ATLAS Analysis

Miriam Watson
PP Group Meeting

Top Physics

Simon, Juergen, Javier, Mark L, John, Chris, Miriam, Tom, Jody

- Theses:
  - Tom McLaughlan: “Measurement of Spin Correlation in Top Quark Pair Production”
  - Jody Palmer: “Top Cross Section Ratios as a Test of Lepton Universality” (in final stages)
- Responsibility:
  - Simon is Top Reconstruction convenor (supporting Run-1 "final" performance recommendations and preparing for Run2 analysis model changes)
- Top width and spin correlations:
  - Top quark width using template method (8 TeV): systematic studies needed (especially jet energy scale)
  - Top spin / polarisation measurements at 8 TeV: aim for definitive paper incorporating new techniques and new variables; possibility of very fast 13 TeV spin correlation measurement.

QCD/ Diffractive physics

Hardeep, Paul N.

- Thesis:
  - Hardeep Bansil: "Diffractive Dijet Production at $\sqrt{s}$ = 7 TeV"
- Hardeep had a STEP award: worked with Prague group to convert thesis analysis to a paper; PRN continuing this work (results not yet public)

- PRN plans to build a small group to analyse existing and future ALFA data for single diffraction (tagged protons).
  - 1 year of postdoc funding from October
  - Applying for a Marie-Curie fellowship with an ex-H1 colleague $\rightarrow$ possible PhD to work in this area

Heavy flavour physics

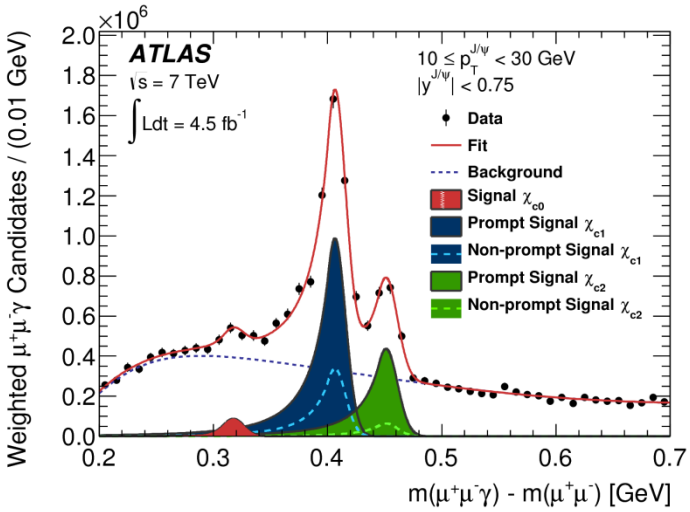
- Thesis:
  - Andy Chisholm: "Measurements of the χ_c and χ_b Quarkonium states"
  - Andy now a postdoc. in the group

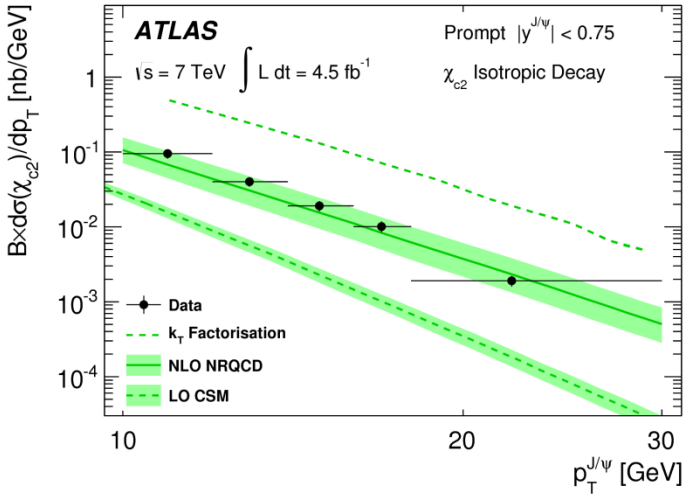
- Responsibility:
  - Andy- ATLAS UK B Physics convenor
  - Miriam- ATLAS B Physics Hadronic Decays convenor

- Published "Measurement of χ_{c1} and χ_{c2} production at $\sqrt{s}$ = 7 TeV"

  JHEP 07 (2014) 154
- Ongoing:
  - Extending published results on vector boson + quarkonium to 8 TeV
  - Charm mesons
  - Possible extensions to χ_c and χ_b analyses

