ROGUE MODE SHIELDING IN NSLS-II MULTIPOLE VACUUM CHAMBERS

BNL, NSLS-II, Upton, New York, 11973-5000, U.S.A.

A. Blednykh, B. Bacha, A. Borrelli, M. Ferreira, H.-C. Hseuh, B. Kosciuk, S. Krinsky, O. Singh and K. Vetter

NSLS-II MULTIPOLE CHAMBERS

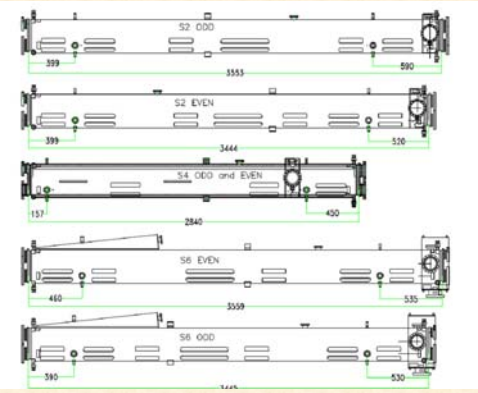

Fig. 1:Types of NSLS-II multipole vacuum chambers.

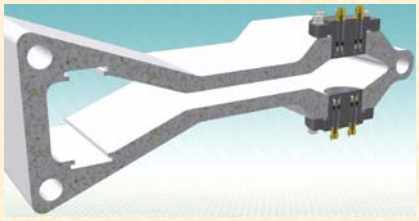

Fig. 2: NSLS-II multipole vacuum chamber profile.

Modes with transverse electric field (TE-modes) in the NSLS-II multipole vacuum chamber can be generated at frequencies above 450MHz due to its geometric dimensions. Since the NSLS-II BPM system monitors signals within 10 MHz band at RF frequency of 500 MHz, frequencies of higher-order modes (HOM) can be generated within the transmission band of the band pass filter. In order to avoid systematic errors in the NSLS-II BPM system, we introduced frequency shift of HOMs by using RF metal shielding located in the antechamber slot.

RF BPM REQUIREMENTS

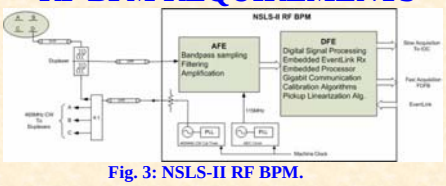

Fig. 3: NSLS-II RF BPM.

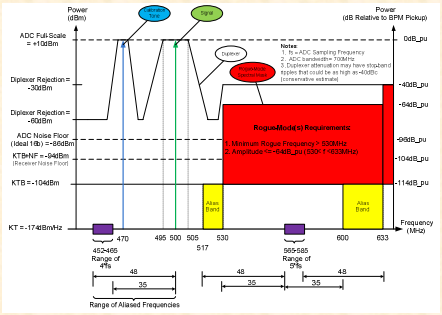

Fig. 4: Rogue-Mode RF BPM Requirements.

BASIC CONCEPT OF ROGUE MODE SHIELDING

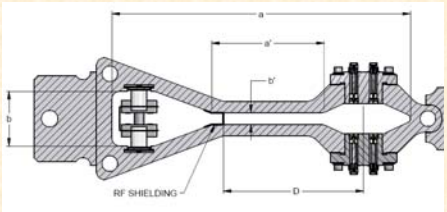

Fig. 5: NSLS-II multipole vacuum chamber profile with RF shileding located at a distance D from the beam pipe center .

Fig. 6: Flexible BeCu RF shielding with 50% of open space inside of the multipole vacuum chamber. The thickness of the RF shielding is 0.25mm.

Fig. 7: Flexible BeCu RF fingers with 50% of open space.

S6 VACUUM CHAMBER

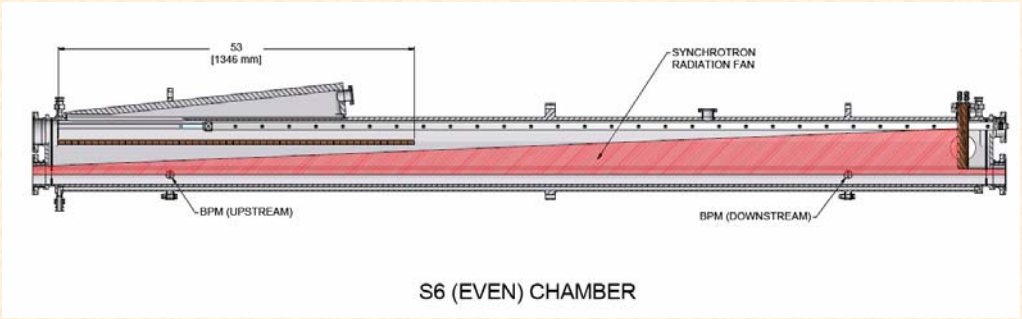

Fig. 8: S6 even multipole vacuum chamber with RF shielding inside. The red shaded region represents the synchrotron radiation fan. Flexible BeCu RF shielding is 1346mm long.

