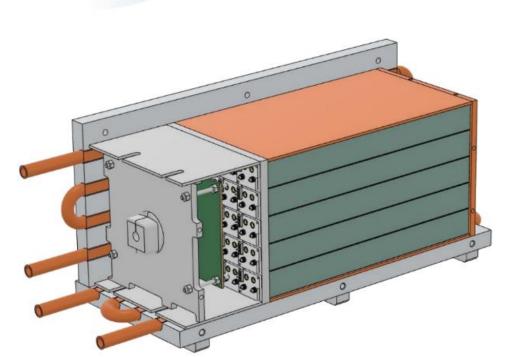
Laboratoire de Physique des 2 Infinis



Backward ECal Test Beam

DESY, Feb 17 - Mar 2 (2025)

*Other DESY beam test: March 28- April 7 (under analysis)
Upcoming requested dates (at DESY): Sep 29 - Oct 13 + Dec 1-15 (2025)

05/07/2025



5x5 PWO prototype with 16 SiPMs per crystal



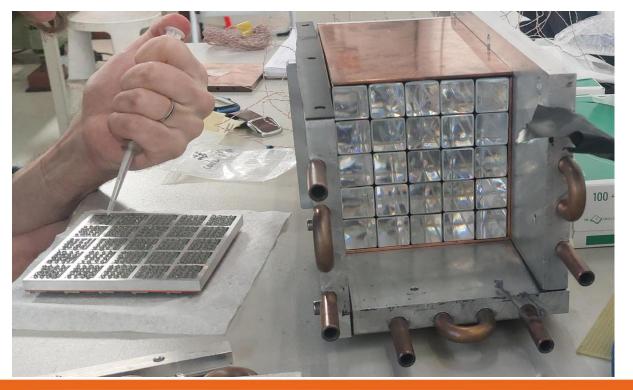






SiPMs: Hamamatsu S14160-3015PS (3x3 mm²; 15µm pixel size)

- > 25 PWO crystals from CRYTUR
- SiPM readout
- Cooling and temp control





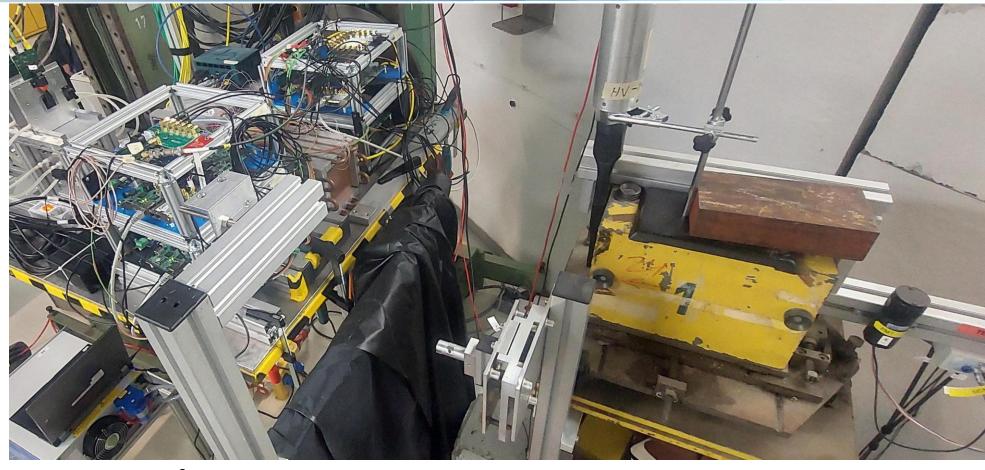
Setup at T24 in DESY test beam facility





FACULTÉ DES SCIENCES D'ORSAY





- → 1 5 GeV electron beam through a 2x2 mm² collimator
- Triggered by 2 scintillators
- Typical DAQ rates: ~50-100 Hz
- Prototype on a X-Y table with 0.1 mm position accuracy

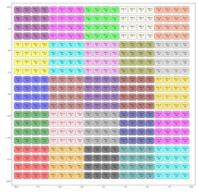


Readout options tested





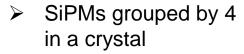




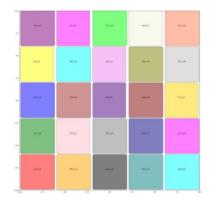


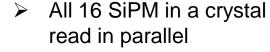
- ➤ 400 channels
- > 530 pF per channel



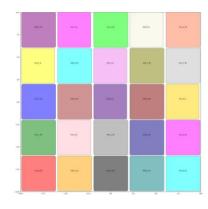


- > 100 channels
- 2120 pF per channel





- > 25 channels
- > 8480 pF per channel



- All 16 SiPM in a crystal read in parallel
- 25 channels
- > 8480 pF per channel

+ Readout with H2GCROC3b chip

+ preamp board & CAEN V1725S 14-bit 250MS/s digitizers



Beam test run plan







- > Gain matching runs: runs centered at each of the 25 crystals
- Energy scans: beam at the central crystals and energy ranging from 1 to 5 GeV
- Position scans: beam across crystals at 4 mm steps

- Typically ran ~2 days for each of the readout configurations (after some debugging and commissioning)
- Analysis ongoing
- Results expected in ~ 6 weeks.

