ALERT Software Meeting

AHDC reconstruction wfType study

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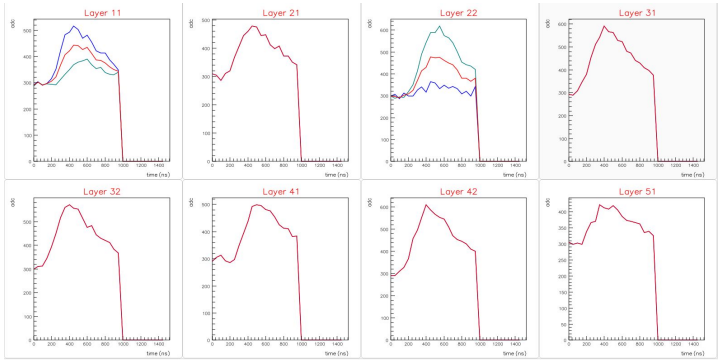
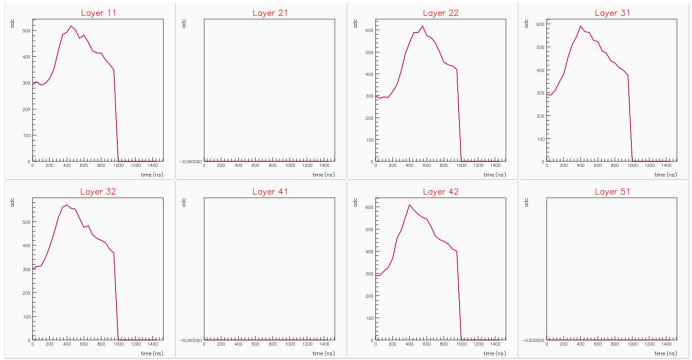
Outline

- wfType study
  - Purpose
  - New classification
  - Obvious cuts
  - Practical cuts
  - Results
- Conclusion

Purpose

- In the current state of the AHDC reconstruction (coatjava 13.3.0), we select “good” waveforms using : wfType <= 1
- Looking at the last cooked data, we notice a drop of the number of reconstructed track.
- Example: Looking at some runs cooked with a previous version of coatjava (13.0.1) and after selecting elastics protons and re-running the wfType algorithm, we notice that we loosed low ADC waveforms.





*The missing waveforms were found to be of type 3 or 5 while we could clearly define a time.

New classification

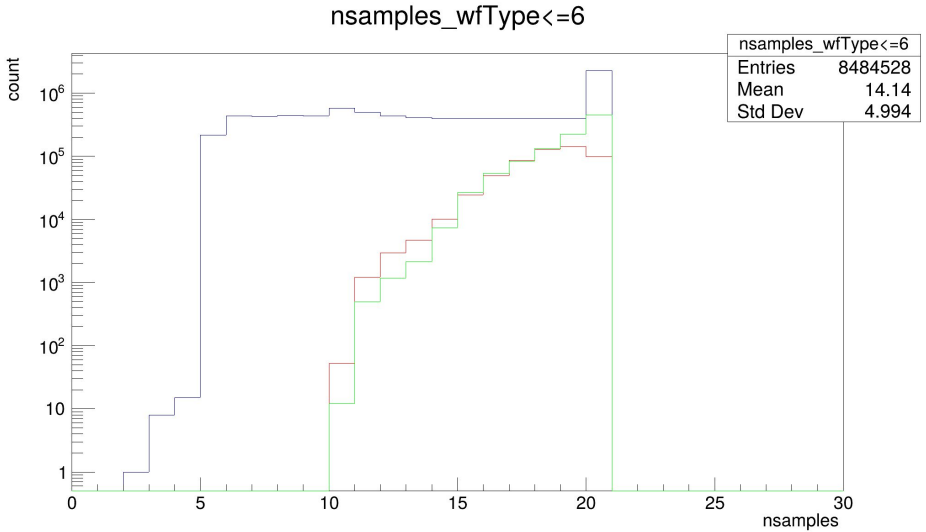
- wfType 6 ⇒ too small (nsamples <= 10)
- wfType 5 ⇒ decreasing baseline (or leadingEdgeTime fails)
- wfType 4 ⇒ bad ToT (300 < ToT < 750)
- wfType 3 ⇒ pileUp
- wfType 2 ⇒ bad trailingEdgeTime
- wfType 1 ⇒ saturing
- wfType 0 ⇒ OK

