First studies on W Boson asymmetry

- First look at W asymmetry
- Selection efficiencies
- Detailed look at distributions

- Conclusion and Outlook

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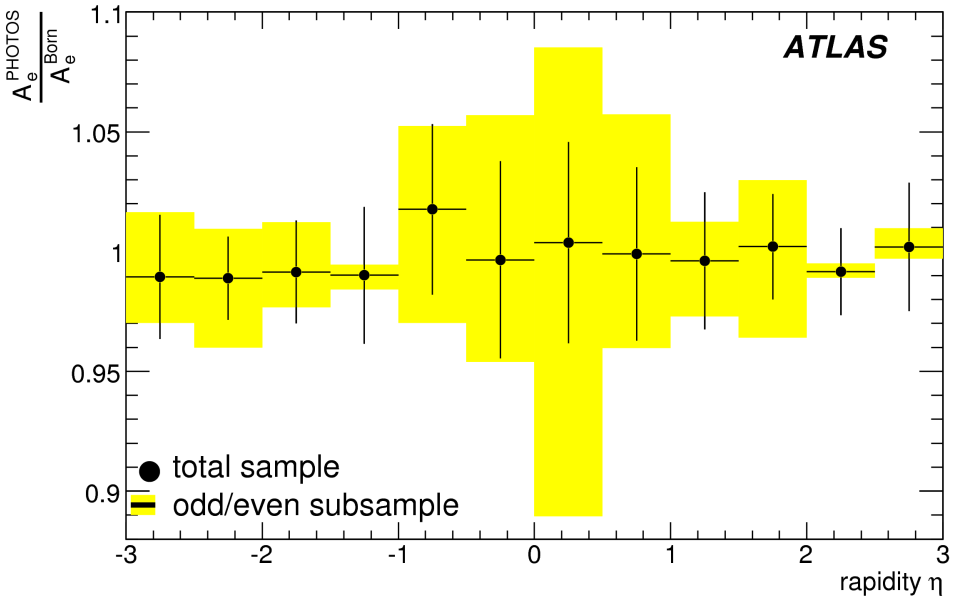
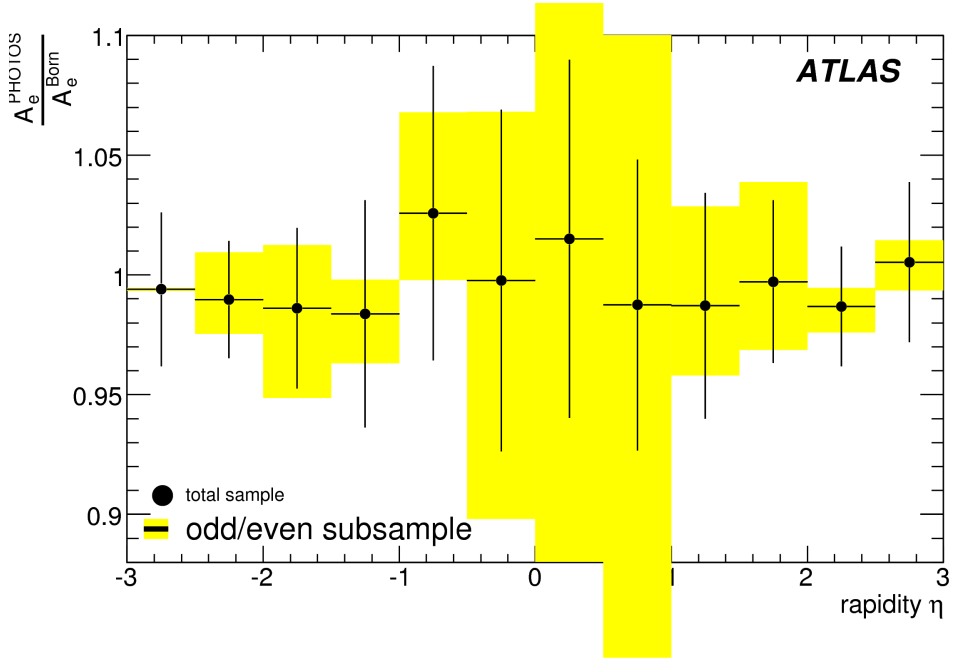
Reminder: Asymmetry not effected by EW corrections

electron asymmetry

$$A_l = \frac{d\sigma/d\eta(e^+) - d\sigma/d\eta(e^-)}{d\sigma/d\eta(e^+) + d\sigma/d\eta(e^-)}$$





- **no effect on Asymmetry**

	relative difference (constant fit)	
	$p_T^e > 10\,\mathrm{GeV}$	$p_T^e > 25\,\mathrm{GeV}$
$A_e^{\mathrm{PHOTOS}}/A_e^{\mathrm{Born}}$	-0.5 ± 0.7%	-0.7±1.1%

Asymmetry might be less sensitive to PDFs differences, but easier to measure with the precision needed

W Asymmetry: Cuts & Acceptances

TDR cuts:

P_T (electron) > 25 GeV

|η| (electron) < 2.4

E_t^{miss} > 25 GeV

Event Recoil < 20 GeV

NO jet > 30 GeV

Datasets

trig1_misal1_csc11.005100.JimmyWenu.recon.NTUP.v12000601
trig1_misal1_csc11.005140.JimmyZee.recon.NTUP.v12000601

scaled to 10 fb^{-1}

Reco cuts:

