SOLARIS
NATIONAL SYNCHROTRON
RADIATION CENTRE

Insertion devices impact on SOLARIS storage ring optics

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NSRC SOLARIS

Storage ring

The SOLARIS centre operates a compact third generation storage ring with design current of 500 mA and energy of 1.5 GeV.
Along its 96 m circumference there are 12 double bend achromat (DBA) magnet cells, 2 active and 2 passive RF cavities.

10 straight sections can be used by insertion devices.

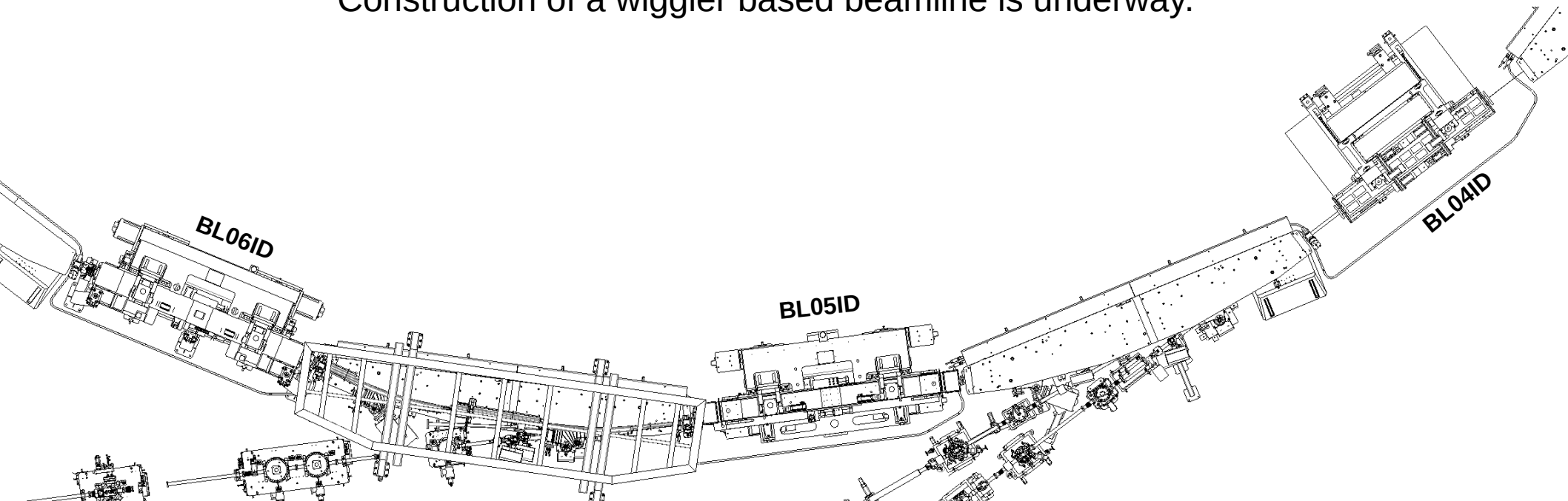
SOLARIS storage ring fragment top view

Insertion devices

Currently, there are three insertion devices installed in SOLARIS storage ring:

Beamline	Type	Period length	Min. gap	Manufacturer
BL04ID	APPLE II EPU	46.6 mm	18 mm	ADC
BL05ID	APPLE II EPU	120 mm	20 mm	KYMA
BL06ID	APPLE II EPU	58 mm	14 mm	KYMA

Construction of a wiggler based beamline is underway.

