Monitoring of the relative beam polarization at COSY–11

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At COSY–11 the determination of the luminosity is based on the comparison of the differential cross section for the proton–proton elastic scattering [1] with the measured rate of events recognized as elastically scattered protons.
In the COSY–11 detector setup [2] the forward scattered proton deflected by the magnetic field of the dipole is registered in drift chambers D1 D2, scintillator arrays and S1 and S3. The second branch of this two body reaction is detected in a position sensitive silicon pad detector. The reaction plain is more or less parallel to the plain of COSY.
In measurenents with a polarized proton beam aiming for the determination of the *analysing power*, beside the luminosity the beam polarization has to be known. This can not be extracted from a measurement in the COSY plain alone. The beam polarization has to be taken from simultaneous measurement at e.g. the EDDA [3] installation.
Another solution could be the registration of elastically scattered protons perpendicular to the COSY plain. Such a luminosity measurement is independent of the orientation of the spin of the beam protons. For this purpose a **Luminosity Monitor System** has been installed at COSY–11.

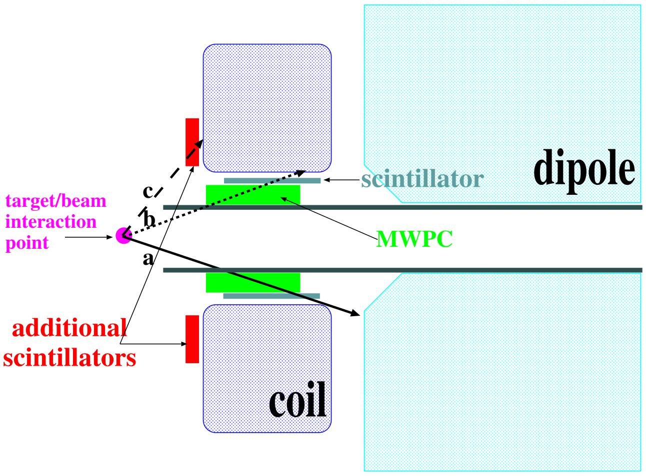

Fig. 1: Luminosity Monitor System extended by two additional scintillators. Trajectory **a** and **b** are valid for 2620 MeV/c. For lower beam momentum (2096 MeV/c) tracks **a** and **c** are suitable.

Figure 1 shows the used detection system together with an example of the trajectory for elastically scattered protons. The Luminosity System, described precisely in [4], was designed and optimized for beam momenta in the 3 GeV/c range. An event for such a beam momentum is presented in Fig. 1 by the vectors **a** and **b**. Both protons cross a MWPC and scintillator. The opening angle of protons in the exit channel for lower beam momentum is larger than for the higher one. At lower beam momenta only one of the protons (**a**) is registered in MWPC, the second (**c**) hits the additional scintillator installed in front of the coil.
First data with polarized beam were taken at COSY-11 in January 2001 during first measurement of the analysing power for the η production in the proton–proton scattering [5]. COSY was operated in the super cycle mode with 15 min. cycles of alternating opposite proton polarization. First results obtained from on-line monitoring are presented

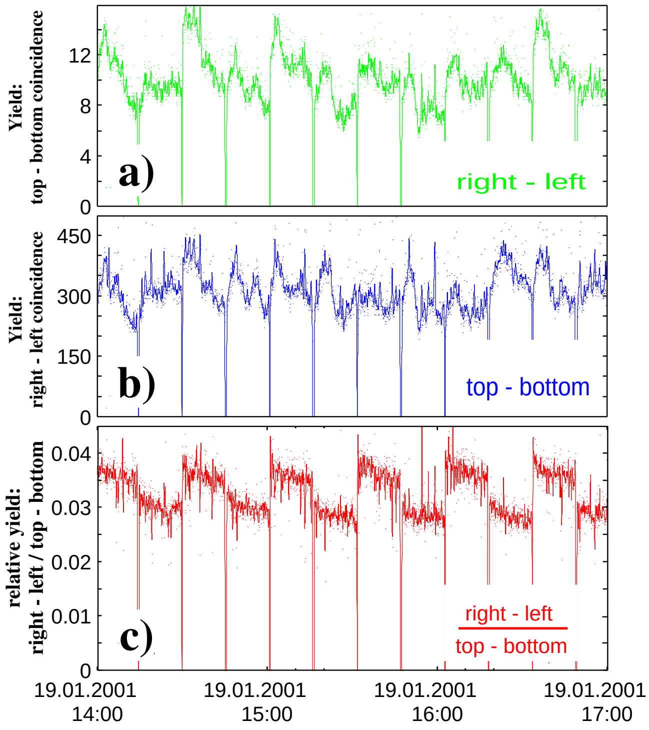

Fig. 2: On-line observation of the effect due to the polarized beam at COSY–11 in January 2001 (description see text).

in Figure 2. Figure 2**a)** shows the coincident event rate registered with the detectors in the COSY plain. It seems that the event rate differs for subsequent cycles of opposite polarization. In Figure 2**b)** the rate measured by means of the Luminosity Monitor System is presented. Changes in the number of events are rather independent on the cycles, so the event rate does not depend on the spin orientation of the beam protons.
Finally, Figure 2**c)** is a result of the normalization of the counting rate of Figure 2**b)** to the one of Figure 2**a)**. Now it is clearly seen, that the normalized number of events is changing from cycle to cycle. With more detailed analysis, the described systems can be used as a monitoring of the beam polarization.

References:

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[5] P.Winter, contribution to this Annual Report.

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