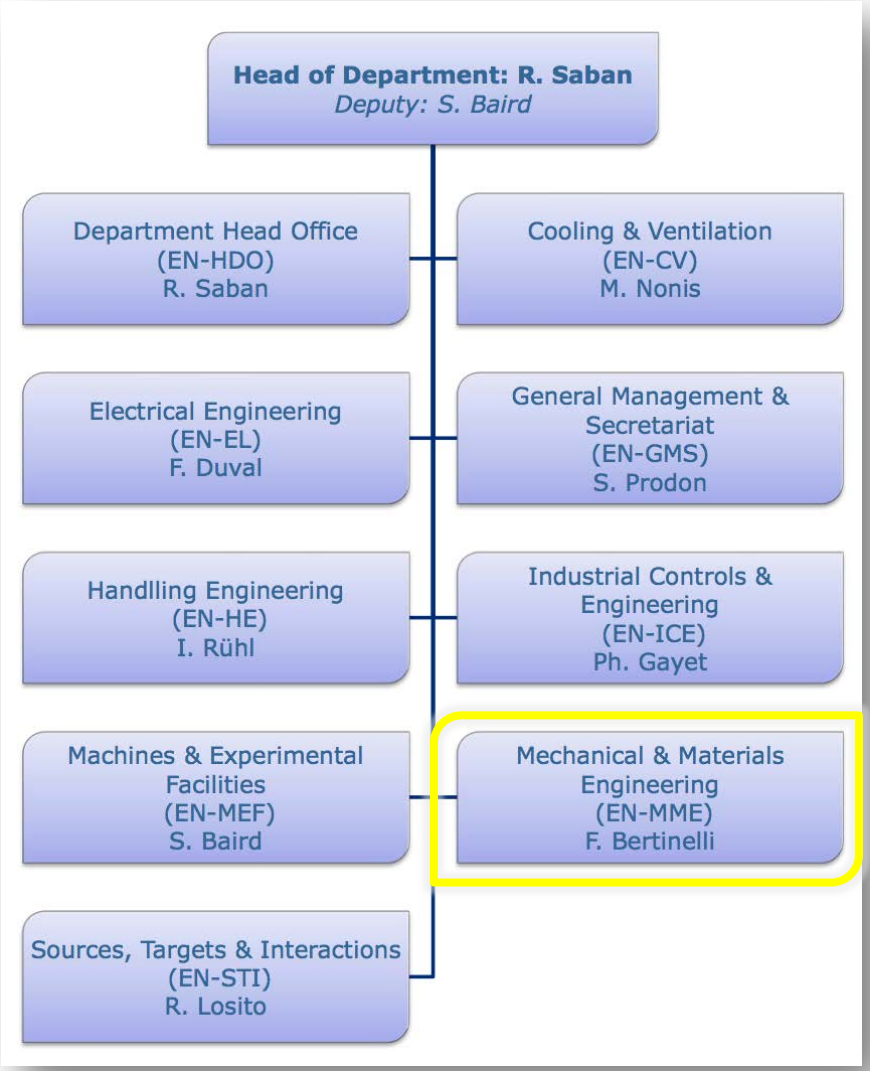
SPAIN @ CERN

27/10/2014 – CERN Geneva

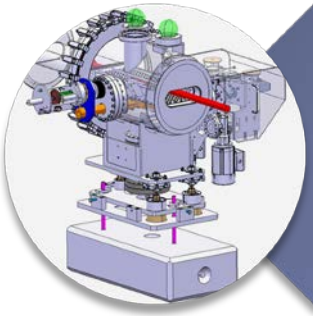
A. Dallocchio on behalf of the EN-MME-FS section

Engineering Dept. Structure



- Infrastructures
- Engineering
- Coordination
- Production

EN-MME: Mechanical & Materials Engineering Group



Engineering & Design

- Design Office:
  - 40 designers and engineers
  - CATIA / SmarTeam, ANSYS, LS-Dyna...
- Experimental Mechanics Lab.

