

Quarkonia measurements with the central detectors of ALICE*

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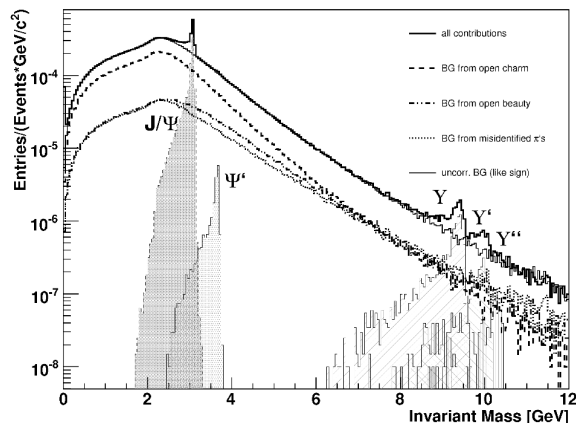


Figure 1: The invariant mass distribution of e^+e^- pairs corresponds to $2 \cdot 10^8$ events reflecting the expected statistics of one ALICE running year. The centrality was 10 % at a multiplicity of 3000. A p_t -cut on single electrons of 1 GeV/c was applied.

With the unprecedented energies of 5.5 TeV in PbPb collisions, available at the LHC, detailed measurements of the various heavy-quarkonia states in heavy ion collisions will be possible for the first time. The ALICE detector will be able to measure quarkonia in the dimuon and dielectron channel in different kinematical regions. These simulation studies investigate the physics capabilities of quarkonia measurements with the inner tracking system (ITS), the time projection chamber (TPC) and the transition radiation detector (TRD) covering a rapidity range from -0.9 to 0.9.

The presented simulations are based on calculations for quarkonia rates within the Color Evaporation model [Acc03]. The expected cross sections for the various quarkonia states are calculated for pp-collisions at $\sqrt{s}=5.5$ TeV. From these cross sections the PbPb-cross sections are calculated using N_{coll} scaling obtained by Glauber model calculations. In addition nuclear shadowing is included using the EKS98 parametrisation.

Due to the cross sections for the rare quarkonia states detailed simulations cannot be performed with today's computer facilities in an acceptable amount of time. For this reason a fast simulator was developed. It consists of three modules: A generator, a detector parametrisation and the analysis. The quarkonia states are generated according to

the calculated rates and to the kinematical distributions obtained by scaling the distributions measured by the CDF experiment. In addition two main sources of background electrons are considered: electrons coming from charm and bottom decays are simulated using the CDF scaled distributions and background due to misidentified pions is simulated by a parametrised HIJING generator tuned to the multiplicity of $dN/dy_{ch}=3000$.

The detector response is then evaluated using parametrisations describing detection probability, momentum resolution and particle identification. The parametrisations were obtained using microscopic simulations of HIJING events with embedded electrons. For a detailed description of the parametrisation see [Gro05].

As can be seen from Fig. 1 and the values from Tab. 1 the J/Ψ and the Υ are detectable with good signal to background ratio and significance. The higher mass states are clearly distinguishable from the background, however the accumulated statistics was not sufficient to give quantitative values. A Gaussian fit to the observed peaks gives a width of 33 MeV for the J/Ψ and 90 MeV for the Υ . Given this resolution the distinction of the different Υ -states will be possible.

For more results and a more detailed description of the performed studies see [PPRVII].

Table 1: Expected signals (S), signal to background ratio (S/B) and significance (SGN) corresponding to $2 \cdot 10^8$ events.

Particle	S	S/B	SGN
J/Ψ	120.000	1.4	260
Υ	1.250	1.6	28
Υ'	470	0.6	13.1

References

- [Gro05] J.F. Grosse-Oetringhaus, *Determination of the Physics Performance of the ALICE Central Barrel using a Distributed GRID Computing Environment*, Diploma thesis, Institut für Kernphysik, Münster, 2005
- [Acc03] A. Accardi *et al.*, arXiv:hep-ph/0308248.
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