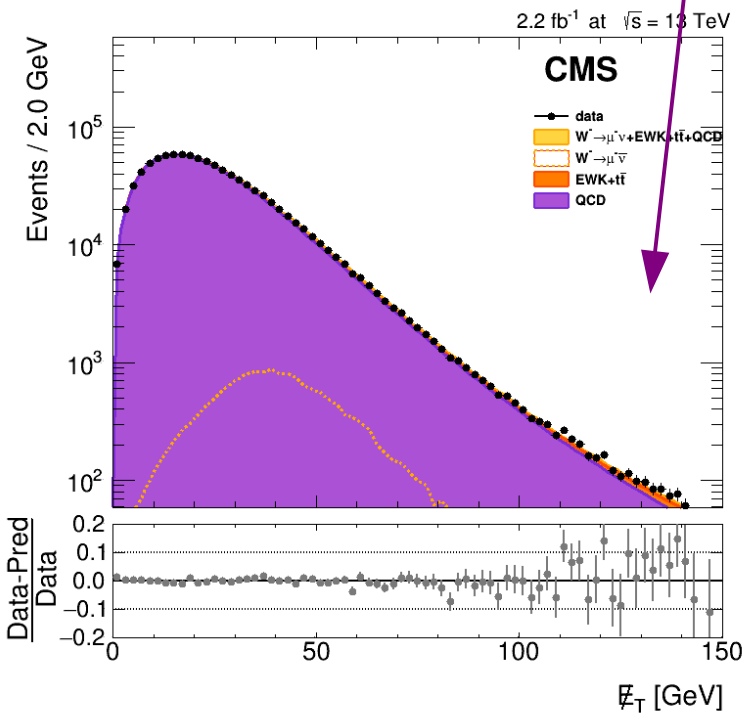
QCD background fits in eta bins

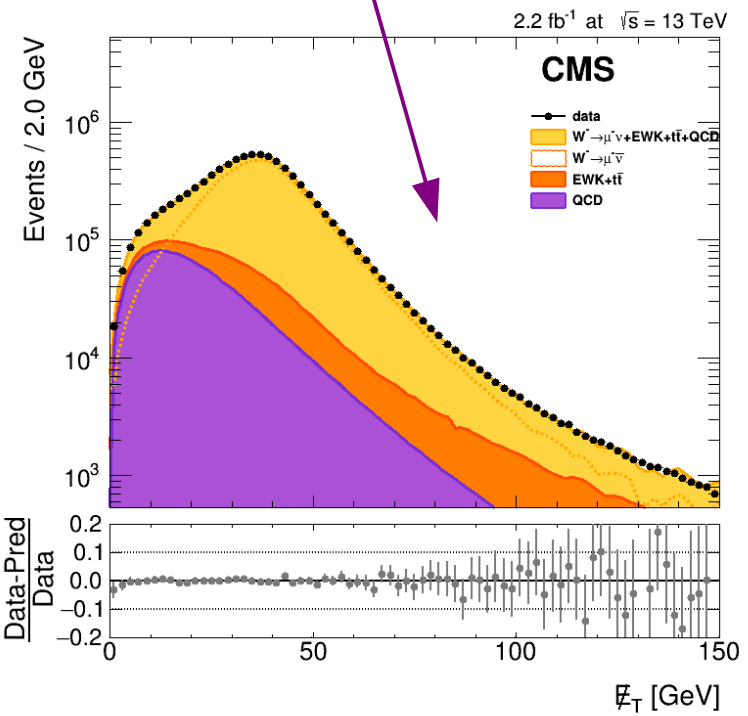
V. Danilov, K. Wichmann

QCD fit function

$$f_{\mathrm{QCD}}(E_{\mathrm{T}}^{\mathrm{miss}}) = E_{\mathrm{T}}^{\mathrm{miss}} \exp\left(-\frac{\mathrm{a3}\ \ \mathrm{a1}\ E_{\mathrm{T}}^{\mathrm{miss2}}\ \ \mathrm{a2}}{\sigma_0 + \sigma_1 E_{\mathrm{T}}^{\mathrm{miss2}} + \sigma_2 E_{\mathrm{T}}^{\mathrm{miss}}}\right)$$

- Fitted simultaneously in control and signal region
- For nominal results sigma$_1$ the same for both regions
- For systematic uncertainties sigma$_1$ different for different regions
  - How does fits look like?



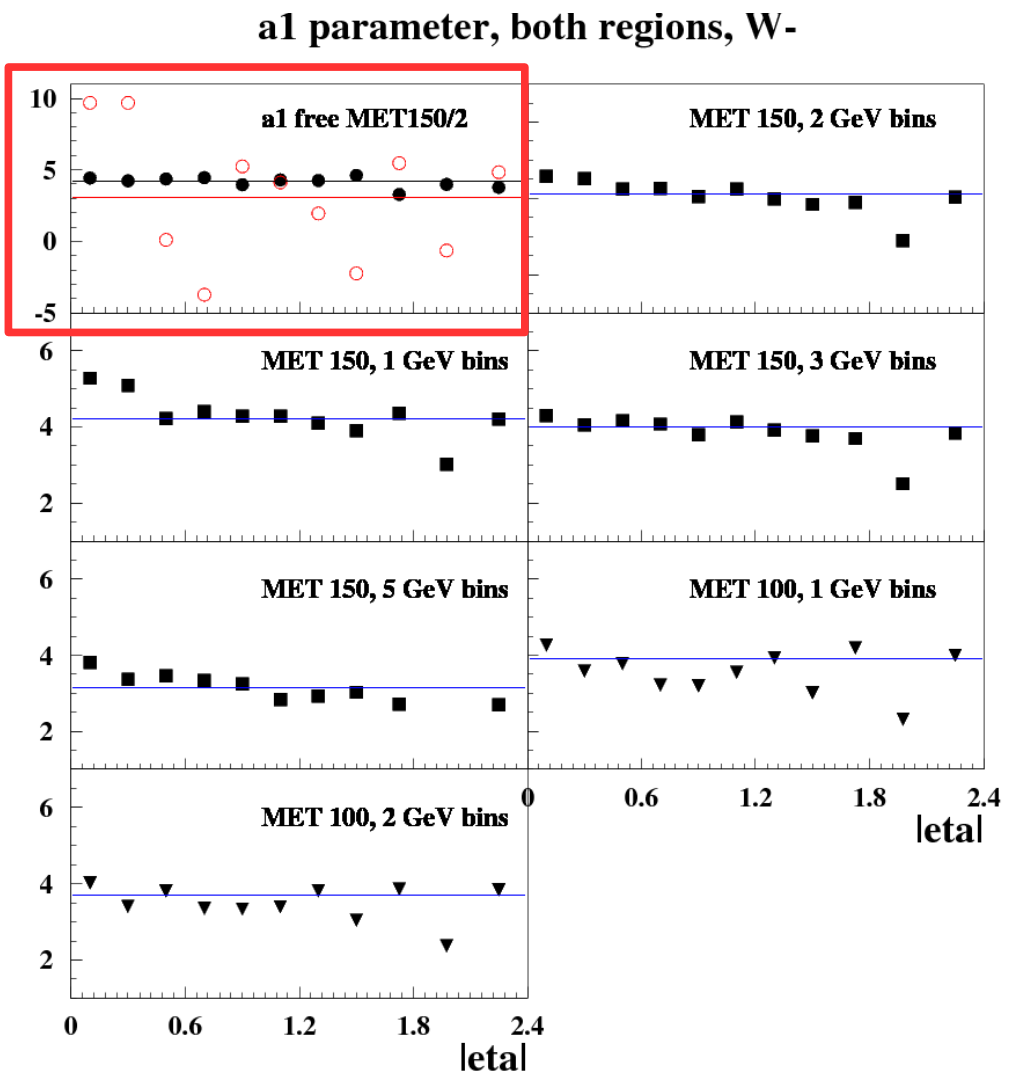


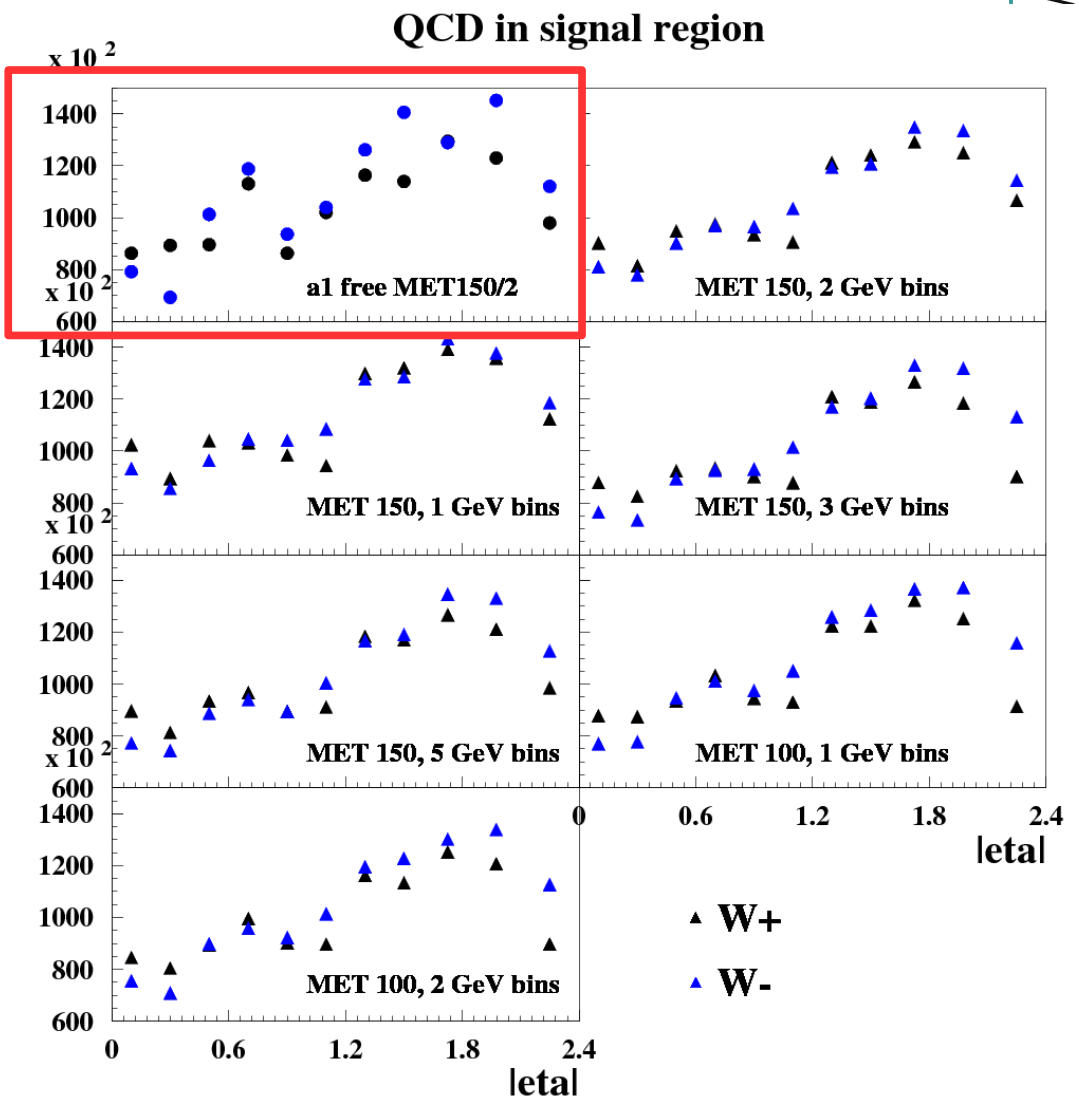
Consider various fits and binnings

- 1) 0 < MET < 150 GeV, 2 GeV bins, a1 for control and signal different
-
- a1_control = a1_signal
  - 1) MET 0-150, 1 GeV bins
  - 2) MET 0-150, 2 GeV bins
  - 3) MET 0-150, 3 GeV bins
  - 4) MET 0-150, 5 GeV bins
  - 5) MET 0-100, 1 GeV bins
  - 6) MET 0-100, 2 GeV bins

