REVOLUTION Project: Progress in the Evolution of SOLEIL Motion Control Model*

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Introduction

REVOLUTION(*) is the **motion controller UPGRADE** project currently in progress at SOLEIL.

SOLEIL's strategy is to move from a single controller to two motion controllers: GALIL for the CLASSIC solution and DELTA TAU Power Brick for the HIGH PERFORMANCE solution.

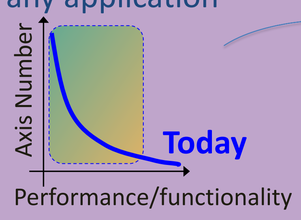
The CLASSIC controller upgrade is about to be completed, replacing the current controller with the new DMC-4183. The integration of Power Brick into the SOLEIL control system is ongoing. For this controller the main work consists in abstracting the system complexity by embedding processing functions into low-level code and giving end-users a simple high-level interface.

(*) ***RE****consider* ***V****arious contr****OL****lers for yo****U****r mo****TION***

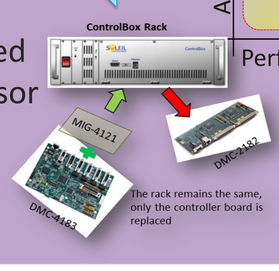
Context of REVOLUTION at SOLEIL

Current model:

One standardized controller for any application



GALIL controller upgrade
DMC-2182 will be progressively replaced by its natural successor DMC-4183



Strategy: Change Model

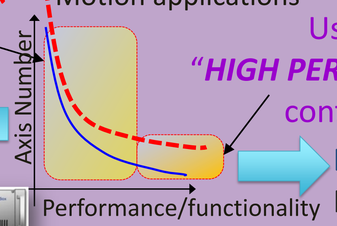
To conciliate the existing installed base with new requirements

Pareto principle

Use of *"CLASSIC"* controller

Tomorrow

Distribution of Motion applications



Next model:

2 controllers selected according to application needs

Use of *"HIGH PERFORMANCE"* controller

DELTATAU Setup development
Power PMAC in Power Brick LV format selected after a long evaluation process

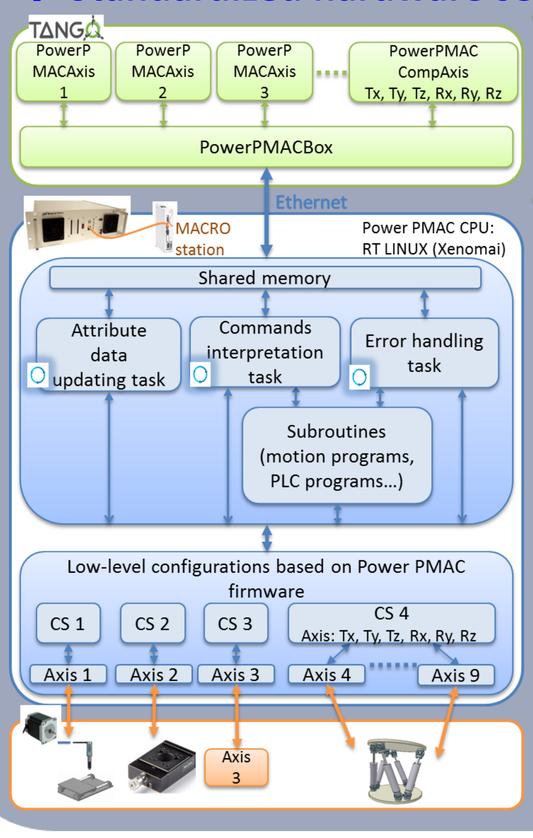
HIGH-PERFORMANCE controller control architecture

Hardware

Power Brick LV-IMS:

- 8-axis controls
- Built-in amplifier
- MACRO network
- standard connectivity

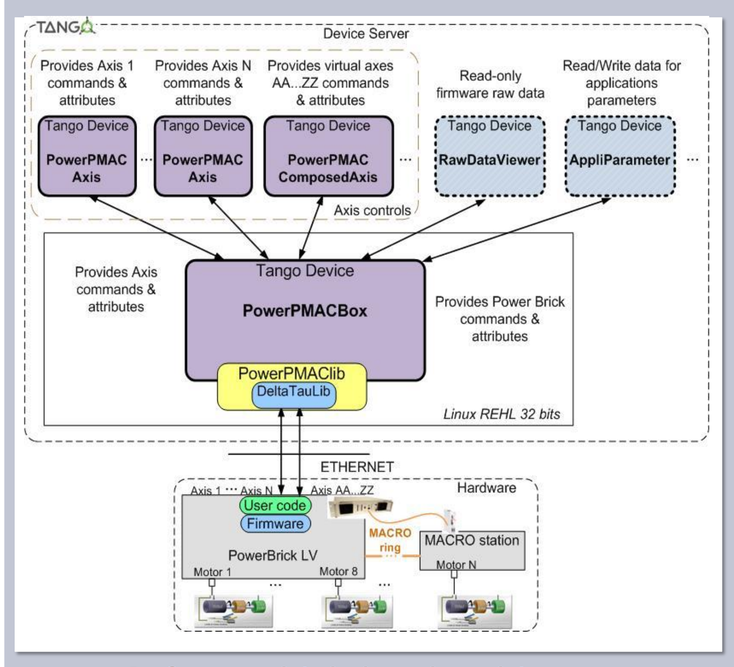
→ **Standardized hardware setups to simplify installation work**



