First look at ICEBERG run 2B SSP data

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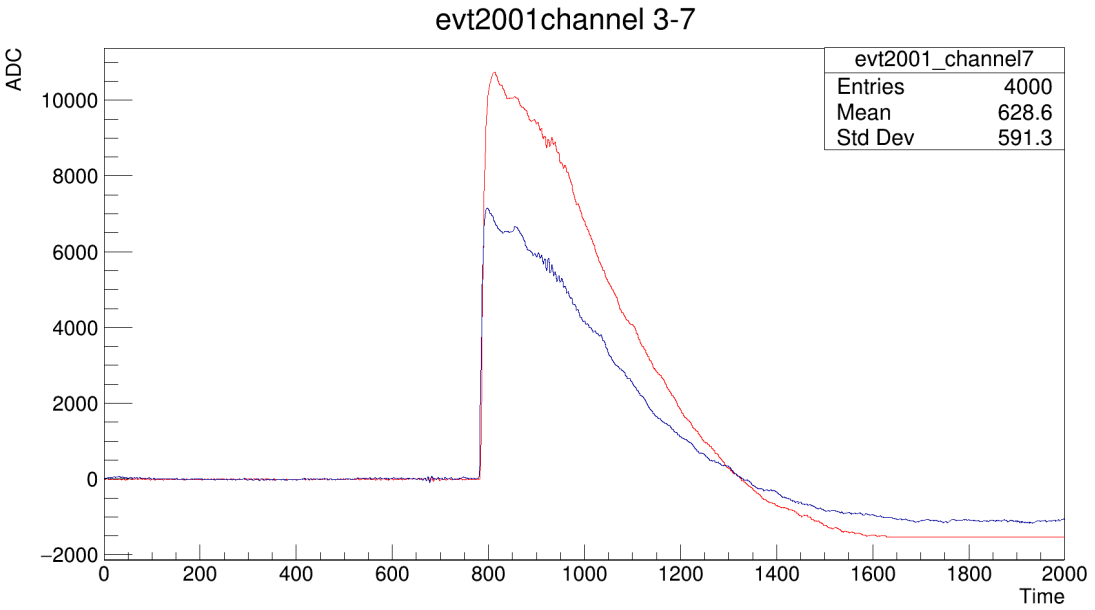
- First look at ICEBERG SSP data

- In this presentation we will show a first analysis about SSP data for ICEBERG related with pulse amplitude, time of the signal and the integral of the pulses. Here channel 3 is standard Arapuca (blue) and channel 7 is X-Arapuca (red).

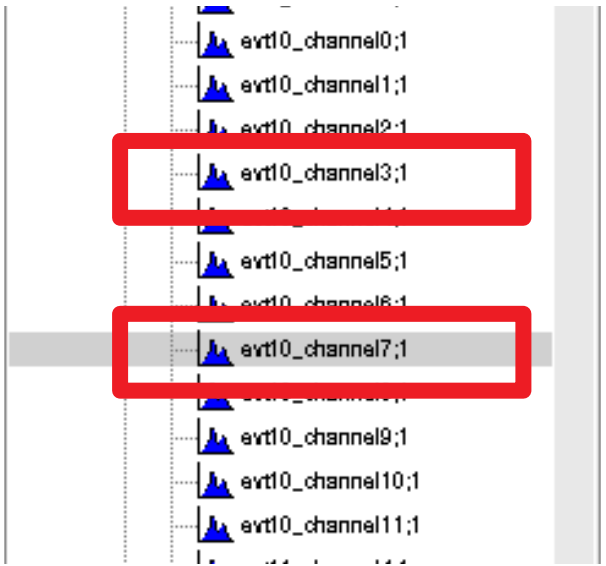
- Thanks to Bishu (CSU) for provide us the data location.



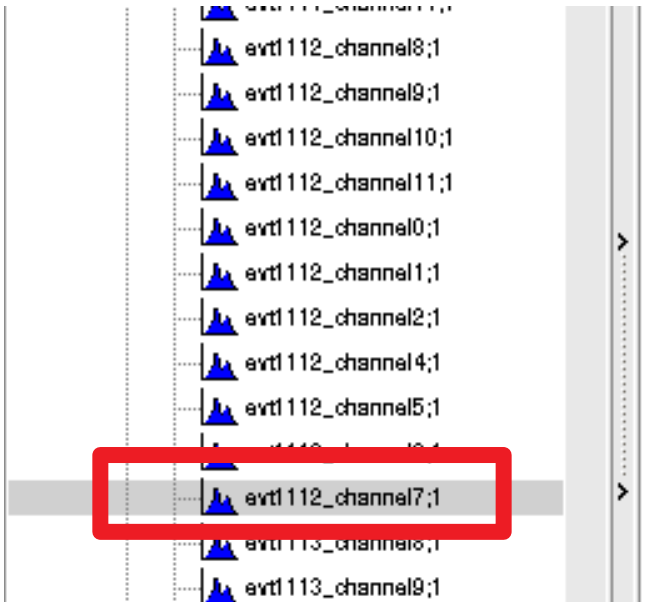
- Event selection

  For the event selection, we selected the pulses that were presents in channels 3 and 7 at the same event, if this file had a pulse just in one channel (3 or 7), we rejected this event.

Event accepted



Event rejected



- Event selection

  Next tables summarized all events used from the SSP files.

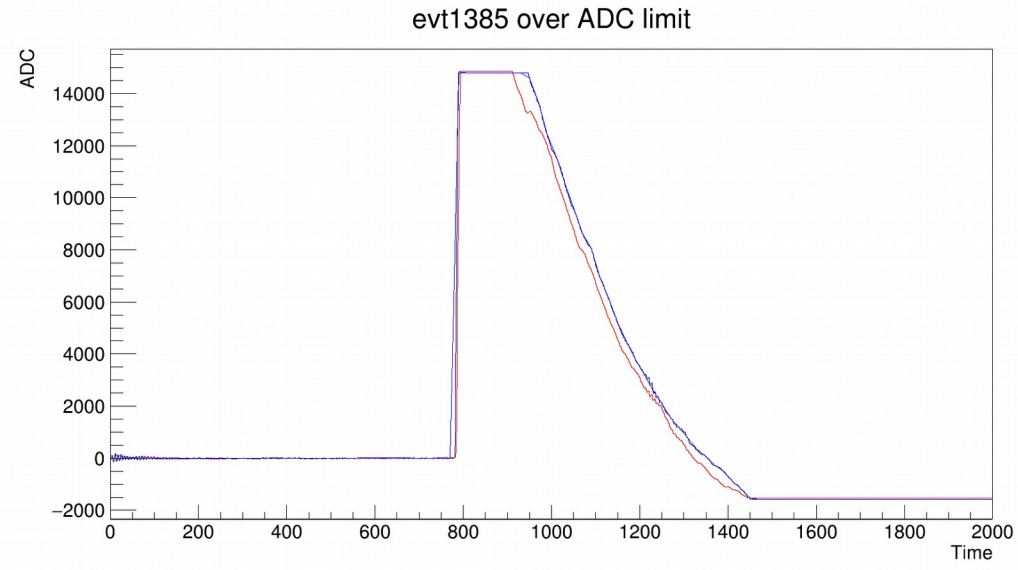
Run (48V - 4hours)	Total events	Coincidence events (ch3-ch7)
2305	2038	1325
2306	2002	1598
2307	2107	1723
2308	290	253
2309	94	82
2310	2023	1796
Total	8554	6777 (79%)

