

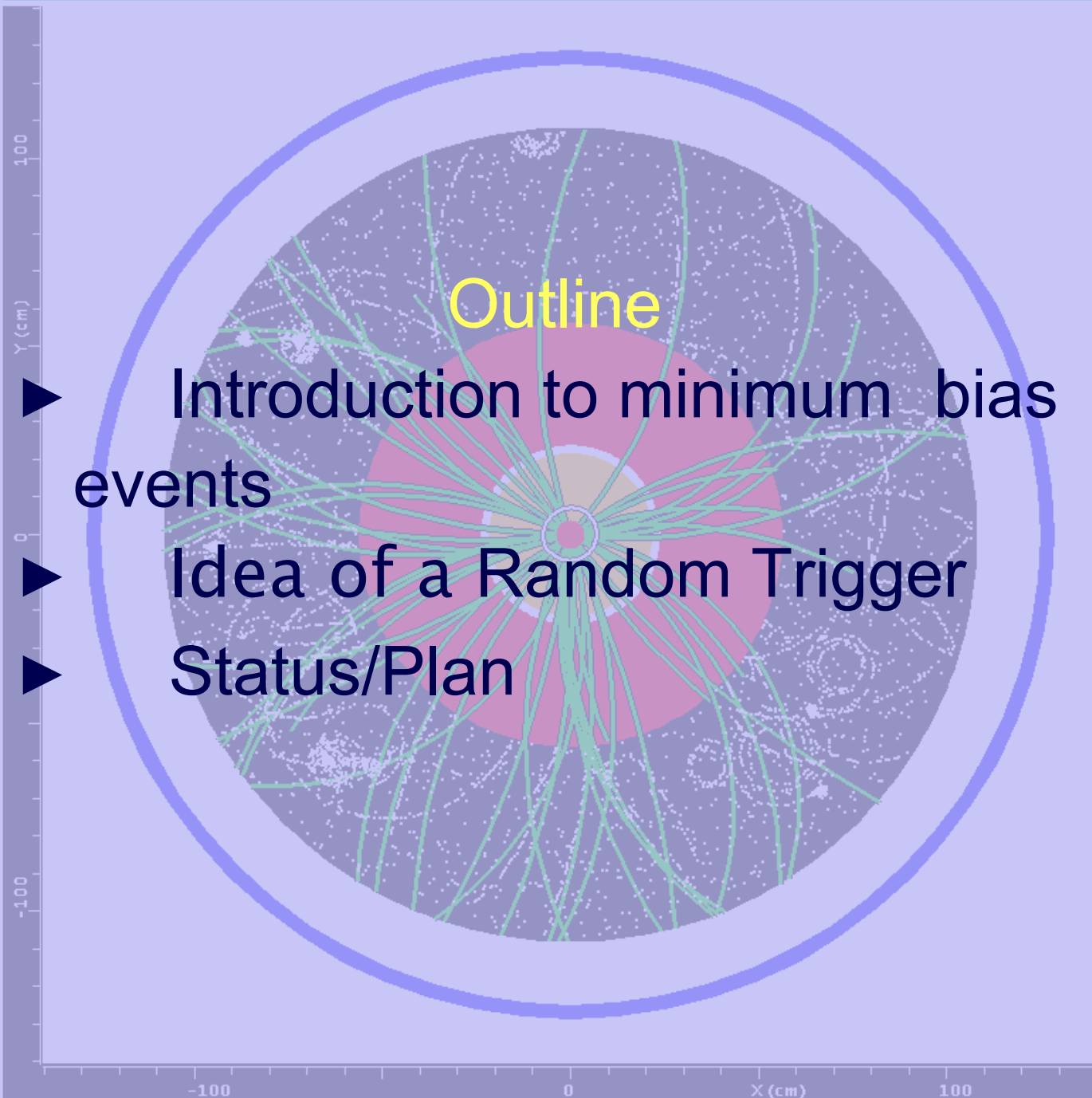


Random Trigger for Minimum Bias Events

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Introduction

- ▶ At LHC-energies physics processes will arise from parton-parton-interaction
 - ▶ Ability to describe parton scattering depends on the amount of p_T , perturbative QCD is only successful for **hard** interactions
 - ▶ At LHC, domination of **soft** interactions, they are responsible for event activity
- ▷ at $p_T \sim \text{few GeV}$ interaction-cross-section for a $2 \rightarrow 2$ parton-scattering will exceed the pp-cross-section
 - ▷ use concept of **multi-parton** interaction:

$$\sigma_{int}(p_{t_{min}}) > \sigma_{tot}$$

more than one parton-parton interactions possible in one event
(has been directly measured at CDF)

