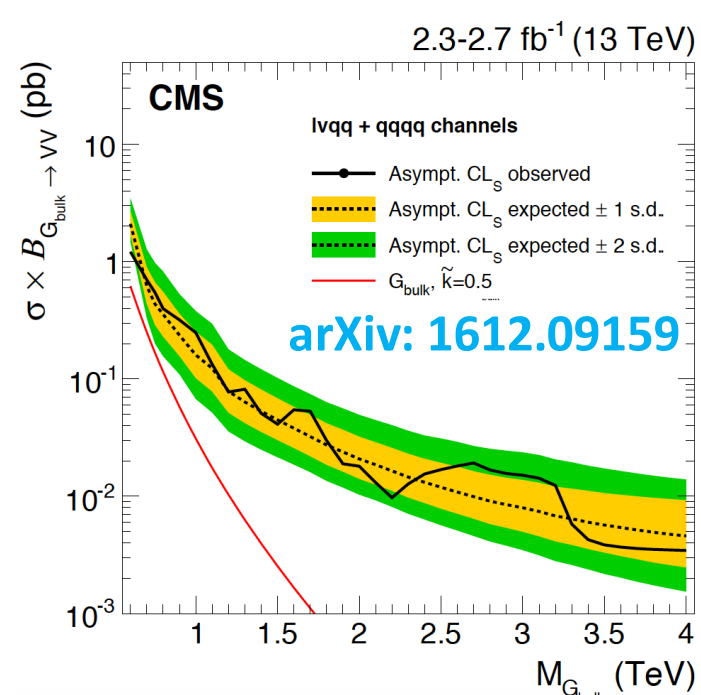
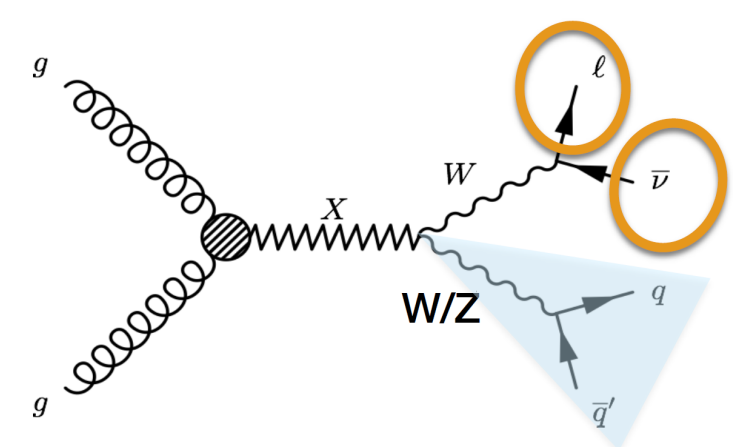
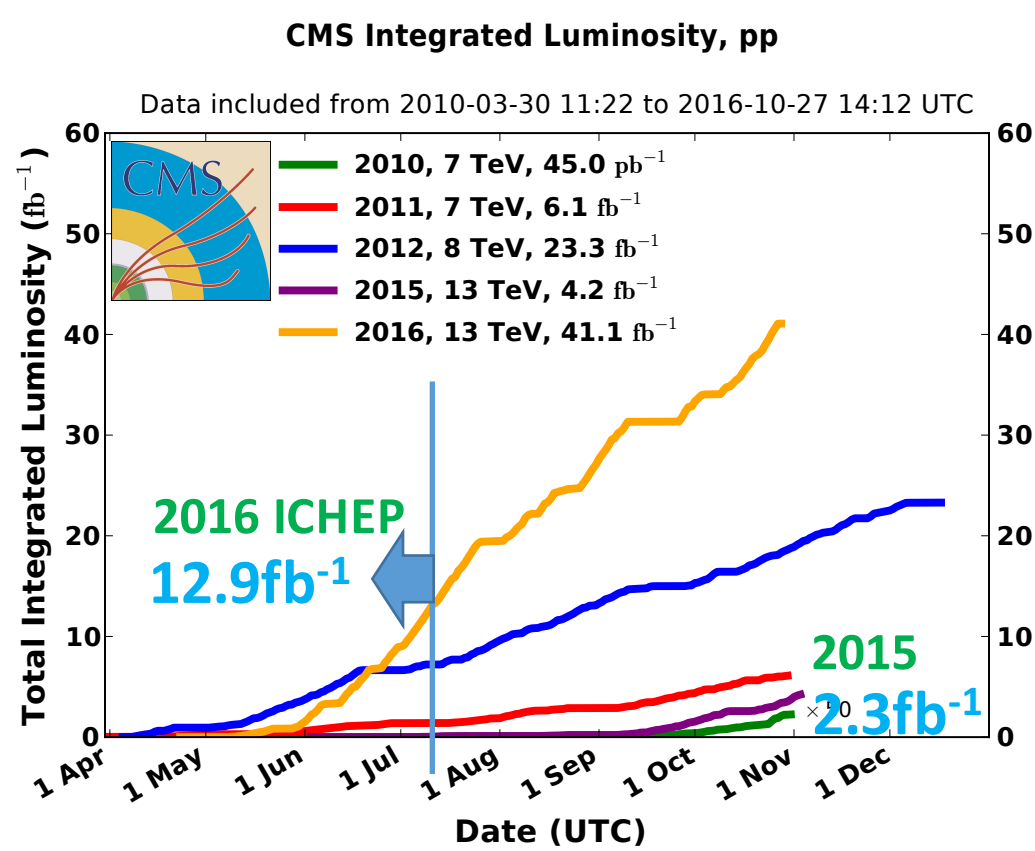


