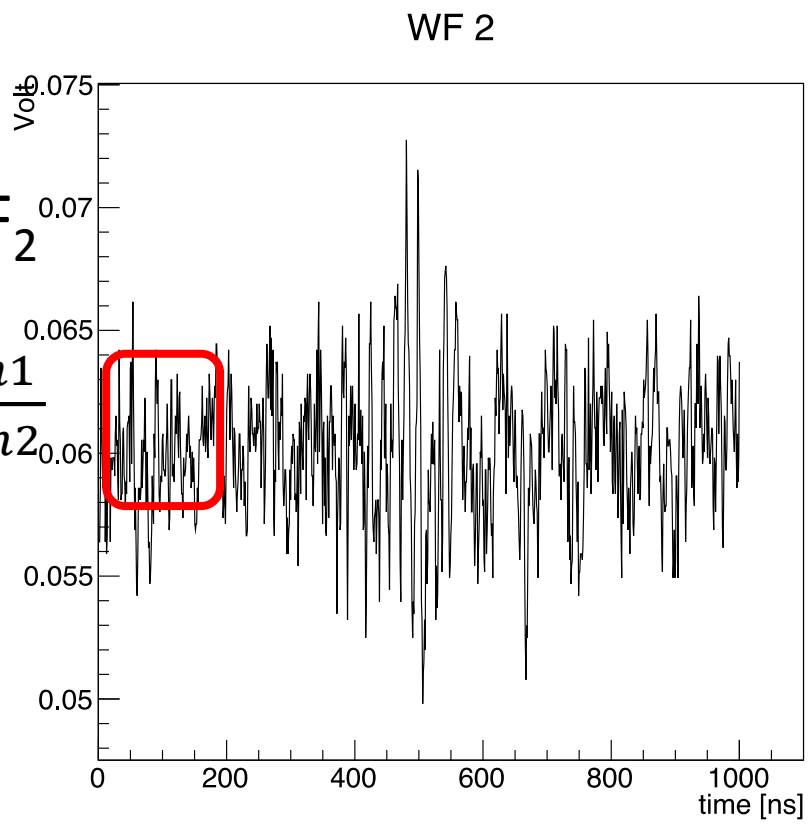
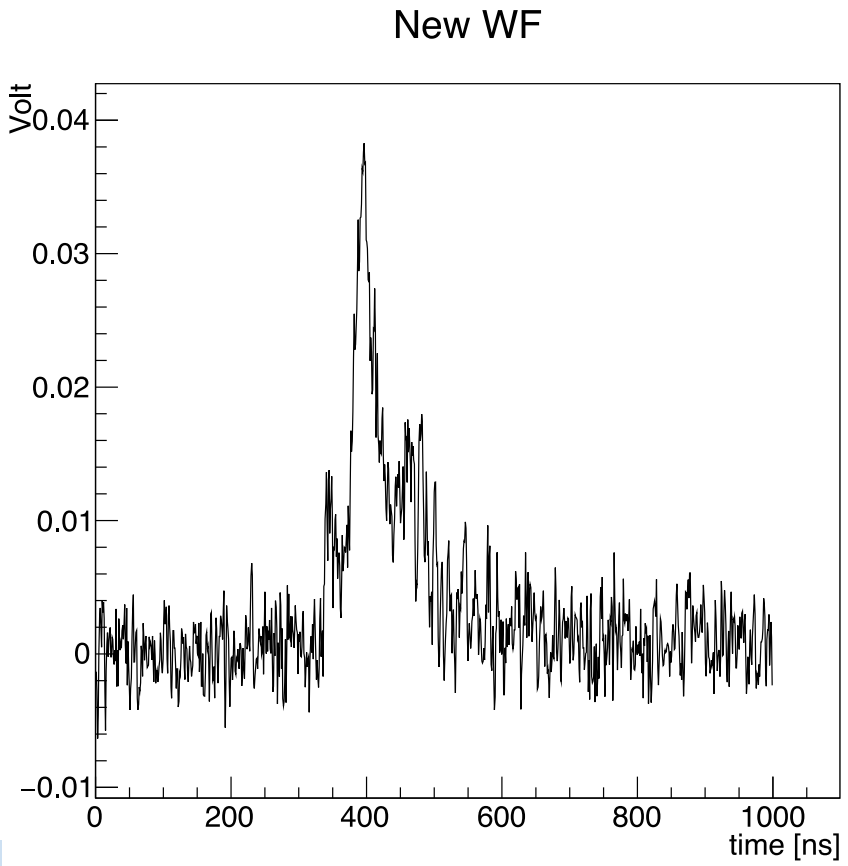


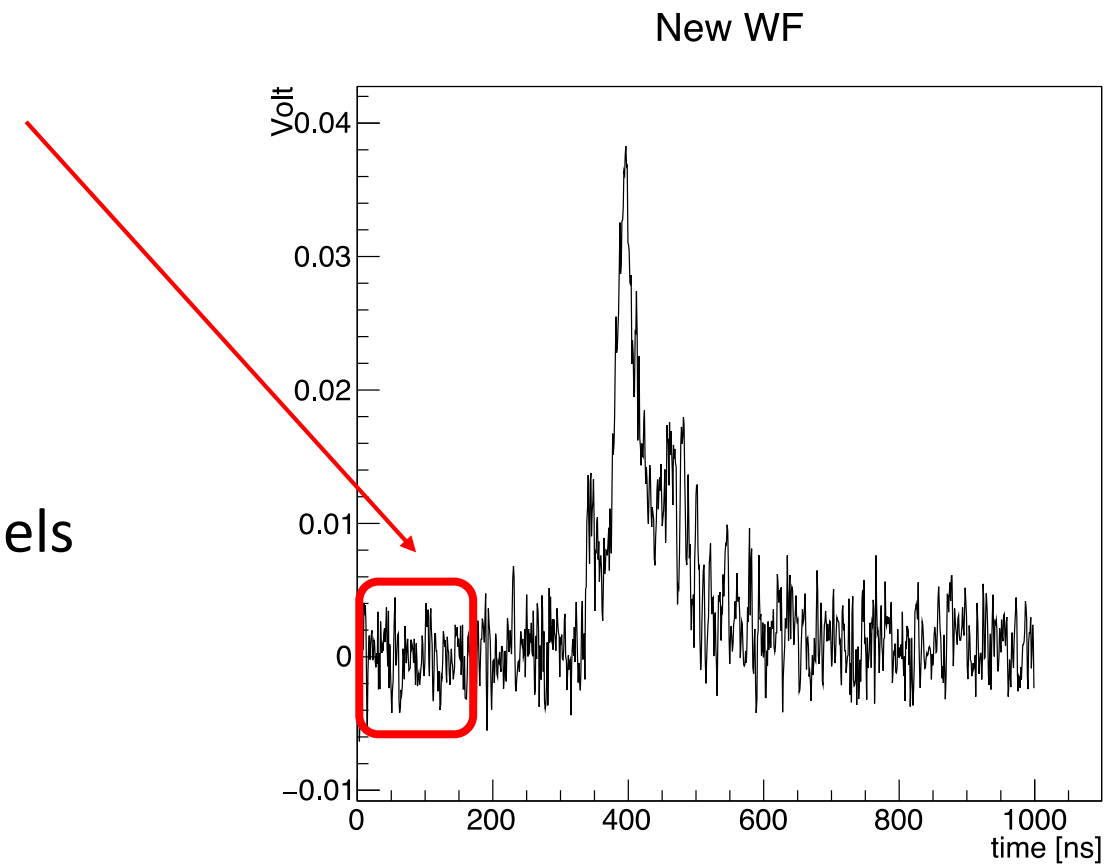


- Run 126 (event 6)

