Status & Plans

Top Quark Mass Measurement in the “Lepton + Jets” Channel

Andreas Jantsch

Max-Planck-Institut für Physik
München

MPI Top Meeting
October 19th, 2009

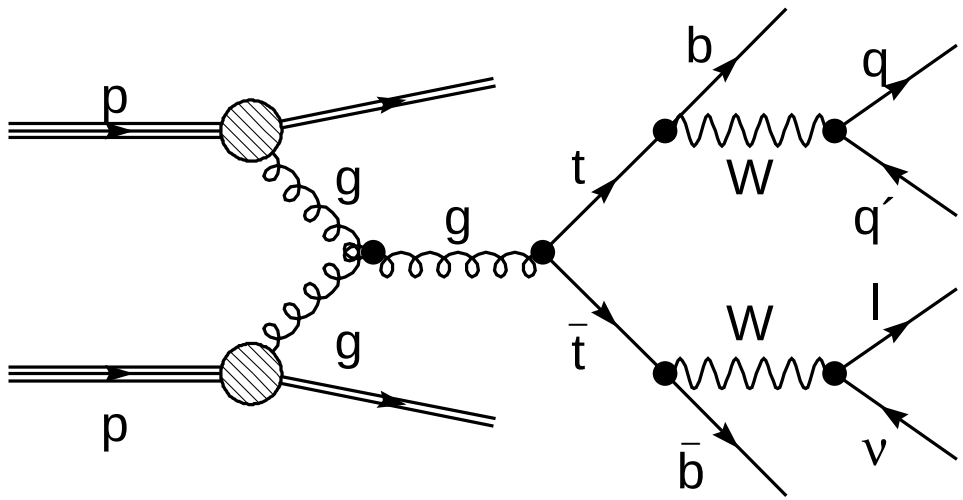
GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

Outline

Introduction: Lepton plus Jets channel

- ⇒ Top Mass measurement in lepton plus jets channel
- ⇒ This talk: results only electron plus jets channel
- ⇒ Data analysis planned for the first 50 pb^{-1} & 200 pb^{-1}



Introduction: Analysis Strategy

Event Selection

- So far: usual cut based selection
- Imrovement under investigation

Reconstruction

- Test of several assumptions/methods
- No B-tagging used

Jet Calibration

- Using my own jet calibration:
  - $\Rightarrow$ Monte Carlo based Jet Level Corrections
  - $\Rightarrow$ Based on QCD Di-Jet events
  - $\Rightarrow$ Jet Shape information used

Measurement

$\Rightarrow$ How to get a top mass value from the final distribution?

Event Selection

- Single Top Note
- Random Event selection for corresponing Luminosity

$\Rightarrow$ MC@NLO: $N_{events} \neq N_{entries}$

Reconstruction

Challenge: find the 3 jets from the hadronic top

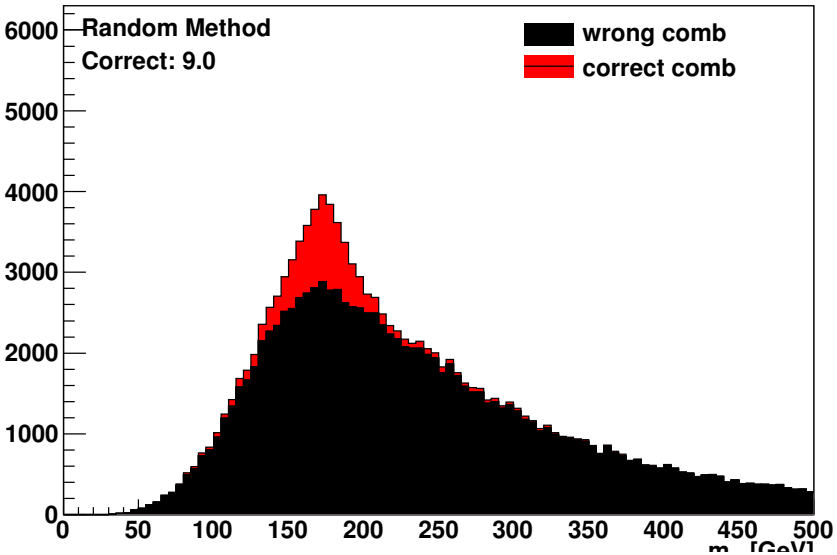
Hadronic Side only

- Check all jet triplets and take the one with:
  - $\Rightarrow$ Random choice (as a reference)
  - $\Rightarrow$ Maximum p_T of the triplet
  - $\Rightarrow$ Minimum of the biggest ΔR in the triplet

