

ATLAS: Report to the PRC

Miroslav Nožička

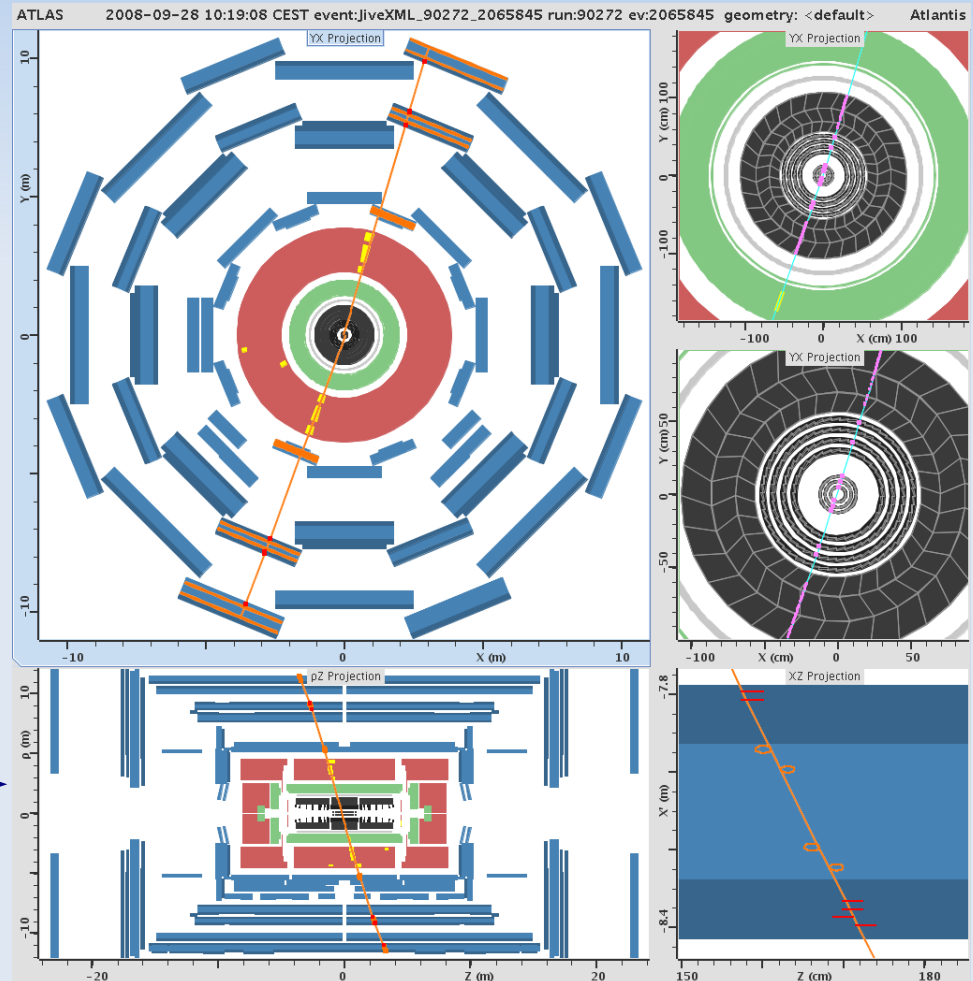
on behalf of the **DESY-ATLAS** group
68th DESY PRC Meeting
5th November 2009, Hamburg



Overview



- DESY ATLAS group members
 - Physics Program
 - Technical Activities
 - Conclusion
-
- ATLAS Detector - ready for first data
 - Being exercised with cosmic rays



DESY-ATLAS Group



- Group members (Hamburg and Zeuthen)
 - 9 senior staff
 - 1 Junior professor
 - 2 YIG leaders
 - 14 Post-Docs (DESY fellowship)
 - 17 PhD students
 - *some members work part time on HERA or ILC*
- Collaborations with:
 - University of Hamburg
 - Humboldt University Berlin
 - DV Zeuthen + IT Hamburg
 - Analysis Centre

ATLAS Responsibilities



■ Pixel Upgrade for SLHC	
■ Prompt Reconstruction Operations Coordinator	David Côté
■ Offline Software Release Coordinators	David Côté, Michael Böhler
■ Derived Physics Data task force convener	Karsten Köneke
■ Standard Model & eGamma DPD maintenance and production	
■ Monte Carlo convener	Judith Katzy
■ Monte Carlo software manager	Ewelina Lobodzinska
■ Trigger Core Convenor	Jörg Stelzer
■ Trigger Monitoring	Mike Medinnis
■ Trigger Configuration	Jörg Stelzer
■ Absolute Luminosity For ATLAS (ALFA)	Karl-Heinz Hiller
■ ATLAS Remote Monitoring Centre	
■ National Analysis Facility User Committee Chair	Wolfgang Ehrenfeld
■ German LHC Outreach Group GELOG Chair	Thomas Naumann