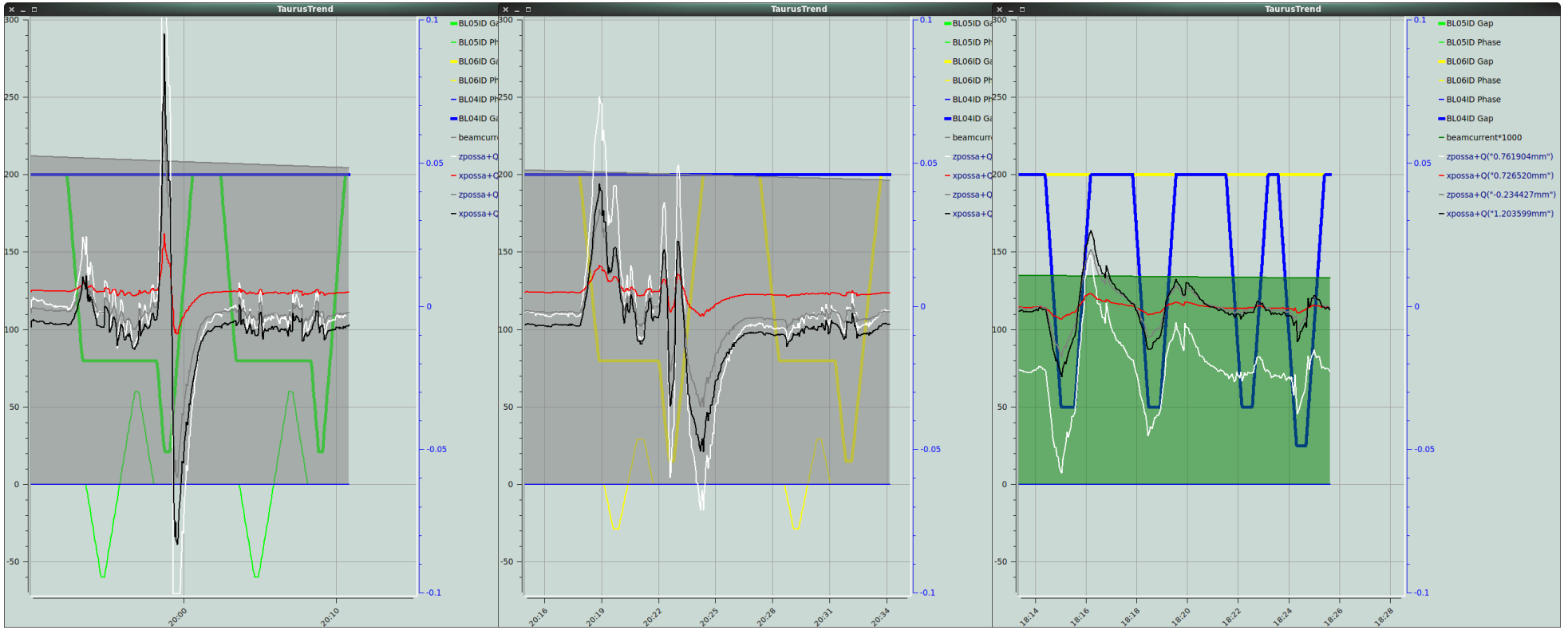


Orbit distortion...

The most visible effect of operating with insertion devices is orbit distortion during the device movement. This effect influences the experiments performed on other beamlines, so a system for correction has been created.

Below you can find the effect of the test movement sequence, performed first with correction off, and then with correction on. In case of both UARPES and PHELIX undulators the disturbance has been reduced from ~150 – 200 μm to ~20 μm.

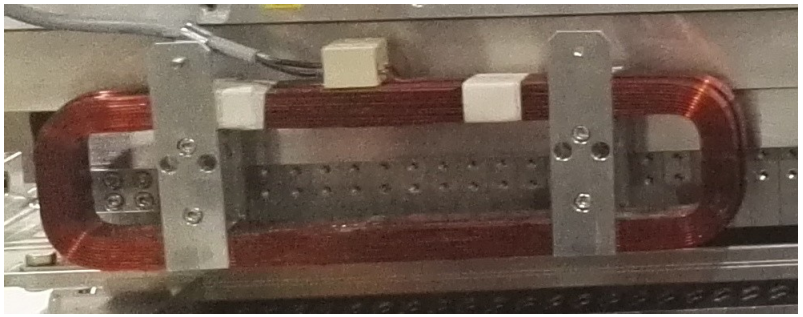
For DEMETER undulator the test table with upgraded power supplies has been measured. It is not ready for operation yet, but orbit stability improvement can be observed up to 50 mm gap.