SiPM signal shapes



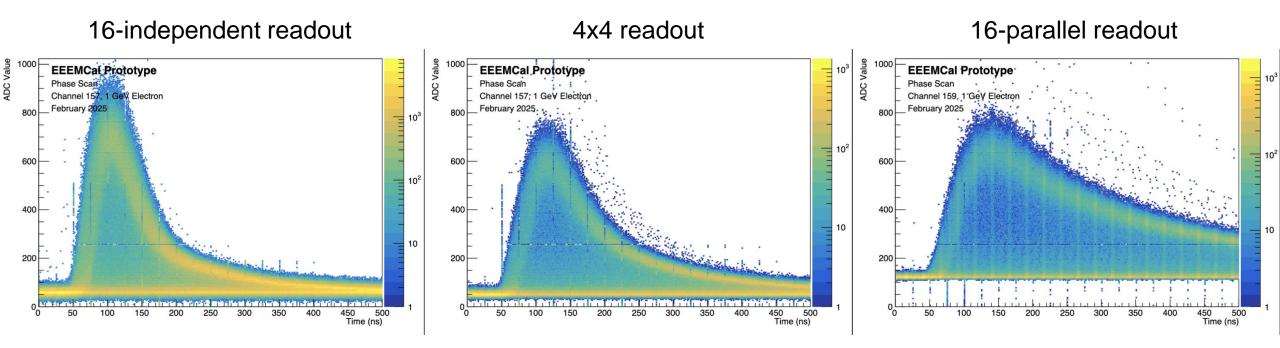


Figure 22: Waveform measured in a phase scan for each of the different daughther boards: all independent (left), 4×4 (center) and all parallel (right). The value of Rf is 1100 (6.7 KOhm). The current conveyor gain is 0.3 (left), 0.1 (center) and 0.05 (right).

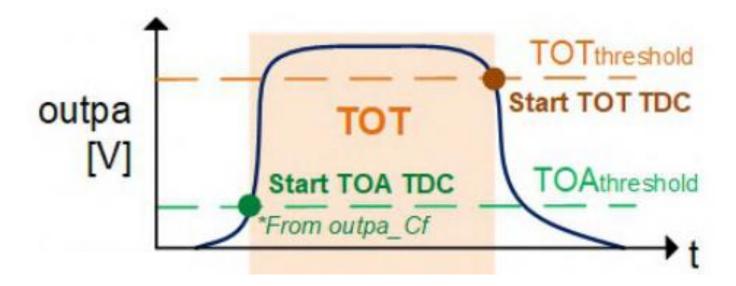






Energy measurement by a combination of a:

- > 10-bit ADC (for small signals) and a
- 12-bit TDC (for large signals)





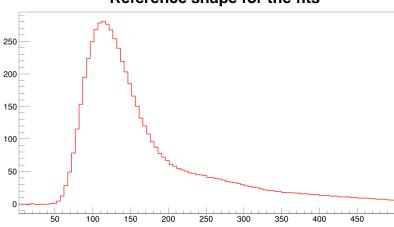
Waveform fits

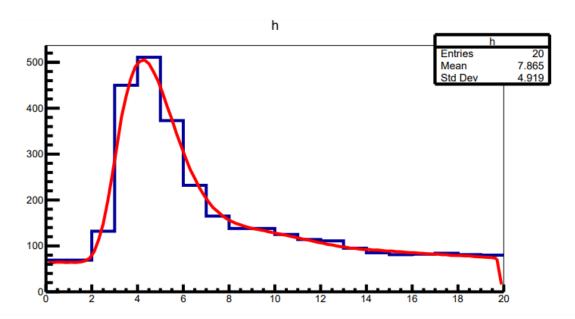


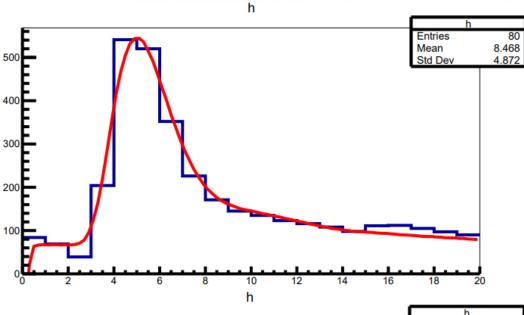


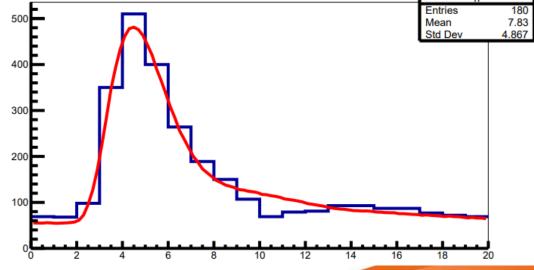


Reference shape for the fits











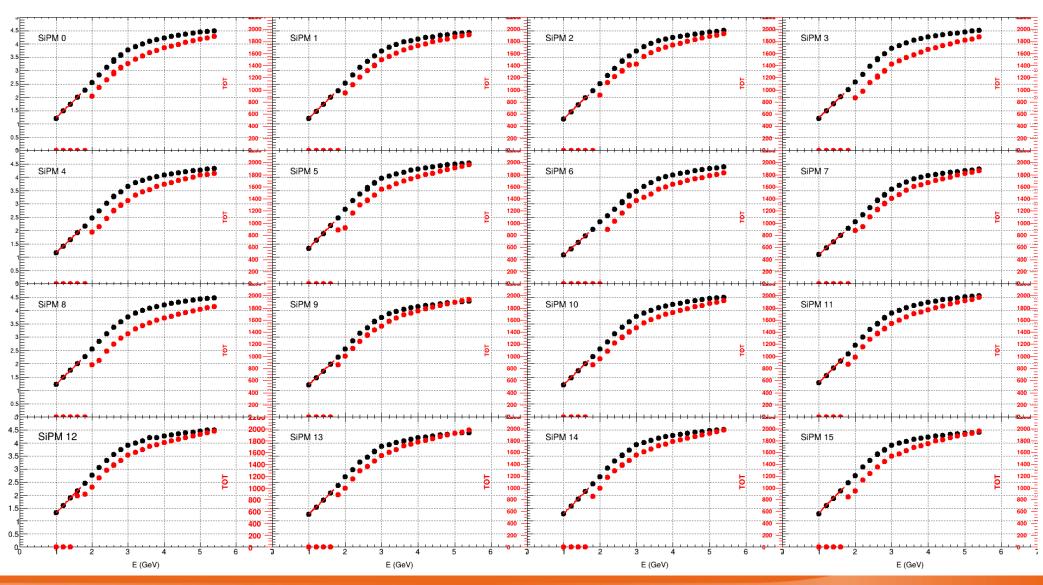
Energy scan: ADC and TOT





 ADC is linear before saturation

 TOT needs correction for non-linearity



Sample event at 5 GeV







Event display (energy per crystal in GeV)