→ Look at a1, a2, a3 params in eta bins

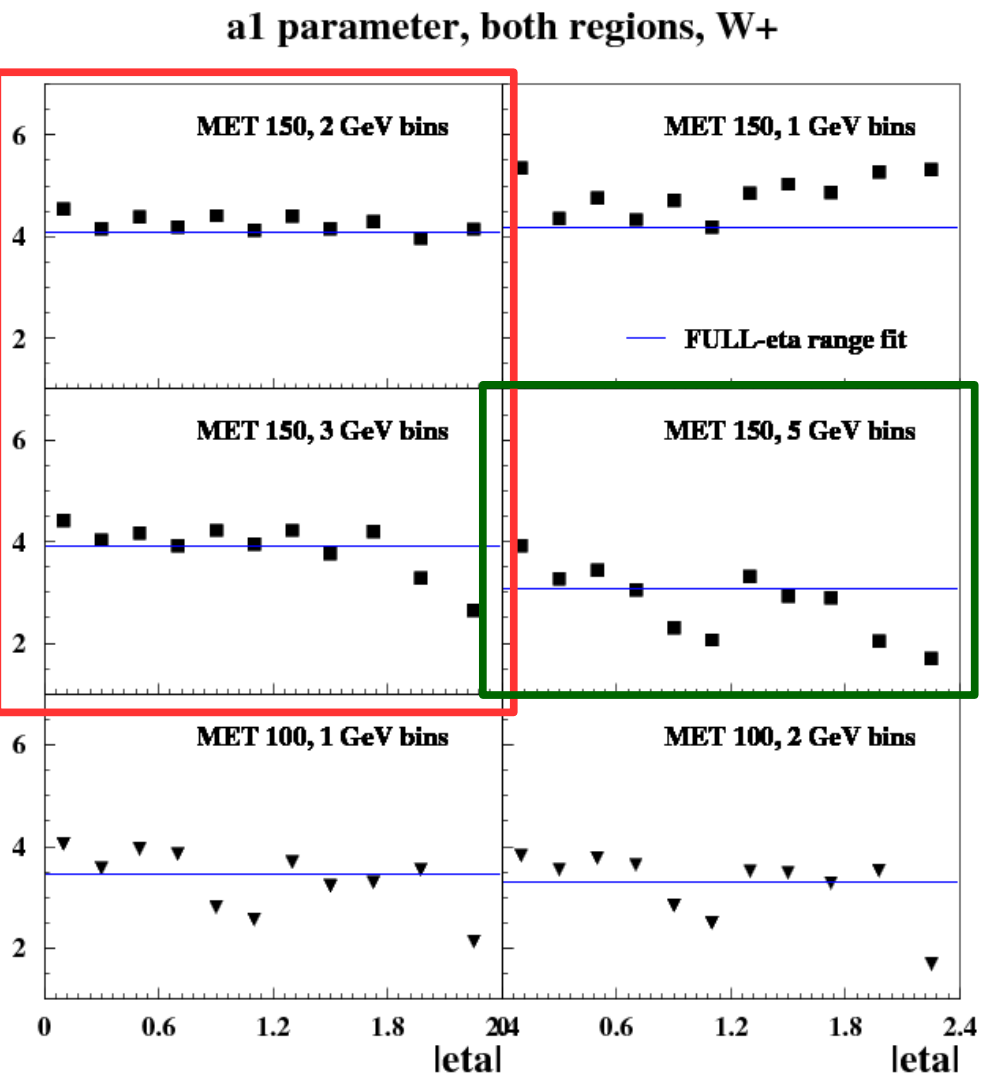
Look at a1, all fits

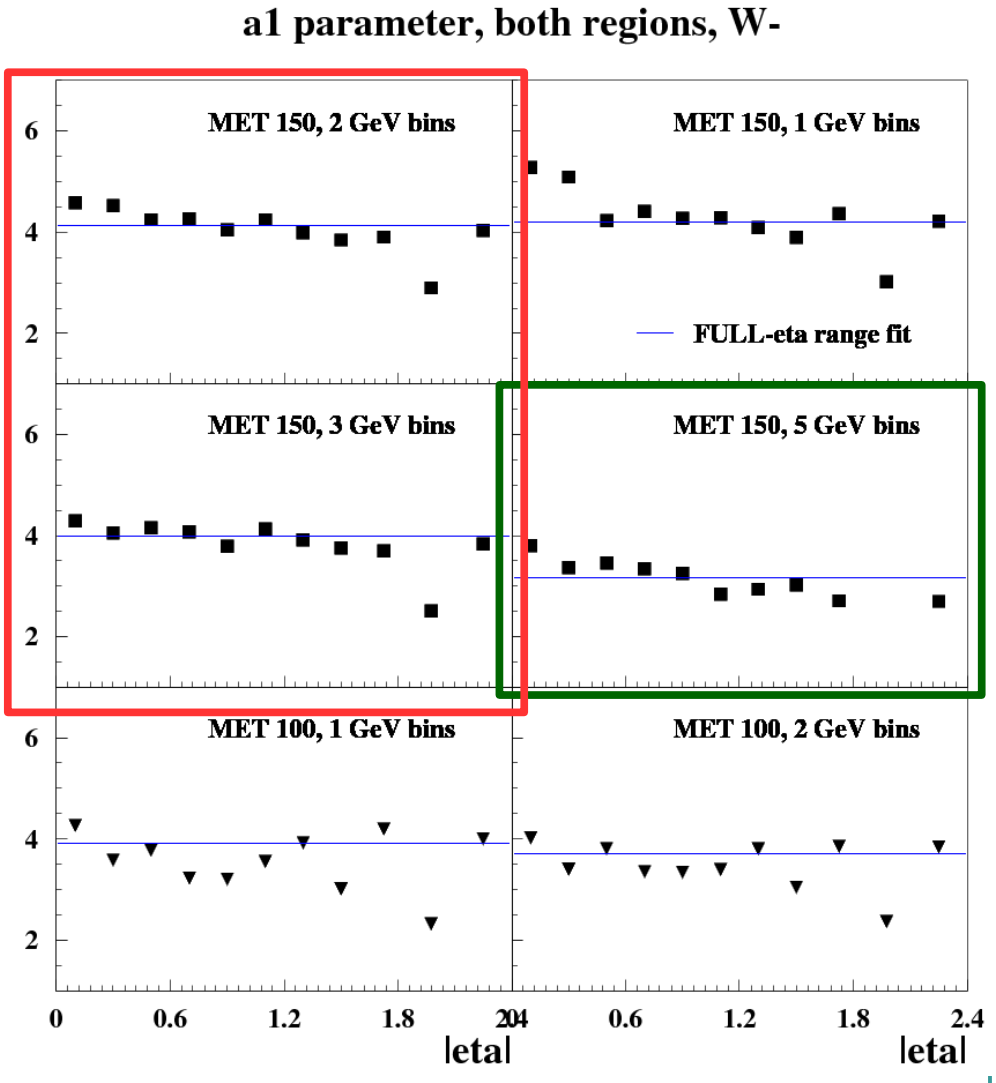




- Fit 1) with a1_signal and a1_control free NOT good (here just examples) → not considered any more