- ▷ divergence of the differential cross-section as $p_t \rightarrow 0$ is solved by introducing a cut-off-parameter $p_{t_{min}}$

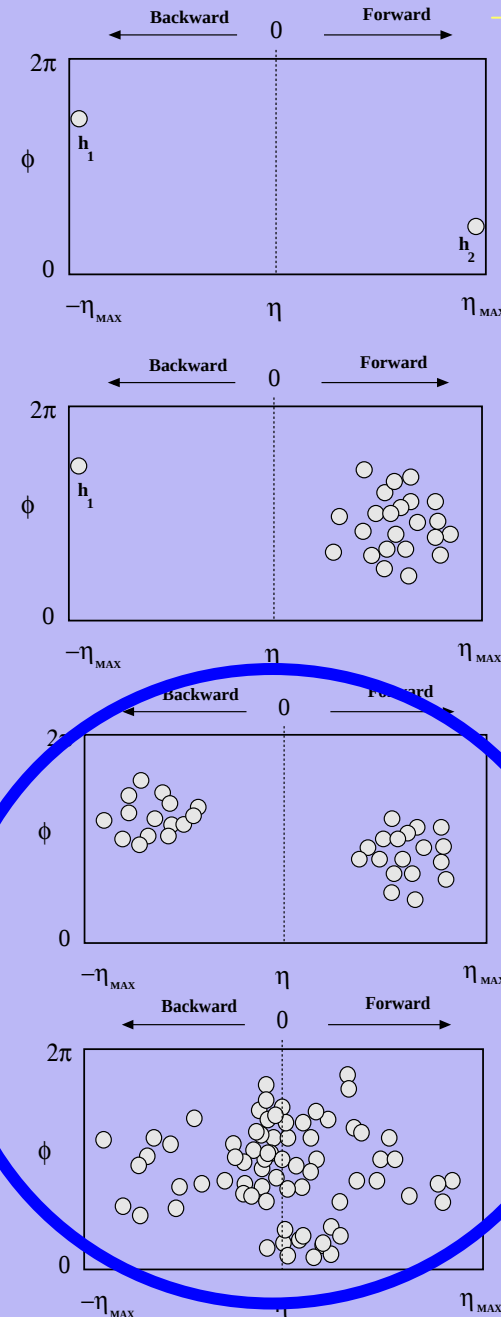
$$p_t \rightarrow 0$$
$$p_{t_{min}}$$

hadronic interaction

- ▶ elastic: $pp \rightarrow pp$
- ▶ inelastic:
 - single diffractive:
 $pp \rightarrow Xp$
 - double diffractive:
 $pp \rightarrow XY$
 - nondiffractive:
 $pp \rightarrow X$

minimum bias events

But: detection depends on the trigger-system





production of a large number of low pT-particles

$$\sigma_{tot} = \sigma_{el} + \underbrace{\sigma_{sd} + \sigma_{dd} + \sigma_{nd}}_{\sigma_{inel}}$$

$$\sigma_{tot} \approx 102 - 118 \text{ mb}$$

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$$\sigma_{nsd} = \sigma_{dd} + \sigma_{nd} \approx 65 - 73 \text{ mb}$$

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- radiation background for detector



