

# DVDM 2.0 for Cold Box First Test at CERN

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# Electronics under test

**M2:**

**DVDM V2.0, 2 channels,  
4x HPK per channel, LAr**

Cold Gain: 2k / 50

Warm Gain: 2k / [1k (+ 3x 50 in line)] ,

No line adapter.

**M1:**

**DVDM V2.0, 2 channels,  
3x HPK per channel, LAr**

Cold Gain: 1k / 50

Warm Gain: 2k / [1k (+ 3x 50 in line)] ,

No line adapter.

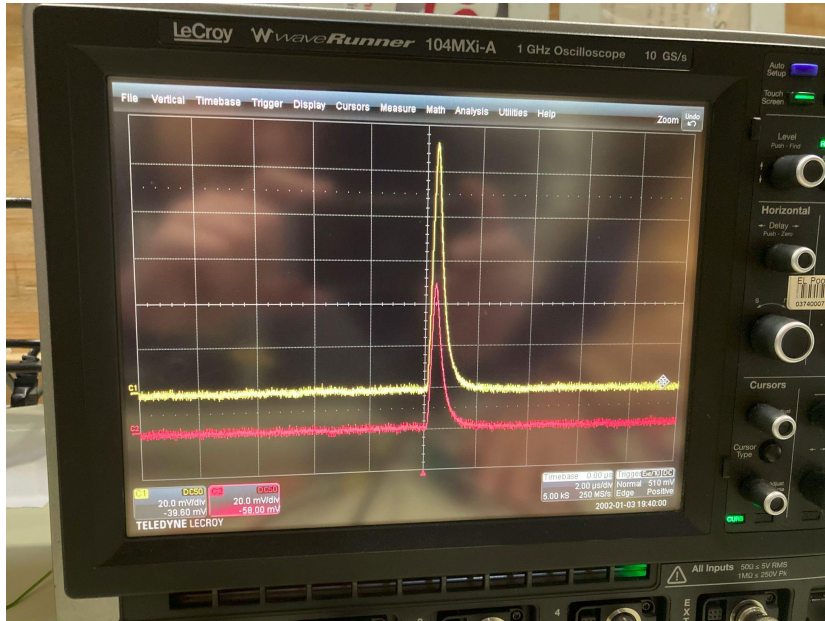


**Test stand**

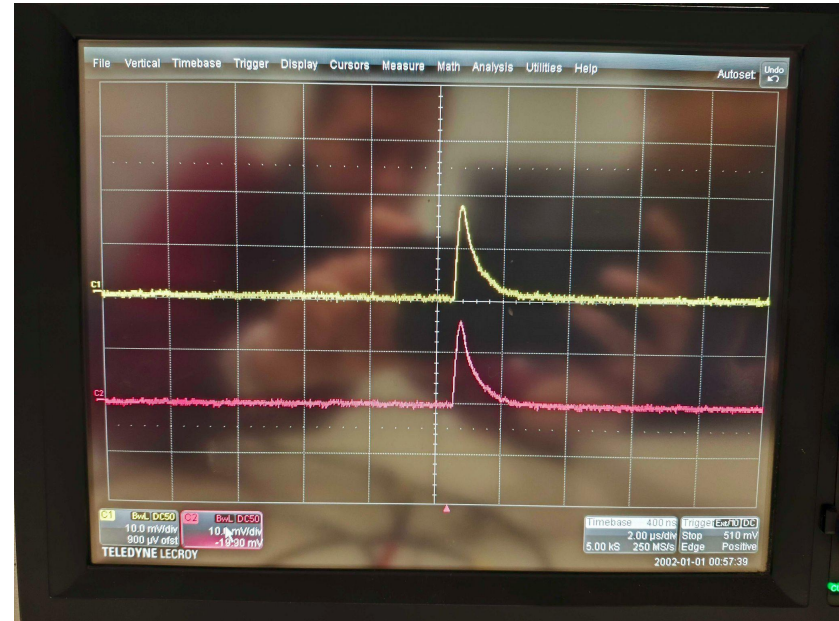


# M1 and M2 waveforms - LED signal

M1 **ch1** and **ch2**

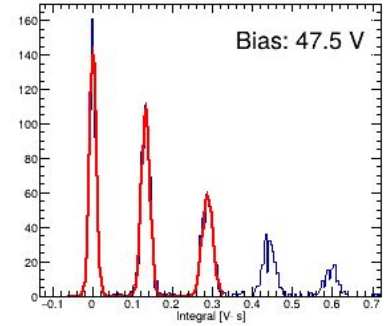
