

Search for high mass resonances at CMS and future plan

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Group Members

- Leader
 - Hwidong Yoo
- Post-doctoral researcher
 - Benjamin Radburn-Smith
- Ph. D. students
 - Kyungwook Nam
 - Kyeongpil Lee
- M.Sc. Students
 - Minseok Oh
 - Dalmin Pai
 - Joonbin Lee

Physics Program Performed

- Search for high mass resonance
 - $Z' \rightarrow 2l$
 - $X \rightarrow Z\gamma$ ($Z \rightarrow 2l$)
 - $Z' \rightarrow 4l$
- Drell-Yan differential cross section measurement at 13 TeV

Achievements

- Preliminary results

- ICHEP 2016 (August, 2016)

- CMS-PAS-EXO-16-031: $Z' \rightarrow 2l$ based on 13/fb data in 2016
 - Benjamin, Kyeongpil, Kyungwook
 - CMS-PAS-EXO-16-034: $X \rightarrow Z\gamma$ based on 13/fb data in 2016
 - Kyungwook, Kyeongpil
 - CMS-PAS-SMP-16-009: DY diff. x-section measurement (2015 data)
 - Kyeongpil, Kyungwook

- LHCP 2017 (May, 2017)

- CMS-PAS-EXO-17-005: $X \rightarrow Z\gamma$ based on 36/fb data in full 2016 dataset
 - Kyungwook, Kyeongpil

- Publications

- $X \rightarrow Z\gamma$ based on 2015 dataset: JHEP 01 (2017) 076
 - $Z' \rightarrow 2l$ based on 2015 dataset: PLB 768 (2017) 57
 - $Z' \rightarrow 4l$ based on 2012 dataset: arXiv: 1701.01345, submitted to PLB

Currently on-going Programs

- $X \rightarrow Z\gamma$ ($Z \rightarrow 2l$): Kyungwook
 - Journal publication under pipeline with 2016 full dataset
 - Preparation of 2017 analysis
- $Z' \rightarrow 2l$: Benjamin, Minseok, Kyungwook, Kyeongpil
 - Preliminary results with full 2016 dataset will be public in summer
 - Journal publication afterward
 - Preparation of 2017 analysis
- $Z' \rightarrow 4l$: Joonbin et. al.
 - Study is on-going with full 2016 dataset
 - High mass Higgs scenario is added
- Drell-Yan differential cross section measurement: Kyeongpil, Dalmin
 - Preliminary results with full 2015 dataset will be public in summer
 - Journal publication afterward
 - Study is on-going with full 2016 dataset

