CI analysis of H1+ZEUS data

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H1/ZEUS meeting 5.9.2018

Relation of this work and ZEUS prel.

- Discussions with ZEUS management about one year ago: can we have a combined CI paper?

  (the input data are H1+ZEUS combined)

- Check whether H1 can contribute significantly to this analysis or to a follow-up paper

- H1 analysis started
- Fitting framework different from Xfitter → good for independent checks

- Following slides present the work done in H1 so far

Setup

- Fits are done using ALPOS fit framework
- Log-normal distribution (all errors are relative)
- This talk: fits to data, using different SM and CI theories

$$\sigma_{\text{fit}} = \sigma_{\text{SM}}^{\text{NLO}} \times \frac{\sigma_{\text{SM+CI}}^{\text{LO}}}{\sigma_{\text{SM}}^{\text{LO}}}$$

$\sigma_{\text{SM}}^{\text{NLO}}$:NLO QCD and HO EW

$\sigma_{\text{SM+CI}}^{\text{LO}}$:leading order SM+CI

$\sigma_{\text{SM}}^{\text{LO}}$:leading order SM

- Using the CI theory in a PDF fit:
  - SM cross section is NLO QCD and may also include EW corrections
  - CI cross section is leading order only but has interference terms
  - Use (SM+CI)/SM like a “correction” to NLO QCD

Models considered

- For “NLO” SM: various settings have been tested
- The idea is to check how much the CI fit is sensitive to these

	HO-EW off	HO-EW on
ZMVFNS	checked	checked
FONLL-B	checked	checked

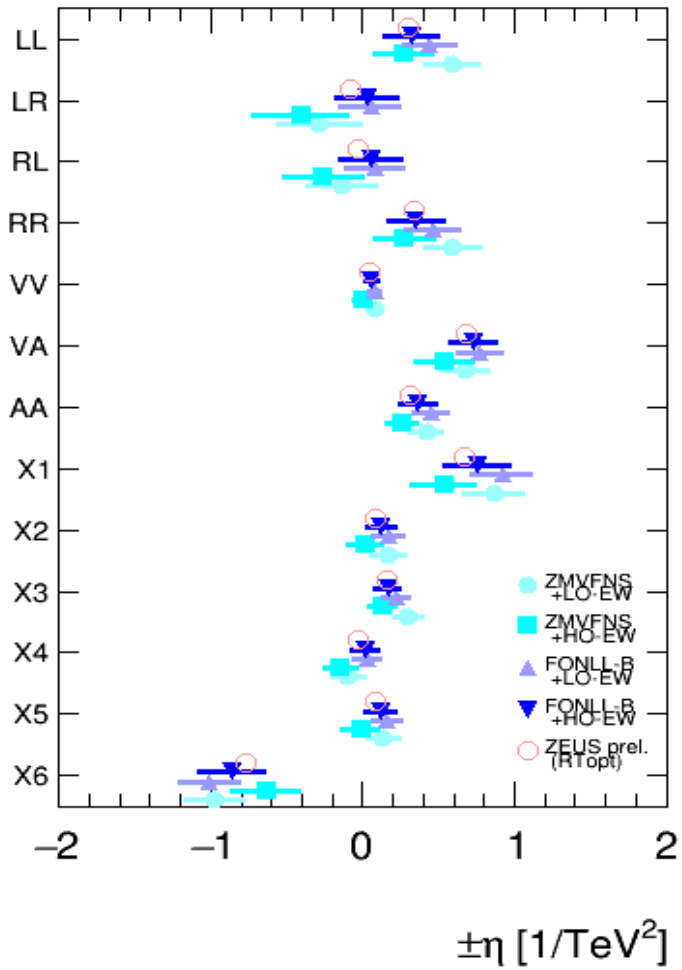
- RTopt was not checked
  - No xF3 prediction
  - It is very slow

