

Electroweak asymmetries

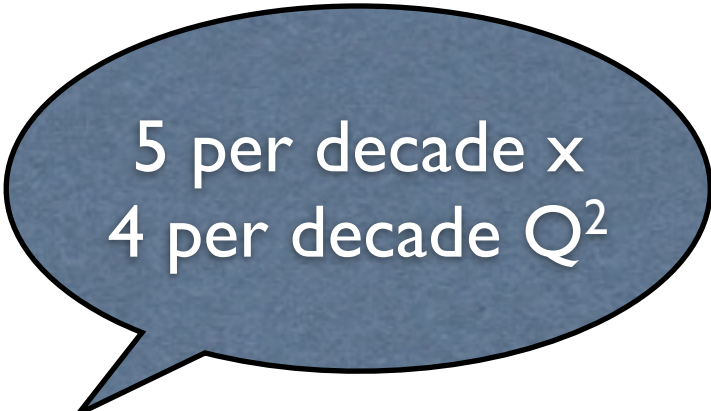
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EIC Task Force Meeting
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Polarised DJANGO

- DJANGO 4.6.10 introduces polarisation
 - ▶ <https://wiki.bnl.gov/eic/index.php/DJANGO>
- Look at electroweak asymmetries from
 - ▶ $e^{\leftarrow} + p^{\leftarrow(\rightarrow)} \rightarrow \nu_e + X$
- Run events through smearing to investigate detector acceptance/resolution
- Trees at
 - ▶ `/eicdata/eic0009/DJANGO`
- Analysis code at
 - ▶ `/eic/u/tpb/analyses/ccAsym`

Smearing and bin migration

- Documented on wiki:
 - ▶ [https://wiki.bnl.gov/eic/index.php/Q2-x bin migration](https://wiki.bnl.gov/eic/index.php/Q2-x_bin_migration)
- Bottom line:
 - ▶ Resolution is good
 - ▶ Bin migration is small with 'standard binning'
 - ▶ Purity typically $> 80\%$ - unfolding should work fine



5 per decade x
4 per decade Q^2

(Definitions)

I classify events (per bin) as...

- ‘**Generated**’, N_G : these are in the true (x, Q^2) bin by definition
- ‘**Smearred**’, N_S : these may or may not be true bin
- ‘**Retained**’, N_R : only events in same bin after smearing
 - ▶ Note G and S histograms are filled every event, R only for events where the bin is the same

(Definitions)

So...