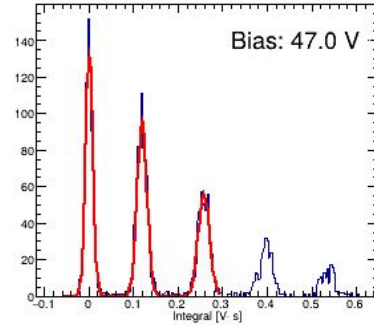
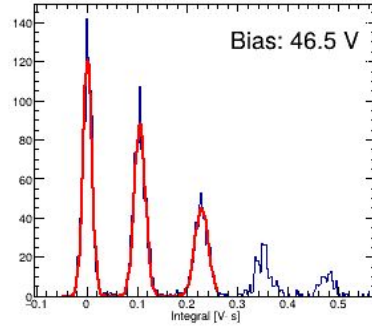
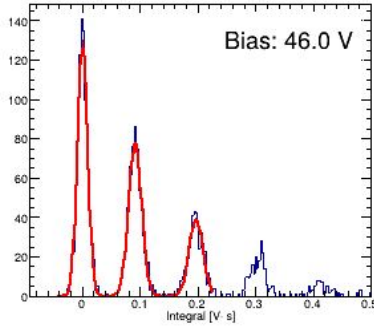
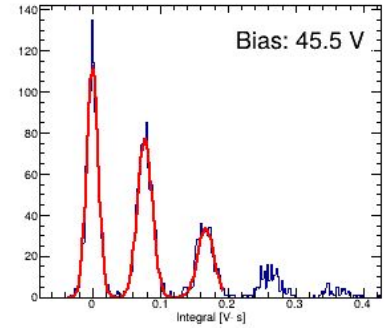
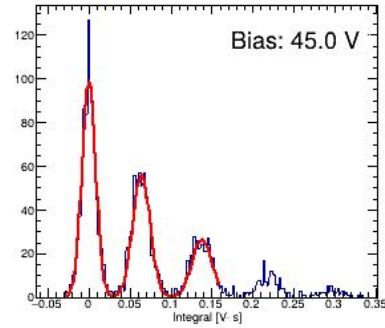
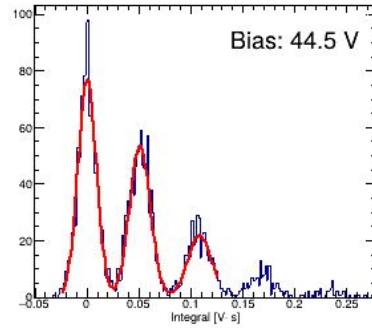
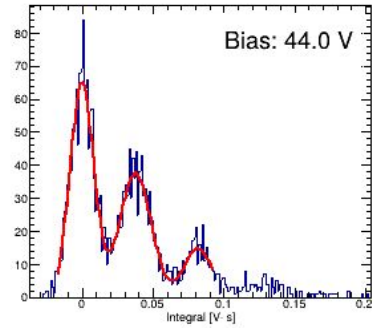


M2 **ch1** and **ch2**

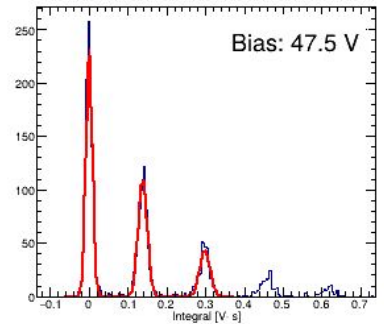
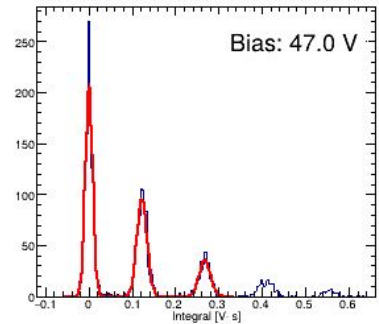
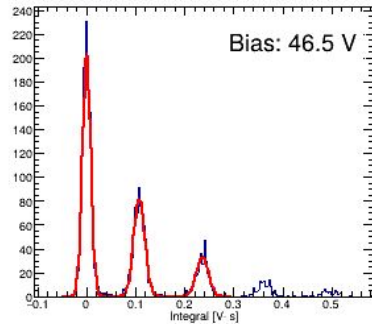
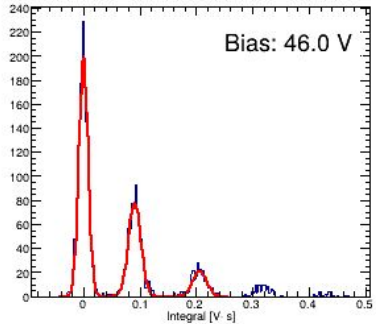
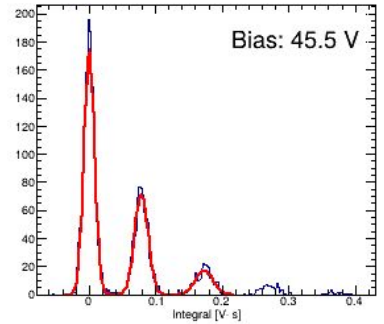
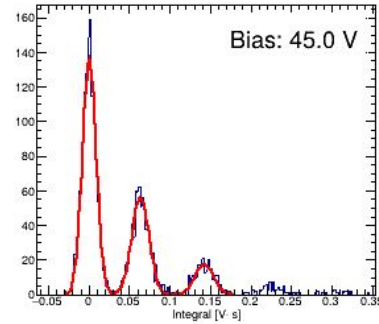
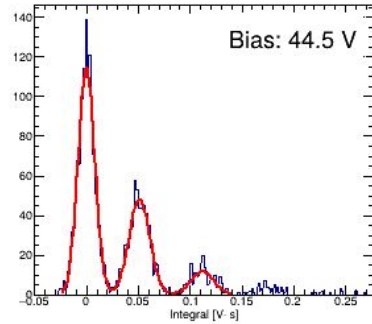
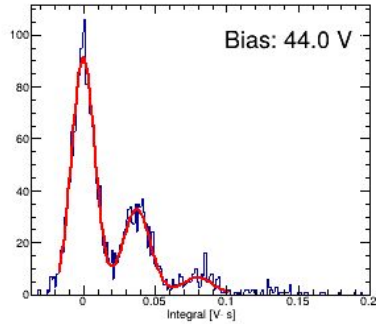




