

PROCESS AUTOMATION AT SOLEIL: TWO APPLICATIONS USING ROBOT MANIPULATORS

Laura MUNOZ

- Introduction
- SOLEIL Robotic Applications
- Conclusions and Future Work

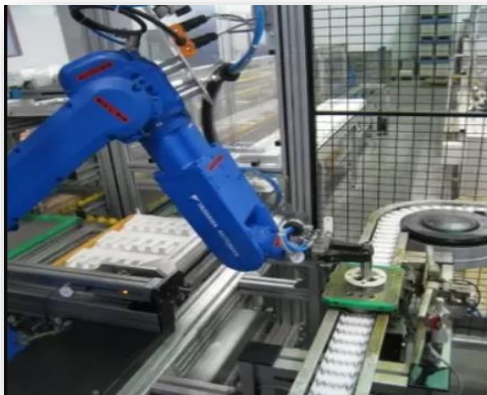
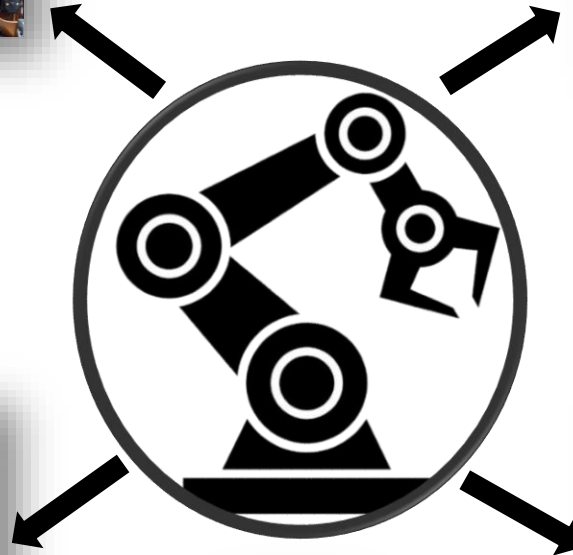
Introduction



Assembly
@KUKA



Welding
@automate org



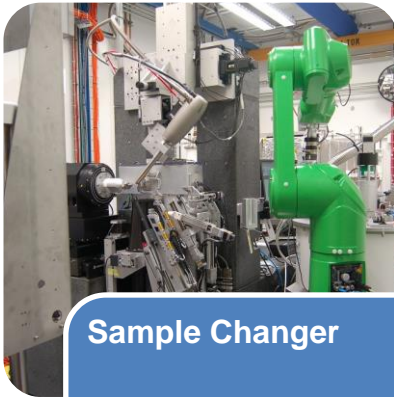
Pick-and-Place
@YASKAWA



Medical and Surgical assistants
@STAUBLI
ICALEPCS 2021, 15/10/2021

Main uses of manipulator robots in a synchrotron:

@NSLS-II



Sample Changer

- Macromolecular Crystallography (MX)
- Biological Small-Angle X-ray Scattering (BioSAXS)
- X-Ray Diffraction

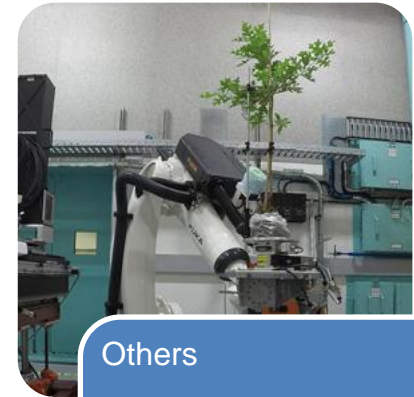
@Dyiamond



Detector Holder

- Bragg CDI and Bragg-ptychography
- Structural dynamics with X-ray techniques
- Coherent diffraction and SAXS experiments

