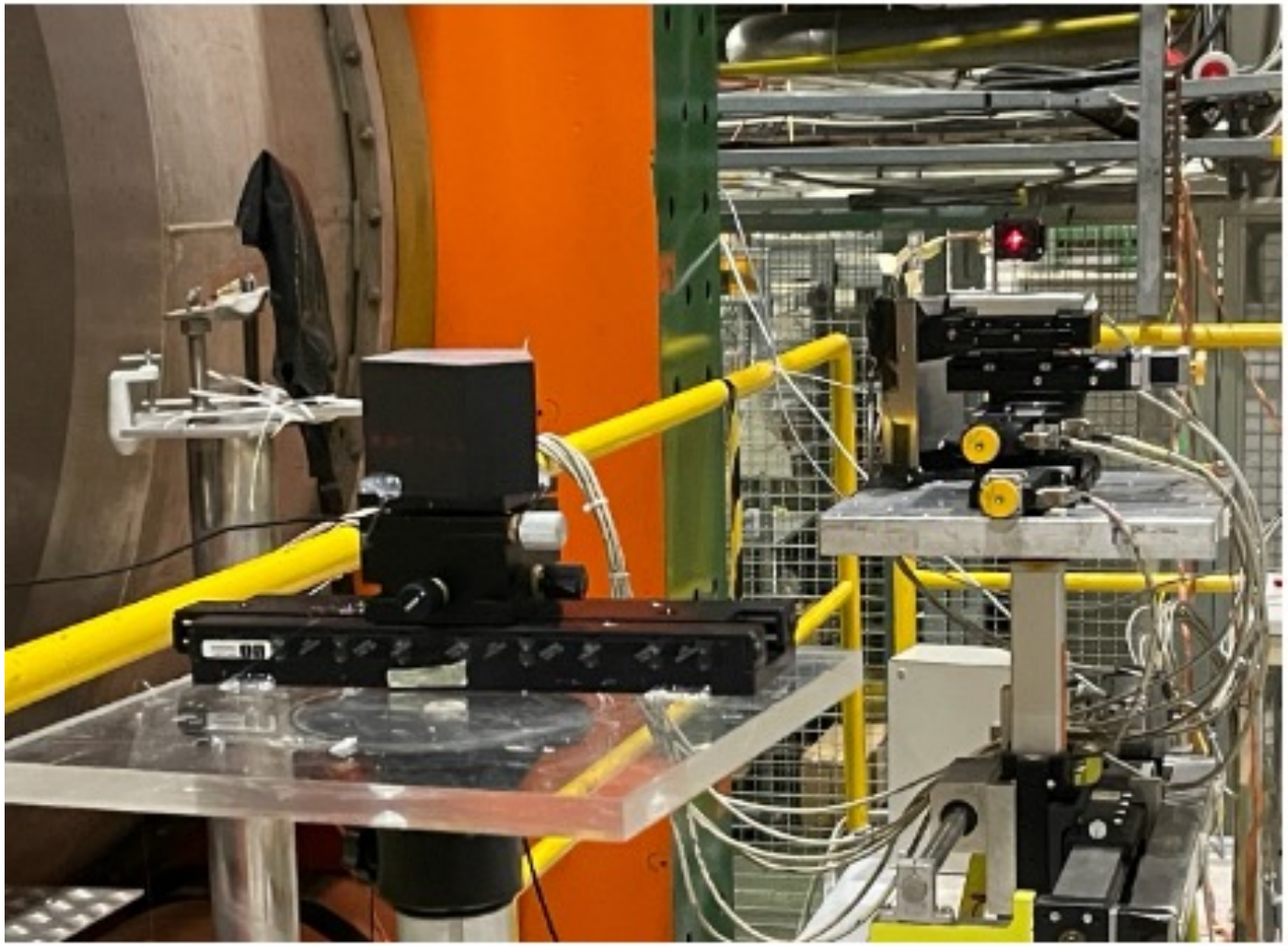
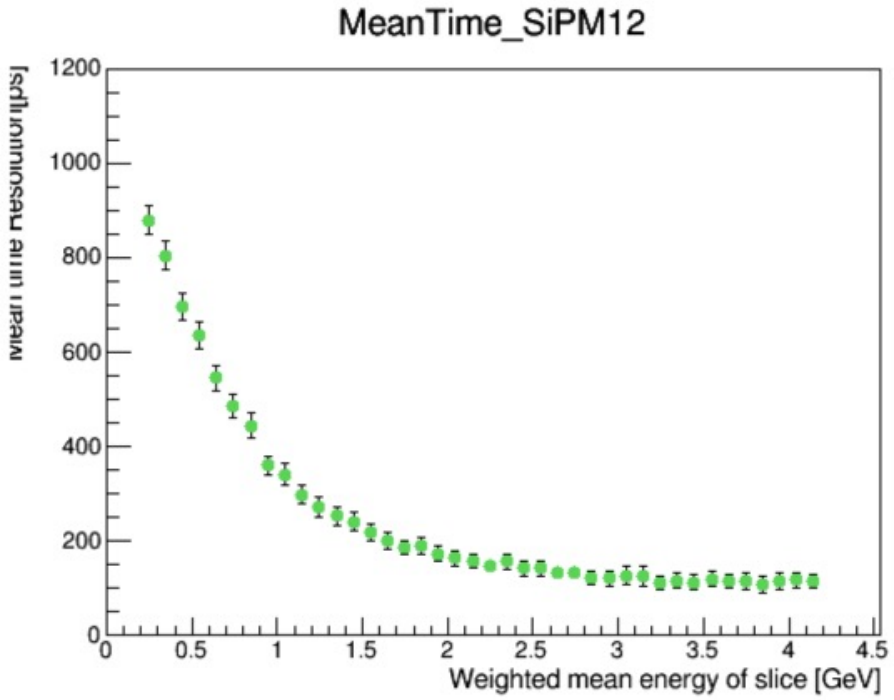
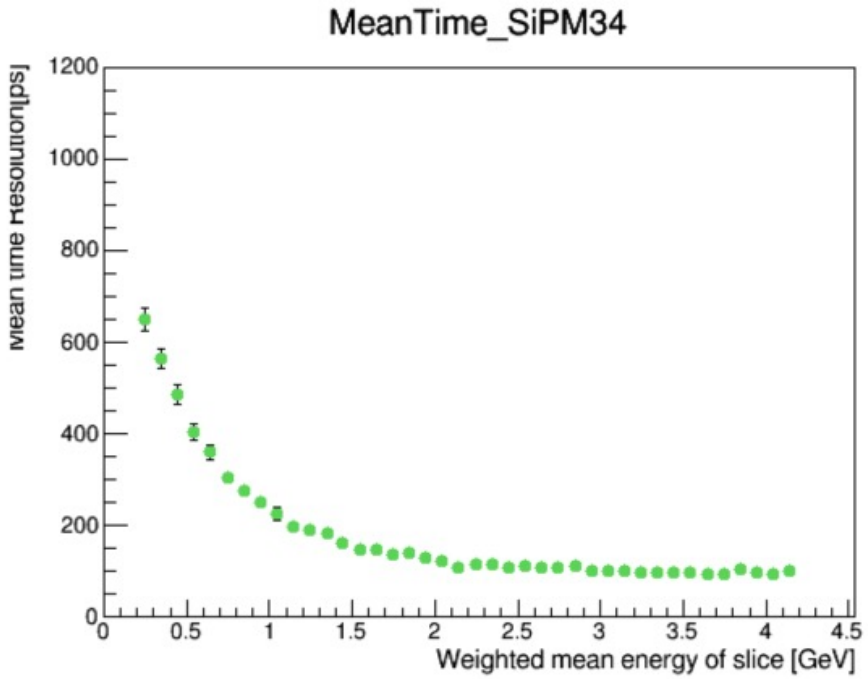


PbF 2 crystals mounted in the CRILIN module on the rotation stage undergoing alignment on the H2 test bench in August 2021.

