Two-stage amplifier
Status update

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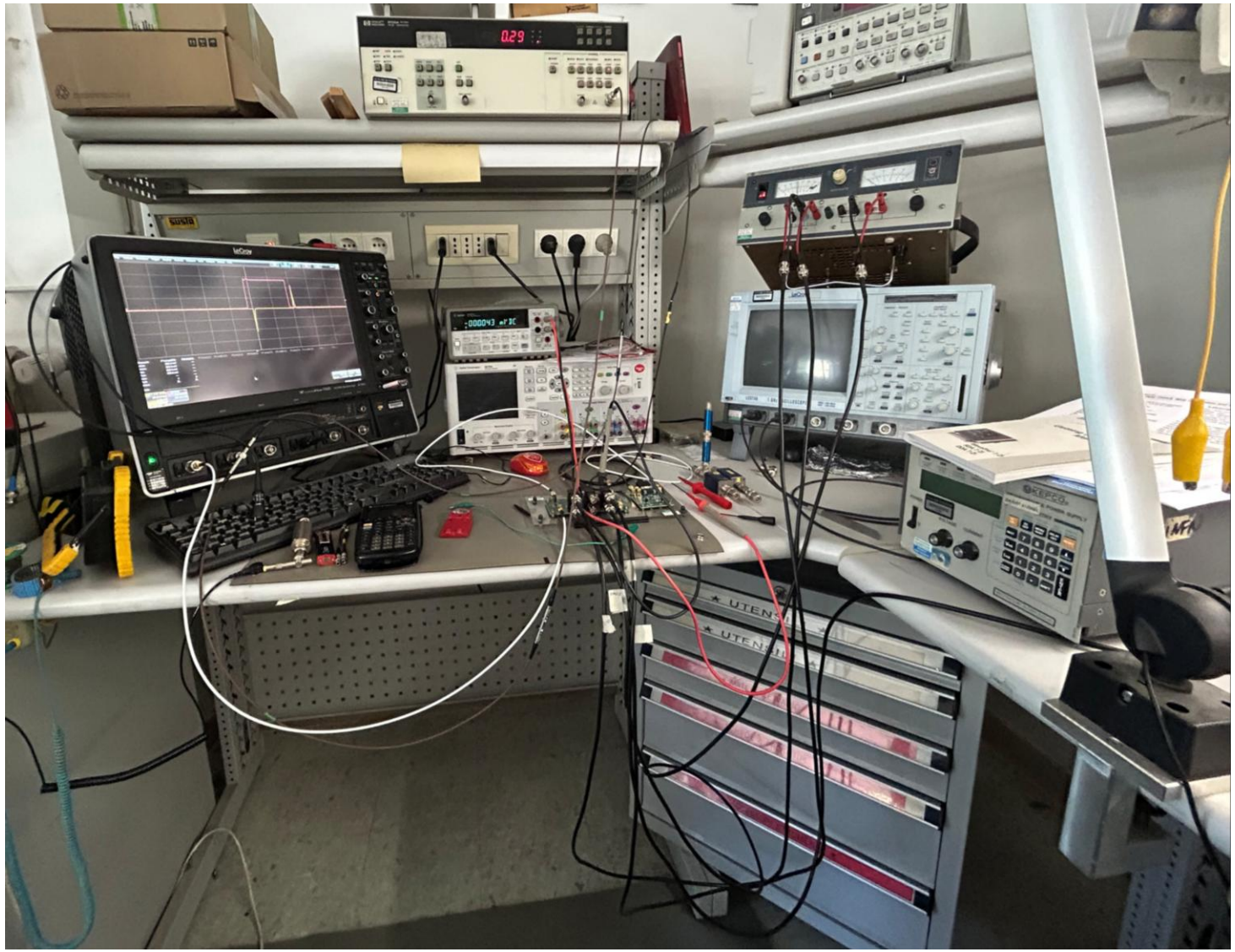
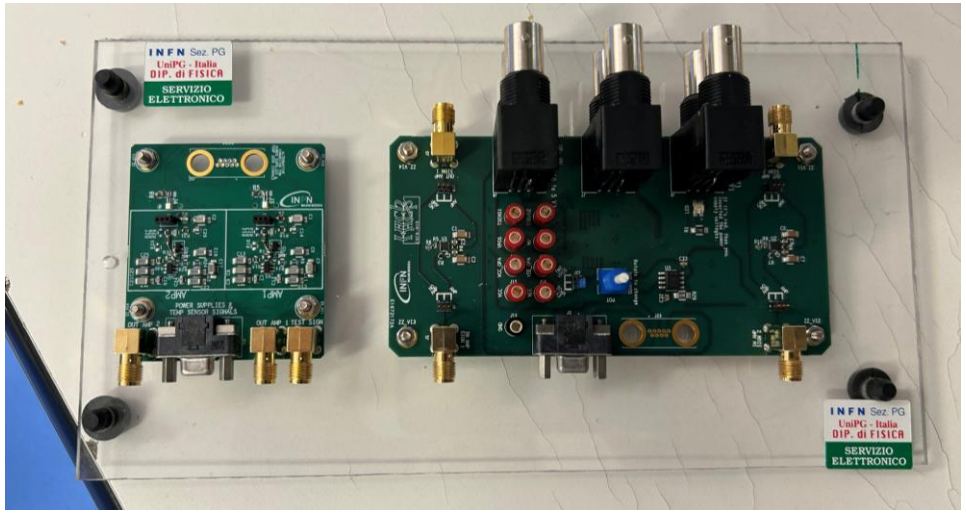
Update meeting

