

Attenuation Analysis

Kyle Spurgeon
Syracuse University

Summary

Background/Motivation

The Analysis process

Results to now

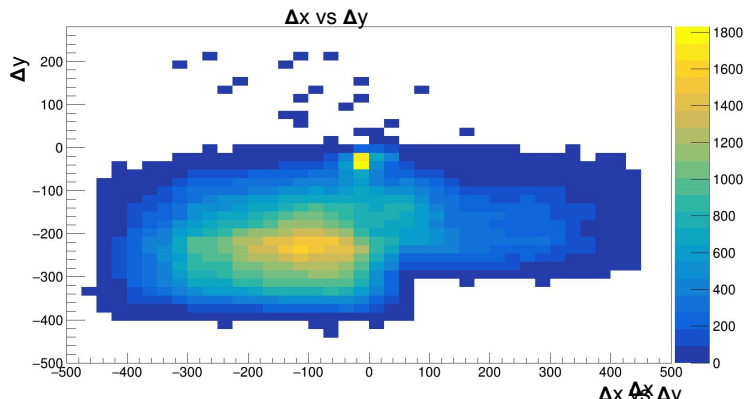
Xenon Cosmics runs

Backgrounds and Motivations

- Bryan has made a very good (pseudo)attenuation measurement using ProtoDUNE data and pure LAr using the ARAPUCA in APA6
- With the introduction of Xenon, a revamped analysis would be great!
 - Look into Xenon, but also carry over Attenuation analysis to Nitrogen Contamination runs
-

The Analysis

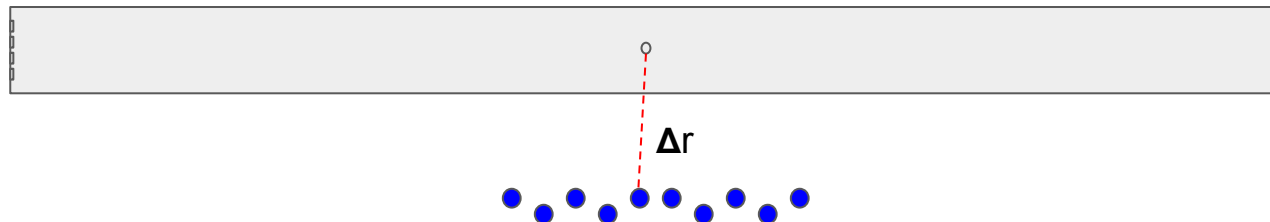
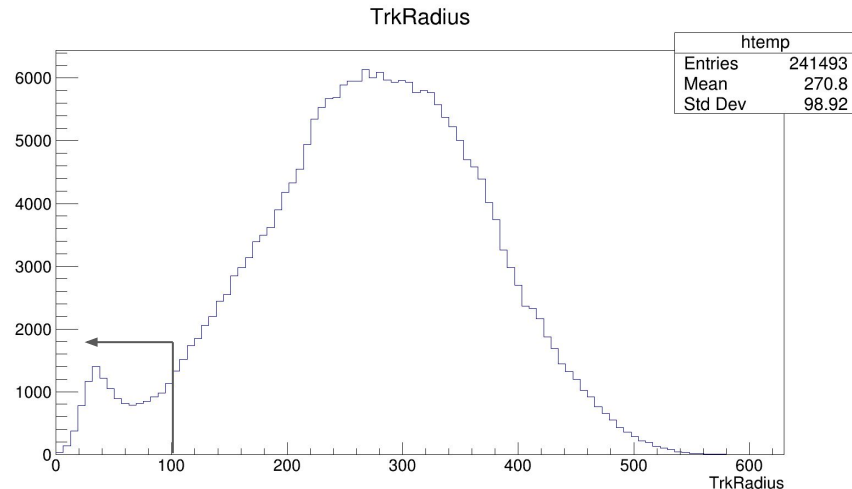
- Get through-going cosmics, preferably parallel travelling ones
- Use Richie's CRT-TPC matching producer.
 - Possibility of strip level accuracy from CRT
 - Matched to TPC tracks with high accuracy
 - Time Matched!
- Once tracks are matched to the CRT, we can match the PDS too
- High Quality, well matched TPC - PDS pairs



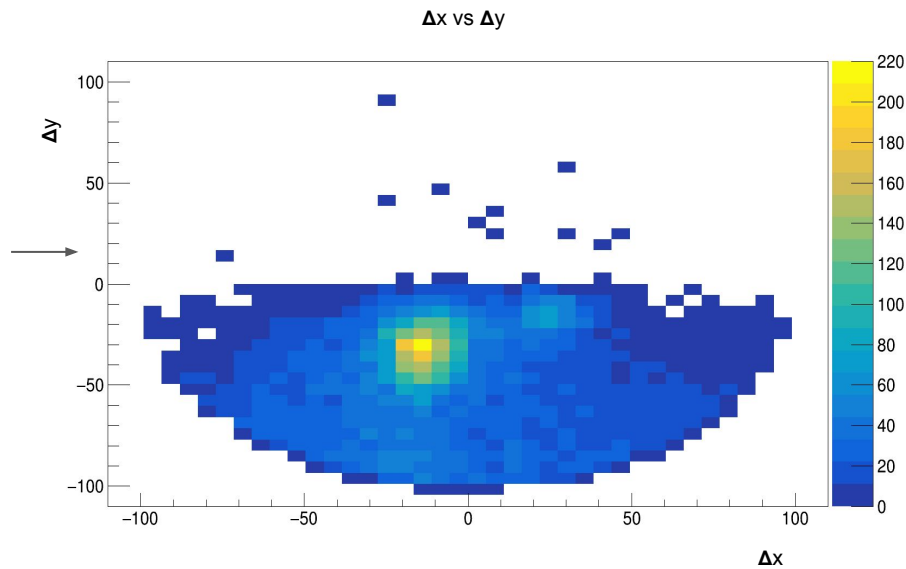
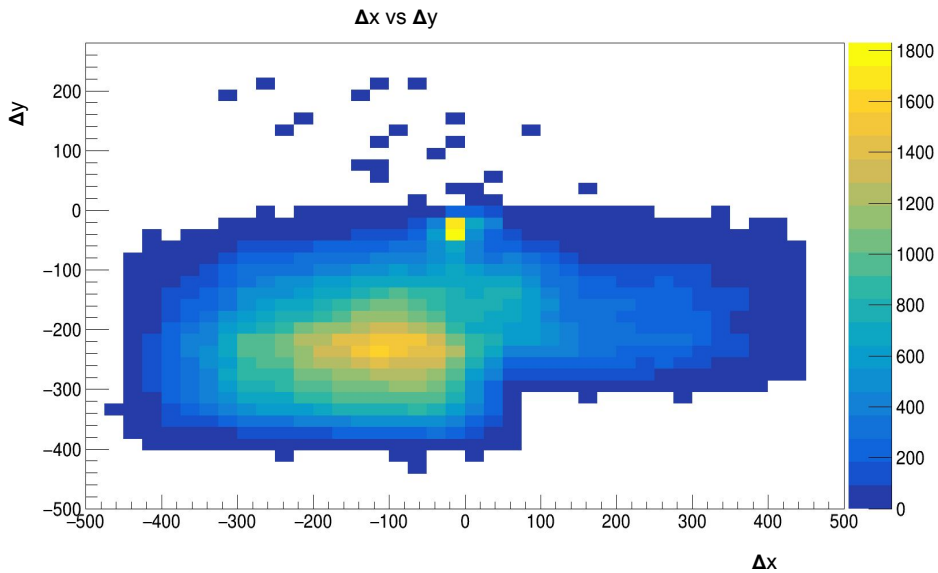
The Analysis

Once time matched:

- Cut on track parallelness
- Collect OpHits within ± 2 mus of CRT
- Calculate radial distance from PDS module to track
 - Center of the PDS module
 - Track hit point whose Z position most closely matches PDS center