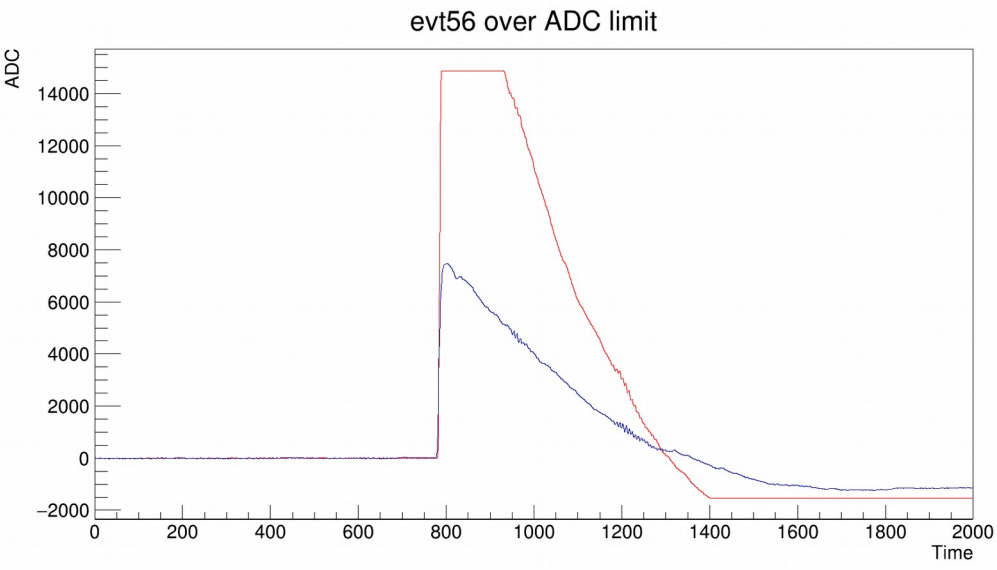
Run (48.5V – 2hours)	Total events	Coincidence events (ch3-ch7)
2311	2060	538
2312	2072	554
Total	4132	1092 (26%)

Run (47.5V – 2hours)	Total events	Coincidence events (ch3-ch7)
2313	2135	2011
2314	2017	1902
Total	4152	3913 (94%)

- Event selection

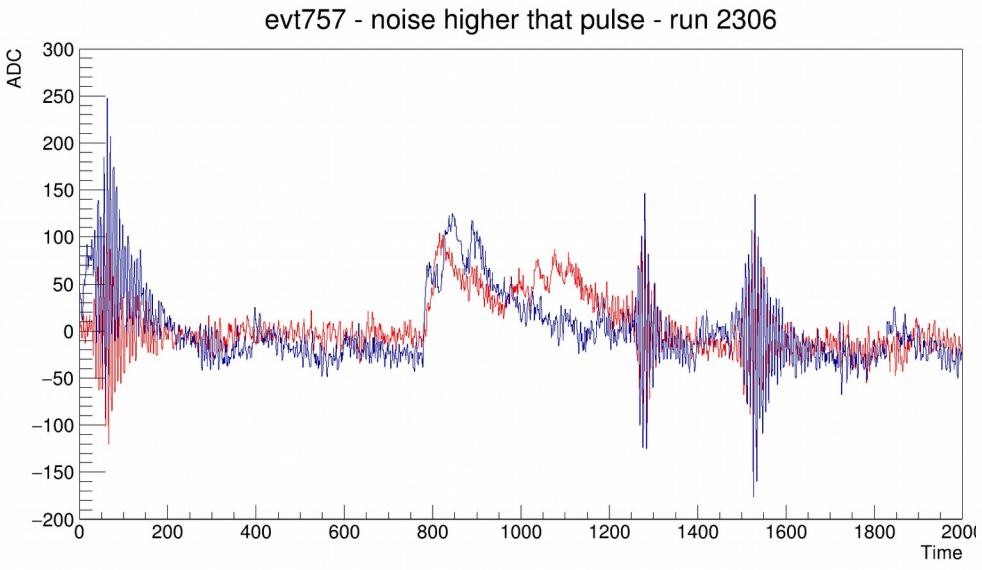
  Using the previous event selection, we saw events higher than the ADC window.

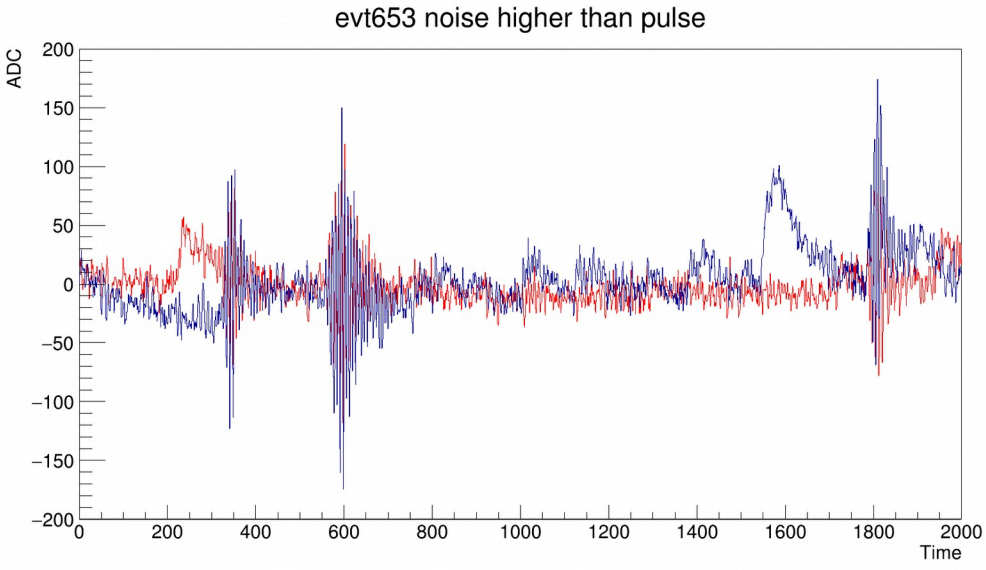




- Event selection

  Besides, we saw some events where noise is higher than the pulse.





- Event selection

  To avoid this kind of events, we did a cut in ADC values, for this first study, we selected only **pulse height** above 240 ADC and below 14100 ADC

Run (48V - 4hours)	Coincidence events (ch3-ch7)	After cut
2305	1325	1121
2306	1598	1398
2307	1723	1488
2308	253	218
2309	82	71
2310	1796	1560
Total	6777	5856 (86%)

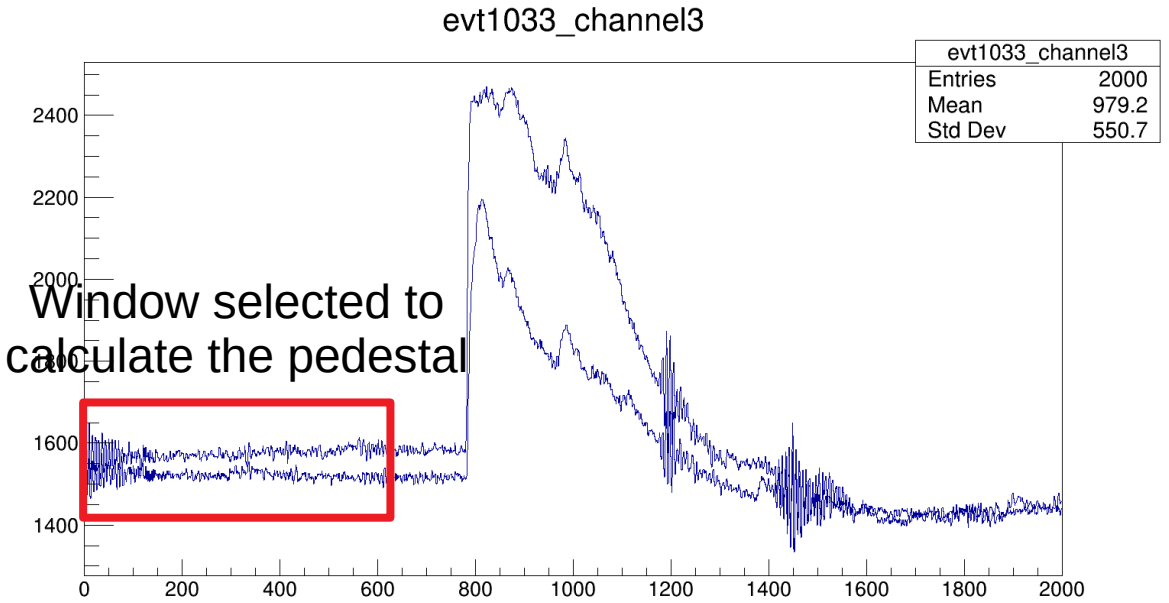
- Event selection

Run (48.5V - 2hours)	Coincidence events (ch3-ch7)	After cut
2311	538	428
2312	554	452
Total	1092	880 (80%)

