MJ – Estimation in 1lep merged regime

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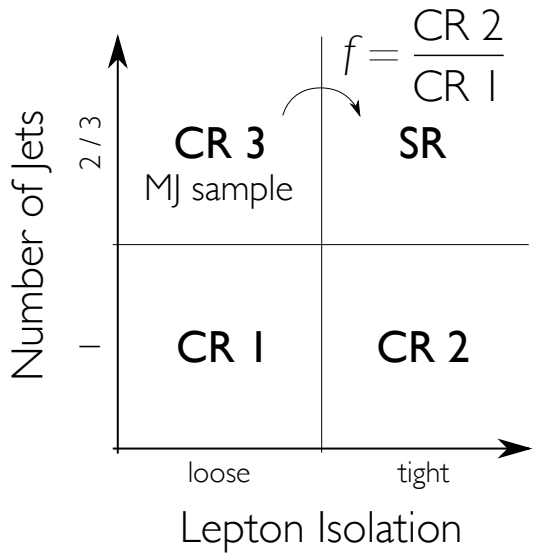
Status of MJ for 1lep



Resolved

- Can use the **Fake Factor** method
- Fake Factors provided SM
- Included by Forrest & Stephen in production
- Calculating *f* by ourselves is tricky, but in progress

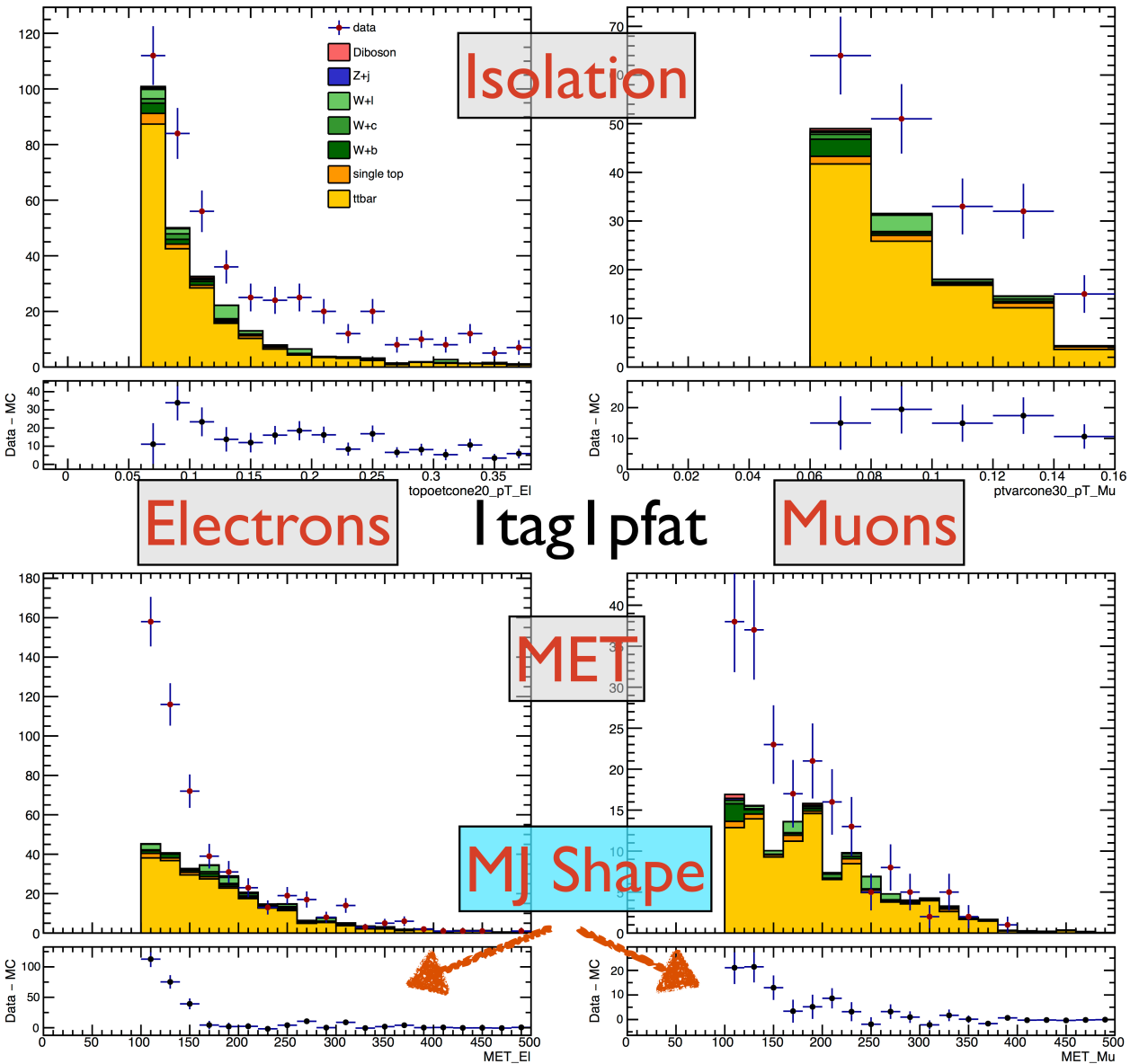
Merged

- **Cannot** use the FF method: no 1-jet CR
- Check necessity of MJ estimation with Isolation Inversion method

Isolation Inversion

Idea

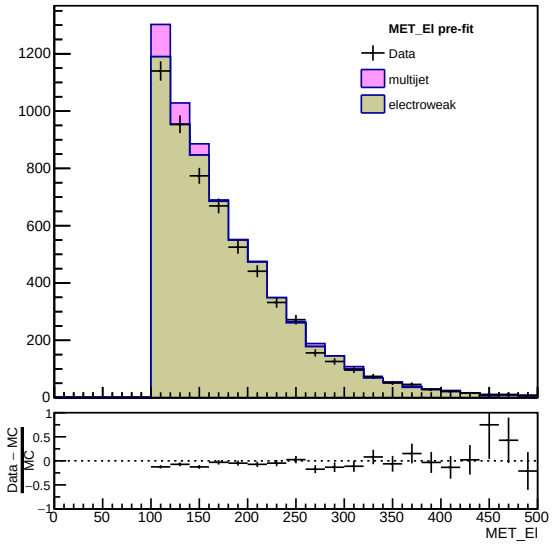
- Isolation inversion is only used in the **merged** regime (PRSR).
