Search for bb Resonance in 7 TeV Proton-Proton Collisions at CMS

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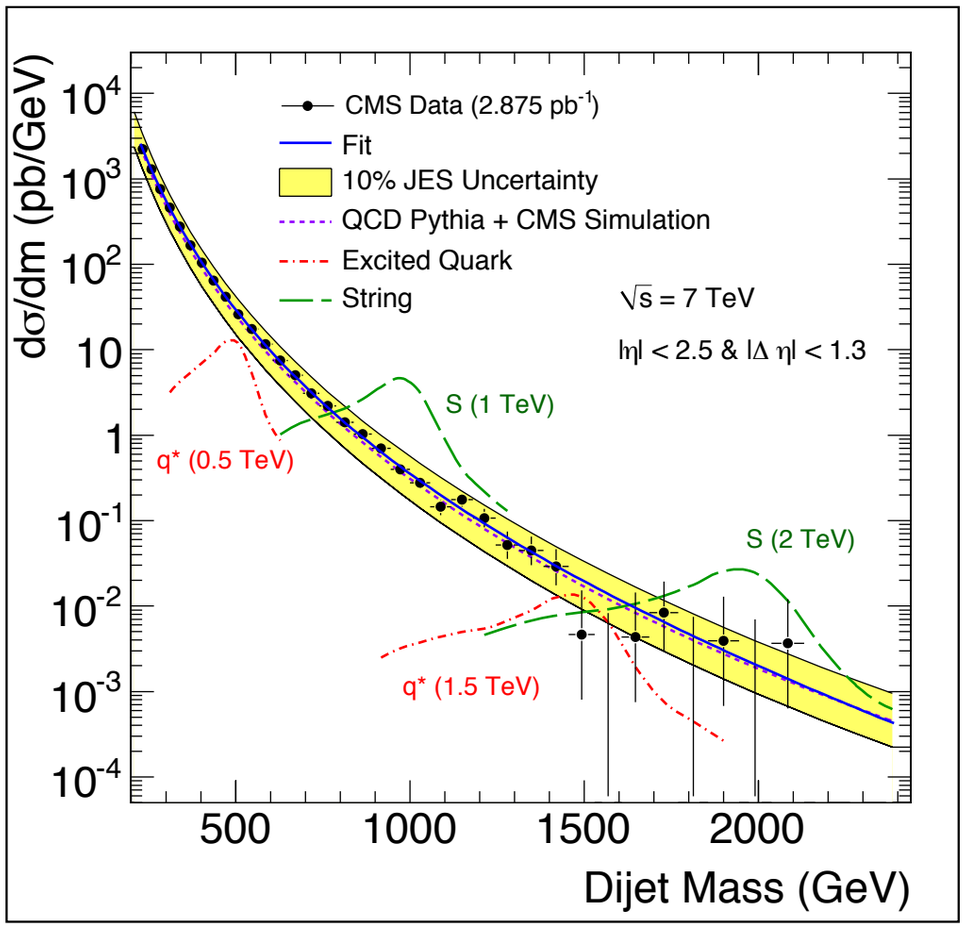
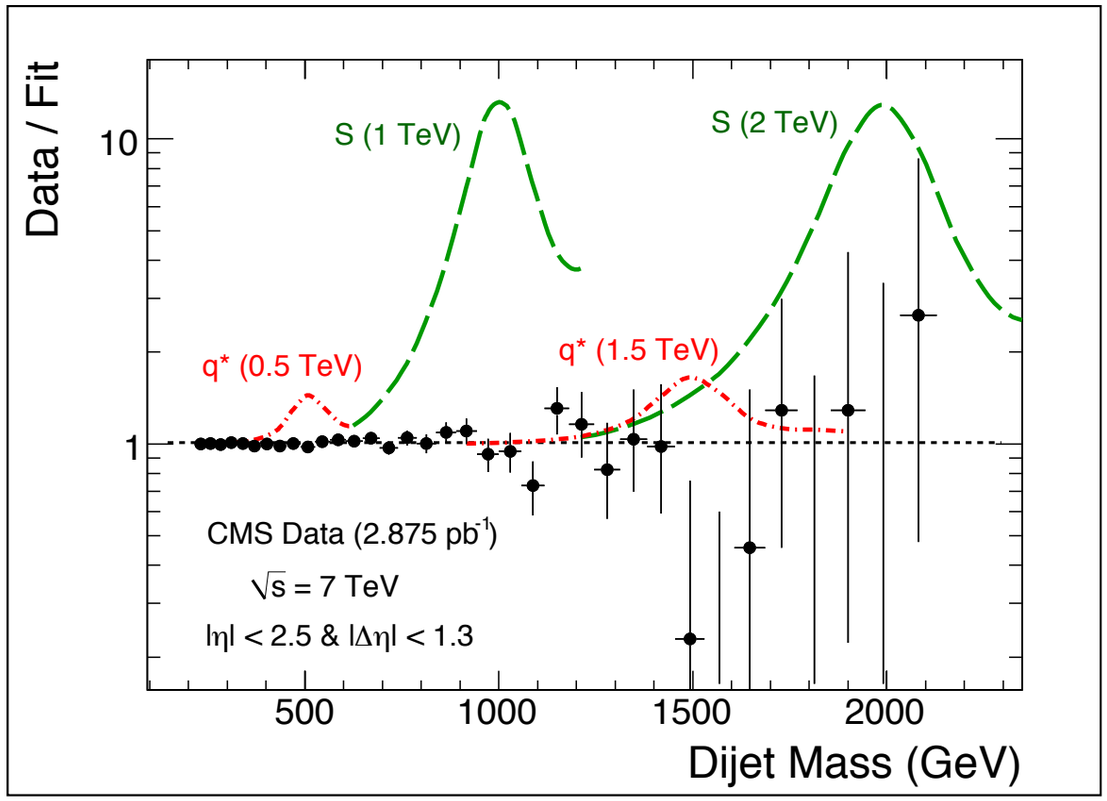
Motivation