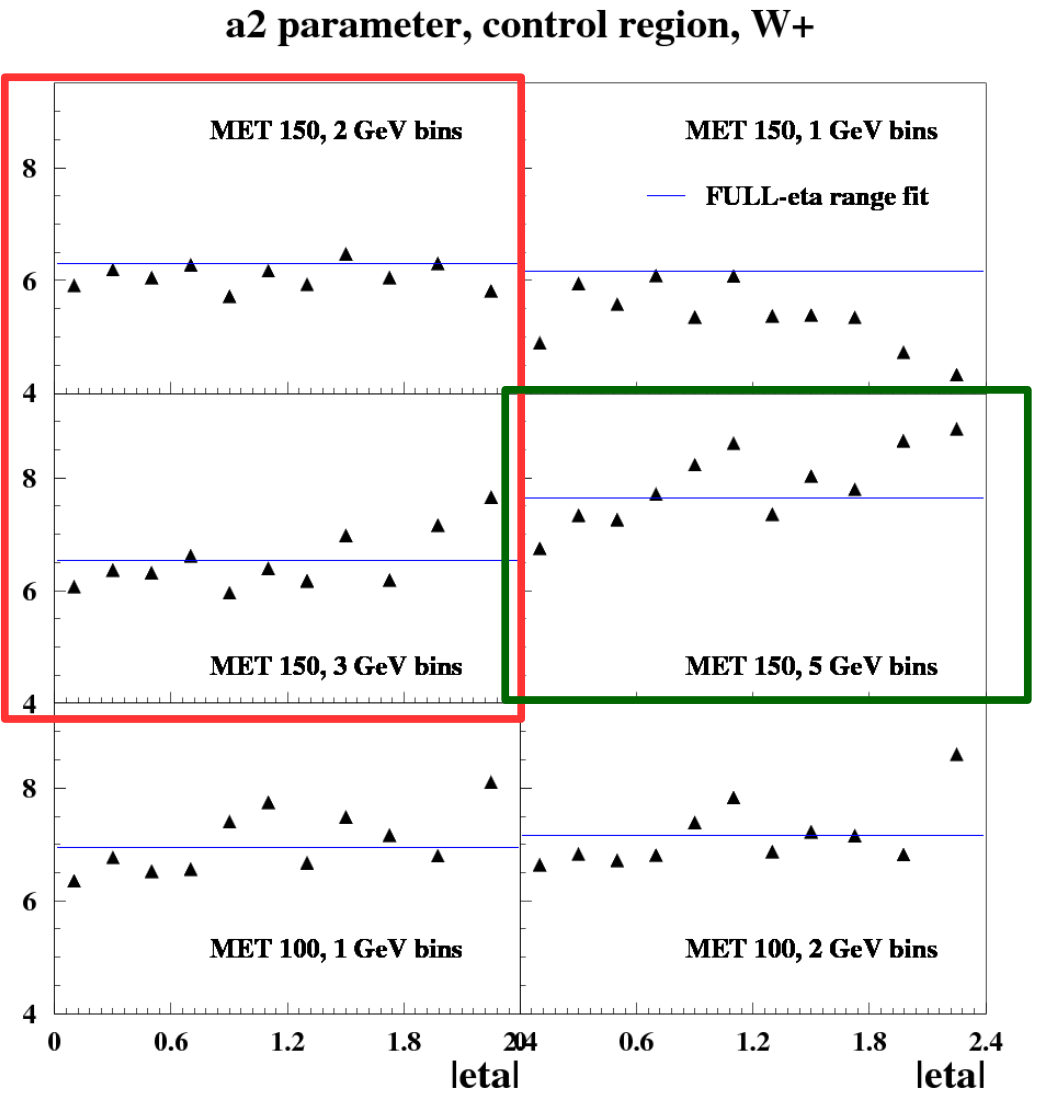
Look at a1, control & signal regions

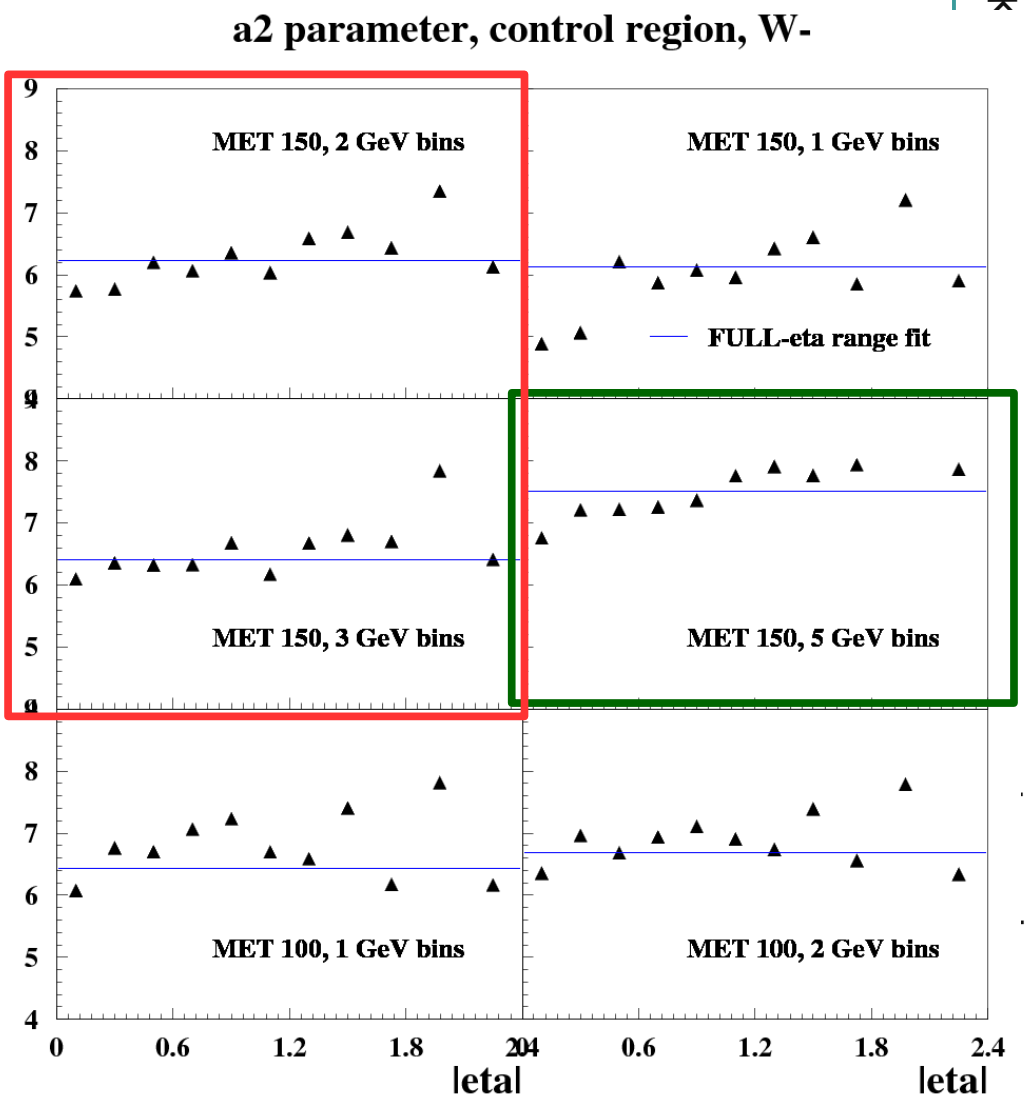




- MET 150, 5 bins → full fit differs from others, large fluctuations in eta bins
- MET 100 → reasonable
- MET 150, 2 / 3 bins → most stable

