Z+jet over γ+jet cross section ratio

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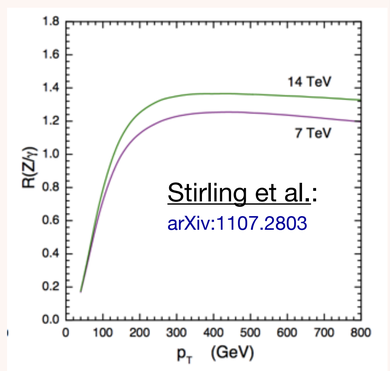
Abstract

We present the ratio of the cross section measurement of the Z/γ*+jet production over the γ+jet production at 8TeV. The full 2012 data collected by the CMS detector are analyzed and correspond to an integrated luminosity of 19.7 fb^{-1}. The measurement is performed in the kinematic region of p_T^V > 100 GeV and in the rapidity range $|y^V|$ <1.4. The analysis is shown with different jet multiplicities and H_T requirements. We present as well the measurement of the photon cross-section in the same range and the cross section ratio between the different jet multiplicities for the photon selection. The Z part of the analysis is presented in a separate poster (Eric Takasugi).

Introduction

Measure the plateau:

- ✦ mass difference is negligible ($p_T^Z \gg m^Z$).
- ✦ $Z \to \nu\nu$: Irreducible background to searches
- ✦ $Z \to \ell^+\ell^-$ used as a proxy for the invisible decay
- ✦ γ+jets used to extrapolate the Z spectrum to high p_T or H_T

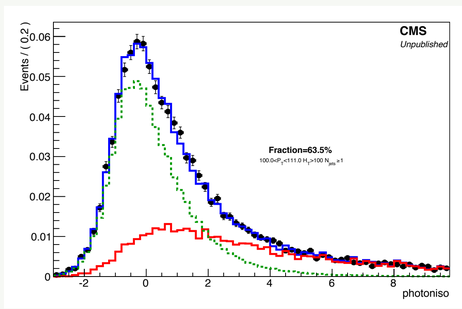


Purity Fit

The signal extraction is performed statistically

- ✦Purity fit on the photon component of the photon isolation.
- ✦Background template: shower-shape sideband
- ✦Signal template: Random-Cone technique
- ✦Differentially in the analysis bin.

Fully data-driven.

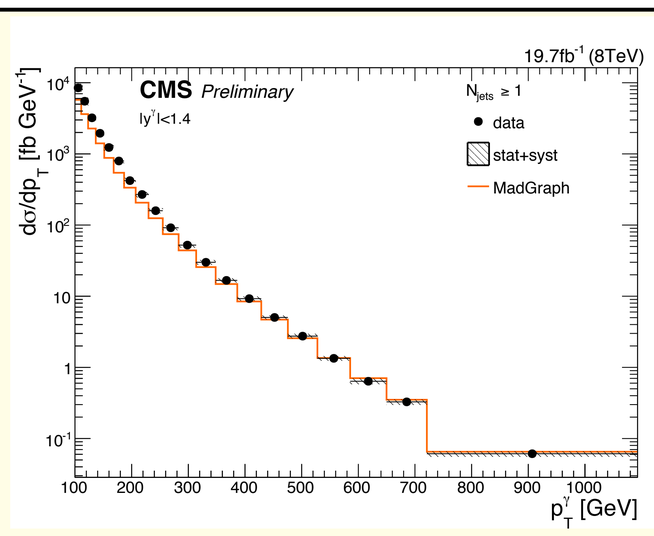


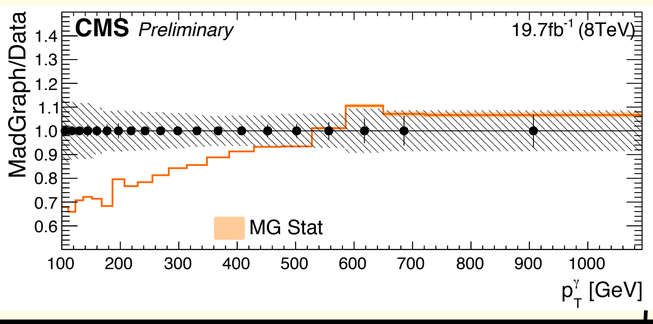
Photon

No k-factor applied to MadGraph.