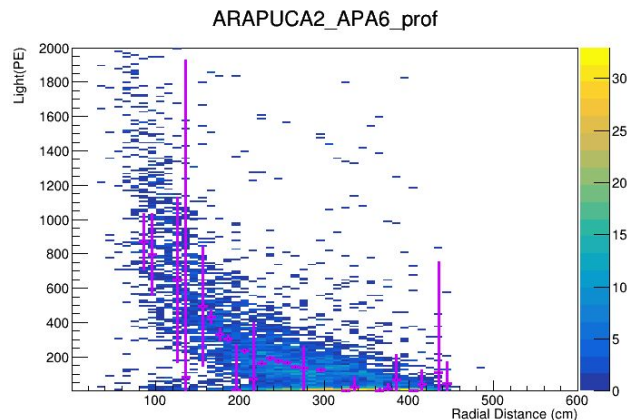
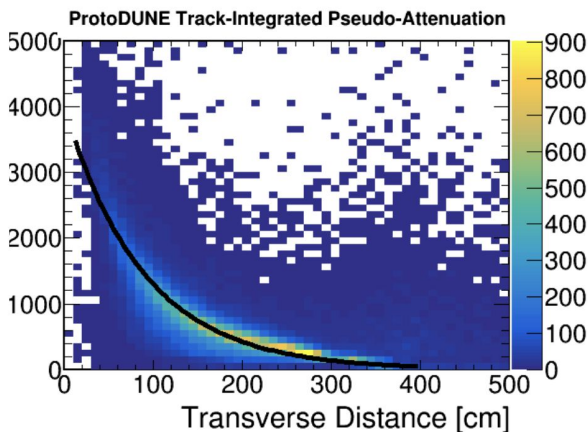
Track radial travel cut



The Analysis

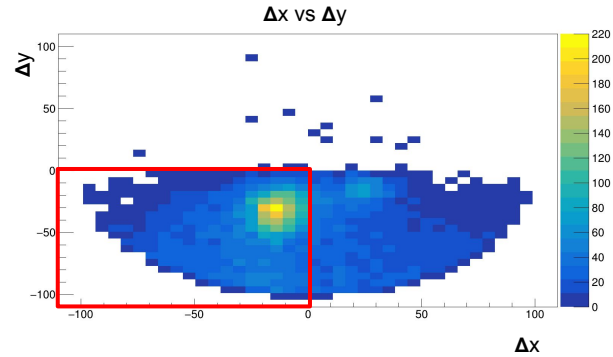
Updates from Bryan's measurement

- Implementation of Richie's module - increases accuracy
- Perform the analysis on the IU Double Shift Light guides instead (also)
 - Perform the analysis on each IU module, also group by sensor type
 - More Detector Coverage, more statistics



We know most of our statistics are non-beam (DAQ) side - so look there

Two sensor types on whole wall



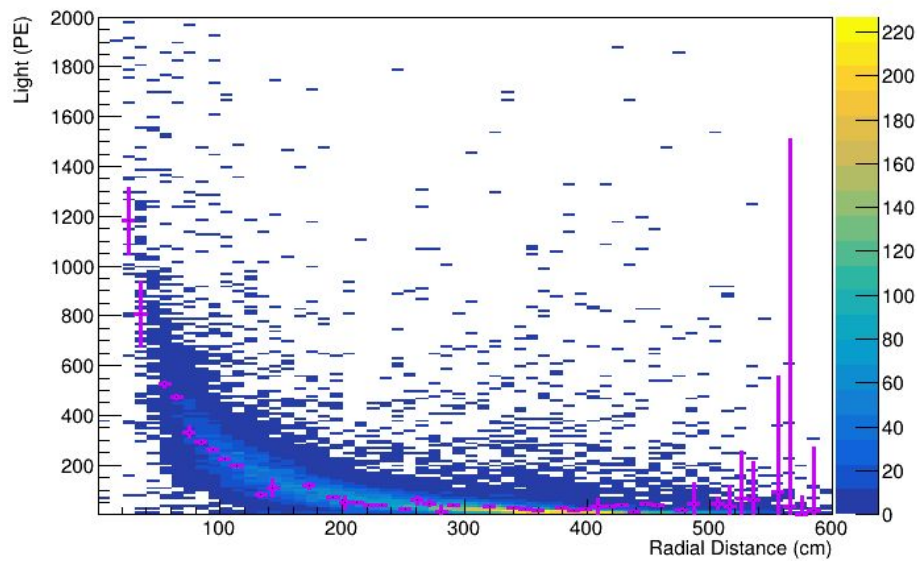
USDaS					
PD Module	HB	SSP	SSPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IU54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IU19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IU26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IU48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IU47	SensL-C1	SSP502	0-3	204	207

MSDaS					
PD Module	HB	SSP	SSPch	DAQch	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IU22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IU09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
ARAPUCA-2	Hamamatsu	SSP603	0-3	264	267
		SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IU01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IU02	Hamamatsu	SSP604	8-11	284	287

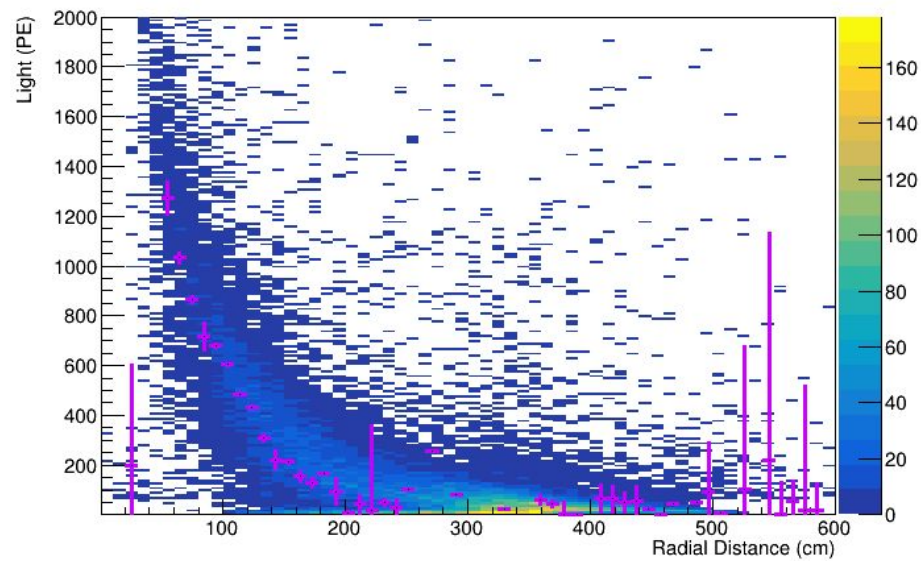
DSDaS					
PD Module	HB	SSP	SSPch	DAQch	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IU50	SensL-C1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IU27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IU37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IU53	SensL-C1	SSP403	4-7	172	175
002-0038-IU35	SensL-C1	SSP403	8-11	176	179
002-0040-FLP06*	SensL-C1	SSP404	0-3	180	183

