

PACMAN

PACMAN is founded under the European Union's 7th Framework Program Marie Curie Actions, grant PITN-GA-2013-606839

<http://pacman.web.cern.ch/>

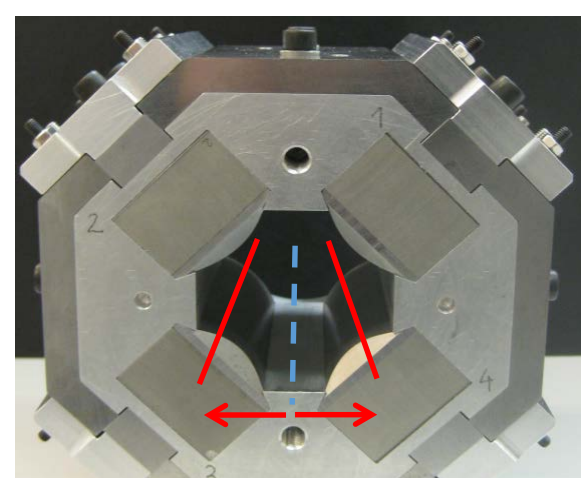


The goal of the next generation of particle accelerators is to achieve the highest number of collisions using **nano-metric beam sizes**. This requires very tight **micrometric pre-alignment tolerances** of the components focusing, accelerating and detecting the beam over the entire length of the accelerator. The Compact Linear Collider (**CLIC**), currently under study at the European Council for Nuclear Research (**CERN**), is an international collaboration working on a machine to collide electrons and positrons at energies up to 3 Tera-electron-volts (TeV) with a smallest beam vertical dimension of 1nm (at the IP). **PACMAN** aims to propose new methods allowing the determination of the reference axis of accelerator components with respect to external alignment targets (fiducialisation process). A test bench, using representative accelerator components of CLIC, will demonstrate the feasibility of the solutions developed, and the achievement of the micrometric accuracy of their fiducialisation procedure.

