

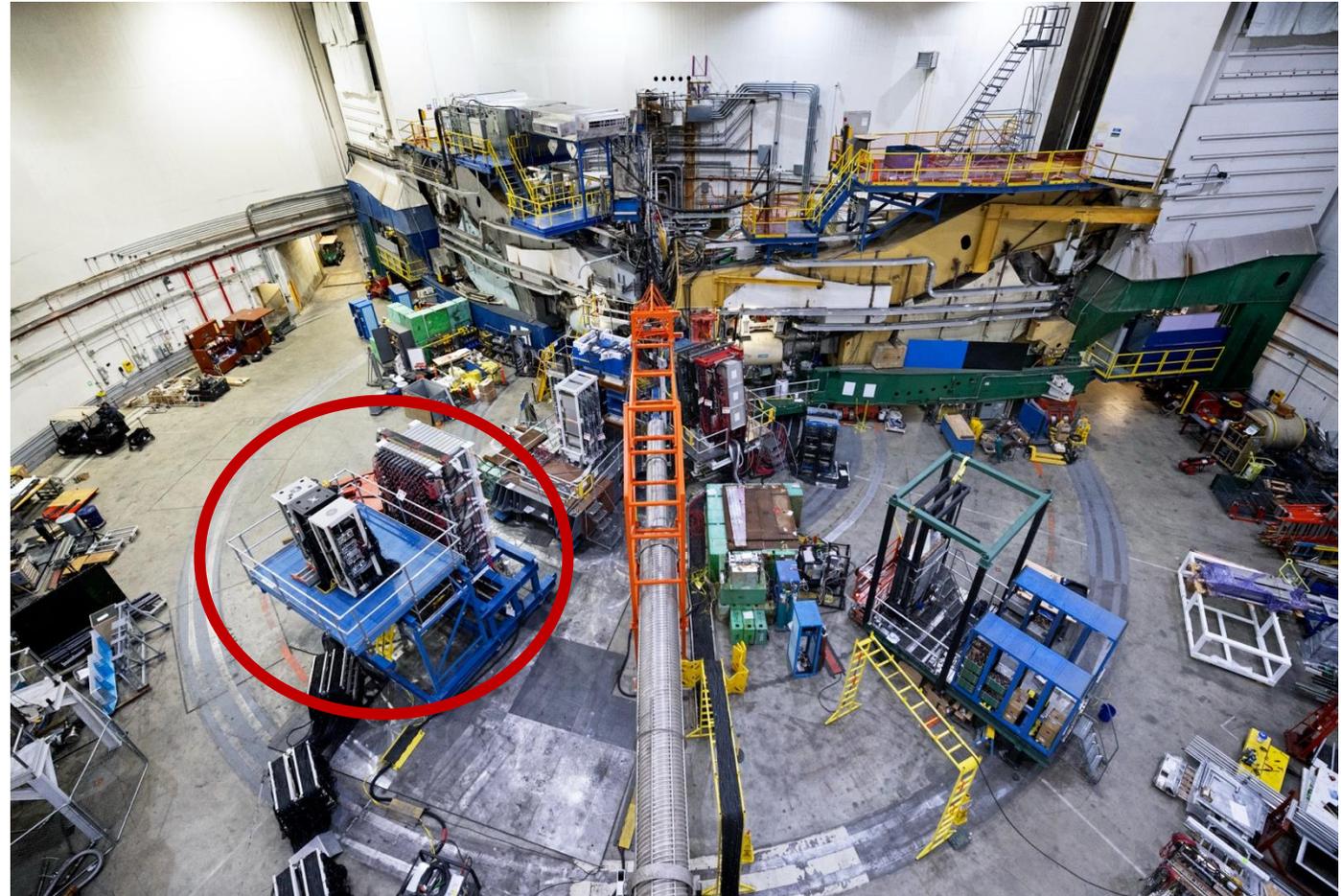
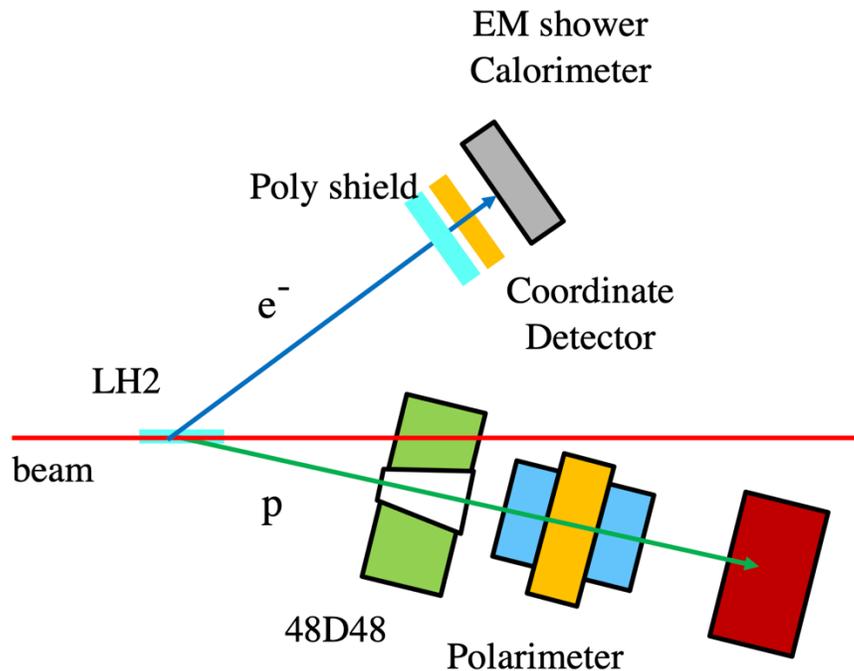
SBS Hadron-Calorimeter (HCAL)

Jiwan Poudel
Jefferson Lab

SBS Collaboration
March 2026

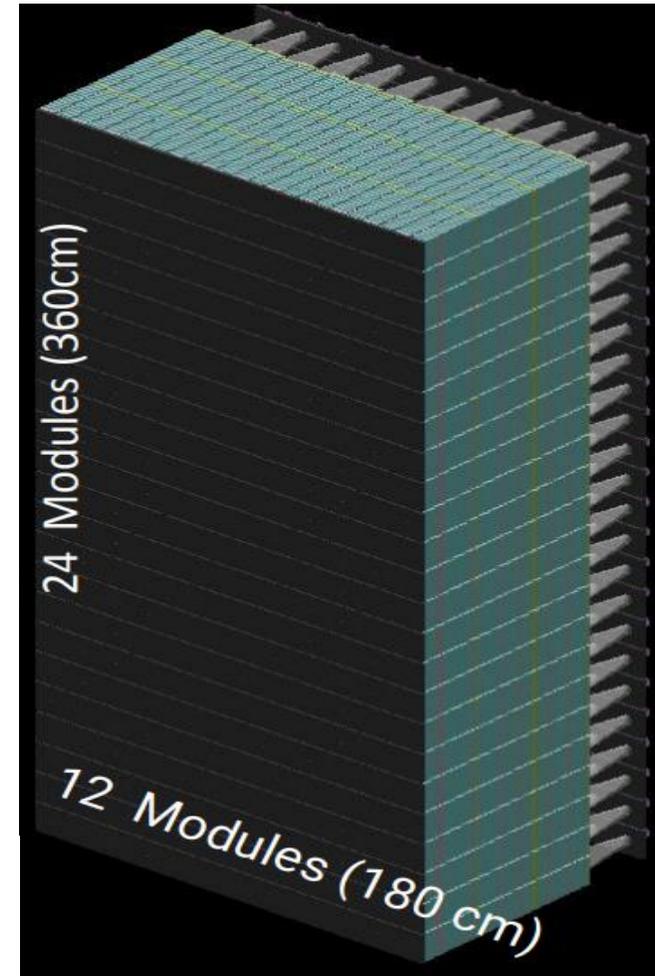
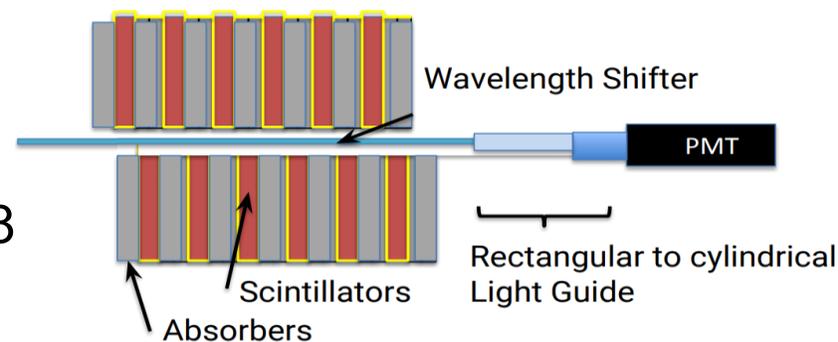
Background

- Super Big-Bite Programs: Completed nucleon form factors (G_E and G_M) experiments
- Hadron (protons/neutrons) Calorimeter is a primary detector in the hadron arm for the SBS Program !!



