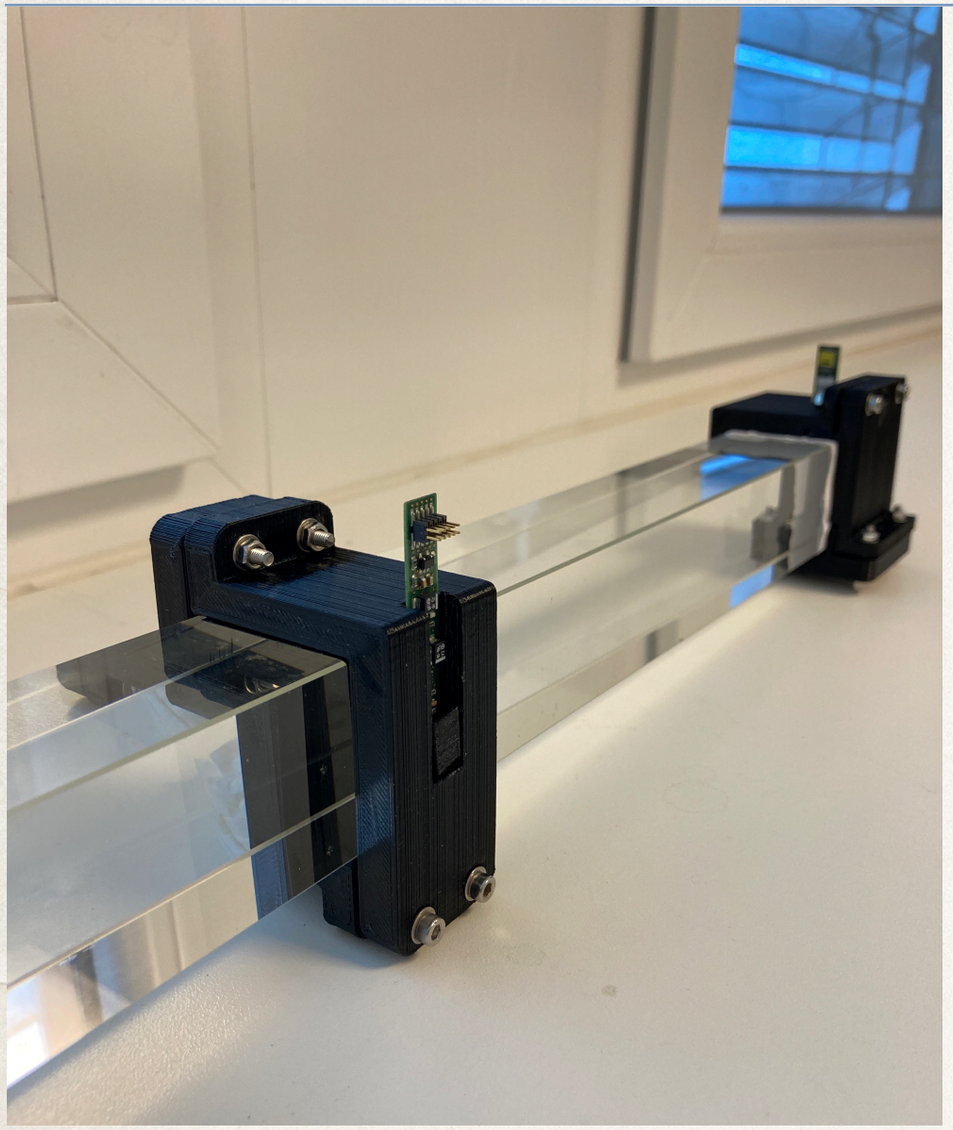
LG measurements

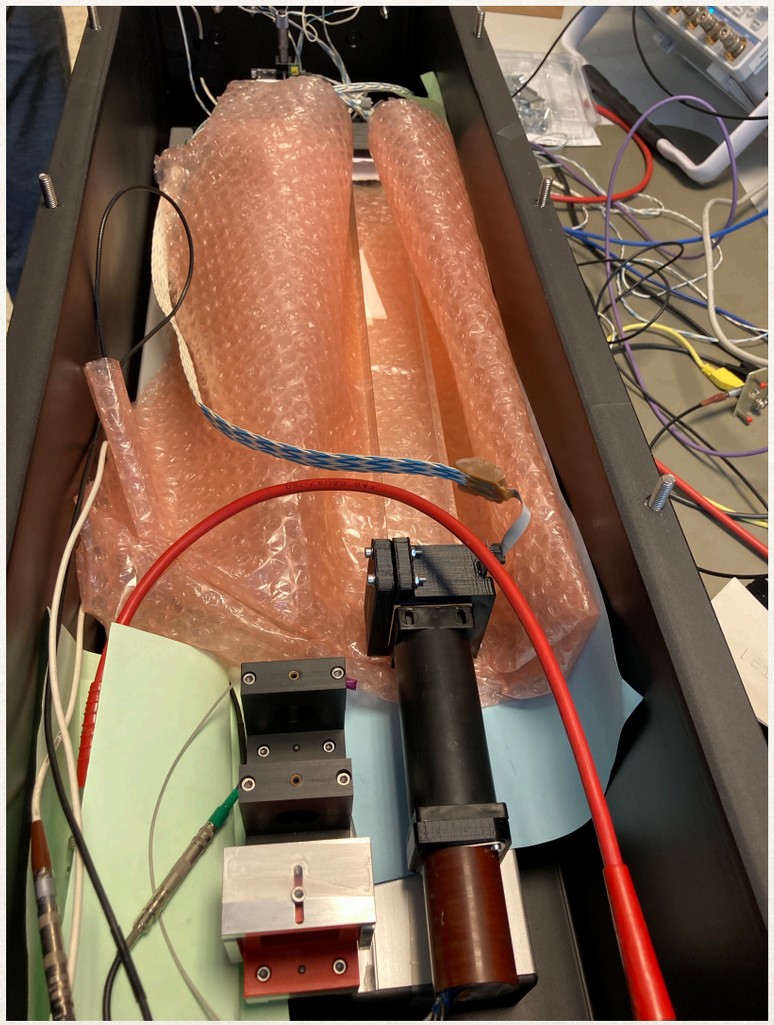
Felix, Maryna, Sasha

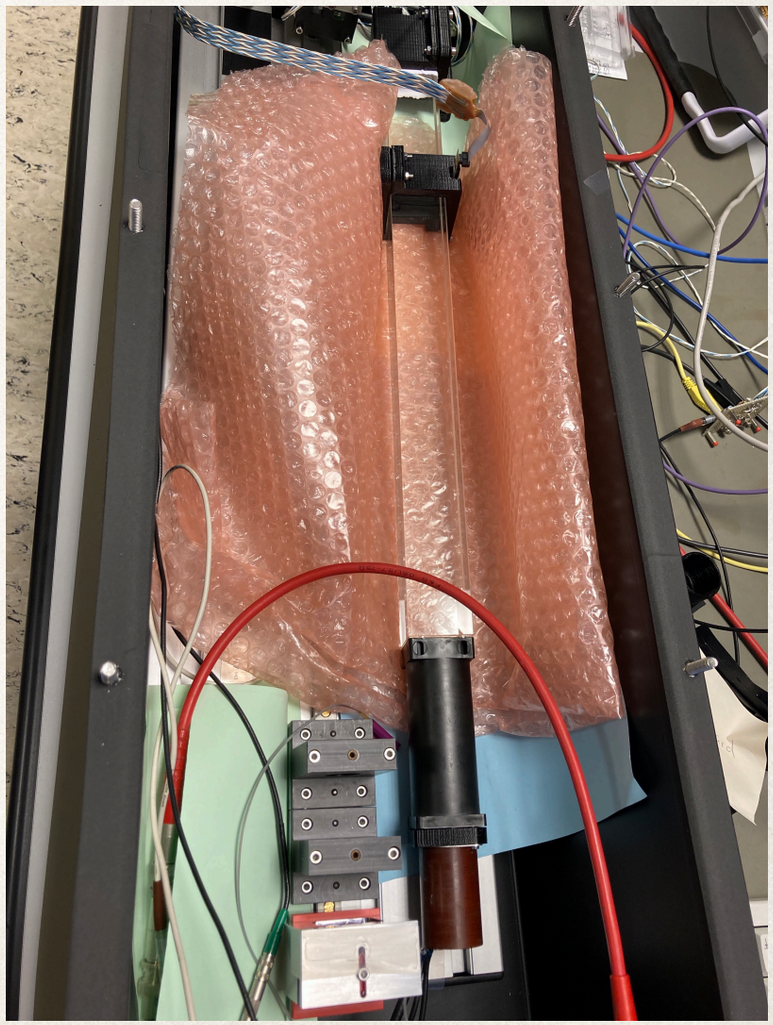
08/09/2021

Testing the response depending on the LED position



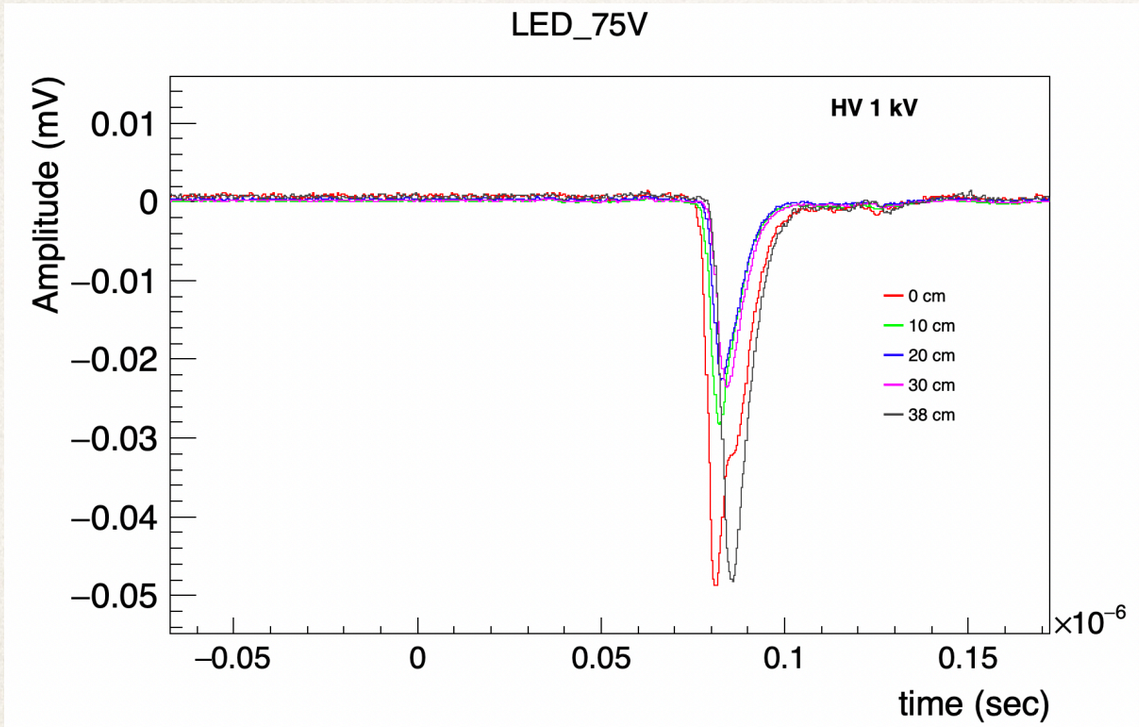
5 locations: close to PMT, 10 cm, 20, 30 cm and 38cm
LED voltages in the range 7.0-9.0 V

