

Search for high-mass resonances decaying to $t\bar{t}$ in the lepton+jets channel new

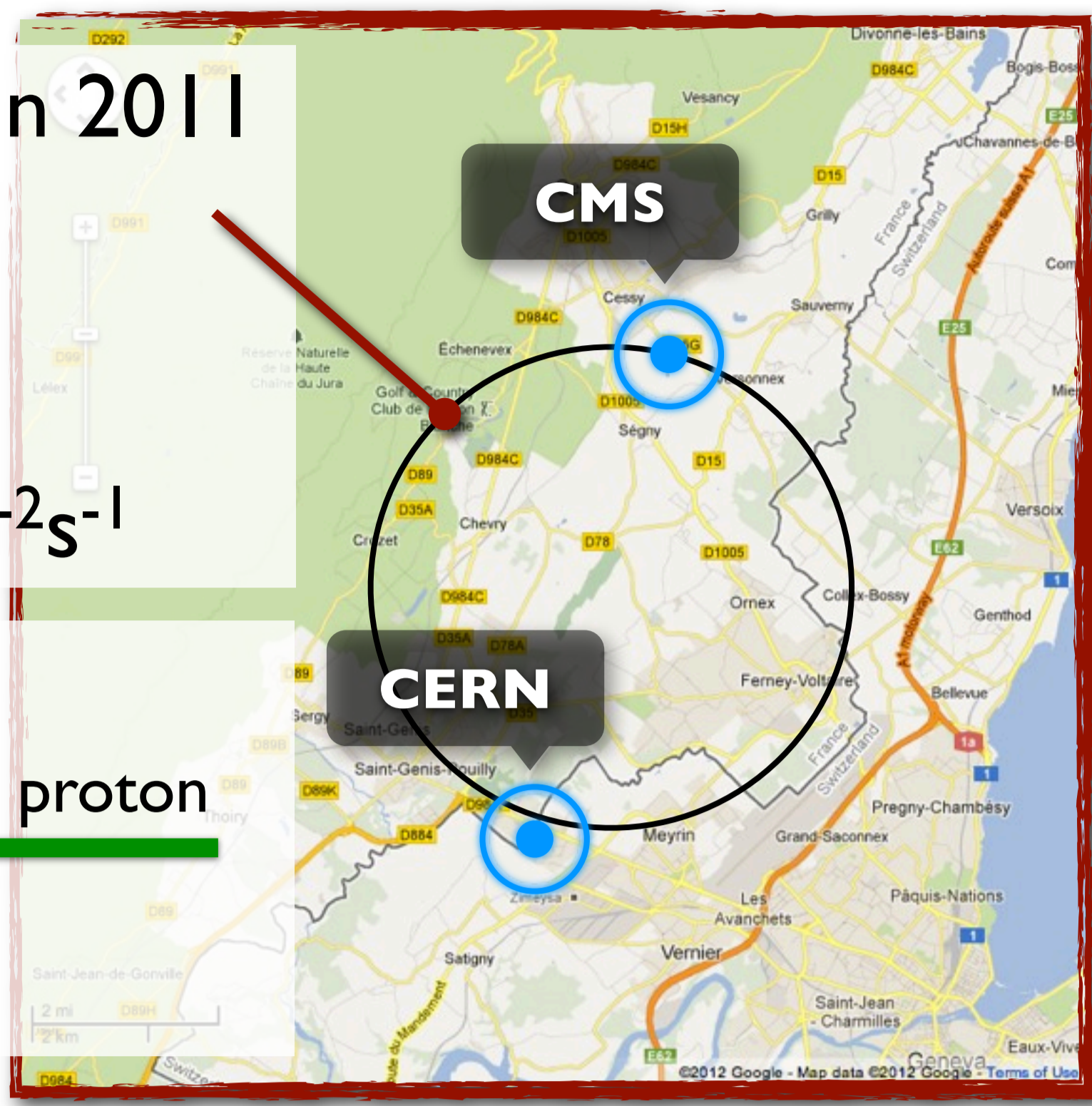
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CMS PAS EXO-11-093

