Search for resonances in the mass spectrum of muon pairs produced in association with b quark jets in proton-proton collisions at $\sqrt{s}$ = 8 and 13 TeV

arXiv:1808.01890

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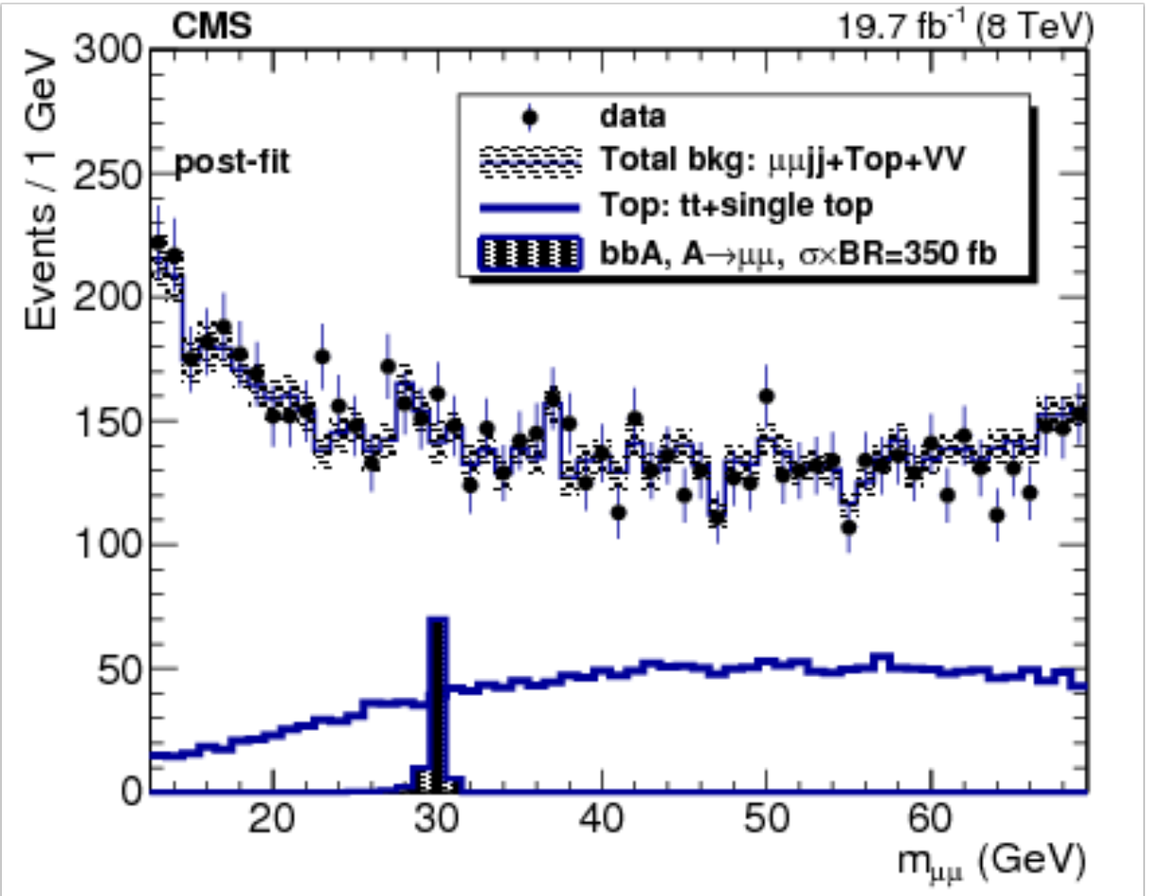
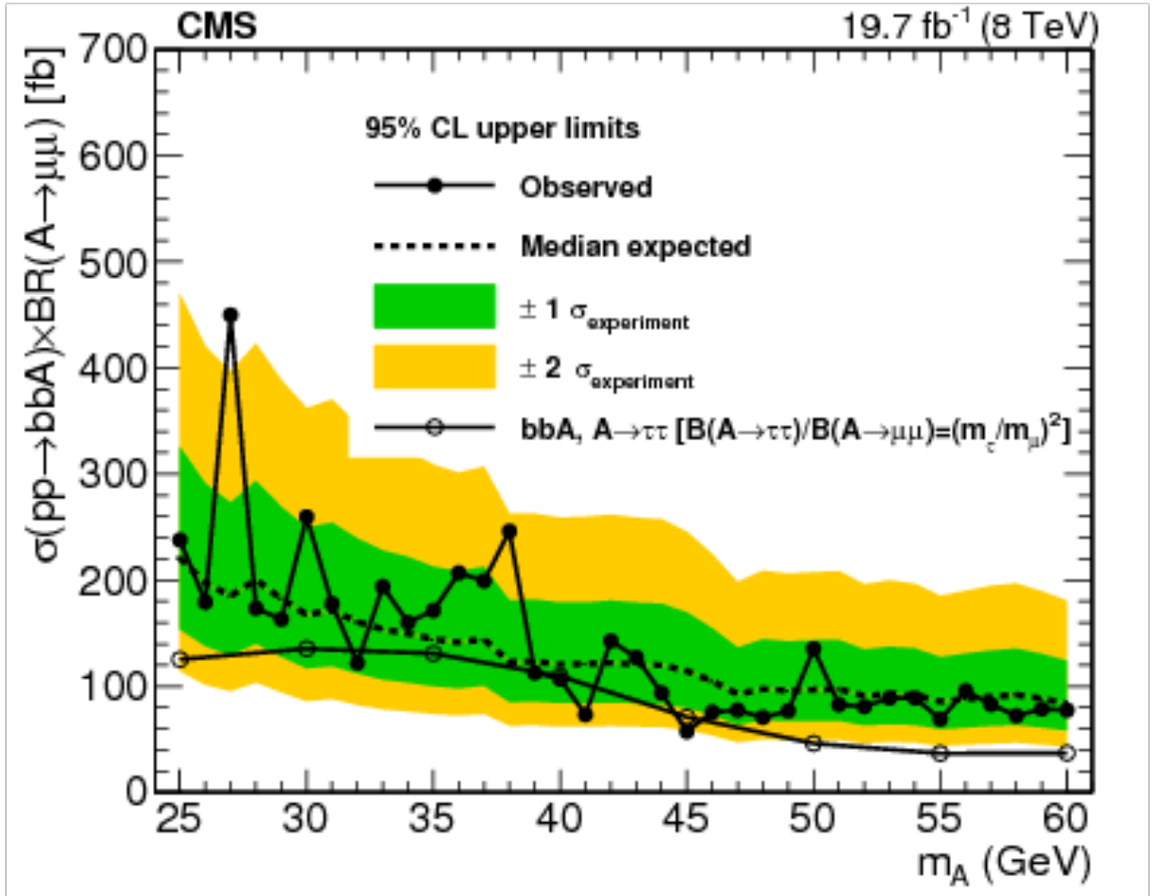
Motivation

previous searches of dimuon resonances with b-jets at 8 TeV data:
https://doi.org/10.1007/JHEP11(2017)010
2HDM was tested
No signal is observed in the dimuon mass range from 25 to 60GeV.

