ATLAS Physics - Introduction

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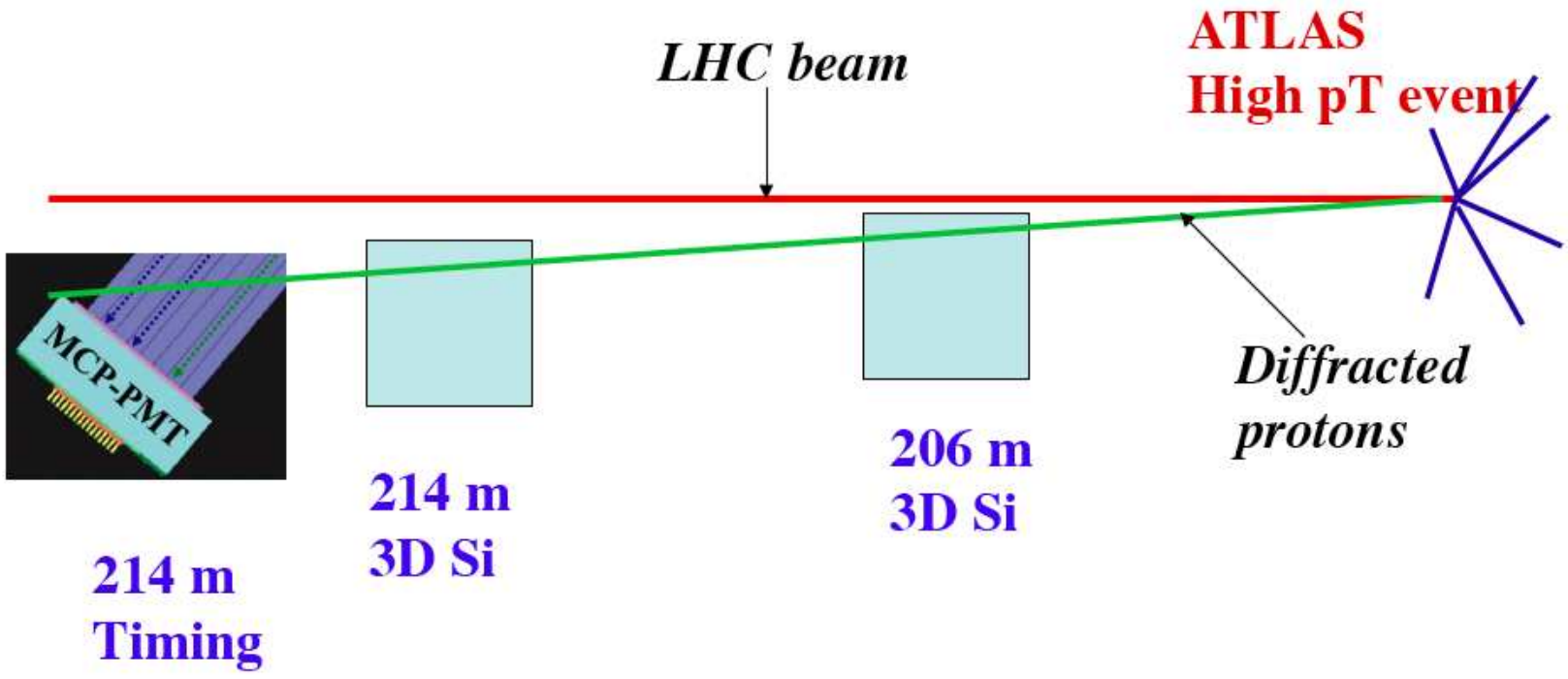
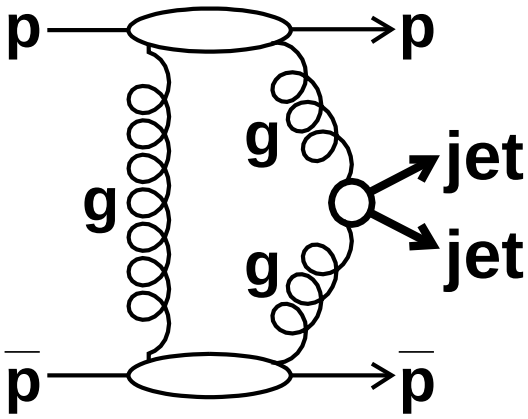
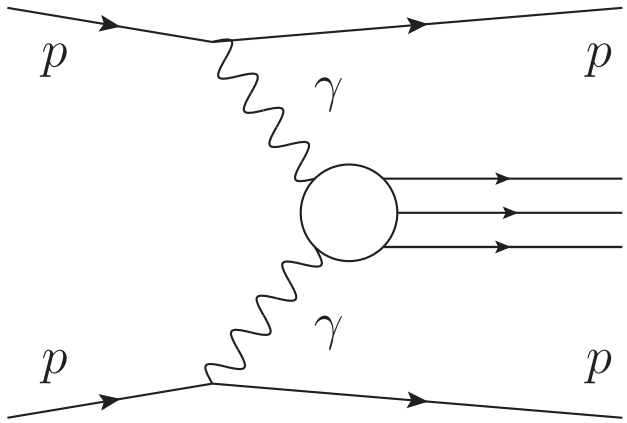
Introduction: The AFP detector