Physics Program

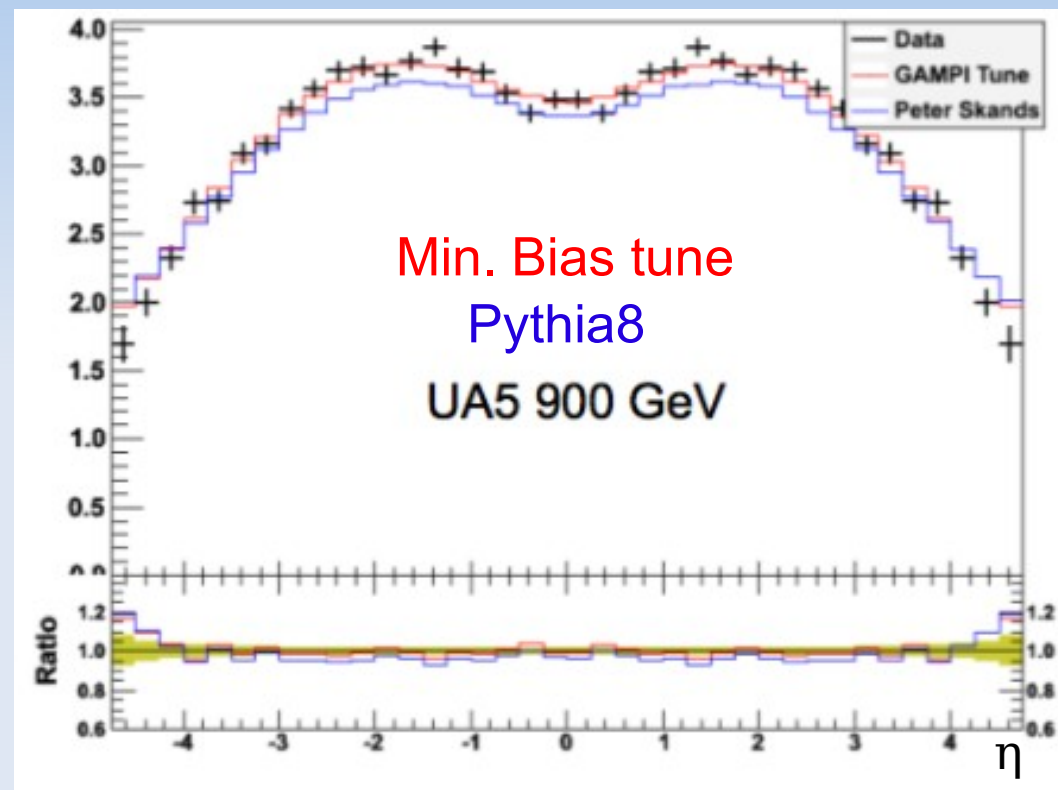


- **Minimum Bias:** determination of charged track multiplicity, MC tuning
- **Standard Model:**
 - $Z \rightarrow e^+e^-$: sensitivity to PDF distribution
 - $Z \rightarrow \tau^+\tau^-$: efficiency, reconstruction and mistagging studies
- **Top:**
 - $t\bar{t}$ cross section with the first data
 - $t\bar{t}$ as calibration: trigger efficiency monitoring
 - new physics with top
- **SUSY:**
 - mSugra (leptons) and GMSB (photons and taus) models
 - discovery studies
 - parameter measurements (masses, lifetimes, etc.)

Tuning of MC Generators for LHC



- Coordination of ATLAS MC09 tune for underlying event and minimum bias
- Development of genetic algorithm for tuning & tuning of pythia8
- In cooperation with Terascale Alliance @ Freiburg & Berlin
- Internal note in preparation



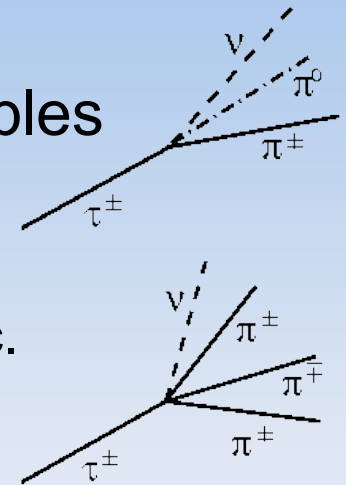
Charged particles pseudorapidity distribution

Preparing to include first ATLAS data

Cut Based Identification of Hadronic τ decays



- Identification of τ hadronic decays based on safe variables for first τ physics at ATLAS
 - Calorimeter based cuts
 - Electromagnetic radius, Ratio of EM energy to total energy, etc.
 - Calorimeter+track based cuts
 - Combined calorimeter and track variables
 - Optimization of the simple cuts: Use genetic algorithm from TMVA
 - 3 set of cuts:



	Efficiency	Bckg. rejection factor
Loose	70%	19
Medium	50%	145
Tight	30%	366

Results are used for τ identification starting from software release 15

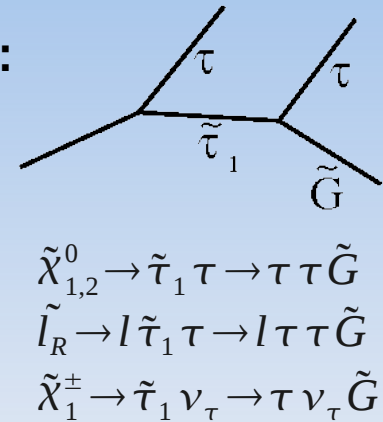
Reference: CDS ATL-PHYS-INT-2009-082 (public note soon)

SUSY GMSB models with τ final states

- MC cut Optimization for detection of GMSB6 NLSP $\tilde{\tau}_1$
 - $\sqrt{s} = 10 \text{ TeV}, L = 200 \text{ pb}^{-1}$
 - Preselection to minimize SM background
 - Selection to optimize signal significance
- GMSB parameter scan $\Lambda, \tan \beta$
 - $\sqrt{s} = 10 \text{ TeV}, L = 200 \text{ pb}^{-1}, 1 \text{ fb}^{-1}$
 - Detection of NLSP using the previous selection
 - Discovery potential for different lumi: signal significance $S \geq 5$
- Study of invariant di-tau mass distribution
 - $\sqrt{s} = 10 \text{ TeV}, L = 8 \text{ fb}^{-1}$
 - Mass difference determination: $M_{\tau\tau}^{max} = \sqrt{m_{\tilde{\chi}_1^0}^2 - m_{\tilde{\tau}_1}^2}$

GMSB6 scheme:

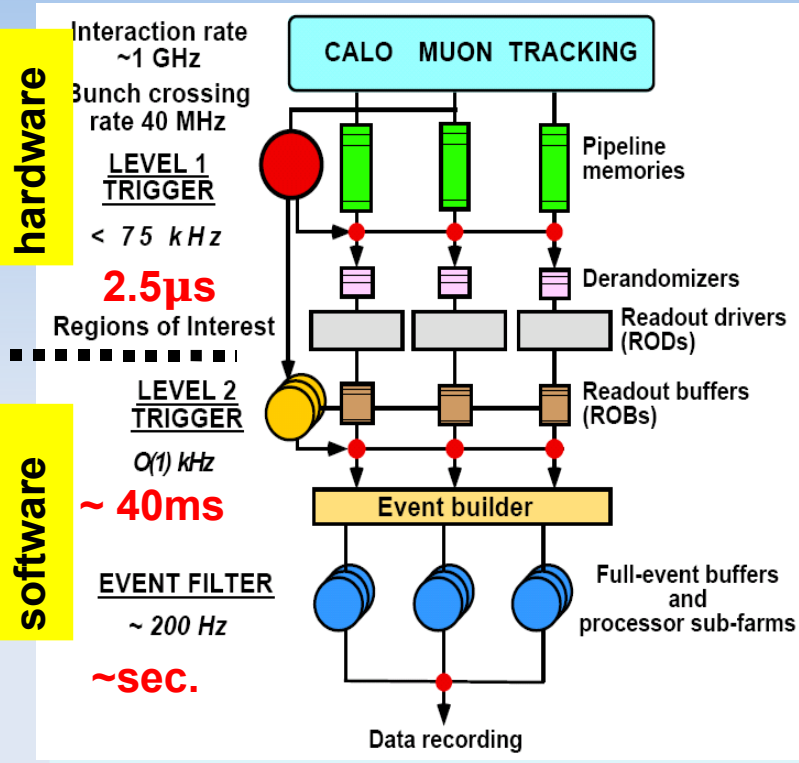
$$\begin{aligned}\Lambda &= 40 \text{ TeV} \\ \tan \beta &= 30 \\ M_m &= 250 \text{ TeV} \\ N_s &= 3 \\ \text{sign } \mu &= + \\ C_{grav} &= 1\end{aligned}$$



