TTbar and W+jet Background Estimate for the RA2

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- Reminder: Description of data-driven TTbar and W+jets background estimation method
- Recent developments:
  - Integration into Christians tool (combining background estimates) & migration to CMSSW_3_X_Y
  - Investigations of uncertainties
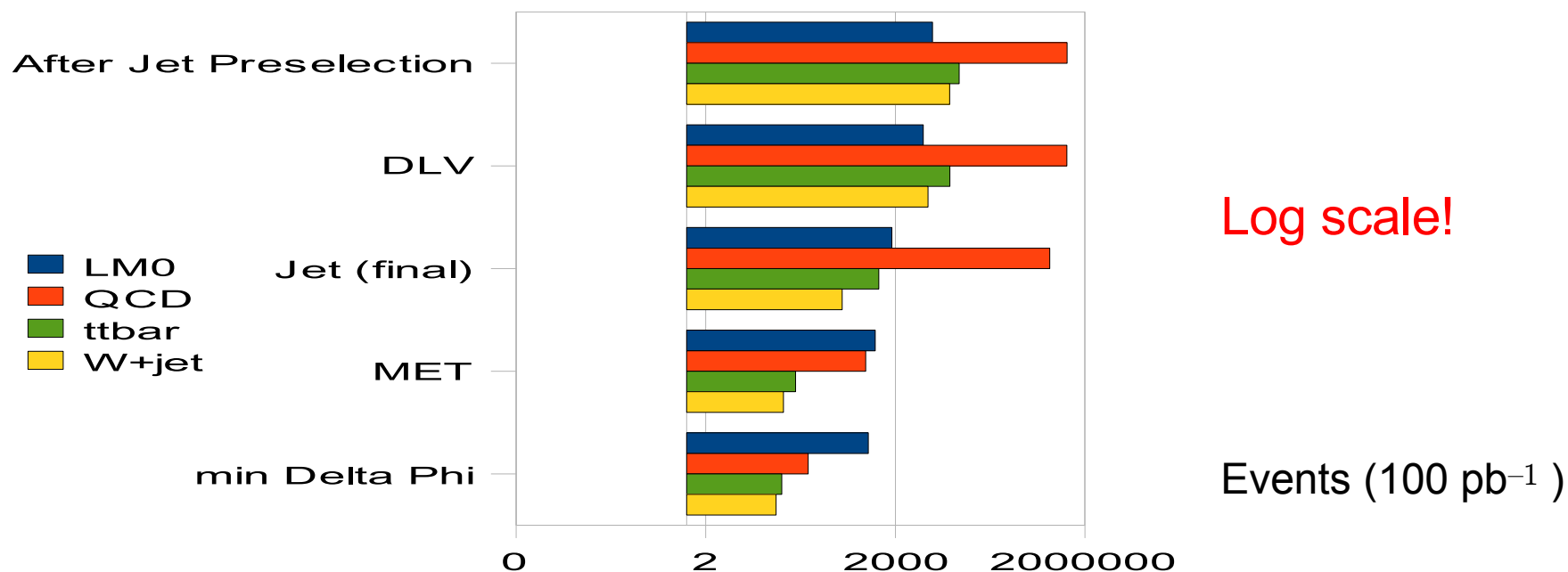 - Closure tests for TTbar&W+jets: electron/muon channel
- Summary & Outlook

For the inclusive Njet SUSY search following cuts are applied:

P_T (Jet1) > 180 GeV, P_T (Jet2) > 150 GeV, P_T (Jet3) > 50 GeV
missing E_T > 150 GeV
min Delta Φ (Jet1/2/3, missing E_T) > 0.3
Direct Lepton Veto (= no isolated lepton allowed)

Log scale!