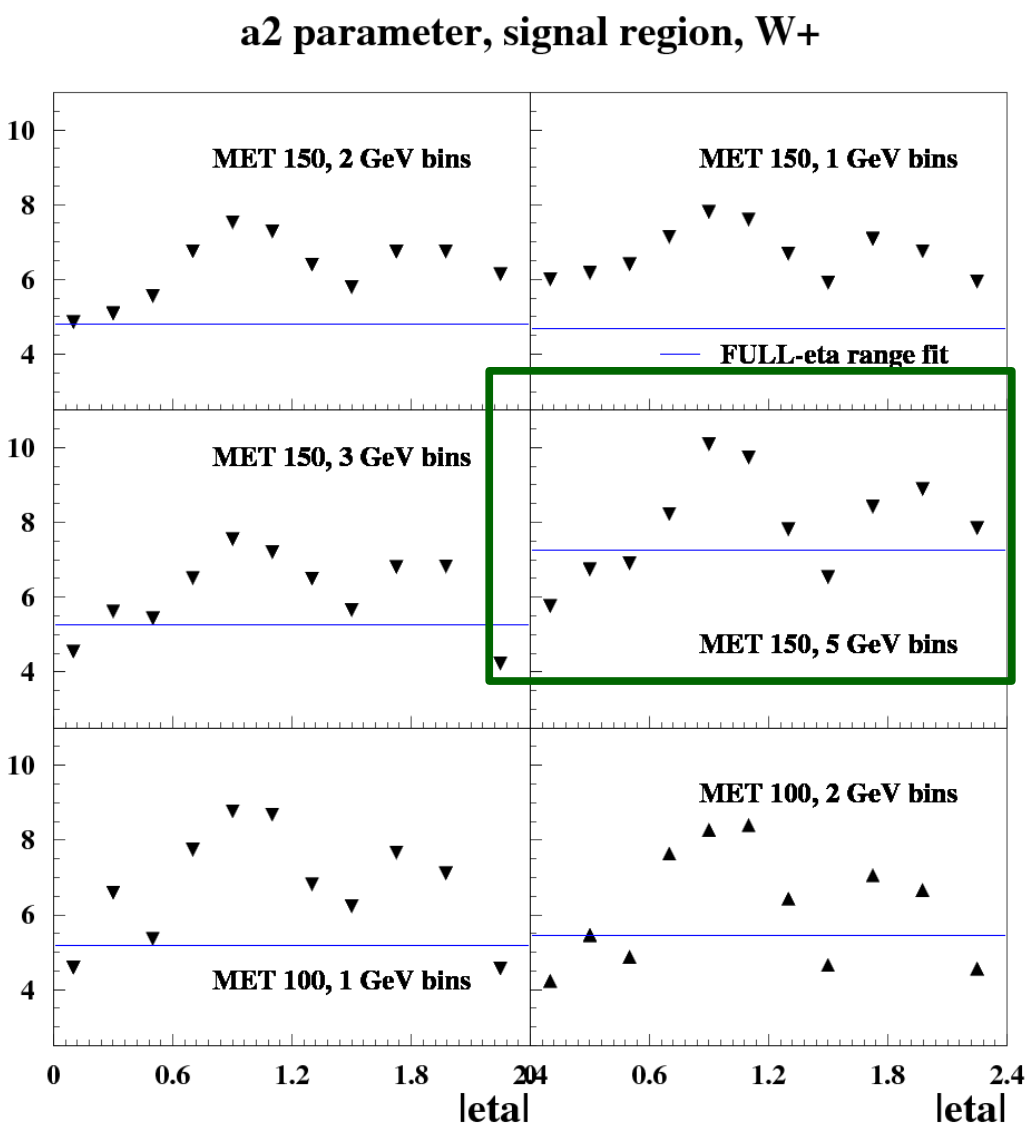
Look at a2, control region

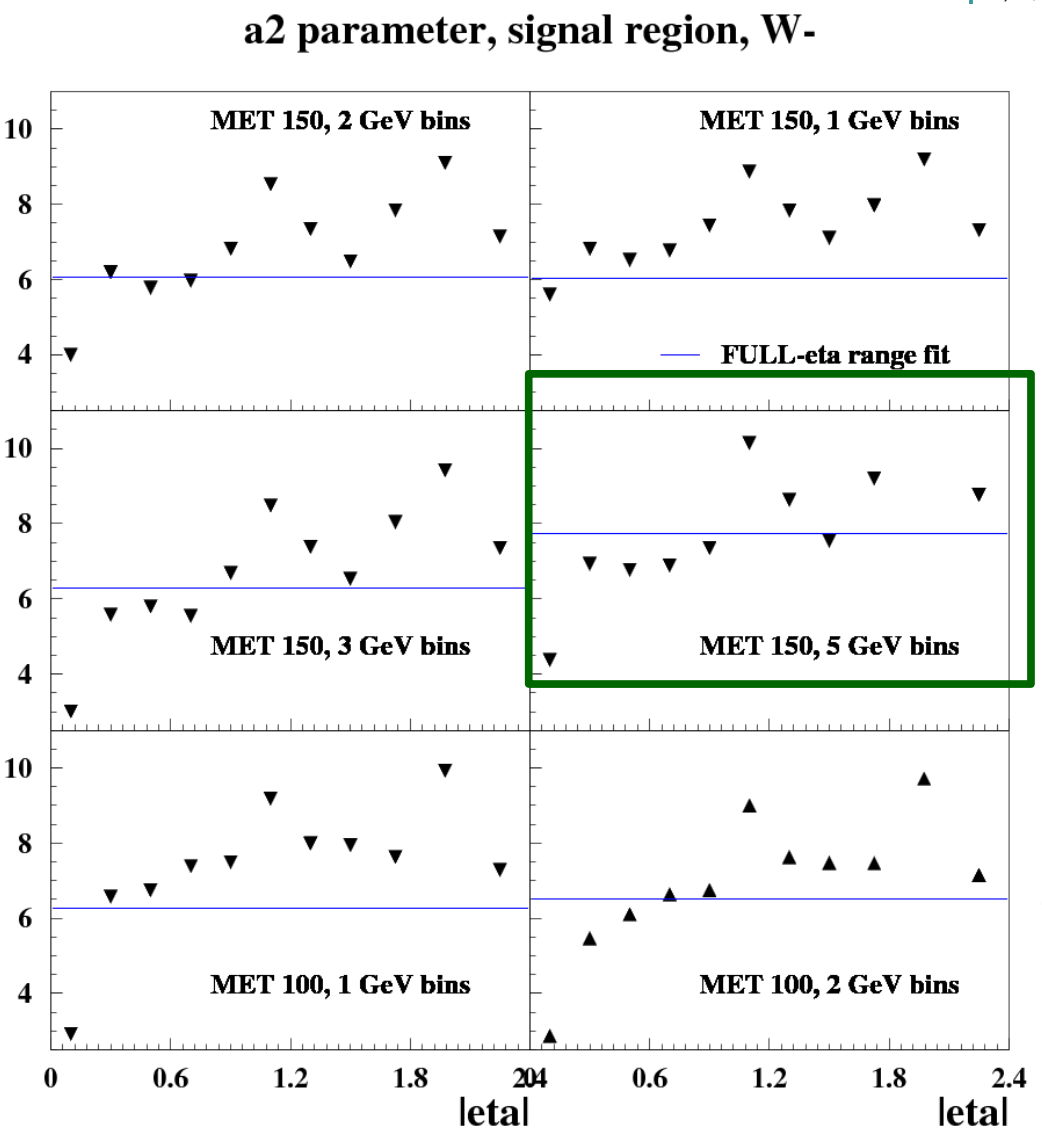




- MET 150, 5 bins → full fit differs from others, large fluctuations in eta bins
- MET 100 → reasonable
- MET 150, 2 / 3 bins → most stable

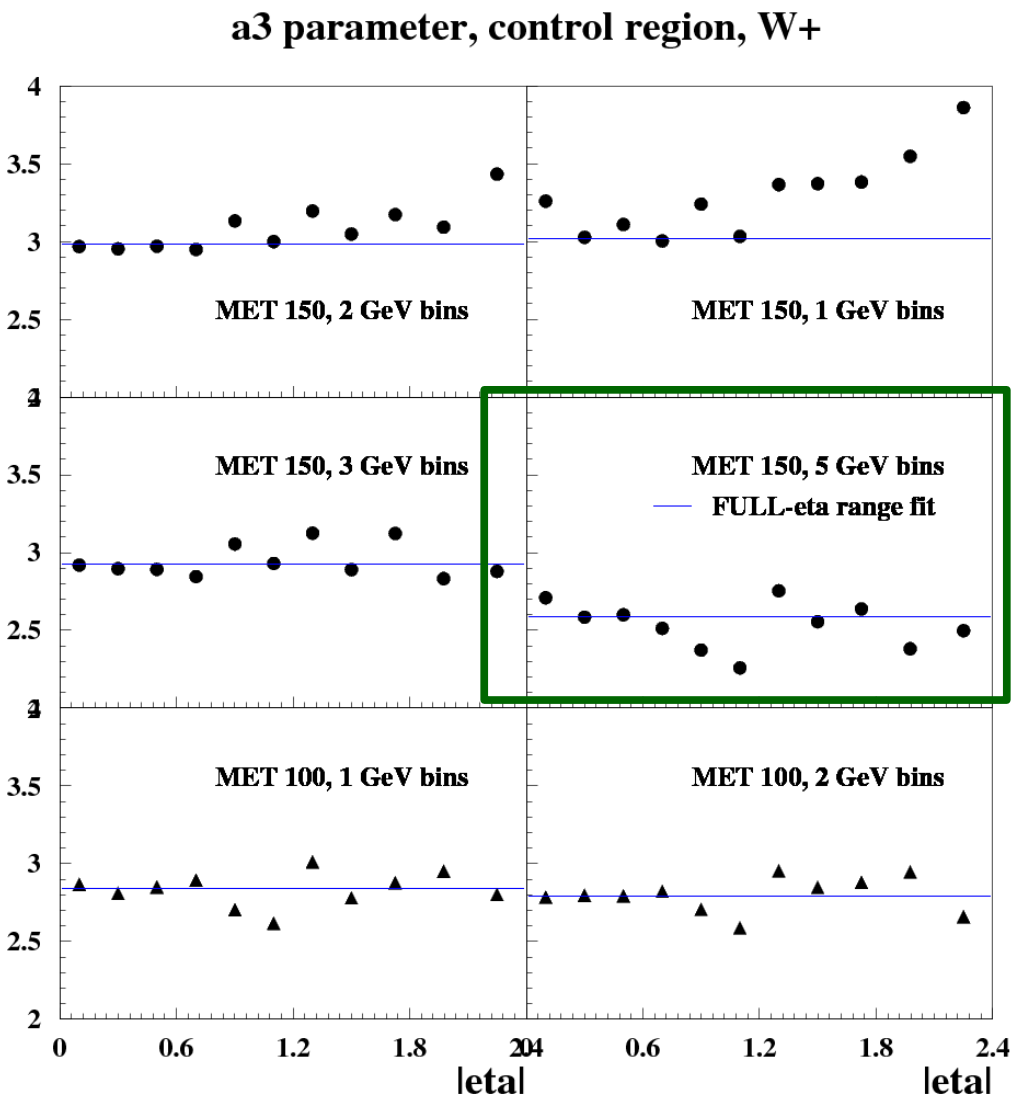
Look at a2, signal region

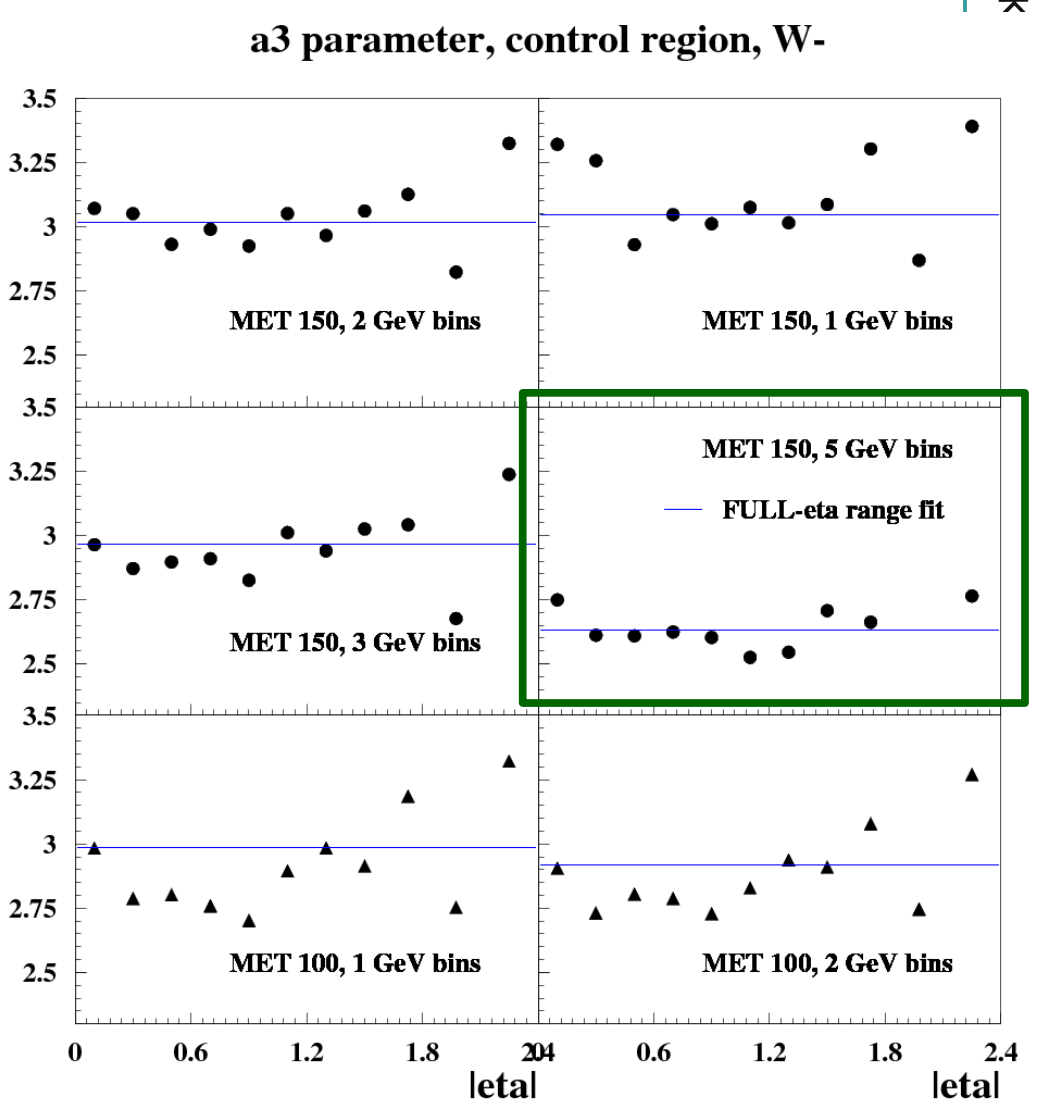




- MET 150, 5 bins → full fit differs from others, large fluctuations in eta bins
- Rest varies a lot ...