CERN TEST BEAM August 2021

- All signals, from both the SiPMs and the MCP-PMTs, were digitized at 2.5 GHz with CAEN DT5742 digitizers.
- The samples were exposed to electron beams of energy 20-120 GeV, tagged photon beams derived from the 120 GeV electron beam, and 150 GeV muon beams.





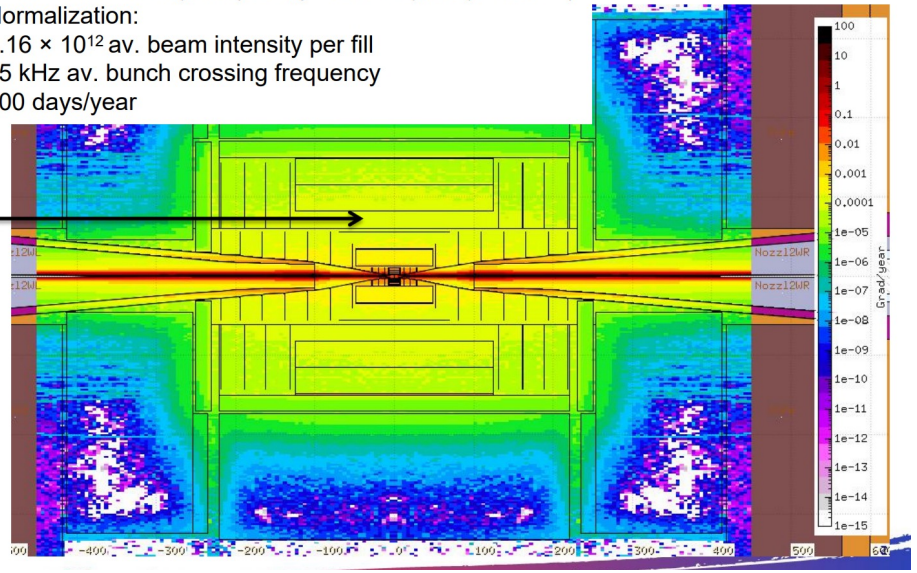
Time Resolution Results

- The time resolution studies are in currently progress; a variety of signal analysis techniques have been used.
- From the difference of measured times with the MCP-PMTs, we obtain a resolution for the time reference signal at the level of 20 ps.
- The analysis of the signals from the SiPMs is more difficult due to the longer signal duration; **the stochastic contribution to the time resolution for the PbF 2 crystals is seen to be less than 100 ps.**

3 TeV: Total Ionizing Dose

Color scale: Grad/year (GeV/g=1.6e-7Gy, 1Gy=100rad)
Normalization:
1.16 × 10^{12} av. beam intensity per fill
15 kHz av. bunch crossing frequency
200 days/year

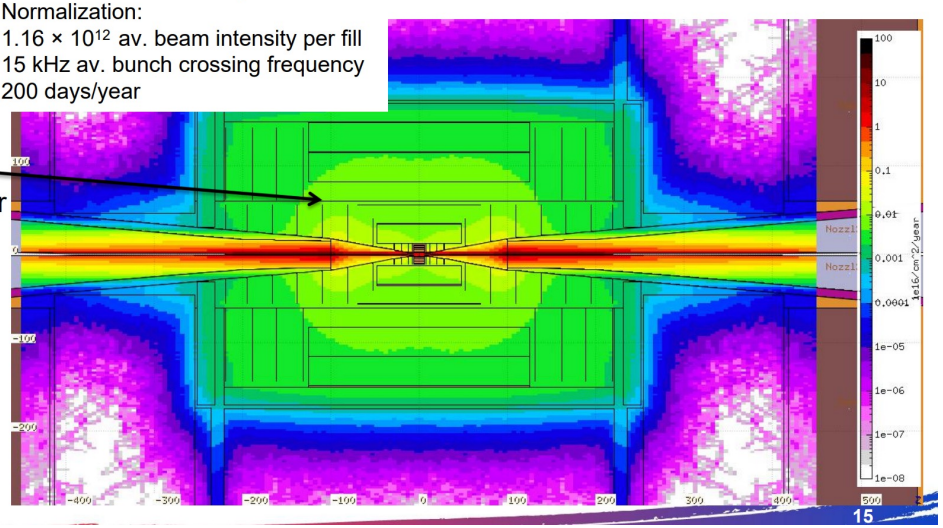
~1e-3/1e-4 Grad/year



3 TeV: 1MeV neutron equivalent

Color scale: 10^{16} / cm^2 / year
Normalization:
1.16 × 10^{12} av. beam intensity per fill
15 kHz av. bunch crossing frequency
200 days/year

~1e14 cm^-2/year



From Camilla's talk:

- **1MeV neutron** equivalent is around ~10^{14}/^{15} cm^2/year on the tracking system and **~10^{14} cm^2/year on ECAL**.
- **TID** is ~1 Mrad/year on the tracking system and **~100 krad/year on ECAL**.

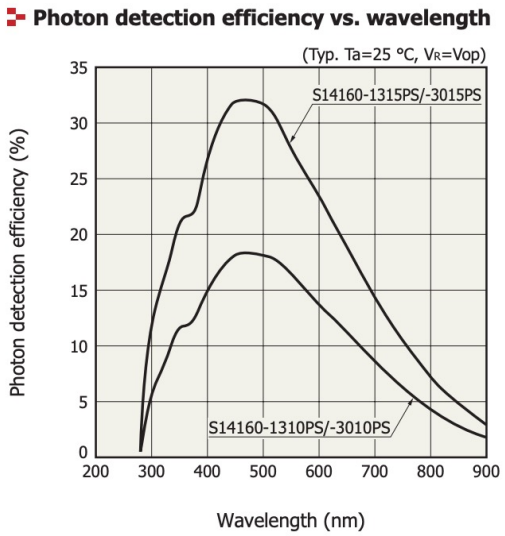
To maximize the radiation hardness selected new SiPMs

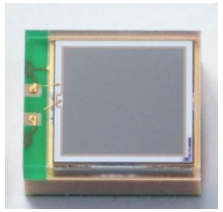
- **50 pieces with 15 um pixel size S14160-3015PS**
- **40 pieces with 10 um pixel size S14160-3010PS**

Goals:

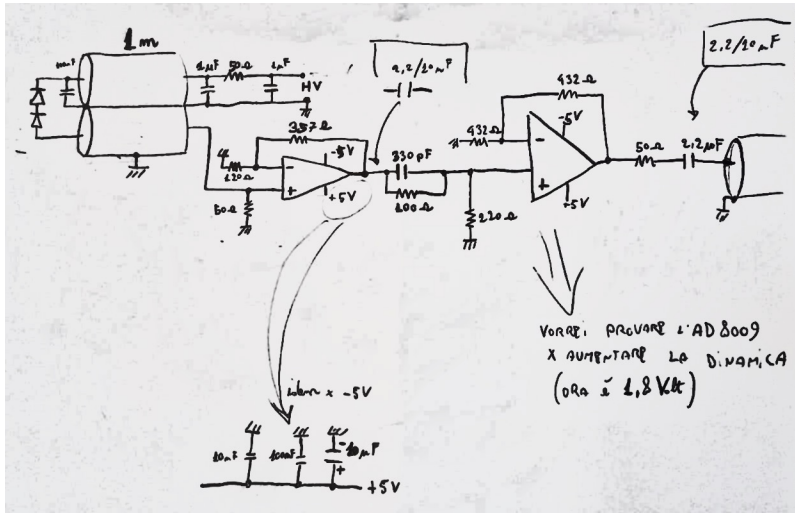
❑ 2 layers of 3x3 PbF_2 crystals, interchangeable, one with 15 um SiPM and one with 10 um SiPM readout.