Events (100 pb^{-1})
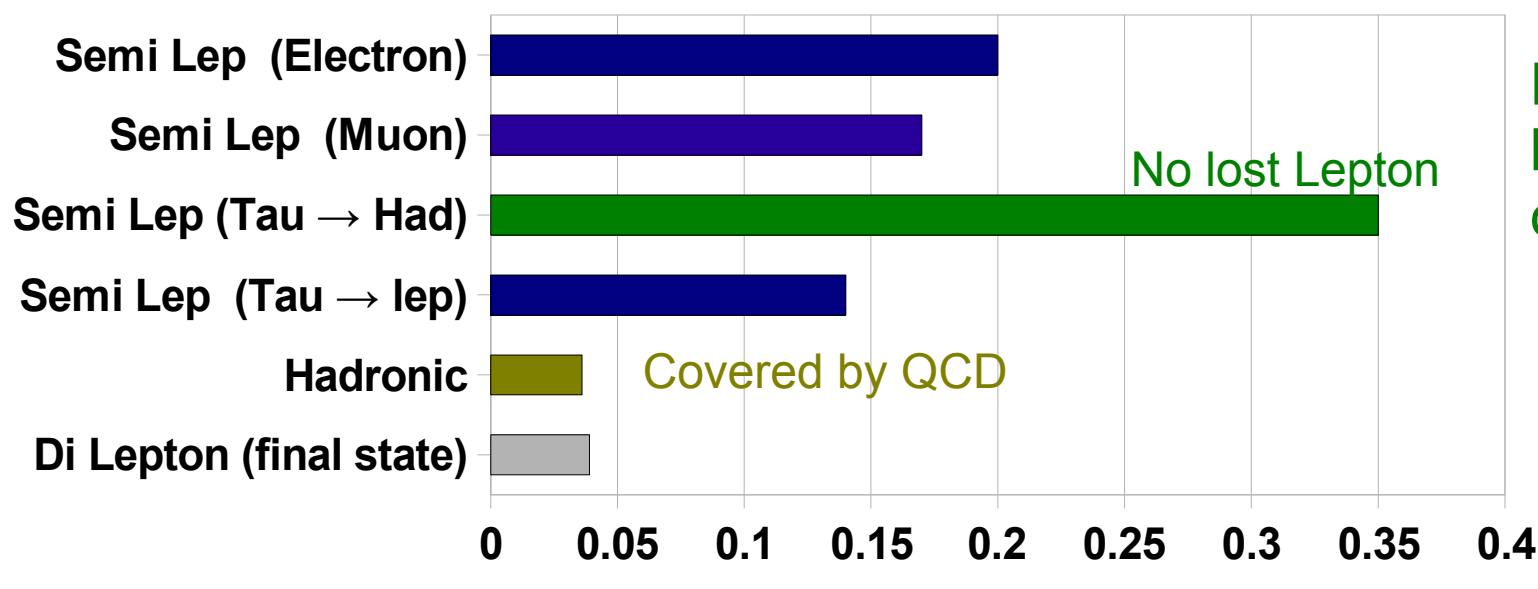
Direct Lepton Veto (DLV) mainly rejects leptonic TTbar and W+jet events
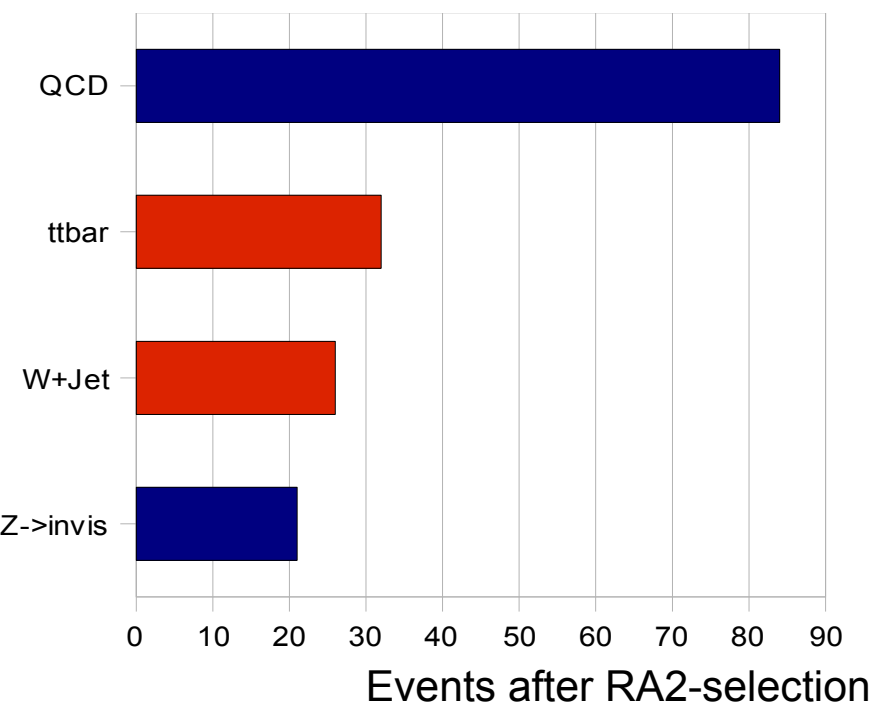
