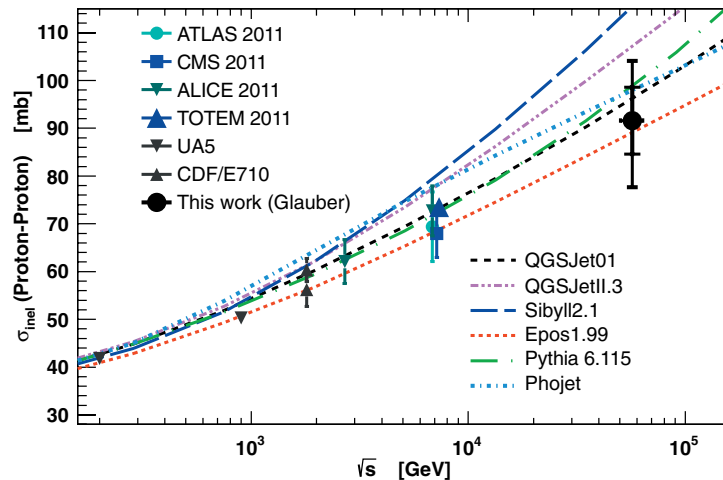
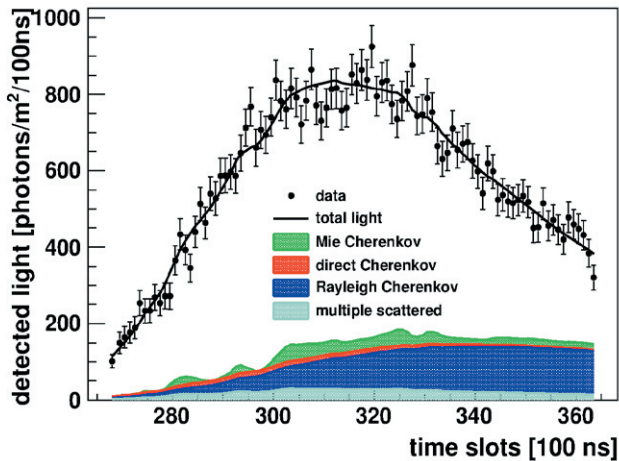