Run (47.5V - 2hours)	Coincidence events (ch3-ch7)	After cut
2313	2011	1755
2314	1902	1645
Total	3913	3400 (86%)

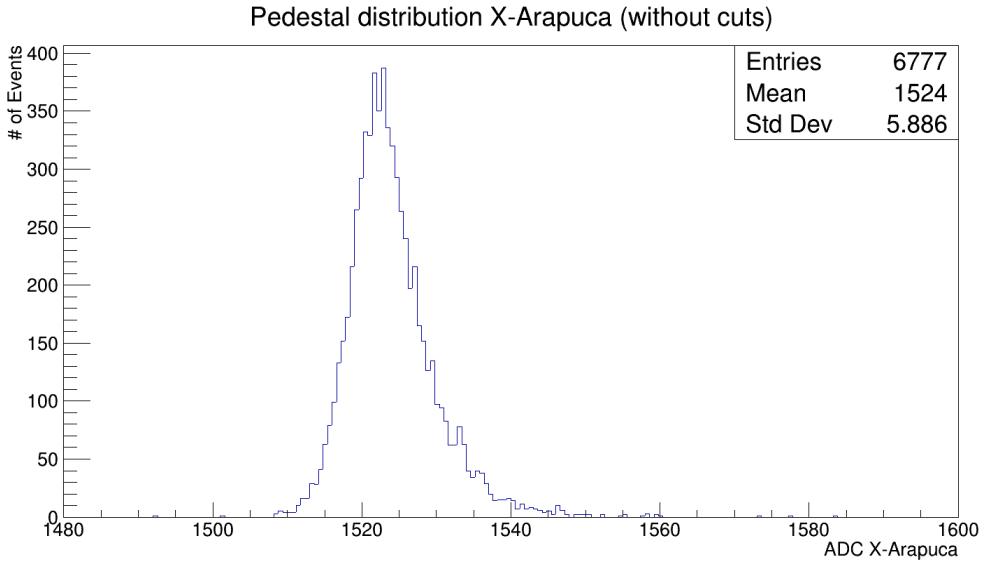
- Pulse analysis - Pedestal

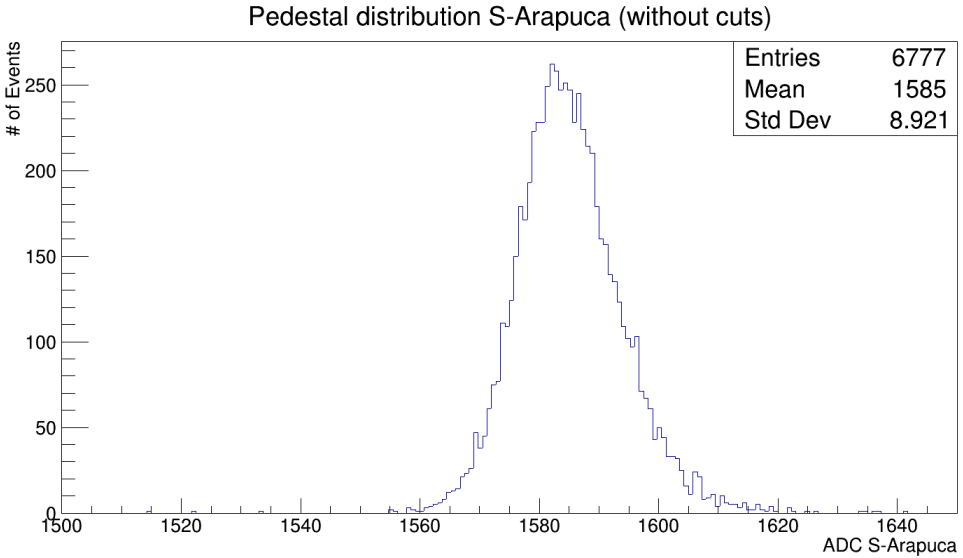
  Using the pulses selected after the ADC cut, we calculated the ADC pedestal for all pulses. The procedure was: for channel 3 and 7, we selected the ADC values below 600 time units, after that, we calculated the mean value for those ADC's and then we did a pedestal distribution of all pulses:



- Pulse analysis - Pedestal

  The pedestal distributions were calculated before the ADC cut.

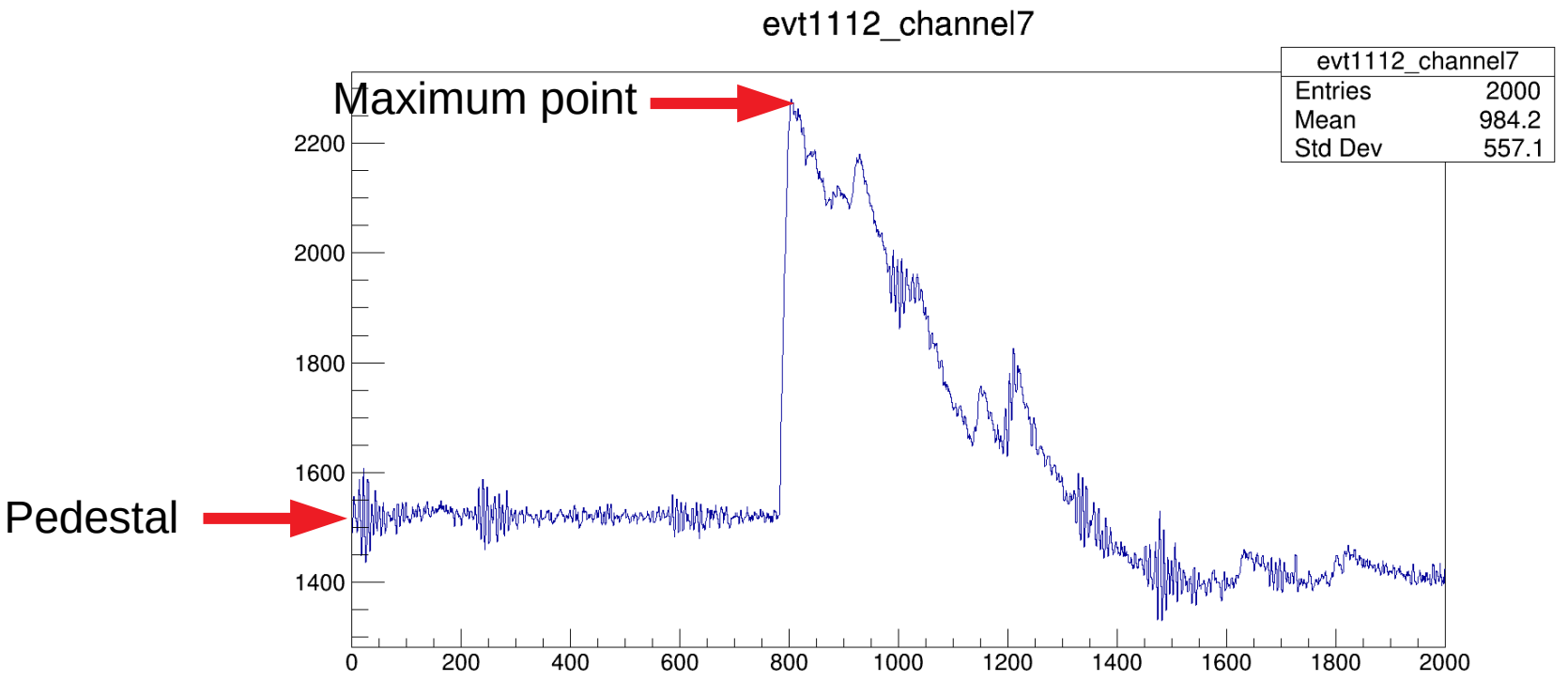




Based in those distributions, we set our pedestal: 1524 ADC for X-Arapuca and 1585 ADC for S-Arapuca