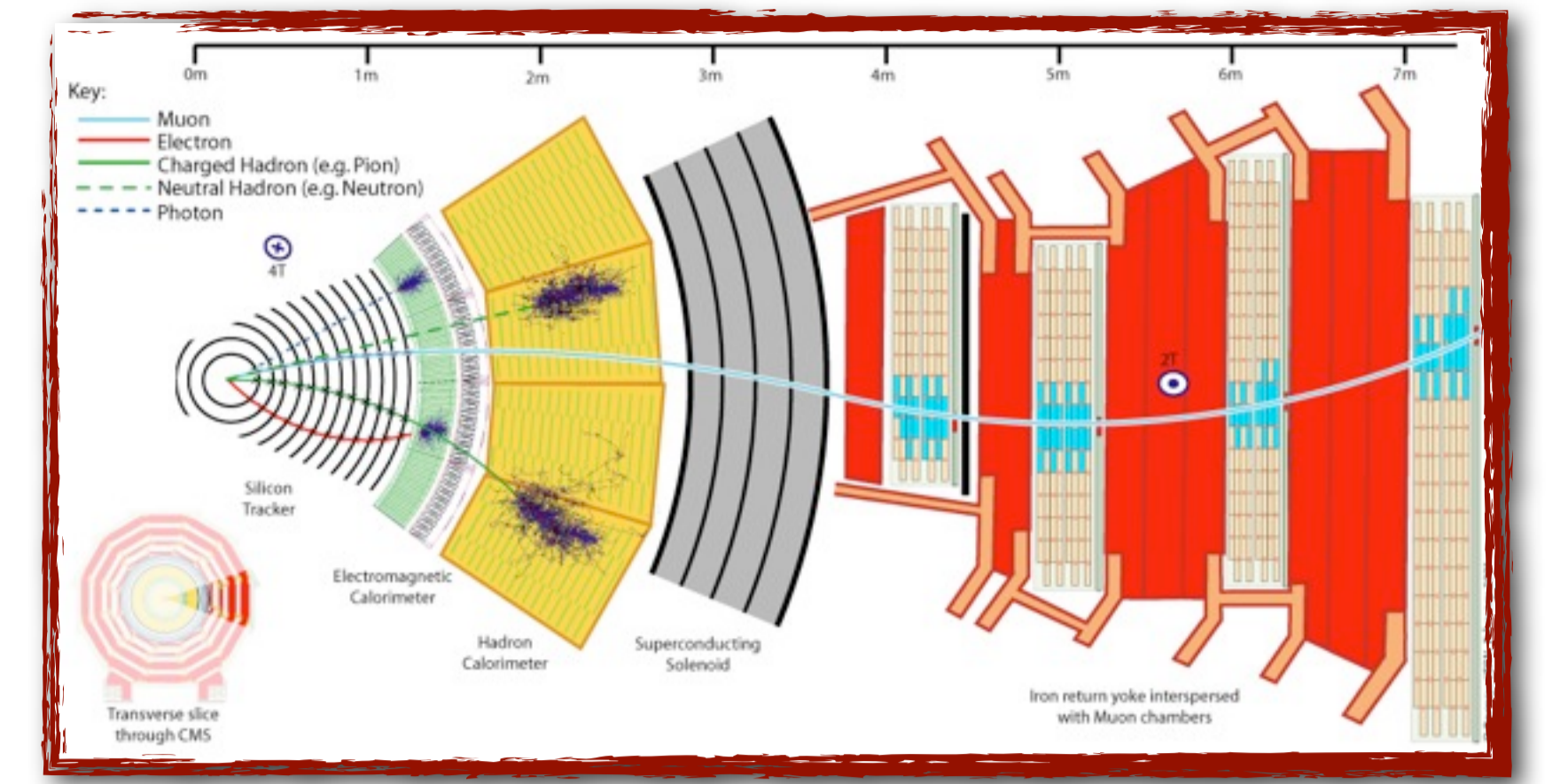
2012 FNAL Users Meeting Poster Session

Large Hadron Collider in 2011

collisions p-p
sqrt(s) 7 TeV
delivered 5 fb⁻¹
inst. lumi 3.5e33 cm⁻²s⁻¹



Compact Muon Solenoid
total weight 12500 T
overall diameter 15.0 m
overall length 21.5 m
magnetic field 4.0 Tesla

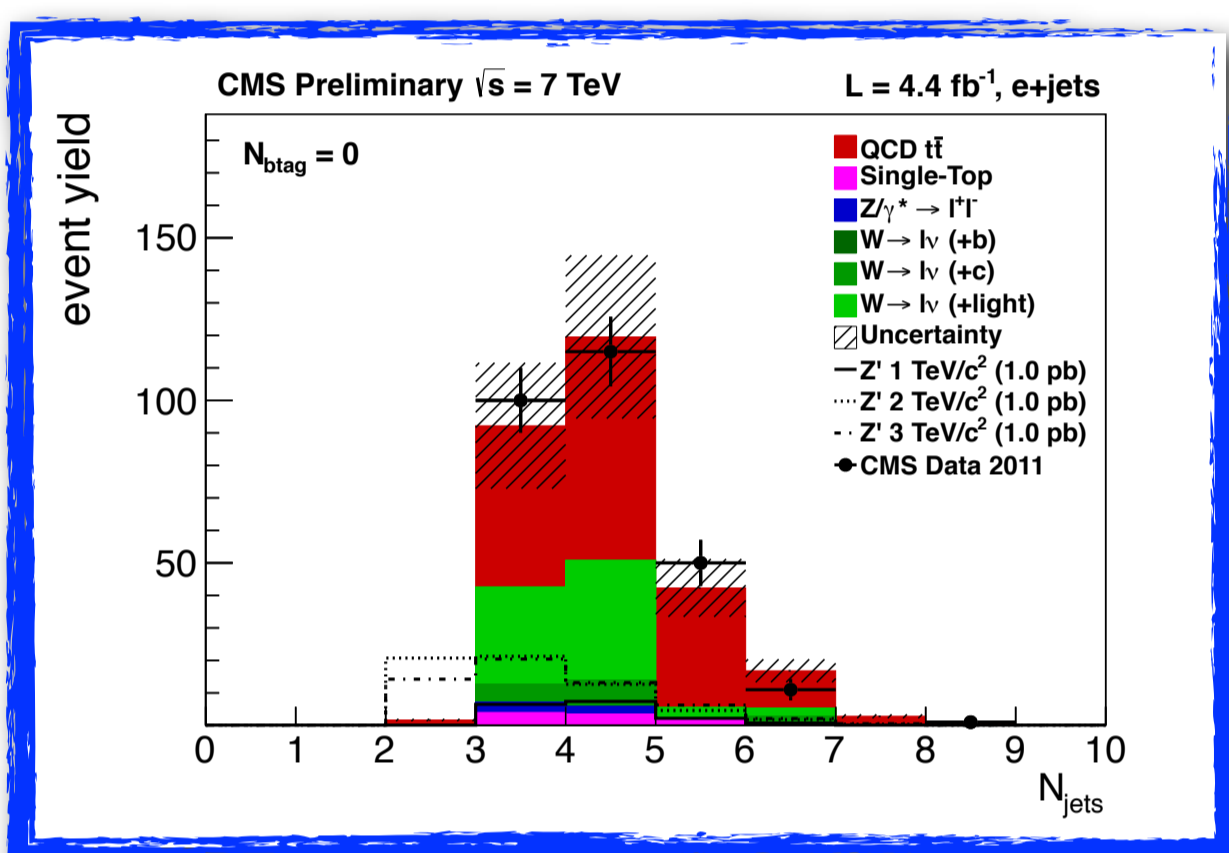


Many **Beyond the Standard Model** theories predict new heavy states (e.g. Z' bosons) decaying to $t\bar{t}$:
topcolor Z' , Randall-Sundrum Kaluza-Klein gluons