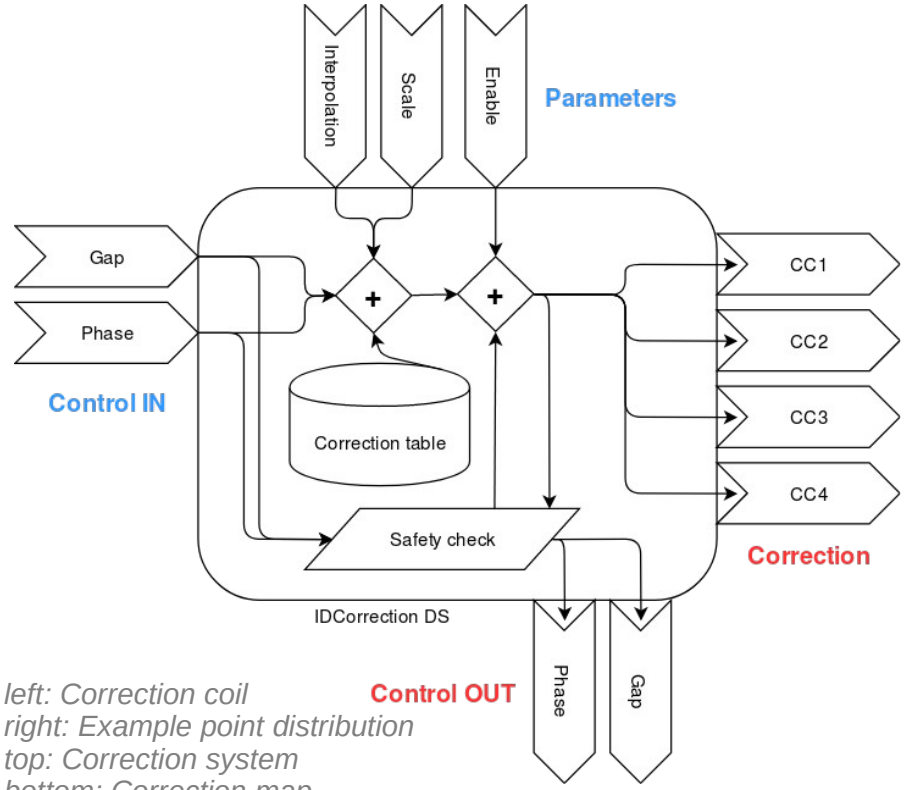


UARPES *PHELIX* *DEMETER*

… and correction

The correction is realized by a set of eight coils, wired as four channels, installed diagonally on both ends of the magnetic structure.