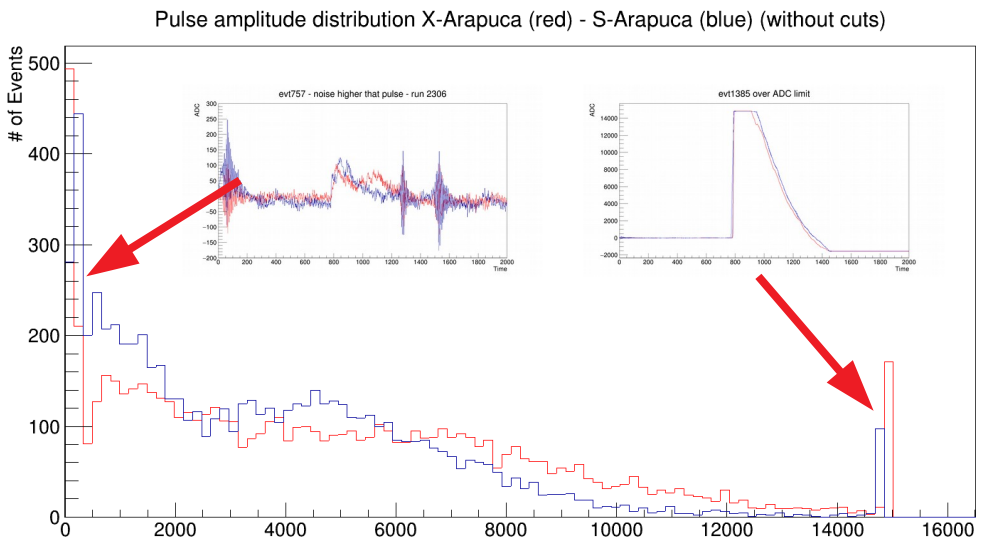
- Pulse analysis – Pulse Amplitude

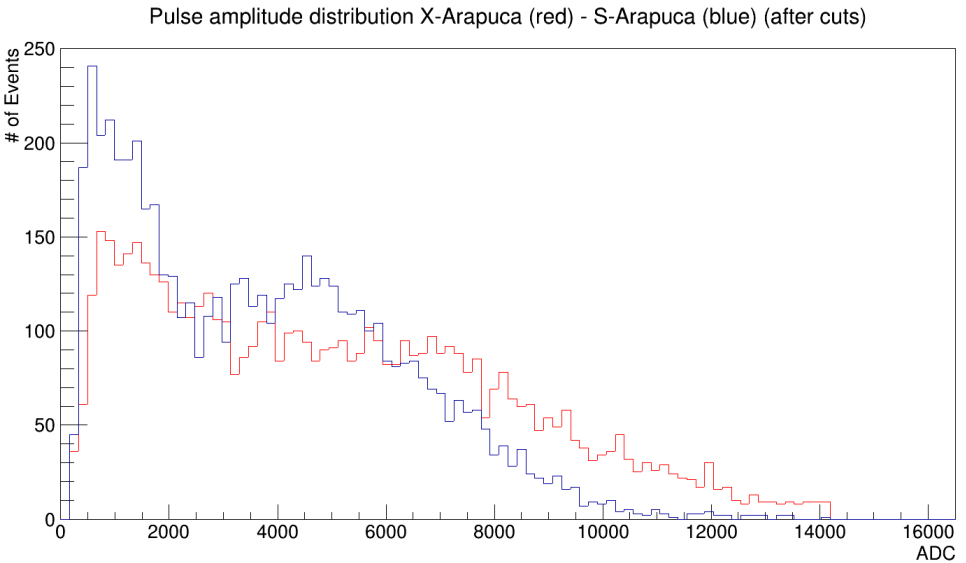
  Once we got the pedestal, we proceed to calculated the pulse amplitude. To do this, first we found the maximum ADC value per each pulse and then we subtracted the pedestal value.



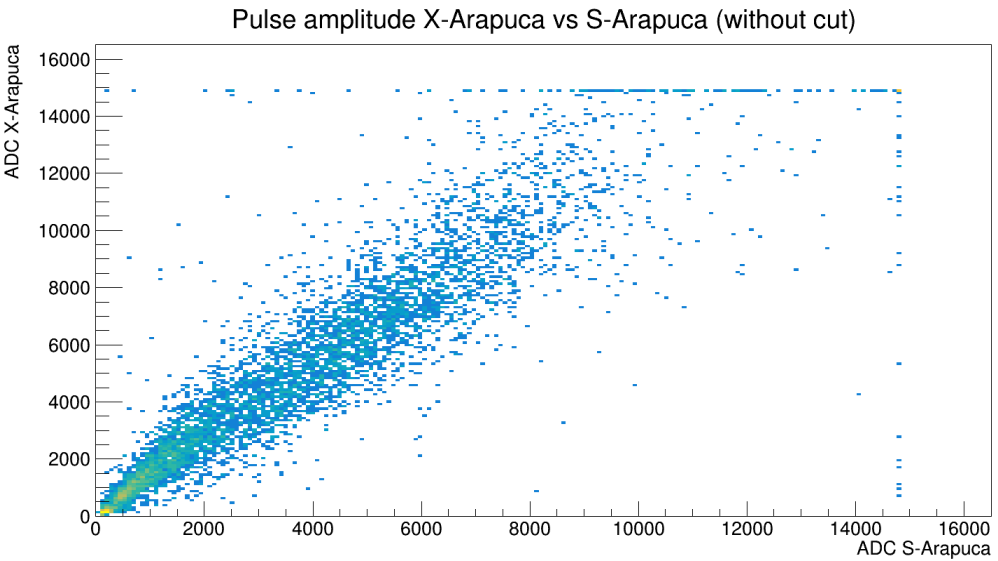
- Pulse analysis – Pulse Amplitude

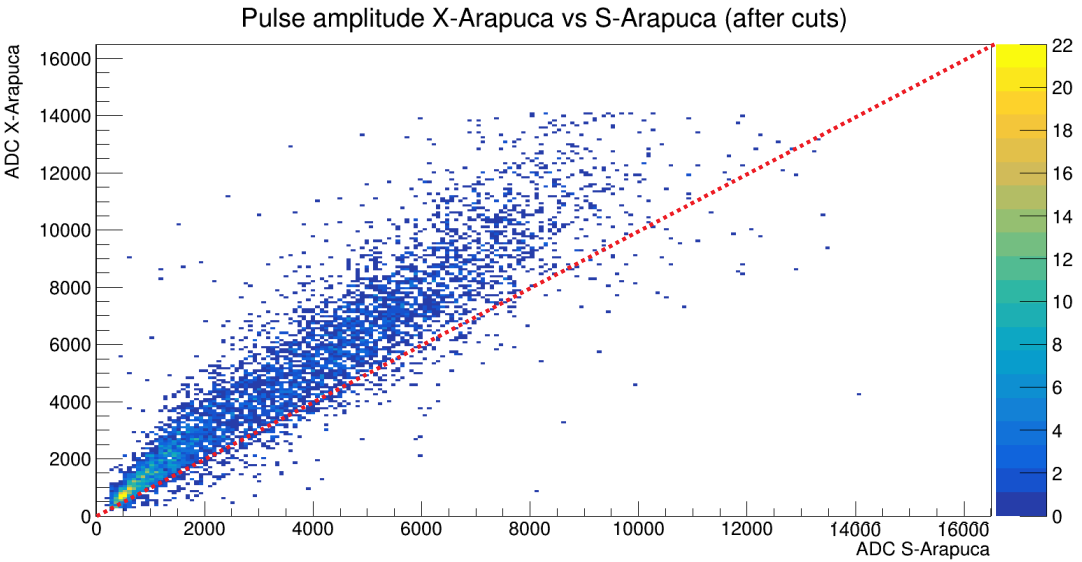
  Using all values of pulse amplitude we have the next distributions.