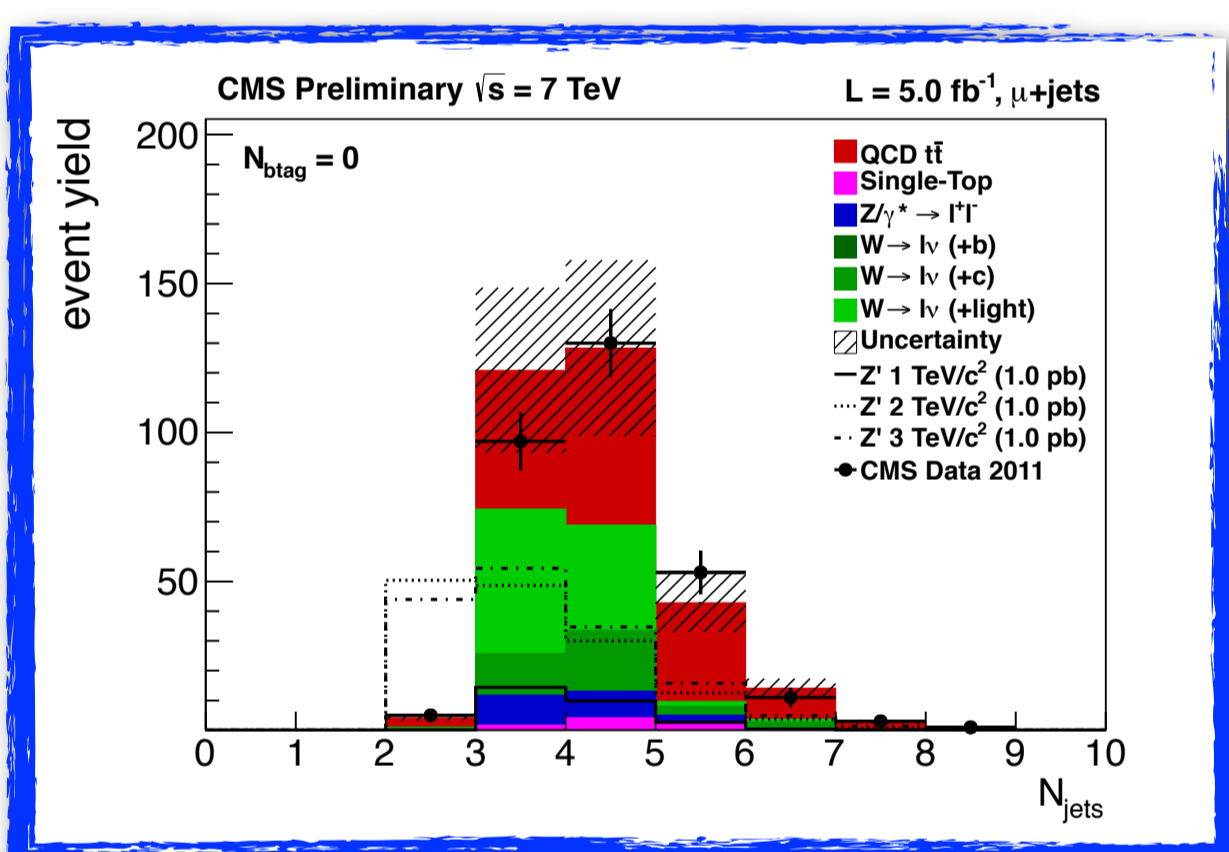
analyze full 2011 dataset: 5fb⁻¹

the isolated lepton requirement
drop the signal efficiency by:

Z' 1 TeV ~ 8%
 Z' 1.5 TeV ~ 28%
 Z' 2 TeV ~ 47%
 Z' 3 TeV ~ 54%



2 jets bin is highly populated with signal and almost **no** background

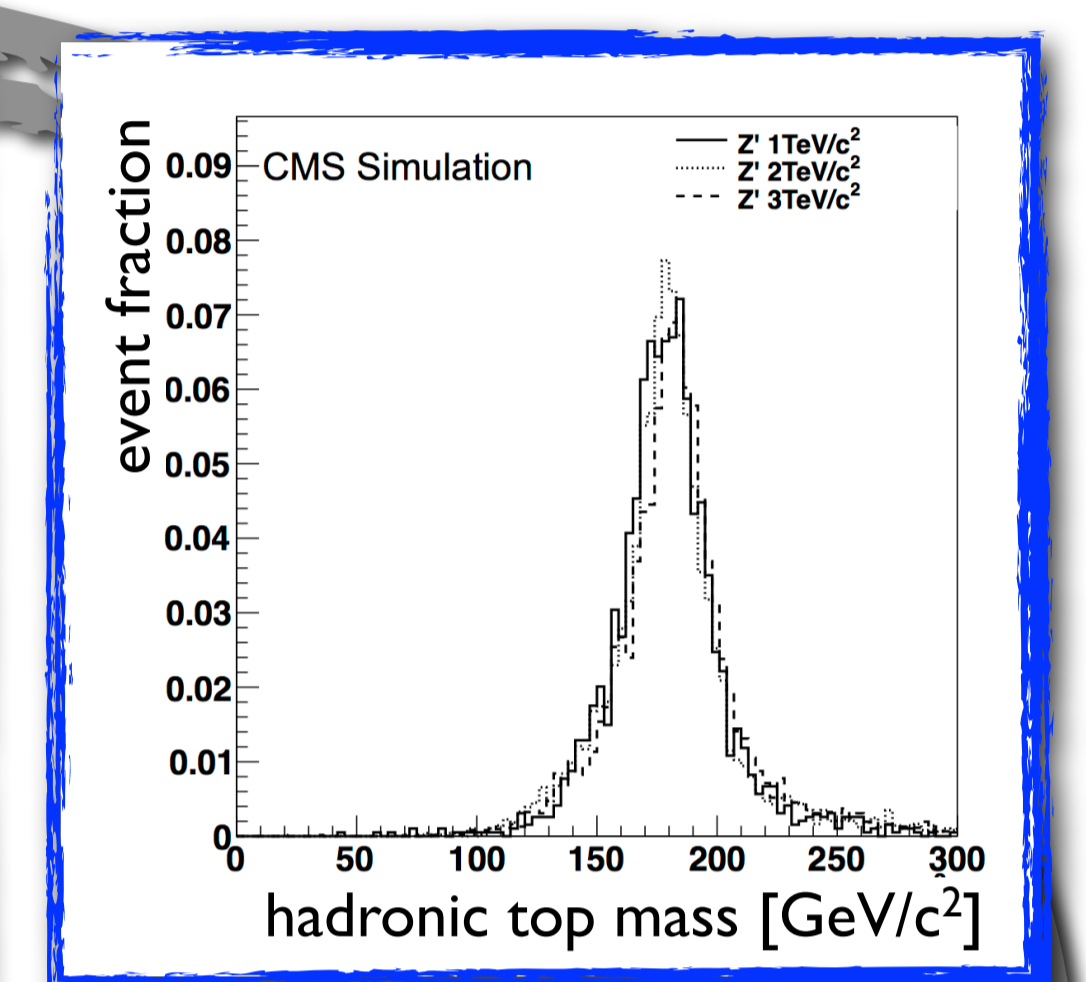
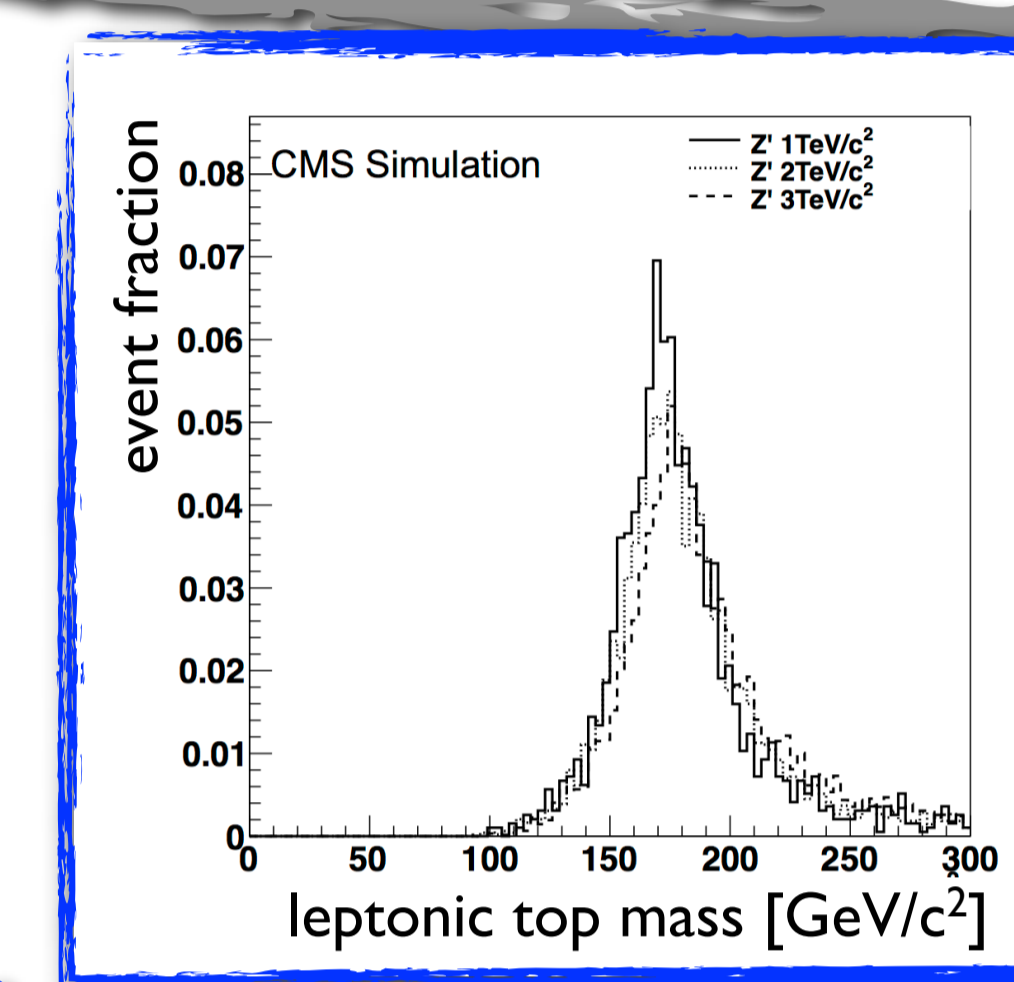


- one lepton (**no isolation** is applied)
- drop event if second lepton is present
- two** or more anti- K_T ($R=0.5$) jets
leading jet $p_T > 250$ GeV
- suppress QCD multijet
2D cut and $\Delta R > 0.5$ or $P_T^{rel} > 25$ GeV
and $H_{Tlep} > 150$ GeV
- additional topological cuts in e+jets channel to reject QCD multijet
- reconstruct top quarks in simulation by matching reconstructed jets to partons