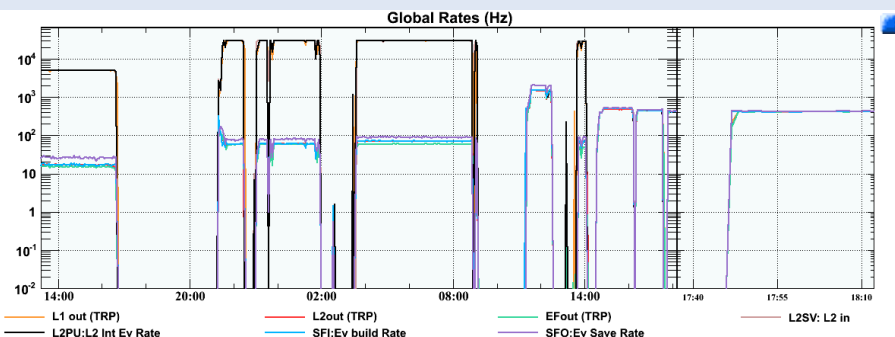
ATLAS discovery potential of SUSY with the first LHC data

Reference: CDS ATL-PHYS-INT-2009-095 (public note soon)

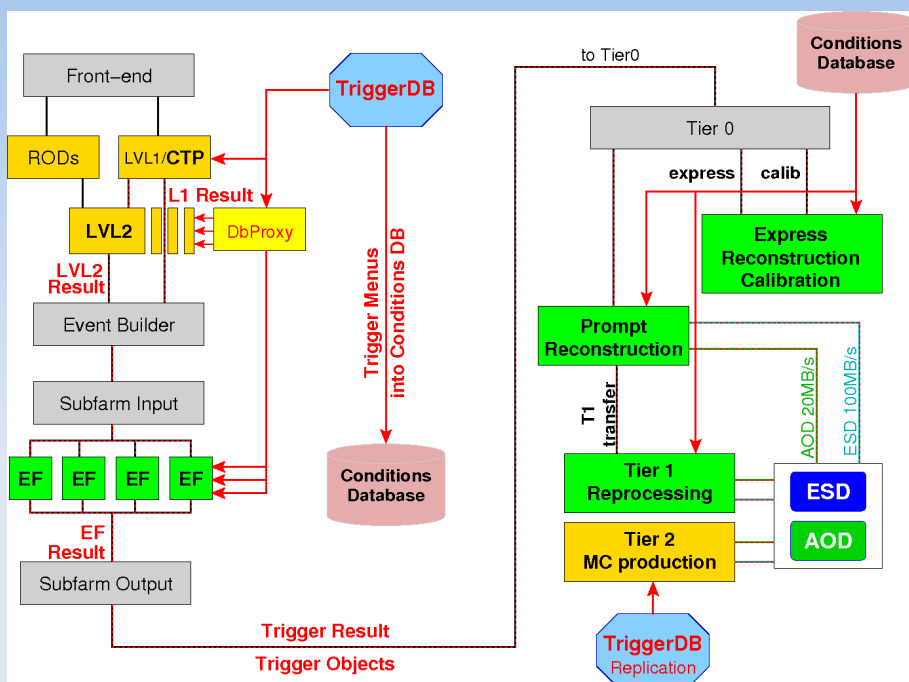
Trigger Activities



- Trigger Core software
 - Trigger setup for online processing
- Trigger Configuration
 - Design and development of the trigger configuration framework
 - Providing trigger information for DAQ and physics analysis
 - Interface and support for online operations
- Trigger Menu
 - Implementation of physics algorithms to trigger framework
- Trigger Monitoring
 - Online monitoring of trigger performance



Trigger Configuration



- Trigger DB
 - Relational DB – entries are not doubled
 - Oracle, MySQL, SQLite
 - Full Trigger information stored in the DB
 - Java based GUI for access to TriggerDB – Trigger Tool

Activities

- Overall functionality of trigger configuration
- Running the trigger offline
- Partial development of the Trigger Tool
- Autoprescale Tool

triggertool 0240122: nozicka@expert-atlas.com: trigger-v2.1.0: all-i-x.com: choosing Oracle

ID	Name	Version	Comment	Origin	Creator	Releases	Status	Status of RPC/TGC
566	Cosmic2009v2	4	with TriggerRelease...	XML UPLOAD	paul	15.5.0.1	OnL	not ready
565	PhysicsLumiE31	7	Physics Lumi IE21 w...	XML UPLOAD	alex	15.4.0.6	OnL	not ready
564	PhysicsLumiE31	6	default physics lumi...	XML UPLOAD	paul	15.5.0.1	OnL	not ready
563	Cosmic2009v2	3	-	XML UPLOAD	paul	15.5.0.1	OnL	not ready
562	Cosmic2009v1	8	Cosmic2009v1 with ...	XML UPLOAD	alex	15.5.0.1	OnL	not ready
561	PhysicsLumiE31	5	lumiE31 with Trigger...	XML UPLOAD	alex	15.5.0.1	OnL	not ready
560	Cosmic2009v1	1	Default Cosmic2009...	XML UPLOAD	alex	15.5.0.1	OnL	not ready
559	PhysicsLumiE31	4	Default E31 Menu. M...	XML UPLOAD	alex	15.5.0.1	OnL	not ready
558	Cosmic V2 - muon w...	1	-	XML UPLOAD	aggaard	15.4.0.6	OnL	not ready

Tree	Menu
L1_IJ2B0_EMPTY	L2_e0_mbrs_c_EFullcalo_cosmic
L1_MBT5_C_EMPTY	EF_e0_mbrs_c_EFullcalo_cosmic
	L2_g0_mbrs_c_EFullcalo_cosmic
	EF_g0_mbrs_c_EFullcalo_cosmic
	L2_g0_mbrs_c_cosmic
	EF_g0_mbrs_c_cosmic
	L2_MBIasCalc_EndCapC_V2
	EF_MBIasCalc_EndCapC_V2
L1_BCM_Wide_EMPTY	L2_m0Bcm_cosmic
	EF_m0Bcm_cosmic
	L2_m0ID_BM_calib_cosmic
	EF_m0ID_BM_calib_cosmic

status

DESY-ATLAS and University of Manchester cover responsibility of Trigger Configuration

