

# Detector induced assymetry in CP violation measurements

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- very small errors in  $D = \frac{\epsilon_+ - \epsilon_-}{\epsilon_+ + \epsilon_-}$   
 $\rightarrow D = 0$  out of  $5\sigma$ -range
- $D$  is much smaller in for the  $UP$ -polarity
- smaller error for  $UP$  due to higher statistics
- no difference in the efficiencies between  $UP$  and  $DOWN$  within scope of the error
- in the MC:  $\epsilon_{D^*} = 0$  (Dst\_reconstructed always 0)  
in our computation:  $\epsilon_{D^*} = \epsilon_{\pi,S} \cdot \epsilon_{D^0}$

- structure of  $\epsilon(\phi)$  probably due to rectangular detector shape
- peak in  $\epsilon_{D^*}(\theta)$  within scope of error

# Total: Efficiencies

Polarity	$\epsilon_{\pi}$	$\epsilon_K$	$\epsilon_{\pi,s}$	$\epsilon_{D^0}$	$\epsilon_{D^*}$
<i>UP</i>	$86.65 \pm 0.01$	$84.63 \pm 0.01$	$76.65 \pm 0.02$	$73.34 \pm 0.02$	$56.31 \pm 0.02$
<i>DOWN</i>	$86.68 \pm 0.01$	$84.67 \pm 0.01$	$76.66 \pm 0.02$	$73.39 \pm 0.02$	$56.35 \pm 0.02$

# Charge +: Efficiencies

Polarity	$\epsilon_{\pi}$	$\epsilon_K$	$\epsilon_{\pi,s}$	$\epsilon_{D^0}$	$\epsilon_{D^*}$
UP	$86.66 \pm 0.02$	$85.02 \pm 0.02$	$76.37 \pm 0.02$	$73.01 \pm 0.03$	$55.86 \pm 0.03$
DOWN	$86.70 \pm 0.02$	$85.07 \pm 0.02$	$76.98 \pm 0.02$	$73.06 \pm 0.03$	$56.33 \pm 0.03$
UP	$\pi$	$K$	$soft\ \pi$	$D^0$	$D^*$
$N_{reco}$	2 669 990	2 620 280	2 352 910	2 249 370	1 720 940
$N_{tot}$	3 081 050	3 082 060	3 081 050	3 081 050	3 081 050
DOWN	$\pi$	$K$	$soft\ \pi$	$D^0$	$D^*$
$N_{reco}$	2 674 000	2 626 350	2 374 360	2 253 370	1 737 460
$N_{tot}$	3 084 220	3 087 370	3 084 220	3 084 220	3 084 220

# Charge -: Efficiencies

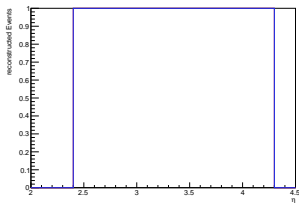
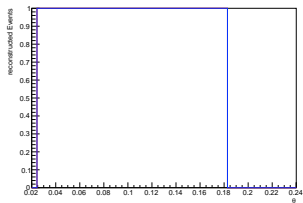
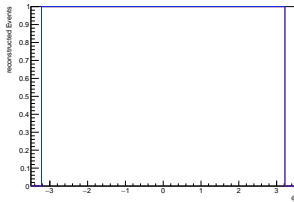
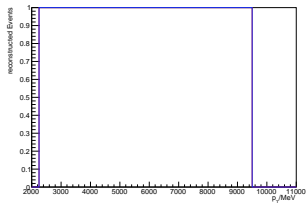
Polarity	$\epsilon_{\pi}$	$\epsilon_K$	$\epsilon_{\pi,s}$	$\epsilon_{D^0}$	$\epsilon_{D^*}$
UP	$86.65 \pm 0.02$	$84.25 \pm 0.02$	$76.93 \pm 0.02$	$73.67 \pm 0.03$	$56.76 \pm 0.03$
DOWN	$86.66 \pm 0.02$	$84.27 \pm 0.02$	$76.34 \pm 0.02$	$73.72 \pm 0.03$	$56.36 \pm 0.02$
UP	$\pi$	$K$	$soft \pi$	$D^0$	$D^*$
$N_{reco}$	2 670 540	2 595 820	2 371 060	2 270 520	1 749 450
$N_{tot}$	3 082 060	3 081 050	3 082 060	3 082 060	3 082 060
DOWN	$\pi$	$K$	$soft \pi$	$D^0$	$D^*$
$N_{reco}$	2 675 660	2 598 950	2 356 980	2 276 140	1 740 180
$N_{tot}$	3 087 370	3 084 220	3 087 370	3 087 370	3 087 370

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

Polarity	$\pi$	$K$	$soft\pi$	$D^0$	$D^*$
<i>UP</i>	$-0.1 \pm 0.4$	$4.7 \pm 0.4$	$-3.8 \pm 0.5$	$-4.7 \pm 0.5$	$-8.2 \pm 0.5$
<i>DOWN</i>	$-0.3 \pm 0.4$	$5.2 \pm 0.4$	$3.7 \pm 0.5$	$-5.0 \pm 0.5$	$-0.8 \pm 0.5$

