

# CERN Survey Team and their Activities

Mark Jones, EN/SMM



ENGINEERING  
DEPARTMENT

# Survey is ...

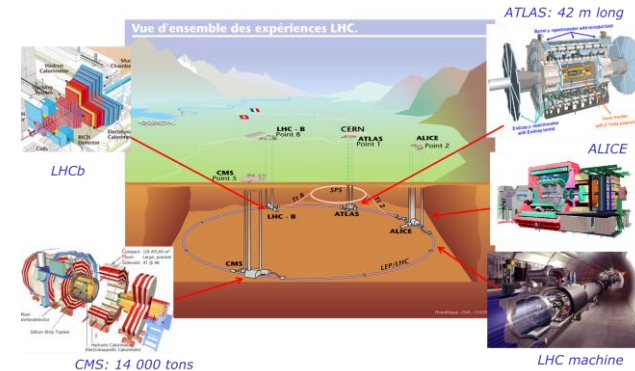
- Part of the SMM Group
- A team
  - ~20 pers. CERN
  - ~15 fellows, technical and doctoral students, project associates ...etc
  - 1 external contract
  - More than 10 nationalities
  - More than 200 students during the last 50 years



# Survey, Mechatronics and Measurements

## Survey Mandate

- Geodetic metrology at CERN
  - Accelerators, beam transfer lines, detectors
- Permanent monitoring and alignment systems
- Geodesy and geodetic infrastructure
- Mathematical models and data processing algorithms
- Quality controls and metrological works
  - Accelerator and detector prototypes and components
- As-built measurements
- Related R&D for existing and future machines and experiments