- Pulse analysis – Pulse Amplitude
- Then we did a 2 dimensional plot of pulse amplitude for X-Arapuca and S-Arapuca





We can see that the pulses amplitude of X-Arapuca is higher that S-Arapuca for most events.

- Pulse analysis – Pulse Amplitude

  In the next table we quantified how many pulses were higher for each event.

Run (48V - 4hours)	After cut	Amplitude Arapuca X > S	Amplitude Arapuca X < S
2305	1121	994	127
2306	1398	1261	137
2307	1488	1326	162
2308	218	202	16
2309	71	66	5
2310	1560	1408	152
Total	5856	5257 (89%)	599 (11%)

- Pulse analysis – Pulse Amplitude

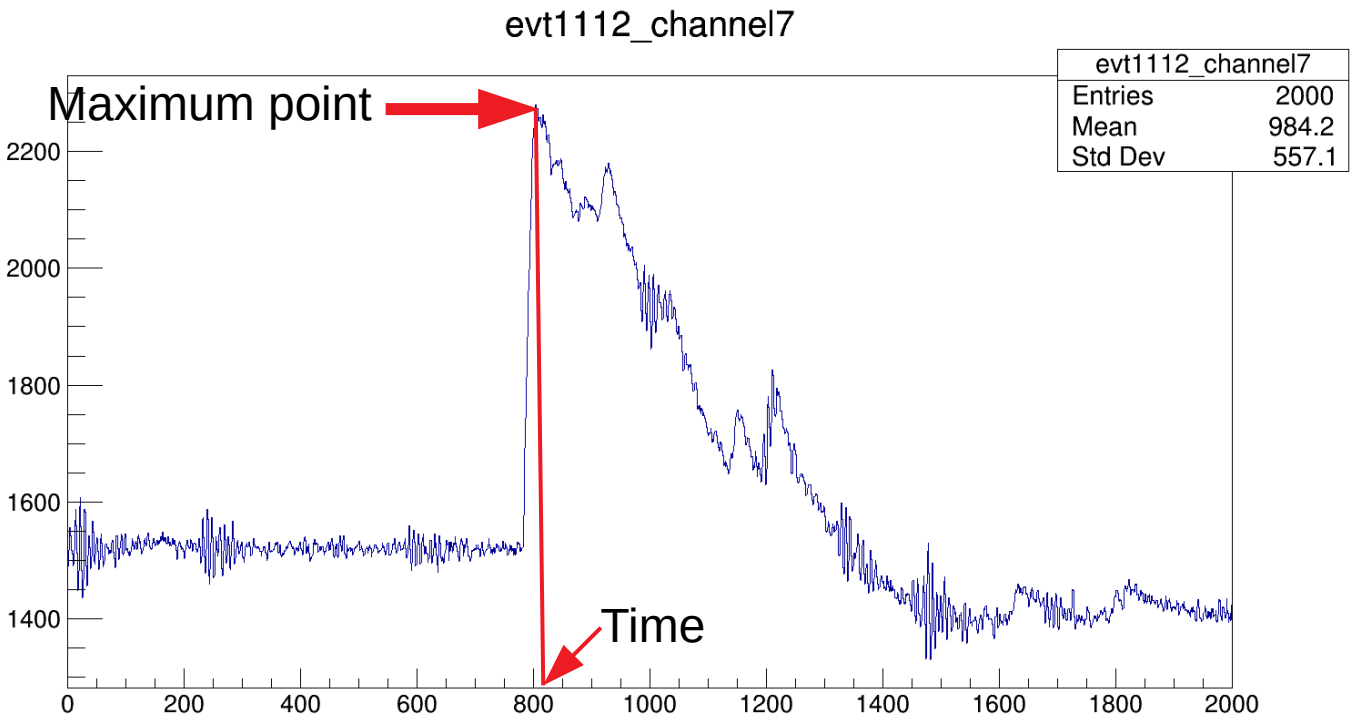
  In the next table we quantified how many pulses were higher for each event.

Run (48.5V - 2hours)	After cut	Amplitude Arapuca X > S	Amplitude Arapuca X < S
2311	428	386	42
2312	452	416	36
Total	880	802 (91%)	78 (9%)

Run (47.5V - 2hours)	After cut	Amplitude Arapuca X > S	Amplitude Arapuca X < S
2313	1755	1502	253
2314	1645	1447	198
Total	3400	2949 (86%)	451 (14%)

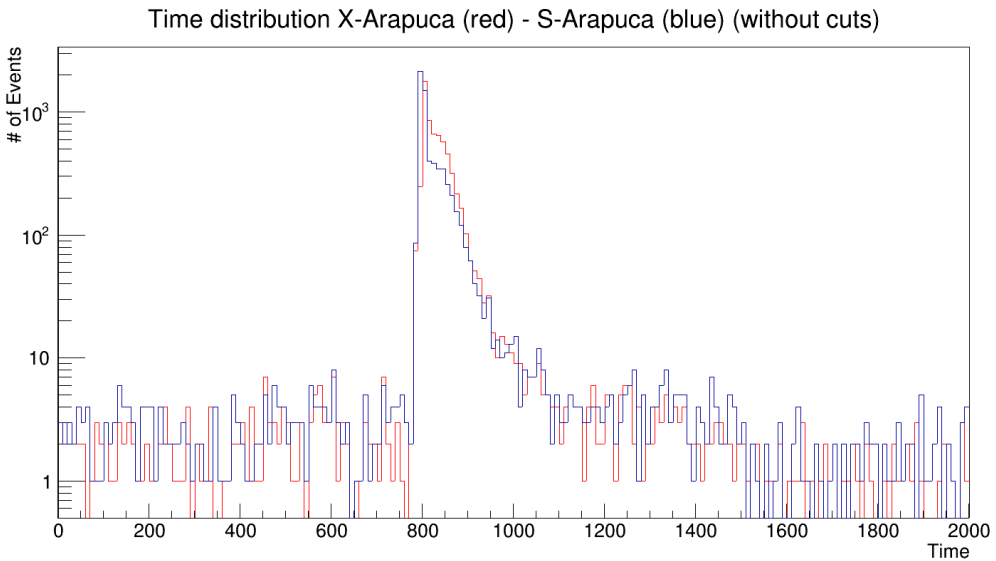
- Pulse analysis – Pulse Time

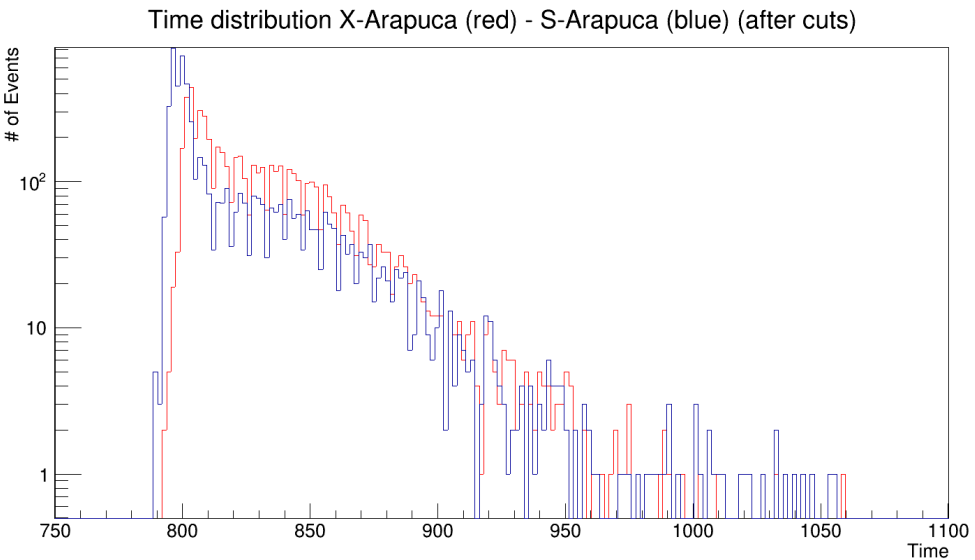
  Once we got the higher point, we found the time at this point per each event.