Results

DS_Sensl_C1



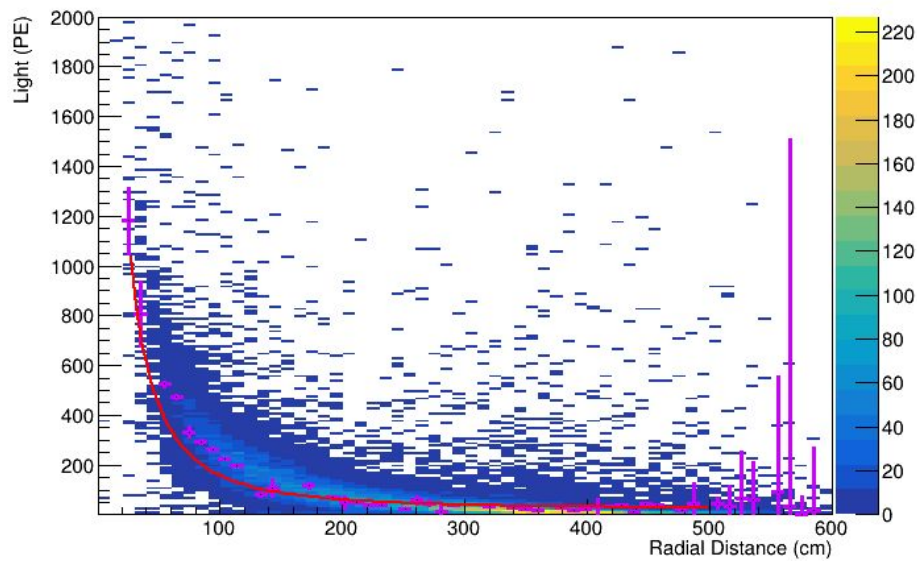
DS_hamamatsu



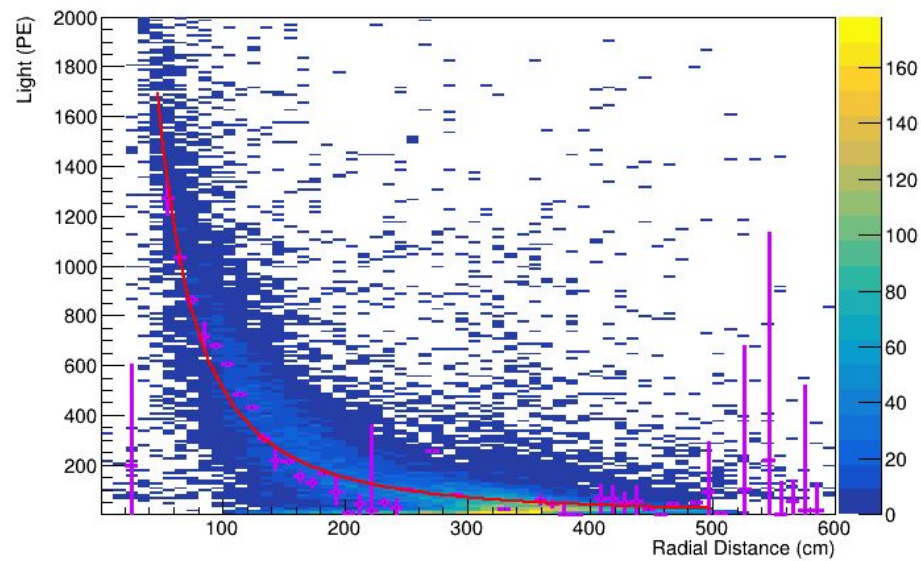
Results

$$\text{Fit} = C + A(x+B)^{-2}$$

DS_Sensl_C1



DS_hamamatsu



Moving Forward

Two big things:

Repeat Measurement in the presence of Nitrogen - very in progress

Get a set of cosmic runs with Xenon present

Need dedicated runs on the order of a week

Would prefer certain pixel pairs

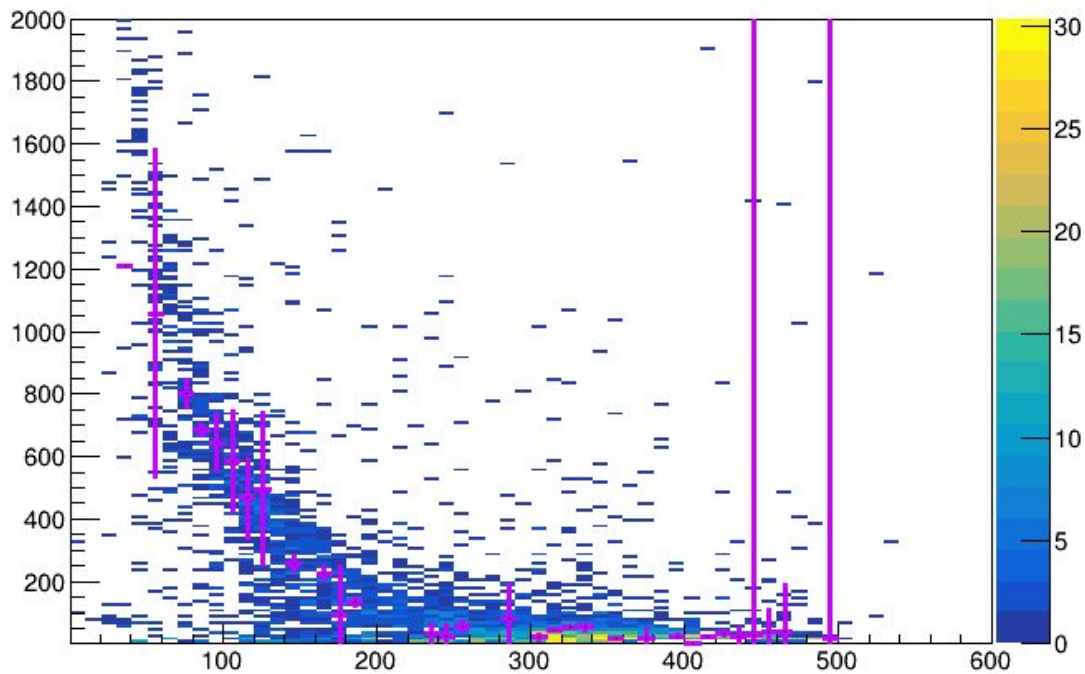
APA5

IU54_DS_APA5

USDs					
PD Module	HB	SEP	SEPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
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002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

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PD Module	HB	SSPch	SEPch	DAQch	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
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002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

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002-0044-IJ50	SensL-C1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



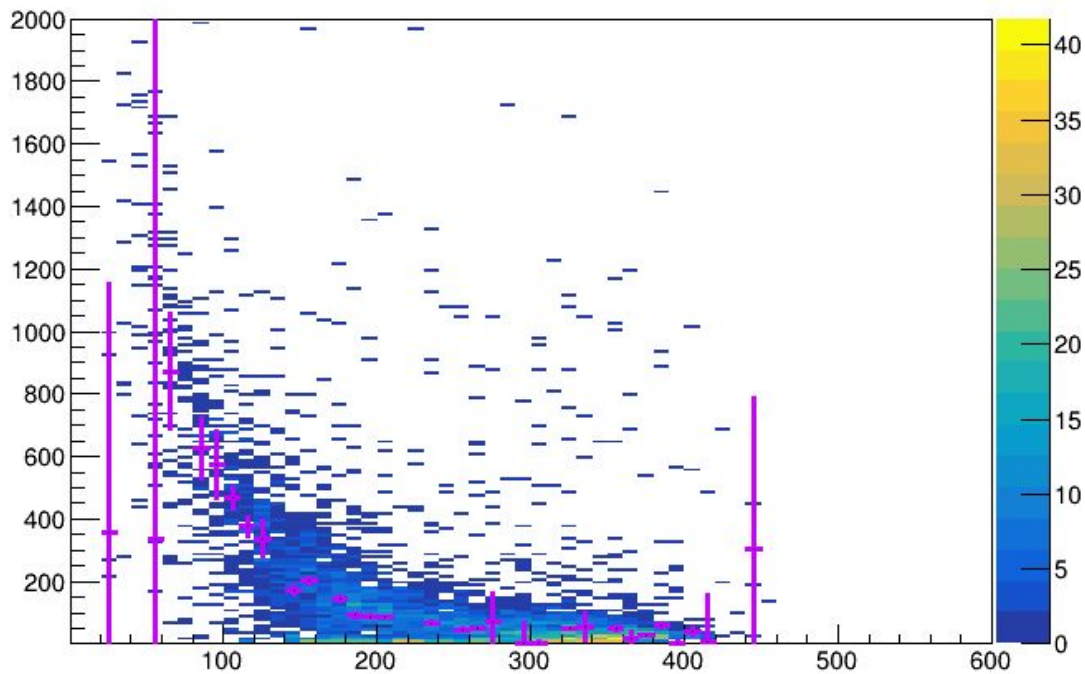
APA5

IU19_DS_APA5

USDS				
PD Module	HB	SEP	SEPch	DAQch
002-0047-FL34	Hamamatsu	SSP503	0-3	216 219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220 223
002-0058-FL24	Hamamatsu	SSP503	8-11	224 227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228 231
003-0026-FL07*	SensL-C1	SSP501	0-3	192 195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232 235
003-0024-FL33	SensL-C1	SSP501	4-7	196 199
003-0004-IJ48	SensL-C1	SSP501	8-11	200 203
002-0041-FL36	Hamamatsu	SSP504	8-11	236 239
002-0036-IJ47	SensL-C1	SSP502	0-3	204 207

