ATLAS Position on LHC Operation Strategy in 2009

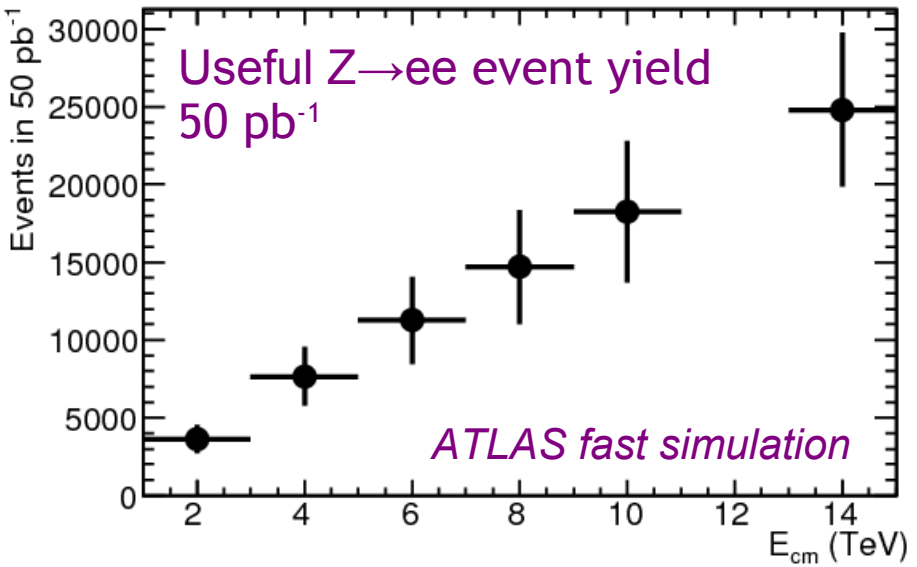
ATLAS wishes to run in 2009 with pp collisions at the highest possible centre-of-mass energy at which operation is safe

The following slides indicate the physics loss as the centre-of-mass energy falls

- $2 < E_{cm} < 14$ TeV – wider than the range being discussed for 2009

Cautions: analyses not reoptimised below 10 TeV
integ. luminosity numbers refer to good data usable for analysis

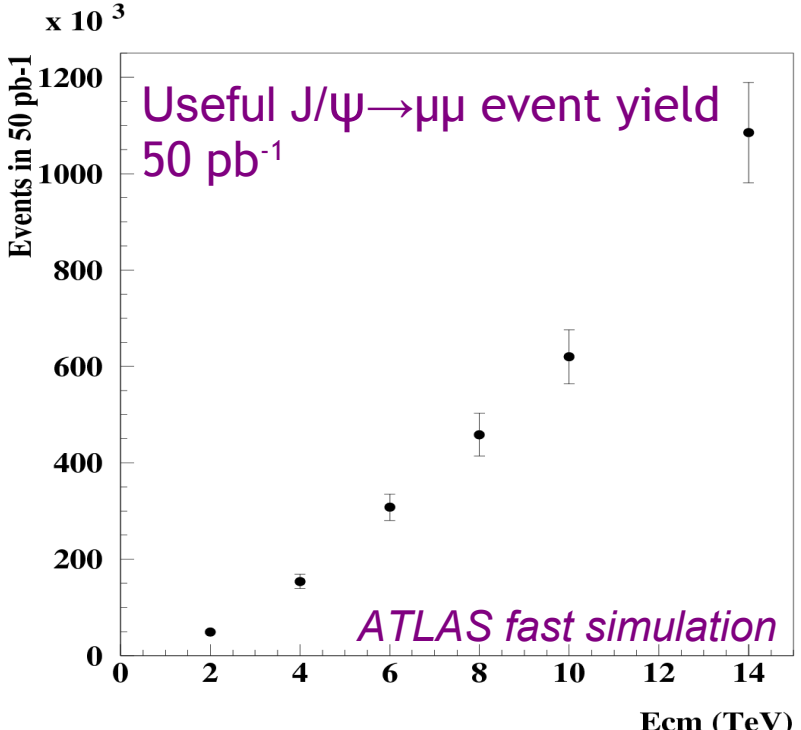
Calibration Samples



Z→ℓℓ is a crucial calibration channel

EM calo. inter-calibration (0.2x0.4 in η-φ) to 0.7%(stat) with 25k Z→ee decays, scales with 1/√N