Production

- Mechanical workshop (4000 m^2):
  - 50 technicians and engineers
  - CNC machining
  - Assembly & metal forming
  - Welding (TIG, MIG, electron beam, laser, vacuum brazing)
- Technical Subcontracting Service

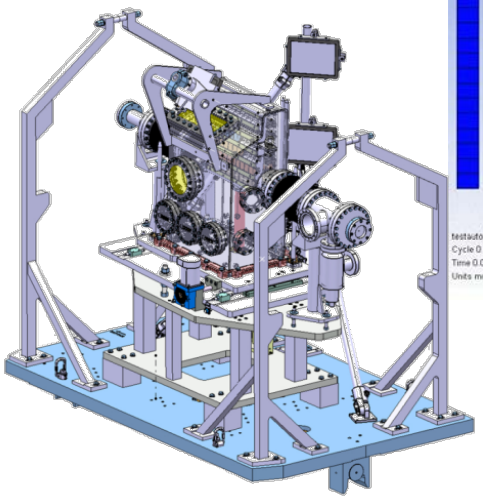
Materials & Metrology

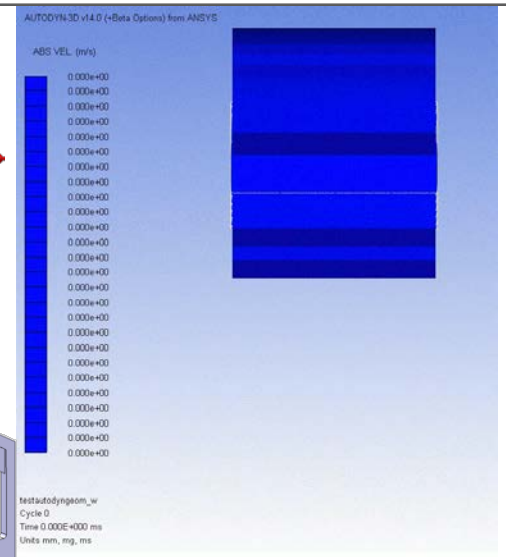
- Material science consultancy:
  - metallurgical analyses, microscopy, mechanical tests
- NDT: US, radiography, tomography
- Metrology: 350 m^2 lab. equipped with CMM.

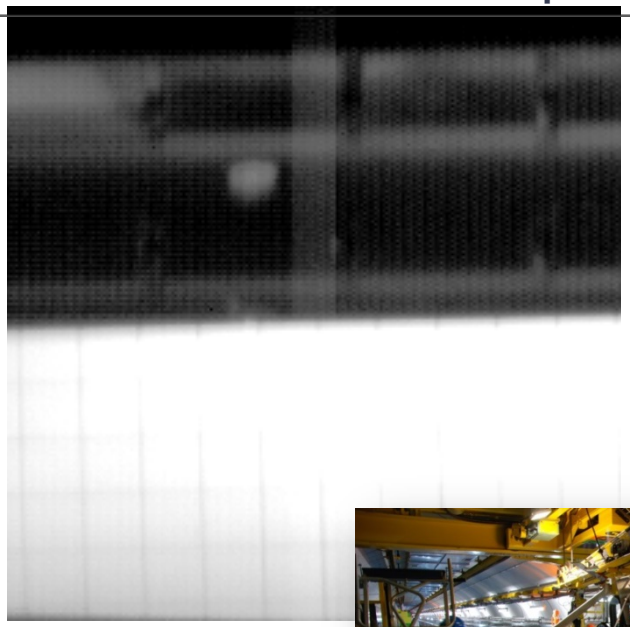
EN-MME Mandate:

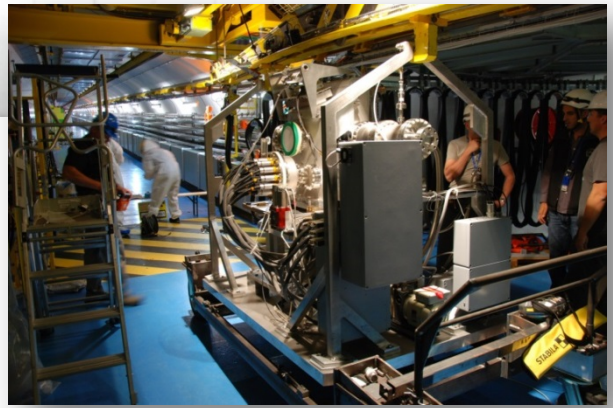
The mandate of the MME group is to provide to the CERN community specific engineering solutions combining mechanical design, production facilities and material sciences. This group owns, maintains and develops the 30 years old know-how on the mechanical construction of beam accelerators and physics detectors.