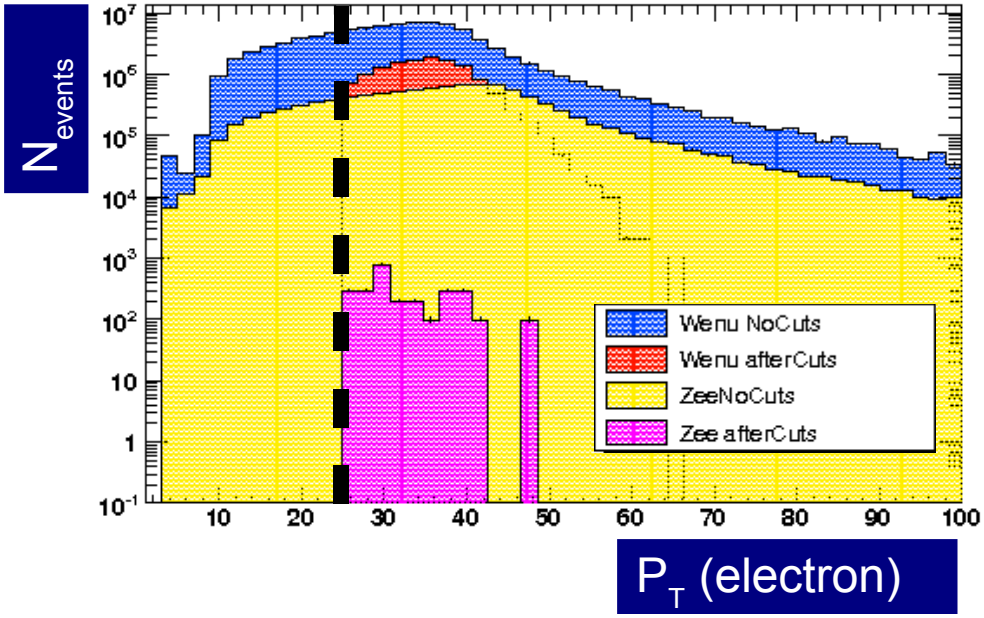
electron: isEM==1
hasTrack

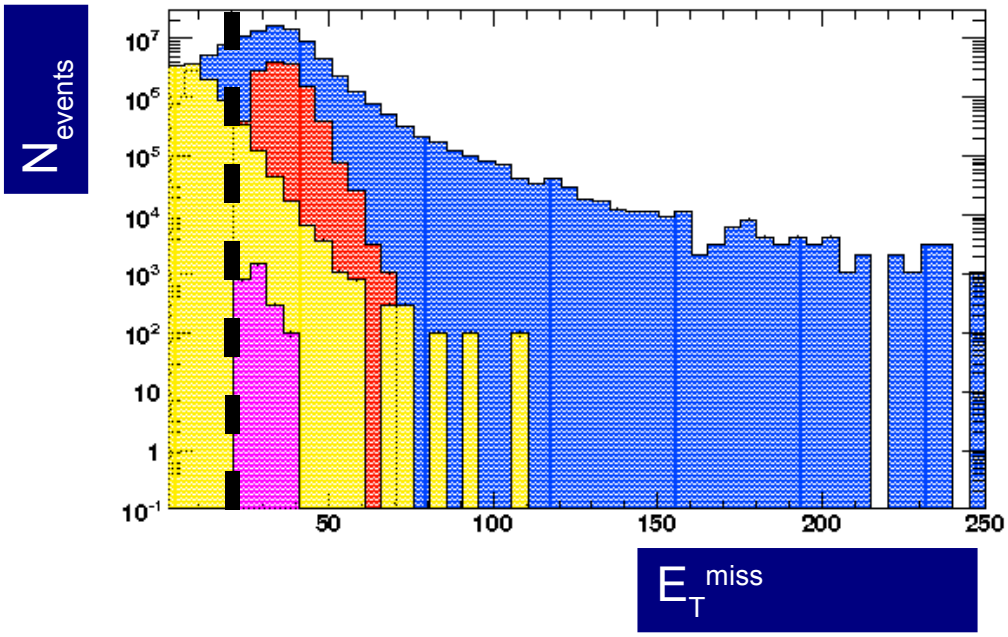
Datasample	cross section	number of events			ϵ_{reco}	ϵ_{cuts}
		before cuts	after Reco	after cuts		$\frac{N_{cuts}^{reco}}{N_{cuts}^{true}}$
$W \rightarrow e\nu$	17350 pb	163650	87124	12386	53.24%	21.73%
$Z \rightarrow ee$	1573 pb	159350	108236	27	67.92%	-