-0.0,t21,B-32	A=0.0,t=12,B=46	A=0.0,t=15,B=15	A=0.0,t=0,B=44	F	0.1,t=11,B=10	A=0.0,t=19,B=33	A=0.1,t=11,B=59	A=0.0,1=3,B=92	A=0.1,1	=-1,B=52	A=0.0,t=9,B=61	A=0.0,t=8,B=60	A=0.0,t=7,B=51	-	A=0.0,t=-27,B=16	A=0.1,1=-4,B=13	A=0.1,1=13,B=40		A=0.1,t=8,B=43	A=0.1,t=6,B=51	A=0.1,t=10,B=31	A=0.1,1=10,B=17
\$=0.0,1=4,B=32	A=-0.0,1=-2,B=31	A=0.0,t=1,B=36	A=0.0,t=-13,B=43	F	0.0,t=3,B=44	A=0.0,t=17,B=53	A=0.0,t=16,B=61	A=0.0,t=-1,B=60	A=0.0,	=-1,B=52	A=0.1,t=1,B=45	A=0.1,t=-1,B=96	A=0.0,1=7,B=57	3-0.0,t-4,B-2	A=0.0,t=17,B=2	A=0.1,1=-3,B=23	A=0.0,1=13,B=54		A-0.1,5-11,B-37	A=0.4,t=13,B=10	A=0.1,1=13,B=6	A=0.1,1=7,B=22
l=0.0,t=-2,B=26	A=0.0,t=-16,B=65	A=inf,t=-1,B=63	A=0.0,t=10,B=43	F	0.1,t=-9,B=46	A=0.1,t=4,B=63	A=0.0,t=-7,B=71	A=0.1,t=16,B=71	N=0.1,1	=5,B=54	A=0.1,t=16,B=50	A=0.0,t=0,B=49	A=0.0,t=-1,B=56	4=0.0,t=16,B=1	A=0.0,t=20,B=4	A=0.0,1=9,B=61	A=-0.0,1=-21,B=15		A=0.1,t=6,B=44	A=0.1,t=16,B=39	A=0.2,1=-14,B=6	A=0.0,t=10,B=22
4=0.0,t=4,B=48	A=0.0,t=-13,B=29	A=0.0,t=-1,B=42	A=0.0,t=-17,B=48	F	0.1,t=6,B=50	A=0.1,t=3,B=53	A=0.0,t=8,B=61	A=0.1,t=-7,B=75	A=0.1,	t=-4,B=47	A=0.0,t=-0,B=47	A=0.0,t=-0,B=85	A=0.0,t=6,B=54	A=-0.0,t=-34,B=26	A=0.1,t=-4,B=22	A=0.1,t=-4,B=6	A=0.0,t=19,B=17		A=0.1,t=6,B=45	A=0.0,t=11,B=44	A=0.1,t=13,B=26	A=0.1,1=12,B=17
				E					<u> </u>						_	In an		1				
0.0,t=-26,B=50	A=0.1,1=12,B=33	A=0.0,t=18,B=47	A=0.0,t=4,B=52	F	0.0,t=23,B=57	A=0.0,t=23,B=49	A=0.1,t=18,B=62	A=0.1,1=16,B=69	A=0.3,1	=5,B=41	A=0.3,t=2,B=43	A=0.2,t=6,B=75	A=0.2,1=8,B=64	-0.1,t=16,B=42	A=0.1,t=16,B=51	A=0.1,1=19,B=58	A=0.1,1=18,B=25		A=-0.0,t=-29,B=55	A=-0.0,t=-28,B=74	A=-0.0,1=-31,B=36	A=0.0,1=21,B=46
-0.0,t=-1,B=28	A=-0.0,1=-23,B=44	A=0.0,t=17,B=51	A=0.0,t=-1,B=47	F	0.0,t=24,B=39	A=0.0,t=27,B=72	A=0.0,t=23,B=50	A=0.1,t=18,B=53	N=0.2,1	=3,B=44	A=0.3,t=1,B=110	A=0.2,t=9,B=66	A=-0.0,t=-1,B=44	v=0.1,t=18,B=48	A=0.1,t=7,B=50	A=0.1,t=9,B=46	A=0.1,t=17,B=35		4-0.0,t=18,B=55	A=-0.0,t=-114,B=50	A=-0.0,1=-3,B=44	A=-0.0,1=-37,B=30
N=0.0,1=-1,B=23	A=0.0,1=18,B=37	A=0.0,t=17,B=49	A=-0.0,t=-6.B=46		0.0,1=24,B=36	A=0.0.1=20,B=73	A=0.0,1=22,B=46	A=0.1,8=17,B=54		=16,B=40	A=0.2,t=16,B=45	A=0.3,8=6,B=58	A=0.3,t=-0,B=59	A=0.1,8=1,8=48	A=0.1,t=0,B=78	A=0.1,t=8,B=58	A=0.1,1=15,B=38		A=0.0,t=-26,B=54	A=0.0,t=-9,B=48	A=-0.0,t=-25,B=44	A=-0.0.1=-6,B=37