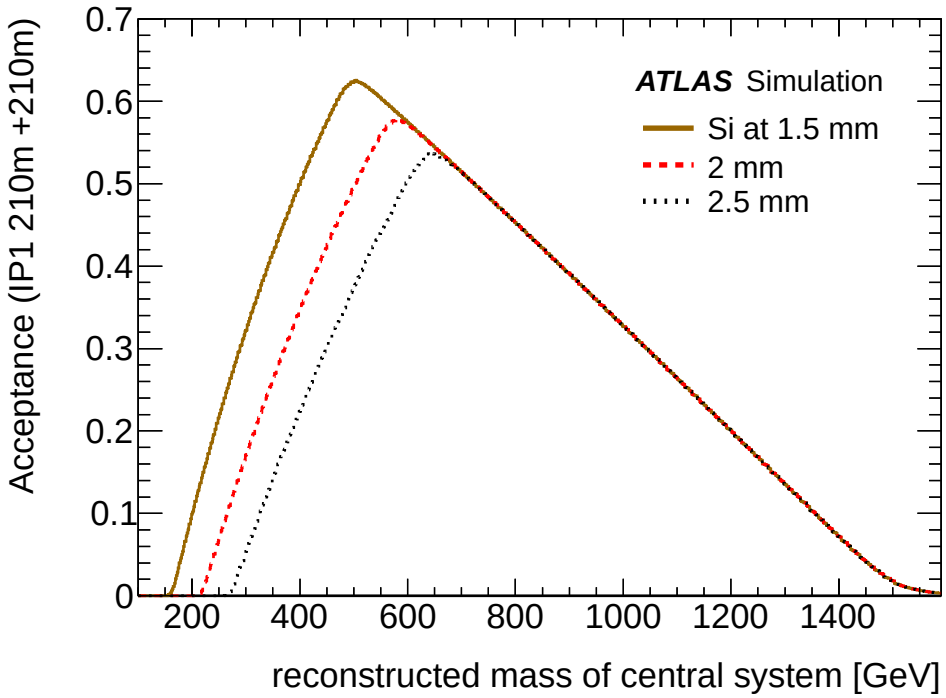


- Tag and measure protons at $\pm$210 m
- Trigger: Rely on ATLAS high p_T L1 trigger; dedicated trigger for low mass object using timing detector; inclusive trigger at very high masses
- AFP detectors: Radiation hard "edgeless" 3D Silicon detectors, 10 ps timing detectors
- Allows running in high pile up conditions by association with correct primary vertex: Access to rare processes

Introduction: Why building AFP?







