

ATLAS Contributions to ICHEP2010

A brief overview of the Collaboration's Output

Max Klein, Liverpool Analysis Meeting 14.7.2010

HIGH ENERGY NUCLEAR PHYSICS

*Proceedings of the Fifth Annual Rochester Conference,
January 31 - February 2, 1955*

Compiled and Edited by

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Department of Physics, The University of Rochester

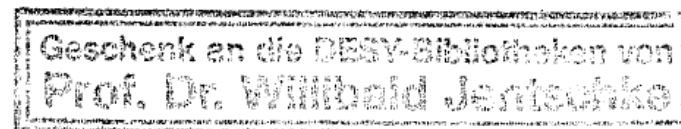
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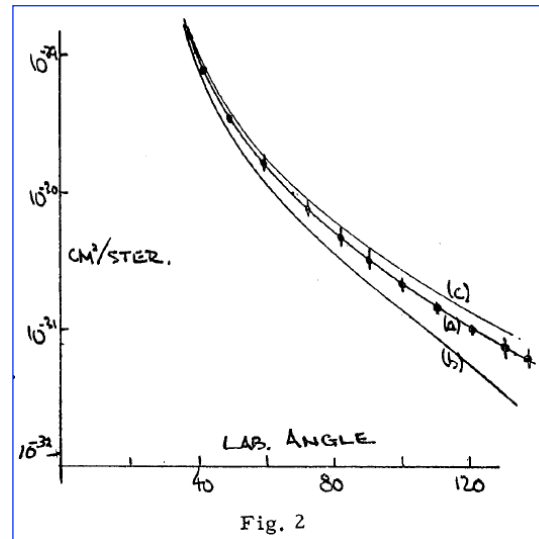
Rochester → ICHEP



Tuesday Afternoon: Accelerator Physics, R. F. Bacher presiding.

Hofstadter opened the discussion with a presentation of some of the extremely elegant electron-scattering work being done by a large group consisting of himself and J. Fregeau, B. Hahn, R. Helm, A. Knudsen, R. McAllister, and J. McIntyre.

PSI 7/10
0.84184 fm
[was .8678]

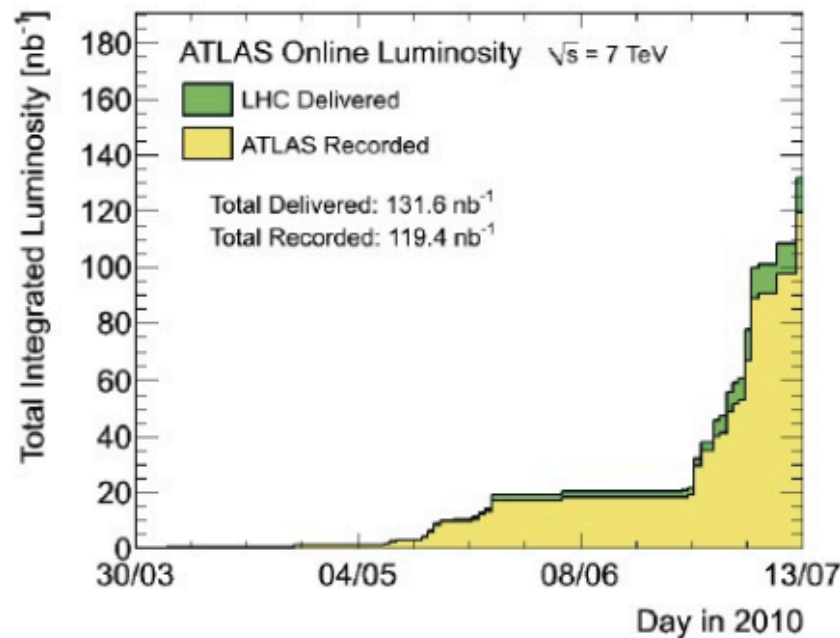


“ICHEP1955”

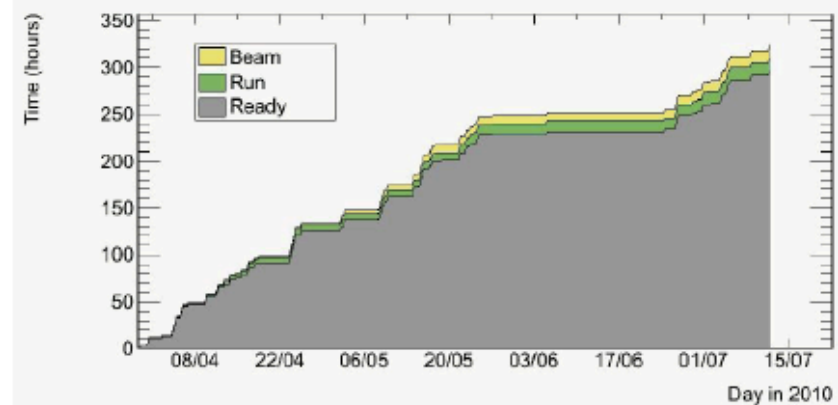
of the moment is considerably larger. The deviation of the experimental curve from the Rosenbluth cross section (c) suggests that there is a finite size to the proton. λ at this energy is about 10^{-13} cm. so that we expect, roughly speaking, a proton radius of this order to be significant in giving deviations. The experimental curve can, in fact, be analyzed a little more closely by inserting form factors into the Rosenbluth expression. An estimate of the proton radius from such an attempt is the value $(7.0 \pm 2.4) \times 10^{-14}$ cm., if one assumes that both the charge and the moment are diffused over the same volume. There is not enough experimental information to separate the two finite-size effects; in principle, however, the separation can be effected experimentally from work of this kind done at a variety of energies.

Luminosity

- Excluding current fill recorded $>35\text{nb}^{-1}$ last week (current fill will add $>20\text{nb}^{-1}$).
- Record peak luminosity of $1.44 \times 10^{30} \text{cm}^{-2}\text{s}^{-1}$.
- Last week very good efficiency (no problems with busy nor any problems during warm start)
 - Very high DAQ efficiency (time weighted): 99.6% of stable beam data recorded (97% ATLAS ready)
 - Very high luminosity weighted efficiency (95.7%)
- Overall efficiency 2010 (luminosity weighted, ATLAS ready): 91.6%

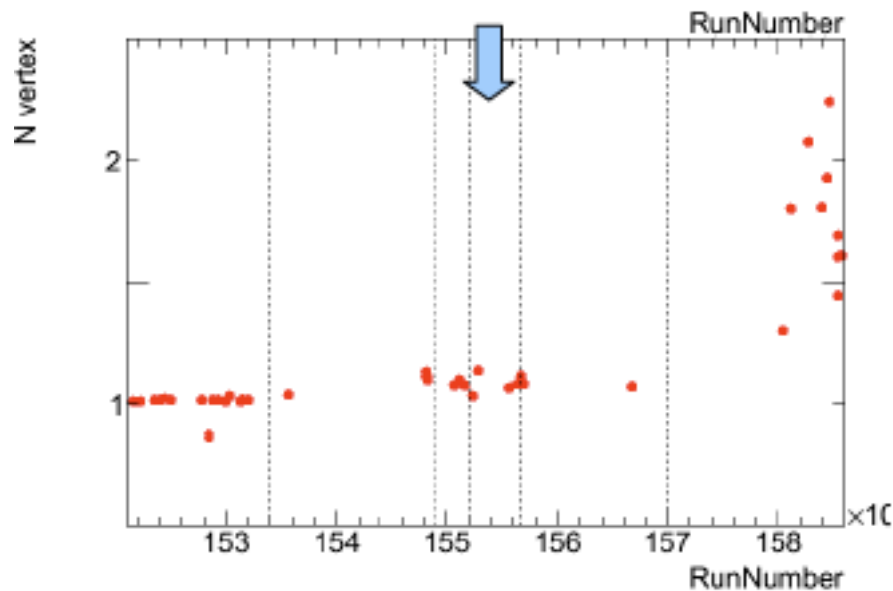


Integrated time of data taking

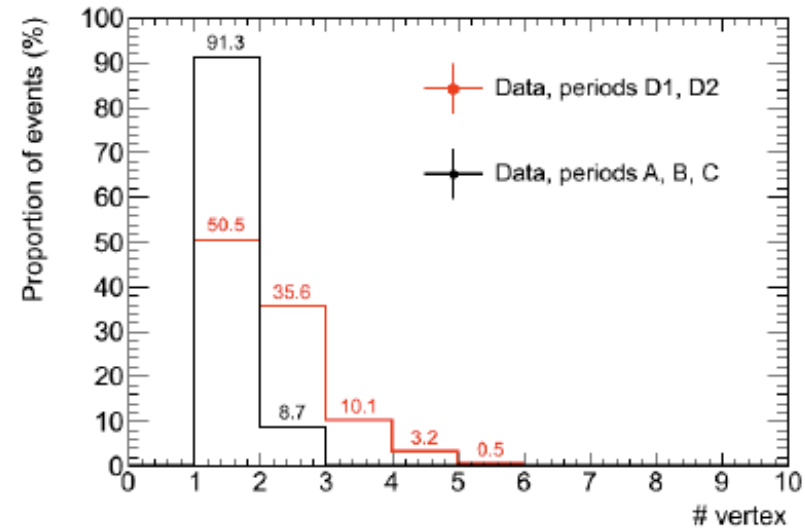


Pile-up

	Run	Max # of protons /bunch (10^{11} p)	Max # colliding bunches
	period A	0,1	1
B	153565-154817	0,2	2
	155112-155160	0,2	3
C	155228-155669	0,2	3
	155678-156682	0,2	8
D1	158045-158392	1	2
D2	158443-158582	0.5 - 1	4

