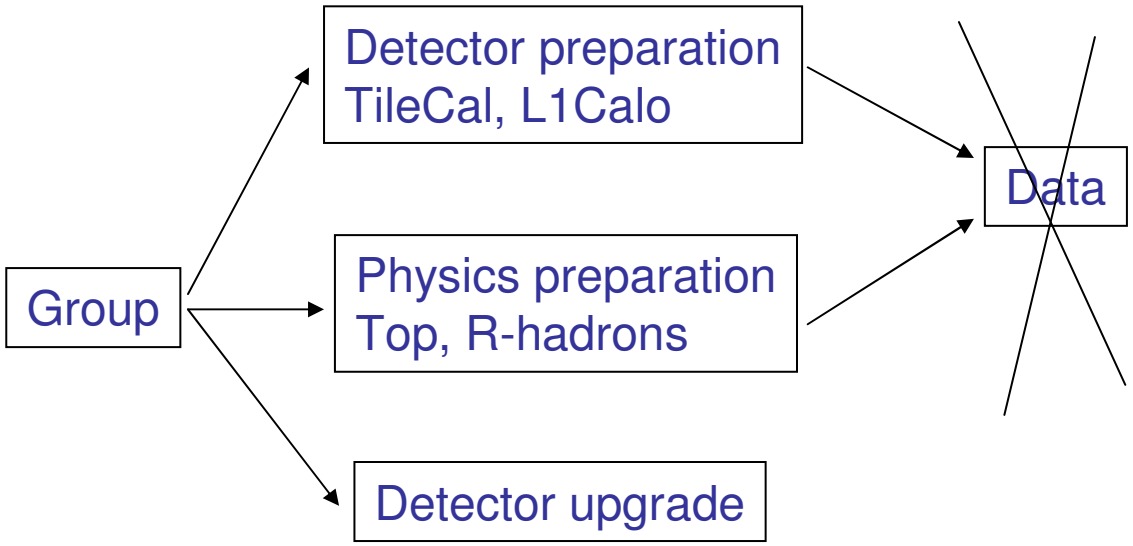
The Stockholm ATLAS group

David Milstead

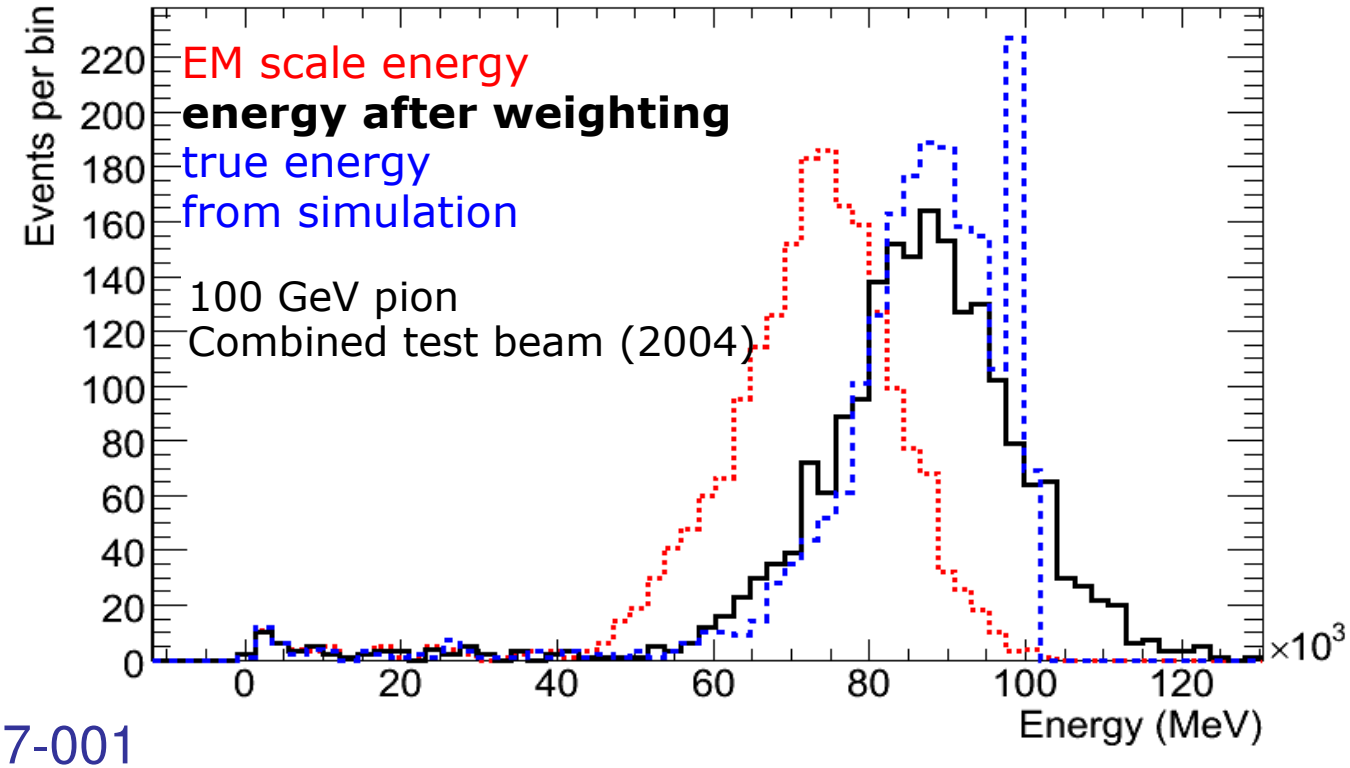


Who are we

- Senior staff
  - C. Bohm
  - C. Clément
  - E. Johansson
  - K. Jon-And
  - S. Hellman
  - D. Milstead
  - T. Moa
  - S. Silverstein
  - B. Selldén
  - J. Sjölin
  - B. Åsman
- Post-docs
  - S. Hillert
  - P. Mermod
- Diploma students
  - K. Bendtz
  - S. Köhler
- Ph.D. students
  - E. Bergeås Kuutmann
  - D. Eriksson
  - K. Gellerstedt
  - A. Hidvégi
  - M. Johansen
  - B. Nordkvist
  - C. Ohm
  - M. Tylmad

Hadronic calibration

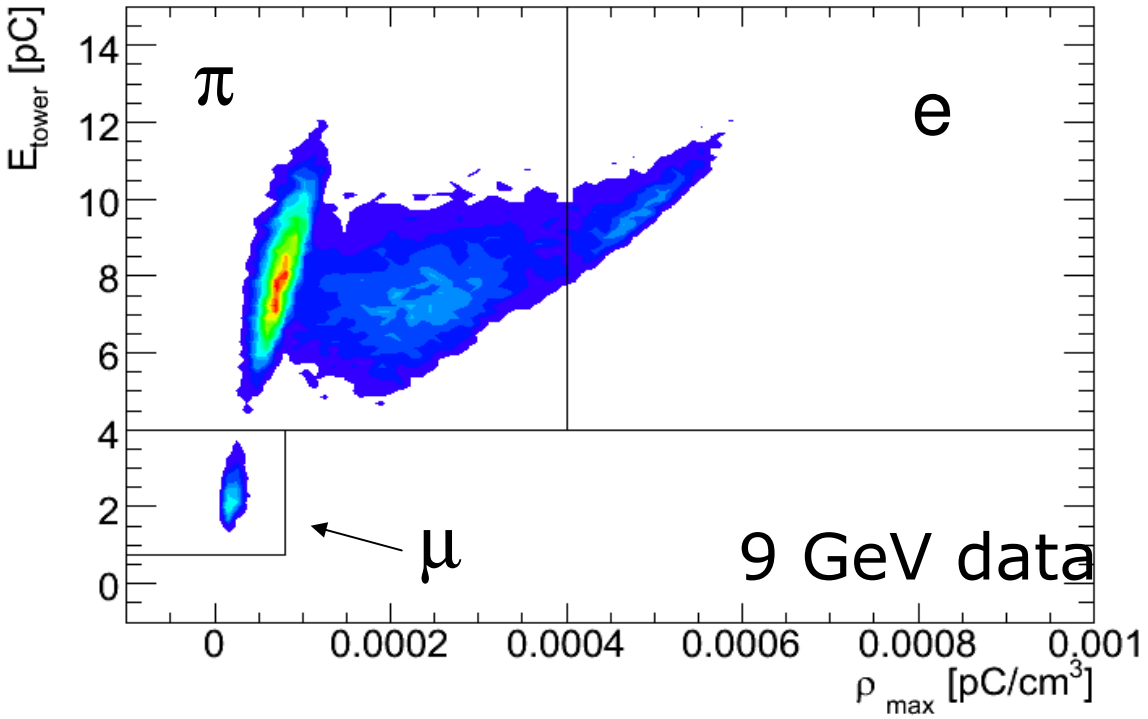
- E. Bergeås Kuutmann, K. Jon-And, D. Milstead
- The calorimeter response to energy deposited by *hadrons* is different than the response to i.e. photons and electrons.
- In ATLAS ~25% of the energy deposited by hadrons is invisible (nuclear excitations, break-ups)
- Compensate for the invisible energy loss by applying weights to the hadronic showers (off-line hadronic calibration)



- ATL-CAL-PUB-2007-001

Very low energy particles in the ATLAS hadronic calorimeter (Tile) test beam 2003

- Elin Bergeås-Kuutmann
- Understanding of low energy processes crucial for calibration
- 3-9 GeV data, mixture of pions, electrons and muons
- Particle separation: total deposited energy E_{tower} vs. maximal cell energy density ρ_{max}
- Identify particle composition
- Development of earlier work: ATL-TILECAL-PUB-2005-001