- Increase sensitivity to (new) physics in ATLAS due to color singlet or photon exchanges
- Sensitivity to high mass central system, X, as determined using AFP
- Very powerful for exclusive states: kinematical constraints coming from AFP proton measurements

Quartic anomalous $W\gamma$ couplings (O. Kepka)

- Reaches the values expected for extradim models (C. Grojean, J. Wells)

Cuts	Top	Dibosons	Drell-Yan	W/Z+jet	Diffr.	$a_0^W/\Lambda^2 = 5 \cdot 10^{-6}$ GeV^{-2}
timing < 10 ps $p_T^{lep1} > 150$ GeV $p_T^{lep2} > 20$ GeV	5198	601	20093	1820	190	282
M(ll)>300 GeV	1650	176	2512	7.7	176	248
nTracks ≤ 3	2.8	2.1	78	0	51	71
$\Delta\phi < 3.1$	2.5	1.7	29	0	2.5	56
$m_X > 800$ GeV	0.6	0.4	7.3	0	1.1	50
$p_T^{lep1} > 300$ GeV	0	0.2	0	0	0.2	35

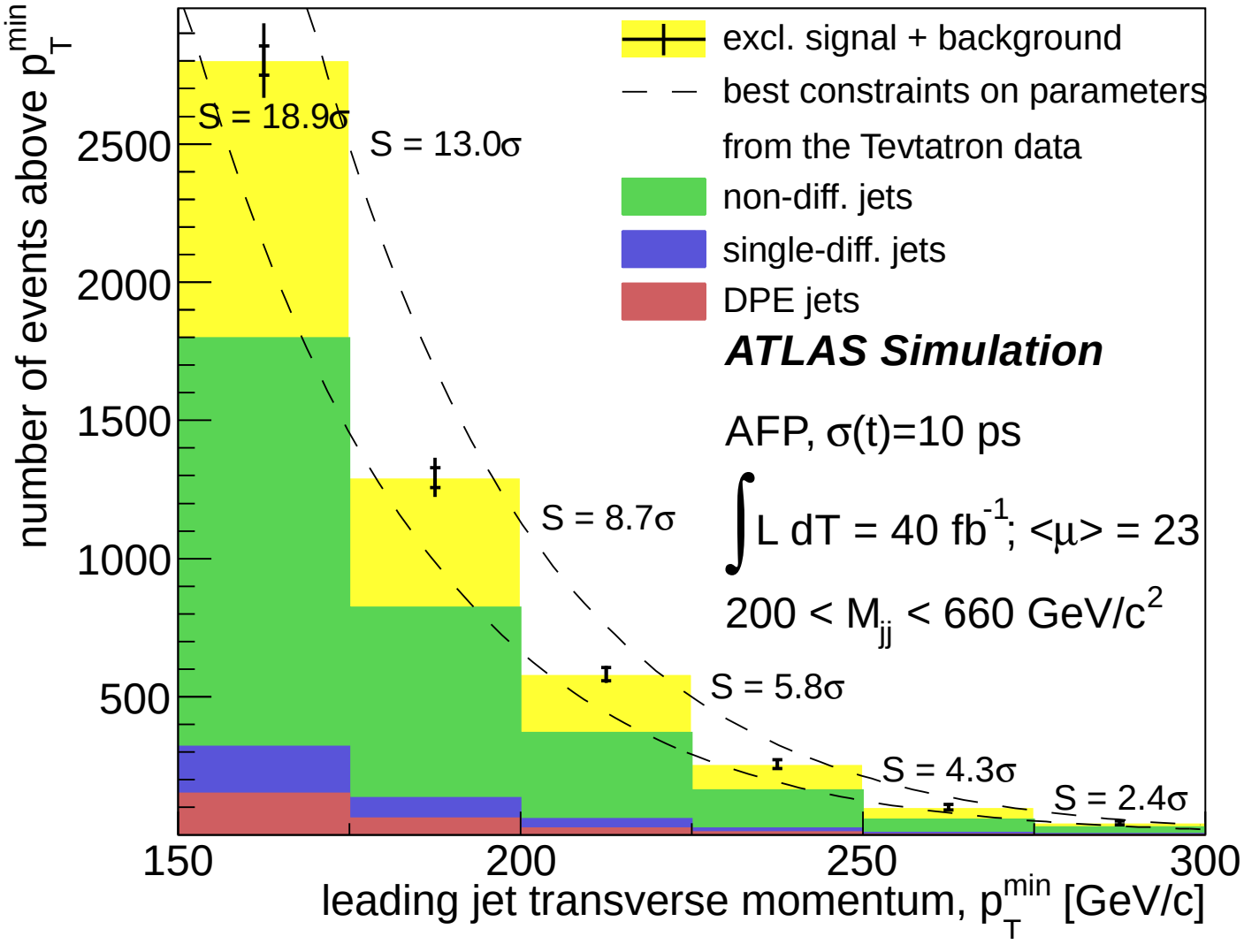
Table 9.5. Number of expected signal and background events for 300 fb^{-1} at pile-up $\mu = 46$. A time resolution of 10 ps has been assumed for background rejection. The diffractive background comprises production of QED diboson, QED dilepton, diffractive WW, double pomeron exchange WW.

