AUTOMATIC DELTATAU PROJECT AND CODE GENARATION FOR GRANITE BENCHES AT SIRIUS

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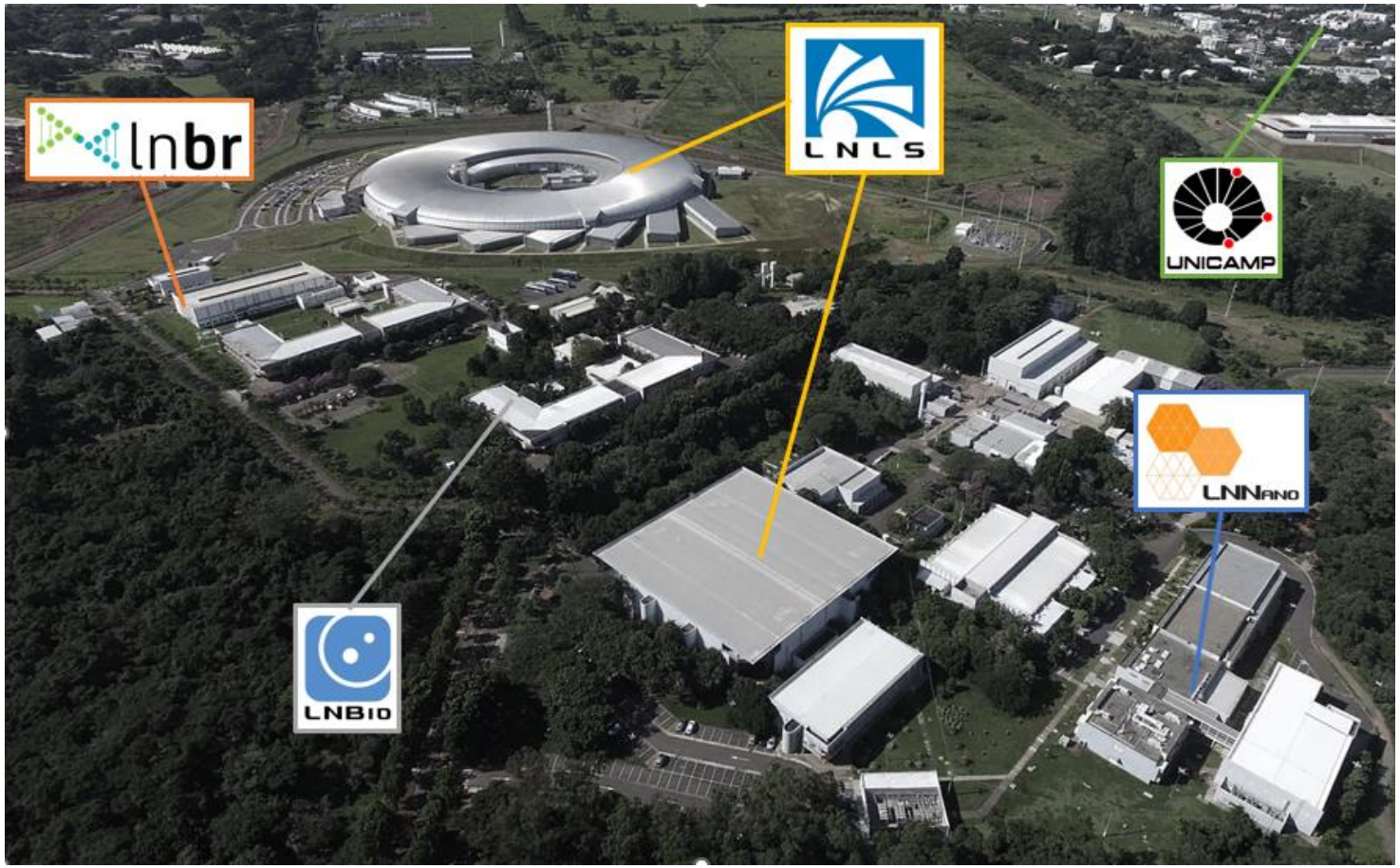
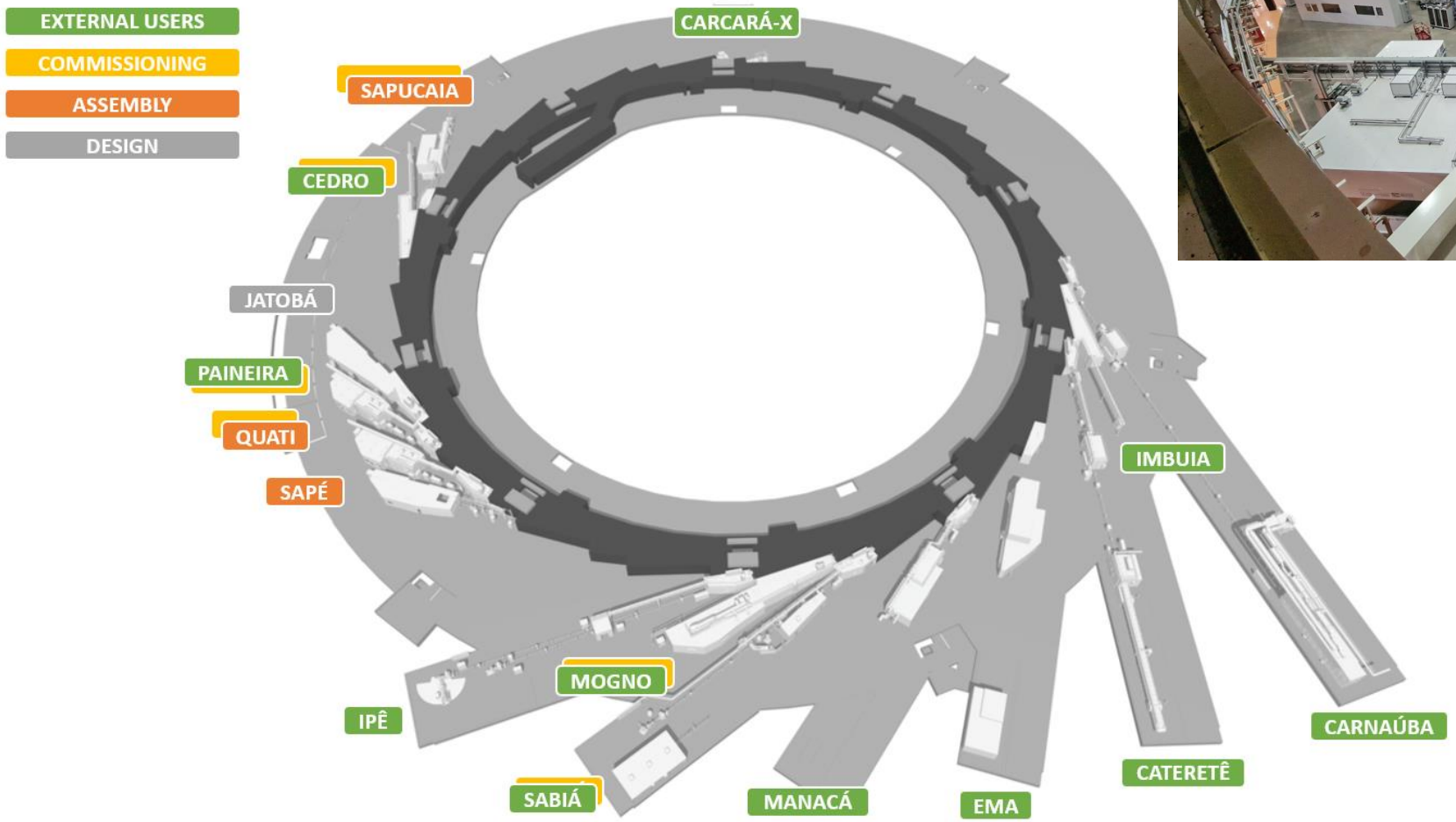
Introduction