New WF

➢ Run 126 (event 6)

- Define the pedestal for the new wave form
  - ➢ Average $= \frac{(sum\ volt\ first\ 100\ bins)NewWF}{100}$
  - ➢ PDS = Average * 1024
- Define the final voltage of the new WF
  - ➢ Sum Volt = Sum voltage of All ADC channels
  - ➢ Final Volt = Sum Volt - PDS



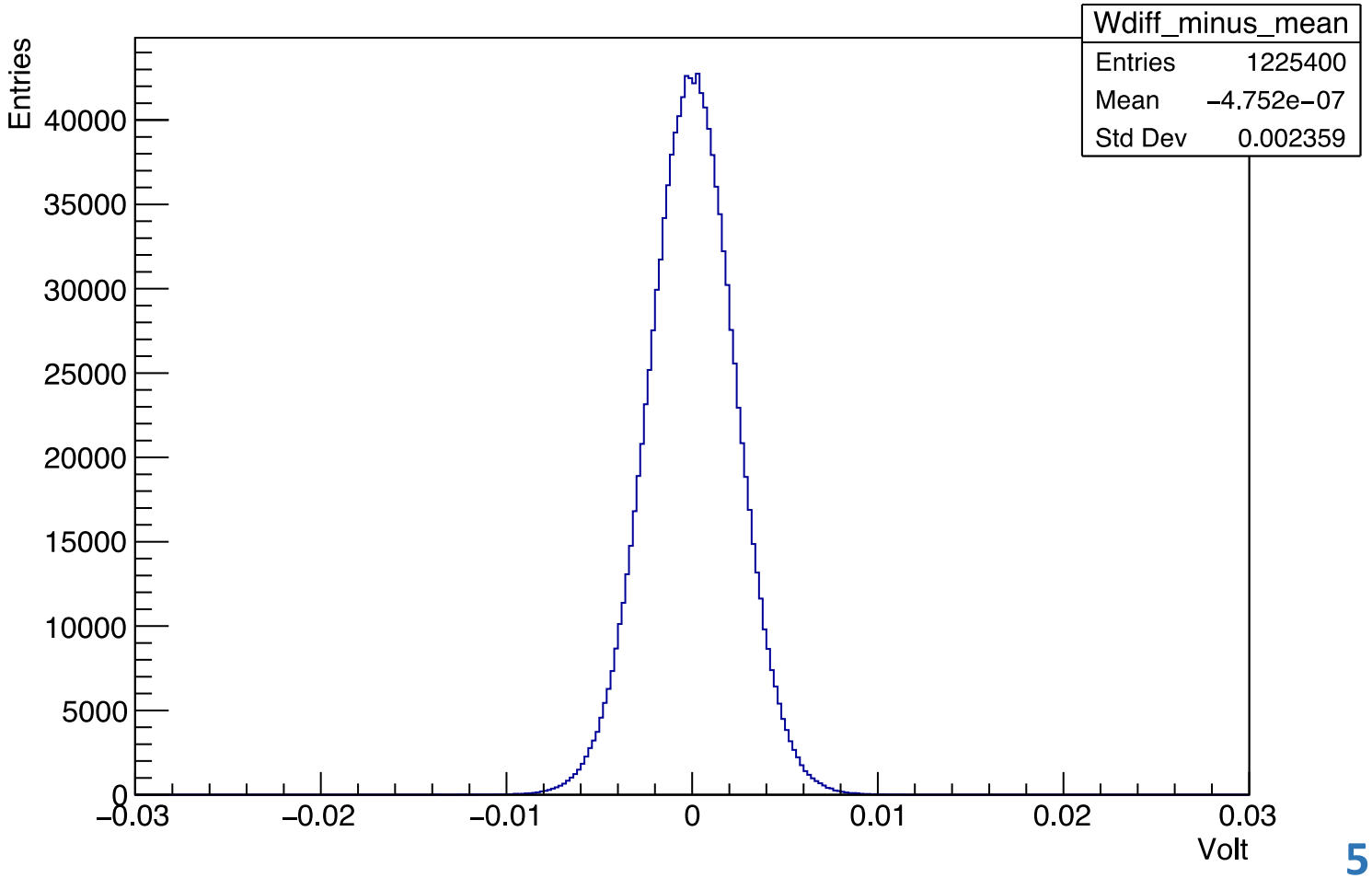
Noise

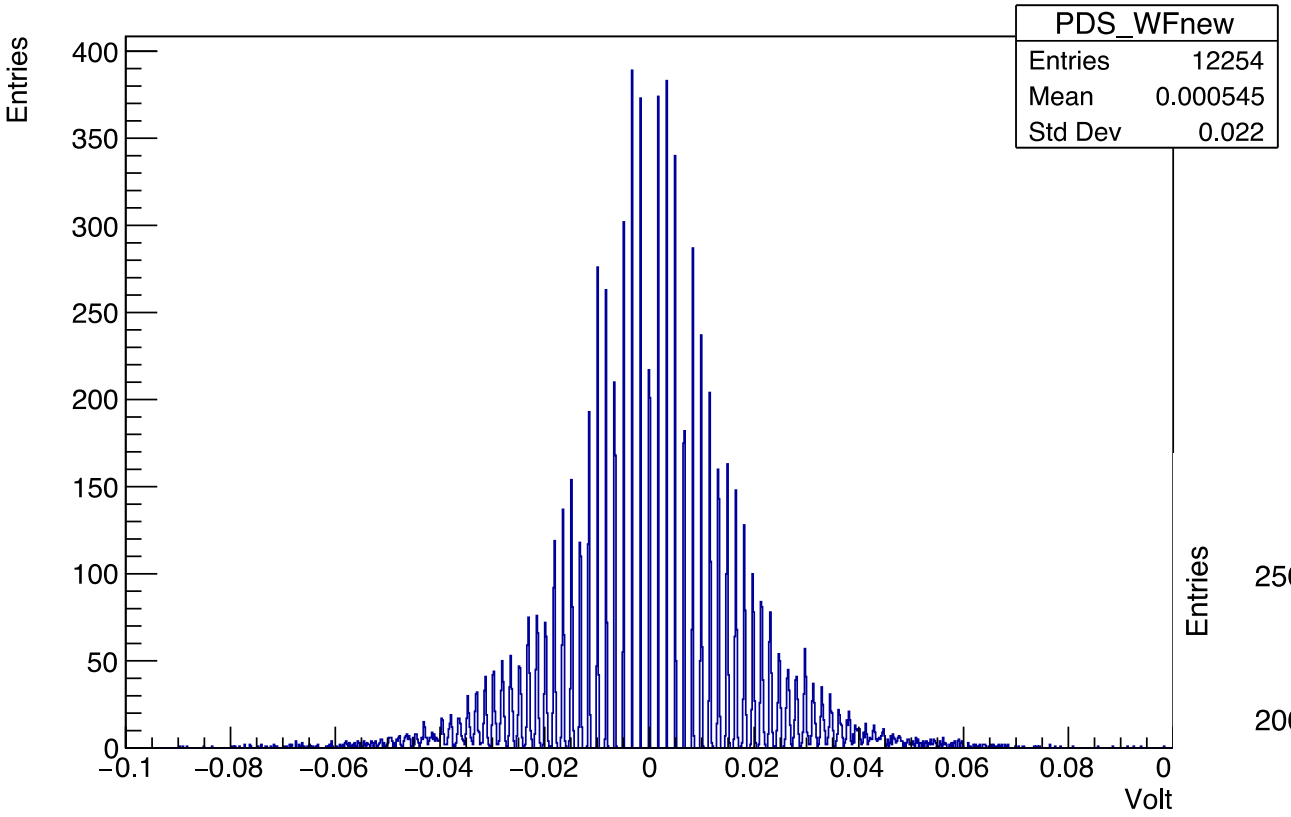
$$\text{Average} = \frac{(sum\ volt\ first\ 100\ bins)NewWF}{100}$$