selections:

- $pt_{\mu 1,2} > 25$ GeV, 5 GeV
- $|\eta_{\mu 1,2}| < 2.1, 2.4$
- $pt_{b\text{-jet}} > 20$ GeV in $|\eta| < 2.4$
- $Et_{missing} < 40$ GeV



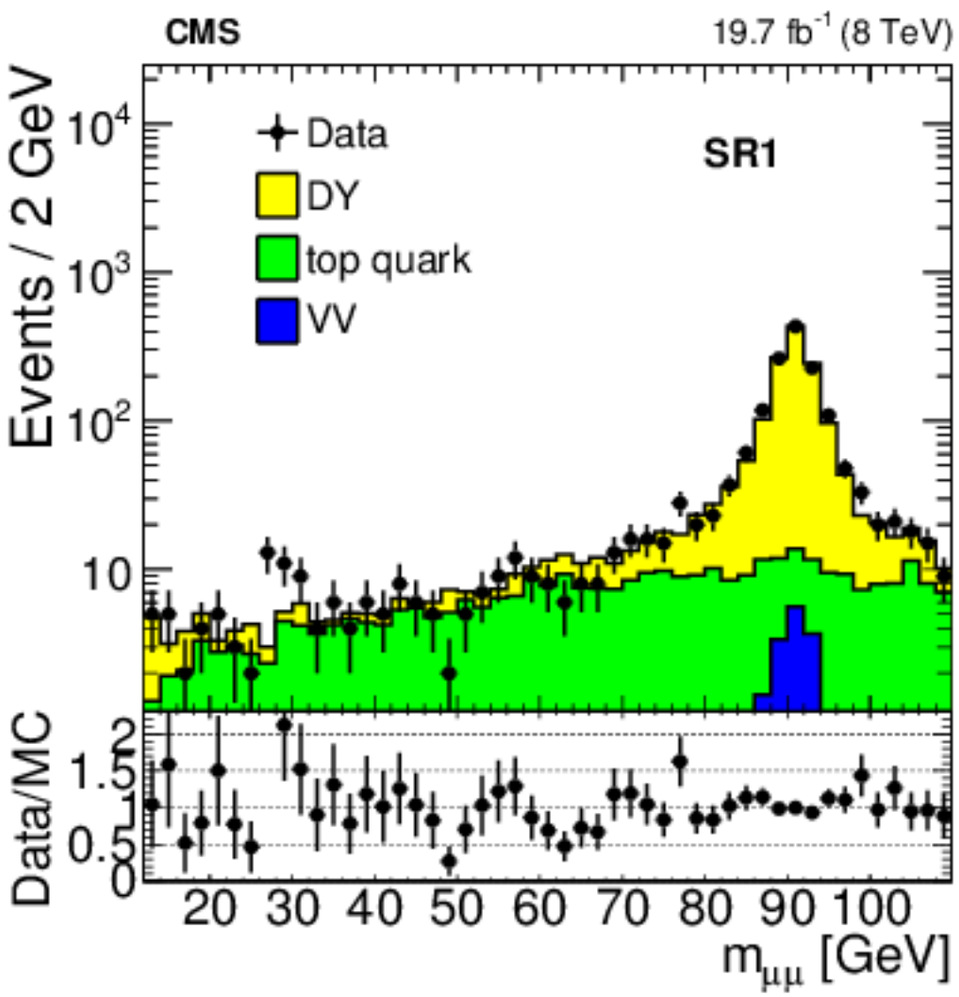


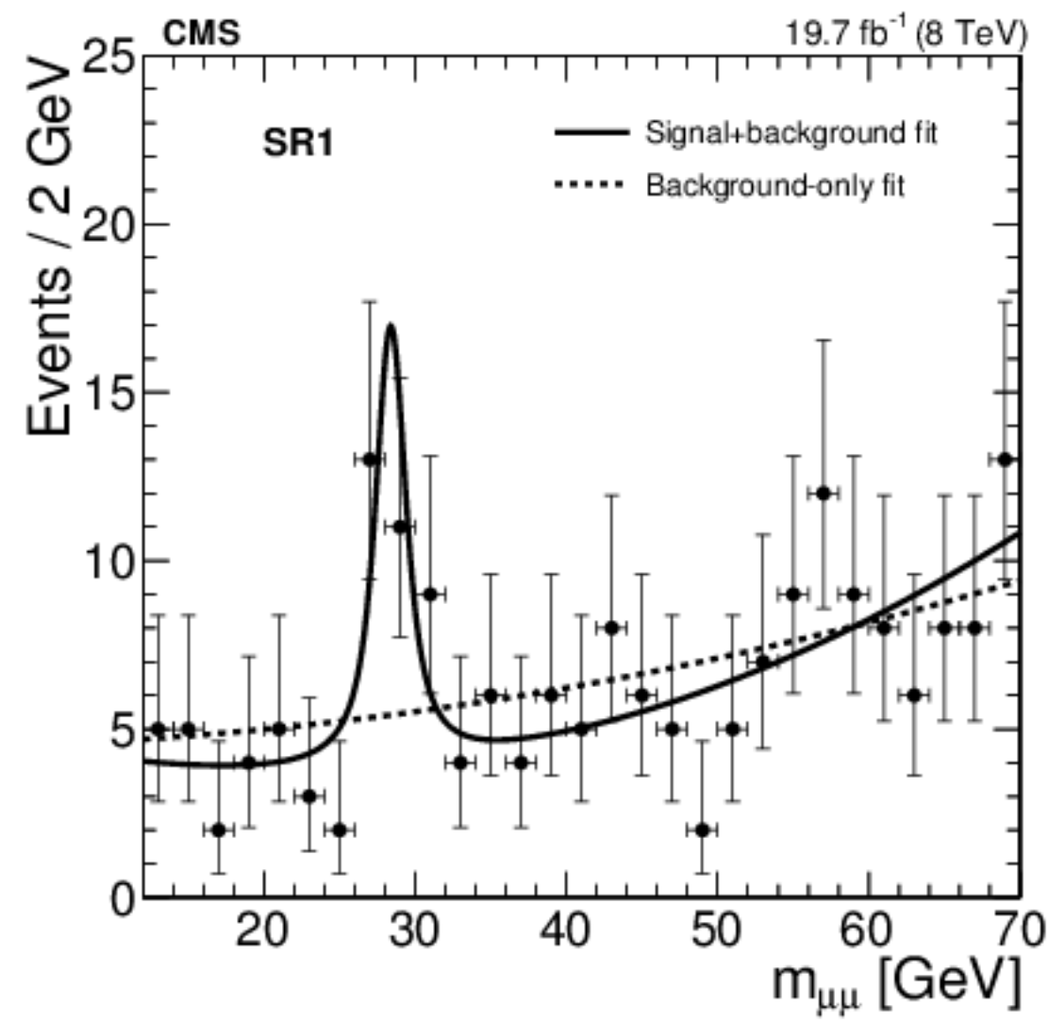
8 TeV results

new selections, boosted μμ - higher pt_{μ},
significant events excess at $M_{\mu\mu}$ ~30 GeV

new selections:

- $pt_{\mu 1,2} > 25$ GeV
- $|\eta_{\mu 1,2}| < 2.1$
- $pt_{b\text{-}jet} > 30$ GeV in $|\eta| < 2.4$
- no other jets with $pt_{jet} > 30$ GeV in $|\eta| < 2.4$
- at least 1 jet with $pt_{jet} > 30$ GeV in $|\eta| > 2.4$

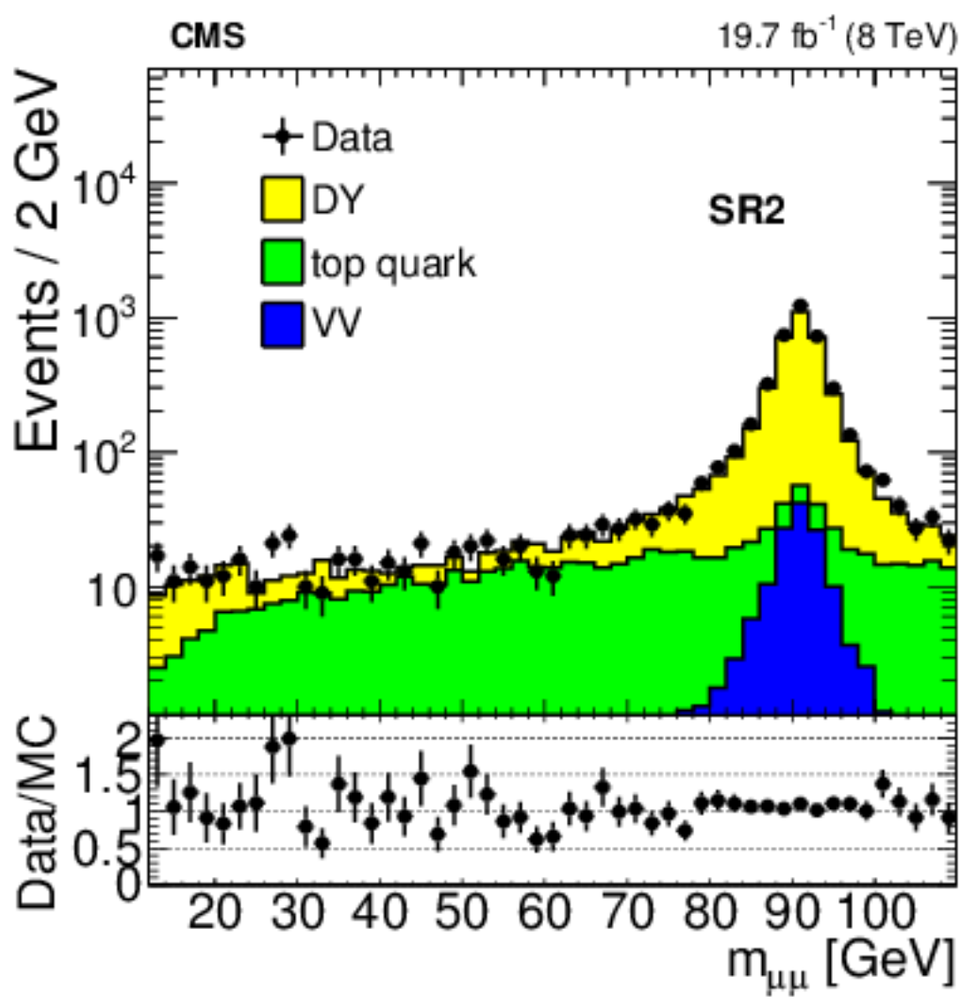


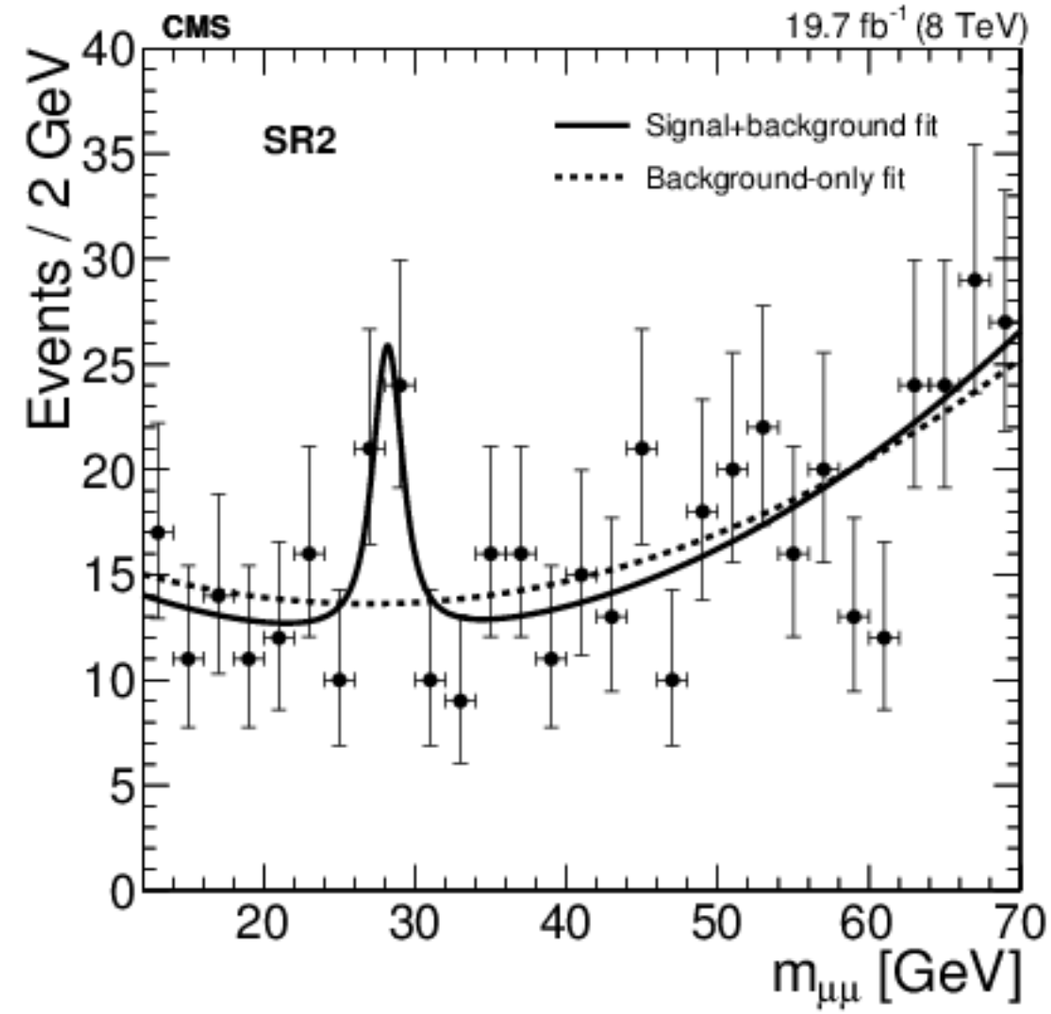


8 TeV results

alternative selections: no intersection with first signal region

- $pt_{\mu 1,2} > 25$ GeV
- $|\eta_{\mu 1,2}| < 2.1$
- $pt_{j1,2} > 30$ GeV $|\eta| < 2.4$, at least 1 b-jet
- no other jets with $pt_{jet} > 30$ GeV in $|\eta| < 2.4$
- no jets jet with $pt_{jet} > 30$ GeV in $|\eta| > 2.4$
- $Et_{missing} < 40$ GeV
- $\Delta\phi_{\mu\mu\text{-}jj} > 2.5$





8 TeV results

events excess characteristics

	first signal region	second signal region
mass (GeV)	28.4±0.6	28.2±0.7
width	1.9±1.3	1.9±1.1
Local significance (s.d.)	4.2	2.9
σ_{fid} (fb)	4.1±1.4	4.2±1.7

