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Preliminary analysis of rise time

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Cluster Counting Meeting

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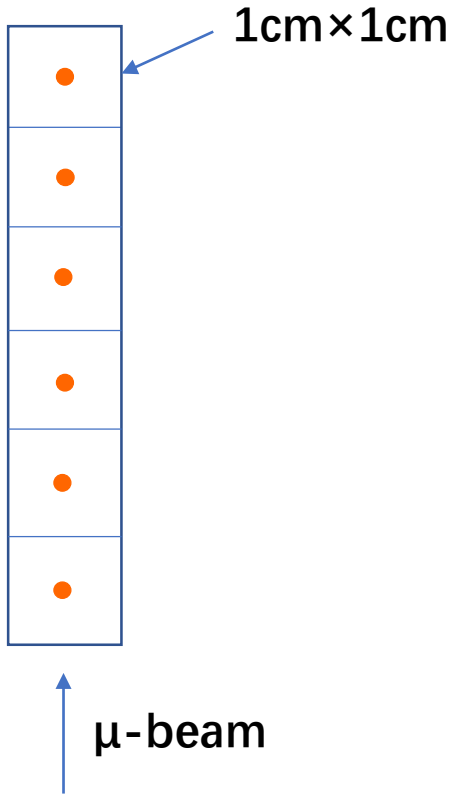
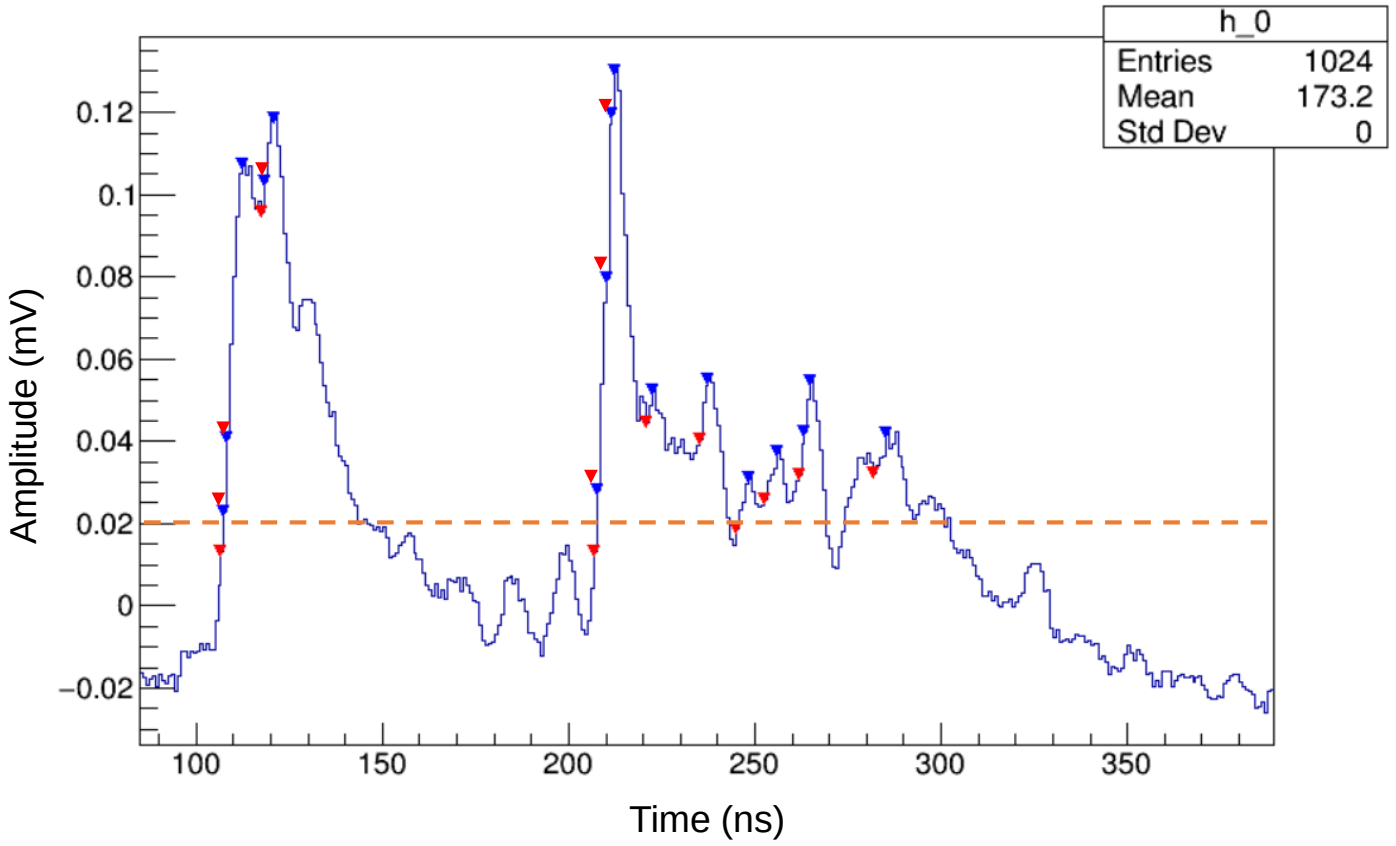
Introduction