MSDs				
PD Module	HB	SSPch	DAQch	
002-0002-FL22	Hamamatsu	SSP601	0-3	240 243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244 247
002-0059-FL08	Hamamatsu	SSP601	8-11	248 251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252 255
002-0060-FL39	Hamamatsu	SSP602	4-7	256 259
		SSP603	0-3	264 267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268 271
		SSP603	8-11	272 275
002-0055-FL40	Hamamatsu	SSP602	8-11	260 263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276 279
002-0011-FL15	Hamamatsu	SSP604	4-7	280 283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284 287

DSdS				
PD Module	HB	SEP	SEPch	DAQch
001-0003-FL01	SensL-C1	SSP401	0-3	144 147
002-0044-IJ50	SensL-A1	SSP401	4-7	148 151
002-0039-FL29	SensL-A1	SSP401	8-11	152 155
003-0002-IJ27	SensL-C1	SSP402	0-3	156 159
002-0025-FL25	SensL-C1	SSP402	4-7	160 163
003-0011-IJ37	SensL-C1	SSP402	8-11	164 167
003-0048-FL42	SensL-C1	SSP403	0-3	168 171
002-0023-IJ53	SensL-C1	SSP403	4-7	172 175
002-0038-IJ35	SensL-C1	SSP403	8-11	176 179
002-0040-FL06*	SensL-C1	SSP404	0-3	180 183



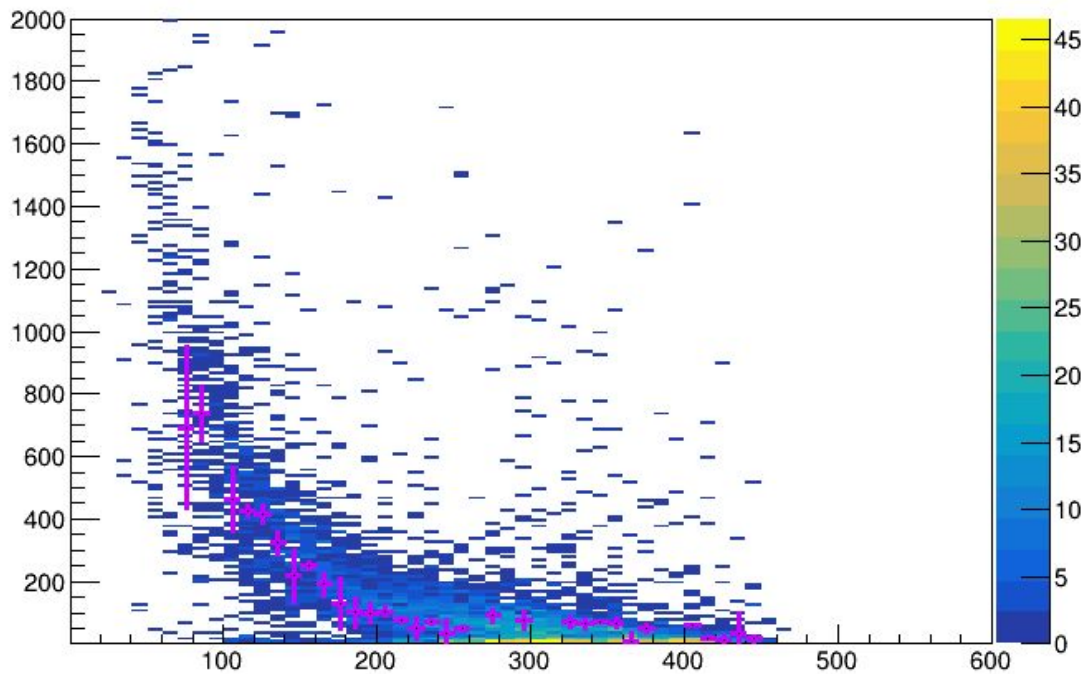
APA5

IU26_DS_APA5

USDSs					
PD Module	HB	SEP	SEPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDSs					
PD Module	HB	SSP	SEPh	DAQh	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDSs					
PD Module	HB	SEP	SEPh	DAQh	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



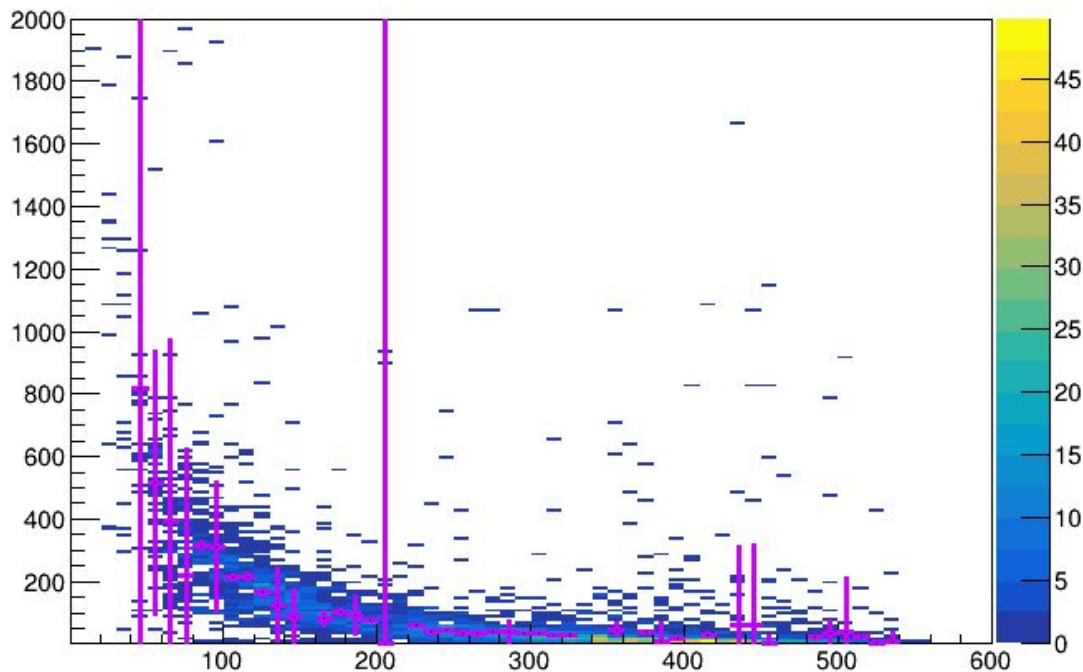
APA5

IU48_DS_APA5

USDs					
PD Module	HB	SEP	SEPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs					
PD Module	HB	SSPch	SEPch	DAQch	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDs					
PD Module	HB	SEP	SEPch	DAQch	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