Introduction

- 2015 data: 2.3/fb, $\sqrt{s}=13$ TeV

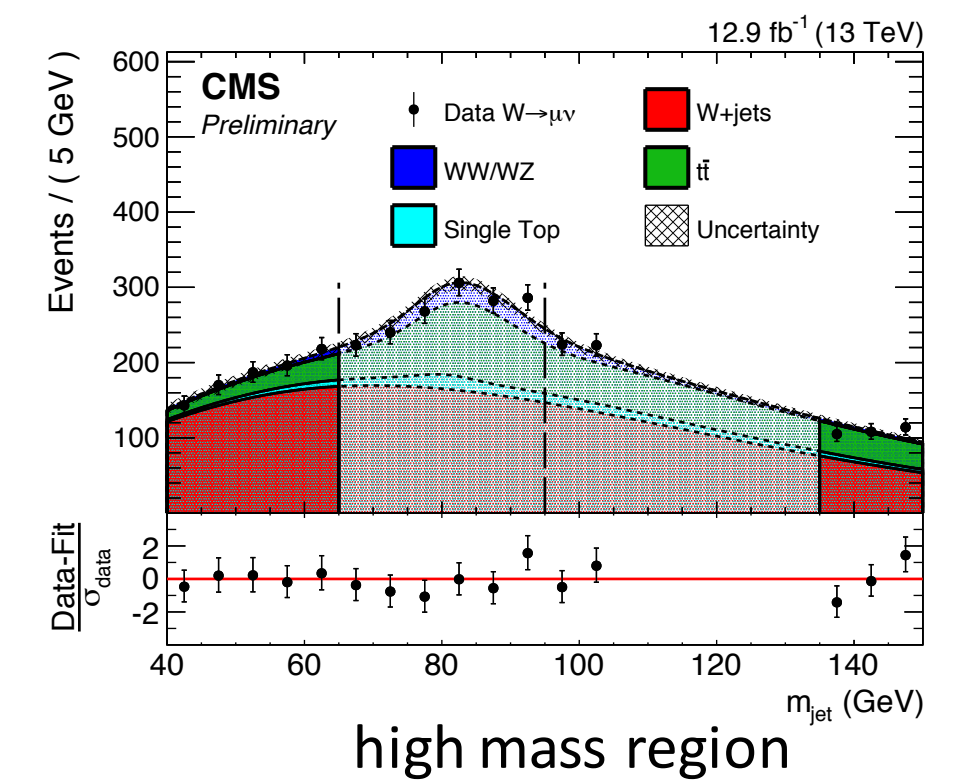
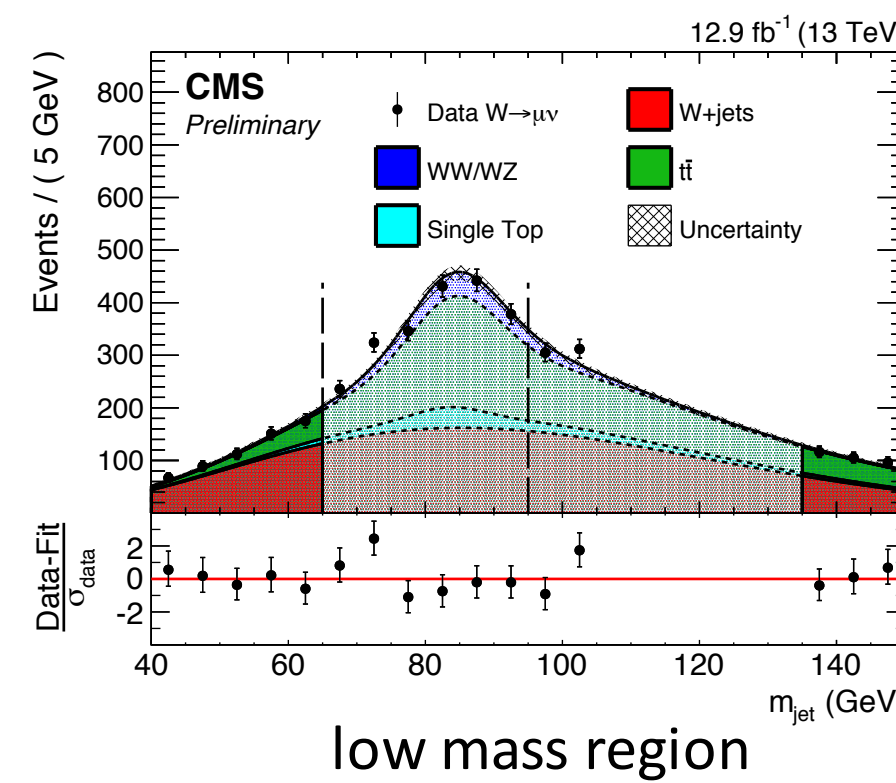