20k Z→μμ events test the *p* scale, alignment and *E*-loss corrections, for muon system to <1%



J/ψ→μμ and ee are also important for early understanding of detector
e.g. detailed alignment studies

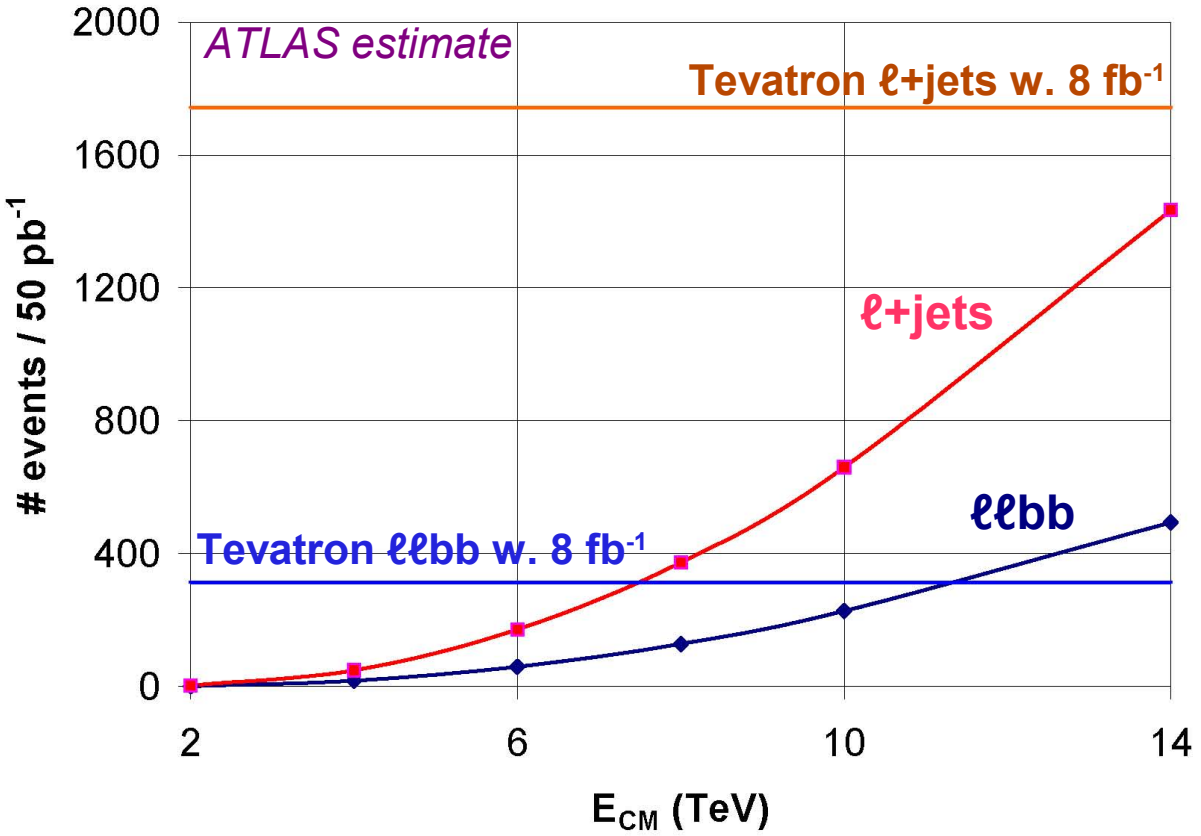
Plot shows J/ψ→μμ yield within fiducial acceptance
$p_T(\mu 1)>6$ GeV, $p_T(\mu 2)>4$ GeV, $|\eta(\mu)|<2.5$