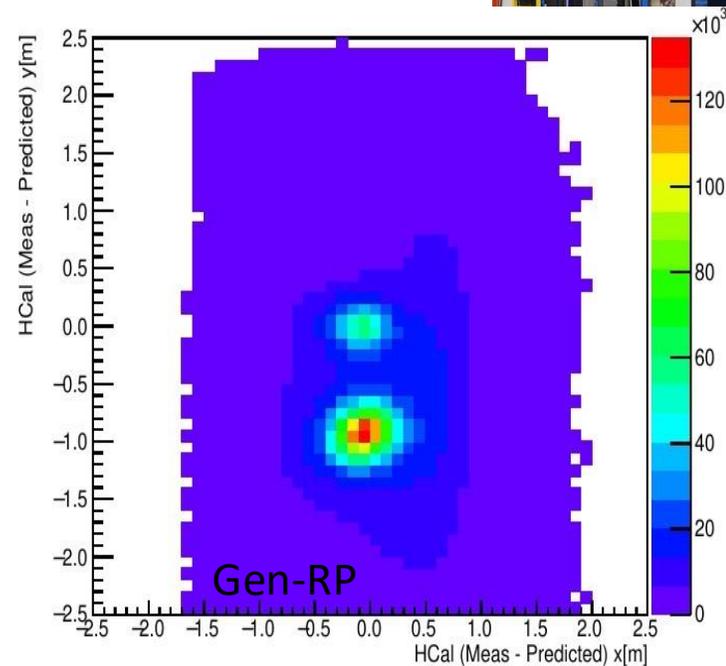
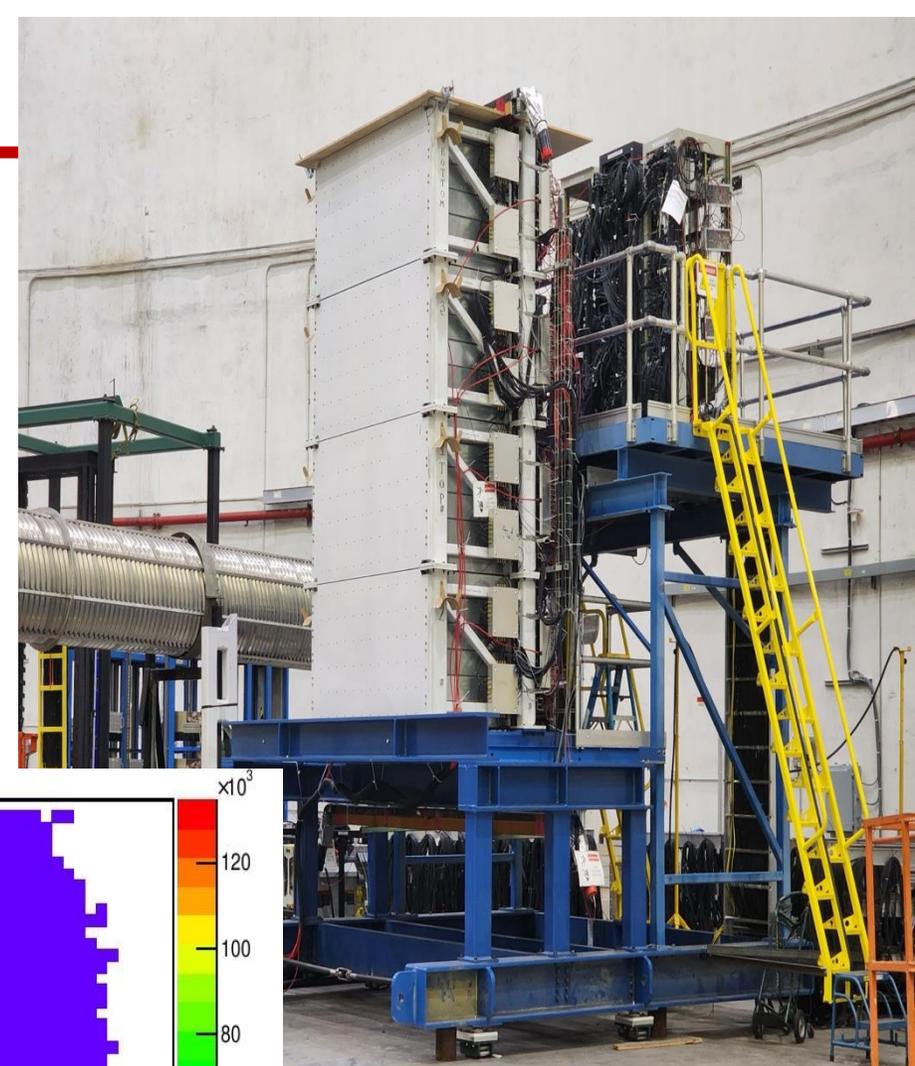
HCAL Detector

- Hadron Calorimeter (HCAL) Detector
- Segmented Calorimeter to detect high energy nucleons: 288 modules (12x24 blocks of 15x15x100cm dimension)
- Each module: 40 layers of Iron absorbers alternate with scintillators, and a wavelength shifter in the middle
 - Iron: hadron shower and scintillator: sample energy
- Two different type 2" PMTs:
 - 12 stage XP2262: 192
 - 8 stage XP2282: 96 (Column 5-8)
- Expectation:
 - Energy resolution $\sim 30\%$
 - Timing resolution ~ 0.5 ns
 - Spatial resolution ~ 4 cm
 - n/p detection efficiency ratio ~ 0.98



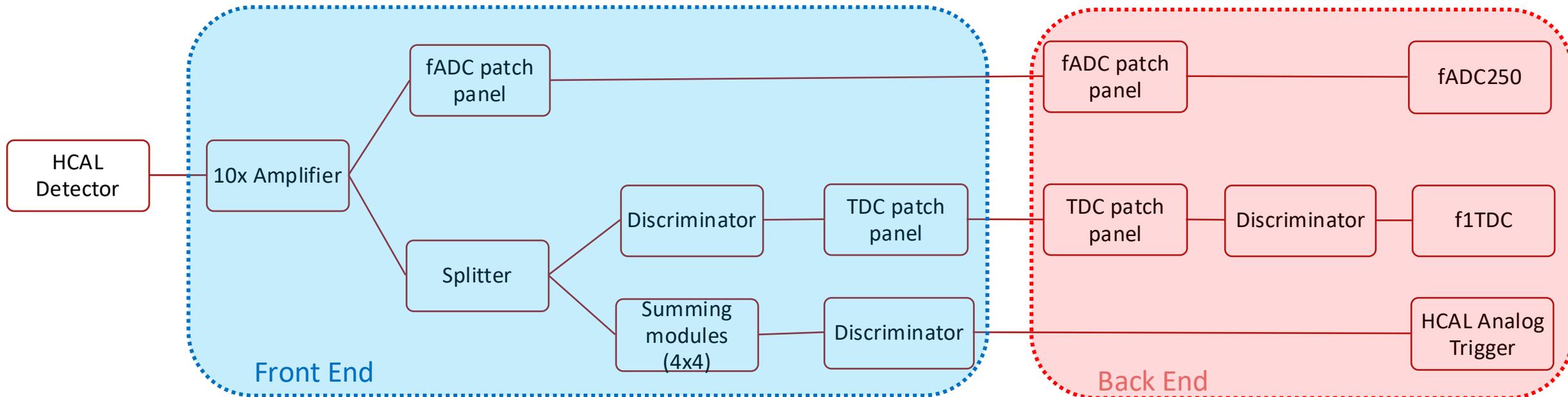
HCAL Detector

- Assembled in four Quadrant vertically
- Sub-system components
 - 2 NIM crates with 18 10x amplifiers
 - 2 NIM crates with 10 summing modules
 - 2 NIM crates with 18 Discriminators
 - Splitters (50:50)
 - 1 CAMAC crate with 18 Discriminator/NIM-ECL
 - 2 VXS crates with CPU+TI+SD
 - 18 FADCs, 2 VTPs and 5 F1TDCs
 - 2 Lecroy crates with 18 HV modules
 - 100 m long coaxial signal cables
 - LED set-up
- SBS magnet helps to separate charge hadrons from neutrals



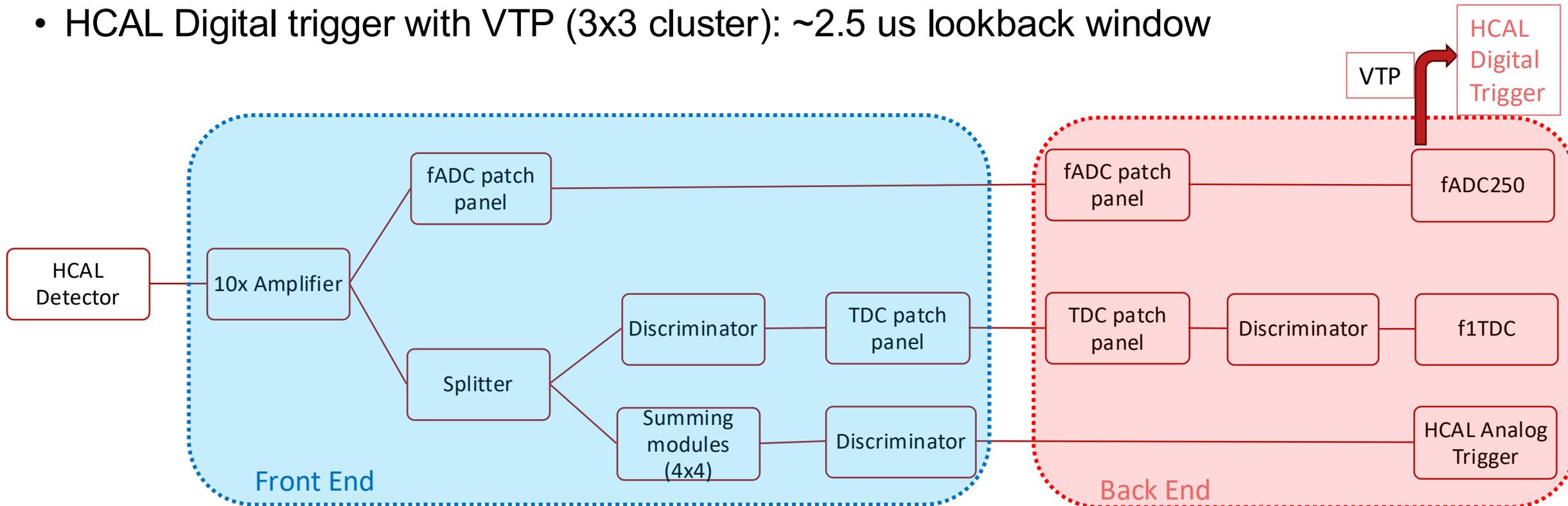
HCAL Data Acquisition

- Signals amplification (10x) at the **Front end** (HCAL upper platform) and readout at the **back end** (DAQ bunker)
- Signal waveform (ADCs) and timing (TDCs) information in data stream
- Summing modules for HCAL Analog trigger (threshold on 8x8 sum)



