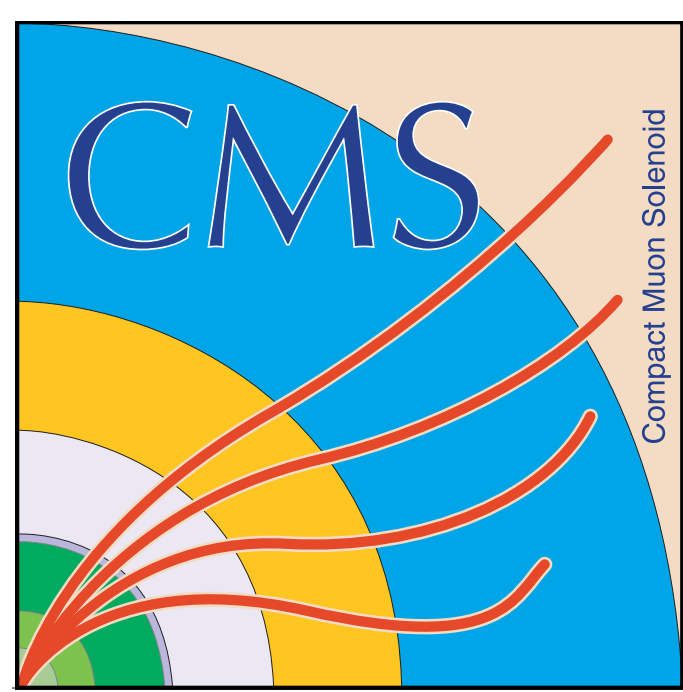


SEARCH FOR EXOTIC VZ RESONANCES DECAYING INTO