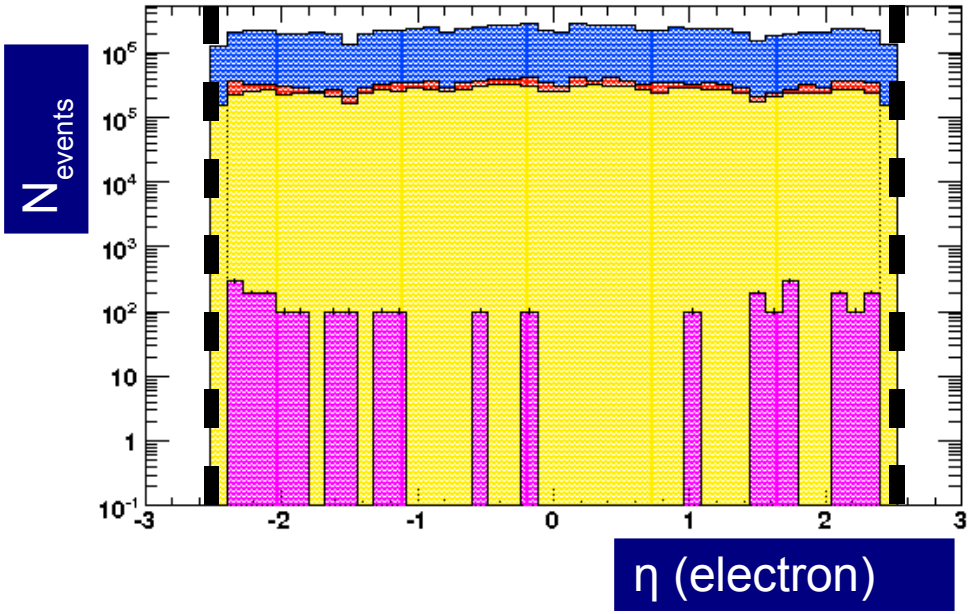
S/(S+B): 0.998

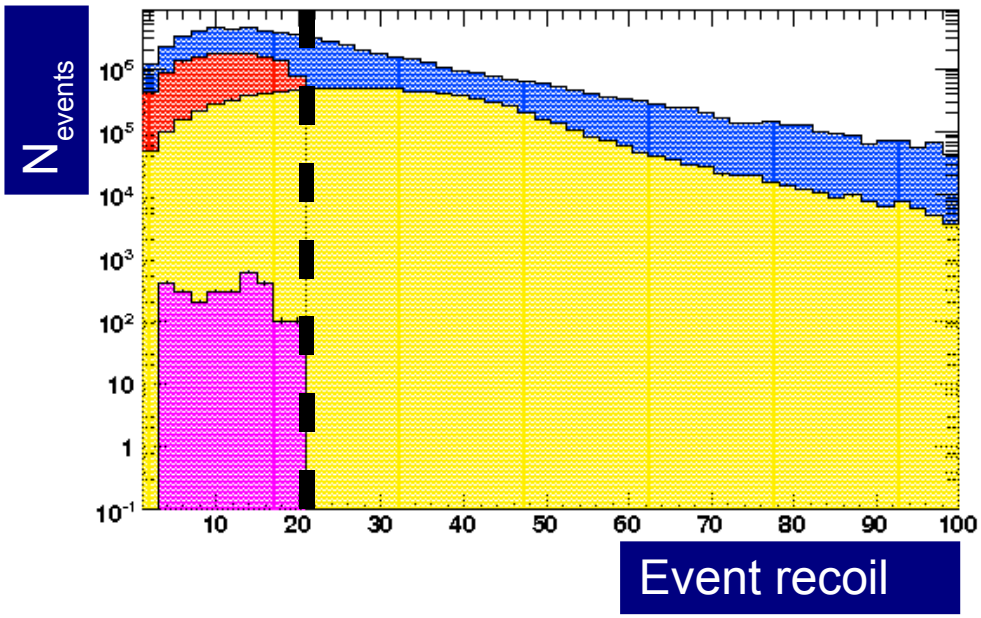
21.7 ± 2.4 %
(averaging over φ efficiency)