- LNLS – Brazilian Synchrotron Light Source
- Sirius - 4th generation storage ring

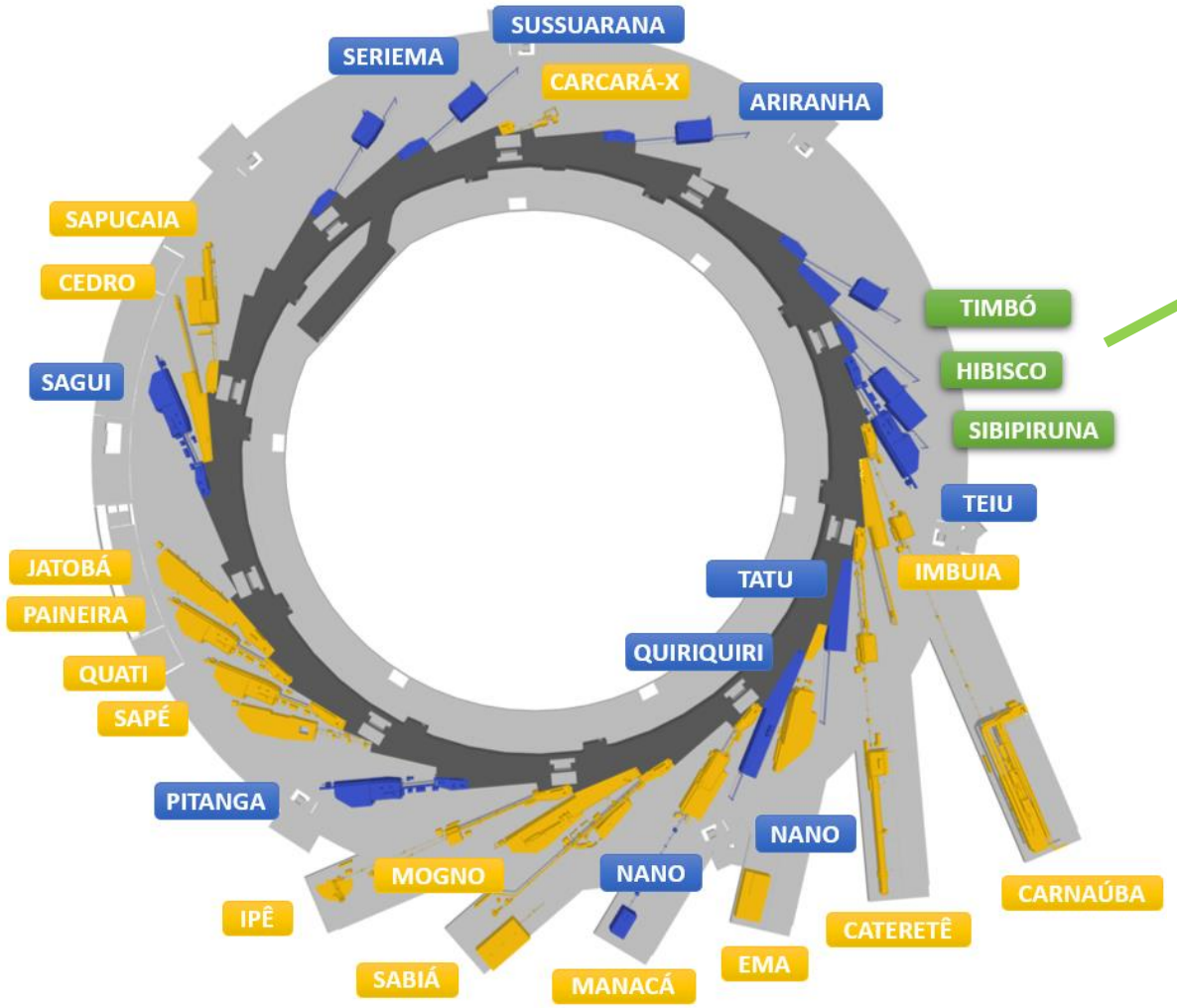


Sirius Status – Phase 1

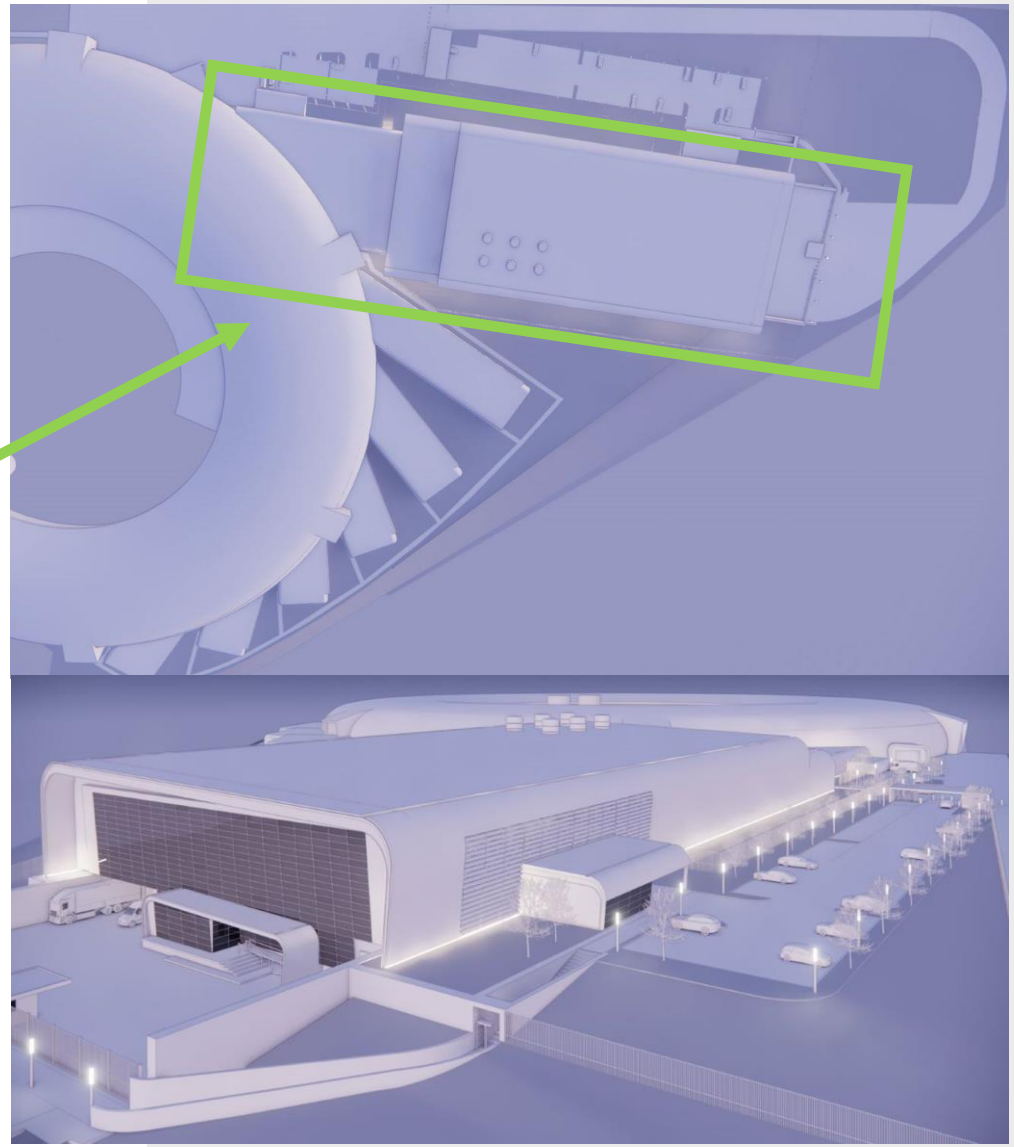