Top Quarks

Background to new physics searches – must measure cross-section & properties in data

Expected Tevatron statistics provide a benchmark:

- Cross-section statistical precision will then be comparable to other uncertainties
- High-precision top physics will be underway



~50 pb^{-1}@14 TeV would match full Tevatron sample

- lose ~factor 2 in cross-section dropping to 10 TeV
- lose ~another factor 2 dropping to 8 TeV

Below 8 TeV samples will be rather small, with a few tens of pb^{-1}

Z' or W' Resonance

Z': Heavy partner of the Z (SSM)
Very clean experimental signal: $Z' \rightarrow \ell\ell$

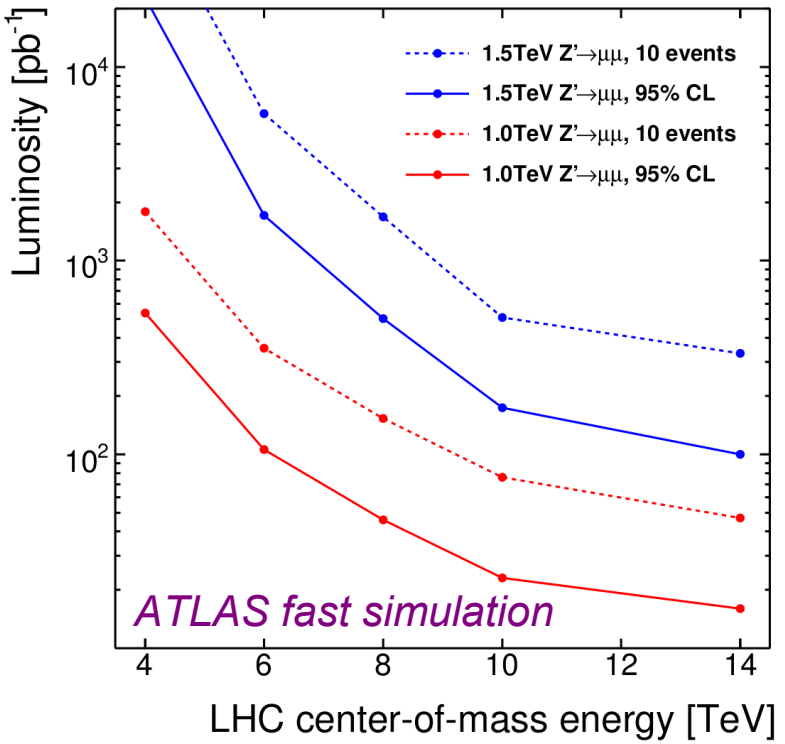
Tevatron 95% CL limit at m=1 TeV

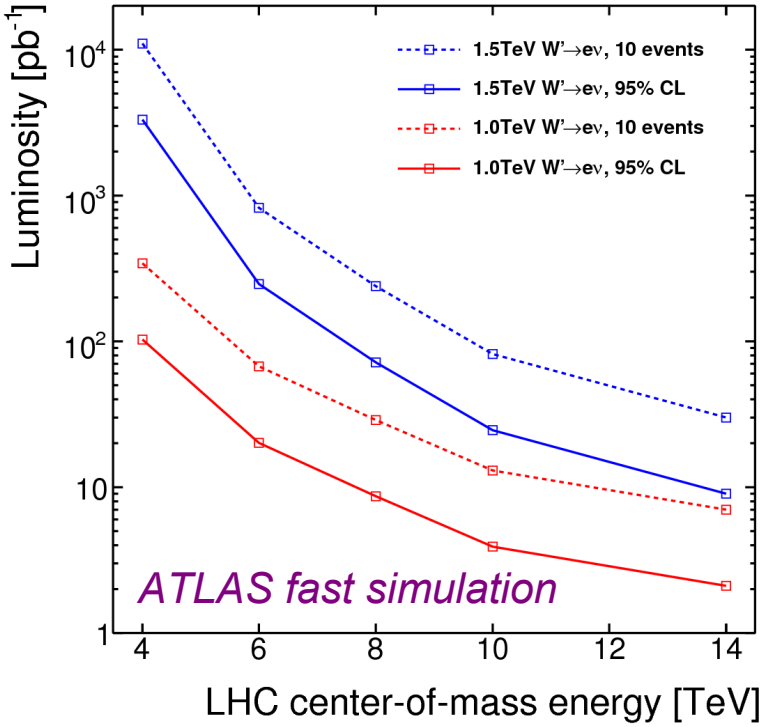
Discovery (10 events, >5σ) just above, with 100 pb^{-1}, possible at E_{cm}=10 TeV