❑ One week Test Beam at Cern requested for end August 2022 (still waiting for answer)



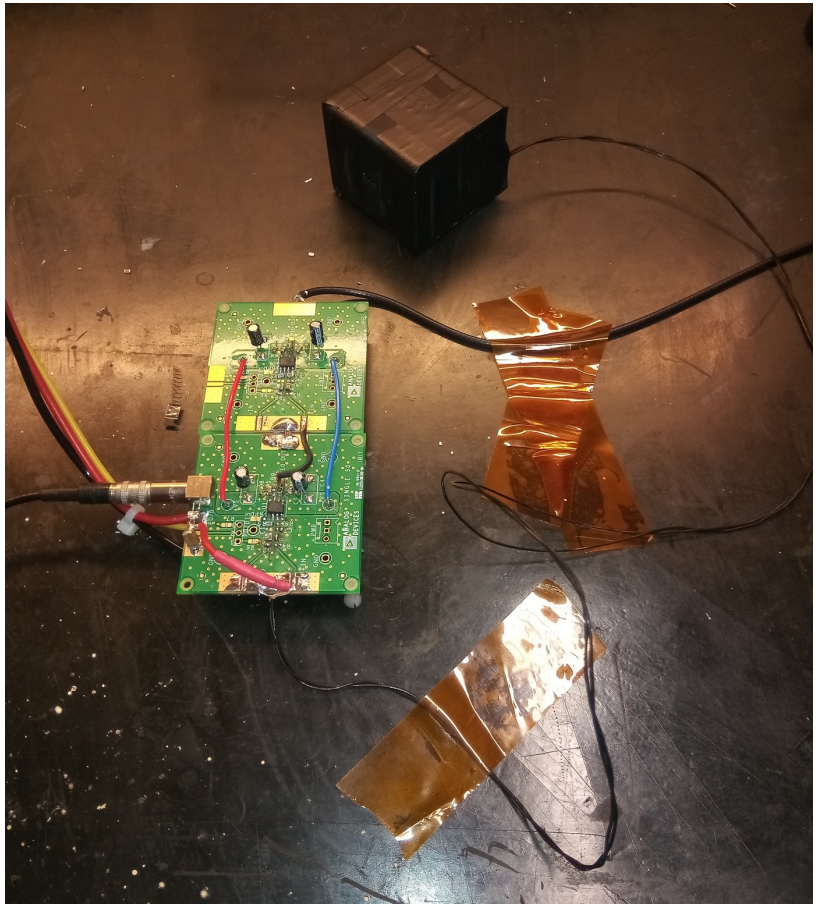


New Front End electronics: Test on 1 channel



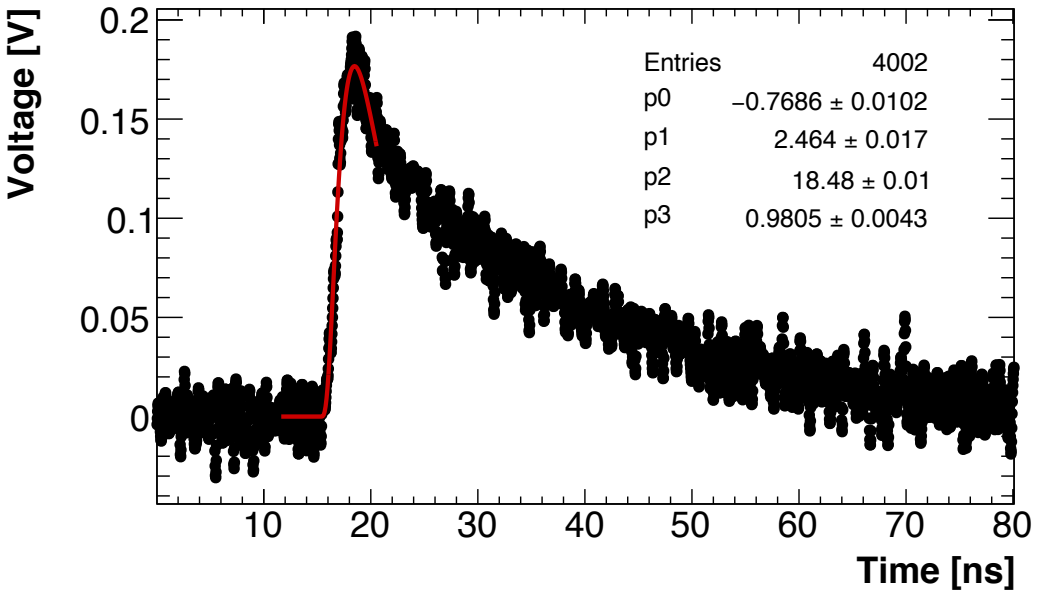
- **Test with two 15 um SiPM in series, ultrafast blue Laser by Hamamatsu and Scope 40 Gs/s from SEA Frascati:**

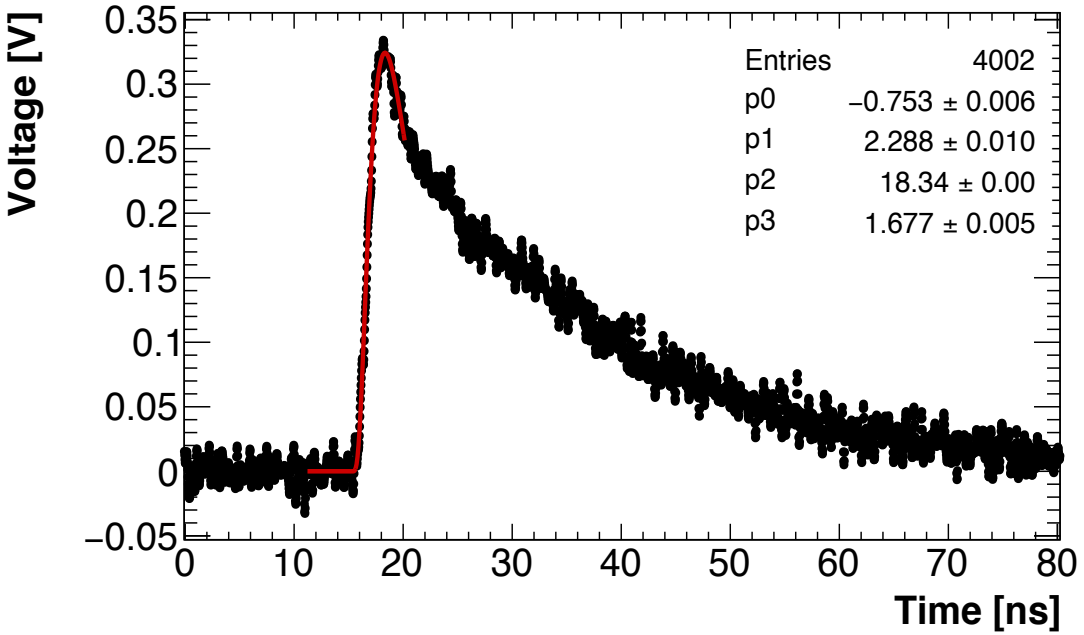
- ❑ Dinamic 0-2 Volt
- ❑ Rise Time ~ 2ns!
- ❑ Full signal in 70 ns
- ❑ 2 SiPM in series far 1 meter from the electronics!