W Asymmetry: Cuts & Acceptances

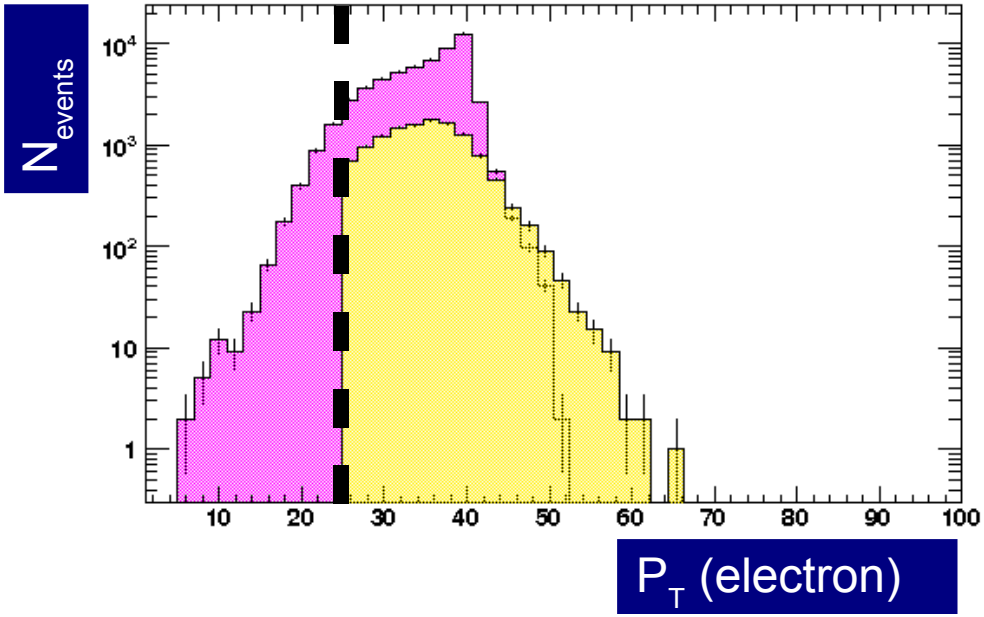


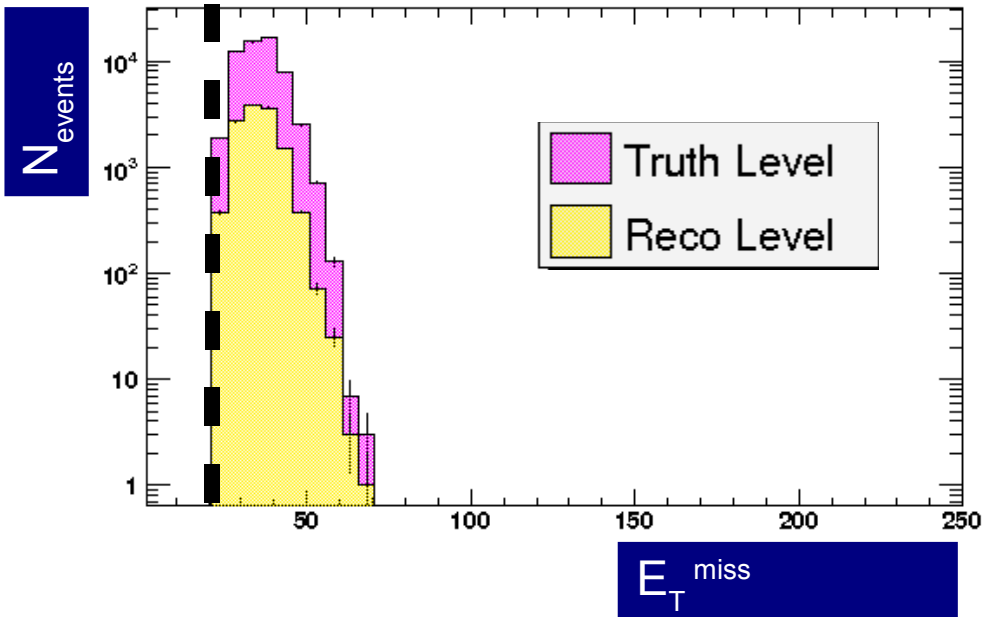


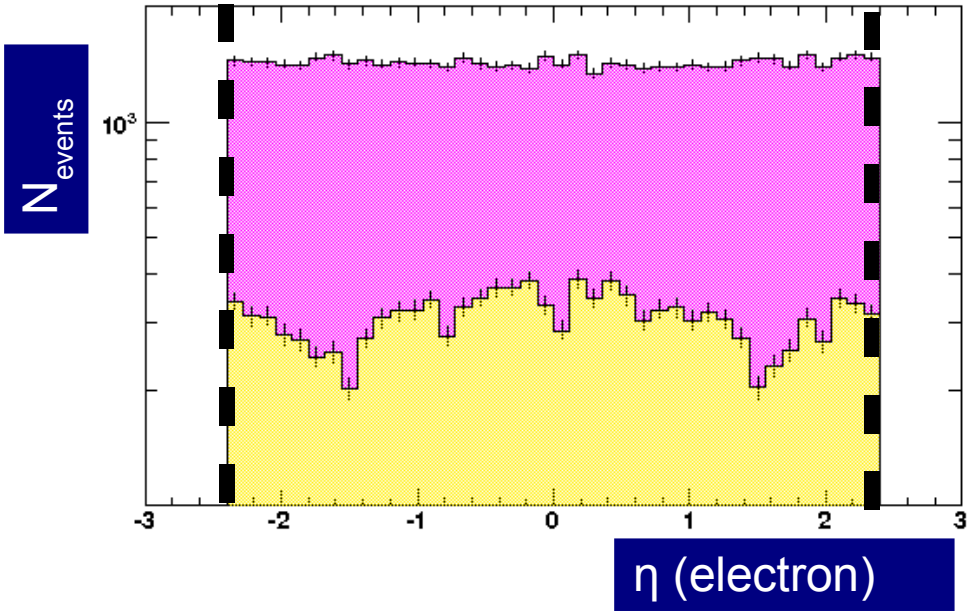


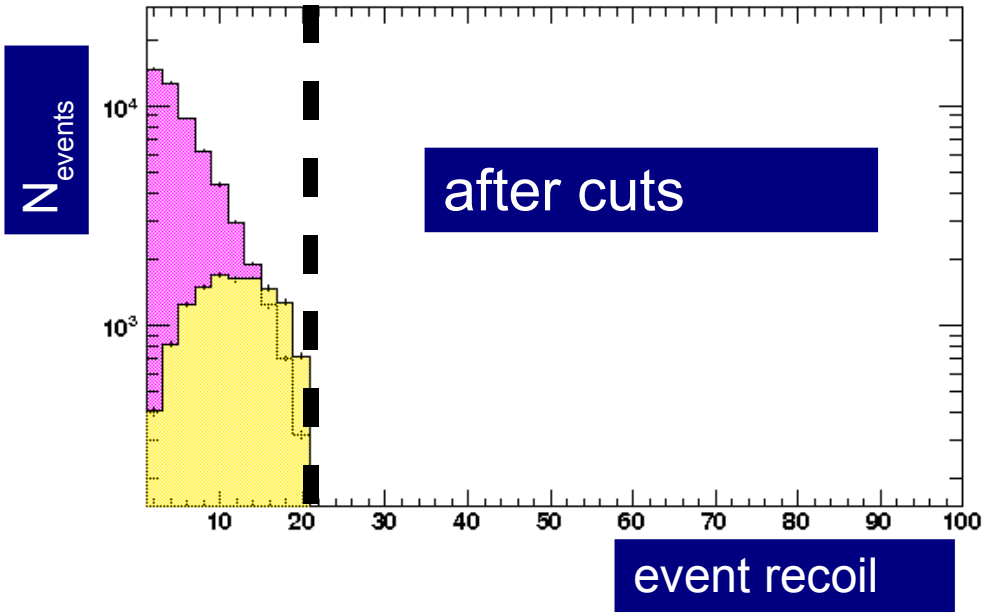