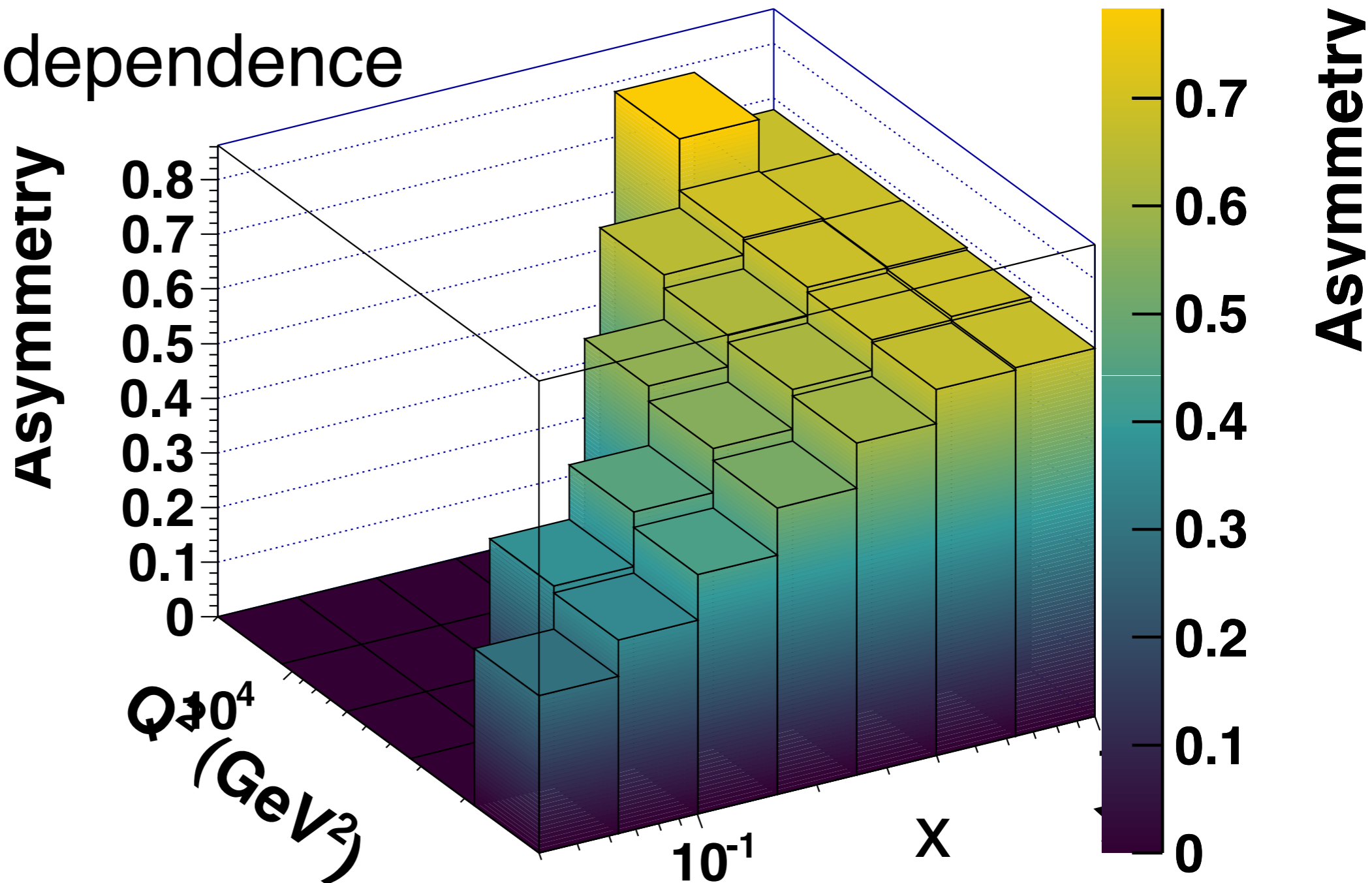
- If $N_{\text{out}(\text{in})}$ = number smearing out of (into) a bin:
 - $N_S = N_G - N_{\text{out}} + N_{\text{in}}$
 - $N_R = N_G - N_{\text{out}}$
- **'Retention probability'** = $N_R / N_G = (N_G - N_{\text{out}}) / N_G$
- **'Purity'** = $N_R / N_S = (N_G - N_{\text{out}}) / (N_G - N_{\text{out}} + N_{\text{in}})$

