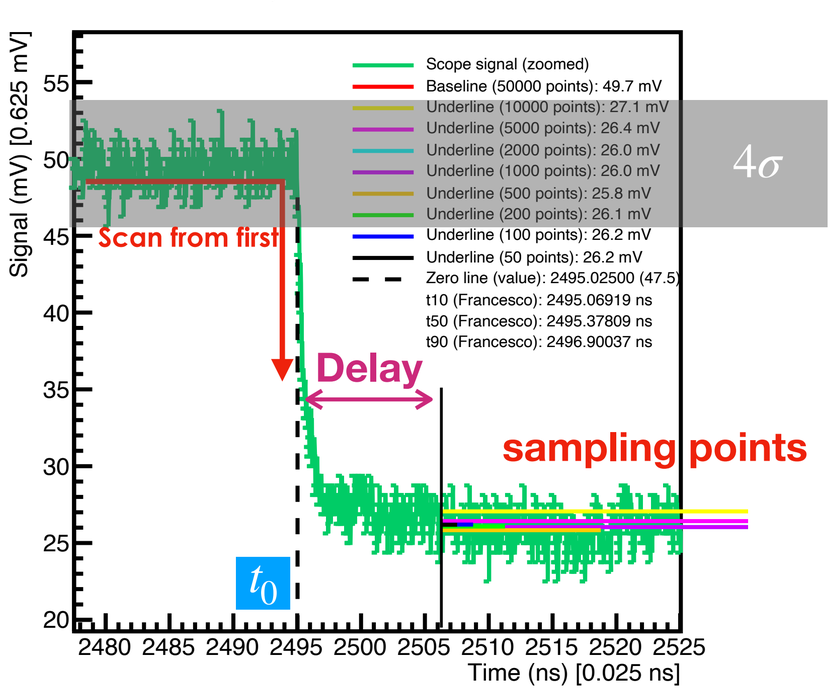
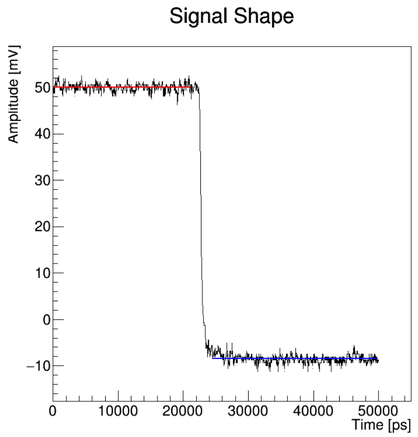
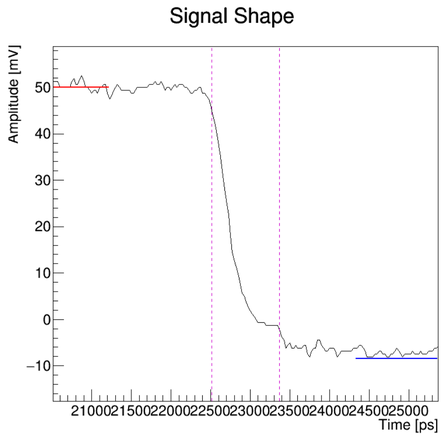
Reminder: Determine t_0 and underline