A JET AND DILEPTONS WITH CMS



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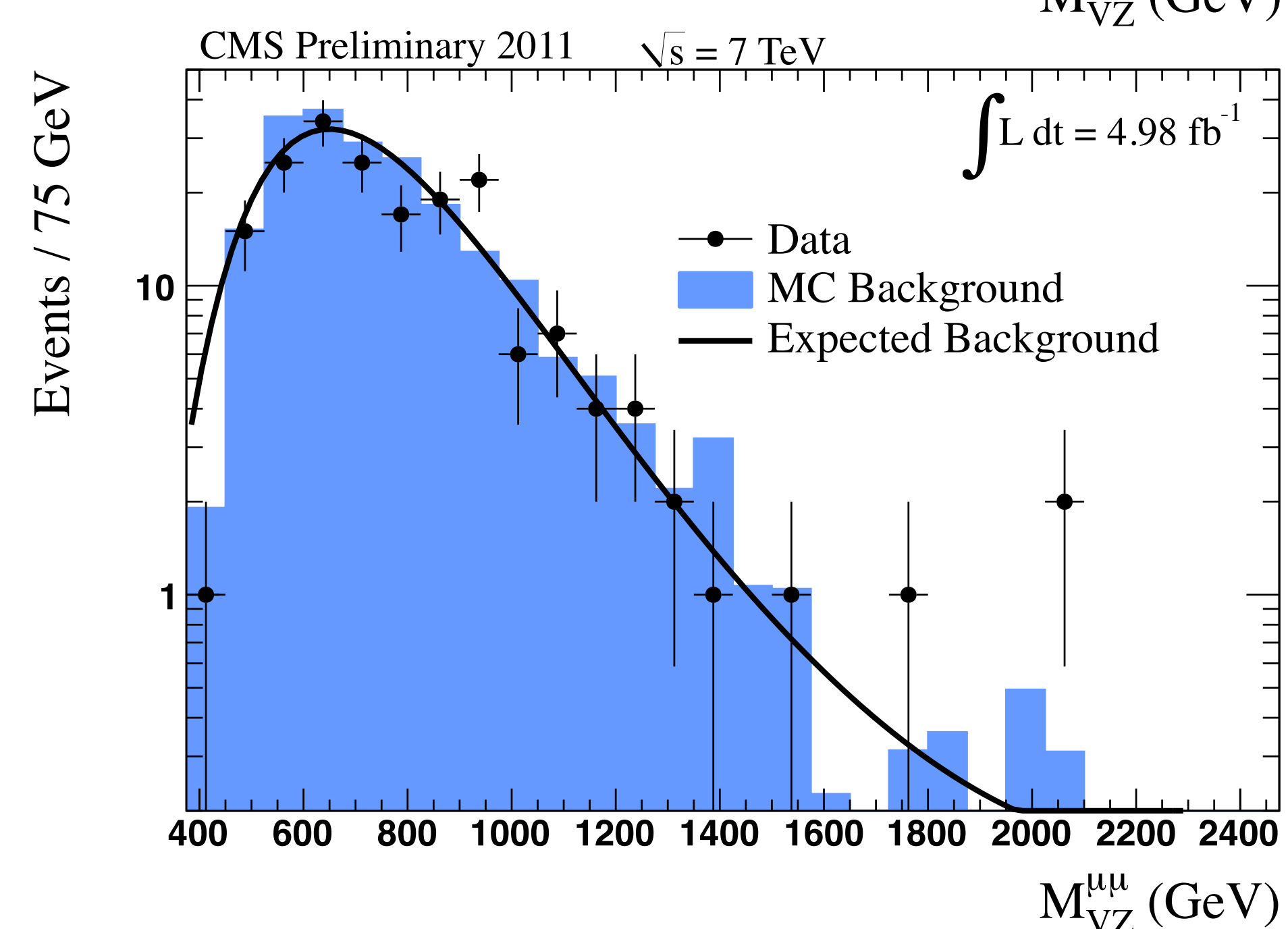
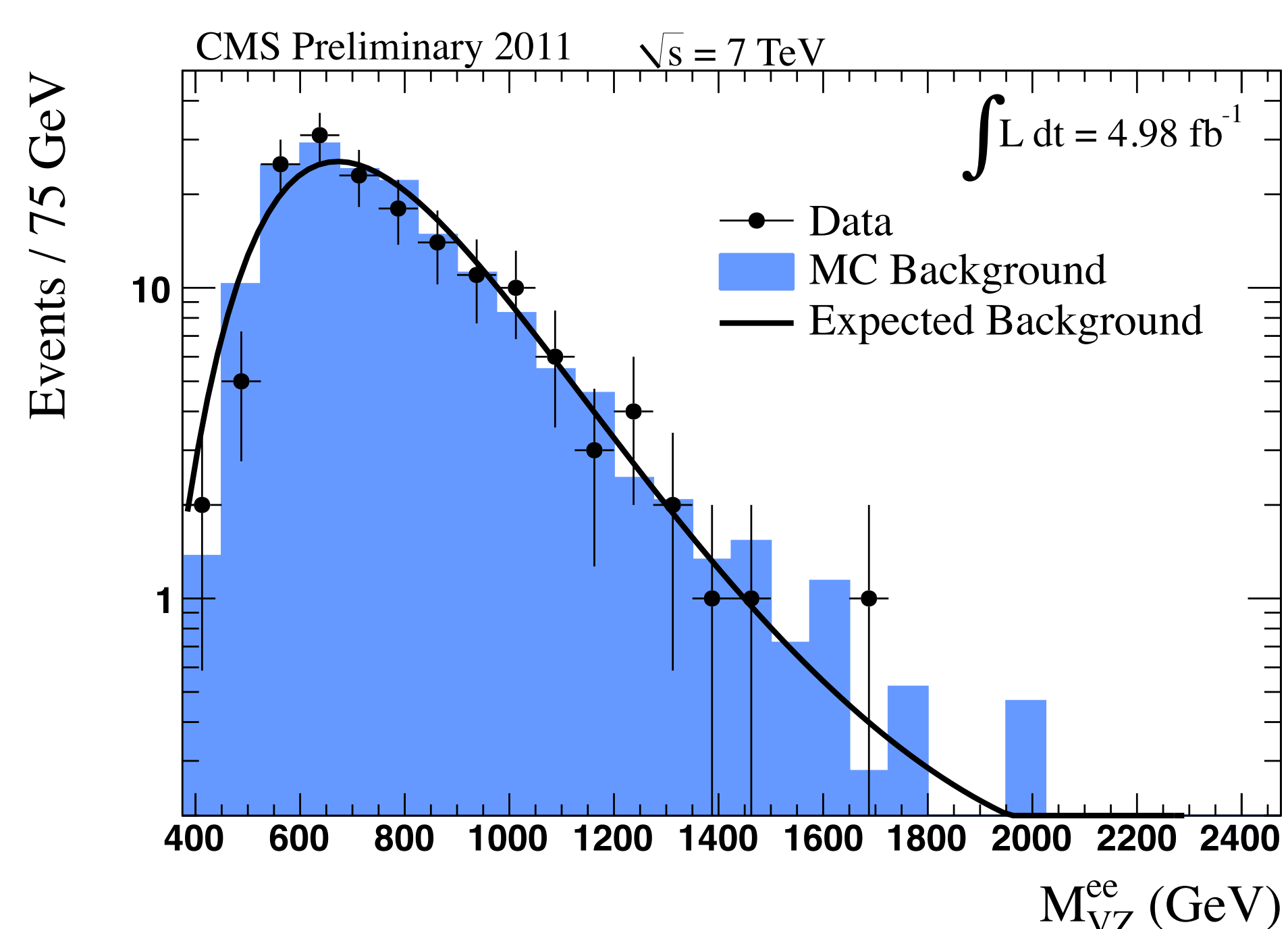
OVERVIEW