<u>For the first 100 bin:</u>

- Distribution of the deviation of each voltage in the new wave form from the average value
- This measures the white noise for single channel:

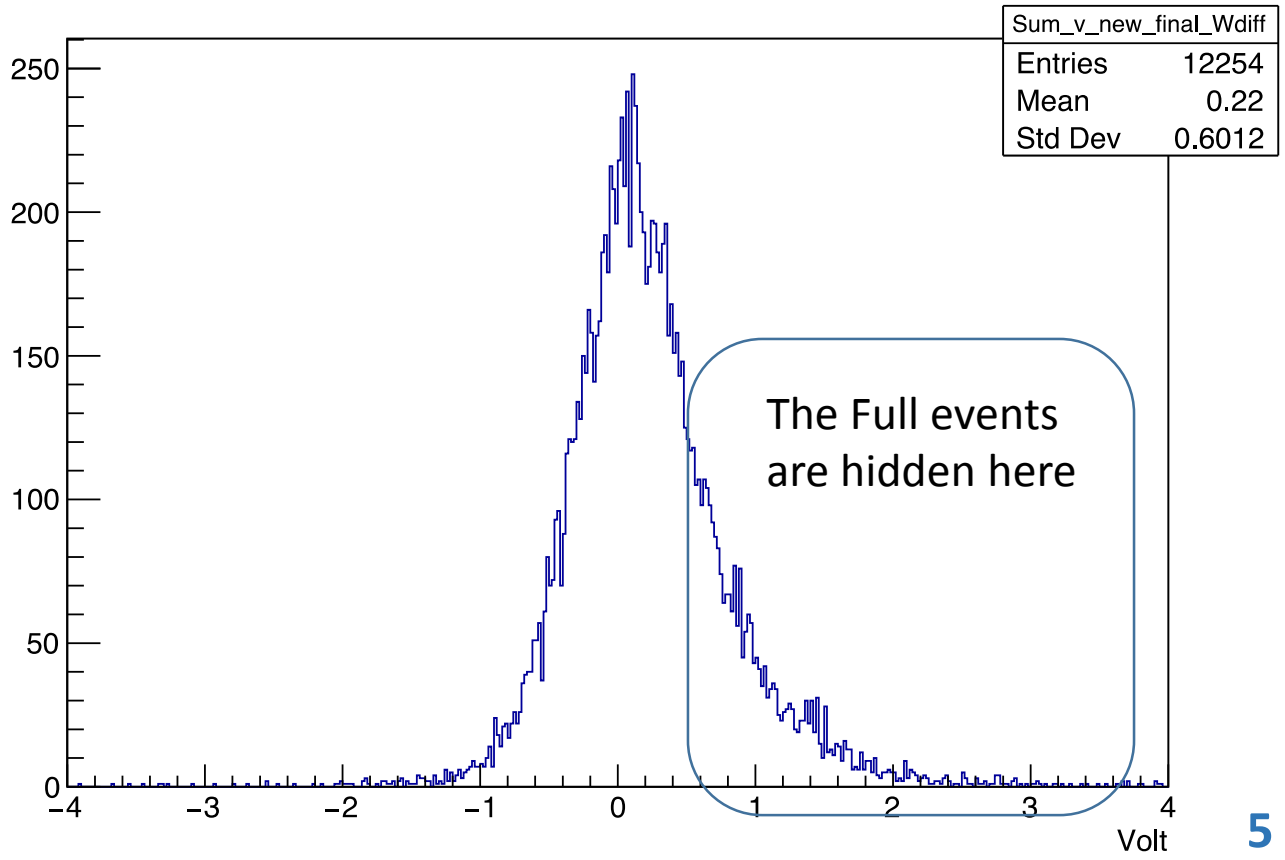
$$\sigma = 2{,}3\ mV/\sqrt{2} = 1{,}6\ mV$$





➢ Run 126 (all events)

Pedestal of the new wave form



Final volte of the new wave form

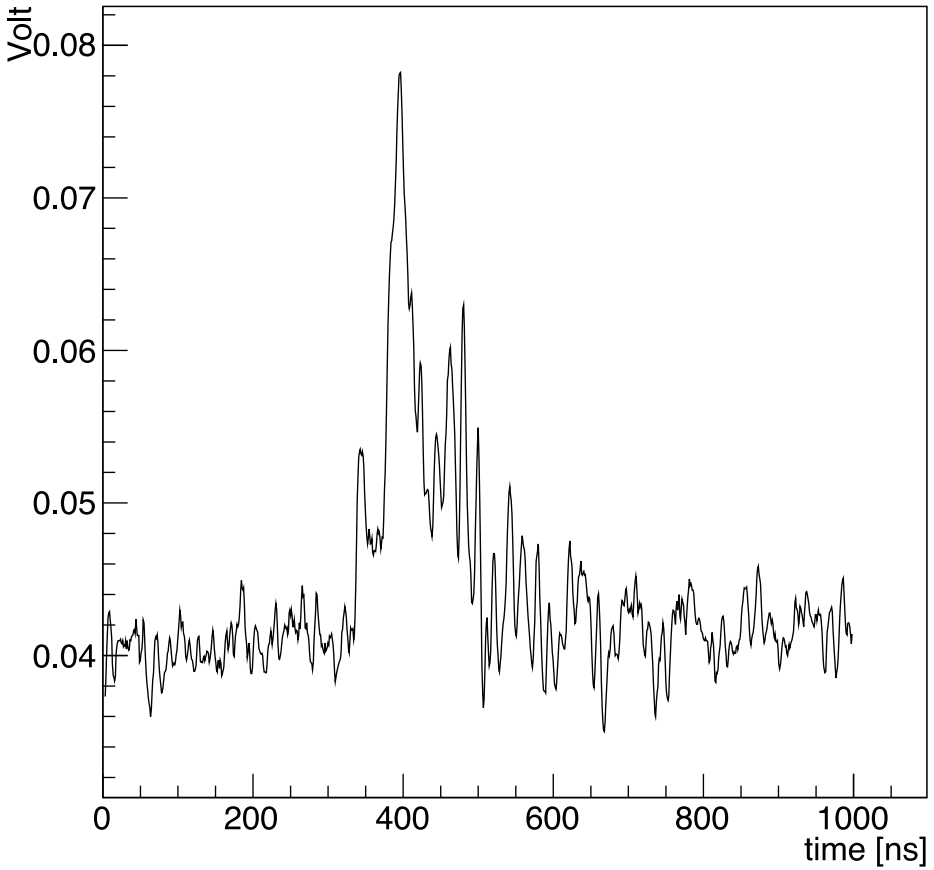
We need a strategy to distinguish full and empty waveform

