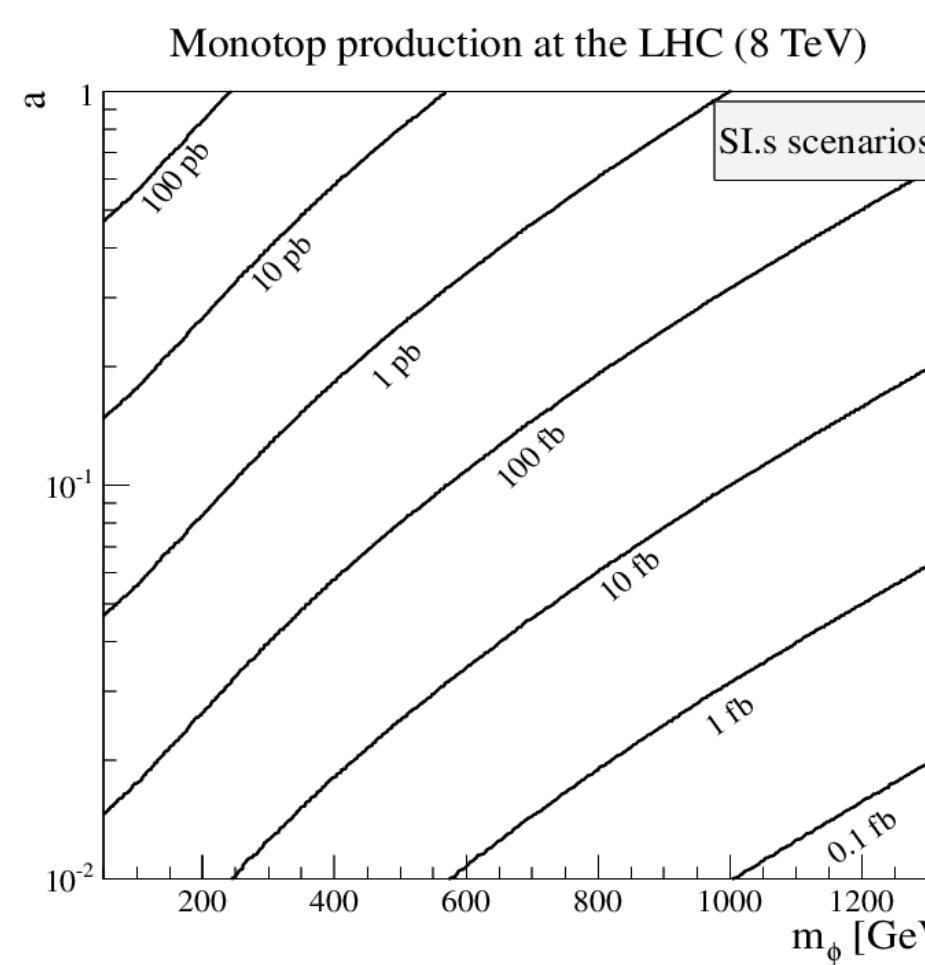


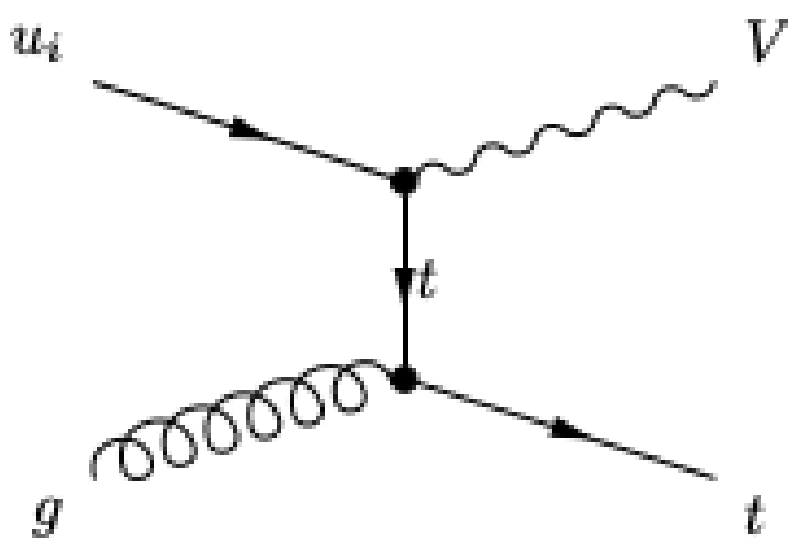
Flavor Changing Neutral Current (FCNC)

V: vector invisible BSM particle (DM candidate)



Free parameters:

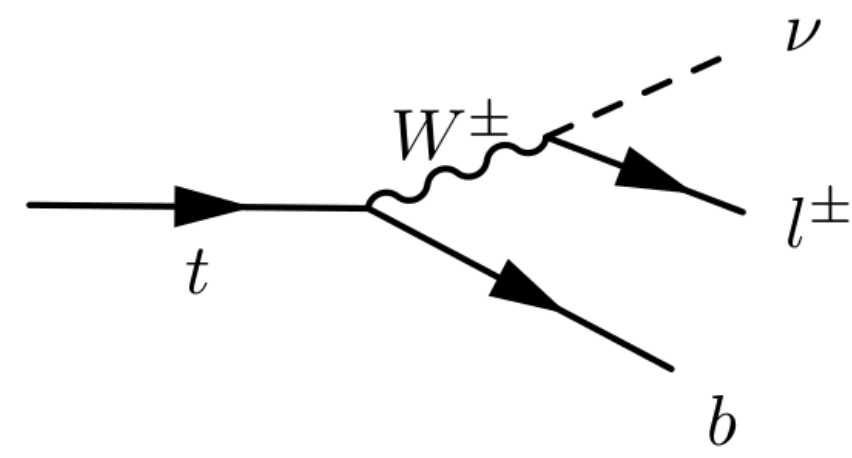
- a : coupling strength
- m_ϕ : mass of the DM candidate