# Measurement of the proton-air cross-section at $\sqrt{s} = 57$ TeV with the Pierre Auger Observatory



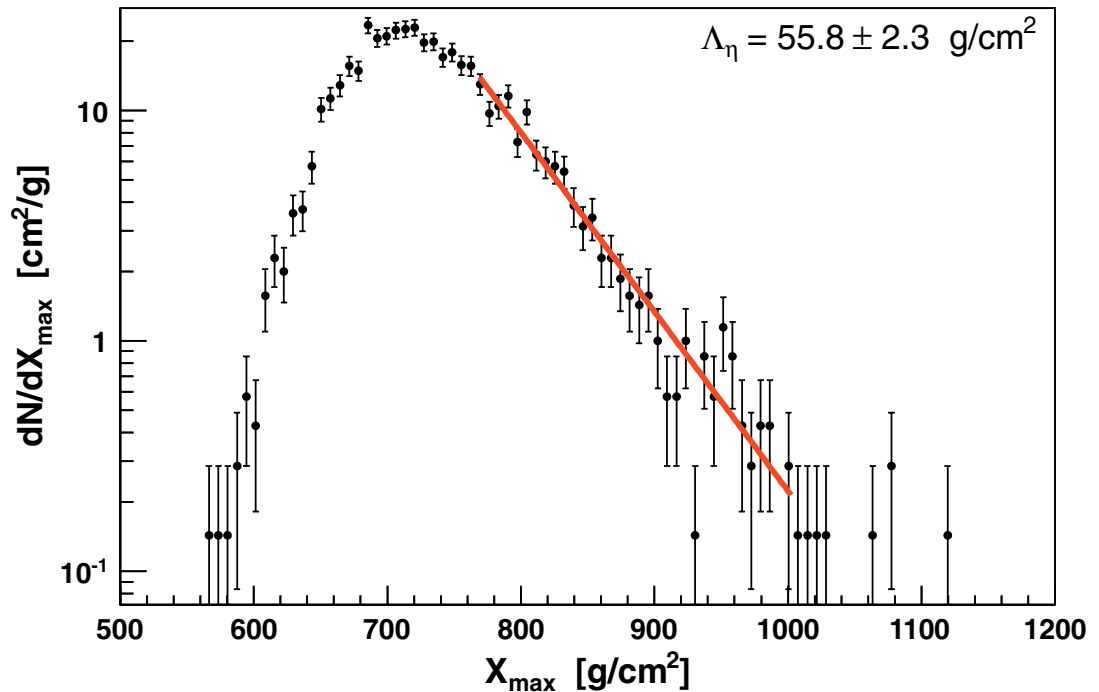
PIERRE  
AUGER  
OBSERVATORY

Jan Ebr for the Pierre Auger Collaboration



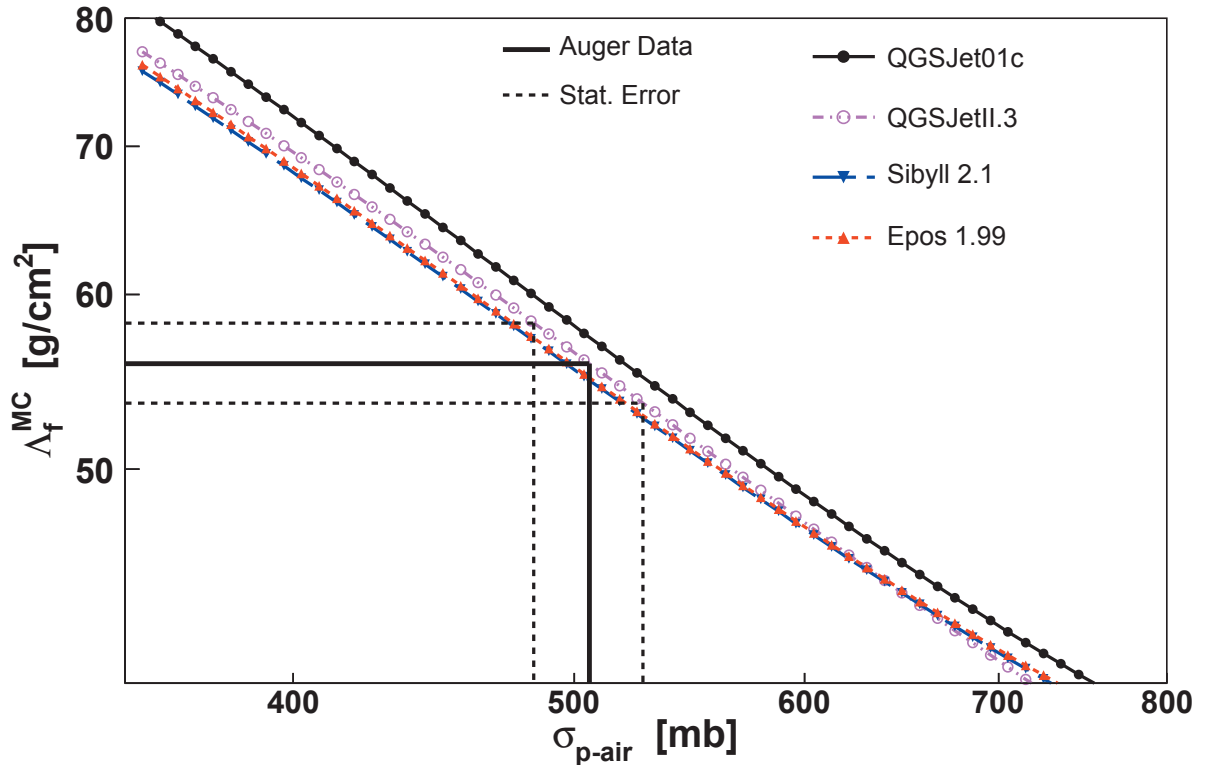
## Fitting the exponential tail of the $X_{max}$ distribution

- selects mainly proton-induced showers
- allows relatively straightforward conversion to cross-section
- requires an unbiased distribution!