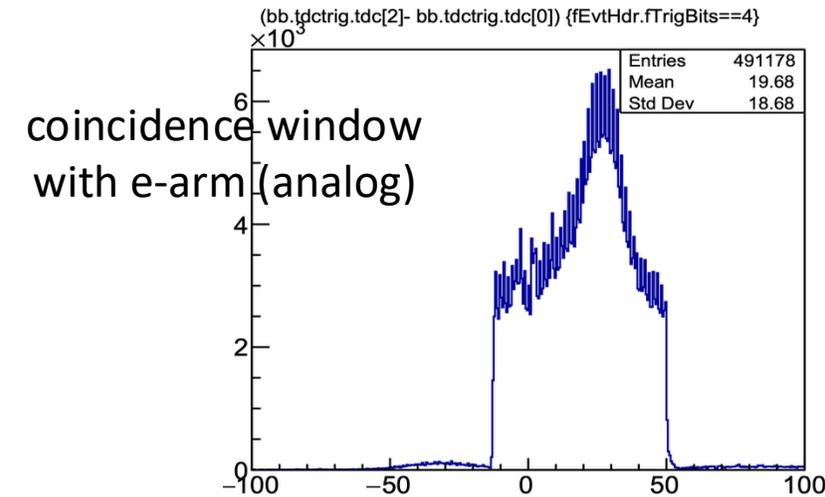
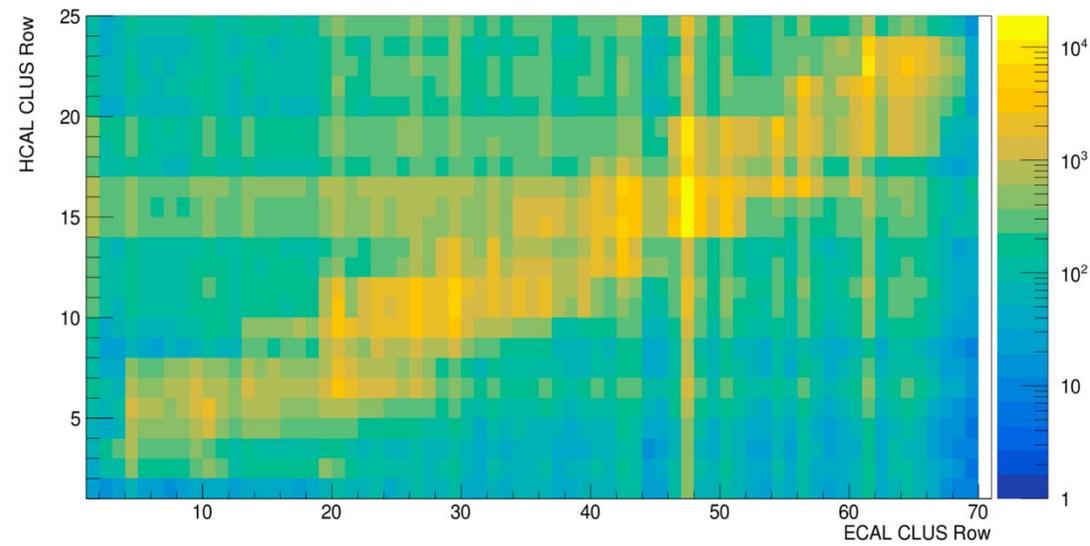
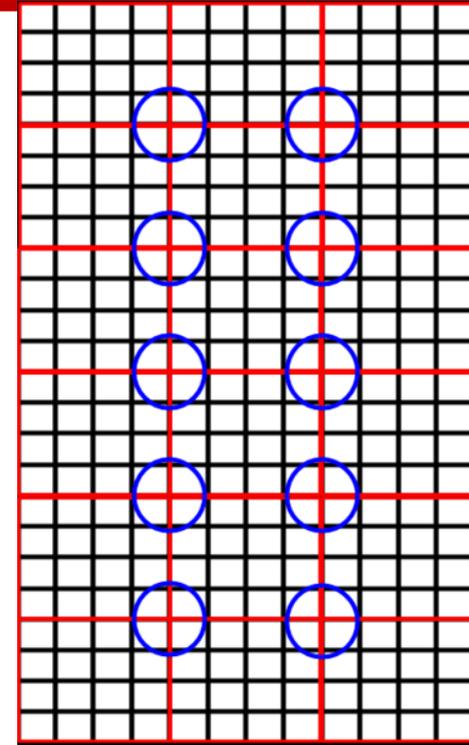
HCAL Data Acquisition

- Signals amplification (10x) at the **Front end** (HCAL upper platform) and readout at the **back end** (DAQ bunker)
- Signal waveform (ADCs) and timing (TDCs) information in data stream
- Summing modules for HCAL Analog trigger (threshold on 8x8 sum)
- HCAL Digital trigger with VTP (3x3 cluster): ~2.5 us lookback window



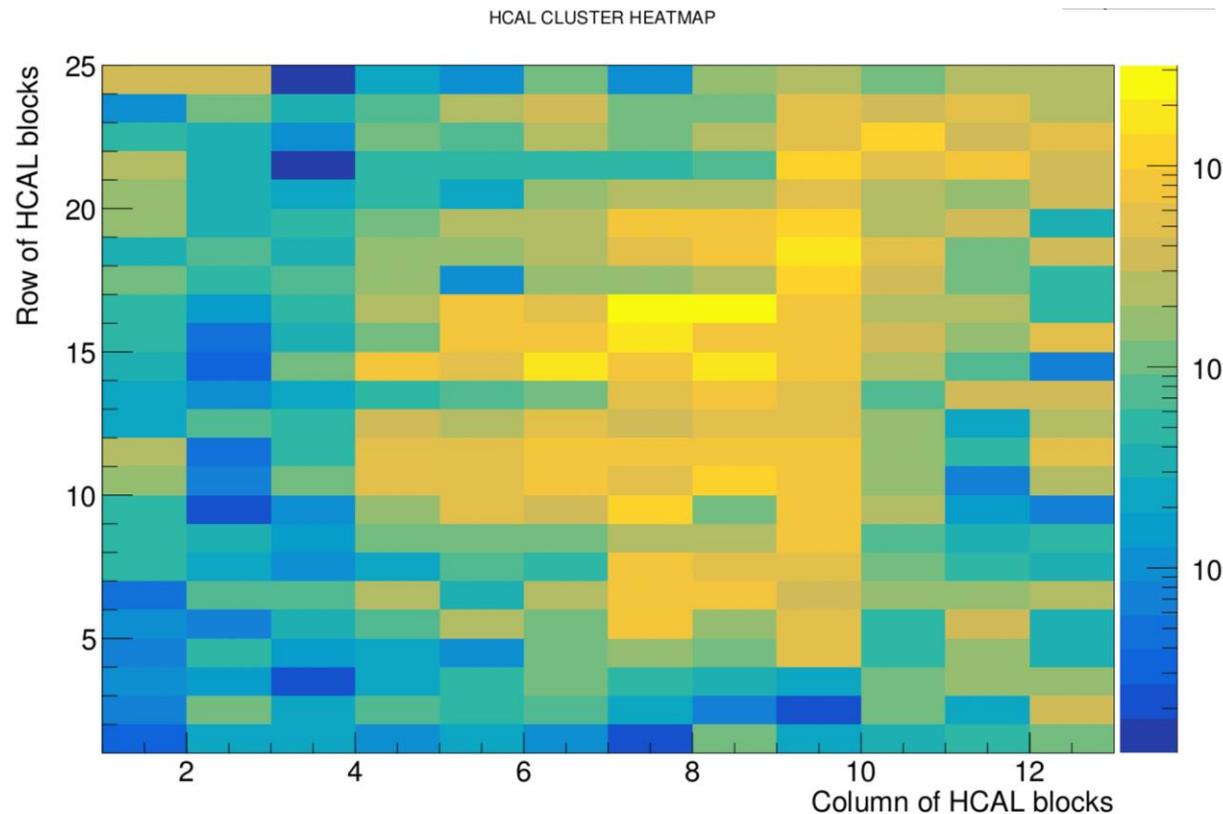
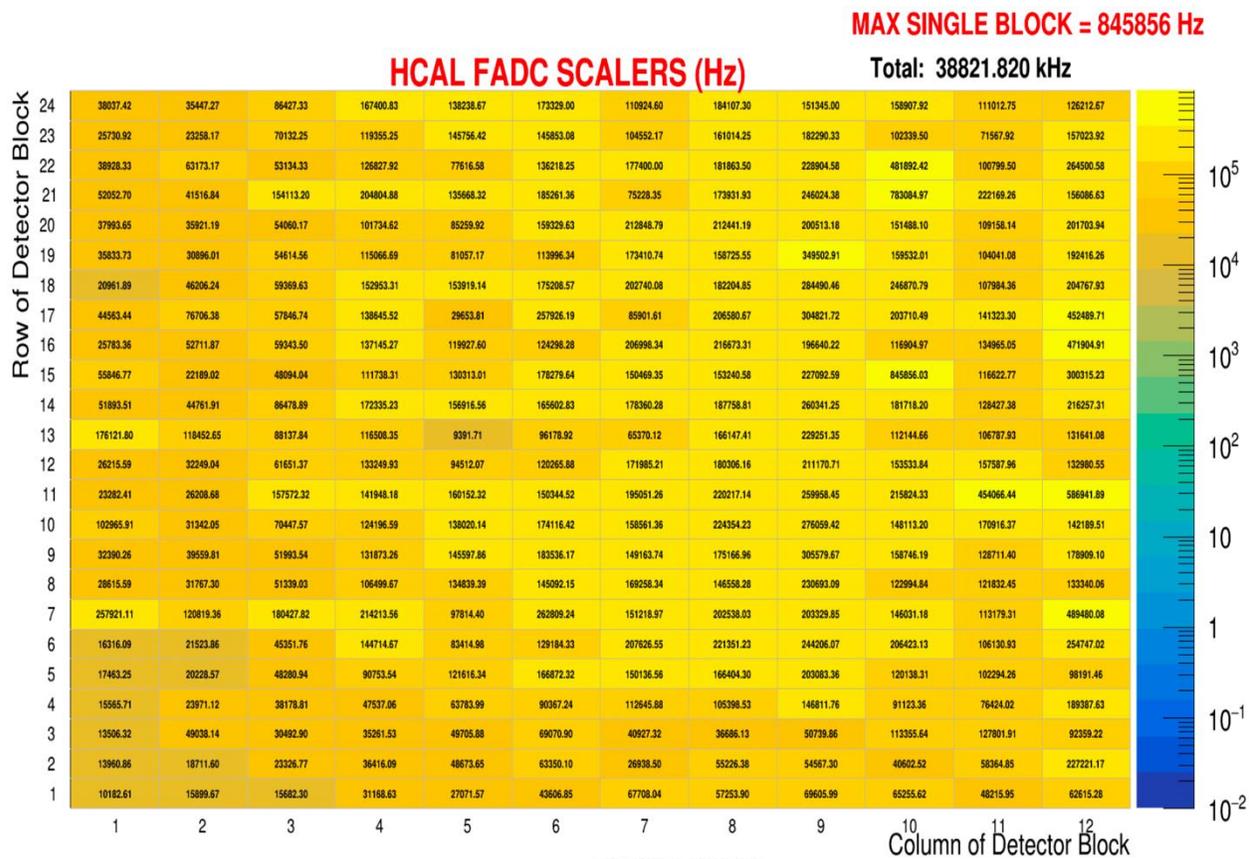
HCAL Trigger