Sirius Status

PHASE I
PHASE II
ORION



Orion (NB4)



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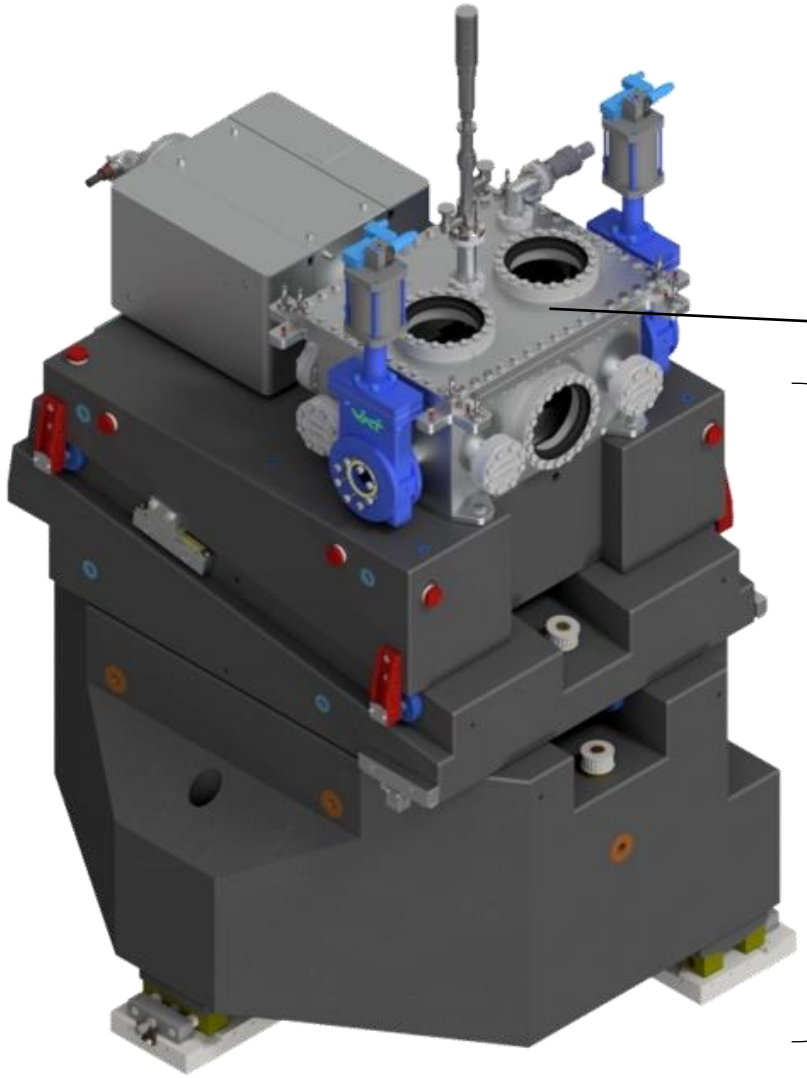
BRAZILIAN GOVERNMENT
BRASIL
UNITING AND REBUILDING

