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Low-energy charmonium, bottomonium and tetraquark production cross-sections from a statistical model

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Many proposed and on-going experiments require the preliminary knowledge of low-energy production cross-sections of different onium and/or exotic states in hadronic e.g. in proton-antiproton collisions, to be able to make estimates to the expected yields, momentum distributions etc. These are necessary ingredients to simulate the detector systems, and to plan the experiments. Here, we propose a statistical based model to estimate the low-energy cross-sections of some charmonium, bottomonium, and the X(3872) possible tetraquark state in proton-proton, pion-proton, and proton-antiproton collisions at a few GeV center-of-mass energies. The X(3872) cross-sections are calculated, using the assumption that it is a diquark-antidiquark bound state in the triplet-antitriplet representation, which gave a good match with the available high energy data in proton-proton collisions at 7 TeV. The estimated low-energy cross-sections can be used as inputs e.g. in transport simulations of heavy-ion collisions, which can be used as event generators to detector studies, which is an important task during the construction of the detector systems. In each case the calculated cross-sections are compared to the available measured data, giving a good match between the two.

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