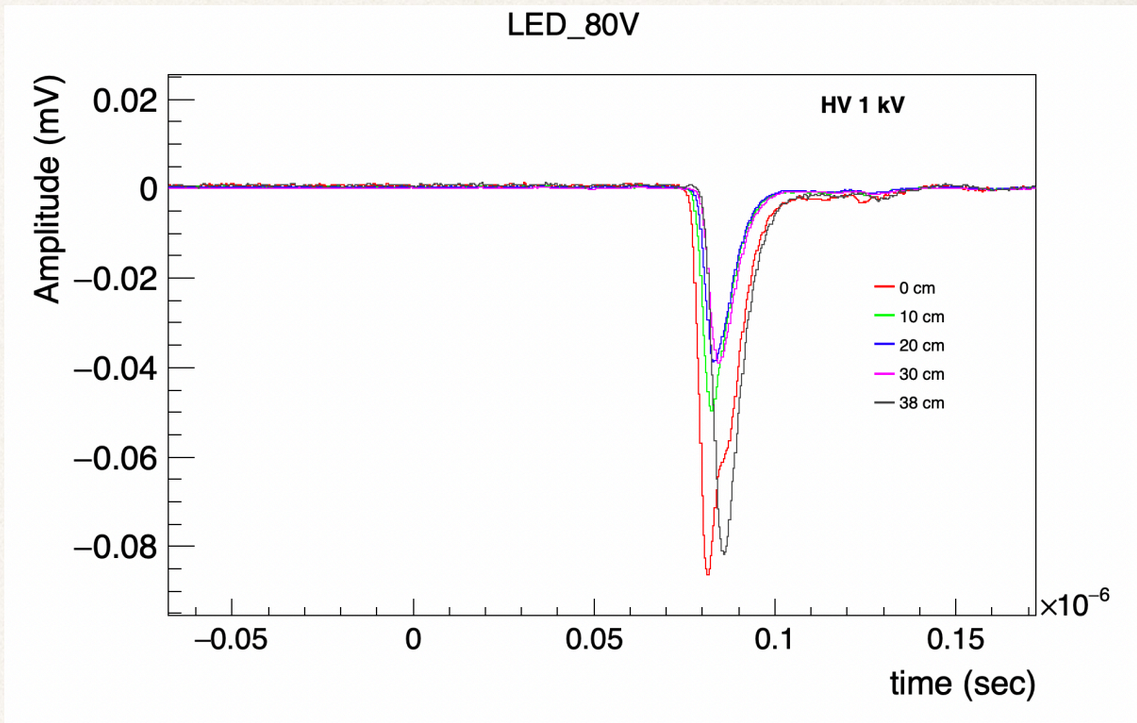


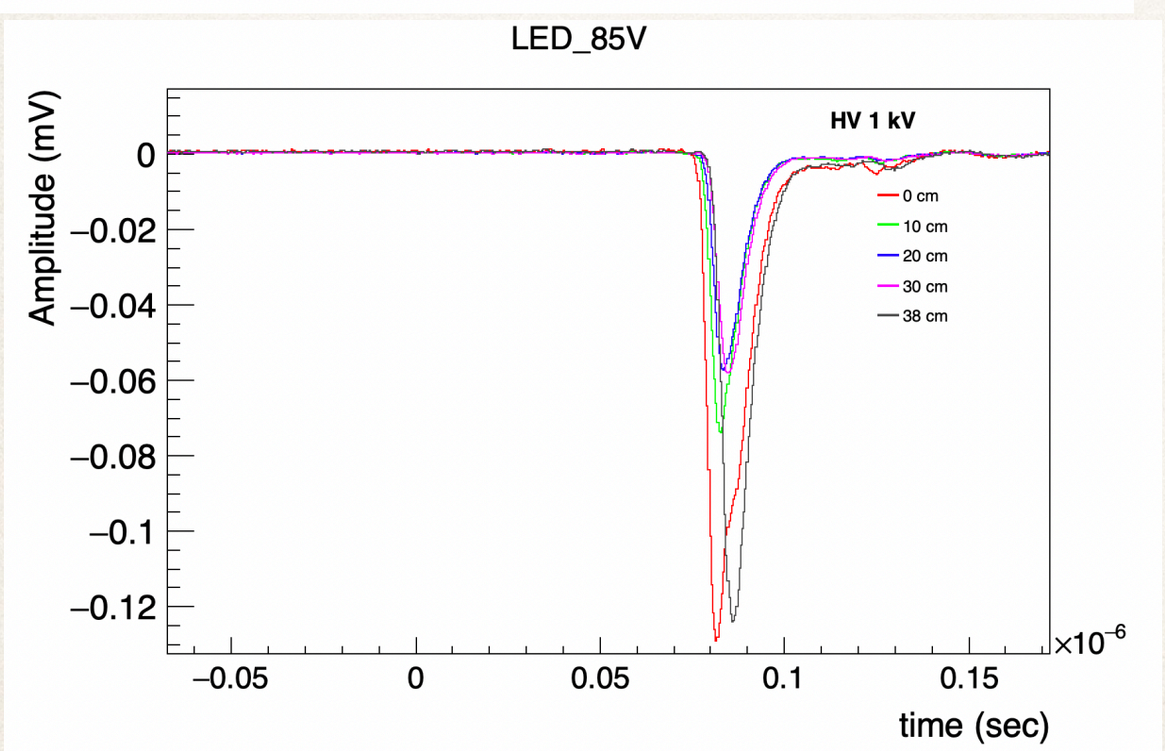


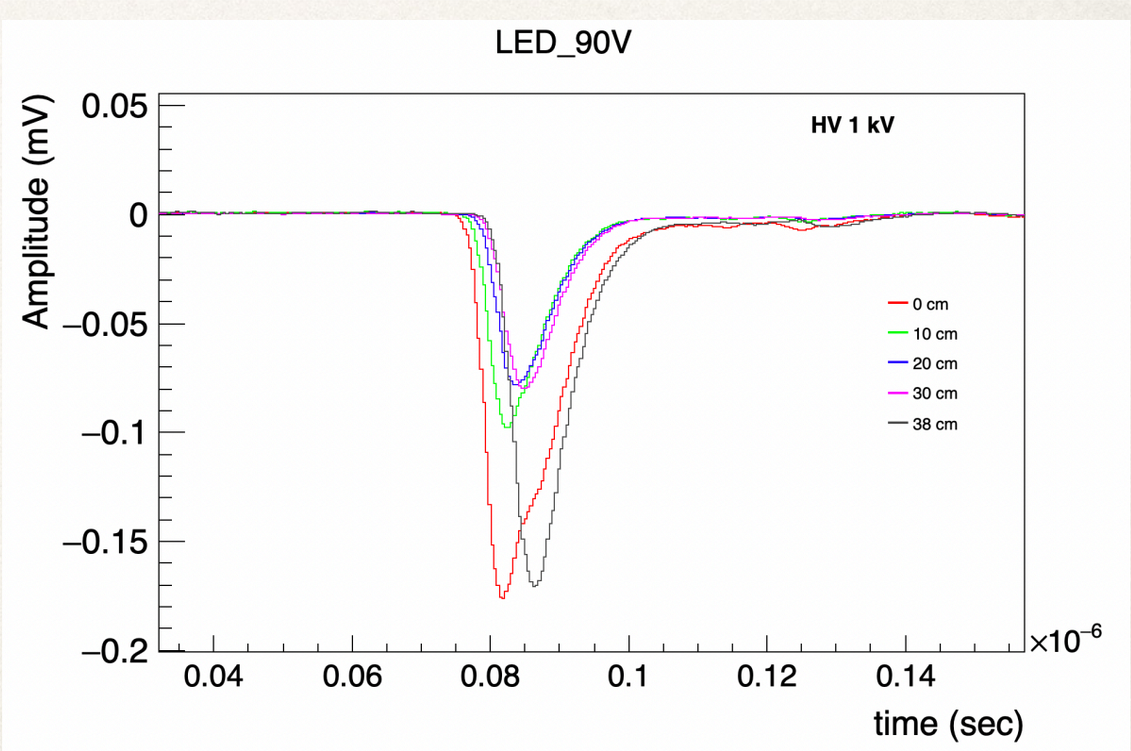
In previous measurements with and w/o wrapping we didn't see the difference when shining LED through the crystal's end which is explained by the total internal reflection (LG refraction index is 1.65, angle 37 grad or 53 grad with respect to surface.)

Signal depending on LED voltage and position



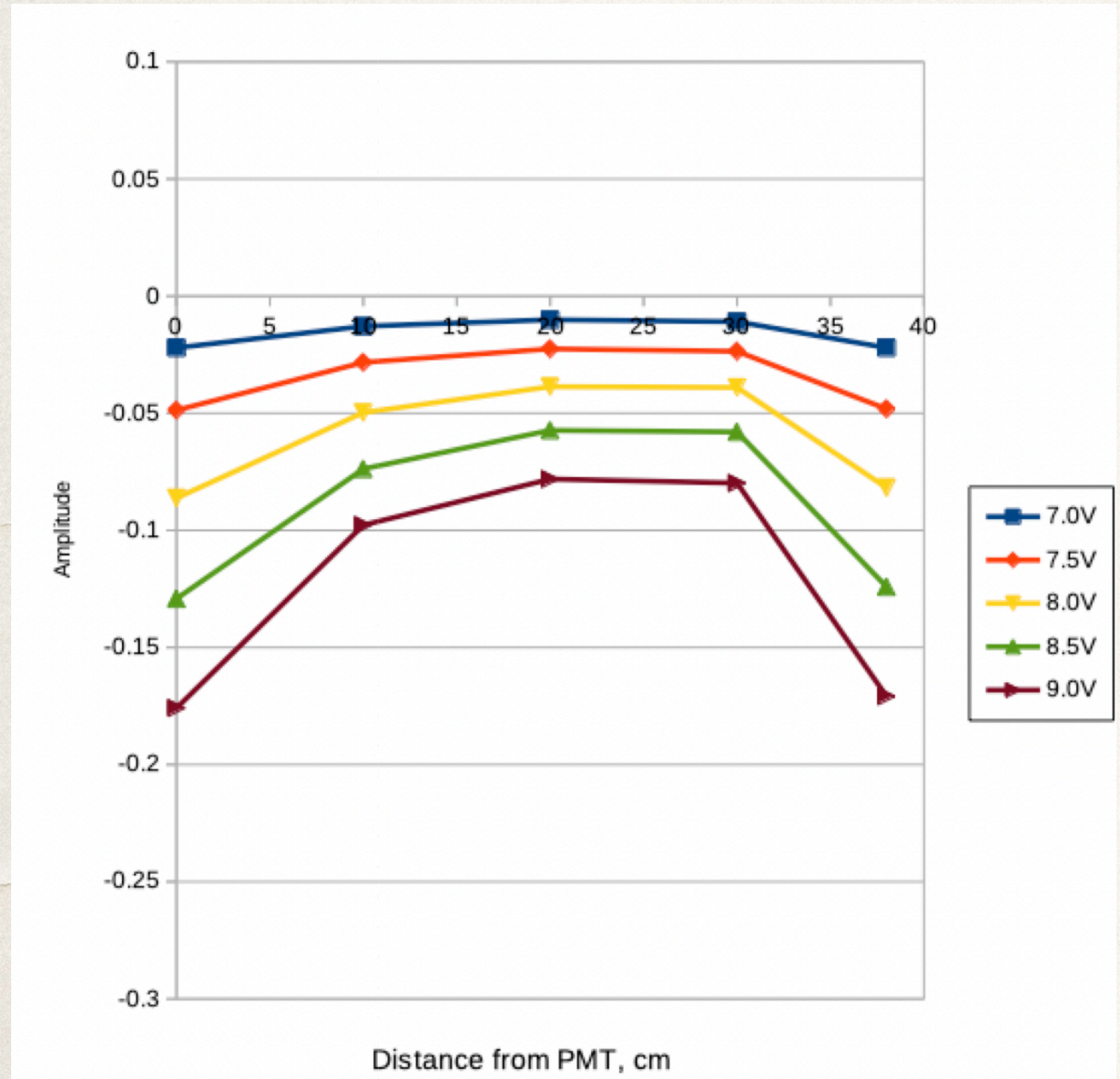


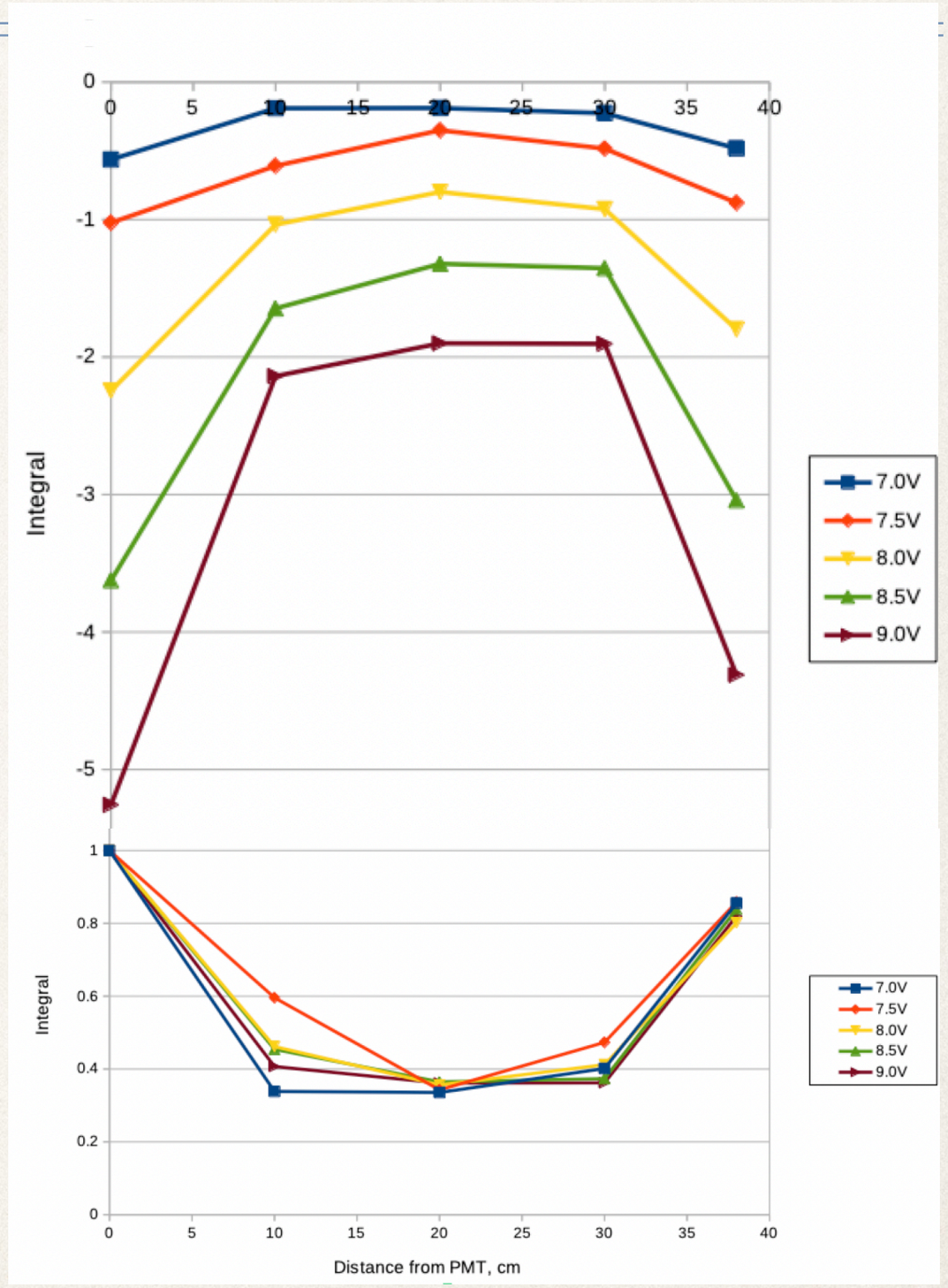




The displayed pulse shapes are obtained from averaging 50 recorded waveforms per LED voltage.