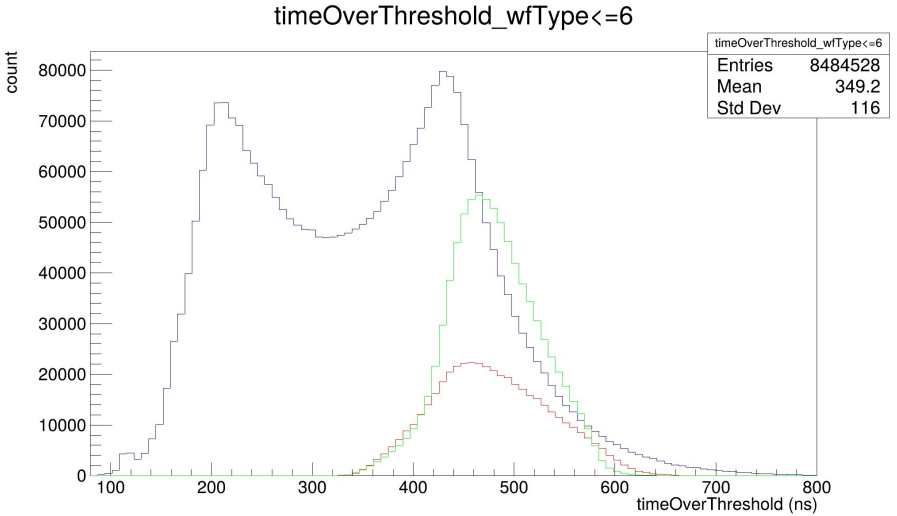
These cuts have been justified.