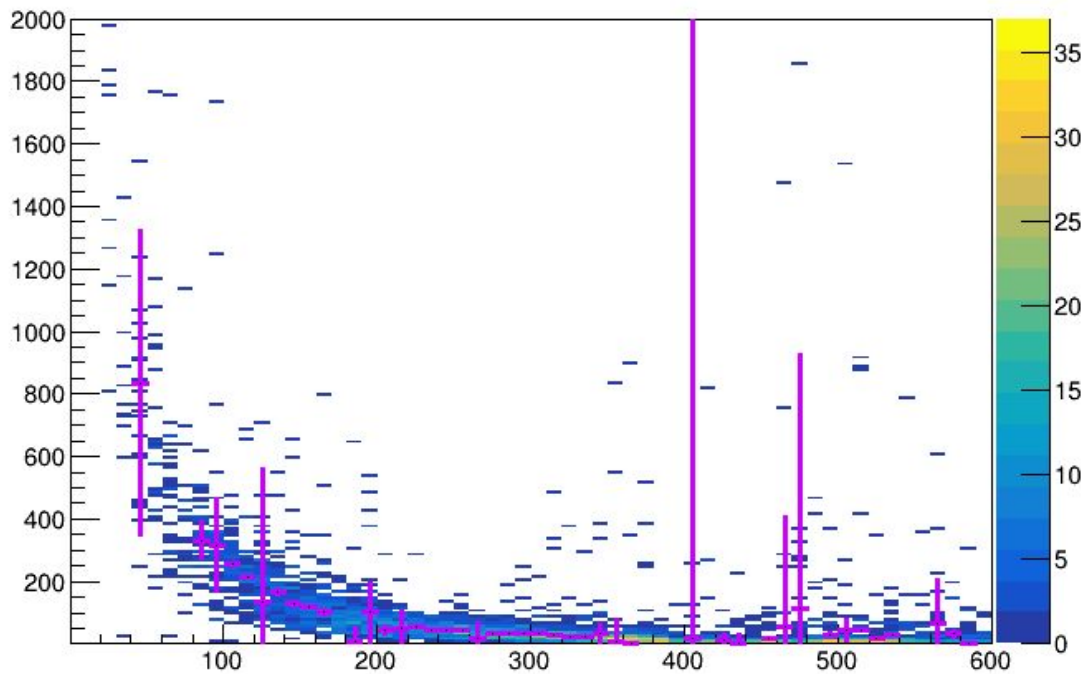
APA5

IU47_DS_APA5

USDs				
PD Module	HB	SEP	SEPch	DAQch
002-0047-FL34	Hamamatsu	SSP503	0-3	216 219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220 223
002-0058-FL24	Hamamatsu	SSP503	8-11	224 227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228 231
003-0026-FL07*	SensL-C1	SSP501	0-3	192 195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232 235
003-0024-FL33	SensL-C1	SSP501	4-7	196 199
003-0004-IJ48	SensL-C1	SSP501	8-11	200 203
002-0041-FL36	Hamamatsu	SSP504	8-11	236 239
002-0036-IJ47	SensL-C1	SSP502	0-3	204 207

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PD Module	HB	SSPch	DAQch	
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002-0020-IJ09	Hamamatsu	SSP602	0-3	252 255
002-0060-FL39	Hamamatsu	SSP602	4-7	256 259
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003-0002-IJ27	SensL-C1	SSP402	0-3	156 159
002-0025-FL25	SensL-C1	SSP402	4-7	160 163
003-0011-IJ37	SensL-C1	SSP402	8-11	164 167
003-0048-FL42	SensL-C1	SSP403	0-3	168 171
002-0023-IJ53	SensL-C1	SSP403	4-7	172 175
002-0038-IJ35	SensL-C1	SSP403	8-11	176 179
002-0040-FL06*	SensL-C1	SSP404	0-3	180 183



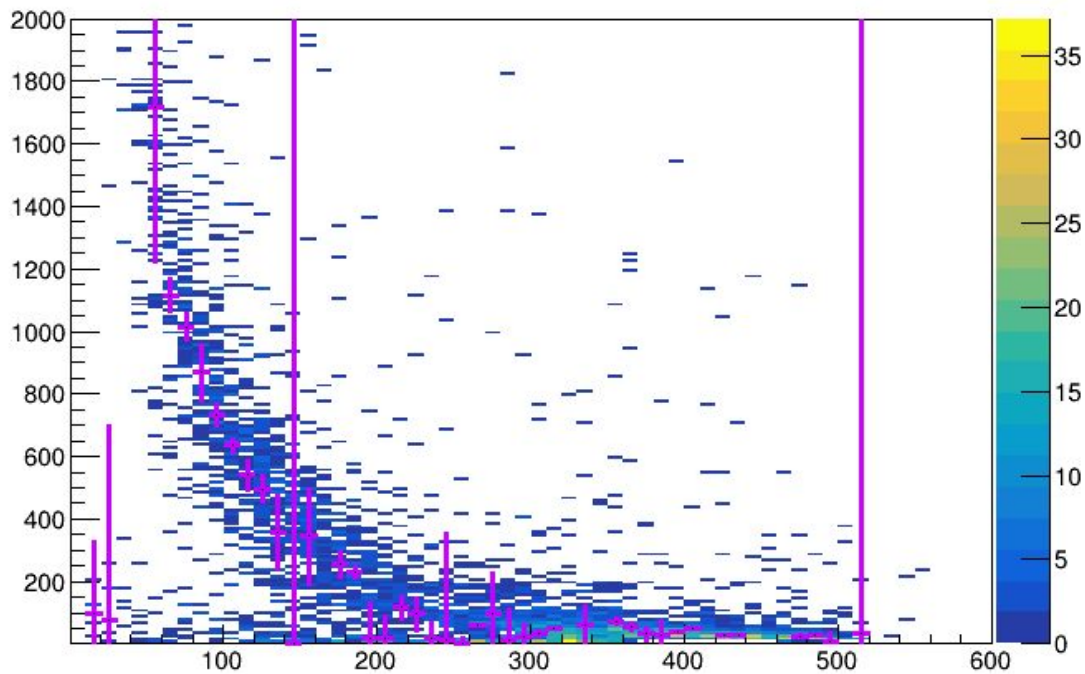
APA6

IU22_DS_APA6

US2us					
PD Module	HB	SEP	SEPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
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003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



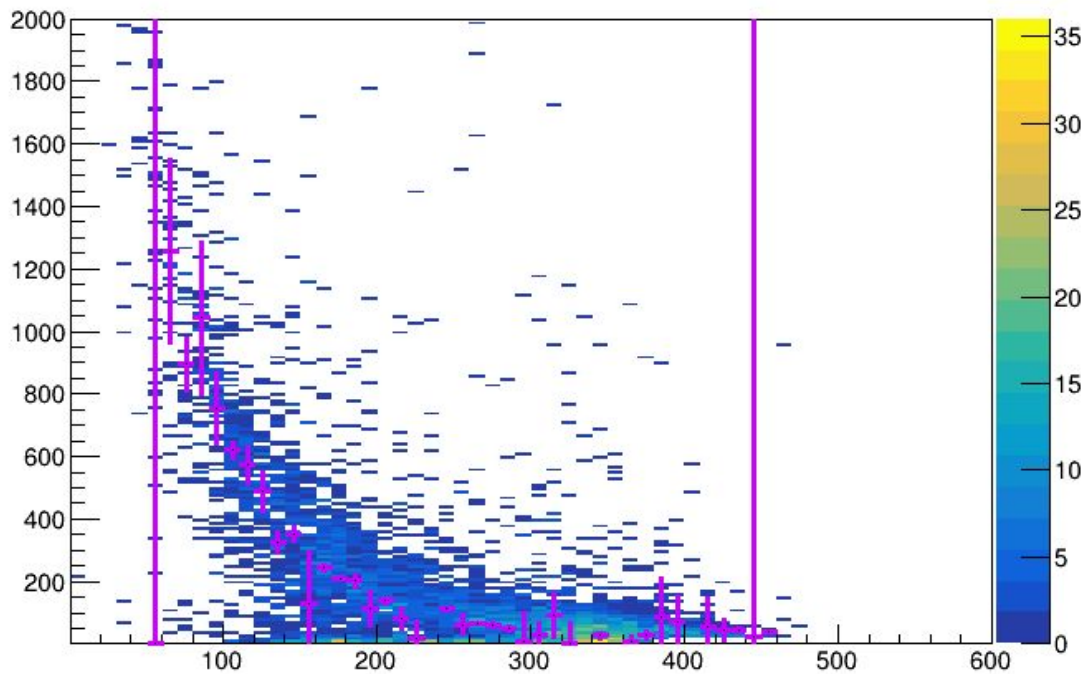
APA6

IU09_DS_APA6

USDs4					
PD Module	HB	SEP	SEPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs4					
PD Module	HB	SSP	SEPh	DAQh	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDs4					
PD Module	HB	SEP	SEPh	DAQh	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



