Beam Target Spin Asymmetries for Transversely Polarized Timelike Compton Scattering

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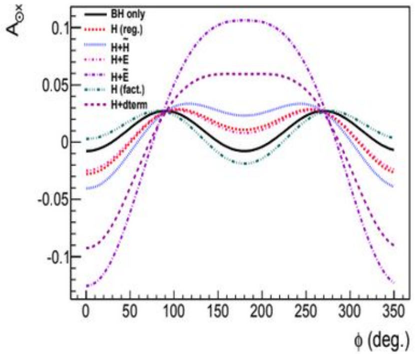
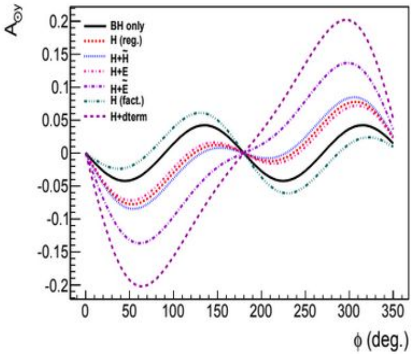
Relevance of BTSA

BTSA shows access to all real CFFs. Extraction of Re E is the most difficult, but is currently poorly constrained so any measurements could be useful

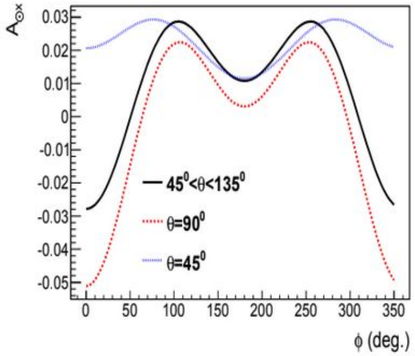
Note that the integrated asymmetry is very similar to the asymmetry at 90º (Highest TCS vs BH). This allows us to use the integrated asymmetry to measure TCS.