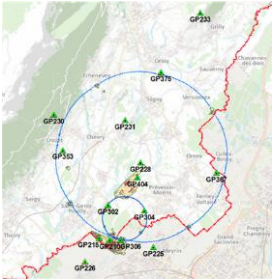


EN-SMM  
Survey Mechatronics  
Measurements  
  
GL: A. Masl  
DGL: H. Mainaud Durand



Key:  
 Staff Member  
 Fellow  
 Associate  
 Temporary Labour  
 Student

# Activities



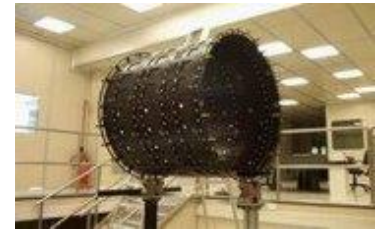
Infrastructure



R&D



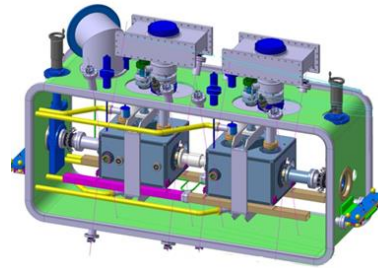
Internal metrology



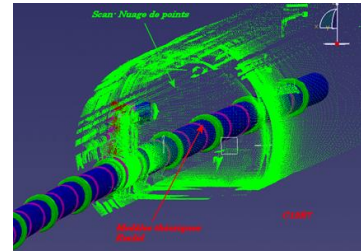
Assembly



Installation



Internal monitoring

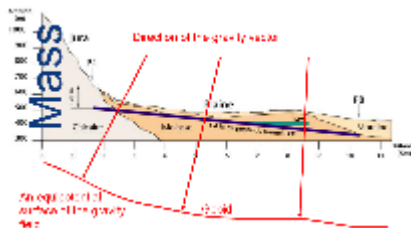
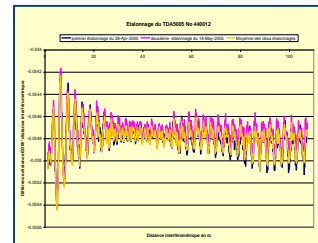
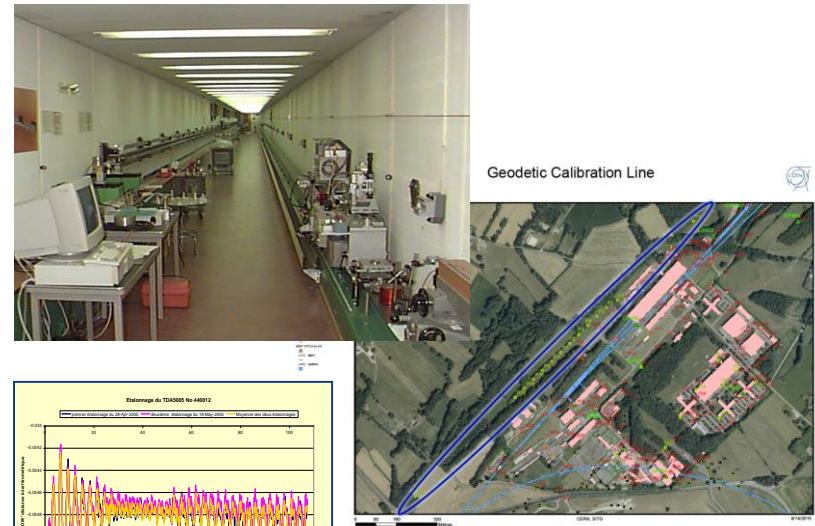
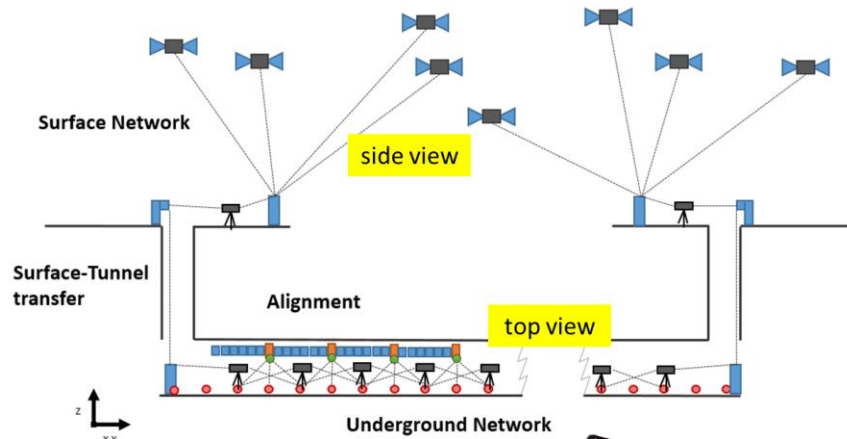


Standard alignment



Remote alignment

# Infrastructure



GYROMAT-2000 - on GP404

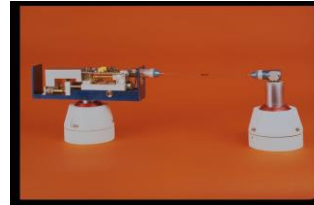
The "Logiciels SU software" logo is prominently displayed. Below it, a collection of software icons is organized into categories:

- Calibration & Test Benches:** SU soft Calibration Bench, SU soft Test Benches, CallDist.
- Data Capture & Alignment:** Carnet4000, SFB, PFB.
- Libraries:** SU soft SurveyLib, SU soft TL\_UTIL2, SU soft EarthTides.
- Tools & Utilities:** PCTopo32, gsiPLGC, SU soft CGC, SUsoft installer.
- Databases & Geode Application:** GEODE SURVEY.
- Data Processing & Analysis:** LGC+, SU soft LGC, SU soft PLGC.
- Shape Fitting:** Shapes, Rabot, Cylinder.
- Transformation:** SU soft CSGeo, SU soft Transform, ChaBa.
- Monitoring & Control:** LHC Lowβ, HIE-Isolde, TAP, DBQ, LAMBDA, Deflectometer.

