SPECIFICATIONS AND GENERAL CHARACTERISTICS OF THE RCBC FOR THE EHS

R. Newport

1. INTRODUCTION

The RCBC is essentially as specified in SPSC/P42/Add. 2/Rev but there have been some detailed changes which are worth noting.

2. GENERAL CHARACTERISTICS (see Figures 1, 2 and 3)

The stainless steel chamber body containing some 280 litres of liquid hydrogen or deuterium is a short horizontal cylinder with a visible diameter of 80 cm. It is closed on one side by a full diameter piston covered with Scotchlite. The piston will be made of a glass-fibre reinforced plastic and will be sealed to the back of the chamber by a single convolution bellows of the same material. Opposite the piston there is a full diameter optical window allowing an efficient retrodirective bright field illumination system to be used.

Both the piston and optical window are enclosed by stainless steel safety tanks to protect against failure of either the bellows or the window. The complete cold assembly is supported as a cantilever from the expansion system side directly on to the iron support structure which provides inertial loading. The vacuum tank which encloses the cold assembly is mounted at the same place and is also supported at the optical side of the iron structure.

The iron structure in addition to providing inertial loading also contributes ~ 10% to the central magnetic field. It will be fixed to the floor at the expansion system side via an anti-vibration mounting in order to provide a reference position with respect to the rest of the spectrometer.
The camera system is mounted on a removable frame which is normally located on the optical side of the iron structure. A lens plate will initially contain three "normal" telecentric lenses but will have locations for two additional high resolution lenses. For normal operation the two "spare" locations will be used for a Polaroid camera and direct viewing of the chamber.

The chamber refrigerator will have helium as the working fluid for safety reasons, although the liquid temperature will be controlled via a liquid hydrogen or deuterium filled heat exchanger. The liquid will undergo ortho-para conversion before entering the chamber.

The expansion system will be driven using a hydraulic actuator to give a cosine shaped pressure-time curve having a period of close to 10 milliseconds. The complete mechanical assembly will be designed for operation at 40 Hz to allow the full thermodynamical potential of the chamber to be realised.

3. SPECIFICATIONS
   3.1 Primary Specifications
      3.1.1 Diameter 80 cm
      3.1.2 Exit angles for the chamber body
         - in the bending plane ± 30°
         - in the dip plane ± 13.5°
      3.1.3 Operating fluids hydrogen and deuterium
   3.2 Dependent Specifications
      3.2.1 Depth 40 cm
      3.2.2 Cycling rate with hydrogen 30 Hz for up to 2 s every 8 s
      3.2.3 Material in the beam exit windows over ± 12°
         < 4% of a collision length
         < 11.5% of a radiation length
      3.2.4 Beam entry window size
         ± 5 cm horizontally
         ± 12 cm vertically
3.2.5 Material in beam entry windows

3.2.6 Precision with respect to the chamber fiducial marks

3.2.7 Optical resolution

3.2.8 Precision of correlation with downstream system

3.2.9 Exit angles for the vacuum tank
    - in the bending plane
    - in the dip plane

3.3 Operational Specifications

3.3.1 Number of cameras

3.3.2 Camera mechanical dead time

3.3.3 Film format

3.3.4 Ambient magnetic field

4. RCBC AND VACUUM ENCLOSURE WINDOWS

Further analyses of the beam entry and exit windows have been carried out and the latest characteristics are summarized in fig. 4. In all cases the thicknesses are determined by the internal pressure requirements.
SCHEMATIC ILLUSTRATION OF RCBC

Fig. 1
HIGH RESOLUTION CAMERAS

DIRECT VIEWING

BEAM

NORMAL ARRANGEMENT

POLAROID CAMERA

1

NORMAL CAMERAS

2

3

POSSIBLE ARRANGEMENT

FOR INCLUDING HIGH RESOLUTION CAMERAS

DIRECT VIEWING

BEAM

NORMAL CAMERAS

POLAROID CAMERA

1

NORMAL CAMERAS

2

3

CAMERA ARRANGEMENTS FOR R.C.B.C.

Fig. 3
Fig. 4 Beam entry and exit window characteristics
General Assembly

Figs 5, 6, and 7 give the present general assembly of the vertex magnet $M_1$. It is unlikely that this assembly will present major modifications in the future.

Field Distribution

Figs 8 and 9 summarize the axial ($Z$) and radial components of the field of the EHS magnet $M_1$ as a function of $X$ (the distance along the beam) and for various values of $Z$. The broken lines correspond to regions which are not traversed by trajectories likely to be of interest. These plots are based on more extensive information supplied by the Saclay group.

People wishing to use these data for calculations can obtain from F. Bruyant (EP Division) copies of a routine which approximates these curves.

The field is being recalculated using the final form for the iron and the latest data for the coils. It is not expected that there will be any significant changes to the values indicated here.