STATUS OF THE MAX IV LABORATORY CONTROL SYSTEM

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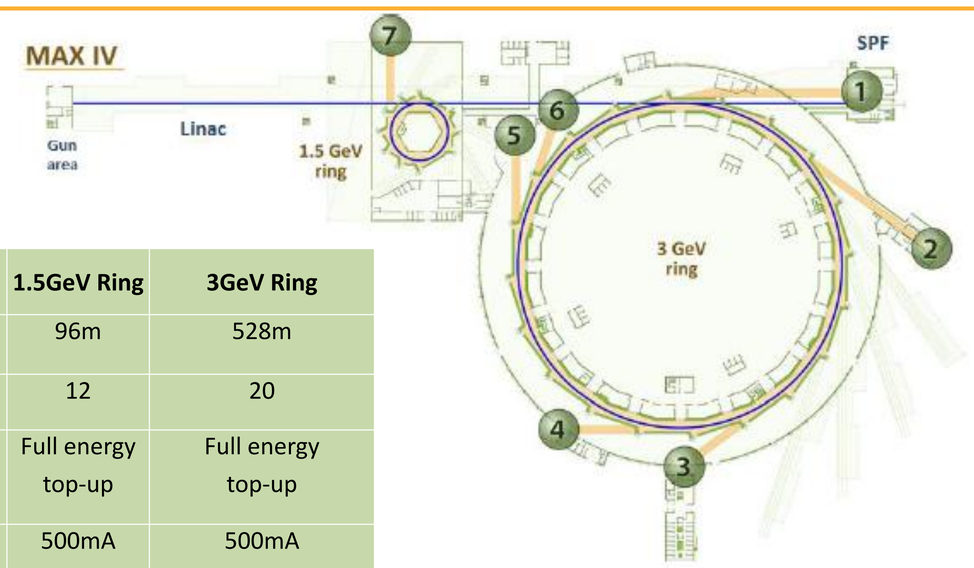
The MAX IV Laboratory project

The MAX IV Laboratory is a new synchrotron light source being built in Lund, south Sweden. The whole accelerator complex consists of:

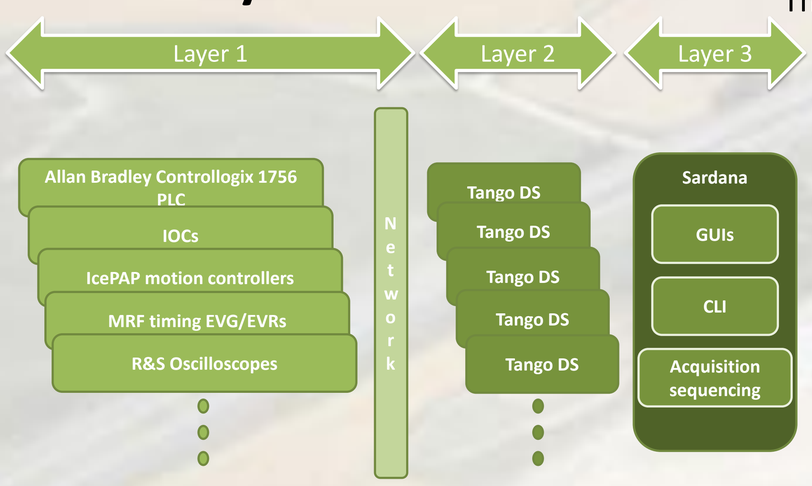
- a 3GeV 250m long full energy Linac
- one 1.5GeV Storage Ring for soft X-ray experiments
- one 3GeV Storage Ring for hard X-ray experiments
- A Short Pulse Facility for pump and probe experiments with 100Hz-shot 100pC bunches around 100fs long
- 7+1 beamlines in the first phase

First X-rays for the users are expected to be delivered in 2015 for the SPF and 2016 for the Storage Rings.