Photon spectrum available for deferent selections:

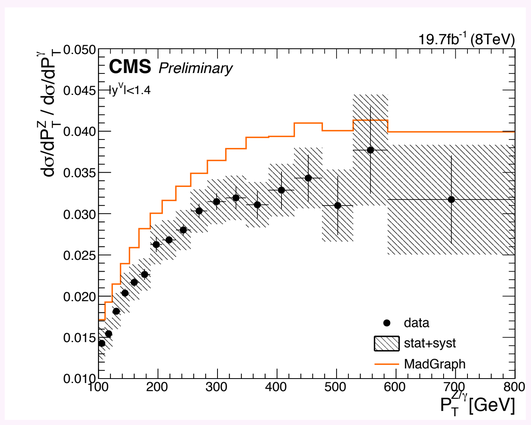
- ✦ $N_{jets} \geq 1$,
- ✦ $N_{jets} \geq 2$,
- ✦ H_T>300 GeV

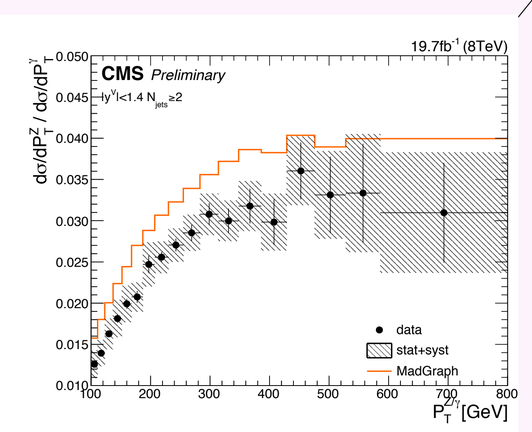


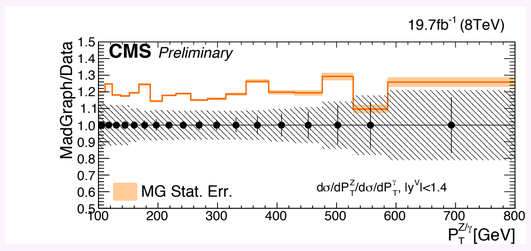


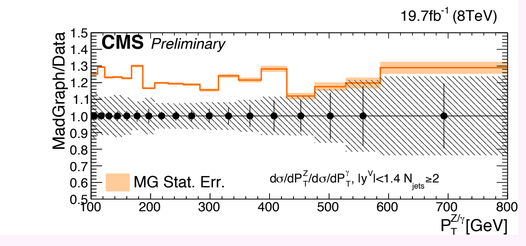
Z over γ

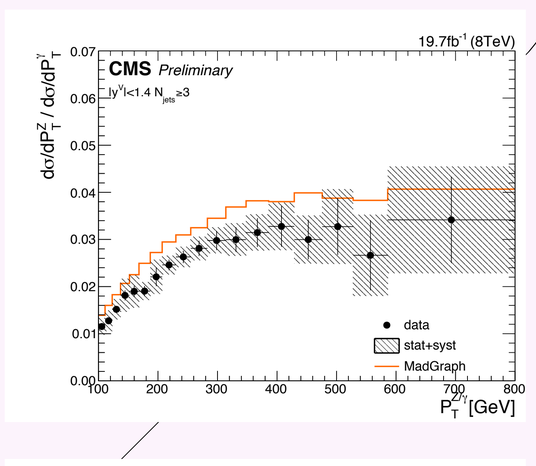
Z+jet over photon+jet cross ratio for $N_{jets} \geq 1$, 2, 3 and for H_T > 300 GeV