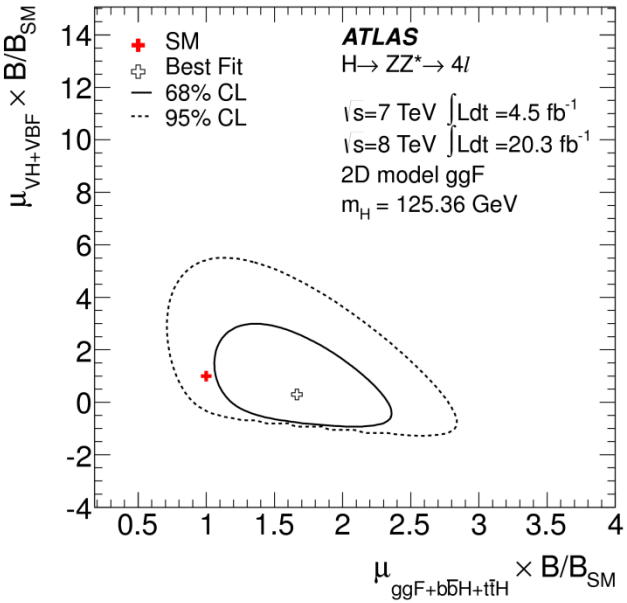
Andy, Miriam, Chris





H→ZZ→4l

- Two recent papers on Higgs properties using the H→4l channel:
  - H→γγ and H→4l Combination mass paper: arXiv:1406.3827
  - H→4l coupling paper arXiv:1408.5191
- Responsibility:
  - Kostas - ATLAS UK Higgs convenor
  - Editorial roles: Kostas (both papers), Ludovica (supporting note)



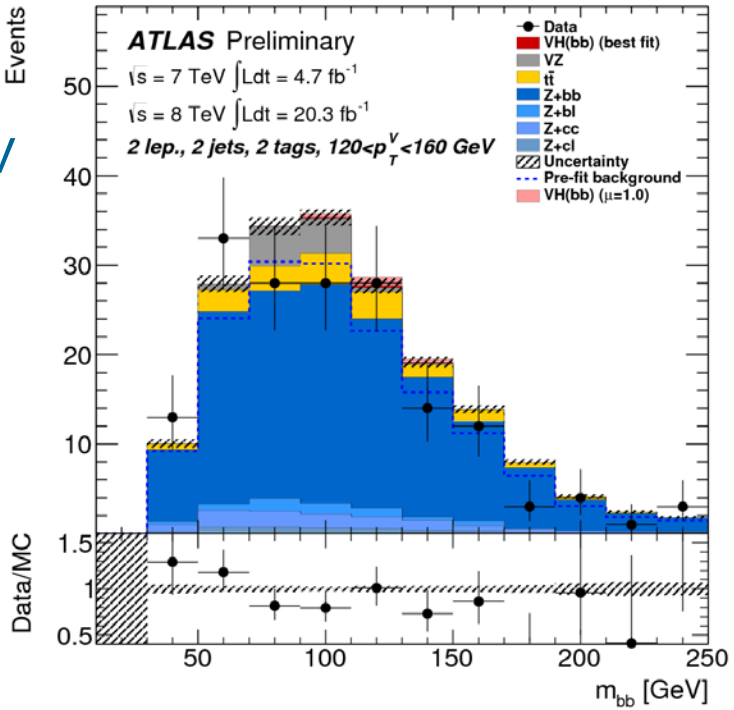
- Activities cover all aspects of the analysis:
  - Improvements to selection and lepton ID; new geometry definitions and calibrations; efficiency scale factors; background estimates
  - LO Matrix Element Kinematic Discriminant, to increase discrimination power between signal and ZZ* background events in mass analysis
  - Multivariate discriminant to increase sensitivity in coupling analysis

- Run 2 preparation:
  - ECFA 2013 paper on the projection of the H→4l coupling measurement sensitivity
  - Aiming to improve electron performance

Paul T., Benedict

Associated (W/Z)H(→bb)

- Associated Higgs production VH (H→bb) channels where V=νν, lν, ll (0,1,2 lepton channels):
  - H→bb highest SM decay rate at m_H=125 GeV (58%)
  - Large QCD backgrounds for inclusive search
  - Production in association with vector boson reduces background
- Birmingham work includes 1- and 2-lepton analyses
- Preliminary results last summer; final publication imminent
- Large number of improvements to the sensitivity including:
  - Using BDT in a multivariate analysis
  - Jet energy scale and b-tagging calibration
  - Missing ET trigger to gain acceptance in 1-lepton channel
  - Limit fitting



- Working on extension to Two Higgs Doublet Model

Additional Higgs/SM studies

Kostas, Ludovica, Andy C et al

- New studies of rare Standard Model and Higgs decays, with potential sensitivity to the charm Yukawa coupling
  - Detailed background studies
  - Branching fraction limits
  - Aim to publish before the end of this year

- Investigate sensitivities to Yukawa couplings in future data at HL-LHC

ATLANTIS

Juergen, also: Pete, Javier

- Preparations for Run-2 ('xAODJiveXML' package) and migration from Run-1 AOD to Run-2 xAOD:
- All reconstructed objects (e, μ, jets etc), tracks, vertices in their old format disappeared → (nearly) empty event displays
  - New package xAODJiveXML created to read xAOD objects, about 12 classes
  - Already included in current Atlas S/W
  - All physics objects now being retrieved
  - Nightly checks for various inputs within Atlas S/W
- Event display here is ATLAS MC test event (ttbar): Track-vertex association working again, xml output understood by current Atlantis version
- To do for Run-2: update trigger data access, object quality variables, b-tagging for jets.
- Test with new MC production and fix any problems seen in Control Room tests this week.