Royal Holloway
University of London

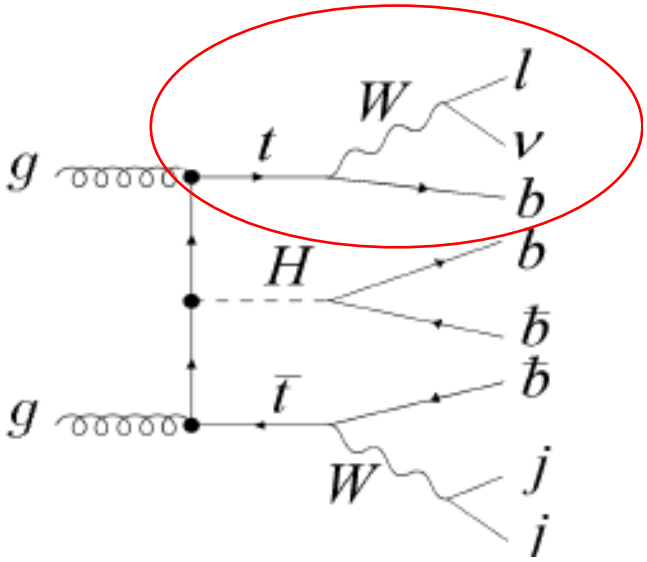
Study for $t\bar{t}H$ reconstruction

Work in progress…

Ricardo Gonçalo, Pedro Teixeira-Dias, RHUL

Introduction

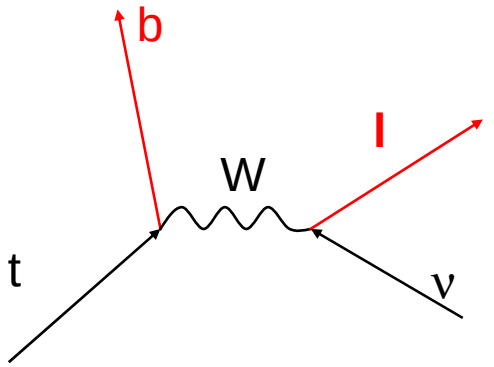
- This is a preliminary study intended for the CSC ttH, H→bb meeting (shown here due to colliding meetings, please bear with me)
- ttH, H→bb (and ttH in general) plagued by too many combinations of b/light jets and leptons; trying to find ways of reducing this number
- Concentrating on getting the right t→blν combination but also looked at t→bjj
- Already know that what I'll show won't help in the likelihood analysis (see Georges Aad's talk yesterday) but perhaps useful to someone else

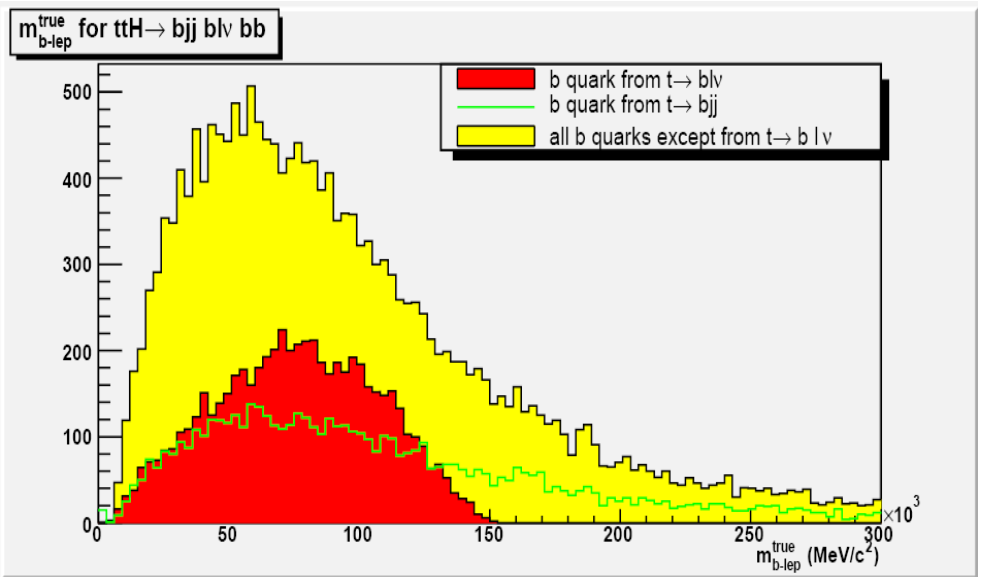


M(b,l) Kinematic edge

$$m_{b,l} = \sqrt{(b+l)^2} = \ldots \leq \sqrt{m_t^2 - m_W^2 + O(0)} \approx 156 GeV$$