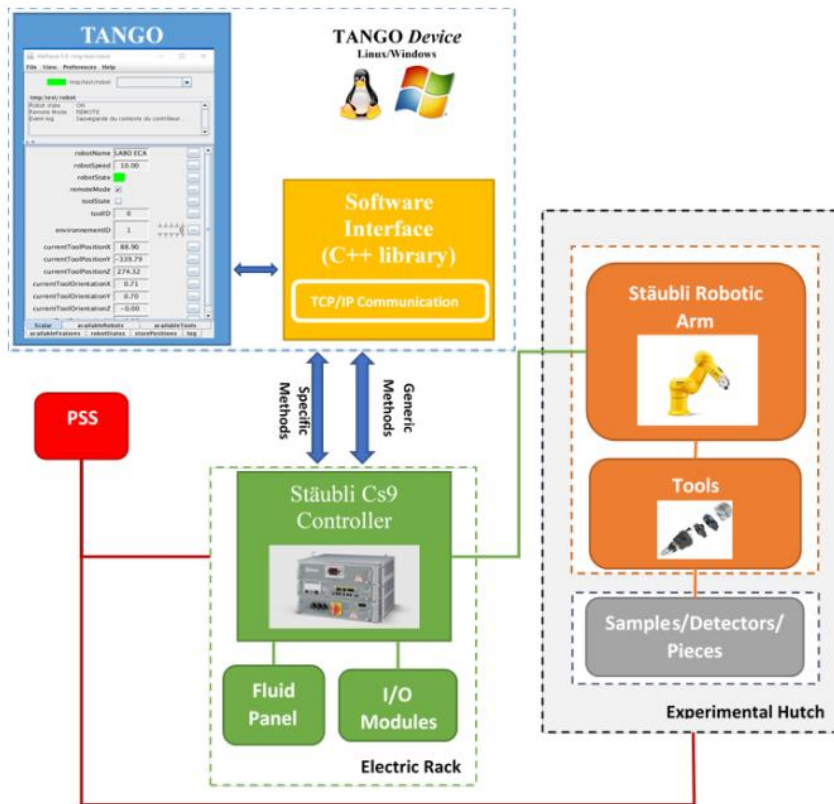
@Australian Synchrotron



Others

- Sample Holder
- High precision manufacturing

This standardization defines a robotic standard on both hardware and software.



- Proficiency in robot integration
- Better operational management
- Support and maintenance
- Possibility of evolving robotic applications