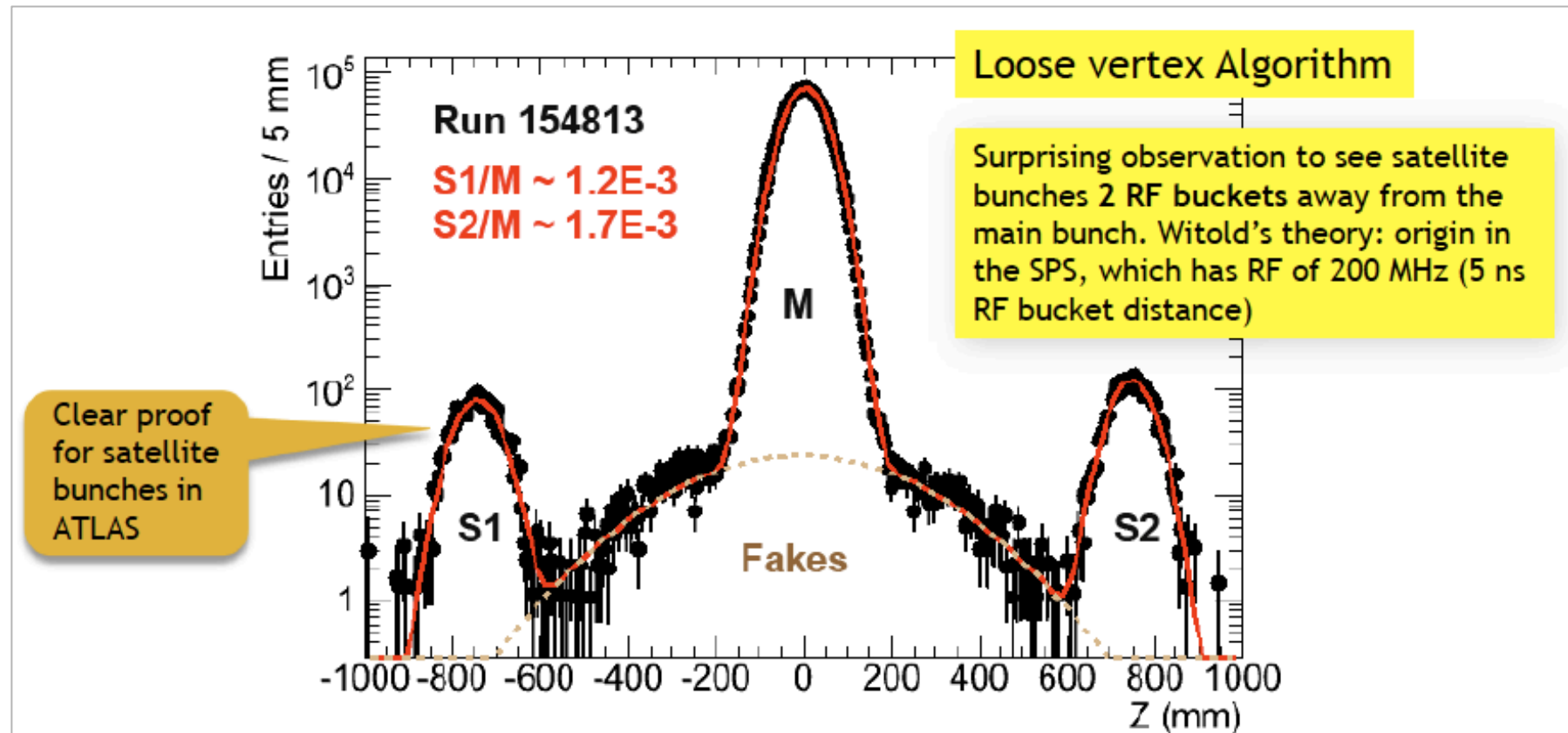


◆ Number of vertexes with at least 3 well reconstructed tracks after all cuts, even on m_T^W :



➔ in period D, half of the events with (potential) pile-up !

Satellite bunches [reminds on HERA..]



- Correct for vertex efficiency and fit 3 Gaussian distributions
 - $z = -75$ cm: fraction wrt. main peak = 0.12 %
 - $z = +75$ cm: fraction wrt. main peak = 0.17%

33 COM → CONF Notes - Overview

Tracking: 418, 350, 393, 402

Charged Multiplicity: 390, 416

Jets: 384, 408, 404, 409, 370, 365, 367, 341

Missing Energy: 371

Leptons and Photon: e: 422, γ : 413, muon:431,430 tau:391

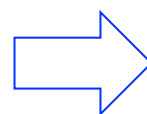
Heavy Quarks: J/ Ψ 401, 434, D*,b: 412, 437, 435, Υ ?, top 512

WZ: 475 [+3 COM]

SUSY: 415, 414, 411, 412

Exotics: 419

Luminosity: LUM-020 [+7 COM]



27 talks
15 posters
1 plenary

Performance of primary vertex reconstruction in proton-proton collisions at 7 TeV

COM-PHYS-418

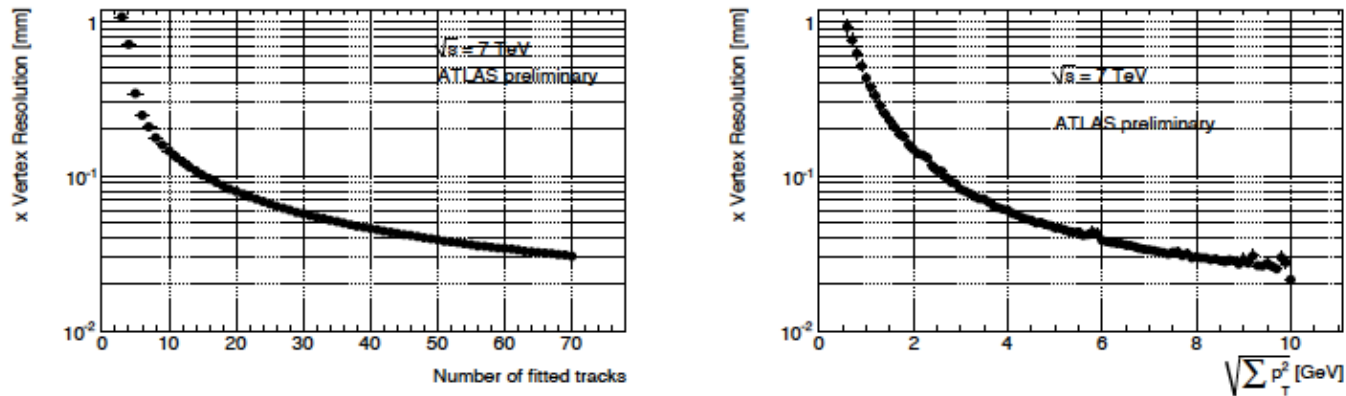


Figure 8: Estimated vertex resolution σ_x in 7 TeV data as a function of the number of tracks N_{tk} (left) or as a function of the value of $\sqrt{\sum_{\text{tk}} p_T^2}$ (right).

