Update on Z+b production measurement at LHC

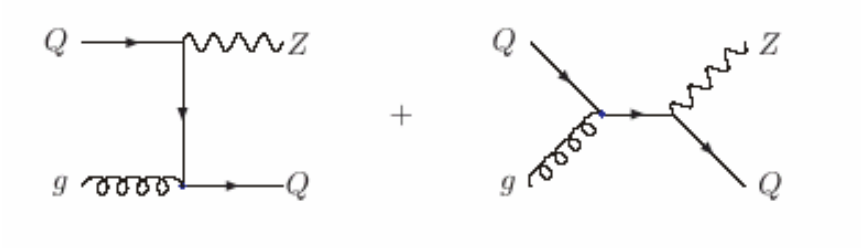
S.Diglio, F.Petrucci, A.Tonazzo, M.Verducci
University of Roma Tre and INFN

- Summary of previous presentation
- A first look at full ATLAS simulation
- Checks on systematics from data
  - b-tagging efficiency
  - background
- Outlook

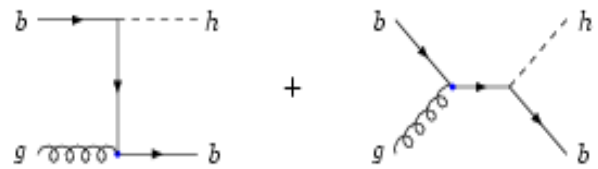
Reminder: motivations for Z+b analysis

A detailed discussion has been given in a previous meeting by F.Maltoni (cfr Phys.Rev.D69:074021,2004)

- Sensitivity to b content of the proton



- Background to Higgs search



Summary of previous presentation

- A very preliminary study of Z+b production in ATLAS has been done, using a fast detector simulation
- We use only $Z \rightarrow \mu\mu$. Two different b-tagging algorithms have been considered:
  - Soft muon
  - Inclusive b-tagging of jets

- The selected samples have high efficiency and very good purity
- The expected statistics is very high

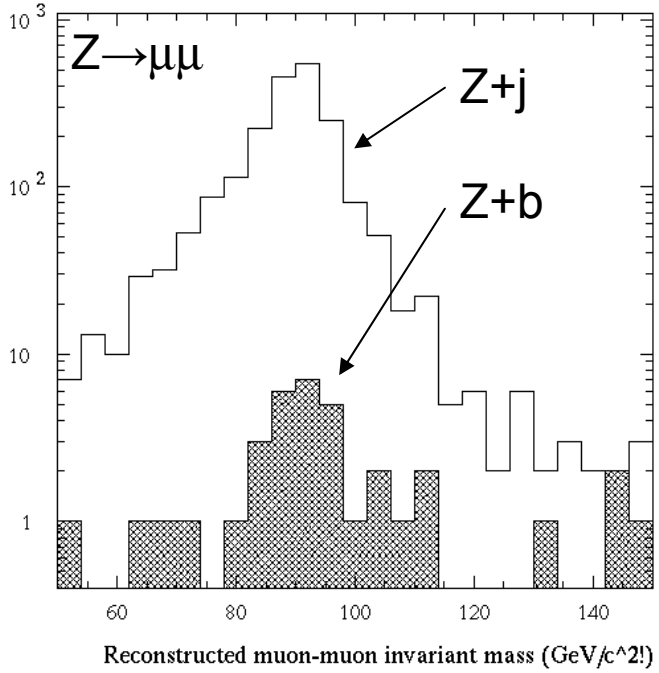
➔ The study is worth being carried on…..

- Main point to be investigated: systematics
  - In particular, control on background level

Study on full detector simulation

- We have taken a first look at a Z+j sample on full ATLAS simulation
- Main conclusions from the previous study on fast simulation are essentially confirmed for the inclusive jet tagging selection:
  - Sample statistics = few 10k events per year at LHC low lumi

    (warning - there was a misunderstanding on “efficiencies” quoted in previous talk: acceptance was not taken into account, nb of events should be reduced by ~60%)
- Some problems with soft muon identification: background might larger than expected….