25/08/26

Set up for TIA charge calibration

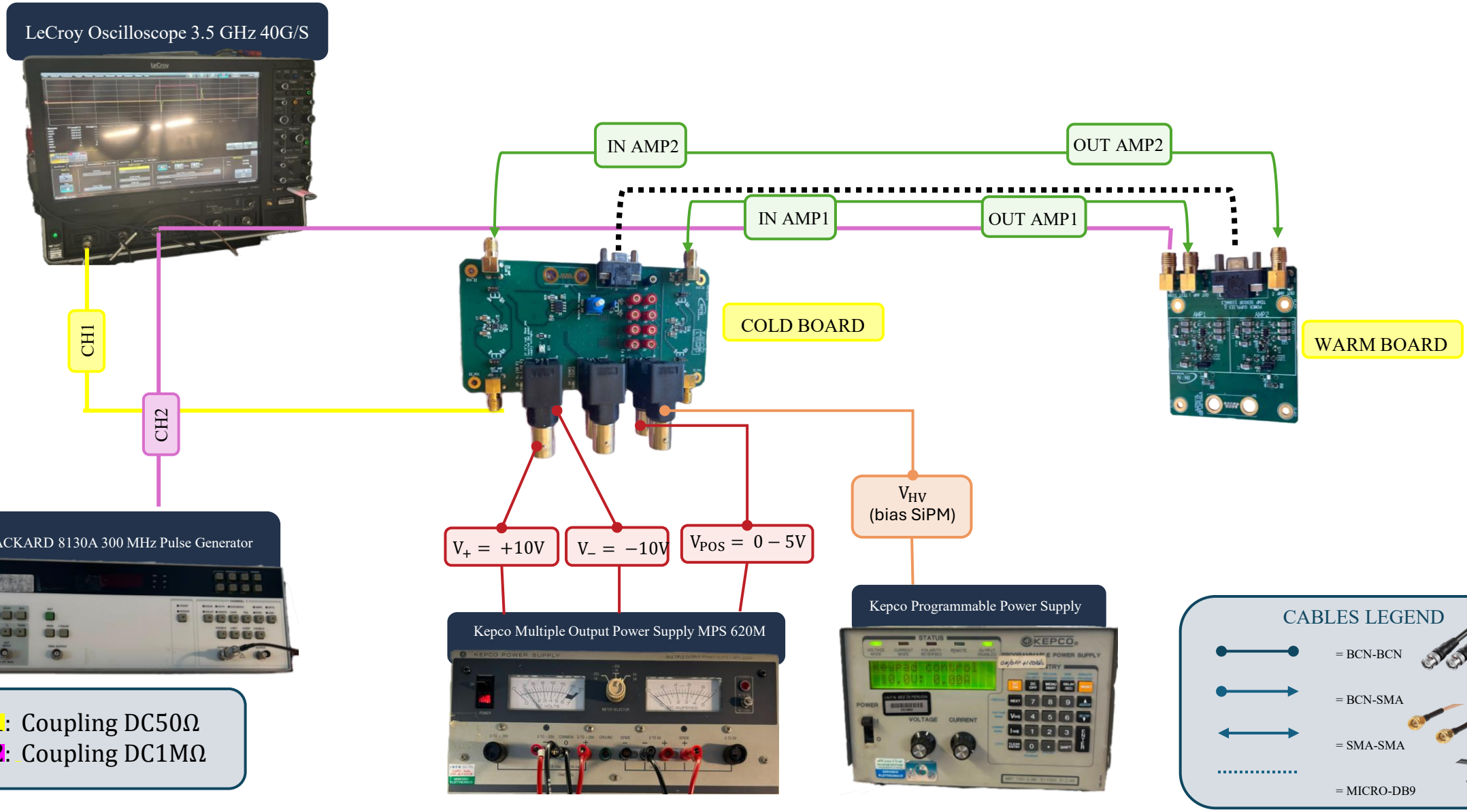




Two-stage amplifier

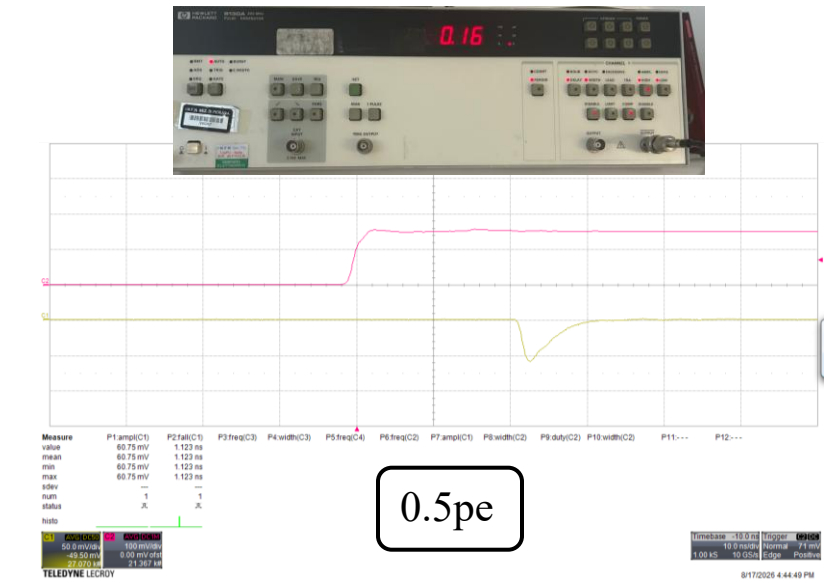
Electronics Laboratory
Measurement date: 18/08/2026