TileCal Timing with Laser

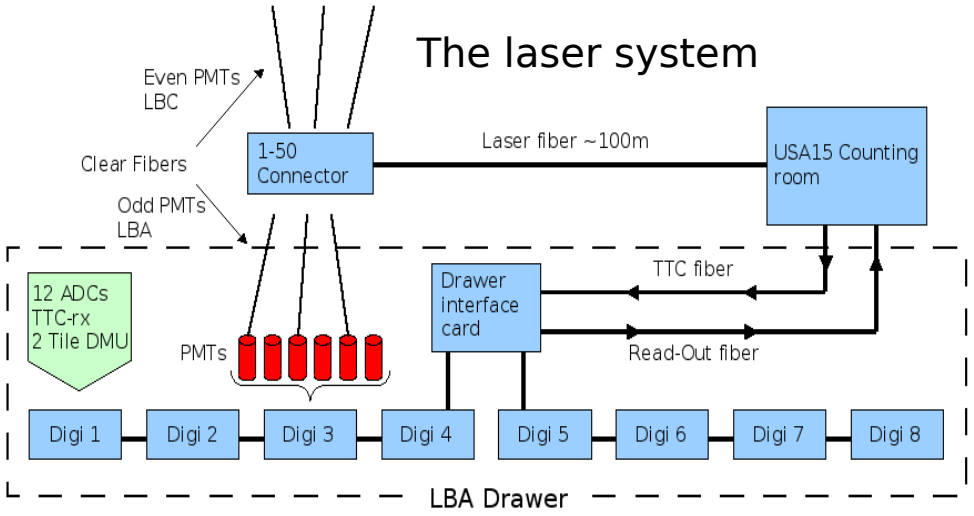
B. Nordkvist, C. Clement

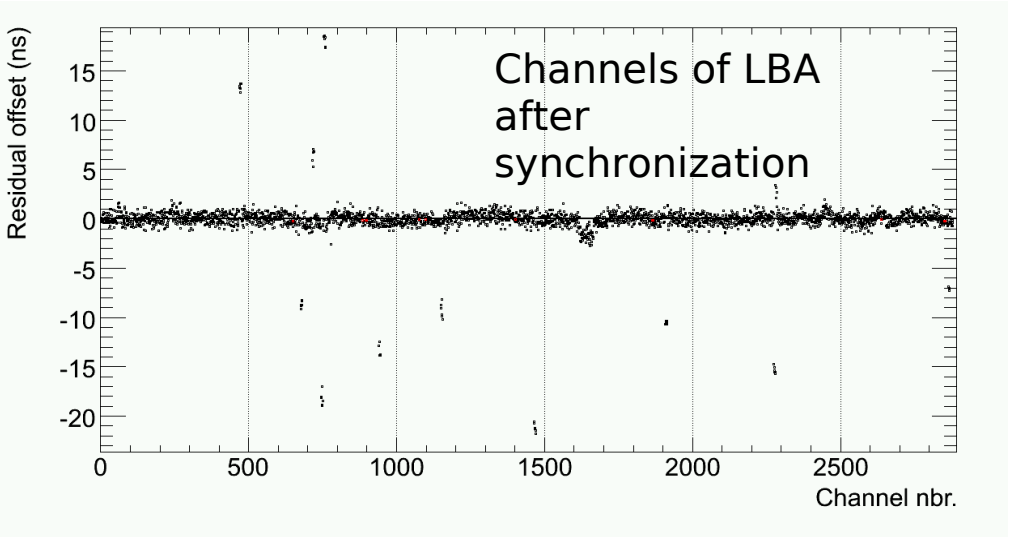
For an optimal energy and time reconstruction TileCal readout must be synchronized to a precision of < 2 ns w.r.t clock signal

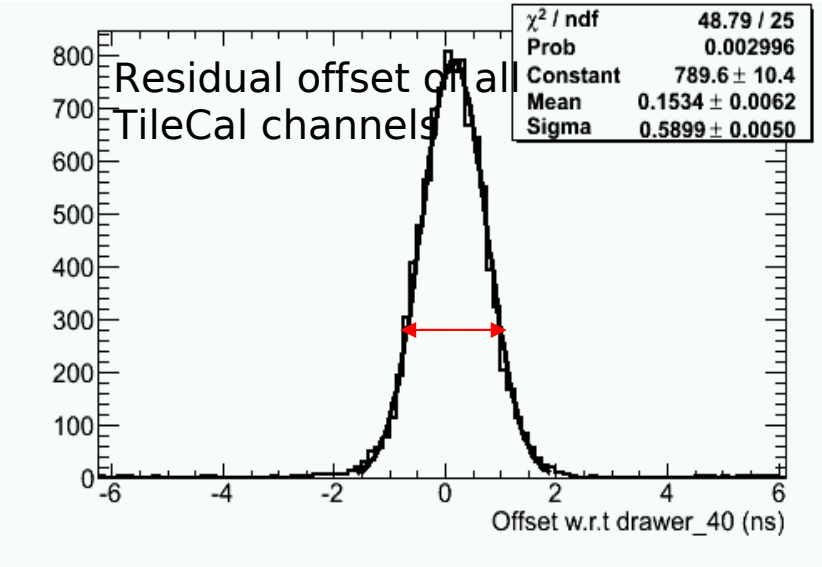
Send simultaneous light pulses to all PMTs and analyze the response