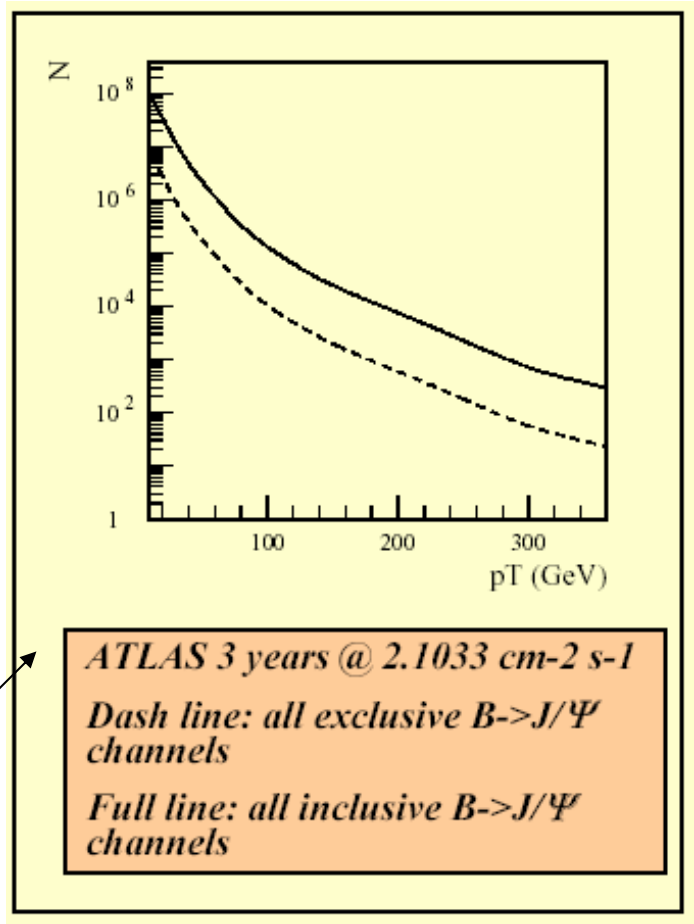


Further studies on larger statistics are ongoing…

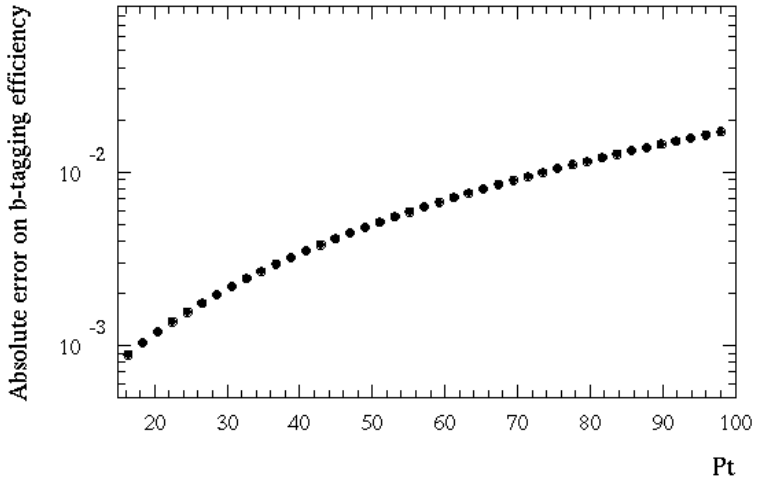
Systematics: b-tagging efficiency

- To check b-tagging efficiency, we can use samples of bb events with one b tagged through J/ψ decay and look at how many times we identify the other b
- Such events will be available with large statistics and will cover a wide Pt range

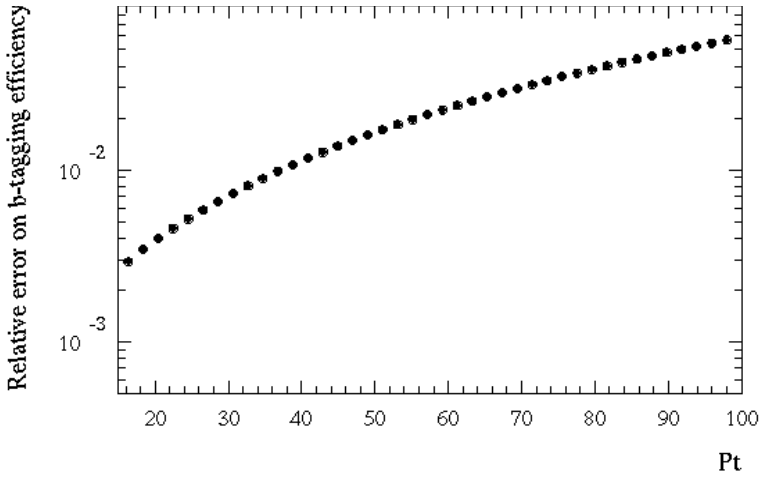
  (cfr talk by M.Smizanska on 26/03/2004)