Obvious cuts – Study run 23003 on D2

bleu – raw
rouge - proton
vert - deuteron

- New classification : raw vs elastics {proton, deuteron}



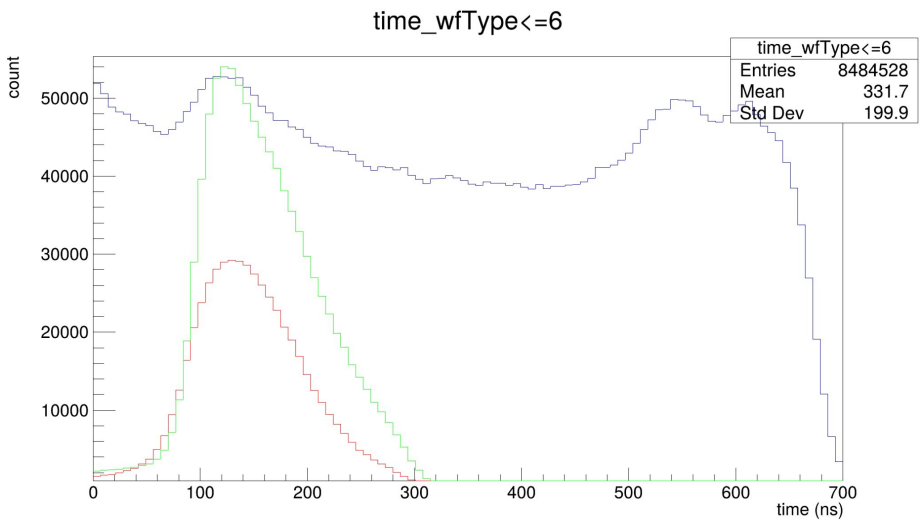


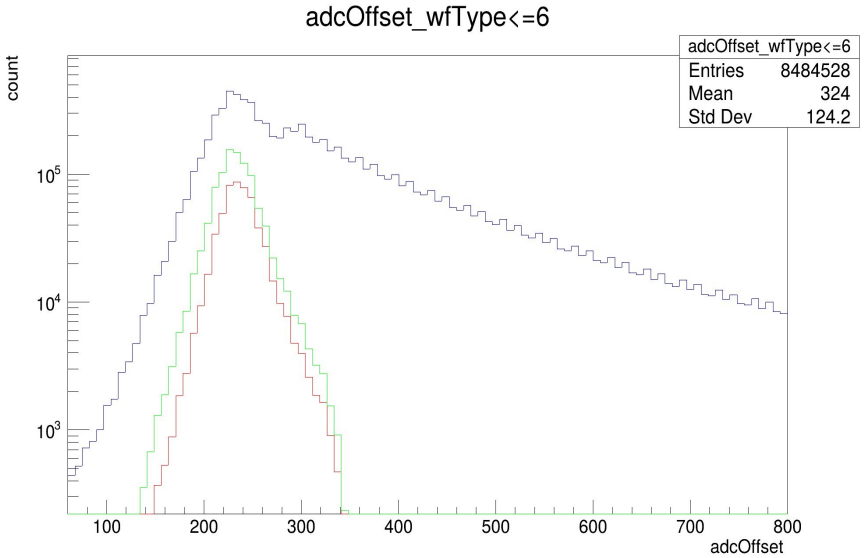
⇒ Evident cuts: nsamples > 10 && 300 < ToT < 750

Practical cuts – Study run 23003 on D2

- Other cuts at the reconstruction level

bleu – raw
rouge - proton
vert - deuteron





⇒ New cuts: 0 =< time <= 300 && 120 <= ped <= 350

Results - run 23003.0000[0-5]

- Efficiency comparison over coatjava version

	ALL	rawCuts 13.0.1	wfTye <= 1 coat 13.3.0	wfTye <= 2 coat dev	wfTye <= 2 & cuts coat dev	wfType <= 2 & cuts (strong) coat dev
		time >= 200 time <= 500			time >= 0 time <= 340 *t0 substractred	time >= 0 time <= 340
		tot >= 350 tot <= 650			tot >= 300 tot <= 750	tot >= 340 tot <= 620
		ped >= 180 ped <= 360			ped >= 120 ped <= 350	ped >= 120 ped <= 350
					samples > 10	samples > 14
Occupancy on the 1st layer	40 %	6 %	4 %	15 %	8 %	5.5 %
elastics protons deuterons	–	9472 2485 3662	5725 921 3020	-	17882 4394 6757	12650 2343 5502

*The efficiency drops compared to the previous version (13.0.1)
  *globally ⇒ 60 % (#13.3.0 / #13.0.1)
  *protons ⇒ 37 %
  *deuterons ⇒ 82 %

*protons ⇒ 37 % is the effect of the low ADC cut

*From this study, it appears that the best solution is, with the new classification: **wfType <= 2 and some additional cuts**

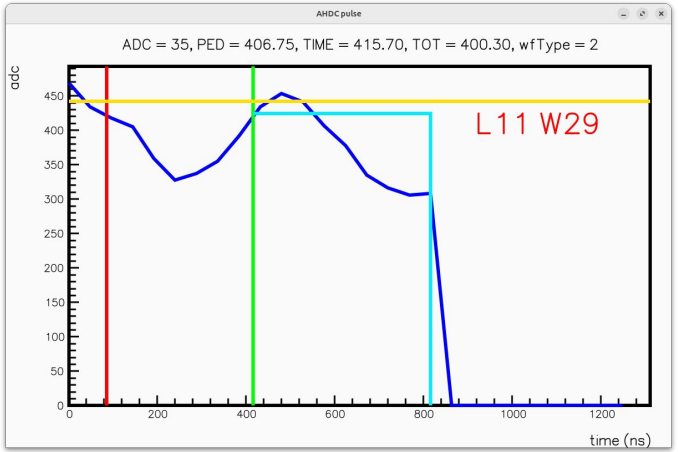
*Improvement
  *globally ⇒ 188 % (#dev / #13.0.1)
  *protons ⇒ 176 %
  *deuterons ⇒ 184 %

Conclusion

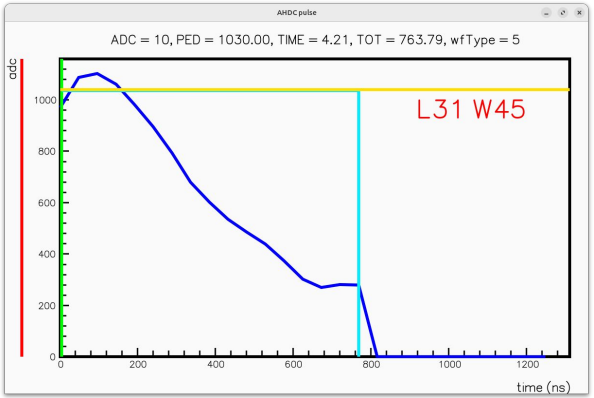
- wfType is a good approach
- In its first implementation, some hard cuts were not enough justified and resulted in a drop of the detection efficiency
- The new study shows an increase of the detection efficiency