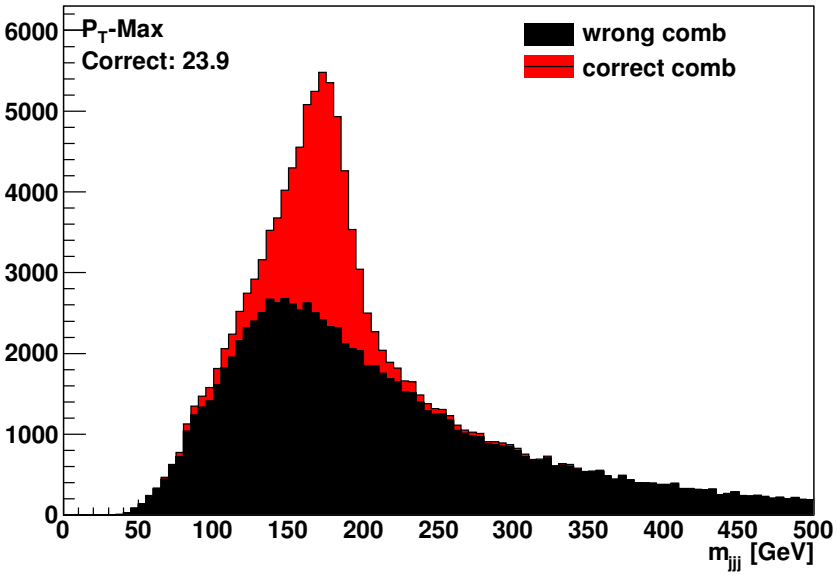
Full Reconstruction

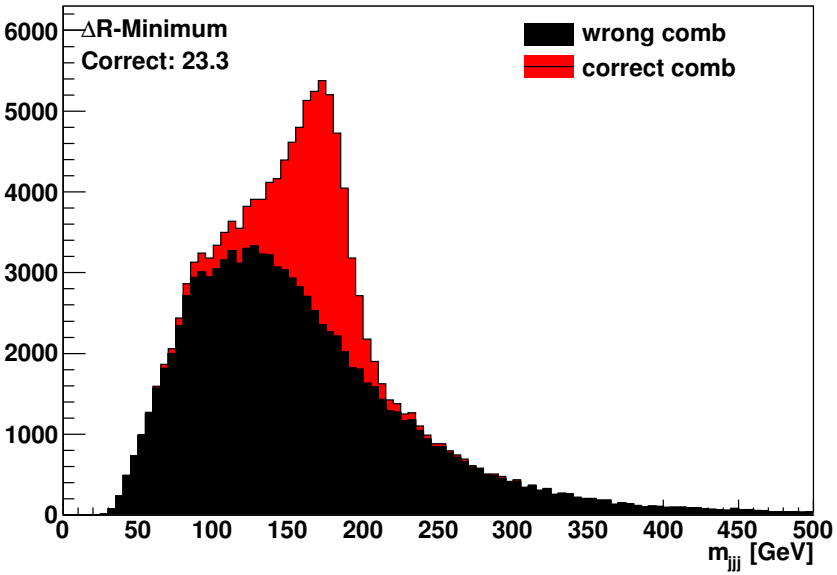
- Check all combinations to reconstruct leptonic and hadronic side
- Here: the 3 highest p_T-jets are always used
- Take the configuration with:
  - $\Rightarrow$ Minimum Δp_T (a.k.a. p_T-Balance)
  - $\Rightarrow$ Maximum $\Delta\phi$
  - $\Rightarrow$ Minimum ΔM

Reconstruction: Hadronic Side only

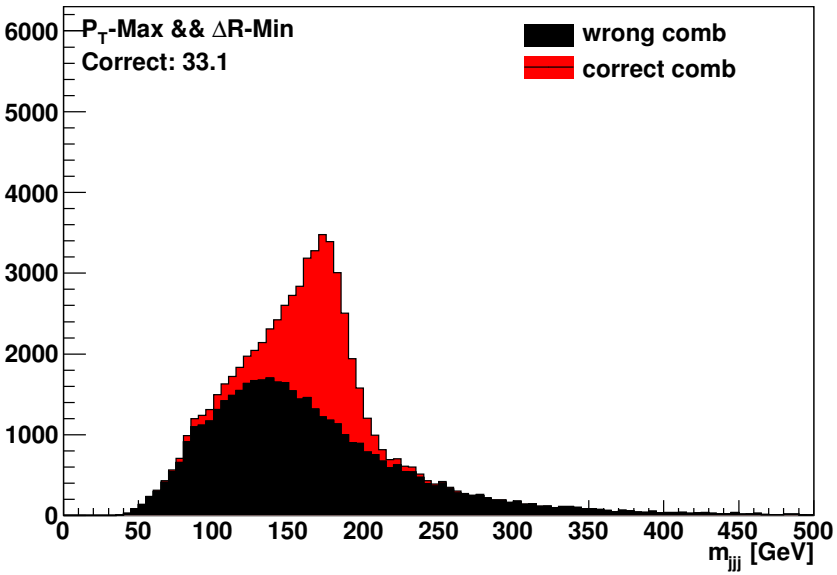


- Check overlap with top quark within $\Delta R < 0.2$
- Signal only to check combinatorical background
- Combination of methods?





Reconstruction: Hadronic Side only

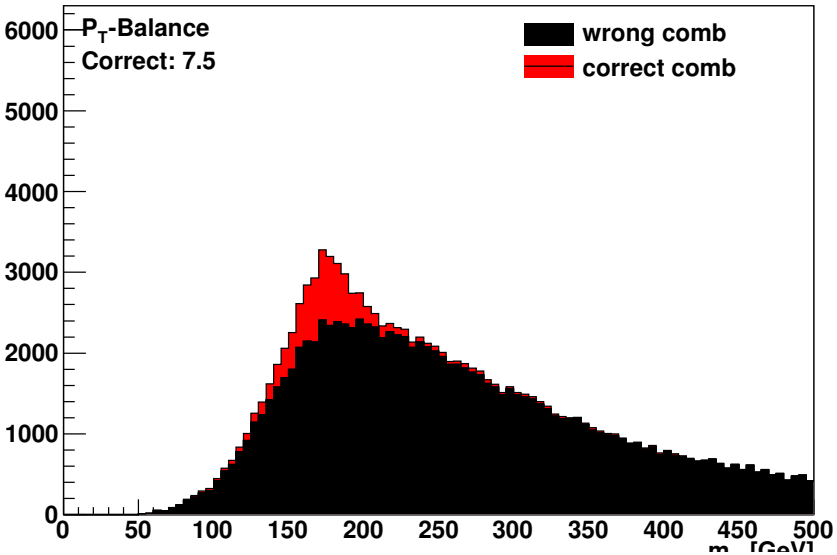


- ΔR-Min & P_T-Max

$\Rightarrow$ Statistics decreases

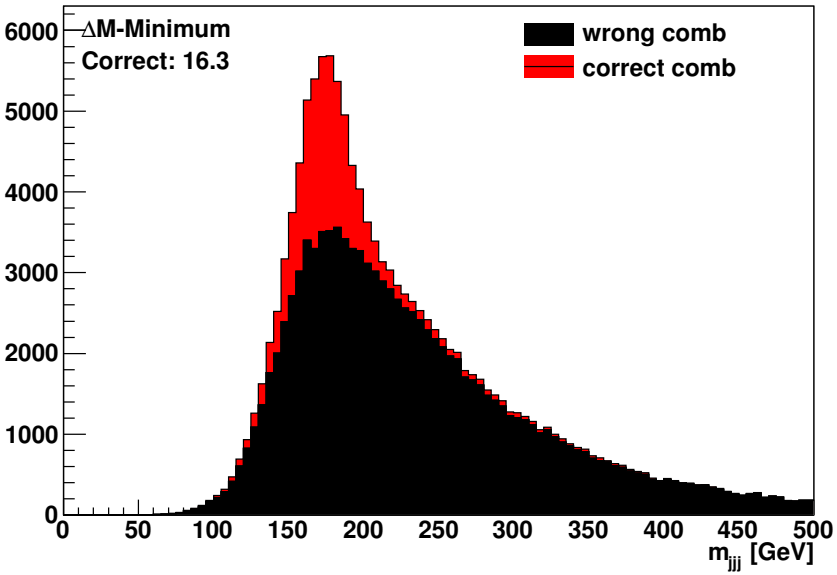
$\Rightarrow$ But 1/3 correct combinations

