

Mini-workshop on RF collaboration WP2

Wednesday 23 June 2021

09h00 – 09h05: Opening remarks (Patrick Marchand)

09h05 – 09h45: Simulations of Robinson Instability for SLS and SLS 2.0 with ELEGANT, by Lukas Stingelin (PSI)

09h45 – 09h50: Questions/comments

09h50 – 10h05: Transient beam loading with normal conducting harmonic RF system, by Alexander N. Matveenko (BESSY)

10h05 – 10h10: Questions/comments

10h10 – 10h50: mbtrack calculation results of bunch lengthening operation at SOLEIL-U, by Naoto Yamamoto (KEK)

10h50 – 10h55: Questions/comments

10h55 – 11h00: Pause

11h00 – 11h40: Simulation results for SOLEIL upgrade, by Alexis Gamelin (SOLEIL)

11h40 – 11h45: Questions/comments

11h45-11h55: DC Robinson instability with an active harmonic cavity, in anticipation of future simulation results, by Jorn Jacob (ESRF)

11h55 – 12h00: Questions/comments

12h00 – 12h25: Discussions/Closing remarks (by all participants)

In 2018, the RF Groups of SOLEIL and ESRF, which had common problematics within the frame work of their upgrades, proposed to collaborate on four WP's, as listed below ; then in a second stage, three other labs, KEK, PSI, HZB decided to join some of them.

	OBJECTS	PARTICIPANTS
WP1	Qualification of the ESRF-EBS cavities for their use in the SOLEIL Upgrade	ESRF/SOLEIL
WP2	Beam dynamic studies in presence of harmonic RF systems (tracking code computations and experiments on existing machines)	SOLEIL/ESRF/KEK PSI/HZB
WP3	Design and implementation of a harmonic RF system with TBL compensation	ESRF/SOLEIL/KEK
WP4	Design of a μ TCA based DLLRF system, easily adaptable to all the above RF syst. (fundamental, harmonic and TBL compensation)	SOLEIL/ESRF HZB/PSI

Beam dynamics studies in presence of harmonic RF systems

- SOLEIL, ESRF, KEK, PSI, and HZB will conduct together comprehensive research on the longitudinal beam dynamics in presence of a harmonic RF system, that is critical for stable operations of such systems in ultra-low-emittance synchrotron light sources.
- KEK & SOLEIL will continue working on the SOLEIL Mtrack code version and use it for modelling and evaluating all possible options for a harmonic system (NC or SC, active or passive), in terms of stability, compatibility with all operation modes, transient beam loading (TBL) effect and its compensation with a feedforward system into a broadband cavity as proposed by KEK, stabilizing effect of a RF feedback ...
- PSI & HZB will crosscheck all these computed results with P-Elegant and perform tests with their harmonic systems, in the SLS (Super3HC, SC passive) and in BESSY II (NC passive).
- The ESRF will implement the relevant models and crosscheck the computed results with the HEADTAIL code.
- Each lab will contribute in modelling the cases to be studied, submit data for the used codes and actively participate in the evaluation of the results, which will be also cross-checked using semi-analytic methods (such as a Vlasov solver using Haissinski solutions).

Cases to be studied with the different codes :

- SOLEIL-U with SC cavities (passive & active) and with NC cavities (passive & active)
- ESRF-EBS with NC cavities (active & passive) and with SC cavities (active & passive)
- BESSY II with present 1.5 GHz NC cavities and BESSY VSR
- KEK-LS with NC cavities (passive & active)
- SLS with Super3HC
- The conditions of tests in SLS and BESSY, as described below
- Include models for RF feedbacks that may be needed to cope with the Robinson instability and for the system of TBL compensation (feedforward into a broad band cavity)

Main tests to be performed in both SLS and BESSY :

- Look for the AC Robinson instability threshold in decreasing the average current while setting the tuning of the harmonic cavities such to maintain their voltage at nominal value; repeat it for different values of the voltage
- Check the impact of the filling pattern
- Evaluate the impact on the instability threshold of the fundamental voltage & tuning
- For different gaps, evaluate the effect of the TBL on the bunch length & Robinson instability
- Study the effect on the instability of a direct RF feedback

Each partner has appointed a local coordinator :

Ryutaro Nagaoka (SOLEIL) - also WP coordinator

Jorn Jacob (ESRF), Naoto Yamamoto (KEK), Lukas Stingelin (PSI), Aleksandr Matveenko (HZB)