- Analog trigger (GEn, GEn-RP):
 - Sum of 8x8 blocks (10 overlapped regions)
 - Common threshold for all sum (remotely controlled)
 - 'OR' of sum signals over threshold
- Digital trigger (GEP):
 - VTP responsible for trigger
 - 3x3 clusters (seed and cluster threshold)
 - Diaggi for monitoring the cluster position and energy in the VTP
 - Correlation matching with e-arm



HCAL Performance during GEp

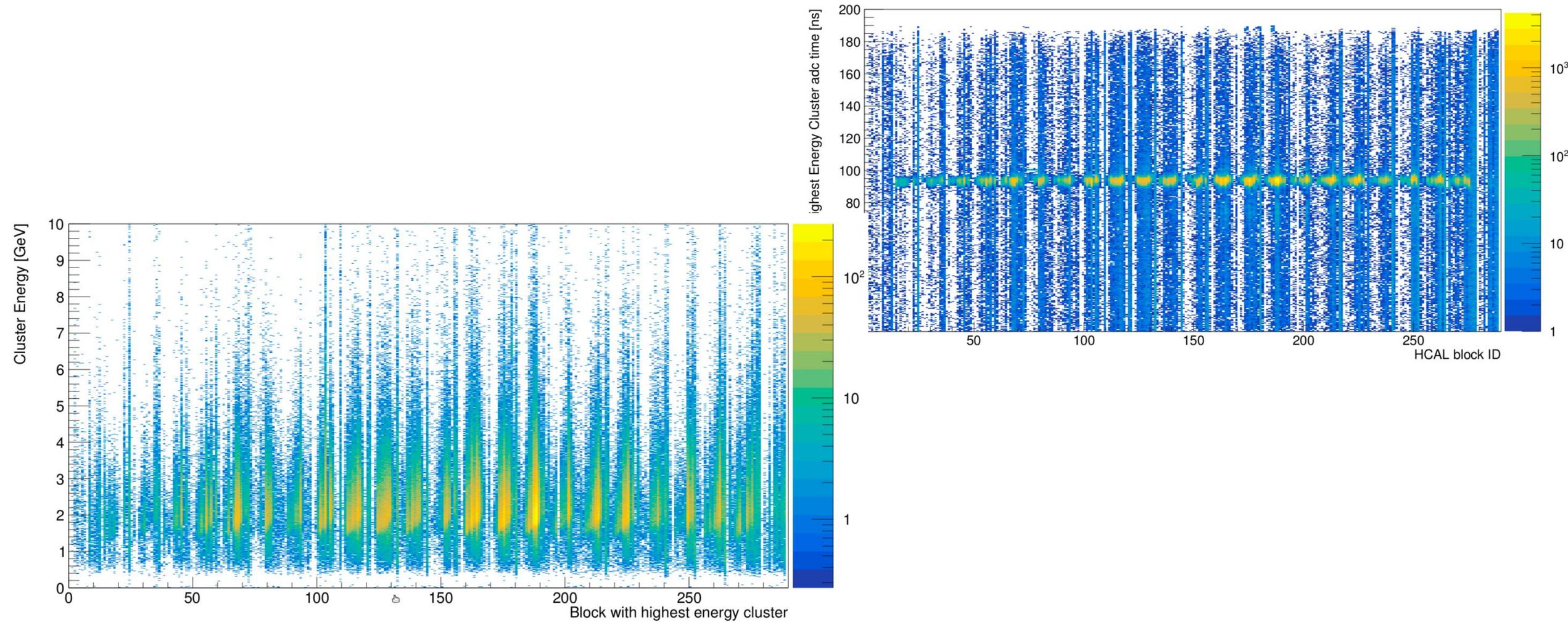
- Plots from highest kinematics runs (5th pass beam) showing fADC scalars (real-time) and CLUSTER heatmap (50k replay)



(Note: Click on bins to get Bin-info)

HCAL Performance during GEp

- Cluster Energy and time for HCAL blocks



HCAL after GEp

- De-cabling after GEp in Hall-A
 - Some cables are reused by Moller
- Two halves of HCAL moved to Test Lab

- NIM paper is still in progress



Issues/Challenges: Lessons

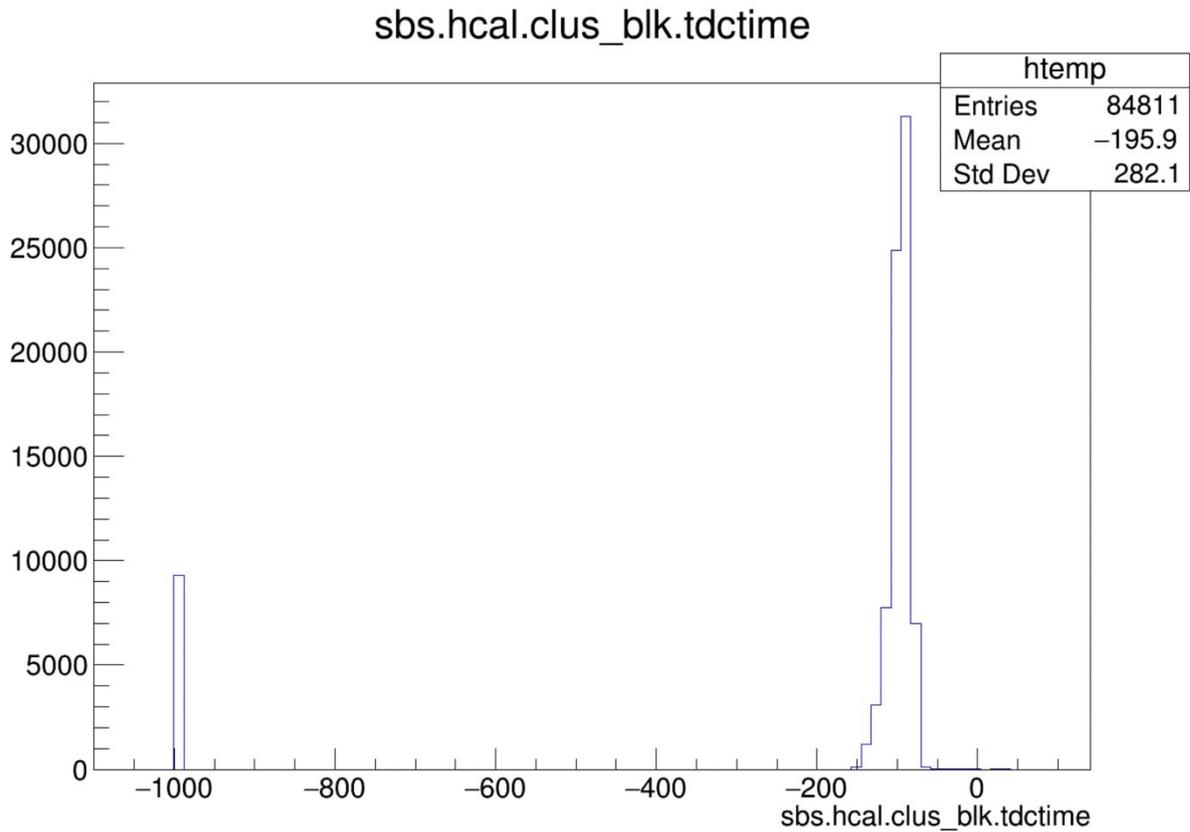
HV Controls

- Bad state of Lecroy HV modules: Vset voltage also dropped to 0 V
- No alarms for shift crew (as standard alarm available only for difference of Vset and VMon voltages)
- Added second set of delayed (4 min) alarms on HCAL Vmon for shift-crews during Gen-RP
- Few spare HV modules