13 TeV results

full 2016 dataset - 35.9 fb-1

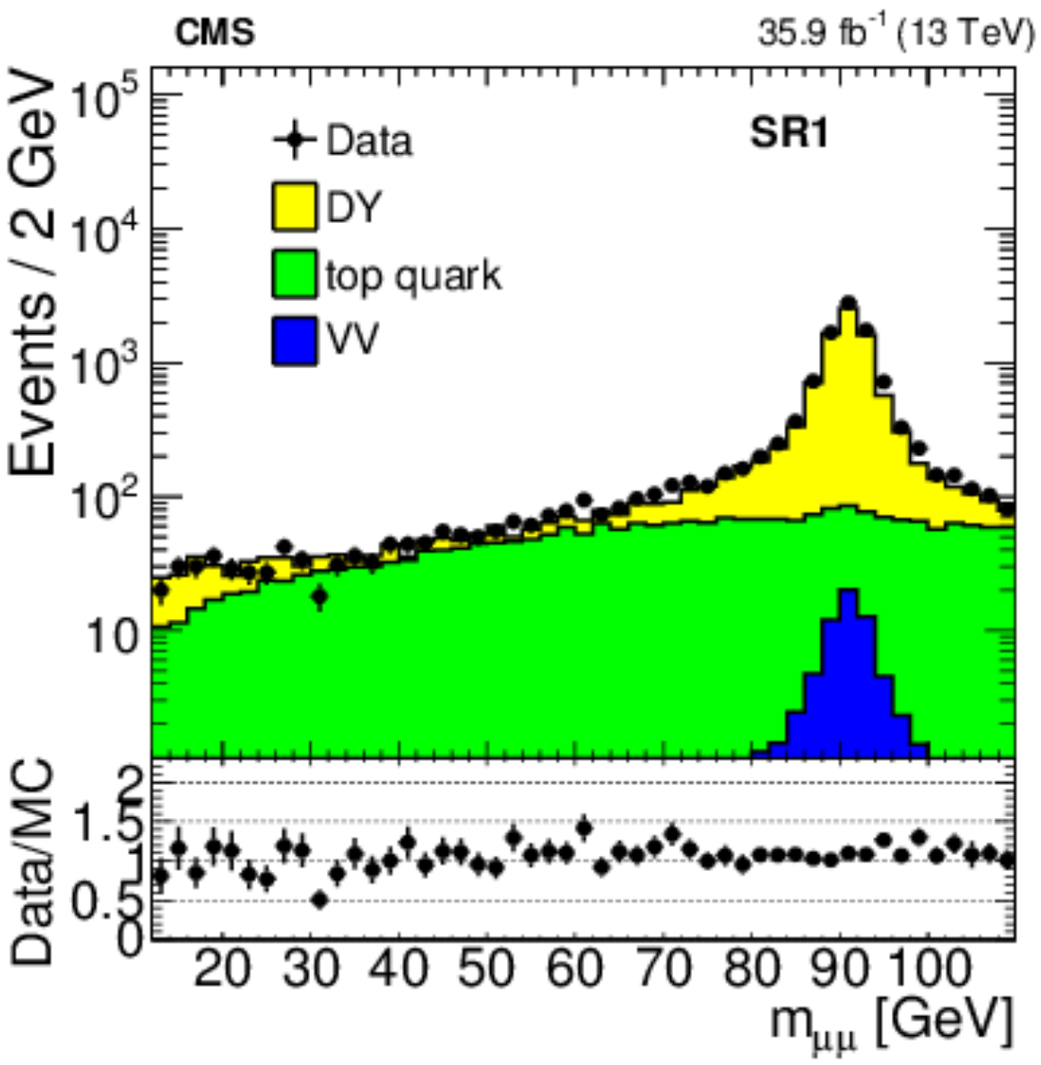
same events selections

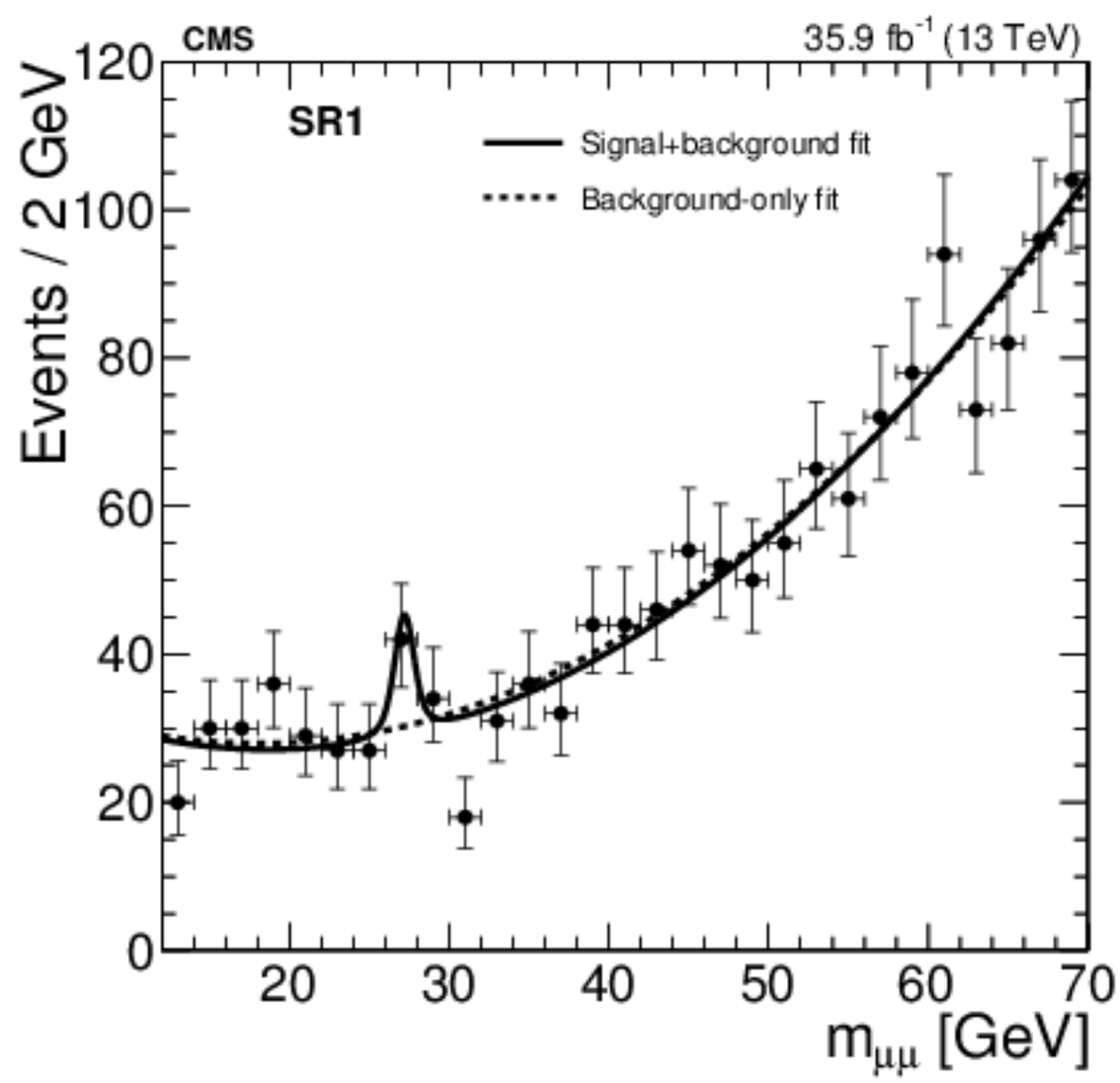
difference between 8 TeV and 13 TeV :

	13 TeV / 8 TeV
