Update on Slip Stacking Beam Studies

August 22, 2003

1. Introduction

In order to maximize the intensity with current rf system, beam studies are continuing. In this note, beam studies and emittance analysis results at 8GeV are described. The rf cavities were operated with class A and beam loading feed forward system was utilized only for the beam at 8GeV.

2. Beam studies and emittance measurements

The total intensity injected to MI was $6.0*10^{12}$ppp(Fig.1). The rf voltage during slipping was 89kV for each cavity and beam was recaptured by rf voltage of 1.6MV(Fig.2).

Figure 3, a mountain range picture of the signals from the WCM, reveals the progress of slip stacking from the beginning to the end. The signal came from WCM with a resolution of 0.5nsec/sample. The data were obtained every 1.42msec for 0.18sec.

The intensity of the first bunch of first bunch train and the last bunch of second bunch train were estimated by integration of bunch area obtained by the WCM. Figure 4 shows the result of the integration of the bunch. The intensity became twice when two bunches were recaptured by one rf bucket after 0.135 sec.

The length of the first and the last bunches shown in Fig. 3 were used to estimate the emittance. Figure 5 shows the estimated 95% emittance during 0.18sec. There was no emittance blow up during the slip stacking process and this indicates that feed forward beam loading compensation system is working with the intensity of $6.0*10^{12}$ppp. Emittance during slipping were 0.09 and 0.1 eVsec for first and second bunch, respectively. After recapture they became 0.45 and 0.35 eV-sec.

There is a requirement that total beam length has to be less than 1.6μsec. Figure 6 shows a total beam signal at 0.18sec and there was no particle out side of 84 buckets.

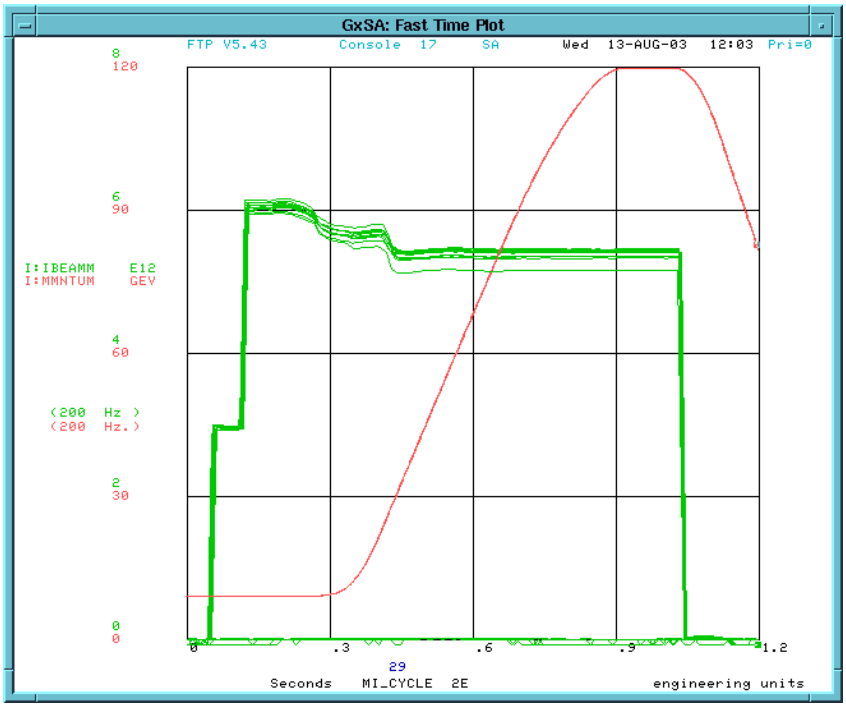

Figure 1. MMNTUM: momentum[GeV], IBEMM: total beam intensity [E12 ppp]