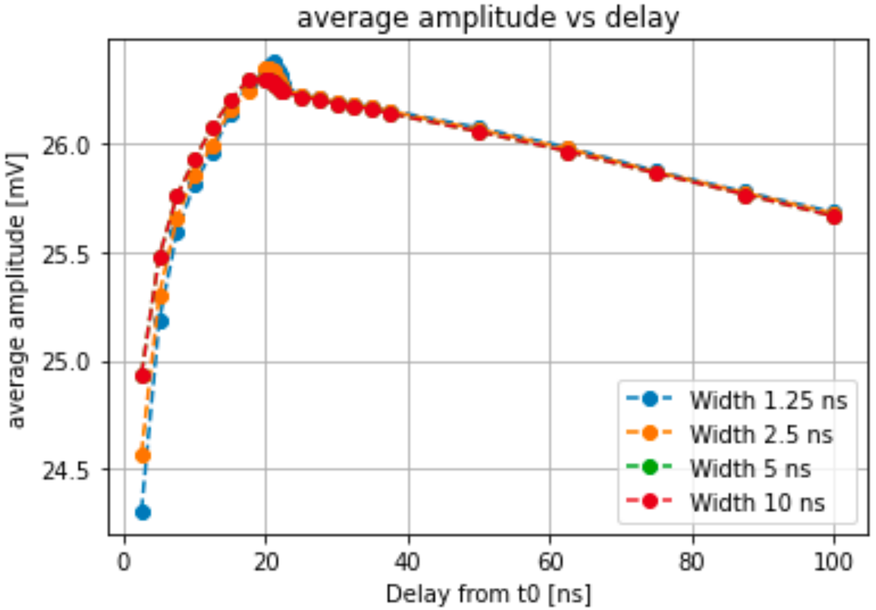




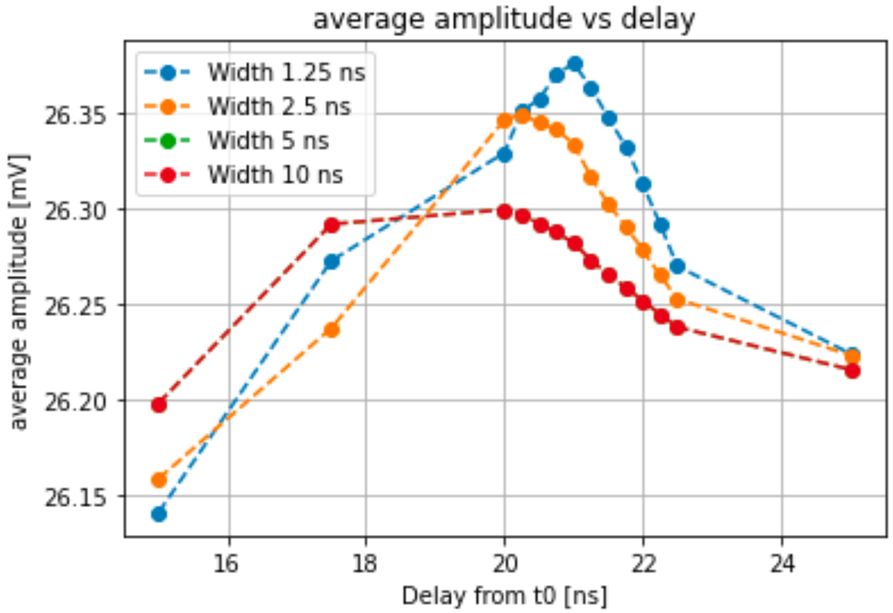
- **Determination of t_0**
  - Important for the stabilisation of the underline value
  - Procedure
    - Compare the signal with the baseline, starting from the left.
    - Count the number of points **~4 sigmas (~4.3 mV)** smaller than the **baseline**.
      - Count **10 points in a row** (250 ps)
      - If there is any point within ~ 4 sigmas during the check, remove the current count stack and scan next point.
    - If the above test is passed, use the point placed **10 points** (250 ps) before as a t_0
      - t_0 is not exactly pointing the starting point of signal. but this value is used as a standard point to obtain a relative position eg. $t_0 + 5ns$
- **Underline**
  - Underline values are determined based on **the relative starting point from t_0**.
  - Similar to the determination of baseline
    - But the falling signal has a **tail** - need to put a **delay**
  - Dependency on the delay and **number of sampling points** studied.