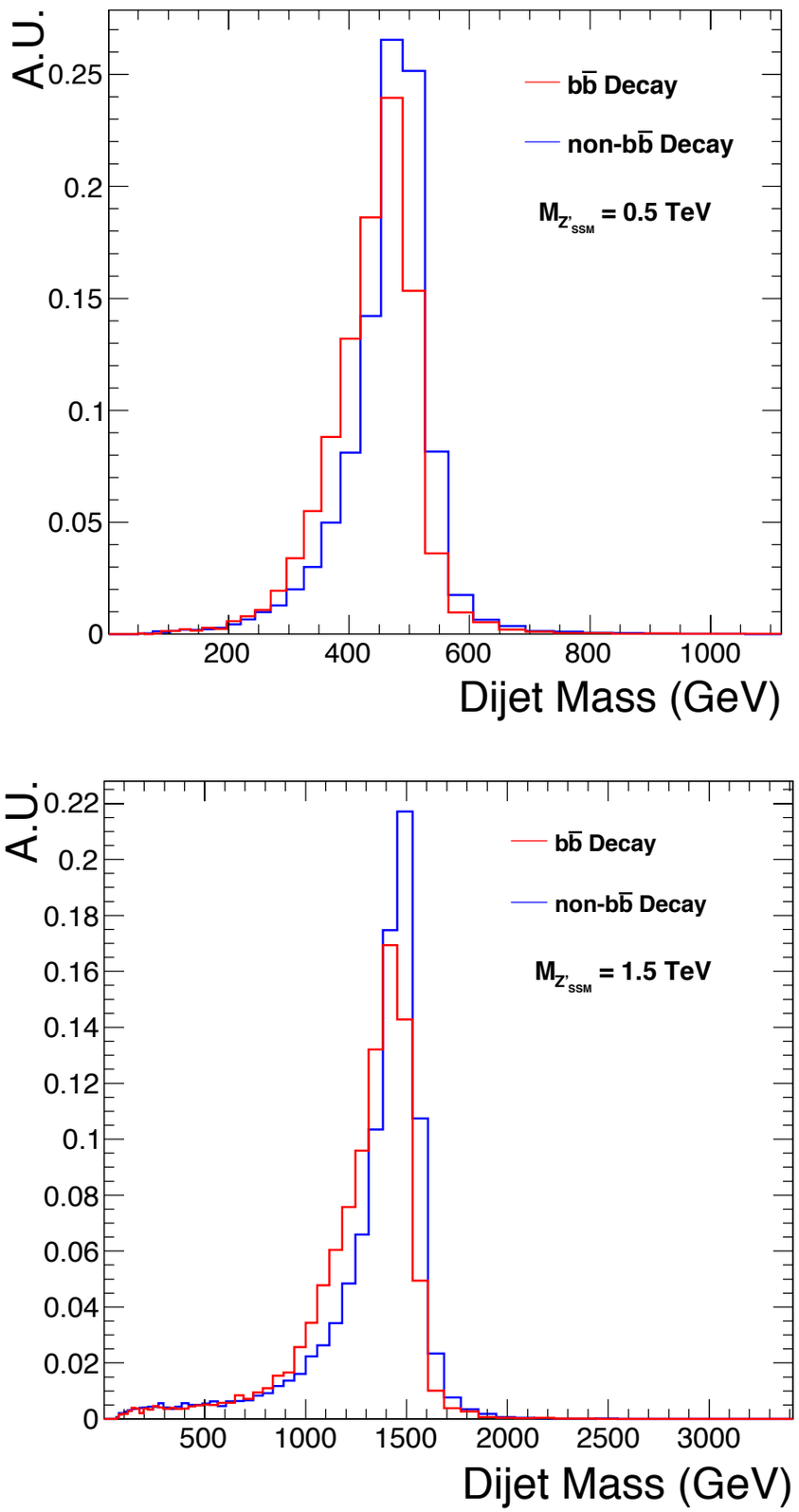


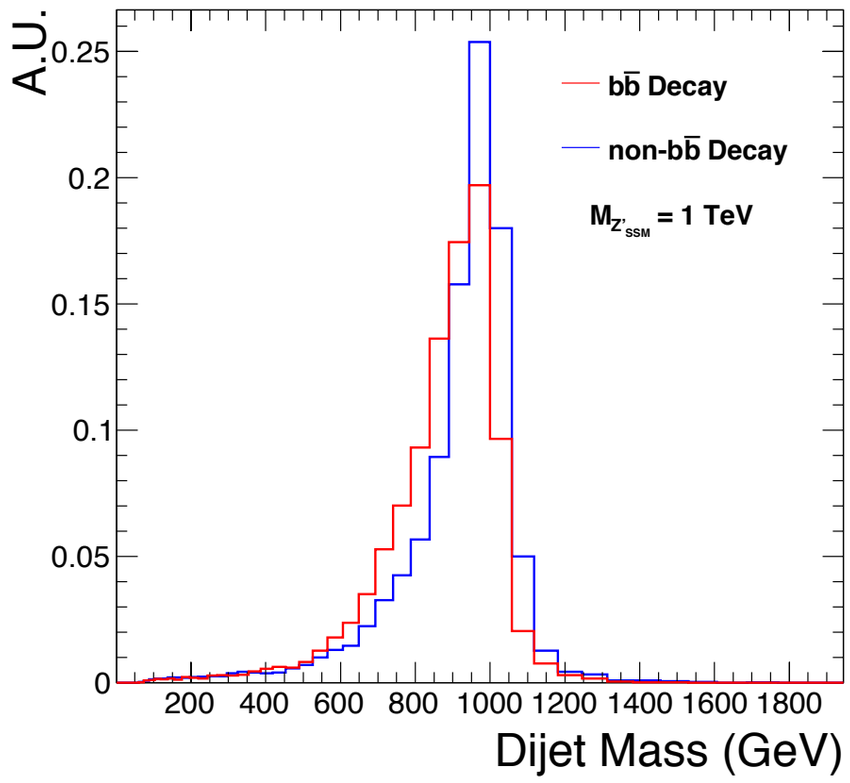
- We search for the new particles in "Dijet Mass" spectrum.
  - ✓ If a resonance exists, it can show up as a bump in Dijet Mass spectrum
  - ✓ It was considered as qq, qg and gg resonances.
- We would like extend this study as b-jet resonances.