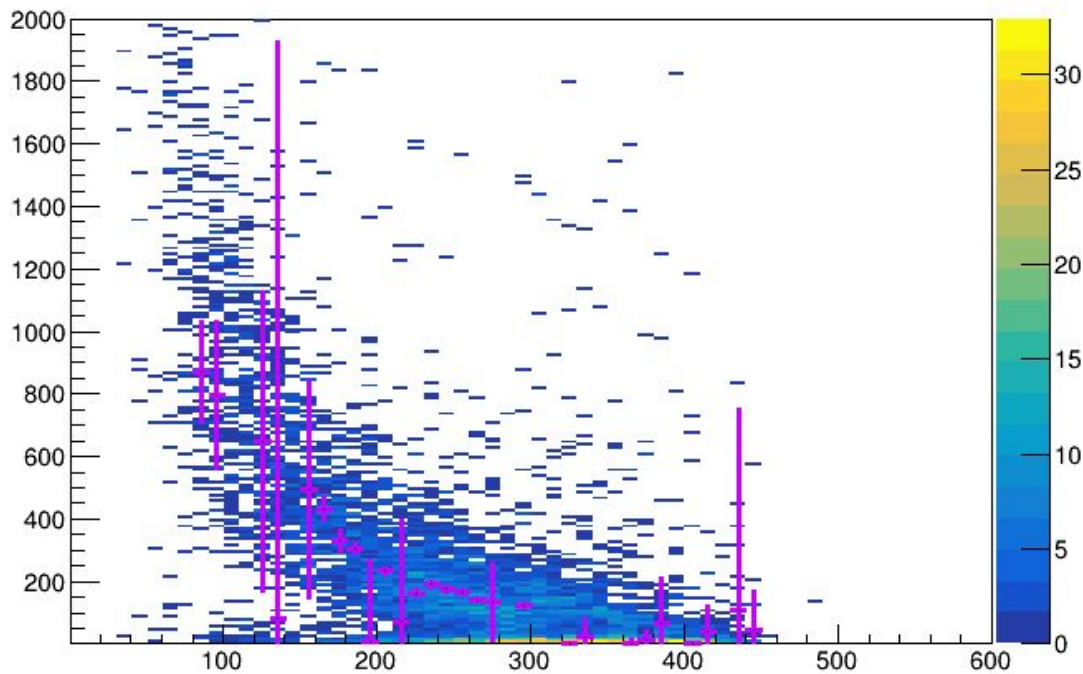
APA6

ARAPUCA2_APA6

USDs					
PD Module	HB	SSP	SSPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs					
PD Module	HB	SSP	SSPh	DAQh	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
ARAPUCA-2	Hamamatsu	SSP603	0-3	264	267
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDs					
PD Module	HB	SSP	SSPh	DAQh	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-C1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



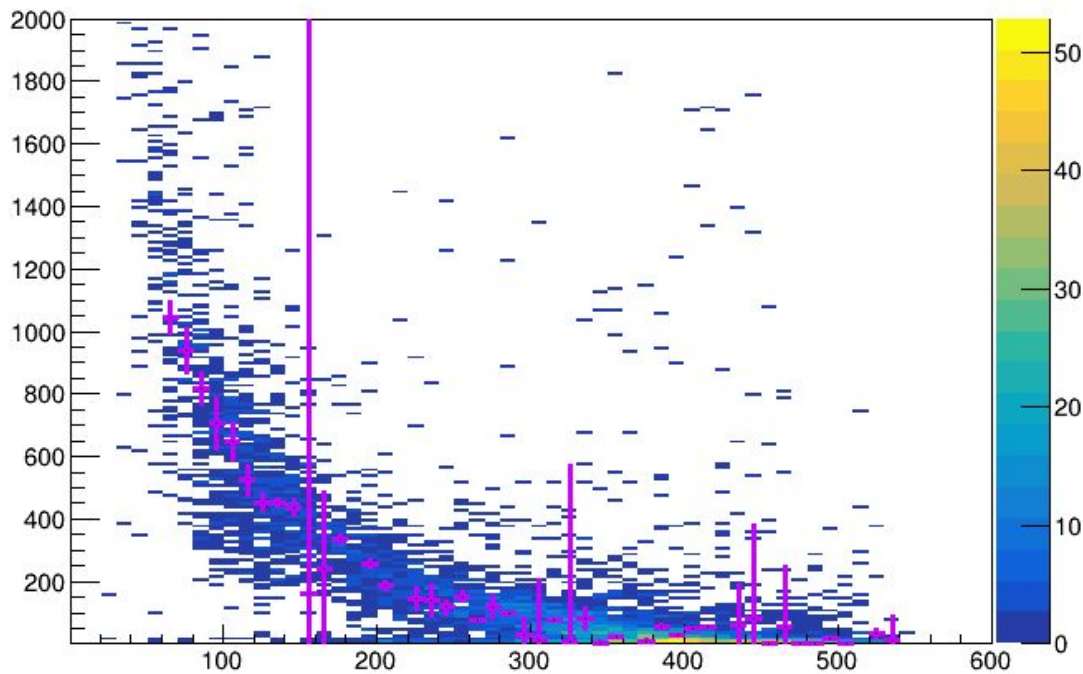
APA6

IU01_DS_APA6

USDSx					
PD Module	HB	SEP	SEPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDSx					
PD Module	HB	SEP	SEPch	DAQch	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDSx					
PD Module	HB	SEP	SEPch	DAQch	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



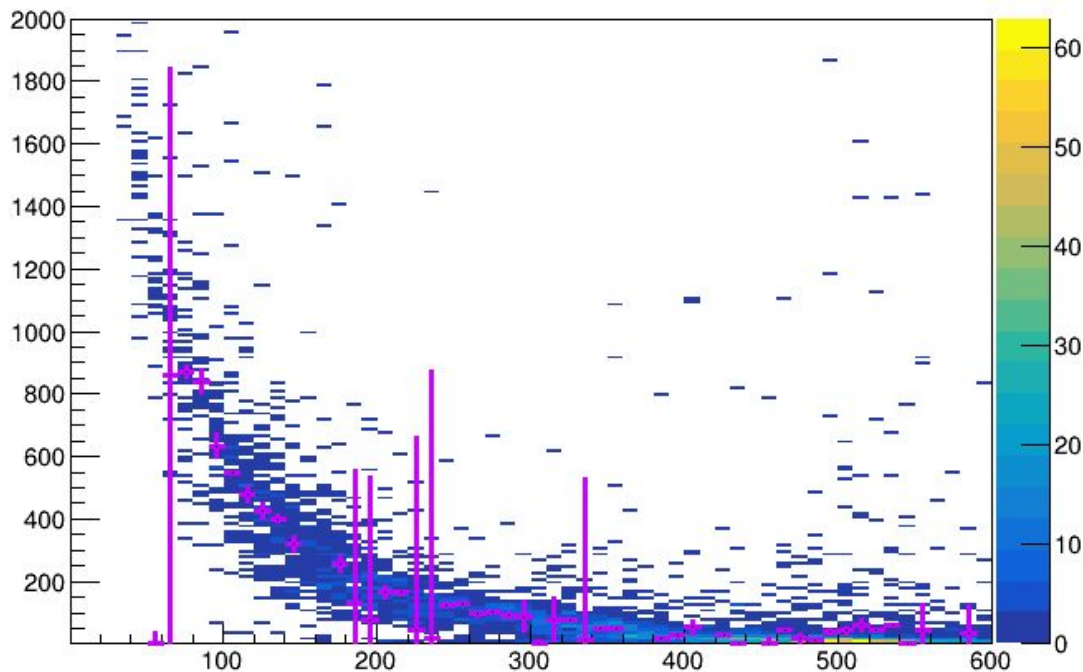
APA6

IU02_DS_APA6

USDs					
PD Module	HB	SEP	SEPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs					
PD Module	HB	SEP	SEPh	DAQh	
002-0002-IJ22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSsDs					
PD Module	HB	SEP	SEPh	DAQh	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