Signal depending on LED position

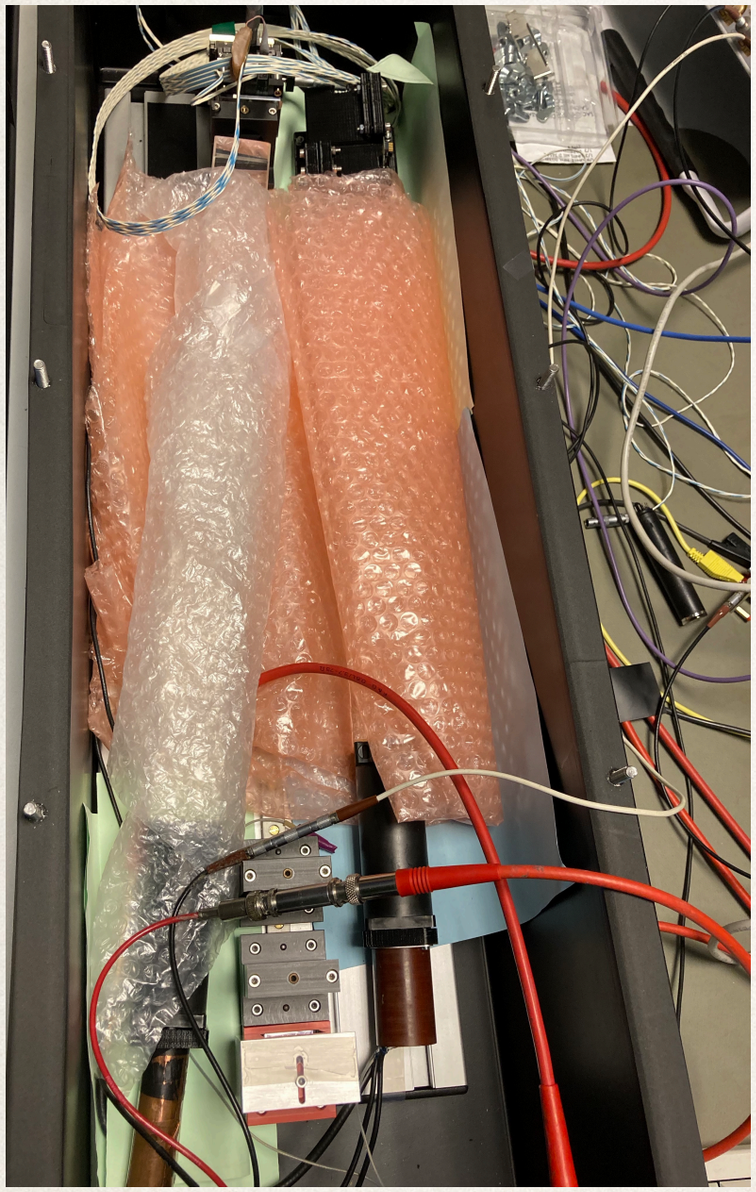


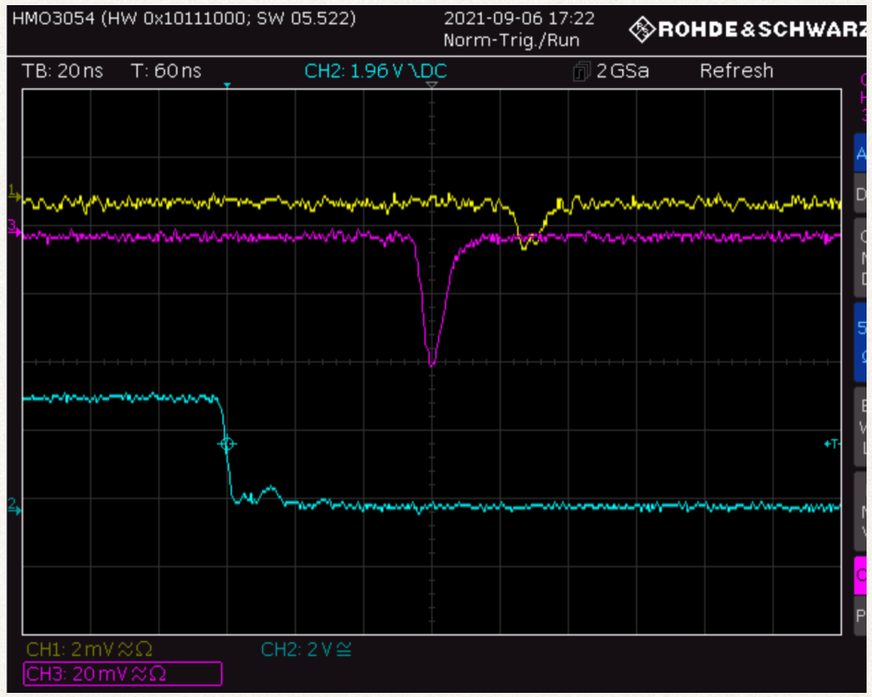


Signal is the lowest in the middle of the crystal, while the highest when the LED is located either close to PMT /or at the end of the block. This is due to the fact that light is leaking from the sides.
It is important to shield crystal from external light sources

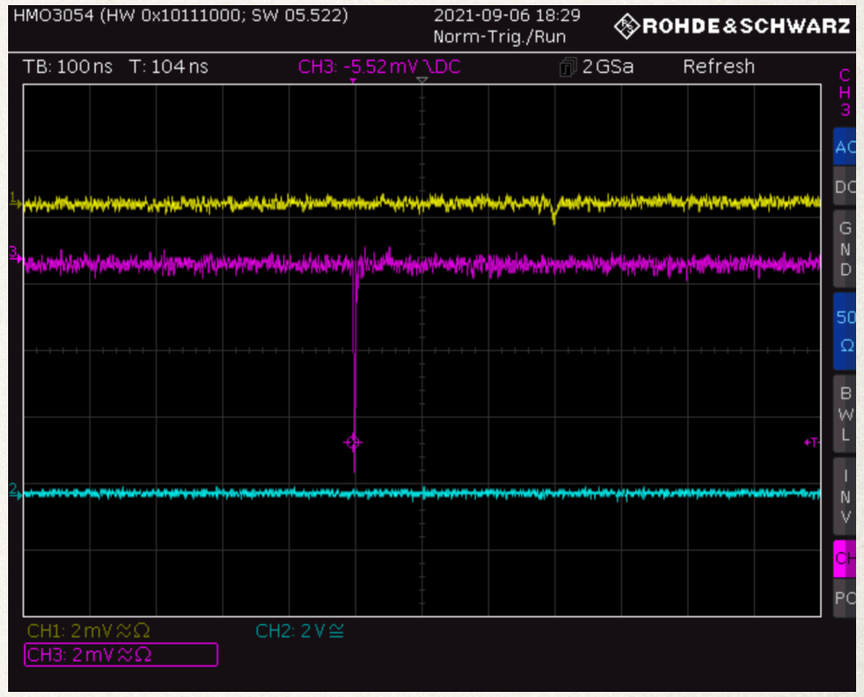
Attempt to catch cosmic muons

Cosmic muon test runs (5-7/09/21)





Both crystals see signal from LED when we read out 2 crystals laying in light tight box;
They are wrapped with plastic and not at all aligned with LED;
Different cables length cause delay;



there is no coincidence when we read out 2 crystals - one on top of another.
1 muon per cm2 per s.
We might expect 10-20 muons/ min

- We could be dominated by the Dark current noise
- For 4 cm LG ~ 12 p.e. per muon are expected
- One of the used PMTs was the random one from the box (no info)
- Good optical interface between PMT and LG block is needed (grease)
- Crystal could be rotated to increase photon yield 10 times
- Need to better understand the noise; verification in simulations

Plan on LG tests

I. **Test LED light (attached to the side) depending on the distance from PMT** - could be used for monitoring, calibration and cosmic detection (1-3/09/21) -> Done

II. **To understand thermal dark current noise**

III. **Cosmic muon test runs**

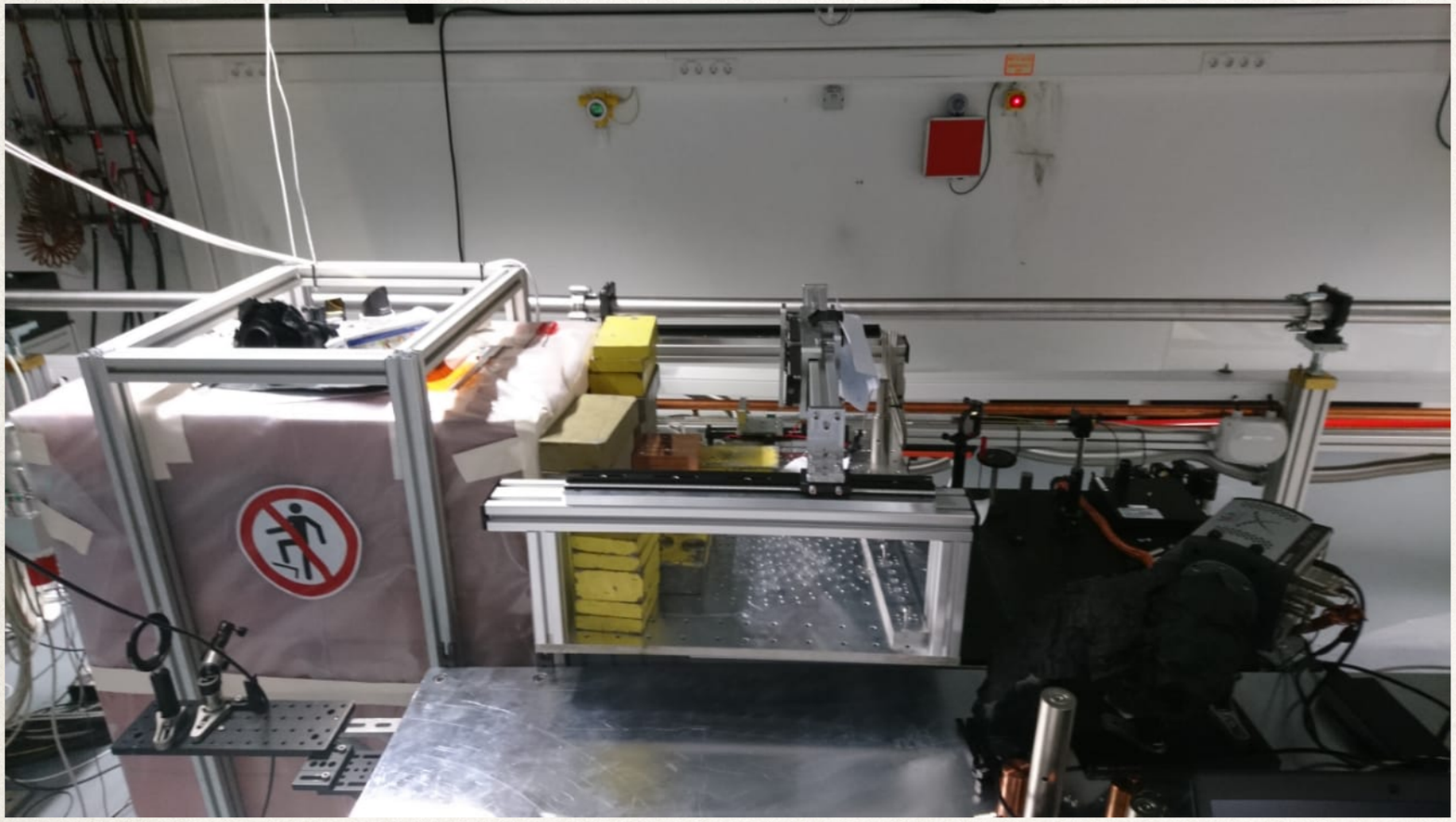
IV. **Test with the radioactive source (Sr-90, Y-90) together with Cherenkov** (at the end of 09/21)