# Integral histograms for each bias voltage: M2 Ch1



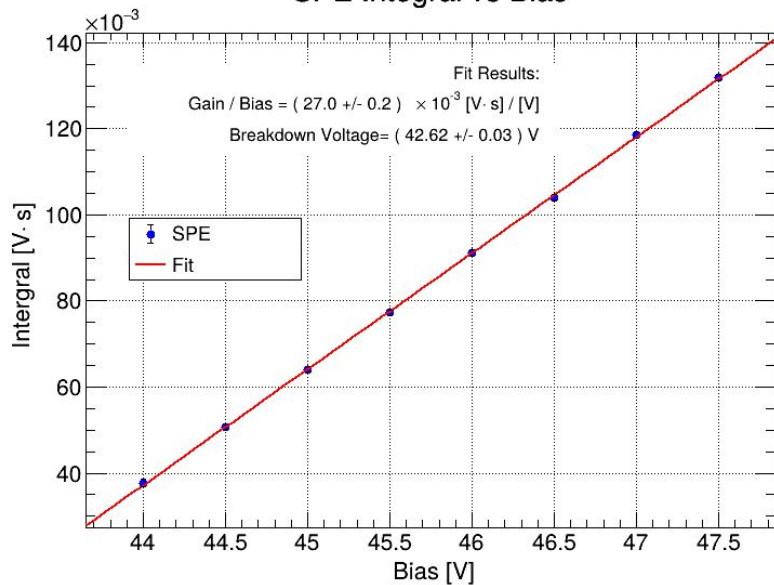
# Integral histograms for each bias voltage: M2 Ch2