Motivation

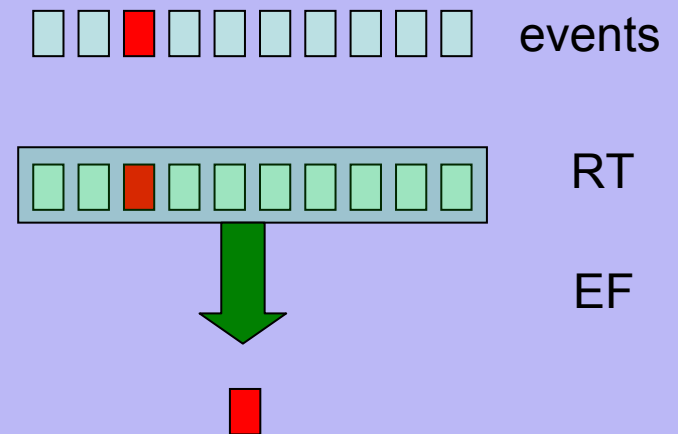
- ▶ need to understand the minimum bias pile-up and the underlying event as a tool for high- p_T -physics
- ▶ strategy:
 1. build trigger for MinBias events
 2. use first year to get the MinBias parameters (p_T , eta, multiplicity, ...)
 3. understand detector and improve physics model



Random Trigger

- ▶ at low $\mathcal{L} = 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$
 - ▶ probability of a minimum bias event per bunch crossing is $O(\sim 10\%)$
 - ▶ trigger on random at LVL1, select in HLT e.g. via track reconstruction in the EF

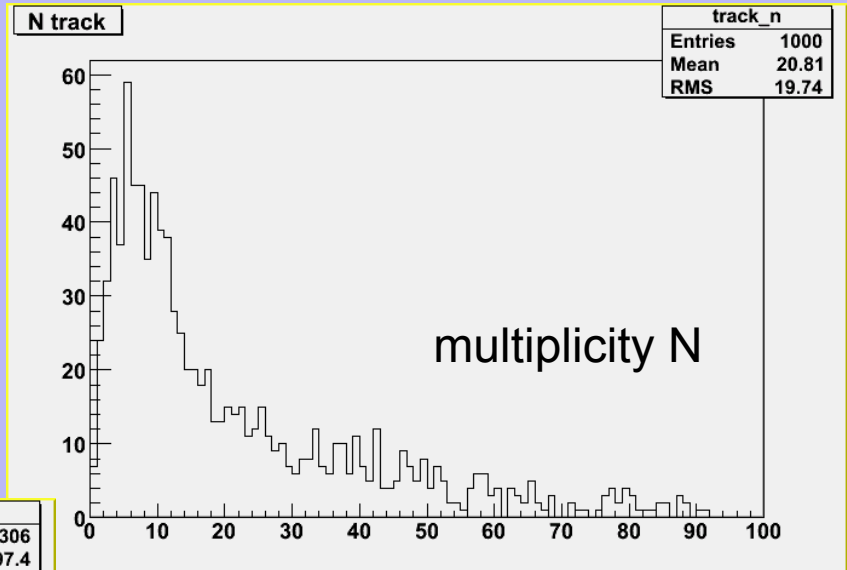
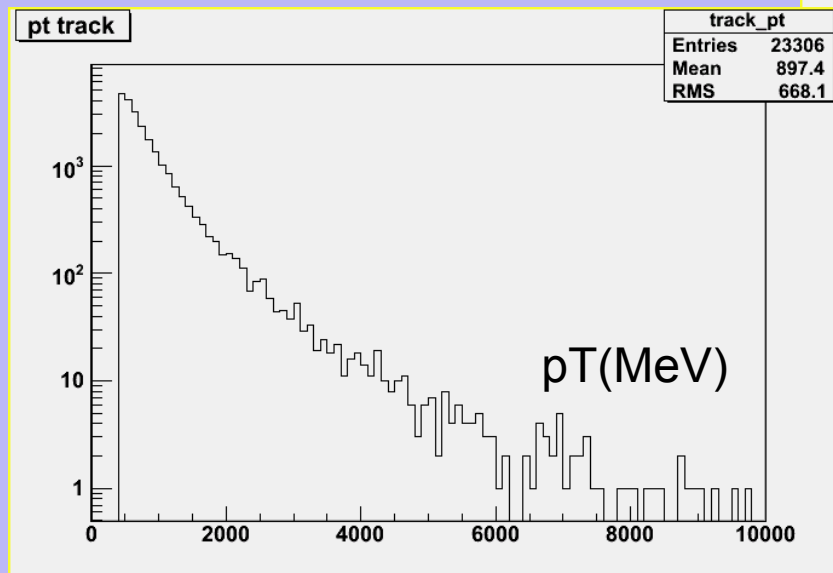
the EF has rejection rate of ~ 10