- TTbar and W+jet events have real missing E_T in leptonic channel
- This lepton is not identified
- It is difficult to separate TTbar and W+jet events completely
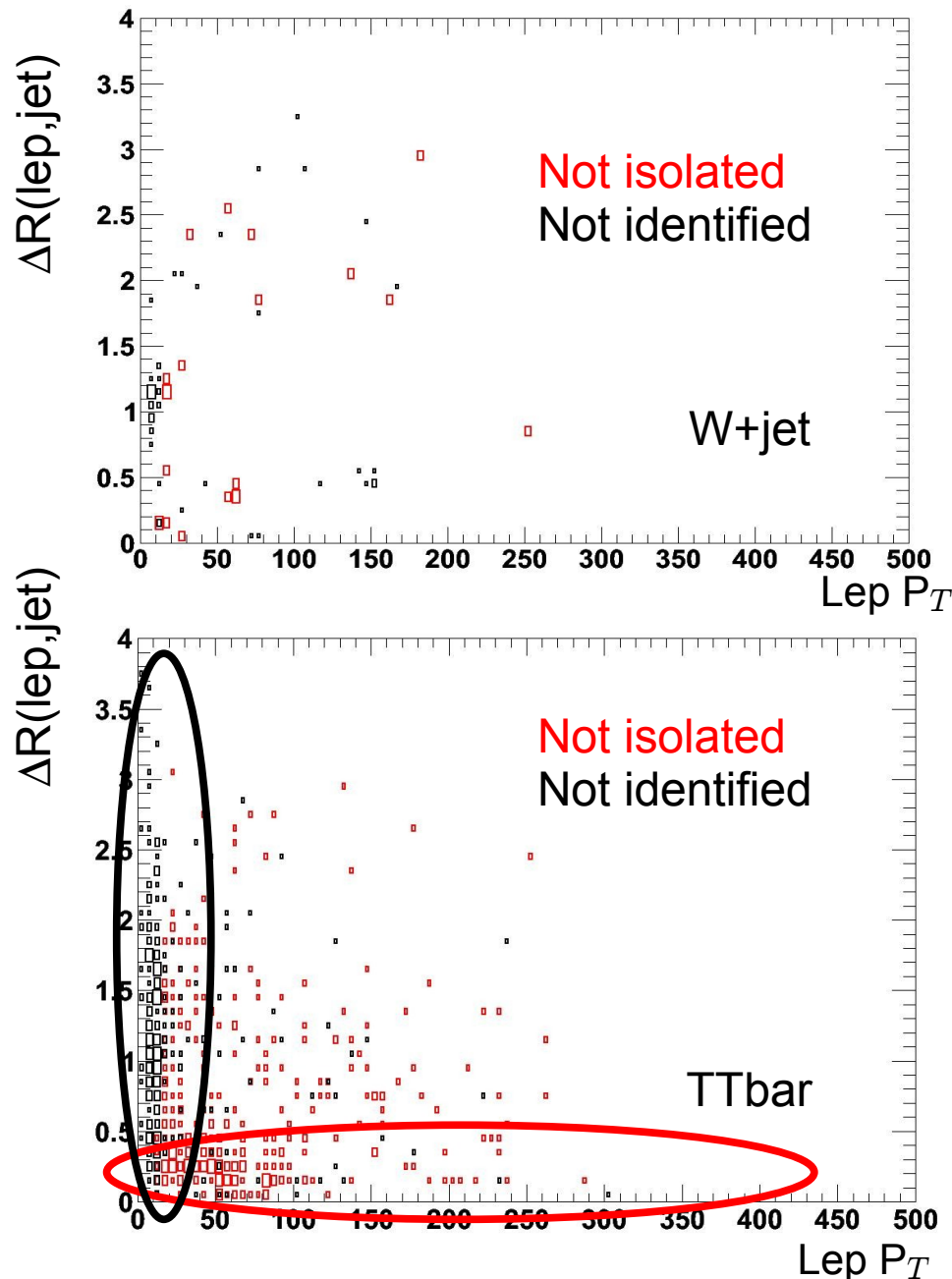
➡ **Combine TTbar and W+jet**