SBS HCAL Left HV Controls									Group
Ch ID	On/Off	Status	Vmon	Imon	Vset	Itrip	Vmax	RmpUp	RmpDwn
Left_145	ON	1	-12	1	0.0	-2550.0	-3120.0	60.7	485.6
Left_146	ON	1	-1538	-616	-1538.0	-2550.0	-3120.0	56.2	505.8
Left_147	ON	1	-10	-0	0.0	-2550.0	-3120.0	60.8	486.7
Left_148	ON	1	-1500	-591	-1500.0	-2550.0	-3120.0	56.2	56.2
Left_149	ON	1	-1601	-607	-1600.0	-2550.0	-3090.0	61.2	61.2
Left_150	ON	1	-1851	-716	-1850.0	-2550.0	-3120.0	61.1	61.1
Left_151	ON	1	-1651	-625	-1650.0	-2550.0	-3090.0	61.0	61.0
Left_152	ON	1	-1722	-666	-1722.0	-2550.0	-3120.0	60.9	60.9
Left_153	ON	1	-1390	-492	-1390.0	-2550.0	-3120.0	61.0	61.0
Left_154	ON	1	-1436	-526	-1436.0	-2550.0	-3120.0	61.4	491.6
Left_155	ON	1	-1454	-538	-1453.0	-2550.0	-3120.0	61.0	61.0
Left_156	ON	1	-1432	-522	-1432.0	-2550.0	-3120.0	61.0	488.0
Left_157	OFF	0	-10	0	-1440.0	-2550.0	-3120.0	60.3	482.5
Left_158	ON	1	-1418	-514	-1417.0	-2550.0	-3120.0	56.2	492.0
Left_159	OFF	0	-8	1	-1466.0	-2550.0	-3120.0	60.9	487.7
Left_160	ON	1	-1410	-507	-1409.0	-2550.0	-3120.0	55.6	500.8
Left_161	ON	1	-1539	-584	-1538.0	-2550.0	-3090.0	61.2	61.2
Left_162	ON	1	-1926	-745	-1926.0	-2550.0	-3120.0	61.0	61.0
Left_163	ON	1	-1460	-553	-1459.0	-2550.0	-3090.0	61.4	61.4
Left_164	ON	1	-1637	-633	-1637.0	-2550.0	-3120.0	61.0	61.0

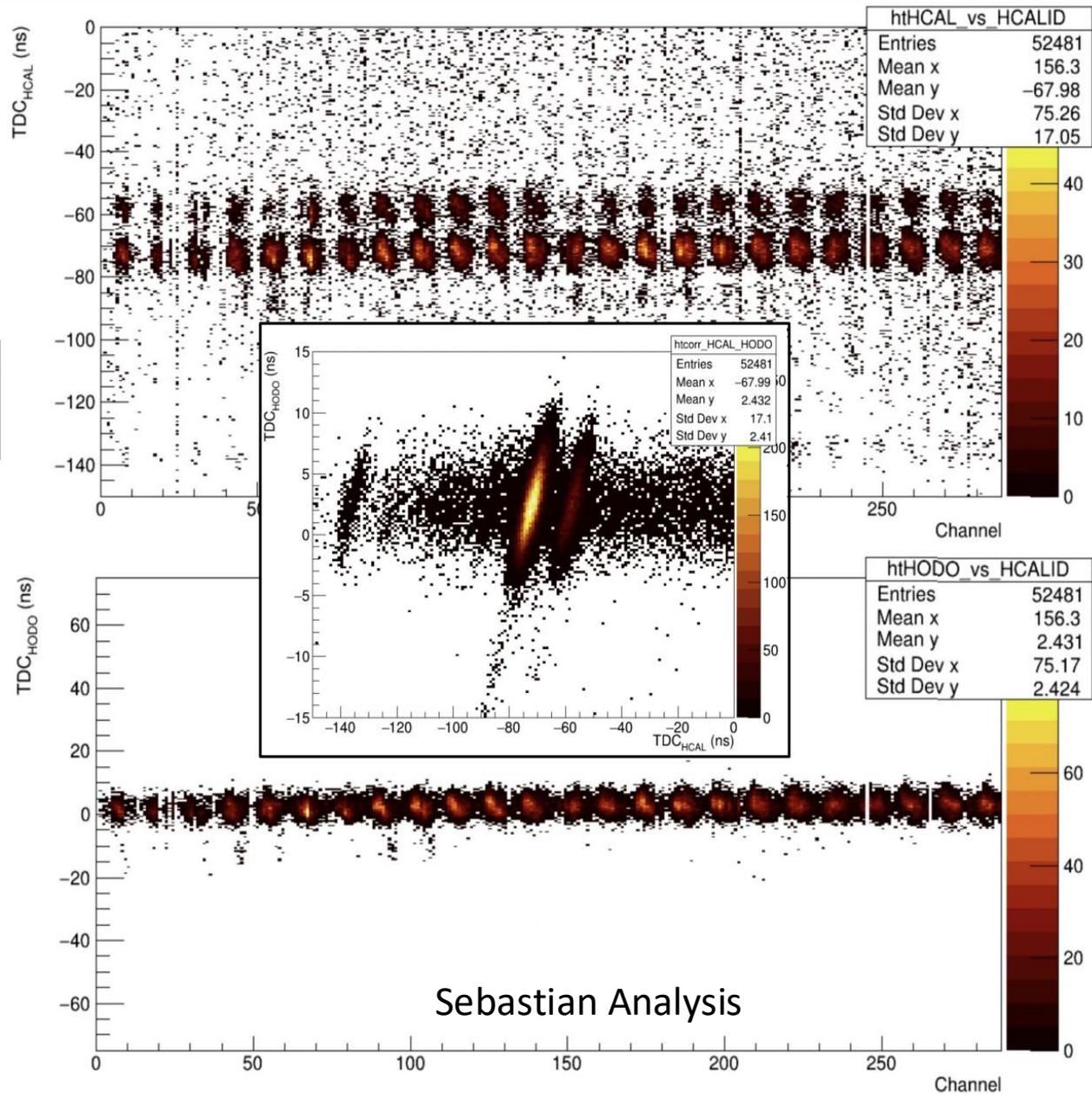
TDC Timing: F1TDC

- Double peaking: Rollover and decoding
- Missing TDC: Hardware (discriminator) and F1TDC buffer (high rate)



HCAL Status

13



Bad Channels

- pedestal-signal unseparated and long tail in signal distribution

	= HCal Module Number			= Amplifier Input Channel		fADC Input (#Input Channel)			= High Voltage Channel		
1	2	3	4	5	6	7	8	9	10	11	12
b6-01/f6-00 L6.0	b6-03/f6-02 L7.0	b6-05/f6-04 L6.1	b6-07/f6-06 L7.1	b6-09/f6-08 L8.0	b6-11/f6-10 L9.0	b6-02/f6-01 L8.1	b6-04/f6-03 L9.1	b6-06/f6-05 L10.0	b6-08/f6-07 L11.0	b6-10/f6-09 L10.1	b6-12/f6-11 L11.1
13	14	15	16	17	18	19	20	21	22	23	24
b4-13/f4-12 L6.2	b4-15/f4-14 L7.2	b5-13/f5-12 L6.3	b5-15/f5-14 L7.3	b6-13/f6-12 L8.2	b6-15/f6-14 L9.2	b4-14/f4-13 L8.3	b4-16/f4-15 L9.3	b5-14/f5-13 L10.2	b5-16/f5-15 L11.2	b6-14/f6-13 L10.3	b6-16/f6-15 L11.3
25	26	27	28	29	30	31	32	33	34	35	36
b7-01/f7-00 L6.4	b7-03/f7-02 L7.4	b7-05/f7-04 L6.5	b7-07/f7-06 L7.5	b7-09/f7-08 L8.4	b7-11/f7-10 L9.4	b7-02/f7-01 L8.5	b7-04/f7-03 L9.5	b7-06/f7-05 L10.4	b7-08/f7-07 L11.4	b7-10/f7-09 L10.5	b7-12/f7-11 L11.5
37	38	39	40	41	42	43	44	45	46	47	48
b8-01/f8-00 L6.6	b8-03/f8-02 L7.6	b8-05/f8-04 L6.7	b8-07/f8-06 L7.7	b8-09/f8-08 L8.6	b8-11/f8-10 L9.6	b8-02/f8-01 L8.7	b8-04/f8-03 L9.7	b8-06/f8-05 L10.6	b8-08/f8-07 L11.6	b8-10/f8-09 L10.7	b8-12/f8-11 L11.7
49	50	51	52	53	54	55	56	57	58	59	60
b9-01/f9-00 L6.8	b9-03/f9-02 L7.8	b9-05/f9-04 L6.9	b9-07/f9-06 L7.9	b9-09/f9-08 L8.8	b9-11/f9-10 L9.8	b9-02/f9-01 L8.9	b9-04/f9-03 L9.9	b9-06/f9-05 L10.8	b9-08/f9-07 L11.8	b9-10/f9-09 L10.9	b9-12/f9-11 L11.9
61	62	63	64	65	66	67	68	69	70	71	72
b7-13/f7-12 L6.10	b7-15/f7-14 L7.10	b8-13/f8-12 L6.11	b8-15/f8-14 L7.11	b9-13/f9-12 L8.10	b9-15/f9-14 L9.10	b7-14/f7-13 L8.11	b7-16/f7-15 L9.11	b8-14/f8-13 L10.10	b8-16/f8-15 L11.10	b9-14/f9-13 L10.11	b9-16/f9-15 L11.11
73	74	75	76	77	78	79	80	81	82	83	84
b1-01/f1-00 L0.0	b1-03/f1-02 L1.0	b1-05/f1-04 L0.1	b1-07/f1-06 L1.1	b1-09/f1-08 L2.0	b1-11/f1-10 L3.0	b1-02/f1-01 L2.1	b1-04/f1-03 L3.1	b1-06/f1-05 L4.0	b1-08/f1-07 L5.0	b1-10/f1-09 L4.1	b1-12/f1-11 L5.1
85	86	87	88	89	90	91	92	93	94	95	96
b2-01/f2-00 L0.2	b2-03/f2-02 L1.2	b2-05/f2-04 L0.3	b2-07/f2-06 L1.3	b2-09/f2-08 L2.2	b2-11/f2-10 L3.2	b2-02/f2-01 L2.3	b2-04/f2-03 L3.3	b2-06/f2-05 L4.2	b2-08/f2-07 L5.2	b2-10/f2-09 L4.3	b2-12/f2-11 L5.3
97	98	99	100	101	102	103	104	105	106	107	108
b3-01/f3-00 L0.4	b3-03/f3-02 L1.4	b3-05/f3-04 L0.5	b3-07/f3-06 L1.5	b3-09/f3-08 L2.4	b3-11/f3-10 L3.4	b3-02/f3-01 L2.5	b3-04/f3-03 L3.5	b3-06/f3-05 L4.4	b3-08/f3-07 L5.4	b3-10/f3-09 L4.5	b3-12/f3-11 L5.5
109	110	111	112	113	114	115	116	117	118	119	120
b1-13/f1-12 L0.6	b1-15/f1-14 L1.6	b2-13/f2-12 L0.7	b2-15/f2-14 L1.7	b3-13/f3-12 L2.6	b3-15/f3-14 L3.6	b1-14/f1-13 L2.7	b1-16/f1-15 L3.7	b2-14/f2-13 L4.6	b2-16/f2-15 L5.6	b3-14/f3-13 L4.7	b3-16/f3-15 L5.7
121	122	123	124	125	126	127	128	129	130	131	132
b4-01/f4-00 L0.8	b4-03/f4-02 L1.8	b4-05/f4-04 L0.9	b4-07/f4-06 L1.9	b4-09/f4-08 L2.8	b4-11/f4-10 L3.8	b4-02/f4-01 L2.9	b4-04/f4-03 L3.9	b4-06/f4-05 L4.8	b4-08/f4-07 L5.8	b4-10/f4-09 L4.9	b4-12/f4-11 L5.9
133	134	135	136	137	138	139	140	141	142	143	144
b5-01/f5-00 L0.10	b5-03/f5-02 L1.10	b5-05/f5-04 L0.11	b5-07/f5-06 L1.11	b5-09/f5-08 L2.10	b5-11/f5-10 L3.10	b5-02/f5-01 L2.11	b5-04/f5-03 L3.11	b5-06/f5-05 L4.10	b5-08/f5-07 L5.10	b5-10/f5-09 L4.11	b5-12/f5-11 L5.11