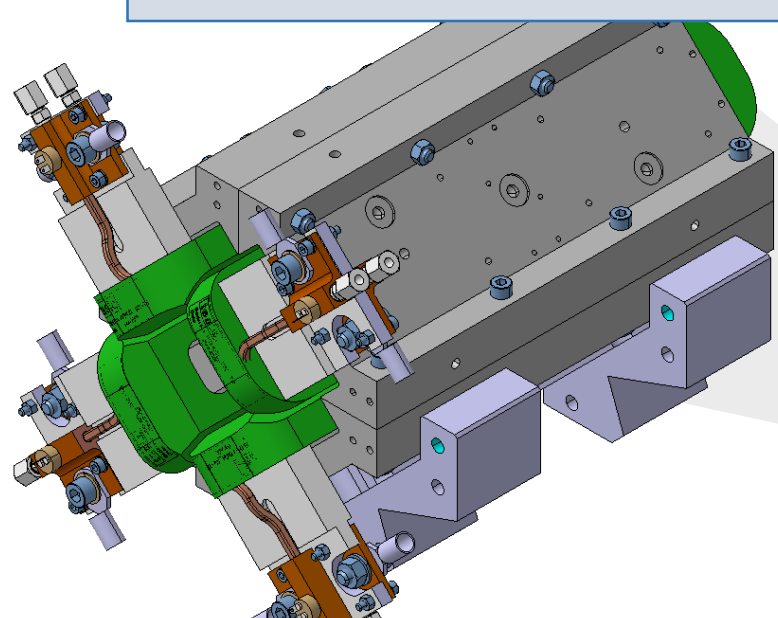


Domenico Caiazza

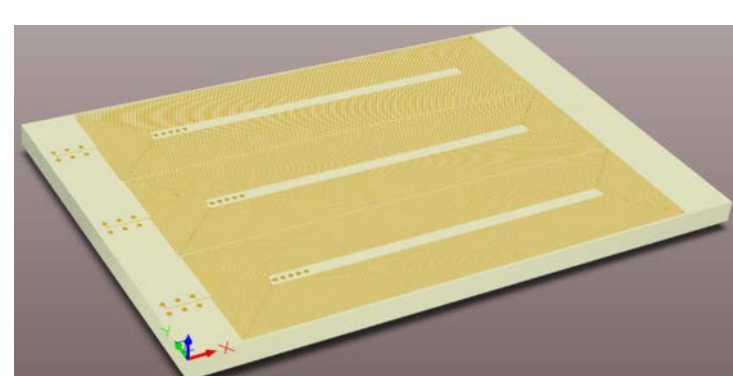
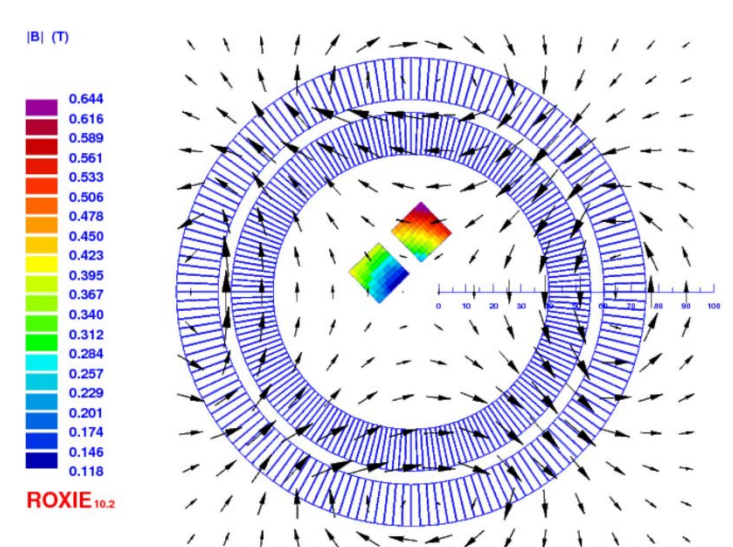
- Main beam quadrupole (MBQ) magnetic axis determination
- Study of vibrating wire measurement technique
- Single-stretched wire method versus vibrating wire method (3-4 μm observed)
- Study on the compensation of non uniform background effects



Vibrating Wire



Rotating Coils



- MBQ Magnetic field characterization with rotating PCB coil
- Design of new small PCB coils with on-board bucking and external shaft using innovative materials.
- Optimise the PCB coil calibration process by studying the effect of higher order harmonics
- Improve the rotating coil test bench setup for PCB coil of small dimensions(< 8mm)