	1.5GeV Ring	3GeV Ring
Circumference	96m	528m
Straight sections	12	20
Injection	Full energy top-up	Full energy top-up
Max stored current	500mA	500mA
Revolution frequency	3.123MHz	0.568MHz
Hor. Emittance	6nm*rad	0.326nm*rad
RF	99.931MHz	99.931MHz

Control system architecture



The control system can be split in three levels

Level 1: This level is composed by all hardware controllers for I/O and real time tasks. At this level, Ethernet is used extensively as field bus

Level 2: TANGO gives network access to the hardware functionality in the previous level providing services for communication, archiving, hardware configuration information persistence and bindings to other languages like MATLAB

Level 3: SARDANA software package running on TANGO provides services like sequencing and client infrastructure for both GUIs and CLIs

PSS and EPS

Both systems are based on Allan Bradley Controllogix 1756 systems. PSS profit from security module and specific software libraries to provide SIL3 capabilities

All internally implemented functionality is accessed from TANGO via the OPC server suite

Diagnostics

Linac and Storage Rings are equipped with Libera Single Pass E and Brilliance + BPM readout electronics. The last ones are all linked via a dedicated ring network at each SR for future FOFB implementation

At the Linac R&S scopes capable to trigger up to 100Hz will be used to read out signals from the RF

Gigabit Ethernet cameras powered via PoE will be used in the whole facility to readout fluorescent screens and other diagnostic elements

Motion control

MAX IV Laboratory has joined the IcePAP collaboration led by the ESRF. The system, allowing Ethernet access and synchronous control of up to 16 chassis with a total of 128 intelligent drivers fits all the requirements in motion control of the facility.

Timing system

The timing, still being defined, will be based on EVG/EVR architecture from MRF. This topic is discussed separately in THPPC103 in these proceedings

IOCs and IT infrastructure

IOC for timing or data acquisition cards will be based on Industrial PCs and cPCI chassis (this last ones mainly when timing functionality is involved) running CentOS Linux

Thanks to the extensive use of Ethernet as field bus, most TANGO device servers controlling hardware devices will be running on a virtualization platform in the central server room simplifying strongly maintenance

VLAN separation will be used to isolate traffic from different families of elements like diagnostic elements or power supplies

Power converters

At MAX IV Laboratory around 1000 power supplies are required to steer the different magnets that control the electron beams in Linac and Storage Rings. The power converters can be divided in 3 different families:

- High power unipolar converters from Danfysik used in the Storage Rings to drive dipoles, sextupoles and octupoles
- Medium power unipolar converters from Delta for the rings and Linac
- Low power bipolar converters from Itest for the correctors of the Linac and the Storage Rings.

All of them are equipped with Ethernet interface and temperature switches for machine protection purposes

Project management

During negotiation with the different hardware providers, especial effort has been put to get TANGO software interfaces directly from the suppliers whenever possible, more on that and on how to manage the project as an Open Source Project can be found in MOPPC086, in these proceedings

The reduced size of the control group makes important the adoption of technologies for configuration management like Ansible (see THPPC013, in these proceedings too)

The scheduling of execution of the different tasks is arranged using Scrum

Conclusions

- Major choices like Ethernet, industrial PCs, Linux, Tango and Sardana have already been made and tested in the existing Maxlab.
- Virtualization will be used wherever it is possible to run Tango DS.
- Implementation for the Linac to be deployed during next months.
- Final implementation for Storage Rings and beamlines is still ongoing and will benefit from the experience with the Linac.

The MAX IV Laboratory

The MAX IV Laboratory opened for operation in 1987 (under the name MAX-lab) and is a national laboratory operated jointly by the Swedish Research Council and Lund University. The laboratory supports three distinct research areas: Accelerator Physics, Research based on the use of Synchrotron Radiation, and Nuclear Physics using high energy electrons.

At present three synchrotron storage rings are in operation MAX I-III and each year close to 1000 researchers visit the laboratory to perform experiments. The MAX IV laboratory is also responsible for the build up of the MAX IV facility situated in the Brunnshög area just outside of Lund and approximately 2 km from the present facility.