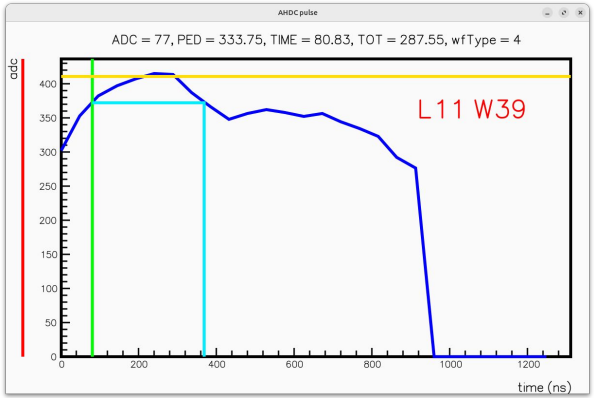
Perspectives

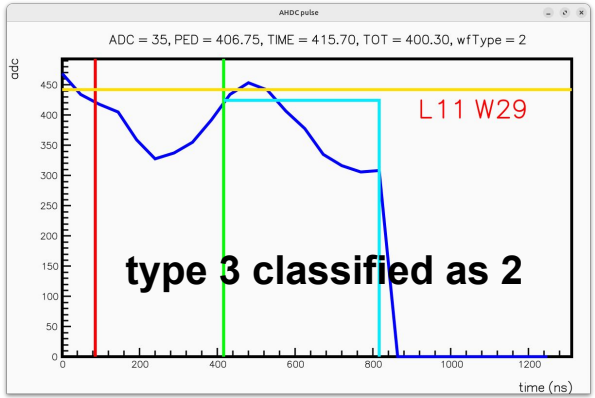
- Detect the wfType 3 – PileUp
- They are sometimes classified as type 2 (bad trailingEdgeTime) or type 5 (decreasing signals)