- **Improvement of "standard" LHC methods by studying $pp \to l^{\pm}\nu\gamma\gamma$ (see P. J. Bell, ArXiV:0907.5299) by more than 2 orders of magnitude with 40/300 fb^{-1} at LHC**

	5σ	95% CL	LEP limit
$\mathcal{L} = 40\ fb^{-1}, \mu = 23$	5.5 10^{-6}	2.4 10^{-6}	0.02
$\mathcal{L} = 300\ fb^{-1}, \mu = 46$	3.2 10^{-6}	1.3 10^{-6}	

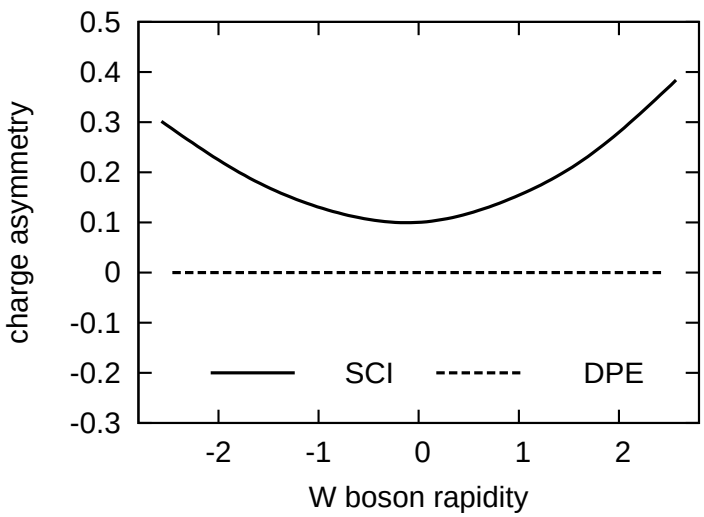
Exclusive jet production (M. Trzebinski)

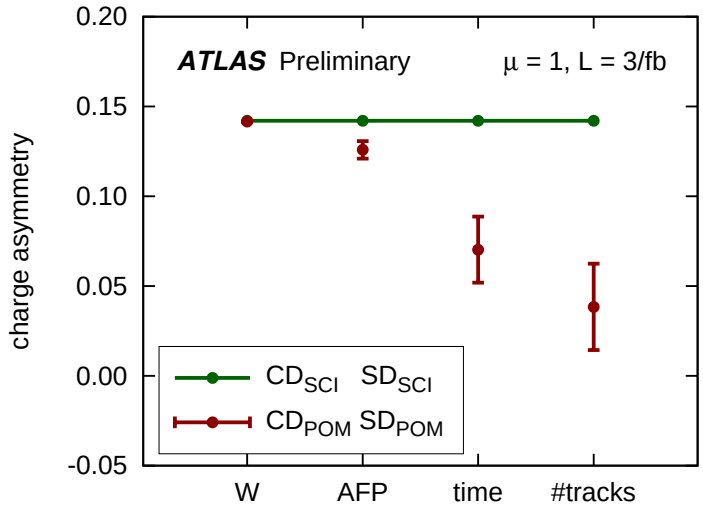
- Jet cross section measurements: up to 18.9 σ for exclusive signal with 40 fb^{-1} ($\mu = 23$): highly significant measurement in high pile up environment, improvement over measurement coming from Tevatron (CDF) studies using $\bar{p}$ forward tagging by about one order of magnitude



