INSTALLATION AND COMMISSIONING OF THE CE-36 MAGNETIC CHANNEL

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During the past year we installed and started commissioning the magnetic channel at the Cooler 6° magnet in the T-section. This system was designed to allow study of the $^{12}C(d,^2He)^{12}B$ reaction as proposed in CE-36. The physics goals and the concept of the facility were described previously.[1] Figure 1 shows the layout of the system. The main purpose of the magnetic channel is to separate 135-MeV reaction protons from the 290-MeV deuteron Cooler beam using the 6° magnet and to focus the protons onto a large segmented 7-cm diameter Ge detector[2]. The horizontal and vertical acceptances of the system are 4° and 2.4°, respectively.

The magnetic system consisting of two dipoles and three large-acceptance quadrupoles was made of in-house surplus equipment. The dipoles previously served as the Cooler 3° magnets. The pole pieces were modified according to POISSON[3] calculations to provide the large and wide gap needed for this experiment. The first quadrupole was built to be the K300 entrance quadrupole. It is followed by two surplus 8-inch gap quadrupoles, one of which had to be modified to compensate for an internal coil short. All magnetic elements were carefully mapped before and after modification. The map of one of the 8-inch quadrupoles is shown in another contribution to this report.

The ME10 HP-CAD system was used to design the layout of the magnet system and the ion optics. The main task was to accommodate all elements and to avoid mechanical and magnetic interferences with the Cooler Ring beam. Figure 1 shows the shielding channel for the Cooler pipe close to the location of the first two channel dipoles. Subsequent TRANSPORT[4] calculations were used to find an ion-optical solution compatible within the limitations of the existing magnetic elements.

The facility is equipped with two detector systems consisting of a plastic detector and an x-y-u sensitive wire chamber. One system is installed at the entrance of dipole 1 and another just in front of the Ge detector. Single-wire readout ensures that two protons can be detected simultaneously. Since a resolution of 300 keV is sufficient for early tests, it was decided to install a helium bag in the system initially instead of constructing a more involved and costly vacuum system.

The complete system is installed on a rigid mounting frame which is equipped with air pads for easy rotation. It can be moved over a range from 1° to 13°, allowing the acceptance to cover angles from $-1°$ to 15° when the $\pm 2°$ acceptance is considered. The air pads also allow easy movement of the system away from the T-section if other experimental modes are needed in this section, such as the CE-03 detector frame or the CE-06 recoil detector chamber. The CE-36 magnetic channel is also equipped with rollers and a hand crank in order to approach the Cooler beam pipe safely. In the 1° position the Cooler shielding pipe fits so closely between the pole pieces of dipole 1 that lifting by air pads is not possible without hitting the Cooler pipe.

The magnetic channel is fixed to a central bearing under the center of the T-section