$\sigma_{Drell\text{-}Yan}$	**1.4**
σ_{tt}	**3.3**
rate of PU jets in the forward region $\lvert\eta\rvert > 2.4$	**~3**

13 TeV results

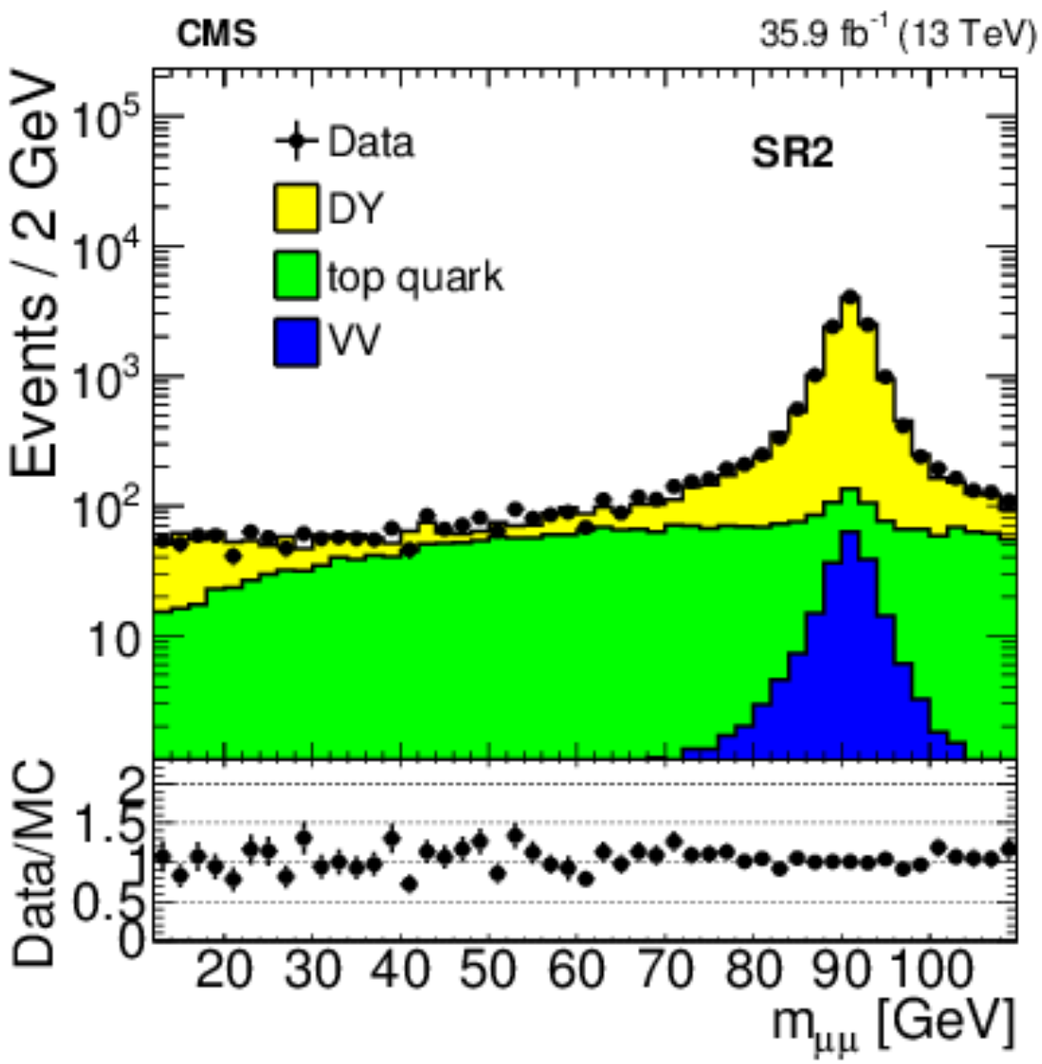
first signal region: small events excess observed