Channel	Models
EXOTIC Resonance	WW Spin-2 Bulk Graviton
X \rightarrow Diboson	WZ Spin-1 HVT (charged)



Background estimation: normalization

- Normalization of the W+jets background in the signal region determined from a fit to the M_J distribution in the lower and upper sidebands of the observed data.
- Analytical form of the t function chosen from simulation studies.
- Contribution of the other backgrounds estimated from the simulation, corrected with scale factors extracted from data in control regions.



Samples

- Analysis based on proton-proton collision data at $\sqrt{s}=13$ TeV collected by the CMS experiment at the CERN Large Hadron Collider during 2016.
- Integrated luminosity: 12.9 fb⁻¹
- Signal: X \rightarrow WW \rightarrow lvqq, with X = Bulk graviton/W', in the mass range 0.6~4.5 TeV
- Backgrounds:
 - W+jets, dominant one, estimated from data
 - TTbar, single top, VW: estimated from simulation

Background estimation: shape

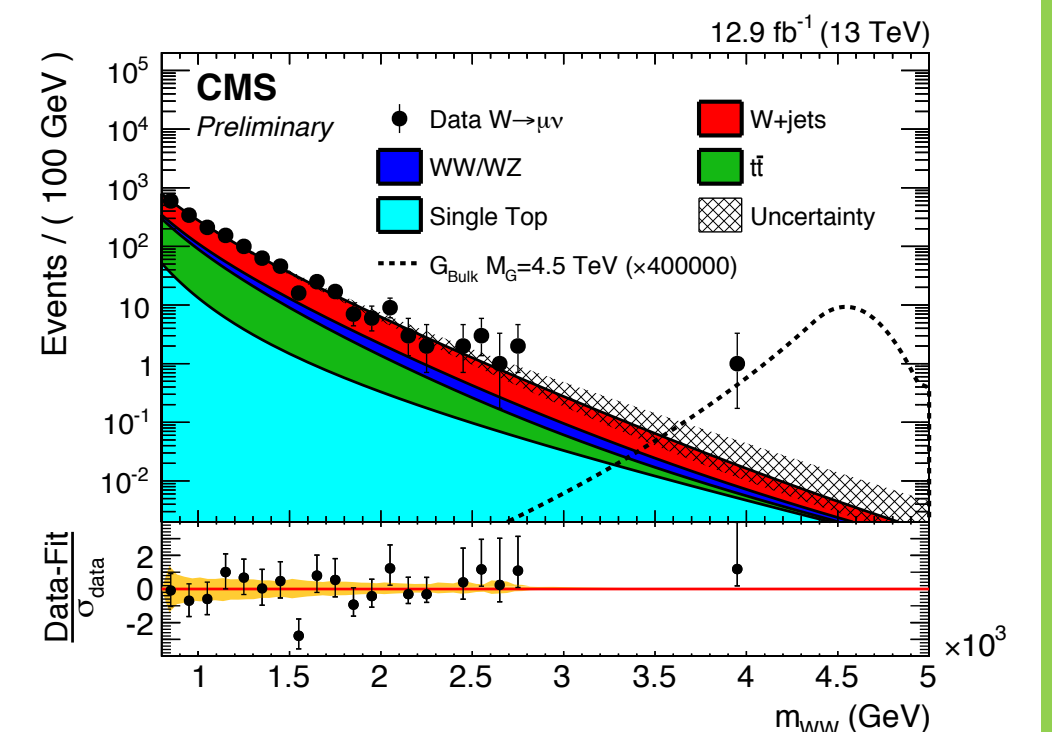
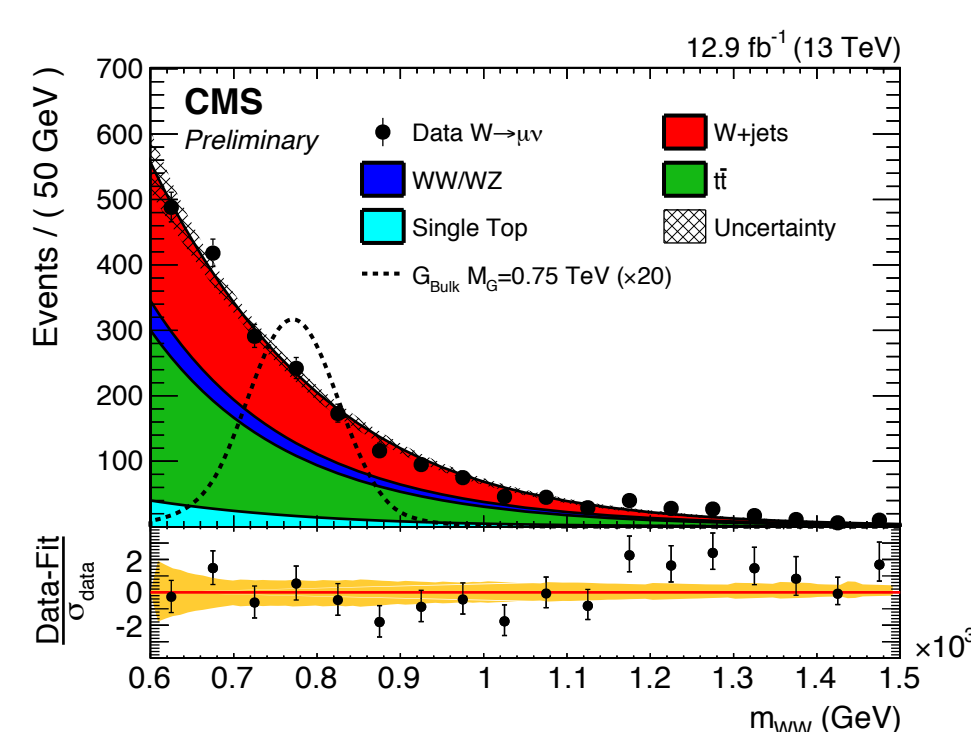
α method

$$\alpha^{MC} = \frac{F_{WW}(SR)^{MC}}{F_{WW}(SB)^{MC}} \iff \alpha^{Data} = \frac{F_{WW}(SR)^{Data}}{F_{WW}(SB)^{Data}}$$

