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Key parameters for the ion velocity distribution at the plasma meniscus of a caesiated negative ion source

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Neutral beams are a valuable option to provide heat and current drive to a magnetically confined plasma. In addition they can be used as a diagnostics for the positive ion temperature and, in case of nuclear fusion reactions, for the amount of helium ash. In the case of ITER, stringent requirements are set on the acceptable beam divergence and aiming in order to propagate such beams up to the tokamak itself. Besides the well-known dependence of the beamlet optics on the beam energy and perveance, other important features affecting the optics are the ion spatial and velocity distribution at the plasma boundary facing the extractor, the so-called plasma meniscus. In a caesiated negative ion source, such distribution is influenced both by the birth energy of the negative ions and by the ion transport in the plasma itself.
In this work, the effect of different plasma parameters on the ion velocity distribution at the meniscus is simulated by means of a particle tracing code with Monte Carlo collisions. Among them, the key role of the positive ion energy in the source is highlighted, as well as the consequences on the optics of the accelerated negative ion beams.

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