AOD-Analysis

- track reconstruction with 11.0.5 showed

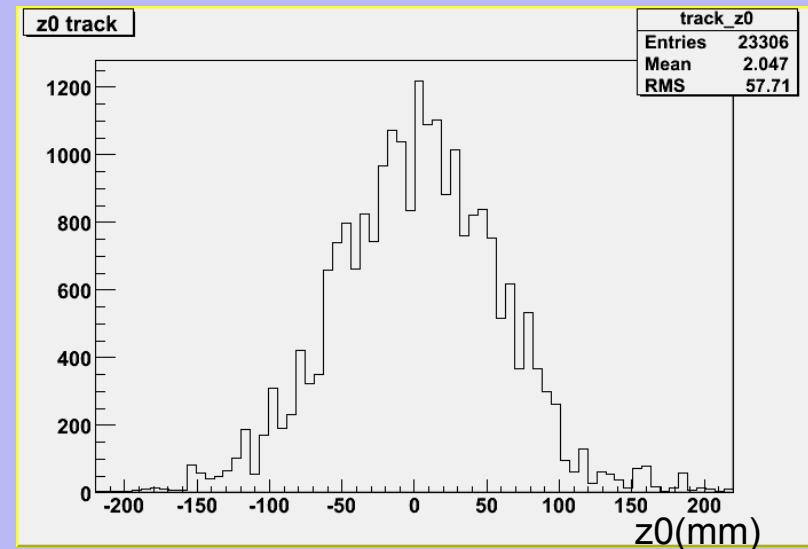
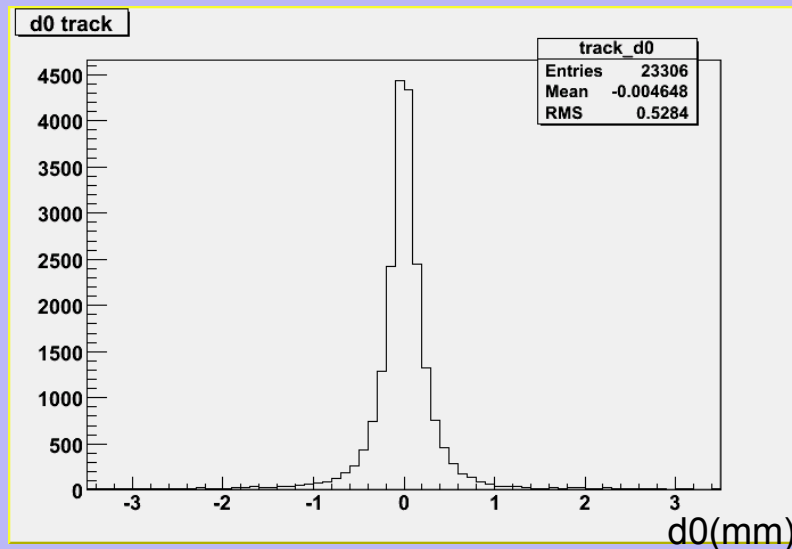