Data Set and Event Selection

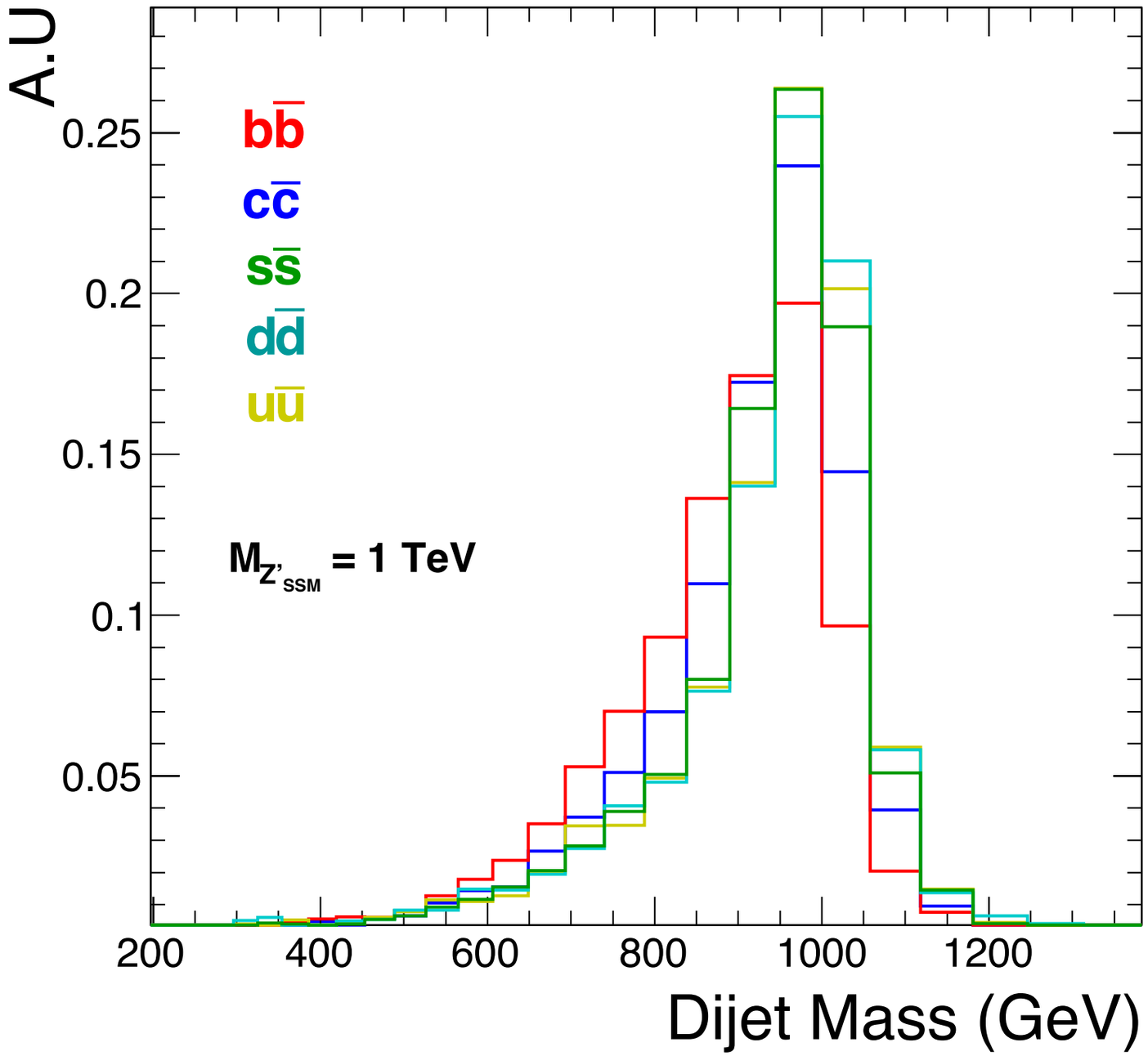
- Since b decay mode was off in official Spring10 Z' to dijet MC sample, new MC samples were generated using FastSim.
  - ✓ Z'_{SSM} at the mass of 0.5 TeV, 0.75 TeV, 1 TeV, 1.25 TeV and 1.5 TeV
  - ✓ /castor/cern.ch/user/s/sertac/ZprimeSSM
- AK7 PFJets
- $|\eta|>2.5$ & $|\Delta\eta|<1.3$
- L2L3 Jet Energy Correction

Resonance Shapes



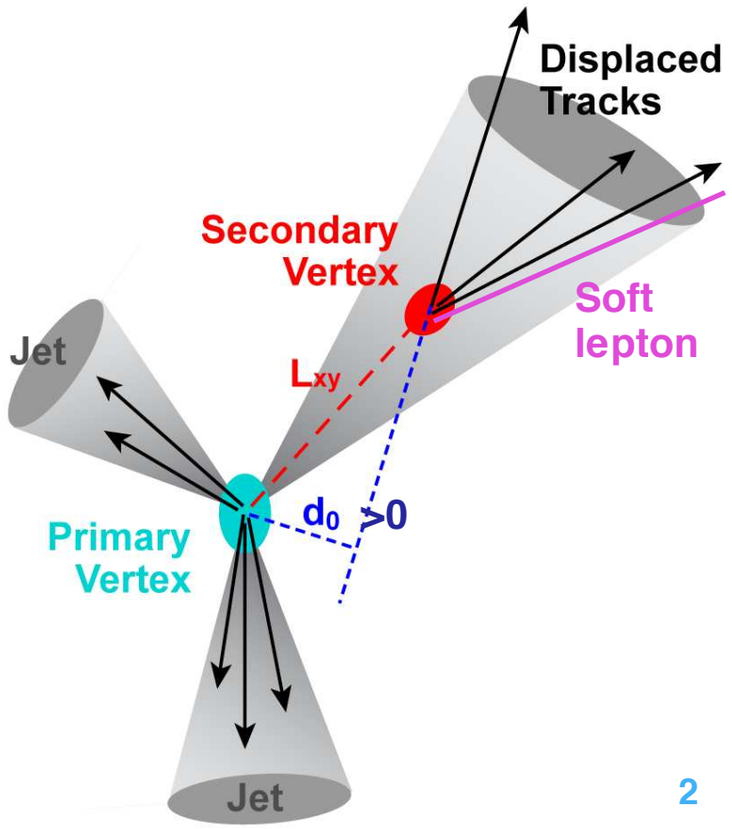


- The signal of b-bbar resonances is shifted to lower mass region and wider than non-bbbar resonances.



- When mass of resonance quarks increases, the signal shifts to lower mass region and becomes wider.

✓ What does it cause this effect apart from FSR?



