ATLAS Activities at Stockholm University

Ughetto M. on behalf of the SU ATLAS group

Stockholm University

November 6, 2017

Member of the ATLAS group at SU

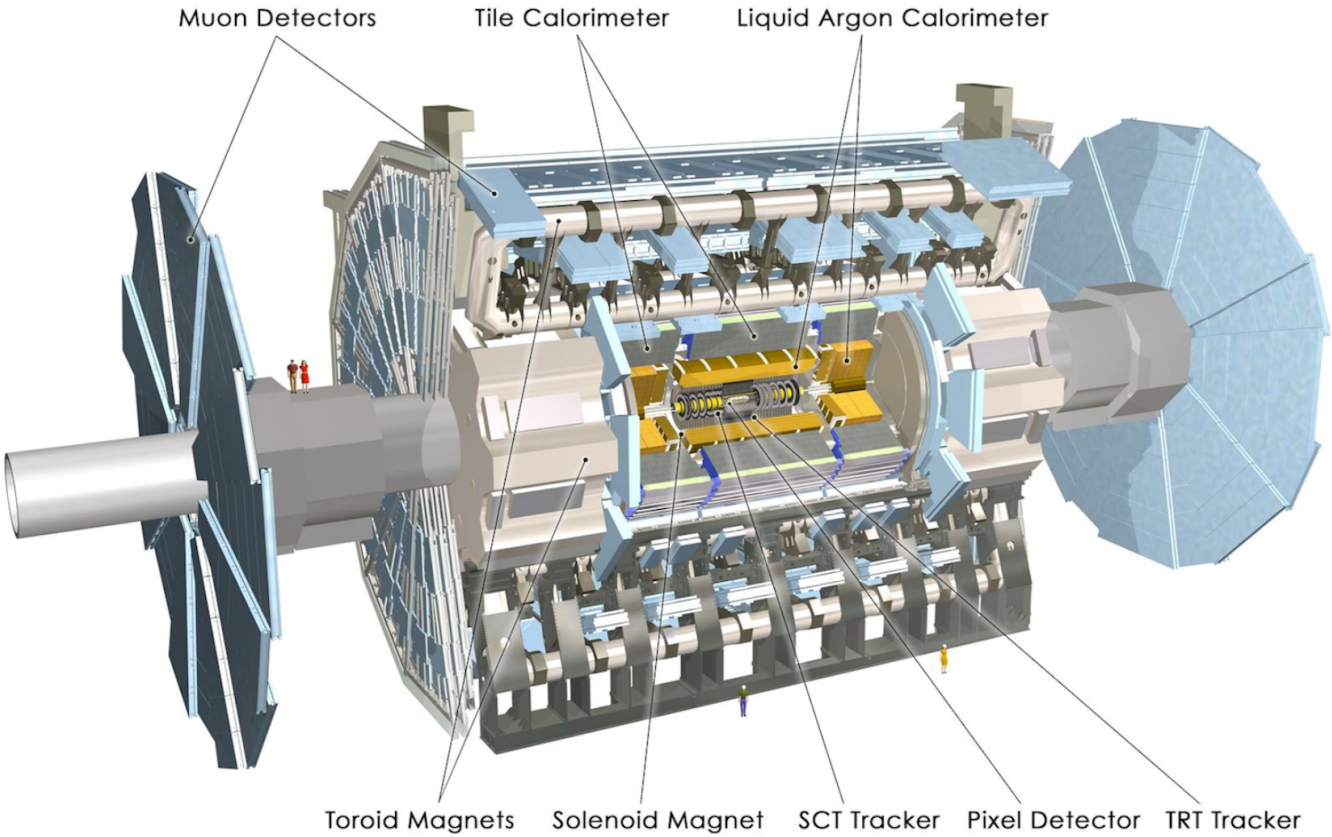
Instrumentation physics:

Christian Bohm	Professor
Rebecca Carney	PhD student
Samuel Silverstein	Senior Lecturer
Eduardo Valdés Santurio	PhD student
Veroncia Wallängen	PhD student

Particle Physics:

Filip Backman	PhD student
Gabriele Bertoli	PhD student [Defending soon]
Olga Bessidskaia Bylund	PhD student [Defended]
Christophe Clement	Professor
Sten Hellman	Professor
Kerstin Jon-And	Professor
David Milstead	Professor
Torbjörn Moa	Docent
Patrawan Pasuwan	PhD student
Nabila Shaikh	PhD student
Anna Shcherbakova	PhD student [Defended]
Jörgen Sjölin	Senior Lecturer
Sara Strandberg	Senior Lecturer
Michaël Ughetto	Postdoc
Barbro Åsman	Professor
Abulaiti Yiming	PhD student [Defended]