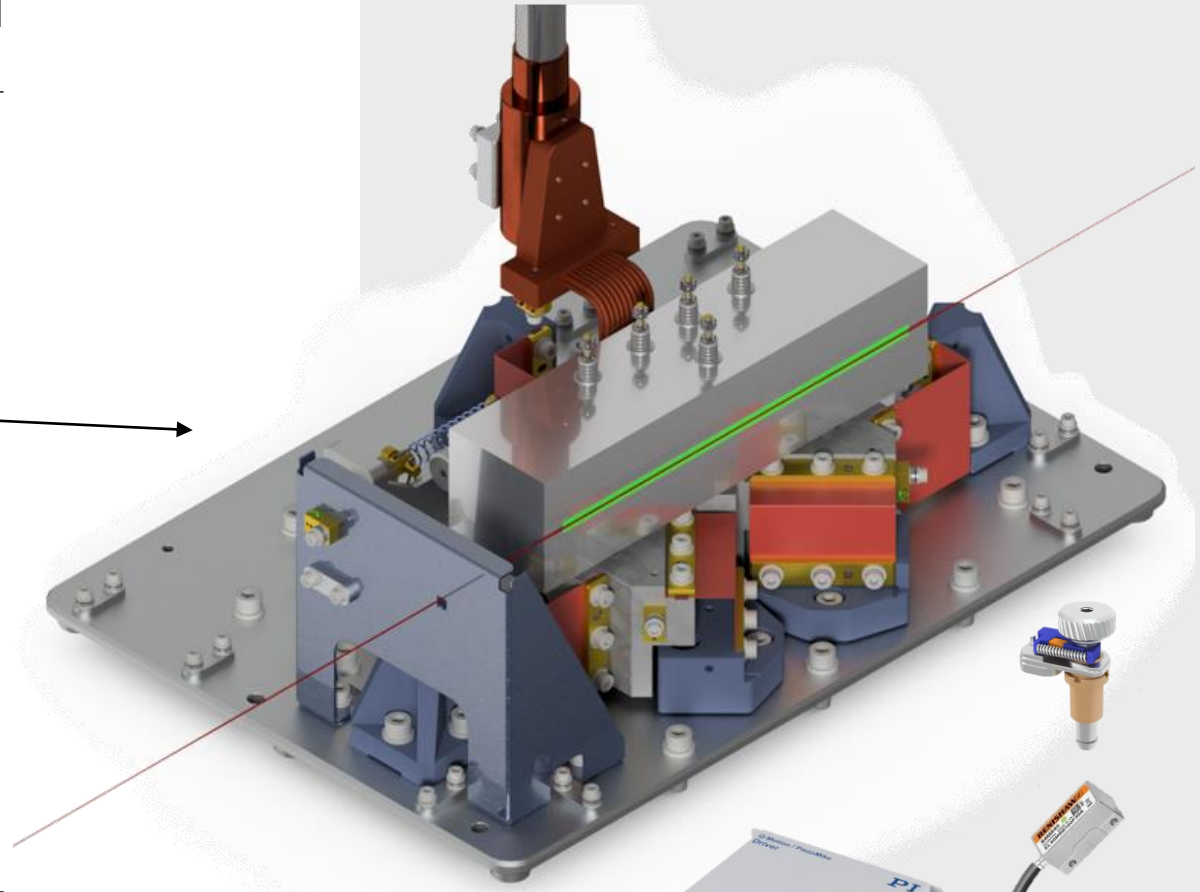
Granite Bench Overview

- High coupling stiffness to the ground and position control



Short Stroke

Long Stroke



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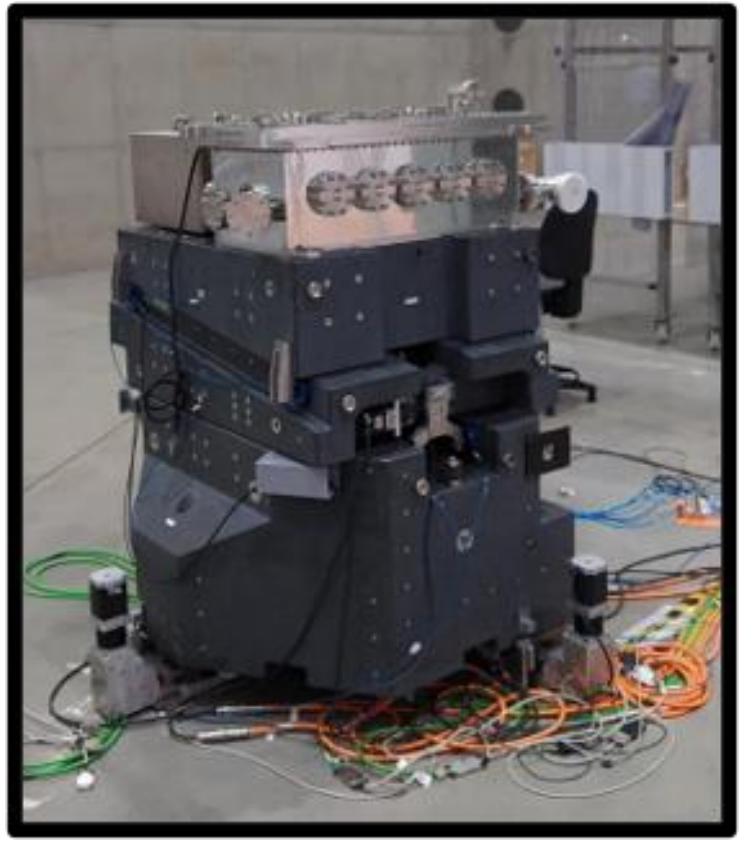
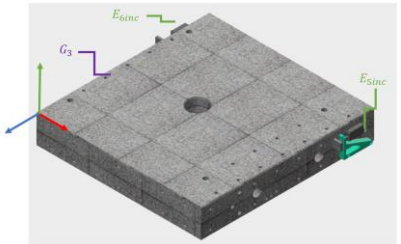
Granite Bench Implementation