Sebastian Analysis

	= Module Number			= Amplifier Input Channel		fADC Input (#Input Channel)			= High Voltage Channel		
145	146	147	148	149	150	151	152	153	154	155	156
a1-01/f10-00 L0.0	a1-03/f10-02 L1.0	a1-05/f10-04 L0.1	a1-07/f10-06 L1.1	a1-09/f10-08 L3.0	a1-11/f10-10 L4.0	a1-02/f10-01 L3.1	a1-04/f10-03 L4.1	a1-06/f10-05 L5.0	a1-08/f10-07 L6.0	a1-10/f10-09 L5.1	a1-12/f10-11 L6.1
157	158	159	160	161	162	163	164	165	166	167	168
a2-01/f11-00 L0.2	a2-03/f11-02 L1.2	a2-05/f11-04 L0.3	a2-07/f11-06 L1.3	a2-09/f11-08 L3.2	a2-11/f11-10 L4.2	a2-02/f11-01 L3.3	a2-04/f11-03 L4.3	a2-06/f11-05 L5.2	a2-08/f11-07 L6.2	a2-10/f11-09 L5.3	a2-12/f11-11 L6.3
169	170	171	172	173	174	175	176	177	178	179	180
a3-01/f12-00 L0.4	a3-03/f12-02 L1.4	a3-05/f12-04 L0.5	a3-07/f12-06 L1.5	a3-09/f12-08 L3.4	a3-11/f12-10 L4.4	a3-02/f12-01 L3.5	a3-04/f12-03 L4.5	a3-06/f12-05 L5.4	a3-08/f12-07 L6.4	a3-10/f12-09 L5.5	a3-12/f12-11 L6.5
181	182	183	184	185	186	187	188	189	190	191	192
a1-13/f10-12 L0.6	a1-15/f10-14 L1.6	a2-13/f11-12 L0.7	a2-15/f11-14 L1.7	a3-13/f12-12 L3.6	a3-15/f12-14 L4.6	a1-14/f10-13 L3.7	a1-16/f10-15 L4.7	a2-14/f11-13 L5.6	a2-16/f11-15 L6.6	a3-14/f12-13 L5.7	a3-16/f12-15 L6.7
193	194	195	196	197	198	199	200	201	202	203	204
a4-01/f13-00 L0.8	a4-03/f13-02 L1.8	a4-05/f13-04 L0.9	a4-07/f13-06 L1.9	a4-09/f13-08 L3.8	a4-11/f13-10 L4.8	a4-02/f13-01 L3.9	a4-04/f13-03 L4.9	a4-06/f13-05 L5.8	a4-08/f13-07 L6.8	a4-10/f13-09 L5.9	a4-12/f13-11 L6.9
205	206	207	208	209	210	211	212	213	214	215	216
a5-01/f14-00 L0.10	a5-03/f14-02 L1.10	a5-05/f14-04 L0.11	a5-07/f14-06 L1.11	a5-09/f14-08 L3.10	a5-11/f14-10 L4.10	a5-02/f14-01 L3.11	a5-04/f14-03 L4.11	a5-06/f14-05 L5.10	a5-08/f14-07 L6.10	a5-10/f14-09 L5.11	a5-12/f14-11 L6.11
217	218	219	220	221	222	223	224	225	226	227	228
a6-01/f15-00 L0.12	a6-03/f15-02 L1.12	a6-05/f15-04 L0.13	a6-07/f15-06 L1.13	a6-09/f15-08 L3.12	a6-11/f15-10 L4.12	a6-02/f15-01 L3.13	a6-04/f15-03 L4.13	a6-06/f15-05 L5.12	a6-08/f15-07 L6.12	a6-10/f15-09 L5.13	a6-12/f15-11 L6.13
229	230	231	232	233	234	235	236	237	238	239	240
a4-13/f13-12 L7.2	a4-15/f13-14 L8.2	a5-13/f14-12 L7.3	a5-15/f14-14 L8.3	a6-13/f15-12 L9.2	a6-15/f15-14 L10.2	a4-14/f13-13 L10.3	a4-16/f13-15 L11.2	a5-14/f14-13 L12.2	a5-16/f14-15 L13.2	a6-14/f15-13 L12.3	a6-16/f15-15 L13.3
241	242	243	244	245	246	247	248	249	250	251	252
a7-01/f16-00 L8.4	a7-03/f16-02 L9.4	a7-05/f16-04 L8.5	a7-07/f16-06 L9.5	a7-09/f16-08 L11.4	a7-11/f16-10 L12.4	a7-02/f16-01 L11.5	a7-04/f16-03 L12.5	a7-06/f16-05 L14.4	a7-08/f16-07 L15.4	a7-10/f16-09 L14.5	a7-12/f16-11 L15.5
253	254	255	256	257	258	259	260	261	262	263	264
a8-01/f17-00 L7.6	a8-03/f17-02 L8.6	a8-05/f17-04 L7.7	a8-07/f17-06 L8.7	a8-09/f17-08 L10.6	a8-11/f17-10 L11.6	a8-02/f17-01 L10.7	a8-04/f17-03 L11.7	a8-06/f17-05 L13.6	a8-08/f17-07 L14.6	a8-10/f17-09 L13.7	a8-12/f17-11 L14.7
265	266	267	268	269	270	271	272	273	274	275	276
a9-01/f18-00 L7.8	a9-03/f18-02 L8.8	a9-05/f18-04 L7.9	a9-07/f18-06 L8.9	a9-09/f18-08 L10.8	a9-11/f18-10 L11.8	a9-02/f18-01 L10.9	a9-04/f18-03 L11.9	a9-06/f18-05 L13.8	a9-08/f18-07 L14.8	a9-10/f18-09 L13.9	a9-12/f18-11 L14.9
277	278	279	280	281	282	283	284	285	286	287	288
a7-13/f16-12 L7.10	a7-15/f16-14 L8.10	a8-13/f17-12 L7.11	a8-15/f17-14 L8.11	a9-13/f18-12 L9.10	a9-15/f18-14 L10.10	a7-14/f16-13 L9.11	a7-16/f16-15 L10.11	a8-14/f17-13 L11.10	a8-16/f17-15 L12.10	a9-14/f18-13 L11.11	a9-16/f18-15 L12.11

