Measurement of the $pp \to pp\phi$ reaction at COSY - 11

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The COSY-11 collaboration measured the $pp \to pp\phi$ reaction using a proton beam momentum of 3481 MeV/c corresponding to an excess energy of about 24 MeV. The improvement of the data analysis program during the last years and especially the more realistic treatment of the magnetic field used in the momentum reconstruction [1] encouraged us to reanalyze the data.

Figure 1 shows the missing mass spectrum for the $pp \to ppX$ reaction, where the outgoing protons were identified by reconstructing their mass from the measured momentum and velocity [2]. Most of the entries in this spectrum originate from the multi-pion production and the production of broad mesons like $f_0(980)$ or $a_0(980)$. The clear peak at the mass value of 780 MeV/c^2 above the background corresponds to the production of the ω meson, however, no indication shows up at a mass of 1020 MeV/c^2, which is the mass of the ϕ meson.

Considering that the ϕ meson decays with 49% into the K^+K^- mesons, and that the mesons $f_0(980)$ and $a_0(980)$ decay predominantly into $\pi\pi$ and $\eta\pi$, respectively [3], it is possible to augment the relative signal of ϕ production by the requirement that additionally to the two protons also a K^+ meson was detected. The missing mass distribution obtained under this condition is shown in figure 2. The requirement of a coincident identification of two protons and a K^+ reduces the number of events significantly . However, now an enhancement at the missing mass value corresponding to the mass of the ϕ meson is clearly visible. The run for the ϕ meson production was only 60 hours, since it was regarded as a feasibility test. An extraction of cross section is in progress.

In 1999 further experiments on the ϕ meson production will be performed, which should allow us to improve the statistics, to identify unambiguously the production of ϕ mesons in the proton-proton collisions, and to determine the cross section at different excess energies.

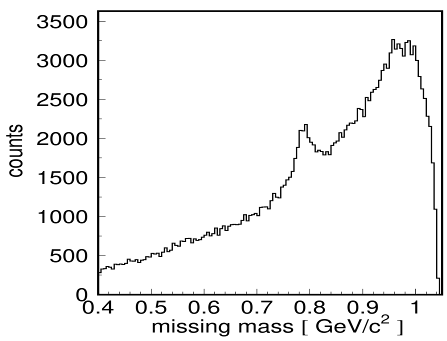

Fig. 1: Missing mass in the $pp \to ppX$ reaction

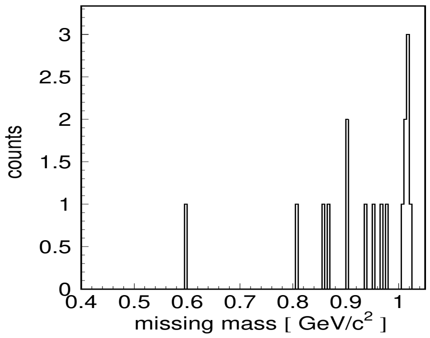

Fig. 2: Missing mass in the $pp \to ppX$ reaction with the additional condition that a third particle with the mass correspondig to a kaon is registered

References:

[1] COSY - 11 collaboration, Annual Report 1995, IKP, FZ Jülich (1996) p. 38

[2] S. Brauksiepe et al., Nucl. Instr. & Meth. **A 376** (1996), 397

[3] C. Caso et al., Eur. Phys. J. **C 3** (1998)