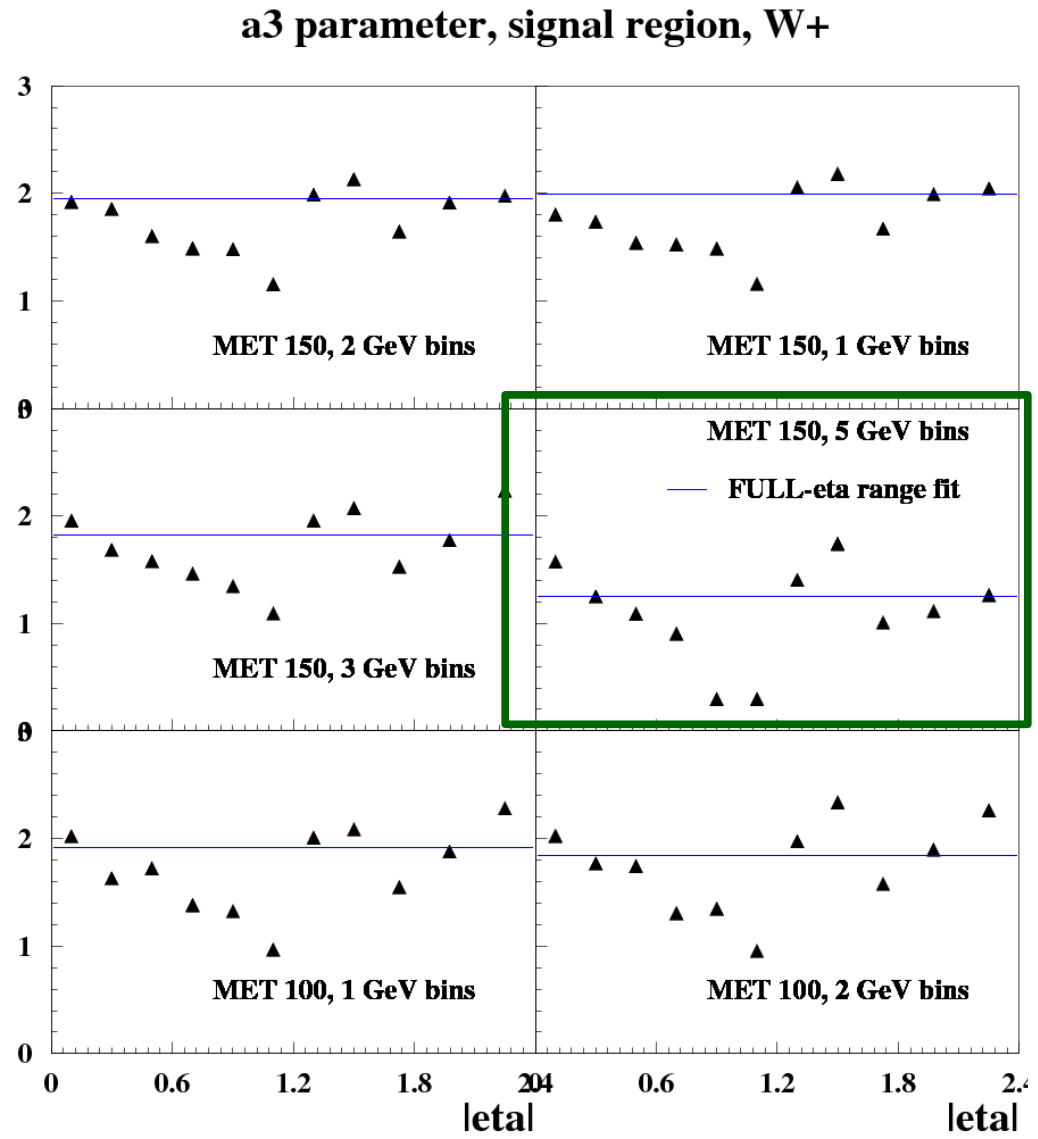
Look at a3, control region

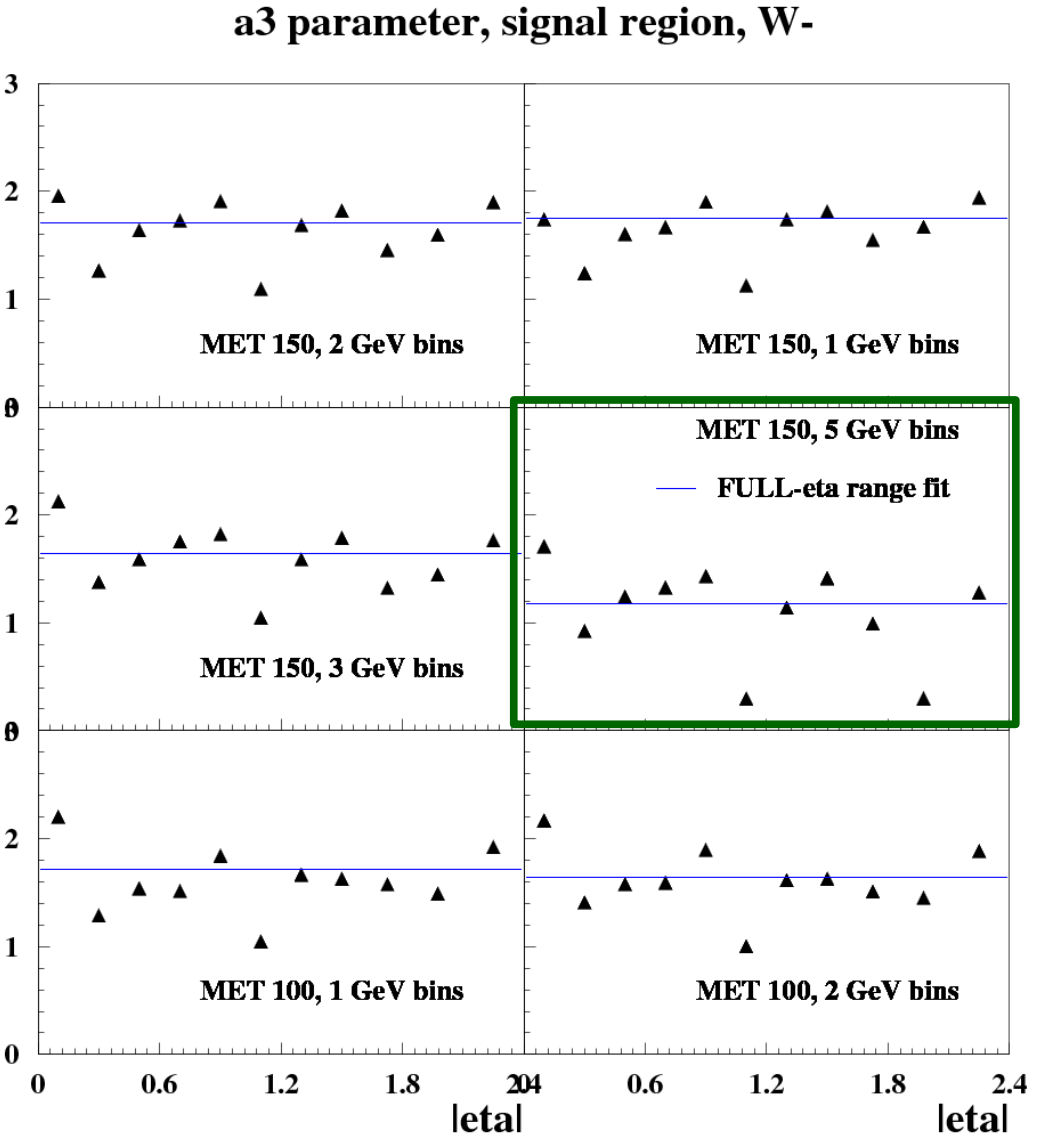




- MET 150, 5 bins → full fit differs from others, large fluctuations in eta bins
- MET 100 → reasonable
- MET 150, 2 / 3 bins → most stable

Look at a3, signal region





- MET 150, 5 bins → full fit differs from others, large fluctuations in eta bins
- rest → reasonable

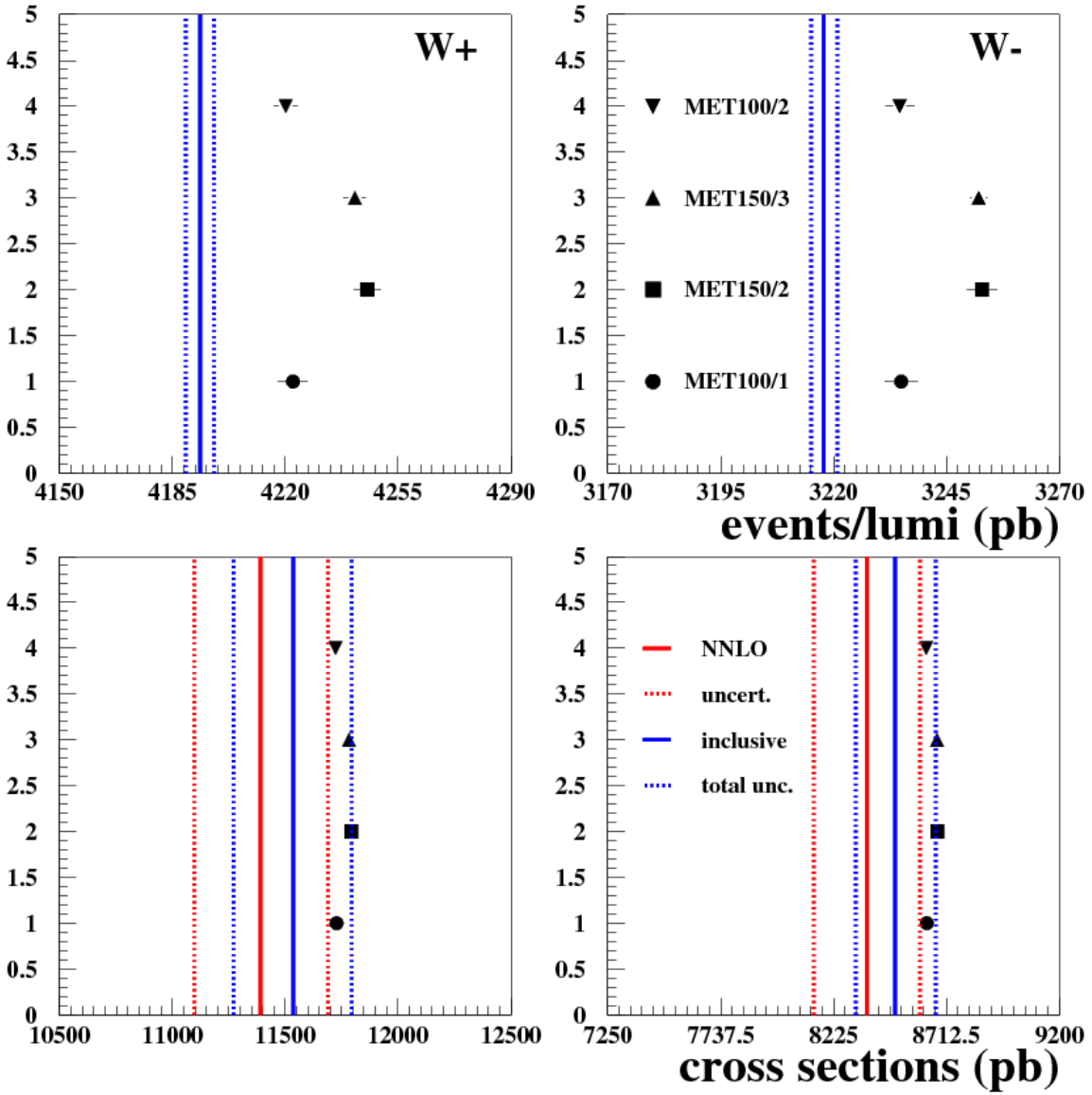
- Conclusions for now?
  - don’t consider MET 150 with 1 or 5 GeV bins
  - Check other bins → other parameters, total cross section, asymmetries