W':
Tevatron 95% CL limit also at m=1 TeV

Discovery (10 events, >5σ) at m=1 TeV, possible with ~20 pb^{-1} at 10 TeV

We will be sensitive to the region just beyond the Tevatron reach, where they might accumulate hints of a signal in 2009/10





Supersymmetry

l+jets+missing-E_T channel

- Not most sensitive, but will be usable before inclusive jets+missing-E_T analysis

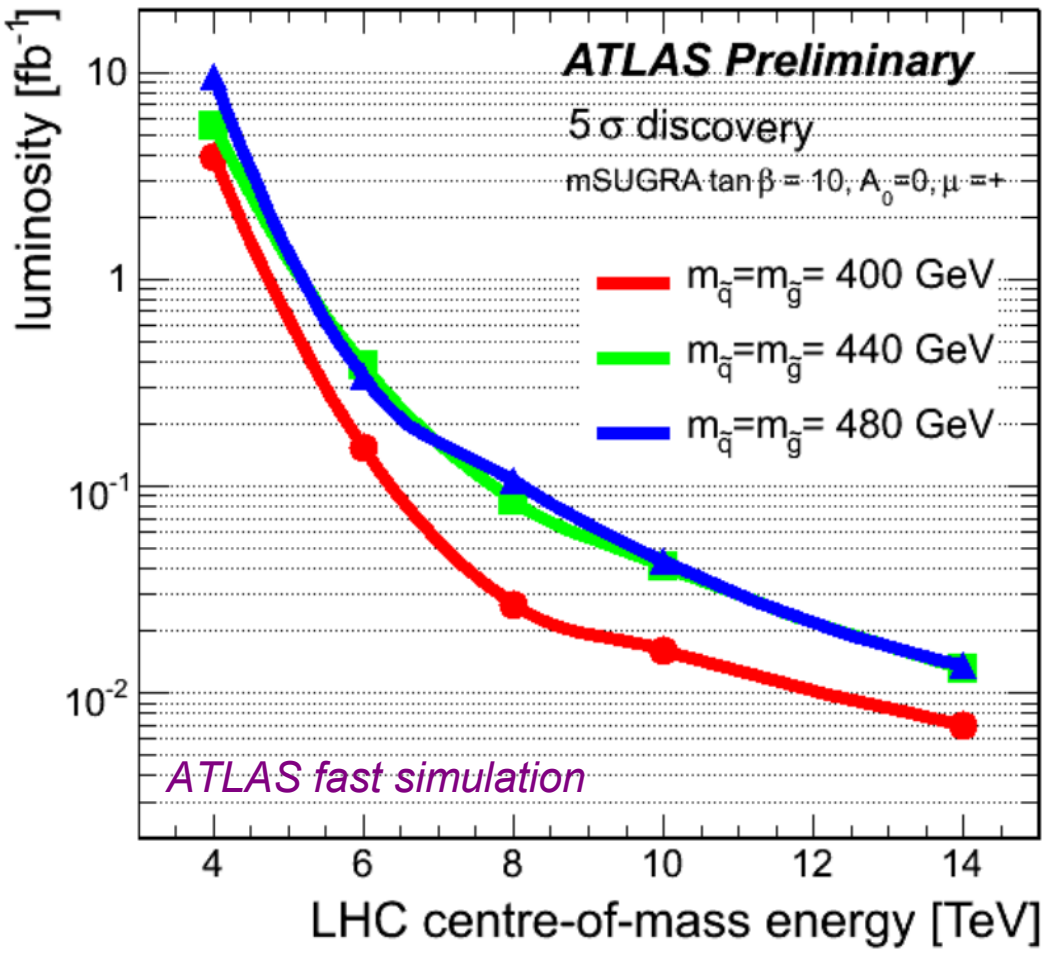
Tevatron limit currently is 380 GeV in this model ($m_{\tilde{q}}=m_{\tilde{g}}$)