Asymmetry

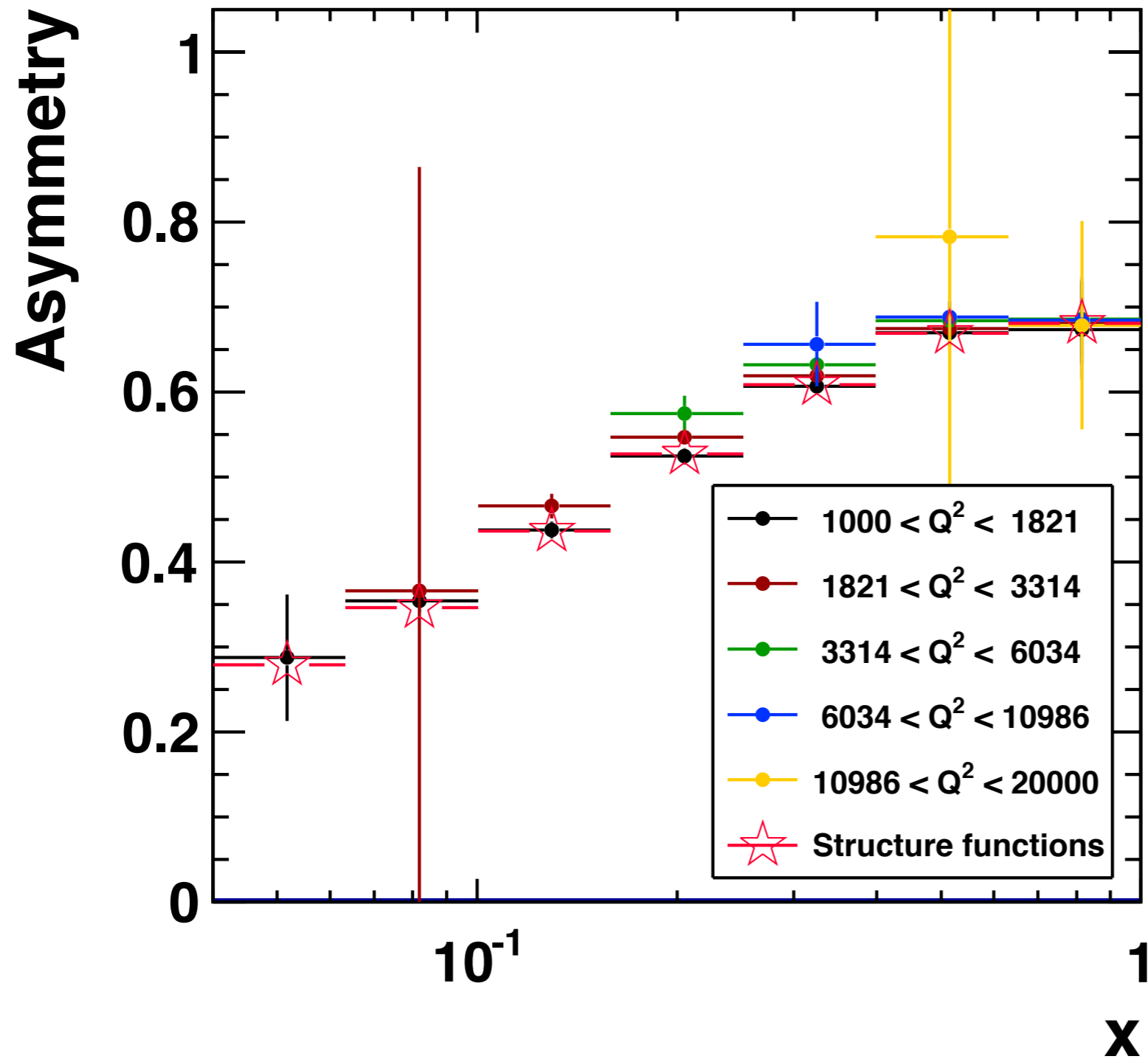
- Calculate asymmetry from
 - ▶ $[N(p^{\leftarrow}) - N(p^{\rightarrow})] / [N(p^{\leftarrow}) + N(p^{\rightarrow})]$
- Just use “retained” counts for asymmetry
 - ▶ Haven’t done any complicated ‘unfolding’ etc
- Scale uncertainties to represent 10 fb^{-1}

Asymmetry

- Large asymmetry
- Little Q^2 dependence



Asymmetry



Check against structure functions

- “Theory” value from structure functions in DJANGO event record
- $A = (-Y_1 * G_5^{CC} - Y_2 * G_1^{CC}) / (Y_1 * F_1^{CC} - Y_2 * F_3^{CC} / 2)$
 - ▶ $Y_1 = 1 + (1 - y) * (1 + y)$
 - ▶ $Y_2 = 1 - (1 - y) * (1 + y)$
- (I checked this with Till when he was here so I assume it's OK!)