Events after RA2-selection

Hadronic tau background is cared for by Maria

No lost Lepton

Covered by QCD

Fraction of TTbar background

Problem:

Different topology in TTbar and W+jet events:

- Boosted top emits W (and therefore lepton) and b close to each other
- ➔ Closest jet is in most cases the associated b-jet
- ➔ Isolation efficiency lower for TTbar events
- ➔ Efficiency in bins of ΔR
- In very hard pp-collisions more W^+ produced W polarization (Markus Stoye)
- ➔ More low P_T leptons in high missing E_T events (out of acceptance)
- ➔ Increases syst. uncertainty

Idea of DLV-Cut Inversion

Direct **L**epton **V**eto: no lepton within event : $P_T > 15$, rel isolation < 0.1 (muon) / 0.5 (electron), passed quality cuts (isGlobalPromtTight, $d_0 < 0.2$cm)
Invert Veto: requiring **exactly one** isolated lepton in control sample

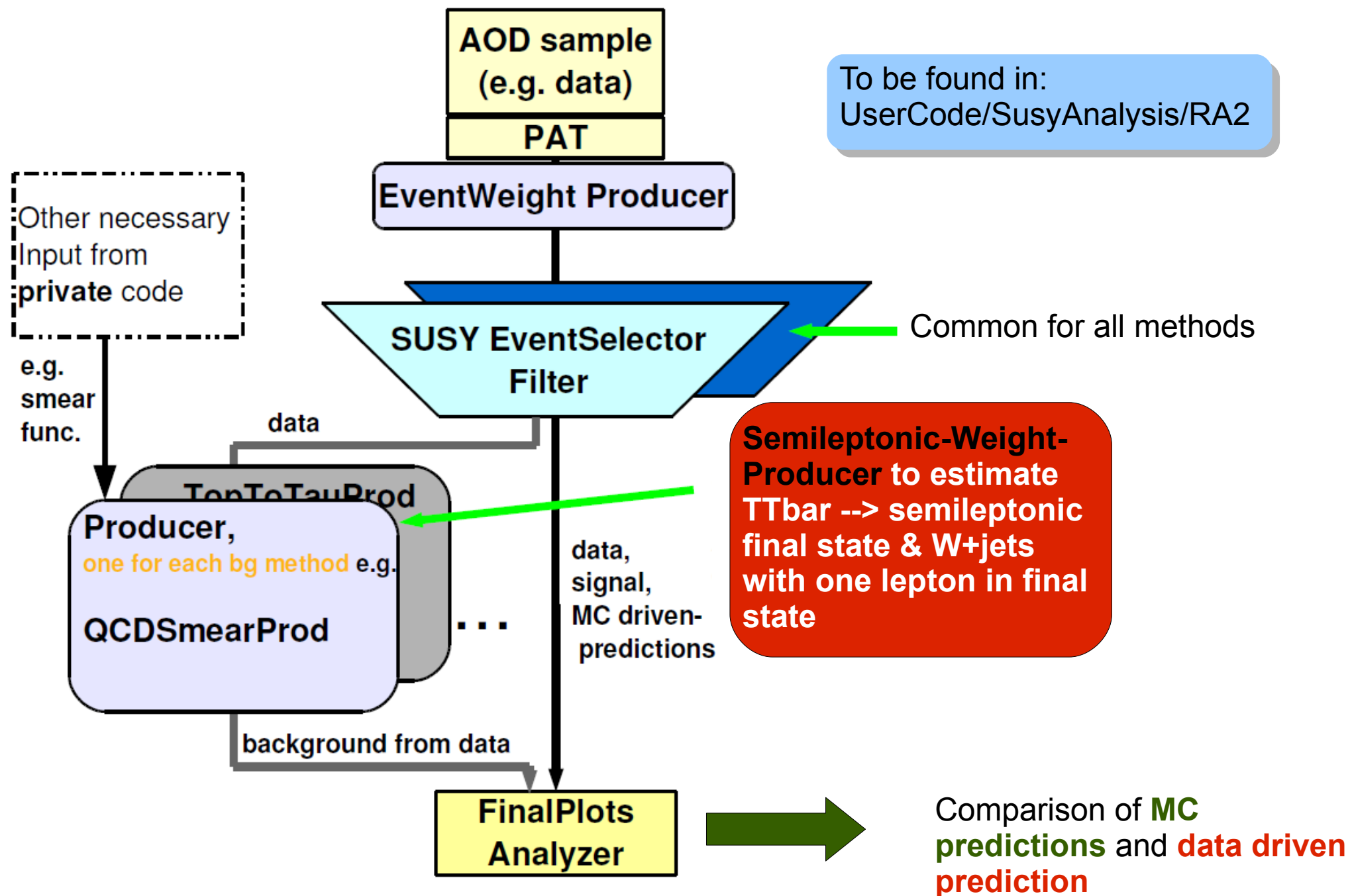|	Out of acceptance	In acceptance
Isolated	Background C	Control Sample
Not Isolated	Background B	Background A (most important)