A search for new exotic particles decaying to the VZ final state is performed, where V is either a W or a Z boson decaying hadronically into two overlapping jets and the Z decays to dielectrons or dimuons. The analysis uses 5.0 fb^{-1} of pp $\sqrt{s} = 7 \text{ TeV}$ data collected by the CMS experiment at the LHC in 2011. The results are interpreted in the SSM W' and Randall-Sundrum models.

THEORETICAL MOTIVATION

In many extensions of the Standard Model the spontaneous breaking of the Electroweak Symmetry is associated to a new strong dynamics appearing at the TeV scale. Its origin can be due to new interactions, extra dimensions, or to a composite nature of the Higgs boson. In such scenarios, the appearance of new resonances coupling to pairs of vector bosons (WW, WZ, ZZ) is expected at the LHC.

BACKGROUND ESTIMATION



Data driven background estimation uses product of:

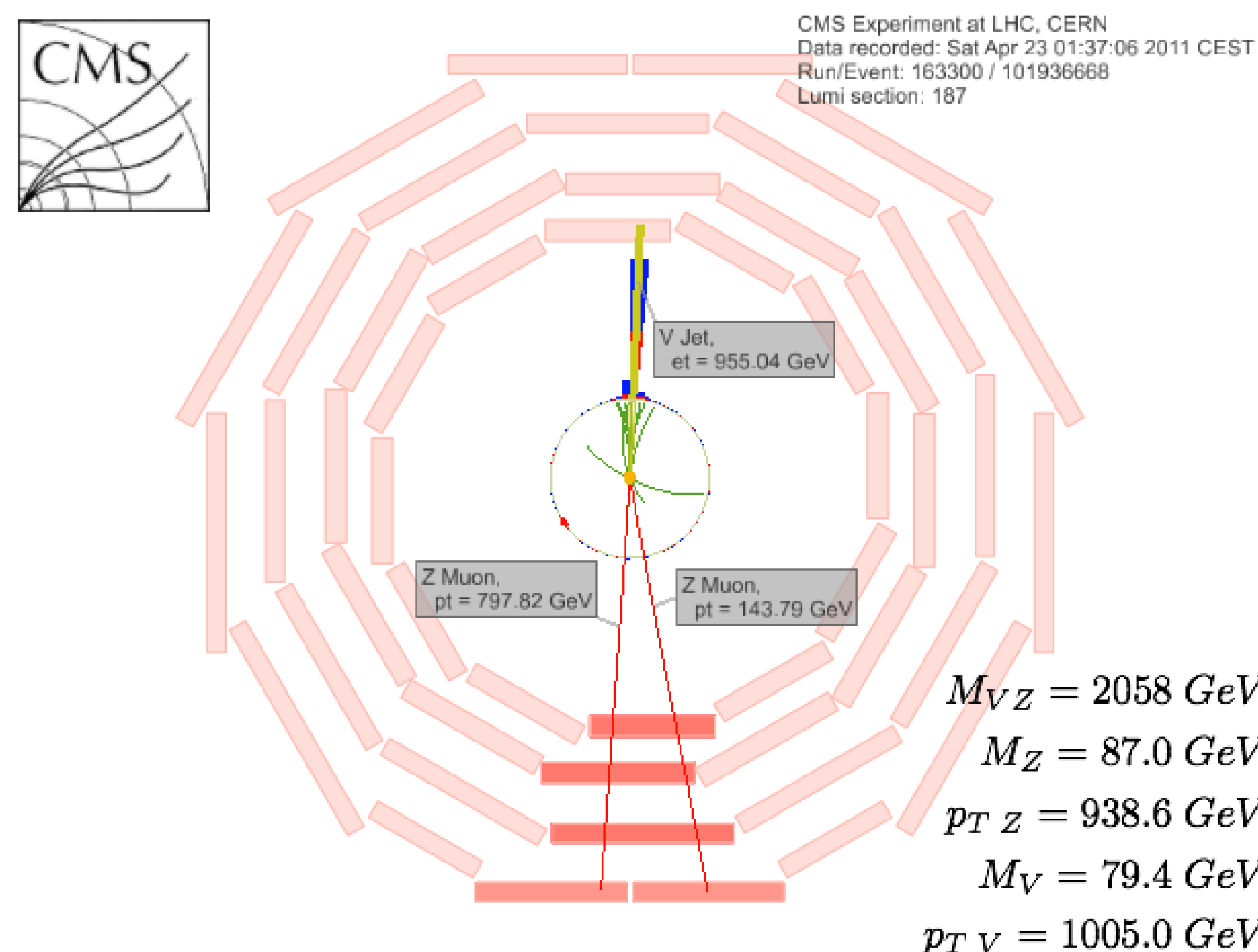
- m_{VZ} distribution with sideband m_j selection ($30 < m_j < 65 \text{ GeV}$), and
- $\alpha(m_{VZ})$: MC ratio of background events in nominal and sideband regions.
- Derived distribution is fitted to analytical function

$$f_A(m_{VZ}) = p_0 \frac{\left[1 - \left(\frac{m_{VZ}}{\sqrt{s}}\right)\right]^{p_1}}{\left(\frac{m_{VZ}}{\sqrt{s}}\right)^{p_2 + p_3 \log\left(\frac{m_{VZ}}{\sqrt{s}}\right)}}$$

and fit result is used to describe expected background distribution with nominal selection.