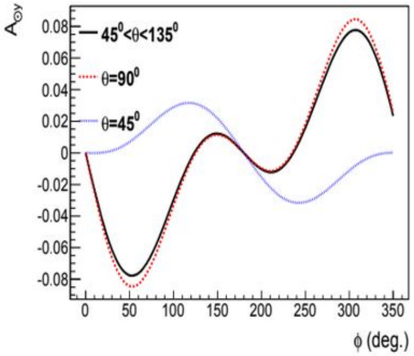




Φ=0º

Φ=90º



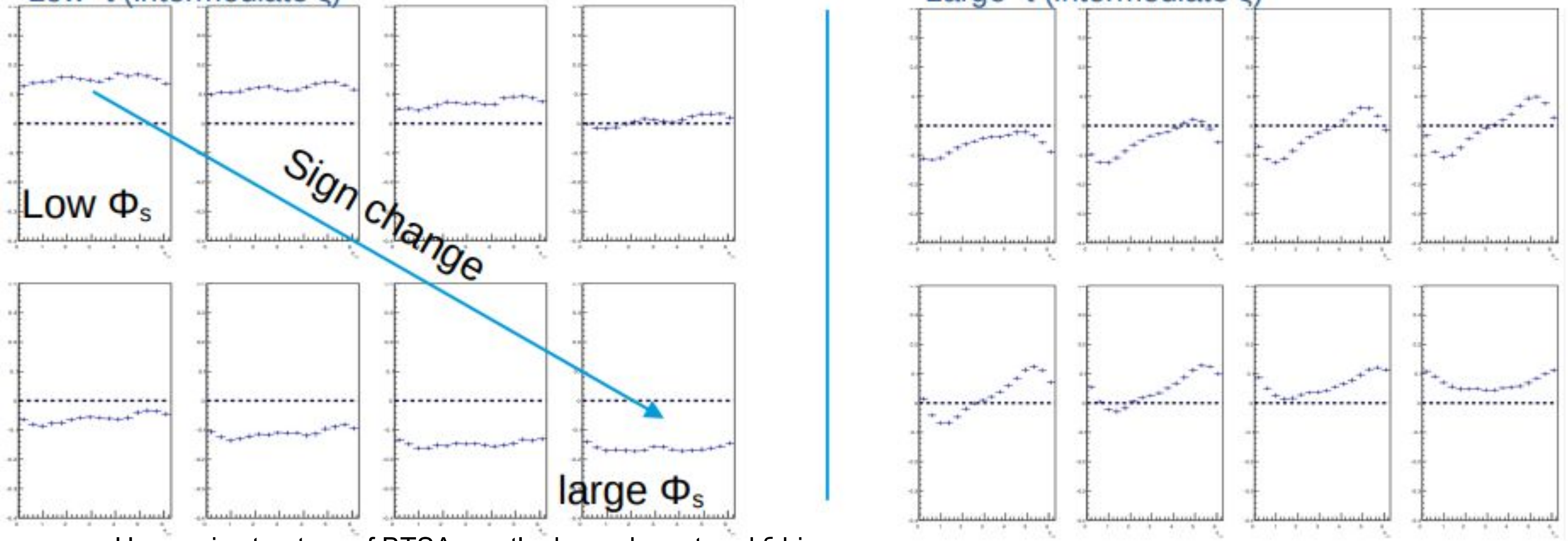


$\xi = 0.2$, $-t = 0.4$ GeV² and $Q'^2 = 7$ GeV²

Projected (ideal) BTSA distributions

Evolutions of the shapes vs Φ, bins in Φ_s from 0 to π at intermediate ξ and for 2 bins in t

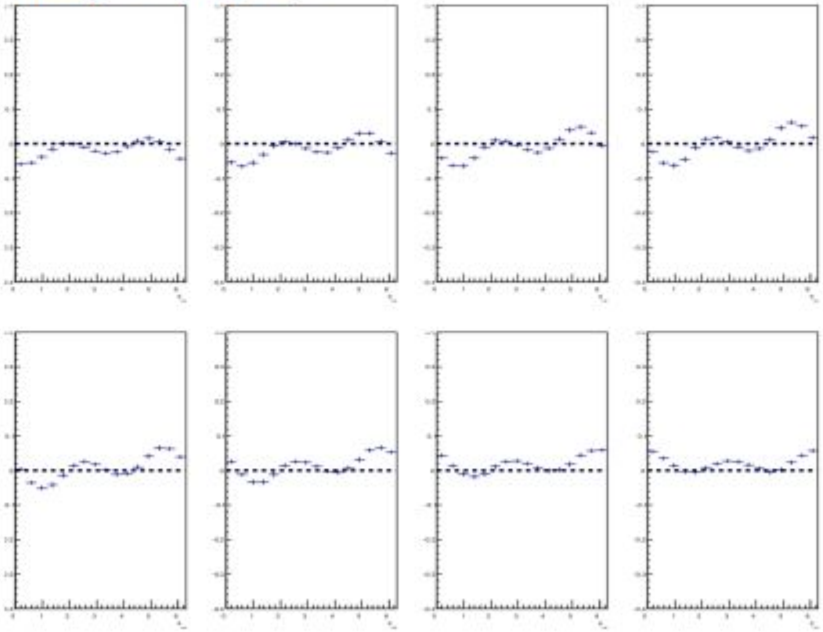
Low -t (intermediate ξ) | Large -t (intermediate ξ)



-Harmonic structure of BTSA mostly depends on t and ξ bins

-BH doesn't cancel, nor is it TCS "only". Harder to interpret but any information is a major input to models and especially for discriminating Double Distribution "types" vs other kinds (strongly differ on Re CFF)

Large -t (large ξ)



-Shape also strongly dependent on ξ (compares to right panel of last slide)
-Very fast evolution of real part of amplitudes with ξ, unlike for the imaginary part
-Importance of selecting the right binning in ξ & t