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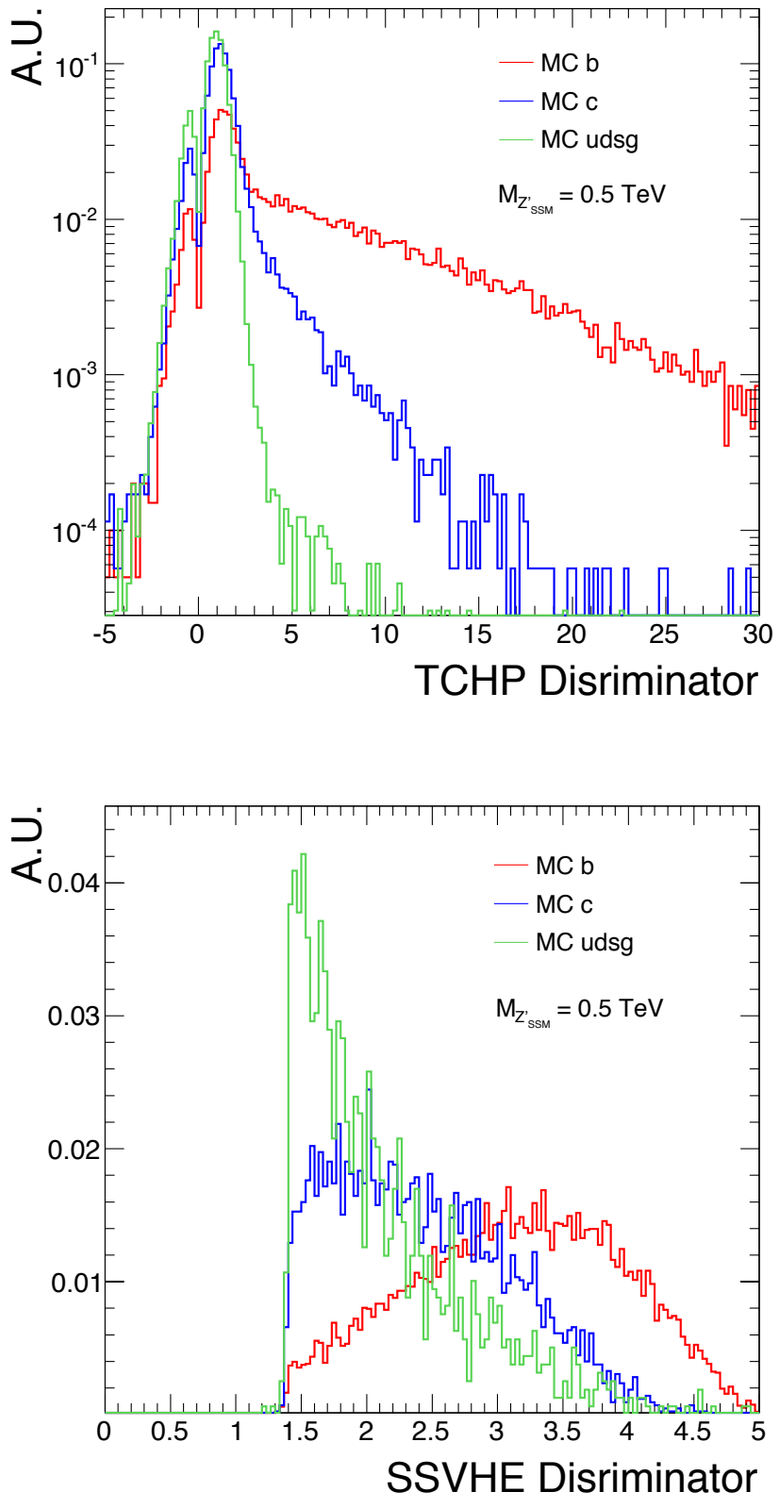
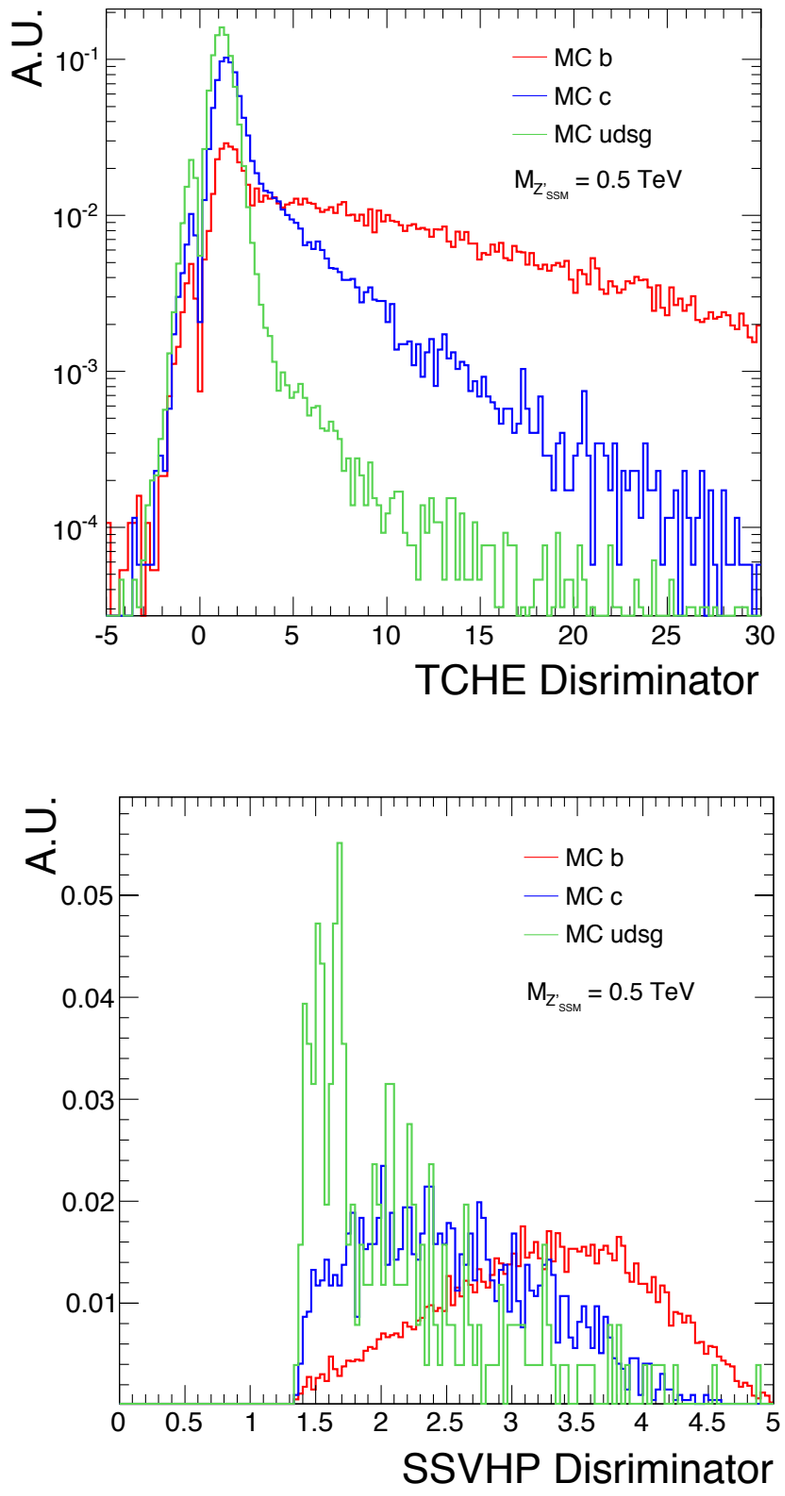
- Impact Parameter based:
  - Track counting High Eff/Pur (2)
  - Jet[B]Probability (2)
- Secondary Vertex based
  - Simple Secondary Vertex
  - Combined Secondary Vertex
- Leptons:
  - Soft mu by IP 3d
  - Soft mu by Ptrel
  - Soft electron
- Combined
  - Combined MVA