				L					<u>ب </u>		~	_	_	_	_	\	_				,	
N=0.0,t=15,B=34	A=0.0,t=16,B=65	A=0.0,t=15,B=40	A=0.0,t=15,B=79		-0.0,1=21,B=44	A=0.0,t=22,B=47	A=0.0,t=15,B=54	A=0.1,t=8,B=49	A=0.3.	t=3,B=46	A=0.2,t=5,B=75	A=0.2,t=6,B=53	A=0.3,1=2,B=68	A=0.1,t=3,B=54	A=0.1,t=19,B=46	A=0.1,t=20,B=47	A=0.1,t=20,B=31		A=0.0,t=21,B=58	A=0.0,t=17,B=41	A=-0.0,1=-6,B=36	A=-0.0,t=-2,B=31
				_			***		П	•			1					1 1				
4=0.0,1=15,B=95	A=0.0,t=18,B=37	A=0.0,t=14,B=35	A=0.0,t=18,B=27		0.2,1=23,B=8	A=0.2,1=19,B=90	A=0.2,t=17,B=53	A=0.2,1=21,B=49	1	P-37868	3.5,1=313=67	-3.6,t-3 B-50	-3.5,1-3-8-57	,=0.2,t=17,B=46	A=0.2,t=16,B=78	A=0.2,1=9,B=39	A=0.2,1=3,B=31		A=0.1,t=13,B=43	A=0.1,t=12,B=28	A=0.1,1=7,8=29	A=0.1,1=10,B=32
-0.0,1=17,B=49	A=0.0,t=18,B=40	A=0.0,t=14,B=41	A=0.0,t=17,B=37		0.2,1=6,B=31	A=0.2,1=9,B=43	A=0.1,8=32	A=0.2,1=16,B=56	J 6.	-2,0072	-3.3,1383-60	-3.9,1-48-57	-3.8,12380	,=0.3,t=16,B=44	A=0.2,t=16,B=37	A=0.2,1=14,B=30	A=0.2,1=7,8=30		4=0.1,t=10,B=34	A=0.1,t=11,B=39	A=0.1,1=9,B=28	A=0.1,1=10,B=34
t=0.0,t=14,B=39	A=0.0,t=14,B=47	A=0.0,t=15,B=30	A=0.0,t=17,B=32	F	0.2,1=7,B=29	A=0.2,1=20,B=31	A=0.2,1=21,B=54	A=0.2,1=20,B=49	J.c.	=-3.0c32	-3.5,1=-30=89	-3.5,1 B-42	-3.4,1-48-51	N=0.3,1=15,B=36	A=0.2,t=18,B=35	A=0.2,t=15,B=40	A=0.2,1=6,B=33		A=0.1,t=10,B=29	A=0.1,t=9,B=49	A=0.1,1=16,B=31	A=0.1,t=11,B=31
A=0.0,t=18,B=37	A=0.0,t=18,B=63	A=0.0,t=17,B=31	A=0.0,t=-24,B=28	F	0.2,1=8,B=36	A=0.2,t=19,B=50	A=0.2,t=19,B=45	A=0.2,t=19,B=45	3,	1=-3, =-56	=3.4,t=-2B=87	=3.4,t=-3.B=65	=3.3,t=-3 B =90	A=0.2,t=18,B=48	A=0.2,t=17,B=35	A=0.2,t=8,B=39	A=0.2,t=2,B=38		A=0.1,t=16,B=34	A=0.1,t=10,B=35	A=0.1,t=12,B=35	A=0.0,t=4,B=32
				_					_													
V=0.0,t=14,B=57	A=0.0,t=13,B=80	A=0.0,t=11,B=49	A=0.0,t=4,B=50		0.1,t=3,B=56	A=0.1,1=8,B=39	A=0.1,t=8,B=48	A=0.1,1=4,B=42	N=0.2,1	-8,B-56	A=0.2,t=6,B=82	A=0.2,t=19,B=59	A=0.3,1=2,B=54	-0.1,t=0,B=55	A=0.1,t=8,B=54	A=0.1,1=4,B=60	A=0.1,1=14,B=51		A=0.1,t=14,B=67	A=0.1,t=12,B=78	A=0.1,t=14,B=75	A=0.0,1=16,B=58
J=0.0,t=10,B=48	A=0.0,t=1,B=39	A=0.0,t=15,B=48	A=0.0,t=16,B=70	E	0.1,1=8,B=114	A=0.1,I=11,B=57	A=0.1,t=0,B=50	A=0.1,1=9,B=44	A=-0.0,	1=-14,B=65	A=0.2,t=5,B=58	A=0.2,t=16,B=80	A=0.2,1=7,B=52	-0.1,t=1,B=80	A=0.2,t=0,B=47	A=0.1,t=8,B=54	A=0.1,0=4,B=56		A=0.1,t=10,B=34	A=0.1,t=11,B=41	A=0.1,1=12,B=85	A=0.0,t=13,B=54