- Pulse analysis – Pulse Time

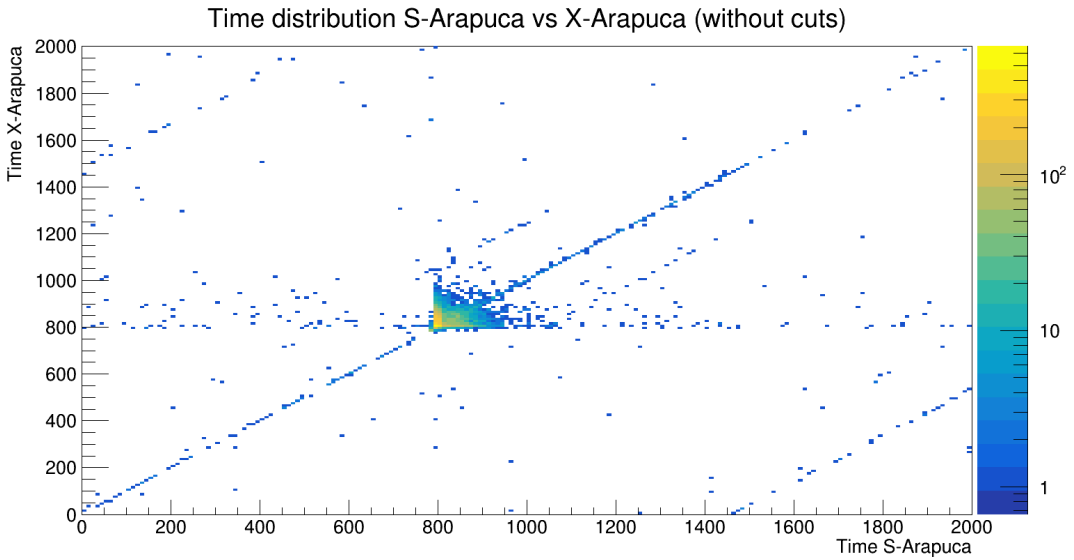
  In these plots we can see how is the time distribution for the higher points.

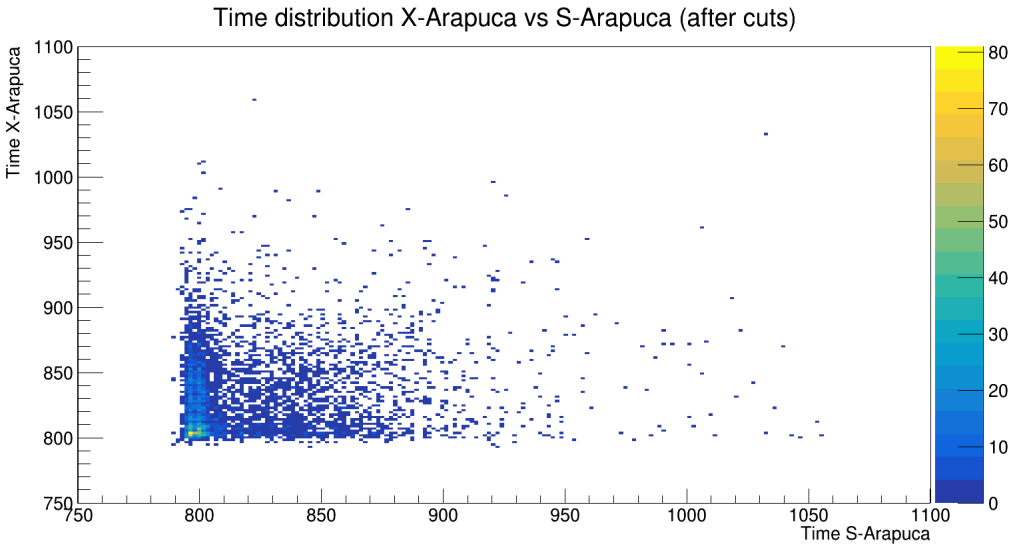




- Pulse analysis – Pulse Time

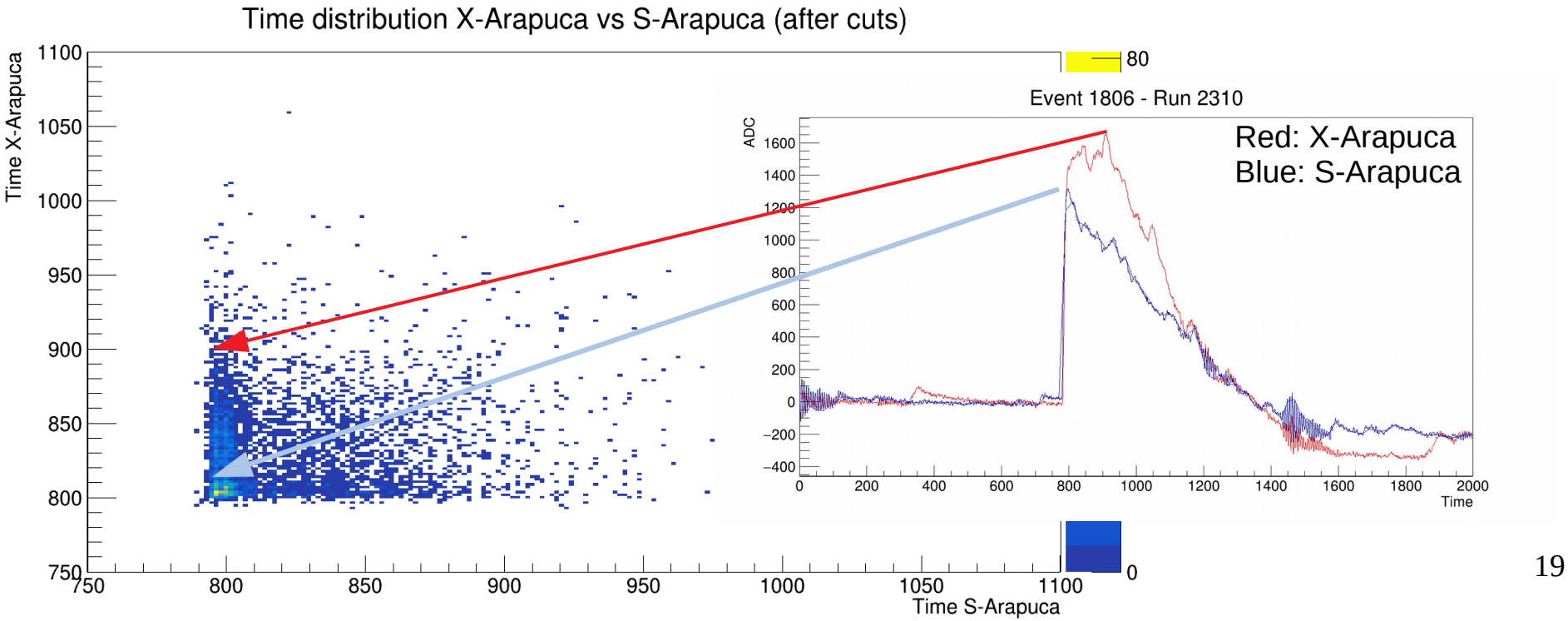
  2 dimensional time distribution.