4 fits, total cross sections

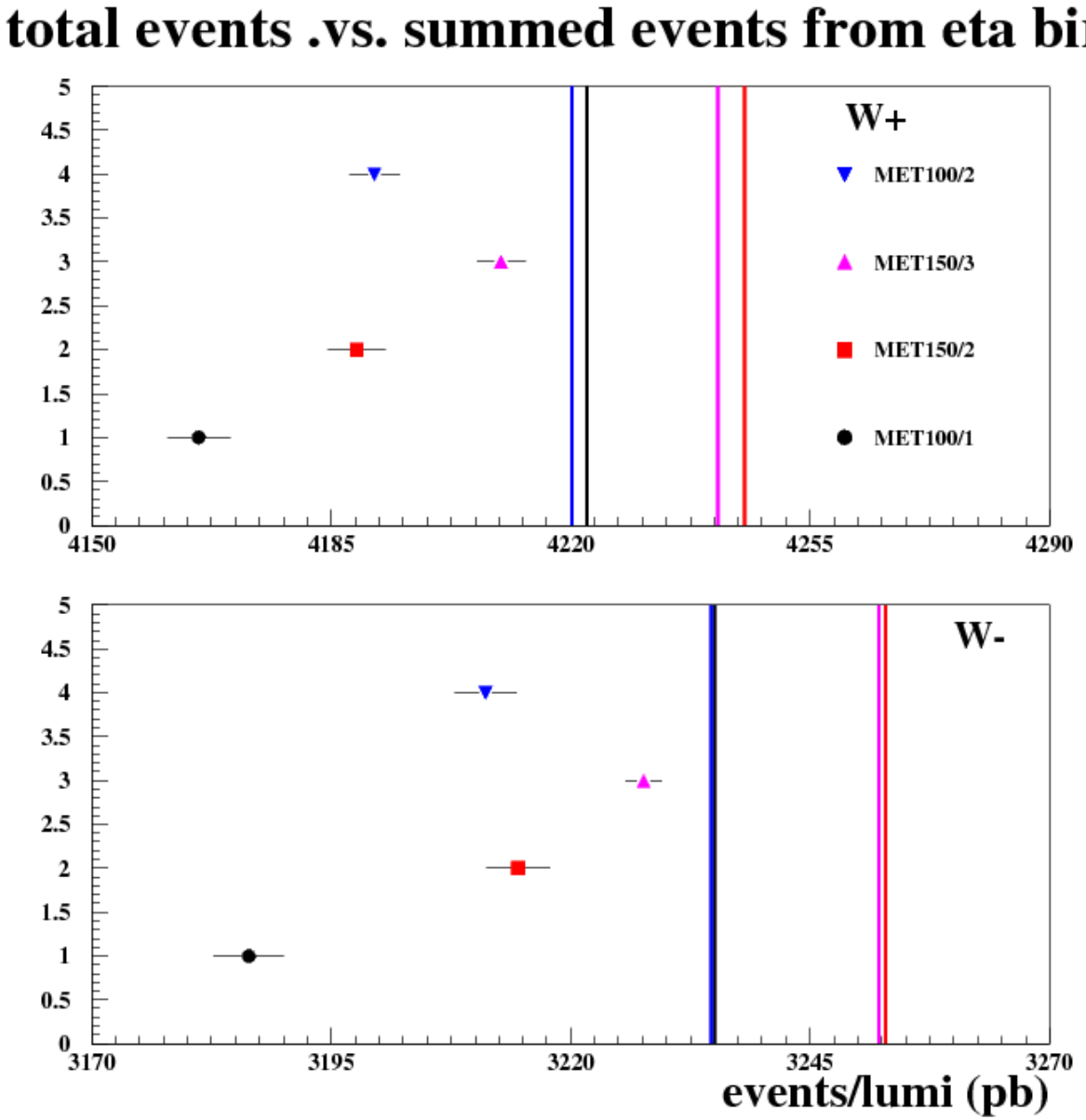
- Inclusive cross sections from latest SMP-16-013 note
  - NNLO calculations, FEWZ, NNPDF3.0
    - W+: 11392 +- 296 pb
    - W-: 8369 +- 229 pb
  - Measurement
    - W+ to mu+: 11534 +- 12 (stat) +-262 (syst) +- 311 (lumi)
    - W- to mu-: 8493 +- 8 (stat) +-173 (syst) +- 229 (lumi)

4 fits, total cross sections

- Inclusive cross sections from latest SMP-16-013 note
  - NNLO calculations, FEWZ, NNPDF3.0
    - W+: 11392 +- 296 pb
    - W-: 8369 +- 229 pb
  - Measurement
    - W+ to mu+: 11534 +- 12 (stat) +-262 (syst) +- 311 (lumi)
    - W- to mu-: 8493 +- 8 (stat) +-173 (syst) +- 229 (lumi)

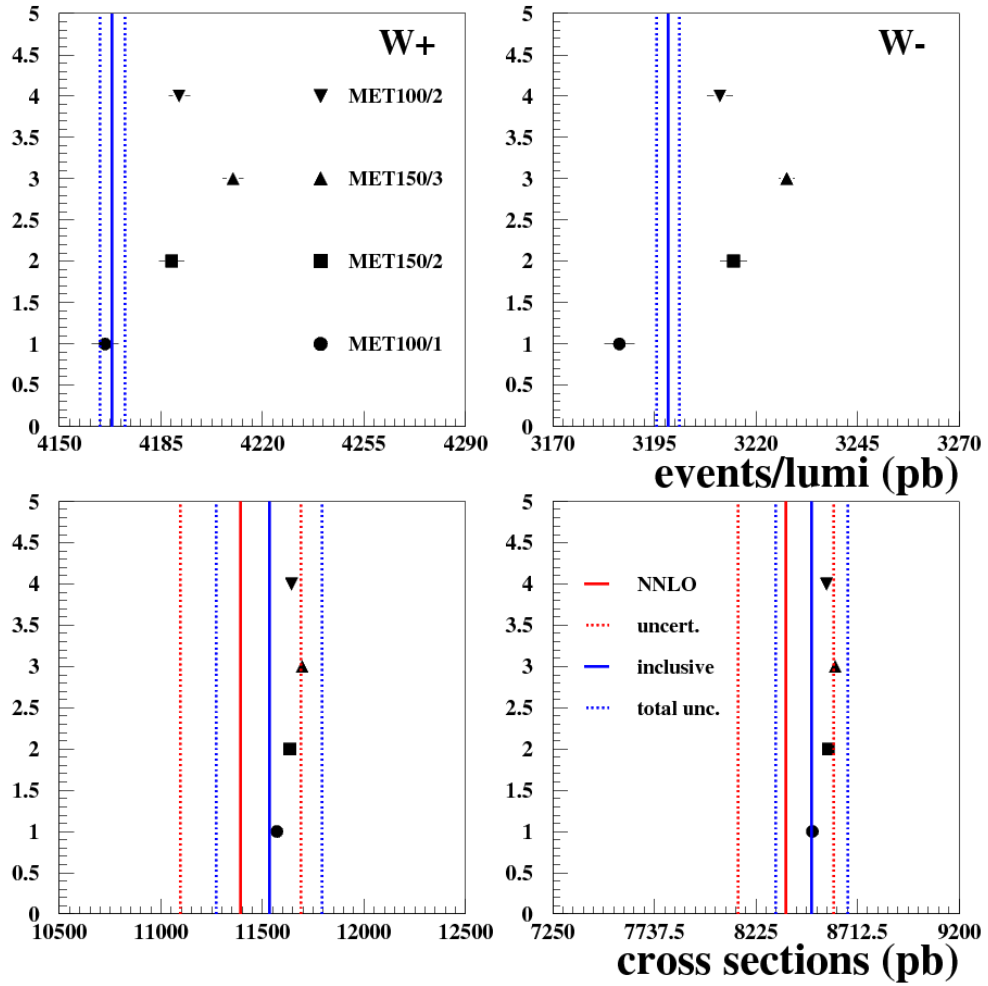


- Seems like we have too many total signal events from fits?
  - Check sum from eta bins
- MET 100 seems to be doing better here?

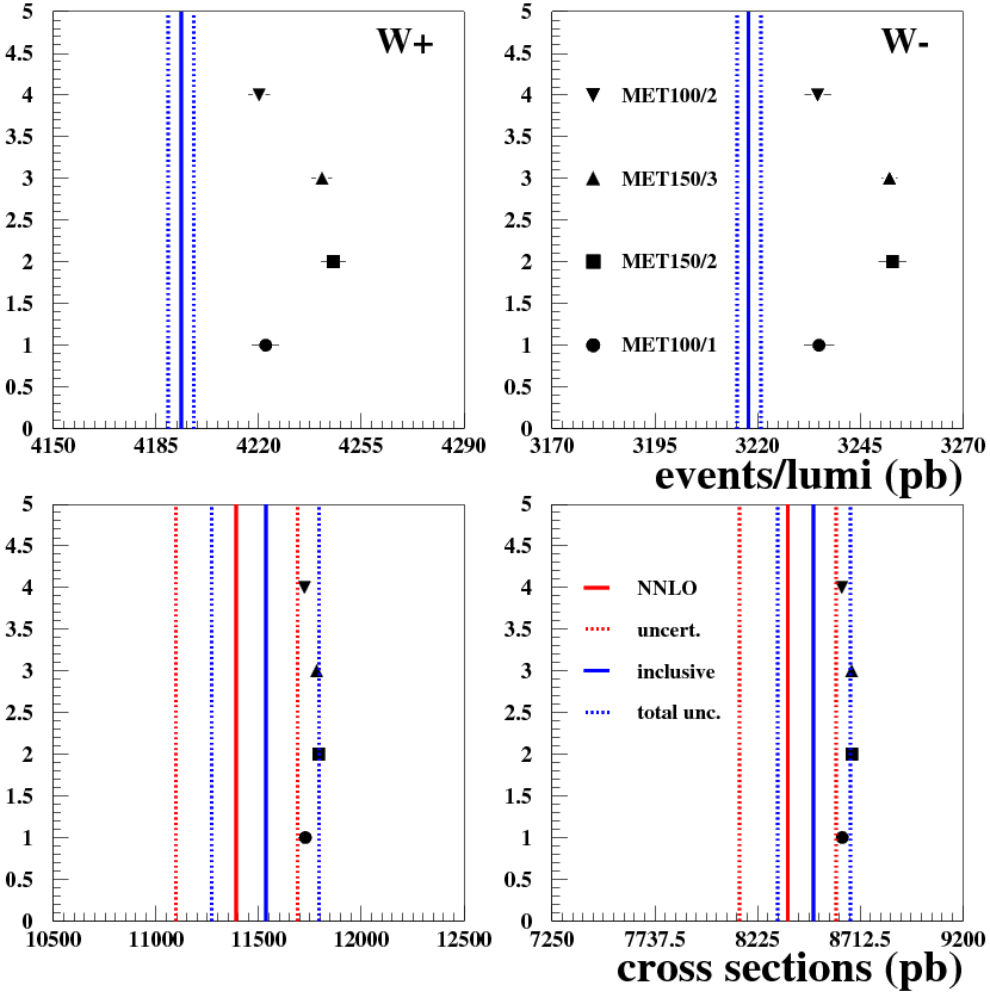


- Seems like there is less events from sum over eta-bin fits than from fit in whole eta range
- Depends on binning