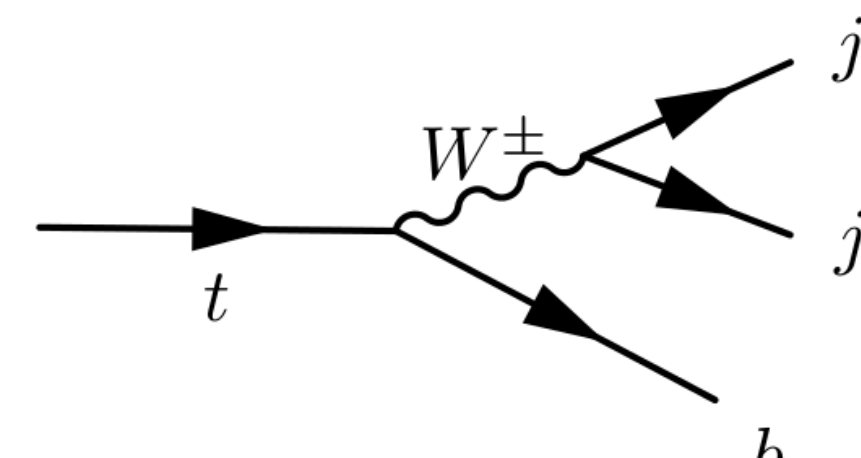
Theoretical context¹

Monotop = top + missing transverse energy (MET)
Monotop production modes via an **effective theory**