A = Control * (1 - Iso Eff)/Iso Eff
B = A * acceptance Ratio
C = Control * acceptance Ratio
Total Background: A + B + C
(corrected with RECO Eff)

- Reconstruction efficiencies as a function of P_T are found from tag and probe method $Z \to \mu \mu$

- Isolation efficiencies as a function of ΔR and relative P_T from tool similar to tag and probe method usable on TTbar & W+Jet. **Thanks to Giovanni Petrucciani** migration to 'official' tag and probe $Z \to \ell\ell$ in progress

- P_T distribution and ratio of TTbar to W+jet from simulation as these information are quite reliable

AOD sample (e.g. data)

PAT

EventWeight Producer

To be found in: UserCode/SusyAnalysis/RA2

Other necessary Input from **private** code

e.g. smear func.

SUSY EventSelector Filter

Common for all methods

data

TopToTauProd

Producer,
one for each bg method e.g.

QCDSmearProd

...

Semileptonic-Weight-Producer to estimate TTbar --> semileptonic final state & W+jets with one lepton in final state

data, signal, MC driven-predictions

background from data

FinalPlots Analyzer

Comparison of **MC predictions** and **data driven prediction**

Closure Test TTbar standalone

- Work in progress. Result preliminary!

- Shape and predicted number of events agree within uncertainties

- Region with low statistics in small ΔR bins get high weight factor as $(1-\varepsilon_{iso})$ is large

→ Main uncertainties from limited statistics in control region

- Systematic uncertainties dominated by uncertainty of the isolation efficiency

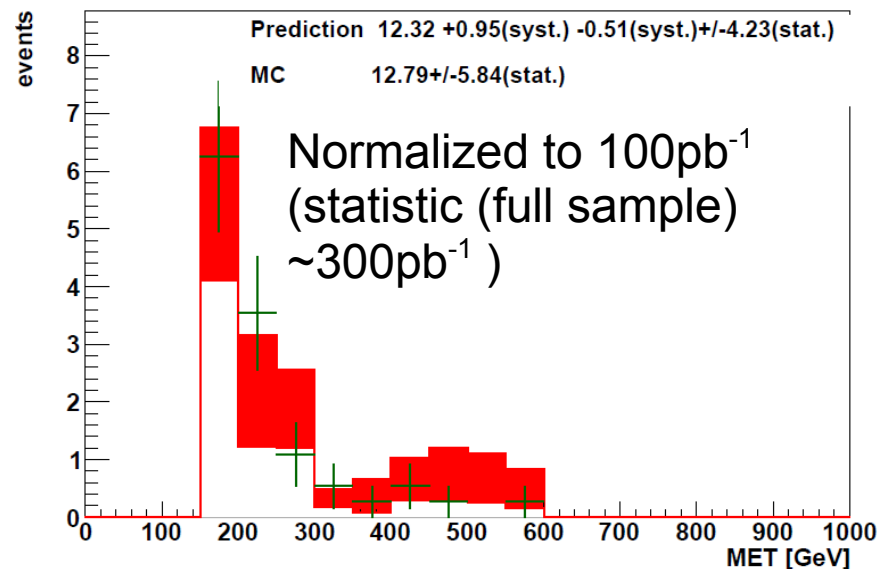 - Here: statistical uncertainties from tag and probe method