- **Motivation**
  - To extract the rise time from data for the simulation of the electronics response
- **Study focused on the waveform recorded by 1cm×1cm tubes**
  - **Data file:**
    - 11Nov_45angle_HVnominalPlus20_1p2GSPS_5k.root
  - **Event selection** (based on the signal after subtracting the baseline)
    - For a good signal, the maximum value of the absolute amplitude after subtracting the baseline should be more than 0.02mV.
  - **The rise time of peaks was calculated**

Algorithm

The points marked in the figure are local maximum points and inflection points



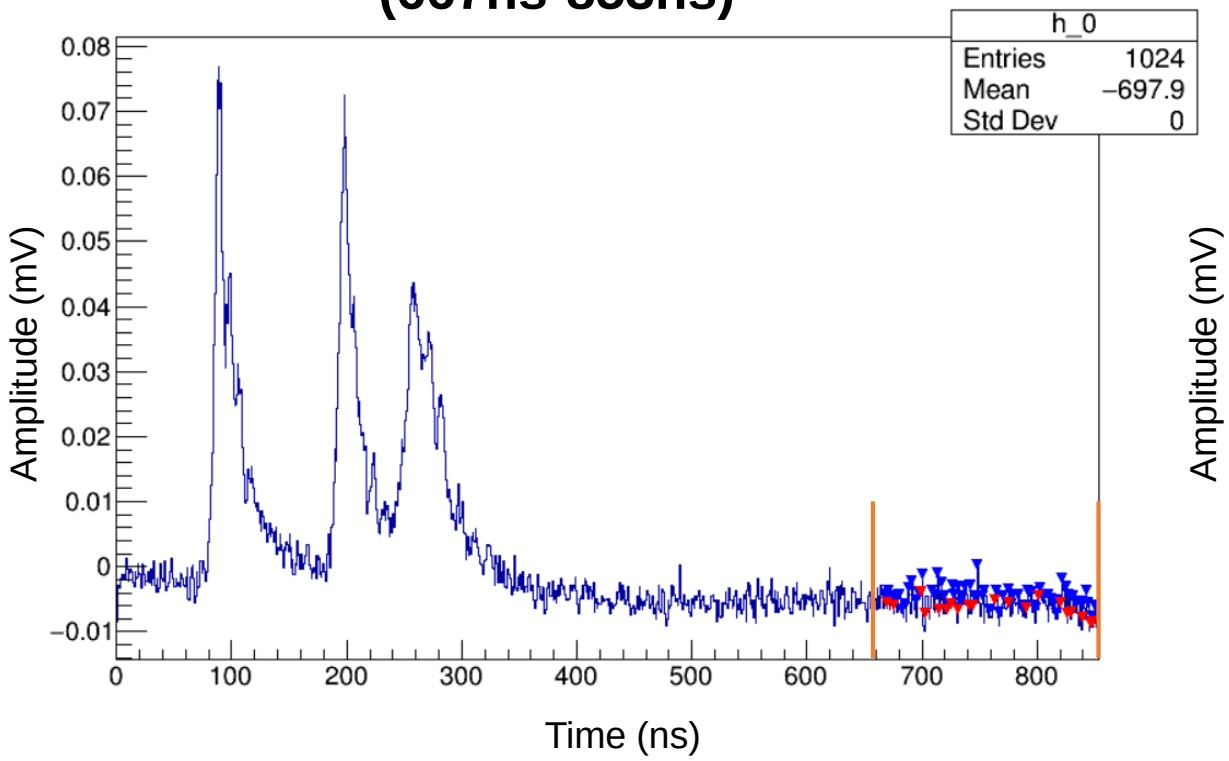
1. Find all the local max of the waveform (>0.02mV)
2. For each local maximum points, find the nearest early point, whose slope starts to decrease (inflection point)
3. The time distance between the local maximum and the inflection points is recorded as the risetime.

