

Quarkonium physics studies in LHCb, CMS and ATLAS



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LHCb

- Important contribution to Monte Carlo production of quarkonia in PYTHIA 6.324: tuning&validation. See [M. Bargiotti](#), [V. Vagnoni](#), CERN-LHCB-2007-042. PYTHIA parameters see this note.
[PARP(141-149)]
- Focus on muon channels
- Planned measurements in LHCb (depending on manpower)
 - Production cross sections for J/ψ and Upsilon, as a function (or in a certain range) p_T , y or x_F . NB also b-cross section from detached J/ψ vertices.
 - Studies of the polarization (spin alignment)
 - Spectroscopy with χ_c states
 - Possibly reconstruction of $\psi(3770) \rightarrow DD$.
- Acceptances: $1.8 < y(\text{quarkonium}) < 4.9$

CMS

- Like LHCb, using PYTHIA (currently 6.409) with same tuning. For details about generation see talk Kraan, HERA-LHC workshop, November 2007
- Focus on muon channels
- Planned measurements: similar to LHCb
 - Production cross sections for J/ψ and Upsilon (1S first, then also 2S), as a function of p_T . NB b-cross section from detached J/ψ vertices.
 - Studies of polarization
 - Hadronic activity (not sure)
 - Spectroscopy with χ_c states
- Trigger:
 - luminosity $\sim 10^{32}$: Double Mu with $P_T > 3$
 - lower luminosity: under study
- Kinematical acceptance:
 - Muons $P_T > 2.5$ and $-2.5 < \eta < 2.5$

ATLAS

- Same as LHCb and CMS: use PYTHIA, same tuning
- Focus on muon channels
- Planned measurements: similar to LHCb and CMS
 - Production cross sections for J/ψ and Upsilon (1S, 2S)
b-cross section from detached J/ψ vertices.
 - Studies of polarization
 - Hadronic activity
 - Spectroscopy with χ_c states
- Trigger:
 - low luminosity(10^{31}):
 - Double muon trigger $PT(\text{each mu}) > 4 \text{ GeV}$
 - Single muon trigger $PT > 10 \text{ GeV}$
 - higher luminosities:
 - Double muon trigger $PT_{\mu 1} > 4 \text{ GeV}$ $PT_{\mu 2} > 6 \text{ GeV}$
- Acceptance: Muons with $Pt > 2.5$ and $-2.5 < \eta < 2.5$