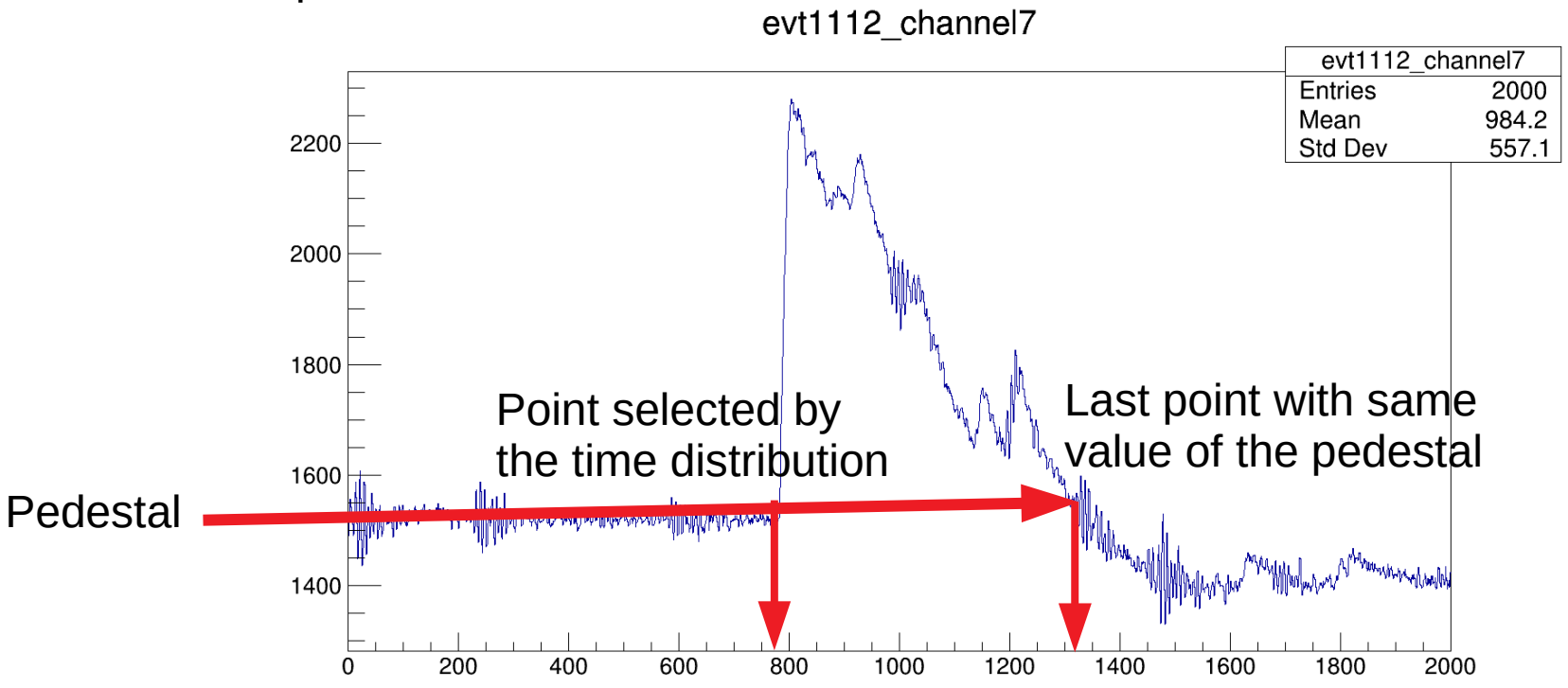
- Pulse analysis – Pulse Time

For the time distribution, we saw a spread in the time of the pulse height of X-Arapuca, this spread is because of the method that we used to get the time of the higher point. The time of X-Arapuca sometimes does not agree with time of S-Arapuca since the waveform of X-Arapuca has an unclear structure at the top of the pulse.



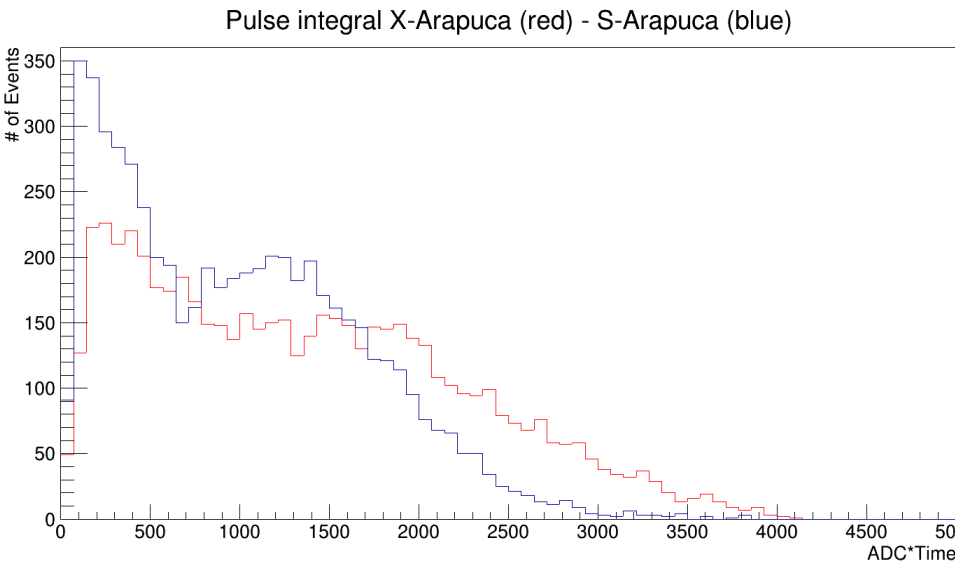
- Pulse analysis – Pulse Integral

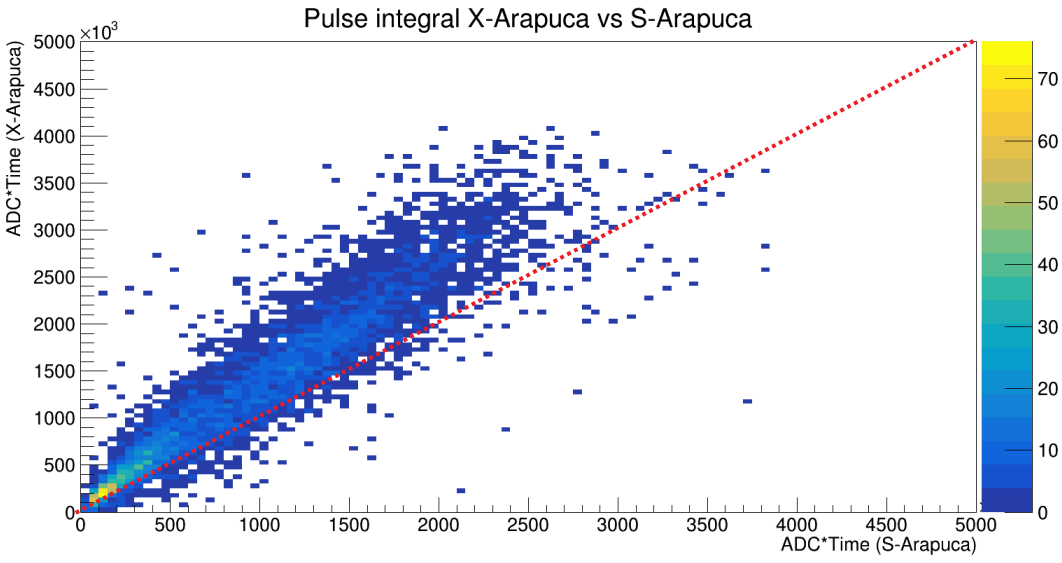
  Finally we calculated the integral of each pulse. To do this, we found the last point in each pulse with the same pedestal value, and using the time distribution, we can see that we do not have pulses with time below 790 (after ADC cut), then we calculated the integral from 790 to the last point.



- Pulse analysis – Pulse Integral

  With the integral values calculated per each pulse, we have the next distributions.