Reconstruction of ATLAS Data



■ Operations & Commissioning

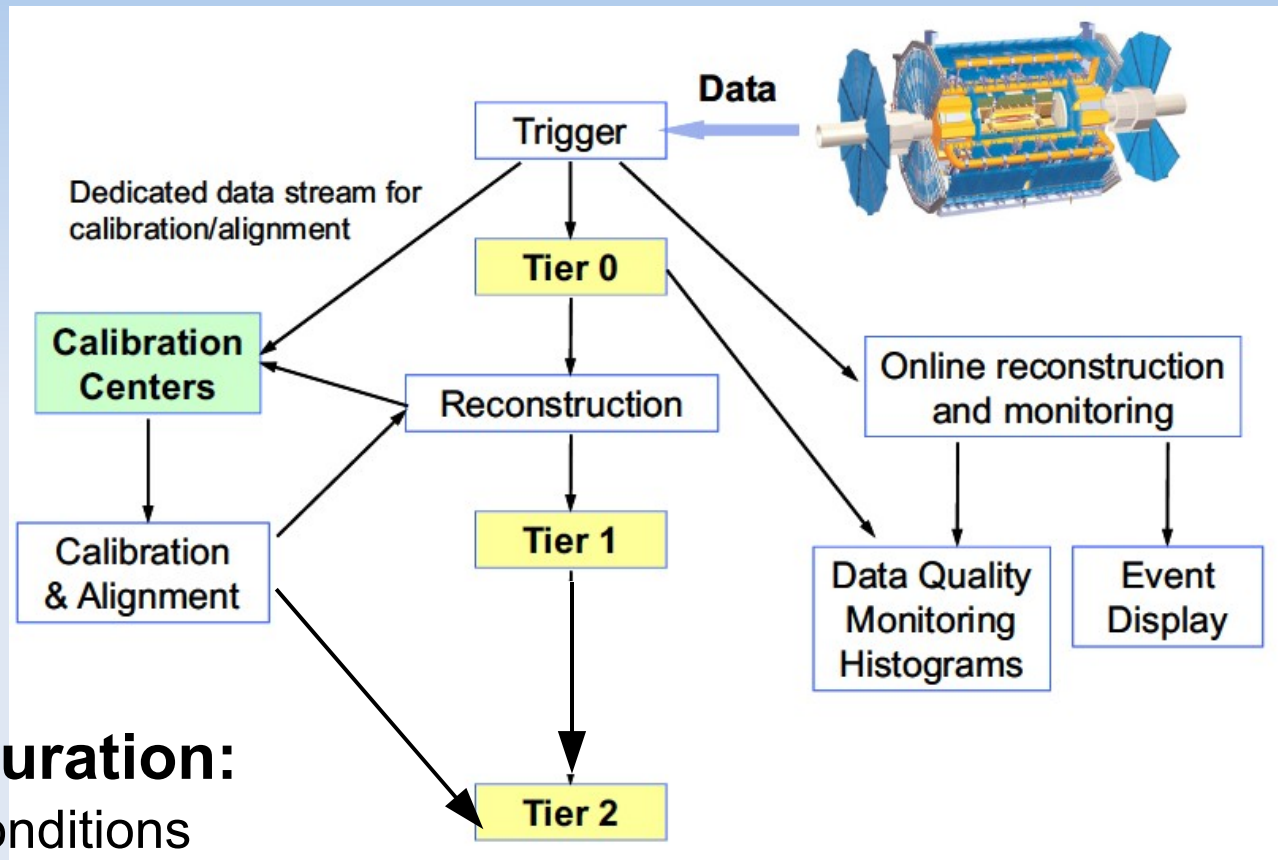
■ Prompt Reconstruction Operations Coordinator

- oversee all Tier0 software & operations, which process and export all ATLAS data *live* as they are recorded
 - data reconstruction, monitoring, calibration, quality assurance

■ Managing 2 of 5 main offline software releases

■ Data-driven auto-configuration:

- Frequent changes of data conditions during commissioning (e.g. magnetic field, beam status)
- Common and flexible interface used by Tier0, Tier1 & users



Event Data Model (EDM) Service



Supervise definition and implementation of the core ATLAS data file formats
Applies to all official data formats (ESD, AOD, HITS, DPD, ...)

■ Schema Evolution

- Manage changes to the EDM over time
- Ensure backwards compatibility of software and data

■ Read-Speed Improvements

- I/O is bottleneck in many steps in the data processing chain today
- Optimise structure of ROOT files
- Optimise ATLAS Transient-Persistent Separation Conversions
- Simplify ATLAS persistent EDM
- Goal: read files at 10 MB/s