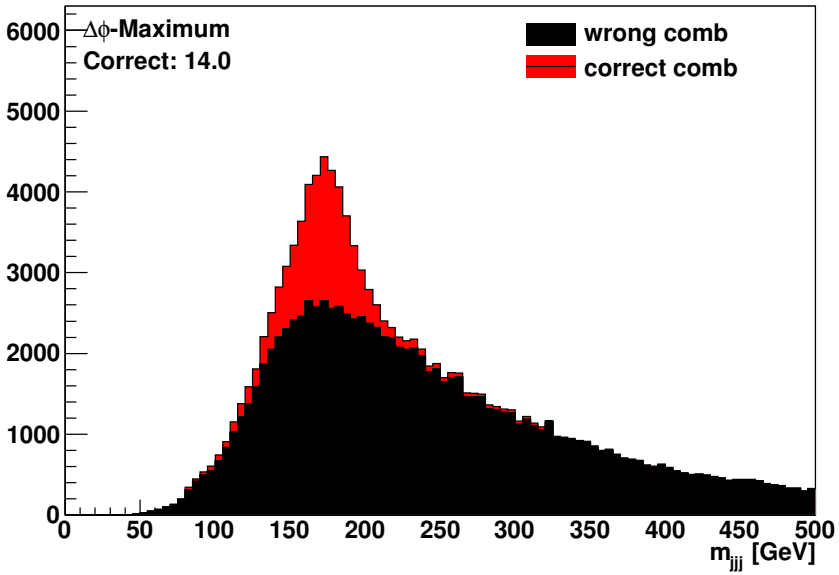
Reconstruction: Full Reconstruction



- Why P_T-Balance worse then random?
- General problem for mass and p_T: prefers smaller values

$\Rightarrow$ Better use Asymetry?
$|a-b|/(a+b)$



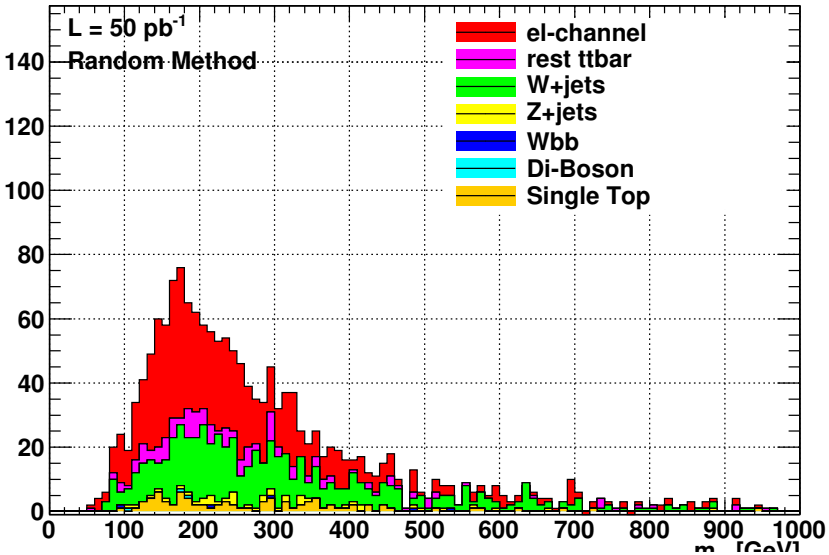


Physics Background

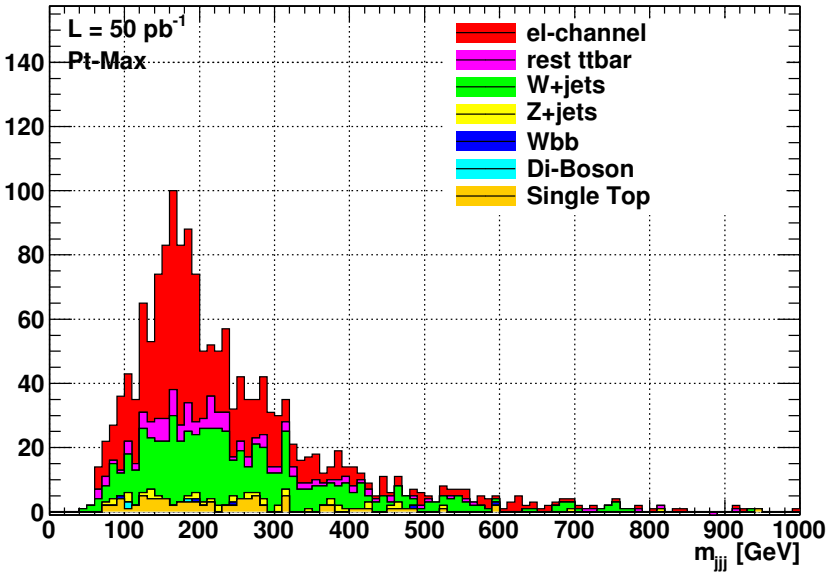
"All non-signal physics processes which pass the selection"