Control architecture standardization goal

- ❑ **Consistency and usability**
- ❑ **Performance benefits**
- ❑ **Easy to use and maintain**

HIGH-PERFORMANCE controller Software standardization



Software high-level architecture

Software layer components

Tango Devices:

- Controller and (physical & virtual) axis controls
- Diagnostic tools

Libraries:

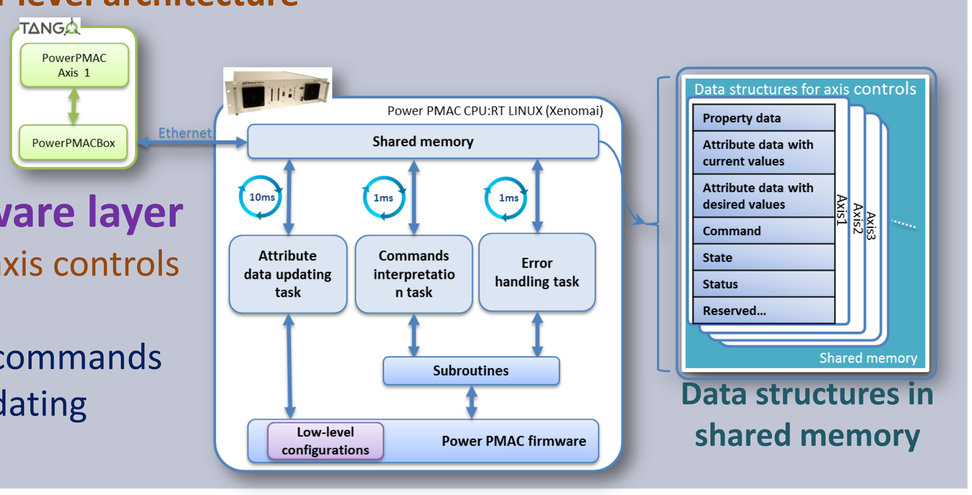
- Communication library
- SOLEIL made library
  - ➢ Link to the data structures stored in the shared memory of the controller

Embedded software layer

Interface for Tango axis controls

Features:

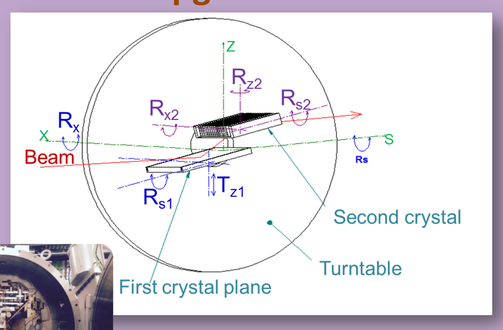
- Interpretation of commands
- Attribute data updating
- Error handling

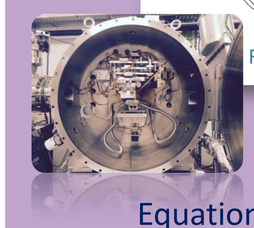


Data structures in shared memory

SAMBA beamline application test

DCM control upgrade





- ✓ Configured for 7 main axes (R_x, T_{s2}, T_{z2}, C1, C2, R_{z2}, R_{s2})
- ✓ Low-level settings validated
- ✓ Kinematic equations implemented to provide direct energy control

$$T_{s2} = \max(T_{s2}^{Min}, \frac{H}{2\sin(\theta)});\ T_{z2} = \frac{H}{2\cos(\theta)}$$

$$C_1(\frac{1}{R}) = A_{1,0} + A_{1,1}\frac{1}{R};\ C_2(\frac{1}{R}) = A_{2,0} + A_{2,1}\frac{1}{R}$$

$$\frac{1}{R} = \frac{1}{2\sin(\theta)}(\frac{1}{p} + \frac{1}{q})$$

$$R_{s2} = P_n(\theta, c_{R_{s2}});\ R_{z2} = P_n(\theta, c_{R_{z2}})$$

$$p_n(\theta, c) = \sum_{i=0}^{n} c_i\theta^i\ c = \begin{pmatrix} c_0 \\ c_1 \\ \vdots \end{pmatrix}$$

Remaining motors synchronized with Rx

Equation between E(photon energy in eV) and the angle θ (°) of the main axis Rx:

$$E = hc\frac{1}{\lambda} = \frac{hc}{2d}\frac{1}{\sin(\theta)}$$

Conclusion

REVOLUTION status

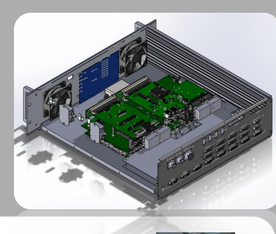
- ➔ New **CLASSIC** controller: Hardware, Firmware validated
- ➔ **HIGH PERFOMANCE** controller: First test with Tango devices in progress

New strategy of changing model being implemented

- ➔ New **CLASSIC** controller: operational **continuity** ensure.
- ➔ **HIGH PERFOMANCE** controller: control **upgrade** applications
  - ❑ Monochromator, Flyscan, Nanoprobe and Goniometer...

New complimentary product Power Brick controller specified:

- ❖ Same CPU(Power PMAC) without built-in amplifier
- \+ Control upgrade direct and easy
- \+ Same tool settings & skill-sets without extra development



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