Both hadronic and leptonic top decays considered

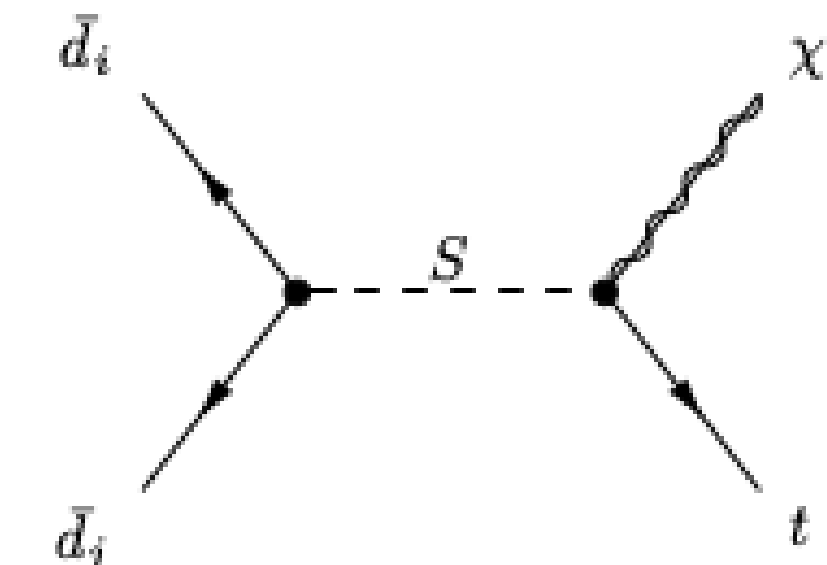


Leptonic channel



Hadronic channel

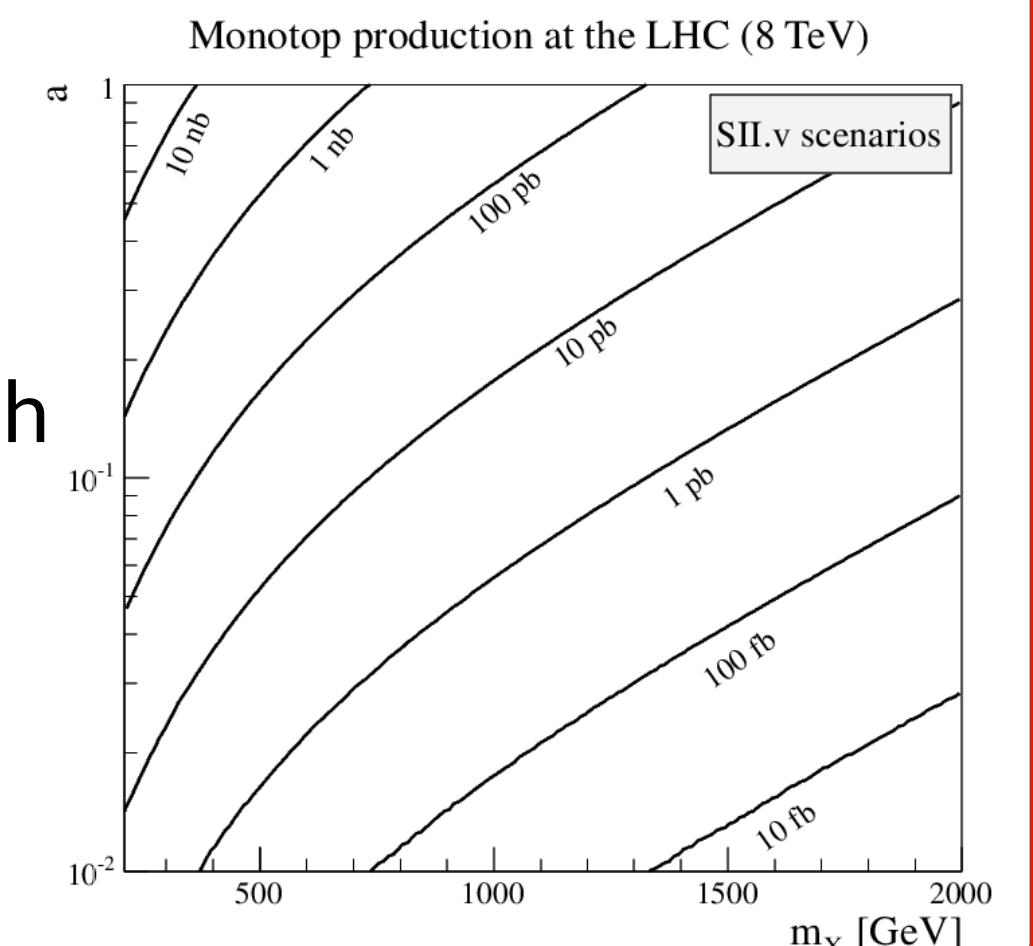
Resonance



S: scalar BSM mediator
X: fermionic invisible BSM particle (DM candidate)

Free parameters:

- a : coupling strength
- m_ϕ : mass of the DM candidate
- m_X : mass of the resonant particle

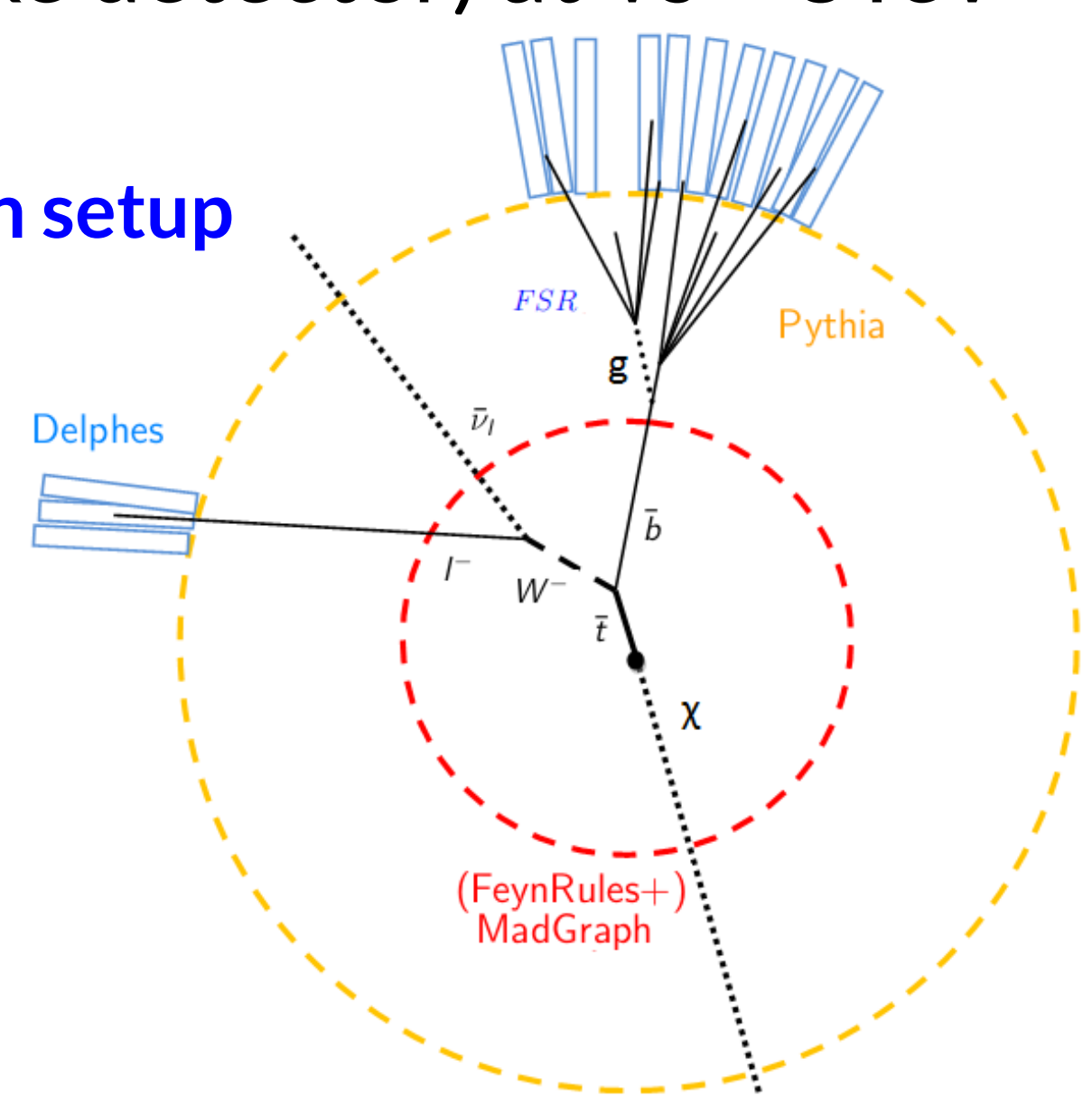


Phenomenology¹

Delphes fast **simulation** (CMS-like detector) at $\sqrt{s} = 8\text{TeV}$ assuming 20fb^{-1} of collisions.

