POLARIZED PROTON ACCELERATION AT THE AGS

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Since a similar lecture[1] will be published in the Proceedings of the 1984 Marseille Symposium on High Energy Spin Physics, I will only give a brief summary of my lecture.

To accelerate polarized protons in the AGS it was necessary to make major hardware modifications in almost every part of the accelerator complex, which is shown in Figure 1. A new polarized H^- ion source was constructed, which now operates at a world record 25 μa. Dr. Alessi described this source in some detail at this conference. A team led by S. Giardano constructed a 200 MHz Radio Frequency Quadrupole (RFQ) to replace the Cockcroft-Walton 760 KeV preaccelerator. We believe that this was the first RFQ successfully used with an operating accelerator.

To maintain polarization during the acceleration cycle in the main ring it was necessary to pass more than 30 strong depolarizing resonances without serious depolarization. The 3 strong intrinsic depolarizing resonances were jumped using 8 fast pulsed quadrupole magnets installed around the AGS ring. These quadrupoles shifted the vertical betatron tune with a 1.6 μsec risetime and thus passed very rapidly through the resonances. Almost 30 strong imperfection resonances were corrected with the appropriate n^{th} harmonic (sin nθ where $G\gamma = n$) produced by the 96 correction dipole magnets in the AGS ring. A new type of strong depolarizing resonance (intrinsic/imperfection) was discovered and overcome near 15 GeV/c.

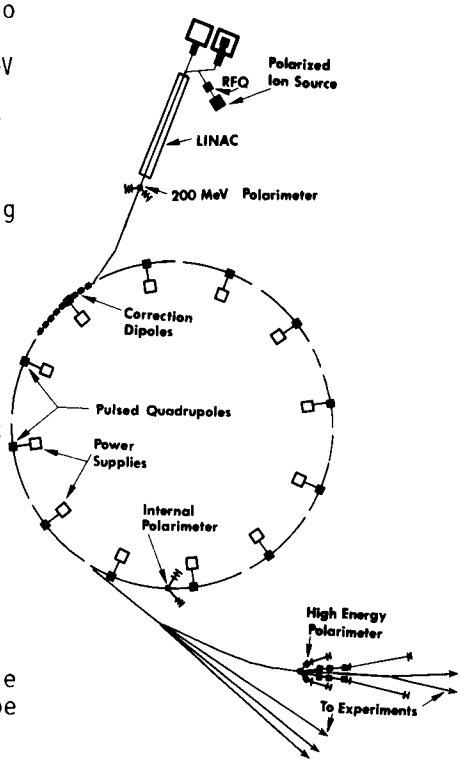

Fig. 1 Diagram of the AGS showing those areas where modifications were made to allow the acceleration of polarized protons.

The 200 MeV polarimeter constructed by Rice measured the polarization at the end of the

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LINAC. The fast internal polarimeter constructed by Michigan measured the relative polarization during the acceleration cycle. The high energy polarimeter shown in Fig. 2 measured the absolute polarization by observing the left-right asymmetry in proton-proton elastic scattering at $P_{\perp}^2 = 0.3$ (GeV/c)^2 where the Analyzing Power, A, was taken to be 4.6 ± 0.4%.

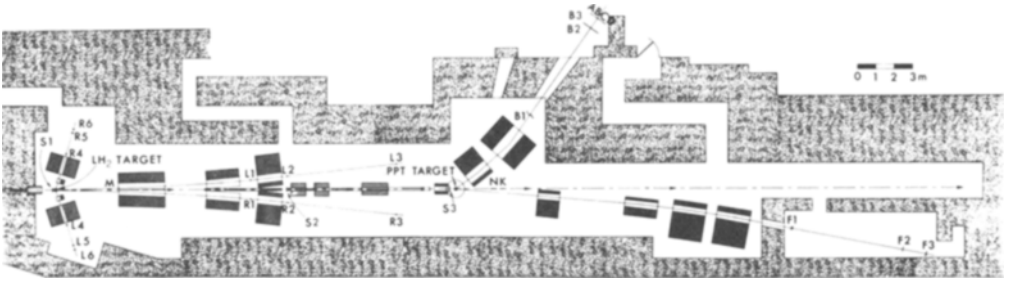

Fig. 2 The Michigan high energy polarimeter is shown on the left. It uses a liquid hydrogen target to measure the left-right asymmetry in p-p elastic scattering. The polarized beam is then scattered in the Michigan polarized proton target and p-p elastic events are detected by the spectrometer which contains magnets for momentum analysis and the F and B scintillation counter hodoscopes.

In July we reached a momentum of 16.5 GeV/c with a polarization of 40% and an intensity of 10^{10} protons per pulse. We expect to increase the momentum, polarization, and intensity during 1985. A detailed paper on the AGS Polarized Proton Beam is being prepared by the Argonne, Brookhaven, Michigan, Rice, Yale polarized beam collaboration.

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1. A.D. Krisch, Polarized Protons at the AGS and High-$P_{\perp}^2$ Spin Experiments, Proc. of the 6th International Symposium on High Energy Spin Physics, Marseille, Sept. 12-19, 1984, J. Soffer, Ed. (to be published).