Systematics: b-tagging efficiency



10 fb^{-1}

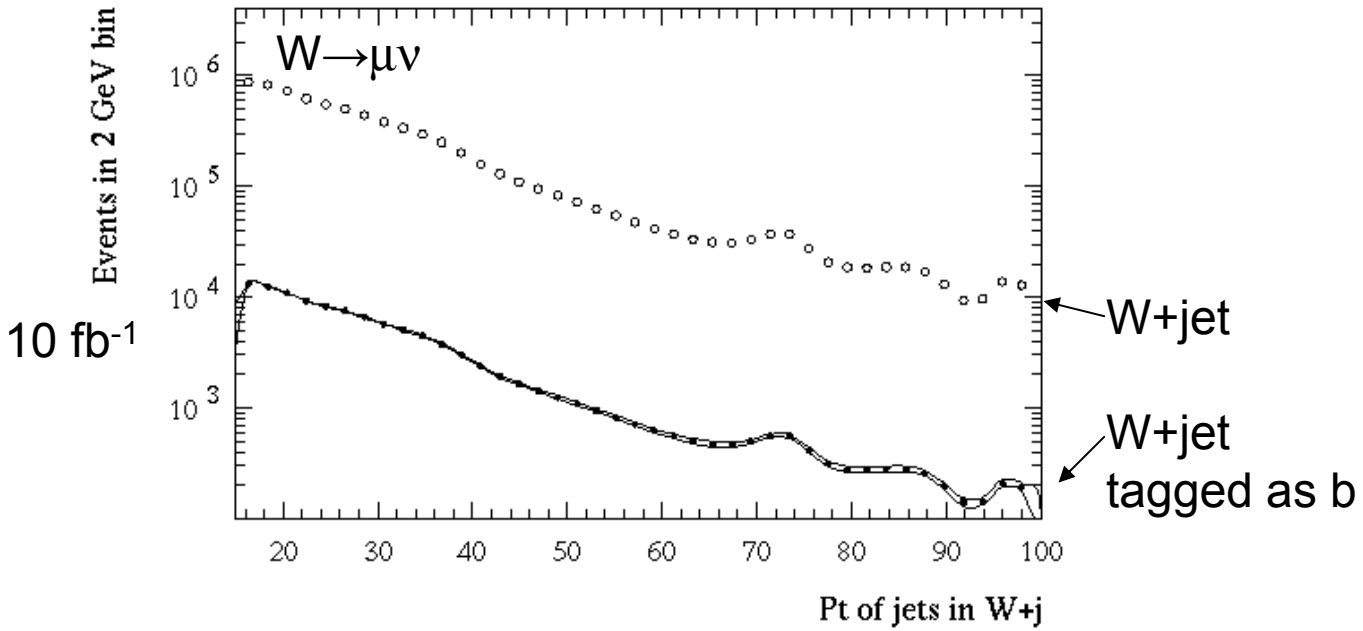


- A total sample of few million events per year with one b→J/ψ(X) will be available
- They will cover the whole Pt range interesting for our analysis
- We can divide Pt range in bins (for ex., 2 GeV) and have enough statistics in each bin

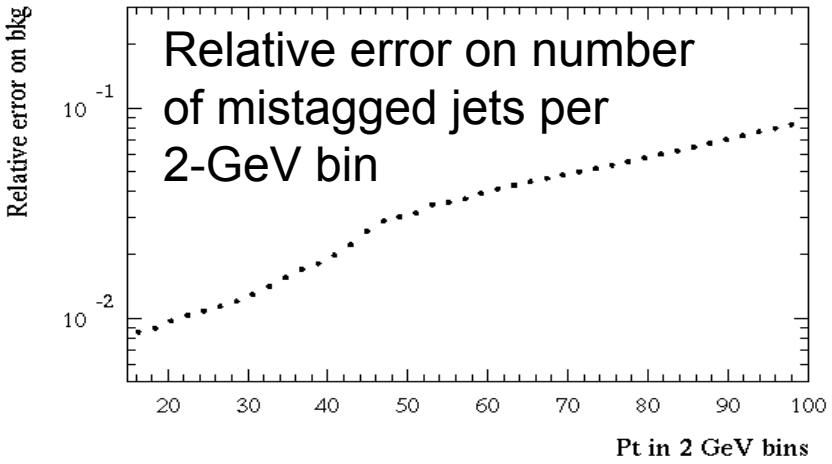
➔ Error on b-tagging efficiency can be at the level of few % in each Pt bin