- plot shows 3 masses above this

5σ discovery beyond current Tevatron limits possible with ~20 pb^{-1} at 10 TeV

Again we will be sensitive to the region just beyond the Tevatron reach, where they might accumulate hints of a signal in 2009/10

Below E_{cm}≈8 TeV, the sensitivity collapses



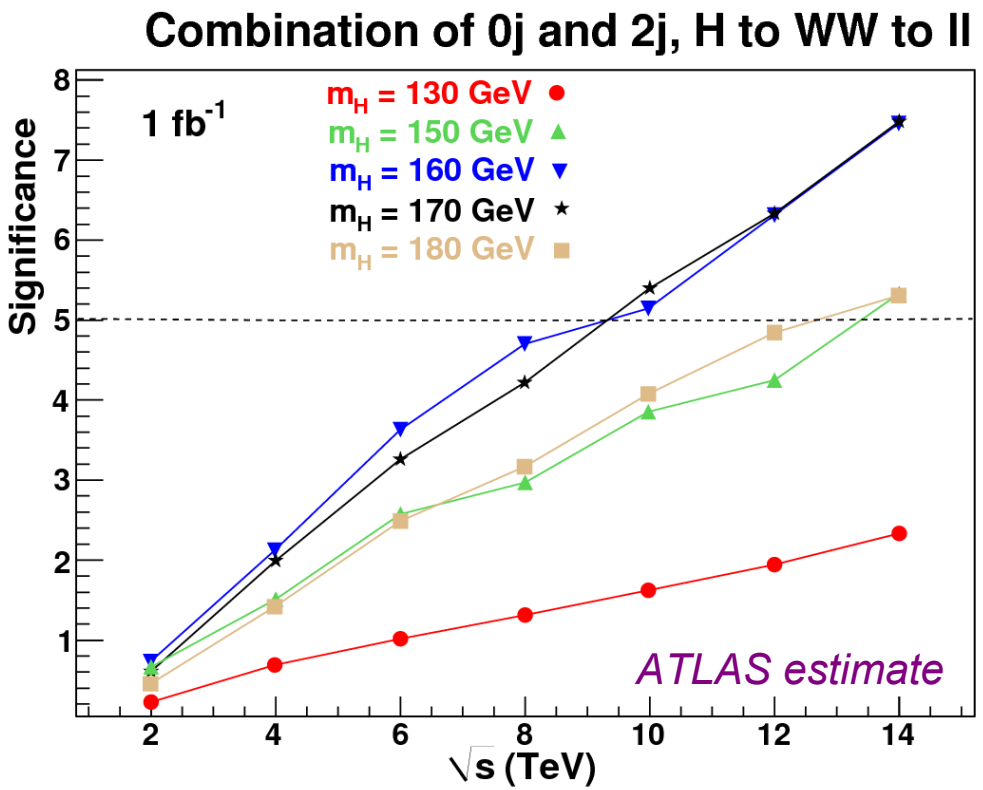
Standard Model Higgs

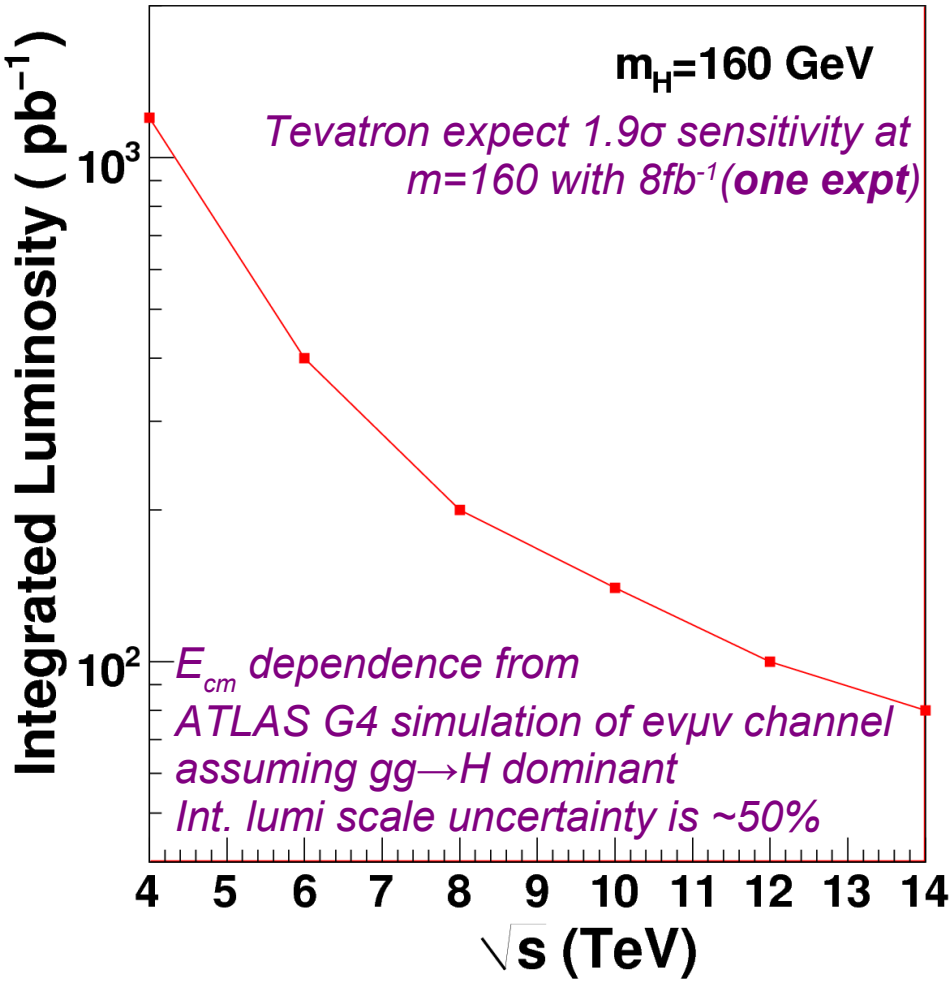
H→WW→ℓνℓν only

Compare sensitivity to Tevatron with 8 fb^{-1}

To match Tevatron with E_{cm} of 10 TeV, need 100-200 pb^{-1}

Massive loss of sensitivity below 6 TeV





With **1 fb^{-1}**, 5σ discovery reach opens, provided E_{cm} above 8 TeV

Summary

ATLAS wishes to run in 2009 with pp collisions at the highest possible centre-of-mass energy at which operation is safe

We would consider $E_{cm} \leq 6$ TeV to be an engineering run

Good discovery reach opens up with a few 10's of pb^{-1} at 8 TeV or higher

- Higher is always better
- Typical equivalence for 8-10 TeV: factor ~2 in luminosity for 2 TeV in E_{cm}

To beat the Tevatron on the Higgs/Z'/W'/SUSY, it is important to

- get as close to 10 TeV – or higher - as possible
- several 10's to 100-200 pb^{-1} of integrated luminosity
- SM Higgs is hardest: ~ match Tevatron with 100-200 pb^{-1}

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