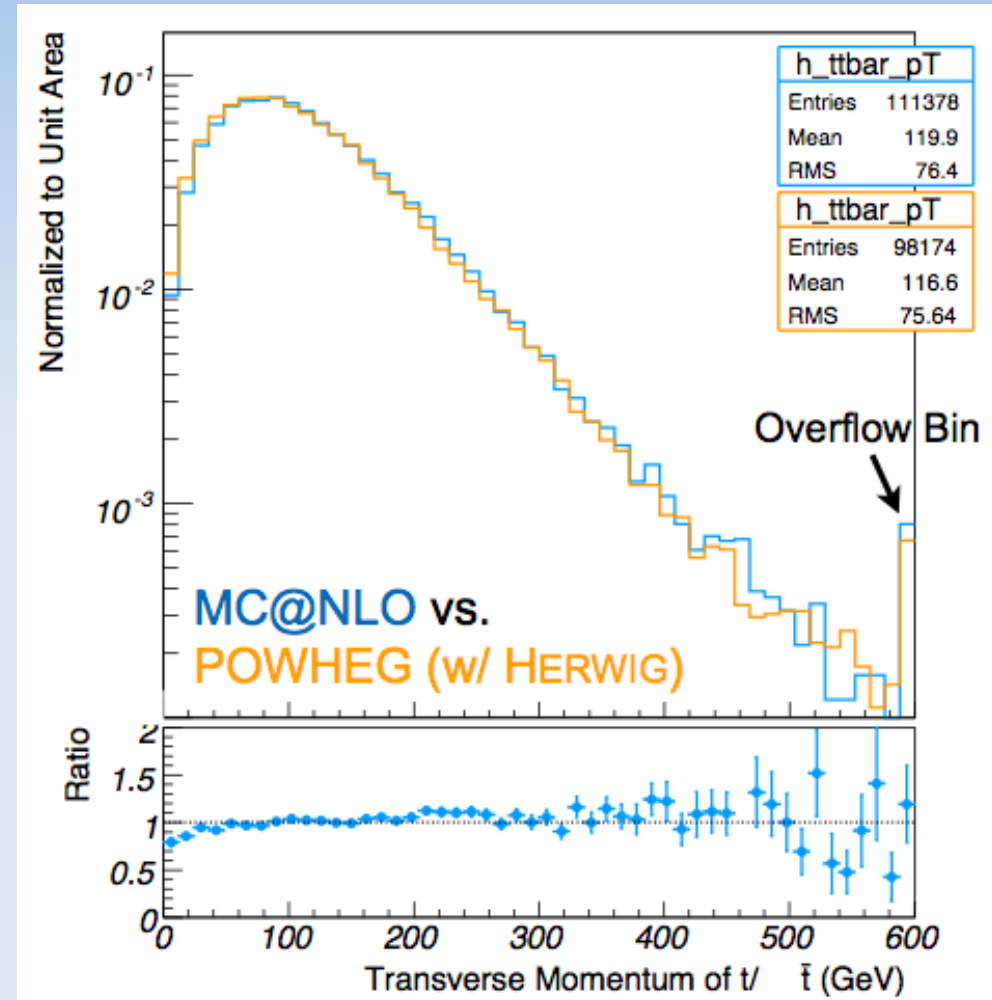
Release rel_5	Success	Messages	Ignored
aodtoad.AOD-15.5.0.log (jo)	✓	<u>0</u>	<u>35</u>
aodtoad.AOD-15.4.0.log (jo)	✓	<u>0</u>	<u>43</u>
aodtoad.AOD-15.3.0.log (jo)	✓	<u>0</u>	<u>43</u>
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aodtoad.AOD-15.1.0.log (jo)	✓	<u>0</u>	<u>43</u>
aodtoad.AOD-15.0.0.log (jo)	✓	<u>0</u>	<u>43</u>
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aodtoad.AOD-14.2.22.log (jo)	✓	<u>11</u>	<u>39</u>
aodtoad.AOD-14.2.21.2.log (jo)	✓	<u>12</u>	<u>39</u>
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aodtoad.AOD-14.2.0.2.log (jo)	✓	<u>6</u>	<u>152</u>
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aodtoad.AOD-13.0.40.5.log (jo)	✓	<u>15</u>	<u>39</u>
aodtoad.AOD-13.0.30.5.log (jo)	✓	<u>14</u>	<u>39</u>

Automated validation of reading old files written in previous software releases with the newest software release

Validation of MC Generators



- DESY long term responsibility for MC generator interfaces to ATLAS software
- Development of HepMCAnalysis tool for generator validation
 - Status: completed and integrated in ATLAS validation framework
- Generator validation and support:
 - POWHEG for top production calculation @ NLO
 - HERWIG++ for SUSY and W/Z production
 - Helac-Phegas for multijet final states*In Cooperation with Terascale Alliance @ Wuppertal*

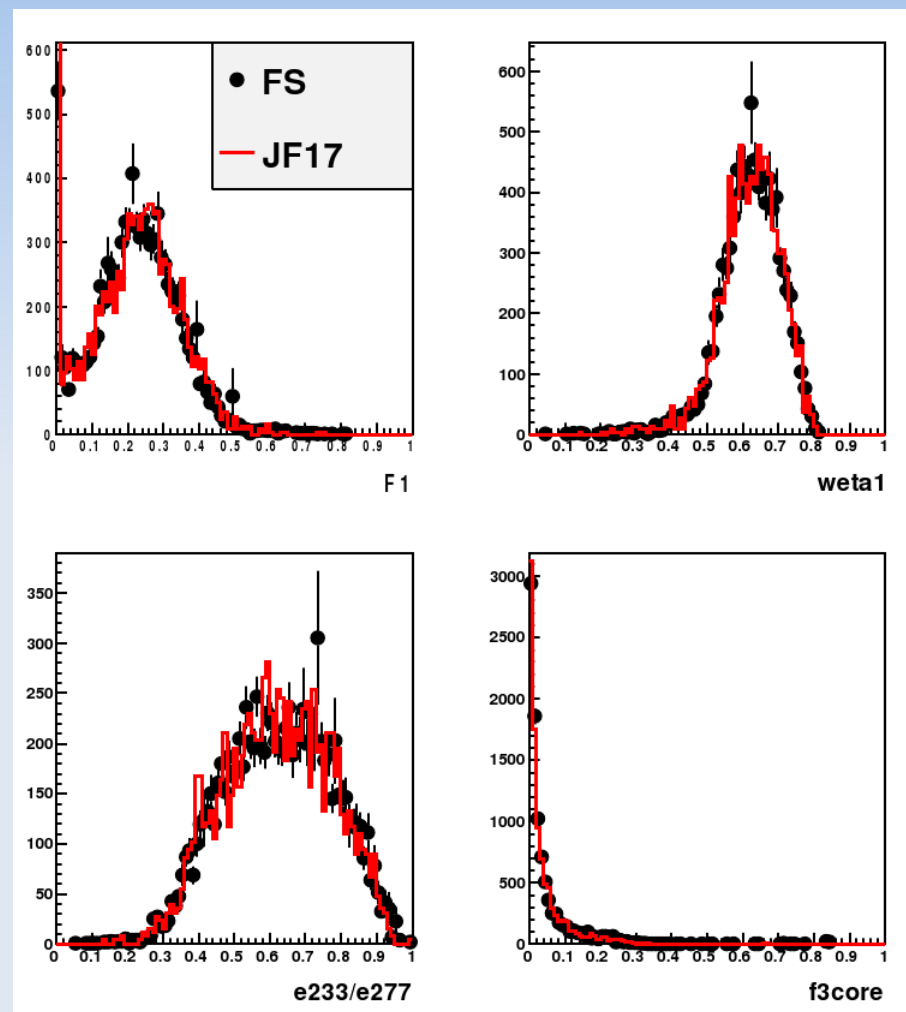


Simulation using frozen showers



- Frozen Showers: fast simulation method for low energy electrons and photons in calorimeters.
- Frozen Showers work together with full simulation, providing comparable results for deposited energy and shower shapes.
- Frozen Showers combined with recent developments which include cut against thermal neutrons and termination of soft particles in dead material give about **7 fold** reduction in simulation time compared to the full simulation for physics events.

Frozen showers are essential for large statistics background simulation, they reproduce well fake rates of the full simulation.