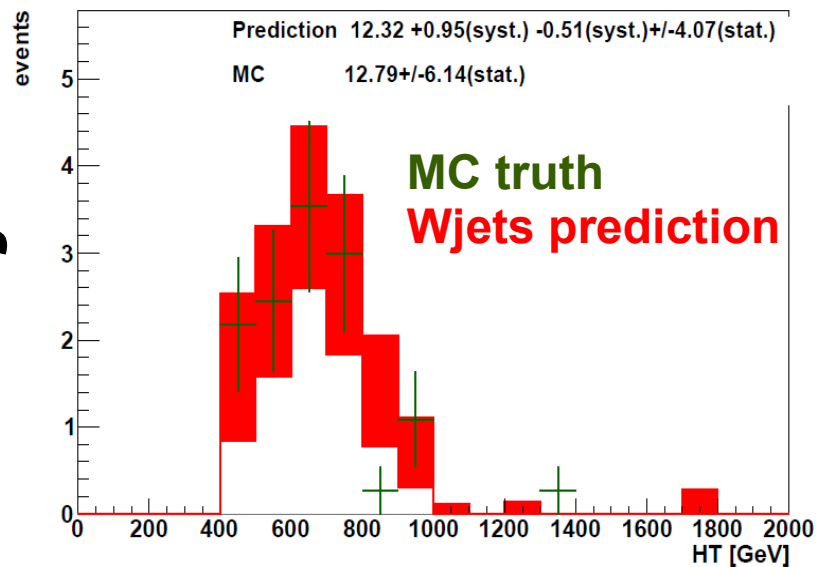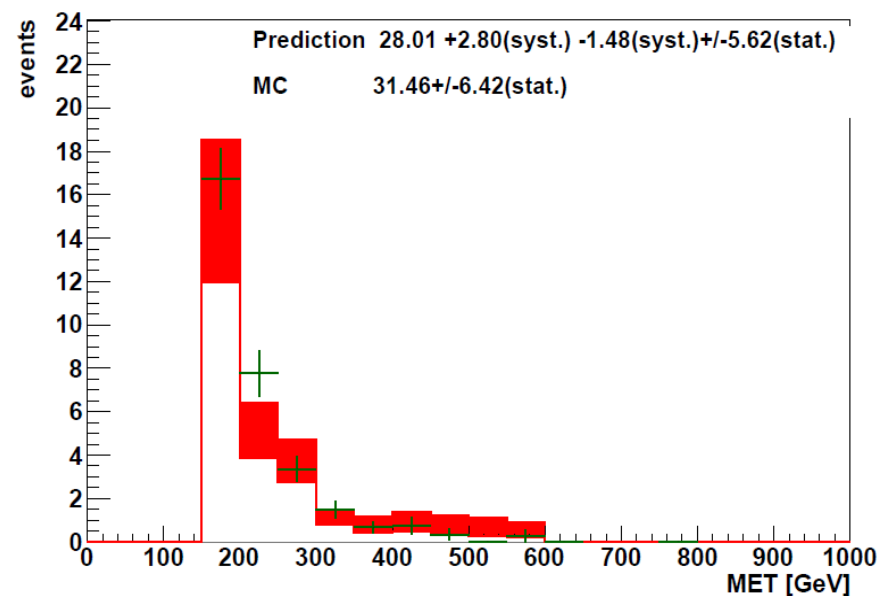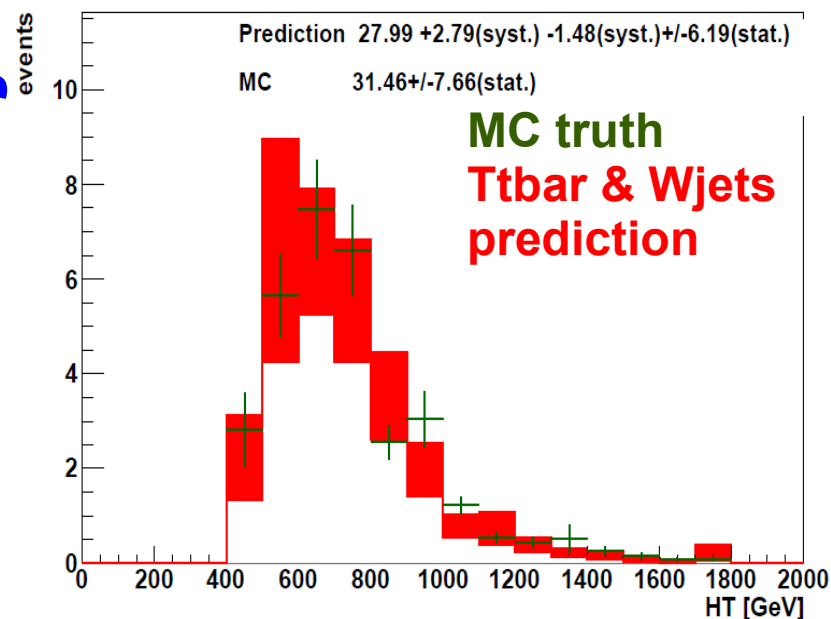Prediction 15.67 +1.85(syst.) -0.97(syst.)+/-3.75(stat.)
MC   18.67+/-3.21(stat.)