Bad Channels

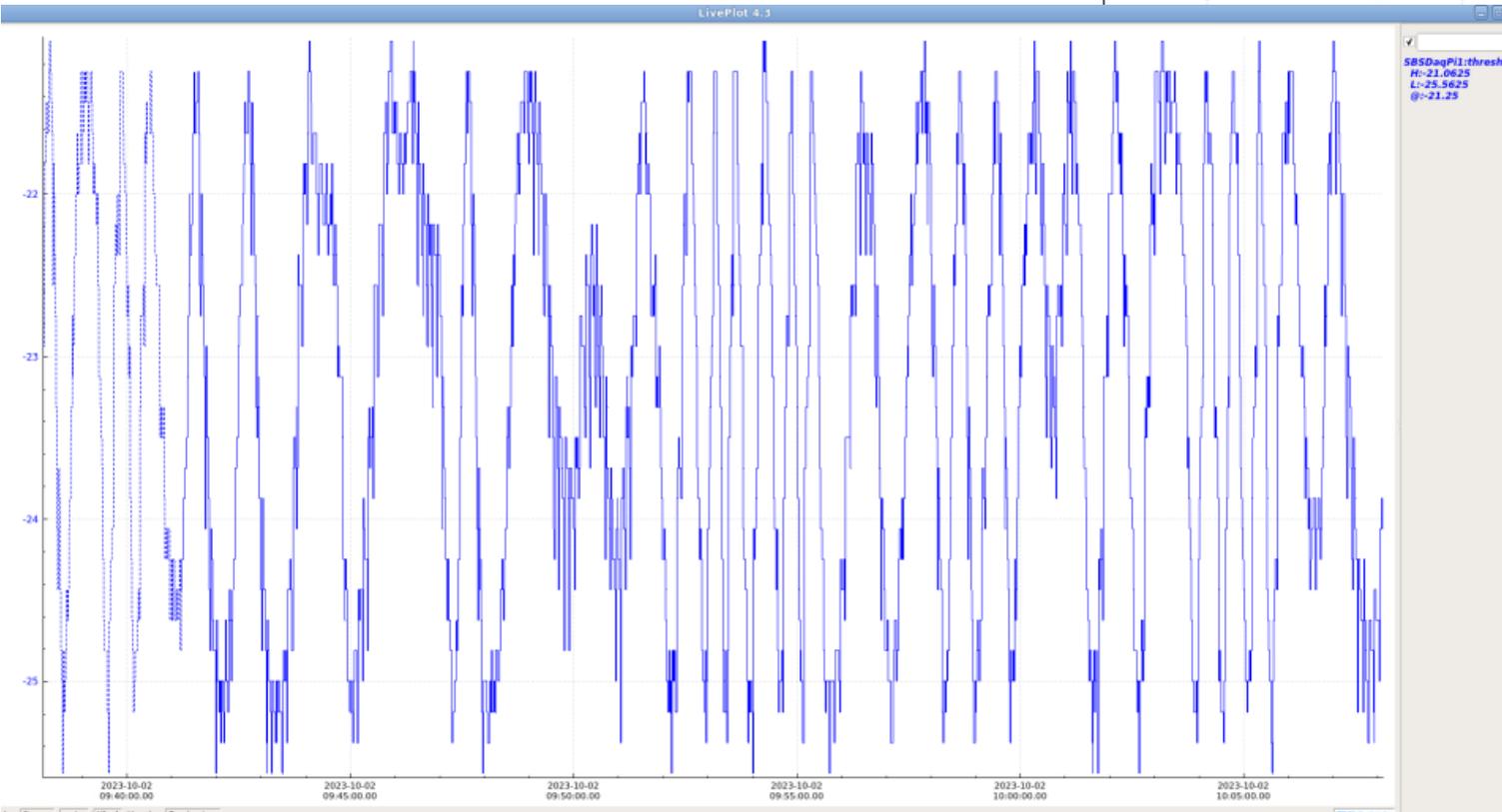
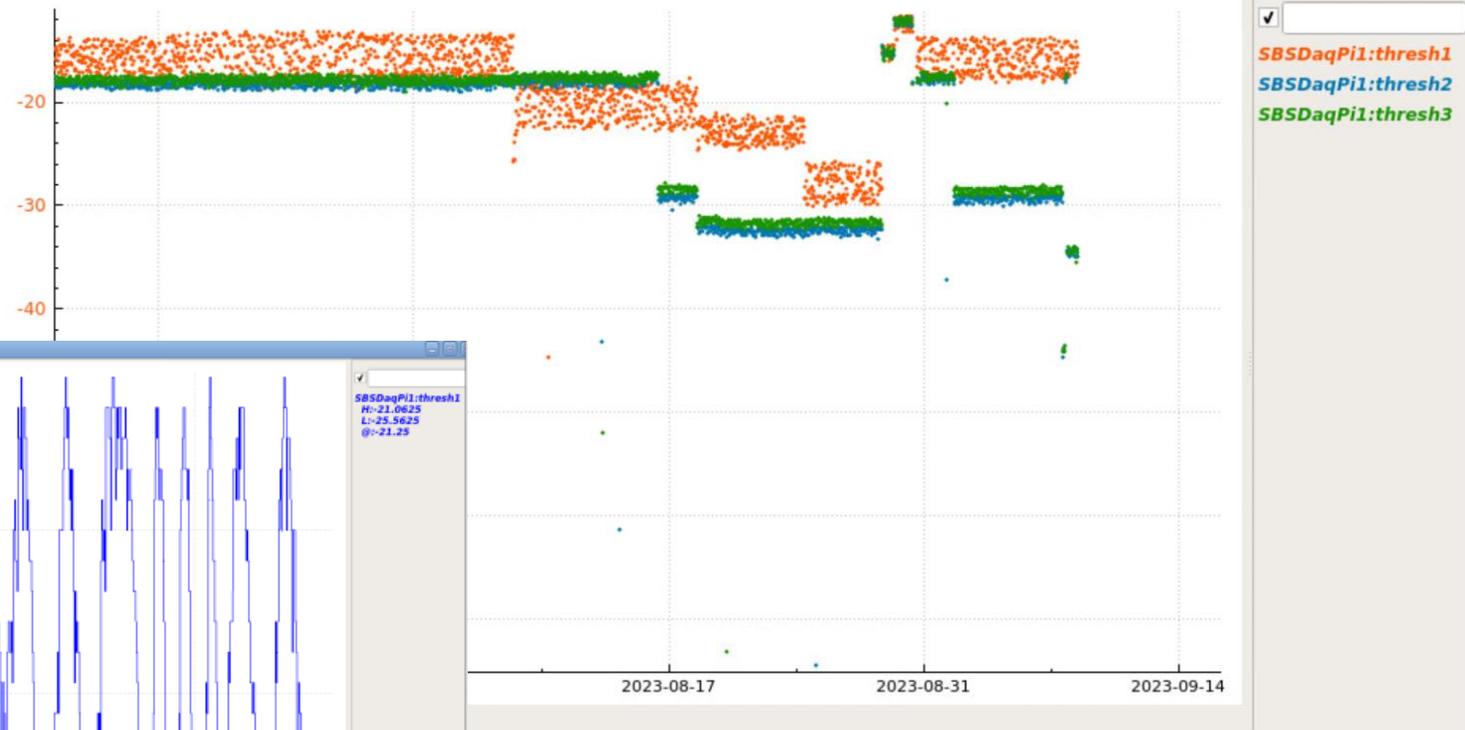
- pedestal-signal unseparated and long tail in signal distribution
- Distribution changed after stacking in the hall
- No change in behavior after PMT swap



	= Module Number		= Amplifier Input Channel		fADC Input (#Input Channel)		= High Voltage Channel																
145	a1-01/f10-00 L0.0	146	a1-03/f10-02 L1.0	147	a1-05/f10-04 L0.1	148	a1-07/f10-06 L1.1	149	a1-09/f10-08 L3.0	150	a1-11/f10-10 L4.0	151	a1-02/f10-01 L3.1	152	a1-04/f10-03 L4.1	153	a1-06/f10-05 L5.0	154	a1-08/f10-07 L6.0	155	a1-10/f10-09 L5.1	156	a1-12/f10-11 L6.1
157	a2-01/f11-00 L0.2	158	a2-03/f11-02 L1.2	159	a2-05/f11-04 L0.3	160	a2-07/f11-06 L1.3	161	a2-09/f11-08 L3.2	162	a2-11/f11-10 L4.2	163	a2-02/f11-01 L3.3	164	a2-04/f11-03 L4.3	165	a2-06/f11-05 L5.2	166	a2-08/f11-07 L6.2	167	a2-10/f11-09 L5.3	168	a2-12/f11-11 L6.3
169	a3-01/f12-00 L0.4	170	a3-03/f12-02 L1.4	171	a3-05/f12-04 L0.5	172	a3-07/f12-06 L1.5	173	a3-09/f12-08 L3.4	174	a3-11/f12-10 L4.4	175	a3-02/f12-01 L3.5	176	a3-04/f12-03 L4.5	177	a3-06/f12-05 L5.4	178	a3-08/f12-07 L6.4	179	a3-10/f12-09 L5.5	180	a3-12/f12-11 L6.5
181	a1-13/f10-12 L0.6	182	a1-15/f10-14 L1.6	183	a2-13/f11-12 L0.7	184	a2-15/f11-14 L1.7	185	a3-13/f12-12 L3.6	186	a3-15/f12-14 L4.6	187	a1-14/f10-13 L3.7	188	a1-16/f10-15 L4.7	189	a2-14/f11-13 L5.6	190	a2-16/f11-15 L6.6	191	a3-14/f12-13 L5.7	192	a3-16/f12-15 L6.7
193	a4-01/f13-00 L0.8	194	a4-03/f13-02 L1.8	195	a4-05/f13-04 L0.9	196	a4-07/f13-06 L1.9	197	a4-09/f13-08 L3.8	198	a4-11/f13-10 L4.8	199	a4-02/f13-01 L3.9	200	a4-04/f13-03 L4.9	201	a4-06/f13-05 L5.8	202	a4-08/f13-07 L6.8	203	a4-10/f13-09 L5.9	204	a4-12/f13-11 L6.9
205	a5-01/f14-00 L0.10	206	a5-03/f14-02 L1.10	207	a5-05/f14-04 L0.11	208	a5-07/f14-06 L1.11	209	a5-09/f14-08 L3.10	210	a5-11/f14-10 L4.10	211	a5-02/f14-01 L3.11	212	a5-04/f14-03 L4.11	213	a5-06/f14-05 L5.10	214	a5-08/f14-07 L6.10	215	a5-10/f14-09 L5.11	216	a5-12/f14-11 L6.11
217	a6-01/f15-00 L7.0	218	a6-03/f15-02 L8.0	219	a6-05/f15-04 L7.1	220	a6-07/f15-06 L8.1	221	a6-09/f15-08 L9.0	222	a6-11/f15-10 L10.0	223	a6-02/f15-01 L9.1	224	a6-04/f15-03 L10.1	225	a6-06/f15-05 L11.0	226	a6-08/f15-07 L12.0	227	a6-10/f15-09 L11.1	228	a6-12/f15-11 L12.1
229	a4-13/f13-12 L7.2	230	a4-15/f13-14 L8.2	231	a5-13/f14-12 L7.3	232	a5-15/f14-14 L8.3	233	a6-13/f15-12 L9.2	234	a6-15/f15-14 L10.2	235	a4-14/f13-13 L9.3	236	a4-16/f13-15 L10.3	237	a5-14/f14-13 L11.2	238	a5-16/f14-15 L12.2	239	a6-14/f15-13 L11.3	240	a6-16/f15-15 L12.3
241	a7-01/f16-00 L7.4	242	a7-03/f16-02 L8.4	243	a7-05/f16-04 L7.5	244	a7-07/f16-06 L8.5	245	a7-09/f16-08 L9.4	246	a7-11/f16-10 L10.4	247	a7-02/f16-01 L9.5	248	a7-04/f16-03 L10.5	249	a7-06/f16-05 L11.4	250	a7-08/f16-07 L12.4	251	a7-10/f16-09 L11.5	252	a7-12/f16-11 L12.5
253	a8-01/f17-00 L7.6	254	a8-03/f17-02 L8.6	255	a8-05/f17-04 L7.7	256	a8-07/f17-06 L8.7	257	a8-09/f17-08 L9.6	258	a8-11/f17-10 L10.6	259	a8-02/f17-01 L9.7	260	a8-04/f17-03 L10.7	261	a8-06/f17-05 L11.6	262	a8-08/f17-07 L12.6	263	a8-10/f17-09 L11.7	264	a8-12/f17-11 L12.7
265	a9-01/f18-00 L7.8	266	a9-03/f18-02 L8.8	267	a9-05/f18-04 L7.9	268	a9-07/f18-06 L8.9	269	a9-09/f18-08 L9.8	270	a9-11/f18-10 L10.8	271	a9-02/f18-01 L9.9	272	a9-04/f18-03 L10.9	273	a9-06/f18-05 L11.8	274	a9-08/f18-07 L12.8	275	a9-10/f18-09 L11.9	276	a9-12/f18-11 L12.9
277	a7-13/f16-12 L7.10	278	a7-15/f16-14 L8.10	279	a8-13/f17-12 L7.11	280	a8-15/f17-14 L8.11	281	a9-13/f18-12 L9.10	282	a9-15/f18-14 L10.10	283	a7-14/f16-13 L9.11	284	a7-16/f16-15 L10.11	285	a8-14/f17-13 L11.10	286	a8-16/f17-15 L12.10	287	a9-14/f18-13 L11.11	288	a9-16/f18-15 L12.11