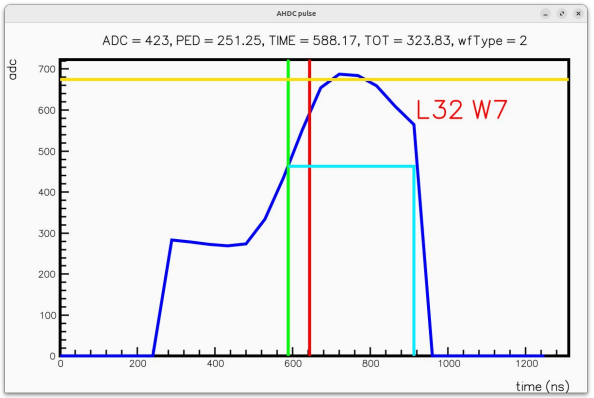


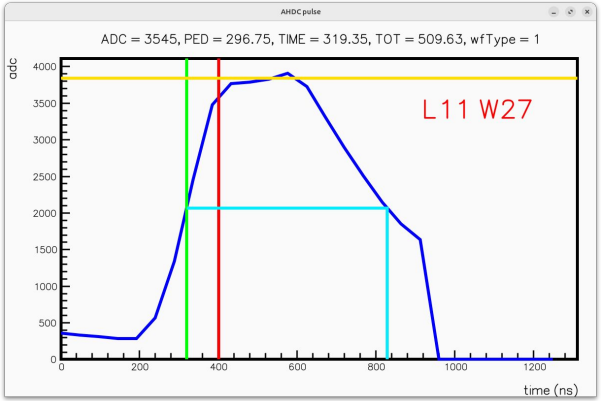
Backup slides

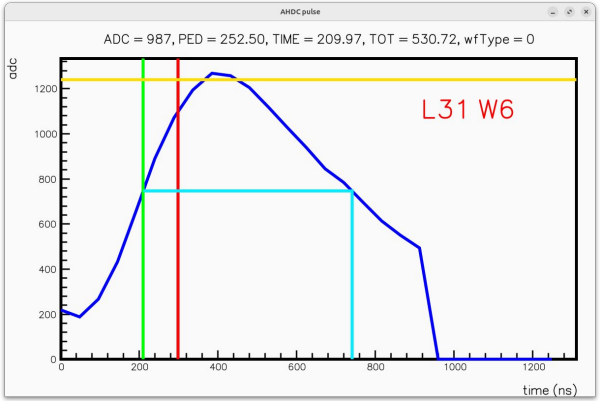




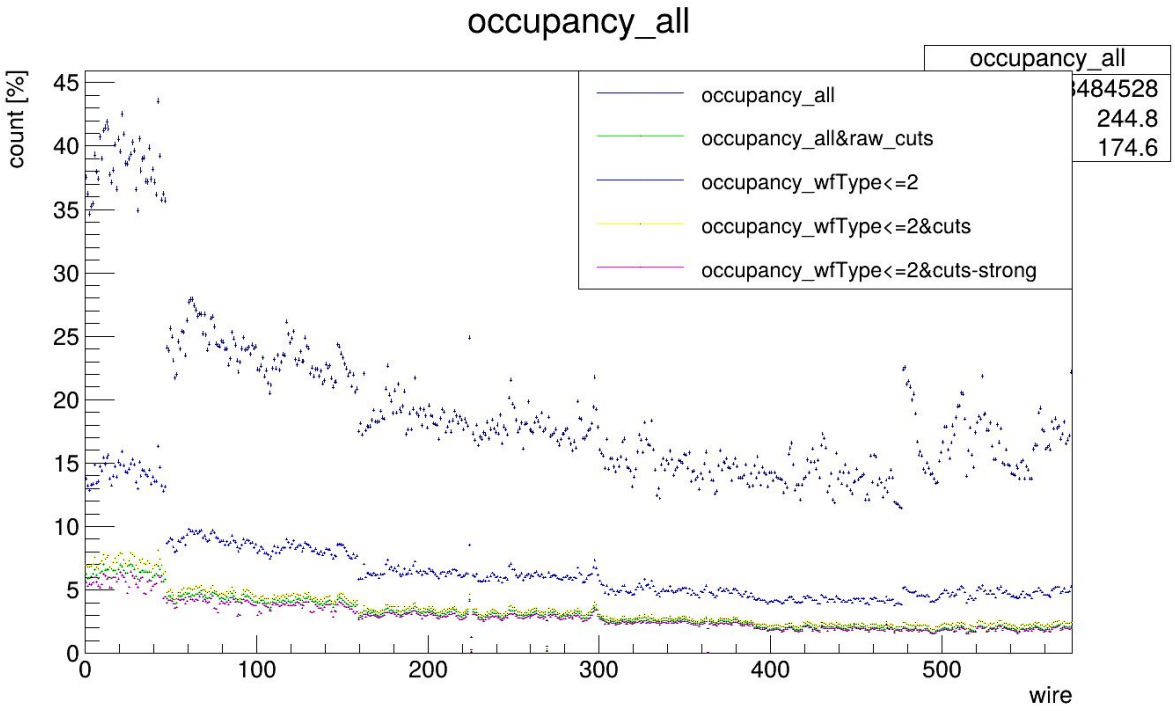








coat-dev

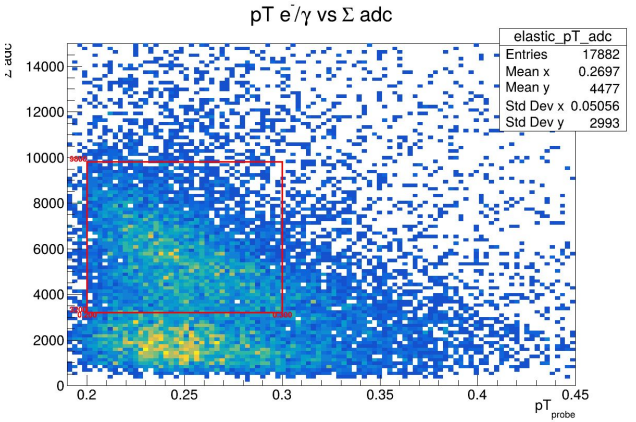

occupancy_all
occupancy_all
484528
244.8
174.6
occupancy_all
occupancy_all&raw_cuts
occupancy_wfType<=2
occupancy_wfType<=2&cuts
occupancy_wfType<=2&cuts-strong
count [%]
wire
0
5
10
15
20
25
30
35
40
45
0
100
200
300
400
500