MC-based simulation setup

- 1) Hard process generated at Leading Order (LO).
- 2) Partons showered and hadronized.
- 3) Detector effects accounted for.

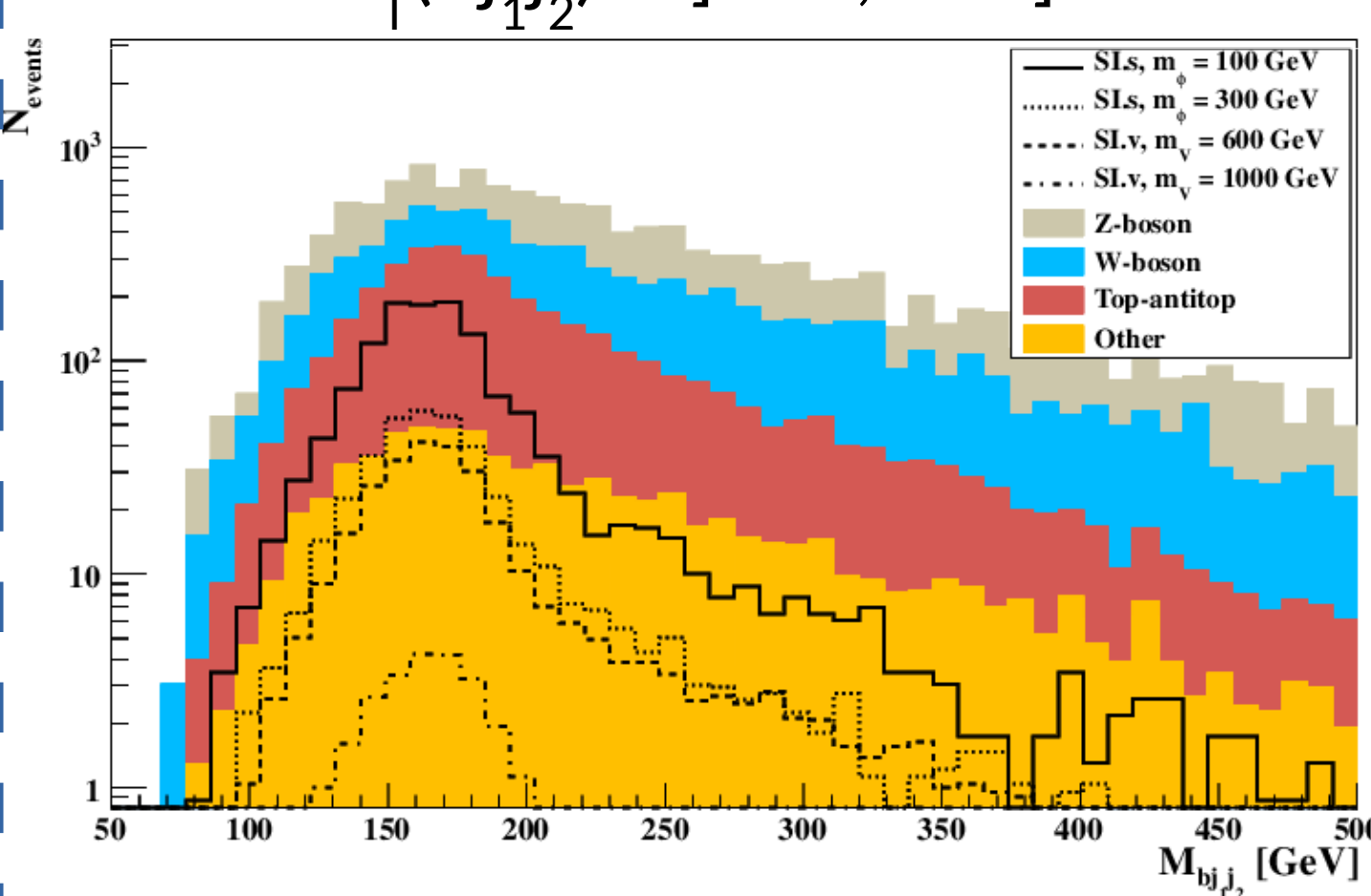


Hadronic channel

Leptonic channel

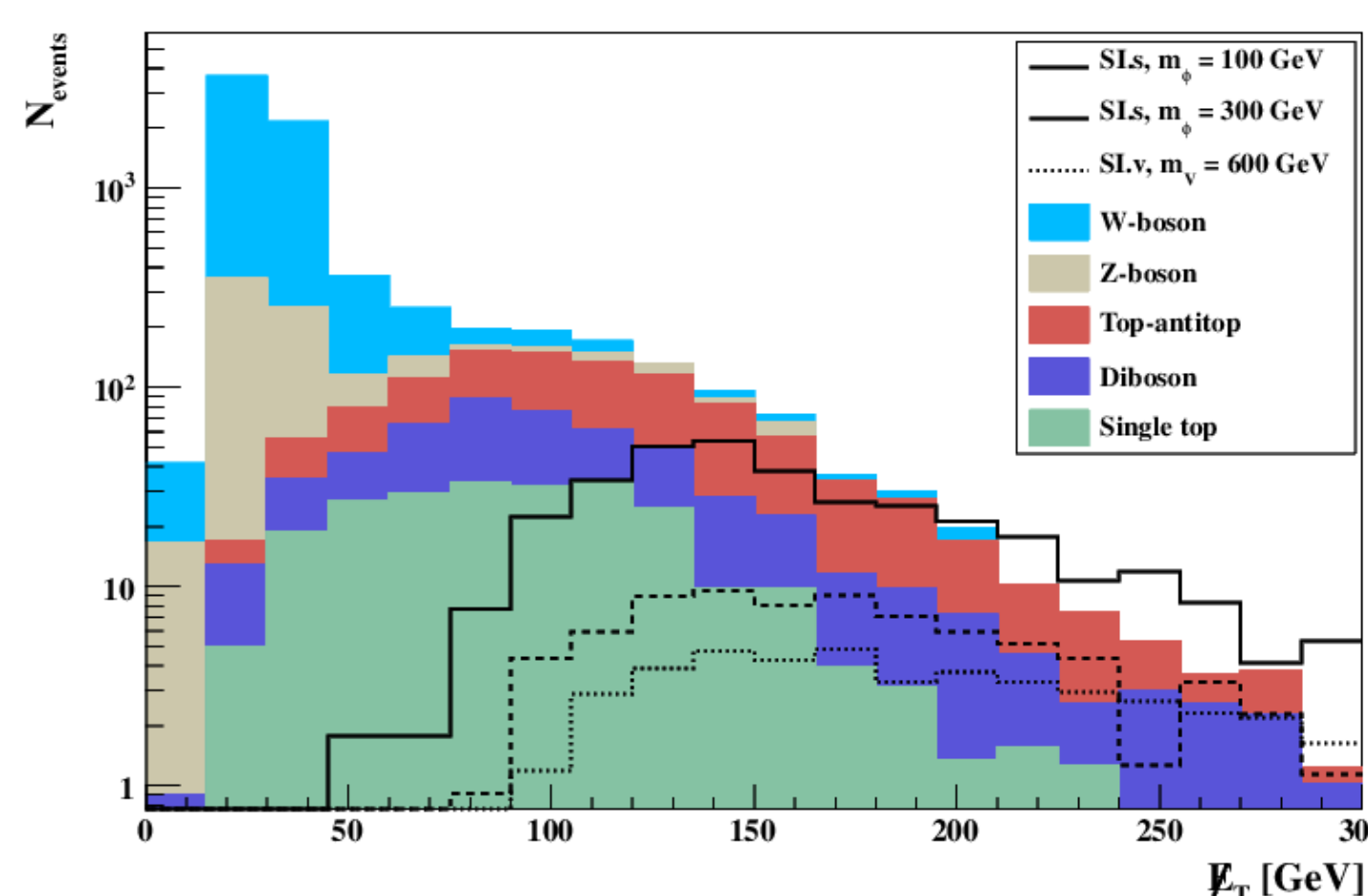
Event selection

- Jets: 2 or 3 lights, 1 b-tagged
- Veto on isolated e, μ
- $M_T(W) \in]50, 105[\text{ GeV}$
- Missing $E_T > 150 \text{ GeV}$
- Top mass reconstruction (b_j, j_2)
 $\rightarrow \Delta\phi(\text{missing } p_T - b_j, j_2) \in]1, 5[$
 $\rightarrow M_T(b_j, j_2) \in]140, 195[$