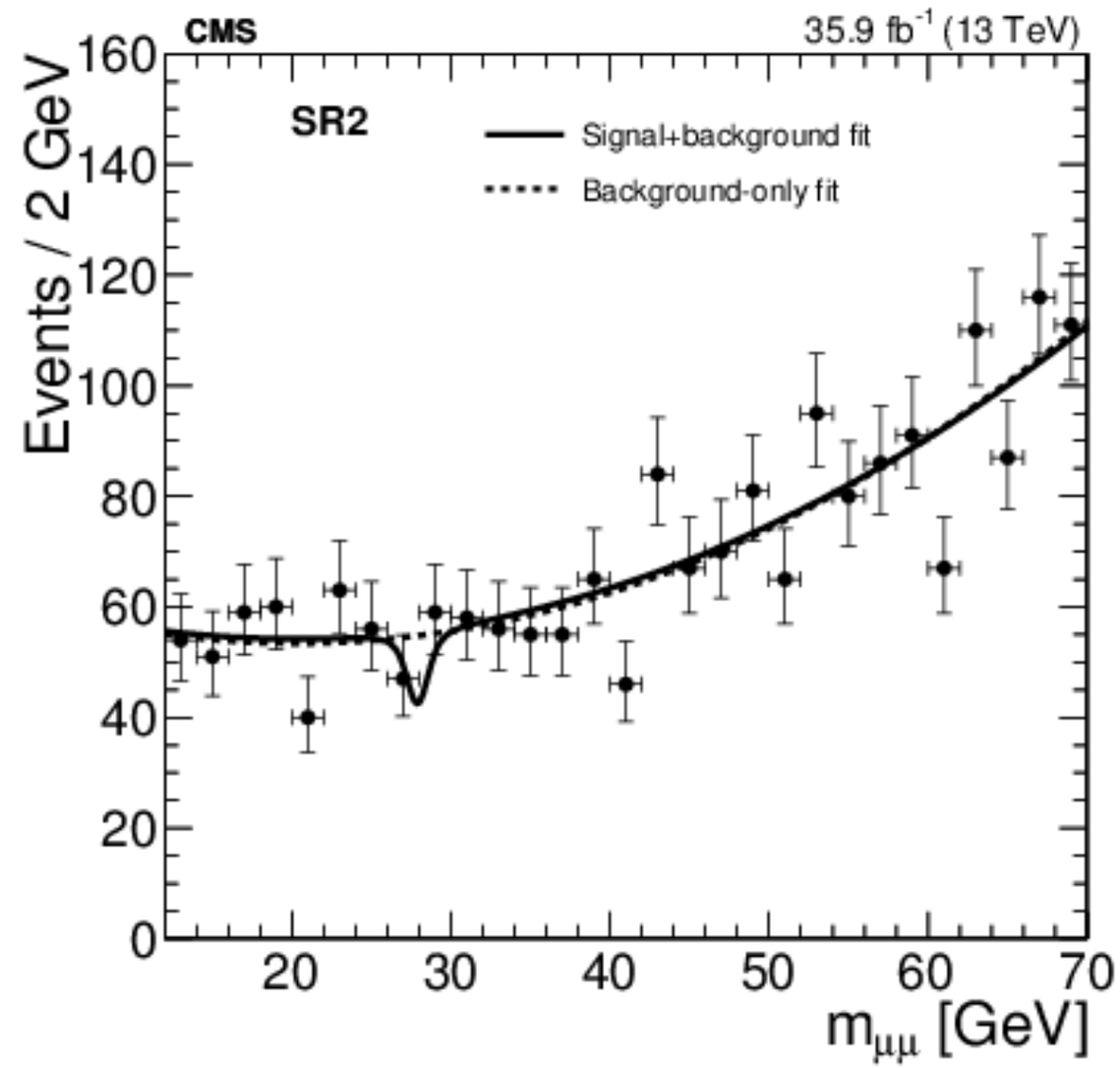




13 TeV results

second signal region: no event excess observed





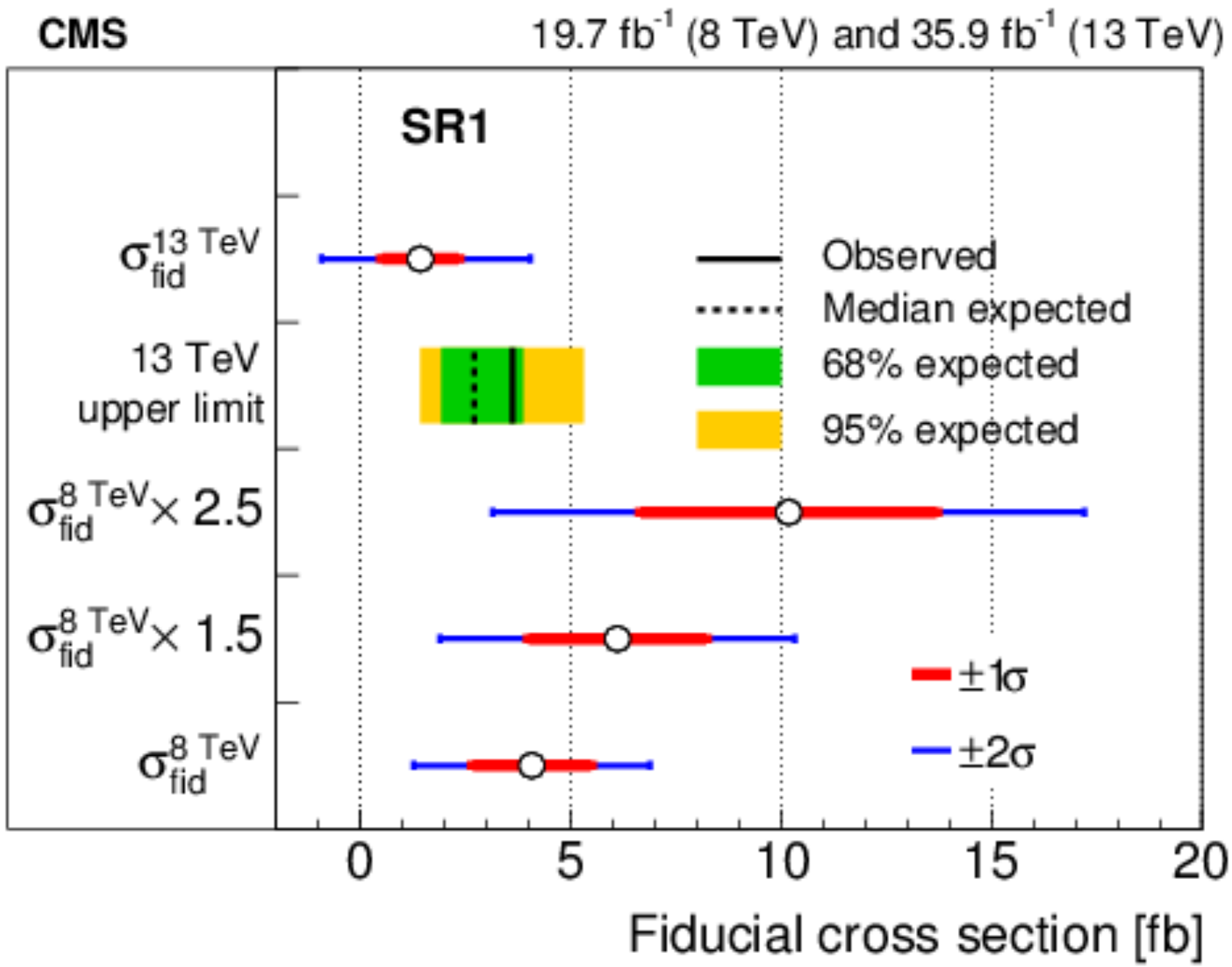
13 TeV results

Summary of 8 and 13 TeV results (2016 data)

	first signal region, 8 TeV	second signal region, 8 TeV	first signal region, 13 TeV	second signal region, 13 TeV
mass (GeV)	28.4±0.6	28.2±0.7	27.2±0.6	-
width (GeV)	1.9±1.3	1.9±1.1	0.7±1.0	-
Local significance (s.d.)	4.2	2.9	2.0	1.4 deficit
σ_{fid} (fb)	4.1±1.4	4.2±1.7	1.4±0.9	-1.5±0.5