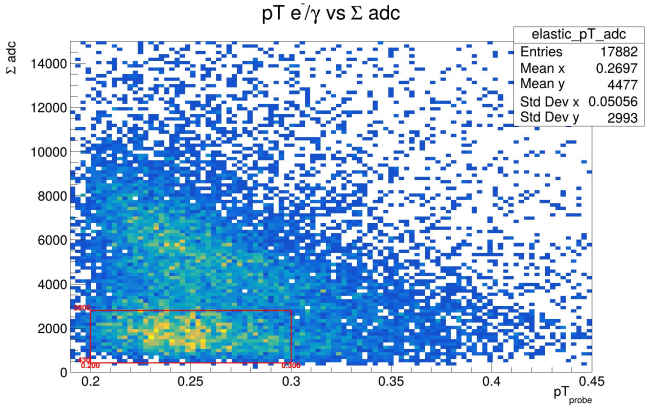
coat-dev

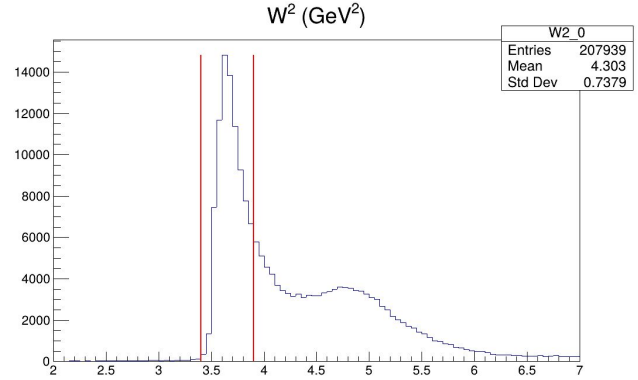
Run 23003.0000[0-5]

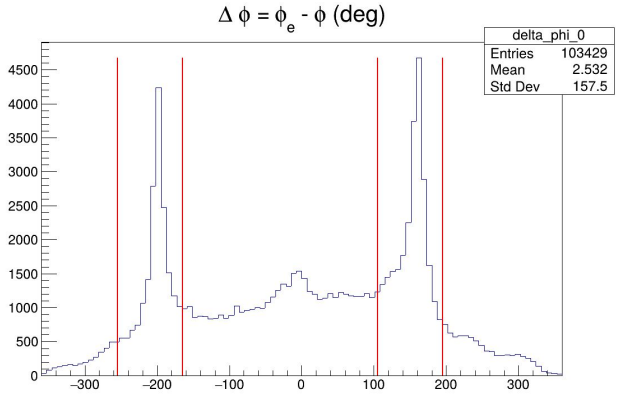
$3.4 < W^2 < 3.9$
$|\Delta\phi$ - peak$| < 45$

“peak” :
-210 and 150









Old classification

wfType = 6 ⇒ invalid WF (i.e numbe of samples < 5 : we cannot define a baseline)
wfType = 5 ⇒ adcMax < 200 (flateness) ??
wfType = 4 ⇒ binMax < 5 **or** the signal cannot cross the threshold before the peak or cannot define a leadingEdgeTime
or s4 - s0 < -200 ??
wfType = 3 ⇒ the signal cannot cross the threshold after the peak **or** cannot define a trailingEdgeTime
wfType = 2 ⇒ s4 - s0 > 200 ??
wfType = 1 ⇒ if more than 3 points are above (ADC_LIMIT - baseline) ; a bad baseline could false the classification
wfType = 0 ⇒ None of the above classification

bug :
https://github.com/ftouchte/coatjava/blob/8786f75ba3cf9e23eff1dceaa0c631271c6c6fc2/common-tools/clas-detector/src/main/java/org/jlab/detector/pulse/ModeAHDC.java#L141 ⇒ type -1 refers to type 6