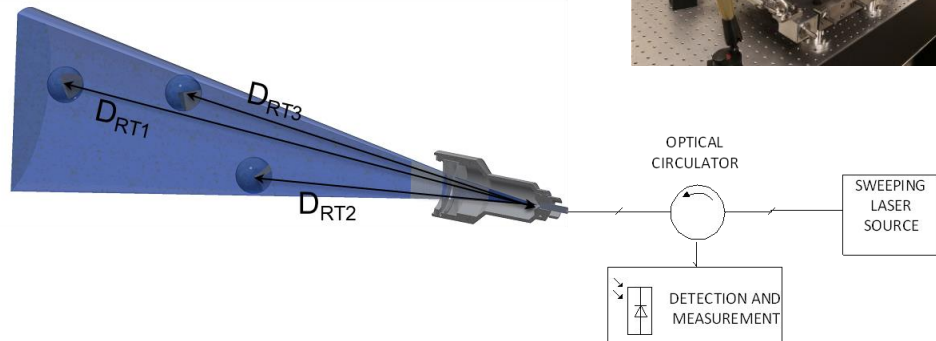
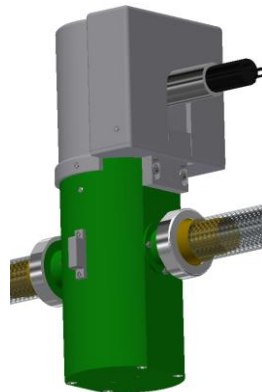
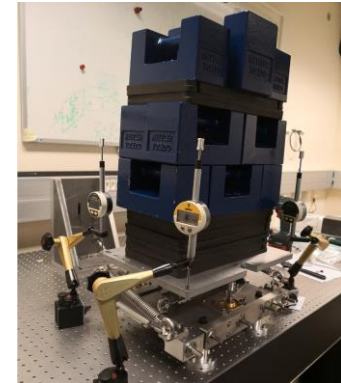
# Workshops

