EmC 63/B
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PROGRESS REPORT ON THE EXPERIMENT FOR THE MEASUREMENT OF THE MAGNETIC MOMENT OF Σ^+

(EmC 62/5 and 62/10)(Bristol, CERN, Lausanne, Munich and Rome).

The test exposures made in April and August 1962 have shown the conditions in which the experiment could be done. In particular the method proposed by Rome (EmC 62/10) using the direct production of Σ^+'s in the emulsion was shown to be not practicable and the way proposed in EmC 62/5 was kept as the only one which, with some improvements, could be successful. Since then, the effort of the groups involved has been concentrated on the following different points which have to be solved or improved.

1) Beam preparation.
2) Liquid hydrogen target (instead of a CH_2 target used for the tests) which will contain the emulsion stack as well.
3) Coils producing a 200 Kilogauss magnetic field into which the liquid hydrogen target has to be fitted.
4) Emulsion properties and emulsion handling at liquid hydrogen temperature.
5) Scanning.

1) Beam Preparation

Tests made in August showed that the proton content in the unseparated beam was 30% and not 8% as had been expected. The technique of separation by energy loss worked well.

Further tests will be made during the run for the Λ^0 magnetic moment experiment (which has less stringent requirements) to find the optimum position

and thickness for the degrader. A section is to be added to the a_2 beam to ensure a well collimated pencil beam free from background and to enable a precise measurement of the momentum. This section will be tested and used for the Λ° run.

2) Liquid Hydrogen Target

The target presents some typical difficulties due to its small size and the impossibility of using any metal parts because of the high intensity pulsed field surrounding it. A prototype has been constructed and preparations are now in progress for testing with liquid hydrogen after having been tested successfully with liquid nitrogen. When the prototype is made to operate satisfactorily several such targets will be constructed.

An estimation of the time needed before being ready for the experiment can only be made after full and successful tests on the prototype.

3) Coils

Several types of coils, have been tested and compared on the basis of the results they gave on the following points.

(i) field : one needs about 200 kilogauss in a cylindrical volume of 7cm of diameter and 10cm long, with a pulse length of around 2-3 msec. half width.

(ii) Safe working conditions : the coil must be strong and built in such a way that no spark reaches the liquid hydrogen target which goes inside it.

The choice has been made of a multiturn type coil in Al, insulated by Aluminium oxide. Two such coils are already made; six more will be ordered soon and could be ready for operation in October.

4) Emulsion properties

One has to study especially

(i) the mechanical properties of the emulsion layer at liquid hydrogen temperature.

(ii) the sensitivity in these conditions

(iii) the processing of very thick emulsions (1200 μ)

(iv) the stacking, the gridding, etc ...

Each of these points has already been studied separately in several places and is known to be feasible. Our purpose is to establish a well defined routine of these combined operations, tested in detail and adapted to the special use we want to make in this particular experiment.

We estimate 3 or 4 months as the time needed to have a good control of these points.

5) Scanning

This part of the experiment seems to be under control since it has been checked on the test exposure that even in the high background produced by a CH_2 target (~5 times higher than for hydrogen) the $\Sigma^+ \rightarrow$ proton decays can be picked up and identified.

It is foreseen that the scanning will take about one year.

Conclusions :

As far as we know the determining point which will make the experiment feasible or not in Period II is the construction and the success of the liquid hydrogen target itself. In 2 or 3 months we will be able to give a more precise picture of our state of preparation.