Science & Technology Facilities Council

Experiment plan in winter ~~2016-17~~ 2017-18

Shinji Machida
STFC/Rutherford Appleton Laboratory

~~19 October 2016~~ 2 November 2017

Study items

- Optimise RF programme (L).
- Tomography in longitudinal phase space (L).
- Identify beam loss during acceleration (L, T).
- Coupling between horizontal and vertical (T).
- Dynamic aperture in horizontal (T).
- Stacking on outer orbit (L, T).

Optimise RF programme

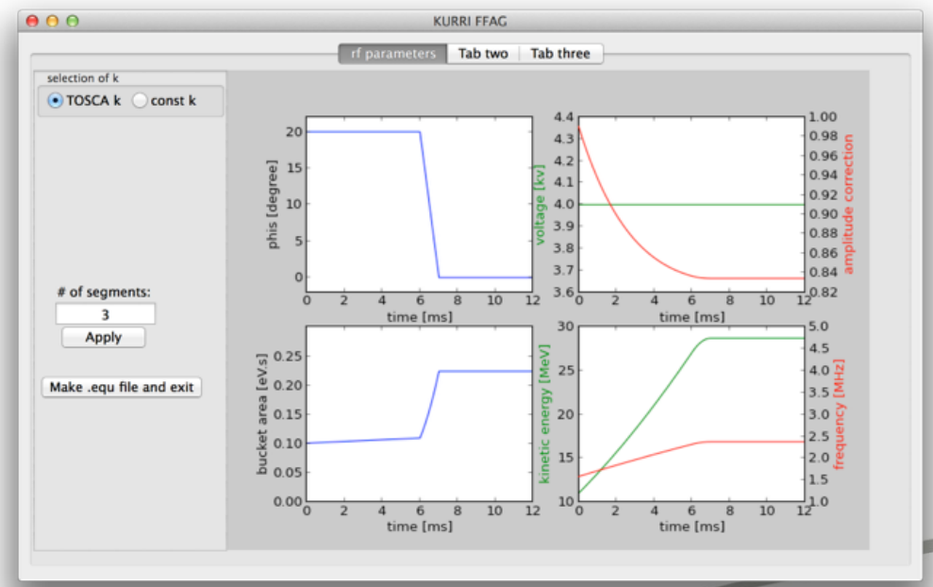
Use RF script to search optimum phis and voltage.

Example 1

Accelerate with phis=20 deg for 6 ms.

Spend 1 ms from phis=20 to 0 deg.

Keep the beam for 5 ms (or more) for measurement.



Science & Technology Facilities Council

3

Science & Technology Facilities Council

Tomography in longitudinal phase space

To understand why the “optimised” setting is better than the others.

Identify beam loss during acceleration (1)

Observed beam loss

Is this because of tune excursion and resonance crossing as a result?