Compute corrections to configure the readout electronics

Residual time spread after synchronization ~0.6 ns







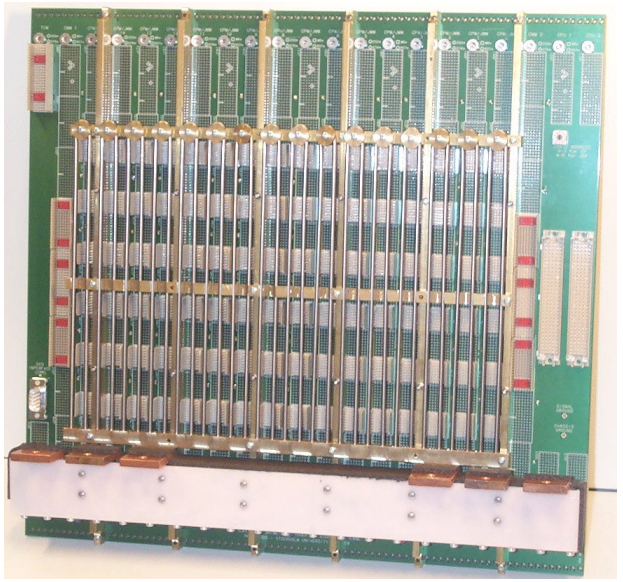
Other TileCal work

- Maintenance and repairs
  - C. Bohm and D. Eriksson
  - Replacement of affected digitizers
  - Responsive to TileCal DQ
    - 15 digitizers in superdrawers to be replaced
    - Timing problems
      - 30 digitizers affected (unresponsive to programming)
      - Could be unrelated to digitizers, eg db
- DQ and Monitoring
  - P. Mermod,D. Milstead
  - Effect of TileCal failures on physics measurements
    - ATL-TILECAL-PUB-2008-011
  - DQ monitoring
    - Updating configuration files for tier0 monitoring

L1Calo

•Working with fully installed system since December 2007

–Almost 300 custom VME boards installed in 17 crates. The 6 processor crates are equipped with the custom-made 22 000 pin backplane designed and manufactured by Stockholm



And of course…..

•Completed most hardware commissioning

–Only a handful of TT needing HW intervention

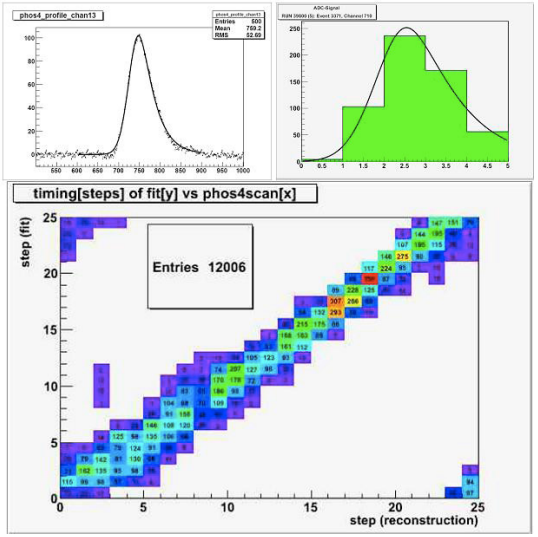
–Firmware releases in final working states, with plans for feature updates. Stockholm provides fw for jet-trigger chain

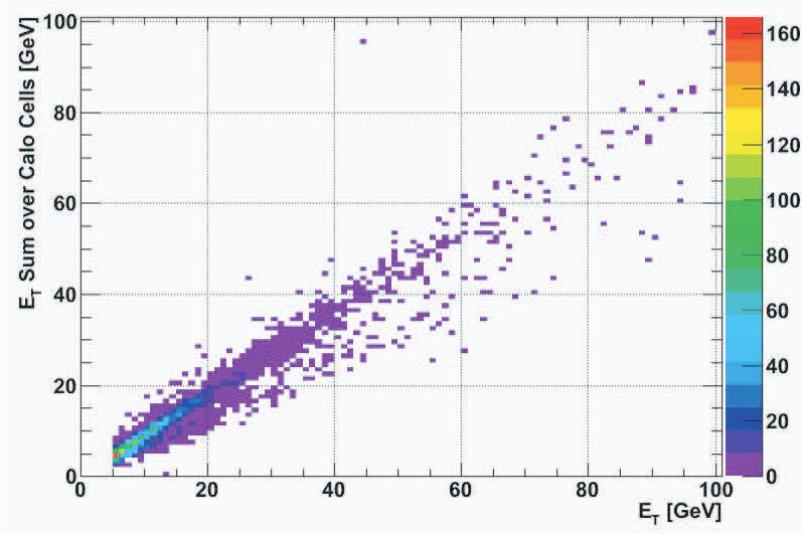
–Data compression in ROD installed/tested

• Contiuous participation in datataking since beginning of 2008.