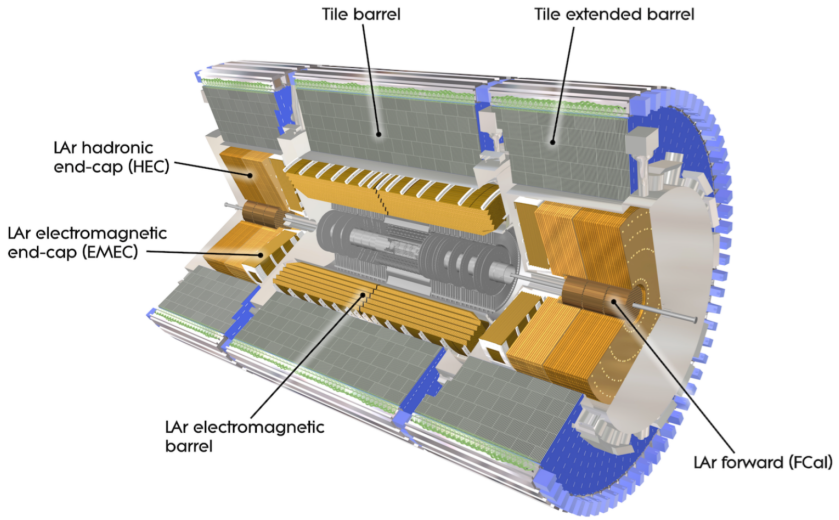
ATLAS overview

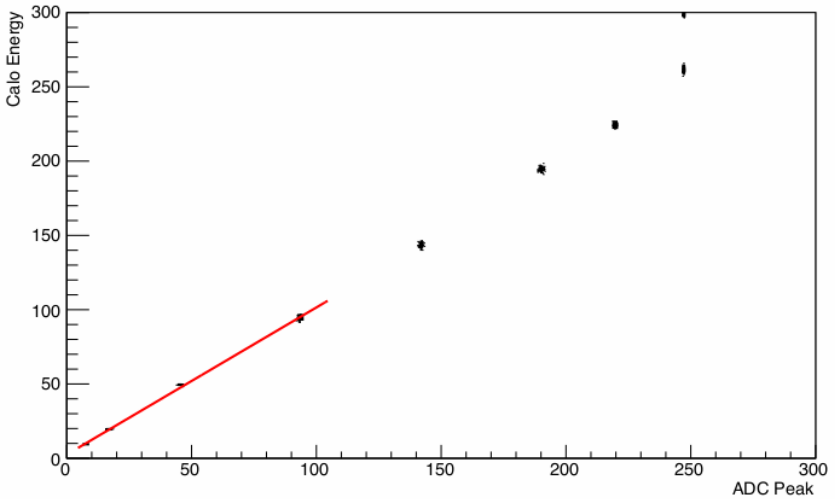


- a 44 m long and 25 m in diameter multi purpose particle detector at the LHC;
- SU group is involved in the hadronic Tile calorimeter and first level trigger (L1 calo).

Tile Calorimeter and L1 Calo operations and performance

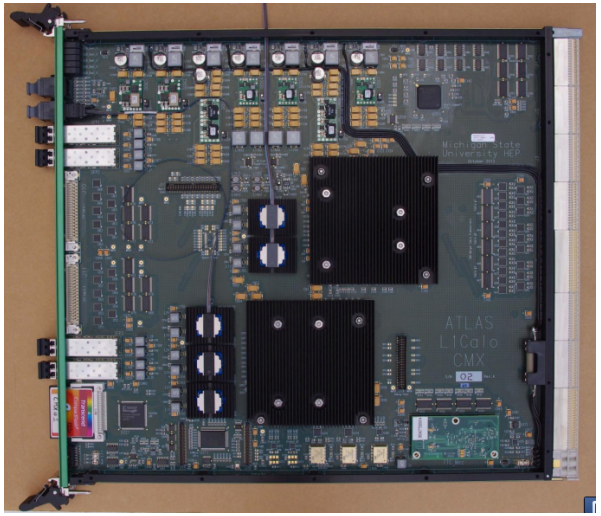
- Making sure ATLAS can record high-quality data:
  - Involved in DQ, calibration and shifts
- Tile Calorimeter
  - Calibration of cell and channel noise
  - DQ leader, DQ validation
- L1 Calo
  - Calibration and online monitoring
  - SU responsible for Optimal Filter coefficients optimization

