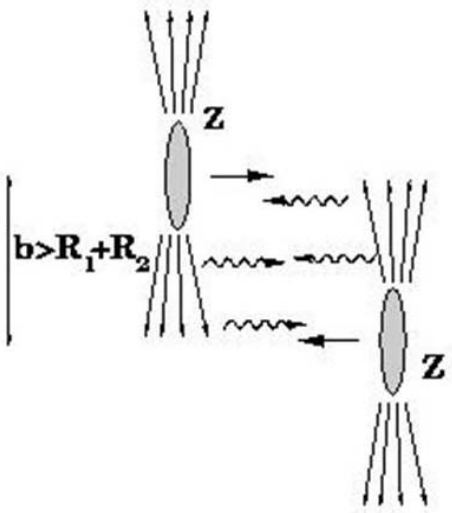
γγ in HeavyIons with ATLAS

CONTENT:

- *γγ collisions and observables*
  - *muon and electron pairs*
  - *high p_T jets*
  - *open charm*

SUMMARY

$\gamma\gamma$ collisions and observables



LHC heavy ions ⇨ powerful (as Z^4) source of quasi-real photons in energy region up to 100 GeV

Expected large collider luminosity allows to consider measurements of:

- accurate calculable process of lepton pair production;
- high p_T jets and open charm production both aimed to study (mainly) gluon component of photon;
- charmed meson production;
- search for bottomonium states η_b

All these could extend LEP results on two-photon interactions

Numbers and plots below correspond to one-week LHC Pb-Pb mode and have been obtained with TPHIC event generator and then simulated with ATLAS simulation program

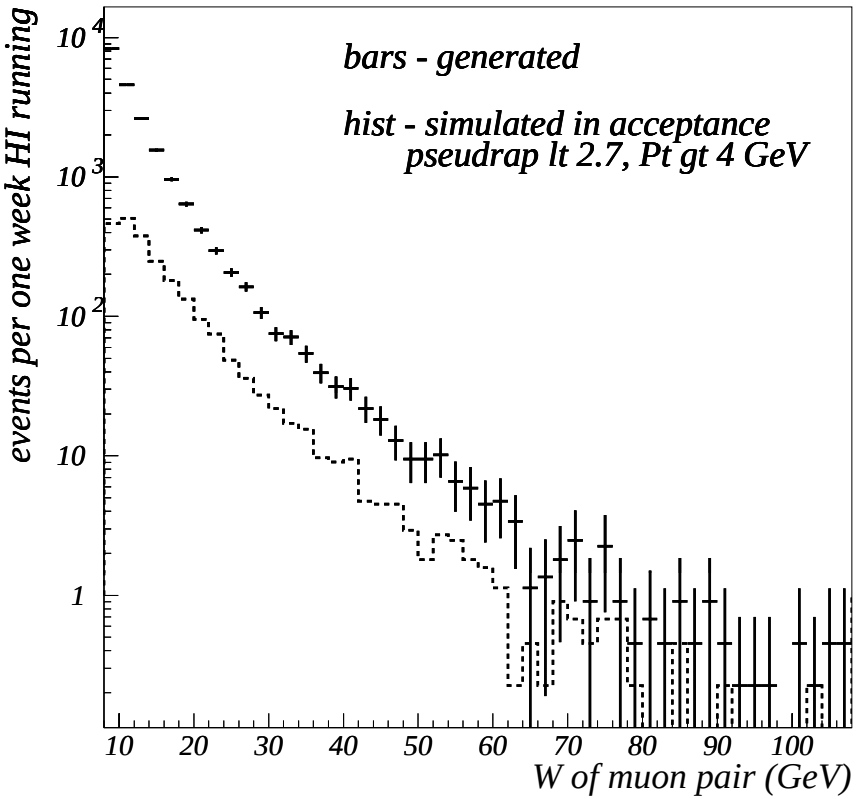
Contribution from photon-pomeron interactions is out of the study

muon and electron pairs

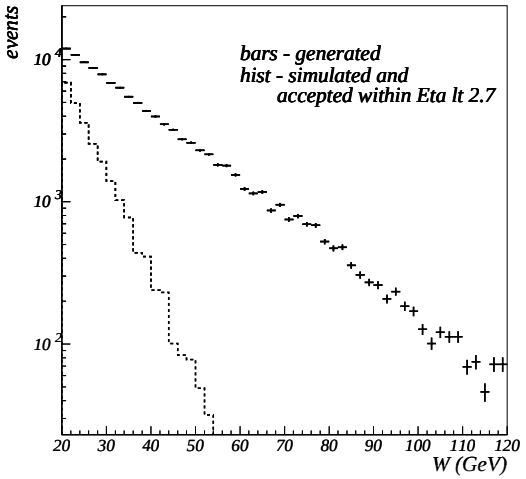
A sample of few thousands (background free) events reconstructed within pseudorapidity range of 2.7 is expected