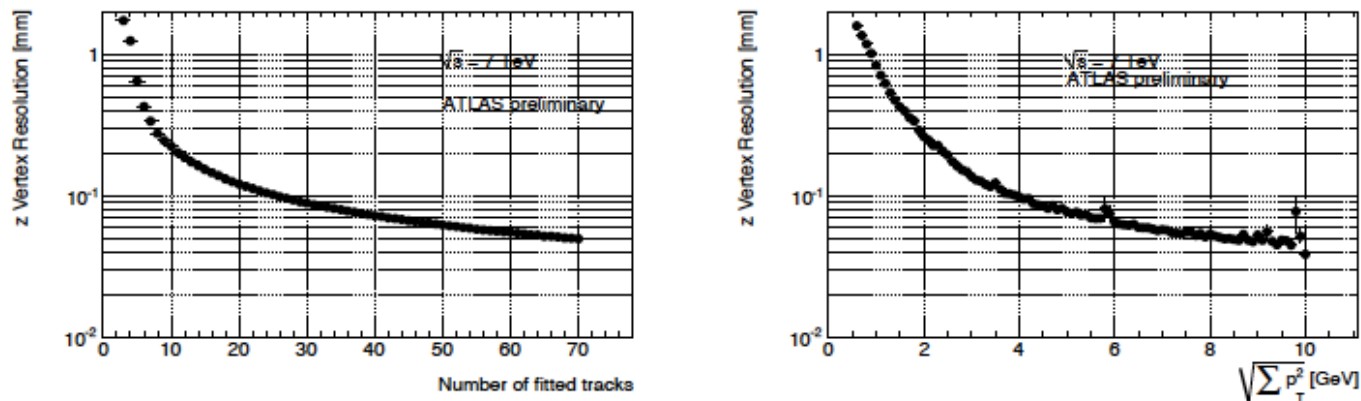
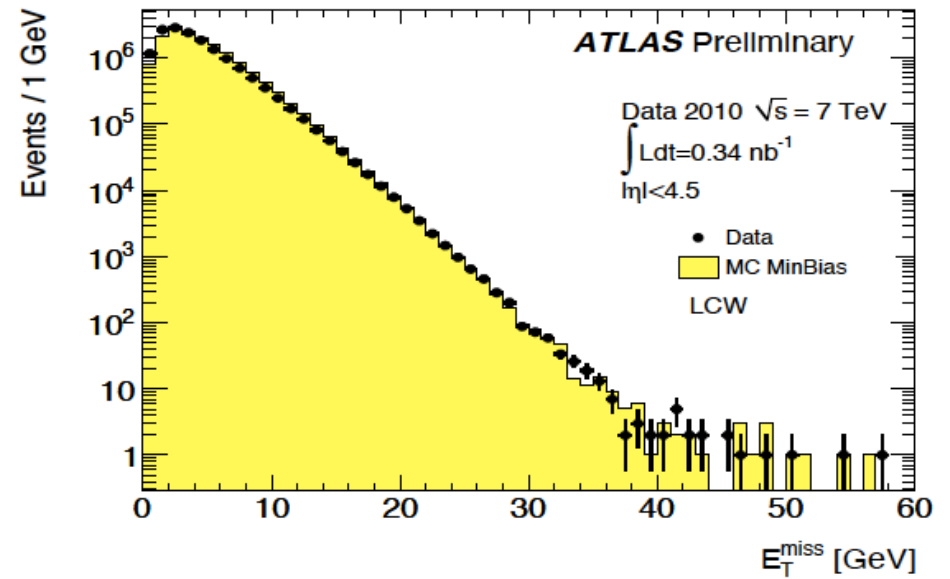
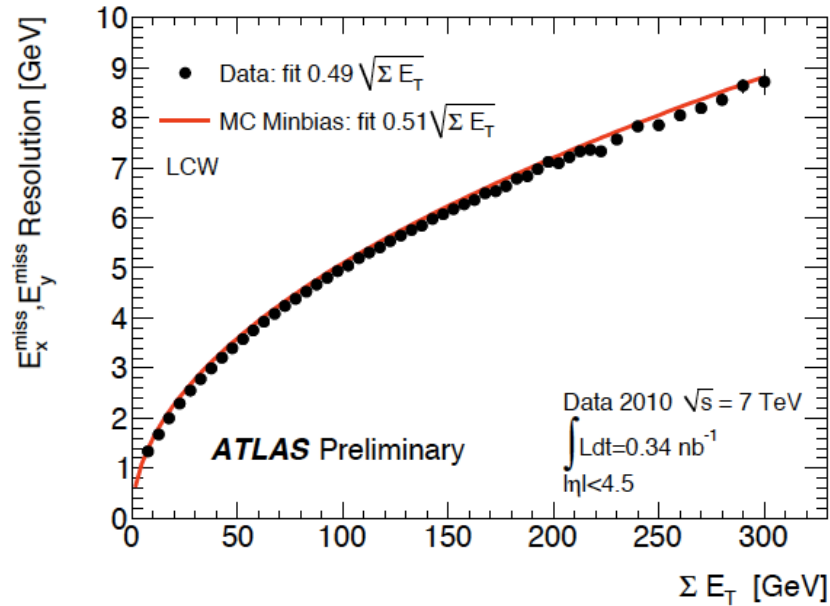


Figure 9: Estimated vertex resolution σ_z in 7 TeV data as a function of the number of tracks N_{tk} (left) or as a function of the value of $\sqrt{\sum_{\text{tk}} p_T^2}$ (right).

Performance of the Missing Transverse Energy Reconstruction and Calibration in Proton-Proton Collisions at a Center-of-Mass Energy of $\sqrt{s} = 7$ TeV with the ATLAS Detector

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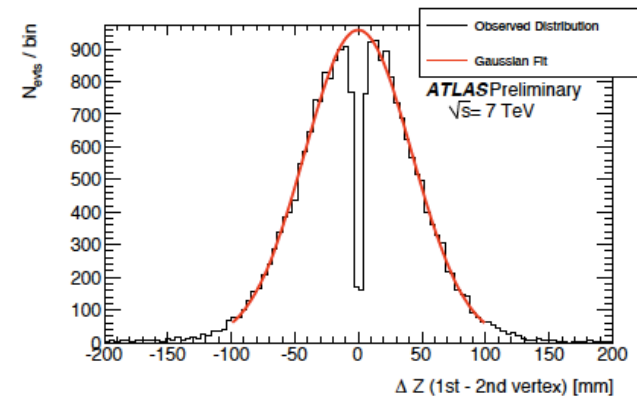
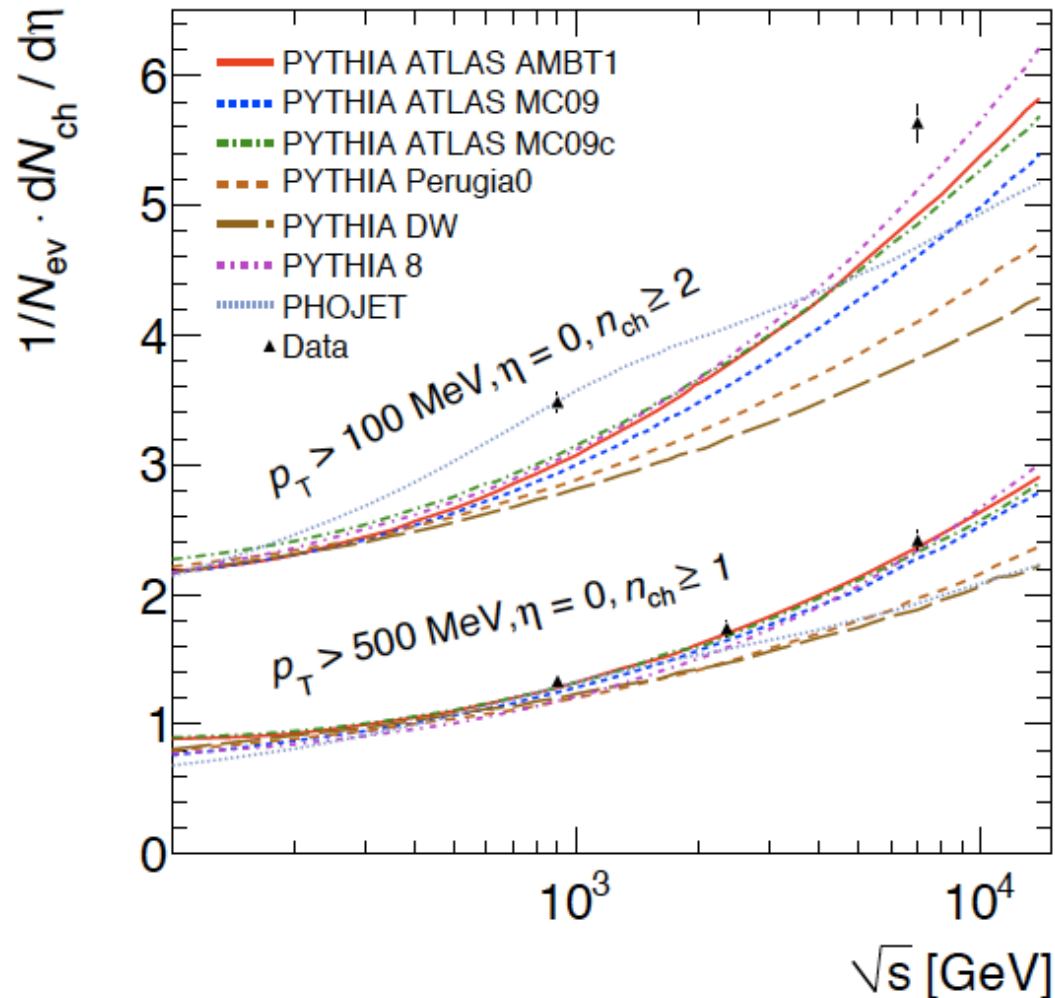