Comparison between Reco and Truth



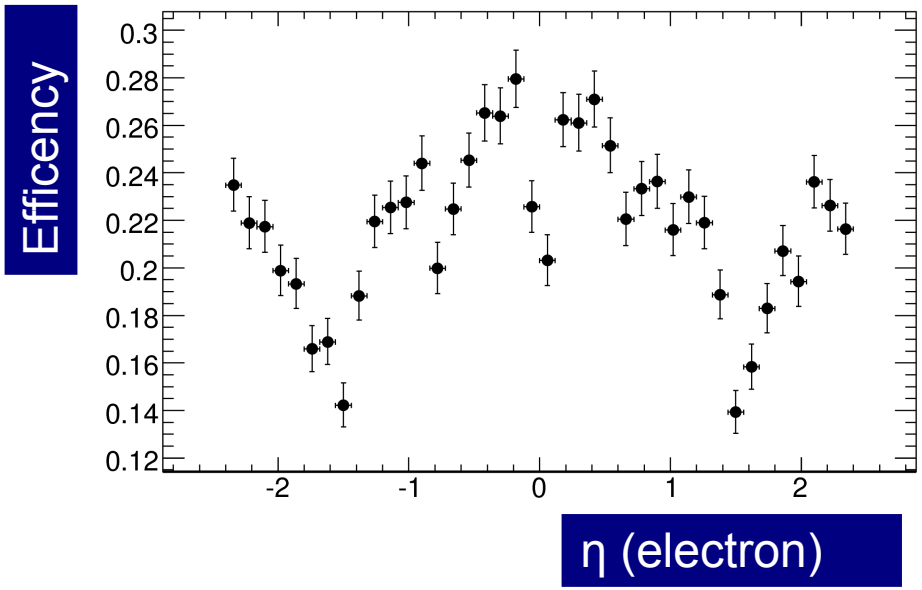


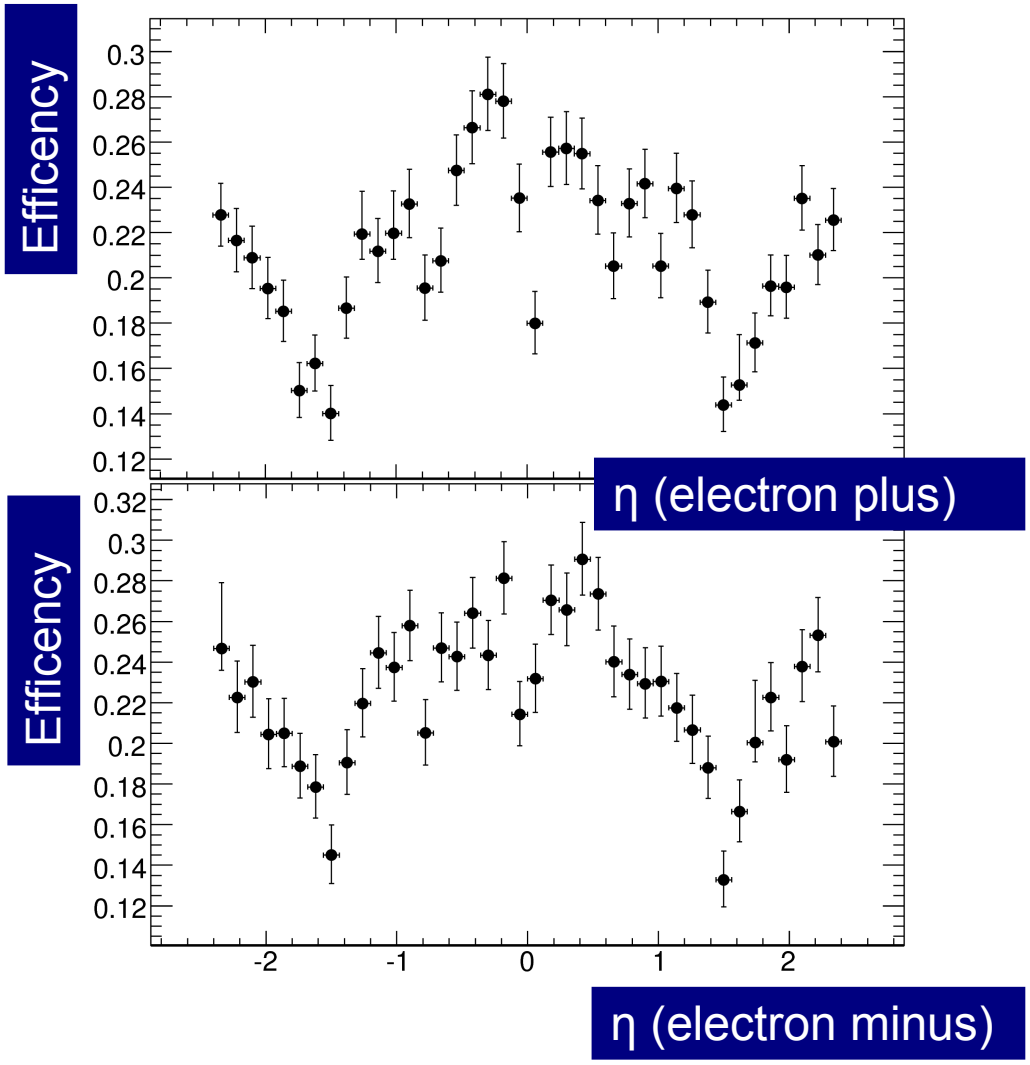




Acceptance efficiencies

minus: 22 ± 3 %
plus: 21 ± 3 %





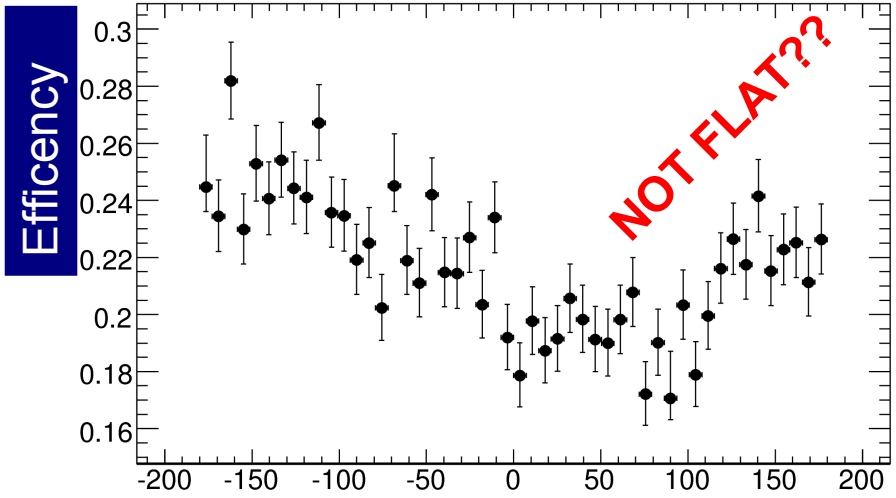