Assuming $\alpha^{Data} = \alpha^{MC}$

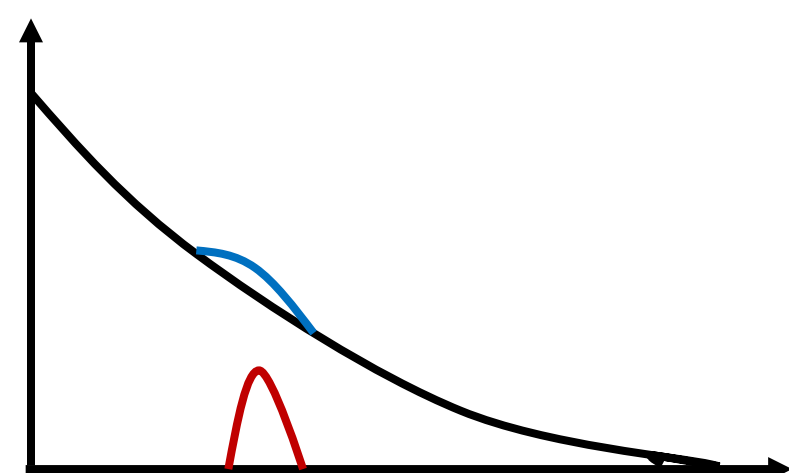
$$F_{WW}(SR)^{Data} = F_{WW}(SB)^{Data} \times \alpha^{MC}$$

- extract shape of the M_{WV} distribution of the W+jets background in the signal region. Then