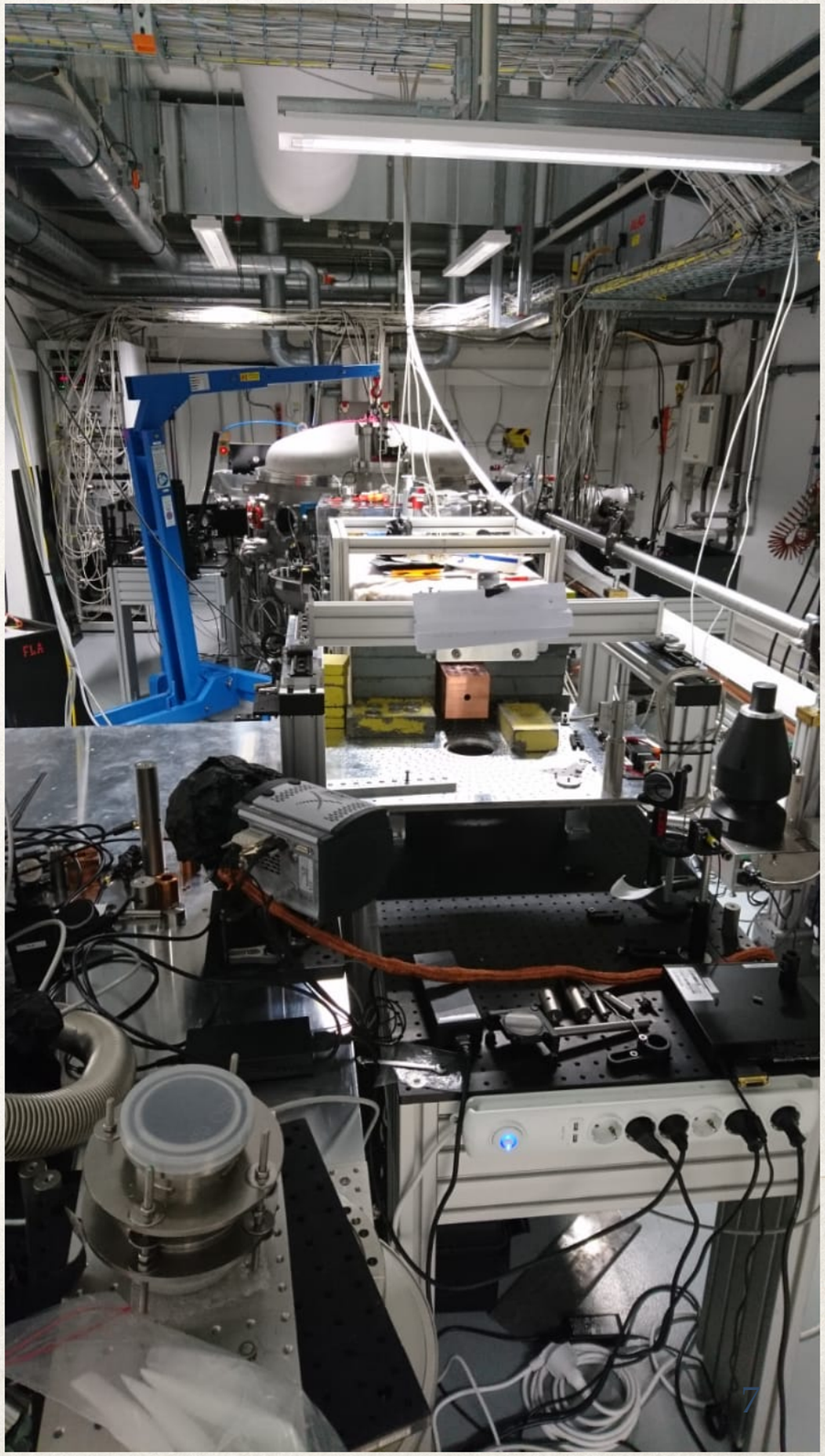
V. **To prepare DAQ for beam tests at Laser Plasma accelerator** - to see real particles and to perform irradiation of the crystal? - (11/21)

VI. **To test at R-Weg facility** - to perform irradiation of the crystal - (11/21)

VII.

Visit to Laser Plasma accelerator



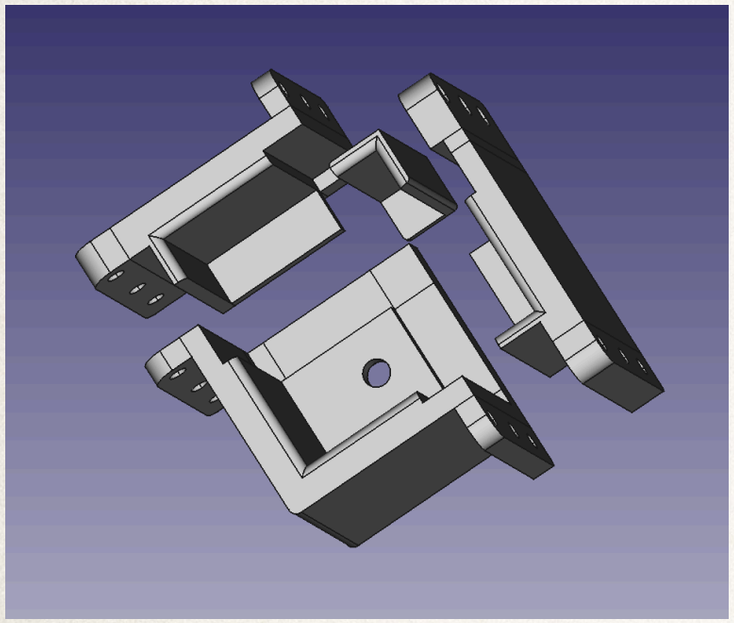


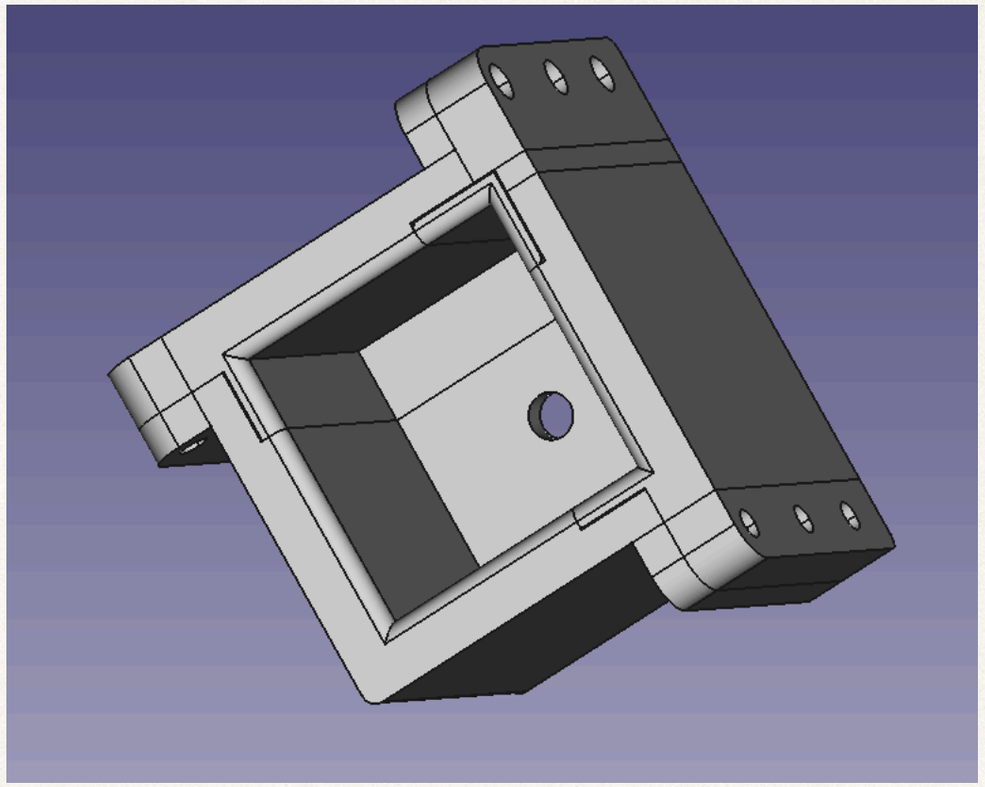
60 MeV 10 pC
Max 10 (2.5 stable) Hz of 6e7 electrons at 0.06 GeV
In laser-plasma acceleration, a strong laser pulse generates a plasma wave in hydrogen gas by stripping electrons from gas molecules. This pushes them to high energies extremely quick.

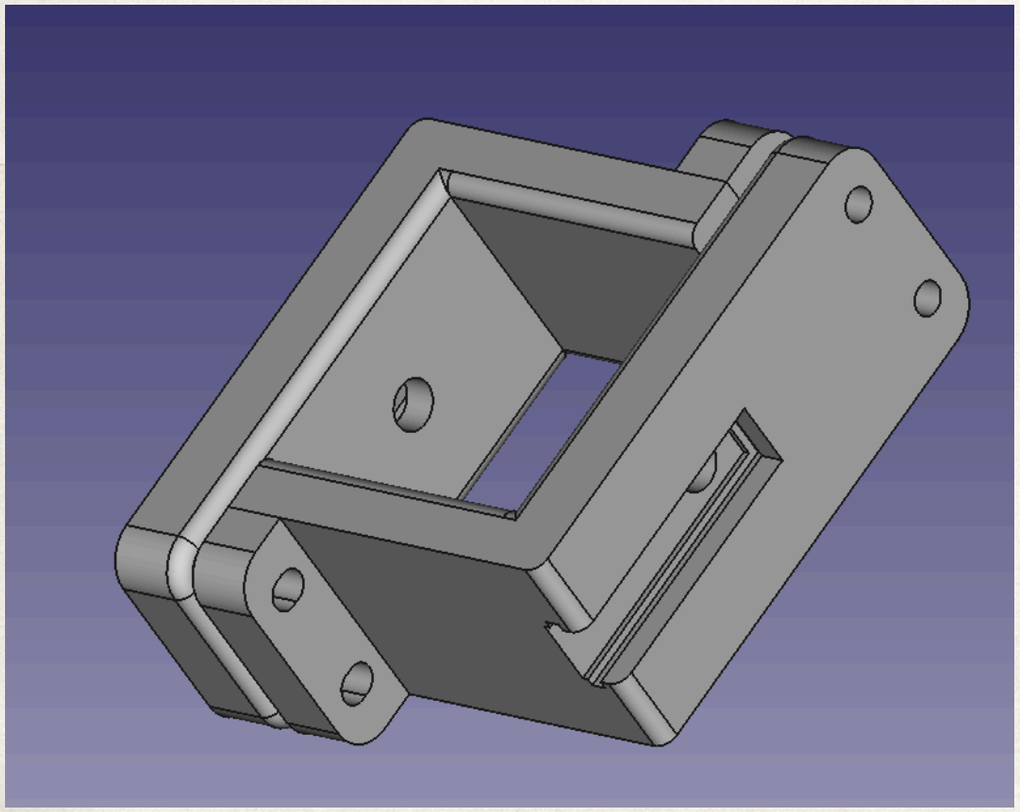
- Discussed possible placements of the crystal and intercalation into the available DAQ system
- Beam tests are possible in 11/21

