Detector induced assymetry in CP violation measurements

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CP asymmetry

DOWN	π	K	Soft π	$D^0 = \pi + K$	$D^* = s\pi + \pi + K$
N_{reco} pos	2674000	2626350	2374360	2253370	1737460
N_{reco} neg	2675660	2598950	2356980	2276140	1740180

UP	π	K	Soft π	$D^0 = \pi + K$	$D^* = s\pi + \pi + K$
N_{reco} pos	2669990	2620280	2352910	2249370	1720940
N_{reco} neg	2670540	2595820	2371060	2270520	1749450

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Table: The asymmetry $A_{CP} = \frac{N_+ - N_-}{N_+ + N_-} / 10^{-3}$

Polarity	π	K	$soft\pi$	D^0	D^*
UP	-0.1 ± 0.4	4.7 ± 0.4	-3.8 ± 0.5	-4.7 ± 0.5	-8.2 ± 0.5
DOWN	-0.3 ± 0.4	5.2 ± 0.4	3.7 ± 0.5	-5.0 ± 0.5	-0.8 ± 0.5

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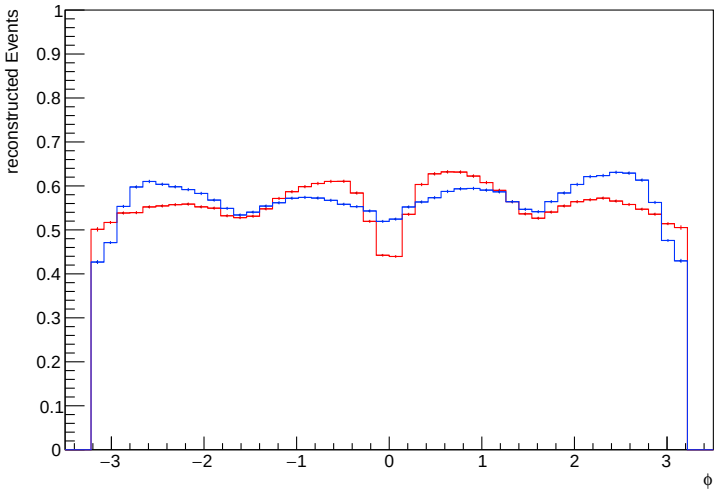
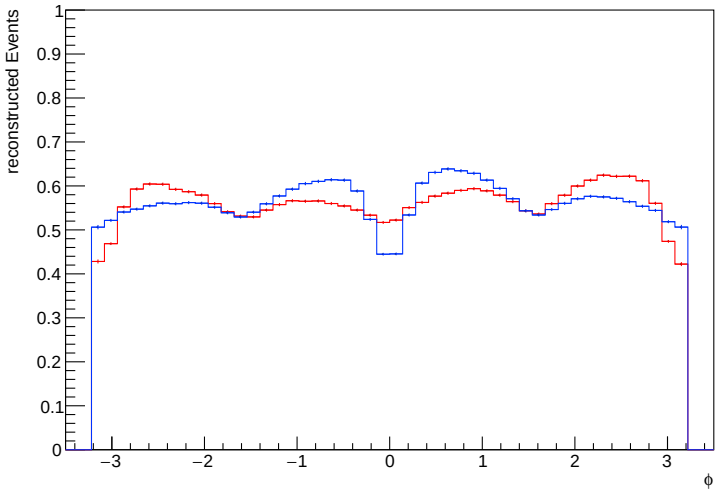
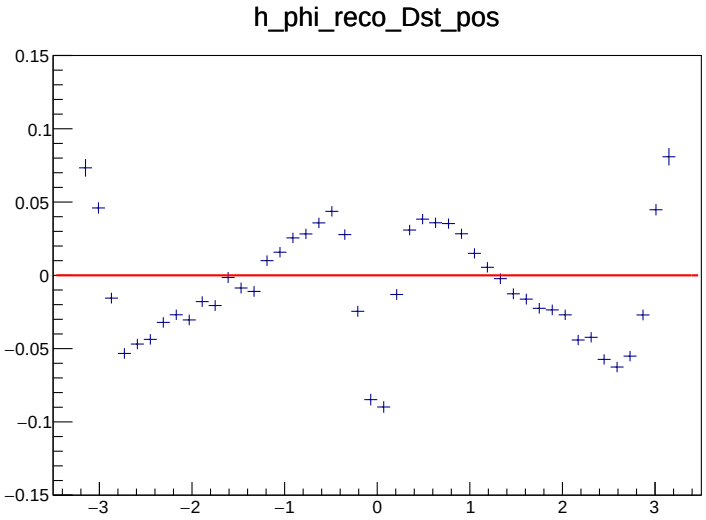
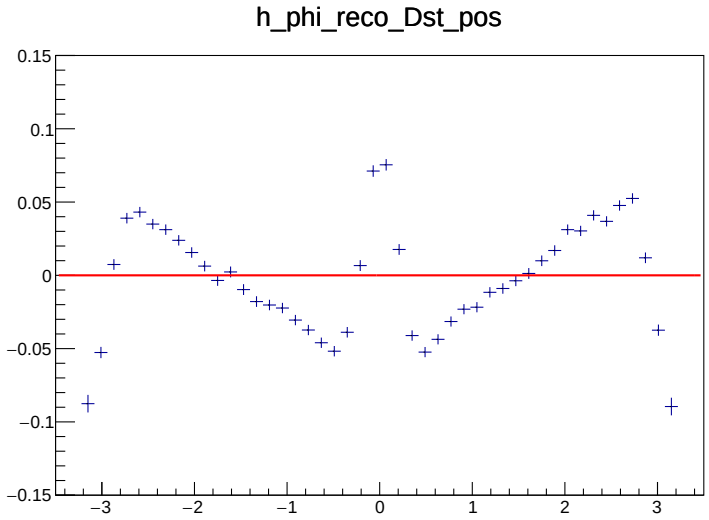
- $D_{soft\,\pi} \& D_{D^0}$ cancel partially in $DOWN$, but add up in UP
- $|A_{CP,D^*}|$ much bigger for the UP-polarity