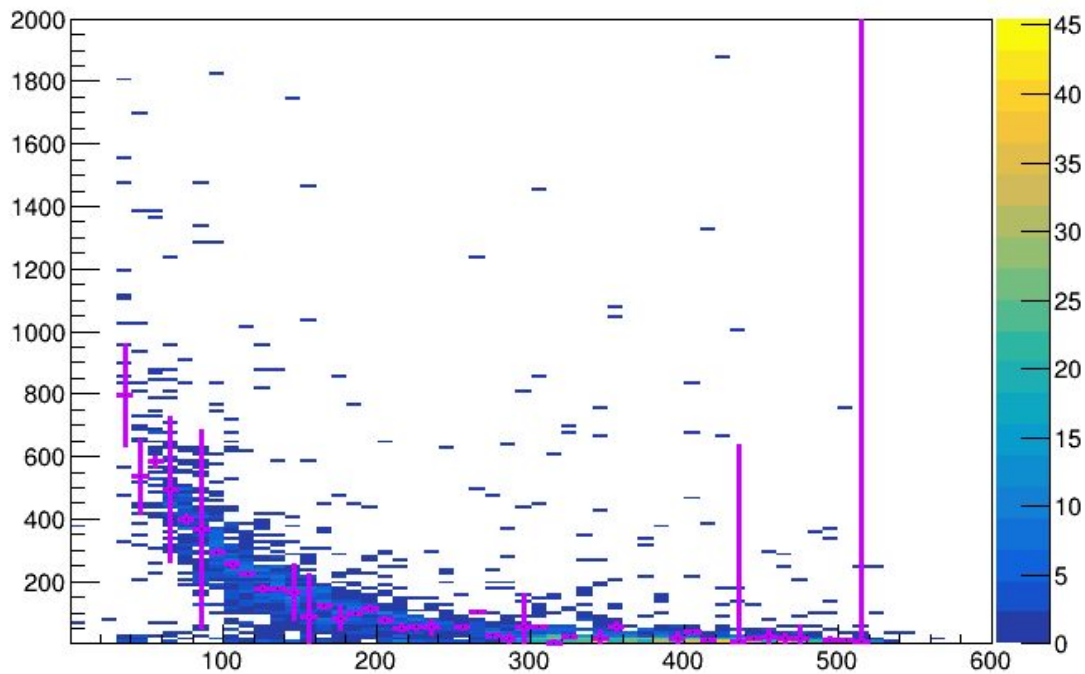
APA4

IU50_DS_APA4

USDs					
PD Module	HB	SSP	SSPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IU54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IU19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	Sensl-C1	SSP501	0-3	192	195
002-0014-IU26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	Sensl-C1	SSP501	4-7	196	199
003-0004-IU48	Sensl-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IU47	Sensl-C1	SSP502	0-3	204	207

MSDs					
PD Module	HB	SSP	SSPh	DAQh	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IU22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IU09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IU01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IU02	Hamamatsu	SSP604	8-11	284	287

DSDs					
PD Module	HB	SSP	SSPh	DAQh	
001-0003-FL01	Sensl-C1	SSP401	0-3	144	147
002-0044-IU50	Sensl-C1	SSP401	4-7	148	151
002-0039-FL29	Sensl-A1	SSP401	8-11	152	155
003-0002-IU27	Sensl-C1	SSP402	0-3	156	159
002-0025-FL25	Sensl-C1	SSP402	4-7	160	163
003-0011-IU37	Sensl-C1	SSP402	8-11	164	167
003-0048-FL42	Sensl-C1	SSP403	0-3	168	171
002-0023-IU53	Sensl-C1	SSP403	4-7	172	175
002-0038-IU35	Sensl-C1	SSP403	8-11	176	179
002-0040-FL06*	Sensl-C1	SSP404	0-3	180	183



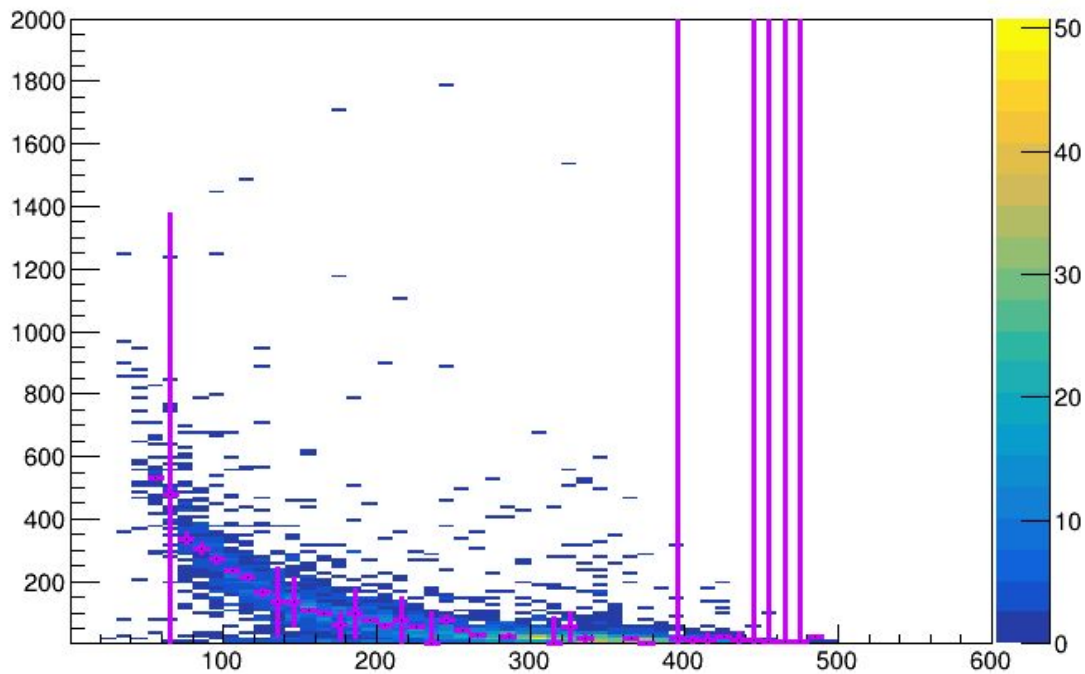
APA4

IU27_DS_APA4

USBus					
PD Module	HB	SEP	SEPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	Sensl-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	Sensl-C1	SSP501	4-7	196	199
003-0004-IJ48	Sensl-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	Sensl-C1	SSP502	0-3	204	207

MSBus					
PD Module	HB	SSP	SEPh	DAQh	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSBus					
PD Module	HB	SEP	SEPh	DAQh	
001-0003-FL01	Sensl-C1	SSP401	0-3	144	147
002-0044-IJ50	Sensl-C1	SSP401	4-7	148	151
002-0039-FL29	Sensl-A1	SSP401	8-11	152	155
003-0002-IJ27	Sensl-C1	SSP402	0-3	156	159
002-0025-FL25	Sensl-C1	SSP402	4-7	160	163
003-0011-IJ37	Sensl-C1	SSP402	8-11	164	167
003-0048-FL42	Sensl-C1	SSP403	0-3	168	171
002-0023-IJ53	Sensl-C1	SSP403	4-7	172	175
002-0038-IJ35	Sensl-C1	SSP403	8-11	176	179
002-0040-FL06*	Sensl-C1	SSP404	0-3	180	183