- Note: Noises need to be suppressed.

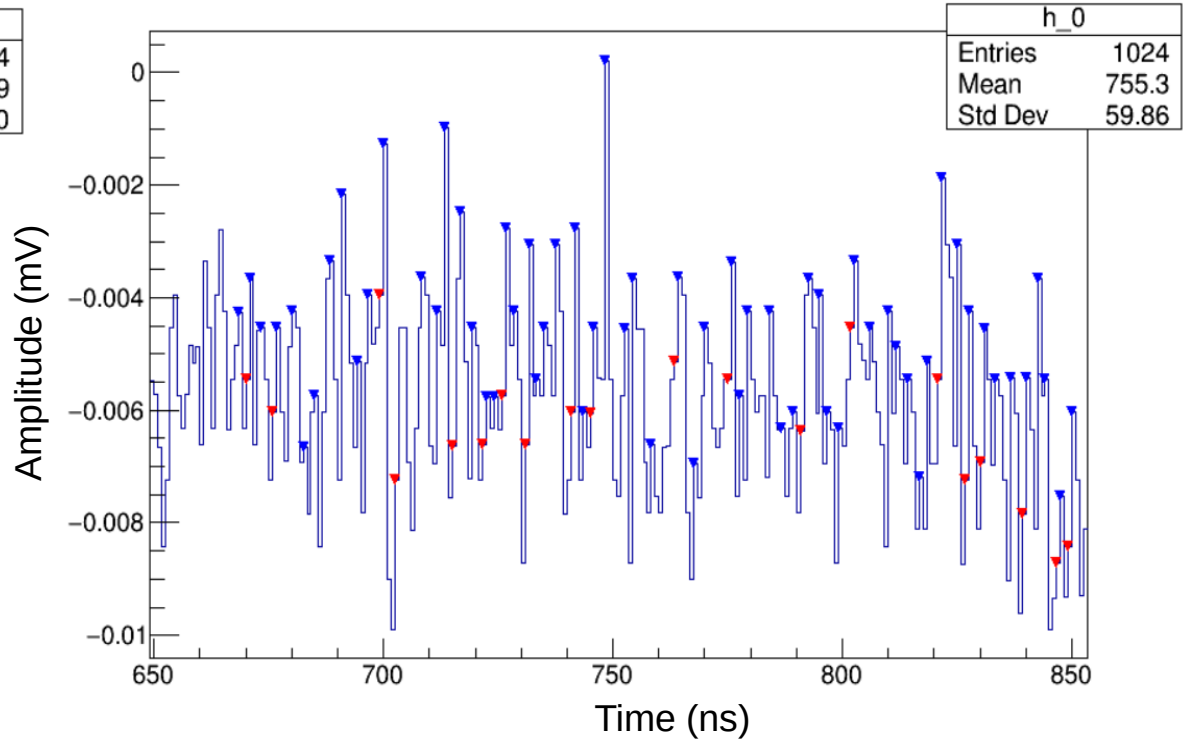
Noise study

- Apply the algorithm to noise waveforms

Noise definition (667ns-853ns)