SOLEIL Robotic Applications



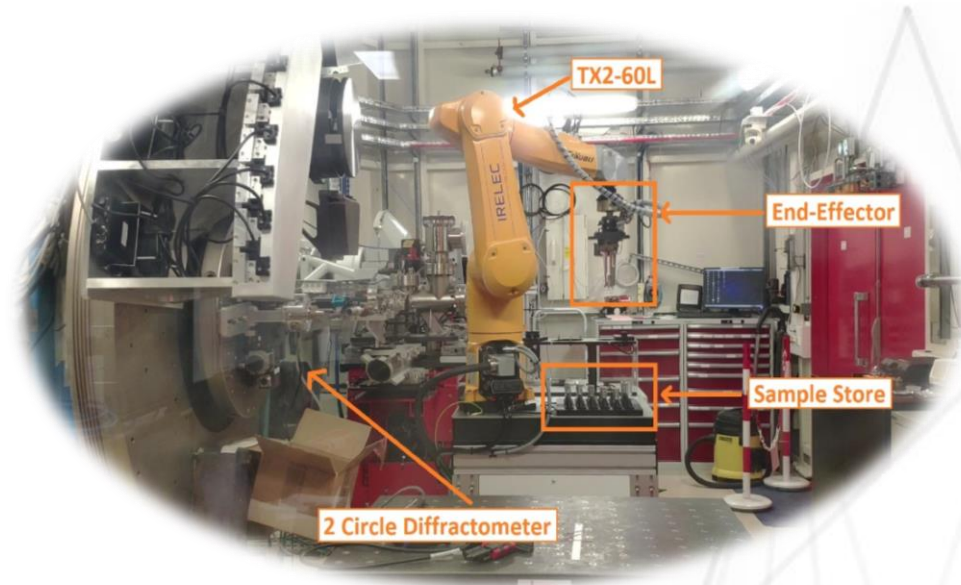


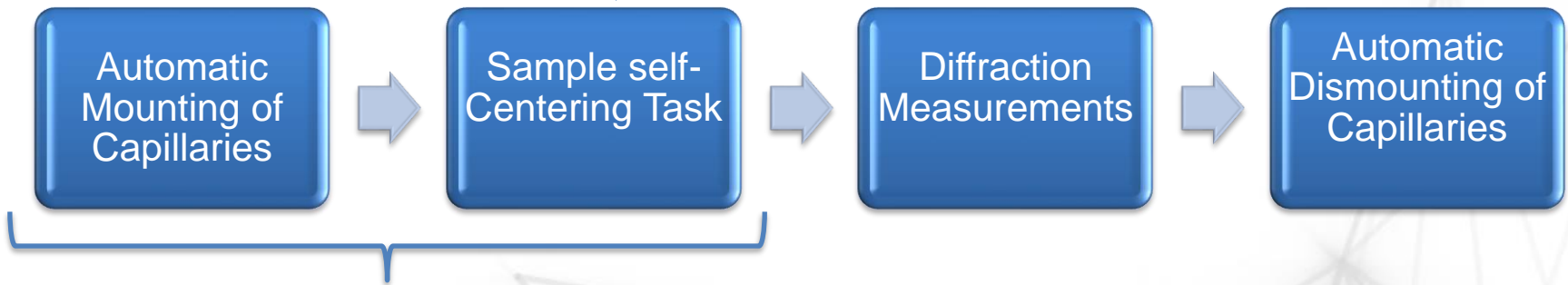
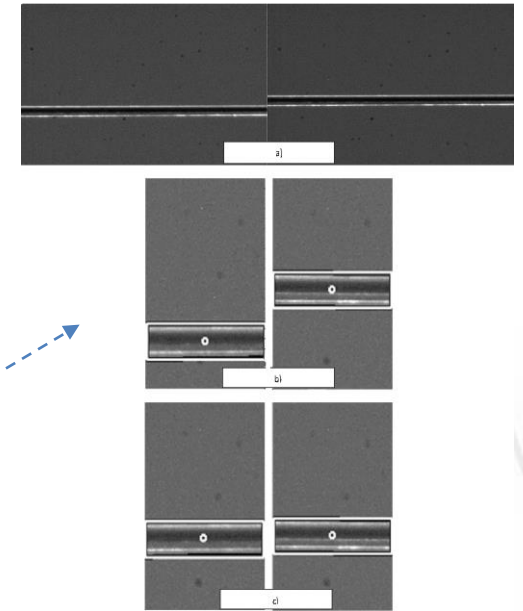