# SPE gain vs. Bias Voltage

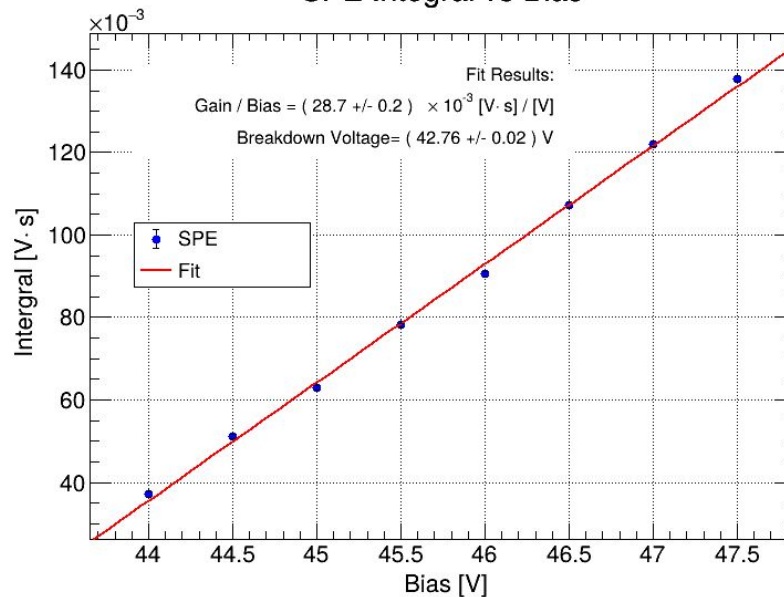
## M2 ch1

SPE Integral vs Bias



## M2 ch2

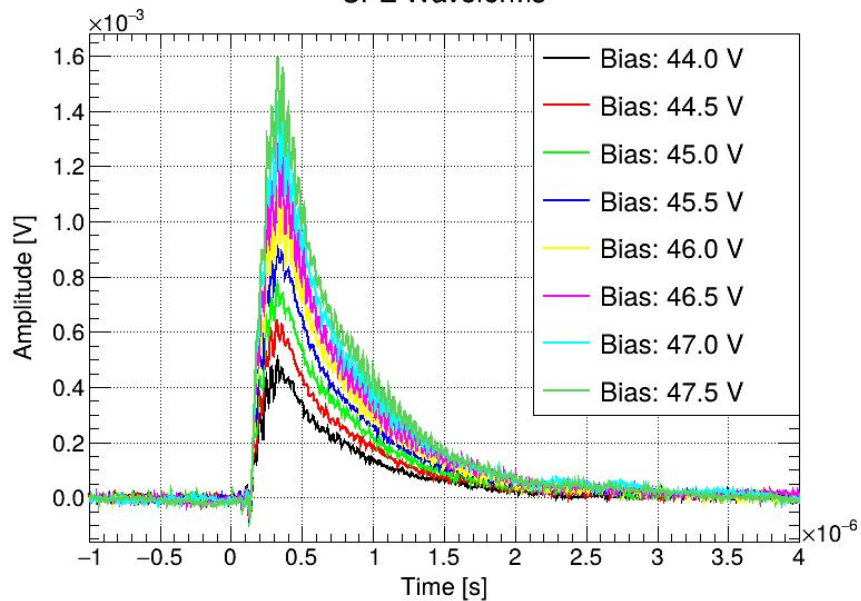
SPE Integral vs Bias



# SPE average waveform vs. Bias Voltage

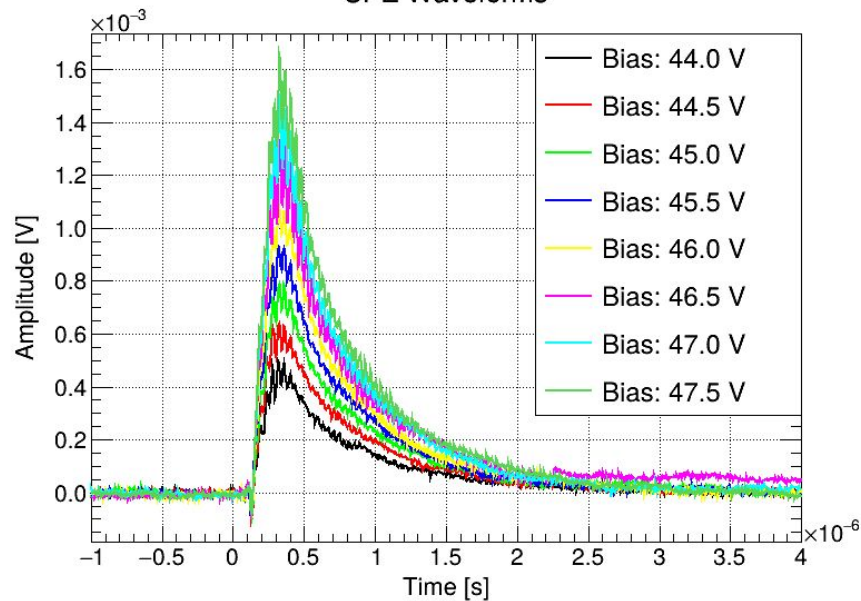
## M2 ch1

SPE Waveforms



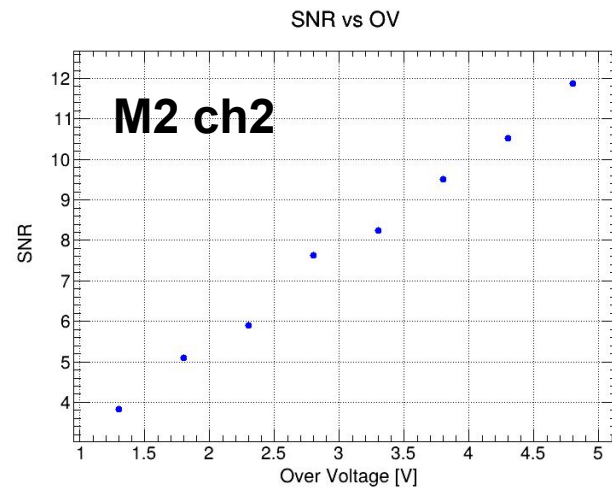
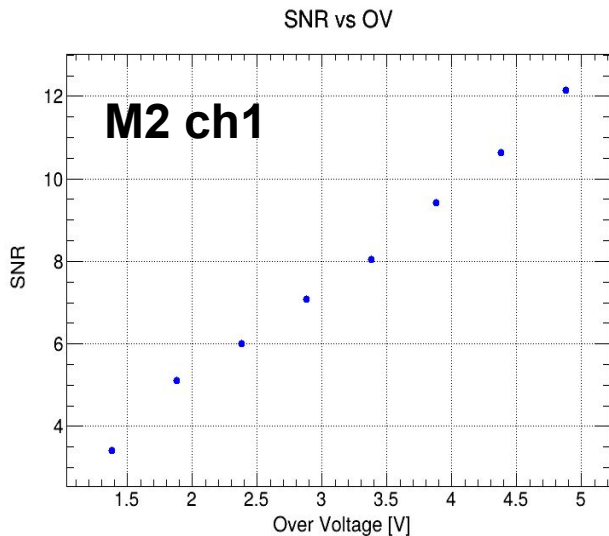
## M2 ch2

SPE Waveforms

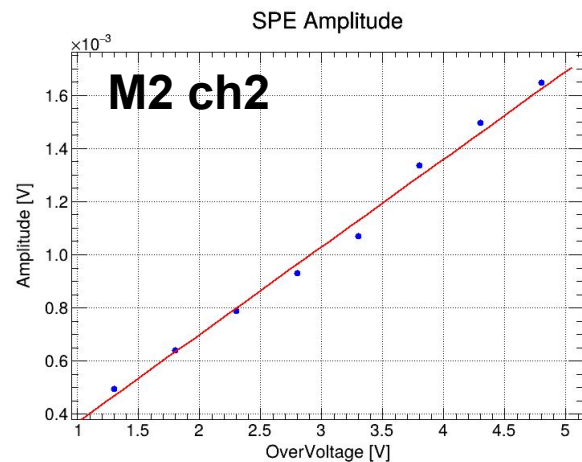
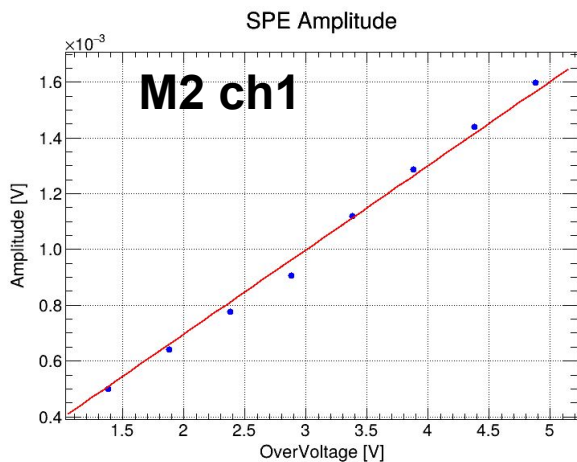