SELECTION

μ $p_T > 35$ GeV
 e $p_T > 70$ GeV

$p_T > 50$ GeV
 μ $p_T > 250$ GeV
 e $p_T > 150$ GeV



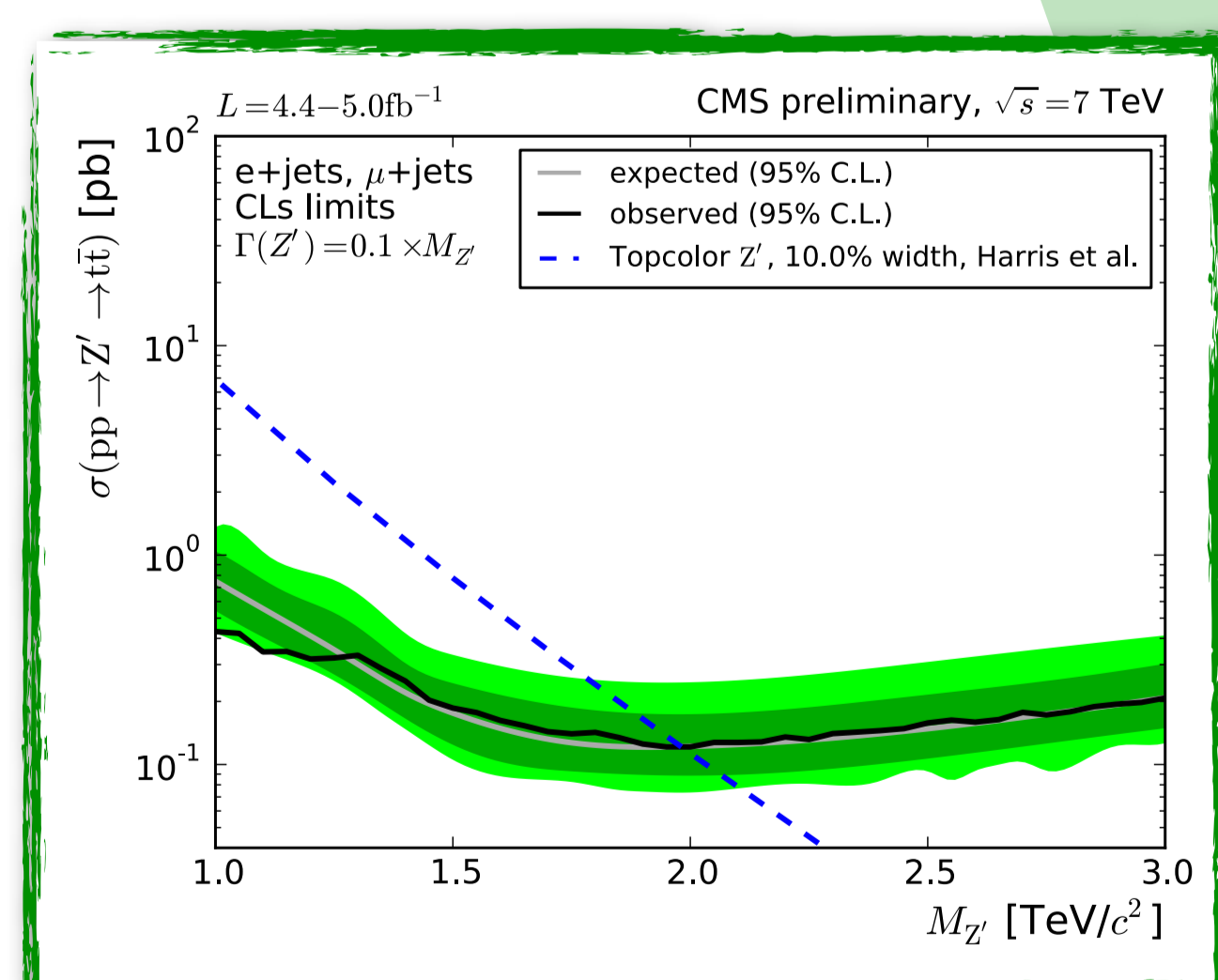