- R&D
  - Prototypes
  - Instruments
  - Accessories
- Maintenance

## Electronics

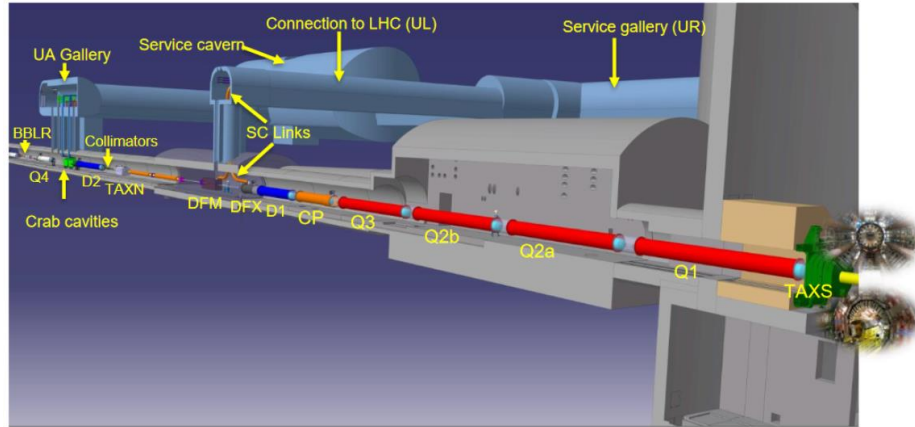


## Mechanics

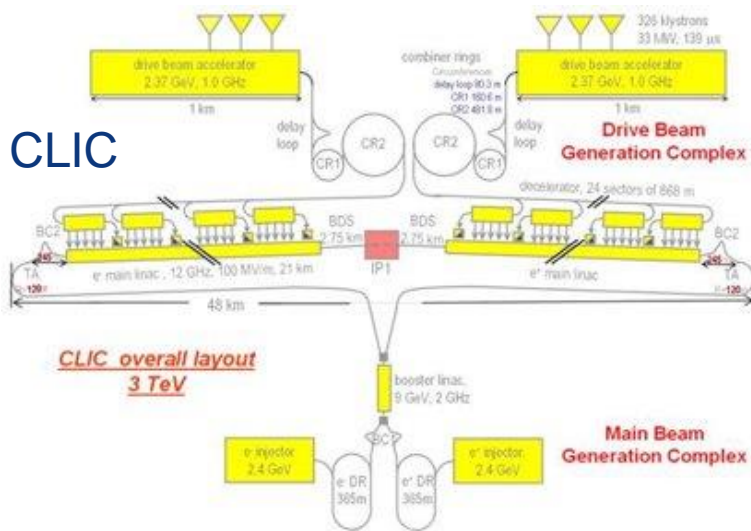


# Projects and Studies

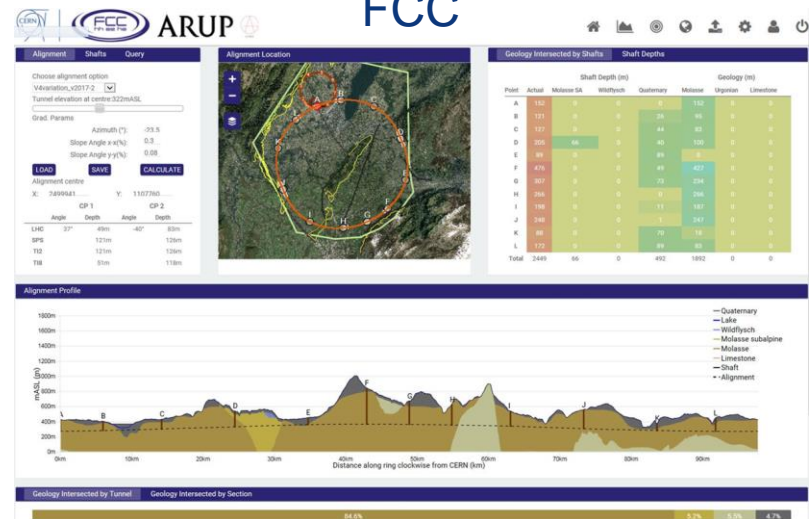
## HL-LHC



## CLIC



## FCC





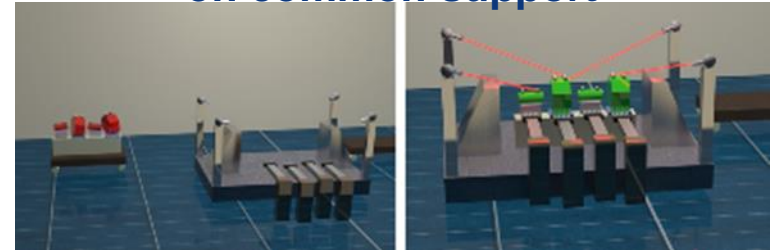
# Internal Metrology and Monitoring

## Internal Metrology & Fiducialisation

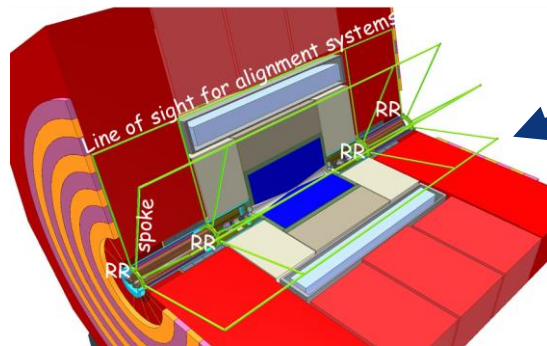
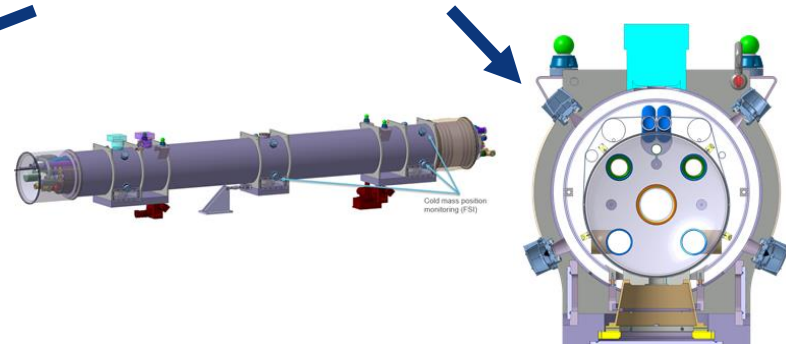
Laser Tracker