Smoothing WFs

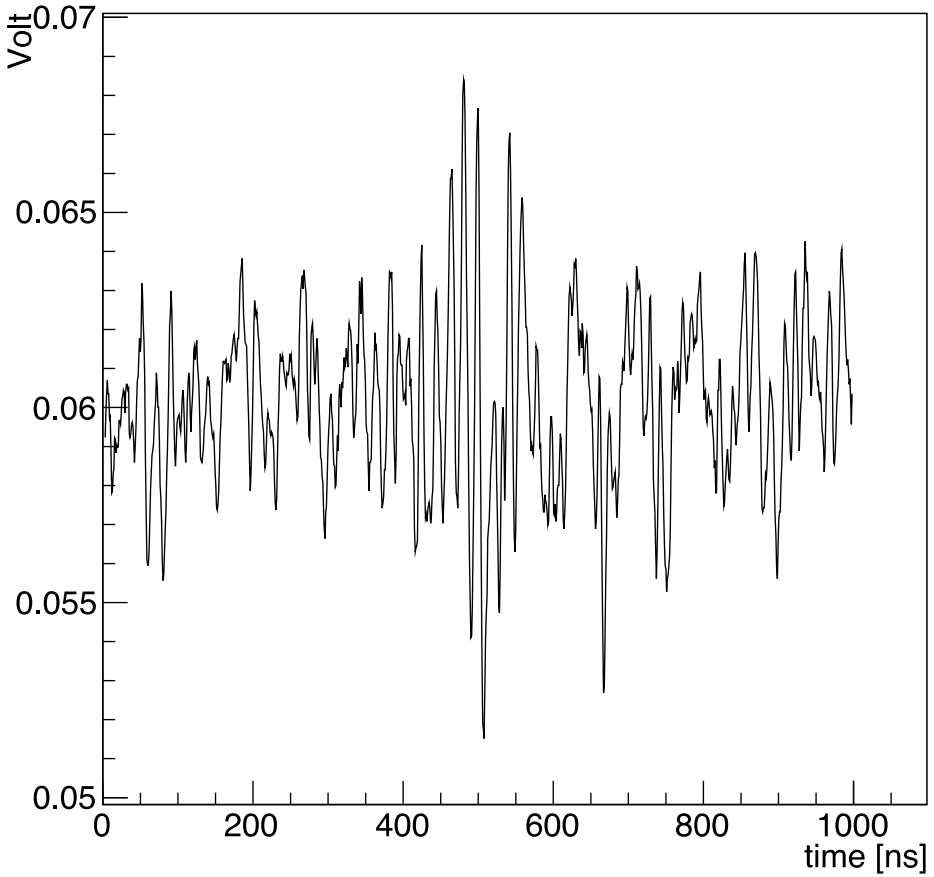
- Run 126 (event 6)

- Smooth the wave forms by averaging the voltage in the neighboring channels of ADC
- Trying different smoothing factor (SF)
- Example: SF = 2 => averaging 5 bins “2bins in left + central bin + 2bins in right”