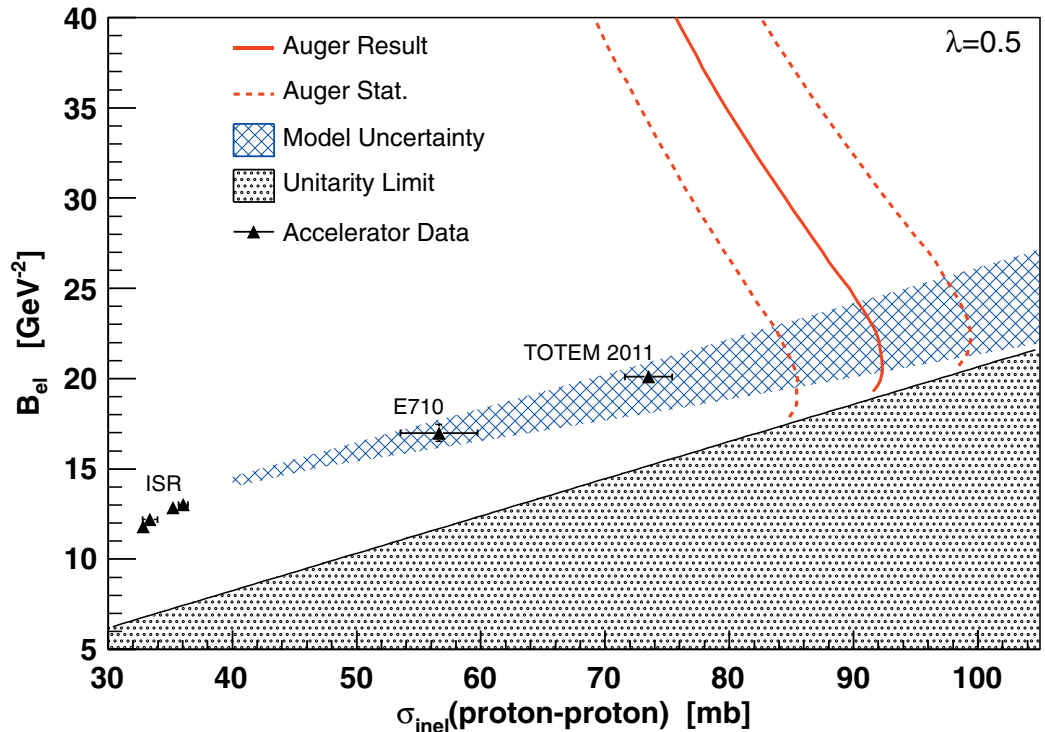
## Extracting the proton-air cross section using Monte Carlo simulations

- the only part dependent on simulations
- systematics given as differences between models



## Conversion to proton-proton cross-section

- in some sense beyond the scope of Auger
- uncertainties in theoretical assumption (slightly moderated by correlations)



$$\sigma_{pp}^{\text{inel}} = 92 \pm 7(\text{stat})_{-11}^{+9} (\text{syst}) \pm 7(\text{Glauber}) \text{ mb}$$

$$\sigma_{pp}^{\text{tot}} = 133 \pm 13(\text{stat})_{-20}^{+17} (\text{syst}) \pm 16(\text{Glauber}) \text{ mb}$$

$$@ E_{\text{CM}} 57 \pm 0.3(\text{stat}) \pm 6(\text{syst}) \text{ TeV}$$