Status of the Preparation to the Commissioning of the ThomX Storage Ring

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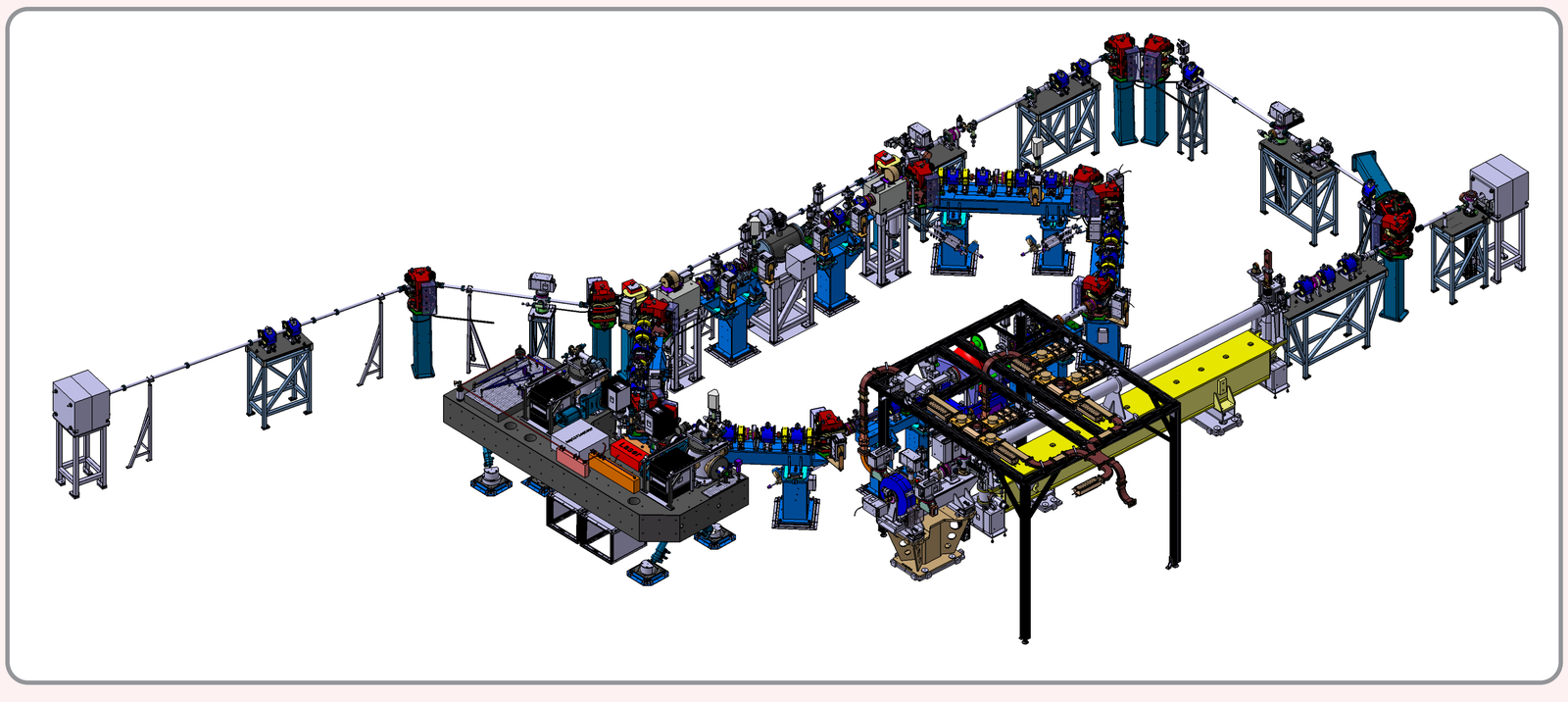
Accelerator Facility Overview

ThomX is a project to build an accelerator based compact X-ray source in Orsay (France). Performance: maximum flux of 10^{13} photons per second with energies up to 90 keV.

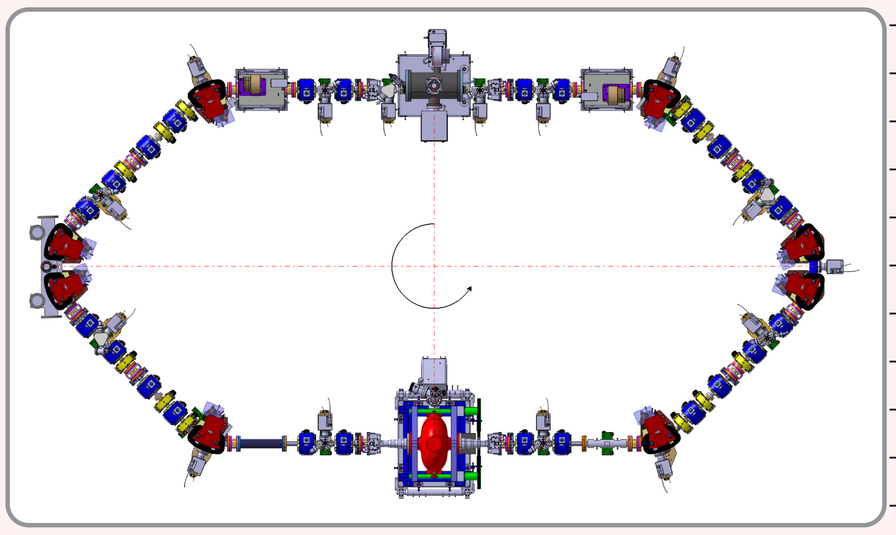


☞ **The final assembly and the hardware testing phase is scheduled for the beginning of 2017.**

- ThomX accelerator complex will be integrated in a new research platform IGLEX (Orsay Campus).
- Refurbishing of the old accelerator building (IGLOO) and experimental hall along with the infrastructure works were launched in the end of 2015 ⇒ ready by the end of 2016.
- To reduce the installation work in the accelerator hall, different components will be preinstalled and prealigned in advance.
- The ThomX control system is based on TANGO.
- A MATLAB interface to the TANGO control system, so-called, Matlab Middle Layer (MML) is used to develop the High Level Applications ⇒ accelerator measurements and physics studies.