use electron identified as decay lepton in truth and in "data" after cuts

no truth-reco matching

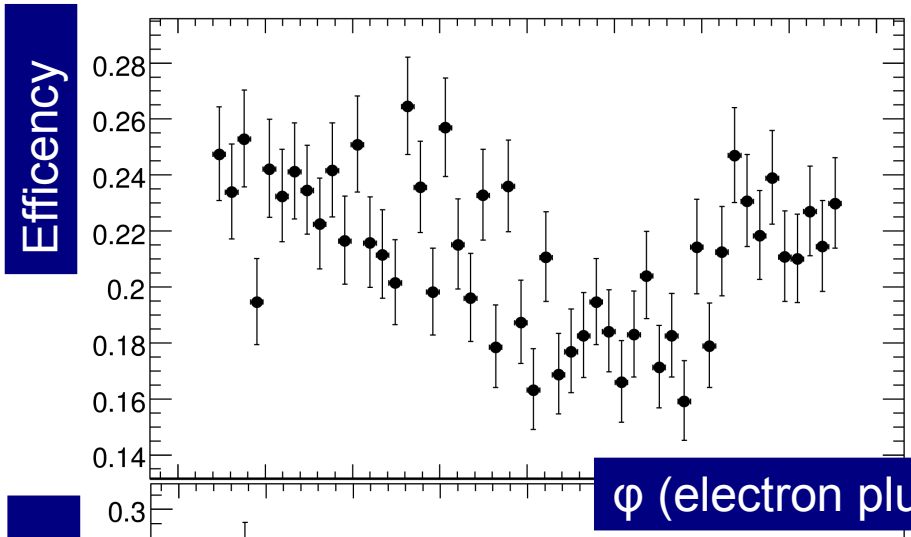
efficiencies for charges consistent with overall efficiencies