Particle Beam Impact : comparison between simulation and experiment



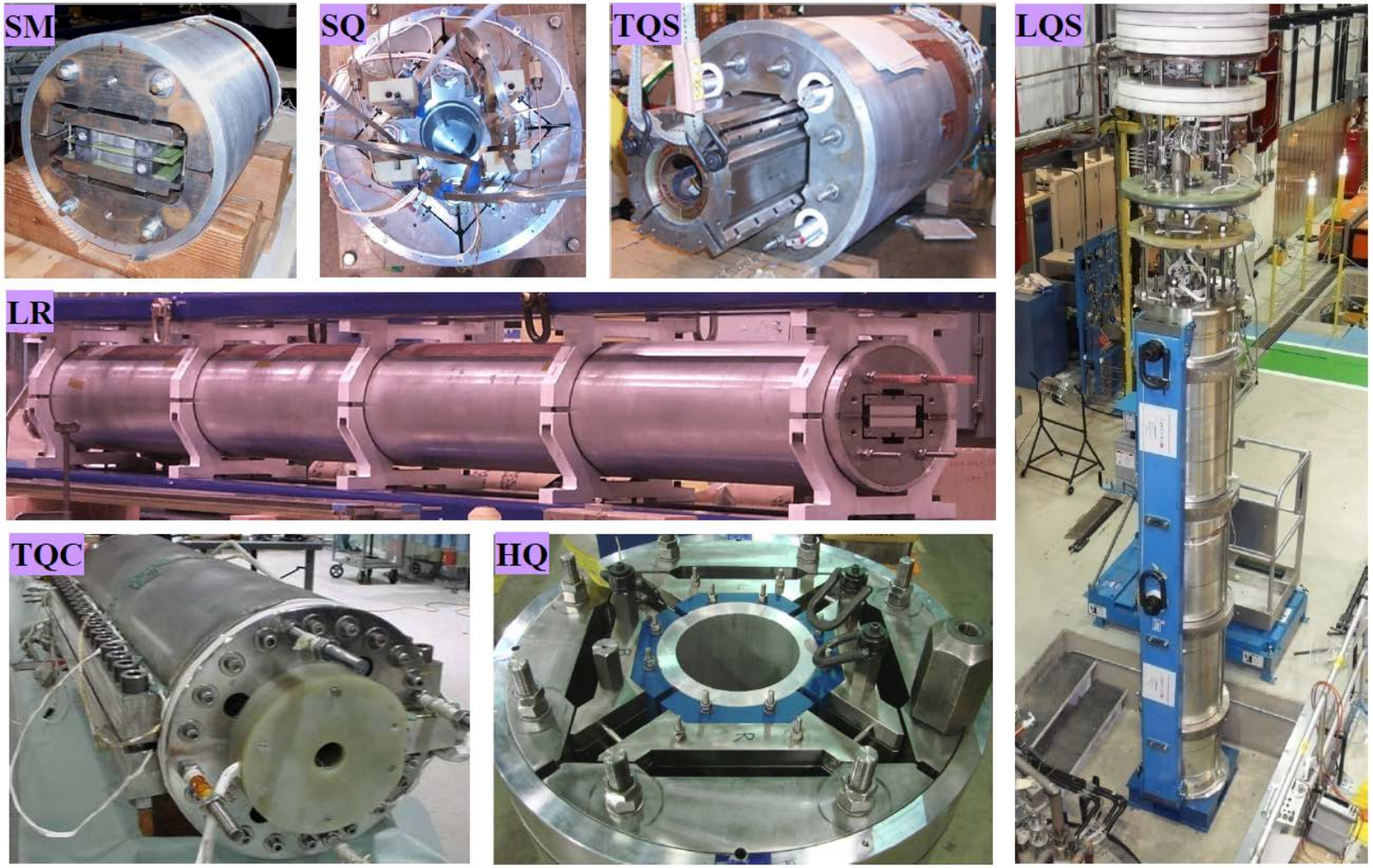




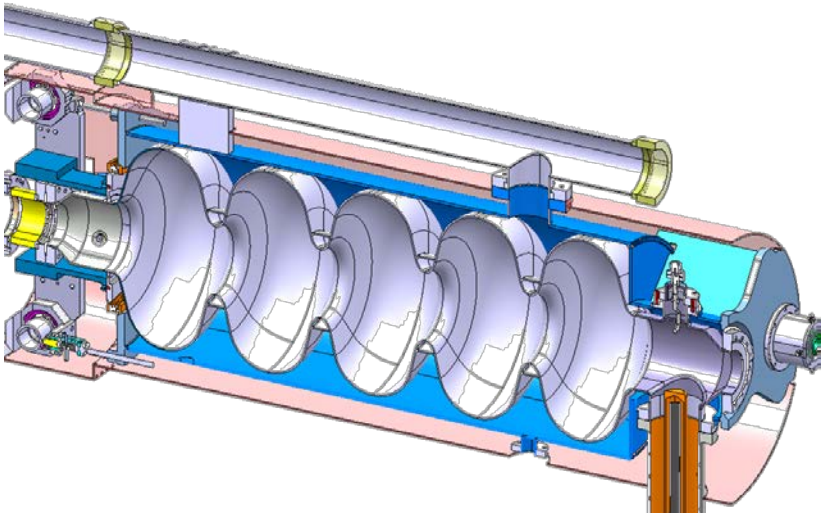


