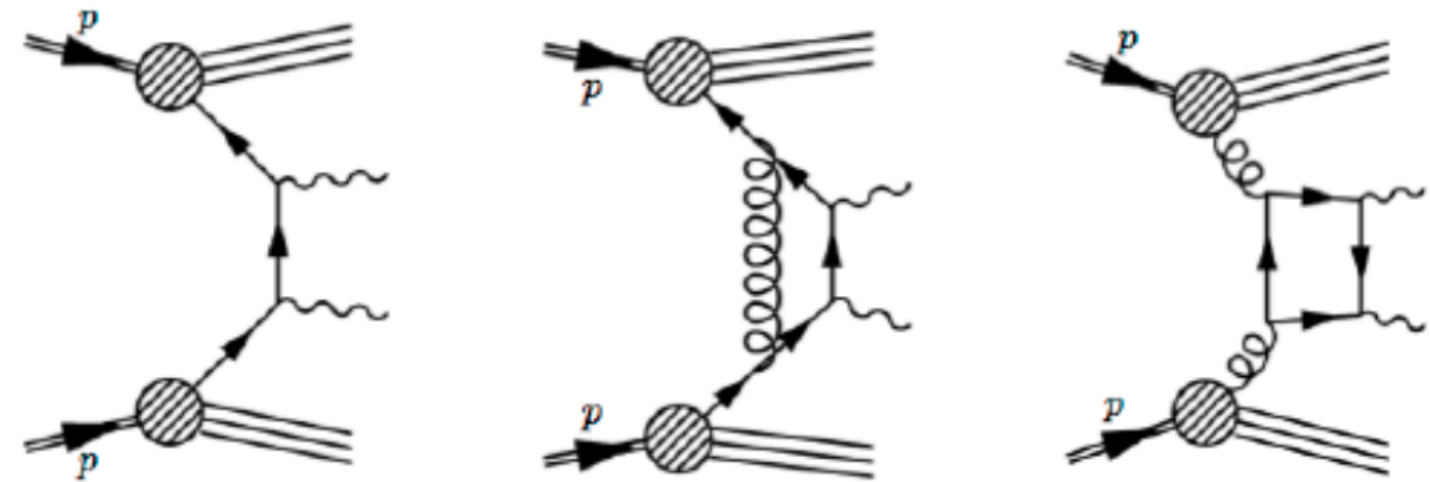


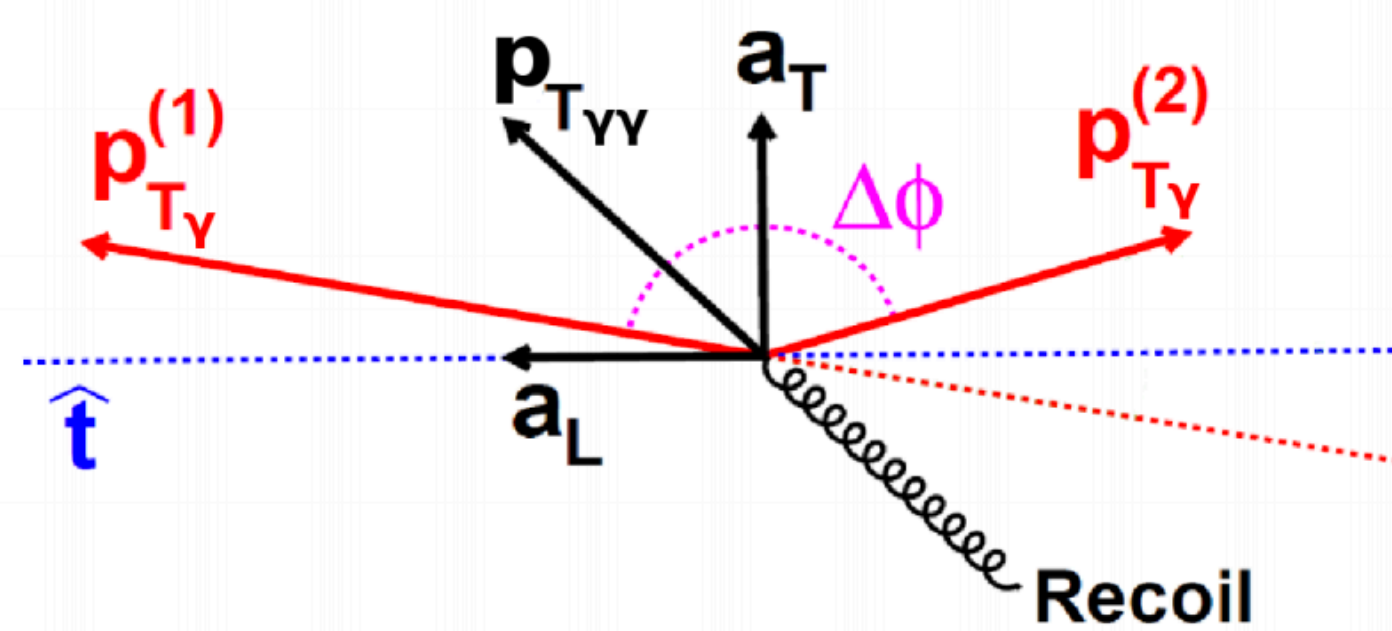
Xingguo Li, on behalf of the ATLAS Collaboration

Motivation



- SM precision measurement of $pp \rightarrow \gamma\gamma + X$
 - Fundamental tests of higher order QCD corrections