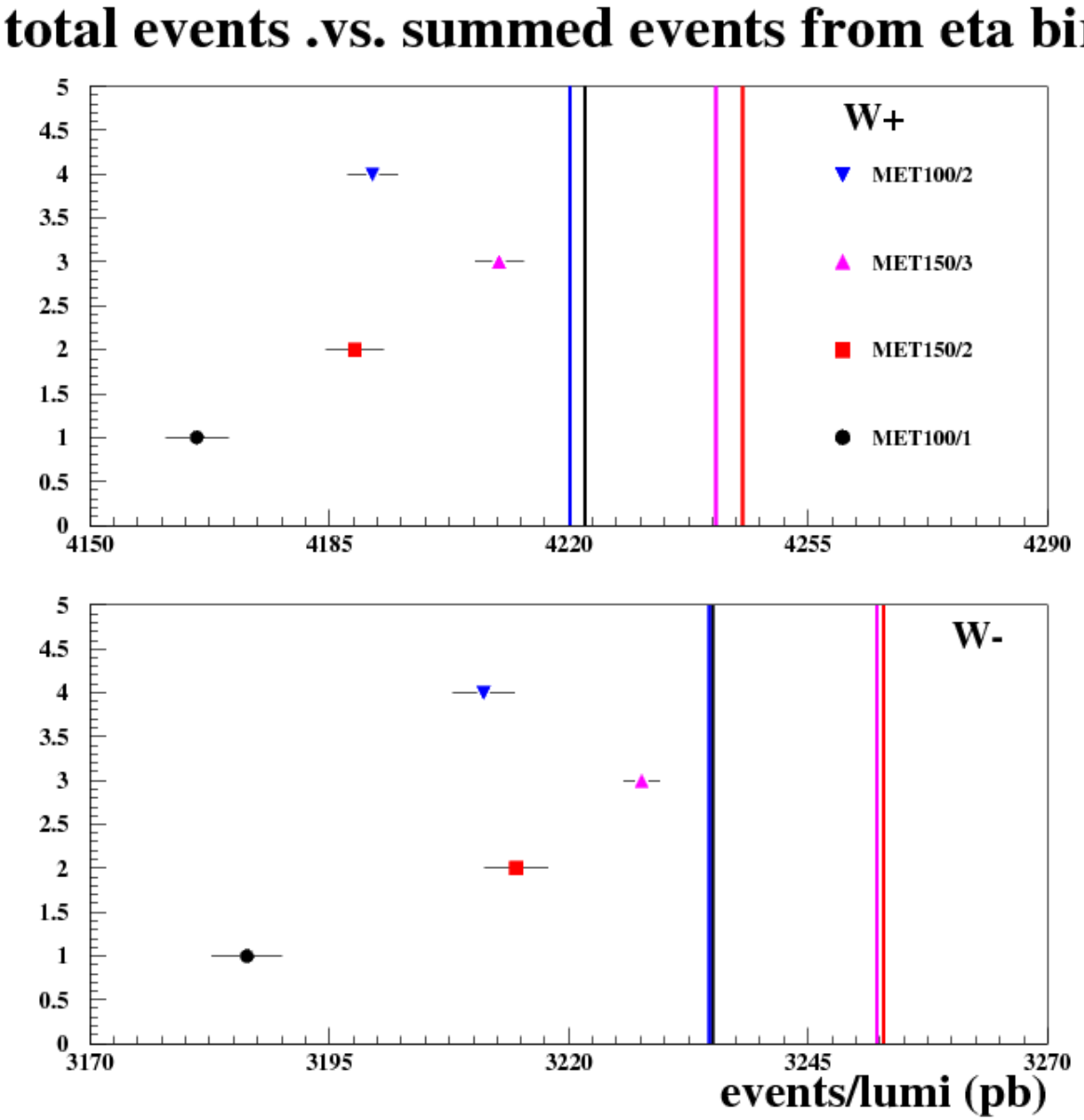
SUM(eta)

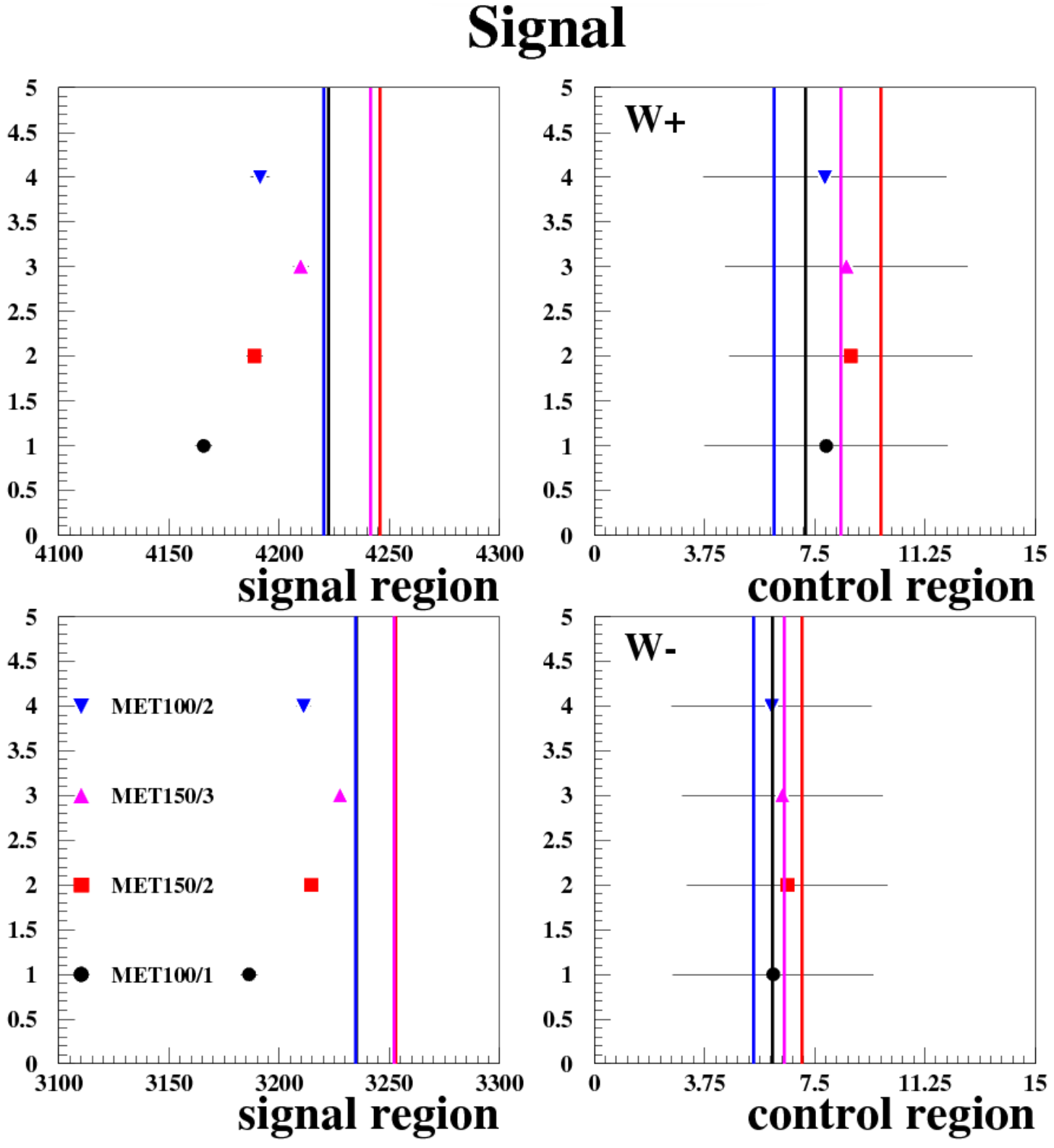


TOTAL

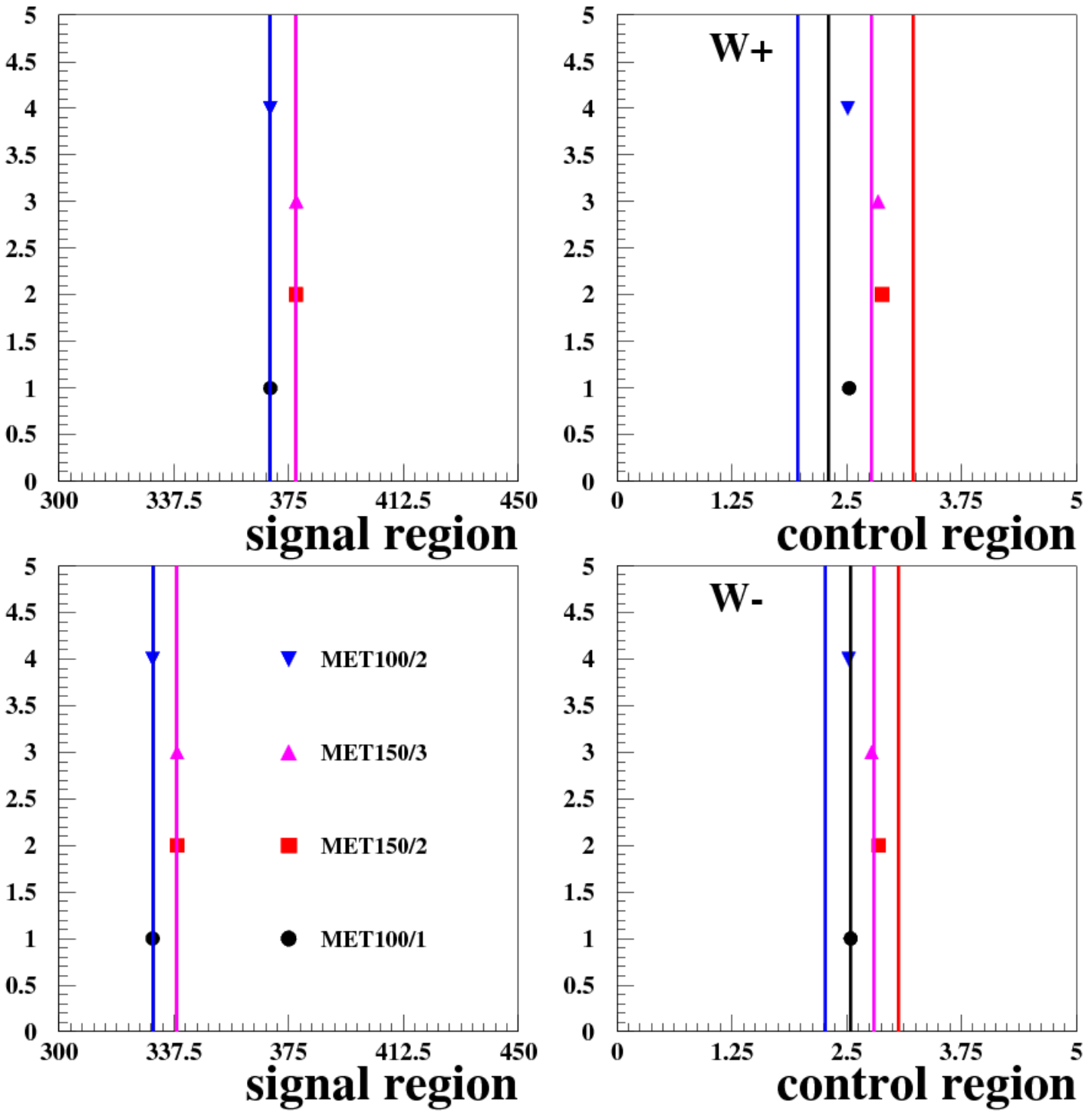


- Where this is coming from?

