Plans for Polarized Beams at VEPP-2000 and U-70

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ABSTRACT

The new electron-positron collider VEPP-2000 is under commissioning now at Budker Institute of Nuclear Physics. This machine with maximum energy per beam 1 GeV is constructed with an intention to measure the hadron production in e^+e^- annihilations in the energy range 0.4.- 2 GeV. To reach the required luminosity $L = 10^{32}\,cm^{-2}\,s^{-1}$, a concept of so called round colliding beams are applied for the machine lattice. Main feature of this lattice is a final focus in two experimental straight sections, based on 14 T superconducting solenoids.

This scheme creates unusual possibilities for the radiative polarization. Each pair of the solenoids has an integral magnetic field equivalent to full Siberian snake. Besides that, a high magnetic field in the bending magnets (up to 24.6 T on the energy 1 GeV) provides very fast spin build-up time. For instance, at the energy 1 GeV the so called Sokolov-Ternov polarization time does not exceed 10 min. Moreover, different sets of solenoids polarities can provide transverse or longitudinal polarization. A calculations show expected polarization degrees quite interesting for future experiments at VEPP-2000.

Many interesting studies of polarization phenomena have been done at the synchrotron U-70, while 40 years its operation in Protvino (Russia). On other hand, many years there is increasing interest to experiments with polarized beams. A possibility to accelerate polarized proton at the synchrotron U-70 is considered. Estimations of the spin resonances are given in the energy range 2.5 – 70 GeV. To suppress depolarizing effects of spin resonances, a scheme with three partial Siberian snakes is suggested. Each snake is a helical fou full twists magnet with 4.5 T magnetic field, that rotates spin by 60 degrees. Analytical considerations and tracking simulations shown that proposed scheme provides the adiabatic spin flip at imperfection resonances and suppresses all intrinsic resonances by quite realistic beam emittance and bending magnets misalignments ± 0.5 mm.