"**TrackCounting**": considers as discriminating variable
the **signed impact parameter significance** of the N^{th} good track
[$N=2$: **HighEfficiency**, $N=3$: **HighPurity**]

"**SimpleSV**" based upon the reconstruction
of a secondary vertex, and uses variables related to it:
2D(3D) decay length or its **significance** or its **boost**
in the rest frame

B-Tagging Discriminant





Discriminant Thresholds

Table 1: definition of the operating points for different b-taggers.

b-tagger	operating point	threshold (D_{cut})
Track Counting High Efficiency Loose	TCHEL	1.70
Track Counting High Efficiency Medium	TCHEM	3.30
Track Counting High Purity Medium	TCHPM	1.93
Track Counting High Purity Tight	TCHPT	3.41
Simple Secondary Vertex High Efficiency Medium	SSVHEM	1.74
Simple Secondary Vertex High Efficiency Tight	SSVHET	3.05
Simple Secondary Vertex High Purity Tight	SSVHPT	2.00

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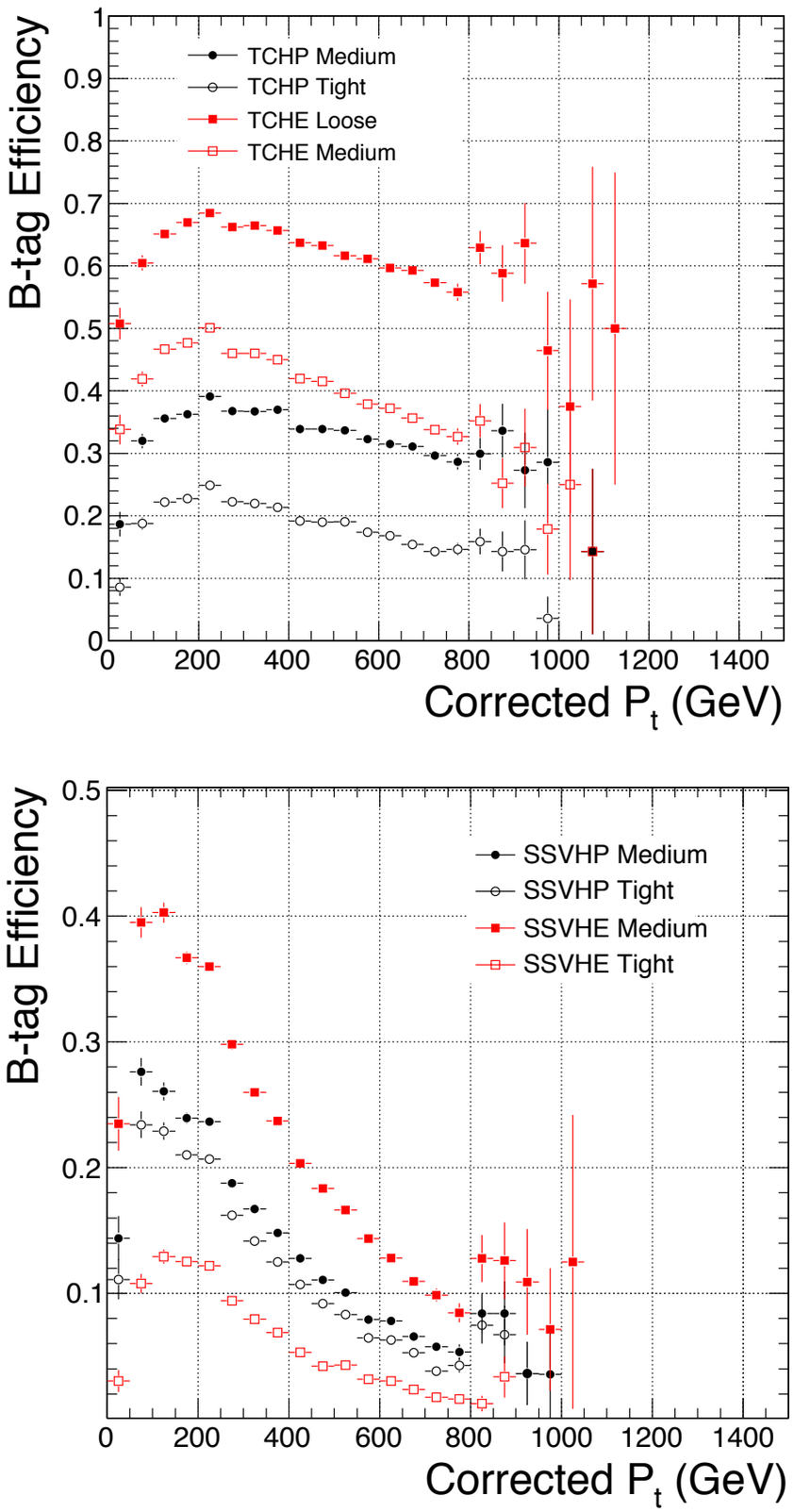
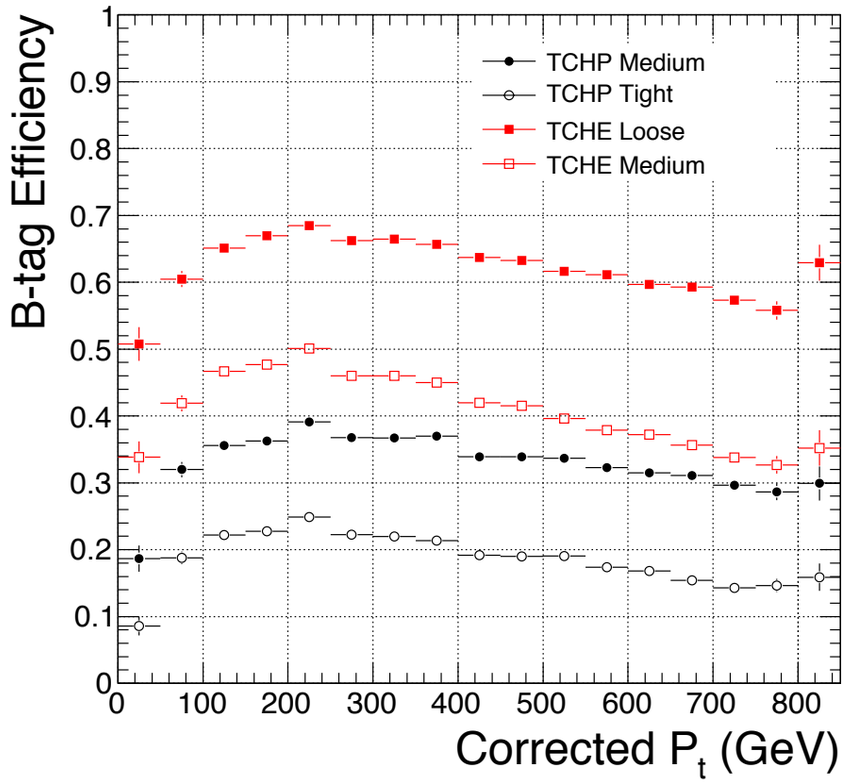
B-Tagging Efficiency vs Pt