Acceptance efficiencies

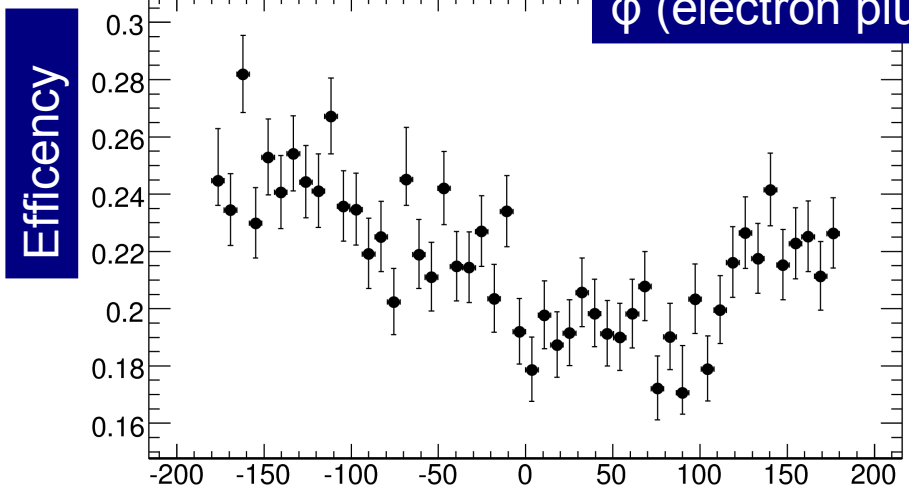
minus: 22 ± 3 %
plus: 21 ± 3 %



φ (electron)



φ (electron plus)



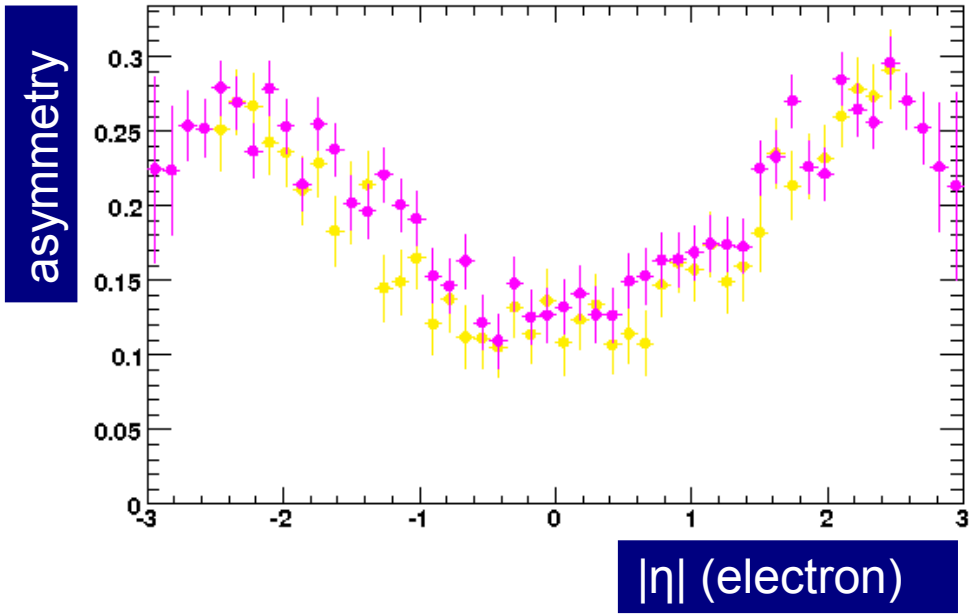
φ (electron minus)

not dependent on charge

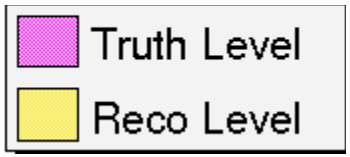
check with calib0 samples, perfect geometry

material in inner detector??

Comparison between Reco and Truth



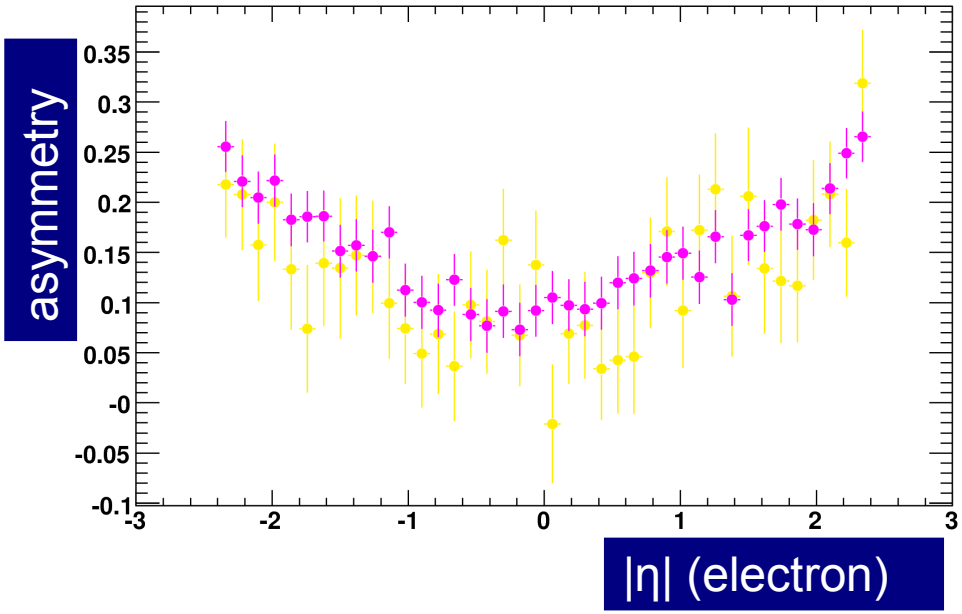
before cuts



diluted asymmetry need to be corrected for

- charge MisID (~11%)
(before acceptance cuts)