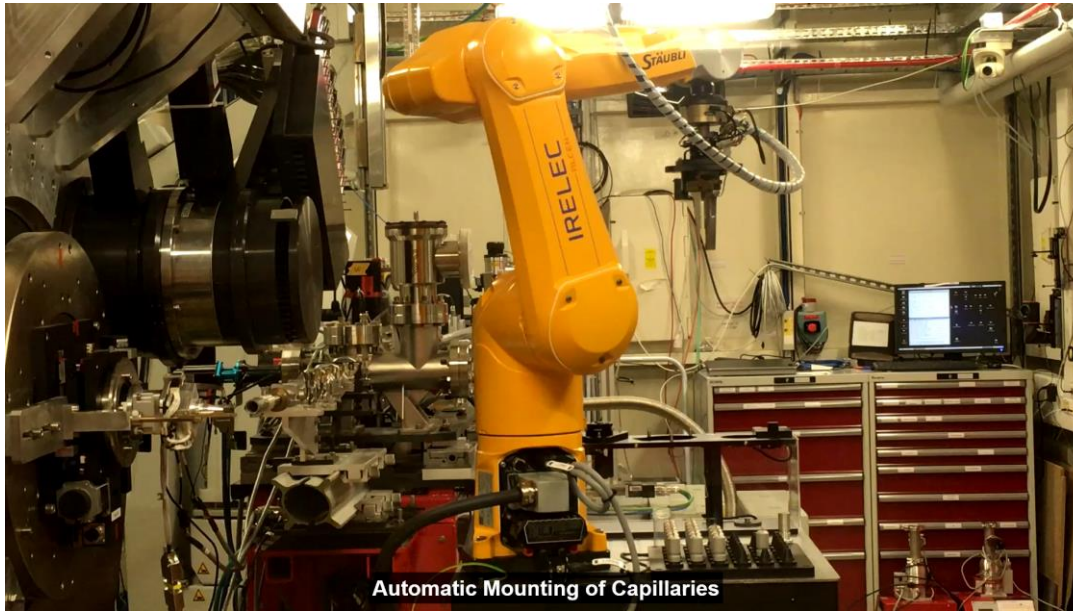
Load capacity	3.7 kg
Reach at wrist	920 mm
Repeatability X-Y (ISO 9283)	± 0.03 mm
Max cartesian speed	10.9 m/s
Robot controller	Cs9 (1.7kVA)