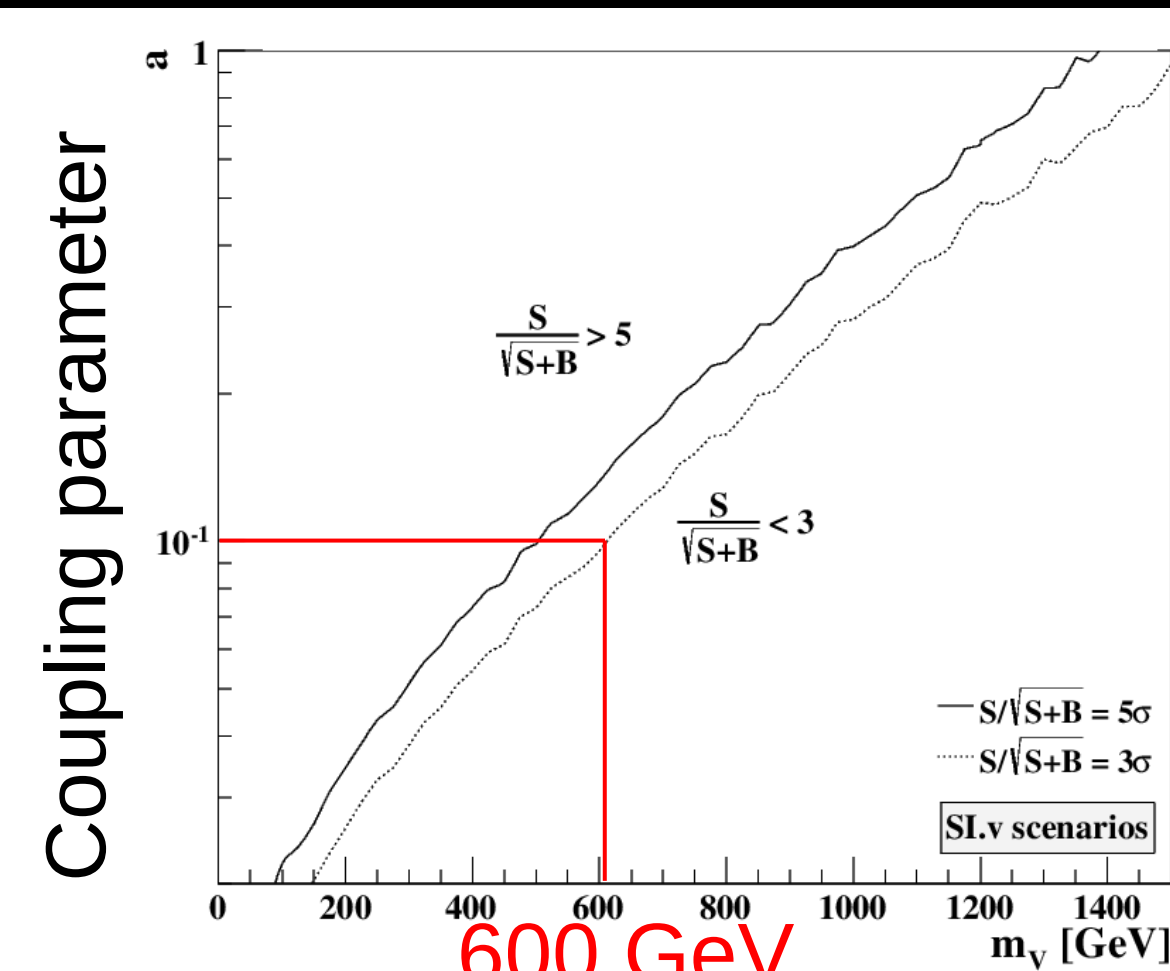
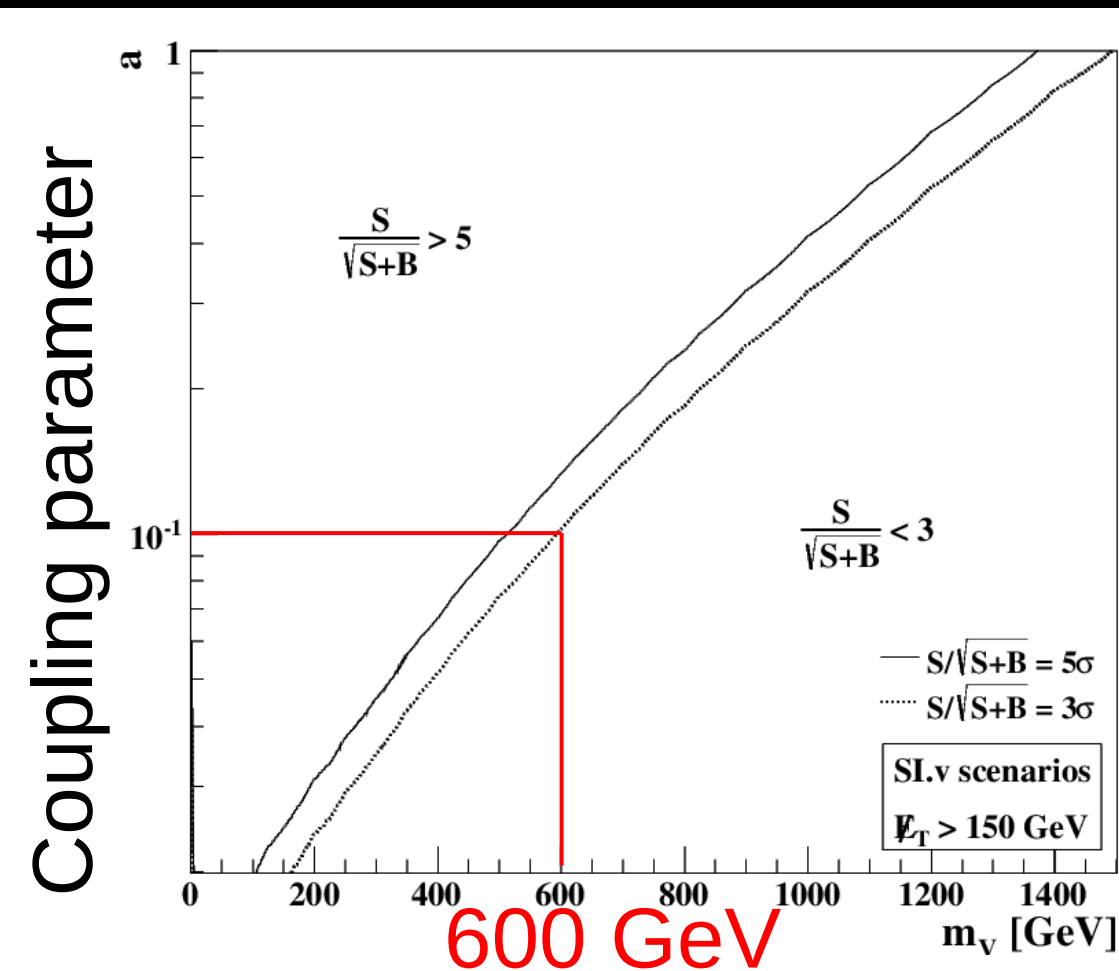
Event selection