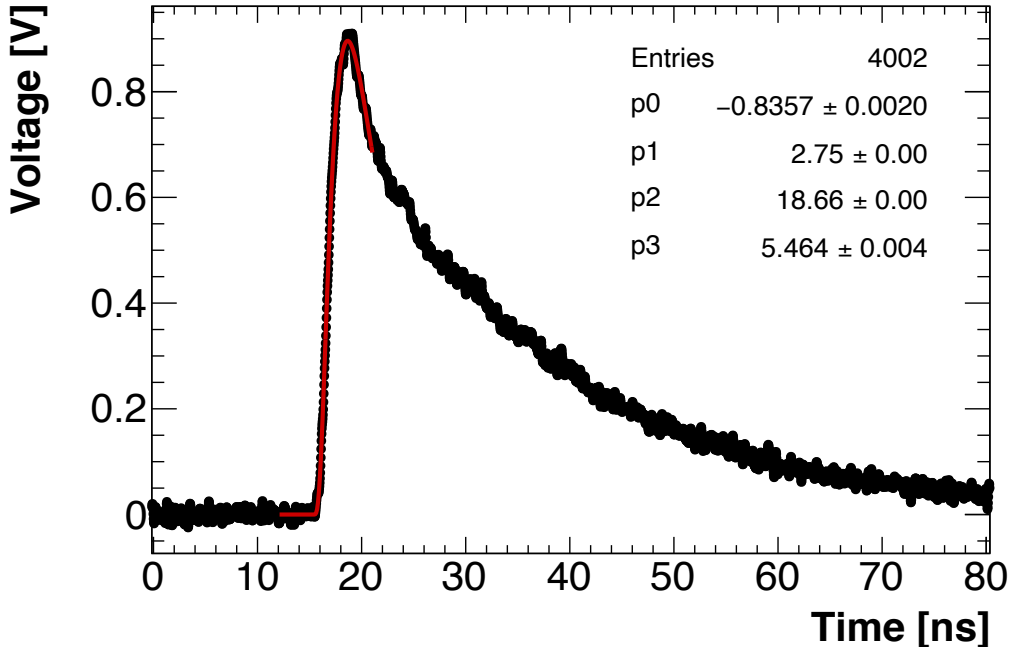


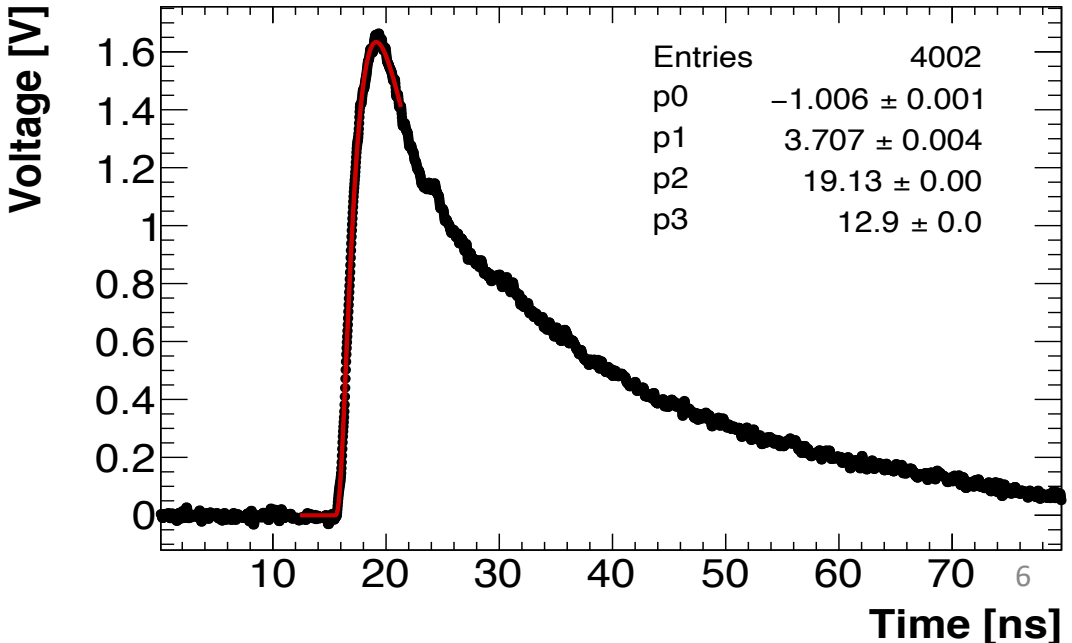
Waveforms at 100kHz

Di Meco/Diociaiuti/Sarra - LNF

