Hadronic cocktail of dielectron sources in pp collisions at $\sqrt{s} = 13$ TeV

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In the study of low mass dielectrons produced in heavy ion collisions, experimental data are usually compared to a hadronic cocktail, that is the sum of all known hadron sources contributing to the dielectron spectrum.

We have obtained for the first time the dielectron mass spectrum from high multiplicity triggered pp collisions at $\sqrt{s} = 13$ TeV, The ratio between this spectrum and the one from minimum bias events, after normalization by the average charged particle multiplicity, has been compared to a hadronic cocktail expectation. The goal is to search for possible deviations in the mass spectrum when the charged particle multiplicity rises. It is expected an enhancement in the low mass region that is acceptance related, caused by modifications of the p_{T} spectra [1]. The region dominated by heavy flavour sources should be enhanced as well, due to higher production yields of charm and bottom mesons in the high multiplicity events [3]. Any other effect like modifications in the relative contributions of different mesons, suppression of short lived vector mesons due to final state interaction with comovers or enhancement due to resonance production in π-π annihilation can be studied.

For the light flavour part of the hadronic cocktail, the different hadronic sources of dielectrons via Dalitz or two-body decays are taken into account up to $\sim$1.3 GeV/c using a fast MC simulation. Acceptance, resolution and relative efficiency effects of the ALICE spectrometer are taken into account based on full Monte Carlo simulations. The cocktail inputs are based on ALICE measurements in pp collisions at $\sqrt{s} = 13$ TeV. For π^0 the used input parametrization is a Tsallis fit to the p_{T} measured spectra of charged pions by ALICE [2]. Other light hadron spectra are generated via m_{T} scaling, with scaling factors following as well ALICE measurement when available. PDG.

For the simulation of the high multiplicity events, we apply to the minimum bias cocktail two different weights based on measurements of ratios of p_{T} distributions of charged particles as a function of multiplicity [1], in order to obtain a lower and upper limit for the high multiplicity cocktail. The lower limit is based in the p_{T} spectra of multiplicities $N_{\mathrm{ch}}^{\mathrm{acc}} \geq 2\langle N_{\mathrm{ch}}^{\mathrm{acc}}\rangle$, corresponding to an increase in the average multiplicity by a factor 3. For obtaining the weight of the upper limit case, we use the previous p_{T} spectra divided by the one from low multiplicities $1 \leq N_{\mathrm{ch}}^{\mathrm{acc}} < \langle N_{\mathrm{ch}}^{\mathrm{acc}}\rangle$, in order to account for an increase in the average multiplicity by a factor 6.

With these ingredients, the expected ratio of high multiplicity over minimum bias events from light flavour sources after acceptance cuts can be seen in Fig. 1, represented as a band between the lower and upper multiplicity increases considered for the HM cocktail. The effect of the efficiency is shown as well. Both minimum bias and high multiplicity cocktails are normalised using as normalization parameter the number of dielectrons from π^0 Dalitz decays before acceptance cuts.

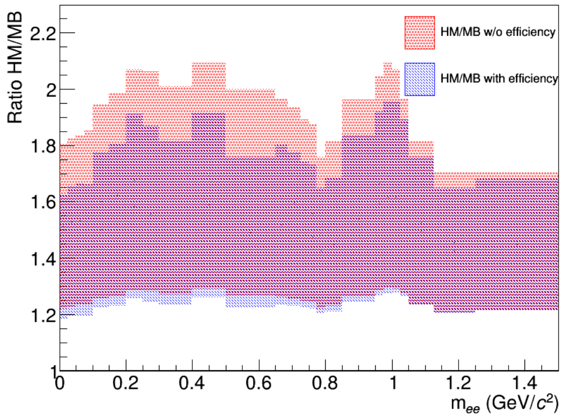

Figure 1: Ratio of the dielectron mass spectrum after acceptance cuts from HM and MB cocktail for the light flavour sources. The blue band represents the ratio HM/MB varying from the lower to the higher multiplicity increases considered for the HM cocktail. The red band represents this ratio when the efficiency weight is not applied.

For the heavy flavour part of the cocktail, we estimate the contribution of correlated semileptonic decays of open charm and bottom mesons making use of a PYTHIA simulation based on the official MC production with enhanced open heavy-flavour contributions of ALICE. We have used this simulation to check the average D meson p_{T} as a function of dielectron invariant mass, and measured values of the enhancement factor of D mesons as a function of its mean p_{T} [3] are used for simulating the high multiplicity dependence.

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References

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