## CLIC – PACMAN Project Fiducialisation & alignment on common support



## Frequency Scanning Interferometry

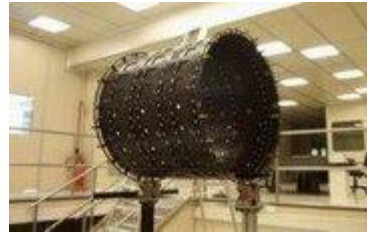


Inside Detector

Inside Cryostat

## Internal Monitoring

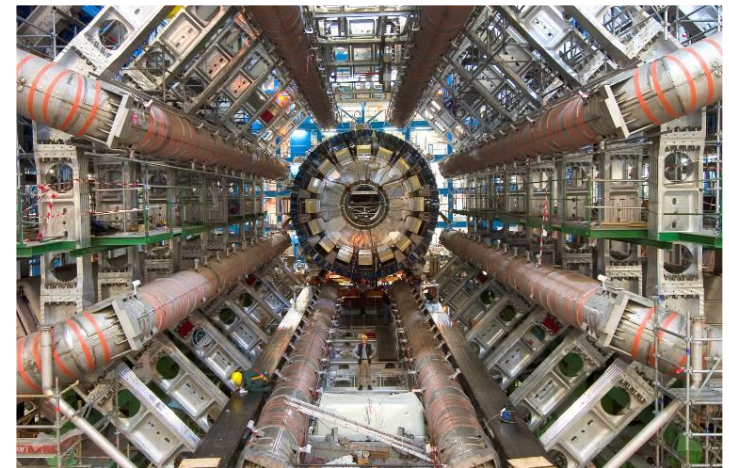
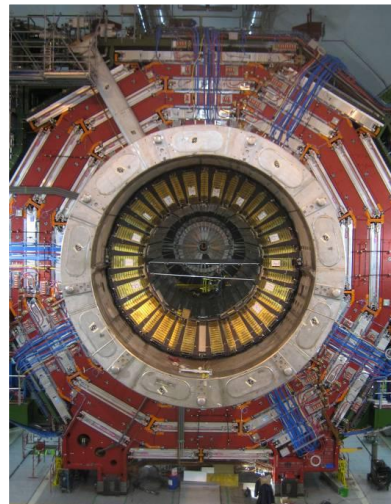
# Experiments