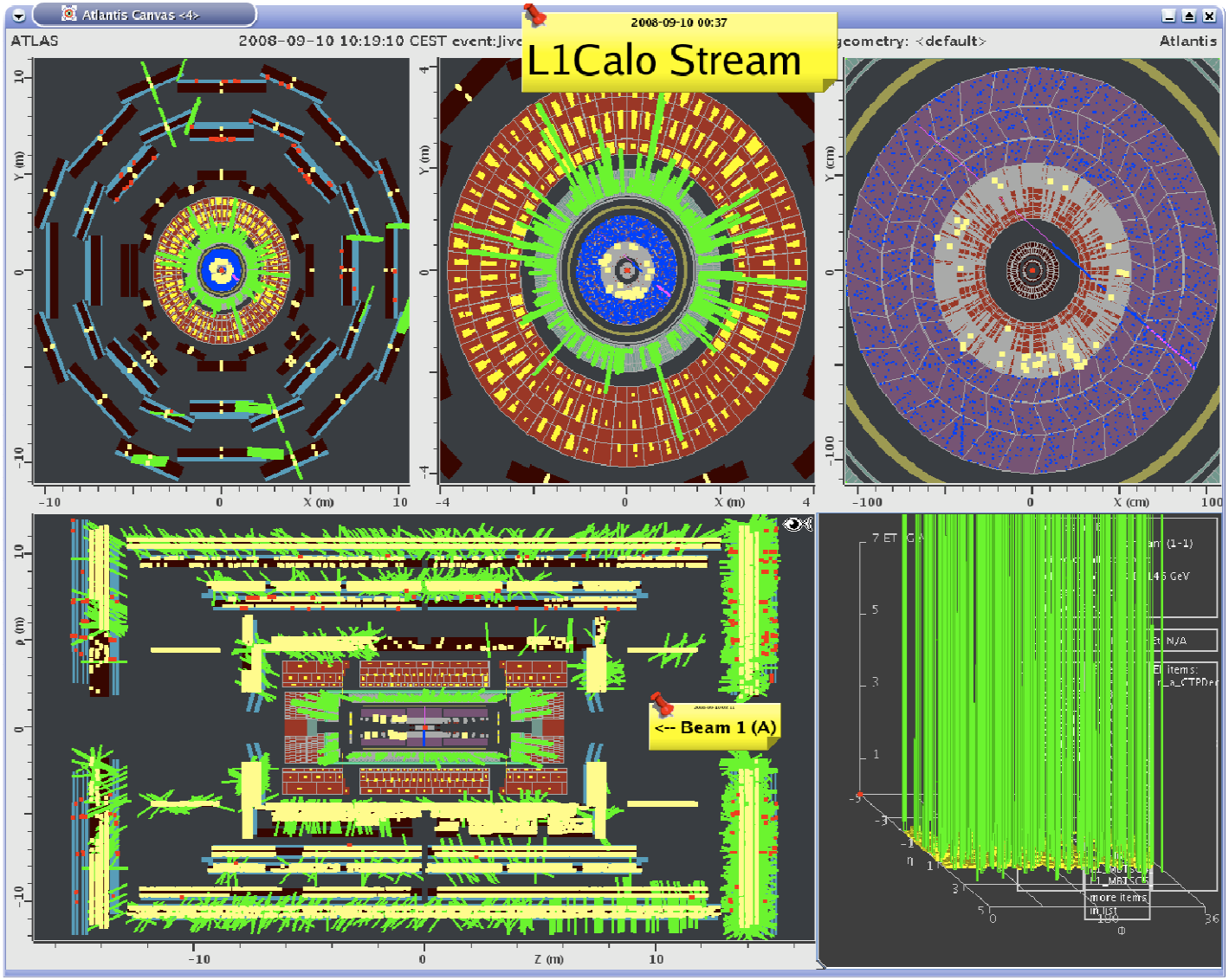
- Sw for on-line monioring of jet-data Stockholm responsibility.

Now concentrate on timing and energy calibration





… first beam-splash event in ATLAS was triggered by L1 Calo

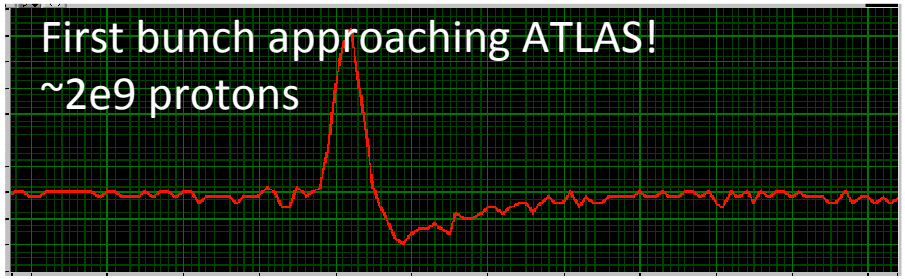


Personnel: Christian Bohm, Christian Ohm, Sten Hellman, Marianne Johansen, Torbjörn Moa, Samuel Silverstein, Jörgen Sjölin, Barbro Åsman

ATLAS BPTX System

- C. Ohm
- Electrostatic beam pick-ups located 175 m away from the ATLAS IP
- Dual use
  - Beam related Level-1 trigger (time reference for read-out in ATLAS)
  - Monitoring system for LHC beams and timing signals

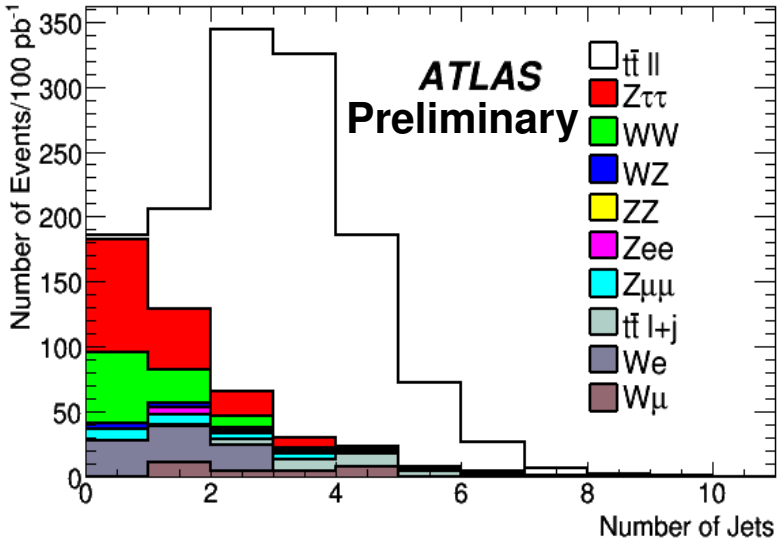
During most running on 10/9 BPTX was the only L1 trigger.