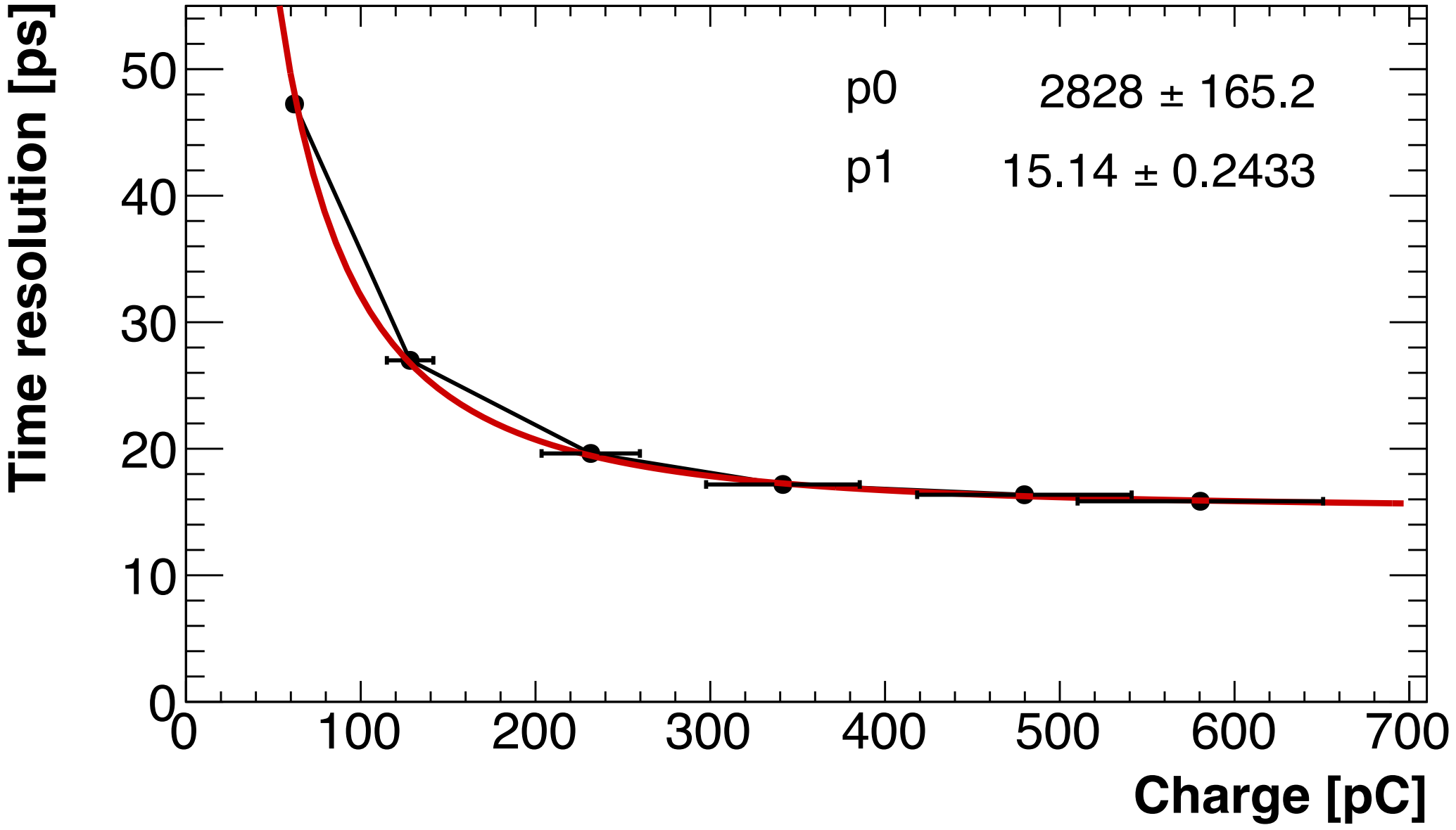




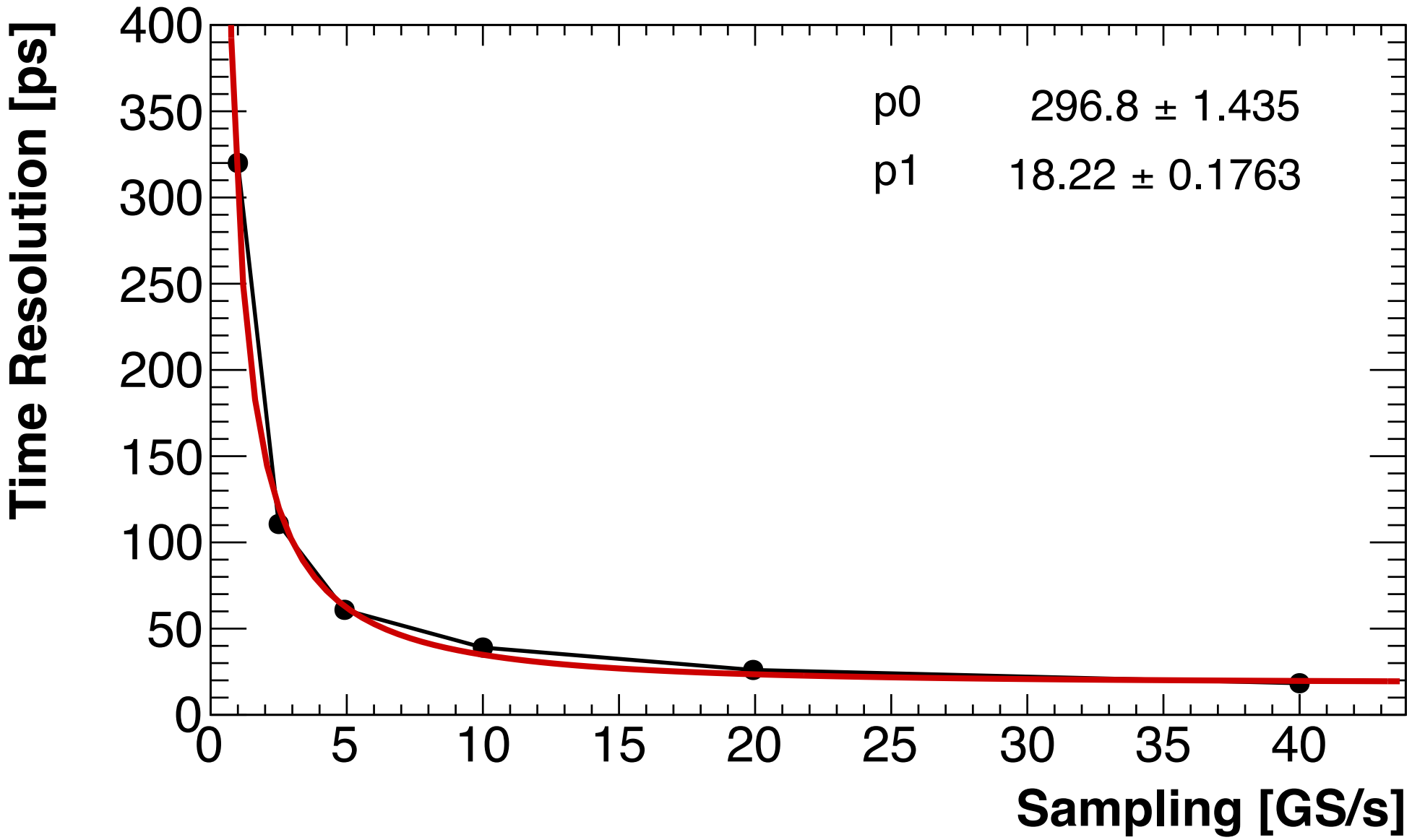




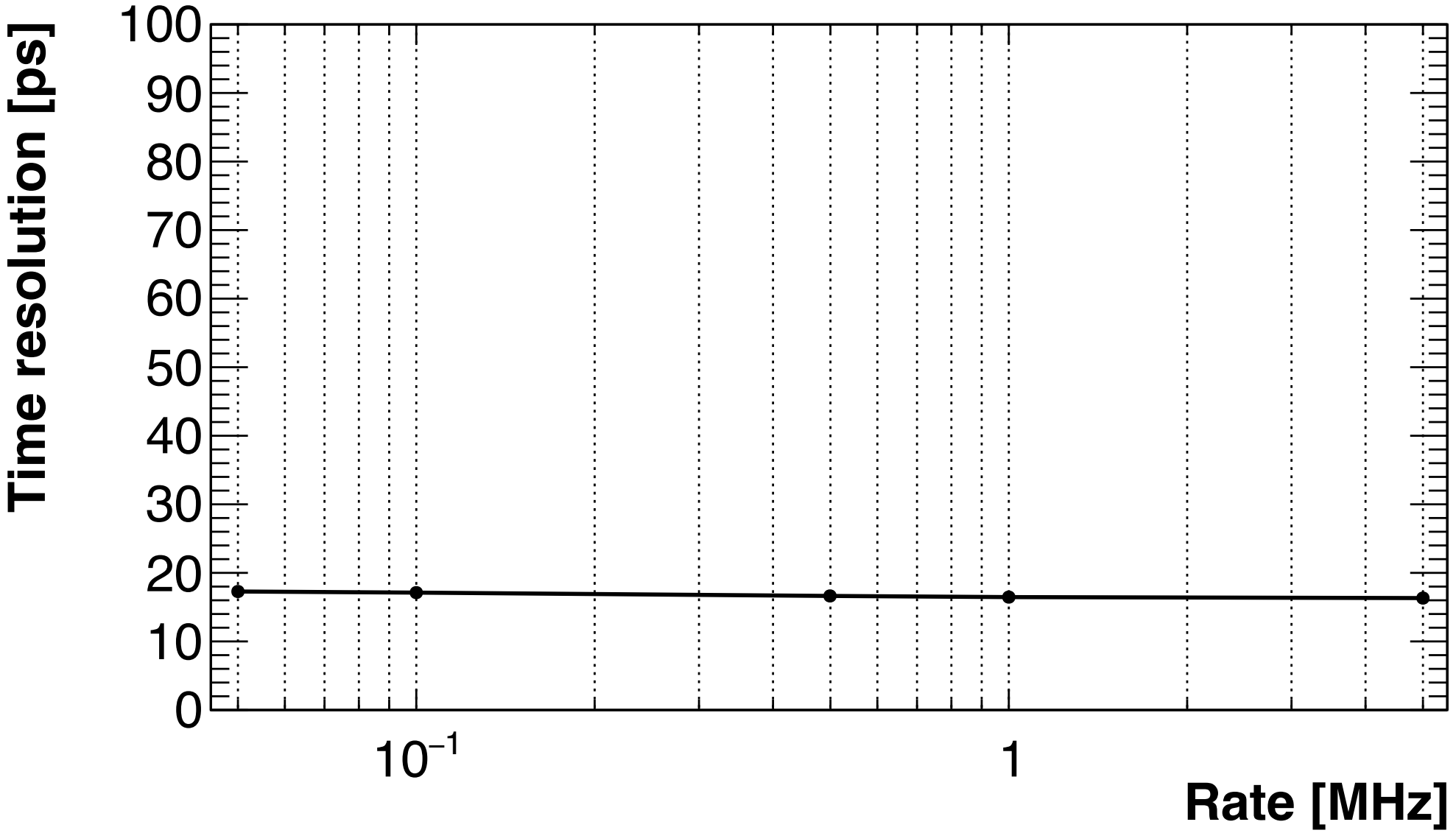