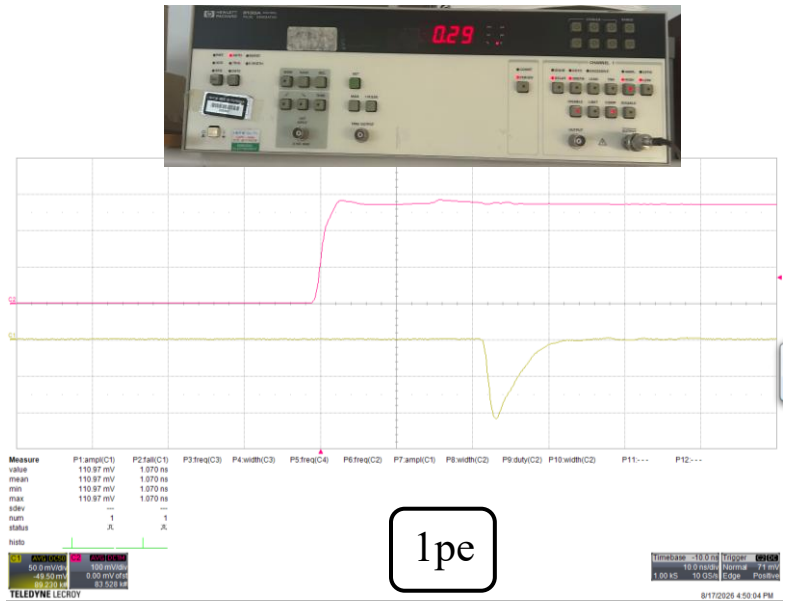
Set up: schematic view

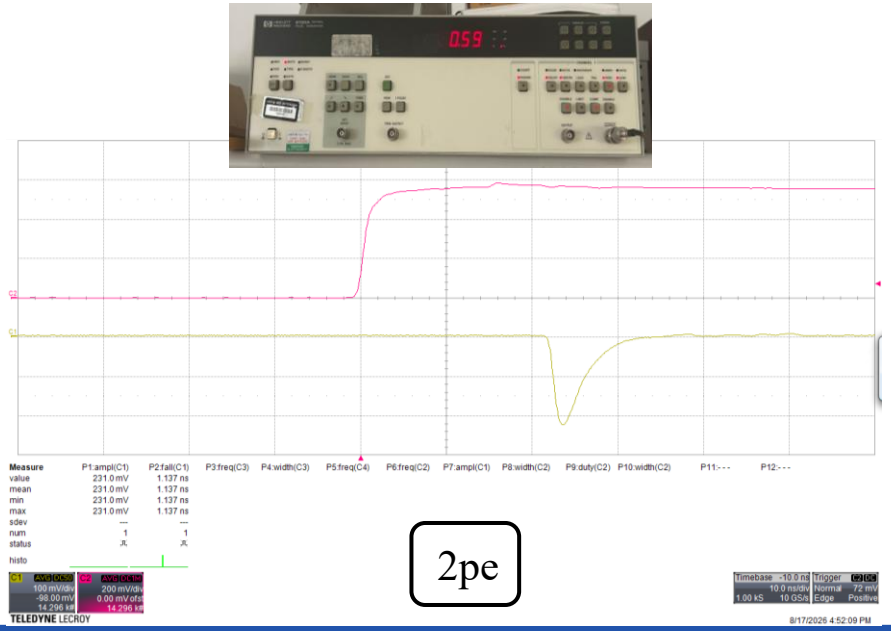


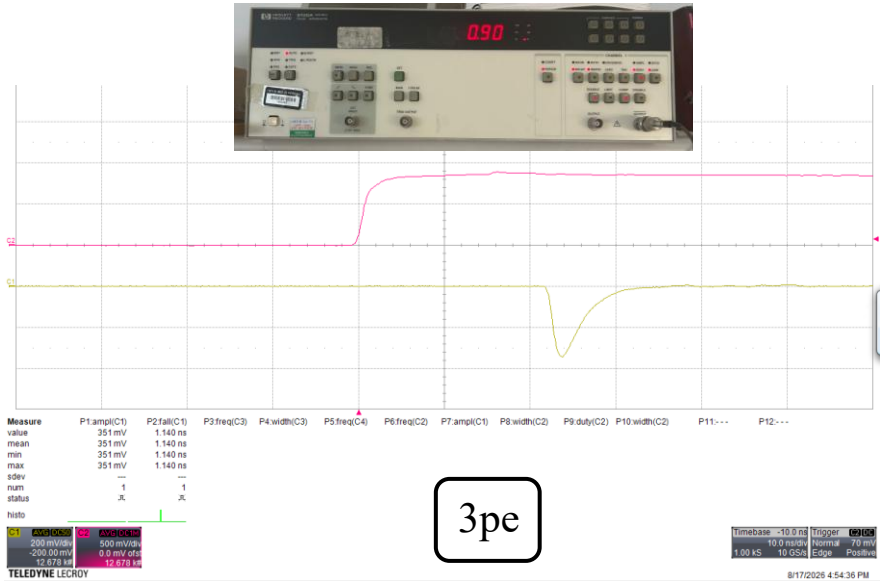
CH1: Coupling DC50Ω
CH2: Coupling DC1MΩ

Calibration dataset: injected charge points





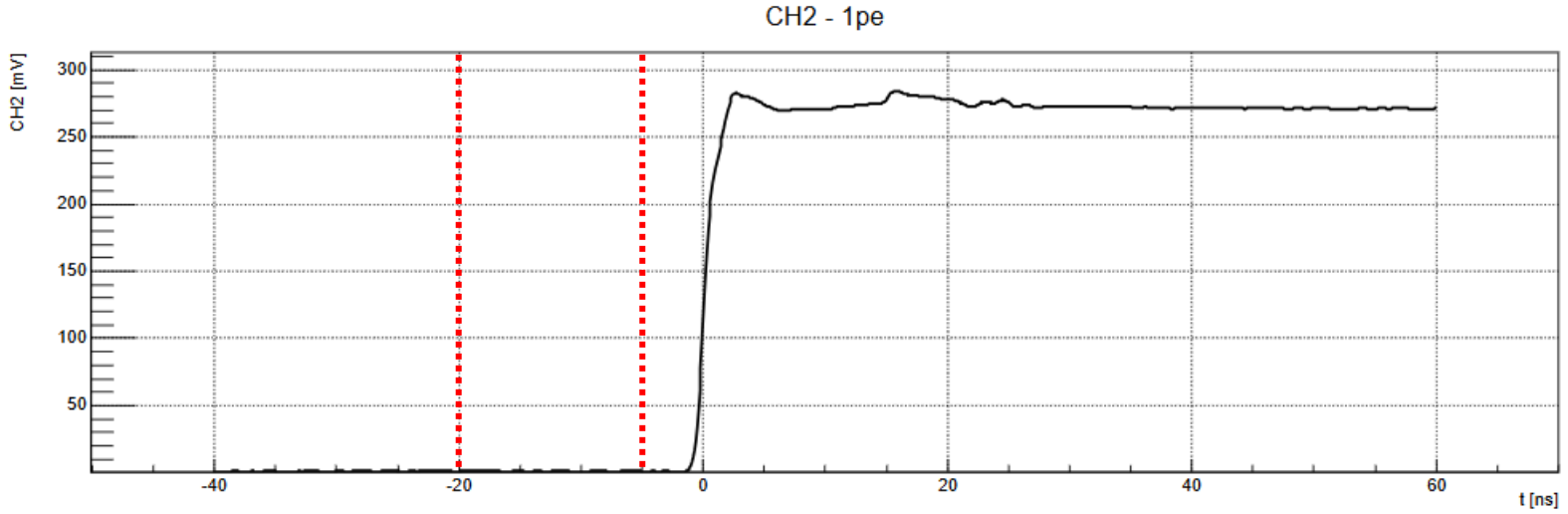




Data-taking and acquisition settings

Data-taking period: 18 August 2026

- No SiPM
- T ≈ 25°C
- **CH1 – TIA output**
  - DC 50 Ω
  - Average: 70 sweeps
- **CH2 – Vtest**
  - DC 1 MΩ
  - Average: 70 sweeps
- **Trigger**
  - Source: CH2
  - Edge, positive slope
  - Level: ~71 mV
- **Acquisition :** 10 GS/s :10 ns/div



