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Short comment on HERMES A_{UT}

Makins, Athens'03; Seidl, DIS'04

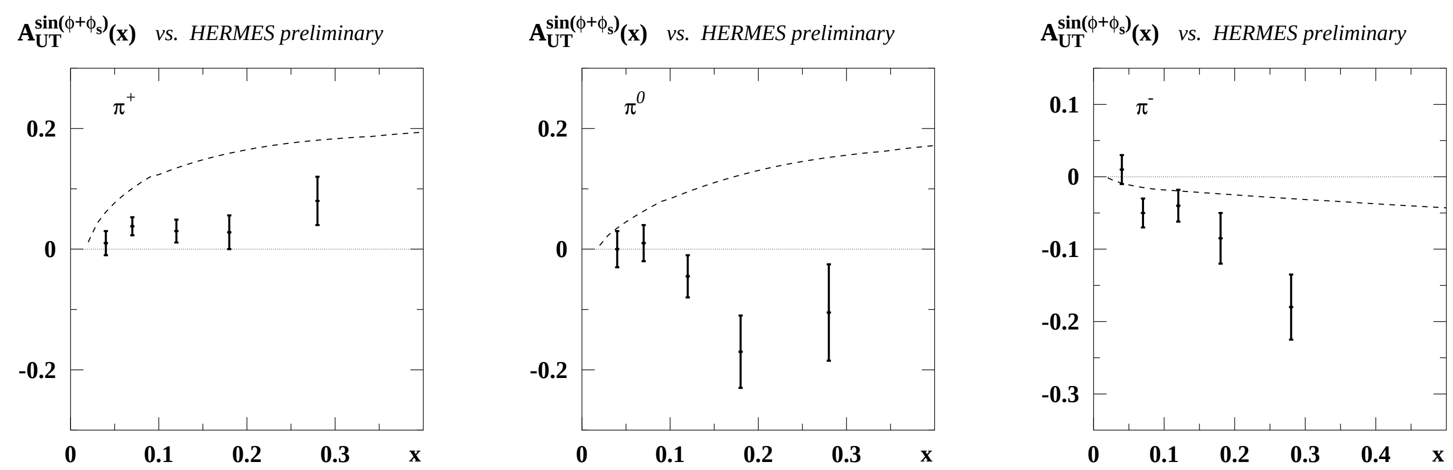
HERMES (prelim.), Collins A_{UT},
$(E = 26.7\,GeV,\ W > 2\,GeV,\ 1 < Q^2 < 15\,GeV^2,$
$\langle z\rangle \approx 0.4,\ 0.2 < y < 0.85,\ 0.023 < x < 0.4,$
$P_{h\perp} > 0.4\,GeV).$

$$A_{UT}^{\sin(\phi+\phi_s)}(x,z) \propto \frac{\Sigma_a e_a^2\, x\, h_1^a(x)\, H_1^{\perp a/h}(z)}{\Sigma_b e_b^2\, x\, f_1^b(x)\, D_1^{b/h}(z)}$$

Transversally polarized proton target.

A.E., Goeke, Schweitzer EPJC32:337(03)

Our predictions was:

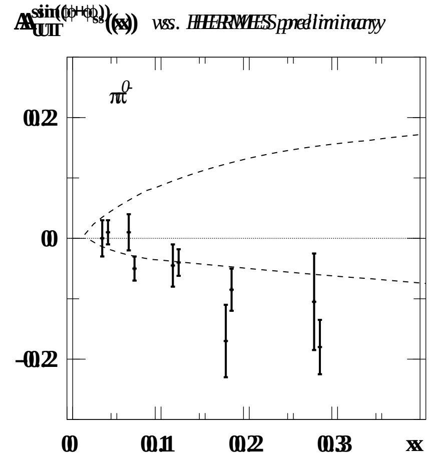


$\Uparrow$

Even sign is wrong for π^0!

