ATLAS: first data and the interplay between collider and flavour physics

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Next year ATLAS will be busy commissioning detector, trigger and DAQ, establishing safe running, calibration,…

LHC commissioning with beams from May onwards, hope for first collisions in summer 2008, will be at low luminosities

Expect up to 100 pb^{-1} in 2008, few fb^{-1} in 2009

Everything is new at 14 TeV: “rediscover” the Standard Model first
J/ψ, Υ, W, Z, t
Validate Monte Carlo programs

Important for calibration, SM- and new physics: ttbar production

100 pb^{-1}: establish signal, measure cross section, use for calibration

1 fb^{-1}: first properties: mass, decay modes

10 fb^{-1}: anomalous Wtb couplings, constrain FCNC decays

Single top (electroweak) production

between 100 pb^{-1} and 1 fb^{-1}: establish t-channel signal

1-10 fb^{-1}: establish s-channel signal: start looking for $H^{\pm}$

10 fb^{-1}: start looking for anomalous flavour-violating single top production

B-physics: triggering easiest at low luminosities = early data

But rare decays need large integrated luminosity

What is interesting with early data?

What should trigger at high luminosity focus on?

Higgs searches: in many final states

1 fb^{-1}: start becoming sensitive to SM Higgs around 160 GeV

5-10 fb^{-1} needed for full coverage

Lightest SUSY Higgs similar to SM Higgs

Other SUSY Higgses: bb, $\tau\tau$, tb, $\tau\nu$ need luminosity, sensitive to tan β

Exotics: can be interesting from day 1 (black holes?)
THE flavour related issue: new quarks and leptons ?
need to prove we understand detector before claiming any signal

SUSY: start with measuring backgrounds (QCD, ttbar, W/Z) from data
search for inclusive signals in multi-jets + high E_T^{miss} + N leptons

N = 0: highest cross section, but severe QCD background
N = 1: reduced QCD bg, and still good significance
N = 2, opposite-sign or same-sign: kinematic edges in mass
→ start constraining SUSY masses

τ's in the final state: high tan β, needs good tau reco
b's in the final state: from h decay, or signs of stop, sbottom

photonic final states, long-lived stau's, tri-lepton signatures,…
slepton and neutralino spin

With 1 fb^{-1} (2009) we already cover preferred g-2 range

Lepton flavour violation: affects dilepton mass edges
Best chance for SUSY squark flavour id: not too heavy stop

How well do we know b-tagging at high p_T ?

B-tagging involves combining IP and vertexing in 2D and 3D, and lepton tags
Calibration: ttbar (+jets)
At high p_T, relies on ability to reconstruct top's at high p_T: being studied

Can we do "t-tagging" in high-multiplicity events?

Will certainly try: also needed for SUSY searches, both in terms of background rejection as well as signal (gluino → stop + top)
t → bW →bqq' , using t and W mass.
But tagging gluino → sup + top seems very difficult to me

ttbar + jets and W/Z + jets are dominating backgrounds for new physics

Their cross section and all kinds of distributions will be extensively studied with control samples.
Also for no-lepton mode searches; QCD and fake E_T^{miss} are background

Questions:

What can we meaningfully contribute to flavour physics with 1 fb^{-1} ?
B-physics as well as high p_T physics
Is our first-data strategy sound?

What are the prime observables to investigate, given the constraints from high precision flavour physics?
What is the model dependence in these constraints?
What should we devote trigger-bandwidth to?

Several groups are trying to derive combined constraints from EW, HF observables
Do we need something equivalent to LEP EW working group with LHC data?
Collaboration of experimentalists+theorists, familiar with LHC data, EW data, B-factory data, EDM, g-2, WMAP, … and understanding of systematics
Coordinated effort to constrain SUSY?

mSUGRA is too constrained, and the MSSM too general.
What is a good framework to work in?

Given our limited flavour-id capabilities (e,μ,τ,t,b but not u,d,s,c)
what can we contribute to flavour studies with inclusive measurements?