L=0.0,1=14,B=47	A=0.1,1=4,B=65	A=0.1,t=10,B=49	A=0.0,t=-5,B=58	F	0.1,t=9,B=47	A=0.1,1=12,B=47	A=0.2,t=1,B=50	A=0.1,t=8,B=78	N=0.2,	=4,B=95	A=0.3,t=0,B=79	A=0.2,t=3,B=57	A=0.2,1=20,B=51	4=0.1,t=13,B=49	A=0.1,t=9,B=58	A=0.1,t=4,B=90	A=0.1,1=11,B=48		A=0.1,t=12,B=42	A=0.1,t=16,B=34	A=0.1,1=12,B=38	A=0.1,1=13,B=50
4=0.1,t=-4,B=41	A=0.0,t=18,B=88	A=0.0,t=11,B=64	A=0.0,t=14,B=55	F	-0.1,t=9,B=47	A=0.1,t=8,B=44	A=0.1,t=11,B=58	A=0.1,t=4,B=77	A=0.2,	t=6,B=63	A=0.2,t=2,B=52	A=0.2,t=3,B=87	A=0.2,t=18,B=45	A=0.1,t=12,B=52	A=0.1,t=12,B=55	A=0.1,t=5,B=50	A=0.1,t=0,B=46		A=0.1,t=13,B=36	A=0.1,t=9,B=69	A=0.1,t=16,B=50	A=0.1,1=9,B=50
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l=-0.0,1=-21,B=35	A=-0.0,1=-17,B=34	A=-0.0,t=-12,B=26	A=-0.0,t=-23,B=28	F	0.0,1=-11,B=45	A=0.0,1=-23,B=45	A=0.0,t=-23,B=37	A=0.0,1=-24,B=28	N=0.0,1	-9,B-51	A=0.0,t=-2,B=56	A=0.0,t=16,B=45	A=0.0,t=-11,B=35	N=-0.2,5=-22,B=54	A=0.3,t=10,B=22	A=0.3,1=11,B=22	A=0.2,1=9,B=43		4-0.0,t=1,B=60	A=0.0,t=13,B=62	A=0.0,1=15,B=52	A=0.0,1=16,B=53
I=0.0,1=27,B=38	A=0.0,t=12,B=34	A=0.0,t=9,B=27	A=-0.0,t=-20,B=15	F	0.0,t=-20,B=43	A=0.0,t=-21,B=40	A=0.1,t=-17,B=37	A=0.0,1=-22,B=32	N=0.0,1	=11,B=51	A=0.0,t=29,B=62	A=0.0,t=-5,B=47	A=0.0,t=-13,B=39	-0.1 8-22,B-56	1000	A=0.3,1=10,B=27	A=0.2,1=11,B=18		A=0.0,t=-1,B=30	A=0.0,t=17,B=41	A=0.0,1=4,B=51	A=0.0,1=12,B=84
-0.0,1=16,B=33	A=0.0,1=23,B=64	A=0.0,t=8,B=80	A=-0.0,t=24,B=24	F	0.0,t=-11,B=46	A=0.0,t=-13,B=38	A=0.0,t=-25,B=23	A=0.0,t=-24,B=25	N=0.0,1	=-1,B=55	A=0.0,t=-8,B=59	A=0.0,t=-13,B=46	A=0.0,t=19,B=42	=-0.2,t=-22,B=62	A=-0.2,t=-22,B=48	A=0.3,1=10,B=33	A=0.4,1=11,B=21		-0.0,t=12,B=30	A=0.0,t=18,B=43	A=0.0,1=16,B=45	A=0.0,1=18,B=69
A=-0.0,1=-1,B=29	A=-0.0,t=-6,B=30	A=-0.0,t=-5,B=29	A=0.0,t=-1,B=21	F	0.0,1=-24,B=39	A=0.0,t=-22,B=39	A=0.0,t=-28,B=40	A=0.0,t=-0,B=23	A=0.0,	t=6,B=133	A=0.0,t=16,B=48	A=0.0,t=-10,B=45	A=0.0,t=18,B=39	A=0.0,1=22,B=21	A=0.3,t=10,B=29	A=0.3,t=10,B=27	A=-0.0,t=-1,B=21		A=0.0,t=15,B=31	A=0.0,t=5,B=61	A=0.0,t=18,B=76	A=0.0,1=21,B=52
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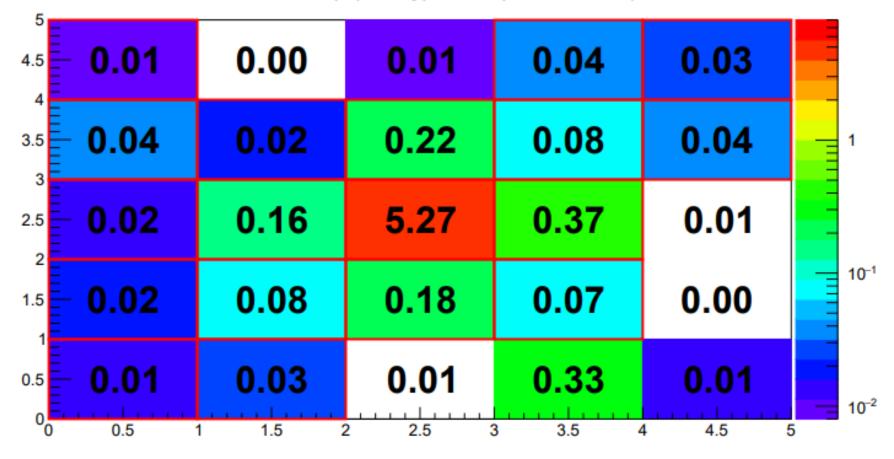
Another event at 5 GeV