- CI models tested
- 1D fits:
  - LL,RR,KR,RL,VV,AA
  - X1,X2,X3,X4,X5,X6
- 2D fits
  - LL-RR, VV-AA
  - X1-X6, X2-X5, X3-X4

Results of 1D fits

- Shown here: fit result with ±1σ (Hessian) errors
- Each fit is repeated 4 times, compare to ZEUS prelim. results [after scaling H1 by factor 4π]
  - ZMVFNS + LO-EW
  - ZMVFNS + HO-EW
  - FONLL-B + LO-EW
  - FONLL-B + HO-EW
- HO-EW: running $\sin^2\theta_W$ and ΔR
- Conclusions
  - EW corrections and HF scheme have some influence
  - "FONLL-B + HO EW" is closest to ZEUS prel.

I consider this as a sanity test of my fitting framework (good agreement with ZEUS prel. - factor 4π yet to be sorted out)



CI model in 2D

- Contact interaction models have up to 16 couplings
- Is is possible to do fits of several couplings?
- Simplest case: measure two couplings and draw in 2D
- Similar studies were done in “physics at HERA” from 1991, vol.2, 1133 (Haberl/Schrempp)
- Also of interest: polarisation

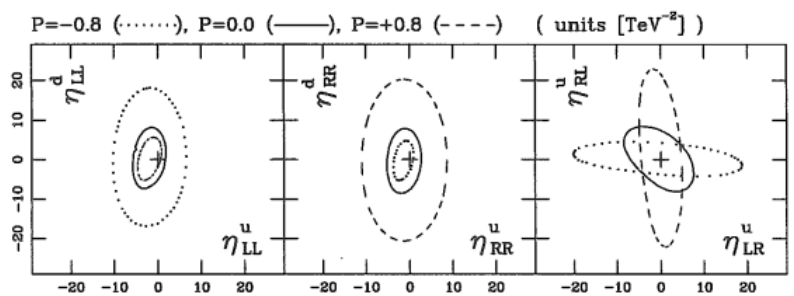


Figure 3: Illustration of the strong impact of e^- beam polarization on the shapes of the model independent exclusion contours.

2D projections of pairs of couplings (Haberl/Schrempp/ Martyn 1991)