Smooth WF1



Smooth WF2

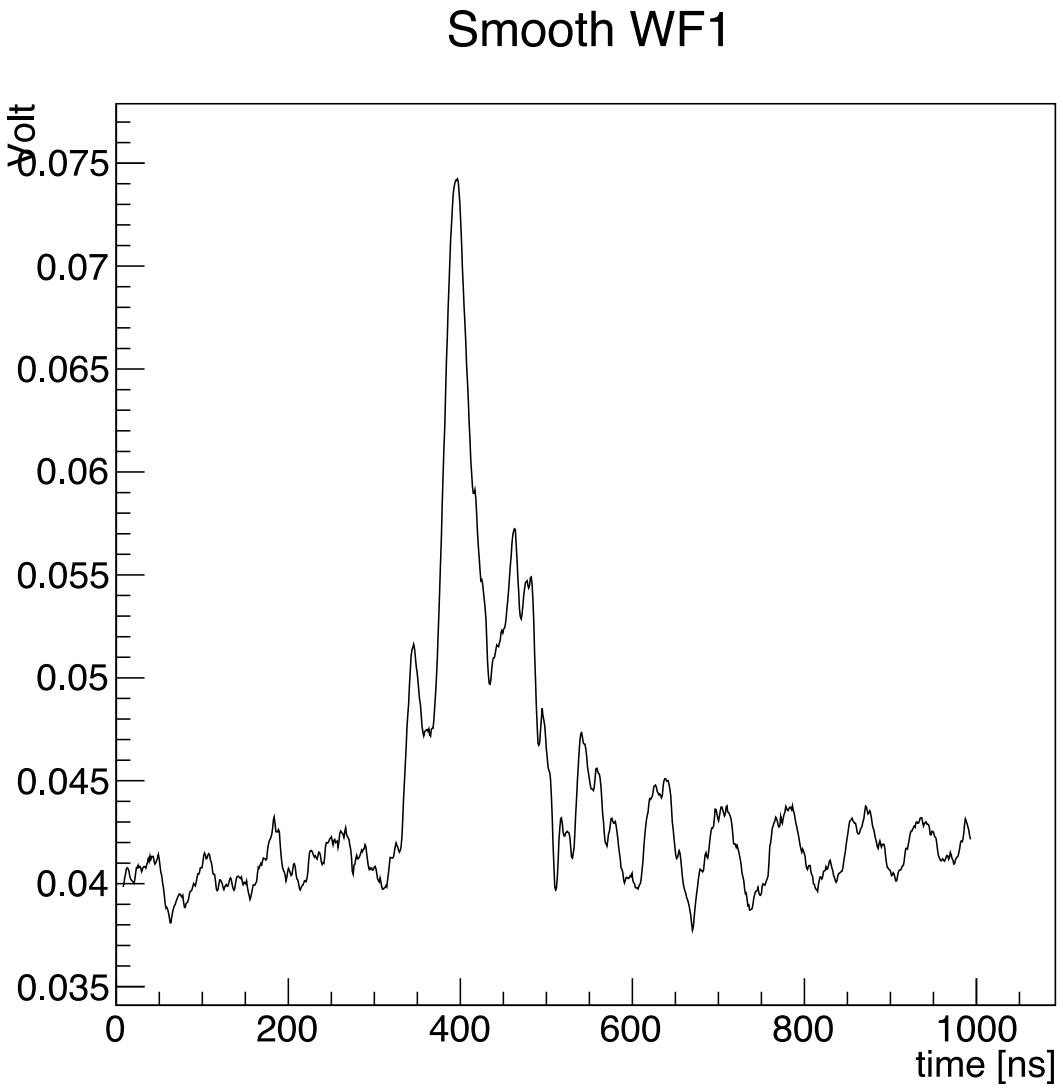


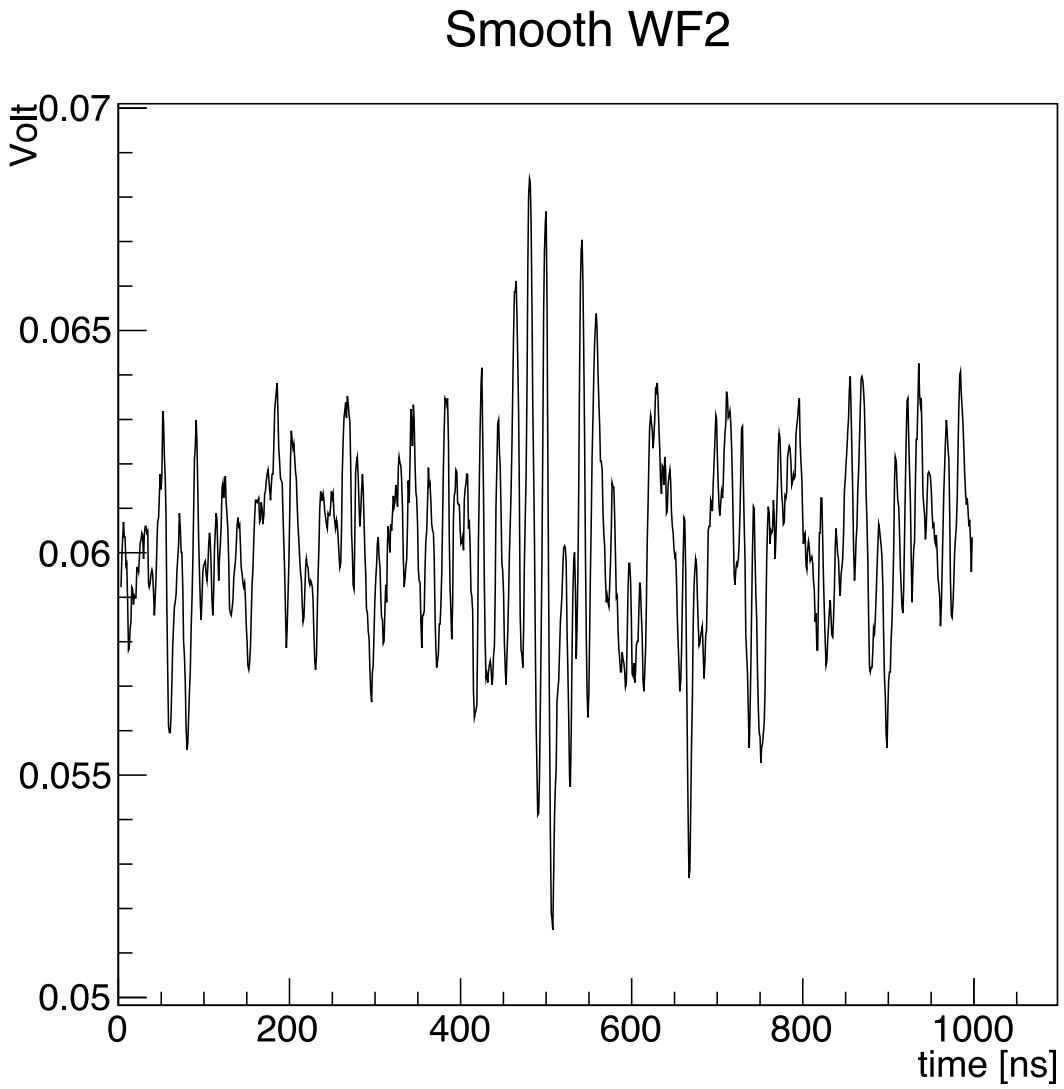
SF = 2

Smoothing WFs

➢ Run 126 (event 6)

➢ Example: SF = 7 => averaging 15 bins “7bins in left + central bin + 7bins in right”





SF = 7

Smoothing WFs

➢ Run 126 (event 6)