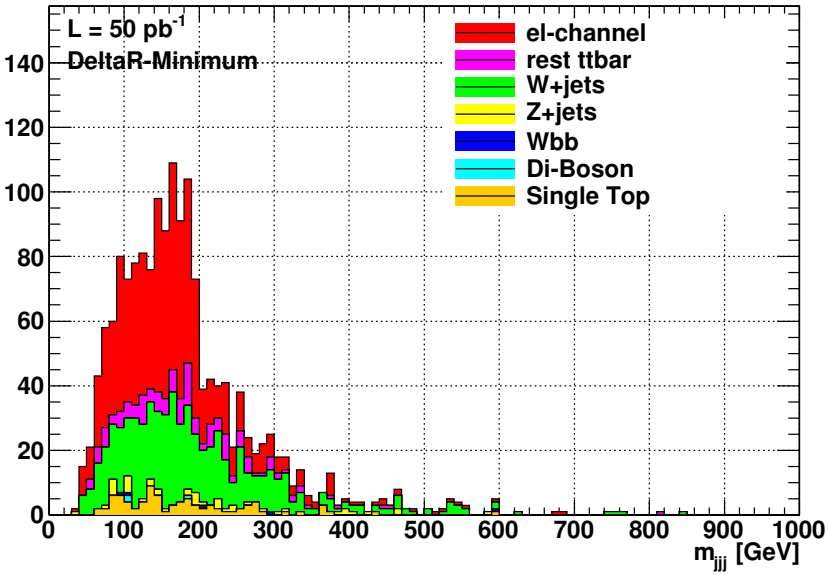
- $\Rightarrow$ Rest ttbar
- $\Rightarrow$ Single Top
- $\Rightarrow$ W plus jets (p0 & p1 only for $\sim 90\, pb^{-1}$)
- $\Rightarrow$ Z plus jets
- $\Rightarrow$ Wbb plus jets
- $\Rightarrow$ Di-Boson
- $\Rightarrow$ QCD background (not yet in)