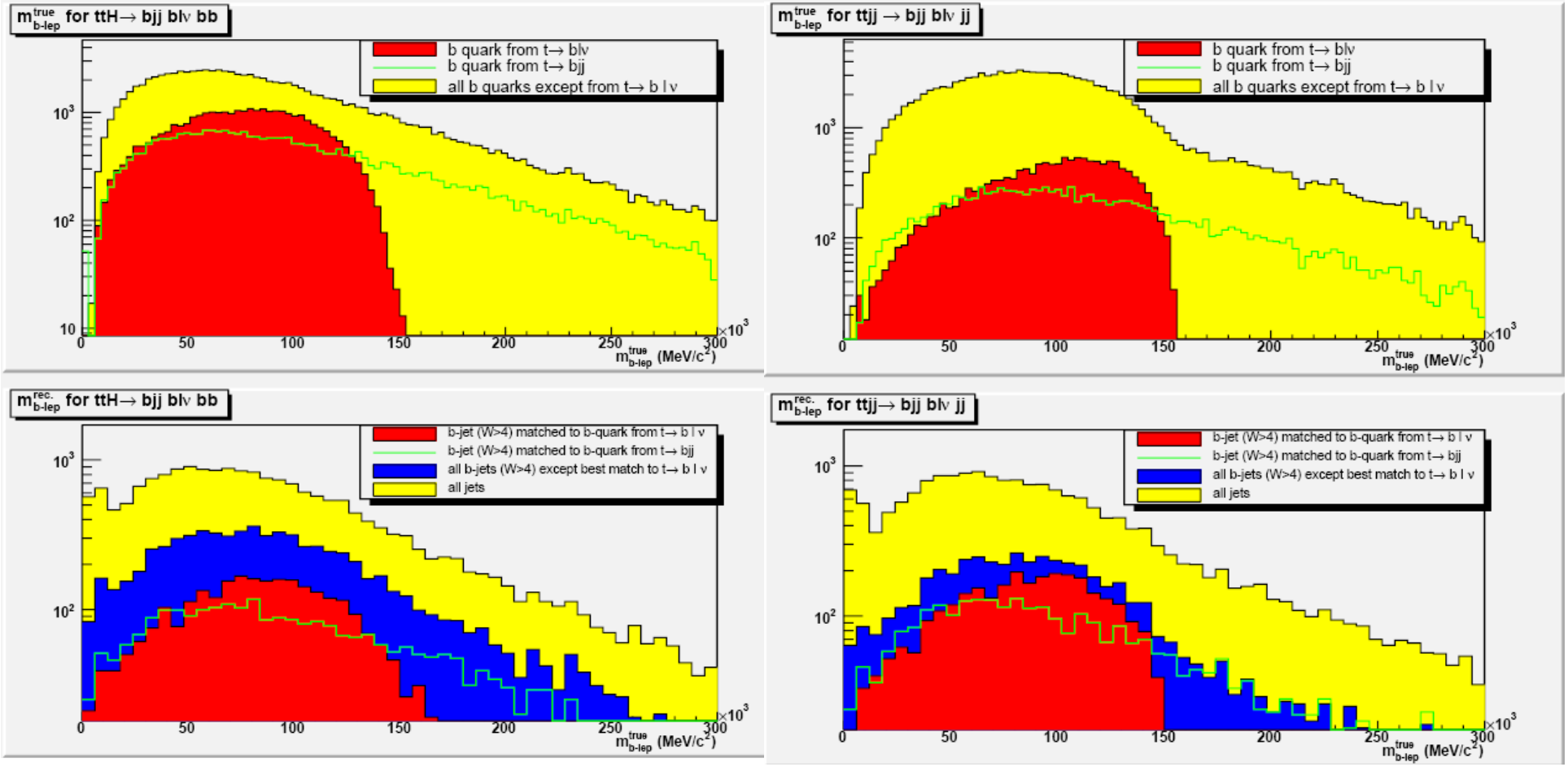
- Invariant mass of the b quark and the lepton in the semileptonic top decay has a kinematic edge (thanks for D.Tovey for pointing this out)
- Can this be used to improve the combinatorial background in ttH reconstruction?
- Data:
  - ttH→blν bjj bb (5341, Pythia)
  - ttjj (5212, MC@NLO + Herwig)
  - Reconstructed with 11.0.41
  - EventView-based Ntuples produced by Lorenzo Feligioni and CPPM group (thanks!)