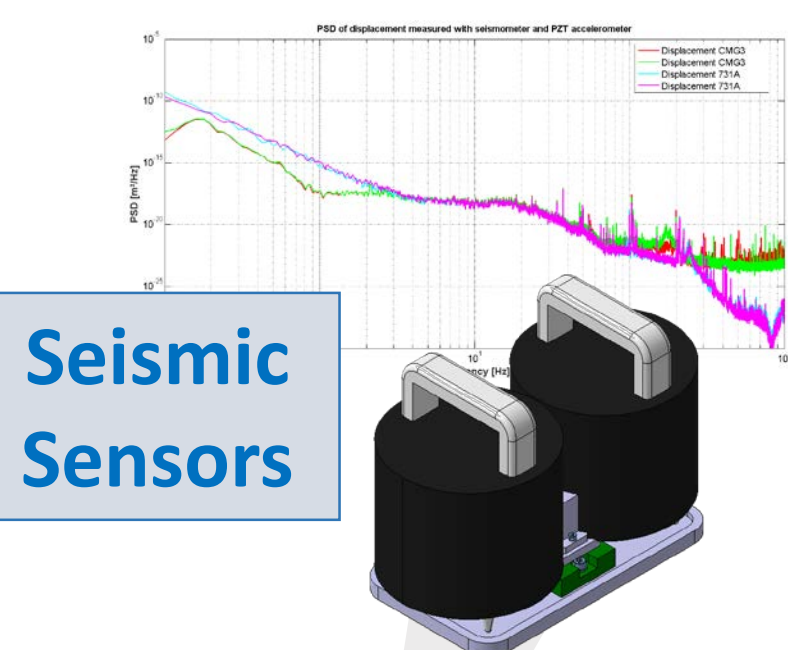


Giordana Severino

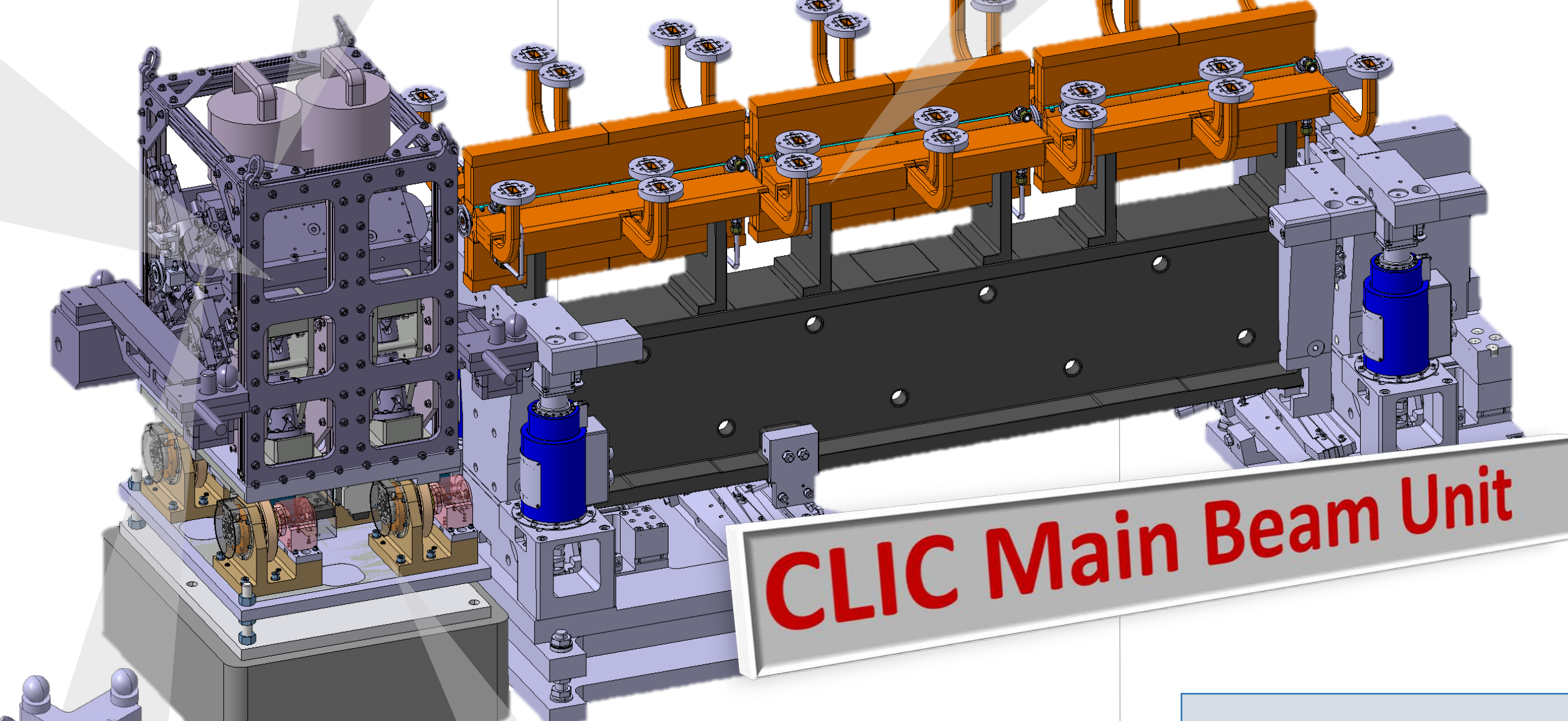


Peter Novotny

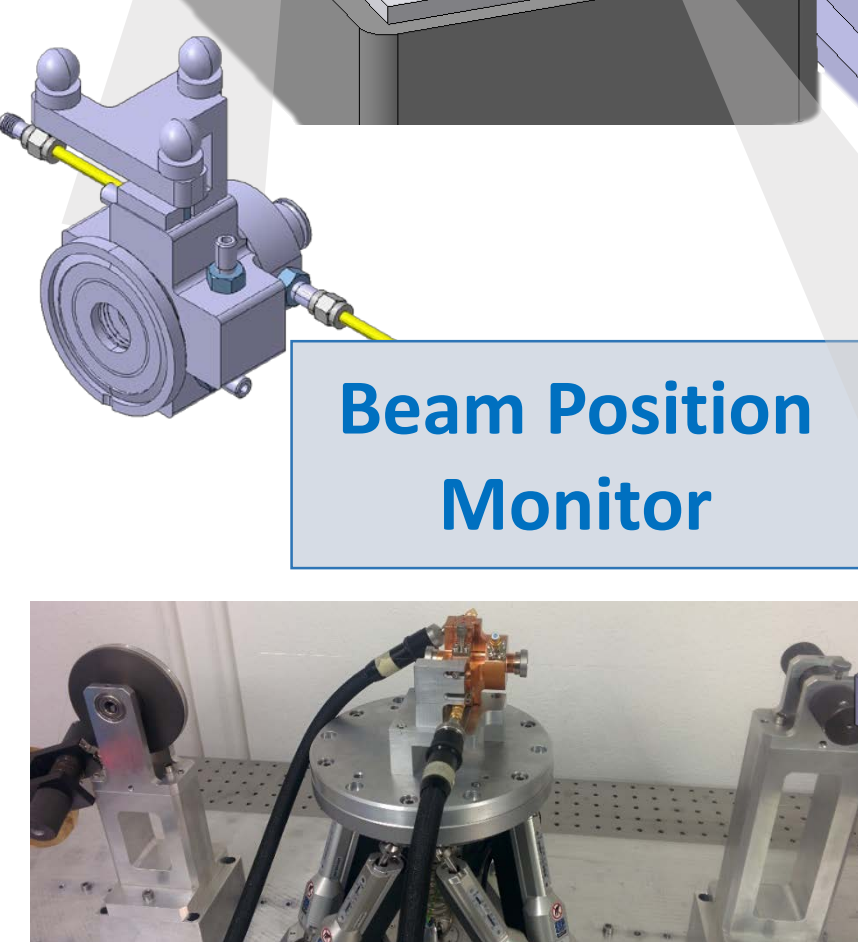
- Vibrational characterization of PACMAN bench with sub-nanometer resolution is important for precise beam position measurements
- State of the art sensors have been characterized but none fits our requirements