 - Sensitive to the soft gluon emission and non-perturbative QCD effect (fragmentation)
 - Irreducible background to $H \rightarrow \gamma\gamma$ and BSM searches

- A measurement of integrated cross section as well as differential cross sections in six variables $m_{\gamma\gamma}$, $\Delta\phi_{\gamma\gamma}$, $p_{T,\gamma\gamma}$, $\cos\theta_{\eta}^*$, a_T and ϕ_{η}^*
 - Two new variables a_T and ϕ_{η}^* with better resolutions introduced to probe low $p_{T,\gamma\gamma}$ physics
 - $\phi_{\eta}^* = \tan\left(\frac{\pi - \Delta\phi}{2}\right) \sin\theta_{\eta}^*$ ($|\cos\theta_{\eta}^*| = \tanh\frac{|\Delta\eta|}{2}$)

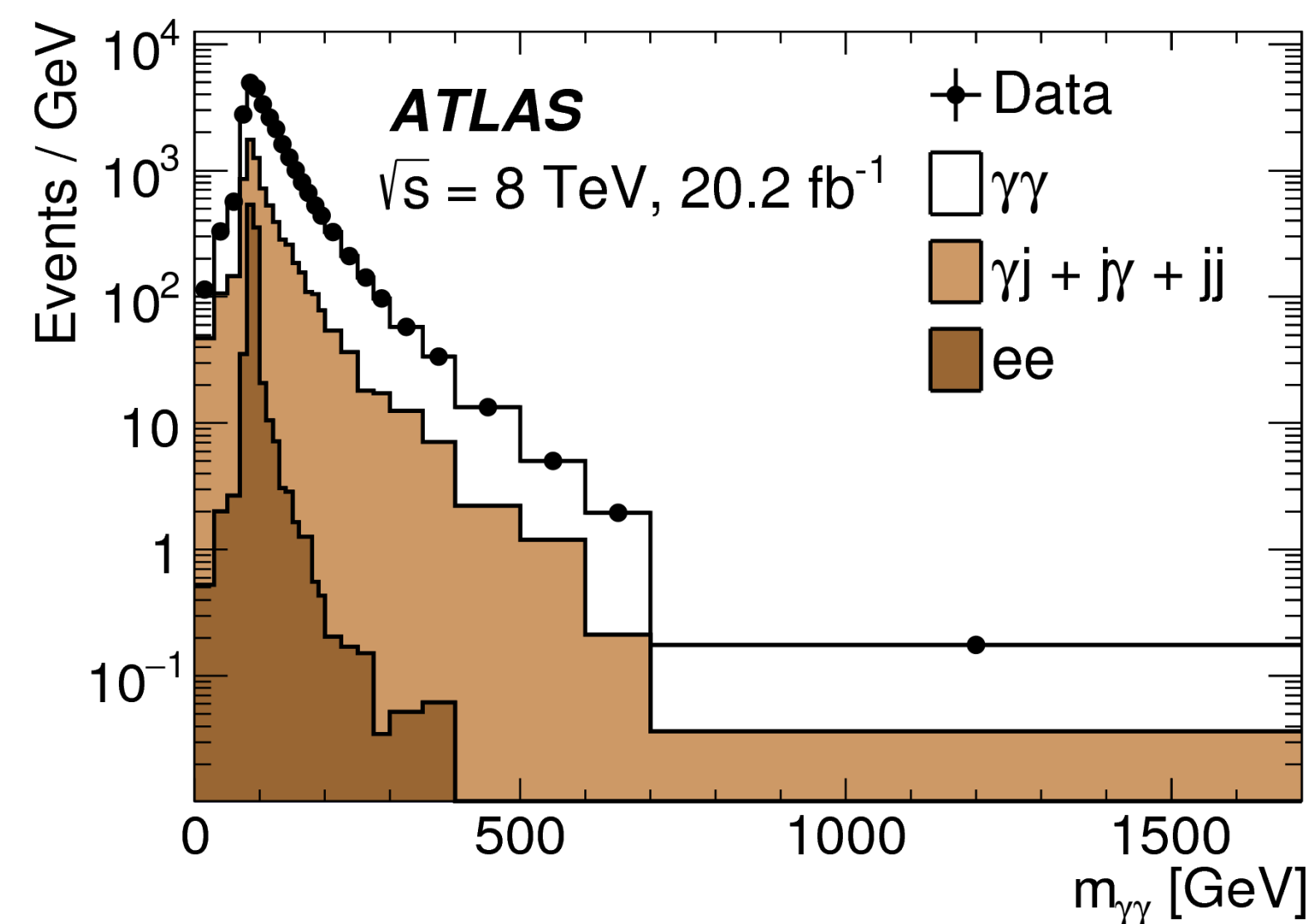


- This analysis considers a pair of photons with
 - $E_T > 40$ GeV, $E_T > 30$ GeV
 - $|\eta| < 1.37$, $1.56 < |\eta| < 2.37$



Methodology

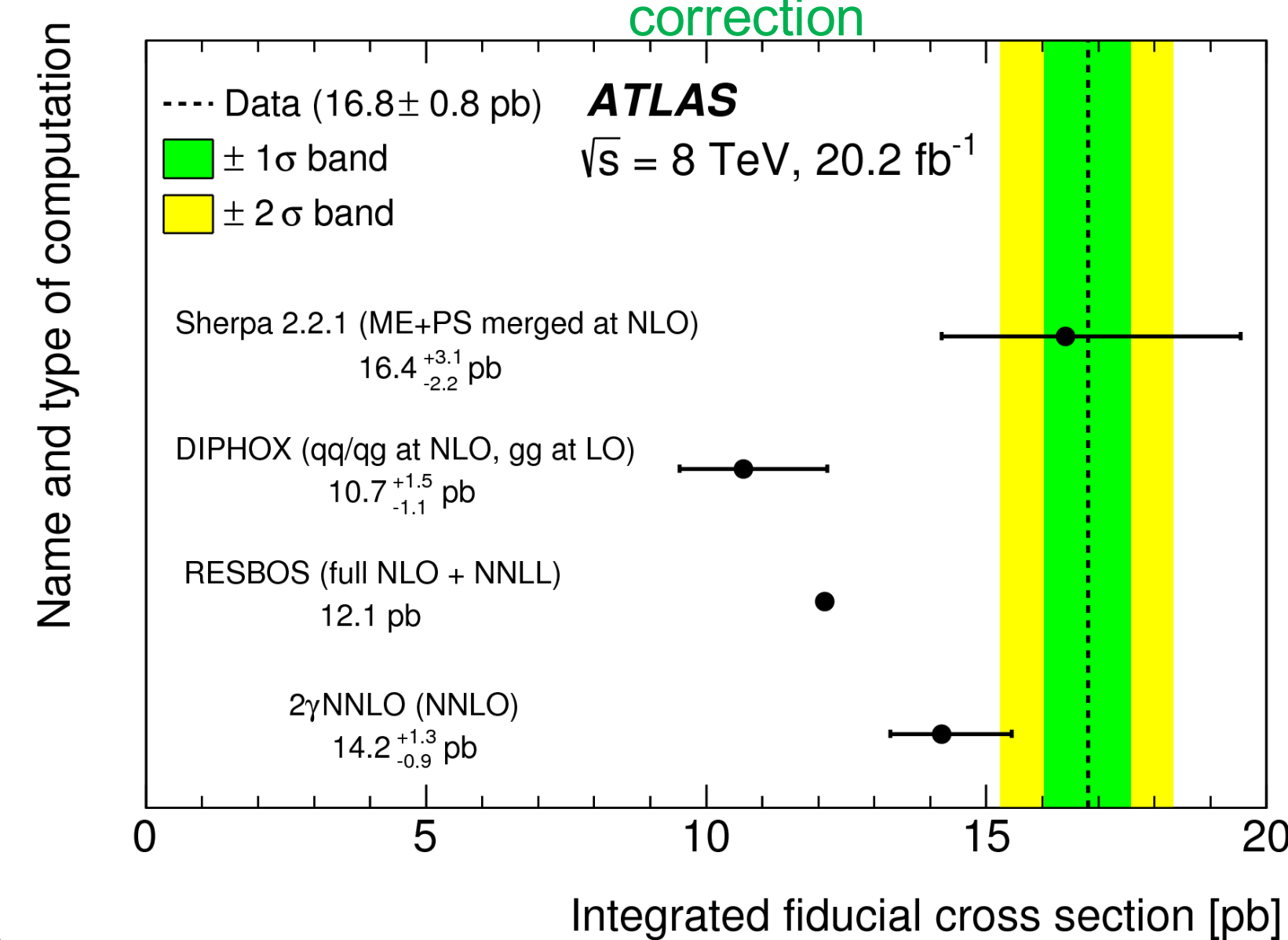