Event display (energy per crystal in GeV)



A-0.032	2,0-49 A=0.0,1-14,0-12	A=-0.0,t=-20,0=44	=0.0,t=-1,B=15	A=0.0,t=-3,B=34	A=0.0,t=-23,B=64	A=0.0,t=-28,B=95	N=-0.0,1=29,B=55	A=0.0,t=6,B=67	A=0.0,t=-21,B=69	A=0.0,1=-1,B=SS	Γ		A=0.0,t=19,B=24	A=0.1;1=1,B=28	A=0.1,t=1,B=41	N=0.0,1=24,0=	A=-0.0,1=22,0	-63 A=-0.0,t=27,B=36	A=-0.0,t=7,B=23
											-	_		<u> </u>					
-0.0;=22,B=34 A=0.0;=2:	21,B=34 A=0.0,t=14,B=35	A=-0.0,t=-20,B=43	\$=0.0,t=-4,B=47	A=-0.0,1=23,B=56	A=-0.0,1=21,D=65	A=-0.0,t=-1,D=64	k=0.0,t=-30,B=56	A=0.0,t=20,D=49	A=0.0,1=-23,0=99	A=-8.0,1=-1,ID=59	10-0).0,t=15,B=5	A=0.1,t=10,D=6	A=0.1;1=1,B=22	A=0.1,1=7,B=59	N=0.0,1=25,D=	2 A=-0.0,1=26,0	-63 A=0.2,1=2,D=16	A=-0.0,t=20,D=24
A=0.0.1=18,B=27 A=0.0.1=-1	-1,B=66 A=inf,t=-1,B=63	A=-0.0,t=23,B=44	-0.0,t=-30,D=47	A=0.0,t=-32,B=67	A=-0.0,1=23,B=74	A=0.0,t=10,B=75	N=0.0,t=-1,D=59	A=0.0,t=-24,0=54	A=0.0,t=-19,0=54	A=0.0,1=-23,B=54	N-0.0	0,t=17,B=2	A=0.0,0=16,B=34	A=0.0,t=12,0=58	A=0.0,t=21,0=19	N=0.0,t=-24,B=	5 A=0.0,1=-4,0=		A=-0.0,t=21,B=24
											1								
-0.0,t13,B-46 A-0.0,t-1	19,B=30 A=0.0,t=-8,B=44	A=0.0,t=-1,B=49	A=-0.0,t=27,B=52	A=0.0,t=17,B=57	A=0.0,t=-35,B=65	A=0.0,t=-29,B=77	A=0.0,t=-1,B=53	A=0.0,t=-22,B=51	A=0.0,t=-26,B=89	A=0.0,t=-25,B=53	N-0	0.1,1-21,8-22	A=0.0,t=-16,B=14	A=0.1,t=11,B=16	A=-0.1,t=18,B=22	N=0.0,t=13,B=	8 A=-0.0,t=25,		A=0.0,t=-41,B=19
											1								
A-0.03-18,D-49 A-0.03-10	16,0-33 A0.0,t34,0-48	A=0.0,t=1,B=SS	4=-0.0,t=-14,0=57	A=0.0,t=20,B=51	A=0.0,t=22,D=63	A=0.1,t=13,B=67	N=0.2,t=12,D=40	A=0.2,t=15,B=46	A=0.3,t=7,B=71	A=0.2,1=14,D=63	N=0.1	1,t=9,B=46	A=0.1,t=20,B=50	A=0.1,t=18,B=60	A=0.1,t=17,B=27	N=0.0,1=22,B=6	A=0.1,t=13,0	71 A=0.0,1=10,B=36	A=0.0,t=14,B=47
							<u> </u>		~	\sim	L						_		
-0.03-13,B-24 A-0.13-13	13,8-37 A-0.0,1-1,8-47	A=0.0,t=19,B=44	-0.0,t-21,B-39	A=0.0,t=16,D=71	A=0.0,t=16,D=47	A=-0.0,t=-10,D=54	N=0.2,t=9,D=42	A=0.2,t=10,B=110	A=0.2,t=10,B=64	A=-0.0,t=-1,D=43	N-0.0	0,t=21,D=52	A=0.1,0=10,D=48	A=0.1,1=17,8=47	A=0.1,t=21,B=35	N-0.0,1-22,B-6	A=0.1,t=13,0	50 A=0.1,t=0,D=42	A=0.0,t=-1,B=31
									~	ldot	L			_					
A-0.1,3-18,B-25 A-0.1,3-13	13,B=37 A=0.0,t=22,B=46	A=0.0,t=13,B=43	-0.1,0-20,D-35	A=0.0,t=20,B=73	A=0.0,1=24,D=45	A=-0.0,t=-14,D=52	A=0.2,t=16,D=39	A=0.3,t=14,B=43	A=0.2,t=3,B=56	A=0.2,1=10,D=56	N=0.1	1,t=16,D=48	A=0.1,0=11,D=75	A=0.1,t=6,B=59	A=0.1,3=17,8=36	N=0.0,1=-3,B=S	A=0.0,t=10,0	48 A=0.1,0=11,B=43	A=0.0,t=17,B=35
							<u> </u>	┸~~		\sim	L	$\overline{}$	_						
A-0.0,t-13,B-30 A-0.0,t-1	-1,B-63 A-0.0,t-18,B-42	A=0.0,t=14,B=79	A=-0.0,t=-16,B=45	A=0.0,t=25,B=47	A=0.0,t=16,B=57	A=0.0,t=14,B=51	A=0.3,t=6,B=43	A=0.2,t=13,B=75	A=0.2,t=10,B=50	A=0.2,t=10,B=64	A=0.	1,1-7,8-58	A=0.1,t=18,B=49	A=0.1,t=19,B=48	A=0.1,t=18,B=28	N-0.0,t-5,B-5	A=0.0,t=21,E	-44 A-0.0,t-17,8-32	A=0.0,t=13,B=28
							~			\sim	- - - - - - - -	$\overline{}$							
								•			_								
-0.03-21,B-95 A-0.03-11							9,1-2,000	11	1	1	Ę.,								
-0.03-21,B-95 A-0.03-11	19,B=34 A=0.0,t=17,B=33	A=0.0,1=22,B=24	B-0.2,1-16,B-34	A-62,1-21,B-86	A=0.1,t=21,B=49	A=0.1,t=22,B=43		1	-3.0,1-20-42	11,02	17	A1:-13,D-44	A-8 3,9-14,B-76	A-0.4,1-6,8-39	A=0.3,t=3,B=32	N=-0.0,1=21,D=	7 A=0.0,1=-4,0=	14 A=-0.0,t=21,B=36	A=0.0,t=8,B=37
I-0.03=14,B=52 A-0.03=1,	1,0=39 A=-0.0,t=-21,0=39	A-0.0.t-16.D-36	-0.2,t=13,B=25	A=0.2,t=16,D=40	A=0.1,0=17,B=37	A=0.1,t=21,B=50	0-19,1-2,0	Lux Va	4.12-2-44	4-1.9,t-23-23	<u> </u>	A,t=15,B=42	A=0.4.0=14.D=35	A=0.4;1=9,B=32	A=0.4,1=7,B=28	N=0.01=29.D=	S A=0.0,t=-17,0	-45 A0.0,t-29,B-32	A=0.0,t=1,B=37
			1	Д	L.	A	1	24,1-25			- 17	٨	Λ	Λ	Λ				