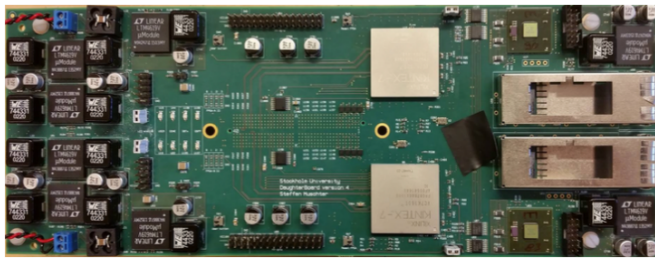




ATLAS upgrade

C.Bohm, S.Silverstein, E.Valdés





- L1 Calorimeter Trigger
  - Firmware support and development for
    - Jet ID algorithm processor
    - Trigger object feature merger (CMX)
  - New fibre plant for L1 topology processor (Phase-I)
- Hadronic Tile Calorimeter upgrade (Phase-II)
  - Continued prototype hardware testing and integration
  - Recently completed the technical design report (TDR)
- Link Daughter Board (DB)
  - Front-end control, data acquisition and readout of upgraded TileCal electronics
  - 9.6 Gb/s readout links with FPGAs and commercial fibre-optic modules
  - Stockholm responsible for production/commissioning of 1024-board system
  - New DB design based on latest FPGA family, first prototypes produced by end of this year.

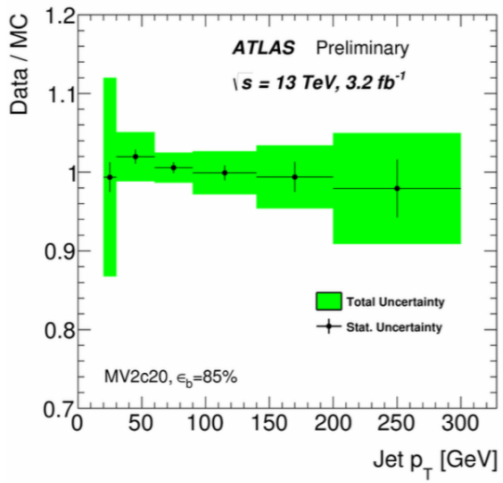
ATLAS General

- DQ shifts, Run Control shifts
- Christophe: co-responsible of the ATLAS Jet/EtMiss group. A large group in charge of:
  - Jet and missing transverse momentum reconstruction (trigger and offline)
  - Calibration of jets (energy scale, resolution)
  - Recommendation to analyses
  - Jet substructure studies and jet-tagging (top, W, Z, Higgs)
- Data preparation:
  - Sara and Prim: track-based luminosity determination in collaboration with the KTH group.
  - Michaël: Data reprocessing

B-tagging of jet and bottom quark physics

O.Bessidskaia Bylund, A. Shcherbakova, S.Strandberg, M.Ughetto

- Algorithm development
  - Identification of jets from bottom quarks (b-tagging) is an important tool in many physics analysis
- Calibration
  - Efficiencies and fakes rates of the algorithms need to be calibrated
  - Currently calibrations extends to 300 GeV
  - Developped dijet-based method to calibrate the b-efficiency up to 1 TeV
  - Developping algorithms for calibrations