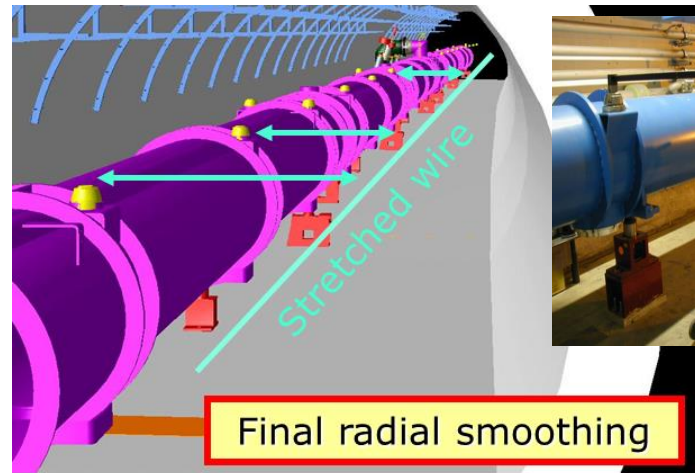
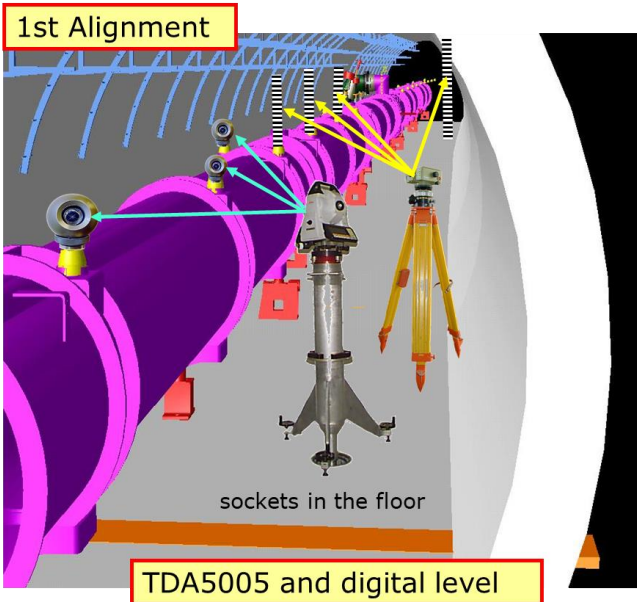
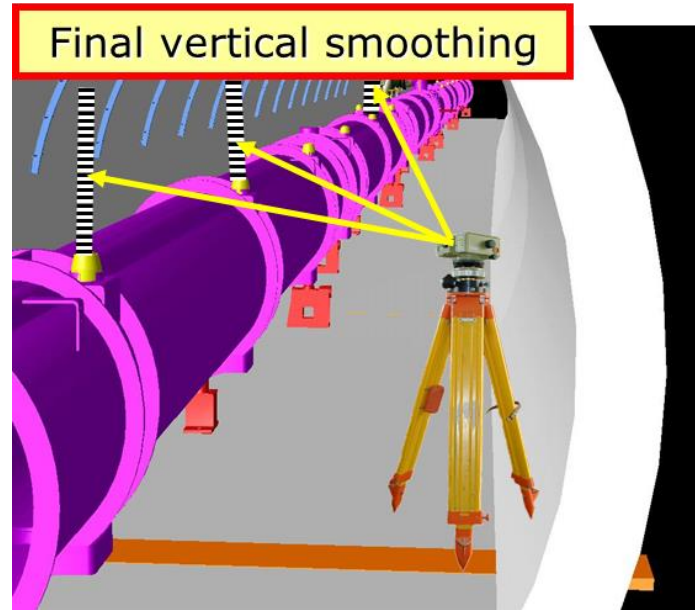
## Assembly



## Installation

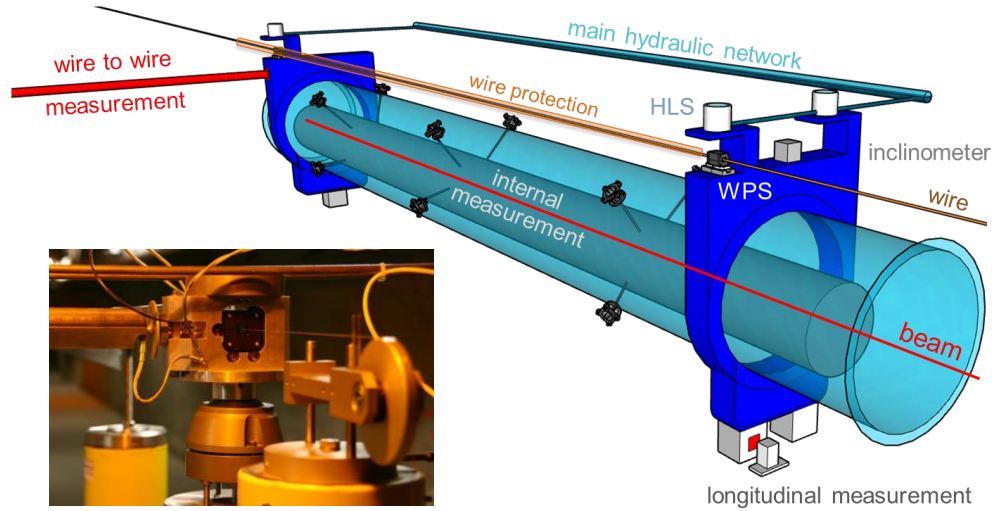


# Accelerators



# Instruments and Sensors

## Continuous Position and Orientation Determination



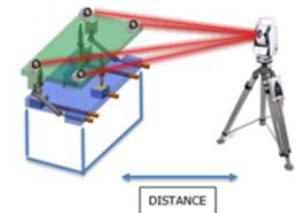
## Periodic Position and Orientation Determination