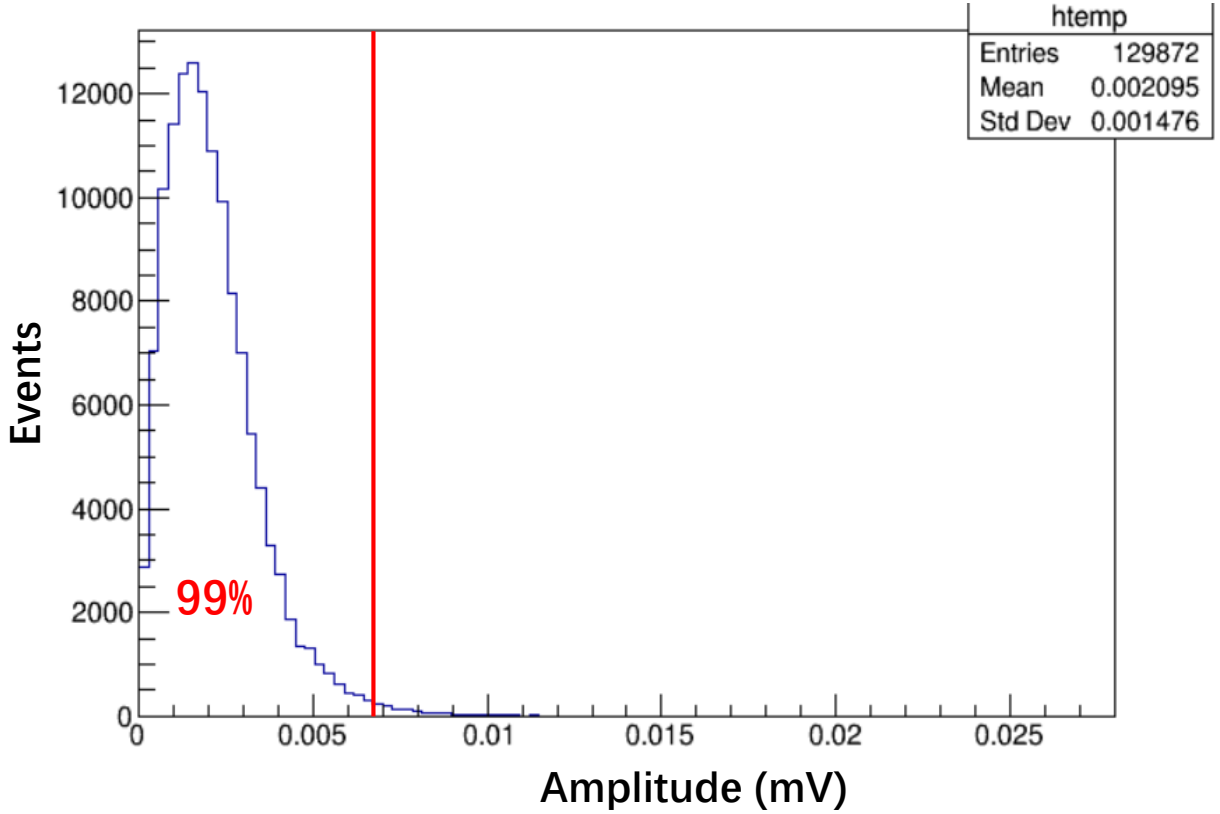


Results



Noise study (II)

The amplitude distribution of rising edges:

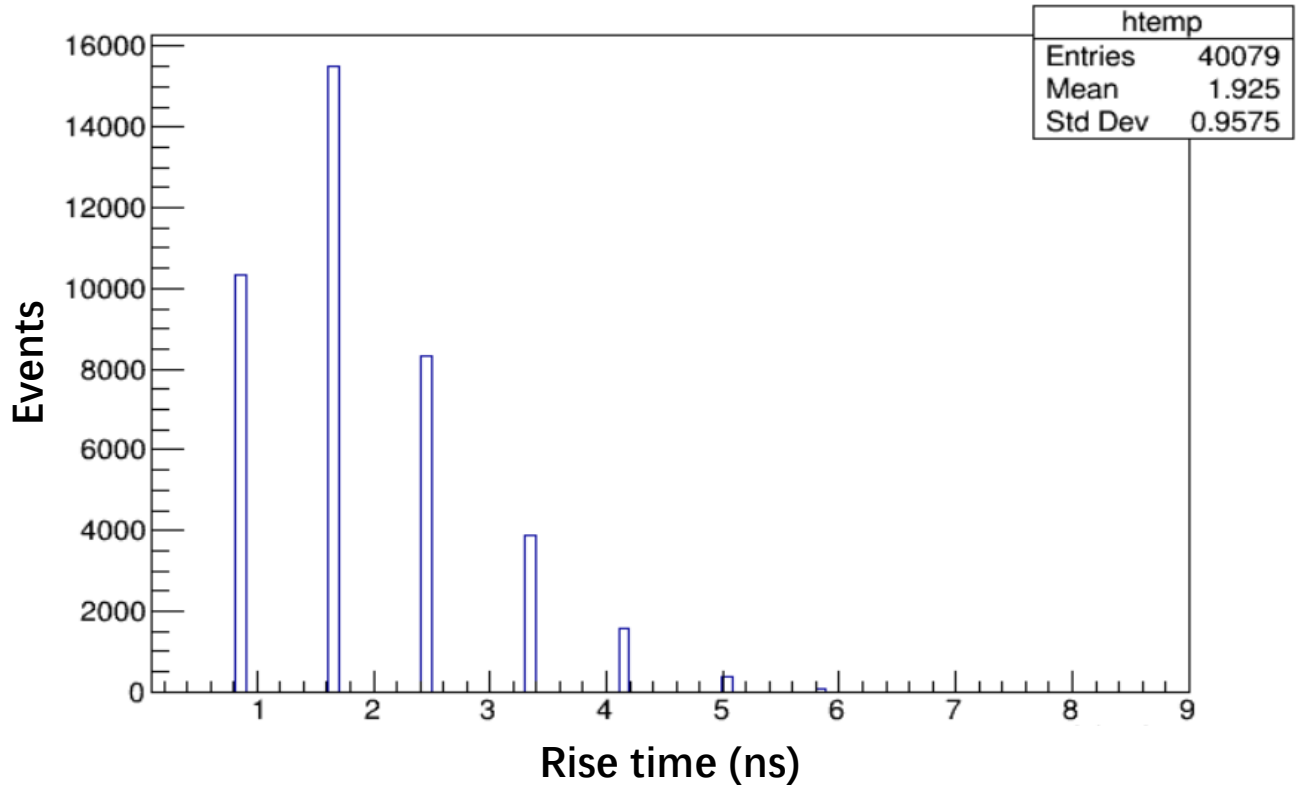


cut	A<0.0039mV	A<0.0067mV
percent	90%	99%

- 99% of the noise amplitudes are below 0.0067mV.
- We apply the 99% cut.

Preliminary results

The rise time distribution of rising edges:

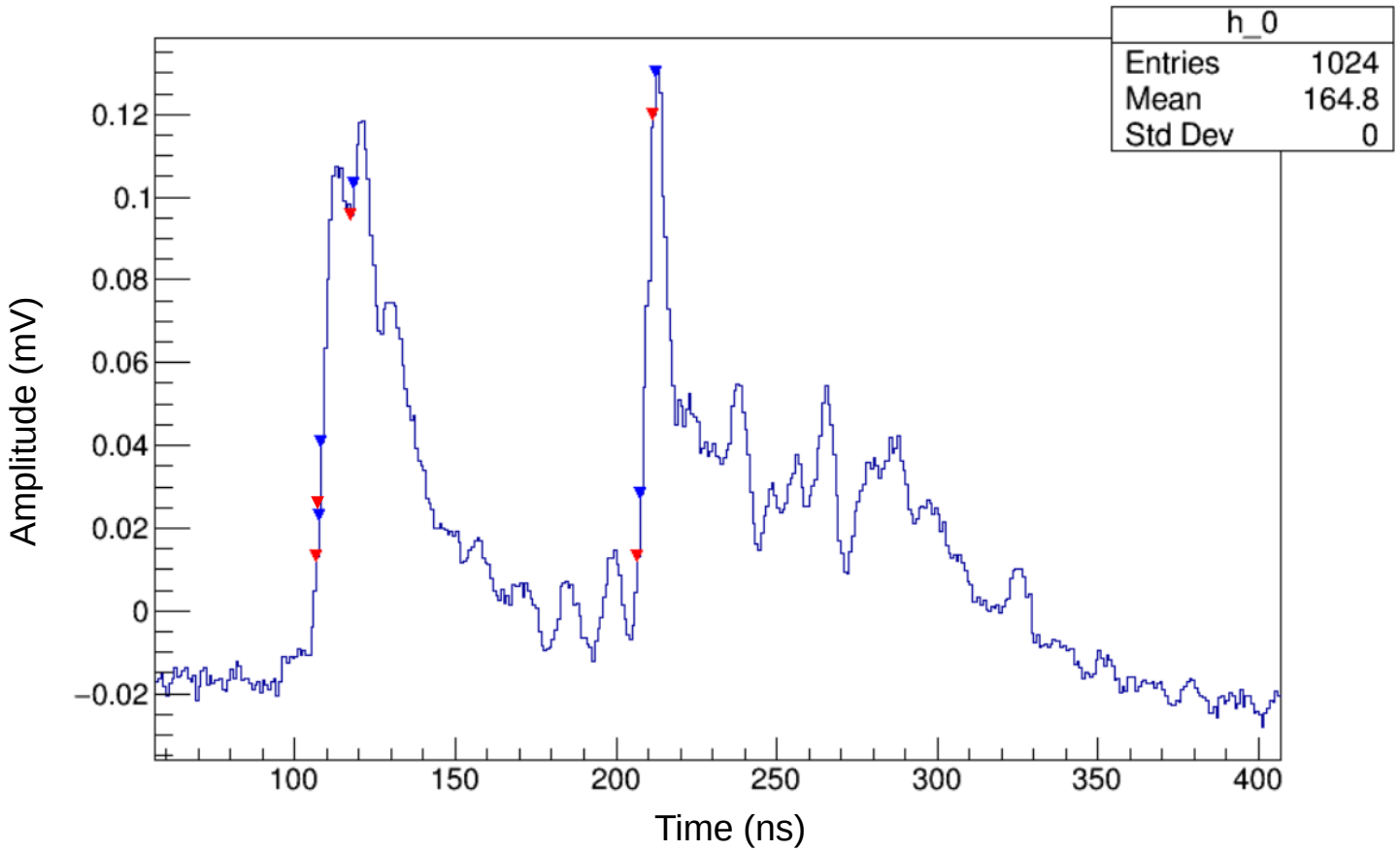


rise time/ns	percent
0.83	26%
1.7	39%
2.5	21%
3.3	9.6%
4.2	3.9%
>=5.0	1.2%

- Each bin is around 0.83ns
- The average of rise time is 1.925ns.
- About 84% of the rise time is under 2.5ns.