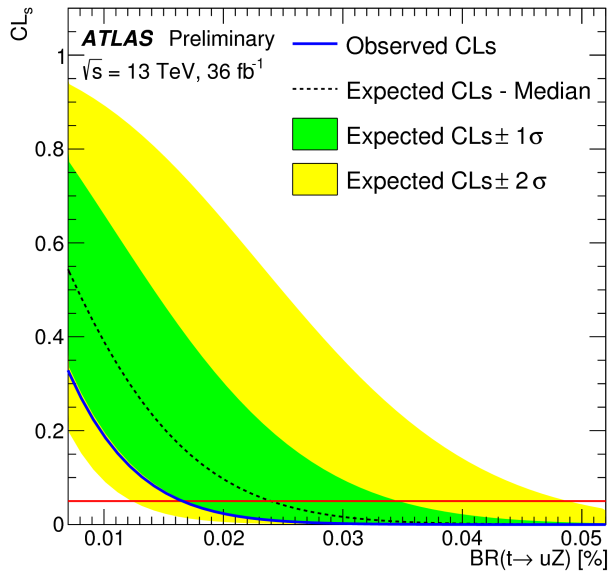


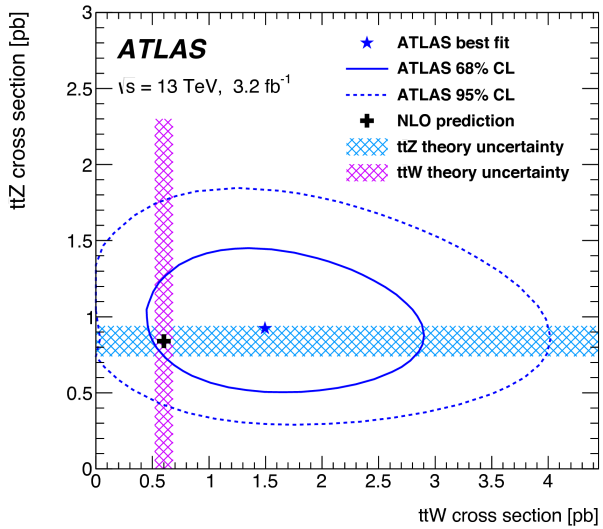
- Software: analysis tools, working points
- Sara responsible for b-tagging data-quality
- Measurement of b-quark fragmentation function

Top Physics

O.Bessidskaia Bylund, K. Gellerstedt, S.Hellman, S.Molander, N.Shaikh, J.Sjölin

- Search for new physics without looking for new particles
- Measurement of top-antitop production in association with a boson
  - Cross-section of tt+Z and tt+W at 13 TeV c.o.m. energy Eur. Phys. J. C77 (2017) 40
  - Couplings of dimension 6, FCNC conserving, operators in EFT
  - tt+H cross-section
- Ongoing measurement projects
  - FCNC in the top sector, e.g. top decay to Z+light quark (ATLAS-CONF-2017-070)
- Estimate of the fake lepton background is one of our specialities
  - One of the contributions to the analysis presented to the right