Laser tracker

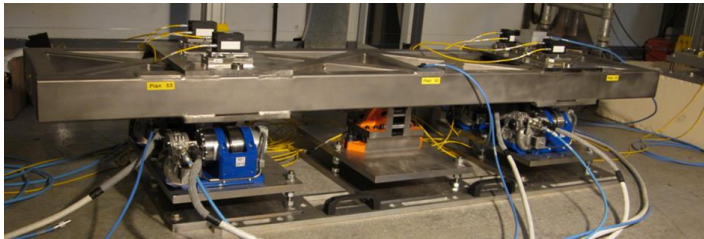
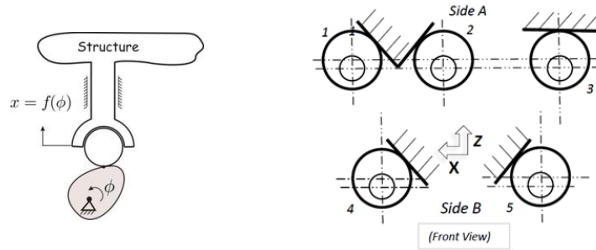


Glass sphere

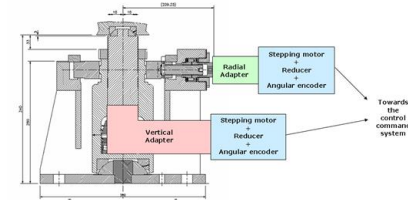


# Adjusting Position and Orientation

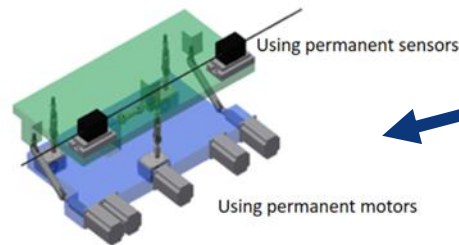
## Cam Movers



## Jacks

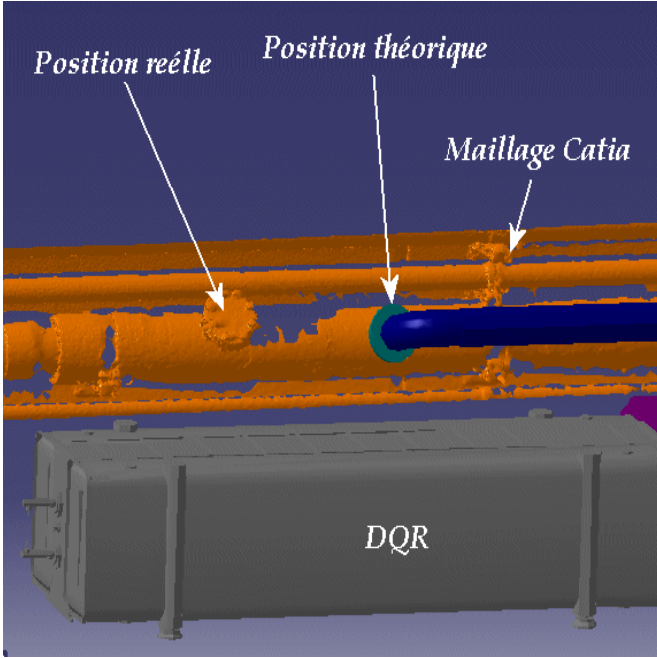