M(b,l) Kinematic edge

Detector effects smear distribution, but may still be useful ☺

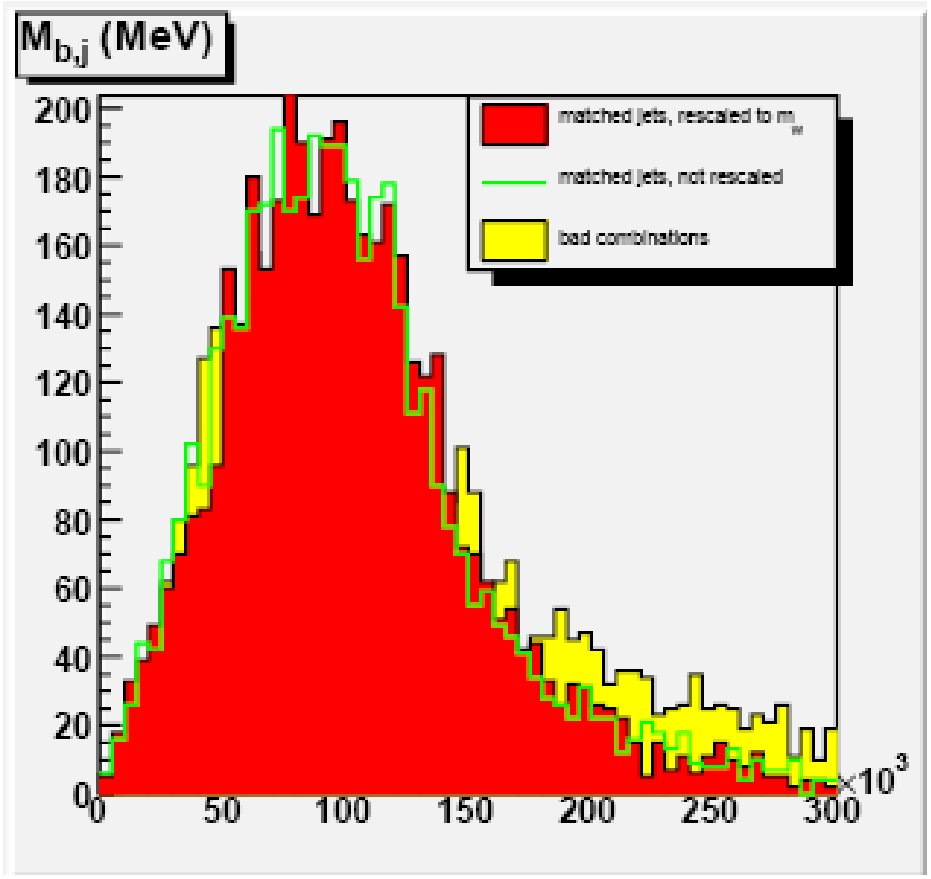


Summary

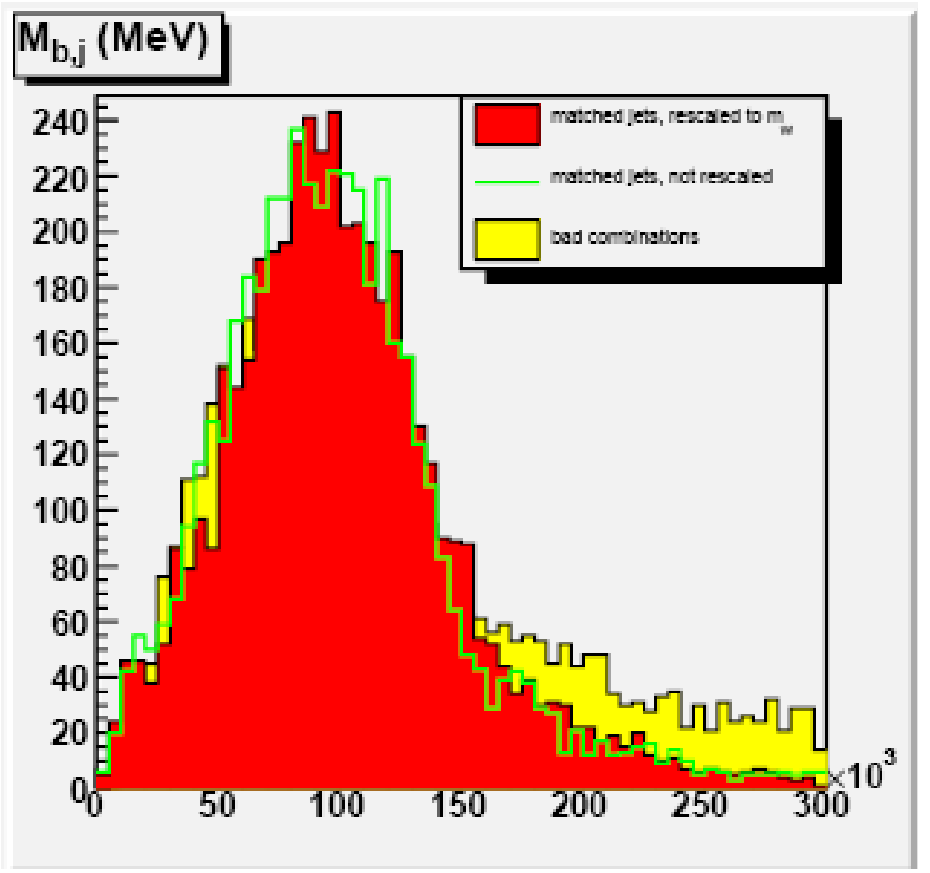
- M(b,l) variable under study for ttH reconstruction
  - Use limited by experimental resolution but doesn't look too bad for $t \rightarrow bl\nu$ case
  - Tried M(b,j) for $t \rightarrow bjj$ but resolution there is worse
  - May be useful in other ttH channels since these are usually plagued by large number of combinations
- A few questions (and answers after discussion with CPPM group):
  - Correlations with other discriminant variables?
    - Yes, with M(blν)
  - Useful in multivariate methods?
    - Unfortunately no! (💣☠ !!!!) After combination likelihood (see G.Aad's talk) bad combinations all have M(blν) < 160 GeV