Average amplitudes with delay

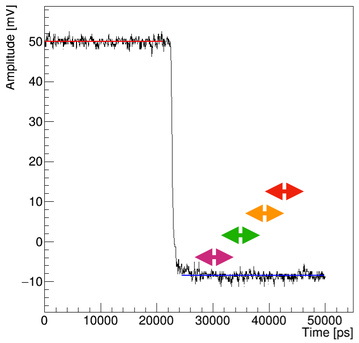
Baseline: 5 ns from t_0 + 5 ns sampling



Cumulated signal



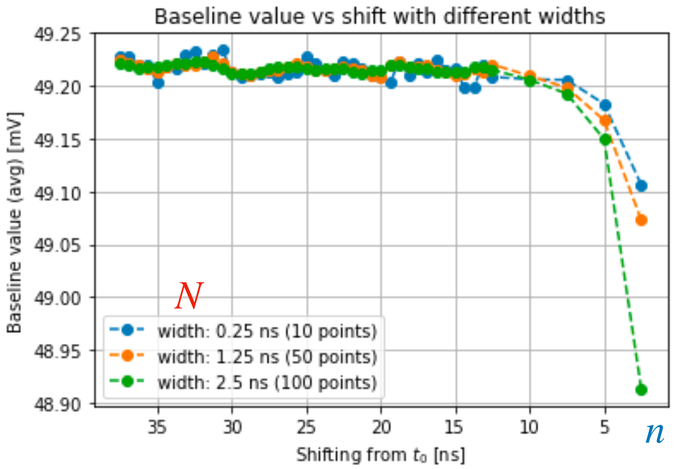
Zoom up around 21 ns delay



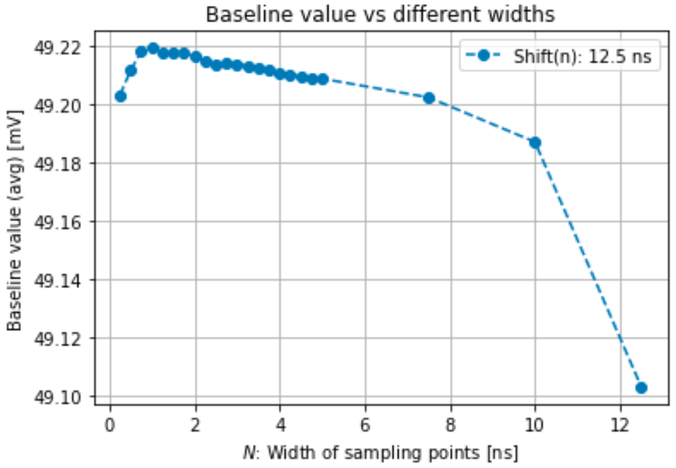
Delay variation of underline (fixed width as 1.25 ns)

- **Maximum amplitude point scan**
  - The maximum amplitude can be obtained when the underline value is the minimum.
    - The signal decreases continuously even after rapid fall.
  - **<u>The maximum point can be found around 21 ns delay (1.25 ns width)</u>**
    - If we choose around 200 sampling points (10 ns), the between 17.5 to 20 ns will be stable.

Baseline vs shift from t_0

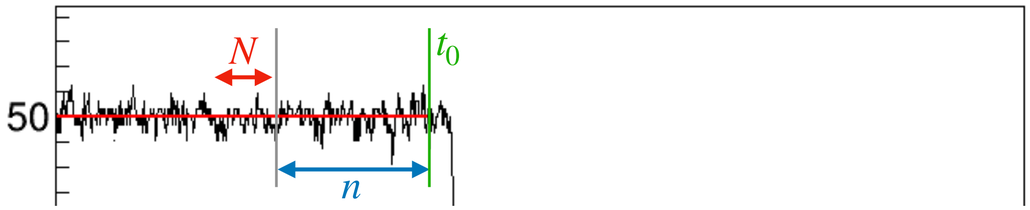


Baseline with different shift/sampling points



Baseline with different sampling points (*N*)

- **Baseline calculation:**
  - Average value of N sampling points(width) counting from n ns shifting to t_0

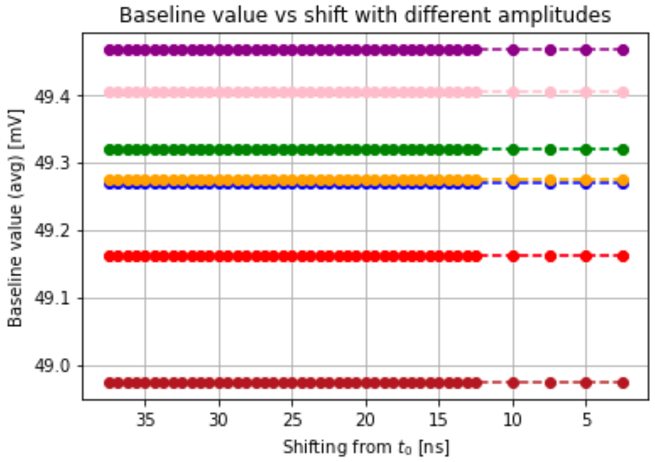


Baseline calculation example with t_0, n shifting, N sampling

  - Average value converges around 49.215 mV after **12.5 ns shift**
    - Standard deviation of sampling points: **~1.6 mV**

  - Average baseline vs various sampling points(*N, width*)
    - The value has the **maximum at 1 ns width**.
      - Relatively stable until 5 ns
      - **Between 0.75 and 2 ns** will be suitable.

Baseline vs shift from t_0 with different amplitude



- **Check with different signal amplitude:**
  - Shows a clear dependence on signal amplitude.
    - σ of the baseline distribution: ~0.1 mV
  - No specific trend of order in higher signals(**80-100**, **100-120**, 120-40)
    - For small amplitudes, small amplitude has small baseline.

- Check with different width (number of sampling points):
  - Having some shared region, but still showing the amplitude dependence.