- Similar sensitivity obtained for 46 pile up events and 300 fb^{-1}

New ideas in W/Z production at the LHC (R. Staszewski)

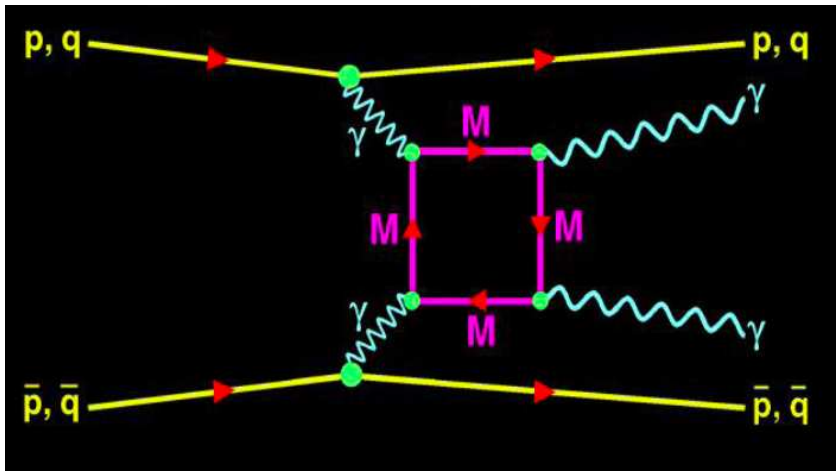




- New simple idea to probe QCD: K. Golec-Biernat, C. Royon, L. Schoeffel, R, Staszewski, Phys. Rev. D84 (2011) 114006.
- Measure W asymmetry: should be 0 if diffraction due to Pomeron exchanges (made of quark and gluons, since $u = \bar{u}$, $d = \bar{d}$), non-zero if due to soft colour exchanges (diffraction explained through soft colour exchanges at the hadronisation phase, same asymmetries expected as for the proton)
- If asymmetry is 0, measure u/d quark density ratio in the Pomeron: first possible measurement ever, important to test QCD evolution which assumes $u = d = \bar{u} = \bar{d}$

Additional topics: full lumi needed

- Main idea: production of objects in which background can be extremely reduced by kinematical constraints coming from AFP proton measurements (system fully constrained)
- Many new anomalous couplings to be studied if Higgs boson exists: new dimension 8 operators appearing leading to anomalous production of WW, ZZ, $\gamma\gamma$: needs full lumnosity, $\gamma\gamma$ is specially interesting (Christophe Grojean)
- Production of magnetic monopoles



- SUSY sparticle production: precise mass measurement, resonant RPV production
- Any production of new objects (with mass up to 1.2 TeV) to be produce either by photon or gluon exchanges: KK resonances, SUSY, black holes...
- Other topics (special runs): Pomeron structure, jet gap jet in diffraction (tests of BFKL dynamics)

Meeting agenda

- 10:10 - W charge asymmetries in diffraction - Rafal Staszewski
- 10:25 - W charge asymmetries in SCI models - Dominik Werder
- 10:40 - Discussion, W asymmetries
- 10:55 - Exclusive production of W pairs at the LHC - Antoni Szczurek
- 11:10 - Anomalous coupling studies - Hervé Grabas
- 11:25 - Discusion, WW exclusive production
- 12:00 - Exclusive production of dijets - Rafal Maciula
- 12:15 - Exclusive production of jets, jet gap jets - Maciej Trzebinski
- 12:30 - Discussion, exclusive jets and jet gap jets
- 14:30 - Diffractive production of charm - Marta Luszczak
- 14:45 - Diffractive production of heavy quark mesons - Wolfgang Schaefer
- 15:00 - Discussion, charm, beauty, vector mesons
- 15:20 - Exclusive production of $\pi^+\pi^-$, K^+K^- - Piotr Lebiedowicz
- 15:35 - Discussion: pion production, soft diffraction
- 15:55 - Other topics for AFP - Christophe Royon
- 16:10 - Discussion, other topics for AFP