0.34 nb⁻¹

Charged particle multiplicities in pp interactions for track $p_T \geq 100$ MeV

COM-PHYS-416

at $\sqrt{s} = 0.9$ and 7 TeV measured with the ATLAS detector at the LHC



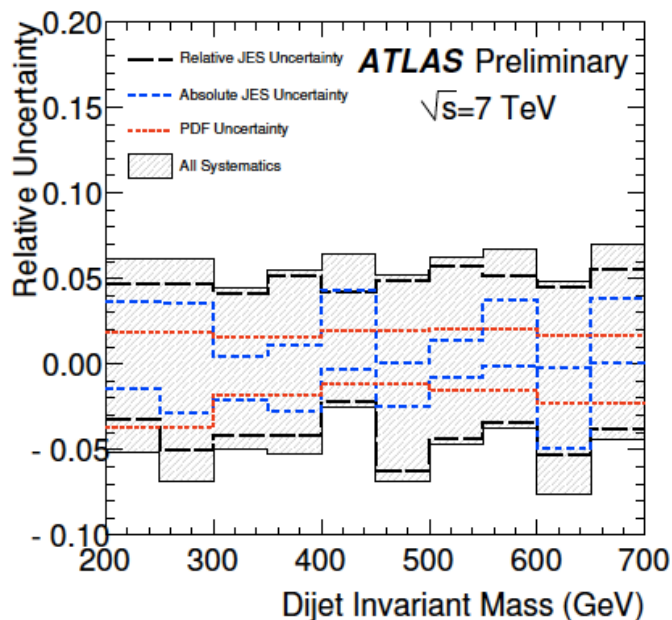
Low pt data exceed any MC

Diffraction??

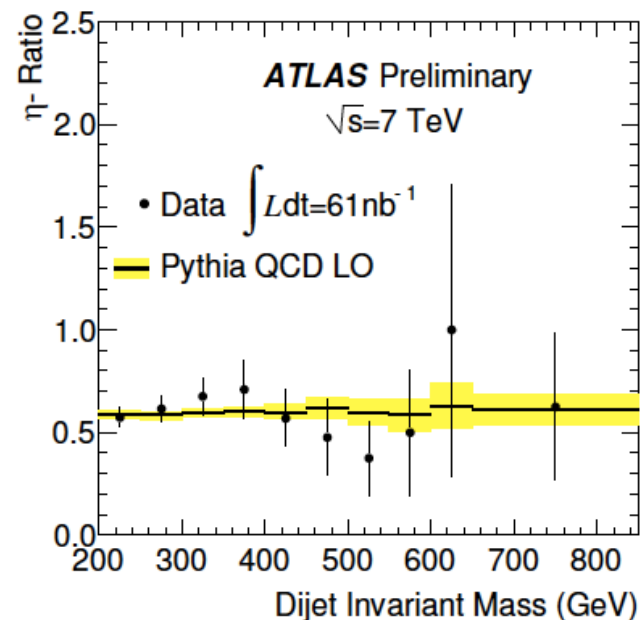
Pile-up??

High- p_T dijet angular distributions in pp interactions at $\sqrt{s} = 7$ TeV measured with the ATLAS detector at the LHC

COM-PHYS-384



(a) Relative systematic uncertainties of the η -ratio spectrum with respect to the QCD prediction.



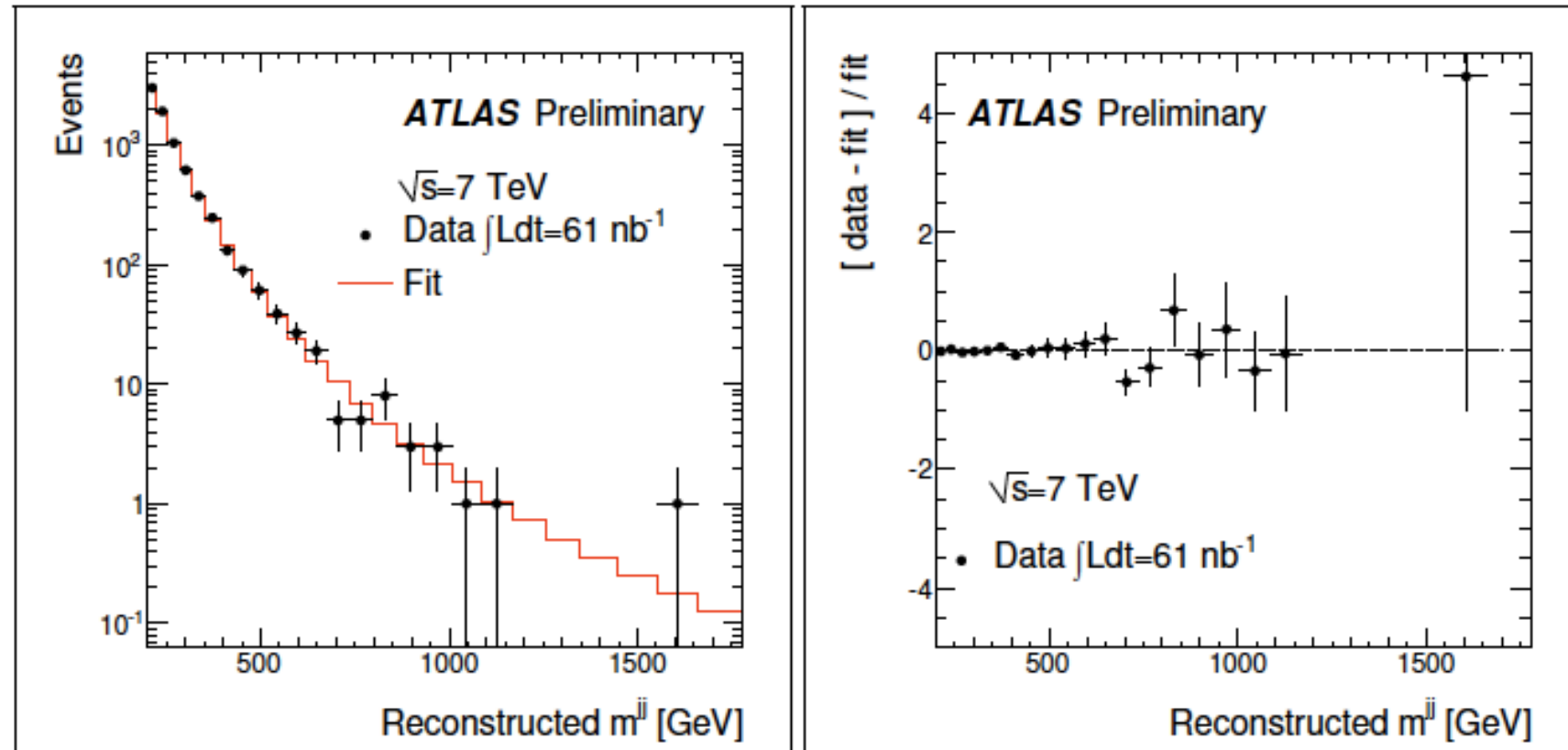
(b) η ratio distribution

η ratio distributions: 2 highest p_T jets: both central (<0.5) to both non-central ($0.5-1$)
Uncertainties: 5-10% JES, pdf: CTEQ 6.6

$R_q < 2.2 \cdot 10^{-4}$ fm, no Quantum Black Holes ..

Search for new particles decaying into dijets in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector

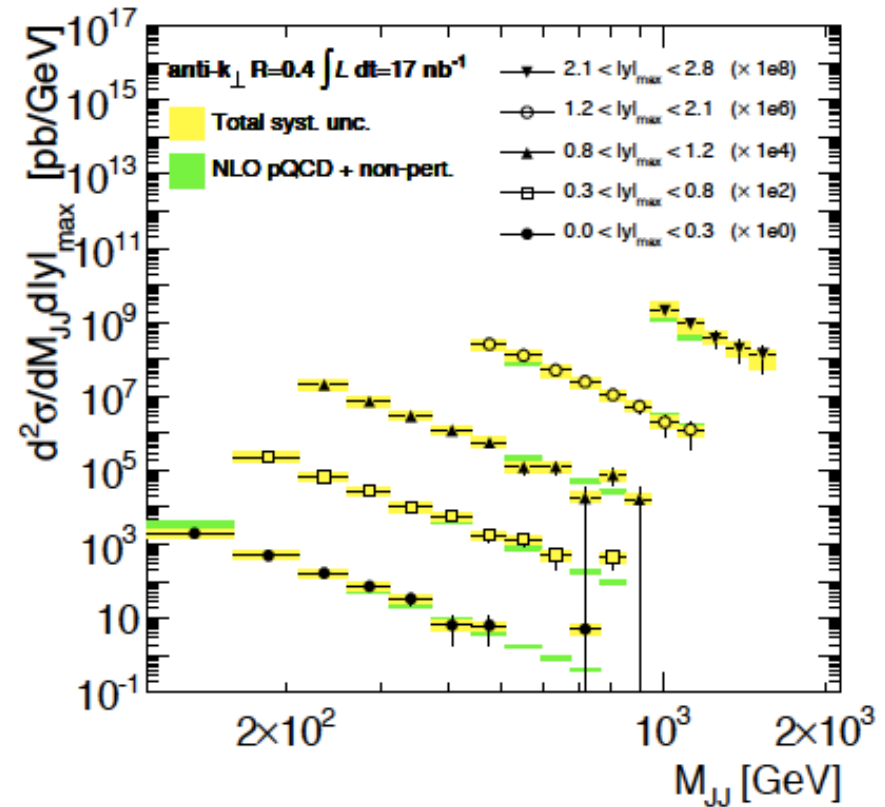
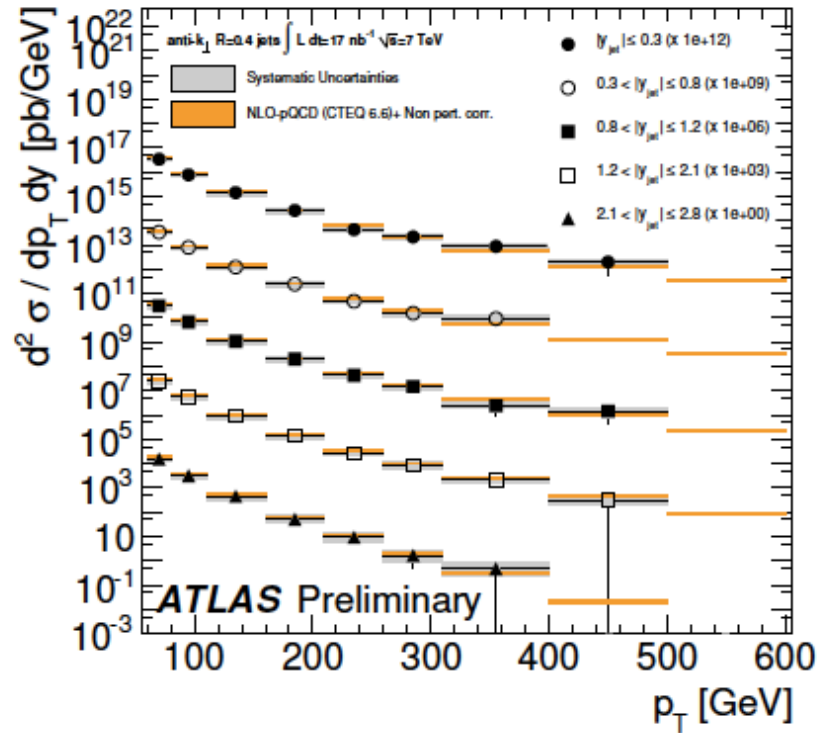
COM-PHYS-419



excited-quark production to determine a 95% credibility-level q^* mass exclusion region of $400 < m_{q^*} < 810$ GeV.

Measurement of jet production in proton-proton collisions at 7 TeV centre-of-mass energy with the ATLAS Detector

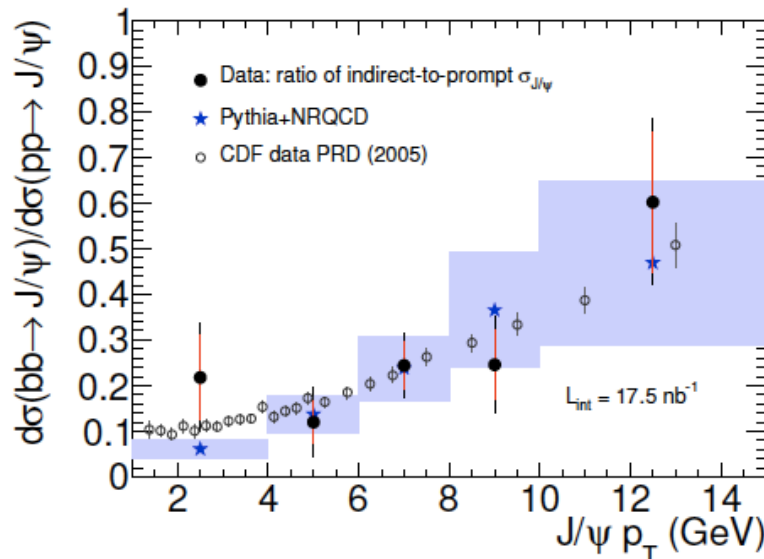
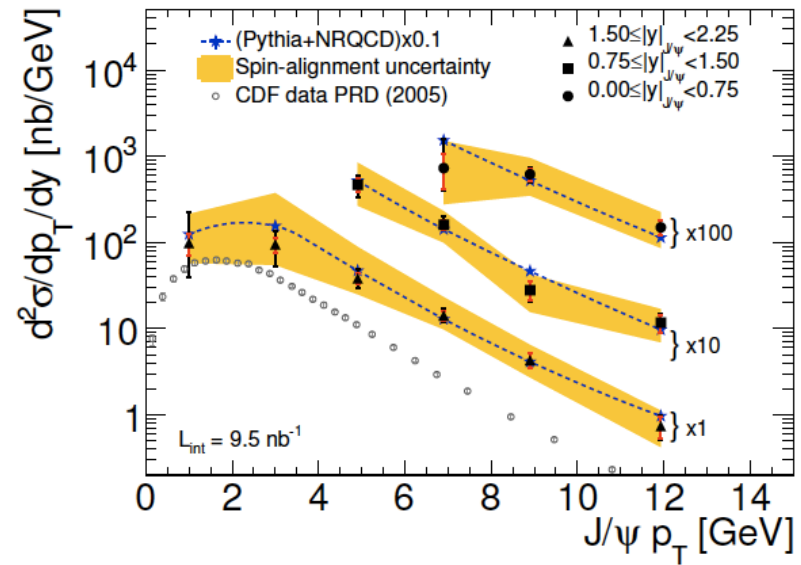
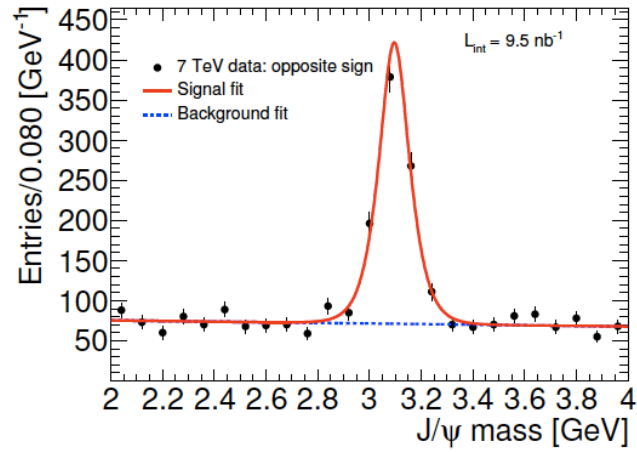
COM-PHYS-408
CONF-2010-050



Good agreement with pQCD up to 500 GeV p_T and 2 TeV dijet mass

A first measurement of the differential cross section for the $J/\psi \rightarrow \mu^+\mu^-$ resonance and the indirect-to-prompt J/ψ cross section ratio with pp collisions at $\sqrt{s} = 7$ TeV in ATLAS