- 1 muon or electron
- Jets: 1 b-tagged
- $P_T(\text{leading jet}) > 75 \text{ GeV}$
- $M_T(W) > 115 \text{ GeV}$
- Cut on missing E_T optimized per benchmark



Sensitivity criteria

- Significance $s = \frac{S}{\sqrt{S+B}}$ is used to probe the sensitivity.
- S (resp. B) is the number of signal (resp. background) events surviving the selection.
- $s = 3$ (resp. $s = 5$) contour lines are related to a **3 σ observation** (resp. **5 σ discovery**) of a monotop hint at the LHC.



Interpretation: **vector** DM candidates with masses **below 600 GeV** can be excluded even with a moderate coupling strength $a = 0.1$ for both channels.

Search² @ 8 TeV

Hadronic channel with 19.7fb^{-1} of pp collisions at $\sqrt{s} = 8\text{TeV}$.

Online trigger: $\text{MET} > 150 \text{ GeV}$

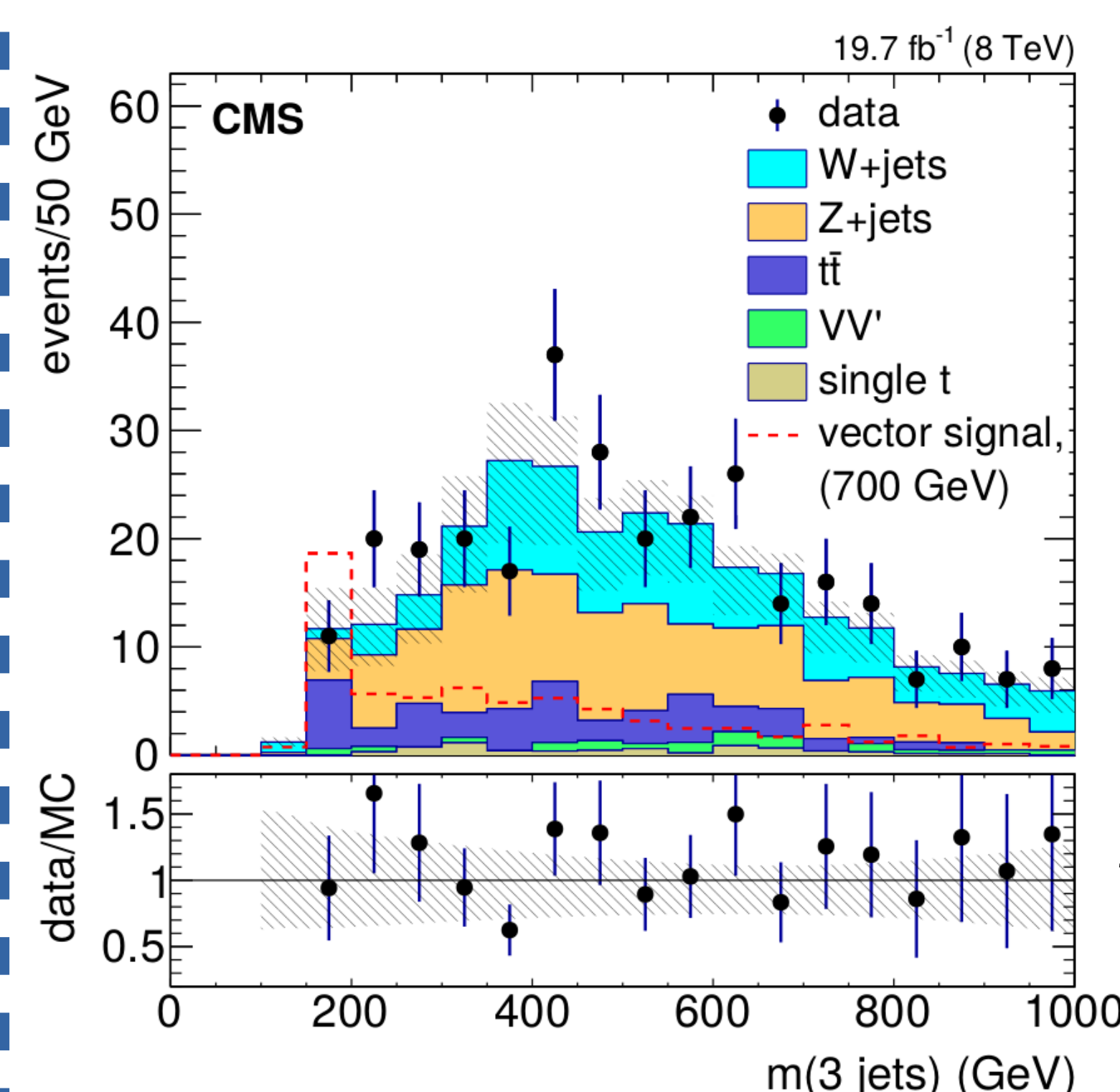
Event selection

- Jets: $p_T(3 \text{ leading jets}) > 60, 60, 40 \text{ GeV}$ with **one b-tagged**
- Veto on event with isolated ($\text{iso} < 0.2$) muon or electron
- $M(b_j, j_2) < 250 \text{ GeV}$
- Missing $E_T > 350 \text{ GeV}$