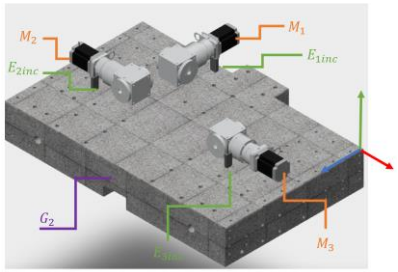
Assembly validation

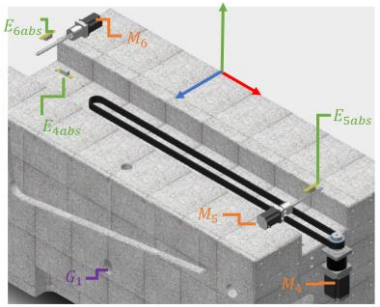


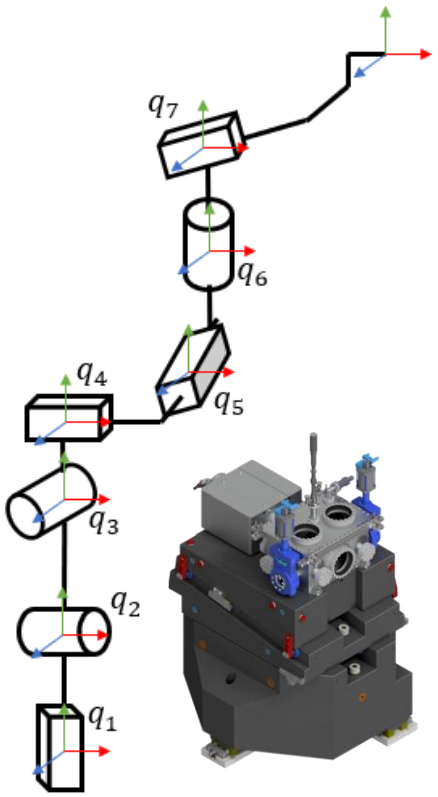
Granite bench (GB)
4 stepper motors with abs. feedback
Air-bearing system for movement
Levelers - Tripod
3 stepper motors with inc. feedback

Kinematics Modeling

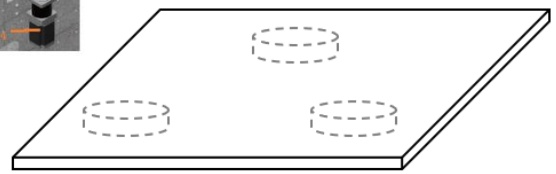








GB – Open Chain



Levelers – Closed Chain

Numerical Method to solve Kinematics Equations

$$e_i = \begin{bmatrix} T_{y',i} \\ \theta_{x',i} \\ \theta_{z',i} \end{bmatrix} \qquad J(e_i) = \begin{bmatrix} \frac{\partial p_1}{\partial T_{y'}}(e_i) & \frac{\partial p_1}{\partial \theta_{x'}}(e_i) & \frac{\partial p_1}{\partial \theta_{z'}}(e_i) \\ \frac{\partial p_2}{\partial T_{y'}}(e_i) & \frac{\partial p_2}{\partial \theta_{x'}}(e_i) & \frac{\partial p_2}{\partial \theta_{z'}}(e_i) \\ \frac{\partial p_3}{\partial T_{y'}}(e_i) & \frac{\partial p_3}{\partial \theta_{x'}}(e_i) & \frac{\partial p_3}{\partial \theta_{z'}}(e_i) \end{bmatrix}$$

Iteraction Vector Jacobian Matrix

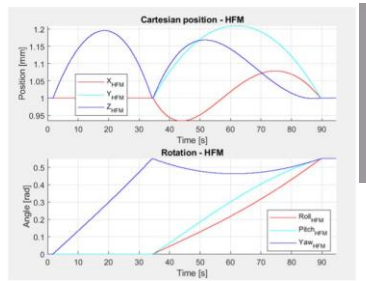
$$G(p_{1,raw}, p_{2,raw}, p_{3,raw}) = \begin{bmatrix} p_{1,raw} - p_1(e_i) \\ p_{2,raw} - p_2(e_i) \\ p_{3,raw} - p_3(e_i) \end{bmatrix}$$

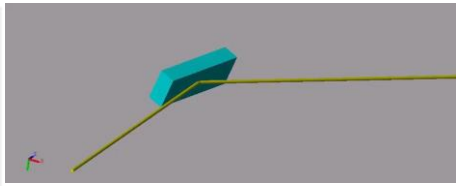
Minimization Vector

$$e_{i+1} = e_i + J^{-1}(e_i)G(p_{raw}, e_i)$$

Iteration Algorithm

Simulation





C Code

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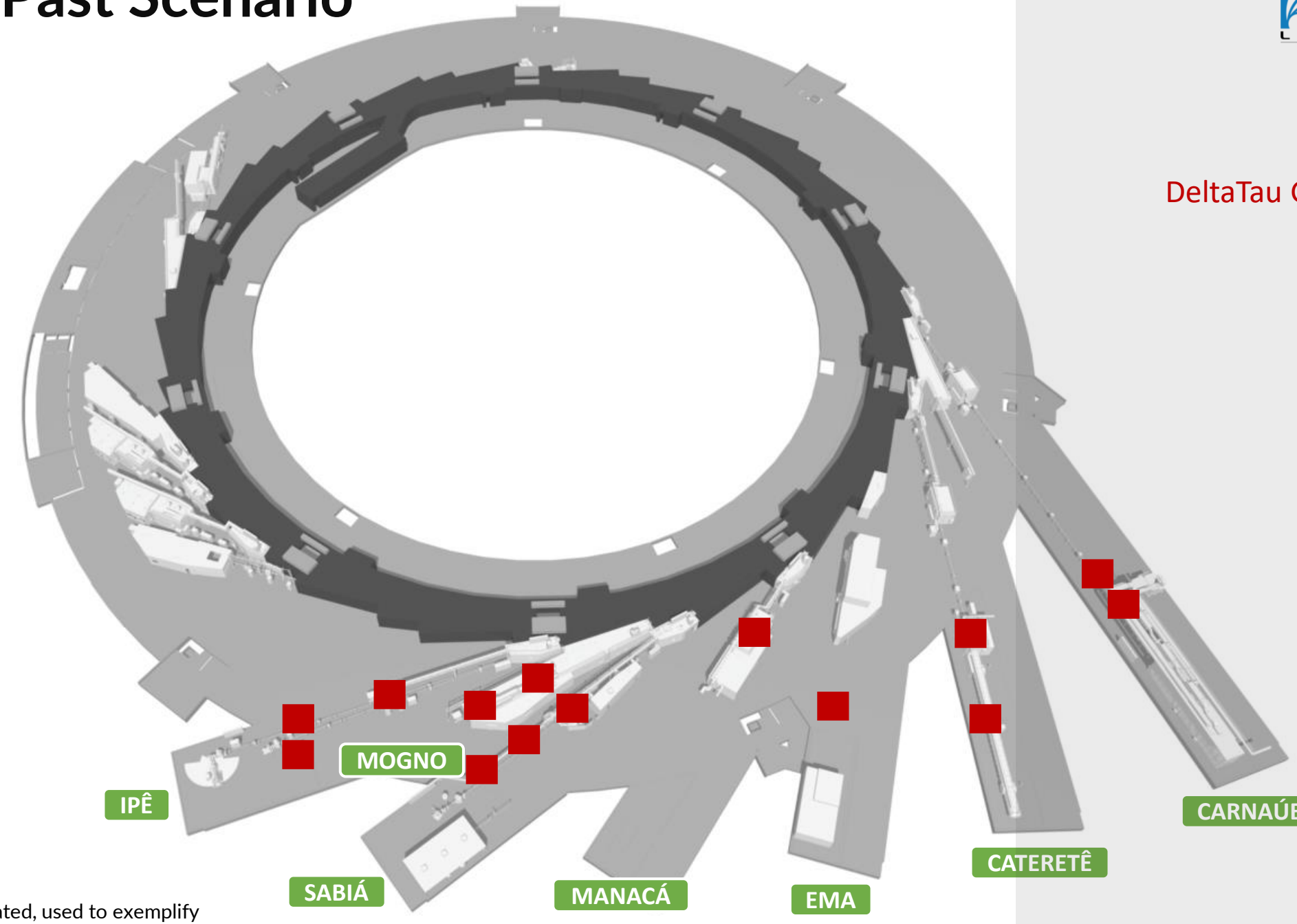
GBs Past Scenario