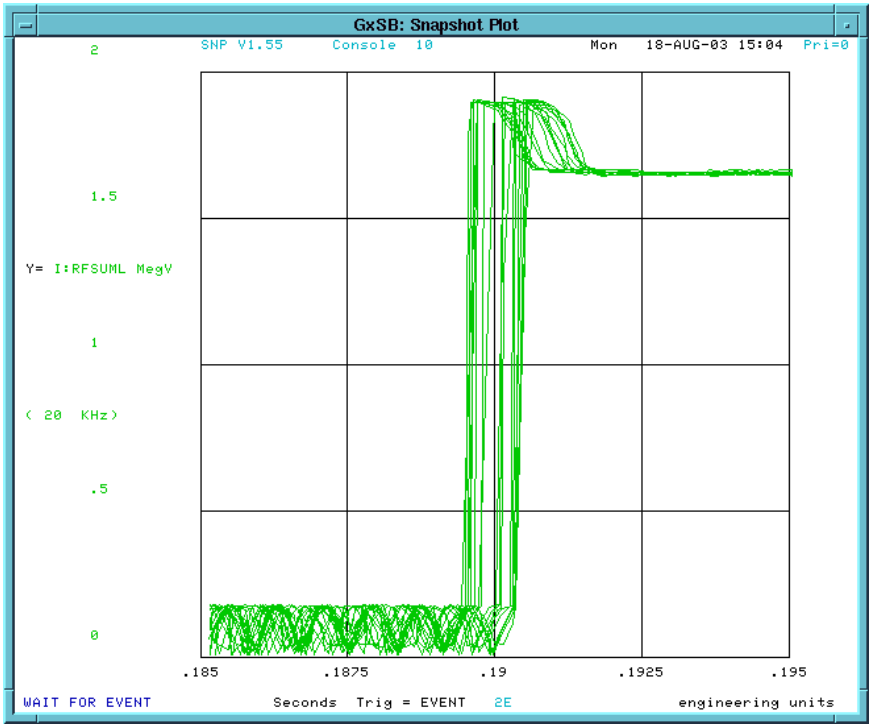

Figure 2. RFSUML: rf voltage[MV] around recapture time.

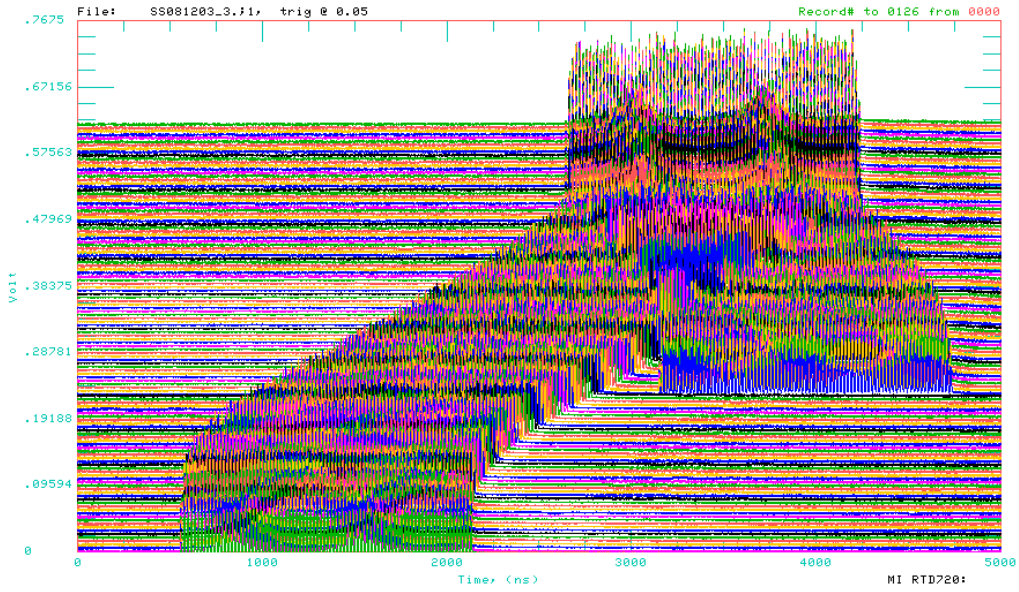

Figure 3. Mt range plot. The signal came from WCM with a resolution of 0.5ns/sample. The data were obtained every 1.42ms for 0.18s.