Binning

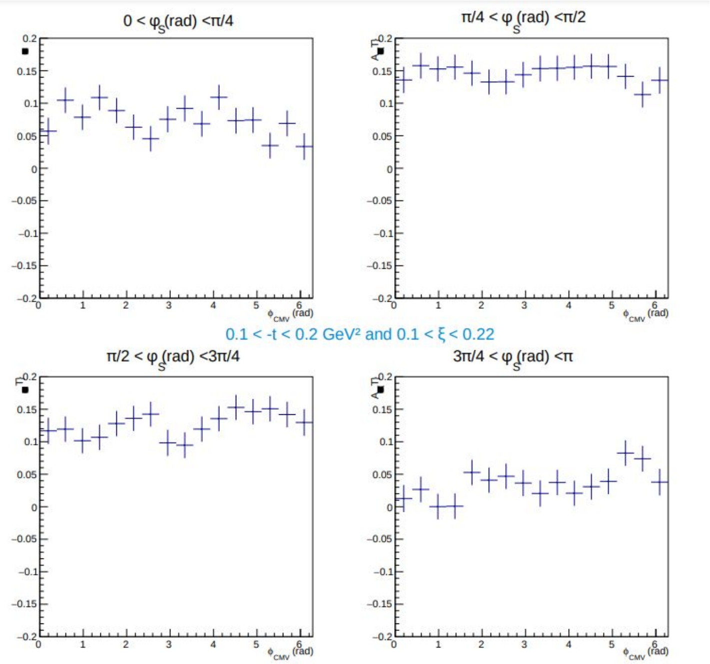
Because of the large uncertainty associated with BTSA, larger bins were used then for TSA

Instead of the 7 kinematic bins in (t, ξ, Q'²) and 16 bins in Φ_s used for TSA, 3 kinematic bins in (t, ξ) and 4 bins in Φ_s were used. The same acceptance cuts were also used, with the exception of θ which was narrowed to [70º,110º] in order to target the region with more TCS

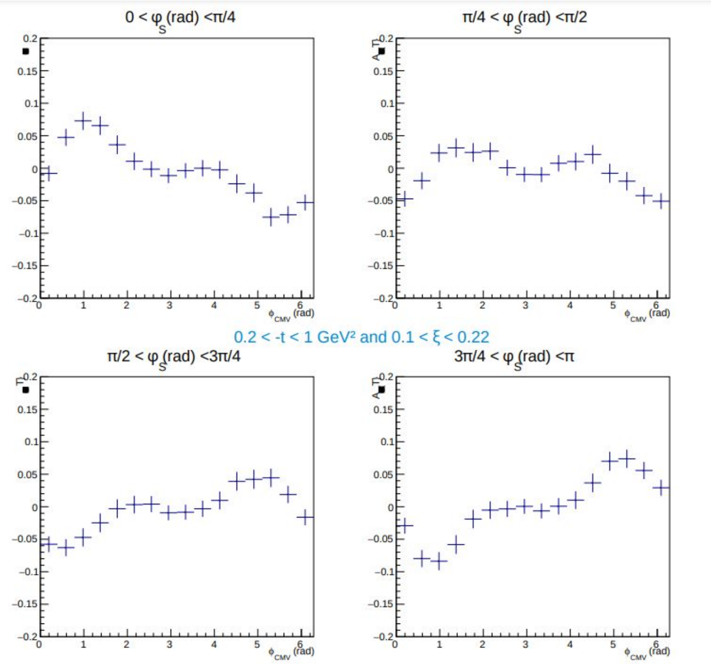
Systematic Uncertainties for BTSA

Target Polarimetry	27%
Beam Polarimetry	1%
Background	5%
Calorimeter	2%
Photon Resonance	<1%
Total	~27.5%