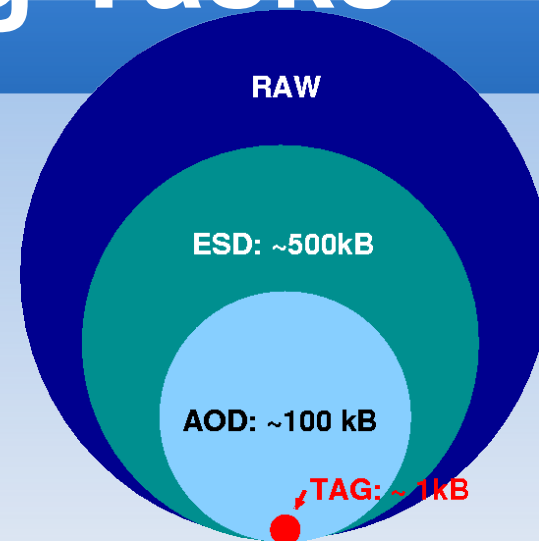


Comparison of fake electron distributions for the full simulation and frozen showers enriched electron fake samples

Other Computing Tasks



- The ATLAS DESY group participation:
 - Group member is ATLAS librarian (release management of the ATLAS offline software)
 - ATLAS offline release building
 - Management and monitoring of ATLAS world wide data distribution
 - Participation in the operation of the GridKa cloud
 - Operation of the Tier-2 center
 - NAF ATLAS support (ATLAS specific user support)
 - DESY operates an instance of the ATLAS TAG database besides CERN and BNL



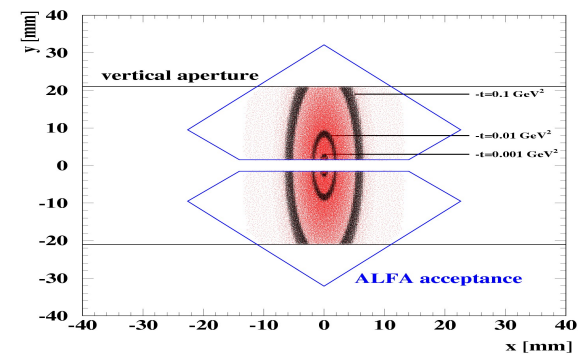
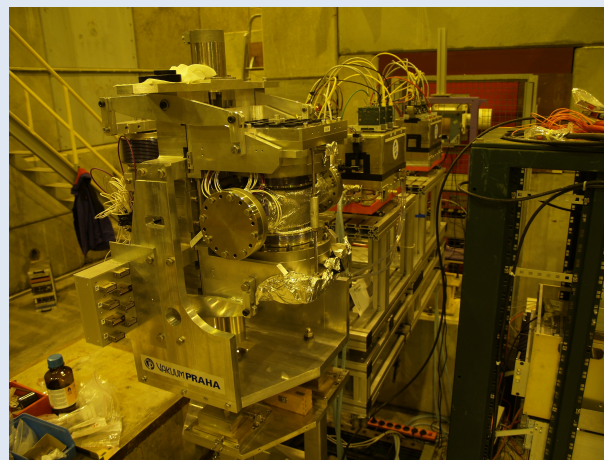
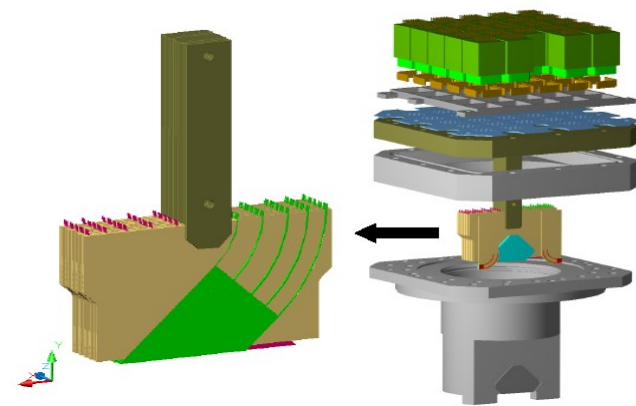
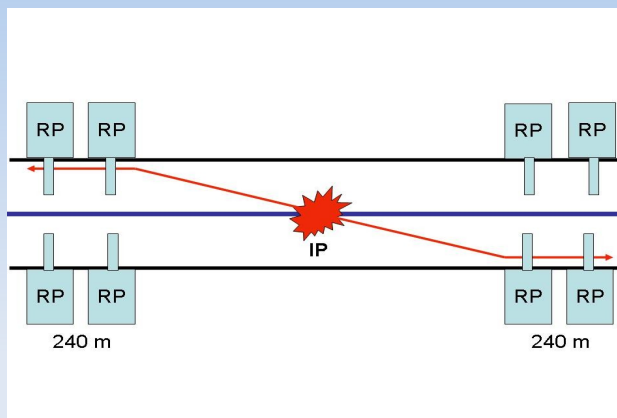
- TAG data is a very dense event summary (detector status, trigger information, physics quantities)
- TAGs can be used for fast event selection
- TAG DB@DESY:
 - Oracle based DB
 - Back end: 4x 4 Core machines/64 GB memory
 - Storage:
 - Current - 2+4 TB
 - Data taking - 10+20 TB