CRISTAL is an Undulator-based X-ray diffraction beamline dedicated to study single crystals and powders.

Experimental Platform for powder diffraction measurements

- 2-Circle Diffractometer →
 - 2 detectors
 - Multi-crystal analyzer detector
 - Curved pixel detector
- TX2-60L Robot
- Mobile Chassis
- Sample Store (36 samples)
- End-Effector:
 - 3-finger centric gripper
 - Collision and overload protection system
 - Laser sensor
 - Pneumatic tool changing system



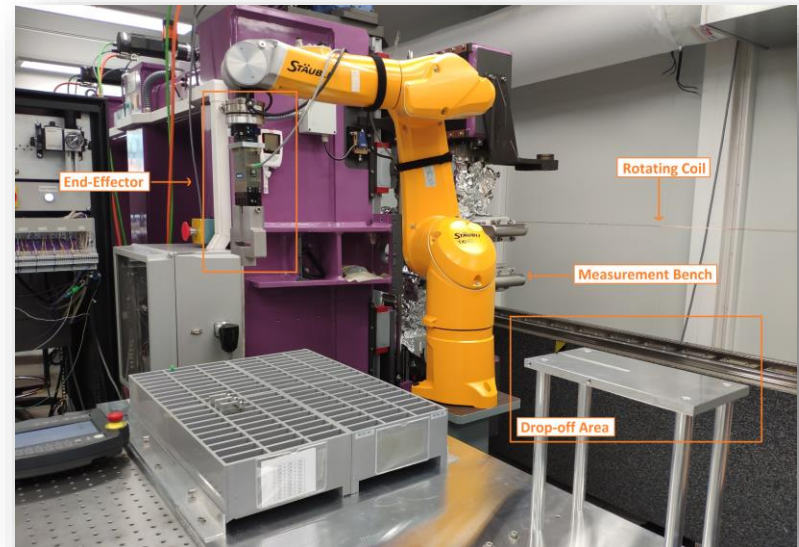


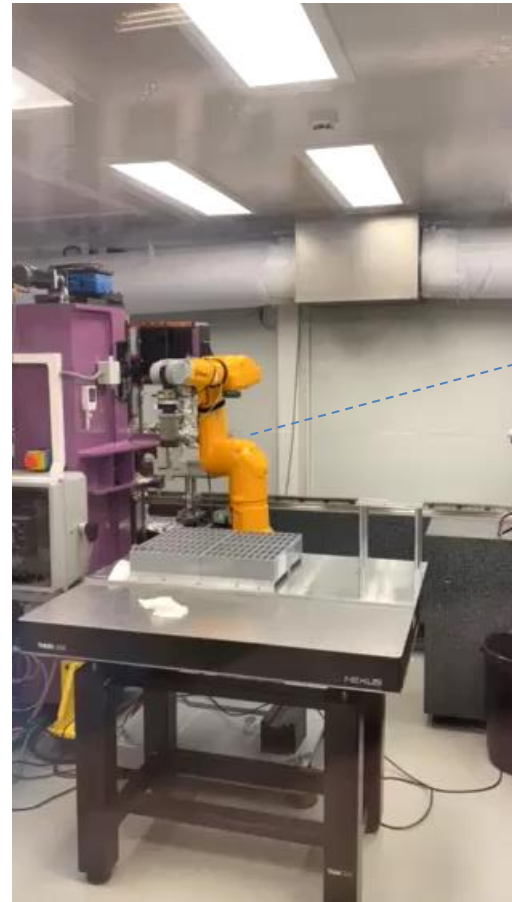
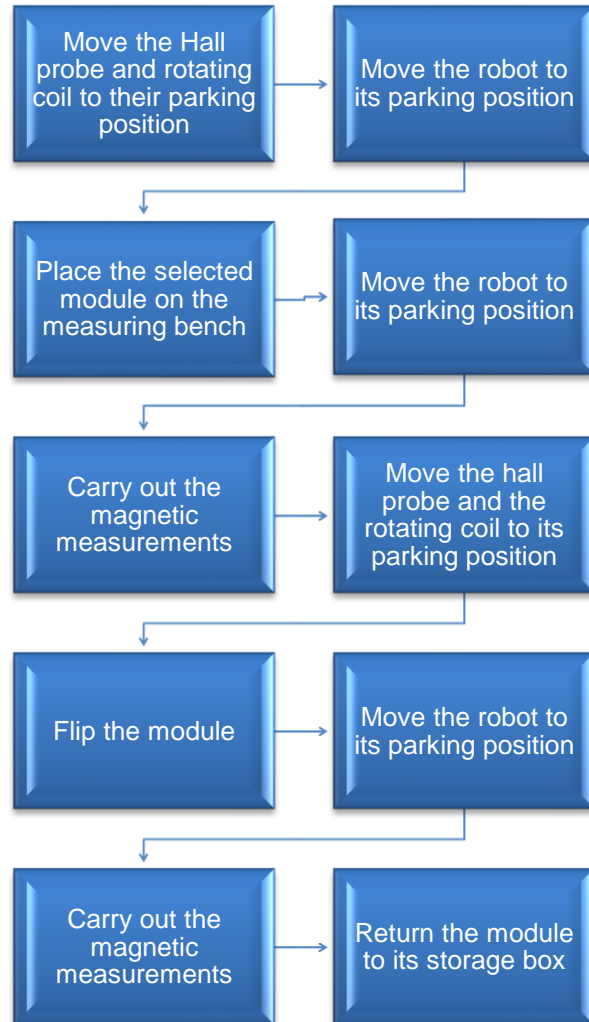
It takes about 1 minute 30 seconds

Magnetic characterization of the magnets of insertion devices.