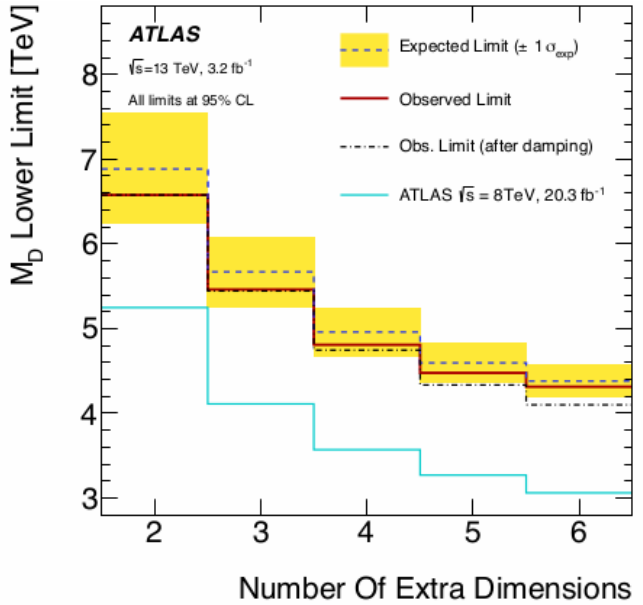


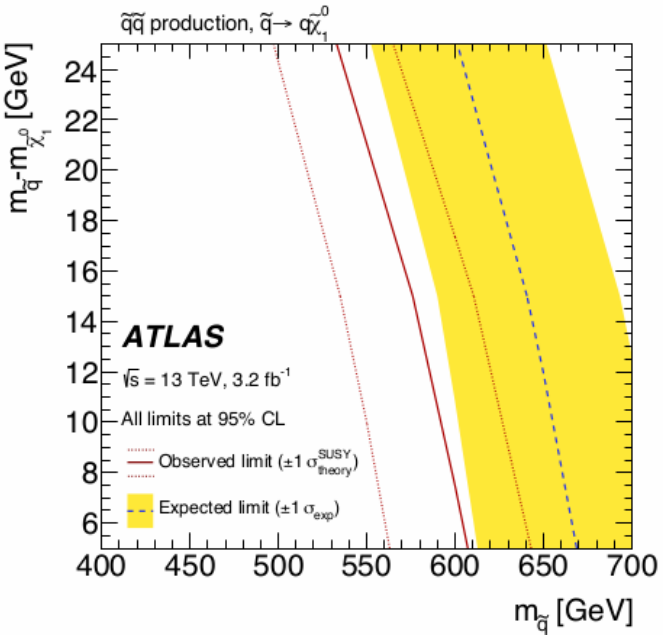


Mono-jet analysis

G.Bertoli, C.Clement

- SUSY and Large Extra Dimensions models can explain Dark Matter
  - Dark Matter candidates and the graviton (the hypothesised mediator of gravity) escape detection, leaving an energy imbalance in the detector
  - Events with an Initial State Radiation (ISR) jet recoiling against missing energy can be used to identify such candidates
- Established sensitivity to ADD and compressed SUSY models
- Background calculations, theory uncertainties and limit settings
- Contributed to papers:
  - doi:10.1140/epjc/s10052-015-3517-3
  - doi:10.1103/PhysRevD.94.032005

