SPE template Studies for ProtoDUNE-HD

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MOTIVATION

• One of the next steps for the ProtoDUNE HD deconvolution module is to obtain the SPE templates from WAFFLES for each of the ProtoDUNE HD channels.



- Waffles is the NP04 PDS analysis framework Written in python, initially developed by Julio Ureña with contributions with other ~10 person.
- SPE template was obtained using Renan's script in Waffles (with few modifications).



SPE templates



Ticks

HPKChannels



Single photoelectron normalized

HPK APA2

SPE_Amp : 10.80081 SPE_Amp : 13.78441 SPE_Amp : 13.42734 SPE_Amp : 13.13744 SPE_Amp : 12.33993 SPE_Amp : 13.50636 SPE_Amp : 13.59418 SPE_Amp : 13.30913 SPE_Amp : 11.9144 SPE_Amp : 13.05208



FBKChannels



FBK APA2

SPE_Amp: 12.90302 SPE_Amp: 10.85122 SPE_Amp: 9.87513 SPE_Amp: 12.62573 SPE_Amp: 9.72592 SPE_Amp: 10.18174 SPE_Amp: 12.39731 SPE_Amp: 12.43264

Single photoelectron normalized



Deconvolución: Wiener +Gauss



It is the average SPE channel endpoint 109 Ch46 (HPK). Obtained from Renan's Script in WAFFLES.

Deconvolution of the waveforms using the ProtoDUNE-HD data from the HPK channels.

The Deconvolution module works with this ProtoDUNE SPE Template!!



ADC

NEXT STEPS

It would be interesting:

• To include in the calibration process the plot with the fit of the peaks and be sure that we are only taking SPE:

draw.plot_charge_peaks(charge_histo,3)



• Compare with other methods or scripts that are being developed to obtain the SPE template to be sure of the quality of the template.



DEEP UNDERGROUND NEUTRINO EXPERIMENT

Channel Map

APA1					
104-7	104-5	104-2	104-0		
150	140	130	120		
104-1	104-3	104-4	104-6		
151	141	131	121		
104-17	104-15	104-12	104-10		
152	142	132	122		
104-11	104-13	104-14	104-16		
153	143	133	123		
105-7	105-5	105-2	105-0		
154	144	134	124		
105-1	105-3	105-4	105-6		
155	145	135	125		
105-26	105-24	105-23	105-21		
156	146	136	126		
105-10	105-12	105-15	105-17		
157	147	137	127		
107-17	107-15	107-12	107-10		
158	148	138	128		
107-0	107-2	107-5	107-7		
159	149	139	129		

109-27	109-25	109-22	109-20
109-21 111	100-23	109-24	109-26 81
109-37	109-35	109-32	109-30
112	102	92	82
109-31	109-33	109-34	109-36
113	103	93	83
109-7	109-5	109-2	109-0
114	104	94	84
109-1	109-3	109-4	109-6
115	105	95	85
109-17	109-15	109-12	109-10
116	106	96	86
109-11	109-13	109-14	109-16
117	107	97	87
109-47	109-45	109-42	109-40
118	108	98	88
109-41	109-43	109-44	109-46
119	109	99	89

Re	d border disconnected channel
	Channel Daphne/APA
	Channel LarSoft
	FBK
	HPK

APA3					
111-1	111-3	111-4	111-6		
70	60	50	40		
111-36	111-34	111-33	111-31		
71	61	51	41		
111-0	111-2	111-5	111-7		
72	62	52	42		
111-37	111-35	111-32	111-30		
73	63	53	43		
111-41	111-43	111-44	111-46		
74	64	54	44		
111-16	111-14	111-13	111-11		
75	65	55	45		
111-10	111-12	111-15	111-17		
76	66	56	46		
111-26	111-24	111-23	111-21		
77	67	57	47		
111-40	111-42	111-45	111-47		
78	68	58	48		
111-27	111-25	111-22	111-20		
79	69	59	49		

112-0	112-2	112-5	112-7
30	20	10	0
112-6	112-4	112-3	112-1
31	21	11	1
112-10	112-12	112-15	112-17
32	22	12	2
112-16	112-14	112-13	112-11
33	23	13	3
113-0	113-2	113-5	113-7
34	24	14	4
112-27	112-25	112-22	112-20
35	25	15	5
112-21	112-23	112-24	112-26
36	26	16	6
112-37	112-35	112-32	112-30
37	27	17	7
112-31	112-33	112-34	112-36
38	28	18	8
112-47 39	112-45	112-42	112-40

duneprototypes/duneprototypes/Protodune/hd/ChannelMap/DAPHNE_test5_ChannelMap_v1.txt



DEEP UNDERGROUND NEUTRINO EXPERIMENT

apa_2_data = [[UniqueChannel(109, 27), UniqueChannel(109, 25), UniqueChannel(109, 22), UniqueChannel(109, 20)],

[UniqueChannel(109, 21), UniqueChannel(109, 23), UniqueChannel(109, 24), UniqueChannel(109, 26)],

[UniqueChannel(109, 37), UniqueChannel(109, 35), UniqueChannel(109, 32), UniqueChannel(109, 30)],

[UniqueChannel(109, 31), UniqueChannel(109, 33), UniqueChannel(109, 34), UniqueChannel(109, 36)], [UniqueChannel(109, 7), UniqueChannel(109, 5), UniqueChannel(109, 2), UniqueChannel(109, 0

[UniqueChannel(109, 17), UniqueChannel(109, 15), UniqueChannel(109, 12), UniqueChannel(109, 10)], [UniqueChannel(109, 11), UniqueChannel(109, 13), UniqueChannel(109, 14), UniqueChannel(109, 16)], [UniqueChannel(109, 47), UniqueChannel(109, 45), UniqueChannel(109, 42) UniqueChannel(109, 40)],