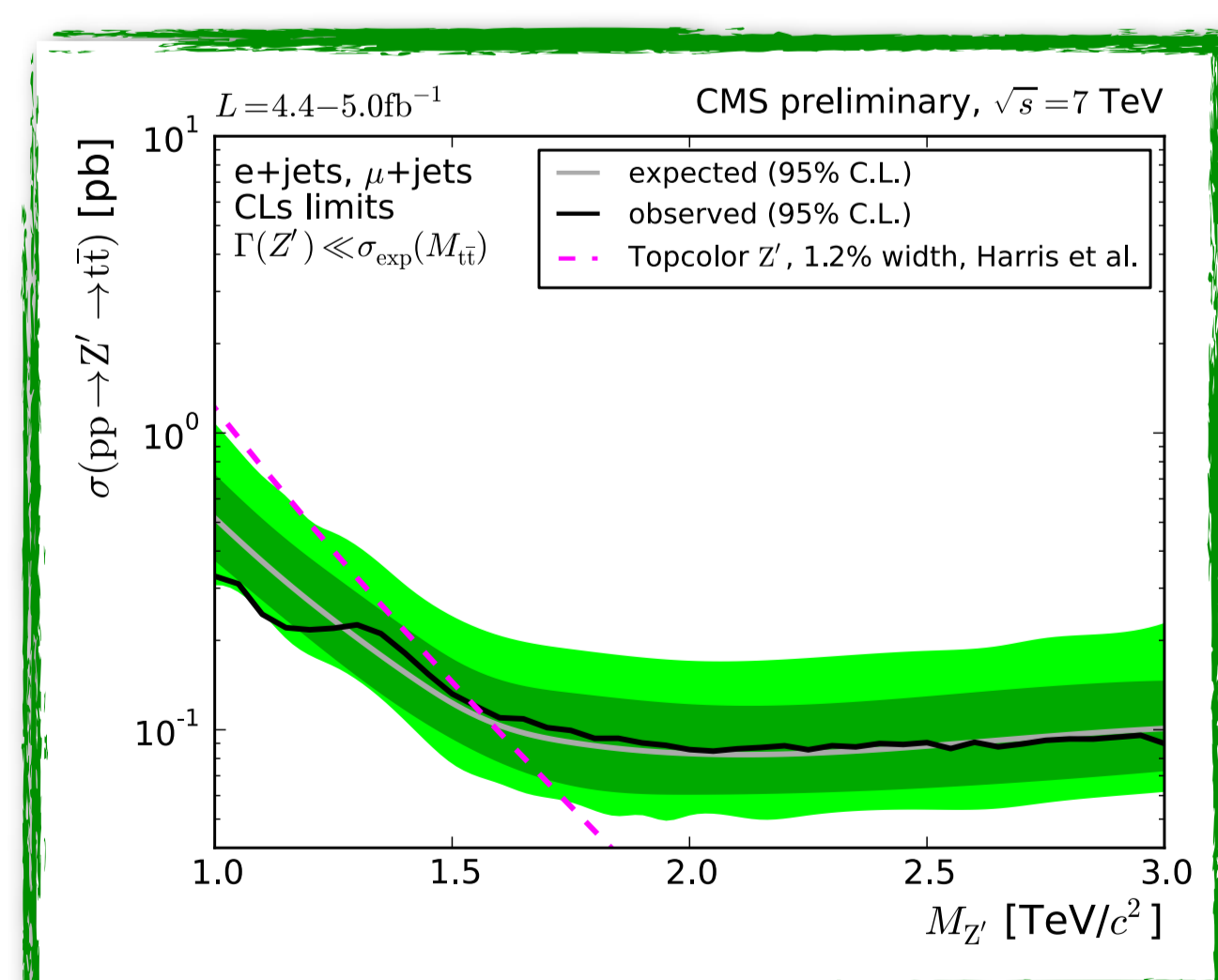
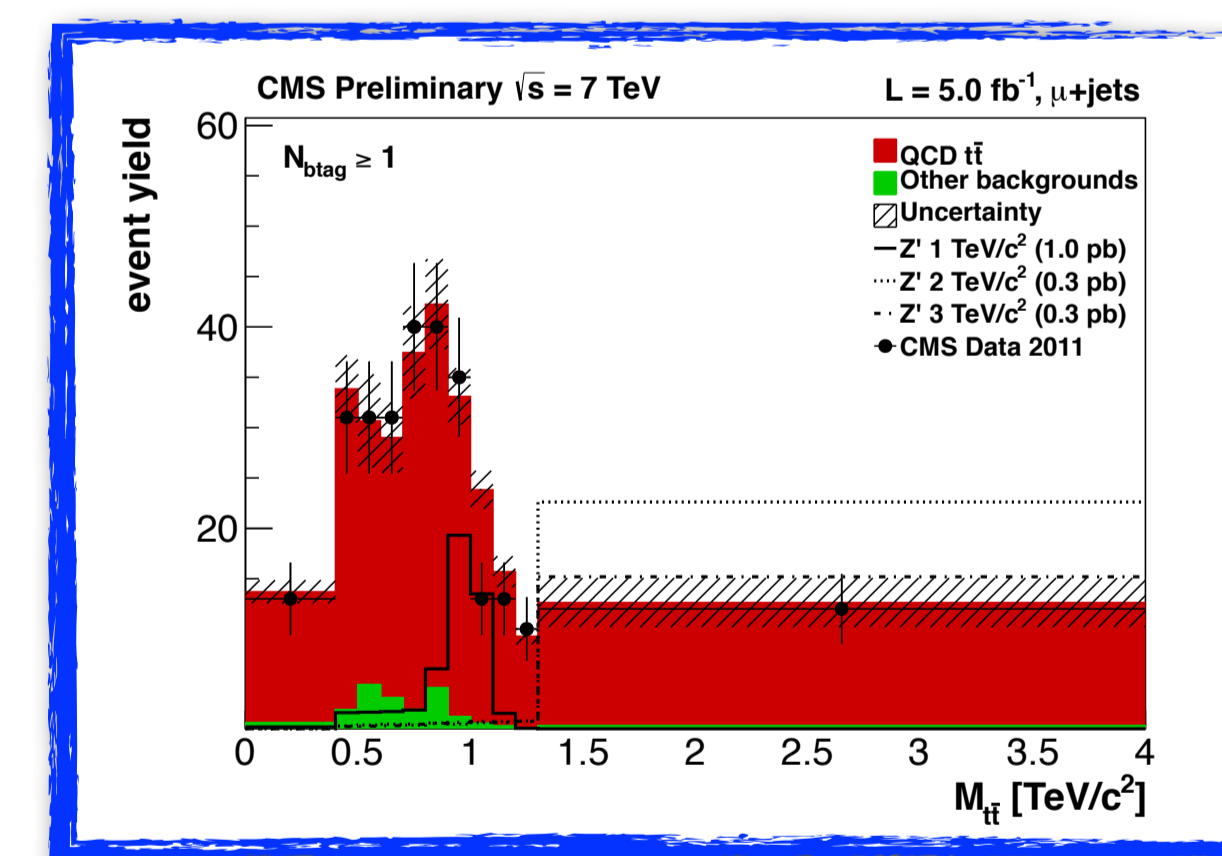
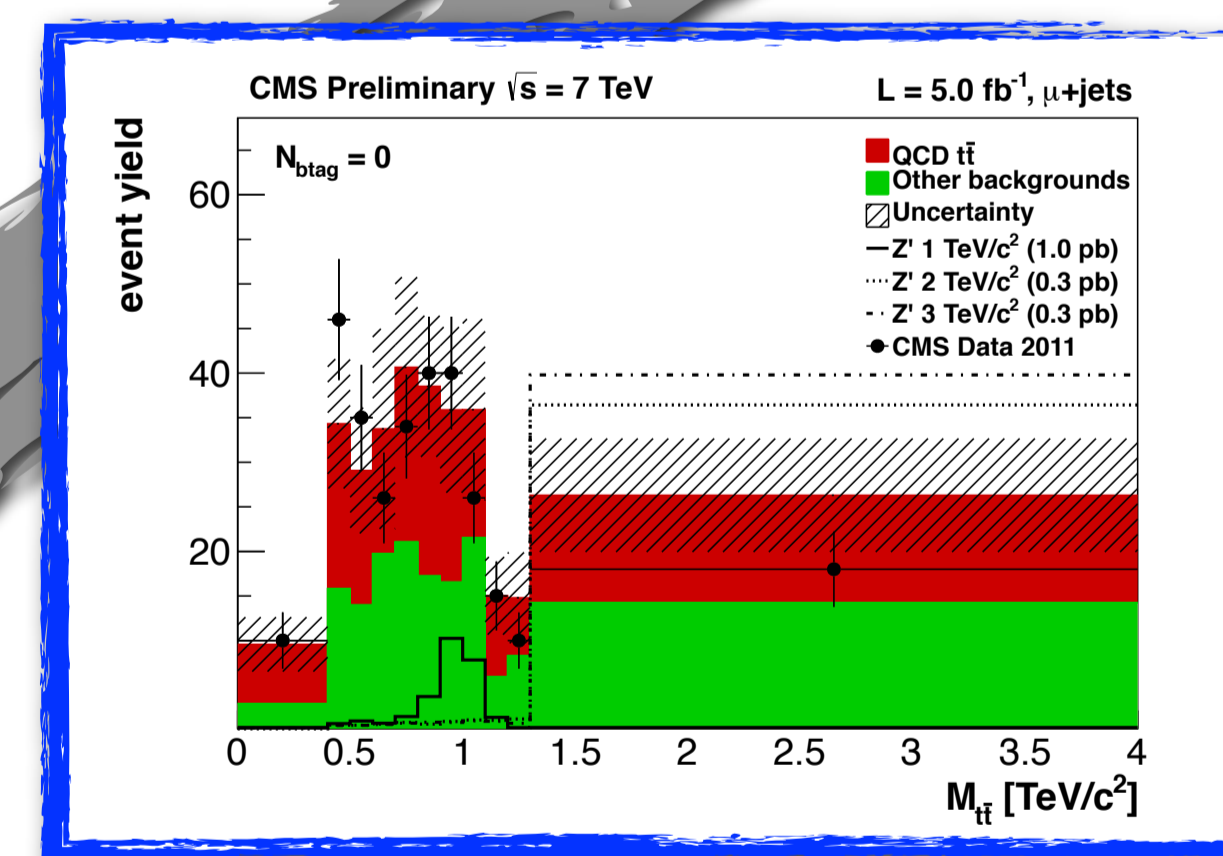
