

# Determination of Tune Spread by digital Base-Band Position Acquisition

-- Preliminary report --

Rahul Singh, Peter Forck, Piotr Kowina, Kevin Lang  
July 6, 2010

Recently the tune measurement system using direct digitized data from the BPMs was used for first accelerator physics investigations. The hardware comprises of the LIBERA 125 MSA/s digitalization, data concentration and the data analysis package TOPOS. The required beam excitation by band-limited noise can be controlled from that software.

The measurements were done for an 11.4 MeV/u  $U^{73+}$  beam at an injection flat-top of 1 s. The beam intensity was varied via defocusing by UH1QQ variation. The plot in Fig.1 shows the vertical tune distribution for  $3 \cdot 10^8$ ,  $1 \cdot 10^9$  and  $2 \cdot 10^9$  stored ions. A shift for the center of the tune distribution as well as a significant broadening is visible and matches roughly with the expectation. While the right shoulders for higher tune values coincide for all measurements, the distribution for the high number of stored ions is asymmetric for lower tune values (left shoulder). This should reflect the particle distribution within the working diagram.

Systematic measurements of this type were performed with a variation of the excitation strength and further steps concerning the number of ions. The horizontal tune had been measured as well. Moreover, the transverse emittance evaluation was recorded for each cycle with the IPM together with the evolution of the stored current. The data analysis is in progress and the results will be reported in more detailed description soon.

The measurement proves the applicability of the system for detailed machine studies.

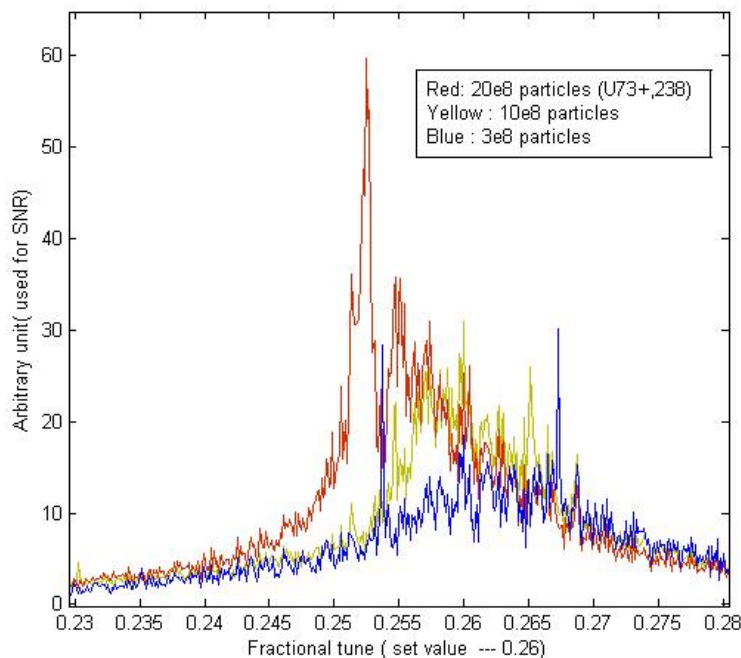


Figure 1: Vertical fraction tune for three different numbers of stored  $U^{73+}$  at injection energy.