First Results: Hadronic Side only

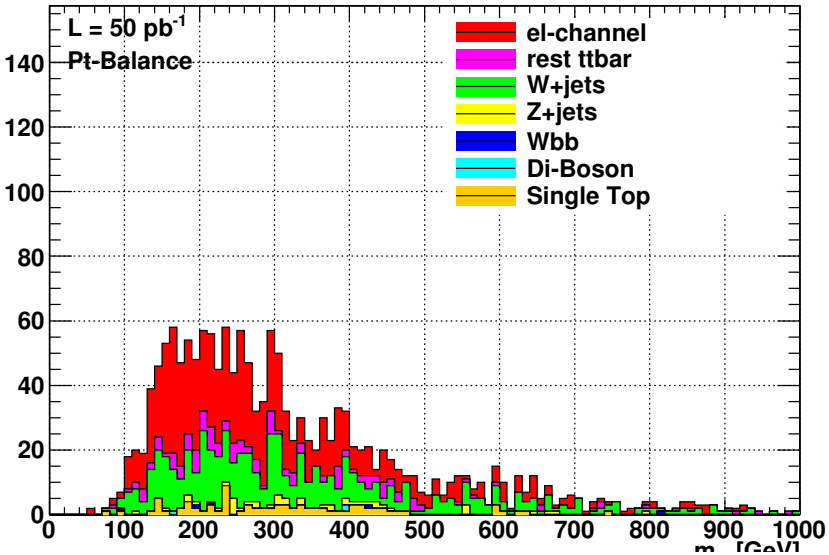


- $50\ pb^{-1}$

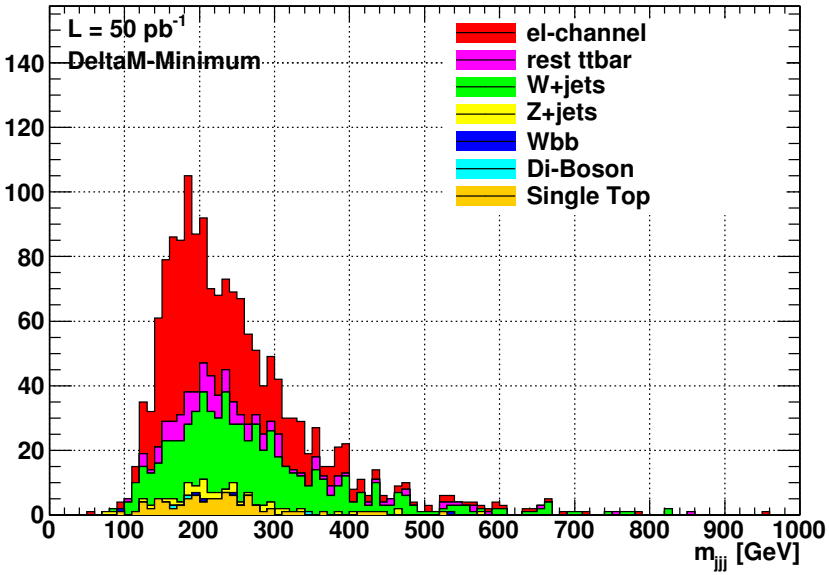


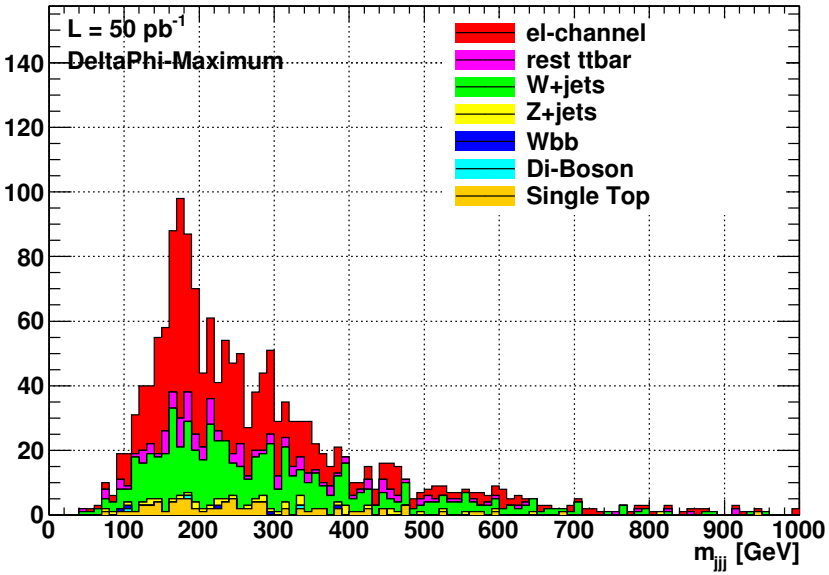


First Results: Full Reconstruction

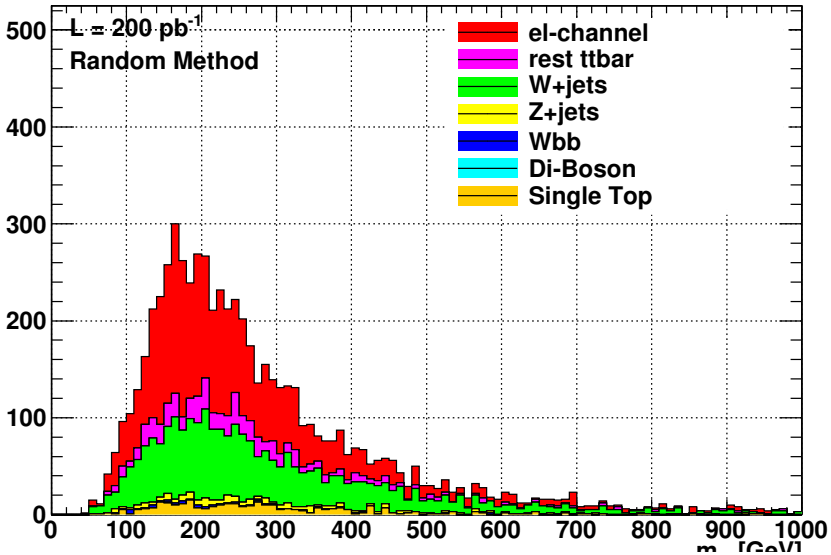


- $50\ pb^{-1}$

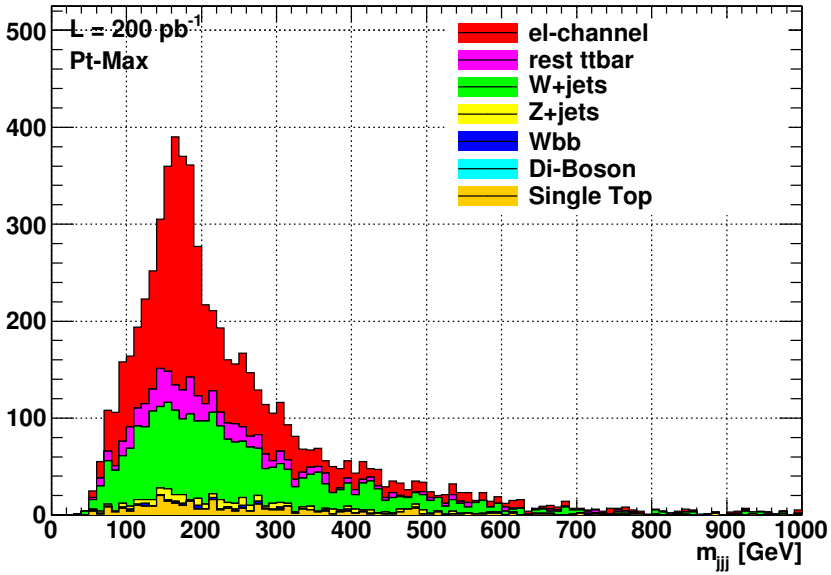


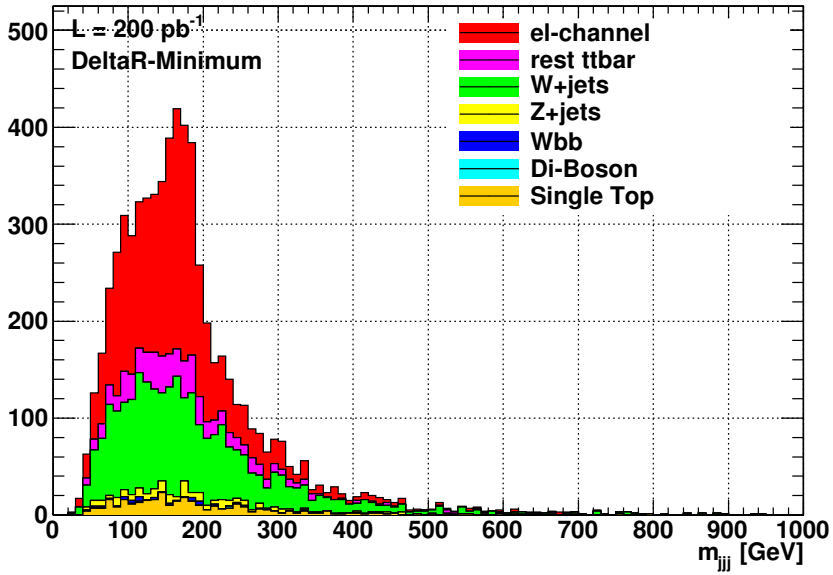


First Results: Hadronic Side only