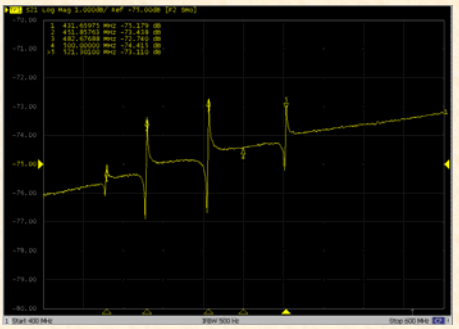

Fig. 9:Measured S21-parameter in the S6 even multipole vacuum chamber with RF shielding inside.

S4 VACUUM CHAMBER

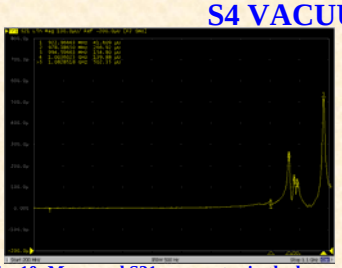

Fig. 10: Measured S21-parameter in the long-length section of the S4 chamber with RF shield.

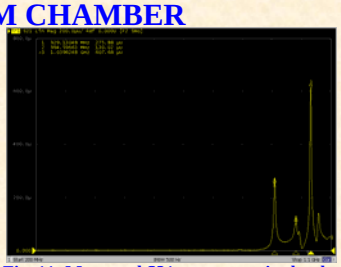

Fig. 11: Measured S21-parameter in the short-length section of the S4 chamber with RF shield

S2 VACUUM CHAMBER

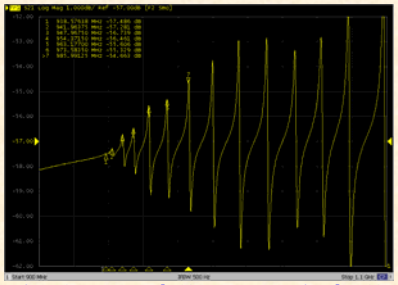

Fig. 12: Measured S21-parameter in the S2 multipole vacuum chamber with RF shielding inside (logarithmic scale).

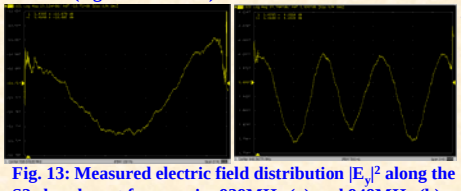

Fig. 13: Measured electric field distribution $|E_y|^2$ along the S2 chamber at frequencies 939MHz (a) and 948MHz (b).

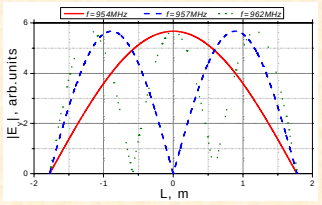

Fig. 14: Numerically simulated electric field distribution inside the S2 chamber with RF shielding for first three values of p (p=1,2 and 3).

Table 1: Frequencies of H_{10p}-modes in 3553m multipole vacuum chamber with the RF shielding inside.

Mode	Measurements f, MHz	GdfidL f, MHz
H_{101}	939	954
H_{102}	942	957
H_{103}	948	962
H_{104}	954	968

CONCLUSION

We demonstrated numerical modeling and experimental studies of the spurious TE modes in the NSLS-II vacuum chambers with antechamber slot. Calculated frequencies of TE-modes in considered chambers with and without RF shielding were verified experimentally. Flexible BeCu RF shielding inside each chamber at proper location shifts frequencies of H_{10p}-modes above ~900MHz, except chambers S6 odd and even. These chambers need special attention because of synchrotron radiation from downstream magnets.

S6 odd multipole vacuum chamber needs to be measured and the RF shielding length has to be optimized.

RF shielding looks adequate for baseline design. Fifty percent of open space provides adequate pumping speed