Time Resolution w.r.t. charge at 100kHz



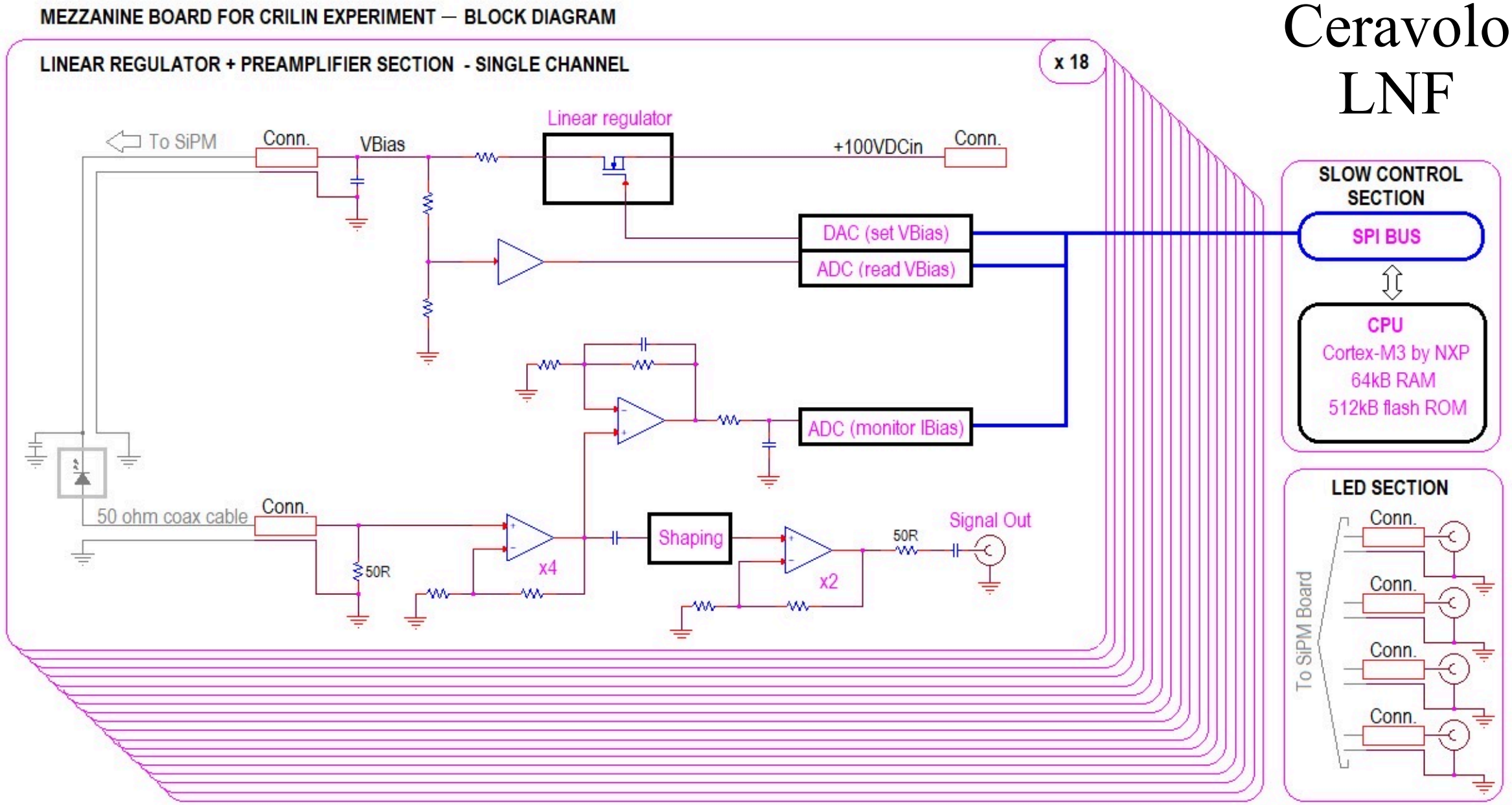
Time Resolution w.r.t. sampling at 1 V and100 kHz