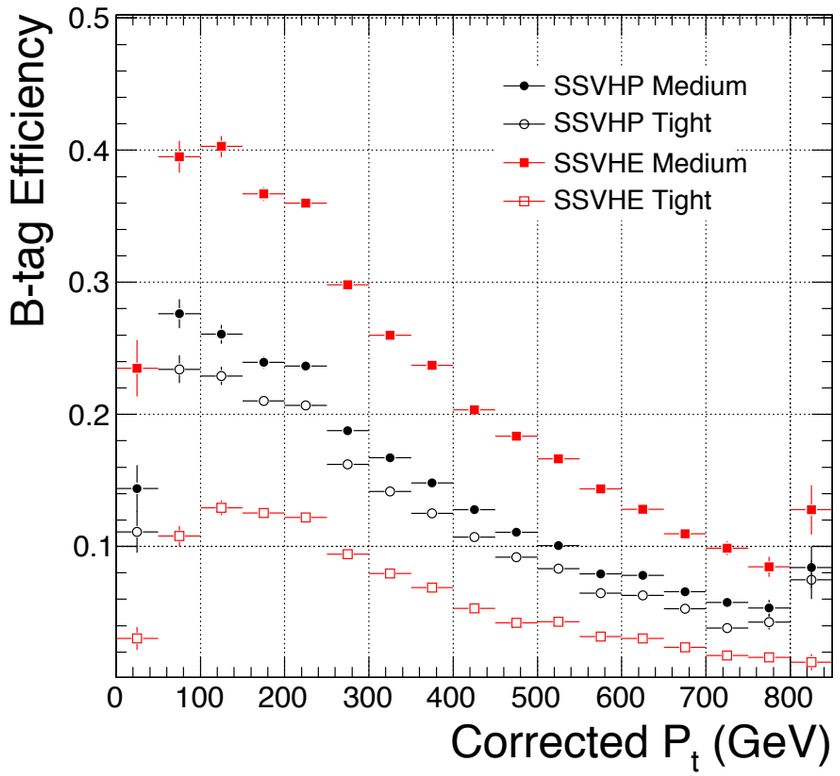
Zoomed in

TC

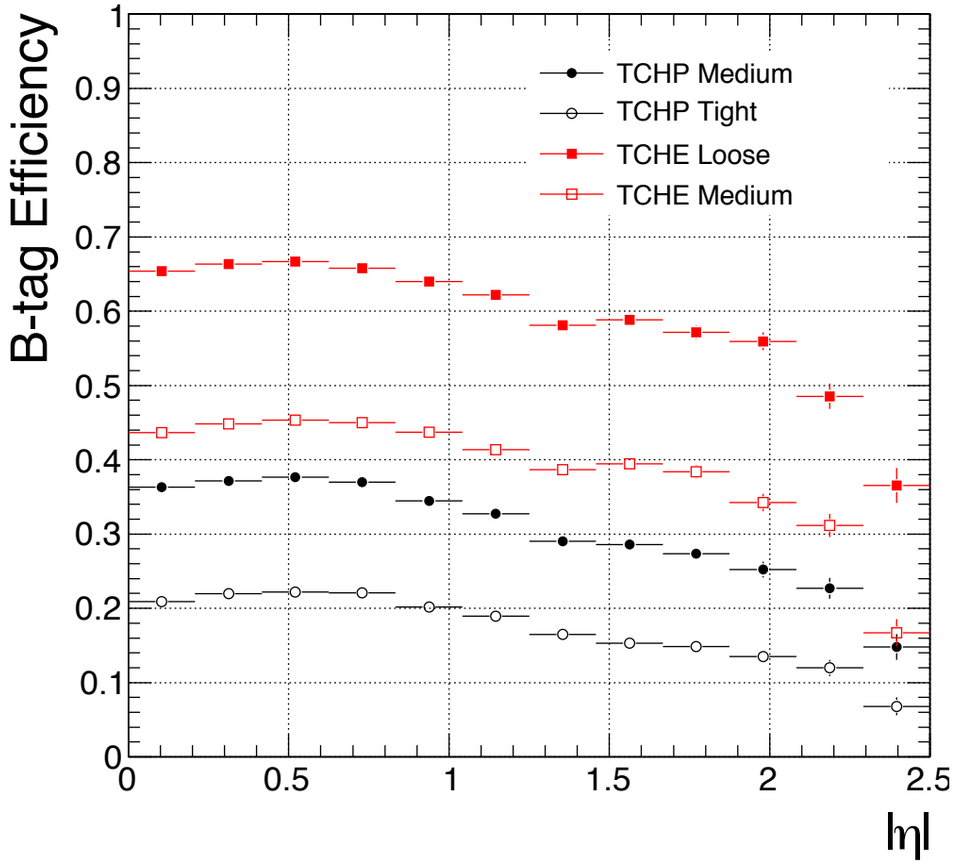


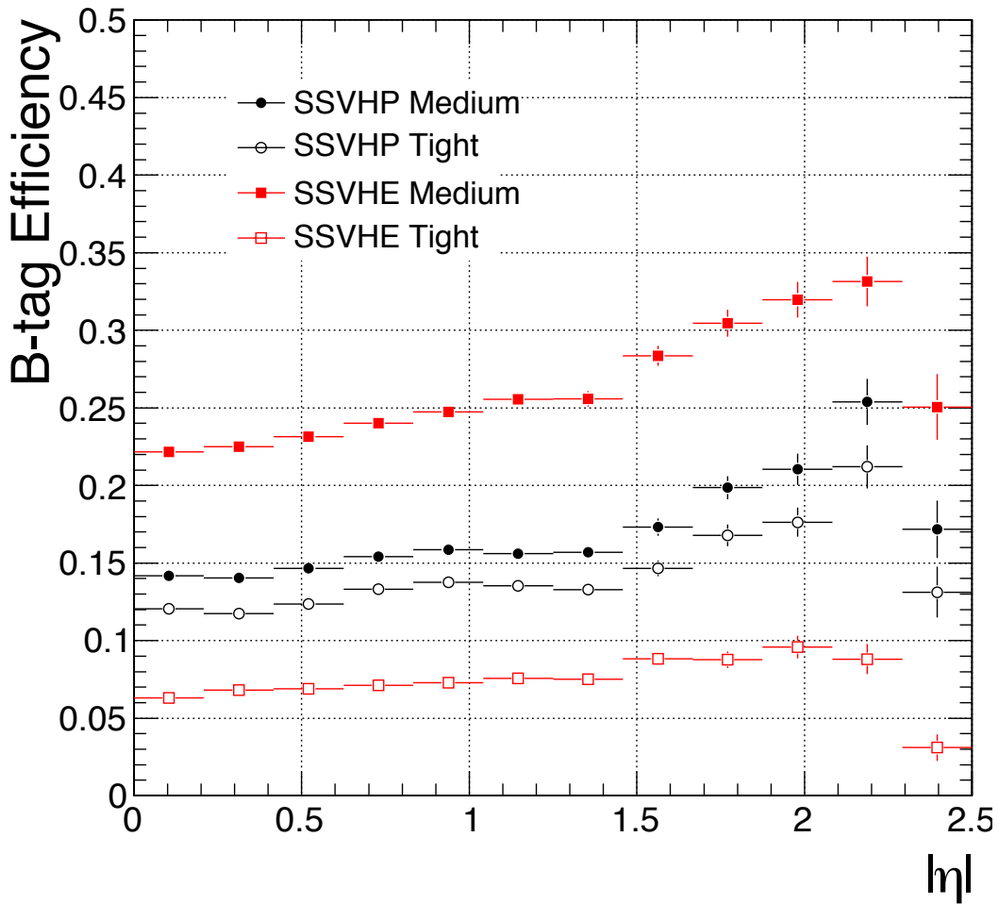
Zoomed in

SSV



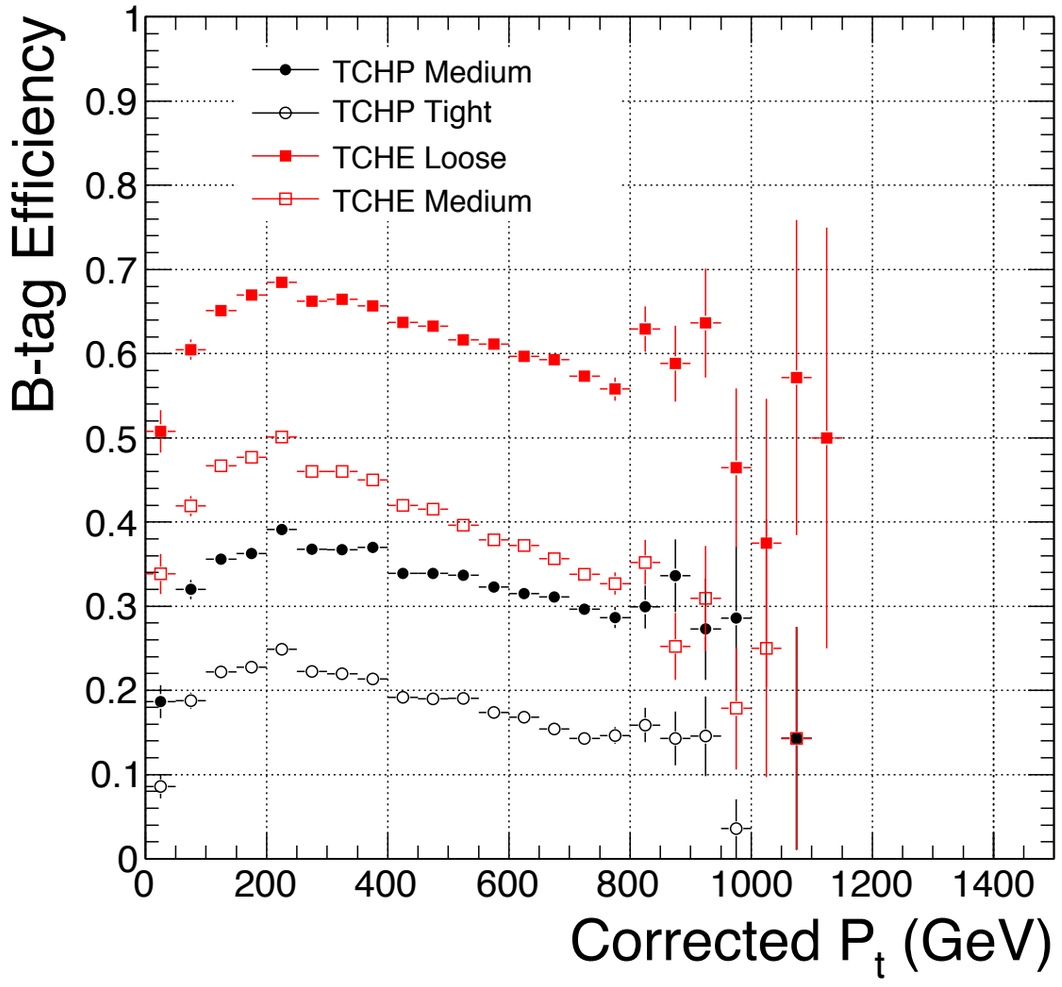
B-Tagging Efficiency vs η

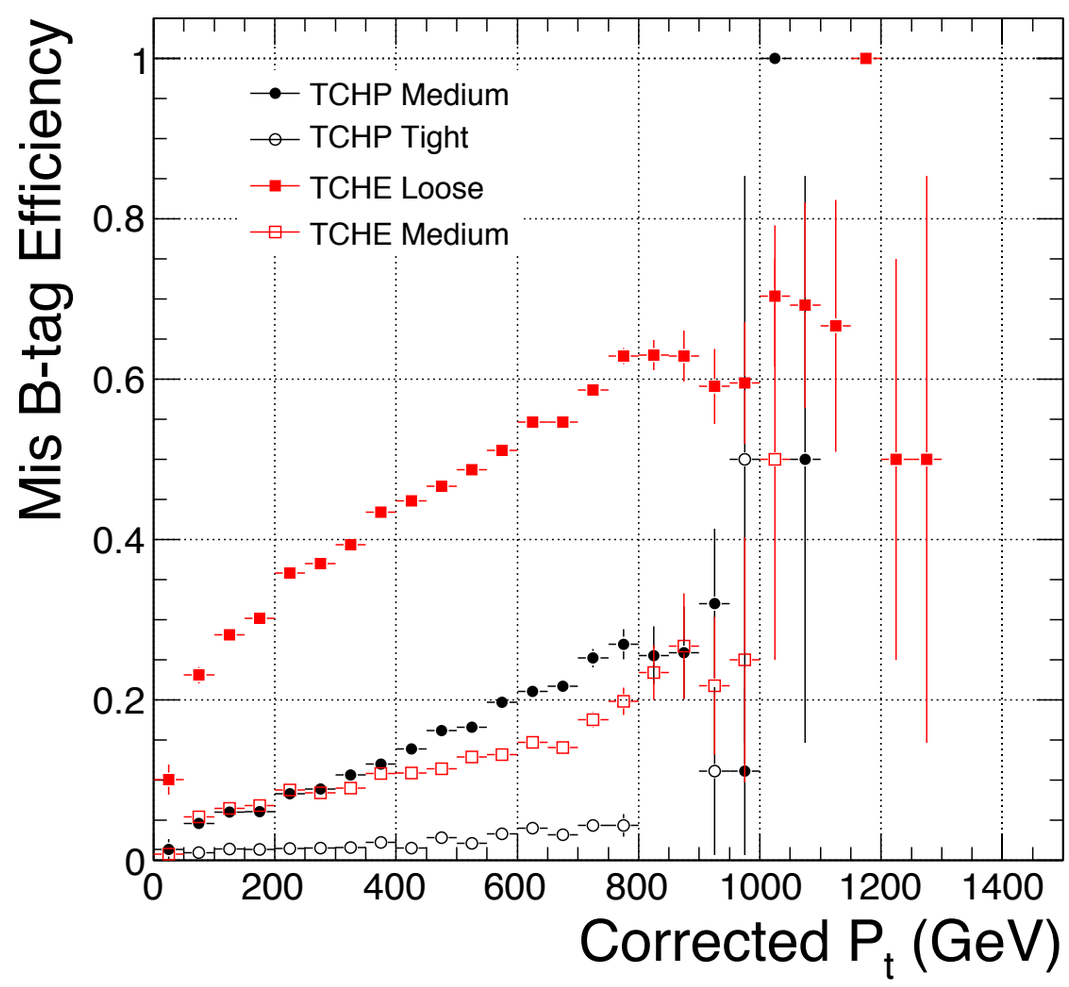