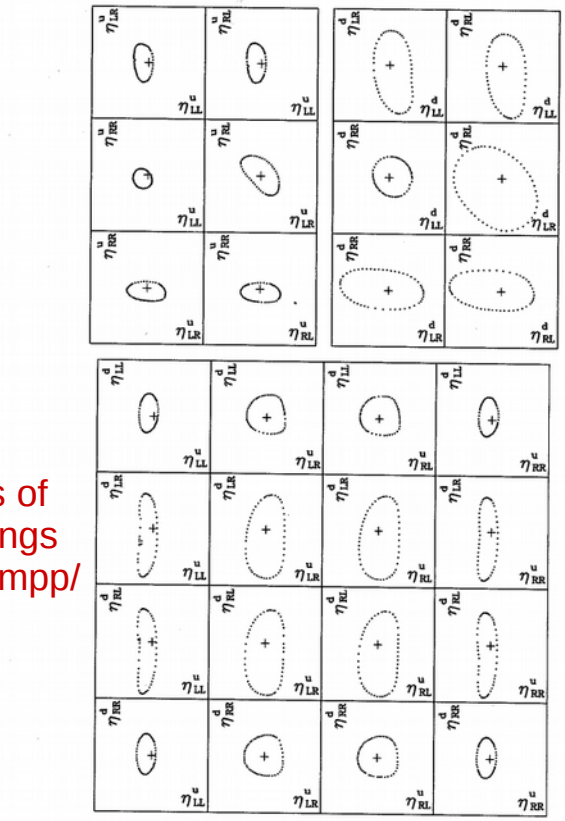
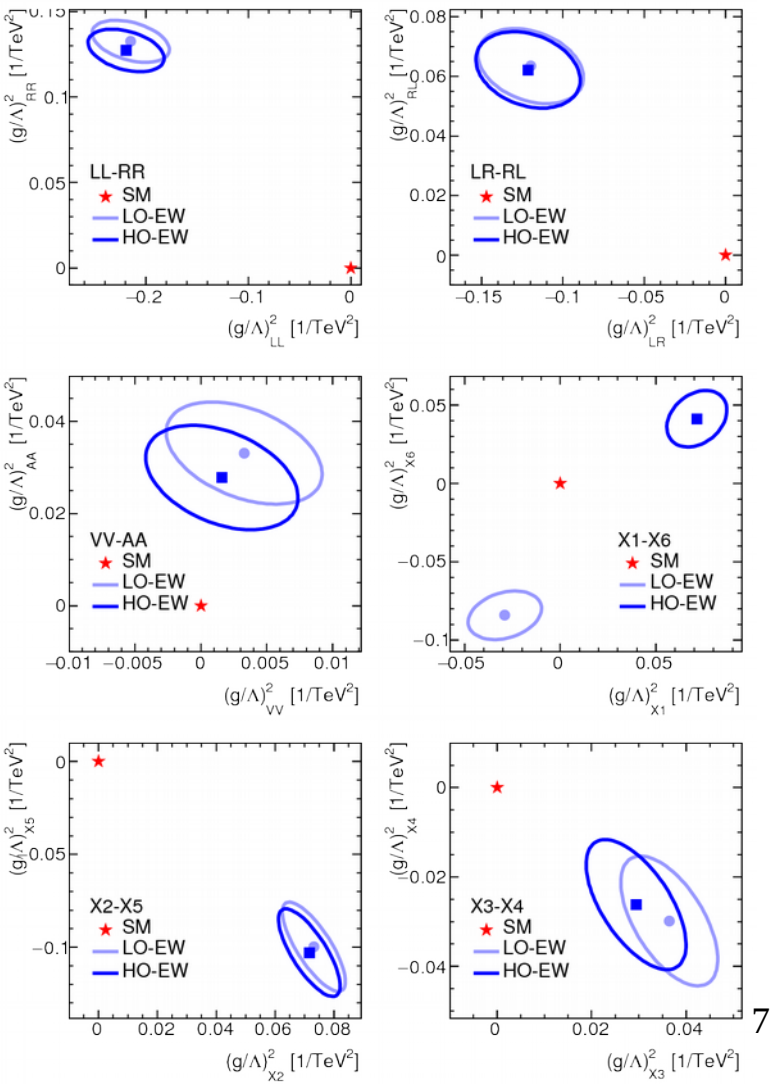


Figure 2: Complete set of 28 ‘shadow projections’ of the model independent allowed parameter domain in eight dimensional parameter space for unpolarized e^- beams. All correlations among the eight contact interaction coefficients η^q_{ij} are included. Each side of the boxes ranges between $(-25, +25)$ TeV^{-2} and the origin (cross) corresponds to the SM.

Beam polarisation can improve sensitivity (Haberl/Schrempp/Martyn 1991)

Results of 2D fits

- Shown here: fit result for $(g/\Lambda)^2$ with ±1σ (Hessian) ellipses [→ ~40%CL]
- Each fit is repeated 2 times
  - FONLL-B + LO-EW
  - FONLL-B + HO-EW
- HO-EW: running $\sin^2\theta_W$ and ΔR
- Results are off the SM [Note: errdef was not set properly for 2 parameters ~40%CL]
- Double-minima not checked yet, have to scan profile likelihood
- For some 2D models [e.g. X1-X6], EW corrections seem important
- More work needed to understand this: 2D seems tricky as compared to 1D



Summary

- H1 CI analysis on combined data was started
- Slow progress due to limited personpower
- For 1D analysis, possible H1 contributions are limited. Agreement with ZEUS prel. results for central fit results [using different setup].

- First look at 2D analysis: could be interesting but also challenging
- Also of potential interest: polarisation [things which LHC can not probe?]

- Discussion: one/two papers? Combined vs ZEUS-only? Timescales?