13 TeV results

Compatibility of 8 and 13 TeV results

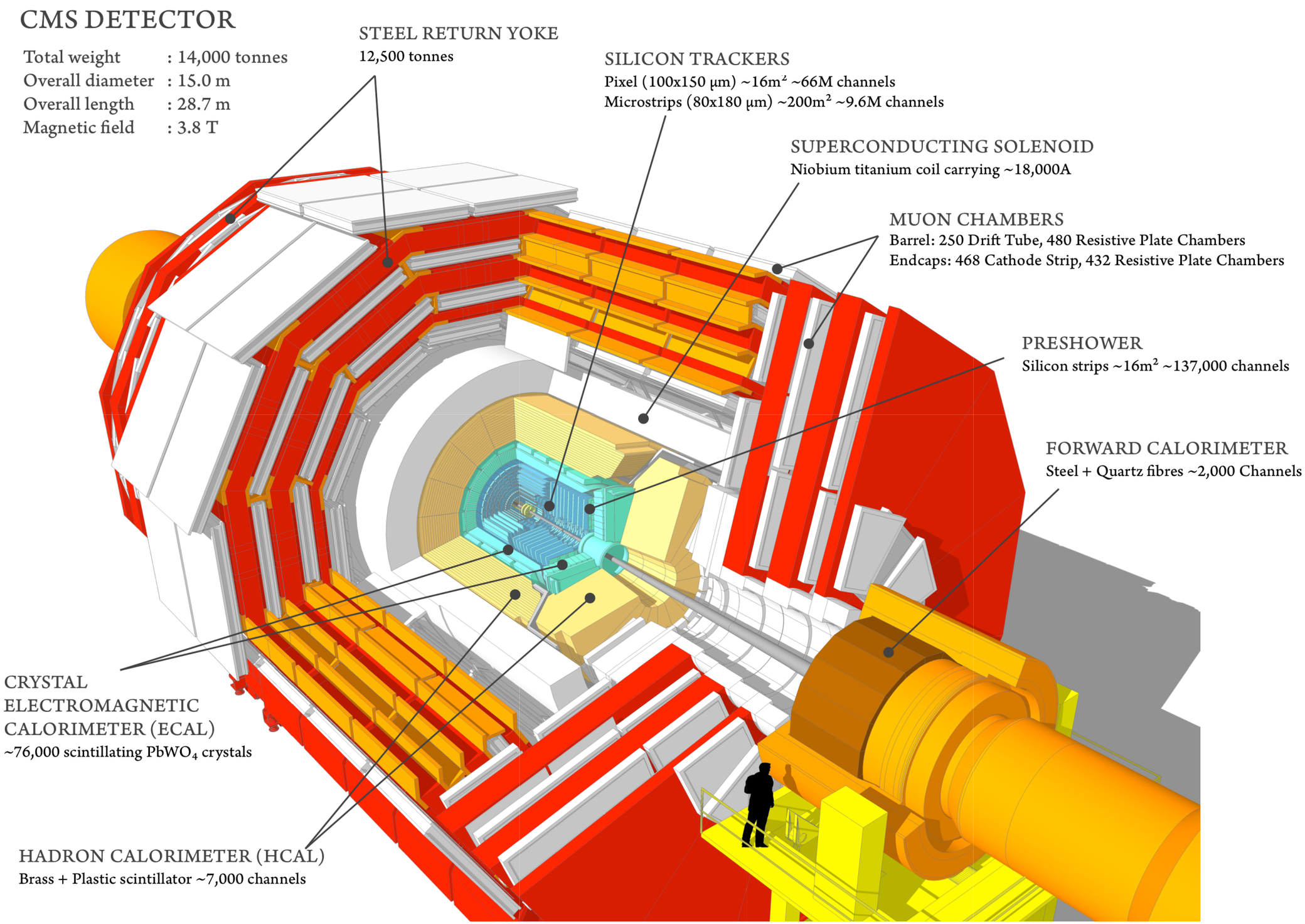


Summary

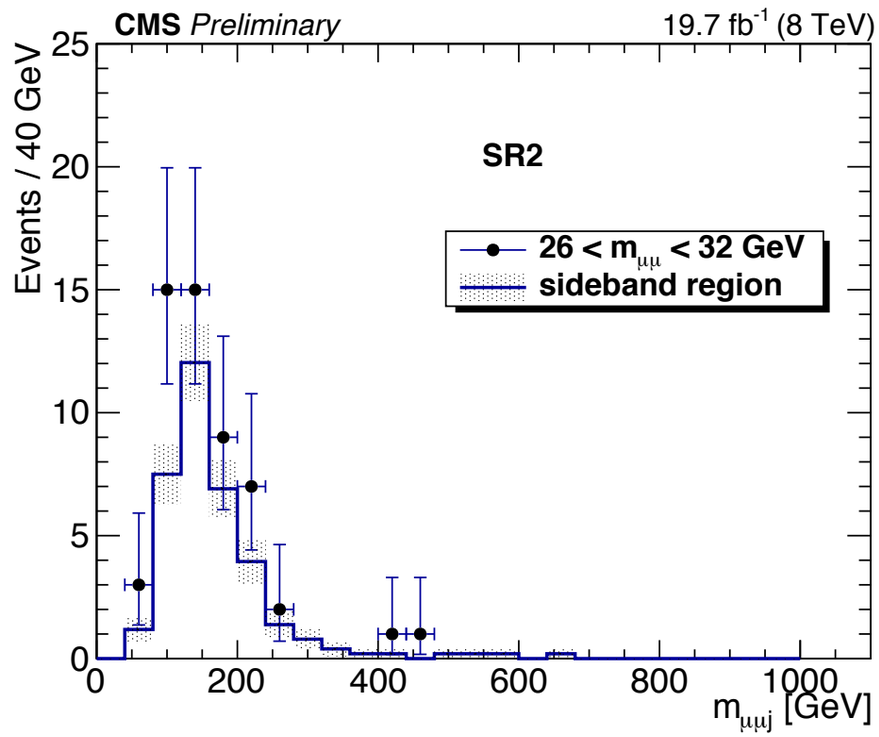
- Events with μ+μ- with b-jet and additional jet studied in two independent signal regions.
- Event excess is observed for both signal regions at $\sqrt{s}$ = 8 TeV , while mild excess in first signal region and negative event yield are seen at $\sqrt{s}$ = 13 TeV, 2016 data.