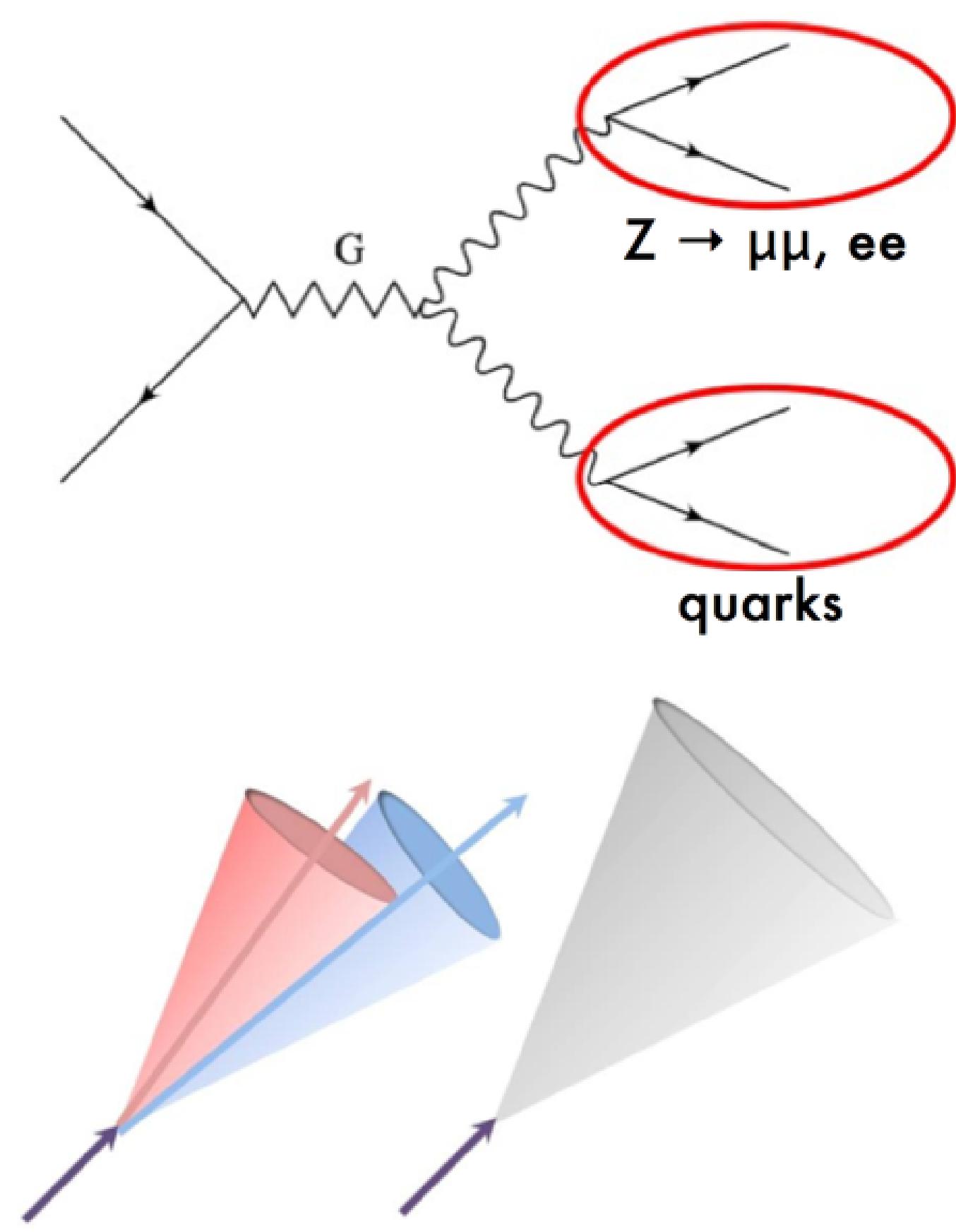
BOOSTED TOPOLOGY

For resonance masses above $\sim 800 \text{ GeV}$, the two-fermion system produced in the decay of each of W,Z is boosted, and the hadronization of the V quarks could produce a single jet with mass close to the W/Z mass. Similarly, care is required when reconstructing the $Z \rightarrow \ell\ell$ boson to avoid inefficiencies due to the traditional definition of isolation.