Backup slides

M(b,j) for t →bW→bjj

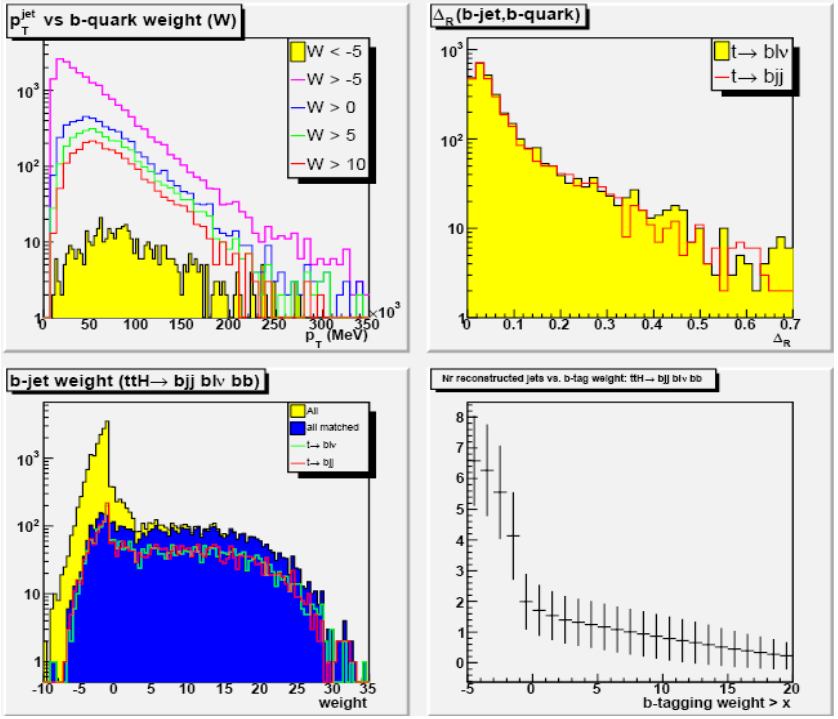


ttH→blν bjj bb

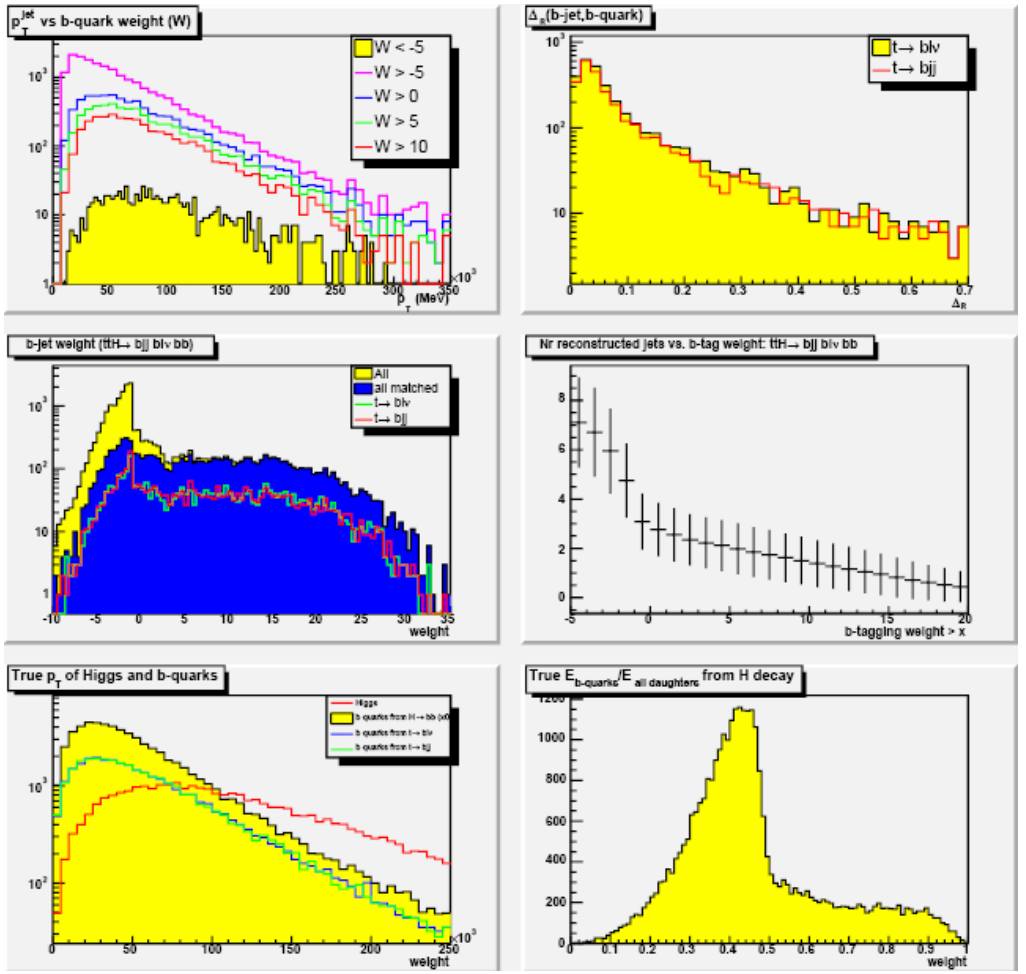


ttjj→blν bjj jj

ttjj→blν bjj jj



ttH→blν bjj bb



- Positive weight selects mostly b-initiatied jets
- Matching done between b quark from t→blν/ t→bjj and closest jet