Correzione della baseline

- Interval: $-30\text{ns} \leq t \leq -10\text{ns}$

$$\overline{V}_{\text{baseline},i} = \frac{1}{N_i} \sum_{j=1}^{N_i} V_{ij}$$

$$V_{\text{corr},i}(t) = V_i(t) - \overline{V}_{\text{baseline},i}$$

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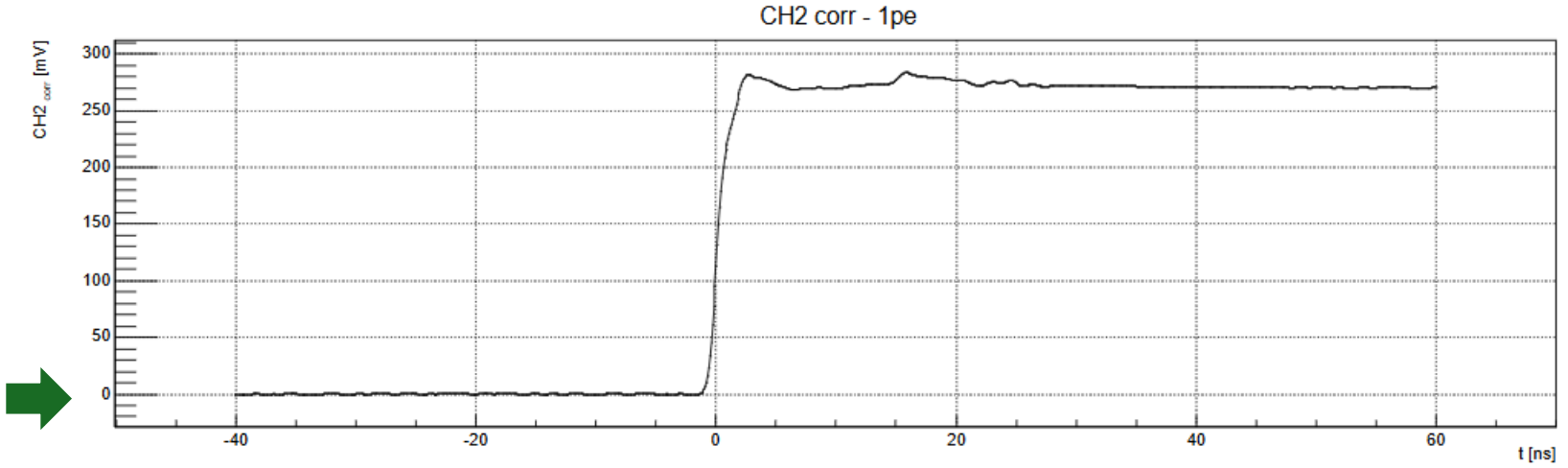
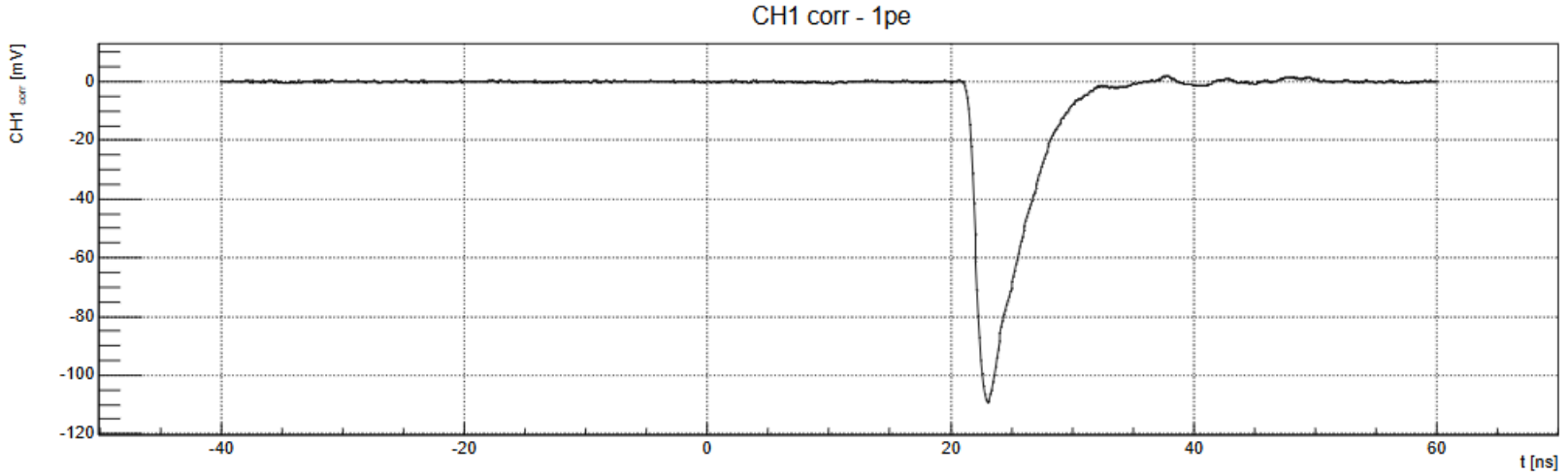




Correzione della baseline

- Intervallo: $-20\text{ns} \leq t \leq -5\text{ns}$