- New vibration sensor under development



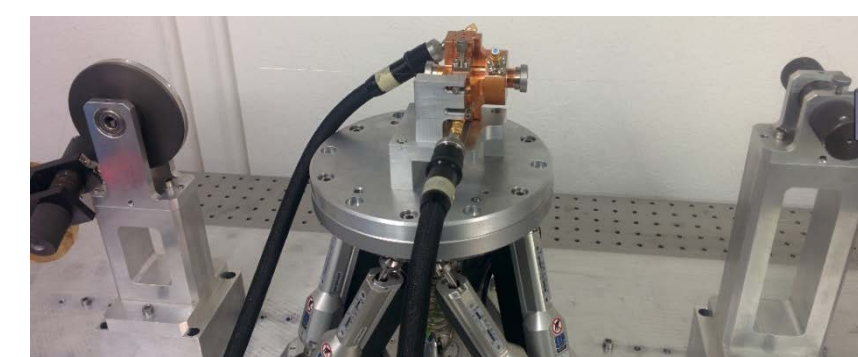
Seismic Sensors



CLIC Main Beam Unit



Beam Position Monitor



- BPM characterization on a dedicated test bench
- Electrical centre location with sub- μm resolution
- RF measurements and simulations at 15GHz
- BPM resolution demonstration (50nm by simulation)