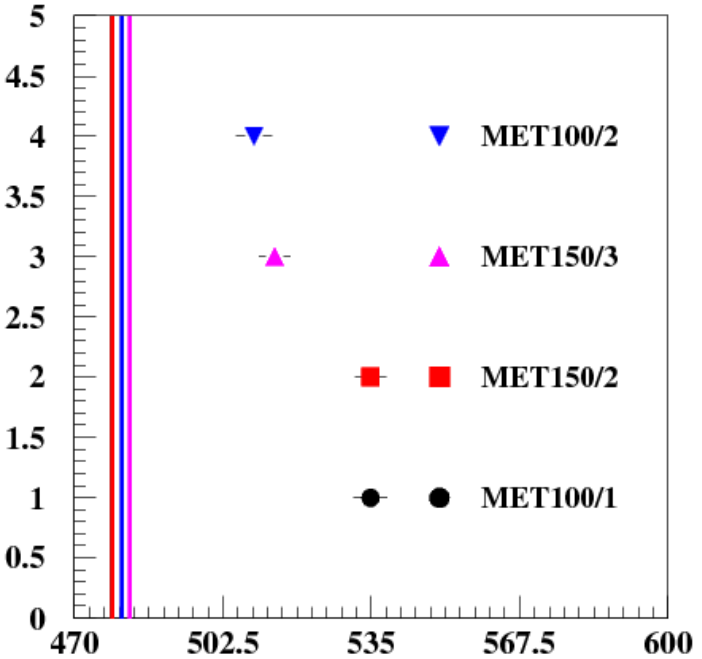


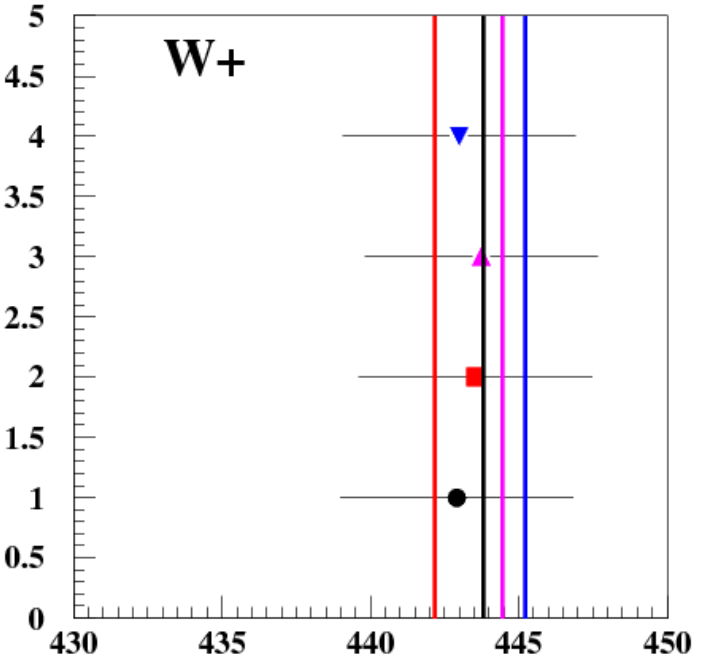

Signal
W+
W-
MET100/2
MET150/3
MET150/2
MET100/1
signal region
control region
signal region
control region

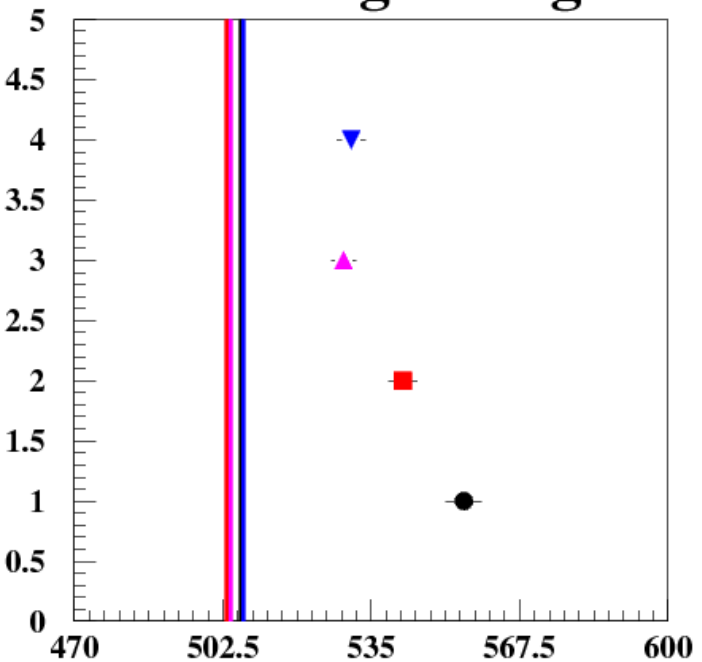
Other BG

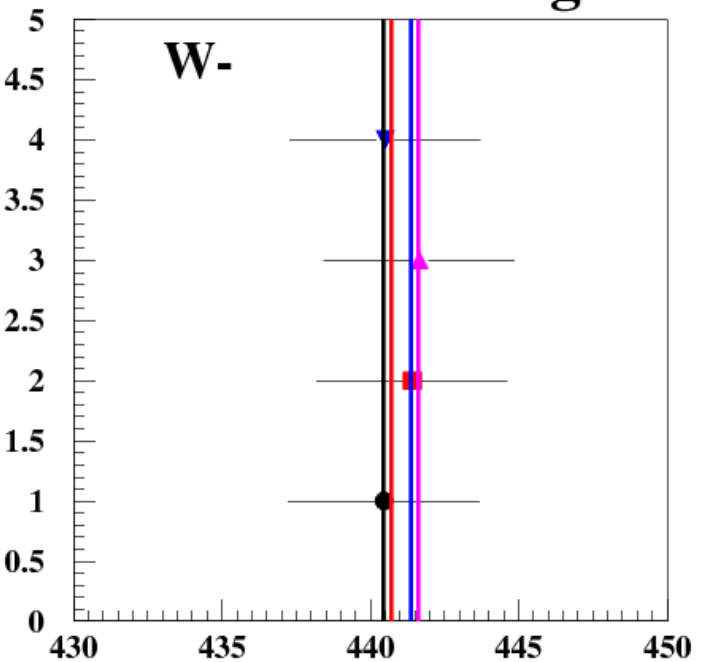

W+
W-
MET100/2
MET150/3
MET150/2
MET100/1
signal region
control region
signal region
control region

QCD BG

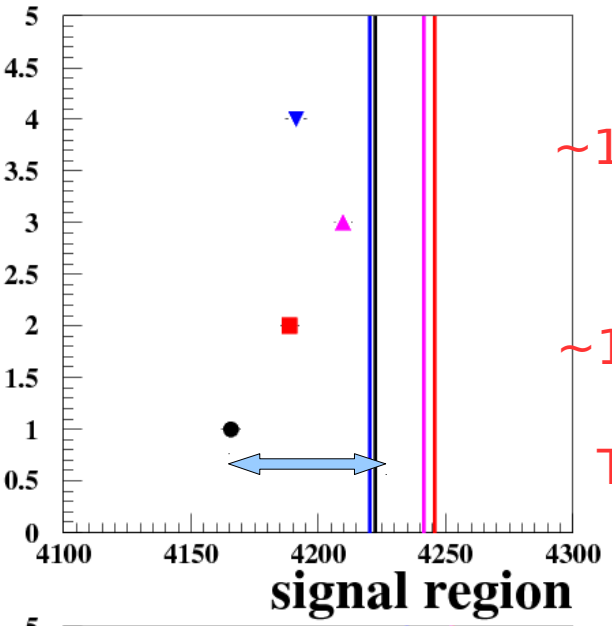

MET100/2
MET150/3
MET150/2
MET100/1
470
502.5
535
567.5
600
signal region


W+
430
435
440
445
450
control region


470
502.5
535
567.5
600
signal region


W-
430
435
440
445
450
control region

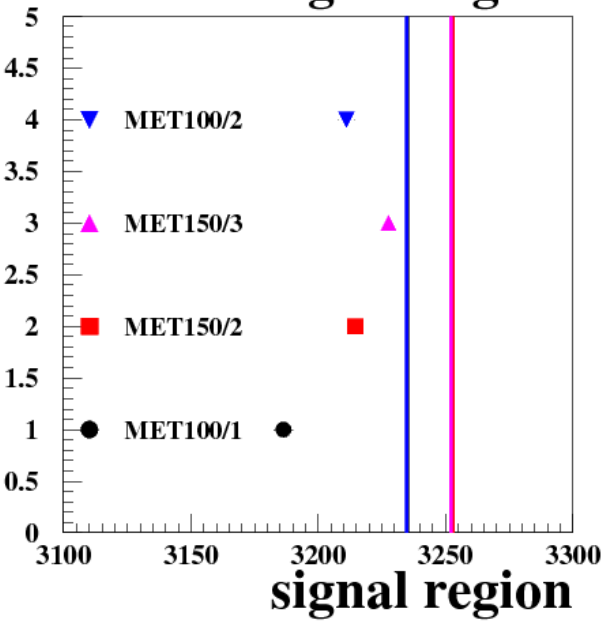
Signal



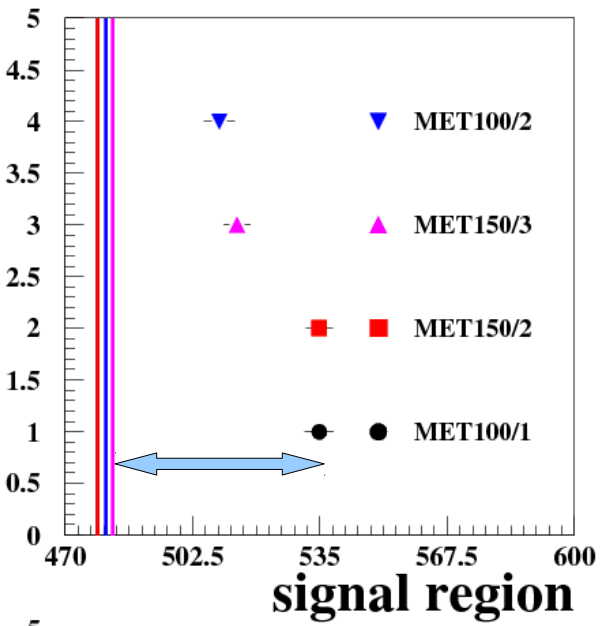
~1-2%

~1-2%

The same for all!



QCD BG



~6%

~10%