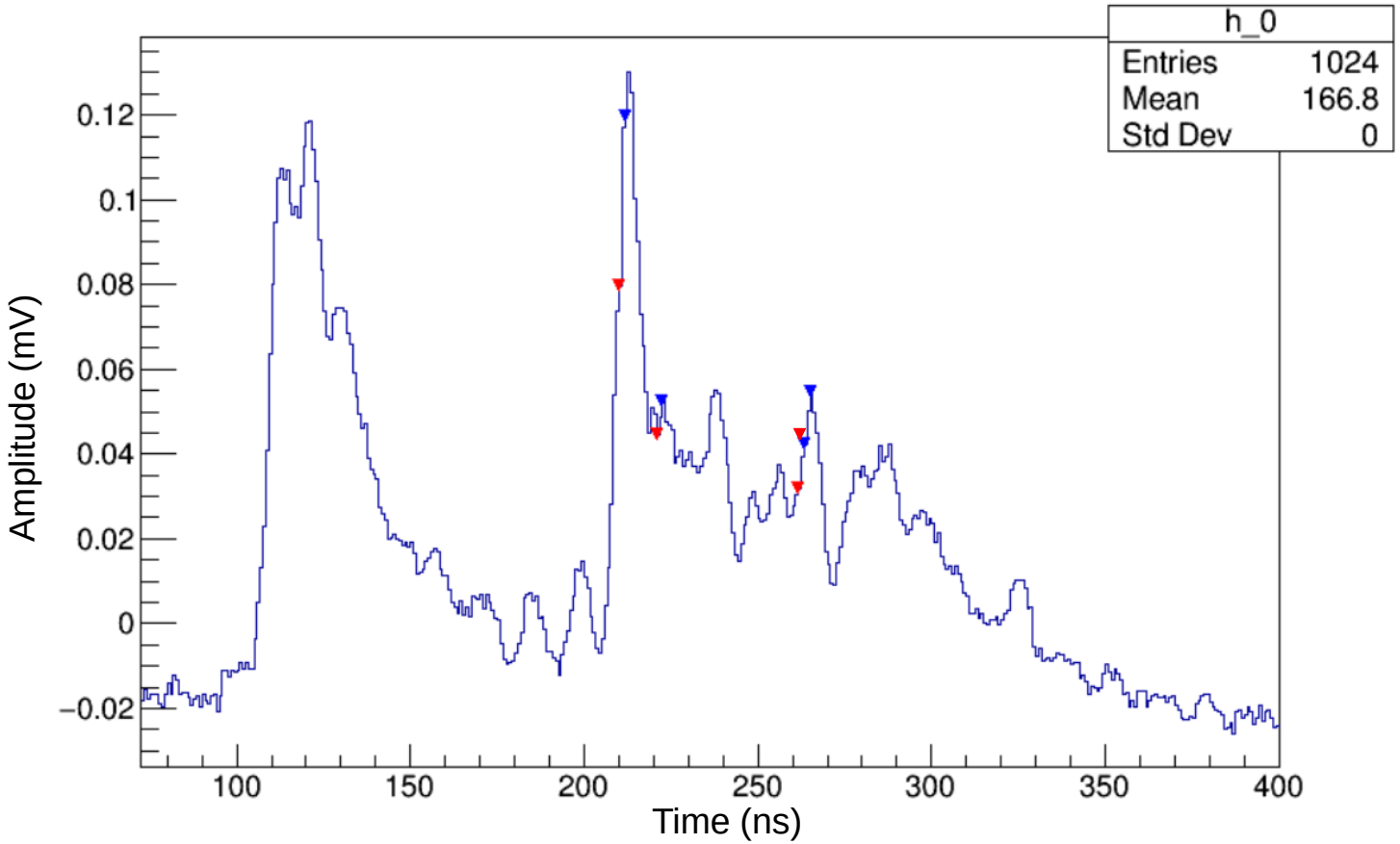
Some plots

Rise time = 0.83ns



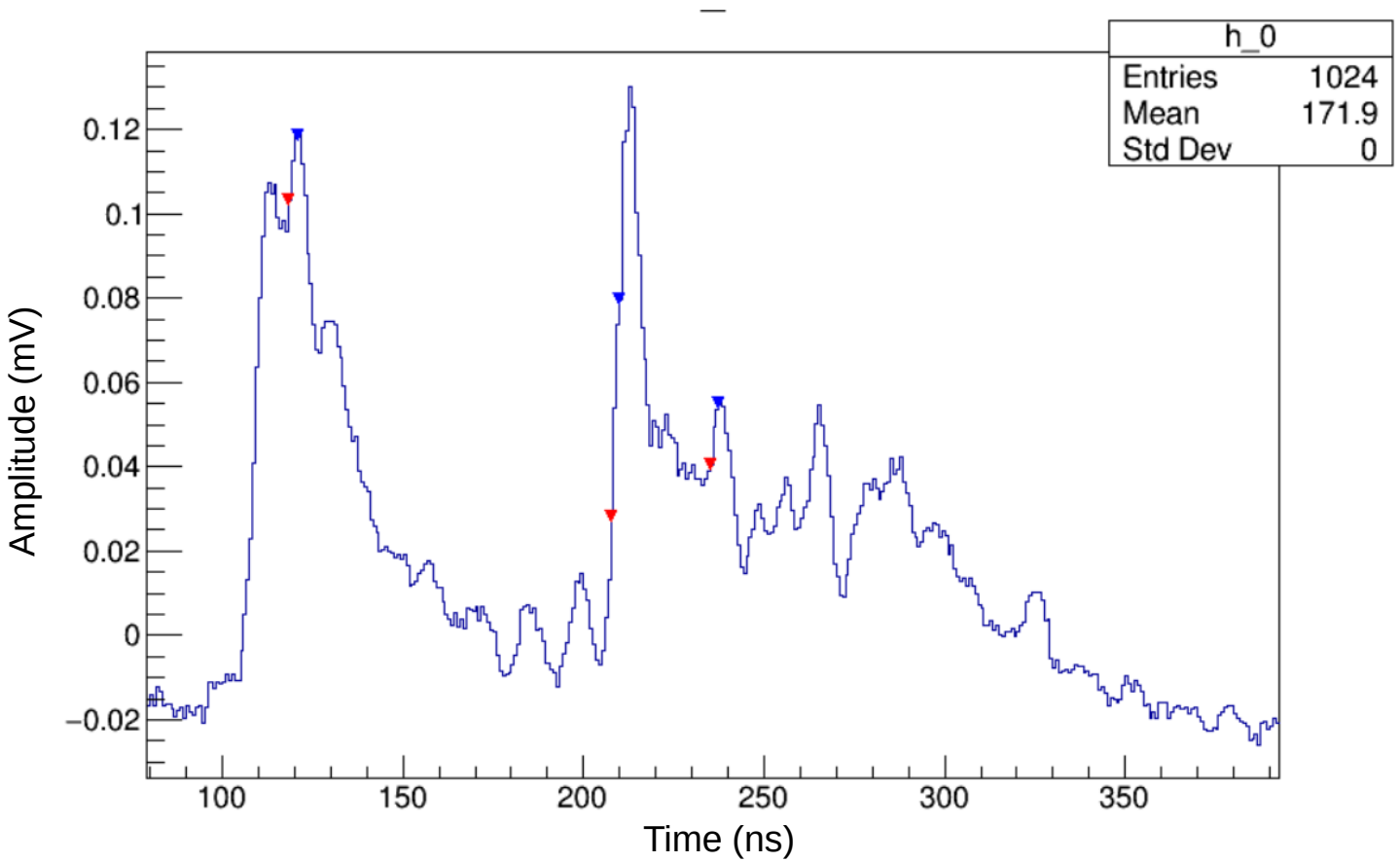
Some plots (II)