Main backgrounds

- $t\bar{t}$ } where a charged lepton from the W decay fails the selection or the detection.
- W+jets } where mis-reconstructed jets induce large missing E_T .
- QCD } where the Z boson decays into a pair of neutrinos.
- Z+jets }

Results

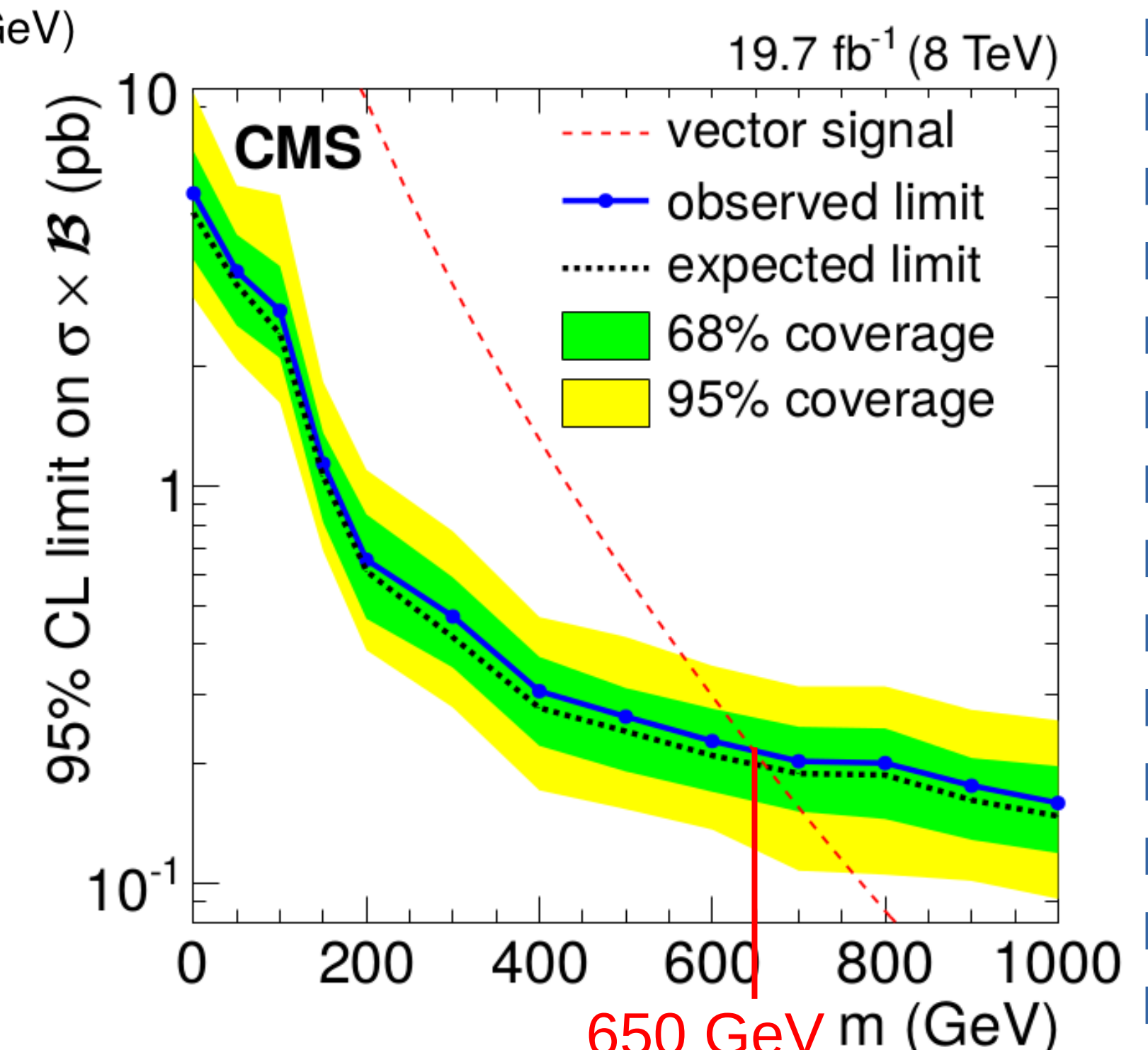


V+jets background contamination is **estimated from data** in its μ -enriched region.

QCD-multijets background is also **estimated from data** using a control region with zero b-tagged jets.

Remaining backgrounds are then **compared to the data** in a region where the signal is expected to live.

A **cut&count** experiment is proceeded to set **limits** at 95% Confidence Level (CL).



Interpretation: **vector** DM candidates with masses **below 650 GeV** are excluded for **hadronic channel** (with $a = 0.1$).

References:

1. J.-L. Agram et al., 'Monotop phenomenology at the LHC', *Phys. Rev. D* **84** (2014) 074025
2. CMS Collab., 'Search for new physics with monotop final states in pp collisions at $\sqrt{s} = 8 \text{ TeV}$ ', arXiv:1410.1149 (2014)