**SNR  
vs.  
OV**

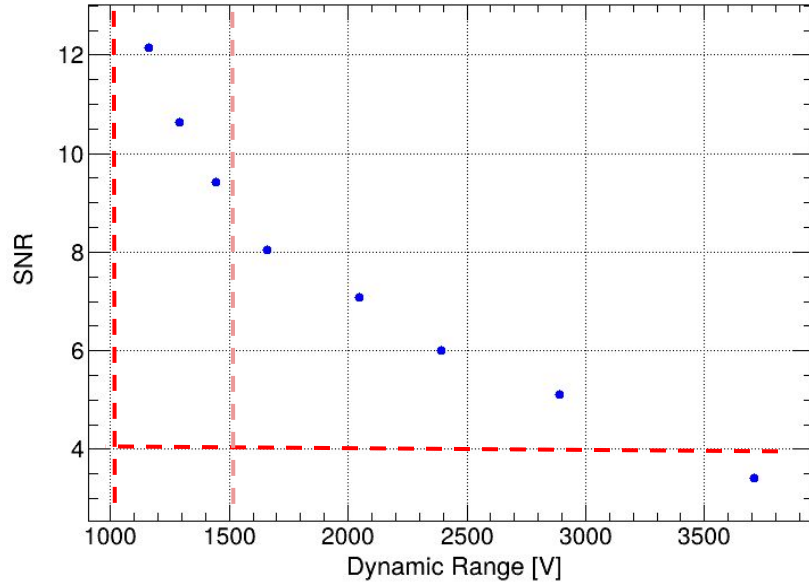


**SPE  
amplitude  
vs.  
OV**



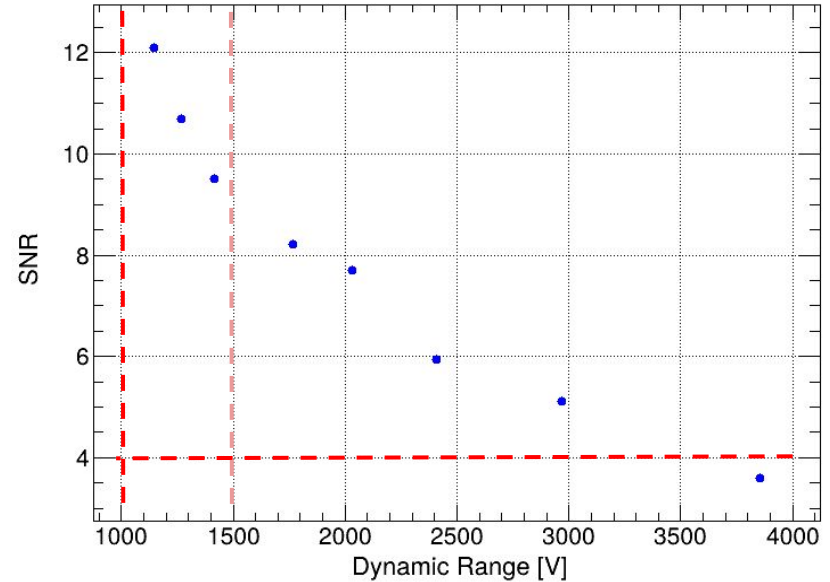
## M2 ch1

SNR vs Dynamic Range



## M2 ch2

SNR vs Dynamic Range



**SNR > 4** above 44 V (OV > 1.5 V)

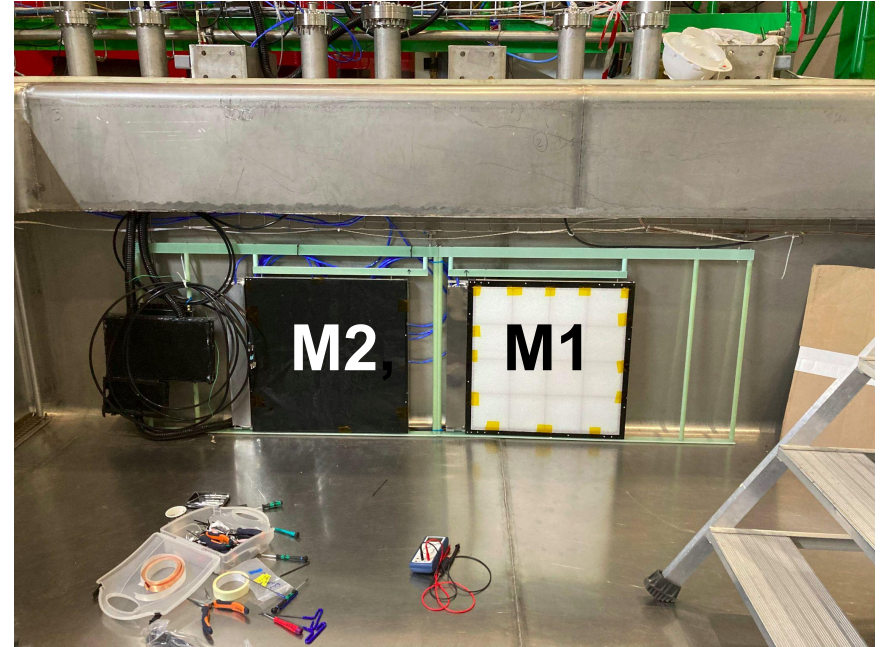
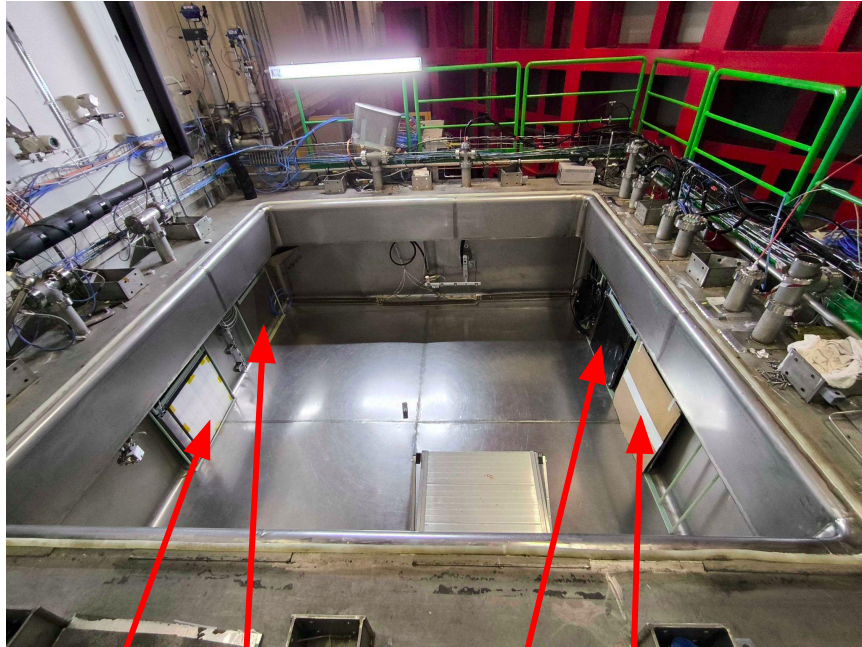
**Dynamic Range > 1100 PE** for all the Bias Voltage values (up to OV ~ 5 V)

# M2 Module performances summary (DVDM 2.0 + HPK in LAr)

M2 Ch 1	Oscilloscope 50 Ohm DC - Saturation = 1.855 V, Breakdown = 42.6 V							
Bias [V]	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5
OV [V]	1.4	1.9	2.4	2.9	3.4	3.9	4.4	4.9
SPE Int [V s]	0.078	0.103	0.125	0.151	0.171	0.197	0.222	0.240
SPE Amp [mV]	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.6
SNR	3.4	5.1	6.0	7.1	8.0	9.4	10.6	12.1
Dynamic Range [PE]	3709	2889	2392	2049	1658	1442	1289	1161

M2 Ch 2	Oscilloscope 50 Ohm DC - Saturation = 1.875 V, Breakdown = 42.8 V							
Bias [V]	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5
OV [V]	1.2	1.7	2.2	2.7	3.2	3.7	4.2	4.7
SPE Int [V s]	0.078	0.104	0.130	0.151	0.171	0.215	0.218	0.239