$$\overline{V}_{\text{baseline},i} = \frac{1}{N_i} \sum_{j=1}^{N_i} V_{ij}$$

$$V_{\text{corr},i}(t) = V_i(t) - \overline{V}_{\text{baseline},i}$$

Injected charge determination

1 Real injected charge

✓ **CH2 plateau measurement**

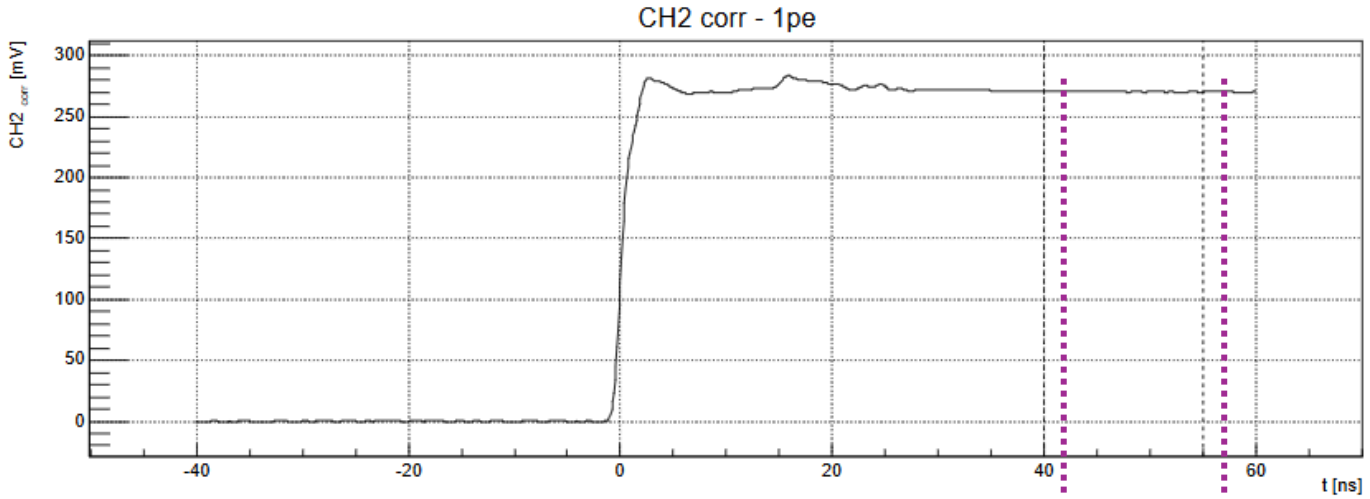
- The baseline is evaluated in the pre-signal region (see previous slide)
- The plateau is evaluated in the stable region after the transient:

$$V_{\text{plateau,CH2}} = \frac{1}{N}\sum_i V_i$$

Interval: $40\text{ns} \leq t \leq 55\text{ns}$.

- The effective voltage step seen by the oscilloscope is :

$$\Delta V_{\text{CH2}} = V_{\text{plateau,CH2}} - V_{\text{baseline,CH2}}$$



✓ **Injected charge**

$$Q_{\text{in}} = C_T\,\Delta V_{\text{CH2}}$$

- with $C_T = 1\text{pF}$.

Calibration point	Pulser setting [V]	$V_{\text{plateau,CH2}}$ [mV]	ΔV_{CH2} [mV]	Q_{in} [fC]
0.5 pe	0.16	150.60	149.52	149.52
1 pe	0.29	271.47	270.59	270.59
2 pe	0.59	556.24	556.68	556.68
3 pe	0.90	844.27	850.19	850.19

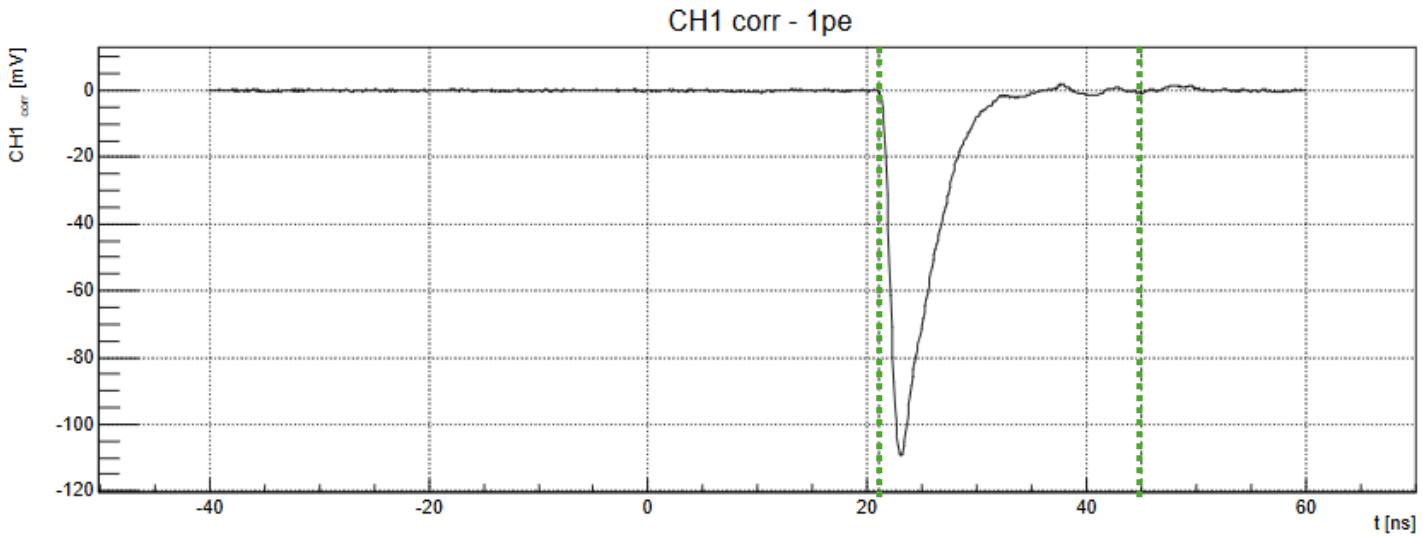
2 CH1 signal integration

- The CH1 waveform corresponds to the TIA output.
- After baseline subtraction (see slide 3), the signal is integrated over a time window: $21\text{ns} \leq t \leq 45\text{ns}$.