with standard pT-cut at
~ 400 MeV we see enough
particles

no further low pT-
specifications needed

Identification of Minimum Bias Events

- ▶ possible cut-criteria
 - impact-parameter

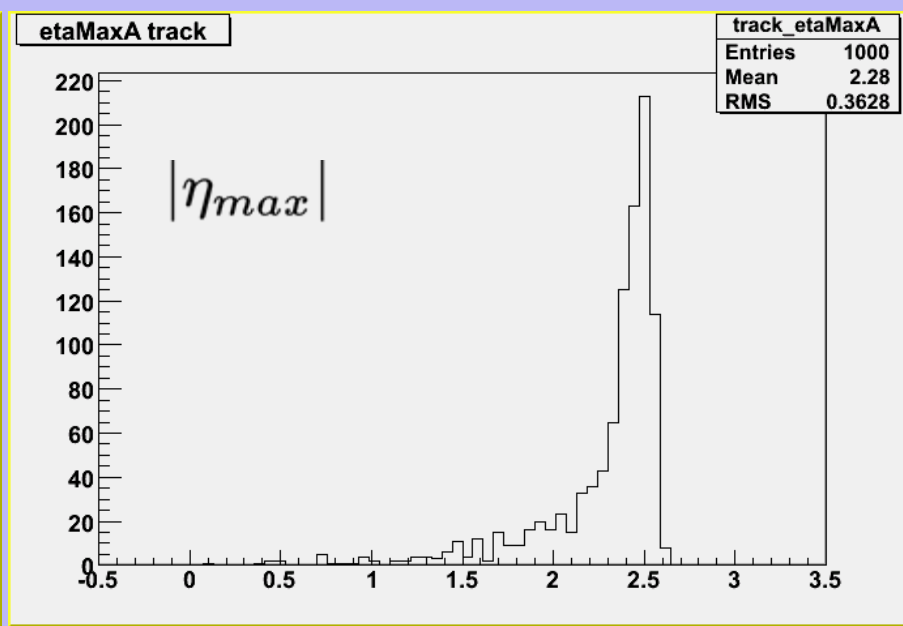
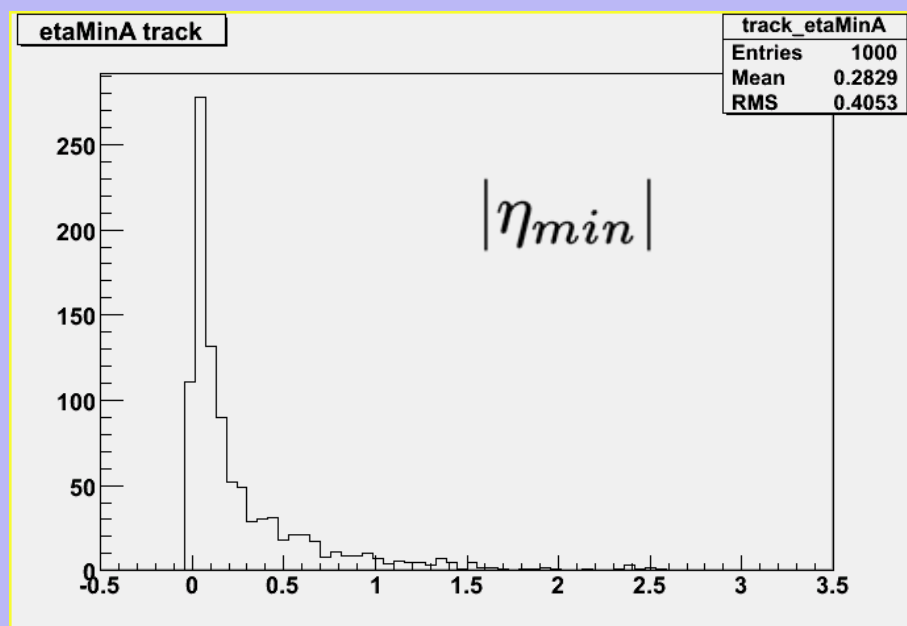


d_0 for transversal plane z_0 for longitudinal plane

Random Trigger as an independant method

► to Minimum-Bias-Trigger-Scintillator

MBTS triggers MinBias events with $2 < |\eta| < 4$, but analysis also showed



there are tracks with $|\eta| < 2$



Status/Plan

- ▶ I'm currently using fakeRoI to work with online-algorithms
 - ▶ started creating bytestream-data in 12.0.1 from simulated minimum bias events in RDO-format to make timing measurements
- ▶ We're in contact with some people from the trigger-group as John Baines, Iwona-Graboska-Bold, Nick Ellis and
- ▶ joining the weekly vrvs-conference of the minimum bias group, Peter Steinberg, Arthur Moreas, Craig Buttar
 - ▶ Minimum bias activity can be found at