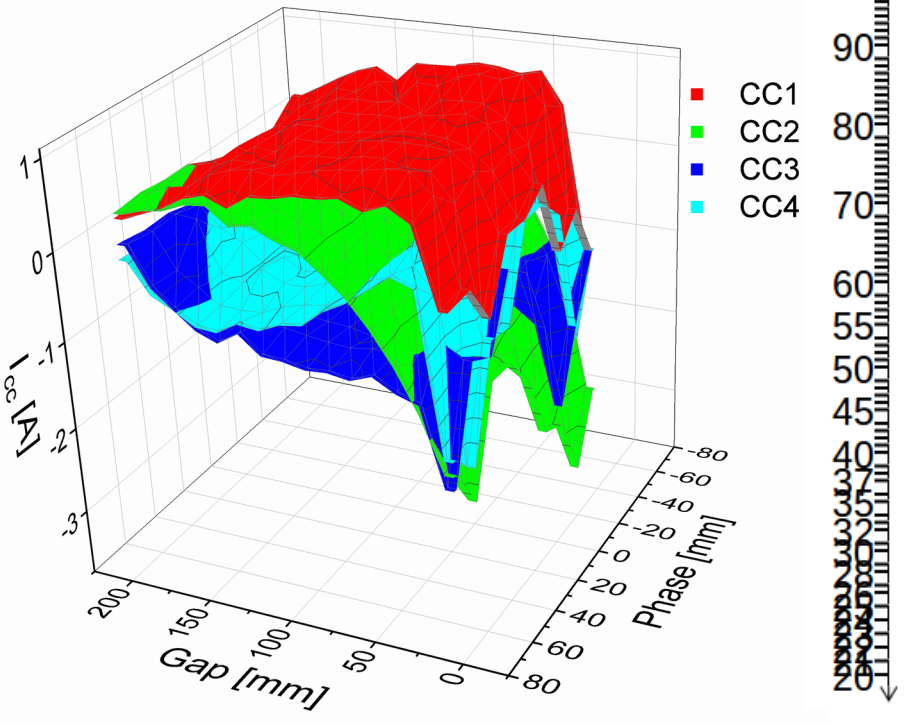




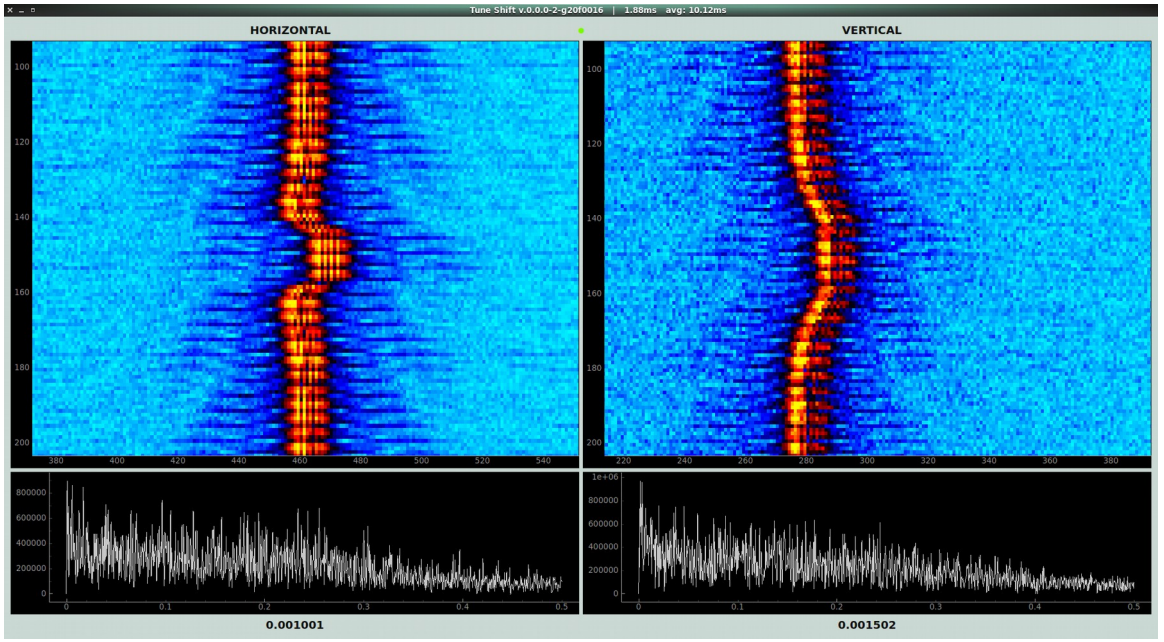
left: Correction coil
right: Example point distribution
top: Correction system
bottom: Correction map

Event-based feed forward system is used to control the currents on the correction coils. Precalculated correction table is interpolated to fit the insertion device position.

The measurement takes on average 20 h and is fully automated.
The application increases the point density along with closing the gap in order to save time while still delivering high accuracy.



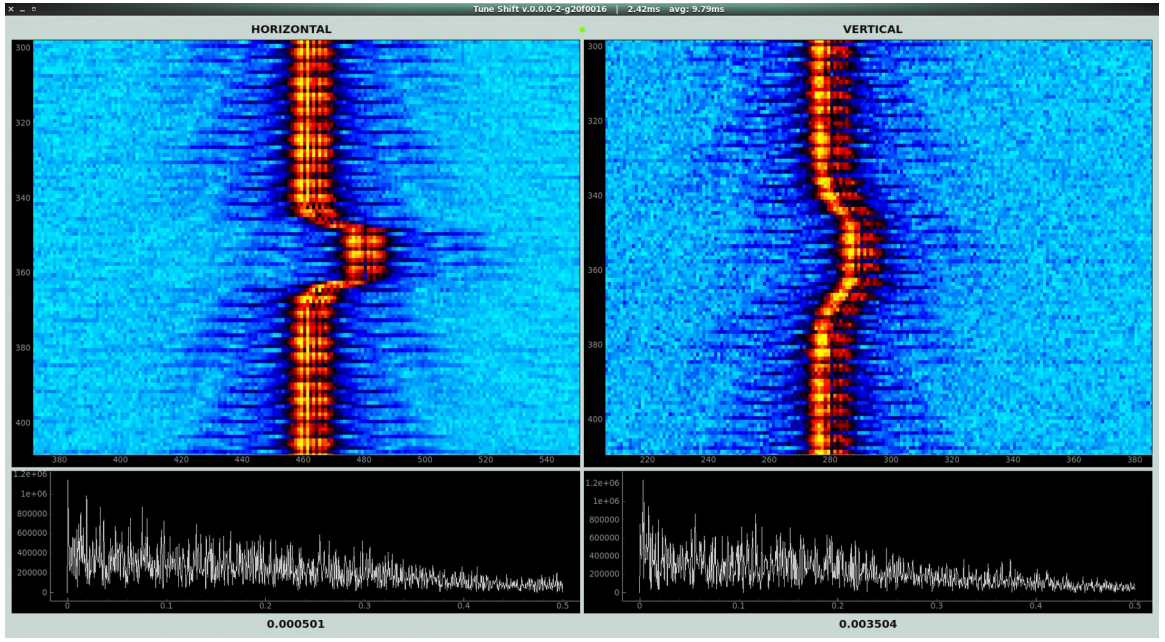
Tune shift



UARPES

Besides position, insertion device movement influences other beam parameters.
Tune shift can be observed for gaps below 30 mm.