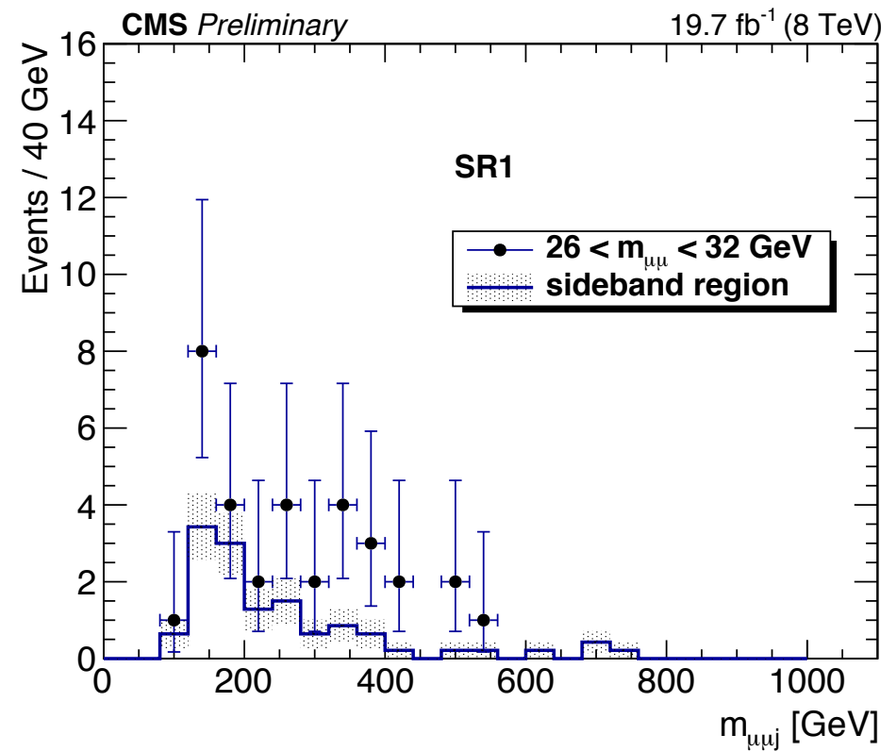
backup

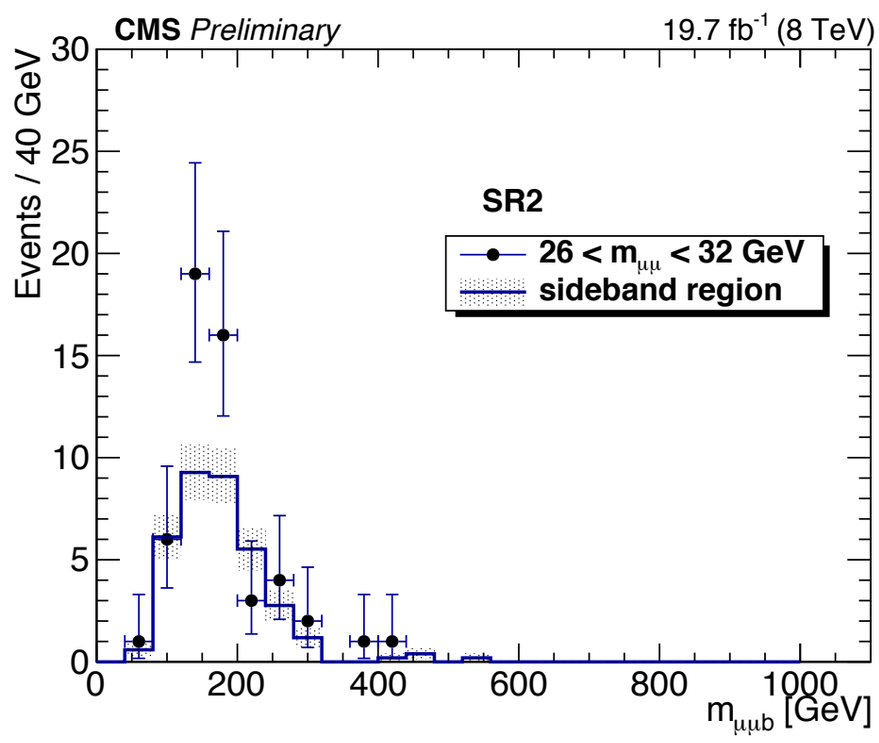
CMS detector

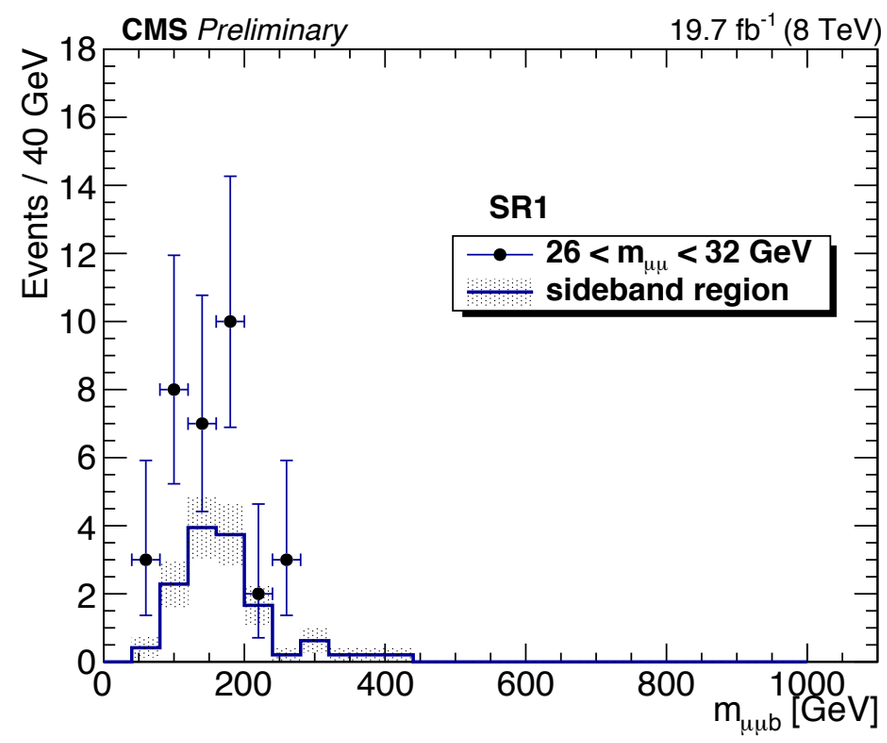


8 TeV results









13 to 8 TeV ratio of parton luminosity