Event Selection

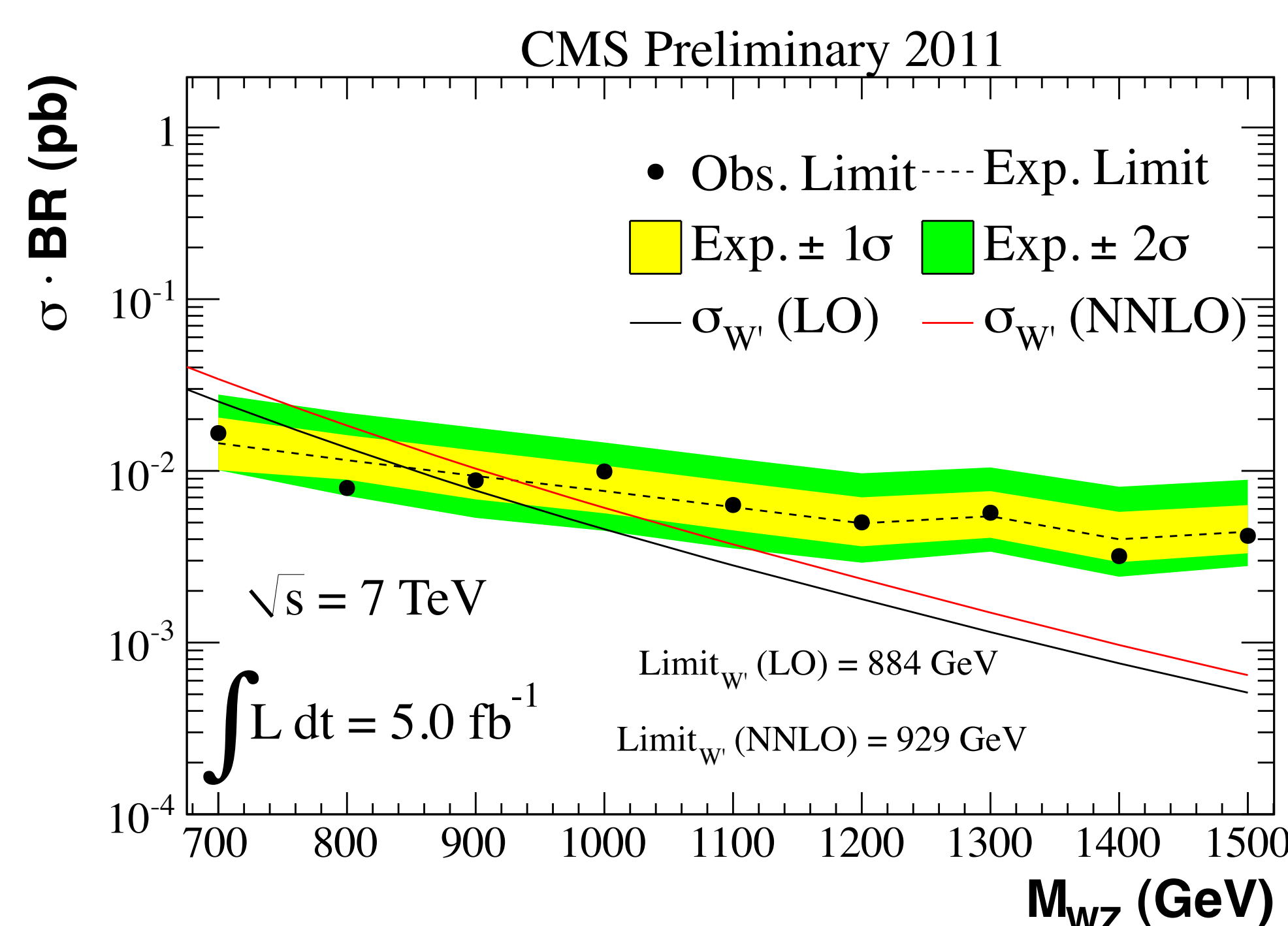
- ≥ 2 leptons, $p_T > 45 \text{ GeV}/c, |\eta| < 2.4$
- ≥ 1 jet, $p_T > 30 \text{ GeV}/c, |\eta| < 2.4$
- $70 < m(Z \rightarrow \ell\ell) < 110 \text{ GeV}/c^2$
- $65 < m(V \rightarrow \text{jet}) < 120 \text{ GeV}/c^2$