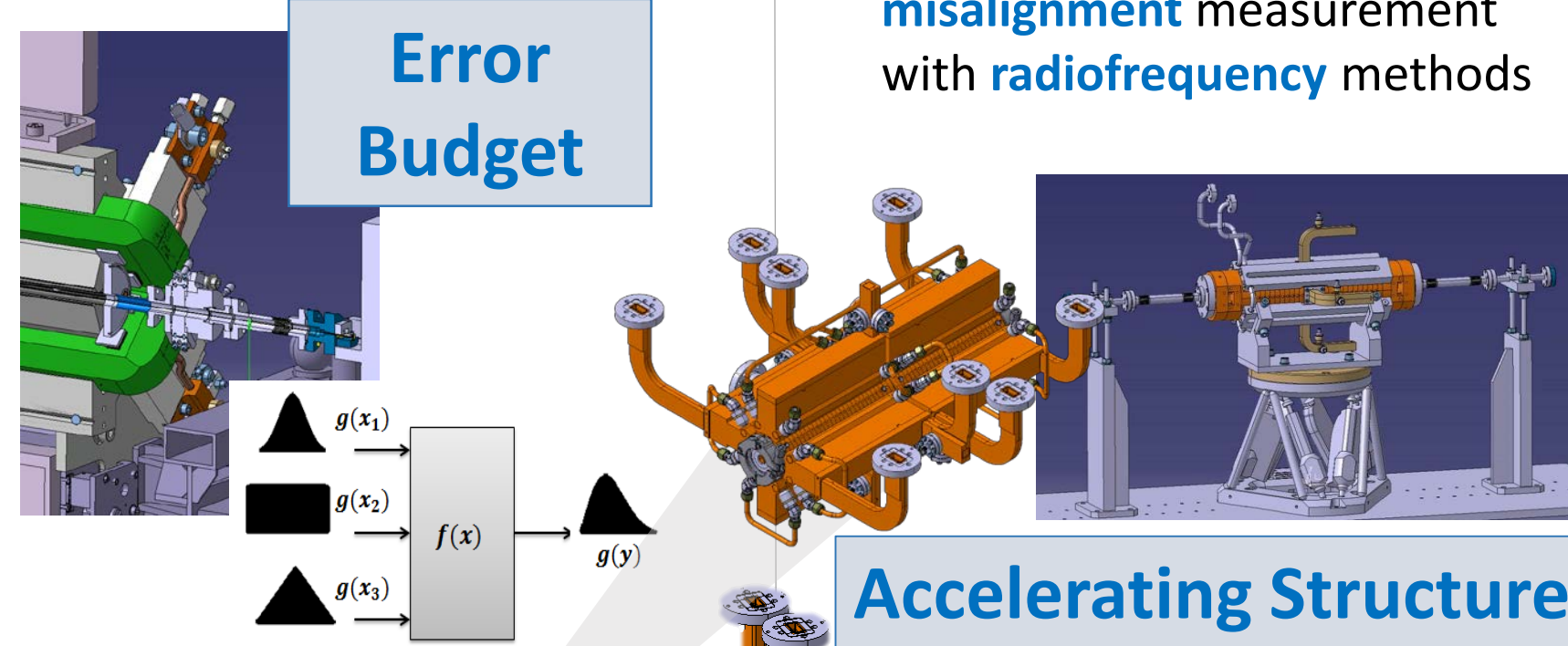


Silvia Zorzetti



Iordan Doytchinov

- Identification of error sources of the PACMAN bench.
- Error analysis and propagation to define the error budgets for the PACMAN subsystems
- Integration of subsystems into the PACMAN test bench
- Methods to minimize / compensate systematic errors.