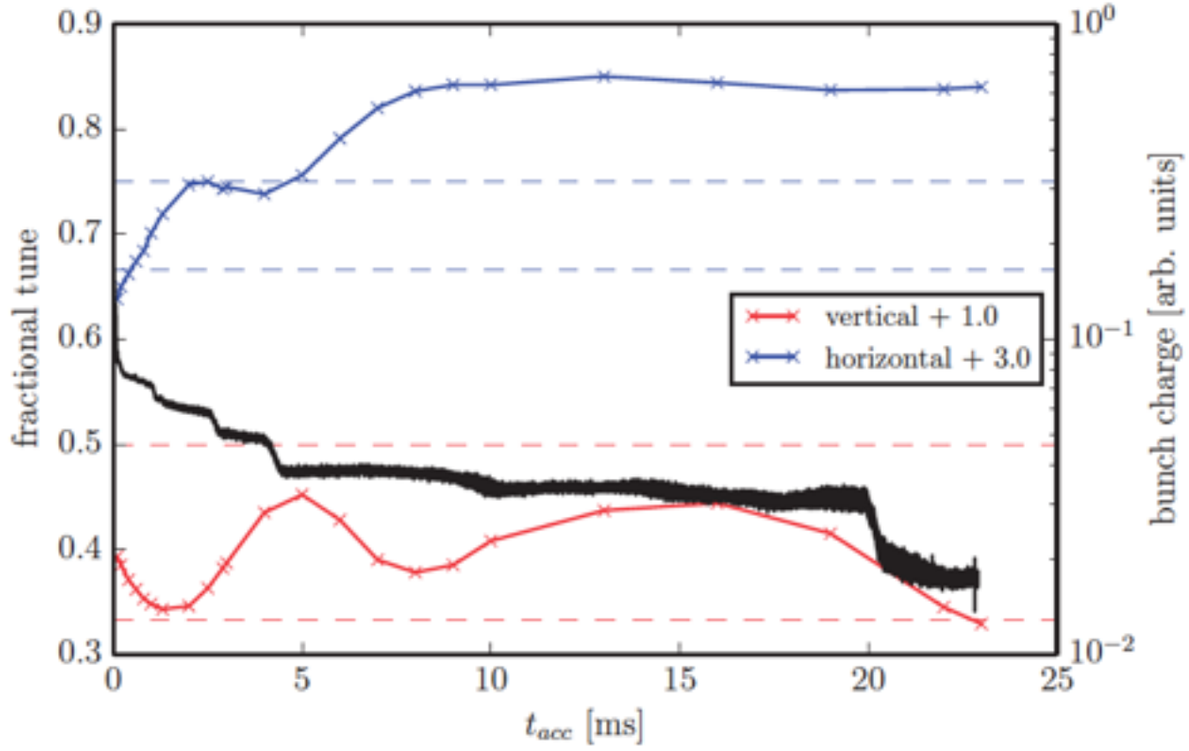


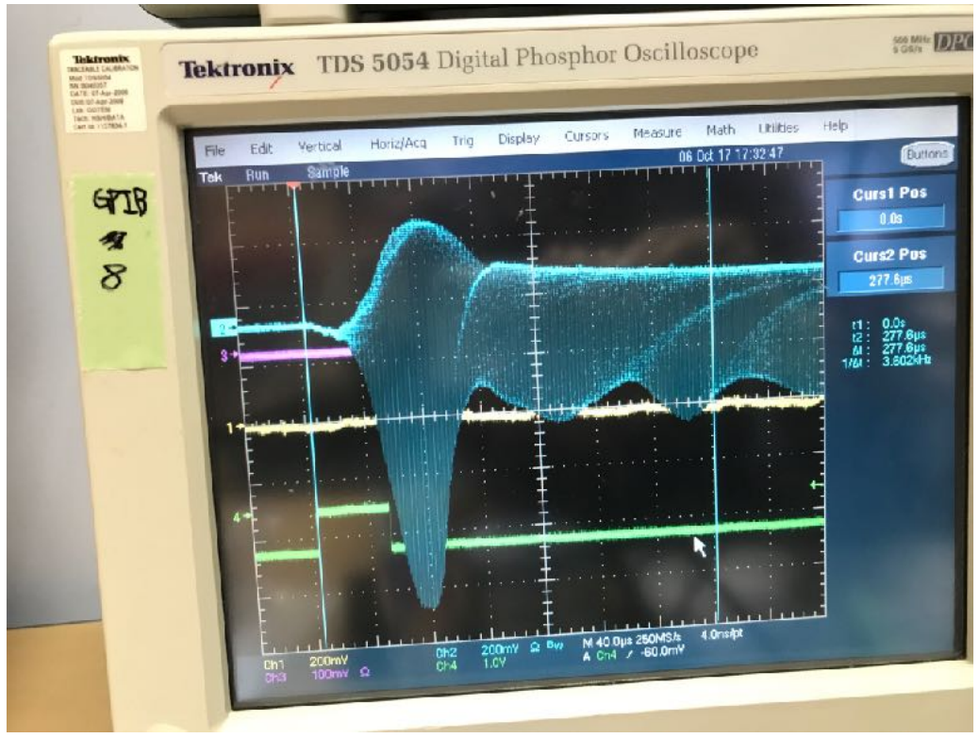
Fig. 22. Measured fractional betatron tunes for the working point $I_F = 814\,A$ and $I_D = 1012\,A$ throughout the acceleration cycle. Horizontal lines indicate nearby structure resonances. Measured beam loss is shown in black points.

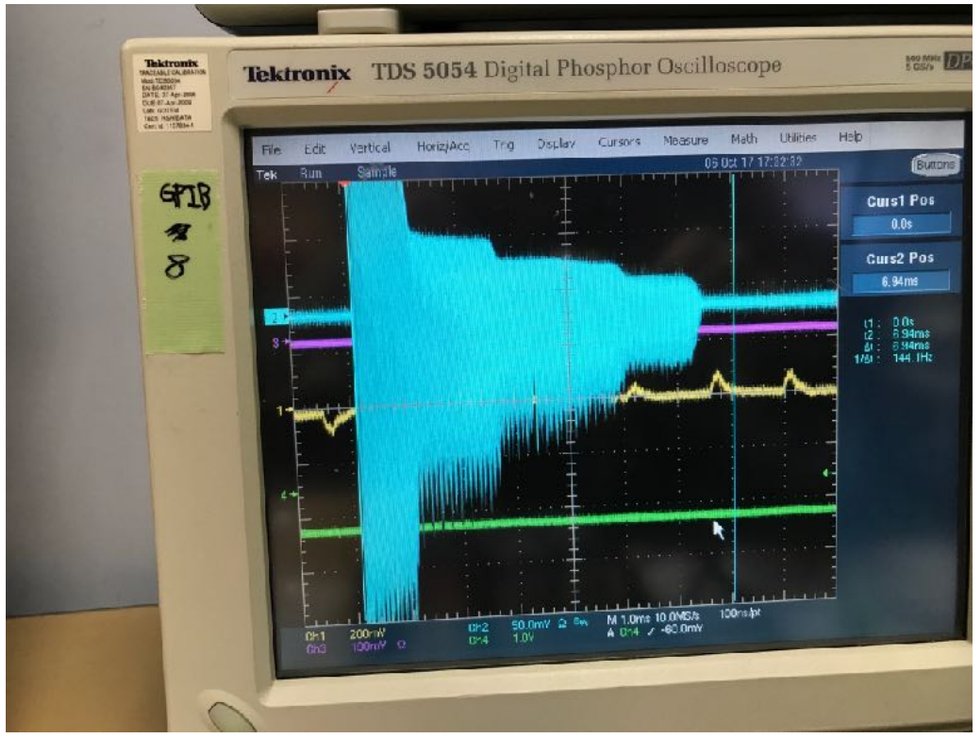
LINAC:

1. All the tanks seem OK. They are in stable operation.
2. Relative phase has been changed by using additional 20 cm cable between the DTL1 signal pickup and the feedback circuit.

Main ring:

1. Succeeded injecting the beam to the main ring.
2. Confirmed that the beam was accelerated up to 24.4 ms which corresponds to the energy of ~110 MeV.
3. We need fine tunings to get the condition of 150 (130) MeV beam extraction. But this is the standard operating procedure.





Identify beam loss during acceleration (2)

Basically tune measurement with more samples

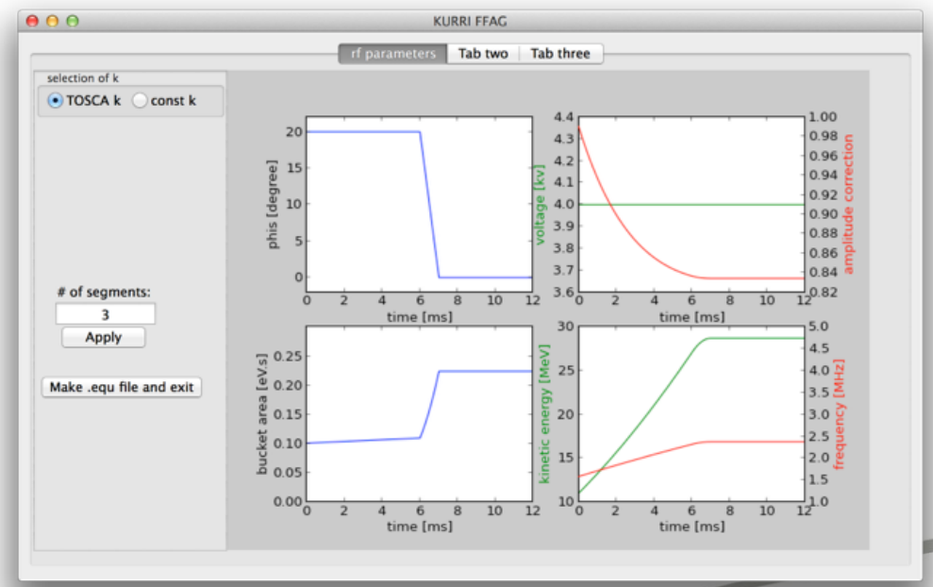
Use RF programme script to make flat top.

Example 1

Accelerate with phis=20 deg for 6 ms.

Spend 1 ms from phis=20 to 0 deg.

Keep the beam for 5 ms (or more) for measurement.



Science & Technology Facilities Council

Science & Technology Facilities Council

Coupling between horizontal and vertical

Measure either quantity or both.

Decrease of horizontal beam size (emittance).

Injection with horizontal mismatch makes large emittance.

Matching in vertical.

From decay signal with horizontal scraper, calculate horizontal beam size.

Increase of vertical beam size (emittance).

Same injection as above.

From beam loss signal with vertical scraper, calculate vertical beam size.

Dynamic aperture in horizontal

Measure the following quantity.

Upper limit of horizontal beam size (emittance).

Injection with horizontal mismatch makes large emittance.

Matching in vertical.

From decay signal with horizontal scraper, calculate horizontal beam size.

Stacking on outer orbit

Ishi-san has already tried.

Tasks before March 2018

	Procedure	Tool	Simulation
Optimise RF programme	◦ Fix one of parameters. ◦ Injection region first.	◦ Python code.	?
Tomography	◦ Bunch monitor signal without acceleration. ◦ Then with acceleration.	◦ **CERN code or our own.**	◦ **Can we use previous data?**
Identify Beam loss	◦ Loss timing is seen. ◦ Tune measurement around those timing.	◦ Python code. ◦ **Tune measurement**	?
Coupling between H andV	◦ **Increase of V emittance.** ◦ **Decrease of H emitttance.**	◦ Scraper in H or V.	◦ **Tracking w/ and w/o space charge.**
Dynamic aperture	◦ **Beam loss measurement with scraper position.**	◦ Scraper in H or V.	◦ **Tracking w/o space charge.**
Stacking	◦ Ishi-san has tried already.		◦ Ishi-san has tried already.

Question and request

- Is the bunch monitor data with fixed RF frequency available? This is for test of tomography software.
- Remind us the tune measurement for H and V at arbitrary momentum.
- Is there scraper for H and/or V? Can we use at arbitrary momentum?
- Any further (numerical) study on beam stacking?