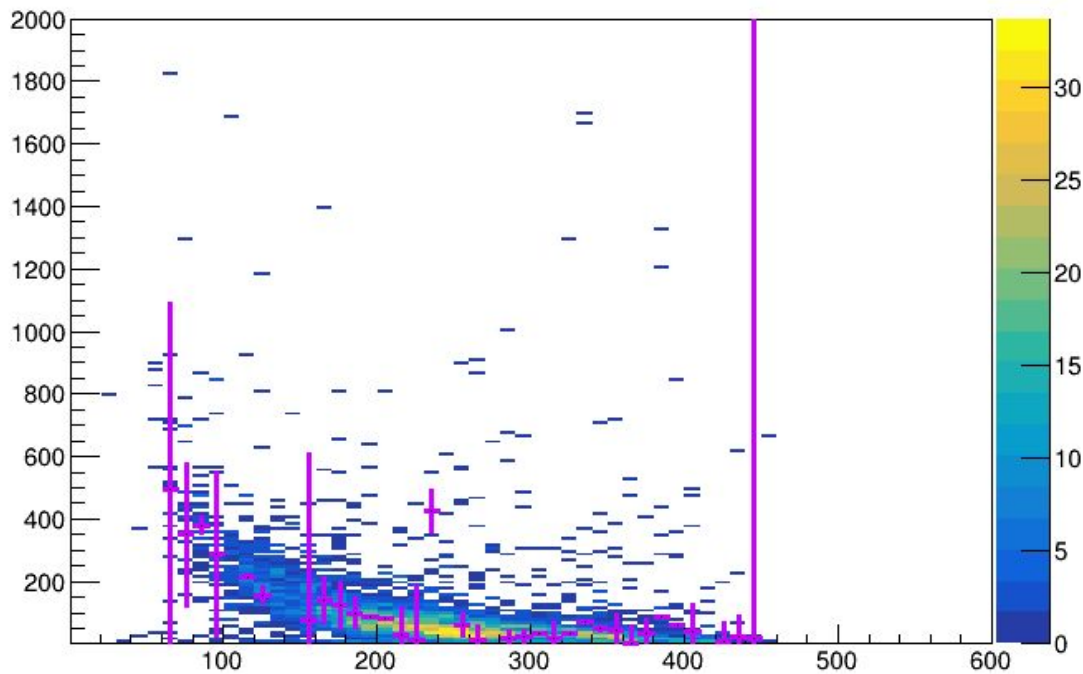
APA4

IU37_DS_APA4

USDs					
PD Module	HB	SEP	SEPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs					
PD Module	HB	SSPch	DAQch		
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDs					
PD Module	HB	SEP	SEPch	DAQch	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



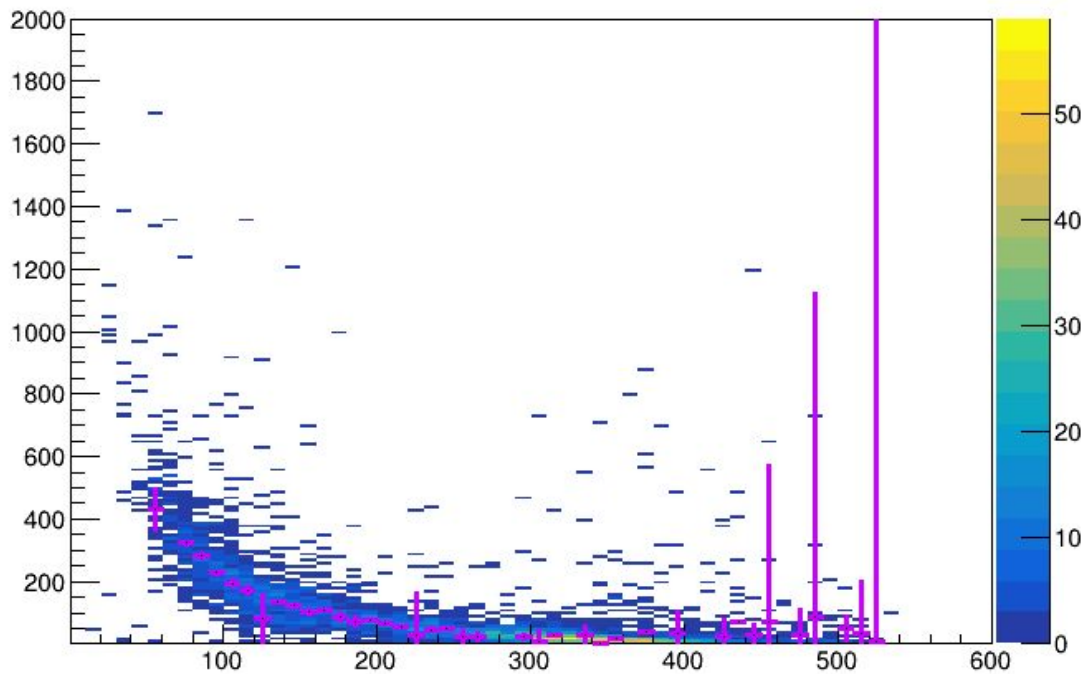
APA4

IU53_DS_APA4

IU53a					
PD Module	HB	SEP	SEPch	DAQch	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs					
PD Module	HB	SEP	SEPch	DAQch	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDs					
PD Module	HB	SEP	SEPch	DAQch	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0013-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183



APA4

IU35_DS_APA4

IU35ds					
PD Module	HB	SSP	SSPh	DAQh	
002-0047-FL34	Hamamatsu	SSP503	0-3	216	219
002-0008-IJ54	Hamamatsu	SSP503	4-7	220	223
002-0058-FL24	Hamamatsu	SSP503	8-11	224	227
002-0063-IJ19	Hamamatsu	SSP504	0-3	228	231
003-0026-FL07*	SensL-C1	SSP501	0-3	192	195
002-0014-IJ26	Hamamatsu	SSP504	4-7	232	235
003-0024-FL33	SensL-C1	SSP501	4-7	196	199
003-0004-IJ48	SensL-C1	SSP501	8-11	200	203
002-0041-FL36	Hamamatsu	SSP504	8-11	236	239
002-0036-IJ47	SensL-C1	SSP502	0-3	204	207

MSDs4					
PD Module	HB	SSP	SSPh	DAQh	
002-0002-FL22	Hamamatsu	SSP601	0-3	240	243
002-0054-IJ22	Hamamatsu	SSP601	4-7	244	247
002-0059-FL08	Hamamatsu	SSP601	8-11	248	251
002-0020-IJ09	Hamamatsu	SSP602	0-3	252	255
002-0060-FL39	Hamamatsu	SSP602	4-7	256	259
		SSP603	0-3	264	267
ABAPUCA-2	Hamamatsu	SSP603	4-7	268	271
		SSP603	8-11	272	275
002-0055-FL40	Hamamatsu	SSP602	8-11	260	263
002-0013-IJ01	Hamamatsu	SSP604	0-3	276	279
002-0011-FL15	Hamamatsu	SSP604	4-7	280	283
002-0031-IJ02	Hamamatsu	SSP604	8-11	284	287

DSDs4					
PD Module	HB	SSP	SSPh	DAQh	
001-0003-FL01	SensL-C1	SSP401	0-3	144	147
002-0044-IJ50	SensL-A1	SSP401	4-7	148	151
002-0039-FL29	SensL-A1	SSP401	8-11	152	155
003-0002-IJ27	SensL-C1	SSP402	0-3	156	159
002-0025-FL25	SensL-C1	SSP402	4-7	160	163
003-0011-IJ37	SensL-C1	SSP402	8-11	164	167
003-0048-FL42	SensL-C1	SSP403	0-3	168	171
002-0023-IJ53	SensL-C1	SSP403	4-7	172	175
002-0038-IJ35	SensL-C1	SSP403	8-11	176	179
002-0040-FL06*	SensL-C1	SSP404	0-3	180	183