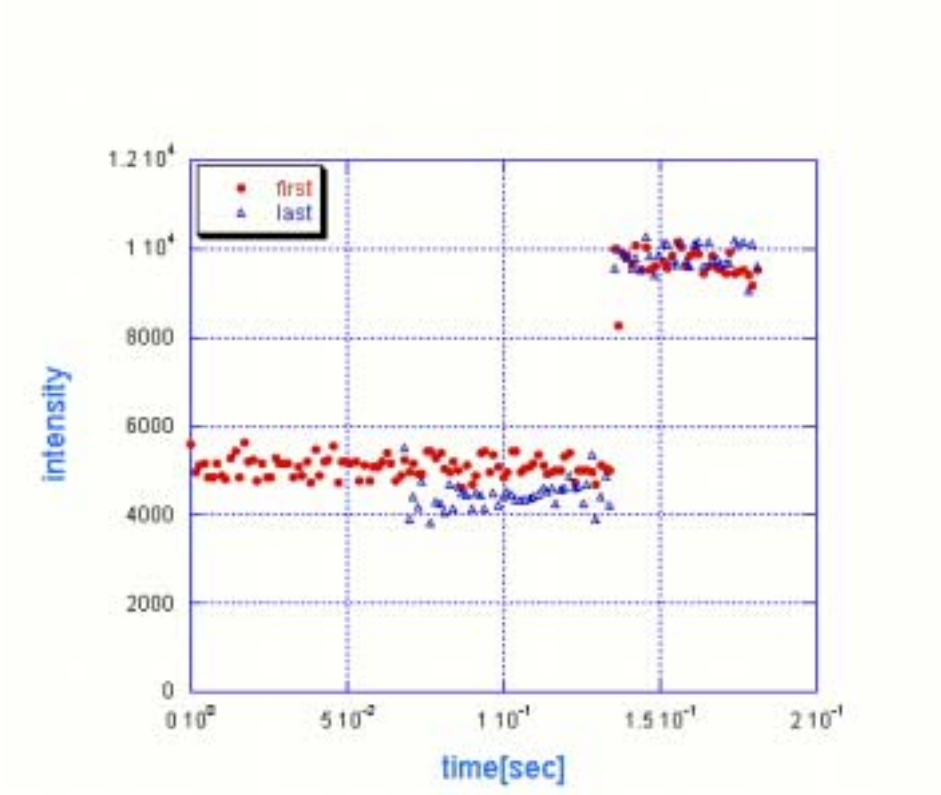

Figure 4. The intensity of the first bunch of first bunch train and last bunch of second bunch train were estimated by integration of bunch area shown in Fig.3.

