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From vacuum acceptance test to vacuum simulation: ELENA case study

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The Extra-Low Energy Anti-proton ring (ELENA) is a decelerator at CERN with the aim to slow down the antiprotons from the Antiproton Decelerator (AD) to a kinetic energy of 100 keV, improving the antimatter experiments trapping efficiency. ELENA operates in the Ultra High Vacuum (UHV) regime to assure a sufficiently long pbar lifetime and reduced beam blow-up. As the ring is under commission, there is an interest to assess its achievable vacuum quality with a simulation study.

The vacuum system is baked and in addition to lumped ion pumps, makes extensive use of non-evaporable getter (NEG) coating for increased distributed pumping. The simulation study uses the open-source software MolFlow+ to integrate data from vacuum tests of individual components done in the vacuum laboratory with the mechanical design of the complete machine. The objective of this work is to provide pressure profiles along the beam trajectory, based on measured outgassing of components combined with the available pumping speed in the system. Moreover, the model is used to simulate several scenarios e.g. the pumping speed of the NEG for different gas species and the potential effect of NEG saturation.

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