COM-PHYS-434

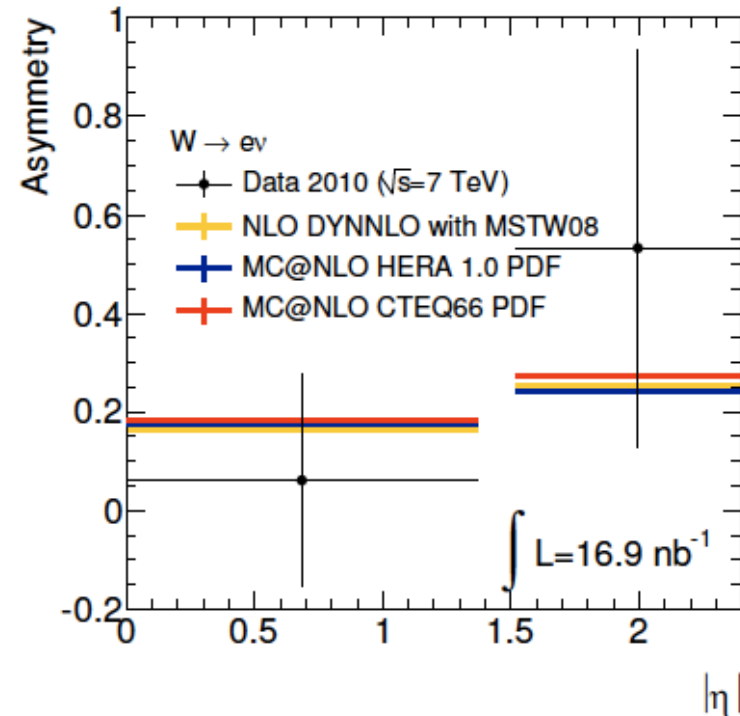
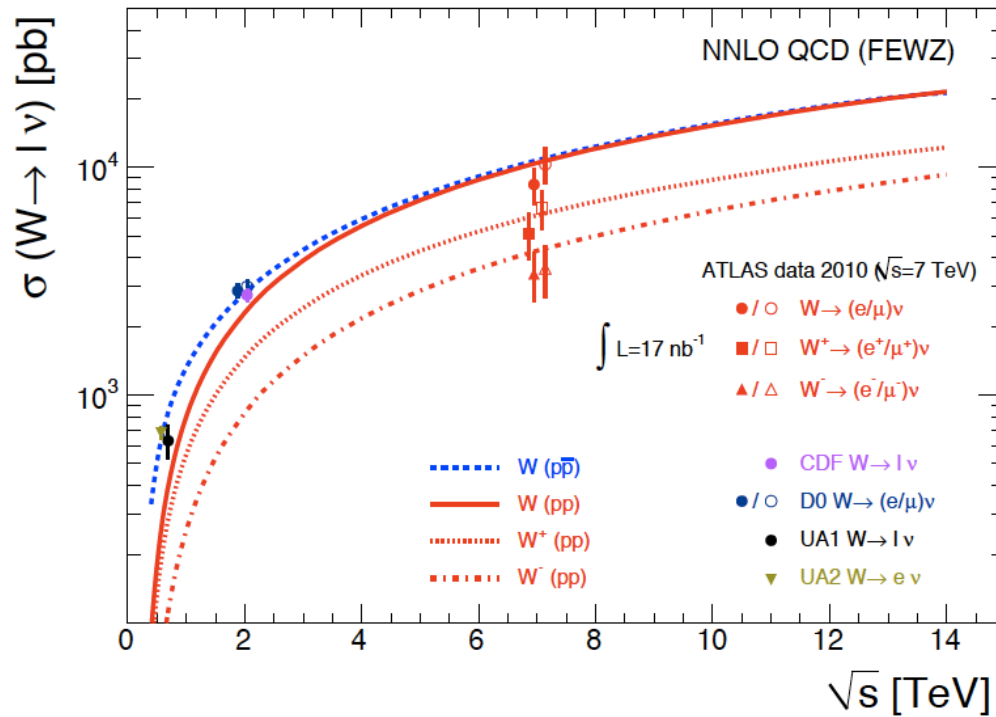


Work on early publication

Yet: PYTHIA factor 10 higher
 Statistics limited (triggers)

Measurement of the $W \rightarrow \ell\nu$ production cross-section and observation of $Z \rightarrow \ell\ell$ production in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector

COM-PHYS-475



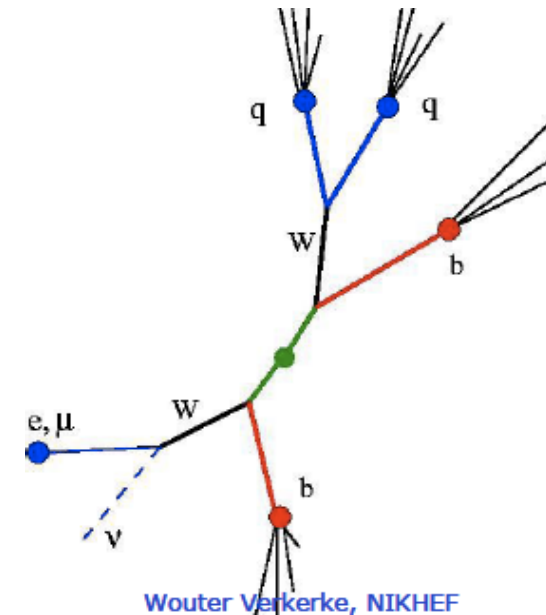
First W cross sections (e and μ) and charge asymmetries. Z being updated to hi L

Expected event distributions for early top pair candidates in ATLAS at $\sqrt{s} = 7 \text{ TeV}$

Hottest Topic for the DG.. Most complex analysis it seems

COM-PHYS-475

- Characteristics of **lepton+jets** channel
 - Final state with hard lepton, neutrino, 2 jets + 2 b-jets
 - Leading background W+(bb)+jets (similar final state), QCD multijet with fake or non-prompt lepton
 - Analysis strategy: look for events with ≥ 4 jets, a hard lepton, missing ET and at least one b-jet
- Characteristics of **dilepton** channel
 - Final state with two hard leptons, 2 neutrinos, 2 b-jets
 - Leading background from Z+jets, W+jets, dibosons
 - Analysis strategy: look for events with ≥ 2 jets, two hard lepton, missing ET
- Comparable sensitivity: lepton+jets has more background, but cross section is 4x larger
 - Use of b-tagging in lepton+jets channel levels playing field almost completely



1 tbar per 6.3 nb⁻¹ of data

Note 1 - Leptons

Note 2 - Jets

Note 3 - ETmiss

Note 4 - Btagging

Note 5 - Fake lepton backgrounds

Note 6 - W+jets backgrounds

Note 7 - Z+jets background

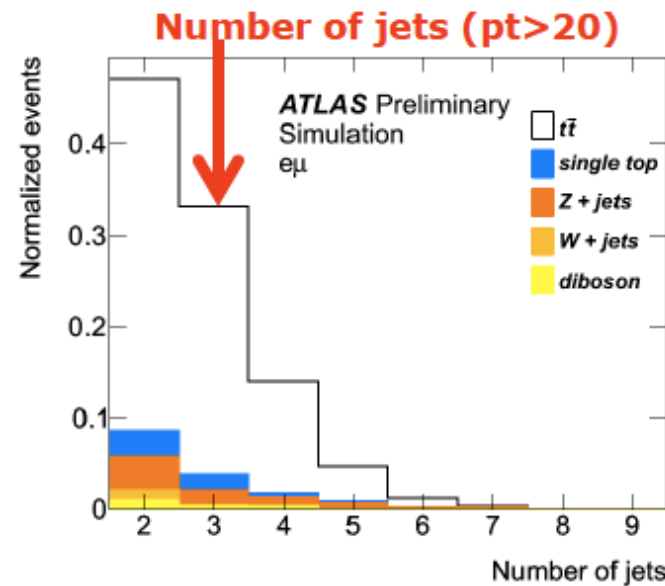
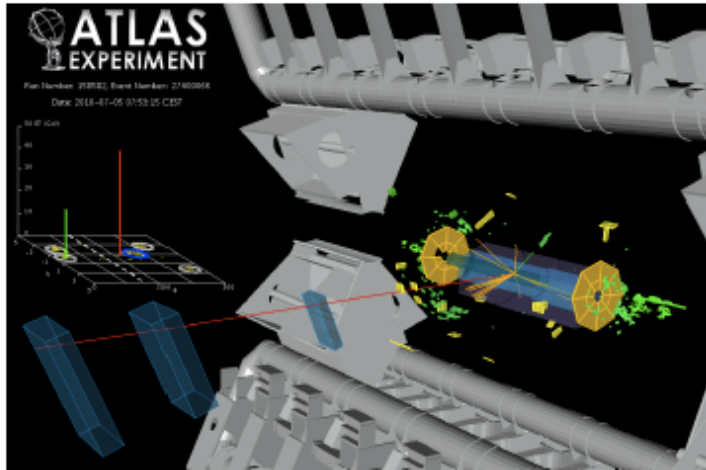
Note 8 - TopReco & dAOD production