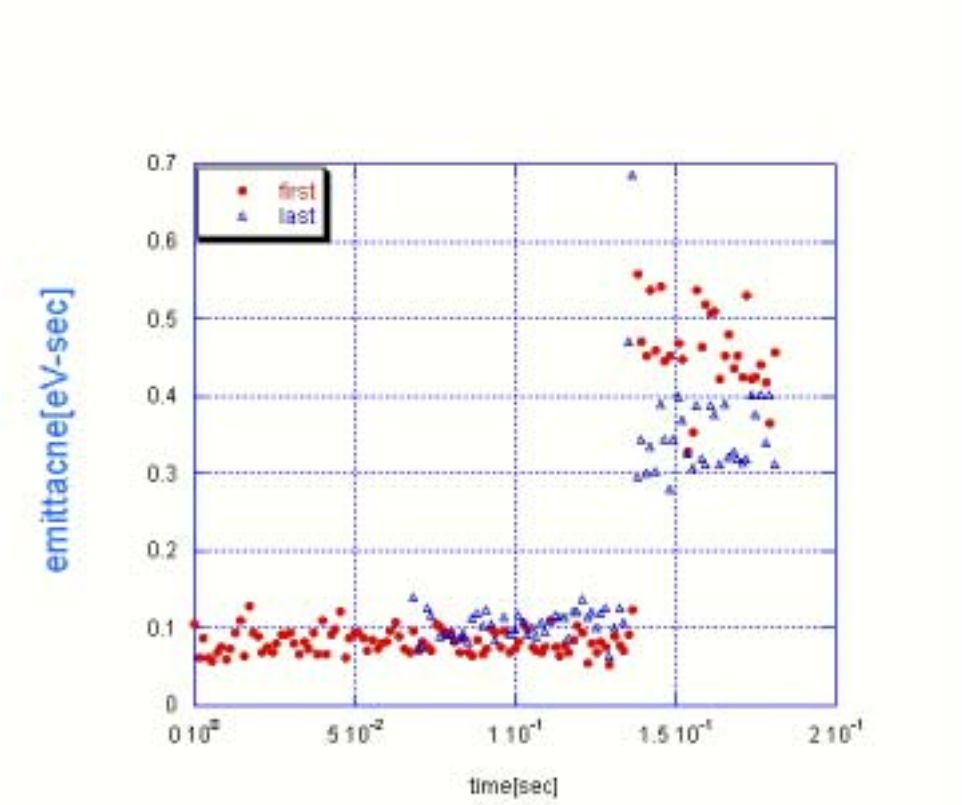

Figure 5. The 95% emittance of the first bunch of first bunch train and last bunch of second bunch train calculated by bunch length shown in Fig.3.

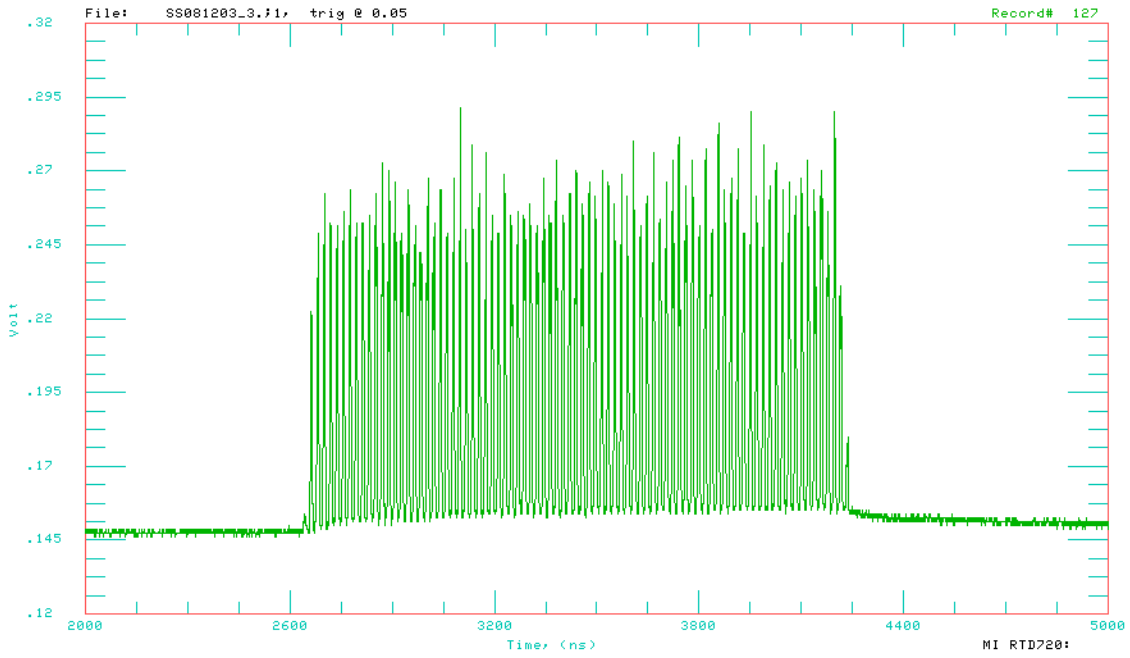

Figure 6. One bunch train shape at 0.18sec.