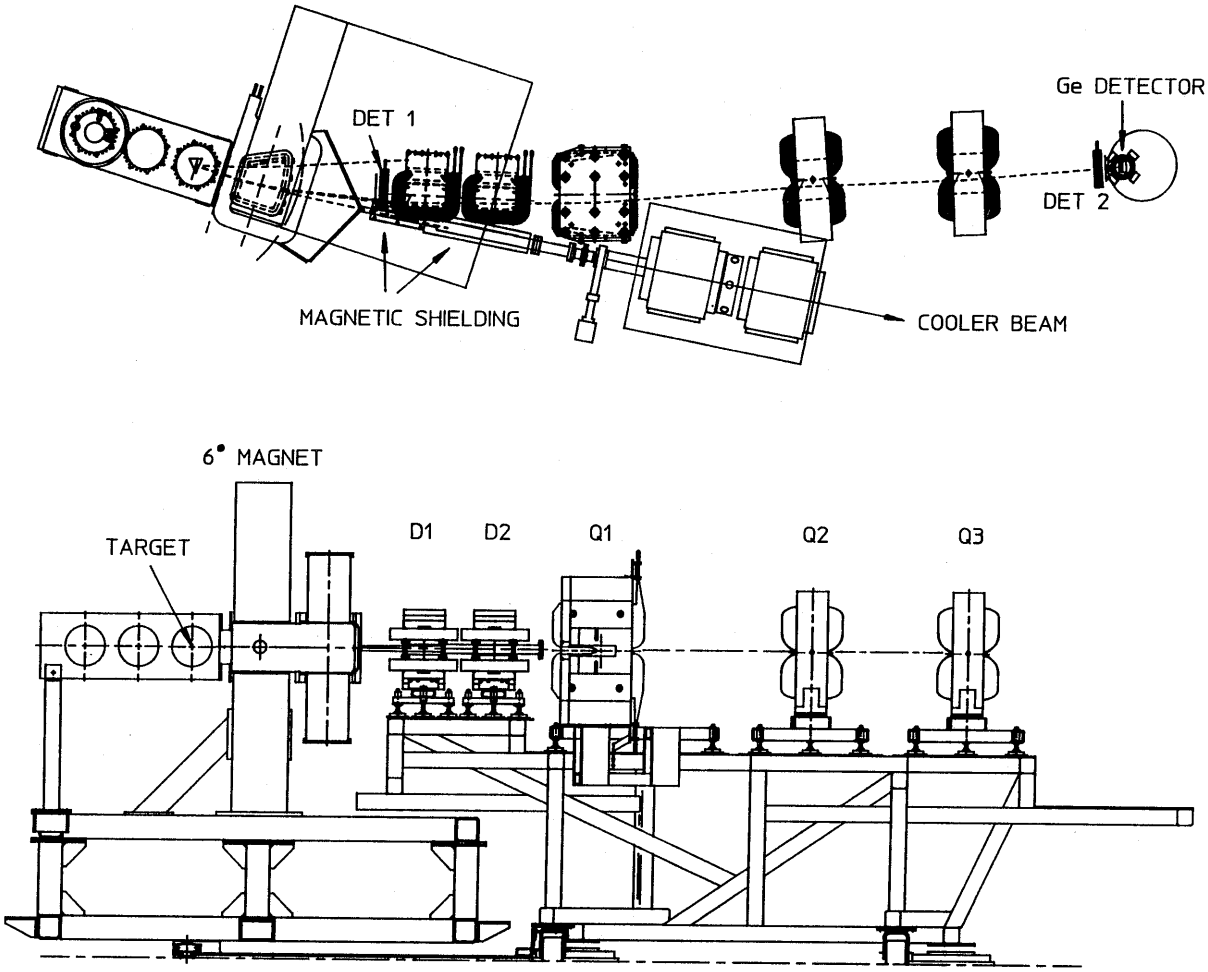

Figure 1. Shown is the layout of the magnetic channel in the Cooler T-section in its closest approach to the Cooler.

chamber port closest to the 6° magnet. The scattering angles depend in detail on the momentum of the reaction products and the exact target location. Therefore scattering angle calibrations are needed for each experimental setup.

After construction and installation, the system was aligned according to the design ion-optics with the help of special alignment fixtures. A first commissioning run using 90-MeV deuterons showed that the Cooler beam continued circulating with the CE-36 channel magnet switched on. The beam was first tuned with all CE-36 channel magnets off. Also tested was the electronics and the detector system which are running fine. First checks of the ion-optics were conducted, despite the fact that the magnetic rigidity of 90 MeV is about 20% larger than the 135-MeV protons for which the system is designed.

A 135-MeV proton beam run is scheduled and will allow commissioning of the system under more realistic experimental conditions.

While the CE-36 channel is well suited to study special cases of physics interest, such as the charge-exchange reaction mentioned above and the search for pionium as proposed in experiment CE-49 (Ref. 5). A system such as the proposed Cooler Chicane Spectrometer is needed, in particular if higher resolution and larger solid angle are required. Any implementation within the present system will require a vacuum chamber in the channel to avoid unacceptable straggling effects for the ^{3}He reaction products associated with pionium production.

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2. R. Pehl, private communication.
3. POISSON/SUPERFISH Group of Codes, LANL, Los Alamos, New Mexico.
4. K.L. Brown, D.C. Cary, Ch. Iselin, and F. Rotacker, TRANSPORT, CERN-80-04 (Geneva, 1980).
5. IUCF Proposal for CE-49, S.E. Vigdor (spokesperson).