Projected Results with New Binning



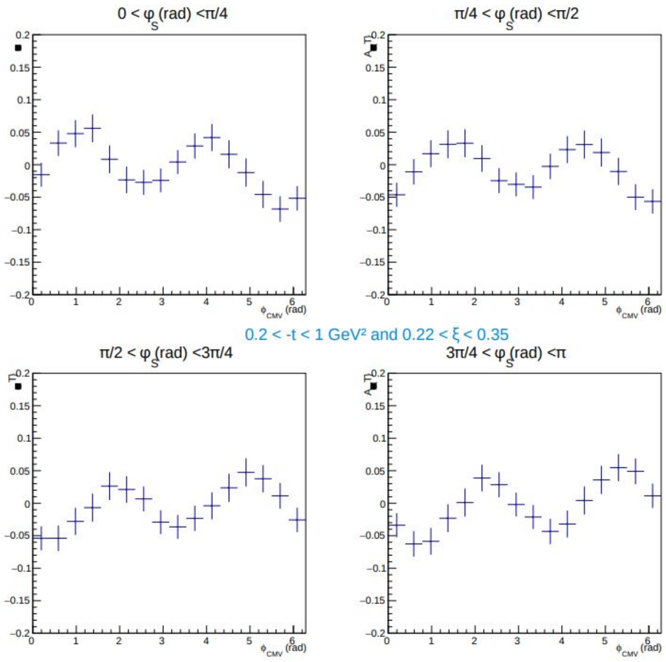
Low -t, low ξ



Large -t, low ξ

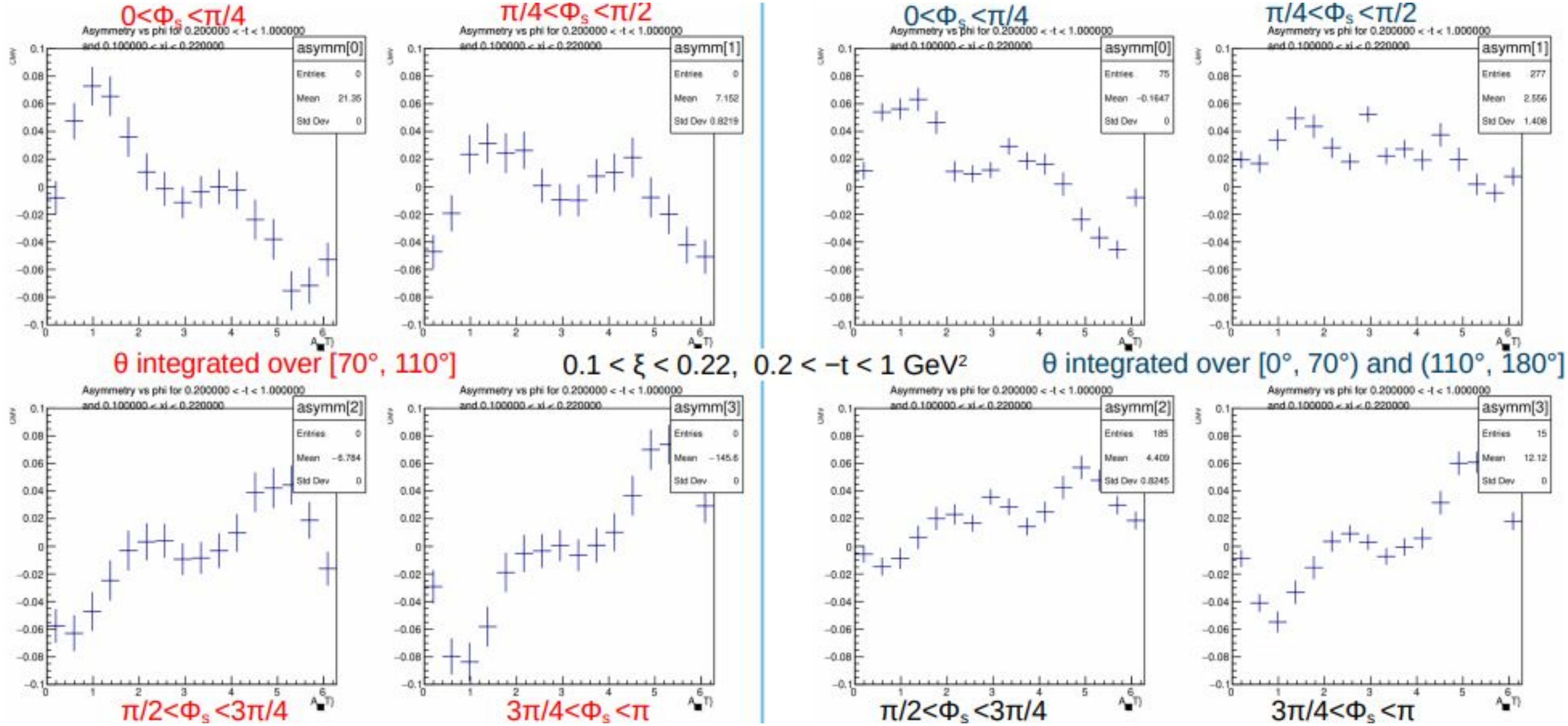
Statistical uncertainties are represented and the histograms include dilution and polarization transfer factors.