B-Tagging efficiency of TC is greater than SSV.

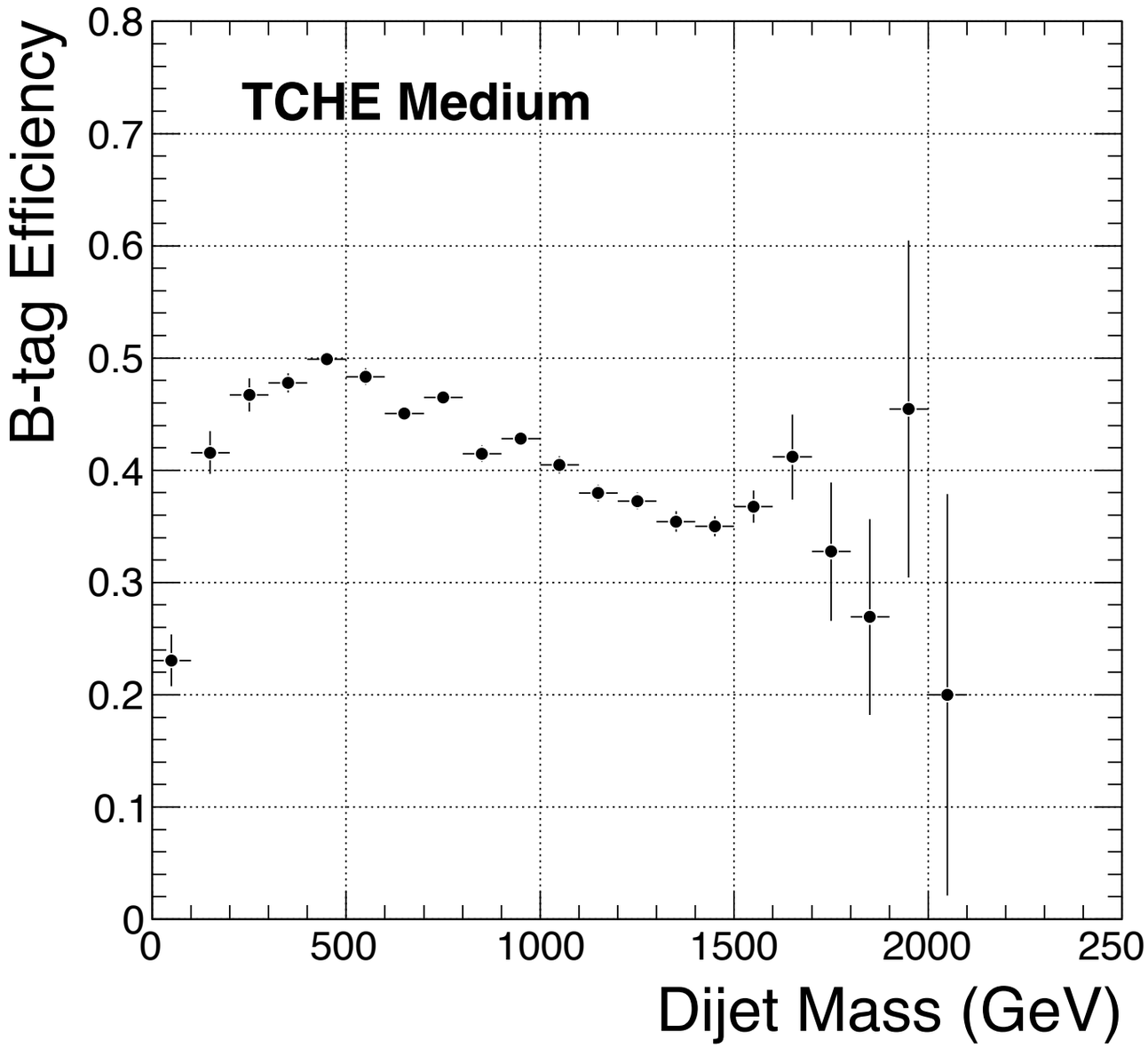
Mis-tagging





- TCHE mis-tagging rate is very high with loose Disc. threshold (1.70).
- TCHE with medium disc. threshold looks like the best option for b-jets resonance search (3.30).
- Can we find out better disc. threshold cut?

B-tagging Efficiency vs Dijet Mass



- B-tagging efficiency as a function of corrected dijet mass varies from 50% to 35% using TCHE with medium disc. threshold.