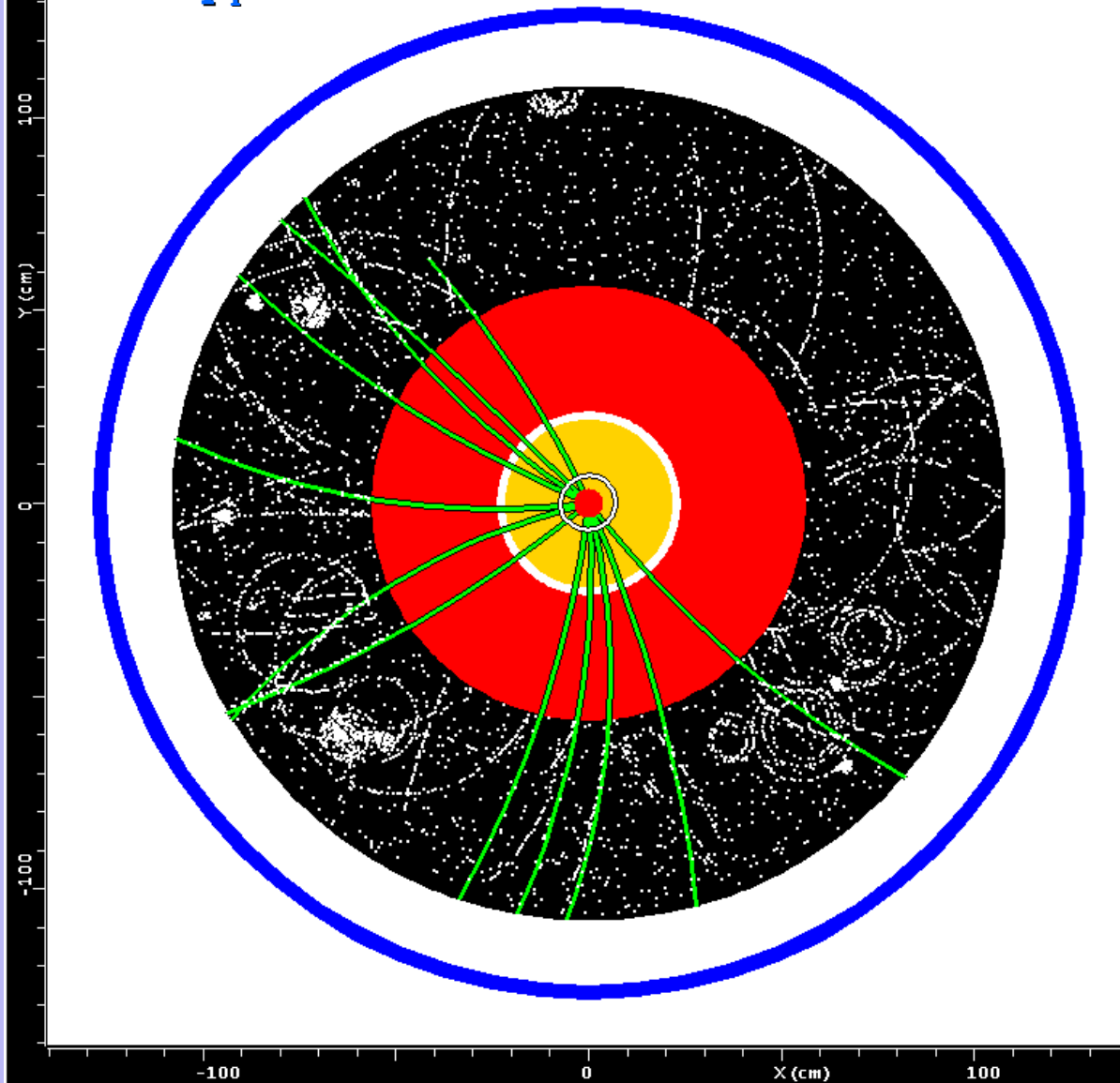
<https://uimon.cern.ch/twiki/bin/view/Atlas/MinbiasWorkingGroup>



Event Display Atlantis : simulated MinBias data

ATLAS Atlantis Event: JiveXML_5001_50404 Run: 5001 Event: 50404

Track $p_T > 1 \text{ GeV}$





references

- ▶ A.Moreas,C.Buttar,I.Dawson: *Prediction for minimum bias and the underlying event at LHC energies*, EPJ manuscript, 29.June 2006
- ▶ A.Moreas: *SM physics with early data*, talk at Physics Overview Week Stockholm 14.July 2006
- ▶ A. Moreas: *Reviewing some Aspects of diffractive Physics*, Minimum Bias Working Group, 15. May 2006