Rise time = 1.7ns



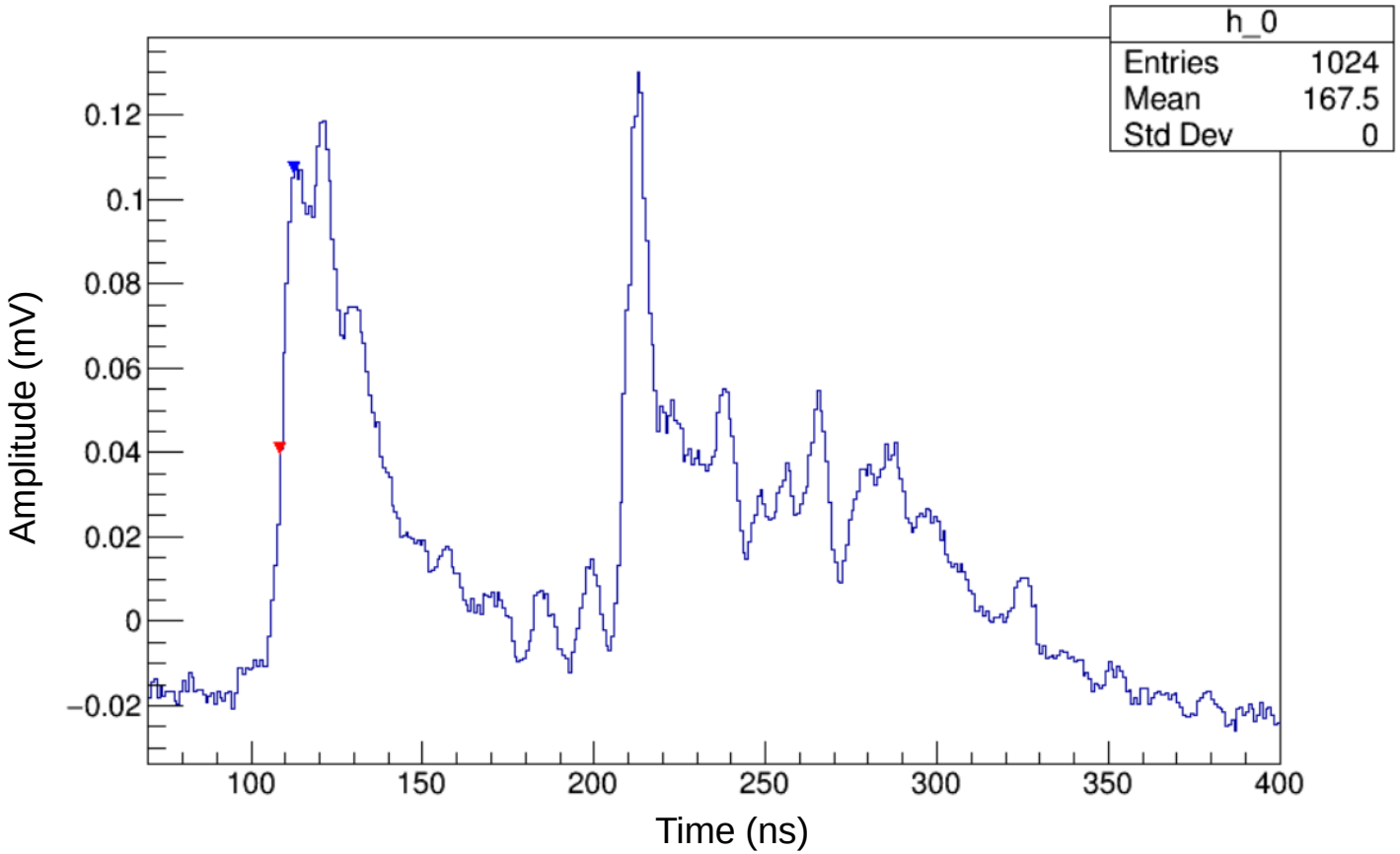
Some plots (III)

Rise time = 2.5ns



Some plots (IV)

Rise time = 4.2ns



Summary

- **Have developed an algorithm for peak rise time calculation**
- **By analyzing the beam test data, the averaged rise time is around 2 ns**
- **To do:**
  - Analysis with peak finding algorithm
  - Implement the rise time in simulation
- **Discussion**
  - Could we check it with simulation using the transfer function?

Thanks!

Amplitude distribution