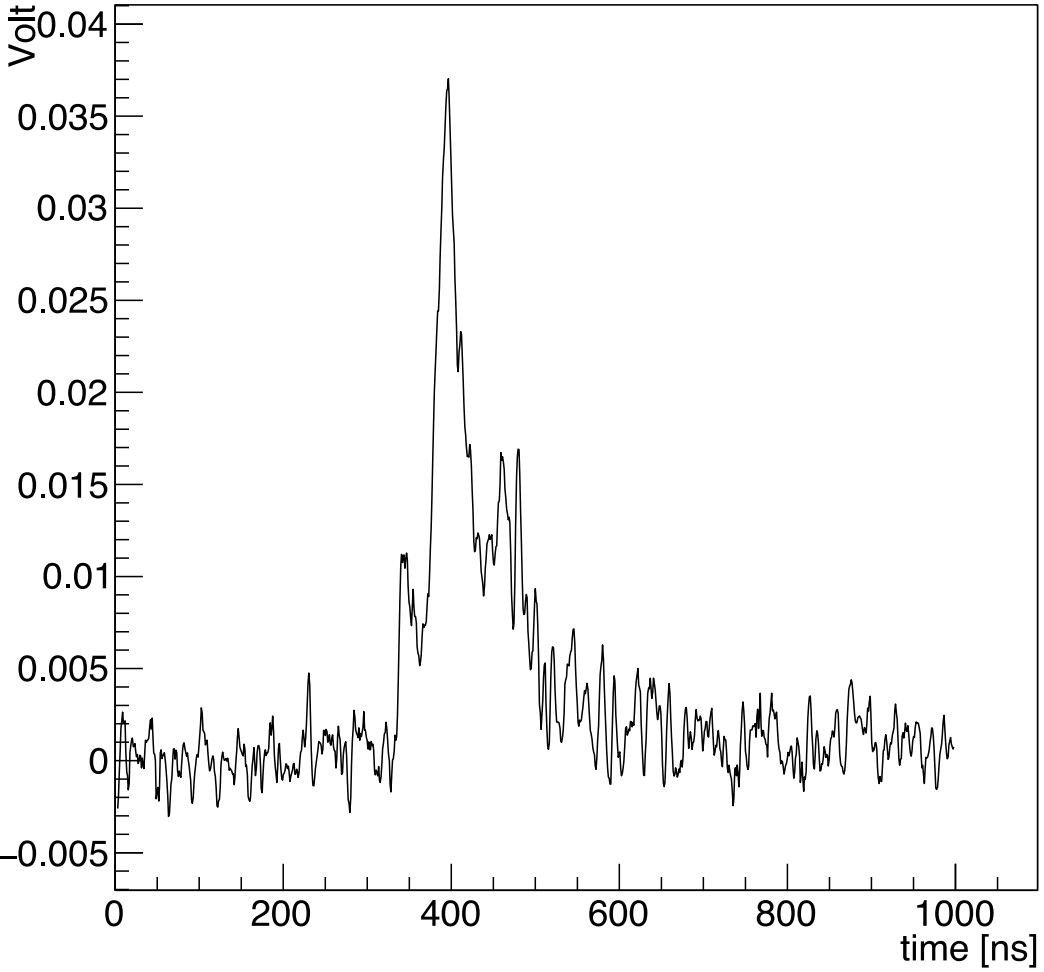
SF = 2

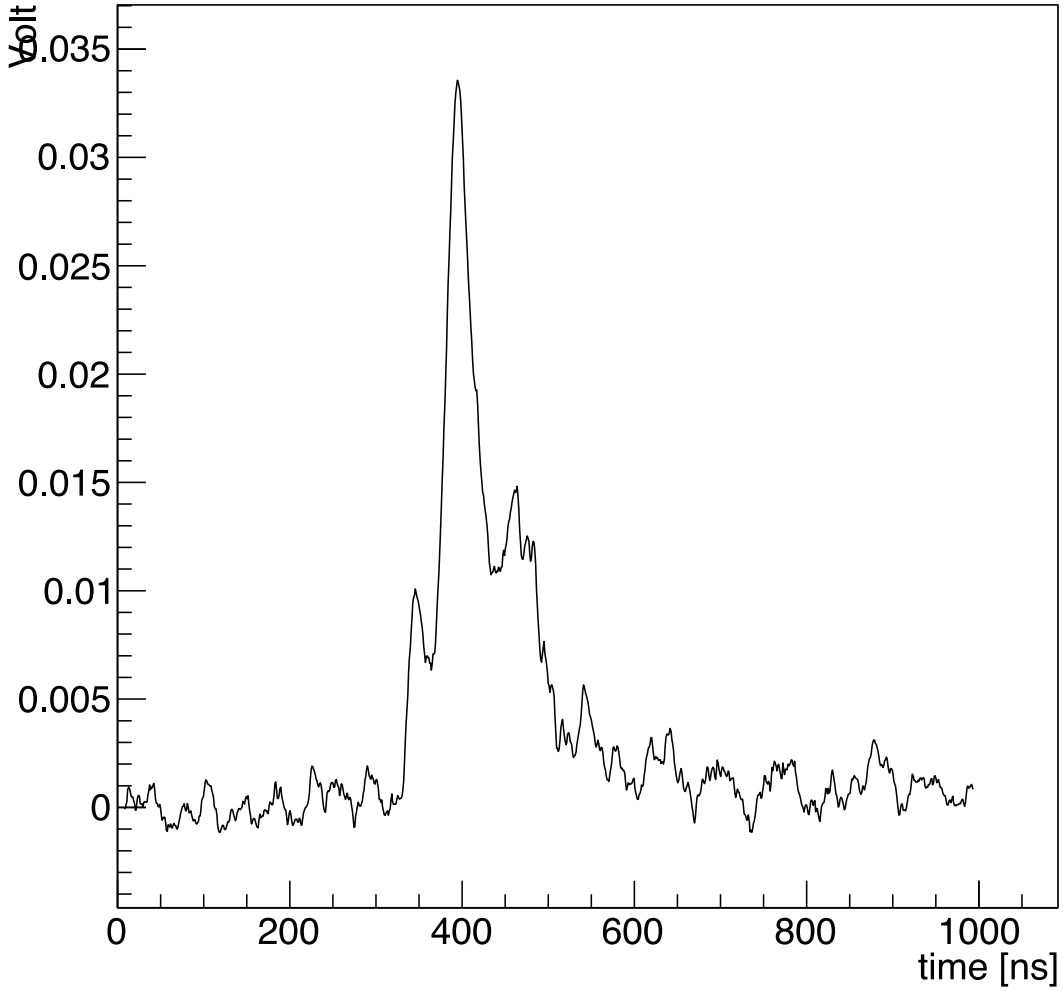
New WF smooth

New WF smoothed

SF = 7

New WF smooth





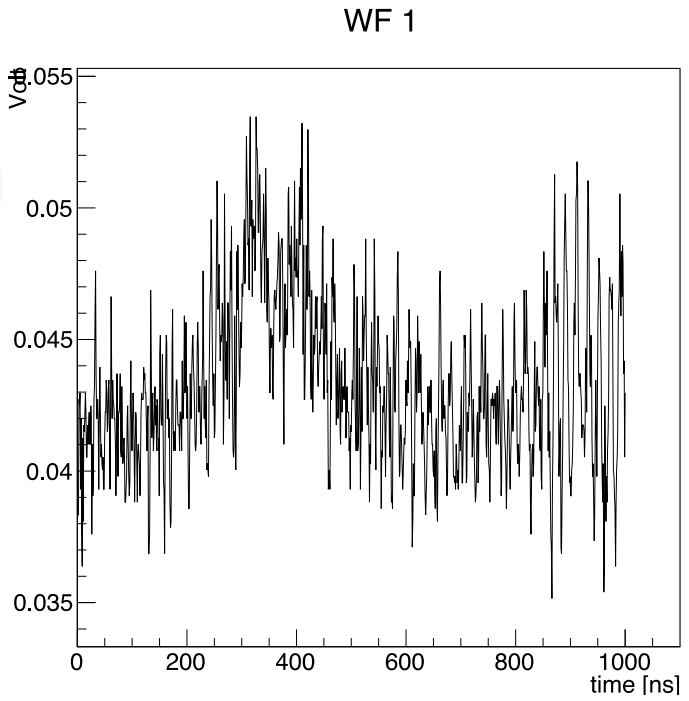
Smoothing WFs

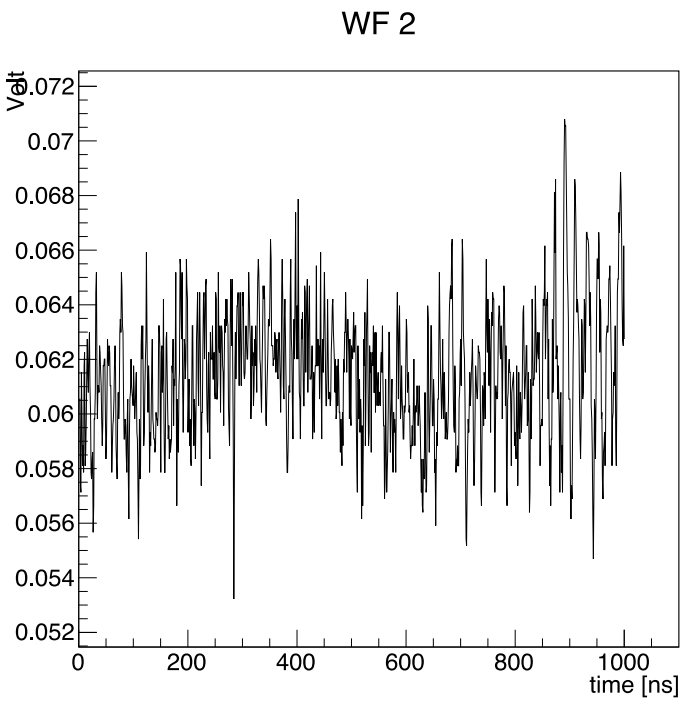
- Run 126 (event 1)