- **In analysis:** Signal lepton needs **tight** isolation.
  → Invert isolation to get control region.
- Because of QCD topology: region is QCD-**enriched**.
- Don't have MJ CxAODs
  - Mismatch of Data and MC in this region is interpreted as MJ
  - Extract MJ shape for MET, use in **tight isolation** signal region
  - Float normalization; TFractionFitter

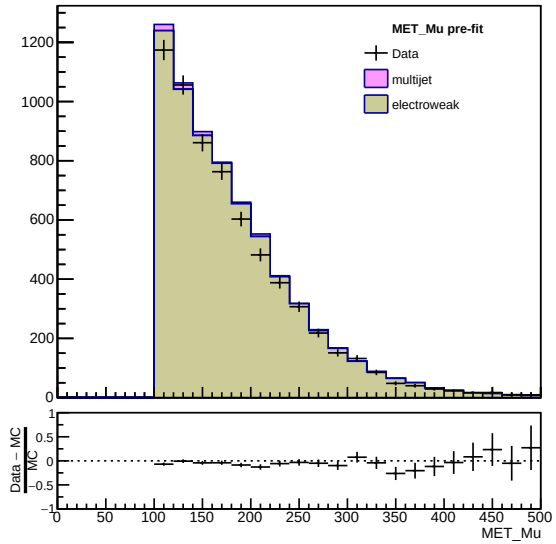

Isolation
data
Diboson
Z+j
W+l
W+c
W+b
single top
ttbar
Data – MC
topoetcone20_pT_El
ptvarcone30_pT_Mu
Electrons
1 tag 1 pfat
Muons
MET
MJ Shape
MET_El
MET_Mu

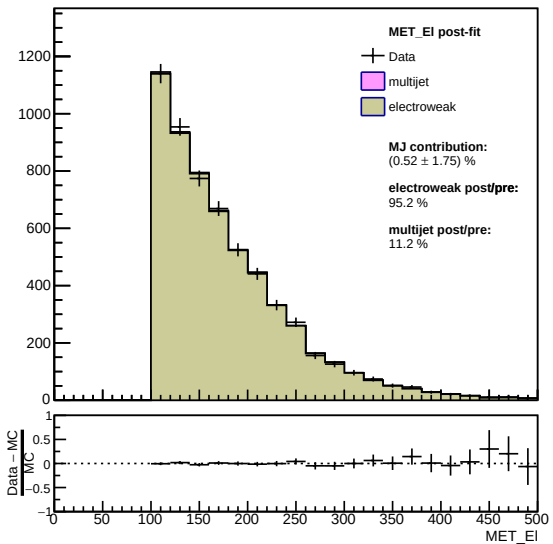
1tag1pfat events in tight lepton iso CRs and SRs