I=0.0.1=22.B=102 A=0.0.1=21	20,0=47 A=-0.0,t=-2,0=26	A=0.0,t=20,B=20	4=0.2,0=14,D=25	A=0.2,t=16,D=34	A=0.2,t=22,B=47	A=0.2,t=21,B=41	0-10,0-2,0-pp	4-17,1-23 00	-3.8,1-35	2.6,1-20-48	===	4,t=16,D=33	A=0.4,0=14,0=37	A=0.4,1=13,0=40	A=0.4;=6,B=35	N=0.0,1=28.B=	7 A=0.0,t=-1,0=	S A=-0.0,t=32,B=33	A=0.0,t=-1,B=34
			A	I,	A	Ja		Thursday	1		- 17	٨	Λ	Λ	^				
k=0.0,t=1,B=39 A=0.0,t=2	24,B-59 A-0.0,t-14,B-30	A=0.0,1=24,B=27	A=0.2,t=17,B=35	A=0.2,t=23,B=23	A=0.1,t=22,B=35	A=0.1,t=23,B=22	A-1.53-2.0045	Lorenter	-3.6,1-20-50	-3.4,5-2,3-43	<u> </u>	4,9=14,B=47	A=0.4,t=14,B=35	A=0.4,t=7,B=38	A=0.4,t=4,B=36	A=-0.0,t=-2,B-	(2 A=-0.0,t=28,	0=42 A=-0.0,1=26,B=4	A=-0.0,t=-1,B=37
	X-03,1-10,0-33	A-02,1-24,0-27	<u>L</u>	<u>L</u>	A	<u>L</u>	1	-3.6,1-2,0-67	1	The state of the s	- 17	^_	^	^	^				A-0.0,1-1,2-3
							<u> </u>	_	_		_								
				-	_							_		_					
\$-0.0,1-0,B-56 A-0.0,1-0,	0,B=01 A=0.0,t=19,B=52	A=-0.0,t=-28,B=\$7	0-0.1,t=14,D=56	A=0.1,t=13,D=42	A=0.1,t=17,B=50	A=0.1,t=14,B=45	N=0.3,1=7,D=56	A=0.2,t=15,D=03	A=0.2,t=19,B=56	A=0.2,1=8,B=54	N=0.1	1,t=13,B=56	A=0.1,0=10,B=57	A=0.1,1=14,B=61	A=0.1,1=18,B=65	N=-0.0,t=-1,B=0	A=0.0,t=-1,0=	79 A=-0.0,t=16,B=79	A=0.0,t=-14,B=58
						_					Ξ								
A-0.0,1-7,	7,B-42 A-0.0,t-19,B-49	A=0.0,1=13,B=70	-6.1,t-17,B-117	A=0.0,1=21,B=60	A=0.1,t=16,B=52	A=0.1,t=19,D=48	0-0.1,t=6,D=60	A=0.2,t=12,B=56	A=0.2,t=14,B=60	A=0.2,t=10,B=55	1-0.1	1,t=16,D=03	A=0.1,0=10,B=49	A=0.0,1=25,8=69	A=0.1,t=12,B=69	N-0.0,1-22,B-	S A=-0.0,1=23,0	-44 A=-0.0,t=241,B=60	A=0.0,t=-17,B=53
		4-11-02-0		4-14-17-17	4-14-11-11	4-01-01-01					<u> </u>		4-14-47-1	4-044-47-40	1.011.0				4-44-70
A-0.0,1-2	29,B=68 A=0.0,t=-14,B=50	A=-0.0,t=-19,0=57	4=0.1,0=11,D=50	A=0.1,t=13,D=49	A=0.1,t=18,D=53	A=0.1,t=18,B=77	1-0.1,2-16,0-93	A=0.2,t=7,B=77	A=0.1,t=16,B=56	A=0.2,1=20,B=51	1	1,t=14,B=51	A=0.1,t=15,B=60	A=0.1,1=4,B=09	A=0.1,t=17,B=58	N=0.0,1=-25,B=	A=-0.0,t=-2,D	36 A=0.0,t=-13,B=37	A=-0.0,t=29,B=52
									_		===								
A=0.0,t=1,B=43 A=0.0,t=2	25,B-90 A-0.0,t-4,B-64	A=0.0,t=10,B=59	A=0.1,t=10,B=48	A=0.1,t=1,B=47	A=0.1,t=19,B=59	A=0.1,t=14,B=79	A=0.2,1=9,B=63	A=0.2,t=6,B=49	A=0.2,t=12,B=86	A=0.2,t=18,B=46	h-0.	.1,s=10,B=55	A=0.1,t=18,B=58	A=0.1,t=16,B=54	A=0.1,t=18,B=49	N=-0.0,t=30,B	38 A=-0.0,t=20,	1=70 A=-0.0,t=25,B=5	A=0.0,t=-17,B=53
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-0.0,1=13,B=32 A=0.0,1=-1	18,D=32 A=-0.0,t=-24,D=26	A=-0.0,t=-20,B=30	4=0.0,t=4,D=42	A=-0.0,t=-172,0=42	A=0.0,t=-3,B=36	A=0.0,t=-13,B=28	N=0.0,1=21,D=49	A=0.0,t=18,B=57	A=0.0,t=0,D=43	A=-0.0,t=-1,B=37	N-0.3	T ^{3,B-35}	A=0.4,0-9,D=22	A=0.2,t=9,B=22	A-03,1-3,8-39	N-0.0,1-13,8-0	A=0.0,t=17,0	61 A=0.0,1=-24,B=51	A=-0.0,t=2,B=51
											¥		_	\					
-0.03=25,B=39 A=0.03=11	11,B=34 A=0.0,t=16,B=30	A=-0.0,t=-0,D=15	=0.0,t=-13,D=44	A=0.0,t=18,D=38	A=0.0,1=4,B=37	A=0.0,t=-13,B=29	k=-0.0,1=-28,E=50	A=0.0,t=-1,0=67	A=-0.0,t=-27,B=60	A=0.0,1=22,B=40	N-0.2	Т 0,В−34	A=0.3,0=3,D=32	A-03:1-18-25	A=0.3,t=12,8=15	\$-0.0,t=16,B=0	A=-0.0,1=5,B=	N=-0,0-=0,0=54	A=0.0,t=11,D=06
											\vdash	Λ <u></u>	<u> </u>	4					
A=0.0,1=28,B=32 A=0.0,1=12	13,B=64 A=-0.0,t=-17,B=02	A=0.0,t=-6,B=22	N=0.0,t=-3,D=46	A=0.0,t=1,D=36	A=0.0,t=-11,B=22	A=0.0,t=-12,B=23	N=0.0,0=18,B=54	A=0.0,t=10,D=50	A=0.0,t=18,B=47	A=0.0,1=8,B=40	1/	AT 3,8-43	A=0.2,0=0,B=26	A-0.4.1-9.0-28	A=0.4,1=9,0=24	N=0.0,1=17,8=0	A=0.0,1=21,0	43 A=0.0,t=-0,B=47	A=-0.0,t=-1,0=68
											Ħ	-		4					
A=0.0,t=21,B=33 A=0.0,t=1	14,B=28 A=0.0,t=-20,B=28	A=0.0,t=28,B=20	A=0.0,t=-1,B=37	A=0.0,t=15,B=36	A=0.0,t=14,B=37	A=0.0,t=15,B=24	k=0.0,t=-3,B=134	A=-0.0,t=28,B=48	A=0.0,t=6,B=46	A=0.0,t=-3,B=40	\- 0.:	-6,B-26	A=0.3,t=9,B=24	A-0.3,t-6,B-28	A=9,5,t=19,B=41	A-0.0,t-18,B-	A=0.0,t=7,B	61 A=0.0,t=27,B=76	A=0.0,t=20,B=51
											₩.								