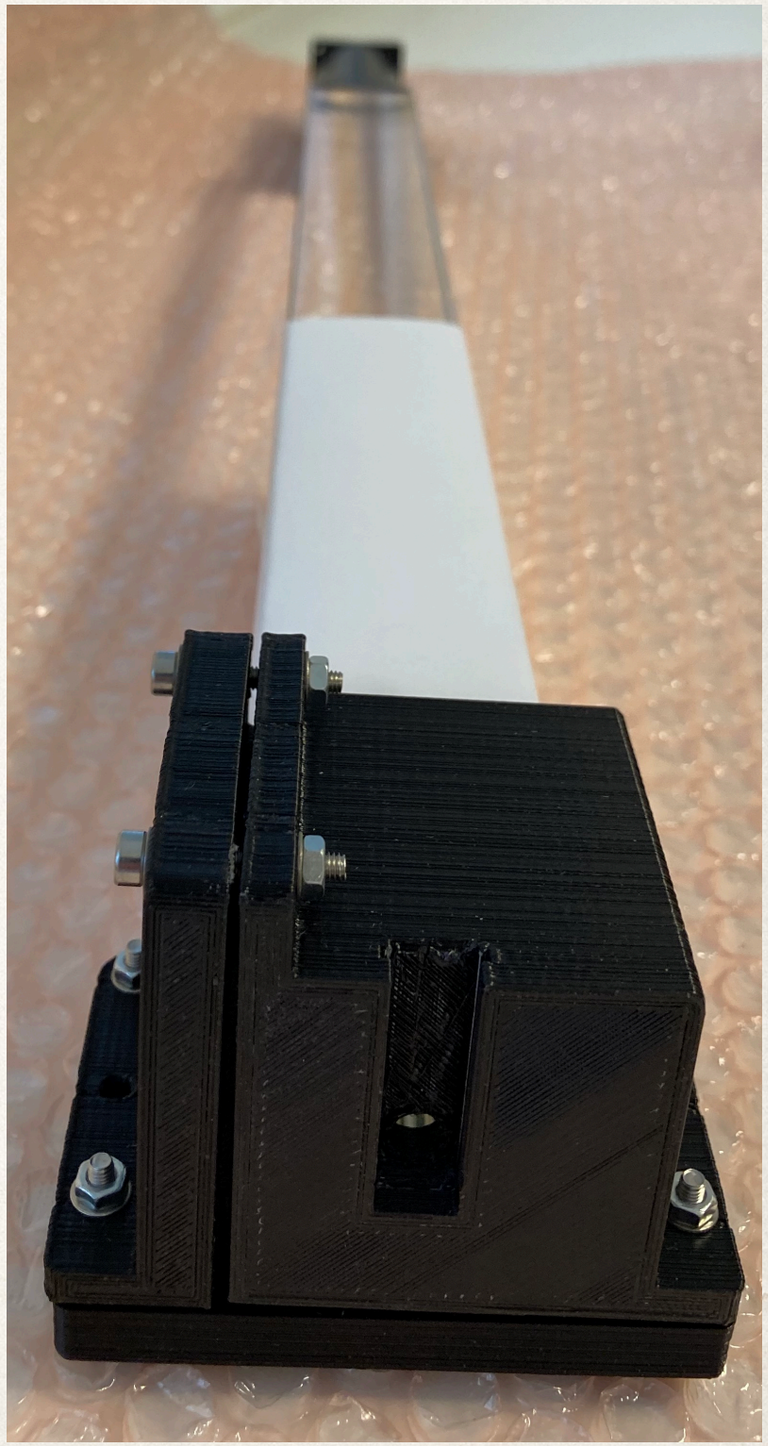
Outlook

Cad model of Supporting structure

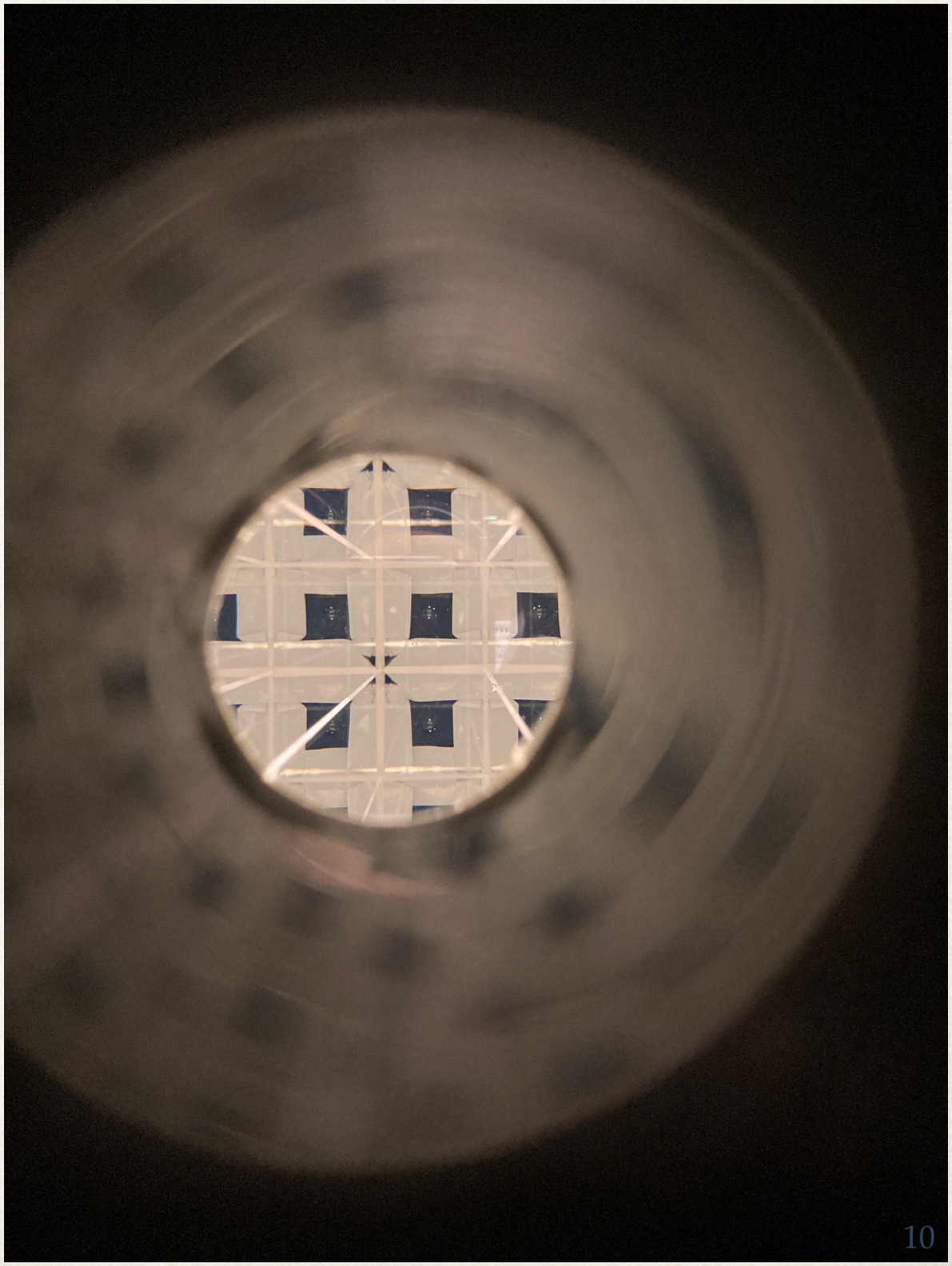




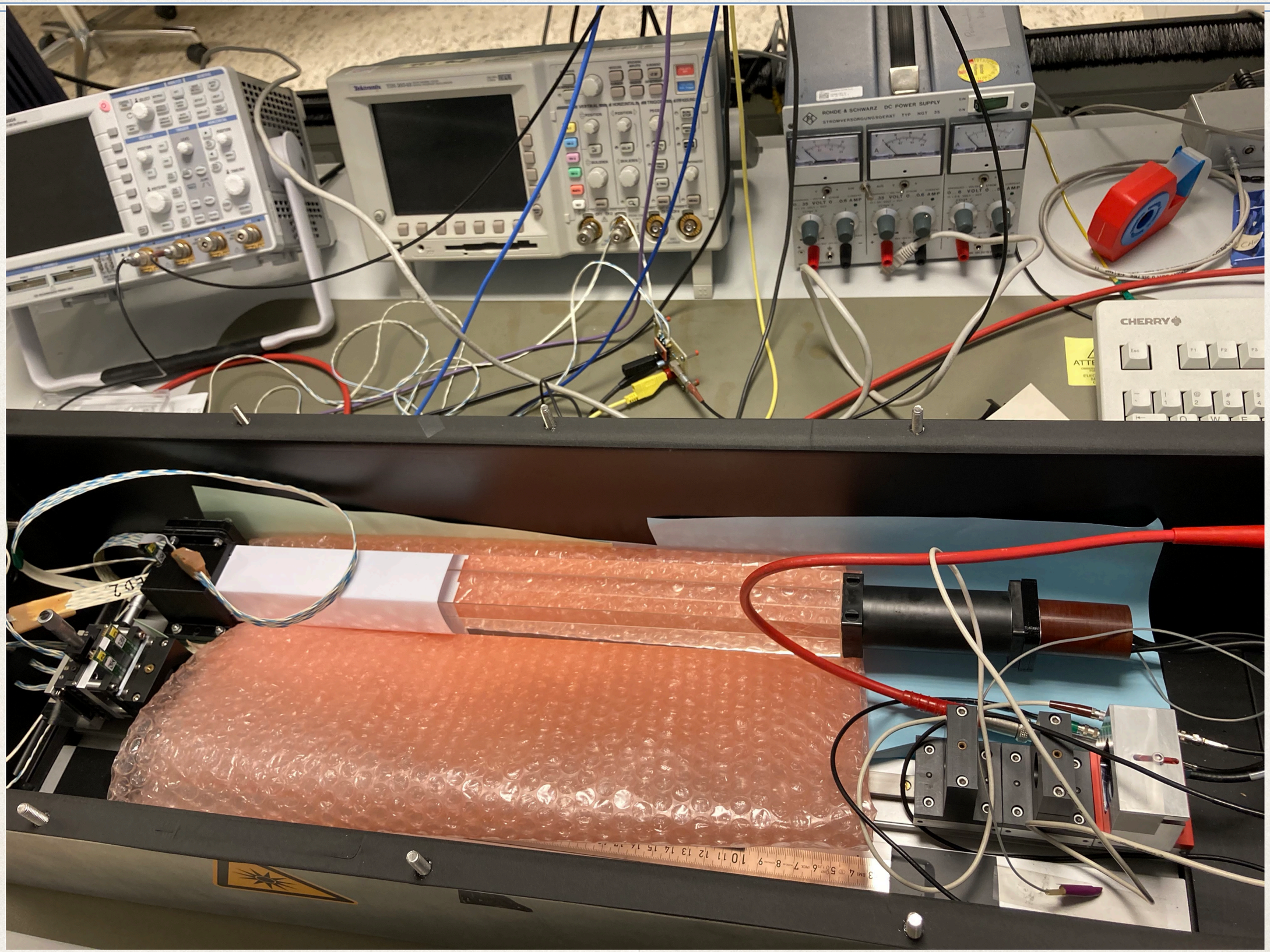




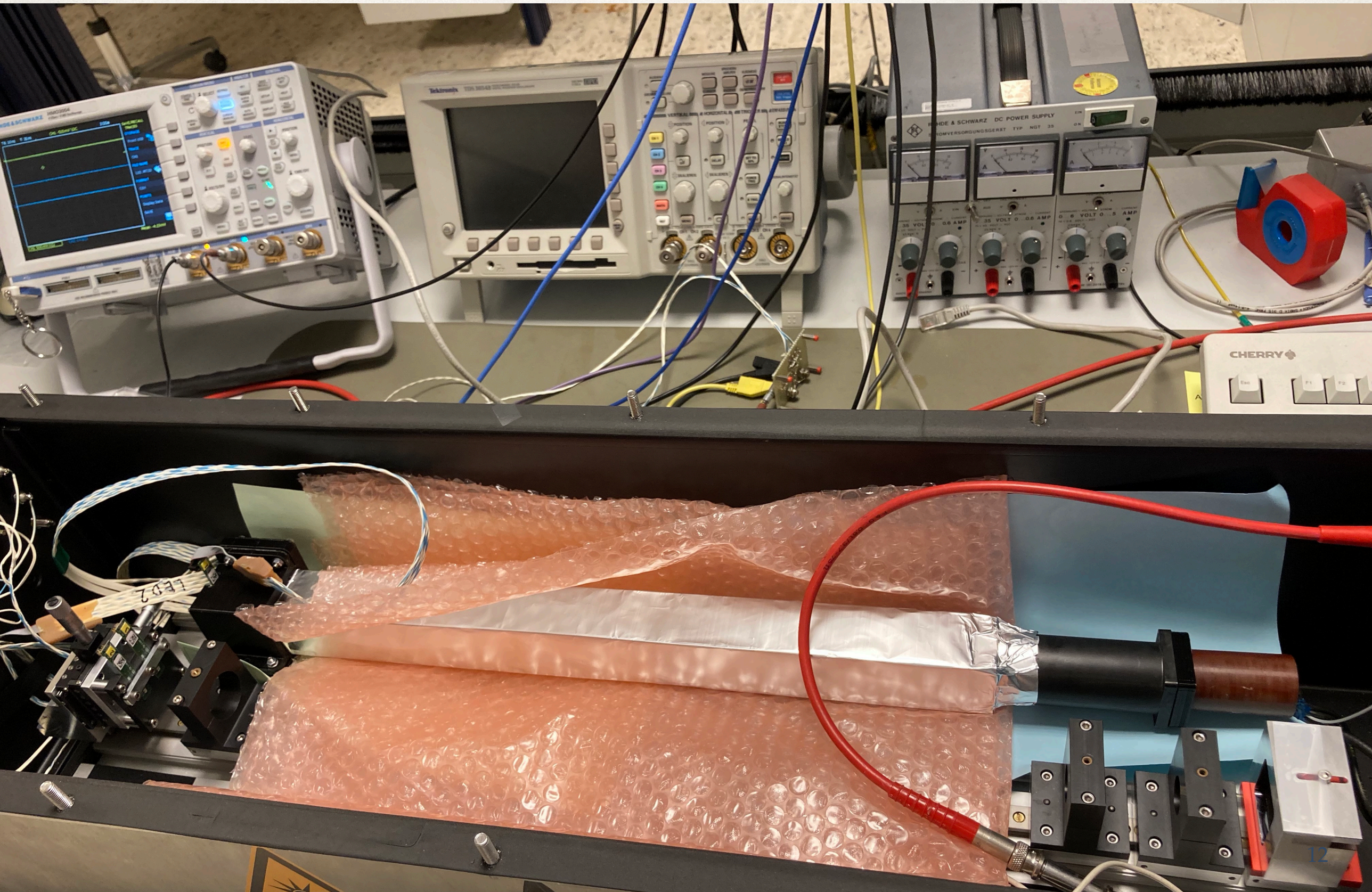
Supporting structure with LED



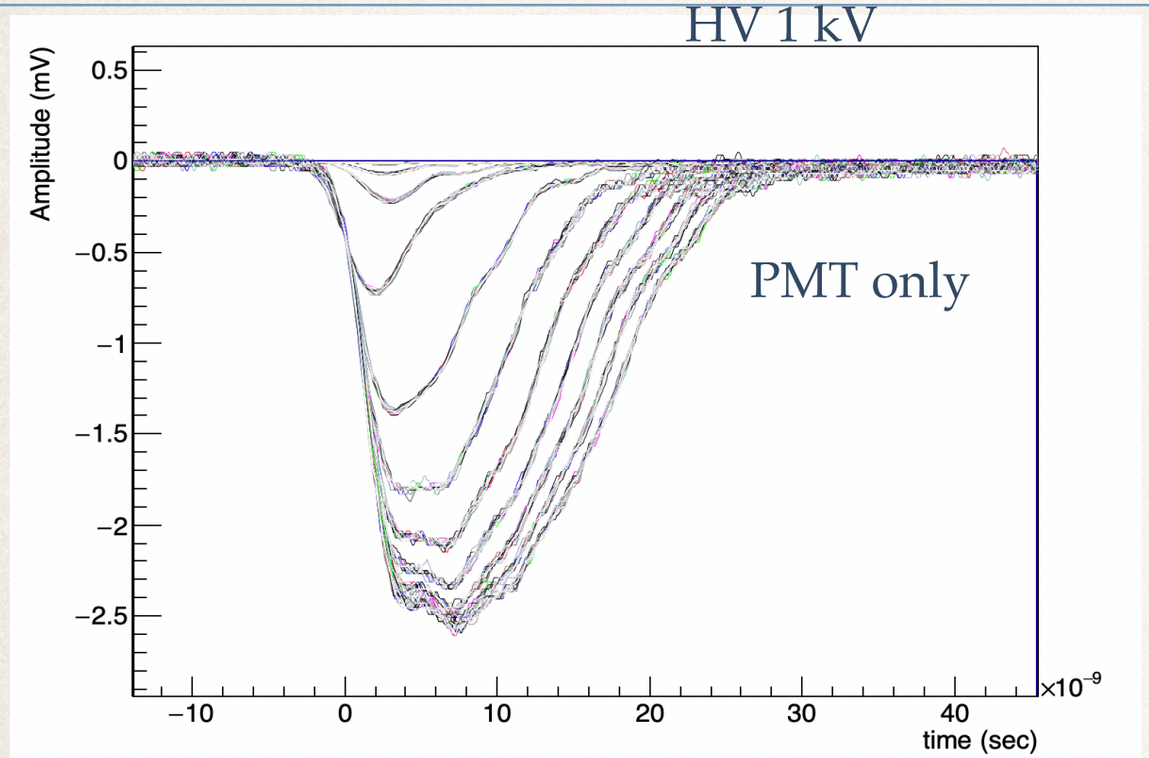
Test setup with crystal partially wrapped in paper