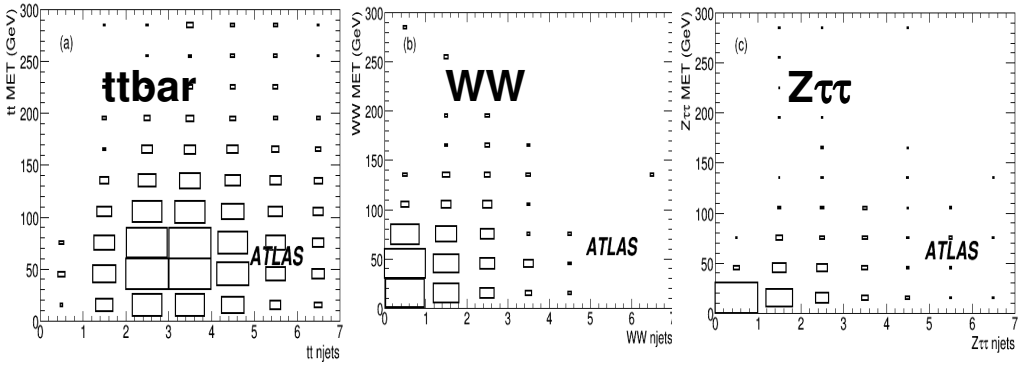


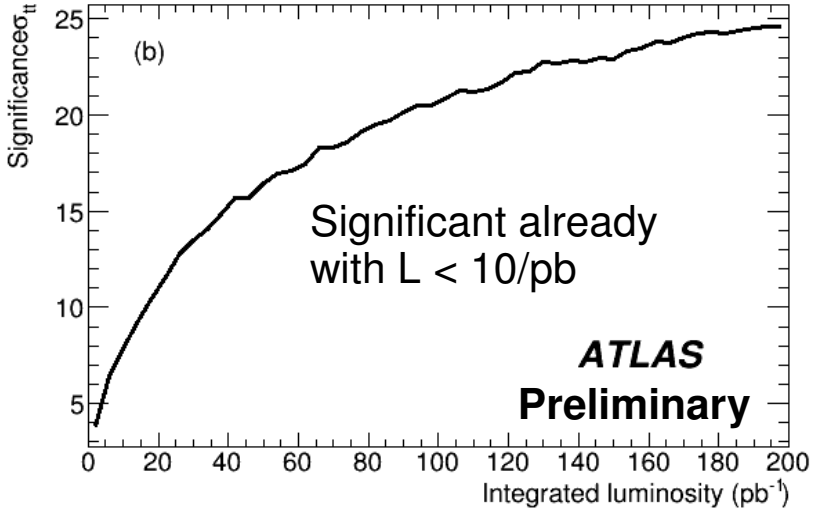
ATLAS note and conference contribution in preparation.

Top pair production cross section

- Dilepton channel
  - Jörgen Sjölin, Karl Gellerstedt
  - Event selection:
  - ee,μμ,eμ
  - ee,μμ : veto Z, $MET>35$ GeV
  - ttbar fraction by binned template fit Etmiss vs. number of Jets:
  - CSC note





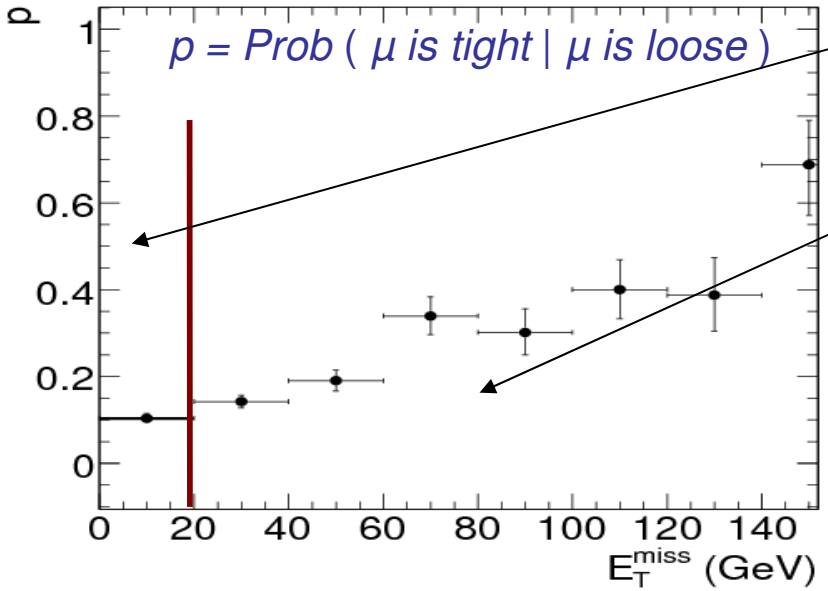


- Exotic resonance decaying to tops
  - Elin Bergeås Kuutmann Jörgen Sjölin
  - KK gluons in RS ED models

