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## MINUTES OF THE RF-MEETING

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(16)

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1. Physical problems of the septum magnet for the East Area

Calculations and measurements have been performed in order to get arguments for the final shape of the septum magnet for the East Area.

In his talk H.H. Umstätter concentrated on the following points :

1. Heat dissipation,
2. bending of the septum,
3. stray field outside the septum.

1.1 Heat dissipation

The septum itself should be as thin as possible, but not too thin, to avoid overheating.

The heat dissipation is a function of the current through the septum, of the resistance of the septum, and of the duty cycle ( $10^{-2}$ ). When the latter is taken into account, the heat dissipation  $N$  for a copper septum equals

$$N = 10^{-2} I^2 R = \frac{(Bn)^2}{\sigma \mu_0} \cdot \frac{h l}{d} \cdot 10^{-2} \quad (1)$$

where  $B$  = magnetic induction  
 $\sigma$  = conductivity of CU  
 $\mu_0$  = permeability  
 $h$  = height  
 $l$  = length  
 $d$  = thickness  
 $n$  = number of turns (4)

Multiplication of N with the thermal resistance gives the temperature distribution. This thermal resistance depends of course on the construction and on the material chosen, and cannot be given yet.

Once this temperature distribution is evaluated, the cooling system has to be designed accordingly.

### 1.2 Bending of the septum

Under the influence of the magnetic field pressure inside the air gap the septum will bend outwards. The pressure in the gap is :

$$p = \frac{1}{2\mu_0} \cdot B^2 h^2 \quad (2)$$

The deflection of the septum is given by formula 3 :

$$\frac{F}{d} = \left(\frac{h}{d}\right)^4 \frac{B^2 n^2}{64\mu_0} \cdot \frac{1}{E} \quad (3)$$

where F = deflection (mm)  
d = thickness (mm)  
h = height (mm)  
E = elasticity module

Formula (3) applies only when the septum is clamped at the edges. If the septum is pivoted at the edges, the value of  $\frac{F}{d}$  must be multiplied by factor 5; this, because the freedom to bend is entirely different in the two cases.

In our case the fixation was not entirely clamped because of the elastic mylar sheets in the septum.

Calculated values are (from 3) :

$$F_{6kG} = 0.1 \text{ mm}$$

$$F_{9kG} = 0.22 \text{ mm}$$

$$F_{12kG} = 0.4 \text{ mm}$$

A measured value is :

$$F_{9kG} = 0.4 \text{ mm}$$

1.3 Stray field

It is essential that the effective width of the septum should be exactly as large as the air gap. The effective width can be trimmed by means of slots in the sides of the septum.

H.H. Umstätter showed some graphs depicting the stray field for various septum widths and two shapes of the air gap.

2. Other business

From now on film badges will only be exchanged once a month.

K. Gase

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