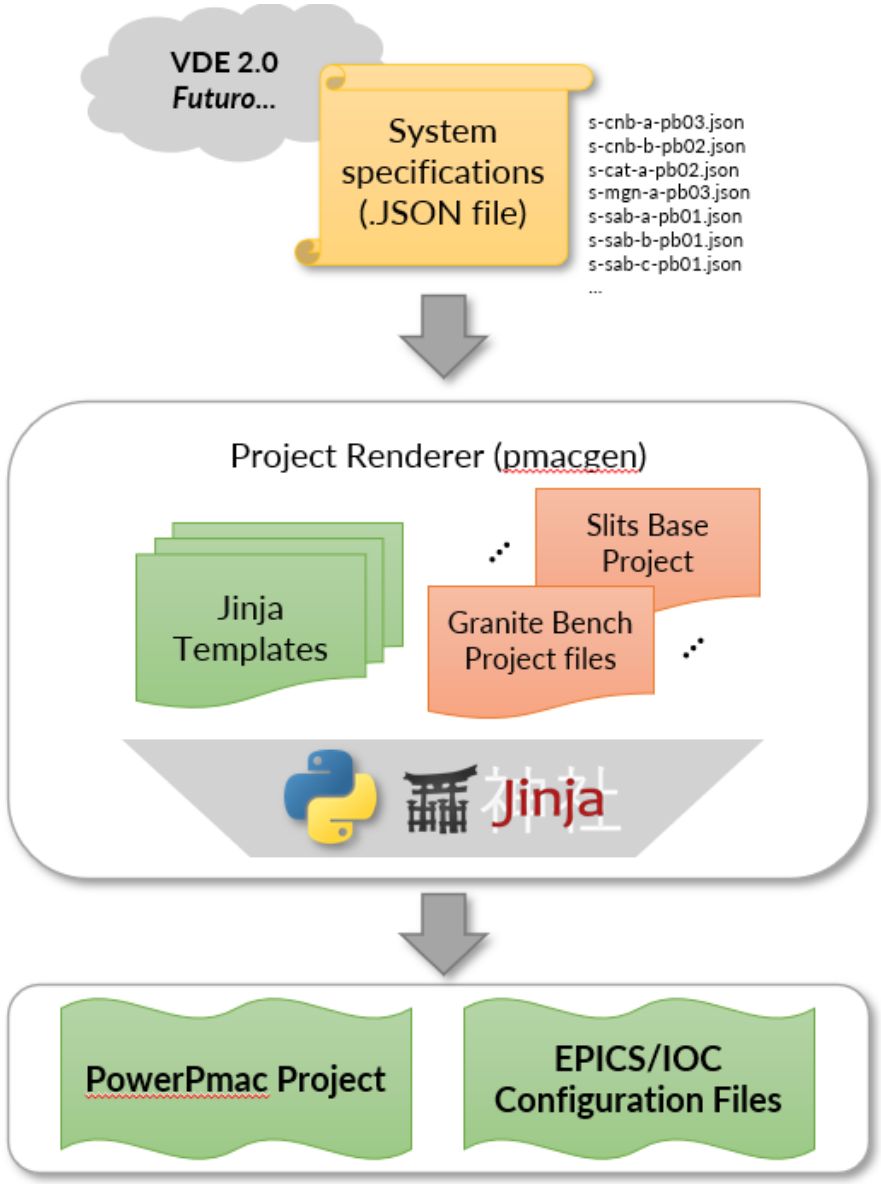


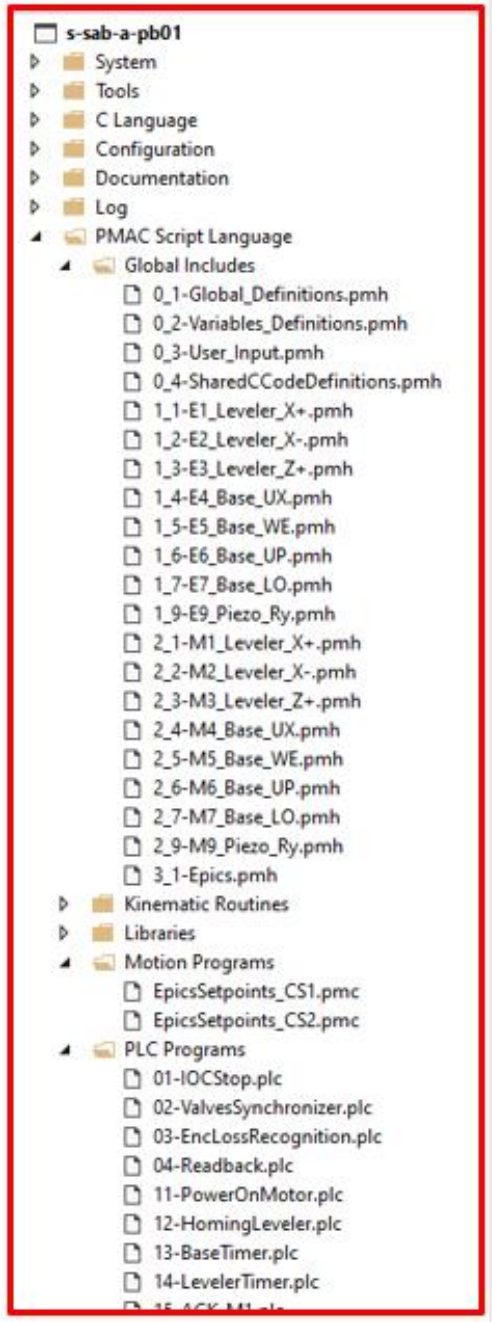
DeltaTau GB Project and code:

s-cnb-gb01
s-cnb-gb02
s-cat-gb01
s-cat-gb02
s-ema-gb01
s-mnc-gb01
s-sab-gb01
s-sab-gb02
s-sab-gb03
s-mgn-gb01
s-mgn-gb02
s-ipe-gb01
s-ipe-gb02
s-ipe-gb03
N