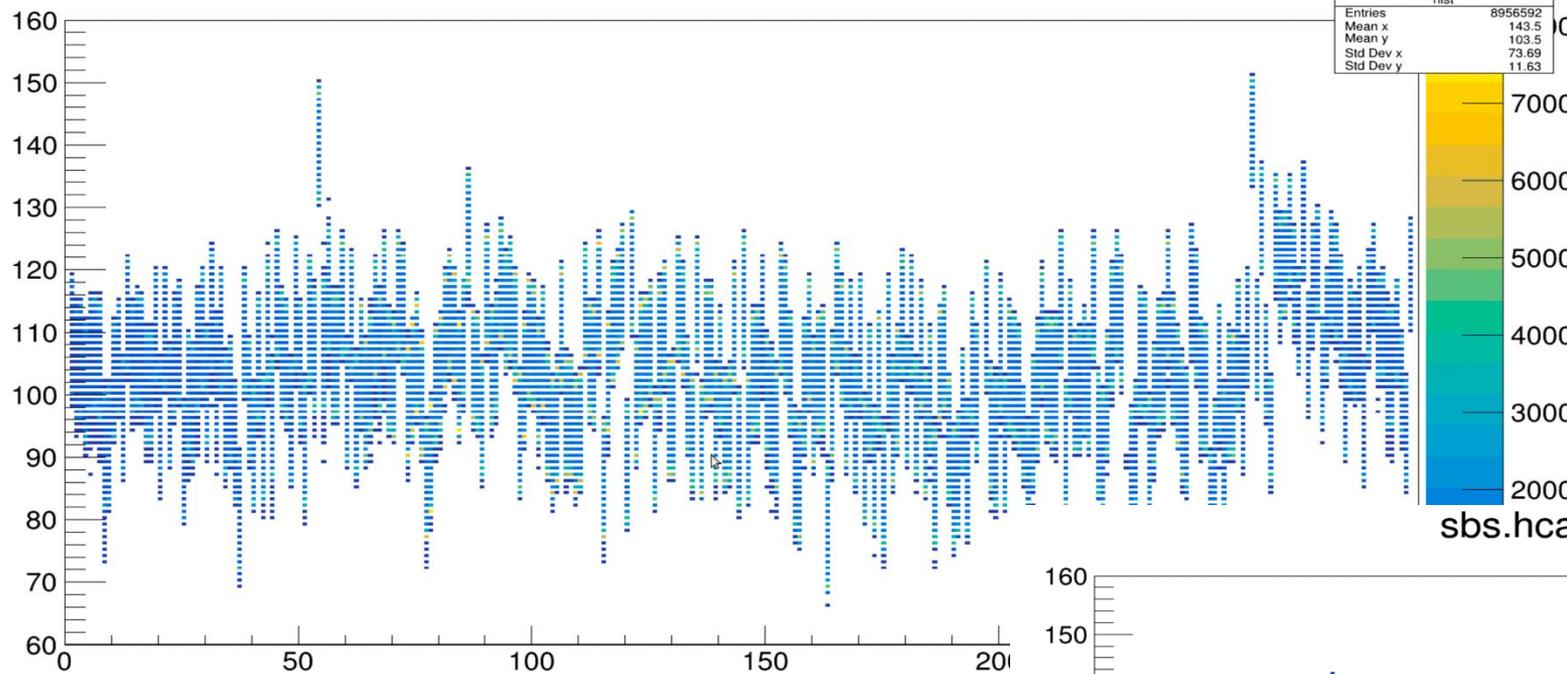
Analog Trigger Threshold

- Fluctuation of Trigger threshold: readback or real?



Background Noise and VTP Trigger

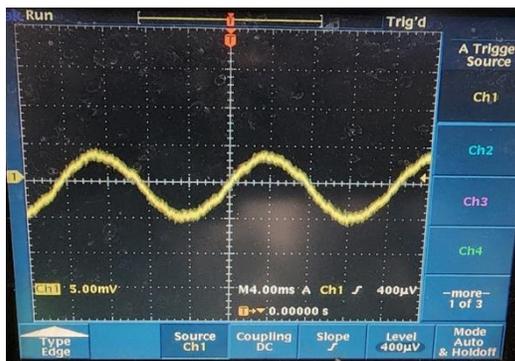
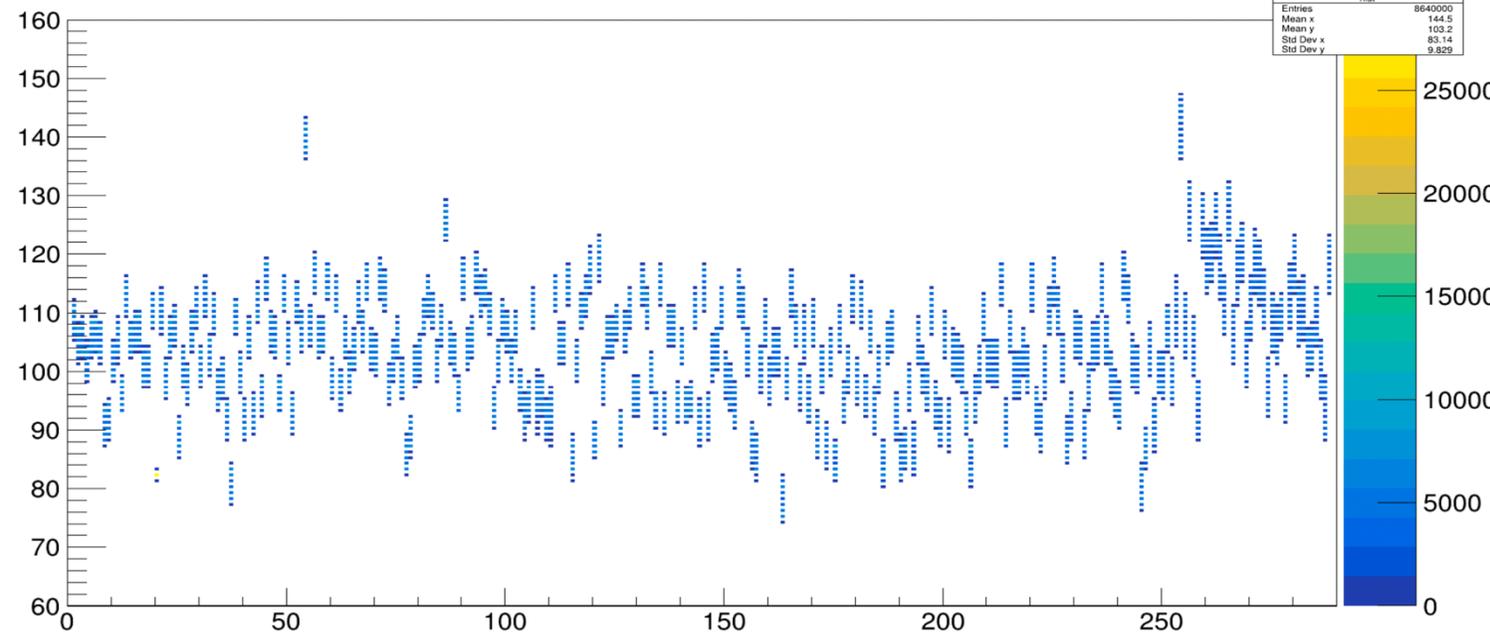
sbs.hcal.ped:sbs.hcal.adcelemID



Not an issue for offline analysis which estimates pedestal in every event for each channel

Trigger-> one pedestal value/ch in config file

sbs.hcal.ped:sbs.hcal.adcelemID



60 Hz noise

HCAL Status

Acknowledgments

- Graduate students:
Mahmoud, Jih-ying
- All the others who
helped de-cabling
- Many thanks to
all SBS
Collaborators !

Many people and institutions were involved in HCal's development:

- Special thanks to **Juan Carlos Cornejo** and **Sebastian Seeds** for getting HCal where it is today.
- Thanks to the many students who have worked on HCal including **Alexis Ortega**, **So Young Jeon**, **Jorge Peña**, **Carly Wever**, **Vanessa Brio**, **Sebastian Seeds**, and **Provakar Datta**.
- Thanks to **Gregg Franklin**, **Brian Quinn**, and the **Carnegie Mellon** team for design, overseeing construction, and ongoing guidance.
- Thanks to **Università di Catania** for major financial contributions.
- Thanks to **Vanessa Brio**, **Cattia Petta**, and **Vincenzo Bellini** for their cosmic commissioning efforts.
- Thanks to **Alexandre Camsonne** and **Bryan Moffit** for DAQ work.
- Thanks to **Chuck Long** for all his help fixing and acquiring things.
- Thanks to **Bogdan Wojtsekhowski** for his guidance and advice.
- Thanks to the rest of the HCal Working Group as well: **Dimitrii Nikolaev**, **Jim Napolitano**, and **Donald Jones**.

Scott Barcus

Jefferson Lab

30