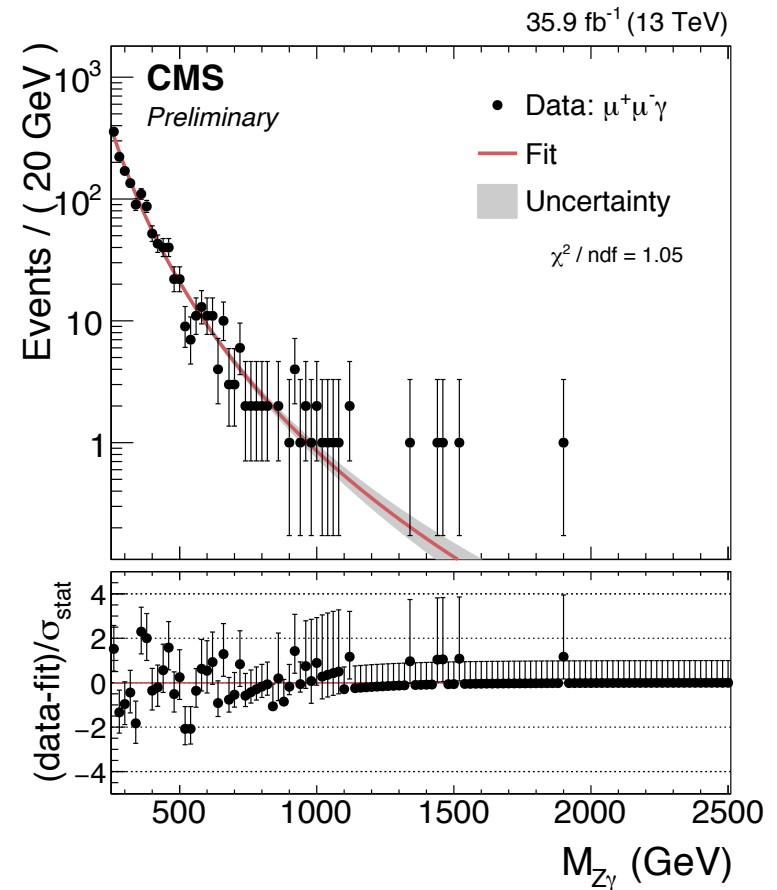
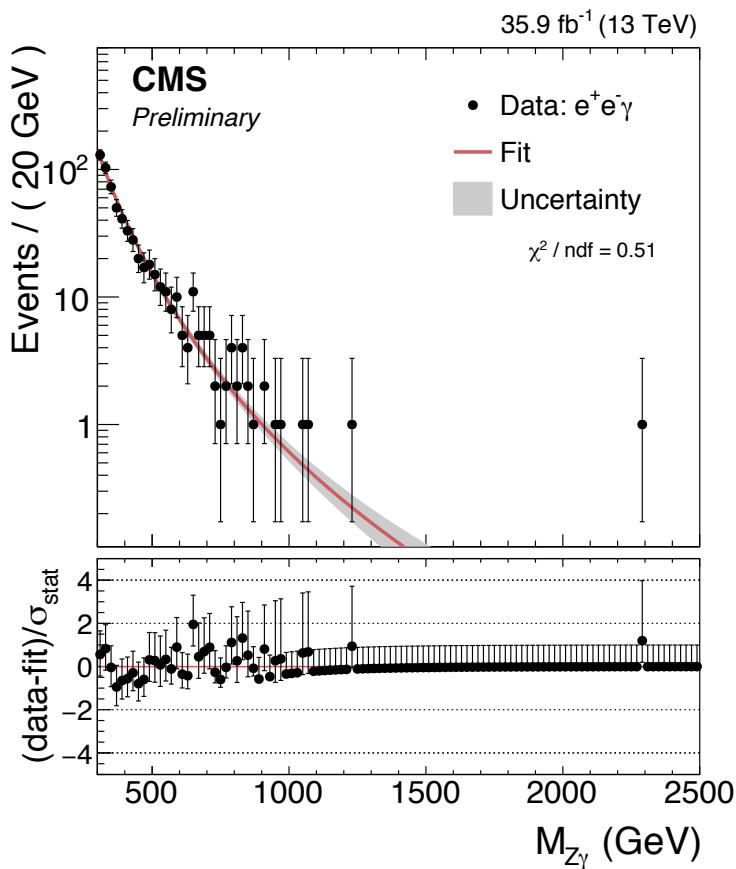
$X \rightarrow Z(l)\gamma$ at 13 TeV

CMS-PAS-EXO-17-005

- Search for high mass resonance in $Z\gamma$
 - Consider both narrow/wide resonances
 - Similar to diphoton search conceptually
- Leptonic channel: Kyungwook is a main analyzer
 - High resolution, low background but low signal BR
 - Channel: $e e \gamma$, $\mu \mu \gamma$
- Hadronic channel: FNAL post-doc is a main analyzer
 - Higher signal BR but lower resolution, higher backgrounds
 - Boosted Z: large-cone jets with substructure