Systematics: background from mistag

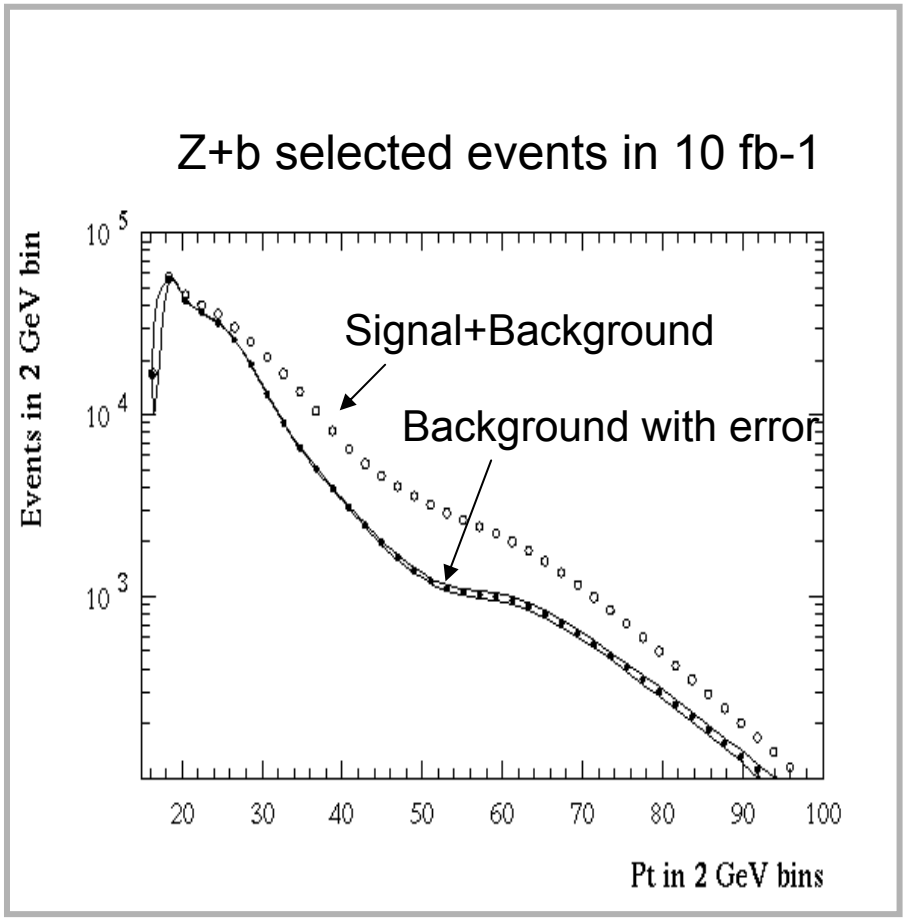
- Check mistagging on a sample where no b-quark jets whould be present.
- As suggested at a previous meeting, we use W+jet
  - Jets will cover the whole Pt range
  - Statistics 30x Z+j (after selection of decays to muons)



Systematics: background



- The relative error on background from mistagging can be kept at the level of few-% in each bin of the Pt range



Summary and outlook

- We will have data samples to control systematic errors related to b-tagging at the few-% level over the whole jet Pt distribution
  - b-tagging efficiency: from bb with one b→J/ψ(X)
  - Mistagging: from W+jet
- Precision of this measurement will be dominated by other sources of systematics, not specific to this analysis:
  - Luminosity measurement
  - Jet reconstruction and energy resolution
- It is likely that the overall precision will be some-%, comparable to uncertainty on theoretical prediction
  - More ideas for checks are welcome !
- Studies on full simulation are ongoing