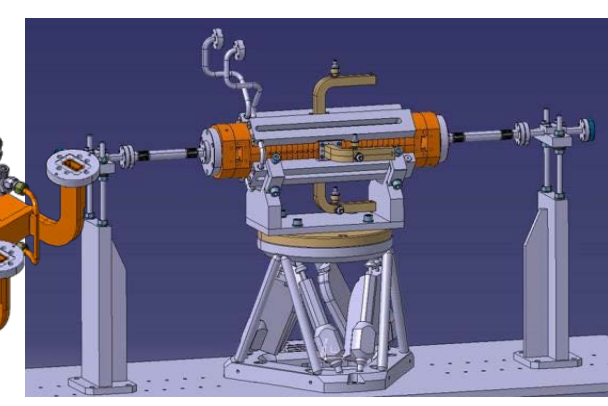


Error Budget

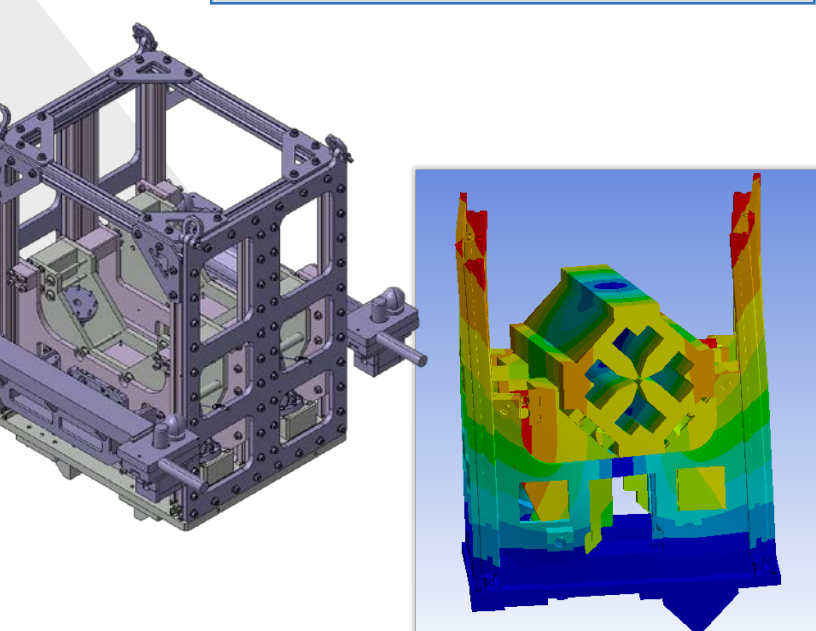


Natalia Galindo Munoz

- Accelerating Structure (AS) expected resolution of 1 μm with an error of 0.01 dB.
- Demonstration of the Wakefield Monitor (WFM) requirement to precisely align the AS with the beam, 3.5 μm resolution in a laboratory environment.
- Cell-to-cell internal misalignment measurement with radiofrequency methods



Accelerating Structure



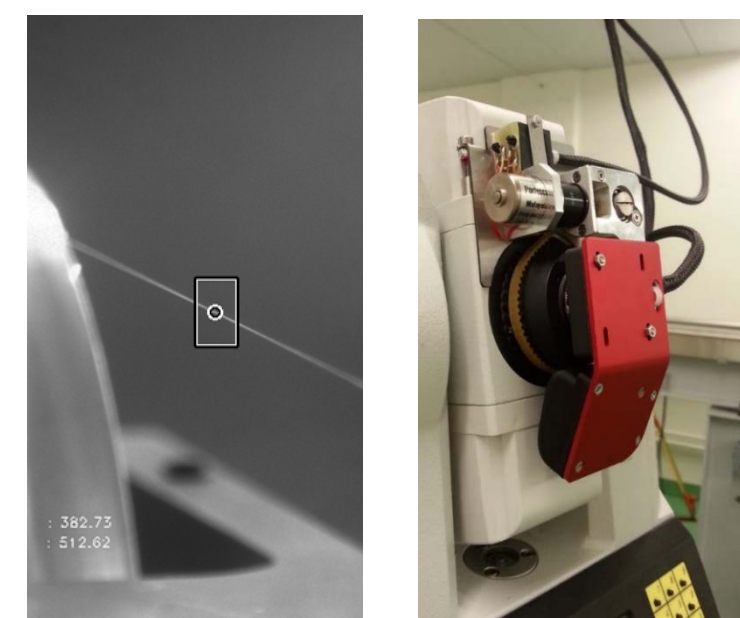
Nanopositioning

- Design of upgraded base plate to be integrated in the final PACMAN bench
- Study of long range integrated pre-alignment and nanopositioning system for the magnet (high stiffness, nanometric displacement)



David Tshilumba

Micro-triangulation



- Micrometric automatic micro-triangulation
- Based on industrial theodolites integrated with CCD cameras
- Algorithm development for stretched-wire detection and 3D reconstruction.
- Simulation of high-precision, short-range, geodetic networks.



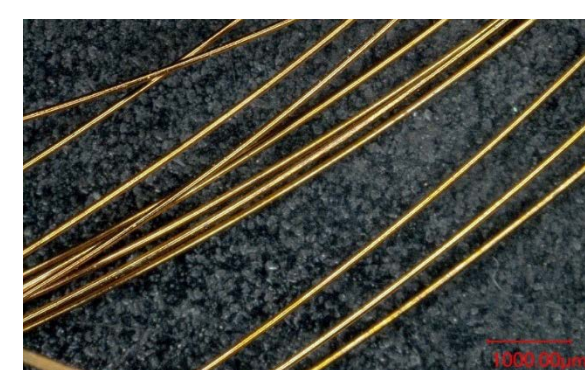
Vasileios Vlachakis



Claude Sanz

- Characterization of the reference wire
- Reference wire axis measurement
- Adaptation of non-contact sensor to coordinate measuring machine (CMM)

CMM



Frequency Scanning Interferometry



- Micrometric multilateration based on Frequency Scanning Interferometry (FSI)
- Simulations for optimum network design
- Retroreflector study for improved measurement geometry.
- Prototype development for portable utilization.



Solomon W. Kamugasa

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