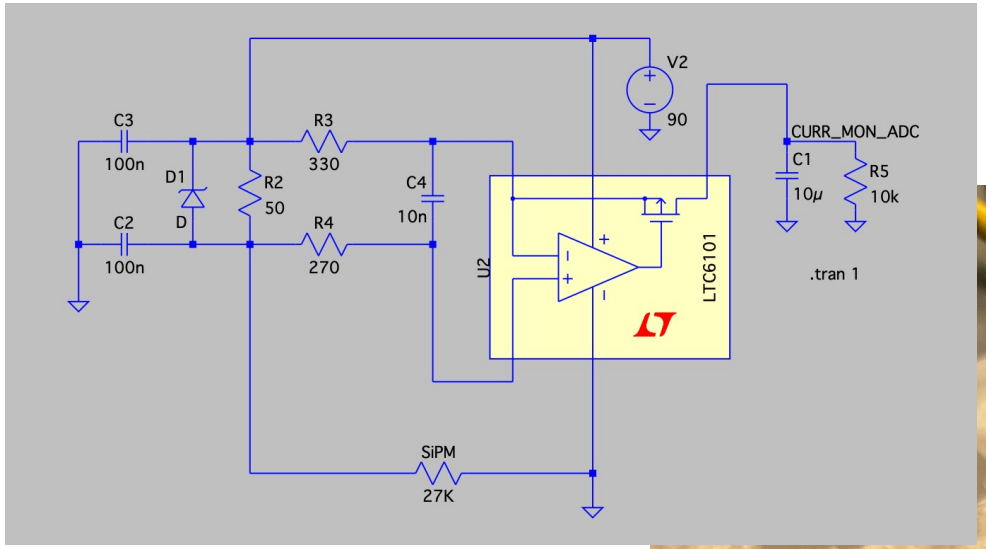


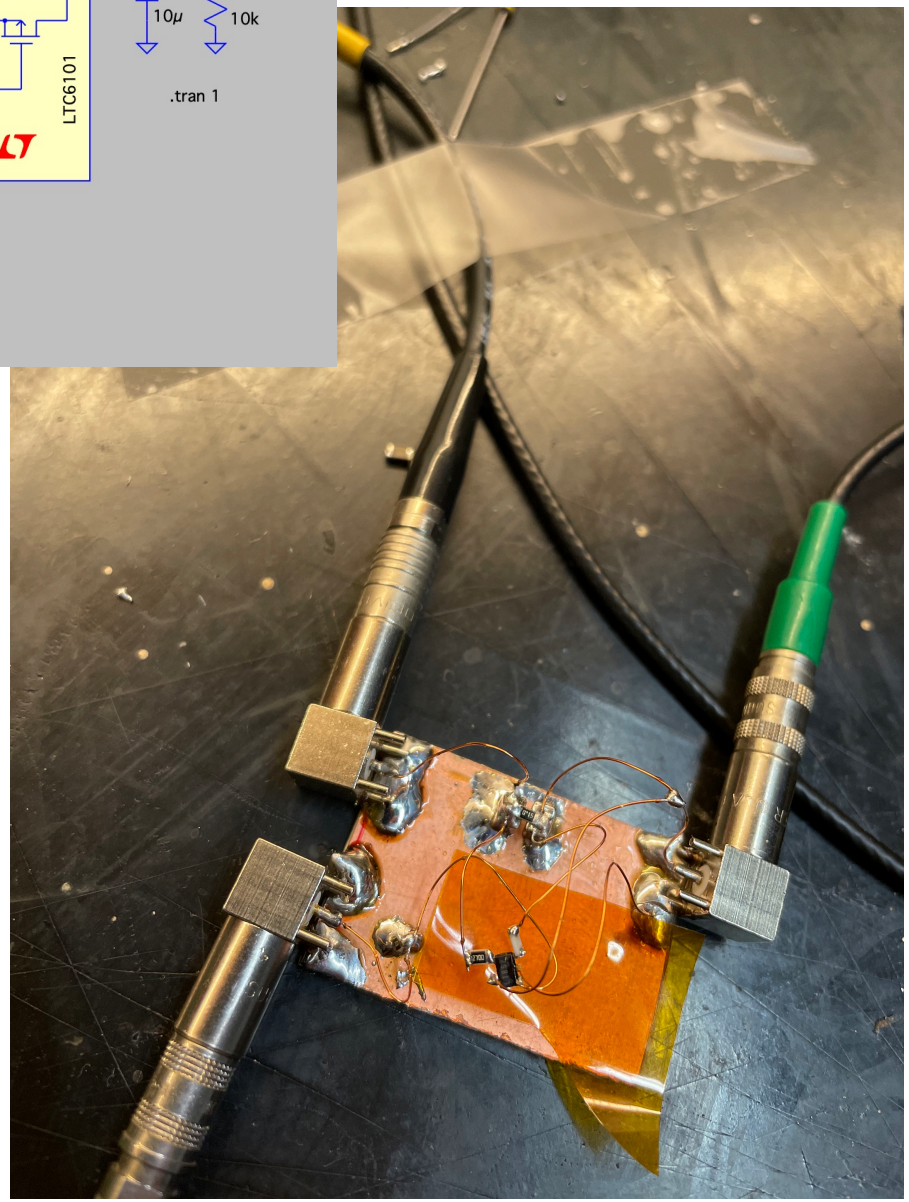
Time Resolution w.r.t. rate at fixed signal



Ceravolo LNF





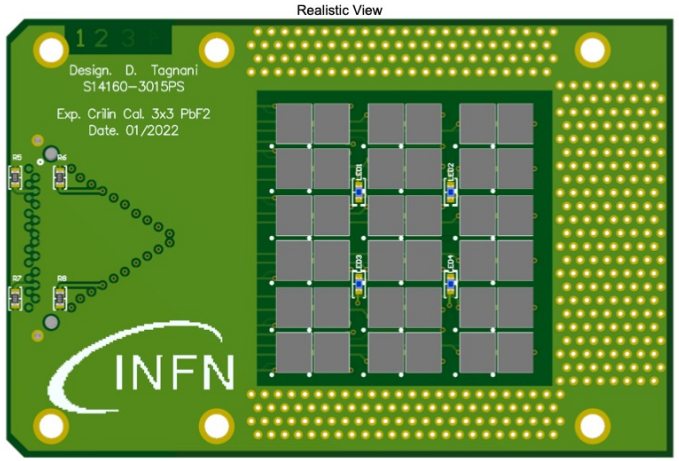


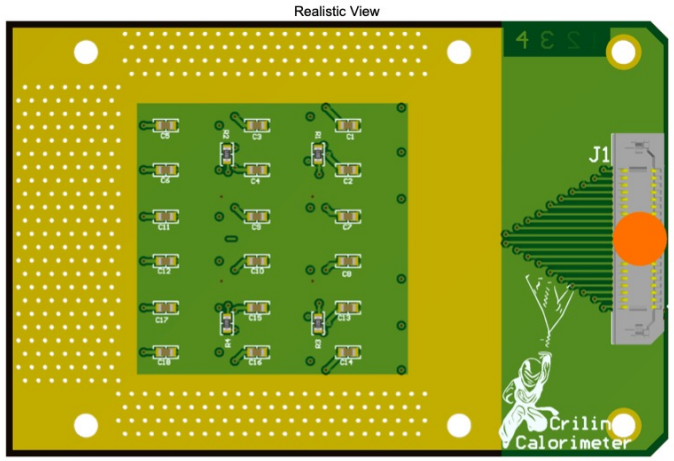
Paesani LNF

SiPM CSA

- Common mode supply voltage up to 105 V
- High-side current sesing
- Range 0-3 mA
- sensitivity < 1 uA for 12-bit ADC
- Will be also used for SiPM irradiation tests with neutrons