ALFA



Absolute Luminosity For ATLAS, to calibrate LUCID detector

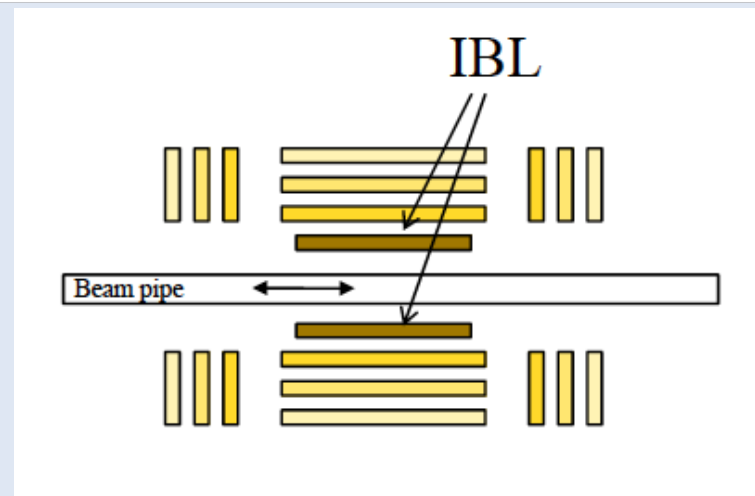
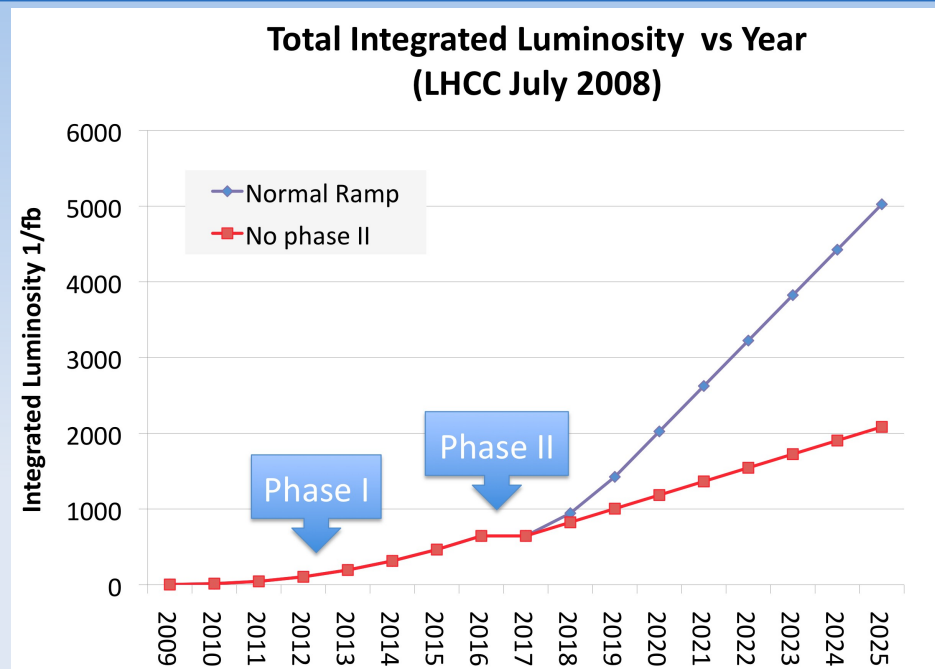
- 4 roman pot stations
- Special runs required
 - LHC optics adjustment
large β , 43 bunches
- LUCID calibration
 - absolute luminosity
measurement precision 3%
- DESY responsibilities:
 - HV supply
 - Fiber Detector Metrology
 - ~50% of multianode PM's
 - Trigger detectors
- Status:
 - 1 station mechanics installed
at LHC



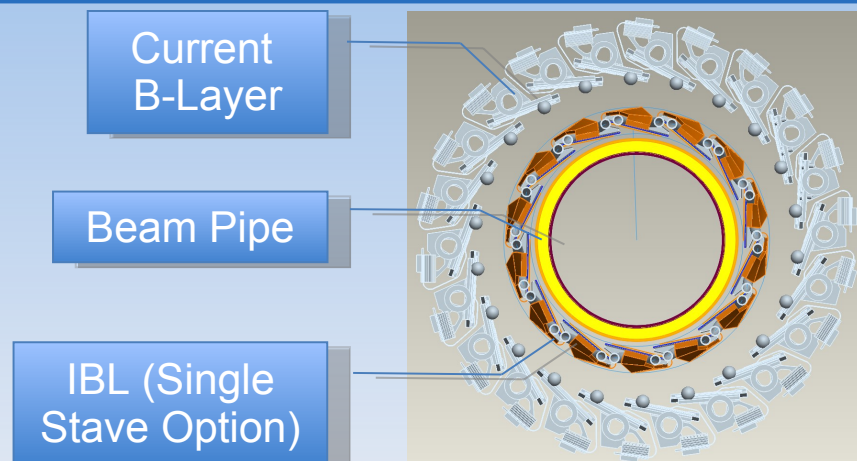
One complete station recently tested in the test beam at CERN

LHC and ATLAS Upgrade Plans

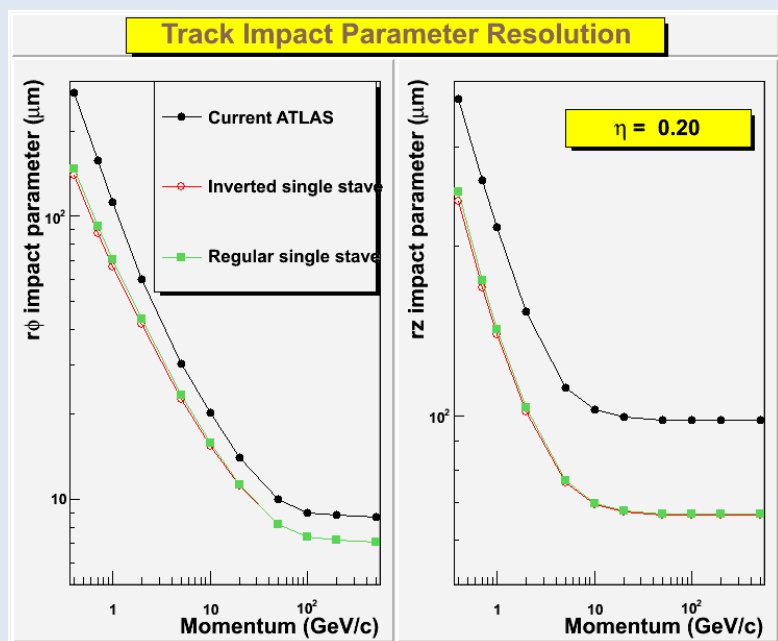
- Two-phase upgrade of LHC machine & detectors
- ATLAS Inner Detector upgrade:
 - Phase I (~2014): new innermost pixel layer inserted into existing pixel detector (Insertable B-Layer, IBL)
 - Phase II (sLHC, ~2018): full replacement of Inner Detector, most likely with all-silicon tracker



Insertable B-Layer



- DESY (& HU Berlin) plans adjusted to delays in upgrade schedule: contributions to IBL
- Strategic importance:
 - Good way of establishing DESY in the sLHC community
 - Good time to join: MOU and TDR in preparation
- Responsibilities: services and simulation
 - Design and testing of high voltage distribution
 - Procurement & test of optical fibers
 - Test beam & EUDET pixel telescope
 - Detailed MC simulations
- sLHC R&D ongoing: test beam, MC simulations, DC-DC powering