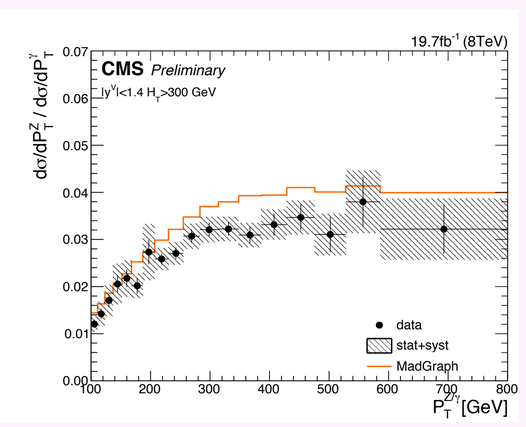


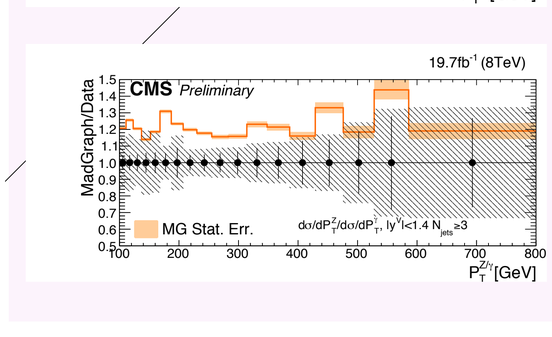


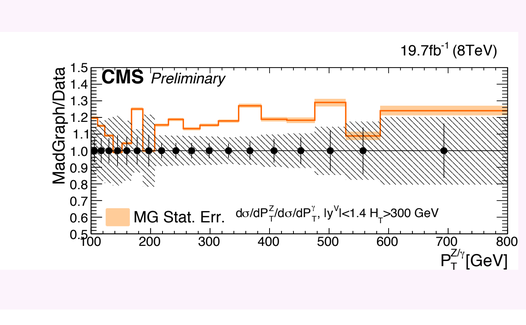




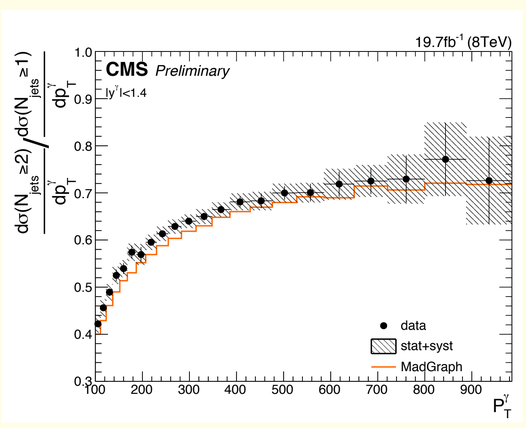


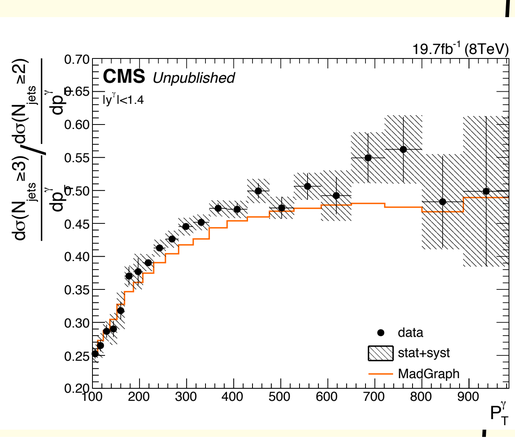


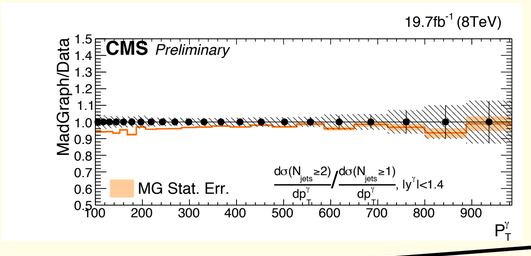


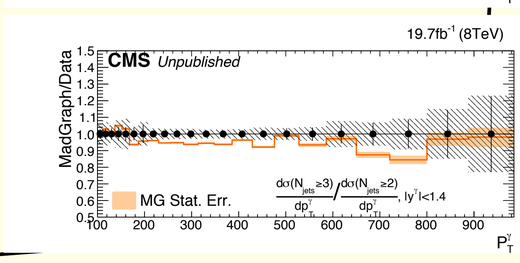


Cross section ratio between the $N_{jets} \geq 2/N_{jets} \geq 1$ and for $N_{jets} \geq 3/N_{jets} \geq 2$









Event Selection

- ✦Off-line selection designed slightly tighter than the trigger
- ✦Isolated Photons: <10 GeV within a cone of radius 0.3
- ✦Electron veto
- ✦One jet of 30 GeV is required in the event.
- ✦$|y^V|$<1.4

Systematics

Different systematics are taken into account and show different importance in different region of the phase space: the templates shape, the jet energy scale uncertainty, the jet energy resolution uncertainty, the pile-up model, the photon-energy scale, and the luminosity.

Conclusions

MadGraph (LO multi-leg MC) has a nice shape agreement, but a 20% disagreement in total rate. This description is stable, within the current precision, for different selection on the hadronic part of the event.

References

CMS Collaboration, “Measurement Z/γ*+jets/photon+jets cross section ratio in *pp* collisions at √s=8TeV”, CMS-PAS-SMP-14-005

S.Ask, M.A.Parker, T.Sandoval, M.E.Shea, W.J.Stirling, “Using gamma+jets Production to Calibrate the Standard Model Z(νν)+jets Background to New Physics Processes at the LHC”, JHEP 1110 (2011)