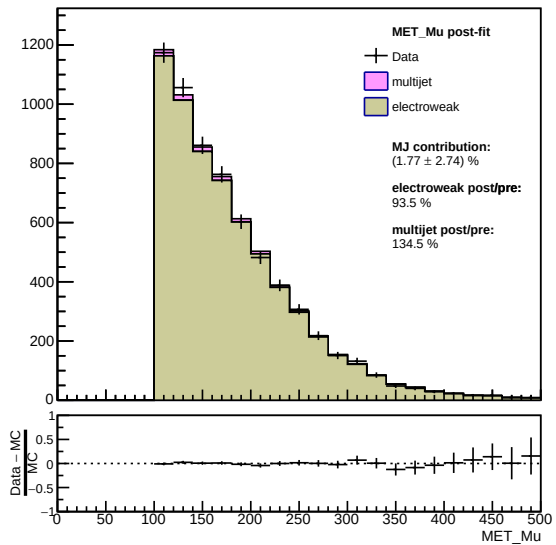
$\chi^2/ndf \ll 1$

with and without multijet









Fit summary:

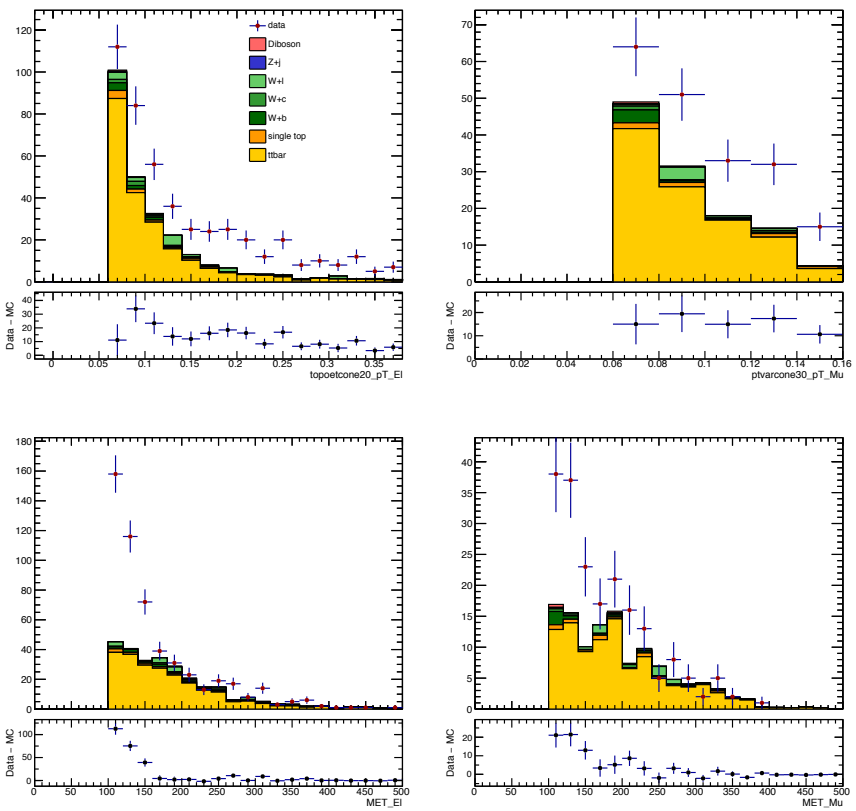
- MJ fit fraction **small**: e: $< (0.5 \pm 1.75)$ %, μ: $< (1.77 \pm 2.74)$ %
- $\chi^2/ndf \ll 1$ with and without MJ
- EWK scale factor similar for e (93.5 %) and μ (95.2 %)
  $\rightarrow$ indicates that pre-fit data-MC mismatch could just be a scaling issue, not a shape issue (**argument against MJ**)