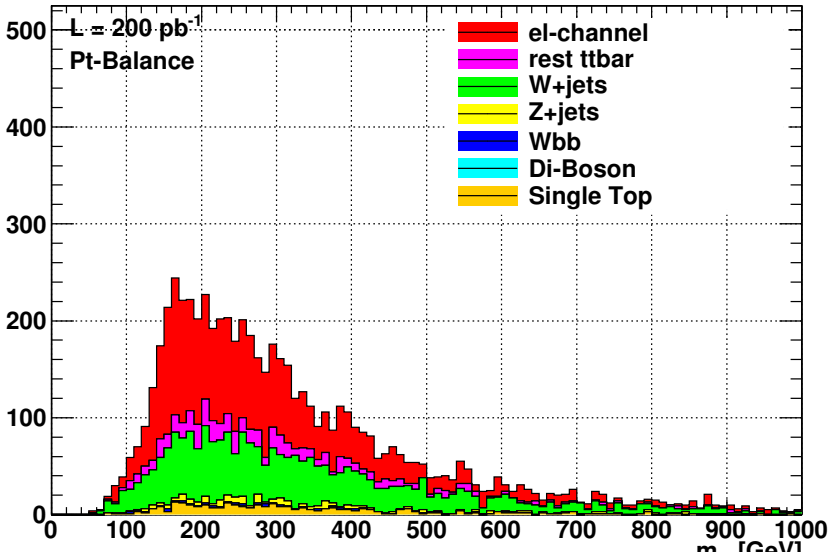


- $200\ pb^{-1}$
- AntiKt4-Jets

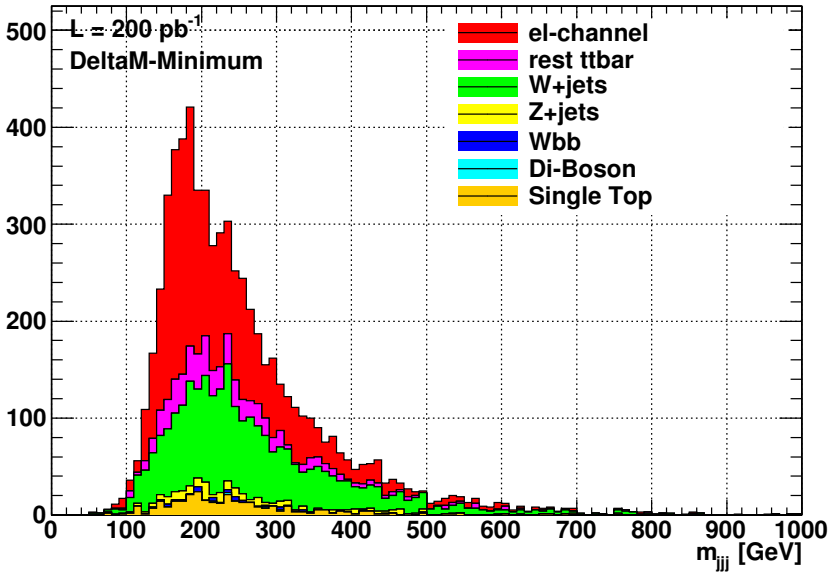


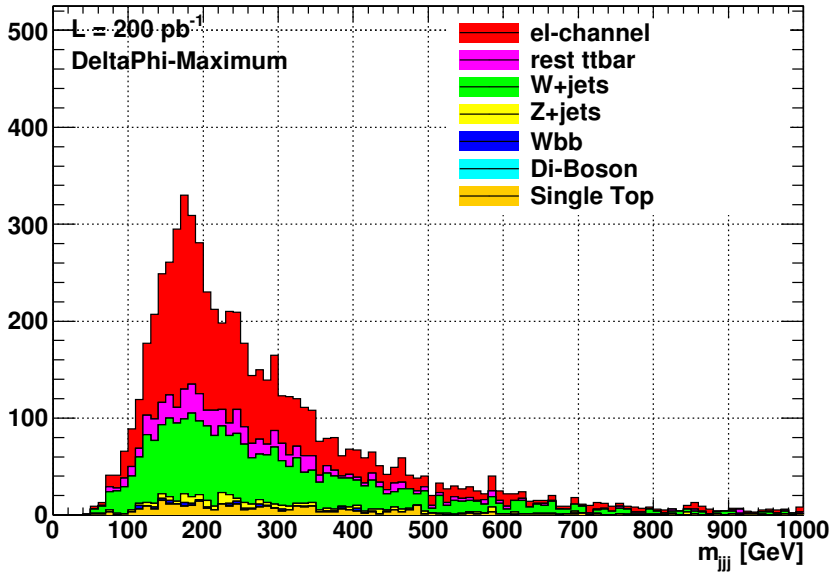


First Results: Full Reconstruction

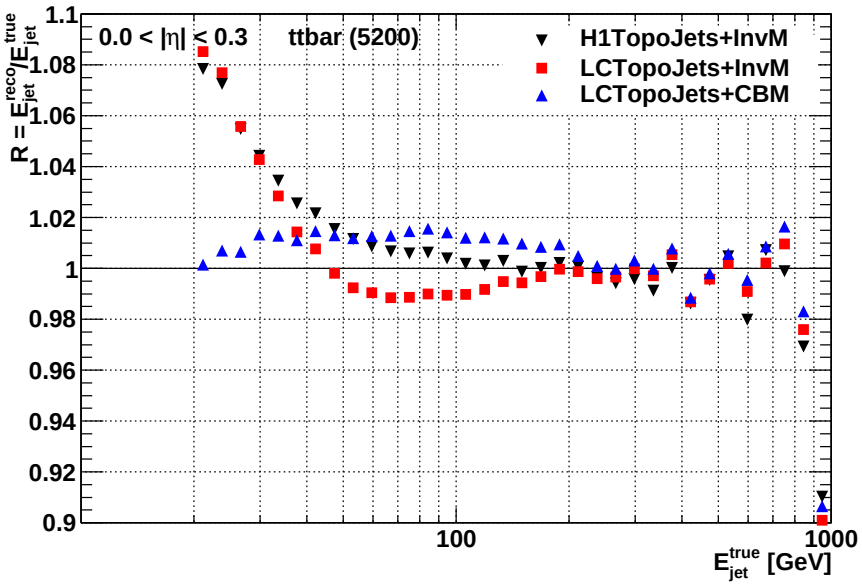


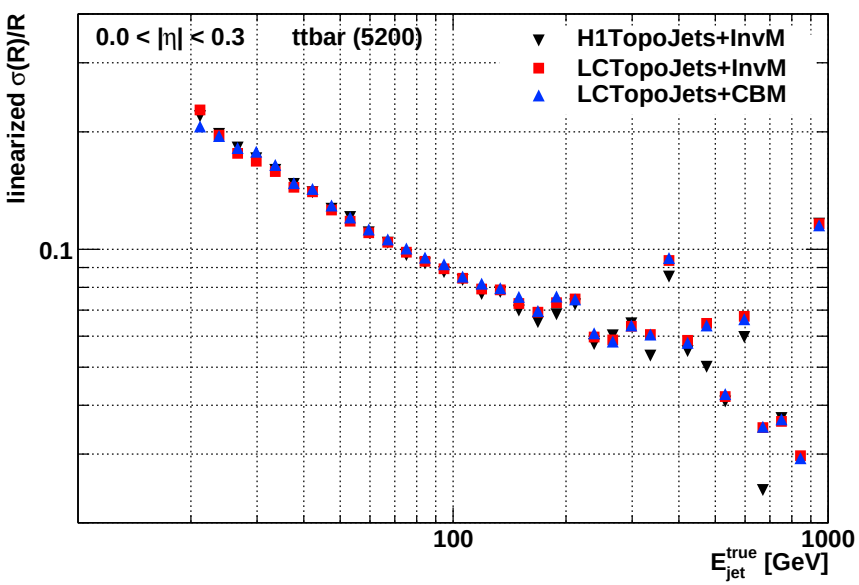
- $200\ pb^{-1}$
- AntiKt4-Jets



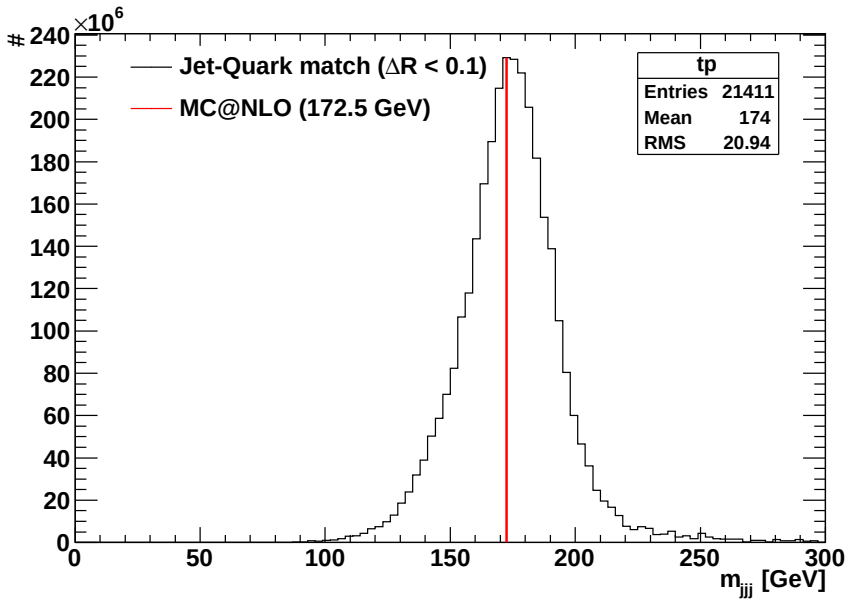


Calibration

