PS/RF Note 91-15
16 July 1991

INFLUENCE OF THE STRAY FIELD OF THE PS MAGNETS ON RF IN THE 114 MHz CAVITIES

MD of 16th July 1991

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1. INTRODUCTION

Experience on conditioning the cavities showed that more run-in time is required, once installed in the PS between the pulsed magnets. The cavity wall nearly touches the magnet coils and their stray field enhances Multipactor (MP) in the cavity or in its elements e.g. RF-window, higher mode damper, piston tuner.

Fortunately leptons are accelerated with a low magnetic cycle (1.7kG) and the stray field is relatively small.

Conditioning may be achieved under these conditions in a few hours, but for the proton cycles (12.6 kG) it seems impossible to reach this state.

Measuring the stray field around the cavities and attempting to condition the cavities under high field should give us information for future LHC cavities.

2. MEASUREMENT OF THE STRAY FIELD

With an Hall probe and an oscilloscope the maximum strayfield at different points around the cavities was measured with respect to the flat top of the proton cycle.

The field vector was mainly vertical with the following values (in Gauss):

- beam pipe, flange	200
- dampers flange	25
- Short flange	15
- RF-window	10
- tuner flange	10
- bus bar	2
- Ion-pump flange	100 (from permanent magnet)

Similar values were obtained for SS4 and SS10

3. RF-BEHAVIOUR OF CAVITY

Both cavities were running satisfactorely in the PS with 15 kW yielding 500 kV at the gap. No problems were encountered with the stray field from the leptons cycle.

For the test a RF pulse of 50 ms wide RF pulse was shifted along the proton magnetic cycle with a repetition of 14 s.

With a field in the magnets above 5kG (or 100 G at the gap flanges) and 500 kV at the gap, the reflection jumped toward 100% and the pressure from 1E-8 to 1E-6 mb.

Cavity SS 10:

At nominal power of 15 kW, MP started with a field in the magnet of 5.2 kG;
rising the power to 42 kW stopped the MP (low reflection, low pressure);
rising the field by 5 % at his power level , MP started again;
decreasing the power 1000 times dit not remove the MP under stray field.

Cavity SS4:

At nominal power of 15 kW, MP started with a field in the magnet of 7.2 kG;
rising the power to 25 kW dit not change the MP,(not tried with more power);
decreasing the power 1000 times dit not remove the MP under field.

4. DISCHARGE SITES

MP was discovered in the past, mainly in the old window and in the dampers. MP in dampers was at low power in run during periods and gave only low increase in reflection and pressure.

The observed full reflection and strong pressure rise may be due to MP at the ceramic of the coaxial window, the gap of the window, or at the walls in the cavity.

To locate the element sensitive to MP, the gap was shorted, maintaining the same full reflection and therefore the same voltage at the RF-window.

In this last case no MP could be observed up to the maximum field.

5. CONCLUSION

It seems that the MP*) enhanced by magnetic field is in the gap region.

The bad behaviour starts at 50% of the maximum field of the magnets. Hence a magnetic shield should reduce the field by at least a factor two.

No improvement in conditioning was observed in intervals of an hour.

Mr. Cornuet AT/MA, claims that a little more distance (cm's) to the magnets (not possible in SS4 or SS10) or small compensation coils may help.

*(the discharges called here "multipactor" could probably better described as a "Penning" discharge)

6. PROPOSAL FOR FURTHER INVESTIGATIONS .

- Conditioning with more time available (days).
- Installation of an optical window (possible at the Ferrite tuner flange).
- Calculating with shielding plates or compensation coils (by Mr Cornuet if possible).
- Installation of shielding or compensation coils.

Distribution

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