✓ The pulse area is evaluated:

$$A_{\text{signed}} = \int_{21\text{ ns}}^{45\text{ ns}} V_{\text{CH1,corr}}(t)\, dt$$

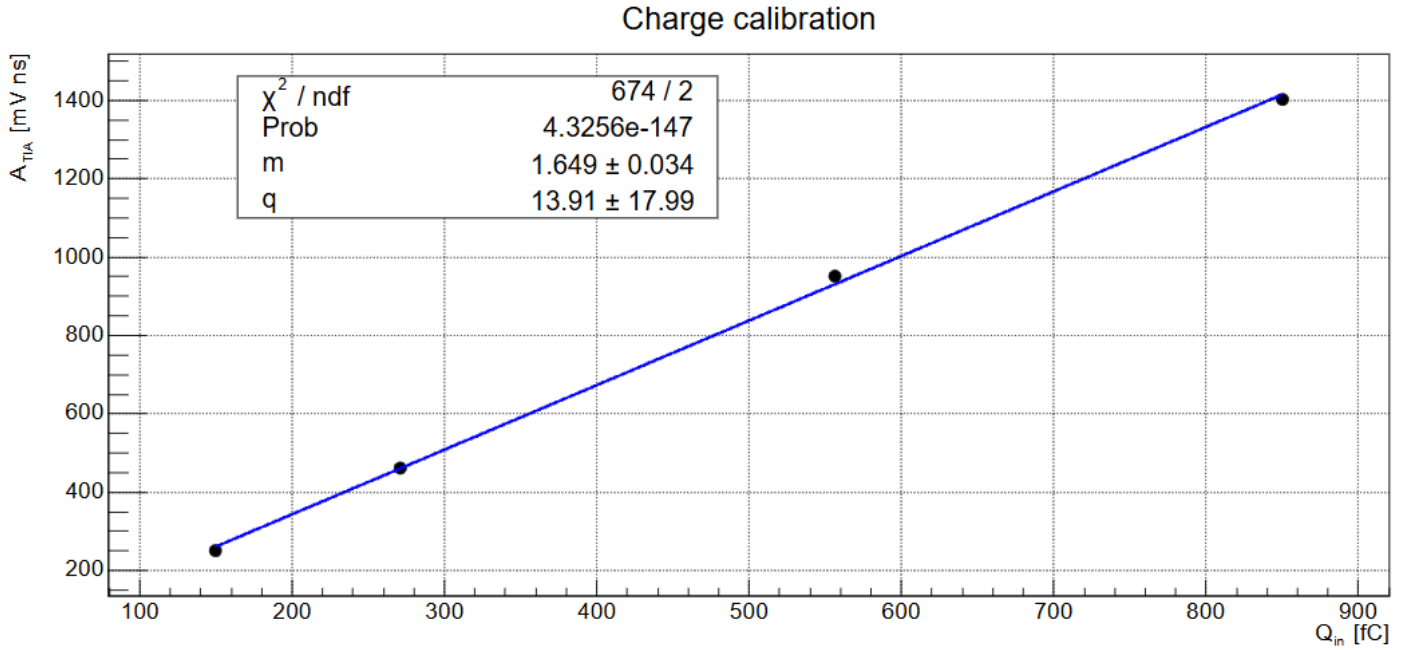
$$A_{\text{signed}} = \sum_i A_i = \sum_i \frac{V_i + V_{i+1}}{2}(t_{i+1} - t_i)$$



TIA pulse is negative:

$$A_{TIA} = -A_{signed}$$

3 Calibration curve



- For each injected charge value, the corresponding TIA pulse area was extracted from the CH1 waveform.
- The calibration points defined as: (Q_{in}, A_{TIA})
- The calibration curve was obtained and performed a linear fit:

$$A_{TIA} = m \cdot Q_{in} + q$$

with:

- m =calibration slope
- q = the intercept.

Preliminary calibration fit: no uncertainties assigned to Q_{in} and A_{TIA}