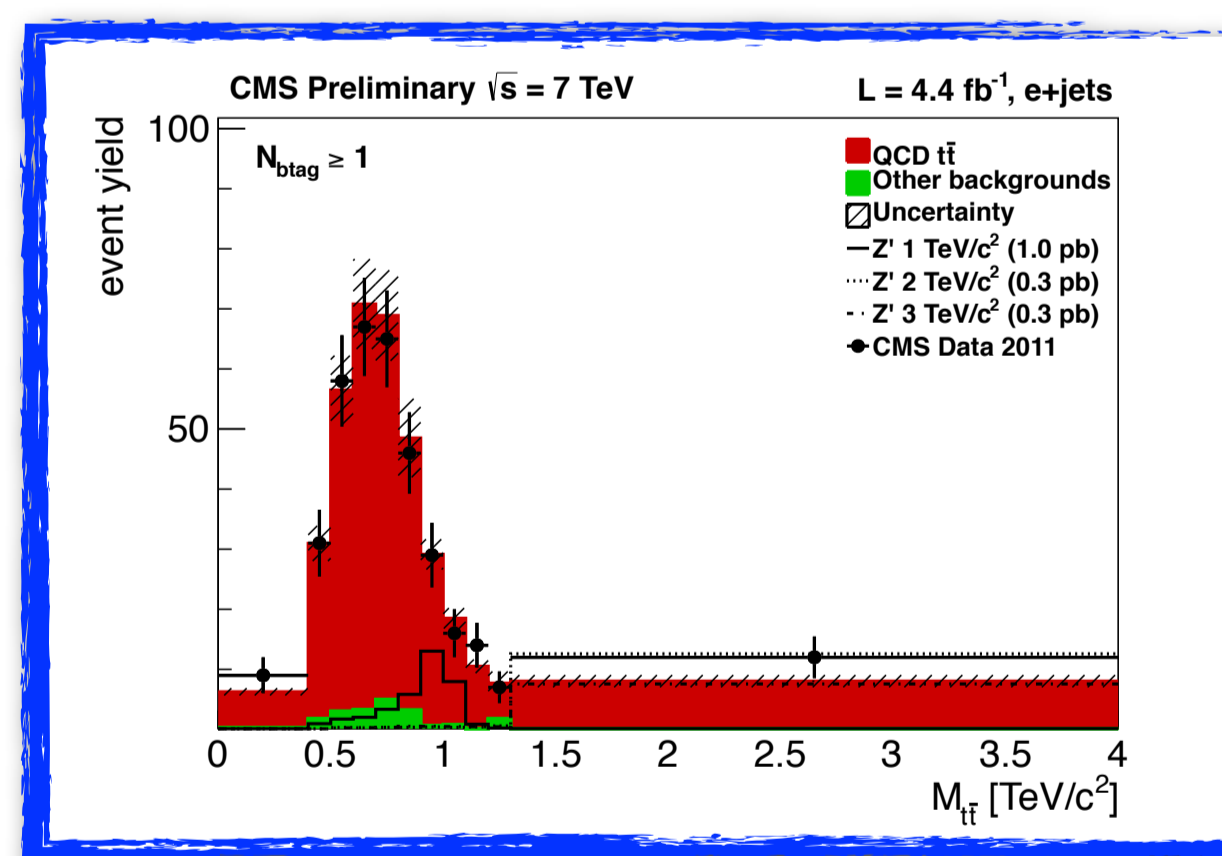
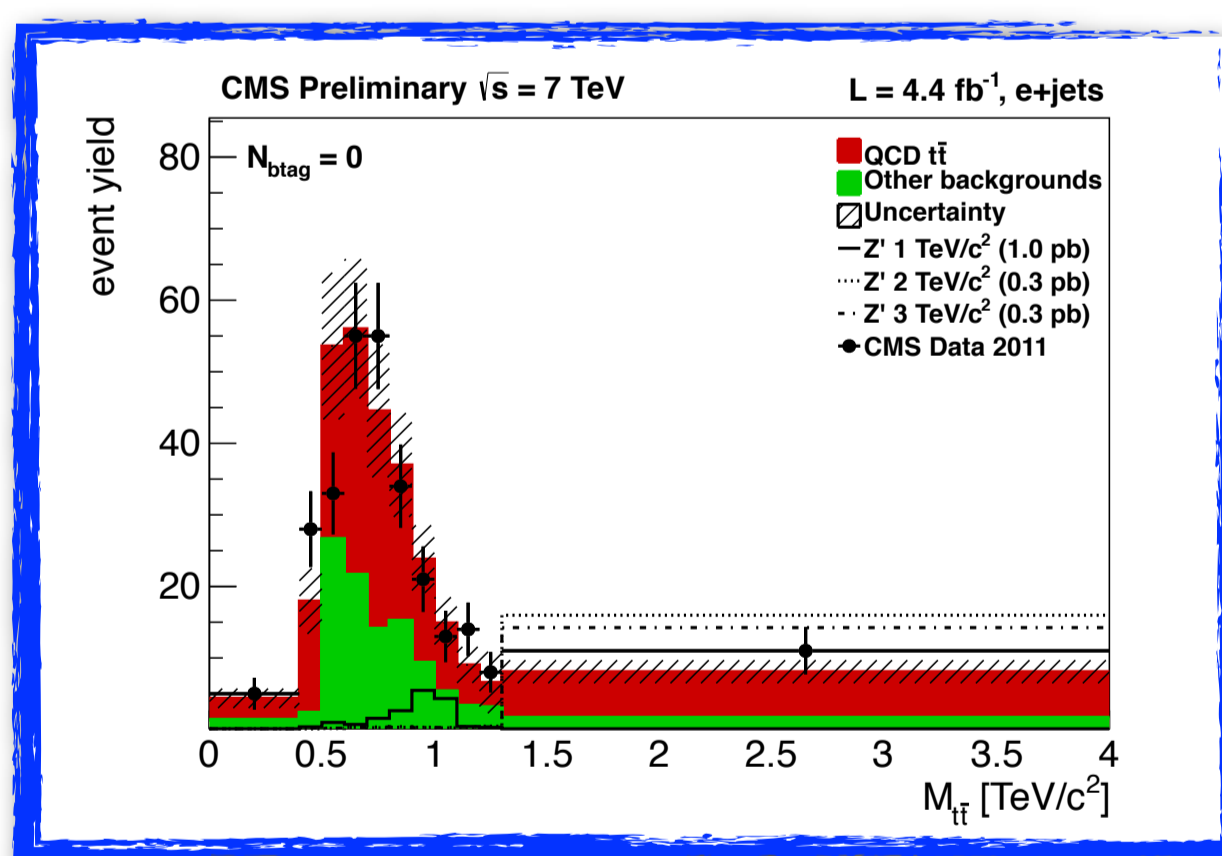
RECONSTRUCT resonance with Chi2