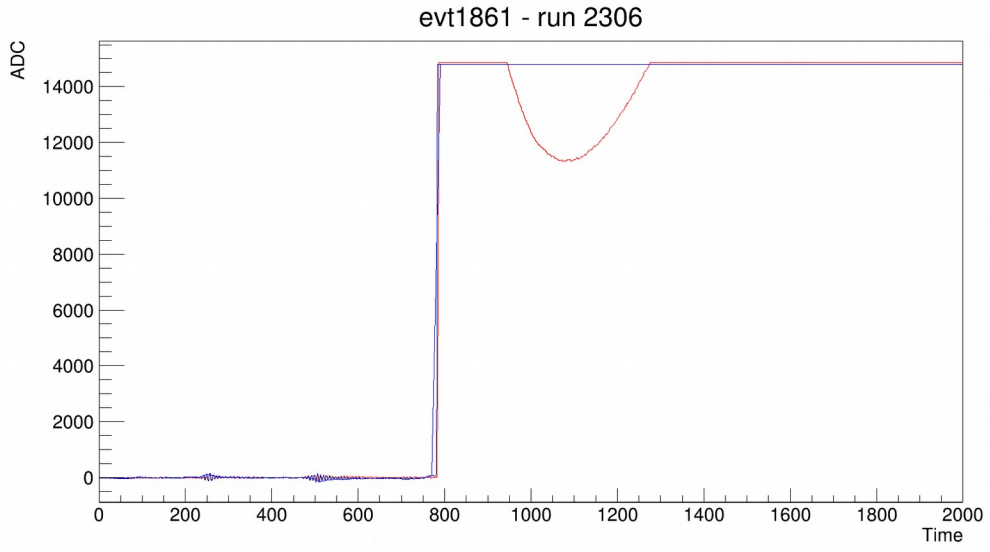


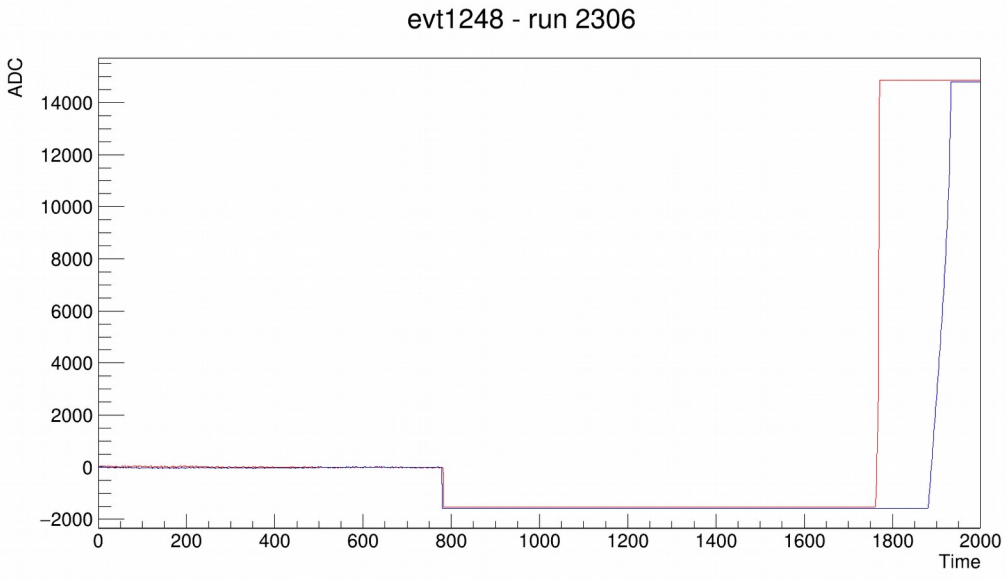


As we saw in the pulse amplitude distribution, the pulse integral of X-Arapuca is larger than S-Arapuca.

- Pulse analysis – strange events

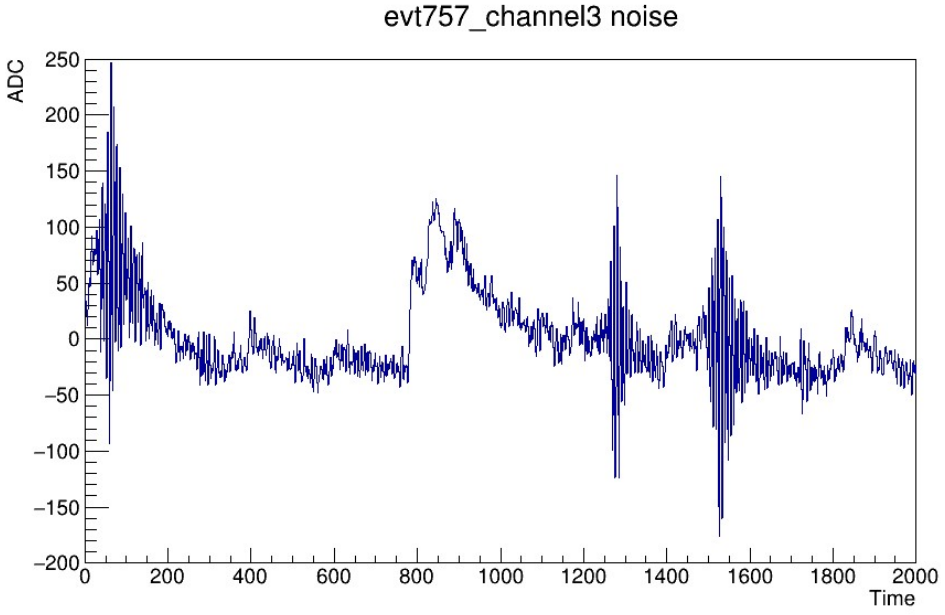
  Checking the files, we saw that the SSP data has events like we will show in the next plots:

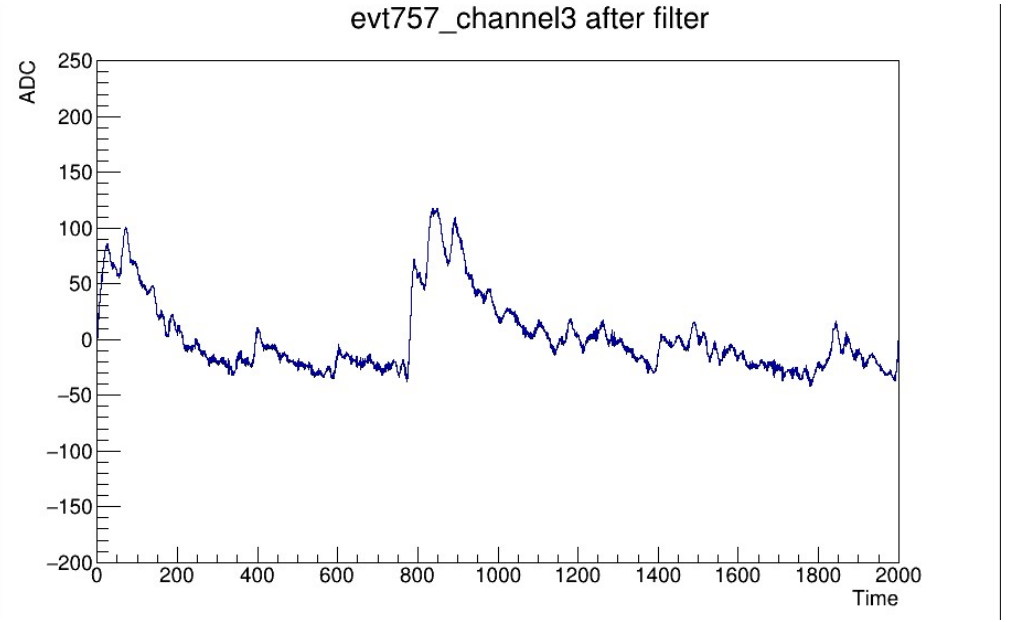




- Next steps

  We are working about a filter using the Fast Fourier Transform to recover small pulses where the noise is higher than the pulse.





- **Suggestions and comments are welcome!**