SPE Amp [mV]	0.5	0.6	0.8	0.9	1.1	1.3	1.5	1.6
SNR	3.6	5.1	5.9	7.7	8.2	9.5	10.7	12.1
Dynamic Range [PE]	3854	2966	2406	2031	1768	1413	1266	1146

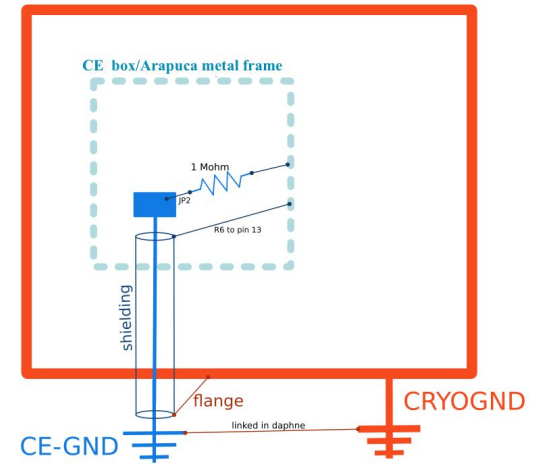
# M1, M2 and M4 installed in the Cold Box



**M4** **M3** **M2** **M1**  
not installed yet

# Membrane module grounding check

Grounding scheme recommendation for protoDUNE VD (module 0)



Module Name	Module	Style	Grounding	Check before installation:		Check after module installation before cable plugged (M) / Wire connected (C)	Check after cable plugged (A) / Wire connected (C)	
	Position			Scheme	Frame / CE Box		A_GND	Frame/CE Box
				DB15 Shielding (M) / Mesh pin (C) <td>CE Box</td> <td>Cryostat Wall (M) / Cathode Frame (C)</td> <td>Cryostat Wall (M) / Cathode Frame (C)</td> <td>CE Box/Frame/ Cryostat Wall (M) / Cathode Frame (C)</td>	CE Box	Cryostat Wall (M) / Cathode Frame (C)	Cryostat Wall (M) / Cathode Frame (C)	CE Box/Frame/ Cryostat Wall (M) / Cathode Frame (C)
Nov24M-A	M1	Membrane VD	standard	0 Ohm	1 MOhm	open	0 Ohm	1 MOhm
Nov24M-B	M2	Membrane VD	standard	0 Ohm	1 MOhm	open	0 Ohm	1 MOhm