Optimized kinematic cuts

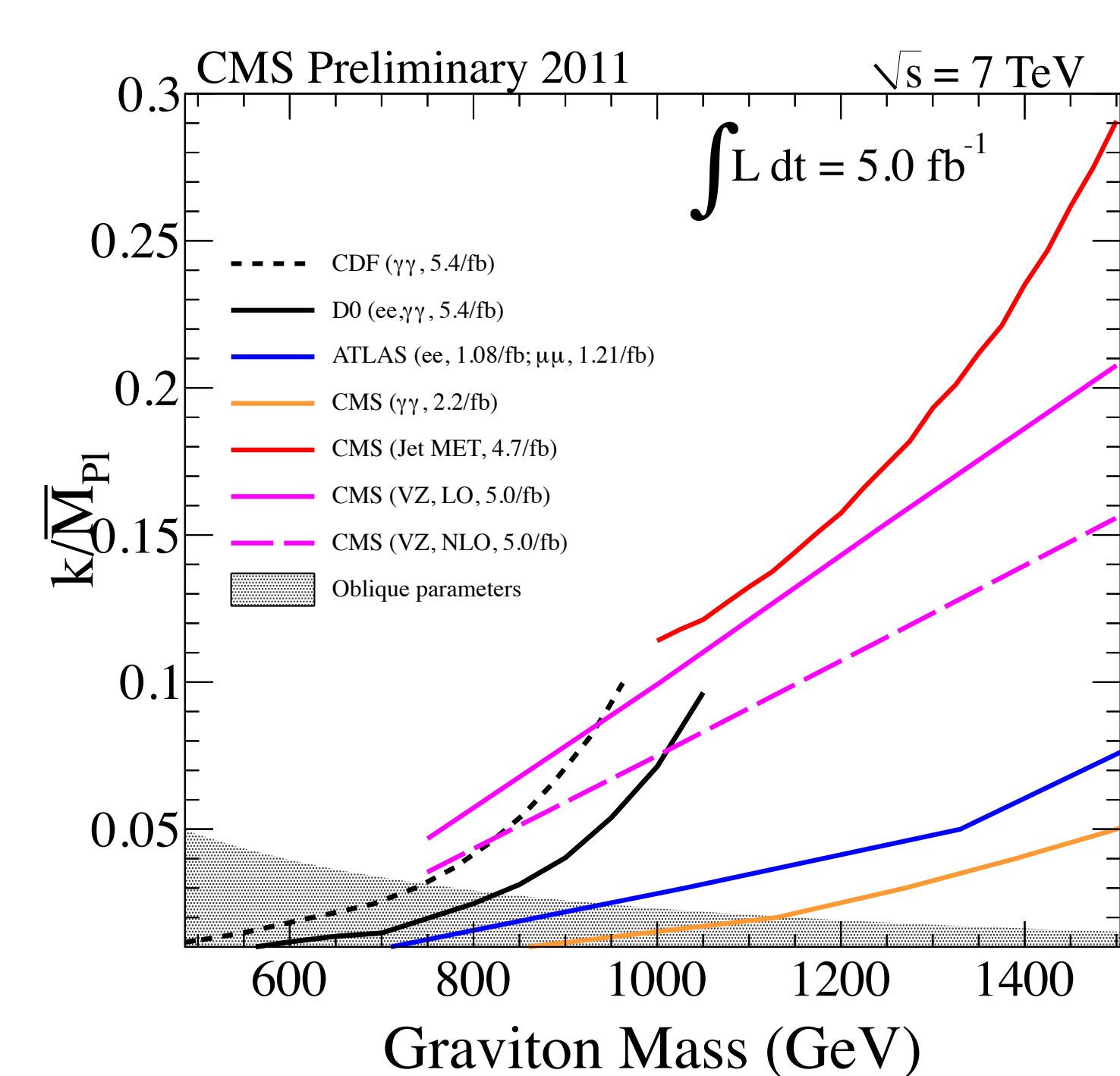
- $p_T (Z \rightarrow \ell\ell) > 150 \text{ GeV}/c$
- $p_T (V \rightarrow \text{jet}) > 250 \text{ GeV}/c$
- $\Delta R (\text{jets, leptons}) > 1.0$

RESULTS



Systematic Uncertainties

- Luminosity (S)
- Jet energy scale (S, B)
- Parton Distribution Functions (S)
- Reconstruction efficiencies (S)
- V mass cut efficiency (S)
- Deviation from MC prediction (B)
- Fit variations (B)



Limits

- Frequentist CLs method
- Exclusions:
 - W' mass in $[700, 929] \text{ GeV}/c^2$
 - RS mass in $[700, 924] \text{ GeV}/c^2$ (for $k/\bar{M}_{Pl} = 0.05$)
- 2D plot assumes narrow width compared to experimental resolution

REFERENCES

CMS Collaboration, Search for exotic resonances decaying into V + Z using final states with a jet and a lepton pair, CMS PAS EXO-11-081, <http://cdsweb.cern.ch/record/1444879/files/EXO-11-081-pas.pdf>