Note 9 - MC samples & HFOR

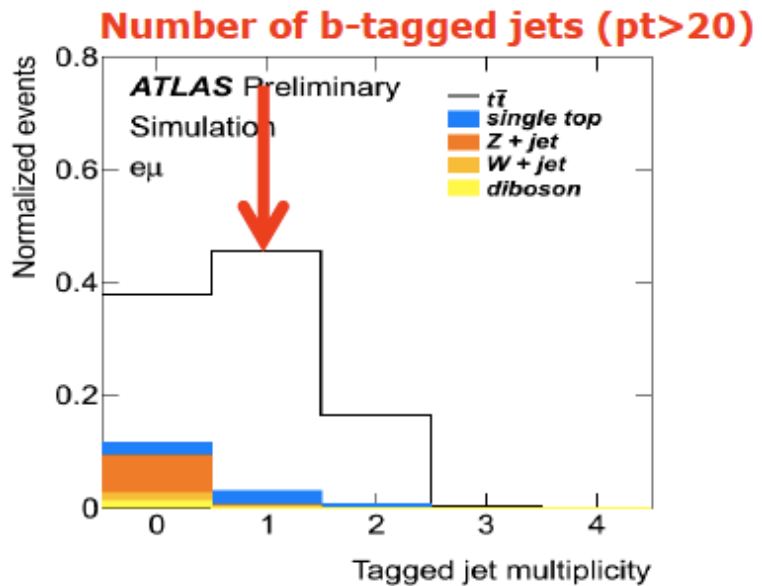
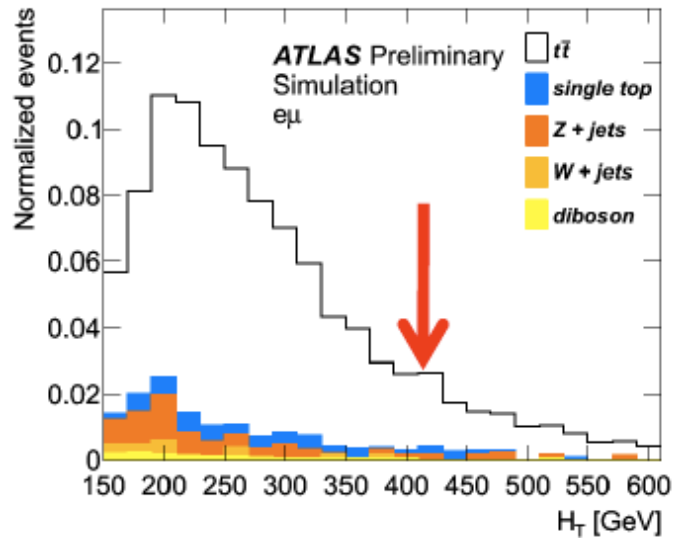
Note 10 - Analysis strategy for l+jets

Note 11 - Analysis strategy for dilepton

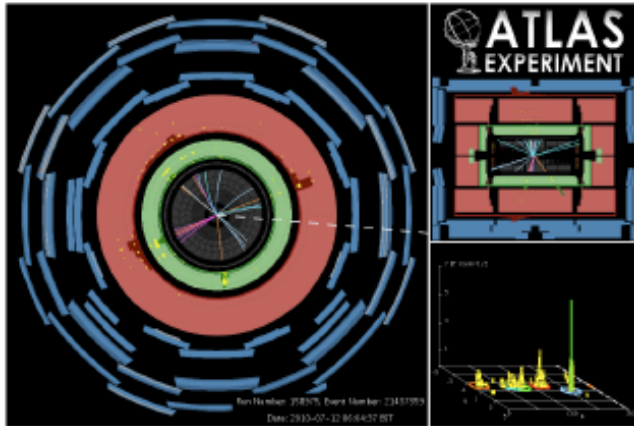
Properties of e/mu +jets candidate



HT (scalar sum of all objects)

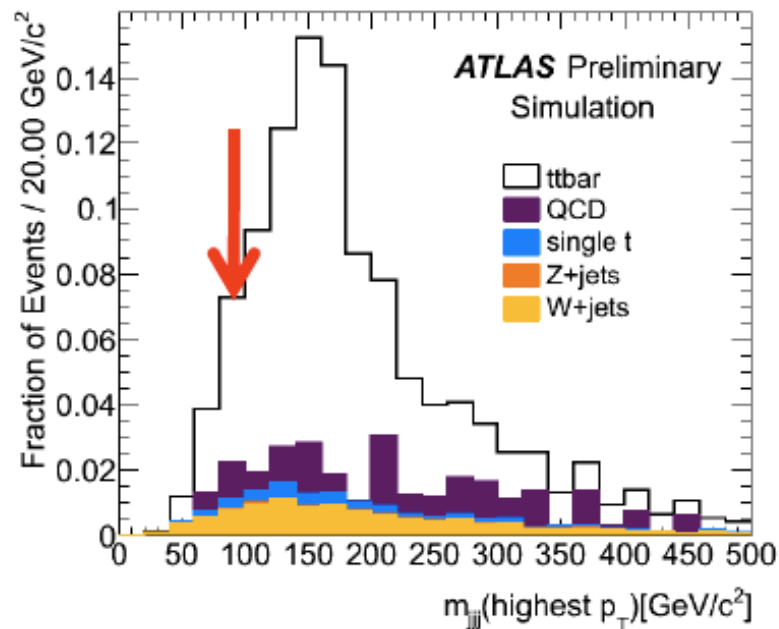


Properties of e+4jets candidate

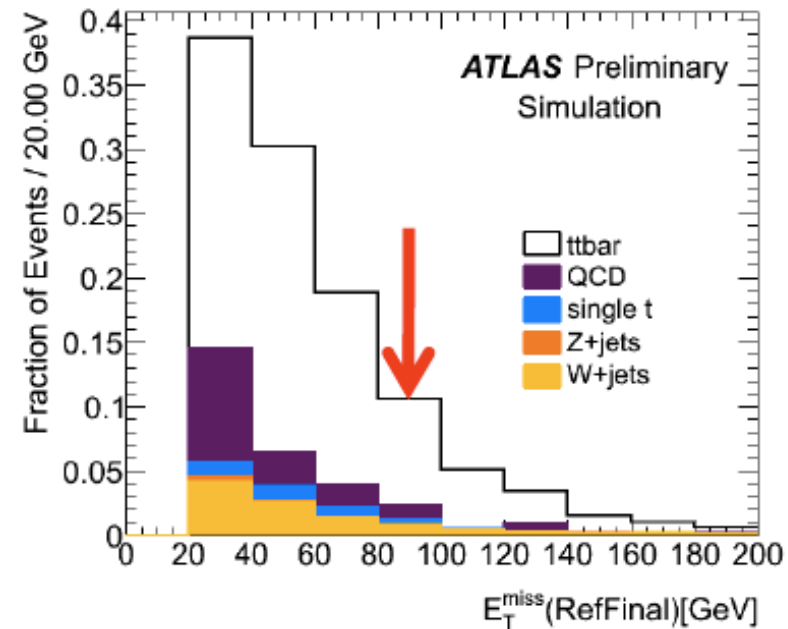


Arrows will **not** be in PUB note
(but intended to be in
CONF note in preparation)

3-jet invariant mass



missing ET



Beyond ICHEP

ICHEP: rich harvest, SM ok up to high dijet masses and pt

many contributions of our group. need to build on these for near and less near future. Review of our contributions may be interesting + due after ICHEP.

→ SUSY10, HCP [August] [cf e.g. SUSY + bjets in backup]

Publications (WZ, J/ψ, ..)

Higher Statistics Exciting times!

The next months

Fill scheme	p/bunch	# bunches	# colliding bunches	Stored E	Peak lumi	Integrated lumi
3x3	1e11	3	2	168	5.0E29	0.03* (3 fills)
6x6	1e11	6	4	336	1.0E30	0.15 (7 fills)
12x12	1e11	12	8	672	2.0E30	0.4 (7 fills)
24x24	1e11	24	16	1344	4.0E30	2.5 (30 fills)

* Assuming 10h per fill and factor 0.5 for lumi decay

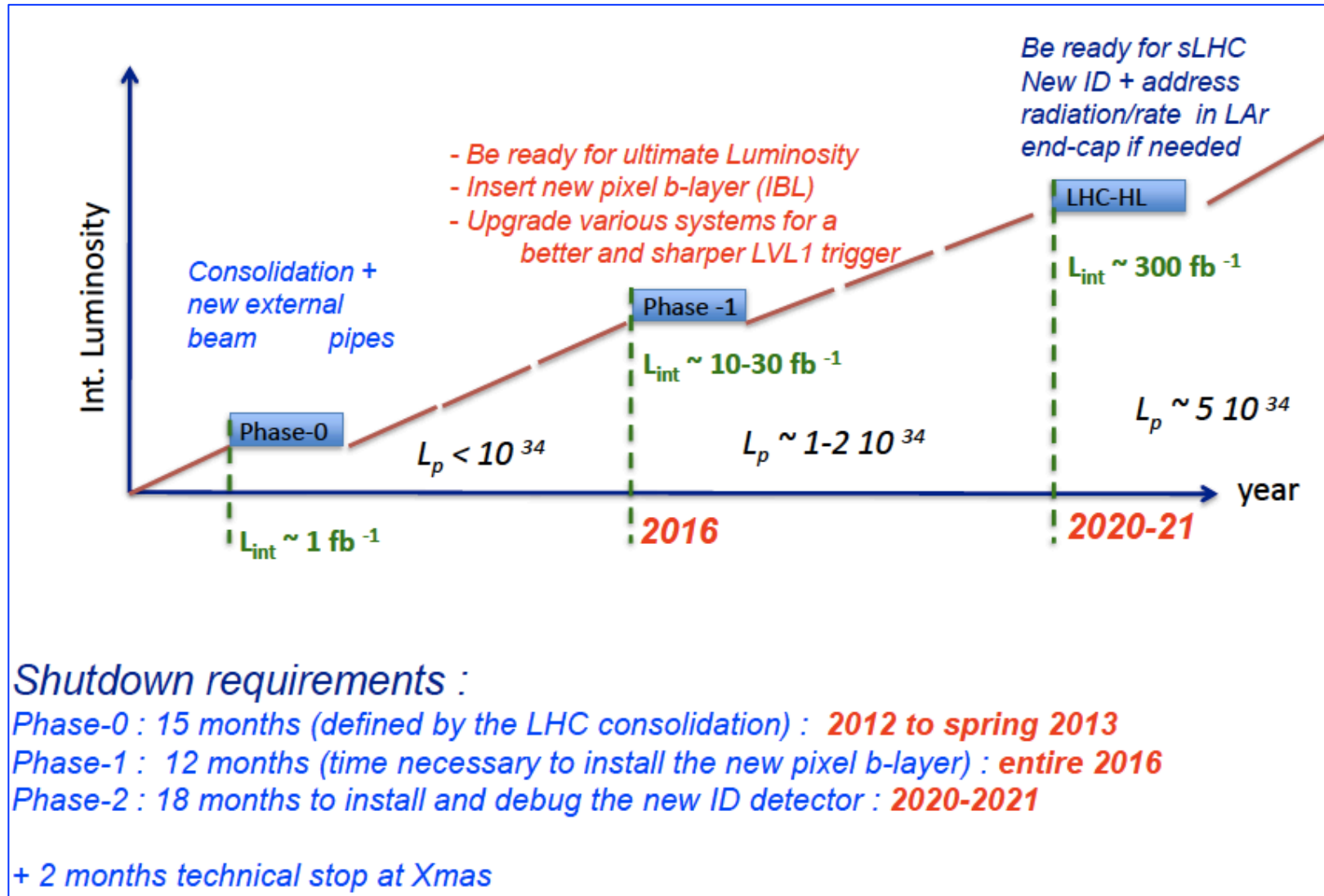
Trains needed... share second half of August between trains commissioning and physics