add the minor backgrounds to the W+jets background to obtain the total SM prediction in the signal region.



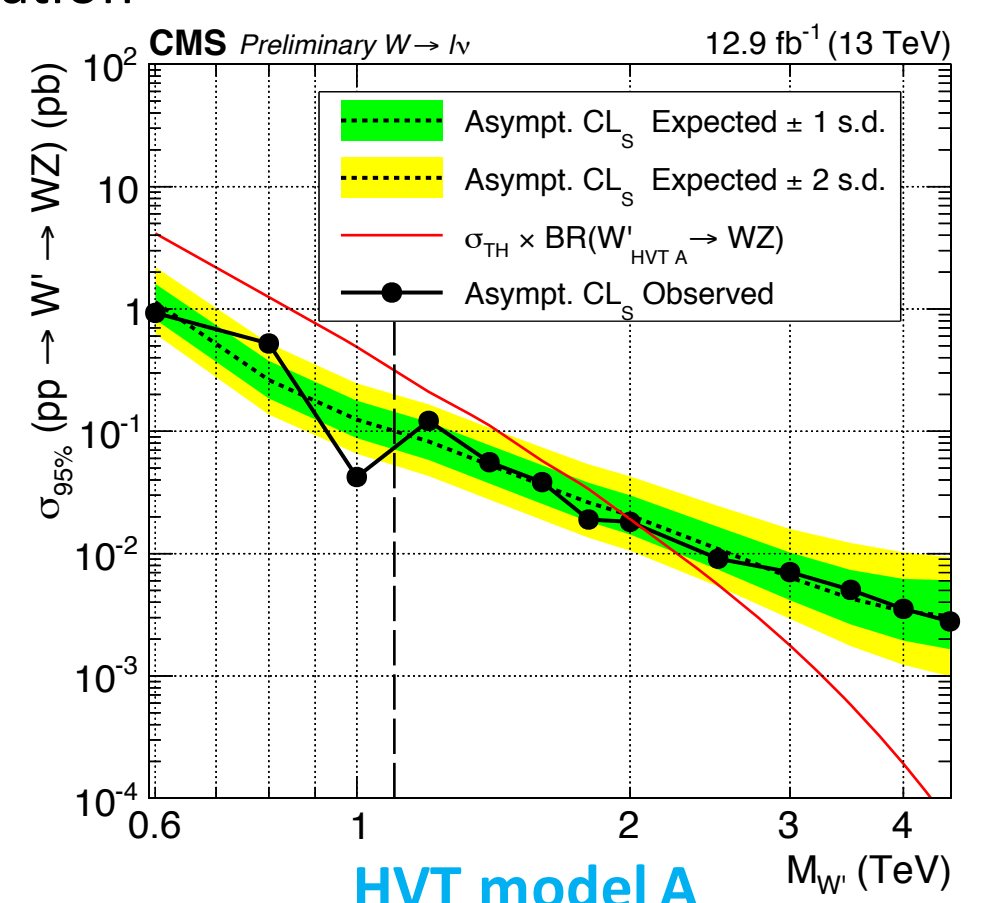
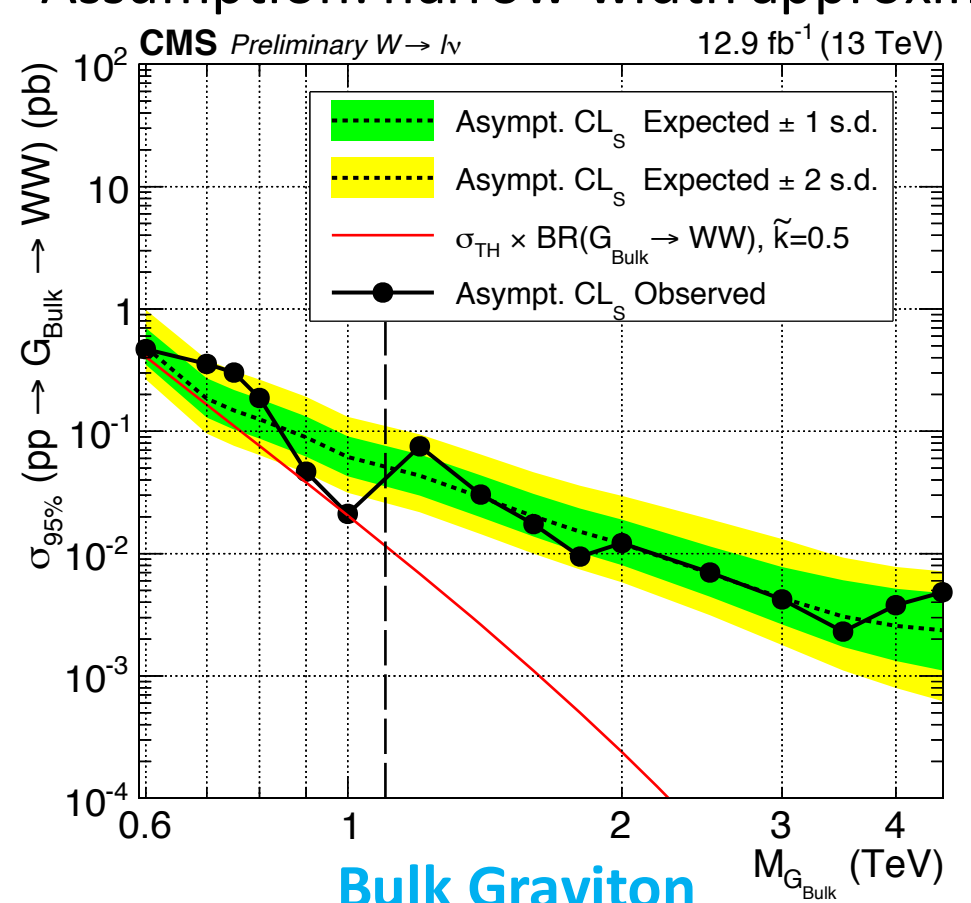
Event reconstruction and analysis strategy

