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SEB Extraction Efficiency as a Function of the Drive Sextupole Strength

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AGS Complex Machine Studies

(AGS Stuies Report No. 309)

SEB Extraction Efficiency as a Function of the Drive Sextupole Strength

Study Period:	01 October 1993, 10:30 am -11:00 am
Participants:	P. Carolan and M. Tanaka
Reported by :	M. Tanaka
Machine:	AGS_SEB @extraction
Beam:	Au^{77+} beam @ p= 28.4 GeV/c/charge
Instruments:	RLM, Drive Sextupoles, SEC010
Aim:	***To demonstrate that the observed low extraction efficiency (~55%) for FY93HIP is due to non-conventional beam losses .***

Introduction:

The slow extraction efficiency depends on the fraction of ions which hit the septum of the first extraction devices (i.e., SMF05) and can be estimated by Eff = 1 - f·w/s, where w is the effective septum thickness, s is the spiral pitch at SMF05 and f is a factor to account for the horizontal beam density variation. Using f = 1.5, w = 1 mm and s = 6 mm we have Eff = ~75 % for the nominal setting. However, during the FY1993 Au^{77+} SEB run, the extraction efficiency remained at the ~55% level despite intensive efforts to tune the SEB parameters[1]. Furthermore we have observed two distinct beam spots on a flag in the ring, indicating that there must be some obstacle in the ring which is thin enough to change part of the Au^{77+} beam to $Au^{78+,79+}$ [2].

Setup and Data Taking:

Measurements of extraction (in)efficiency and normalized beam losses at SMF05 and SMF10 were made as a function of the drive sextupole current (strength). The current was changed from 200 A(where the whole beam was lost) to the maximum allowed value 450 A. Since the spiral pitch is proportional to the strength of the drive sextupoles, we expect the extraction efficiency increases and the beam losses at SMF05 and SMF10 reduce as the sextupole current increases until that the spiral pitch becomes too big for the available aperture.

Results:

Fig.1 shows the (in)extraction efficiency, F05 and F10 losses as a function of the drive sextupole current (I_{SX}). The set point for HIP was 450 A. Fig. 2. shows the inefficiency vs. the efficiency. Fig.3 shows the variation of the late circulating beam intensity (LCBM) during the data taking. The LCBM was used to normalize efficiencies.

- the (in)efficiency gets flat already at I_{SX} = 350 A and stays constant up to I_{SX} (set point) =450 A as well as the normalized F05 and F10 losses.
- the inefficiency is not quite inversely proportional to the efficiency, probably due to a large fluctuation in LCBM as seen in Fig. 3.
- the normalized F05 and F10 losses seem too low to account for the high inefficiency although they are not well calibrated.

Conclusions:

✍ The SEB in(effciency) data as a function of the drive sextupole strength are consistent with the view that the observed large beam losses are due to the unknown thin obstacle in the ring which reduced the available aperture significantly. See Ref. [3] for a likely candidate.

References:

[1] K. Brown, AGS Studies Report 302.
[2] Y.Y. Lee's view.
[3] L. Ahrens' 17.Nov.93 memo to E. Bleser.

Subject: AGS Ext. Ineff. Measurement as a function of DS

Date: 01.Oct.93 10:46

Machine : HIP/SEB Au^{77+}

Exp. : P. Carolan / M. Tanaka

Result: Ineff. ≤ 40-60 %