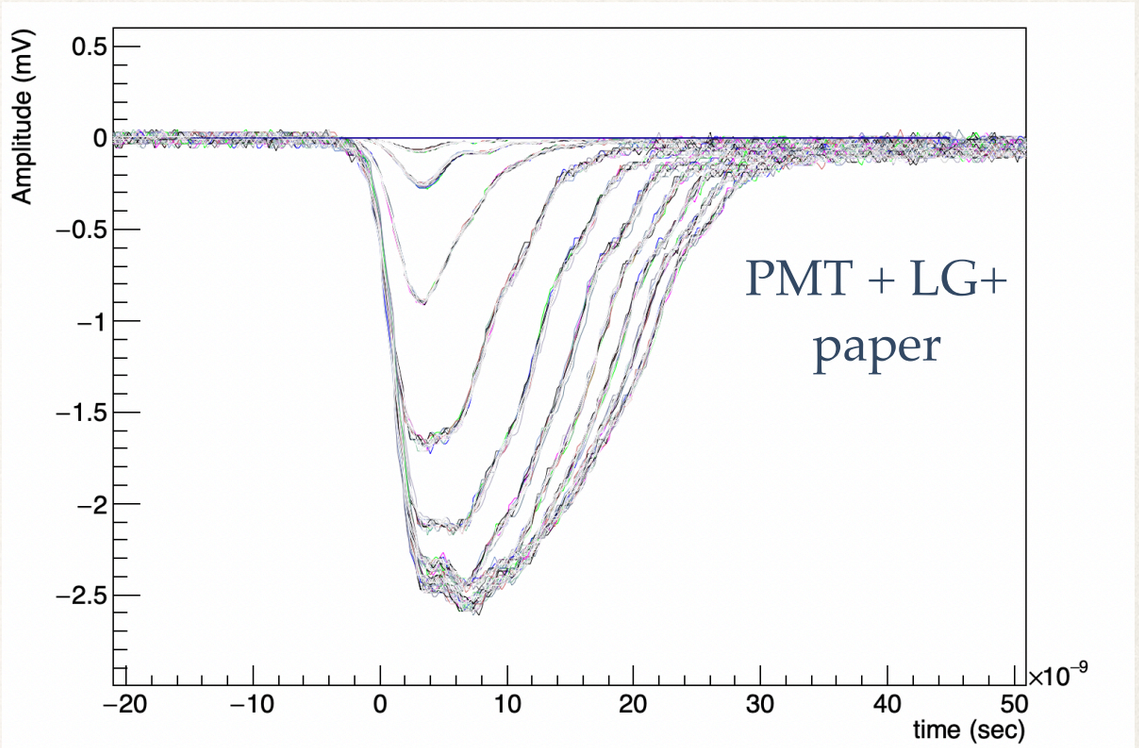


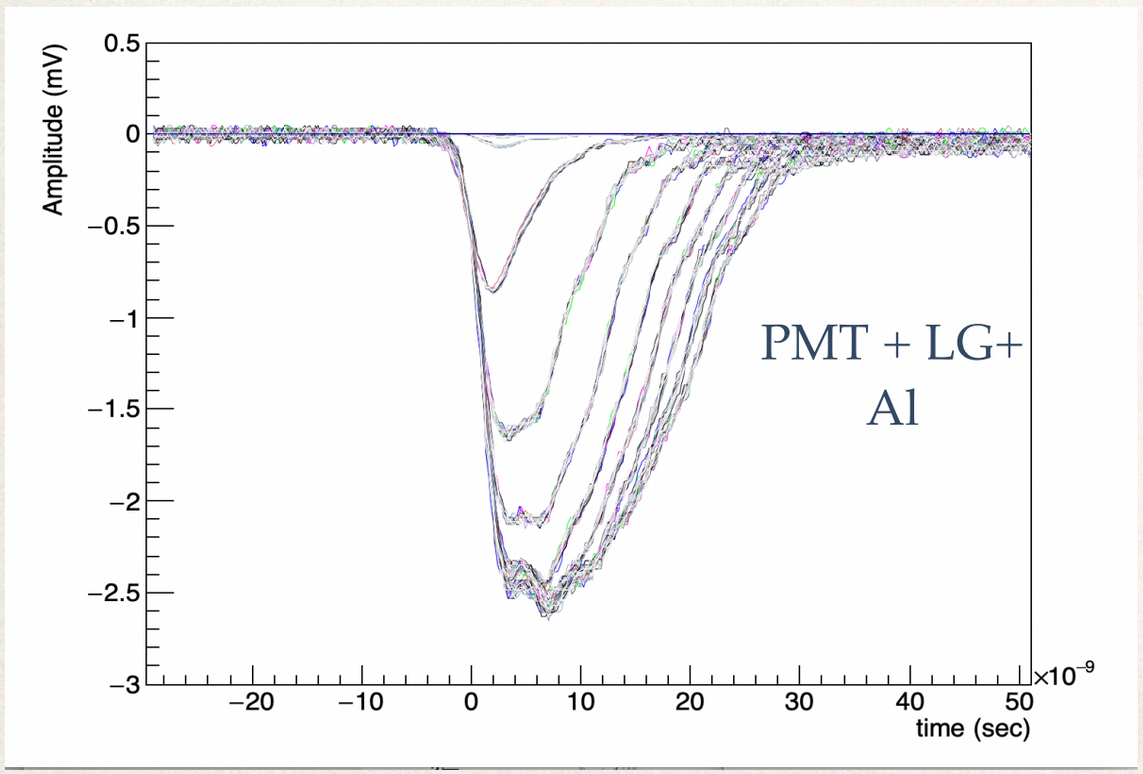
Test setup with crystal wrapped in Al

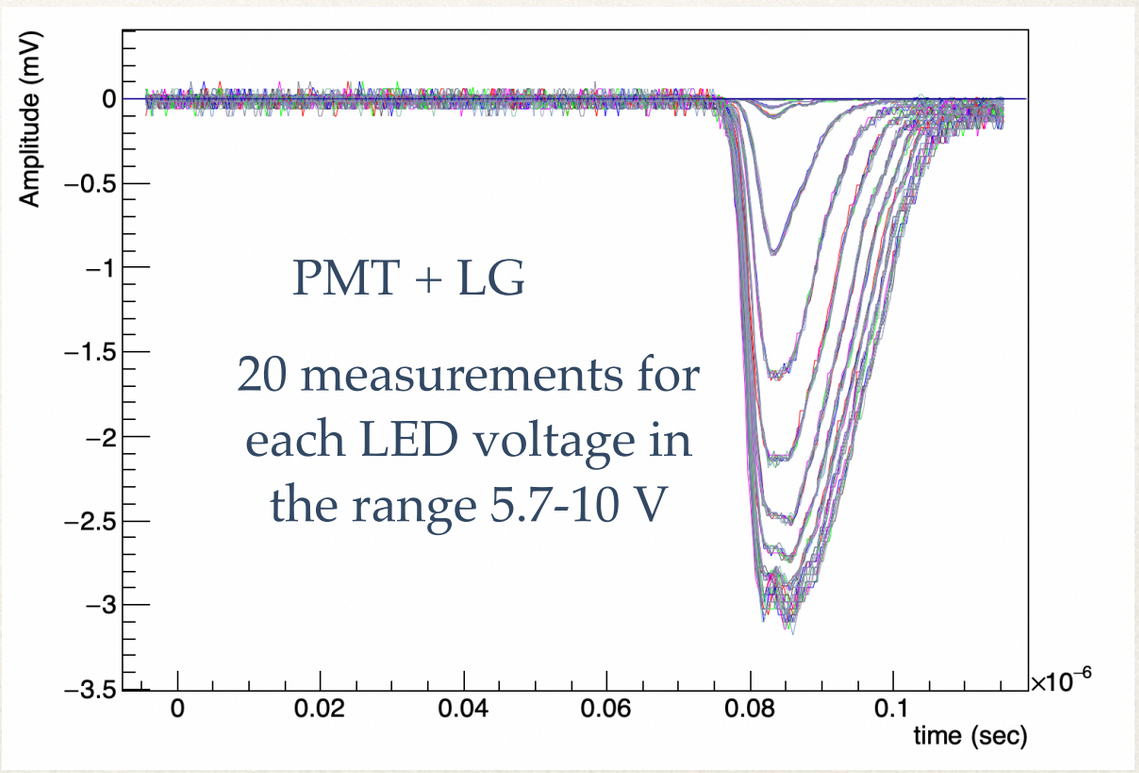


Signal Measurements with crystals

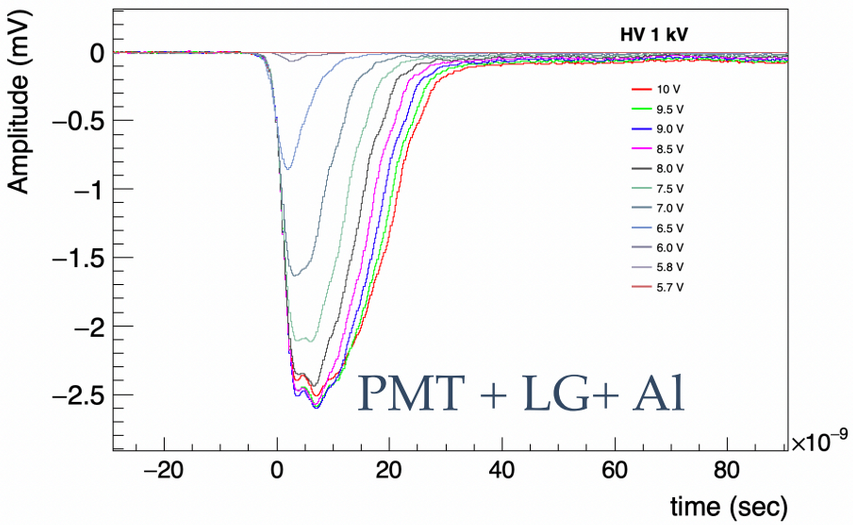


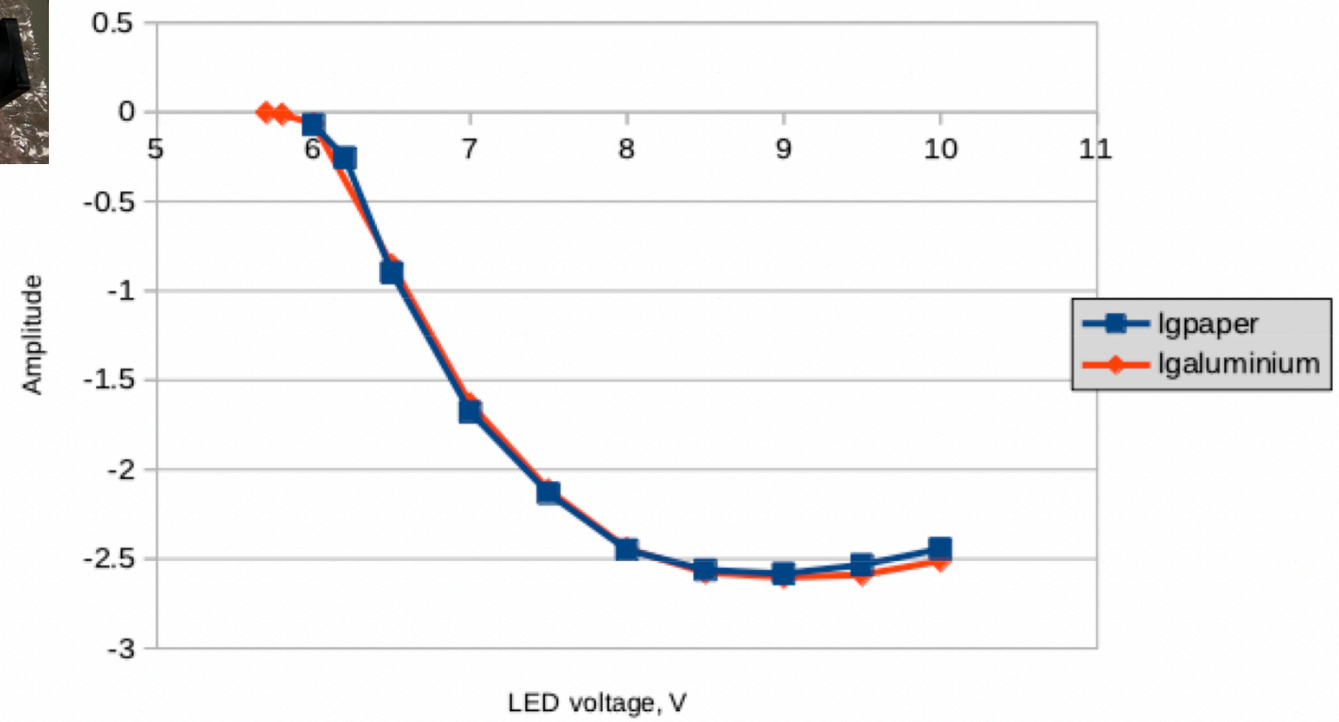


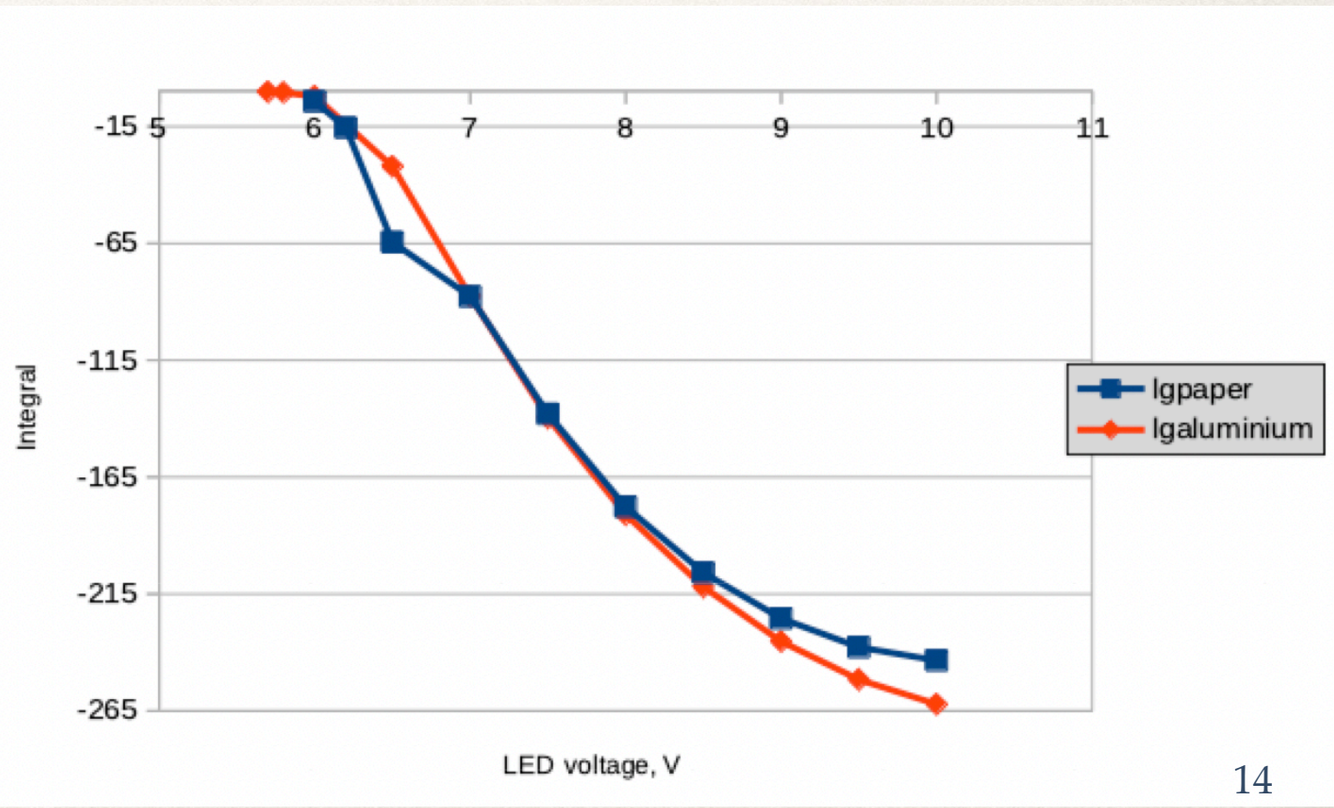




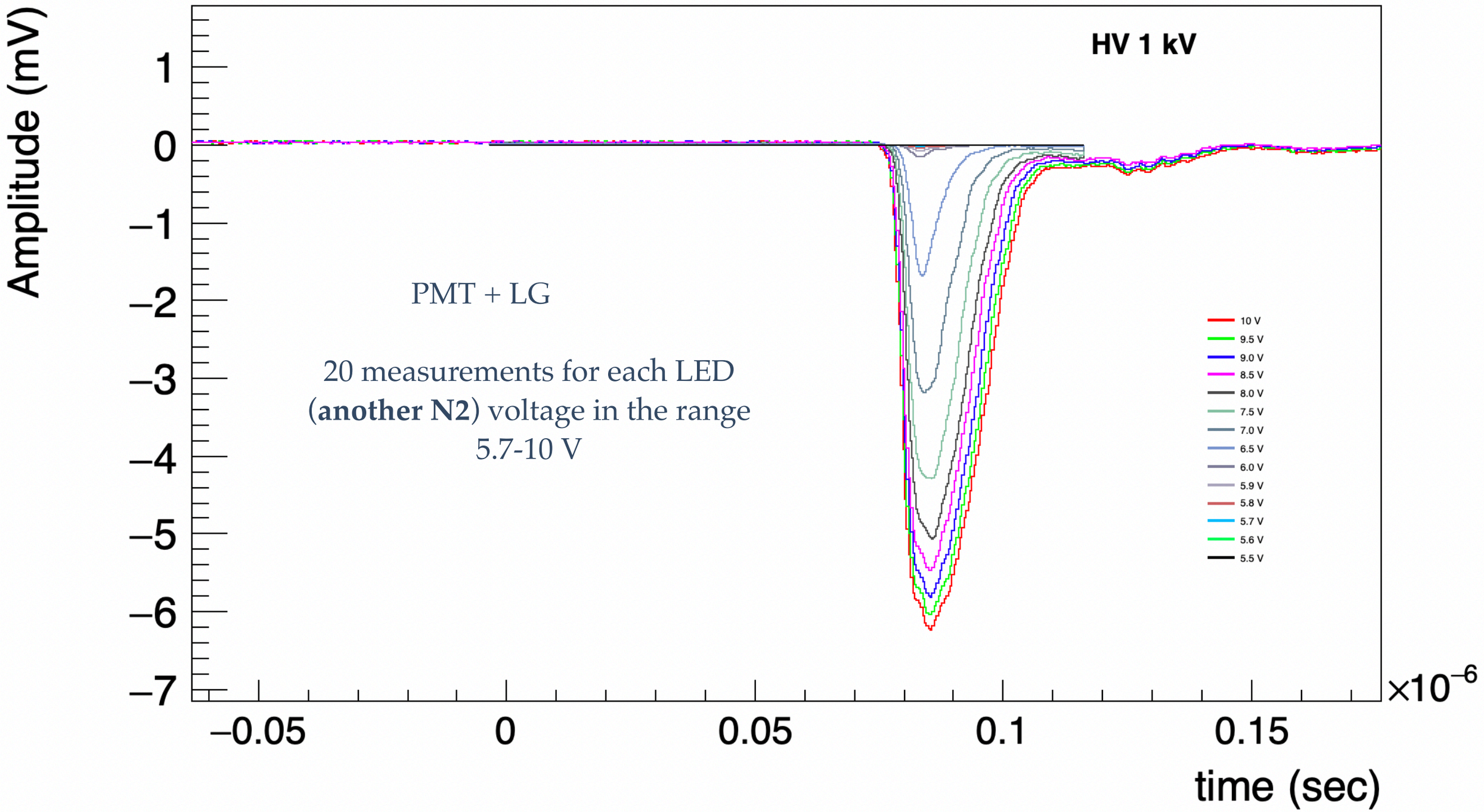
Signal dependance on LED voltage



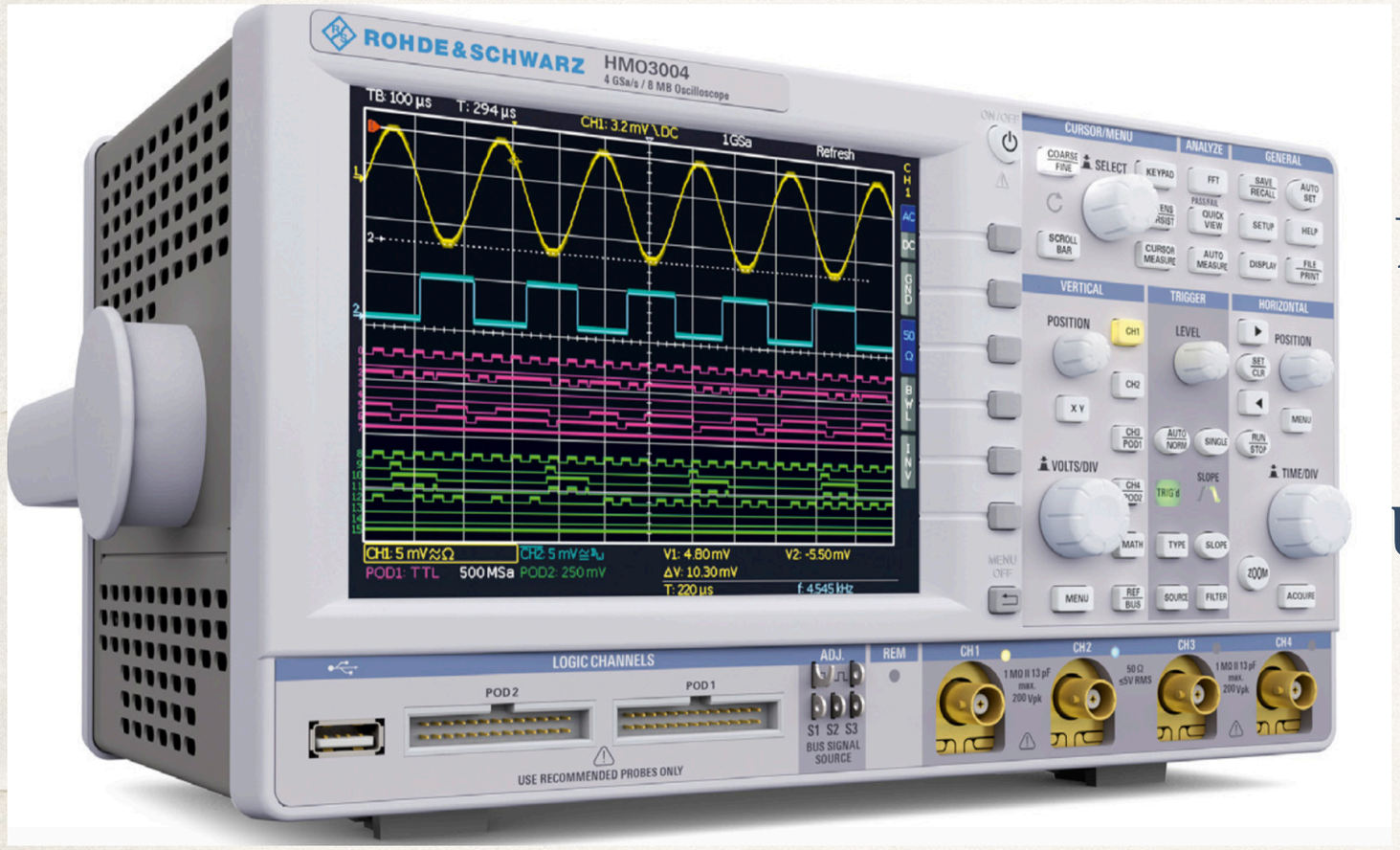




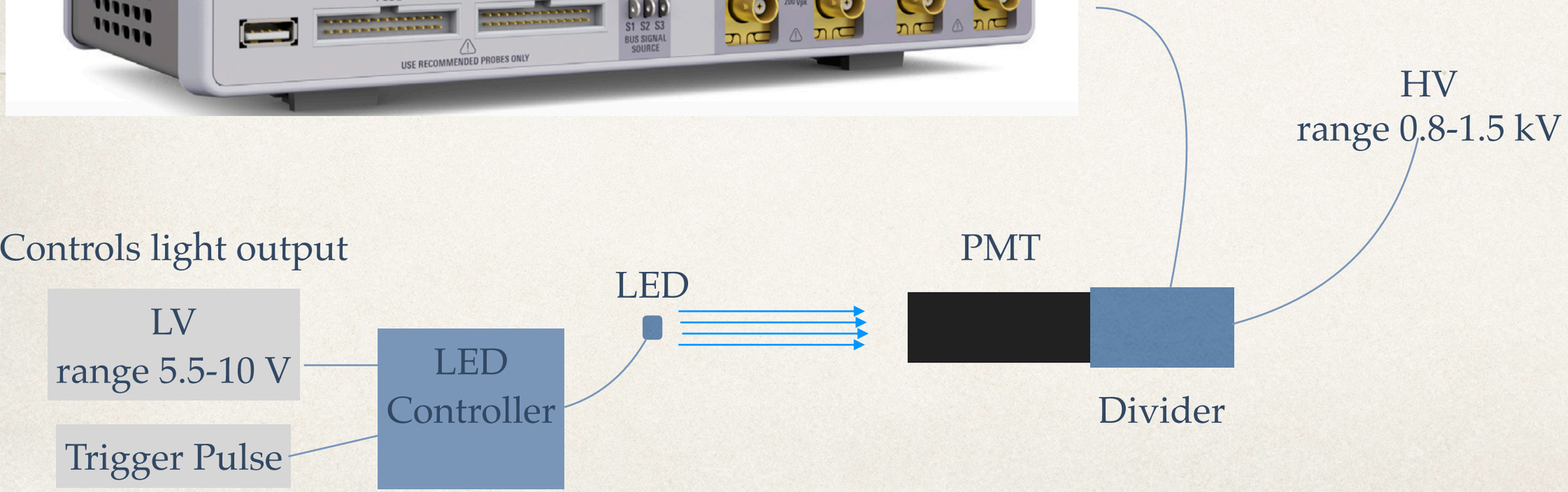
To be continued…..


HV 1 kV
PMT + LG
20 measurements for each LED
(**another N2**) voltage in the range
5.7-10 V
10 V
9.5 V
9.0 V
8.5 V
8.0 V
7.5 V
7.0 V
6.5 V
6.0 V
5.9 V
5.8 V
5.7 V
5.6 V
5.5 V
Amplitude (mV)
1
0
−1
−2
−3