- Reconstruction of the full event, to search for a local excess in the diboson invariant mass spectrum.
- Leptonically decaying W bosons reconstructed by identifying isolated high-momentum leptons.
- Measured missing transverse energy (ET) used to estimate the neutrino longitudinal momentum, by imposing the constraint $M_{l\nu} = M_W$.
- High boosted regime: quarks coming from the hadronically decaying vector boson very collimated, reconstructed as a single jet.
- Information from jet substructure used to identify these jets.
- Two main observables:**
 - M_J : mass of the merged jet. Events split according their M_J value in Signal region (SR):
 - $\tau_{21} < 0.45(0.6)$ for low(high) mass analysis
 - Jet mass windows [65-95] for W, [75-105] for Z
 - Sideband region (SB) ([40-65] and [135-150 GeV]), for the estimation of the background.
 - M_{WV} : four-body invariant mass, used for the limit computation:
 - Low mass analysis [600-1000] with M_{WV} 0.6-1.5 TeV
 - High mass analysis [1000- 4500] with M_{WV} 0.8-5 TeV

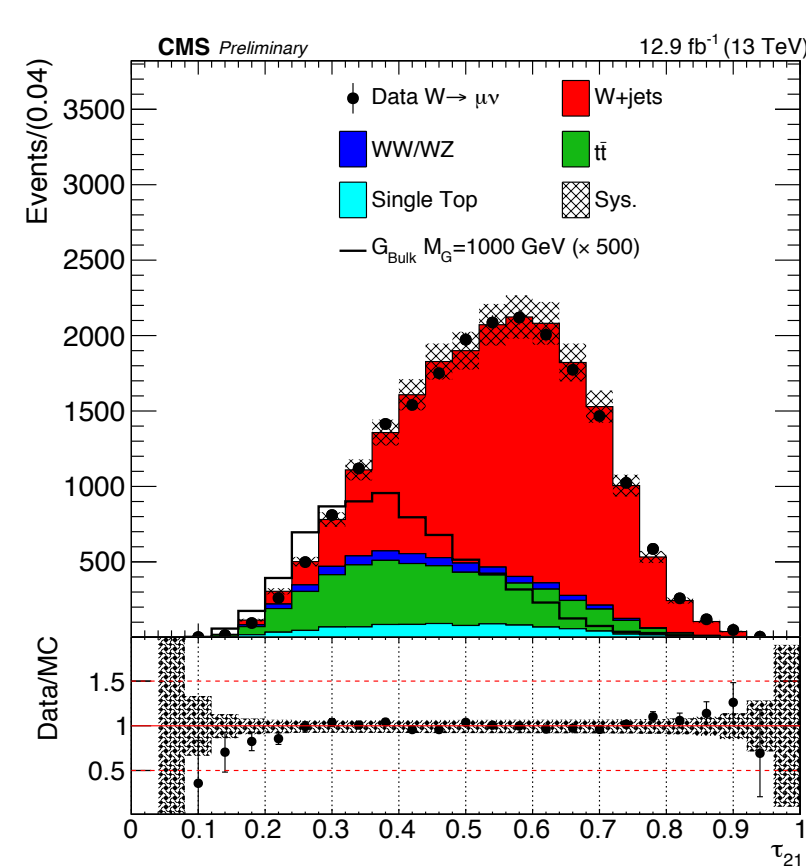
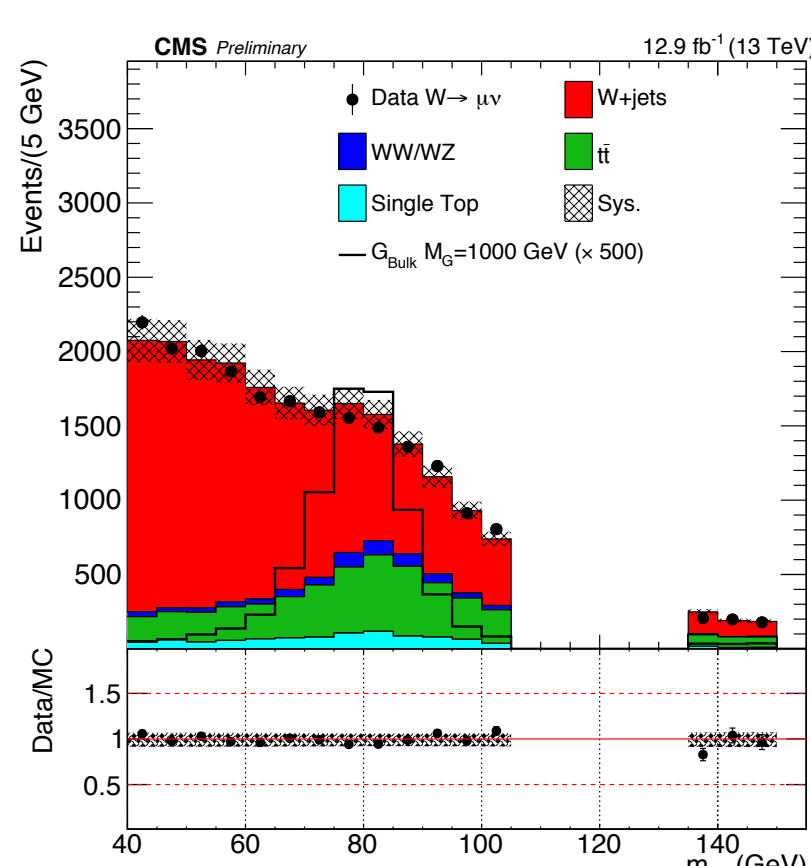


Statistical interpretation

- Compare M_{WV} distribution observed in data with SM background prediction
- Exclusion limits in the context of bulk graviton model and HVT model A scenario. Combination with another channel (X \rightarrow WW)
- Assumption: narrow-width approximation



Data VS MC



Conclusion

- Search for resonances decaying to WW or WZ by 2016 early data
- No evidence for a signal is found
- Results interpreted as upper limit on the production cross section for bulk graviton and HVT models.

Ref: CMS-PAS-B2G-16-020