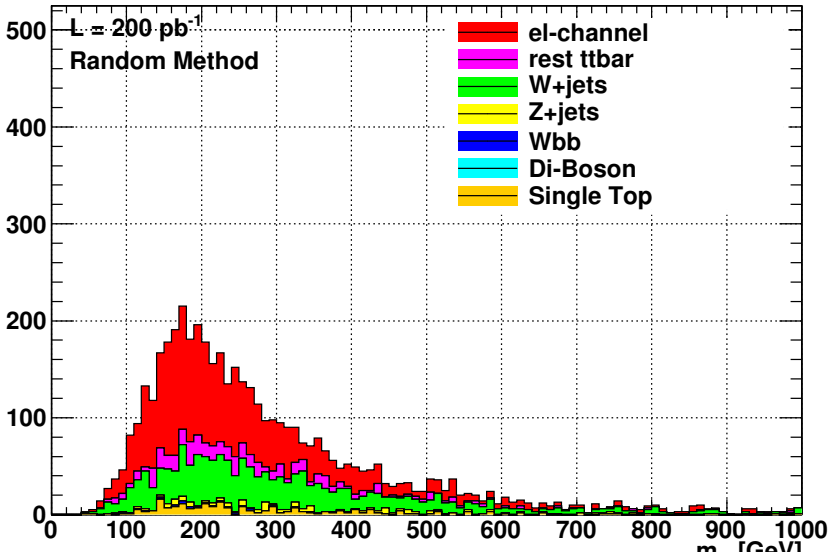




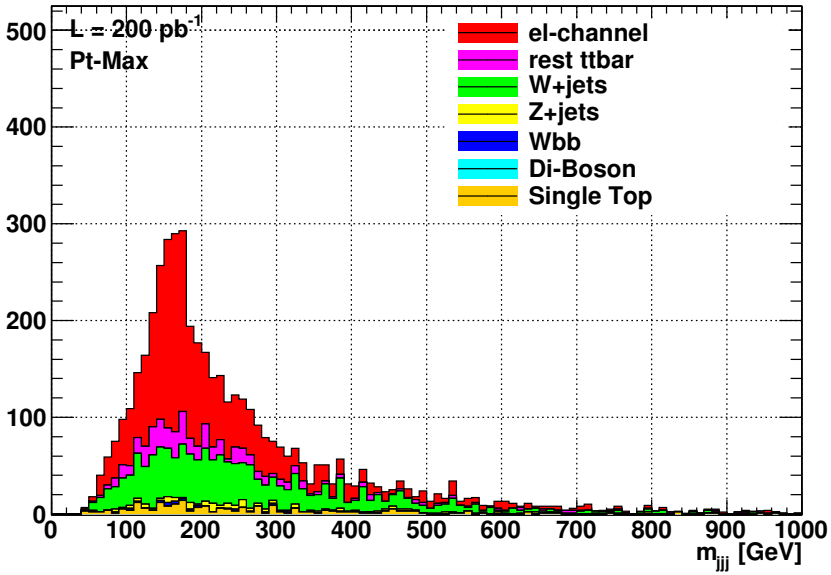
- JES for $t\bar{t}$-sample (5200)
  - $\Rightarrow$ Linearity for quark-jets $\sim 2\,\%$
  - $\Rightarrow$ Simpler "InvM" w/o using jet moment degrade to $\sim 9\,\%$
  - $\Rightarrow$ Resolution comparable
- Top Mass Reconstruction using quark match (no comb.)
  - $\Rightarrow$ Mean slightly overshooting