−4
−5
−6
−7
−0.05
0
0.05
0.1
0.15
×10⁻⁶
time (sec)

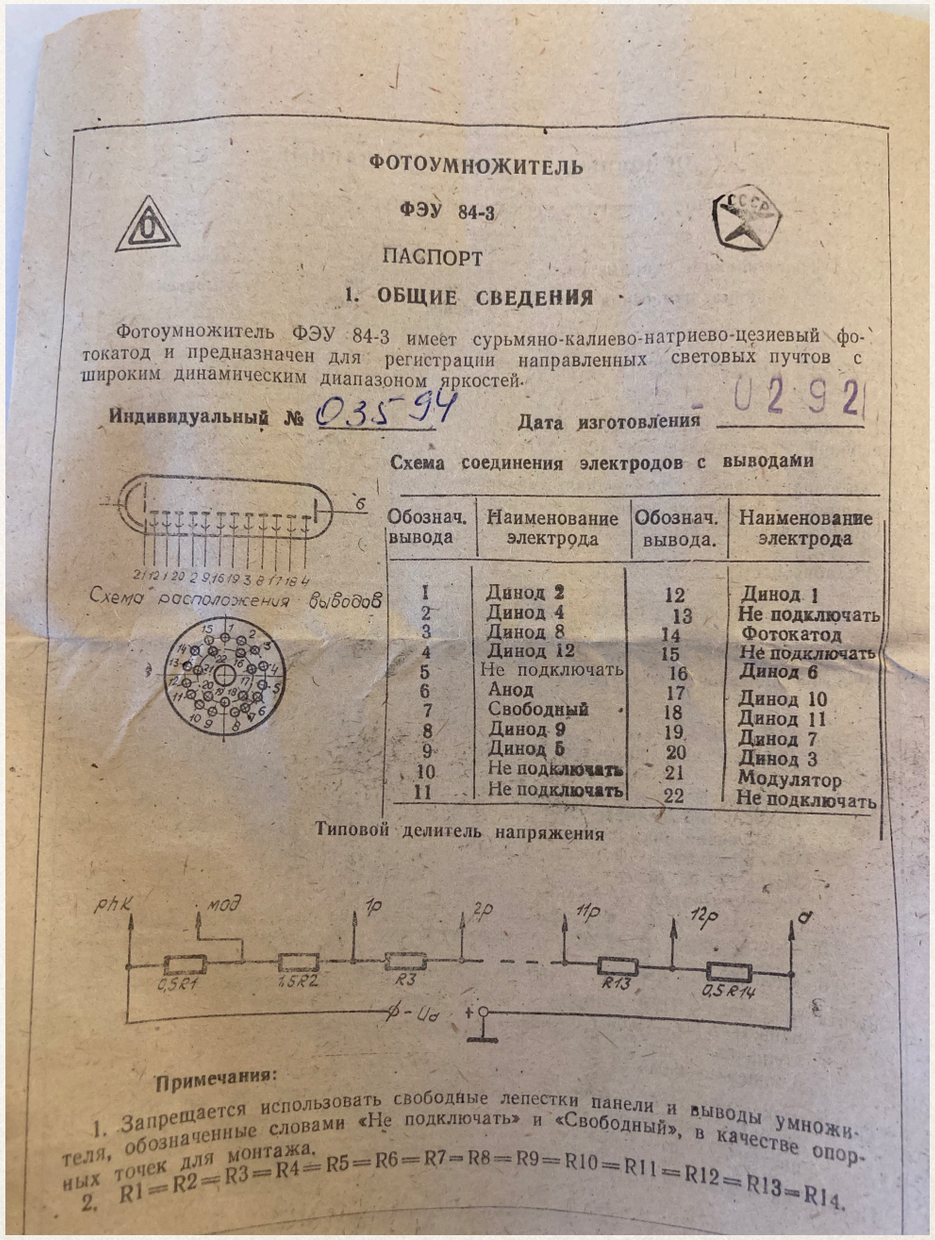
Signal readout



Digital Oscilloscope HMO3004
4 GSap/sec
4 analog channels
USB interface for signal storage



New PMT



ФОТОУМНОЖИТЕЛЬ

ФЭУ 84-3

ПАСПОРТ

1. ОБЩИЕ СВЕДЕНИЯ

Фотоумножитель ФЭУ 84-3 имеет сурьмяно-калиево-натриево-цезиевый фотокатод и предназначен для регистрации направленных световых пучтов с широким динамическим диапазоном яркостей.

Индивидуальный № 035-94 **Дата изготовления** 02 92

Схема соединения электродов с выводами

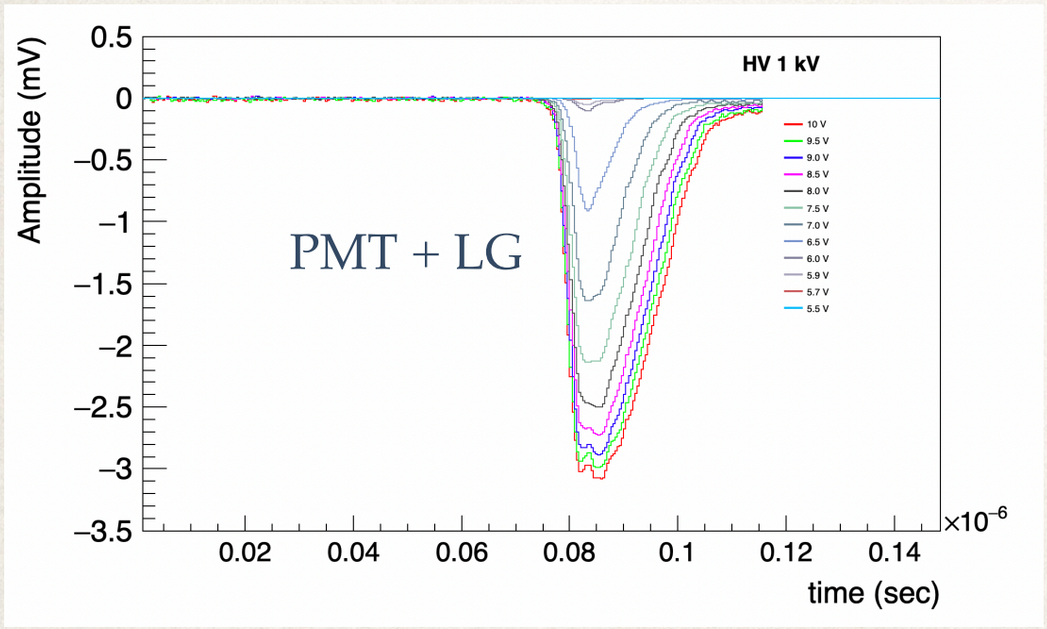
Схема расположения выводов

Обознач. вывода	Наименование электрода	Обознач. вывода.	Наименование электрода
1	Динод 2	12	Динод 1
2	Динод 4	13	Не подключать
3	Динод 8	14	Фотокатод
4	Динод 12	15	Не подключать
5	Не подключать	16	Динод 6
6	Анод	17	Динод 10
7	Свободный	18	Динод 11
8	Динод 9	19	Динод 7
9	Динод 5	20	Динод 3
10	Не подключать	21	Модулятор
11	Не подключать	22	Не подключать

Типовой делитель напряжения

Примечания:

1. Запрещается использовать свободные лепестки панели и выводы умножителя, обозначенные словами «Не подключать» и «Свободный», в качестве опорных точек для монтажа.
2. R1 = R2 = R3 = R4 = R5 = R6 = R7 = R8 = R9 = R10 = R11 = R12 = R13 = R14.


HV 1 kV
PMT + LG
10 V
9.5 V
9.0 V
8.5 V
8.0 V
7.5 V
7.0 V
6.5 V
6.0 V
5.9 V
5.7 V
5.5 V
Amplitude (mV)
0.5
0
−0.5
−1
−1.5
−2
−2.5
−3
−3.5
0.02
0.04
0.06
0.08
0.1
0.12
0.14
×10⁻⁶
time (sec)