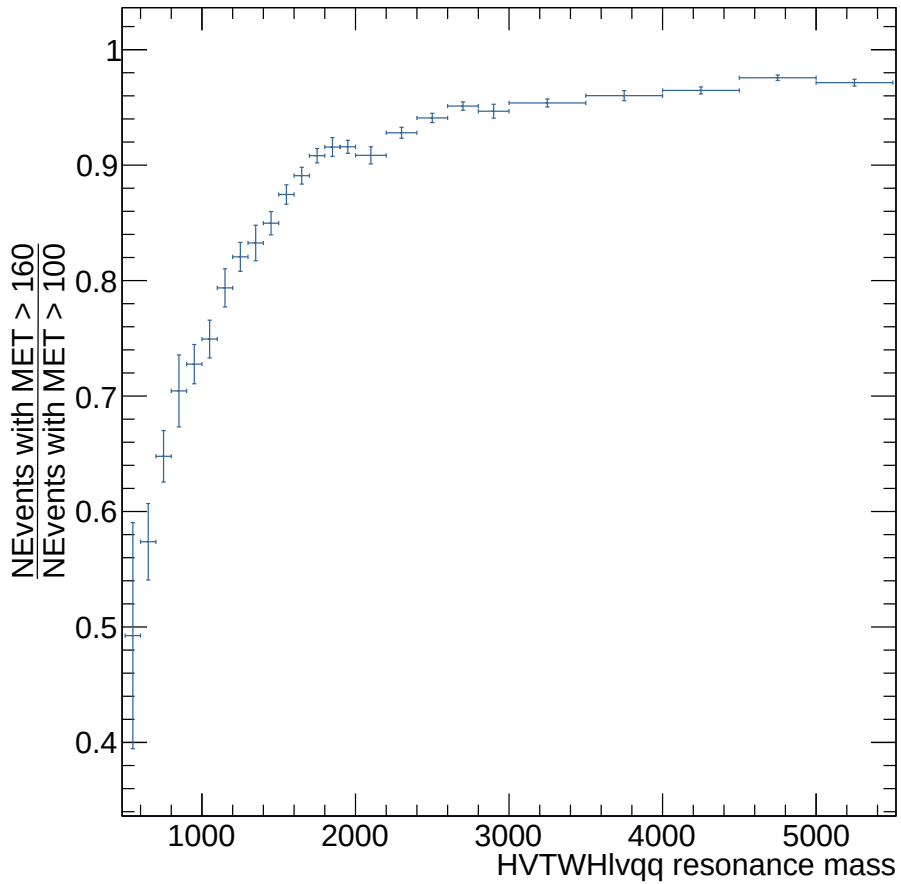
In any case, MJ is without a doubt small.

To further suppress it, check 2 approaches:

- Tighten MET cut
- Suggestion by **Takuya**: MET/pTV > 0.2

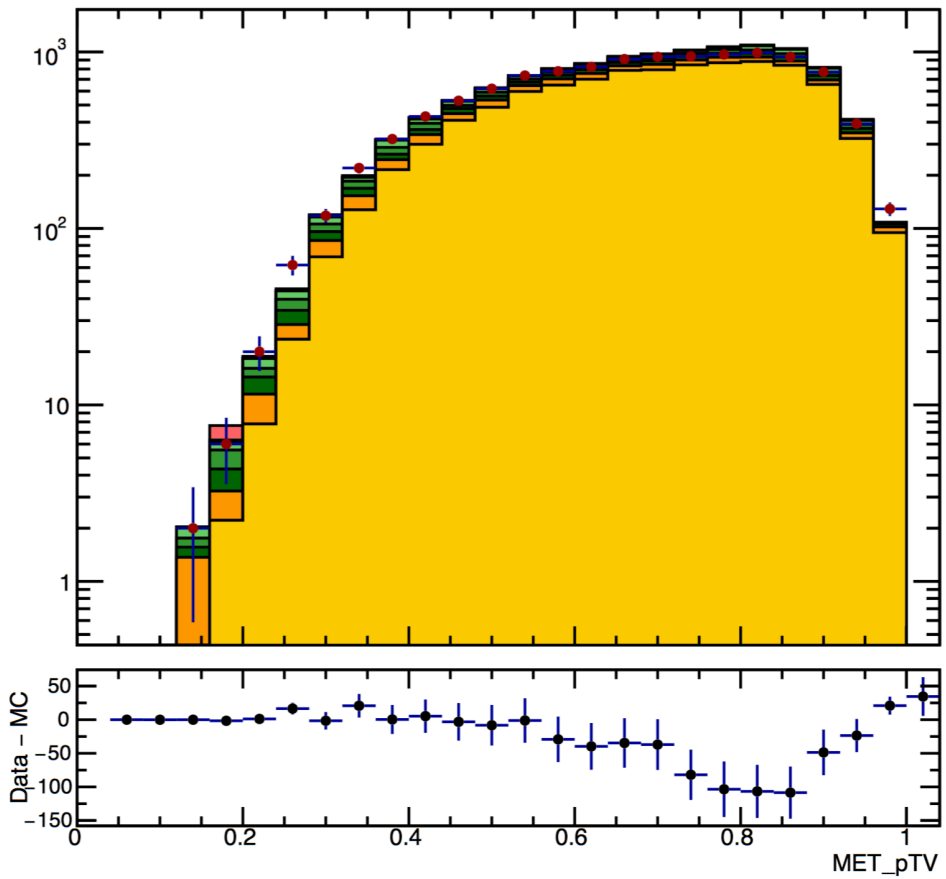
Tighter MET cut





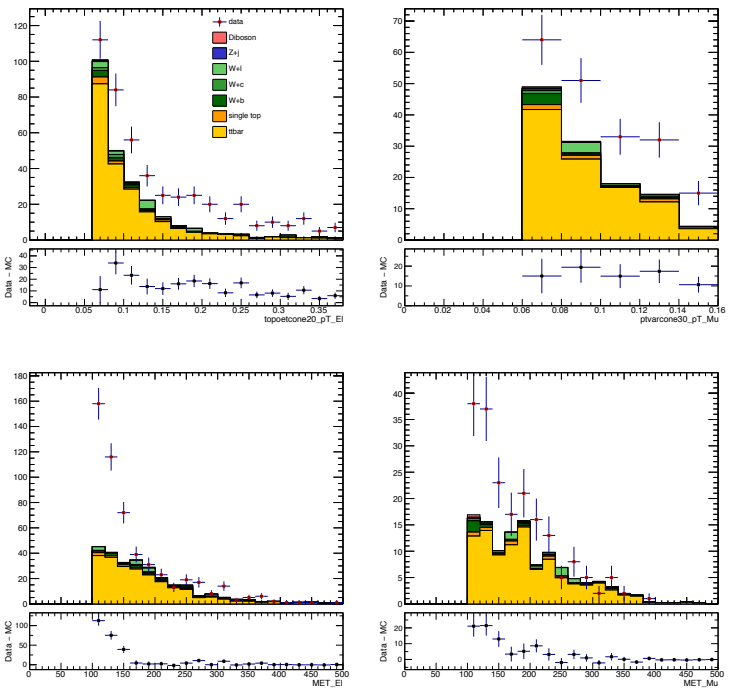
Takuya cut: MET/pTV > 0.2

1tag1pfat tight lepton

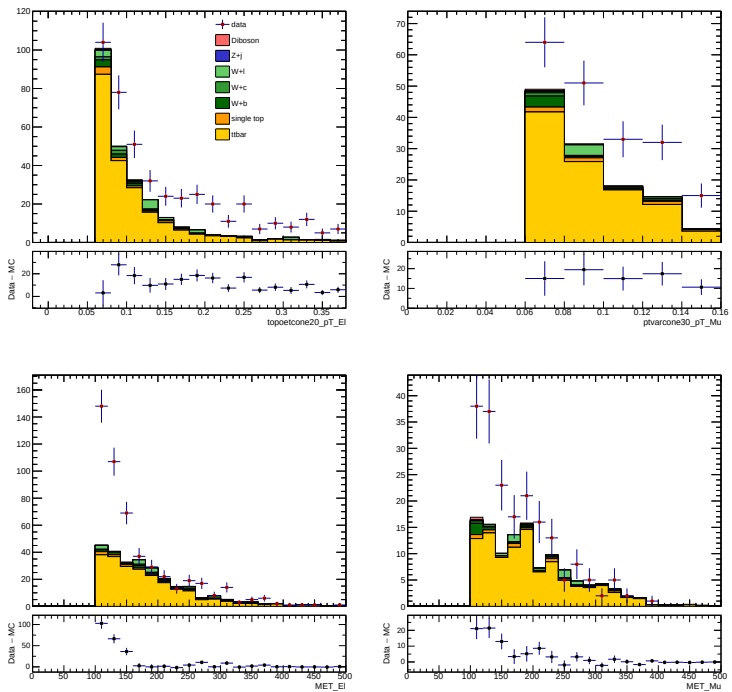


Takuya cut: MET/pTV > 0.2

MJ estimate, no cut



MJ estimate, with cut



Cut has basically no effect on MJ estimate.

Summary

- MJ background was estimated for MET in **1tag1pfat** (PRSR) regions with the **Isolation Inversion** method
- Naive fit shows very small (**negligible?**) MJ contribution
- Tighter MET cut would **eliminate** MJ even in the inverted isolation region but would also kill large fractions of signal, esp. for low resonance masses
- First checks with Takuya cut don't show improvement

Not mentioned today: Fake Factor method (resolved).

Short summary:

- Had to produce new MJ CxAODs — missing 1-jet events.
- First check: necessary events are there.
- ToDo: Split into $E_{\mathrm{T}}^{\mathrm{miss}}$, $|\eta|$, $p_{\mathrm{T}}^{\mathrm{V}}$ bins and calculate f

BACKUP

Detailed requirements – Fake Factor CRs