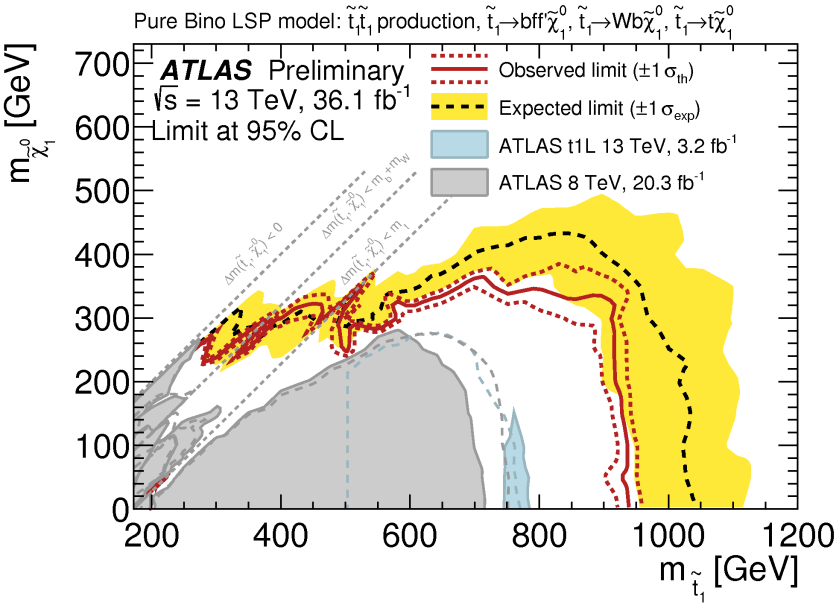


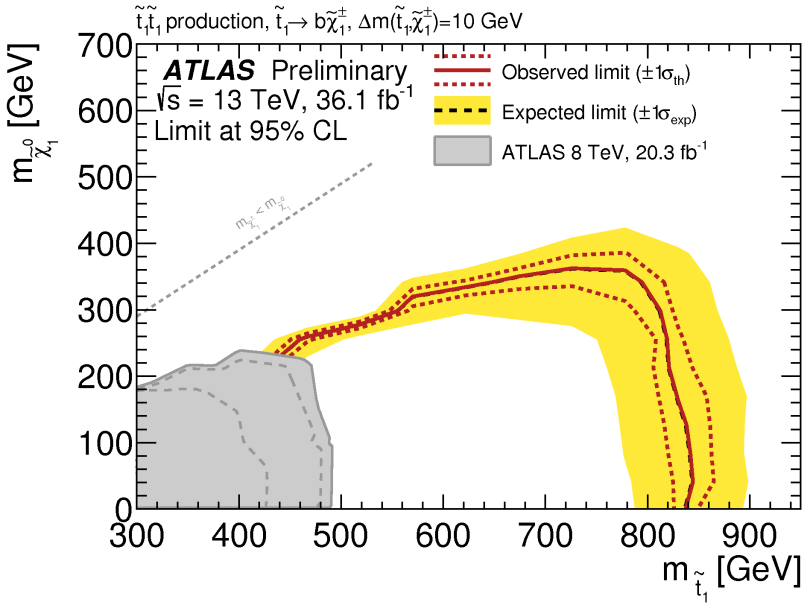


Search for stop pair production

K.Jon-And, A.Scherbakova, S.Strandberg, M.Ughetto, A.Yiming

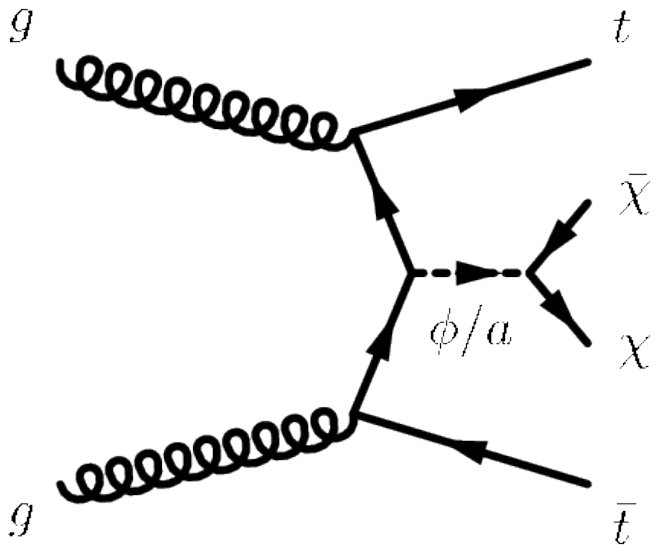
- Searches for a light stop motivated by natural SUSY
  - Probe mass-space with simpified models of stop decays in 1-lepton final state: $\tilde{t} \to b\chi_1^{\pm}$, $\tilde{t} \to t\chi_1^0$
  - Sensitivity studies, signal grid scans and interpretations of the Run1-results in a large set of pMSSM models
- Run 2 results:
  - 3.2 ifb pubished (Phys. Rev. D 94 (2016) 052009)
  - 36 ifb public (ATLAS-CONF-2017-037)



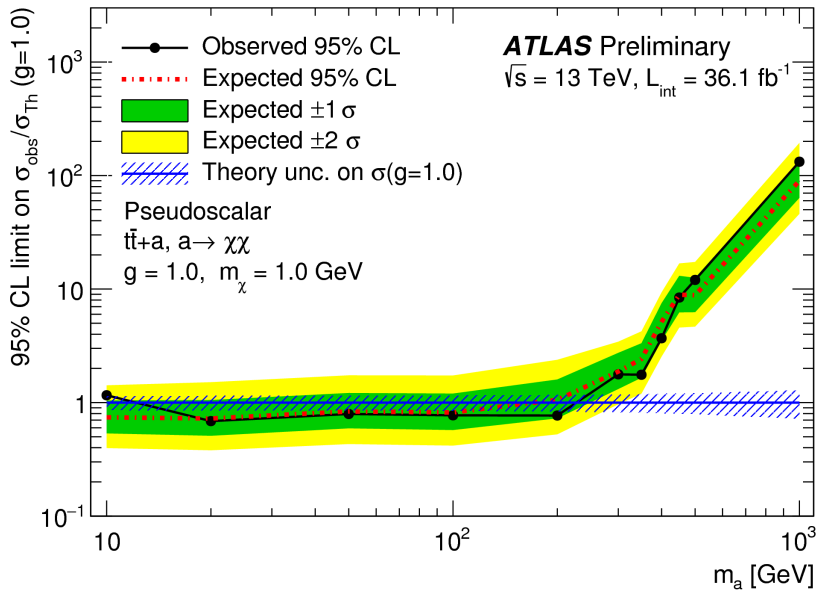


Search for Dark Matter + Heavy Flavour

A.Shcherbakova, S.Strandberg



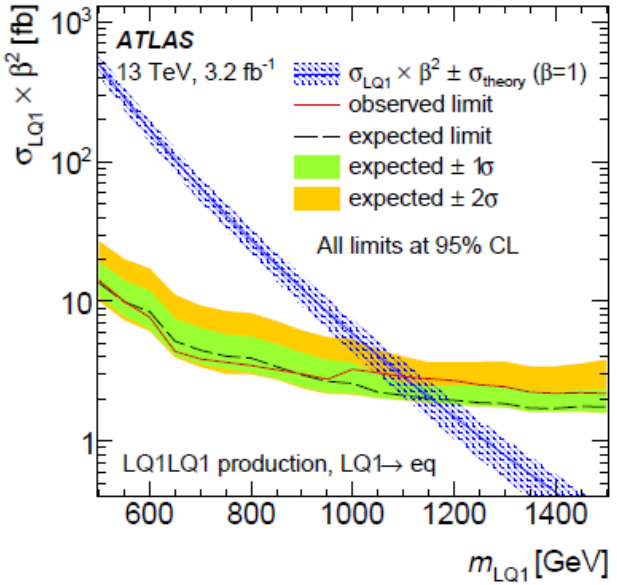
- Wimp DM could be produced at the LHC
  - Run 1: use EFT in DM searches
    - Enhanced DM couplings to heavy quarks for some EFT operators (motivated by MFV)
- Run 2: use simplified models
  - Models developed in the DM working group, in collaboration with CMS and theorists
- Involved in ttbar+MET and bb+MET searches
- Results available on arXiv (1710.11412) and submitted to EPJC