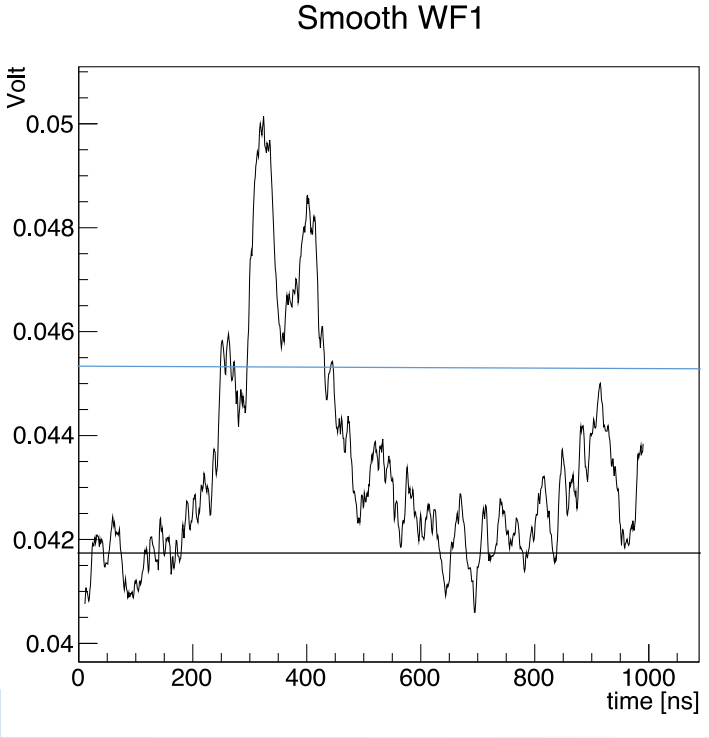
- No Smooth

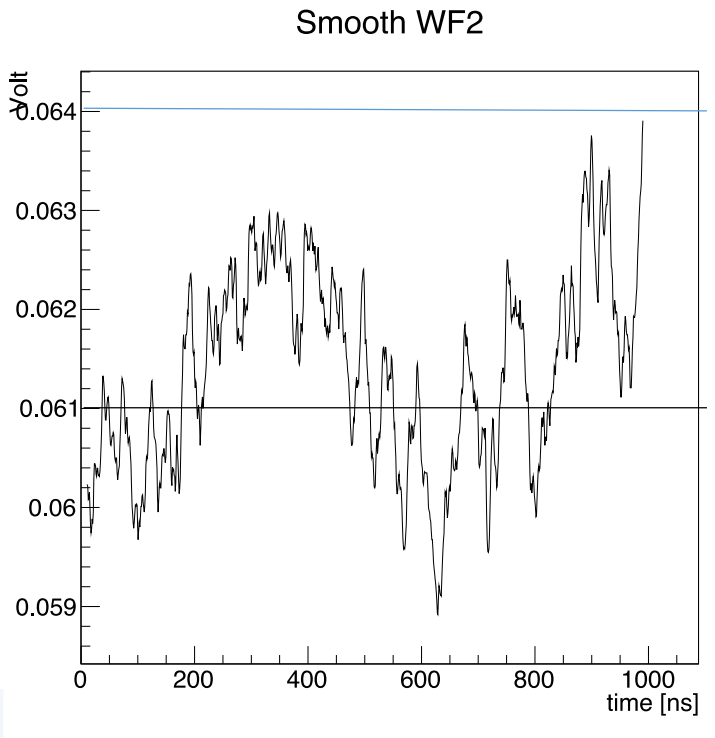
SF = 10

- It could be a good technique to separate empty by full waveform. It seems that a threshold of about 0,003 over the baseline could work.
  To be tested!







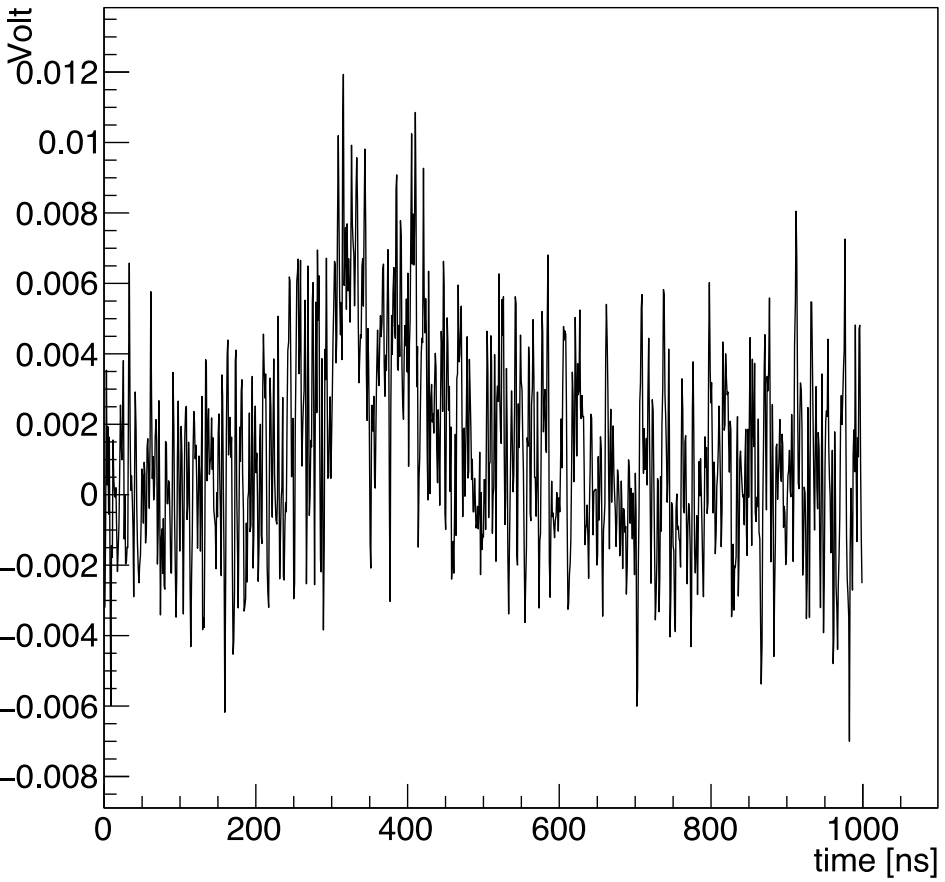


Smoothing WFs

➢ Run 126 (event 1)