	July			Aug				Sep					
Wk	26	27	28	29	30	31	32	33	34	35	36	37	38
Mo	3x3	6x6	12x12										
Tu	3x3	6x6	12x12										
We	3x3	6x6	12x12										
Th	6x6	12x12	...			24x24	Cryogenics stop		24x24 And cmg trains		Jeune G		Cryogenics stop
Fr	6x6	12x12											
Sa	6x6	12x12											
Su	6x6	12x12											

Moved to 12x12 only in the night from Monday to Tuesday

The bright future

M.Nessi 13/7/10



backup

B-jets + MET

- Search for SUSY in B-jets + MET (w/o leptons) final states:
 - Third generation squarks might be lighter
 - If there, copiously produced at the LHC
 - Short term plans:
 - [CONF Note for SUSY10](#): Plan to perform data/MC comparisons for final states with MET, jets (at least one b-tagged) with and without leptons.
 - Follow general approach of 0-lepton/1-lepton SUSY CONF Note for ICHEP ('almost' approved on Monday)
- Tight schedule:
- 22nd July -> Approval at the SusyWG meeting
 - 2nd -5th August -> Approval at the ATLAS cluster week
- [Medium/Long term plans](#):
 - Soon INT note for sensitivity at 7 TeV
 - Followed by INT notes describing background estimation methods (data-driven for QCD, Top)

Organization and tasks for CONF note

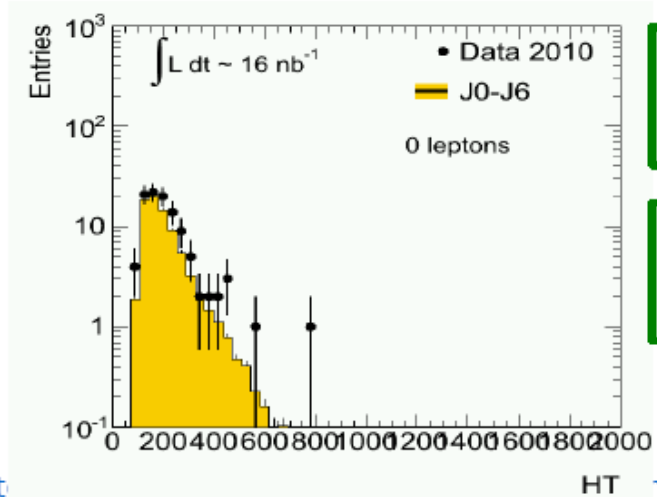
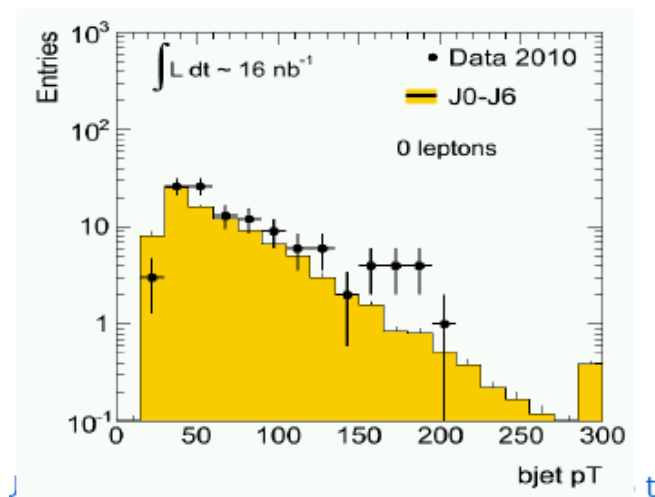
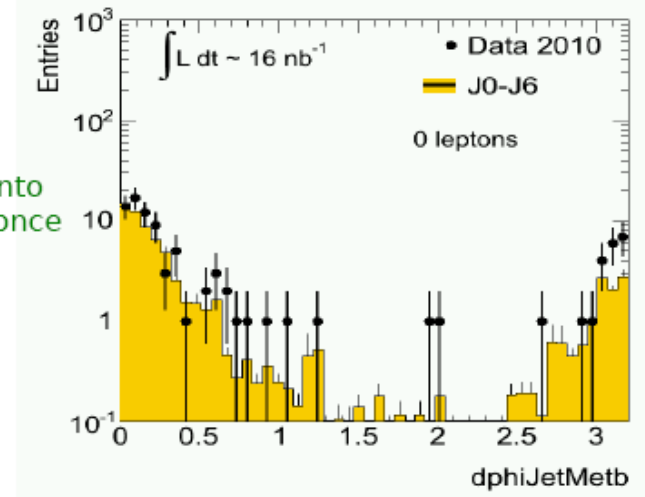
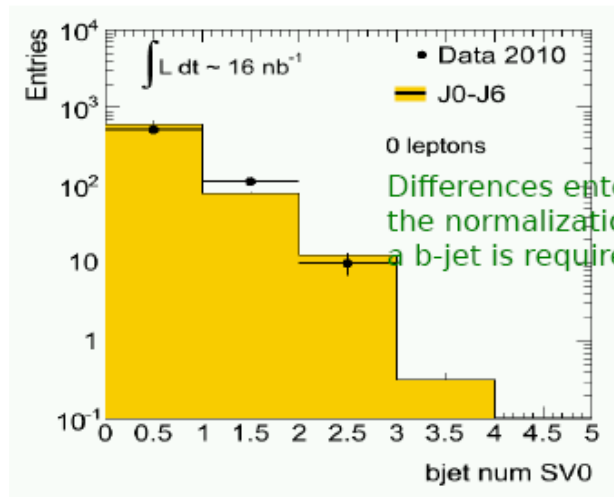
- Small group of people (~ 15), from Sheffield, Freiburg, SLAC, Tokyo
 - From Liverpool: MD, Graham, Paul and Sara
- Two editors were appointed: Monica D'Onofrio and Xavier Portell
- Dedicated informal meetings were organized (see latest in: <http://indico.cern.ch/conferenceDisplay.py?confId=100180>)
- A list of tasks and discussions on the evolution of the different topics can be followed in the Sharepoint: <https://espace.cern.ch/atlas-phys-susyinclbjets/default.aspx>
- Current decisions are kept up-to-date in the wikies. Cutfow comparison wiki: <https://twiki.cern.ch/twiki/bin/view/AtlasProtected/SusyBJetsCuts2010> and a plots and style wiki: <https://twiki.cern.ch/twiki/bin/view/AtlasProtected/SusyBJetsPlots2010>
- Note in SVN (atlasgrp/Physics/SUSY/Papers/SUSY2010/b-jet):
 - Both CONF and INT supporting note for CONF
- Already in contact with b-jet and Jet/EtMiss conveners
 - Finalizing details on b-tagging systematic uncertainties
 - Discussing about possible effects of b-jet energy scale with Jet/EtMiss conveners

From last week (8th of July SUSY Etmis meeting)

- Much more distributions now!

All are after MET significance cut of 1.7 GeV

All plots normalized using the factor from the first method (0.61)



Other plots in CONF draft and wiki

1-lepton mode plots are also in the pipe-line

ofrio, Xavier Portell 1