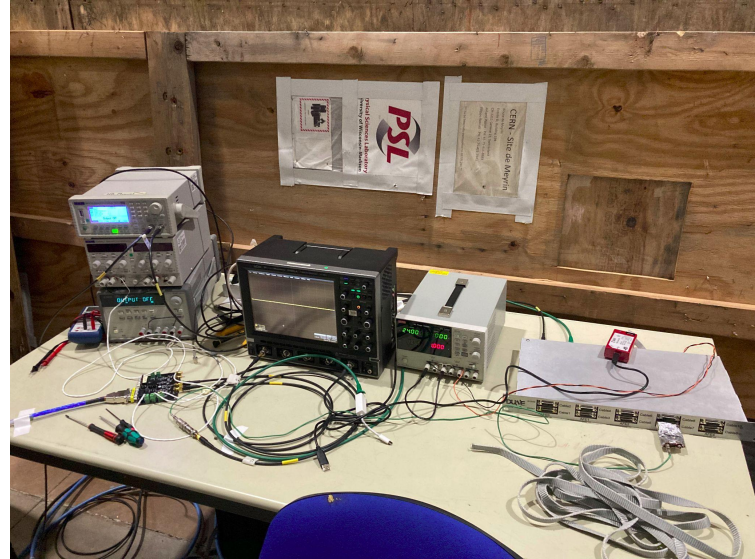




# Ongoing activities

M1 data analysis with oscilloscope data  
M1 and M2 data analysis with DAPHNE

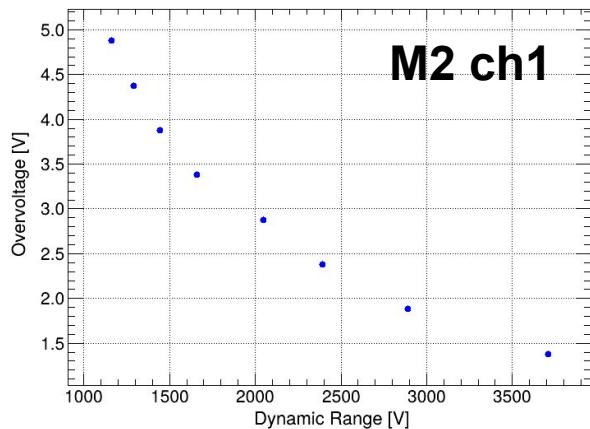
C2 and C3 installation and test completed  
C1 and C4 to be tested in the next days