The UARPES undulator shifts both the horizontal and vertical tune by 0.0045.



PHELIX

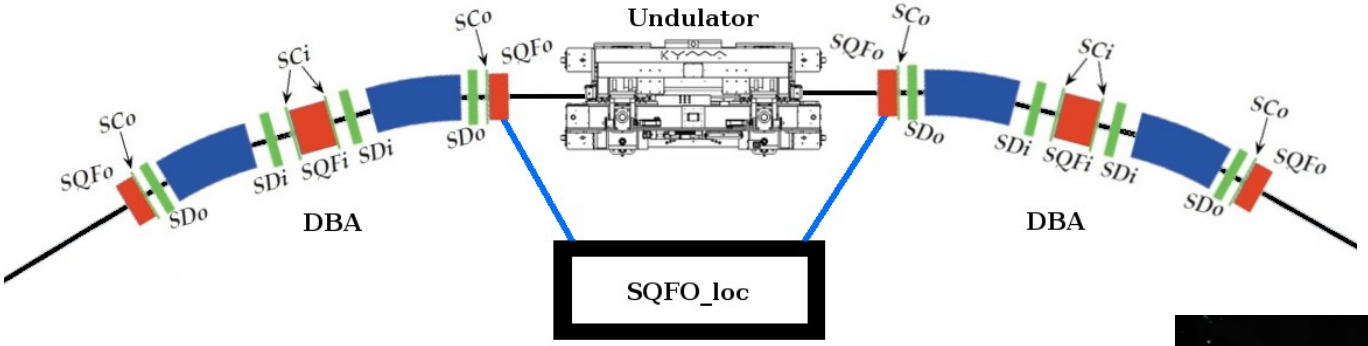
For PHELIX undulator horizontal shift is 0.0075 and vertical is 0.0055.

Tune signal on the images has been captured during undulator closing to its minimum gap, 20 mm for UARPES and 14 mm for PHELIX, and then opening again.

Future plans

Future plans involve improving the insertion device correction performance as well as construction of new devices.

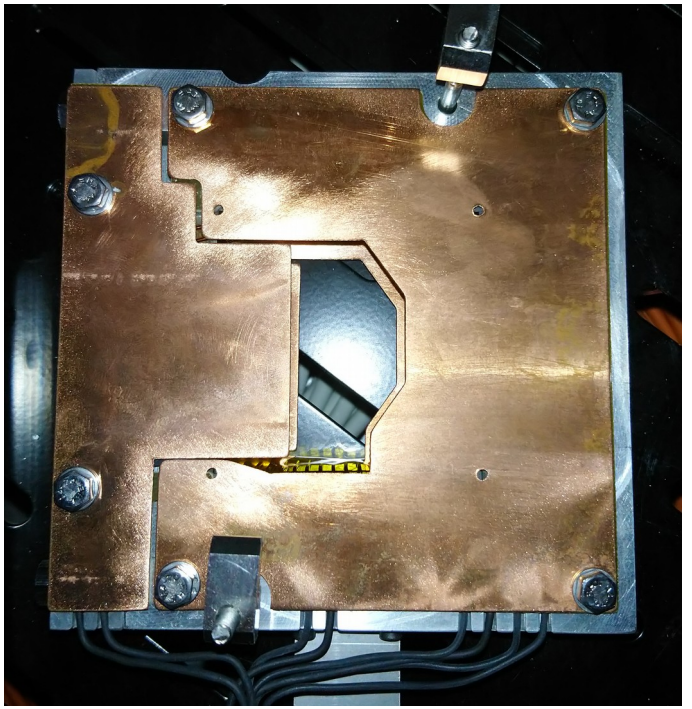
Tune control loop using local SQFO magnets is planned to be run along the correction system.



Local SQFO magnet and power supply connection

Commissioning of the fast orbit feedback system is also in progress. This will allow for correction of distortions coming not only from insertion devices with bandwidth up to 10 kHz.

In 2022 the SOLCRYS hard x-ray beamline that will use superconducting wiggler as a source will be commissioned.



Fast corrector magnet

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Thank you!

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