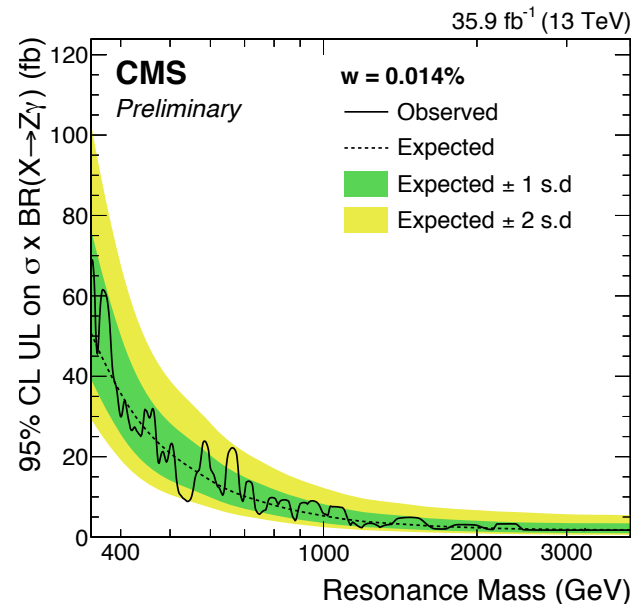
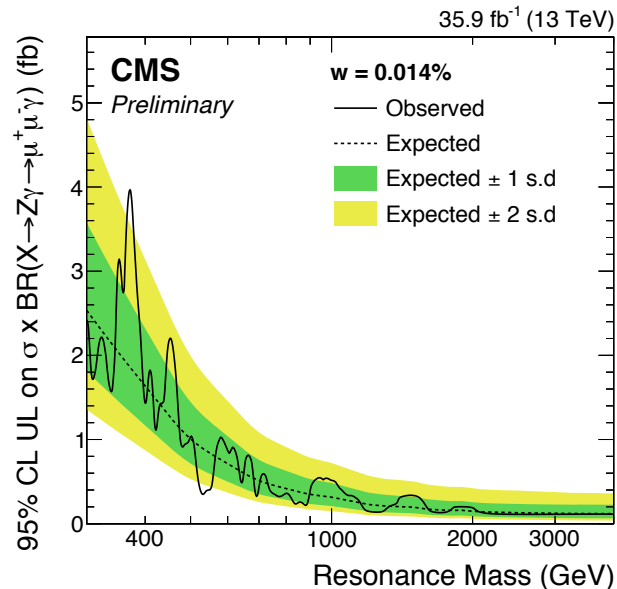
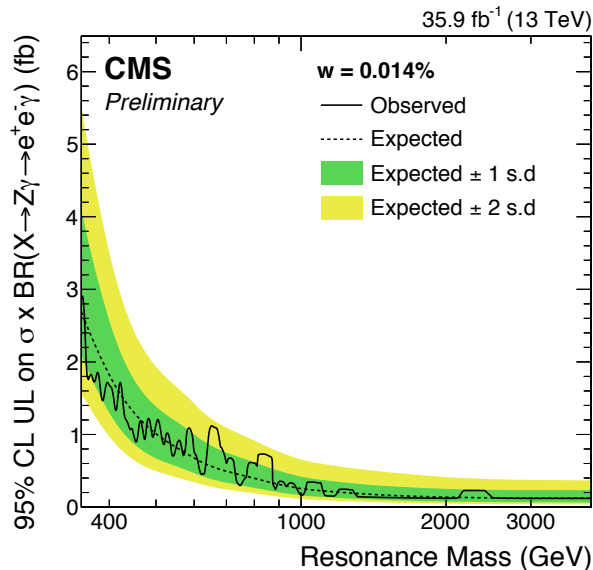
Z γ Mass Spectra

- Background shape parametrized with $f(x) = x^{a+b \log(x)}$
- Leptonic channels are dominant at $M < 1$ TeV



Limits on $Z\gamma$ Resonances

- Set limits for $M(X) > 350$ GeV for narrow resonance
- No significant excess
 - More than 2 sigma excess around 370 GeV in muon channel only



Limits on $Z\gamma$ Resonances

- 2012 (8TeV, 19.7/fb) + 2015 (13 TeV, 2.7/fb) combination
 - JHEP 01 (2017) 076