Comparison - $D^*\phi$









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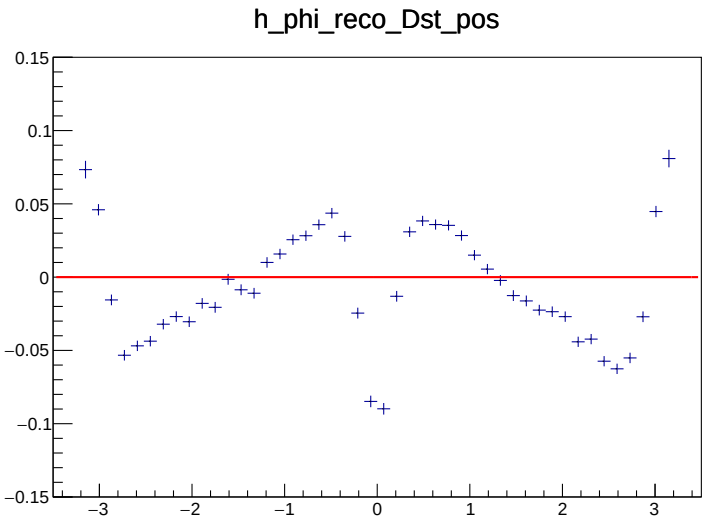

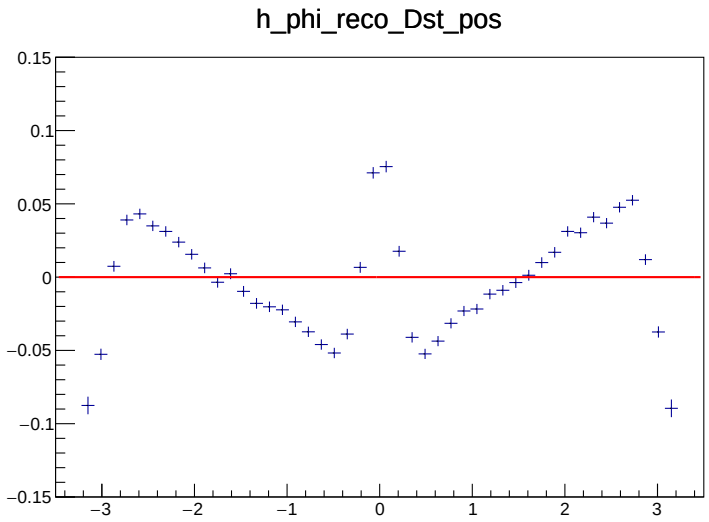

- A_{CP} dependent on direction in the detector
  $\rightarrow$ detector induced *CP*-asymmetry due to rectangular shape

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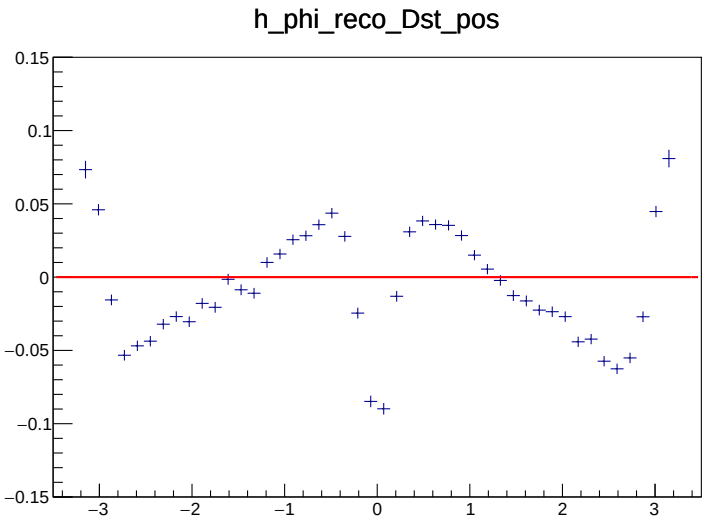