Tagnani
Roma 3

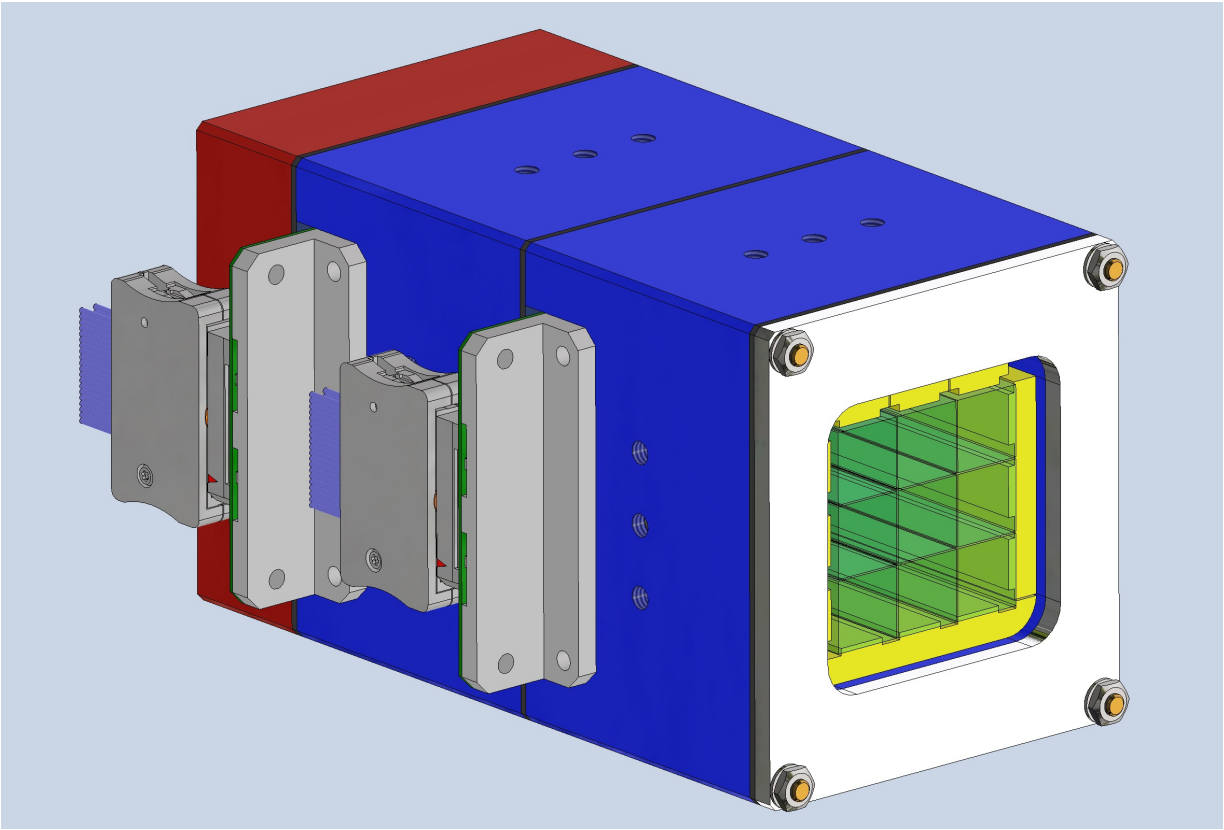


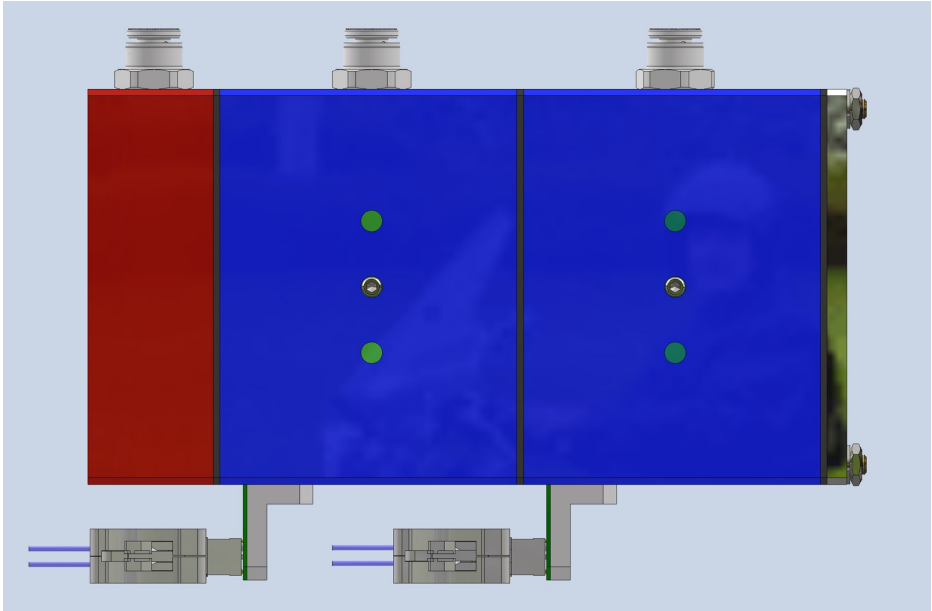


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES:		FINISH:		DEBURR AND BREAK SHARP EDGES	TITLE: SiPM_Board_3x3_18ch-S14160-3015PS_Rev.0-1.PCBDwf	REVISION
	NAME	SIGNATURE	DATA		INFN SEZIONE DI ROMA TRE VIA DELLA VASCA NAVALE 84, 00146 ROMA (RM) ITALY	
DRAW	Diego Tagnani		04/02/20			
CHK'D						
APPV'D						
MFG	Diego Tagnani					
QA				MATERIAL:	Author: Diego Tagnani	A3
				WEIGHT:	SCALE 1:1	SHEET 1 OF 6

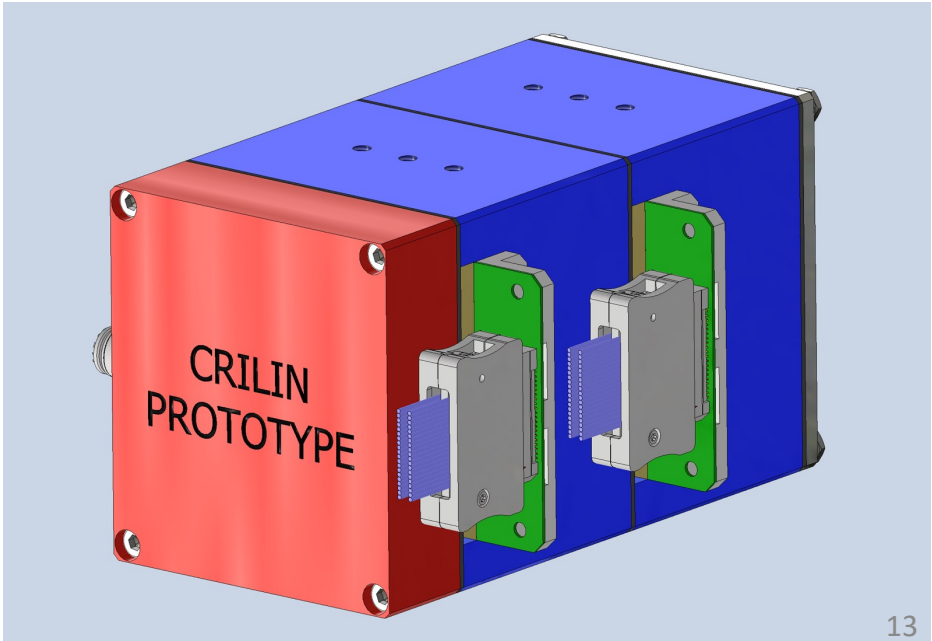
Scheda SiPM

- Per ora connettore sulla scheda, in futuro piattina adattata in Kapton e connettorizzazione a fine calorimetro





Saputi
Ferrara



Richieste:

- 50 pieces with 15 um pixel size S14160-3015PS

  Usati 2keuro destinati alla meccanica → Possibile ri-integrazione?

Considerazioni per 2023:

- Gli studi al variare del Sampling mostrano una cosa contro-intuitiva: più si fa veloci col fronte più la risoluzione è dipendente dal sampling;
- Troppo costoso lavorare a frequenze > 2.5 GHz;
- Per il futuro consiglio di cambiare strategia: non flash ADC ma pico-TDC e time overthreshold;
- Stiamo analizzando altre tecniche, template fit, ma lavorare con 1-3 punti sulla salita è difficile;
- Una soluzione col pico-TDC ridurrebbe anche il data rate.