- Background subtraction
 - Hadronic background ($\sim 20\%$), electron background ($\sim 3\%$)
 - Two data-driven methods have been applied to extract diphoton yields, giving consistent results



- Correction for detector efficiency and resolution to particle level

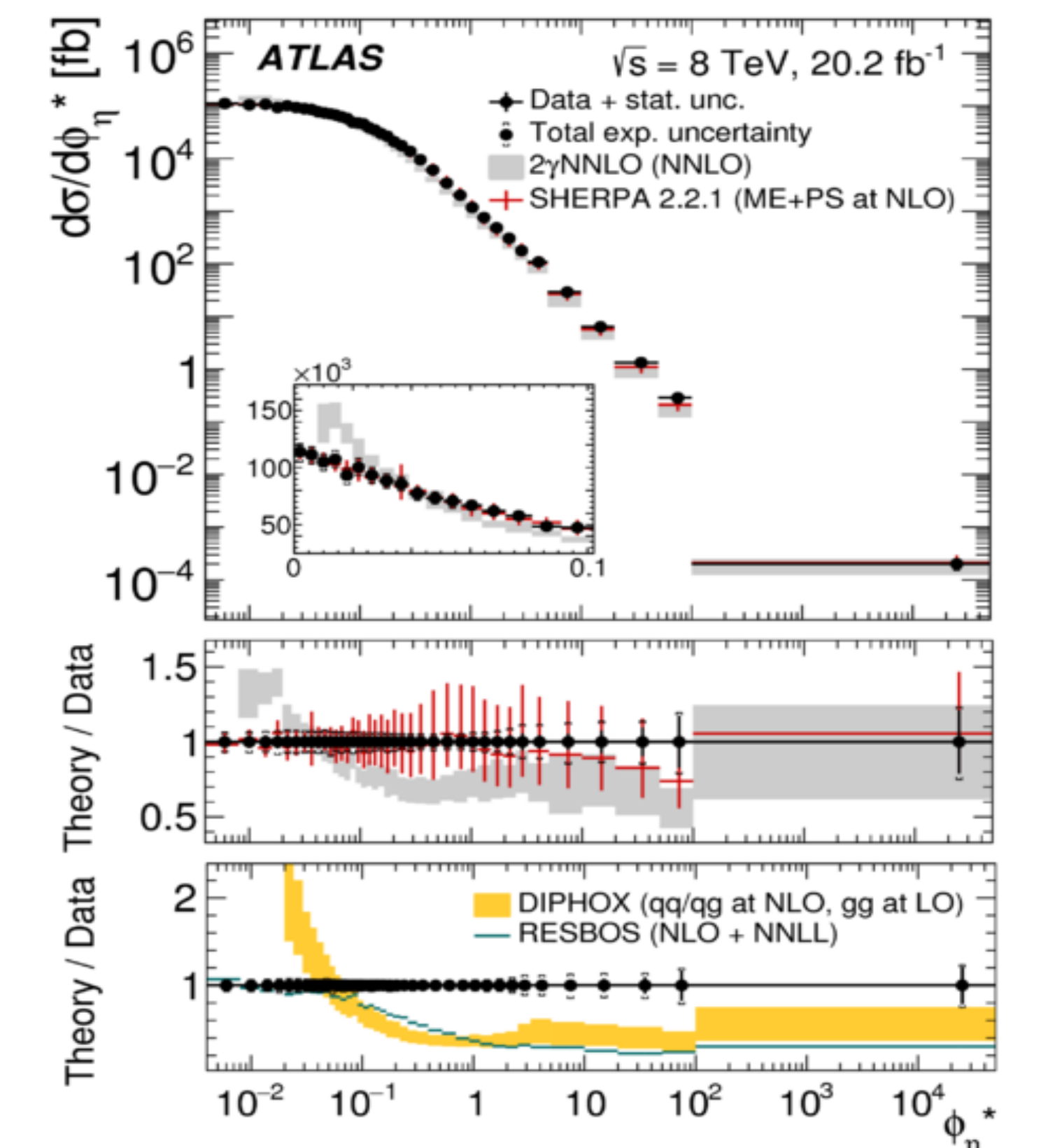
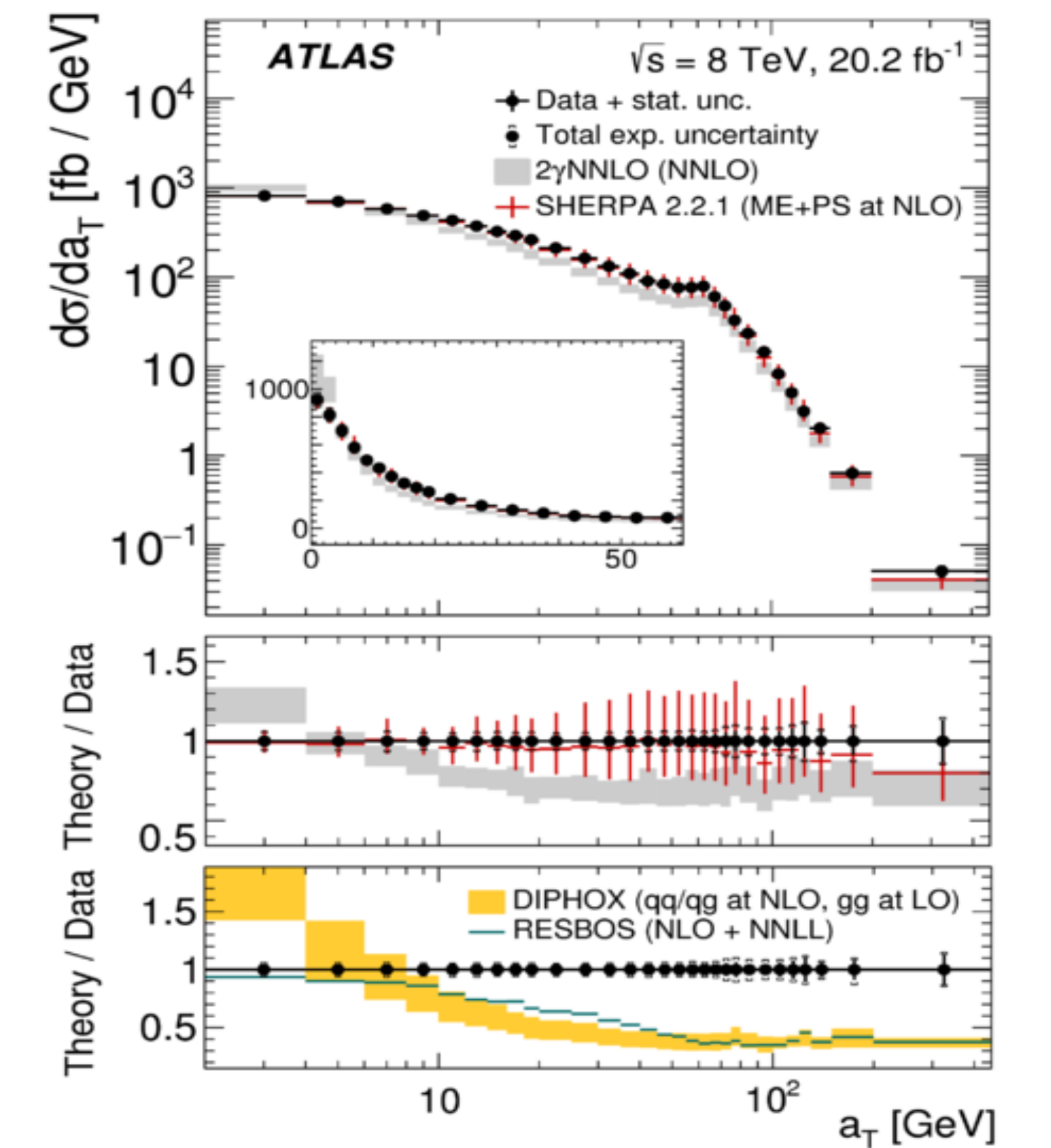
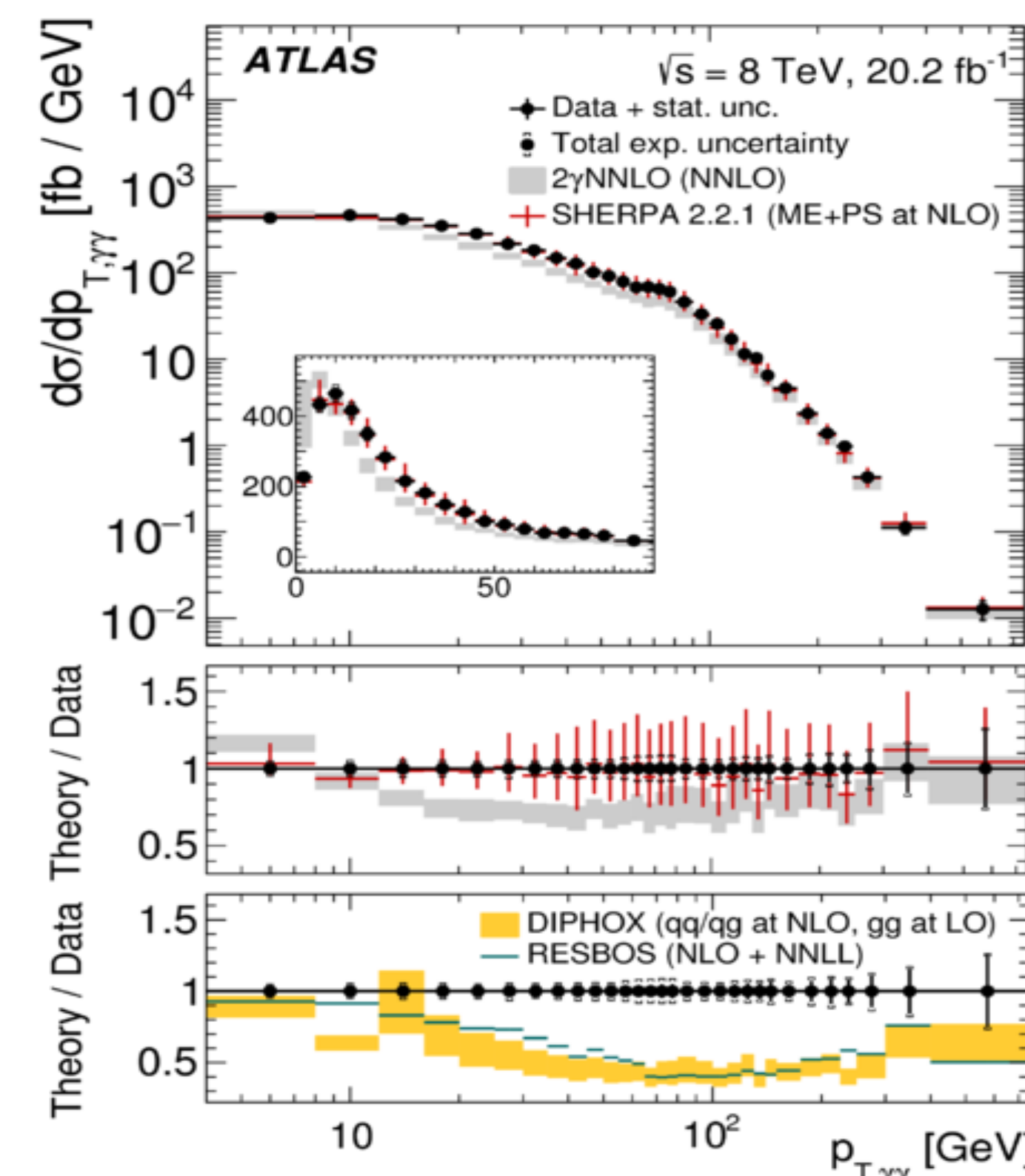
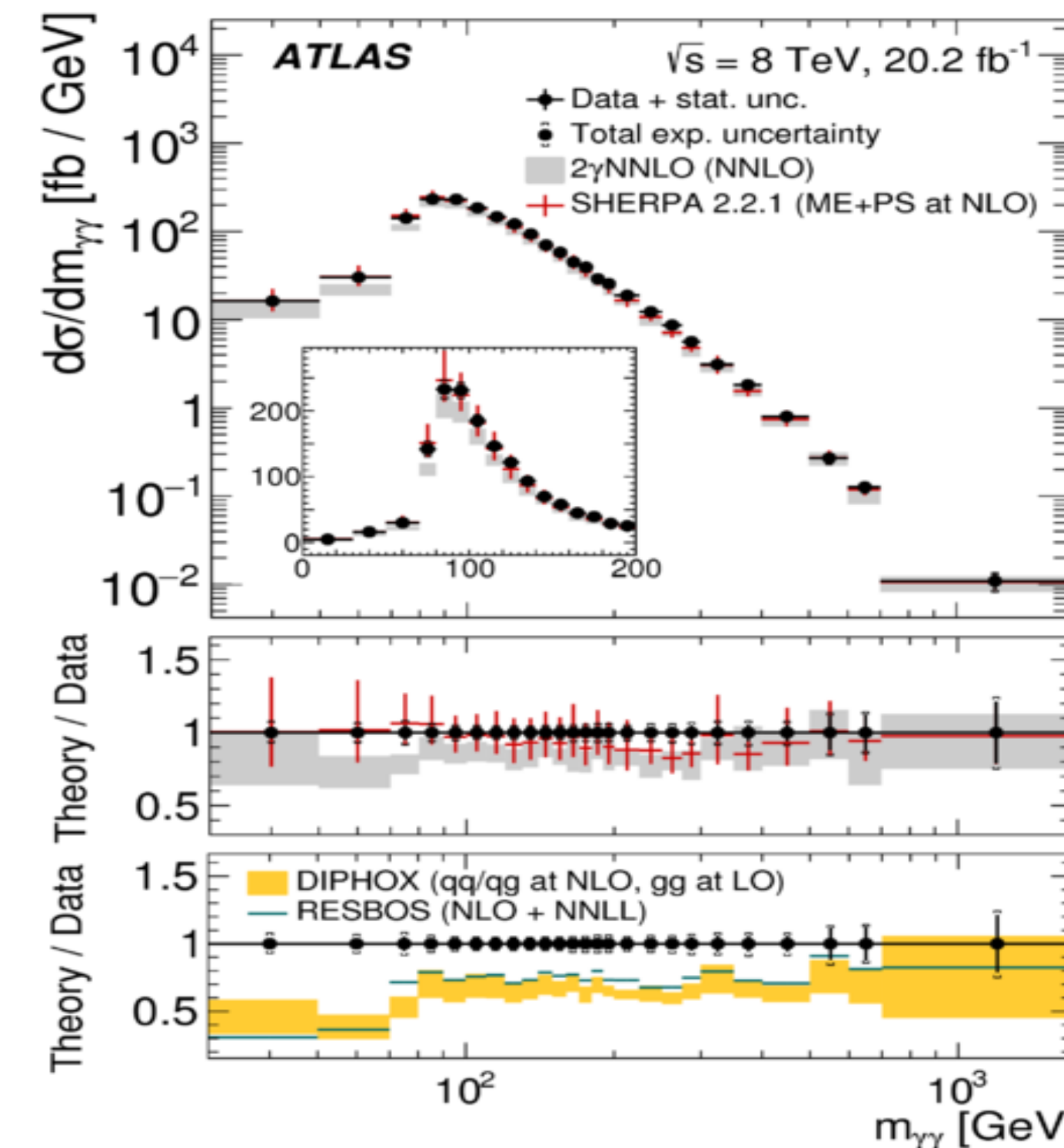
$$\sigma = \frac{N_{\gamma\gamma}}{\epsilon_{\text{trig}} \cdot C \cdot \int L dt}$$

$N_{\gamma\gamma}$: Number of genuine diphoton events
 ϵ_{trig} : Trigger efficiency
 C : Detector effect correction
 $\int L dt$: Integrated luminosity



Results

- Data are compared to fixed order predictions (DIPHOX, 2γNNLO and RESBOS) and ME+PS at NLO SHERPA 2.2.1 predictions
- SHERPA 2.2.1 prediction gives the best description of data



- Fixed order N(N)LO calculation (DIPHOX and 2γNNLO) fails at low a_T and ϕ_{η}^* region whereas resummed pQCD calculations of soft gluons (RESBOS) or parton shower algorithm (SHERPA 2.2.1) are able to describe this region.