New problem in spin physics?
How it could be possible that

$$0 > A(\pi^0) \cong A(\pi^-)\,?$$



- Charge conjugation and isospin invariance

$$H_1^{\perp u/\pi^+} = H_1^{\perp \bar{u}/\pi^-} = H_1^{\perp d/\pi^-} \ldots \equiv H_1^{\rm fav}\,,$$

$$H_1^{\perp d/\pi^+} = H_1^{\perp \bar{d}/\pi^-} = H_1^{\perp u/\pi^-} \ldots \equiv H_1^{\rm unf}\,,$$

$$H_1^{\perp a/\pi^0} = \frac{1}{2}(H_1^{\perp a/\pi^+} + H_1^{\perp a/\pi^-}) = \frac{1}{2}(H_1^{\rm fav} + H_1^{\rm unf})\,.$$

Same for $D_1(z)$

- $x\&z$-dependence factorization

$$A(\pi^0) = \frac{\sigma(\pi^+)}{\sigma(\pi^+)+\sigma(\pi^-)}\,A(\pi^+) + \frac{\sigma(\pi^-)}{\sigma(\pi^+)+\sigma(\pi^-)}\,A(\pi^-)$$

or

$$A(\pi^0) - A(\pi^-) = a[A(\pi^+) - A(\pi^-)] \approx 0\,,$$

$$\Downarrow$$

$\boxed{a = \frac{\sigma(\pi^+)}{\sigma(\pi^+)+\sigma(\pi^-)} \approx 0}$ that is nonsense!

$x\&z$ factorization is under suspicion
and should be carefully checked!

Even without $A(\pi^0)$ the suppression of $A(\pi^+)$ is a problem:

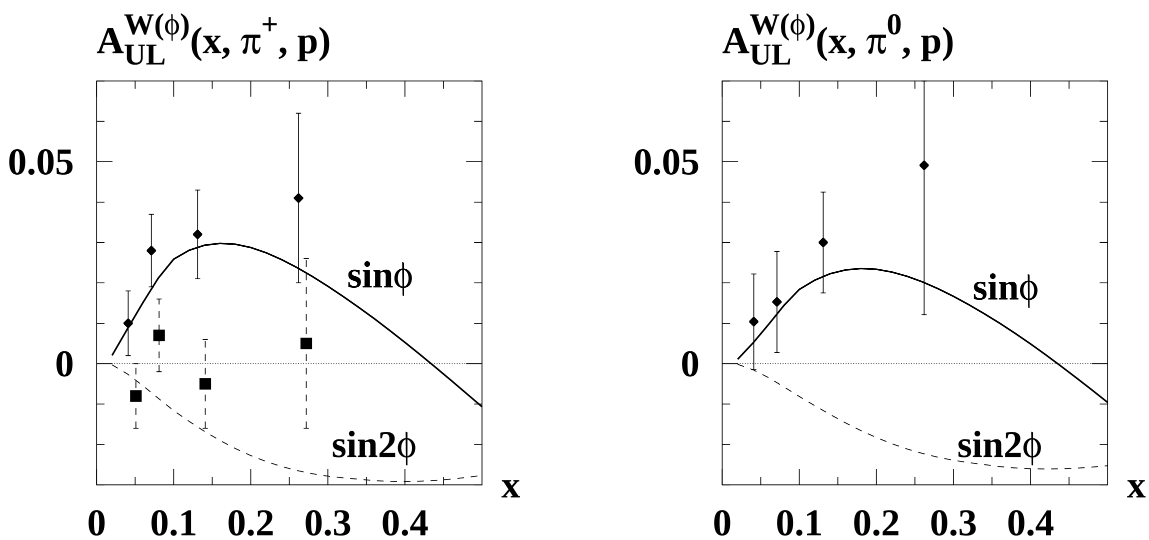
$A(\pi^-) \propto (h_1^d H_1^{\rm fav} + 4 h_1^u H_1^{\rm unf})$ should be < 0 (i.e. $H_1^{\rm unf} < 0$),

while

$A(\pi^+) \propto (4 h_1^u H_1^{\rm fav} + h_1^d H_1^{\rm unf})$
gain $\mathbf{positive}$ addition $h_1^d H_1^{\rm unf} > 0$!!

Of course one can take smaller $\frac{H_1^{\rm fav}}{D_1^{\rm fav}}$

(or smaller $\frac{h_1^u}{u}$) but then we miss understanding of A_{UL}!



Conclusions

1. We seems understand more complicated A_{UL} asymmetries (Collins, Sivers, A_{UT}-contribution, ...)
2. We do not understand more transparent $A_{UT}^{\sin(\phi+\phi_s)}$ asymmetry!
   (The HERMES data are however PRELIMINARY!)
3. More data are waited from COMPASS, CLAS and HALL-A experiments.