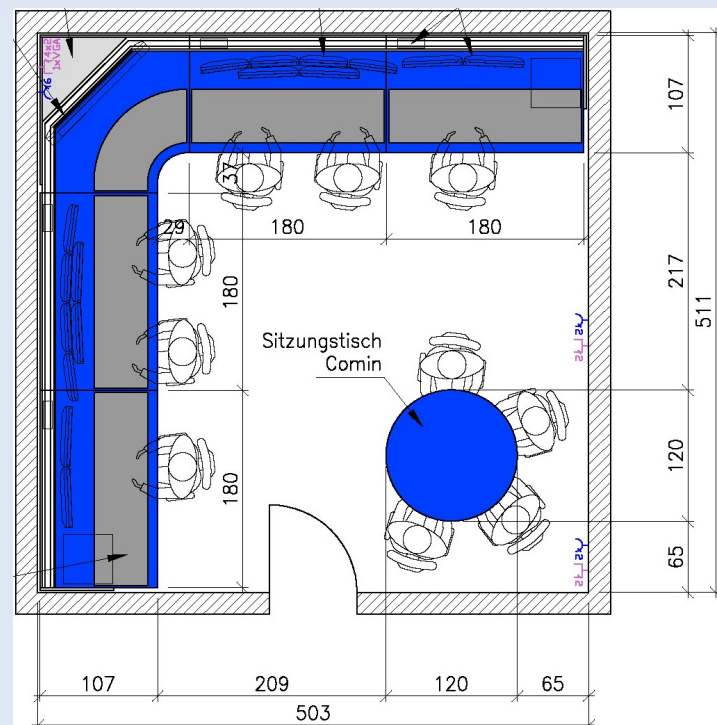
Remote Monitoring Centres at Hamburg and Zeuthen



- Project driven by ATLAS, Univ. of Chicago and DESY
- Follow recommendations from Helmholtz evaluation and the example of the LHC@FNAL Fermilab Remote Center
- Involve German ATLAS community
- Good instrument to bring LHC and ATLAS activities to the lab and public
- ATLAS and DESY management strongly support the idea
- ATLAS Control Room services limited to P1
 - mirror copy of basic services outside P1
 - web based services like event displays, HD webcams etc

■ Status

- initial set up in bldg. 3 till bldg. 1 renovated
- 1 monitoring and 1 display station set up
- HD video conference equipment ordered
- evaluate setup
- room in Zeuthen in CERN design under construction



Summary



- DESY group playing major and leading roles in many ATLAS activities
- DESY-ATLAS group well prepared for LHC start up
- Imminent LHC startup necessitates an increase in already strong involvement in ATLAS online operations:
 - Shifts
 - Online expert activities
 - Data Management
- Involvement of DESY group in ATLAS upgrade for sLHC is of strategic importance

Backup slides

SUSY models with fittino

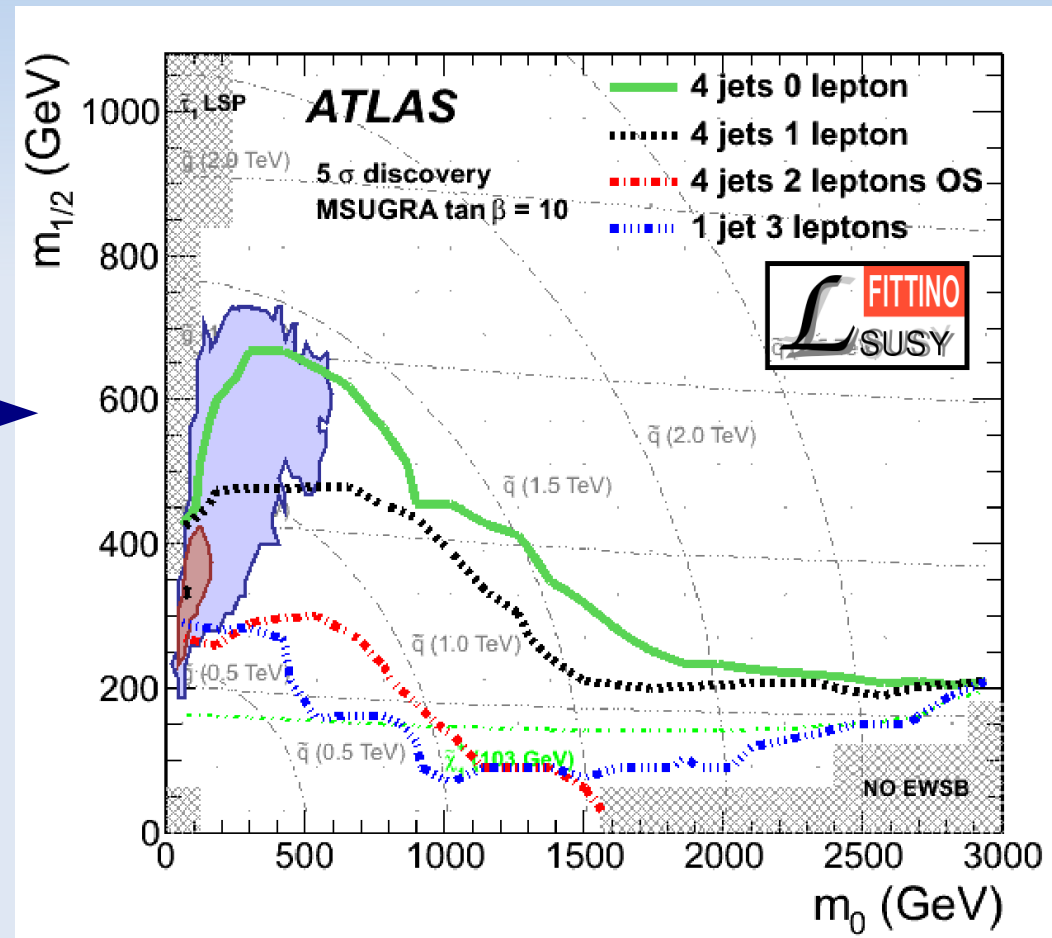


- Fitting SUSY models parameters using fittino
- Using existing measurement data

- Prediction of the ATLAS discovery reach for mSugra

$$\sqrt{s} = 14 \text{ TeV}$$
$$L = 1 \text{ fb}^{-1}$$

Good chance for early SUSY discovery at LHC



Reference: [arXiv:0907.2589v1 \[hep-ph\]](https://arxiv.org/abs/0907.2589v1)

Miroslav Nožička

Trigger Menu and Commissioning



- Trigger menu development
 - **Trigger menu: Defines the list of triggers run at each level**
 - **Responsible for preparing the menu for the experiment**
 - Requests from various physics, performance and detector groups
 - Make sure that we have the appropriate trigger at each phase of the experiment
 - **Menus for cosmic run, physics run, MC production**
- Trigger commissioning
 - Trigger ntuple produced at Tier0 during the reconstruction
 - **Development of the ntuple related to the menu**
 - Preparing for analyzing data and giving quick feedback to the operation of the experiment