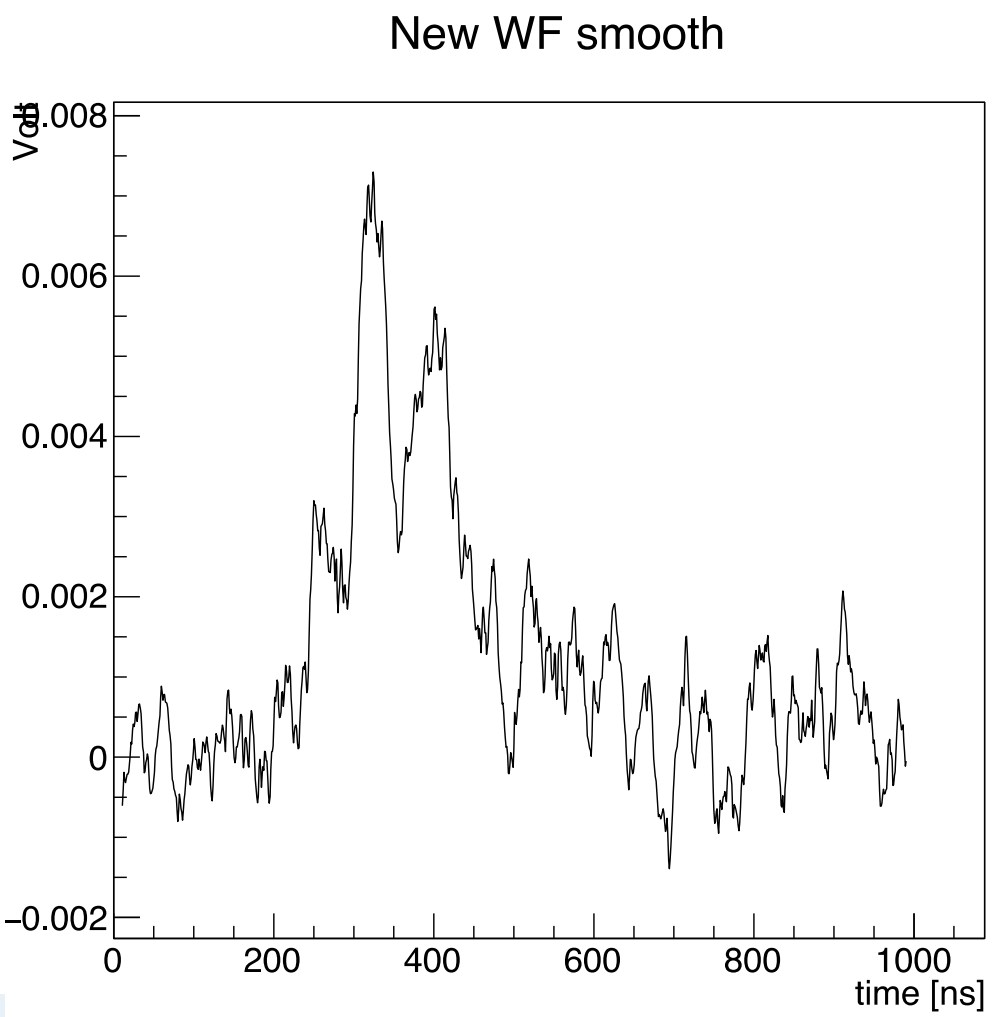
No smooth

New WF



New WF

SF = 10



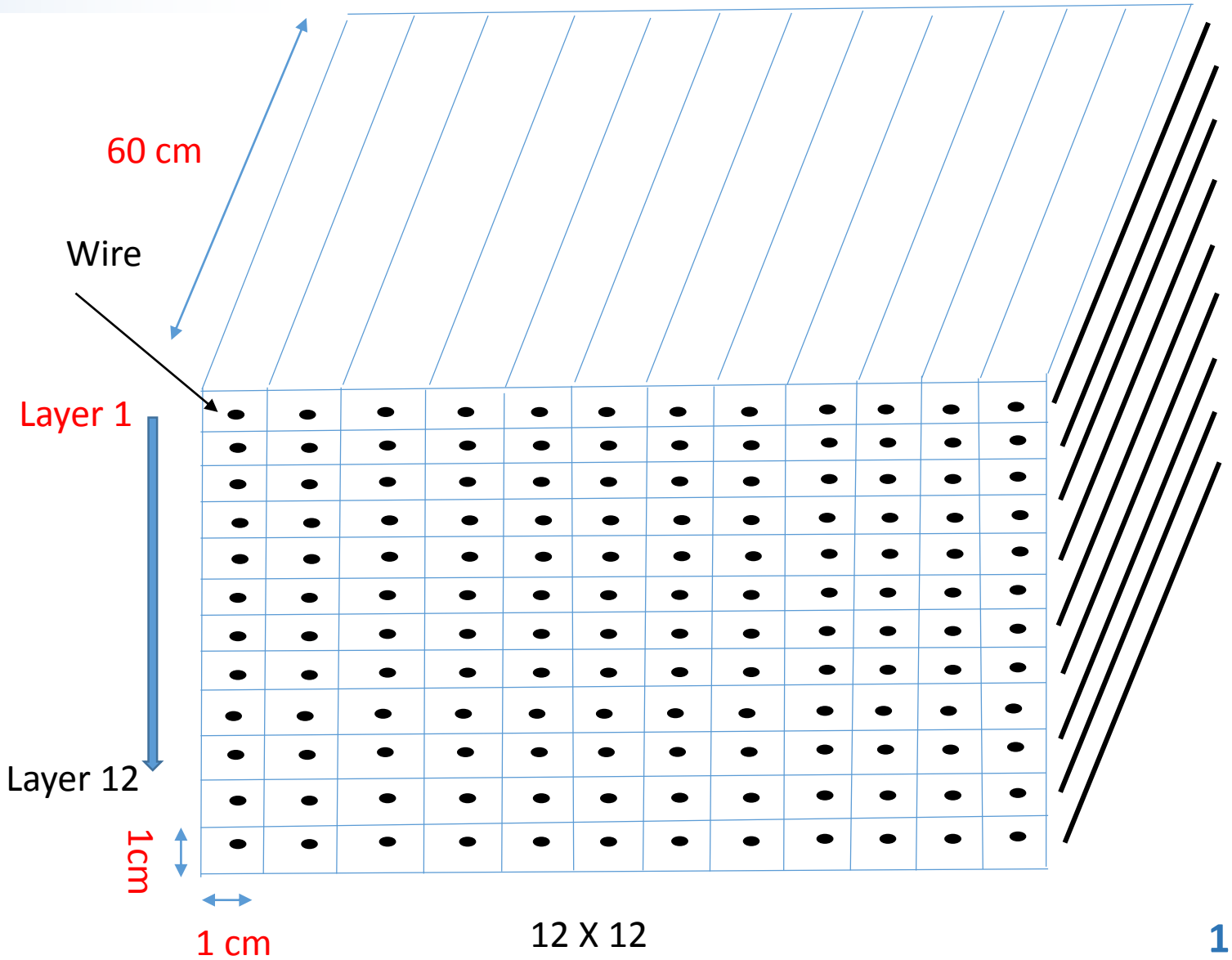
Next Step

- Finalizing the Identification of the noise in each cell.
- Identify the first cluster in each cell.
- Distribution of the drift time in each cell.
- Charge integral distribution.
- coarse track fit from hit pattern.

Backup

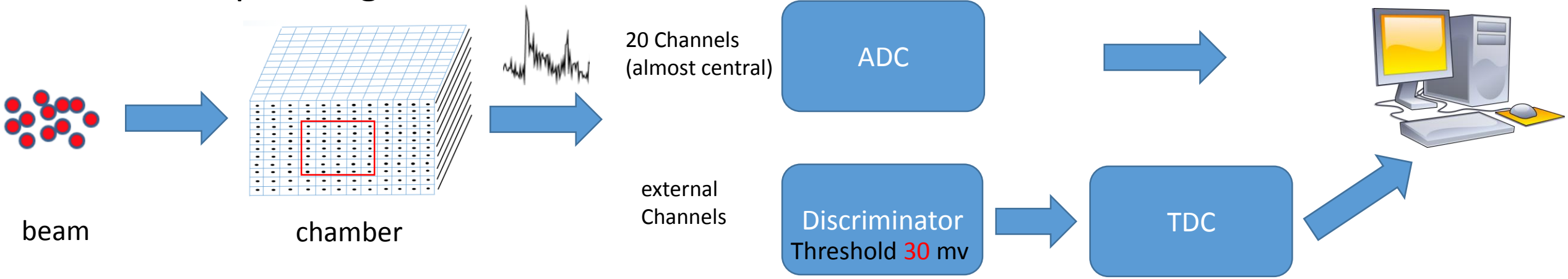
Detector setup

- The chamber consists of 12 x 12 cell
- Each cell is 1 cm x 1 cm
- the wire length is 60 cm
- The voltage applied to each wire is volt about 1475V (depends by the runs)
- The gas used is 90% He 10 % i-C4H10



Test Beam

- The chamber is exposured to different types of beams (Muon , Electron, Pion and Kaon) with energy 20-60GeV
- The setup during the test beam:



- During the test beam:
  - We read just 20 cells in the central core.
    (Layer 7 was broken)
  - Data is stored in /lustre/cms/store/user/taliercio/TestBeam/Drift/

- Distribution of the maximum volte value in all ADC channels in the new wave