Methodical tasks (luminosity monitor, electromagnetic calorimeter calibration and muon reconstruction efficiency)

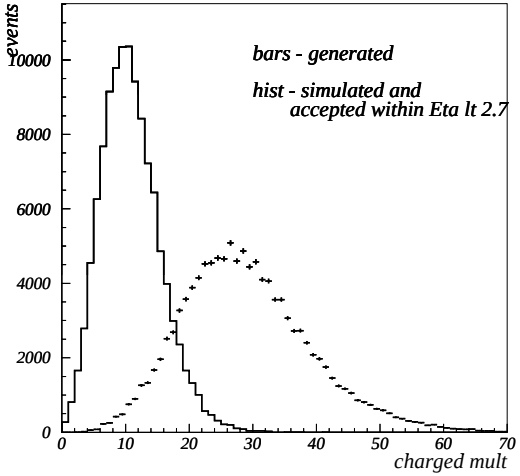
Measurement tasks (comparison with QED calculations, prove of photon-flux calculations to be applied for multihadron analysis)



high p_T jets



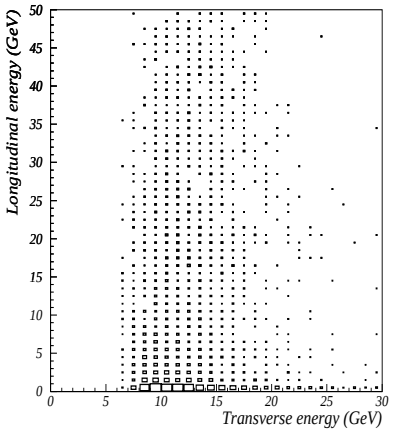
general features of $\gamma\gamma$ into hadrons (rather small multiplicity of F/B boosted events, loose an essential part of produced particles) lead to
a) model dependence
b) need of 'soft' trigger conditions



Solution is in choice of large p_T processes to be studied – jets with large transverse momenta (sensitive to photon PDF) and open charm production (with a large contribution coming from γg fusion)

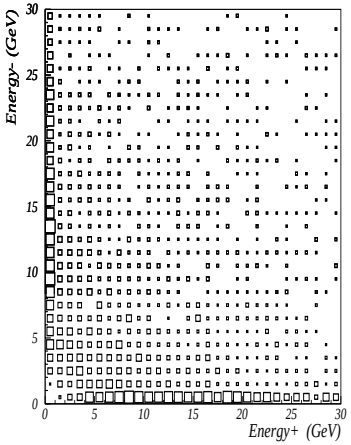
high p_T jets

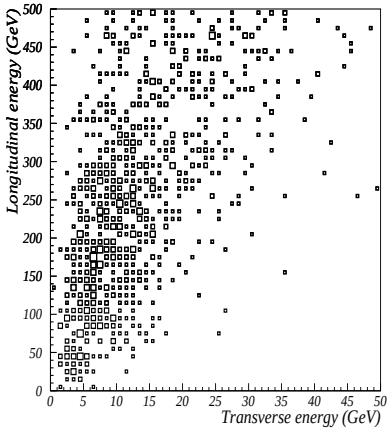
source of background - HI collisions occurred at large impact parameters



Correlation between transverse and longitudinal energy

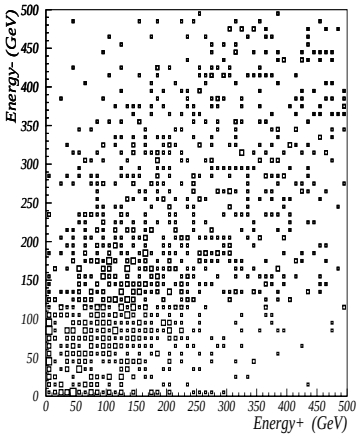
Remove events with E_{long} above 50 GeV