$$\chi^2 = \left[\frac{M_{lep} - \bar{M}_{lep}}{\sigma_{M_{lep}}} \right]^2 + \left[\frac{M_{had} - \bar{M}_{had}}{\sigma_{M_{had}}} \right]^2$$

the Chi2 parameters are extracted from simulation by matching reconstructed jets to partons

- cut on Chi2 to suppress W+jets and QCD contributions ($< 1\%$ of QCD is left after all cuts)
- use secondary vertex b-tagged jet to split events into 0-btag and 1-btag channels (52% b-tag and 1% mistag rate)

reconstructed $t\bar{t}$ invariant mass in e+jets, mu+jets, and 0-btags and 1-btags channels



- reconstructed resonance mass is used as input for limit setting procedure
- re-binning is required to cover low-statistics in the tails
- use CLs method to **set the limit**

Excluded mass region

narrow Z' mass < 1.55 TeV
wide Z' mass < 1.98 TeV

limits comparison between different searches for Z'

	narrow Z' mass	wide Z' mass	type
CMS TOP-11-010	< 1.1 TeV		dilepton
CMS TOP-11-009	< 1.3 TeV	< 1.7 TeV	lepton+jets (at threshold)
CMS EXO-11-093	< 1.6 TeV	< 2.0 TeV	lepton+jets (boosted)
CMS EXO-11-006	< 1.6 TeV	< 2.0 TeV	all-hadronic