ThomX Storage Ring

Stability of the electron beam is of great importance for the Compton based X-ray source.



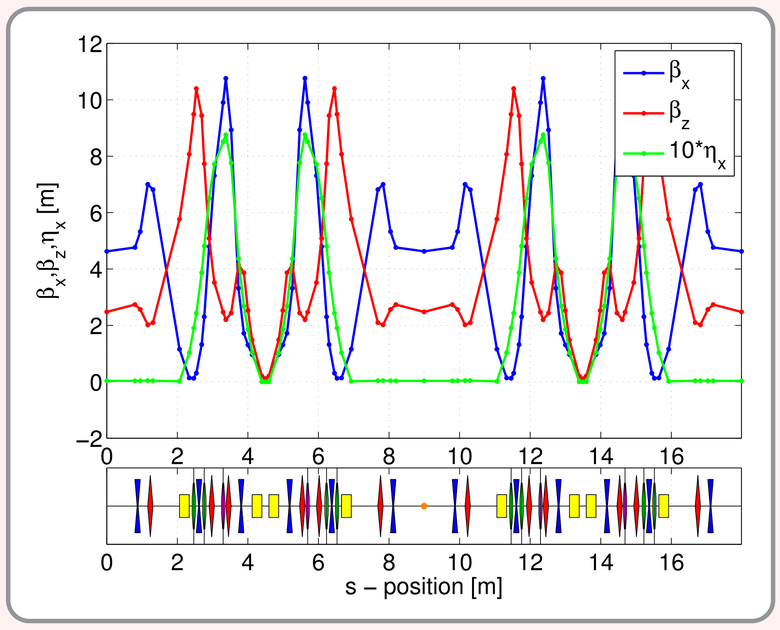
Parameter	Value	Units
Beam energy	50 – 70	MeV
Bunch charge	1	nC
Bunch length (rms)	20 – 30	ps
Circumference	18	m
Revolution Frequency	16.7	MHz
Current	16.7	mA
RF frequency / Harmonics	500 / 30	MHz
Momentum compaction	0.0125 – 0.025	
Betatron tunes	3.17 / 1.64	
Natural chromaticity	- 3.3 / -7	
Damping time, tr. / lg.	1 / 0.5	s
Repetition frequency	50	Hz
Beam size at IP (rms)	70	μ m

☞ *ThomX is a nonlinear dynamics dominated machine:* **mismatched beam injection, absence of the synchrotron damping, strong affect of intrabeam and Compton scattering** and **collective effects including the ion instabilities, ring impedance, etc...**

☞ Operation and commissioning of the ThomX is a big challenge.

Ring optics

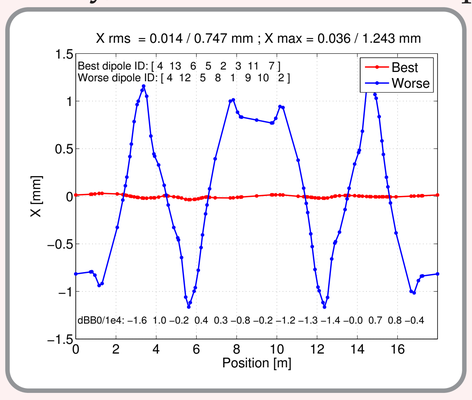
- ThomX SR design is based on a DBA optics with a two-fold symmetry.



- Very dense integration.
- 8 dipoles, 24 quadrupoles, 12 sextupoles and 12 dualplane corrector magnets integrated in the sextupoles.

Subsystem Status and Installation

- Installation and prealignment of the quadrupoles and sextupoles on 8 girders ⇒ transportation to the accelerator building.
- Primary beam diagnostics: 12 button BPMs (turn-by-turn data). Synchrotron radiation monitor and the beam loss monitor.
- Longitudinal and transverse feedbacks: 500 MHz ELETTRA-type cavity, 40 kW solid state amplifier (20μs) + stripline (5μs).



- The magnets of the SR have been fabricated and the measurements of the multipole errors being finished.
- Field components are well within the tolerances imposed.
- Dipole sorting ⇒ minimisation of the closed orbit distortion.

Guideline for Commissioning

- A three months commissioning time is foreseen for the ThomX SR.
- Commissioning will start with lower bunch charge (200 pC or less) and lower injection frequency (a few Hz) ⇒ increase of the beam lifetime and decrease the impact of the collective effects.
- Closed orbit is established ⇒ the first-turns analysis (tune, chromaticity and orbit measurements and correction) using the BPM signal.
- RF system ON ⇒ longer beam storage ⇒ more precise information about the beam orbit ⇒ injection optimisation, the optics measurements, beam extraction.
- Beam tuning with the electron-photon Compton scattering.

☞ **According to the present planning, the first X-ray beam delivered to the users is expected in 2018.**