New binning still shows the evolution of harmonic structure with change in t and ξ

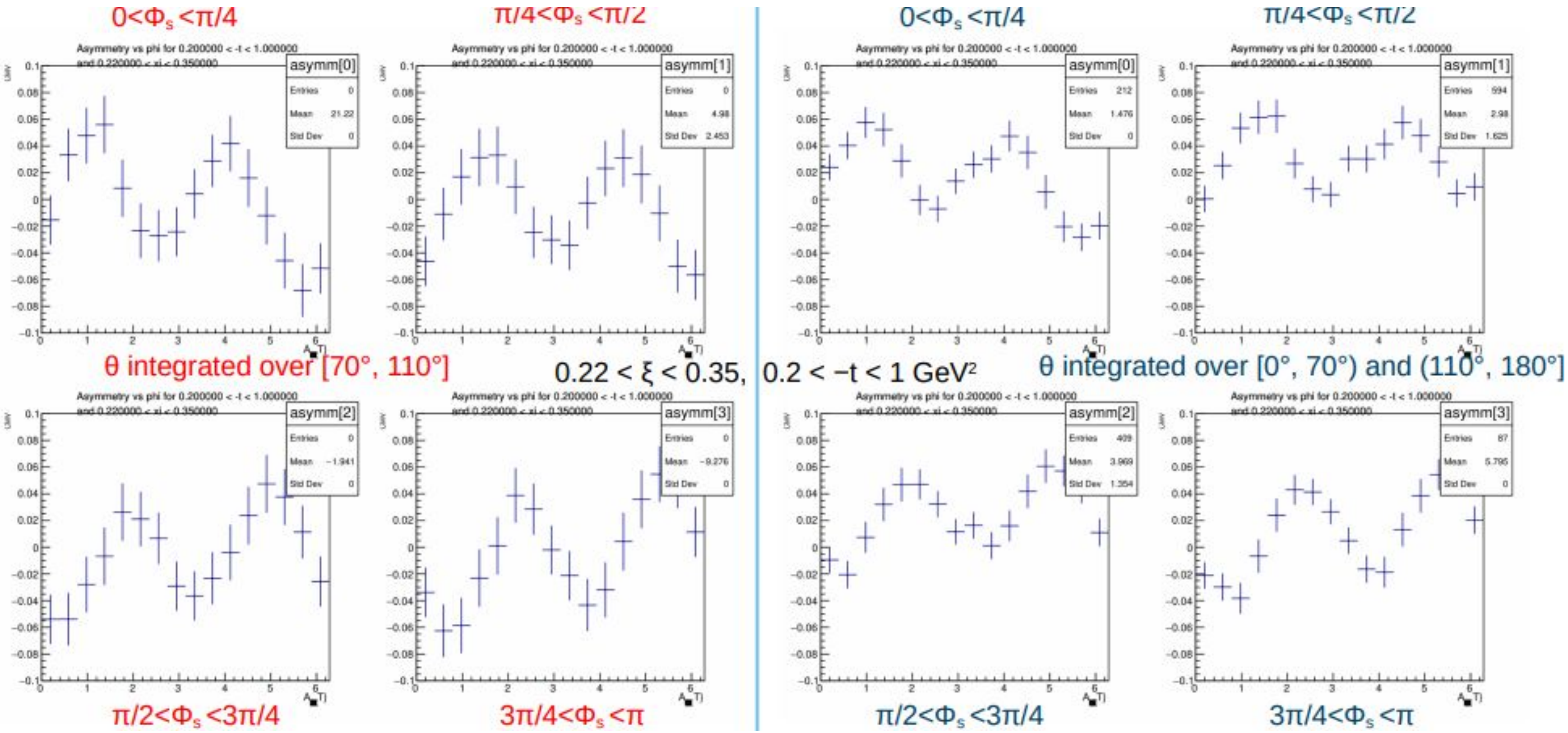


Large -t, large ξ

Comparing results integrated inside [70º,110º] vs Integrated outside range



Asymmetries integrated inside [70º, 110º] show more extreme negative values compared to outside, which is only BH



Asymmetries integrated inside [70°, 110°] show more extreme negative values compared to outside, which is only BH

- Asymmetries integrated around 90^o, where there is more TCS, show greater magnitude of negative values

- Integrated asymmetry is different enough from just BH to extract physics

-It may be prudent to do left/right asymmetries for statistical reasons instead of full Φ distribution

Summary

-BTSA analysis is complementary to currently proposed experiment and would require no additional beam time

-Could be included in the proposal or could do a run group proposal

-Even if we only analyze left/right asymmetries, there is no existing data about real CFFs from TCS so it would still provide valuable information

-Analysis of BTSA will be more difficult then TSA because BH dominates