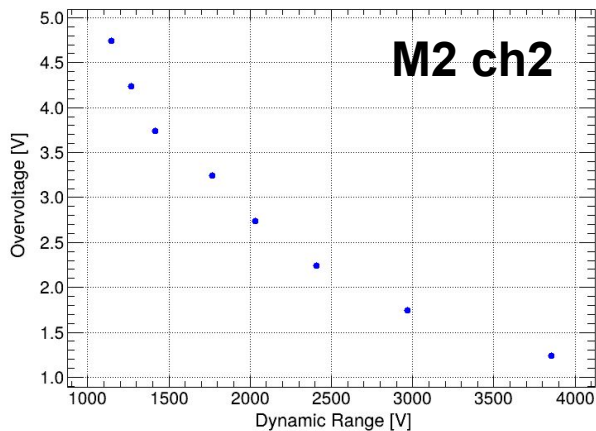
BACKUP

# M2 Ch1 and Ch2

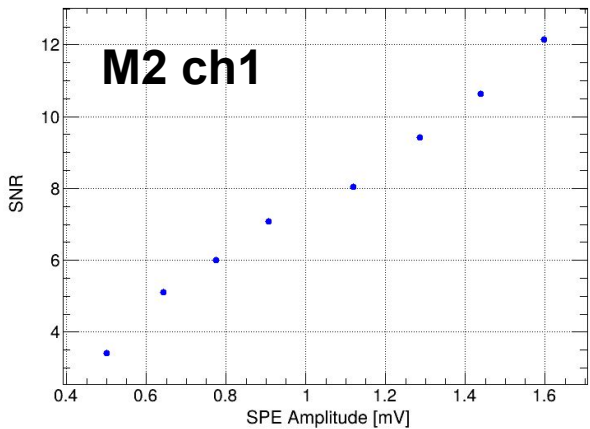
OV vs DR



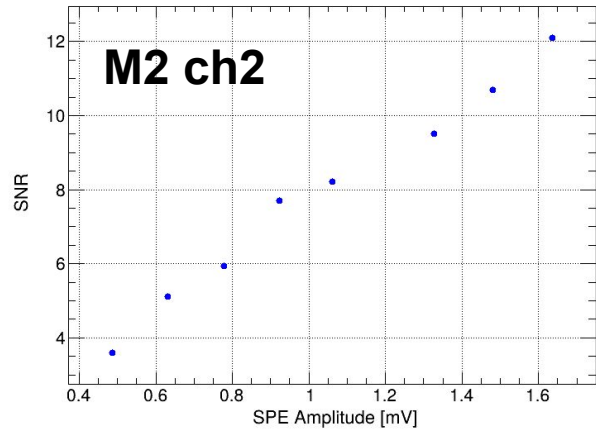
OV vs DR



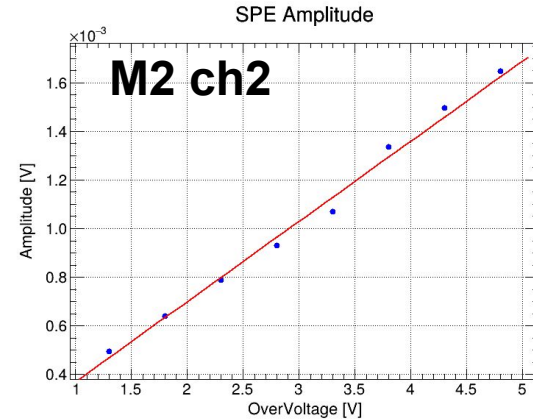
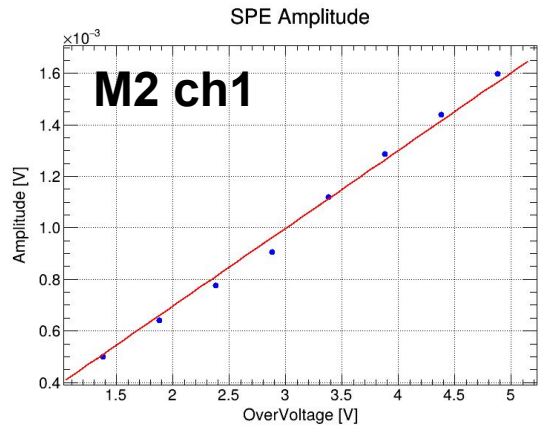
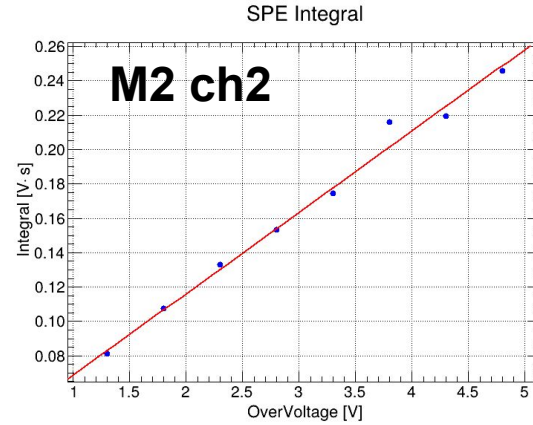
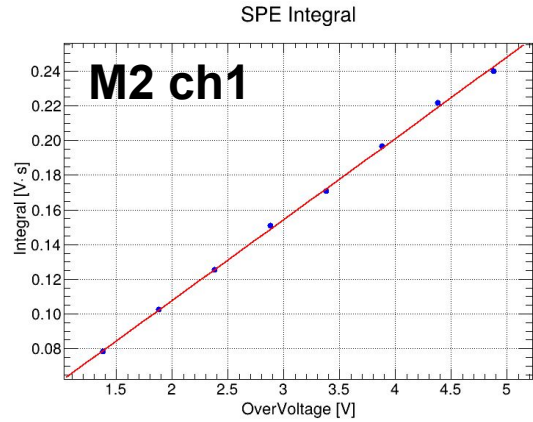
SNR vs SPE Amplitude



SNR vs SPE Amplitude



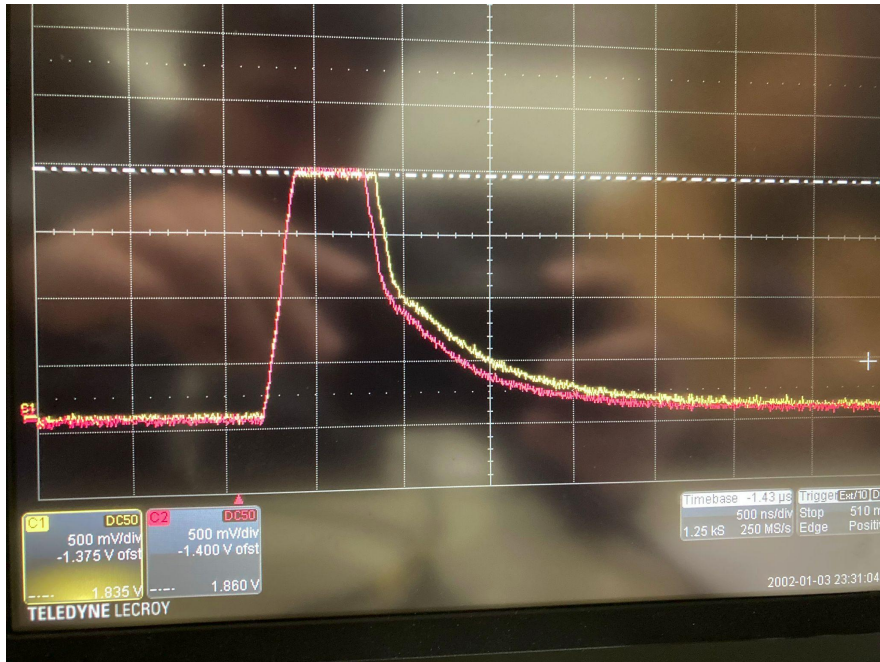
# SPE Integral and Amplitude vs Overvoltage





# Saturation

M1 **ch1** and **ch2**



M2 **ch1** and **ch2**