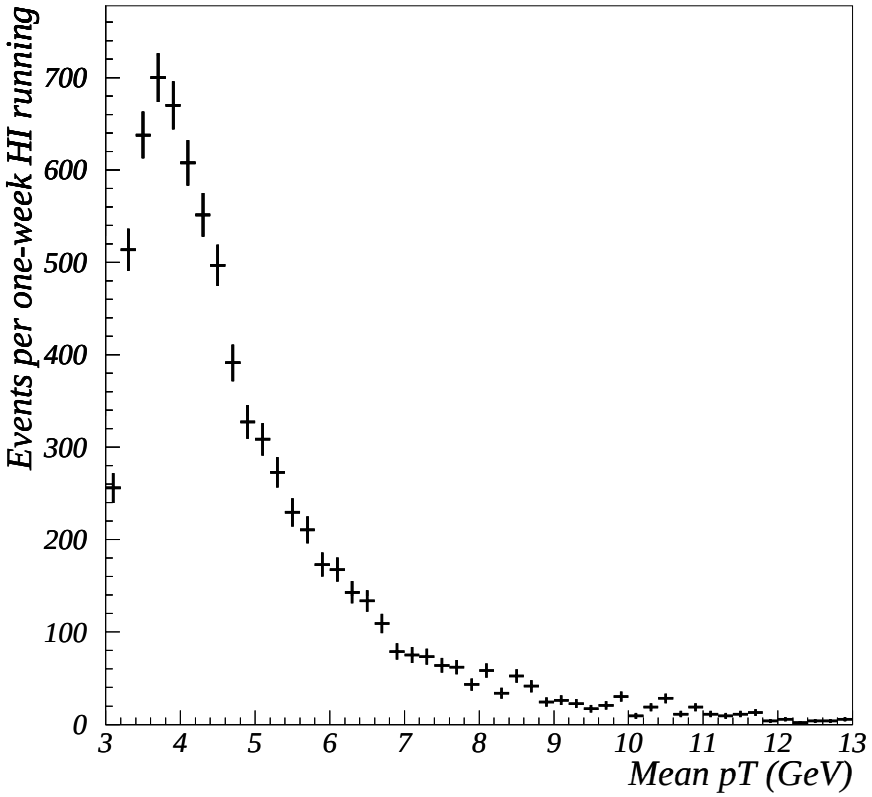


Forward-backward energy correlation

Remove events with $|E_F-E_B|$ more than 20 GeV



high p_T jets

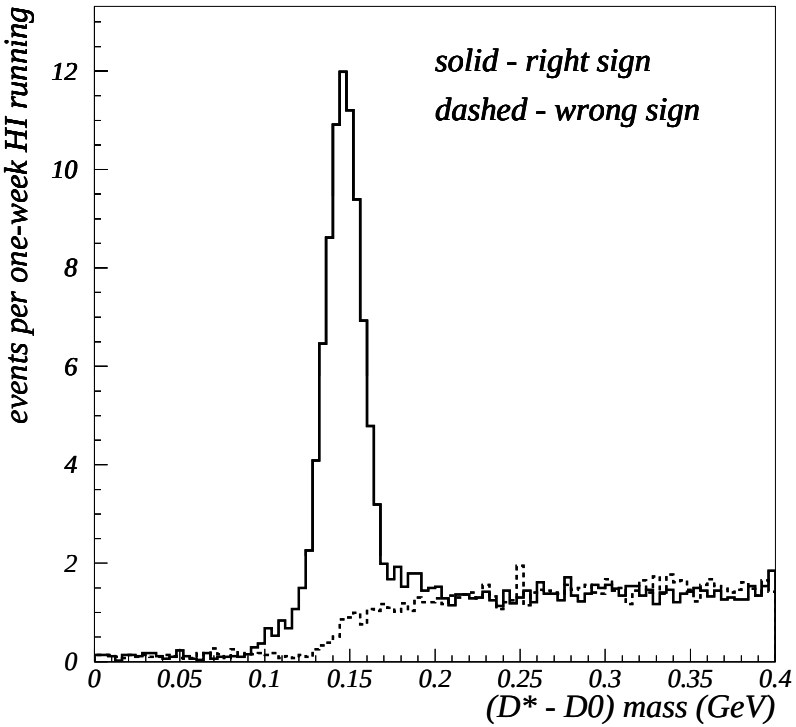


Events with two jets within pseudorapidity 2.7 and transverse energy more than 3 GeV selected by K_T-clustering algorithm

Background coming from peripheral HI collisions is estimated to be few percents

Expected statistics of one-week running (around ten thousands events) is enough to make a comparison with QCD-based calculations

open charm



formation of charmed mesons via photon-gluon scattering

Search for chain
$D^{*+} \Rightarrow D^0 \pi^+ \Rightarrow K^- \pi^+ \pi^+$
and look at mass difference of reconstructed D* and D^0

Around hundred events per week are expected in 2-prong D^0 decay mode.

Absence of K/π separation is not crucial unlike 4-prong mode where combinatorial background dominates.

summary

ATLAS feasibilities to γγ reactions initiated by HeavyIon collisions are studied for production of

- *lepton pairs*
- *high p_T jets*
- *charmed mesons*

Expected statistics for planned one-month LHC HI running should allow to study structure of quasi-real photons