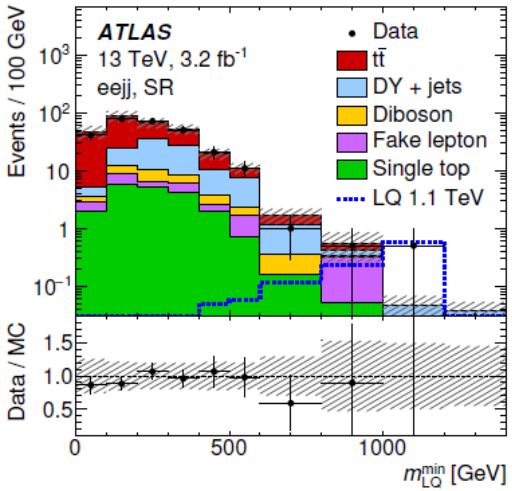


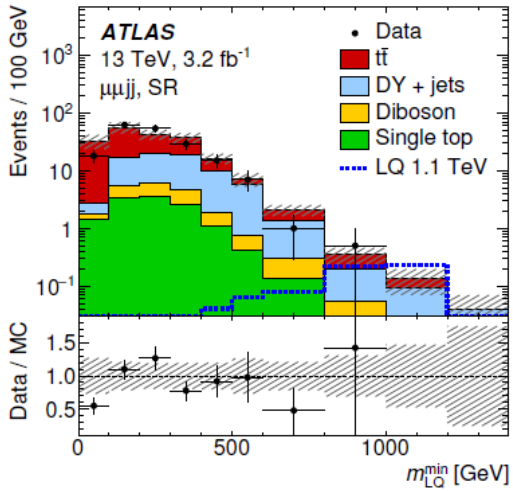
Search for leptoquarks

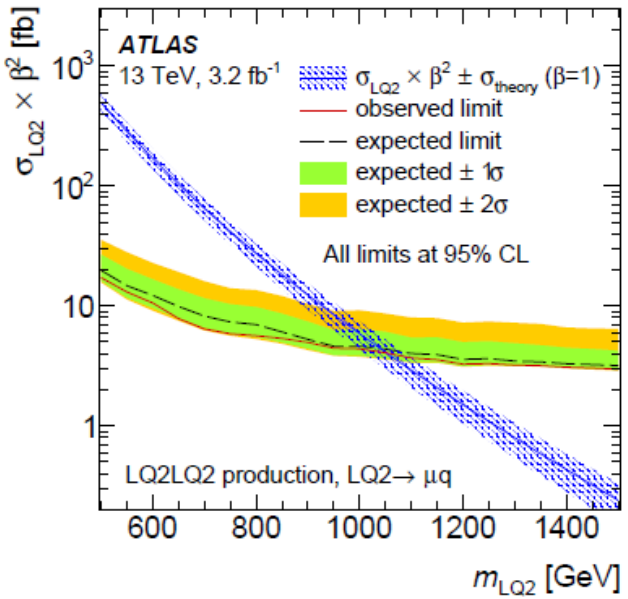
D.Milstead, R.Pöttgen - now Lund

- Coordination, analysis, paper editor arXiv: 1605.06035 [hep-ex]
- Symmetry between lepton and quark sectors (e.g. unification models)
- Lepton-jet resonance search at 13 TeV c.m. energy
- High precision 13 TeV search being finalized
- Expanding to include MET signatures









Conclusion

The group at Stockholm University is involved in many areas of ATLAS activities:

- Operations, performance and data quality
- Data analysis
- Upgrade
- Outreach: Master classes, forskarfredag

Looking forward 2018 data-taking and future exciting results.