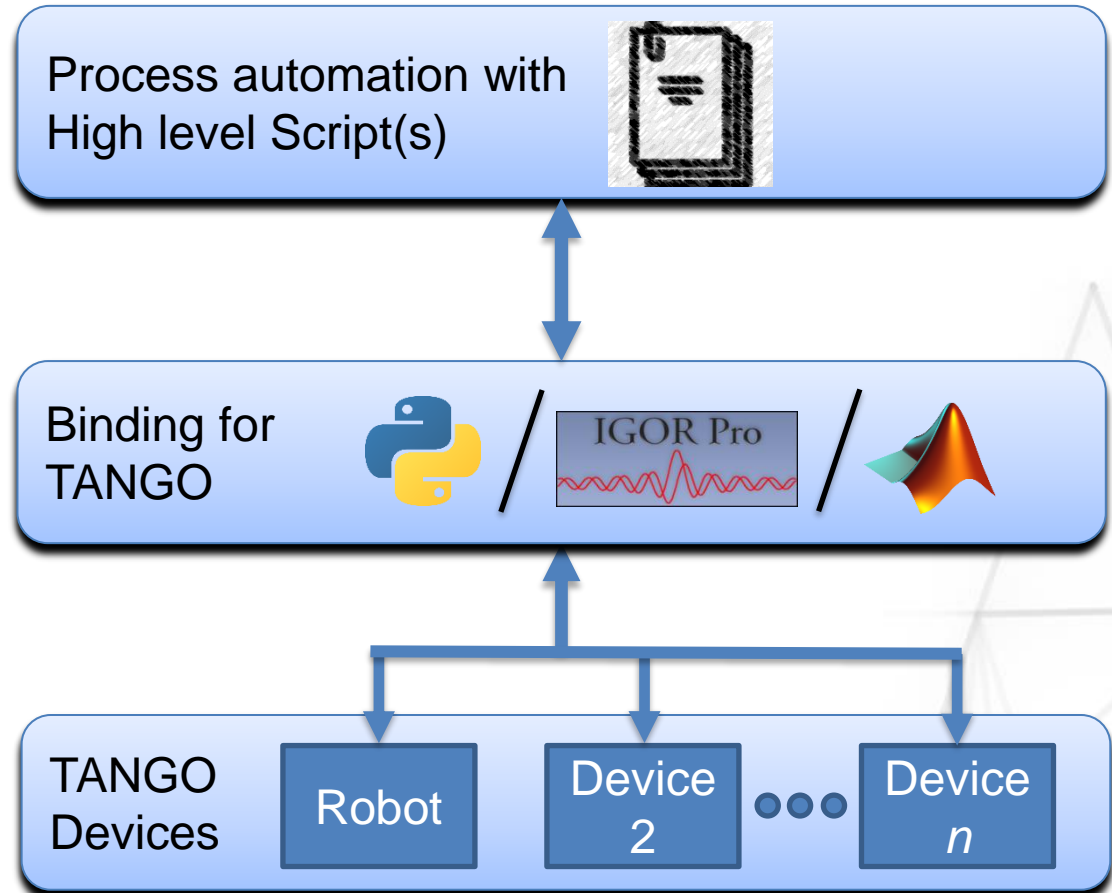
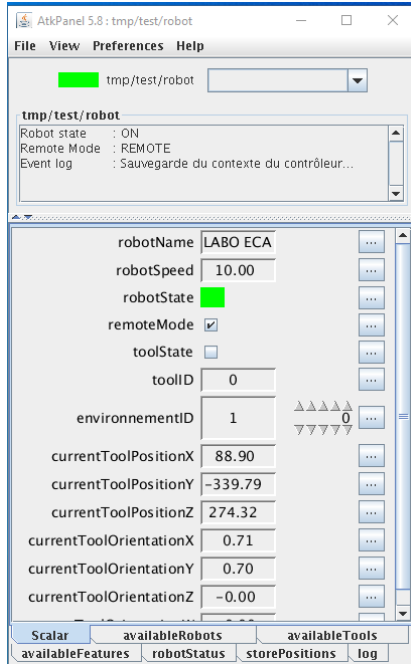
Experimental Platform

- Hall effect probe
- Rotating coil
- Storage Boxes (120 Modules)
- TX2-60L Robot
- End-Effector:
 - Electric 2-finger parallel gripper
 - Force/Torque sensor system
 - Manual changing system





The process takes about 15 minutes



It allows to easily integrate the robot to the processes of the beamlines/teams

Conclusions and Future Work

- Two applications have already been deployed using the SOLEIL robotic standard.
- The standardization permits the robot to be a “brick”, easy to integrate.
- One application was designed and developed *in-house*.
- Opportunity to carry out experiments/measurements 24 hours a day.

Ten other applications have already been identified to include industrial robots in the automation of experiments.



New challenges must be addressed

Avoid collisions

Complex sample
environments
integration

High demands on
accuracy and stability