2 methods:
MC and tag&probe



after cuts

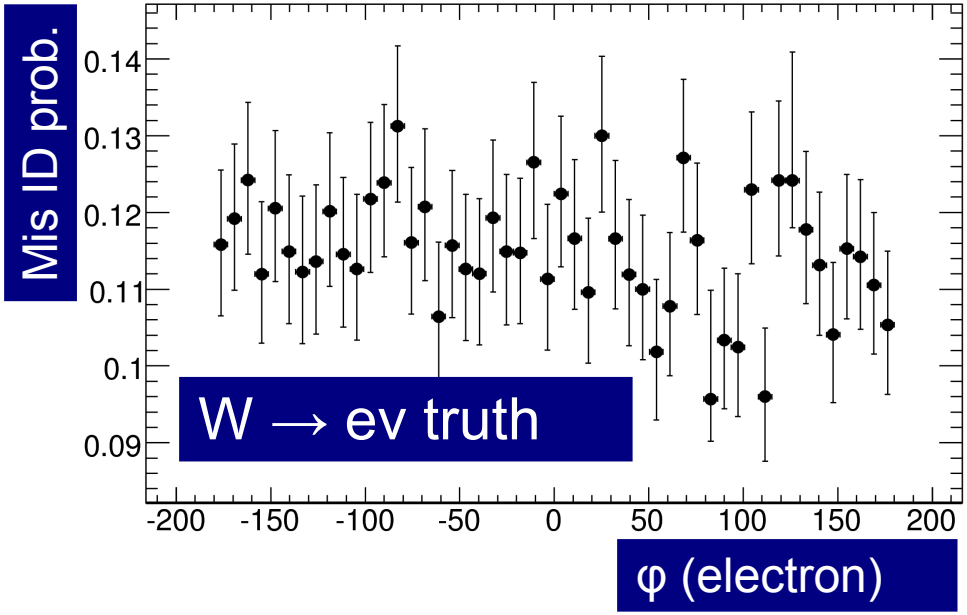
$$A_l^{reco} = (2g-1)\frac{\epsilon_{trk}}{N(W)_{trk}^{reco}}\left(\frac{N(W)_{trk}^{reco} - f_{trk}N(W)_{cal}^{reco}}{\epsilon_{trk} - f_{trk}}\right)$$

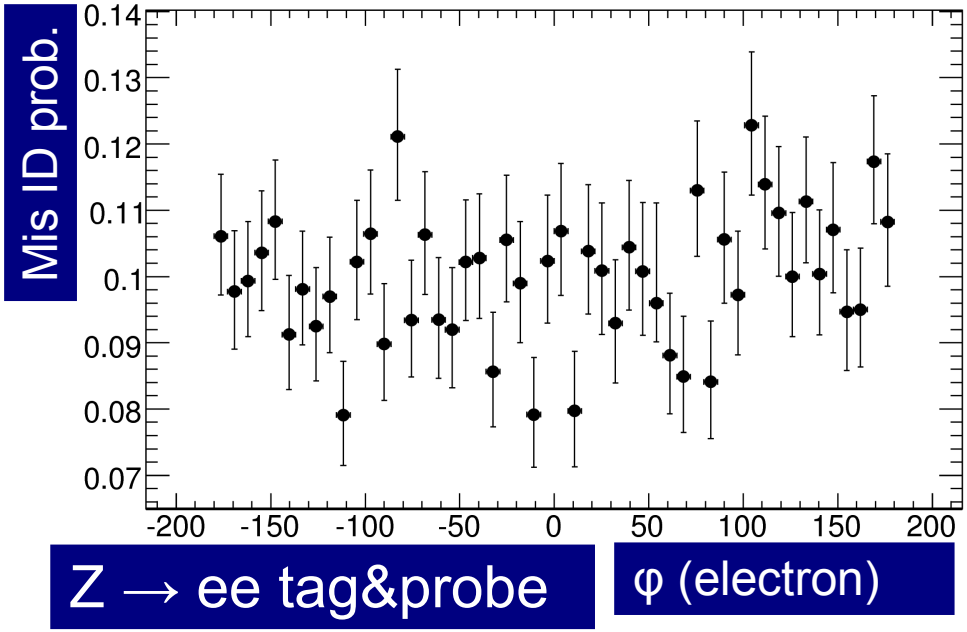
f = fake rate for track or calo cuts (incl. QCD)
ε = efficiency (track or calo cuts)
g = charge MisID rate

Conclusions

- Asymmetry is not affected by EW correction
  - **good candidate for early measurements**
- First look at cuts and efficiencies for asymmetry measurement
  - **selection efficiency ~20%**
  - **good W/Z separation, high purity sample**
  - **Misidentification before event selection ~11%**
- Further steps to be taken
  - **include jet samples in background studies**
  - **estimate charge MisID rates differentially with constitent cuts**
  - **estimate jet fake rate (another source of asymmetry dilution)**

Needed: Correction for charge misID





- **same level of MisID probability for data (tag &probe) and MC method** (note: Cut on inv. mass Z_{ee})
- **However differential distributions look different**
- **Cut on inv. mass related???**