MC truth
TTbar prediction

Prediction 15.69 +1.85(syst.) -0.97(syst.)+/-2.93(stat.)
MC   18.67+/-2.19(stat.)

Normalized to 100pb^{-1}
(statistic (full sample) ~3fb^{-1})

HT

MET

W+jets

Ttbar & W+jets

Prediction 12.32 +0.95(syst.) -0.51(syst.)+/-4.07(stat.)
MC   12.79+/-6.14(stat.)

MC truth
Wjets prediction

Prediction 12.32 +0.95(syst.) -0.51(syst.)+/-4.23(stat.)
MC   12.79+/-5.84(stat.)

Normalized to 100pb⁻¹
(statistic (full sample)
~300pb⁻¹)

Prediction 27.99 +2.79(syst.) -1.48(syst.)+/-6.19(stat.)
MC   31.46+/-7.66(stat.)

MC truth
Ttbar & Wjets prediction

Prediction 28.01 +2.80(syst.) -1.48(syst.)+/-5.62(stat.)
MC   31.46+/-6.42(stat.)

Summary & Outlook

- Successful migration to CMSSW_3_X_Y release

- Integration into the RA2 framework (Ch. Autermann)

- Good results for combined closure test (W+jet & TTbar) for electrons and muons

- Statistical uncertainties dominate until ~1fb^{-1}

- Migration to 'new' official Tag&Probe tool started recently, providing feedback to MuonPOG

- Signal contamination:

  - First glance on signal contamination:

    - For both LM1 and LM4 about 2/3 of TTbar statistics in control sample **but** mainly large values in ΔR --> only small weight factors (more quantitative studies ongoing)

    - Double check that contaminations from QCD are negligible by using b-enriched QCD sample

  - Reproduce all plots with new efficiencies and include them to RA2-note

Ttbar:

/TTbarJets-madgraph/Summer09-MC_31X_V3-v2/GEN-SIM-RECO

W+jets:

/Wjets-madgraph/Summer09-MC_31X_V3-v1/GEN-SIM-RECO

Skimmed and 'patified' using CMSSW_3_1_4 and SUSY recipe

T&P sample Z+jets 'available' in CMSSW_3_4_1:

/Zjets-madgraph/Summer09-MC_31X_V3-v1/GEN-SIM-RECO