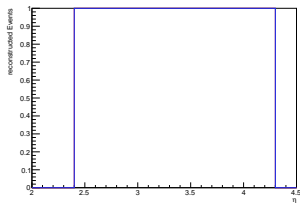
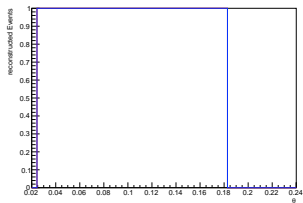
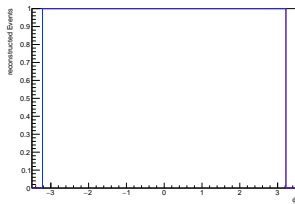
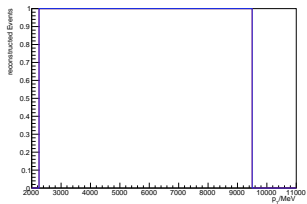
- calculation via  $N_{\text{reco}}$  doesn't work,  $N_{\text{tot},+/-}$  different  $\rightarrow$  no normalization
- interesting:  $D_{soft\pi}$  &  $D_{D^0}$  cancel partially in *DOWN*, but add up in *UP*

# Comparison of different charges with $UP$ polarity - $D^*$

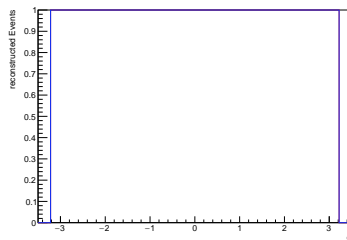
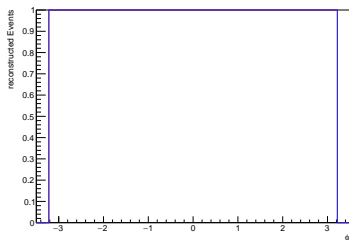




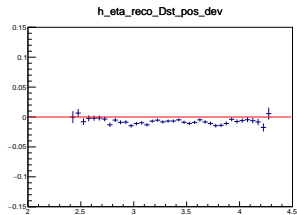
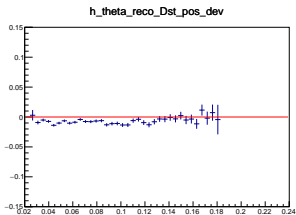
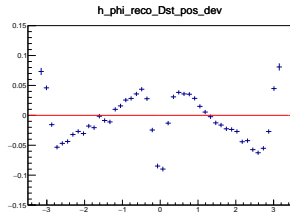
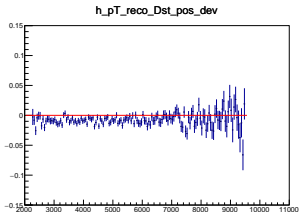
# Comparison of different charges with *DOWN* polarity - $D^*$



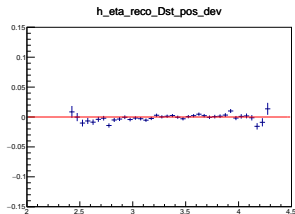
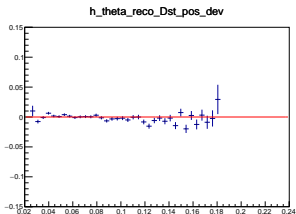
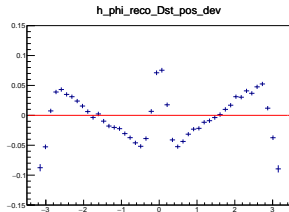
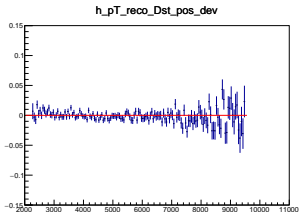
# Comparison - $D^*\phi$



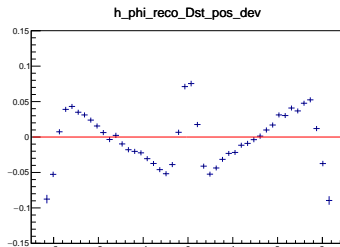
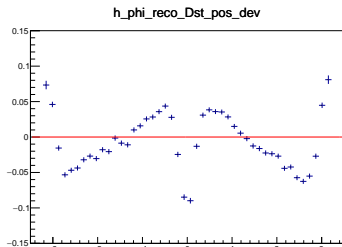
# $D^*$ asymmetry dependencies - $UP$ polarity



# $D^*$ asymmetry dependencies - *DOWN* polarity



# $D^*$ asymmetry - $\phi$



- left  $UP$ , right  $DOWN$
- clear dependency in  $\phi$ , inverted  $UP \leftrightarrow DOWN$
- doesn't seem to have dependency on other topological variables  
→ form of the detector is biggest source of induced CPV

# $D^*$ asymmetry UP+DOWN