[UniqueChannel(109, 41), UniqueChannel(109, 43), UniqueChannel(109, 44), UniqueChannel(109, 46)]]

[UniqueChannel(109, 1), UniqueChannel(109, 3), UniqueChannel(109, 4), UniqueChannel(109, 6

Channel Map

APA2

104-7			
150	104-5 140	104-2 130	104-0 120
104-1 151	104-3 141	104-4 131	104-6 121
104-17 152	104-15 142	104-12 132	104-10 122
104-11 153	104-13 143	104-14 133	104-16 123
105-7 154	105-5 144	105-2 134	105-0 124
105-1 155	105-3 145	105-4 135	105-6 125
105-26 156	105-24 146	105-23 136	105-21 126
105-10 157	105-12 147	105-15 137	105-17 127
107-17 158	107-15	107-12	107-10
107-0 159	107-2 149	107-5 139	107-7
			 Protocol 1
APA3	111-3	111-4	111-6
APA3 111-1 70	111-3 60	111-4 50	111-6 40
APA3 111-1 70 111-36 71	111-3 60 111-34 61	111-4 50 111-33 51	111-6 40 111-31 41
APA3 111-1 70 111-36 71 111-0 72	111-3 60 111-34 61 111-2 62	111-4 50 111-33 51 111-5 52	111-6 40 111-31 41 111-7 42
APA3 111-1 70 111-36 71 111-0 72 111-37 73	111-3 60 111-34 61 111-2 62 111-35 63	1111-4 50 1111-33 51 1111-5 52 1111-32 53	111-6 40 111-31 41 111-7 42 111-30 43
APA3 111-1 70 111-36 71 111-0 72 111-37 73 111-41 74	111-3 60 111-34 61 111-2 62 111-35 63 111-43 64	111-4 50 111-33 51 111-5 52 111-32 53 111-44 54	111-6 40 1111-31 41 111-7 42 111-30 43 1111-46 44
APA3 111-1 70 111-36 71 111-0 72 111-37 73 111-41 74 111-16 75	111-3 60 111-34 61 111-34 61 111-34 62 62 63 111-35 63 111-34 64 1111-34 64	111-4 50 111-33 51 111-5 52 111-32 53 111-44 54 111-13 55	111-6 40 1111-31 41 111-7 42 111-30 43 111-46 44 41 111-111 45
APA3 111-1 70 111-36 71 111-0 72 111-37 73 111-41 74 111-16 75 111-10 76	111-3 60 1111-34 61 1111-35 62 1111-35 63 1111-43 64 1111-14 65 1111-12 66	111-4 50 51 51 52 52 53 53 53 53 53 51 111-44 54 54 55 55 56	111-6 40 111-31 41 111-7 42 111-30 43 111-45 44 111-11 45 111-17 46

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111-40

111-27 79

78

111-42

111-25

68

69

109-27	109-25	90	80				
109-21 111	109-23 101	109-24 91	109-26 81				
109-37 112	109-35 102	109-32 92	109-30 82	dunepr	ototypes / dune	eprototypes / Protodur	ne / hd / C
109-31 113	109-33 103	109-34 93	109-38 83	Code	Blame 16	0 lines (160 loc) ·	1.64 KB
109-7	109-5	109-2	109-0	49	9 0 30 82		
114	104	94	84		9 0 42 92		
109-1 115	109-3	109-4	85	51	9 0 35 102	2	
109-17	109-15	109-12	109-10	52	9 0 37 112	2	
116	106	96	86	53	9 0 36 83		
109-11	109-13	109-14	109-16	54	9 0 34 93		
117	107	97	87	55	9 0 33 103	3	
109-47	109-45	109-42	109-40	56	9 0 31 113	3	
109-41	109-43	109-44	109-46	- 57	9 0 0 84	apa_2_data = [[Unique(
119	109	99	89	58	9 0 2 94		[Unique(
				59	9 0 5 104		[Inique(
			\backslash	60	9 0 7 114		Elladaua
APA4				61	9 0 6 85		Lourdner
112-0	112-2	112-5	112-7	62	9 0 4 95		[Unique(
30	20	10	0	63	9 0 3 105		[Unique(
12-6	112-4	112-3	112-1	64	9 0 1 115		[Unique(
112-10	112-12	112-15	112-17		9 0 10 86		Illaiguo
32	22	12	2	66	9 0 12 96		Lourdoor
112-16	112-14	112-13	112-11	67	9 0 15 100	5	lourdned
33	23	13	3		9 0 17 116	5	[Unique(
113-0 34	113-2	113-5	113-7	69	9 0 16 87		
112-27	112-25	112.22	112.20	. 70	9 0 14 97		
35	25	15	5	71	9 0 13 107	7	
112-21	112-23	112-24	112-26	72	9 0 11 117	7	
36	26	16	6	. 73	9 0 40 88		
112-37	112-35	112-32	112-30	74	9 0 52 98		
112.31	112,33	112-34	112,36		0 0 /5 100	2	
38	28	18	8				
112-47	112-45	112-42	112-40				
39	29	19	9				

neprototypes / Protodune / hd / ChannelMap / DAPHNE test5 ChannelMap v1.txt

duneprototypes/duneprototypes/Protodune/hd/ChannelMap/DAPHNE_test5_ChannelMap_v1.txt

github.com/DUNE/waffles/blob/main/src/waffles/np04_data/ProtoDUNE_HD_APA_maps.py



111-45

111-22

58

59

111-47

111-20

48

49

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Thank you!!

