Top physic topics of ATLAS groups in Bonn

Ian Brock, Markus Cristinziani,
Birte Domnik, Marc Lehmacher,
Serge Duarte Pinto, **Duc Bao Ta**,
Norbert Wermes

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Top physic topics

- Group Wermes/Cristinziani
- Top physics in dileptonic final state:
  - Birte Domnik
    - Mass measurement using the lifetime of b-hadrons
  - Marc Lehmacher
    - B-tagging studies
    - Later: cross section measurement with b-tagging
  - Duc Bao Ta
    - Cross section measurement without b-tagging

New members

- Group Brock
  - 1 PhD Student: Serge Duarte Pinto

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B-tagging studies

- Improving b-tagging by studying influence of
  - Track selection
    - Number of hits in B-layer
    - Rejection of tracks from material interactions in Pixel detector
  - Inefficiencies of Pixel detector
  - Performance at large η, p_T

- Experience will be used for cross section measurement with b-tagging

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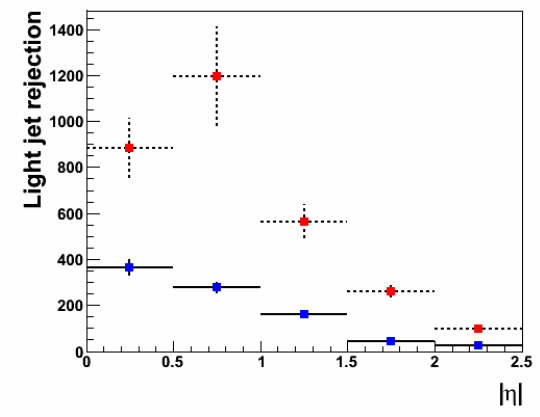
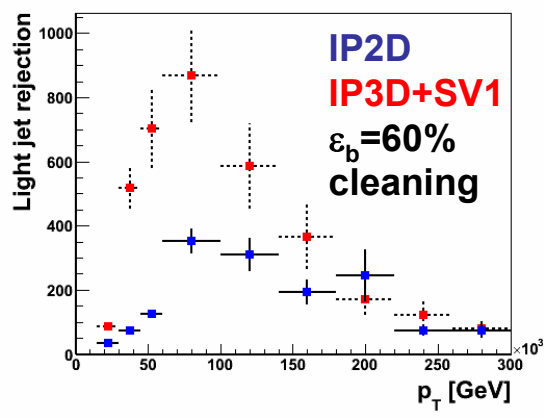
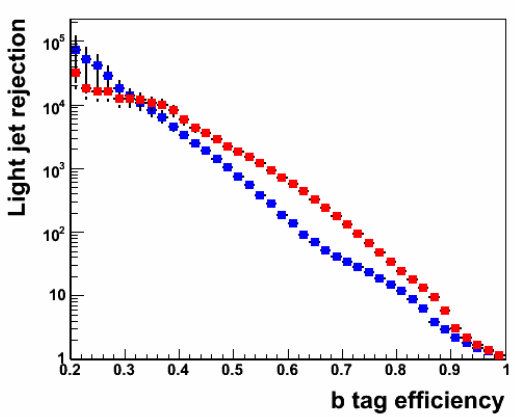
Improving b-tagging with track selection

- With ttbar (MC@NLO) sample:







Light jet rejections @ ε_b=50%, cleaning	IP3D+SV1
OLD, No Ded. Cal., nHitBLayer≥1	1919 ± 211
OLD, Ded. Cal., nHitBLayer≥1	2007 ± 226
OLD+NEW, Ded. Cal., nHitBLayer≥0	2121 ± 247

- Waiting for more statistics from the central production

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Mass measurement using the lifetime of b-hadrons in dilepton channel

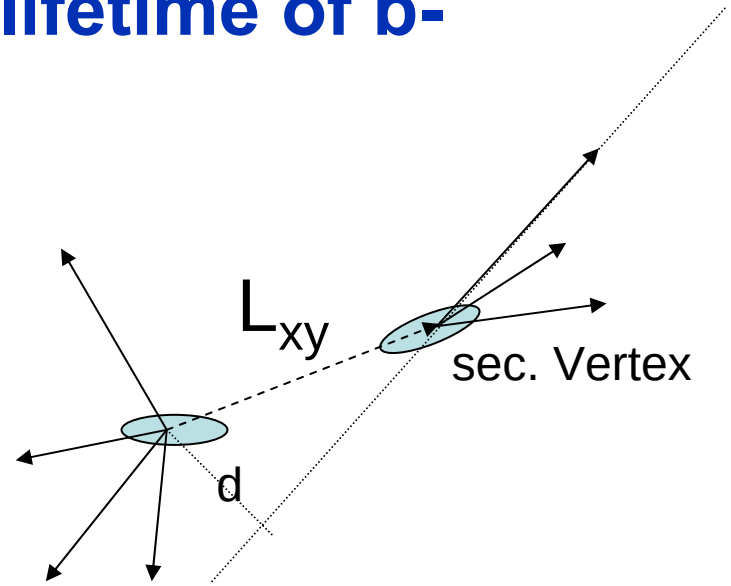
- Makes use of the mean life time of b-hadrons:

$$t \rightarrow Wb$$

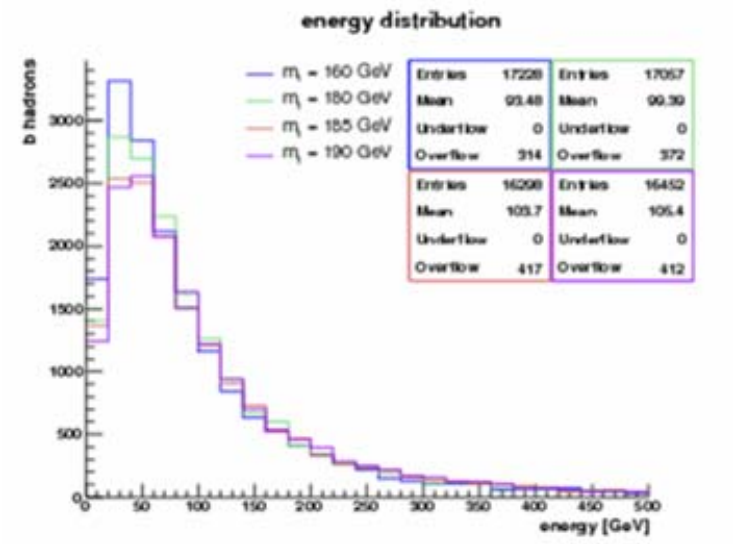
$$p_{b/W} \propto f(m_t)$$

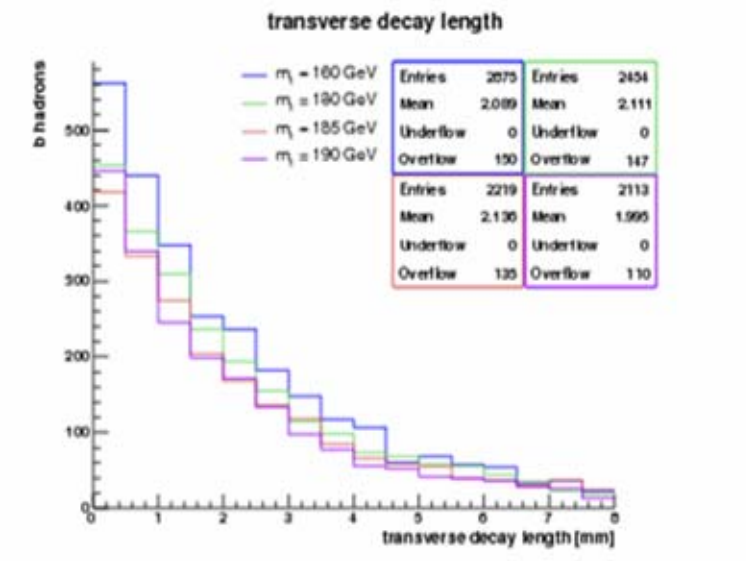
$$\langle L \rangle = \tau_0 \frac{p}{m_b}$$

$$\langle L_{xy} \rangle = c\tau_0 \sqrt{\left(\frac{\langle E_T \rangle}{m_b c^2} \right)^2 - 1}$$



- In truth:





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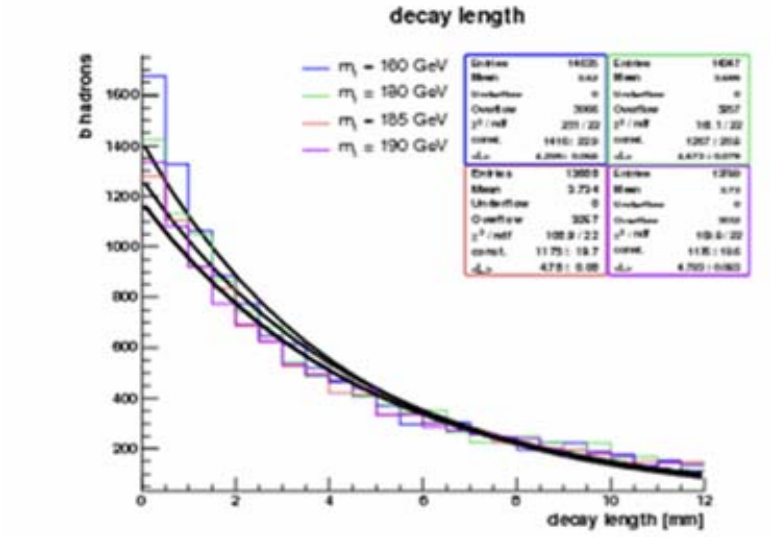
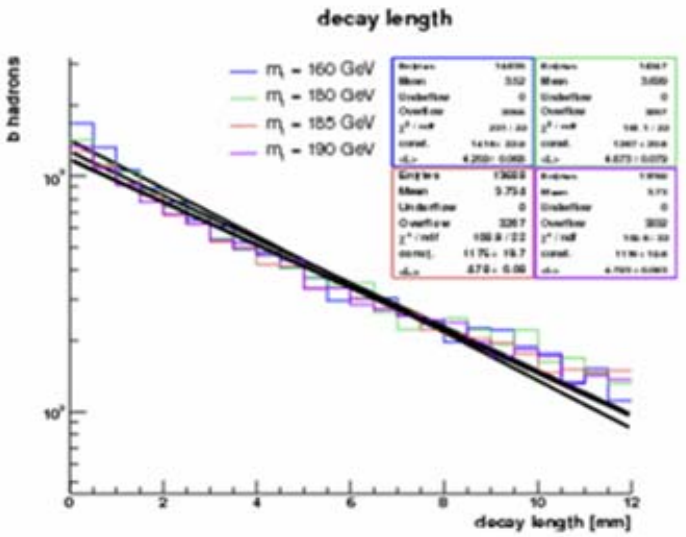
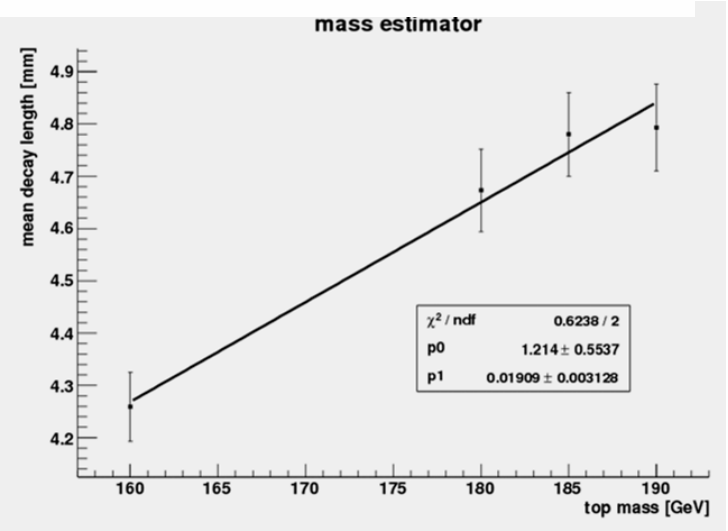
Calculation of a mass estimator





- Largest uncertainties:
  - X_b fragmentation function
  - inclusive b-hadron lifetime
  - ISR effects
- Investigation of the feasibility with a realistic model of the ATLAS detector



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Cross section measurement without b-tagging

- Using a likelihood to determine the excess of the signal over the background

- Considered samples, fullsim (later: trigger and misaligned detector)
  - Signal: ttbar dileptonic final state (including taus) (MC@NLO)
  - Background:
    - ttbar semileptonic
    - Z->ll (MC@NLO)
    - WW, WZ, ZZ (MC@NLO, Herwig)

- Do pre-selection cuts:
  - Require 2 isolated leptons ($\Delta R>0.4$) of opposite charge
  - Veto on events in the Z peak region (85-95 GeV) (only for ee and μμ final state)
  - Number of Jets >=2
  - MET 25GeV, Lepton 0/1: 20GeV