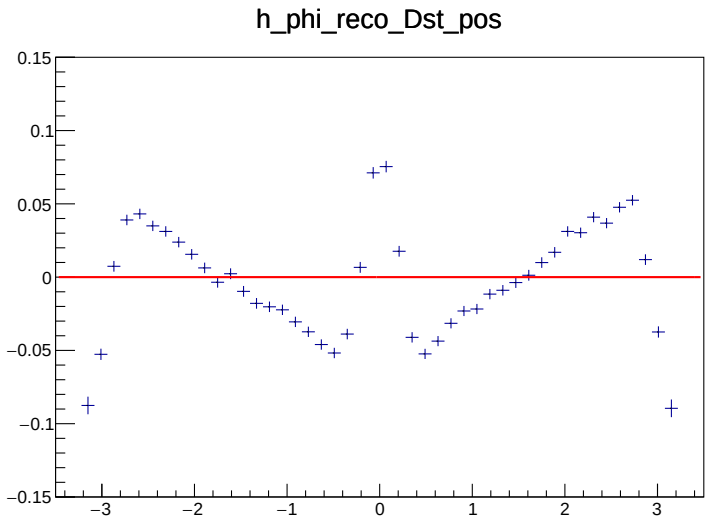

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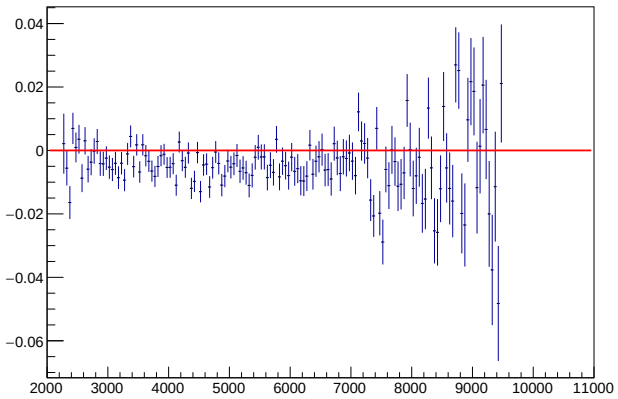
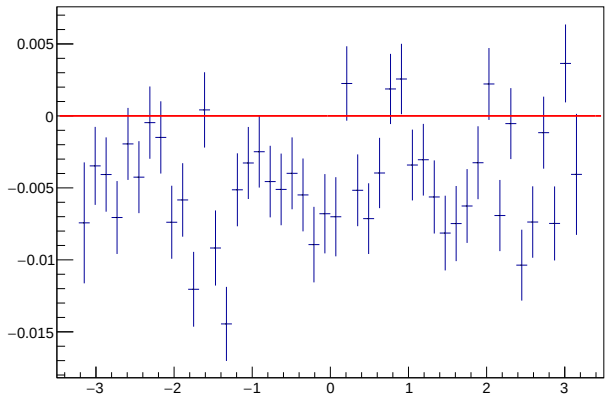
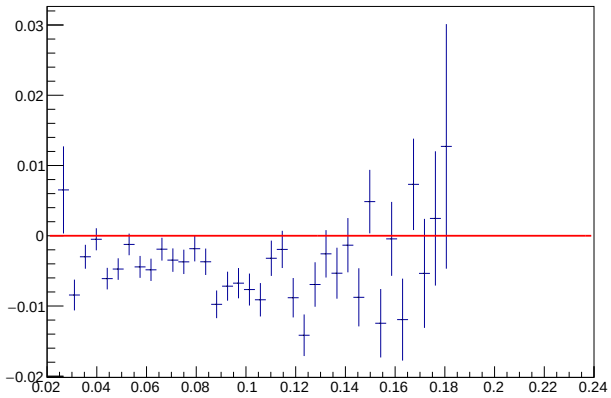
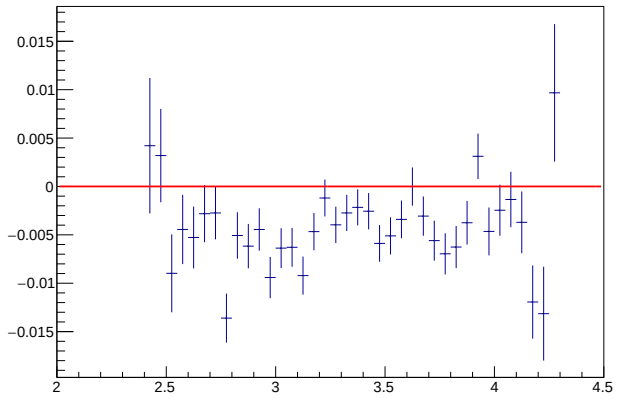
- add together samples with different magnet polarisation

D^* asymmetry UP+DOWN









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UP + *DOWN*	-0.2 ± 0.3	5.0 ± 0.3	-0.1 ± 0.3	-4.9 ± 0.3	-4.5 ± 0.4

- soft pion asymmetry completely can be ruled out
- significant reduction of total $|A_{CP}|$ in D^* decays