





# Establishing a Reference Network for the alignment of Sirius

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Energy: 3 GeV
Emittance: 0.25 nm.rad
Circumference: 518 m
Nº of magnets: 650
№ of girders: 220

LN

Storage Ring Alignment Tolerances	
Between Magnets	0.040 mm
Between Girders	0.080 mm





### Methodology – Networks Layout





- Representation of radiation shielding into SpatialAnalyzer
- Primary Network Nominal Points
- Secondary Network Nominal Points



- Points materialized with SMR nests
- Embedded into the concrete
- Wall, floors and pillars (Hall)



# Methodology – Survey









- 8 different campaigns
- Double-levelling procedure
- Level reference for calculation











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- Secondary network internal connections:
  - Exp. Hall  $\leftrightarrow$  Hutches
  - Exp. Hall ↔ Long Beamlines
  - Made by bridge tracker stations, measuring points in both environments









- Storage Ring and Experimental Hall networks should be connected via the radiation shielding holes, a very restricted line of sight
- Development of a technique for reciprocal orientation between Laser • Trackers



# Methodology – Calculations



#### Earth Curvature Compensation

- The Earth isn't flat! ٠
- Alignment of distant components with respect ٠ to the source beam
- The greater the distance, the lower the network ٠





#### **Constraints**

- Preserve the network shape, measured by ٠ reference stations
- Level: absolute max error between the ٠ calculated network and the original levelled points
- Radius: average error between the 5-resulting ٠ "line of sights" and the original stations mean



#### Parameter Optimization





## **Resulting Networks**











Avg. Vertical Uncertainty: 0.083 mm

Avg. Radial Uncertainty: 0.034 mm

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2.1

1.6

1.2

0.7

0.2

1.7

1.3

0 0

[mm]

6.2%

23.6%

43.1%

27.1%

0.3%

2.3%

30.9%

66.5%

[mm]















Crystal of SARS-CoV-2 3CL and structure of the protein, obtained from the first experiment conducted at Manacá Beamline at Sirius. <u>https://www.lnls.cnpem.br/first-experiments-are-carried-out-on-sirius/</u>