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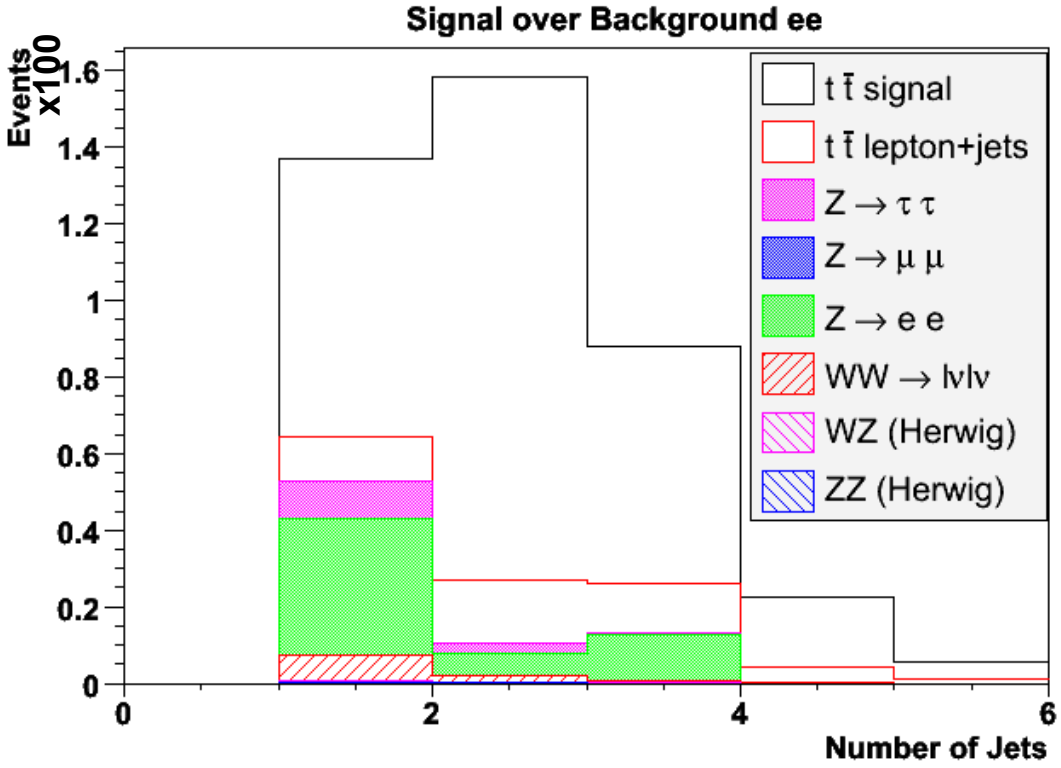
Selection in ee

- cuts on jets: 35/25 GeV
- Efficiency 2.7% (without jet==1 bin)
- S/B 3.7 at S/sqrt(S+B) 12.5 ($100pb^{-1}$)



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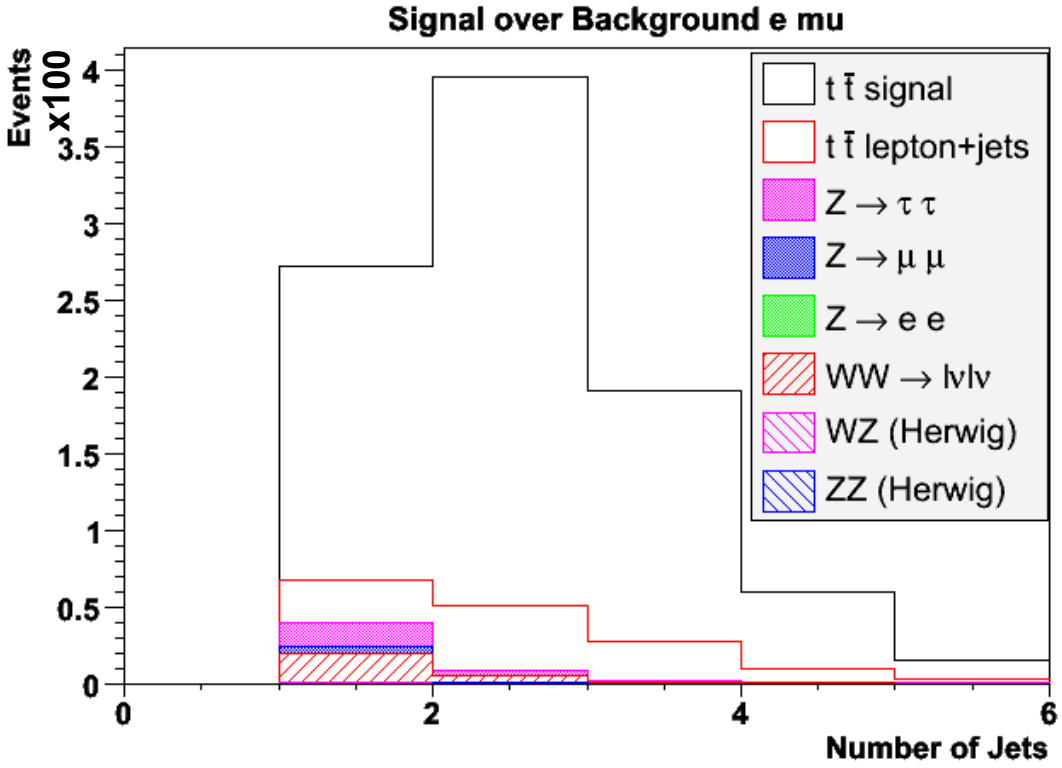
Selection in eμ