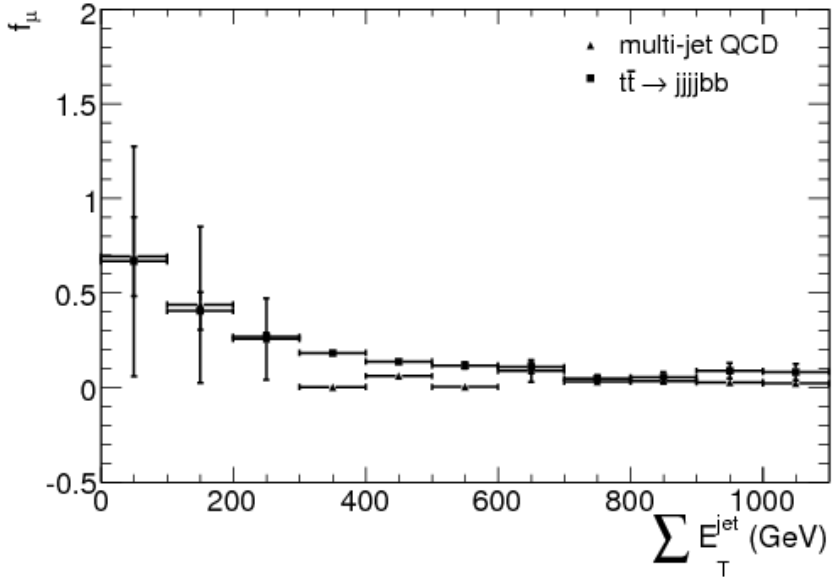
Data driven estimate of fake muon backgrounds

Christophe Clément, Jörgen Sjölin, Maja Tylmad, Per Hansson (KTH), B. Åsman

- Data-driven approach for isolated muon signals from SUSY and top analyses.



- No real muons (from W/Z), p = fake rate
- Sample contains real muons, probability is combination of fake rate and efficiency



- Study of fake rate systematics due to calo energy, number of jets etc.
- Parametrize fake rate vs $\sum E_T^{jet}$
- ATLAS note is under preparation.

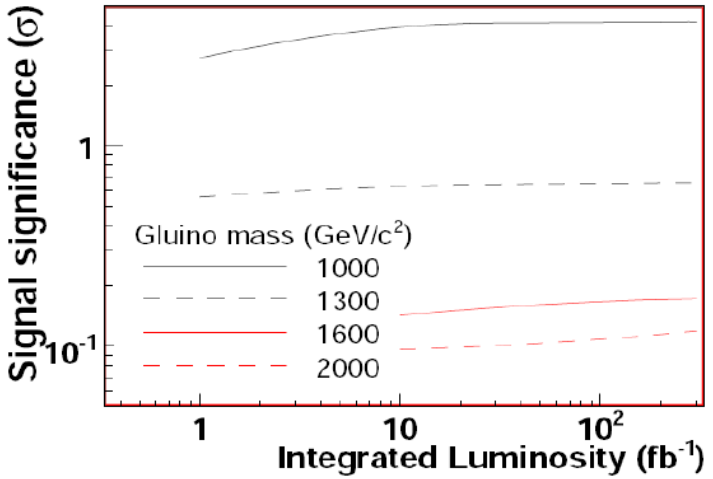
R-hadrons

- S. Hellman, M. Johansen, P. Mermod, D. Milstead, C. Ohm
- D. Milstead convening ATLAS RPV and long-lived SUSY subgroup
- Stable massive hadrons in many BSM scenarios
- Discovery potential:
  - Stop and gluino R-hadrons
  - Hard muon-like track
  - 2xID tracks
  - HT/LT and jet selections
- CSC publication

SMP	LSP	Scenario	Conditions
$\tilde{\tau}_1$	$\tilde{\chi}_1^0$	MSSM	$\tilde{\tau}_1$ mass (determined by $m^2_{\tilde{\tau}_{L,R}}$, μ, $\tan\beta$, and A_τ) close to $\tilde{\chi}_1^0$ mass.
	$\tilde{G}$	GMSB	Large N, small M, and/or large $\tan\beta$.
		$\tilde{g}$MSB	No detailed phenomenology studies, see [23].
		SUGRA	Supergravity with a gravitino LSP, see [24].
	$\tilde{\tau}_1$	MSSM	Small $m_{\tilde{\tau}_{L,R}}$ and/or large $\tan\beta$ and/or very large A_τ.
		AMSB	Small m_0, large $\tan\beta$.
		$\tilde{g}$MSB	Generic in minimal models.
$\tilde{l}_{s1}$	$\tilde{G}$	GMSB	$\tilde{\tau}_1$ NLSP (see above). $\tilde{e}_1$ and $\tilde{\mu}_1$ co-NLSP and also SMP for small $\tan\beta$ and μ.
	$\tilde{\tau}_1$	$\tilde{g}$MSB	$\tilde{e}_1$ and $\tilde{\mu}_1$ co-LSP and also SMP when stau mixing small.
$\tilde{\chi}_1^+$	$\tilde{\chi}_1^0$	MSSM	$m_{\tilde{\chi}_1^+} - m_{\tilde{\chi}_1^0} \lesssim m_{\pi^+}$. Very large $M_{1,2} \gtrsim 2$ TeV $\gg \lvert\mu\rvert$ (Higgsino region) or non-universal gaugino masses $M_1 \gtrsim 4M_2$, with the latter condition relaxed to $M_1 \gtrsim M_2$ for $M_2 \ll \lvert\mu\rvert$. Natural in O-II models, where simultaneously also the $\tilde{g}$ can be long-lived near $\delta_{GS} = -3$.
		AMSB	$M_1 > M_2$ natural. m_0 not too small. See MSSM above.
$\tilde{g}$	$\tilde{\chi}_1^0$	MSSM	Very large $m^2_{\tilde{q}} \gg M_3$, e.g. split SUSY.
	$\tilde{G}$	GMSB	SUSY GUT extensions [25–27].
	$\tilde{g}$	MSSM	Very small $M_3 \ll M_{1,2}$, O-II models near $\delta_{GS} = -3$.
		GMSB	SUSY GUT extensions [25–29].
$\tilde{t}_1$	$\tilde{\chi}_1^0$	MSSM	Non-universal squark and gaugino masses. Small $m^2_{\tilde{q}}$ and M_3, small $\tan\beta$, large A_t.
$\tilde{b}_1$			Small $m^2_{\tilde{q}}$ and M_3, large $\tan\beta$ and/or large $A_b \gg A_t$.