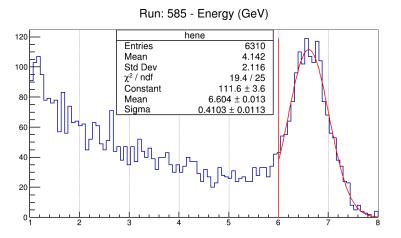


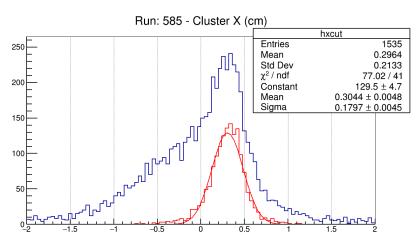


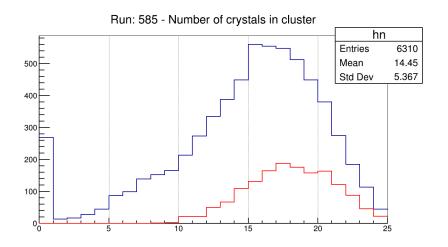


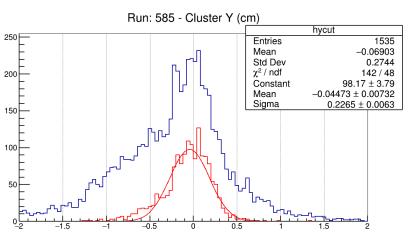
6.2% energy resolution

Still far from goal: ~2%











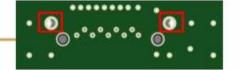
Grounding issue in to HGCROC boards





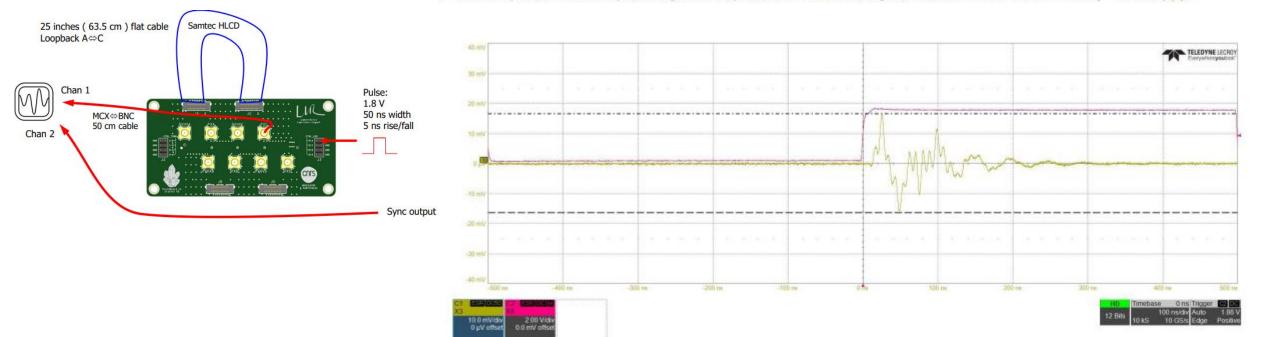


Initial Scheme (cf p.5)



No GND connection of the flat cable connectors pins (floating shields)

=> The amplitude of the spikes significantly varies when moving the cable. Here, "best" case (~33mV pp)



Signal Trigger

O. Le Dortz / LLR

25 April 2025



Grounding issue in to HGCROC boards: fixed

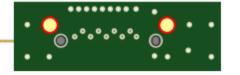






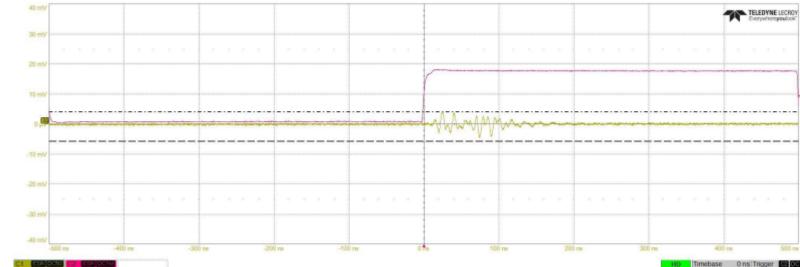


After shield pins soldering



Noticeable reduction of the spikes amplitude (~10mV pp)

Conclusion: soldering the 2 GND pins on each connector **recommended** (if not already done)!





Signal Trigger

O. Le Dortz / LLR

25 April 2025





Stability of the bias voltage supply







HGCROC boards (aka protoboards) connected, a large oscillation in the power supply is observed (400 mV peak-to-peak, ~37kHz) This affects all SiPMs, as the power supply is common

This should not happen in the discrete readout at DESY





HGCROC boards disconnected



Summary and outlook







- Analysis still ongoing
 - Channel-by-channel ref shapes
 - > Better calibration of individual channels
 - Mask (and correct for) bad/dead channels
- Investigation on different sources of background and fluctuations (Power supply, HGCROC boards, light leaks...)









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