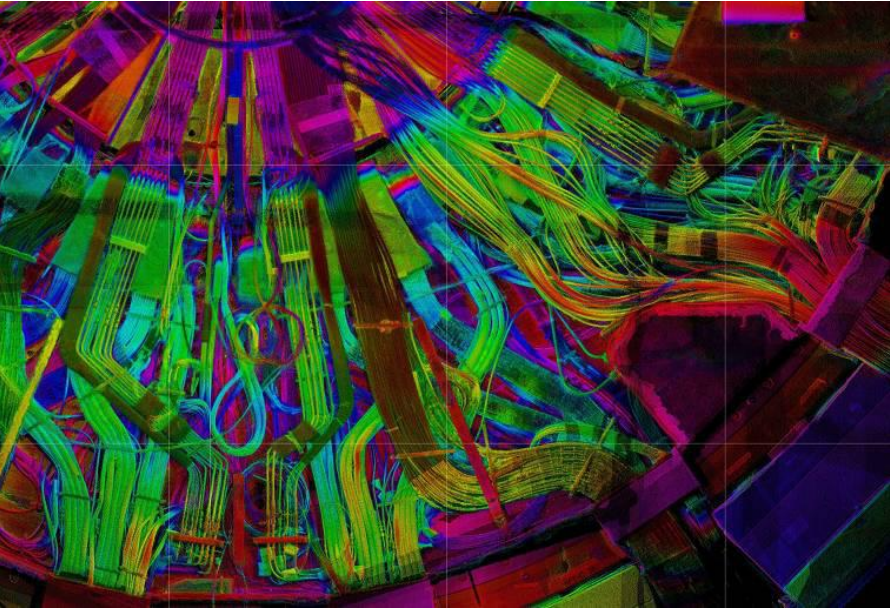
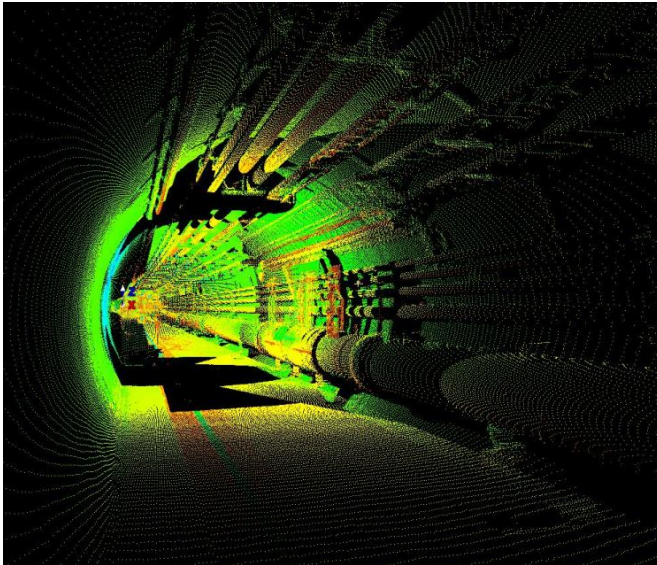
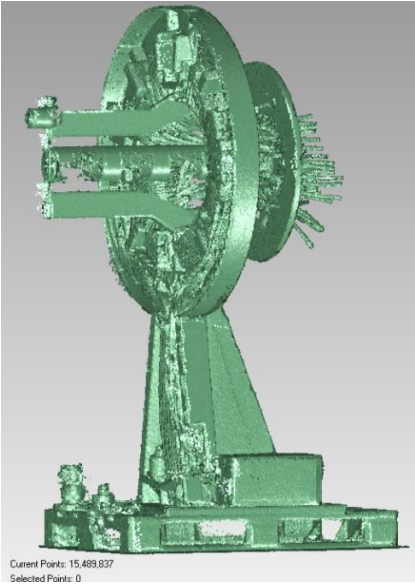
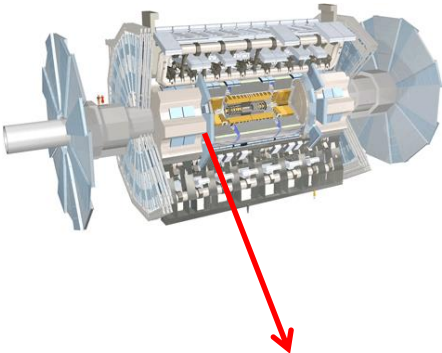


Manual or Motorized



Universal Adjustment Platform

# As-Built Measurements





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