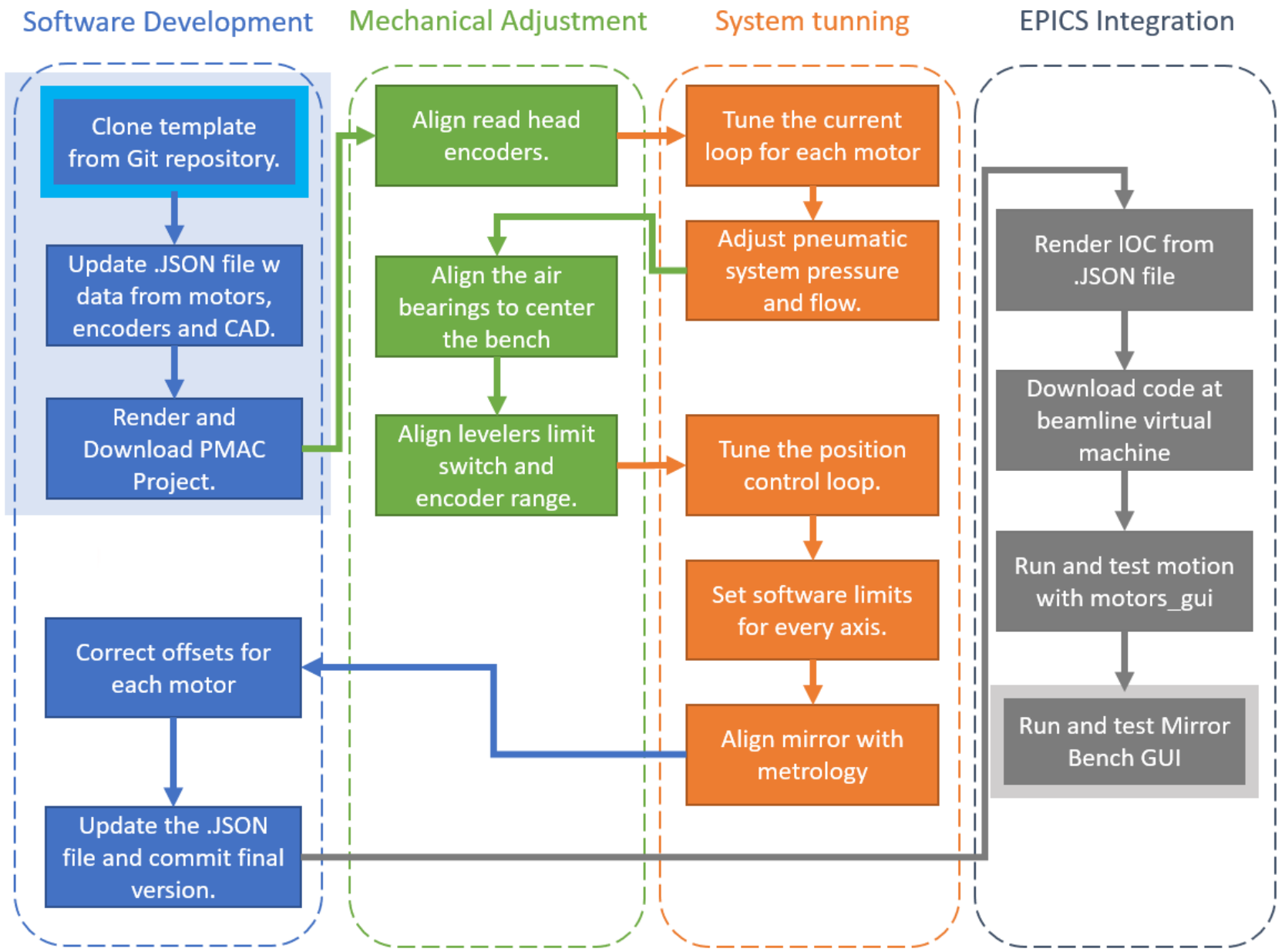
Not fully updated, used to exemplify

Power Pmac Project Generation

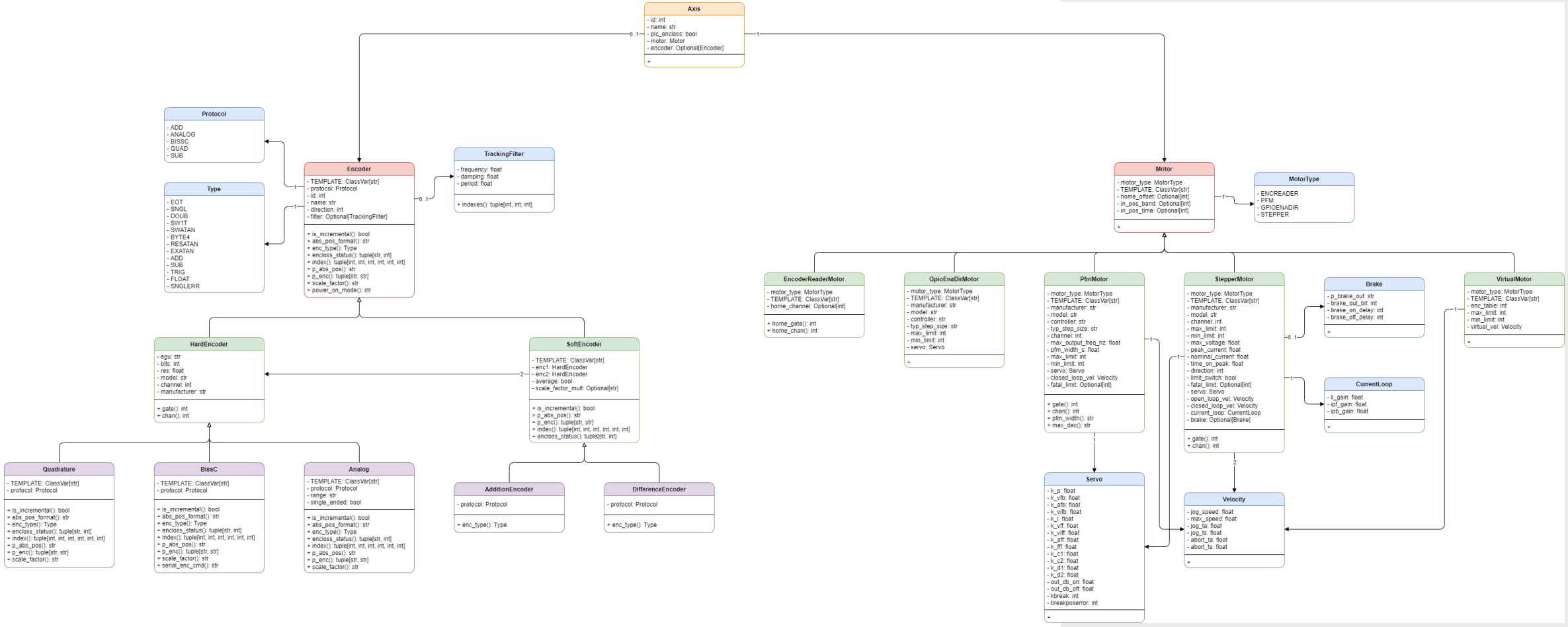




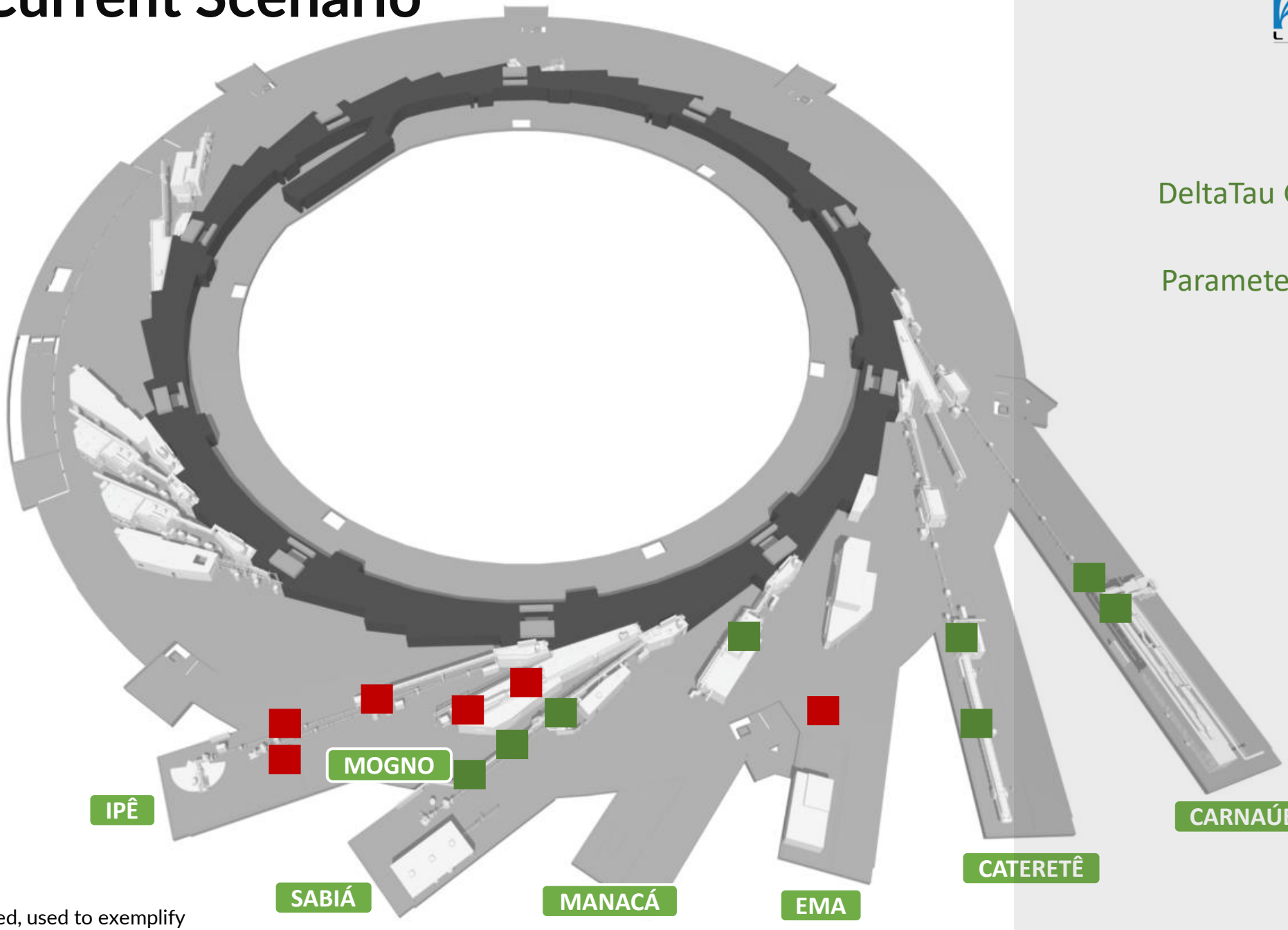
Power Pmac Project Generation



Class Diagram of PMACGEN Library



GBs Current Scenario



DeltaTau GB Project and code:
s-gbX

Parameters and deployed code
s-cnb-gb01
s-cnb-gb02
s-cat-gb01
s-cat-gb02
s-mnc-gb01
s-sab-gb01
s-sab-gb02
s-sab-gb03
s-ipe-gb01
s-ipe-gb02
s-ipe-gb03

Not fully updated, used to exemplify

Summary

Advantages of rendering projects from data files:

- Maintain only one repository, single source of truth
- Increase standardization among mirror granite benches
- Reduce maintenance cost by speeding upgrade to future versions
- Concentrate the parameters of each system in one database

THANK YOU

cnpem.br

LNLS + sirius

CNPEM
Brazilian Center for Research in Energy and Materials

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