Long term performance of the COSY/Jülich polarized ion source

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The COoler SYnchrotron and storage ring COSY [1] located at the Institute for Nuclear Physics (IKP) of the Forschungszentrum Jülich provides routinely polarized protons and deuterons with momenta between 0.3 GeV/c and 3.8 GeV/c for experiments at several internal and external target places. Since January 1996, the cyclotron JULIC operates as the injector of H^- or D^- beams for stripping injection into the COSY ring with polarized beams delivered by the colliding beams source [2, 3]. The original source has been designed and set in operation by groups from the universities Bonn, Cologne and Erlangen as a colliding beams source in continuous operation [5]. In parallel to beam delivery to the synchrotron the atomic beam part, the cesium ionizer, neutralizer and the ion extraction have been optimized continuously for pulsed operation. By advancing the components of the polarized ion source the number of polarized particles for injection into the cyclotron has reached about 5×10^{12} protons, delivered in a 20 ms pulse with a repetition rate of 2 seconds [6]. The polarization of the circulating beam in COSY is measured routinely during acceleration and at maximum momentum with the internal EDDA detector and exceeds 70 % after compensation of depolarizing resonances for highest beam energies [4]. The polarization of the source is optimized with Breit Rabi techniques and a Lambshift polarimeter behind the ion source. High analyzing powers for elastic scattering of the beams on carbon targets enable efficient determination of the nuclear vector polarization behind the cyclotron. In order to provide polarized beams with the highest possible intensity and polarization routinely, components of the source and diagnostic tools for neutral beams and polarization measurements have been optimized over the last years. An important long term activity has been the controlled, local production of dispenser ionizers for the cesium beam part, because the source's over all performance is correlated to the cesium ionizer's performance and depends strongly on the availability and quality of dispenser ionizers with a porous tungsten button. Within the last two years the production process at the Forschungszentrum has been improved substantially and a new generation of tungsten dispensers is now available. In parallel laser cleaning and production methods have been applied for dispensers. The production process, the start performance and also recovery of used dispensers benefited significantly from laser application. This report describes briefly the characteristics of the ion source in its present mode of operation, the achievements and programs towards higher beam intensities for polarized H^- and D^- beams with high reliability.

References

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