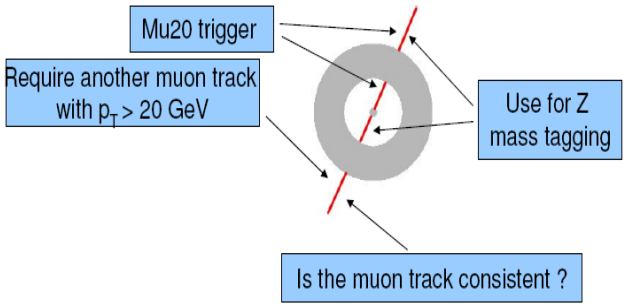
Table 1
Brief overview of possible SUSY SMP states considered in the literature. Classified by SMP, LSP, scenario, and typical conditions for this case to materialise in the given scenario. See text for details.

hep-ph/0611040

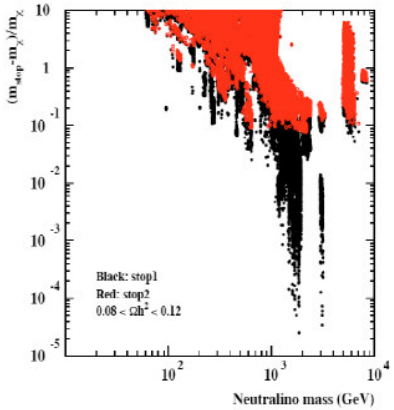


Further R-hadron work

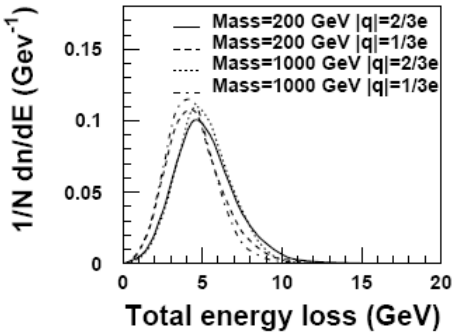
- Mass reconstruction with muon system
- Calorimeter signatures (timing)
- Backgrounds from data
  - Tag and probe with Z decays
  - ATL-COM-PHYS-2008-140



- Stable stop scenarios in MSSM-7
  - Parameter space, relic density, decay widths and cross sections
  - J. Edsjö,M. Johansen, D. Milstead, A. Sellerholm

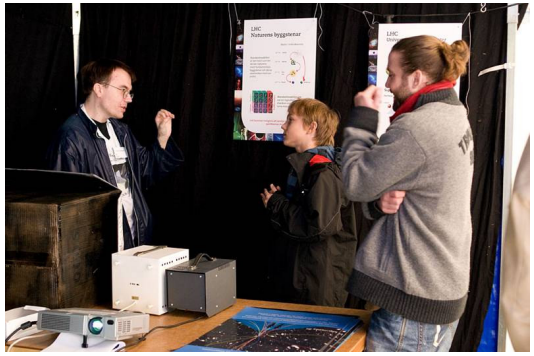


- Scattering model in material
  - Triple Regge approach
  - D. Milstead, A. Kaidalov, O. Piskounova, Y. De Boer
  - J.Phys:G35:075009,2008.



SU Outreach

- E. Johansson – convener E&O group
- Information, brochures, animations
- Physics in Kungsan - Stockholm Central Park
- Media appearances to deny the end of the world.
  - Many of us had our ”15 minutes of fame”
- 10 September Party



Tile Upgrade

- C. Bohm – Tile upgrade steering group and representative to ATLAS upgrade group
- General upgrade plan: EoI 2009, TP 2010 and TDR 2011
- Tile upgrade plan: EoI 2008 and R&D proposal early 2009
- Tile,LAr and L1Calo to devise joint strategy
  - To accept full readout to counting room as the preferred solution
  - Decide on location of the Tower builder
  - How much do Tile and LAr collaborate
- Changes
  - Minimal detector change - first layer degraded by 50%
  - FE electronics: replace for enhanced radiation tolerance for sLHC
  - BE electronics: development of tower builder/feature extractor
  - Mechanics for easier access
- Digitizer interest: drawer electronics and BE (Stockholm)

Summary

- Detector preparations for TileCal and L1Calo
- Promising analyses for data exploitation
  - Dileptons/top
  - Stable massive particles
- Long and successful outreach program
- Upgrade preparations underway.