Polarization optimization studying in the polarization

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A novel polarization technique had been successfully implemented in the RHIC polarized H- ion source upgrade to higher intensity and polarization for use in the RHIC polarization physics program at enhanced luminosity RHIC operation.

Limitations of the polarized H- ion current, suitable for application at RHIC and other high-energy accelerators and colliders can be overcome in pulsed operation source by using instead of ECR a high brightness Fast Atomic Beam Source (FABS) outside the magnetic field. A high current and low divergence primary proton of ~5.0-8.0keV energy is neutralized in the pulsed hydrogen neutralizer cell. The H atomic beam is injected into a superconductive solenoid containing a pulsed-gaseous He-cell ionizer and the optically pumped polarized Rb vapor cell. The injected H atoms are ionized in the He with 80% efficiency and then enter the polarized Rb-cell. The protons pick-up polarized electrons from the Rb atoms to become a beam of electron-spin polarized H atoms then passes through a magnetic field reversal region, where the polarization is transferred to the nucleus via hyperfine interaction (Sona-transition technique). The negative bias voltage of ~2.0-5.0kV applied to the He-cell decelerate proton beam to allow energy separation of the polarized hydrogen atoms and residual hydrogen atoms of primary beam.
Higher polarization of the FABS source is achieved by: a) the separation and neutralization of residual hydrogen due to bending magnet and collimators more than 25-30 times, b) better efficiency Sona-shield transition for the smaller beam diameter of ~ 1.5 cm, c) of the optimized magnetic field and the frequency of the pump laser. All these factors combine to make it possible to increase the polarization in pulsed OPPIS to ~90%, and the source intensity to over 10 mA.

References

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