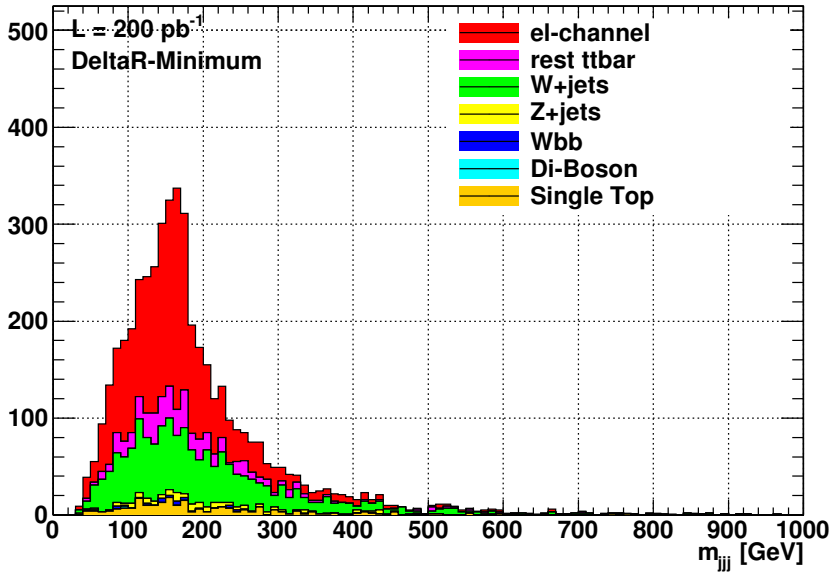


First Results: Hadronic Side only

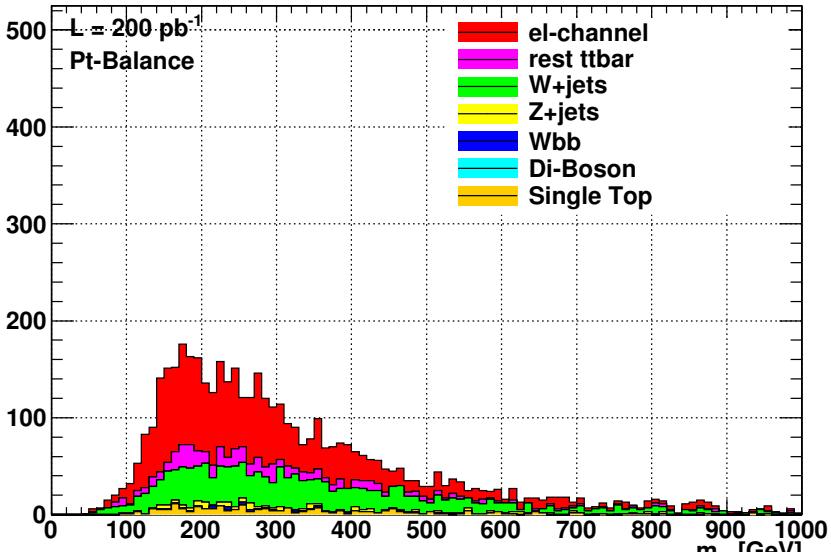


- $200\ pb^{-1}$
- AntiKt4-Jets, Local Hadron Calibration only



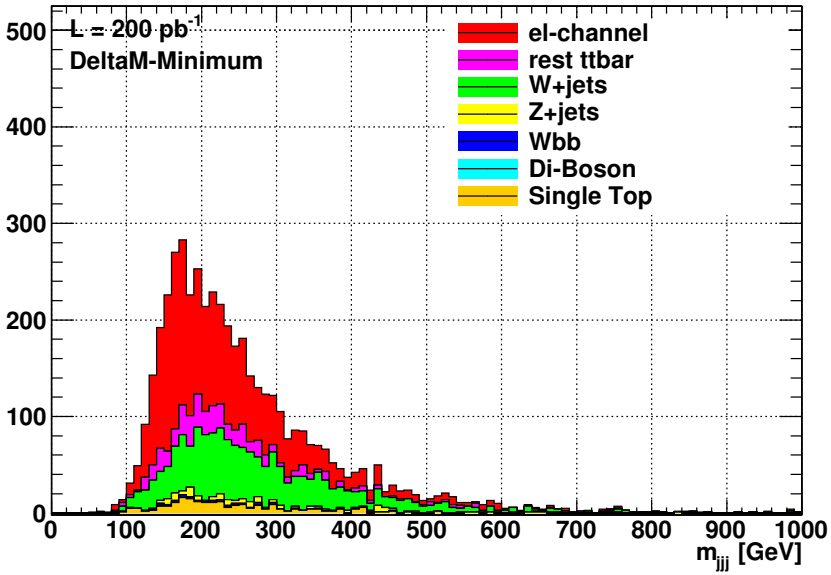


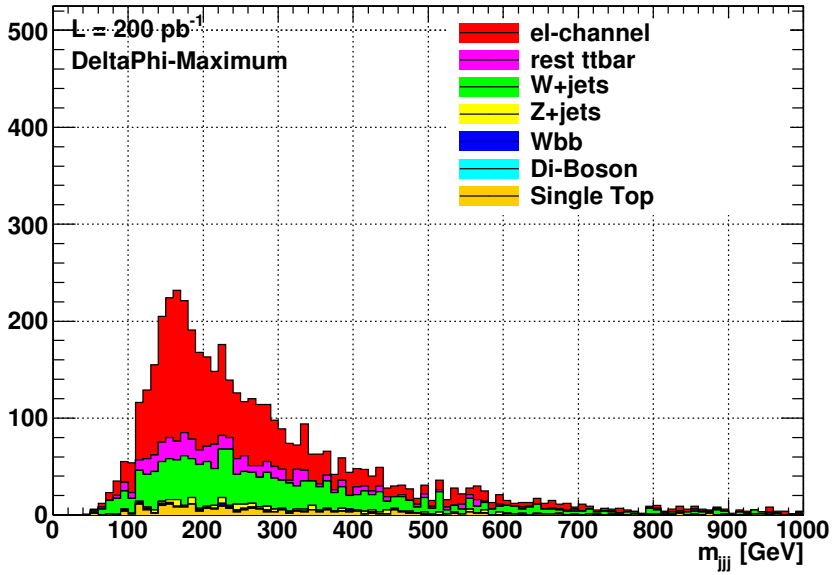
First Results: Full Reconstruction



- $200\,pb^{-1}$
- AntiKt4-Jets, Local Hadron Calibration only

$\Rightarrow$ better use Asymetry?
$|a-b|/(a+b)$





Measurement

- Looking for a good method to get the best top mass value from the final distribution

$\Rightarrow$ Fit (Gauss+Background)

$\Rightarrow$ Template Method not applicable due to different Jet Calibration

$\Rightarrow$ Ideas???