- cuts on jets: 30/25 GeV
- Efficiency 7.1% (without jet==1 bin)
- S/B 5.8 at S/sqrt(S+B) 23.3 ($100 pb^{-1}$)



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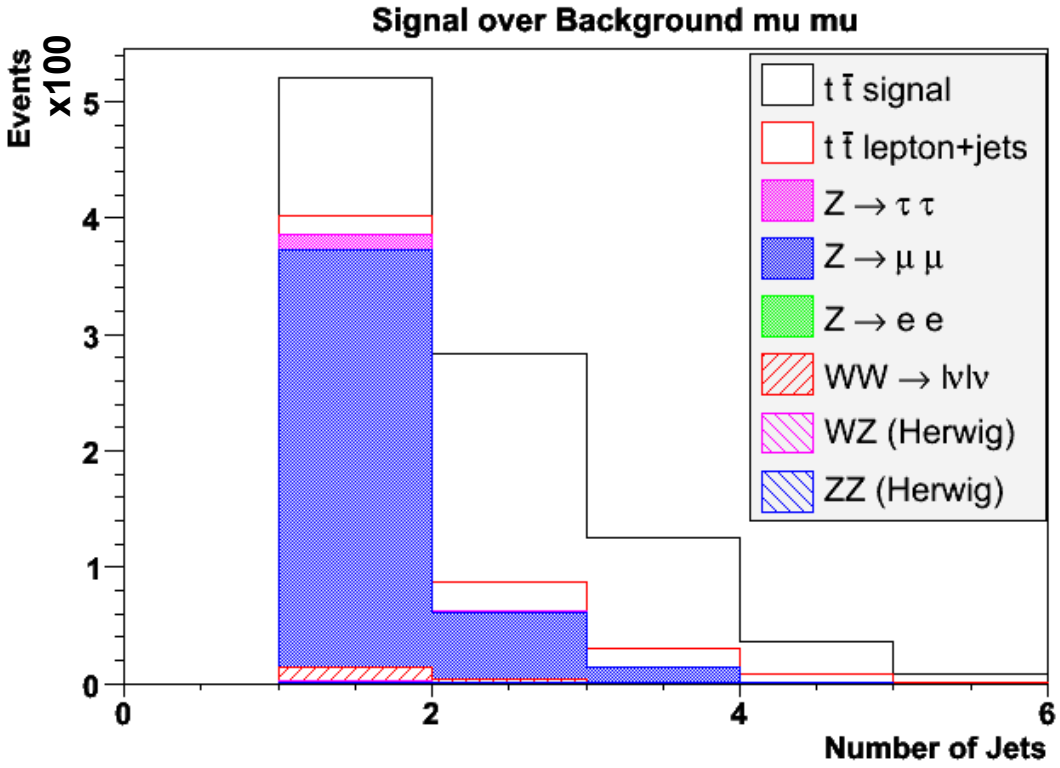
Selection in μμ

- cuts on jets: 30/25 GeV
- Efficiency 4.1% (without jet==1 bin)
- S/B 2.6 at S/sqrt(S+B) 15.4 ($100pb^{-1}$)



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- Optimization still limited by statistics, esp. for background:
  - Z->ll only a few events scaled up by factor O(10) for 100pb^{-1}
  - not enough for sensible pdfs

- Statistics expected to increase with new centrally produced samples (CSC12)

- Ideas to increase purity:
  - Quasi-reconstruction of the kinematics under the assumption of top mass and W mass, may use best fitting top mass as one likelihood variable

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