CERN | EN Engineering Department

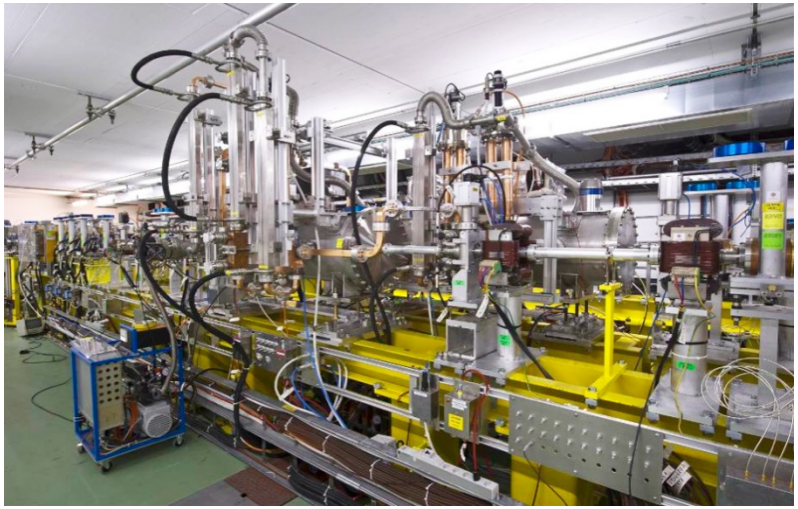
Superconducting Magnets

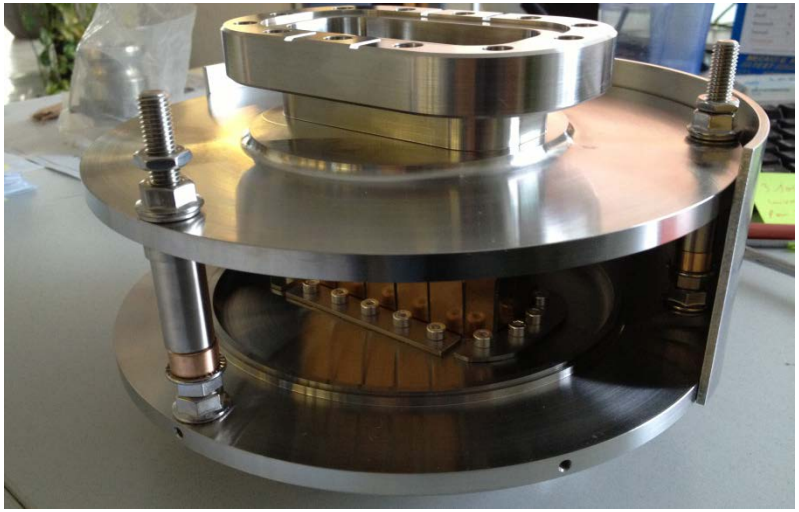


Superconducting RF Cavities



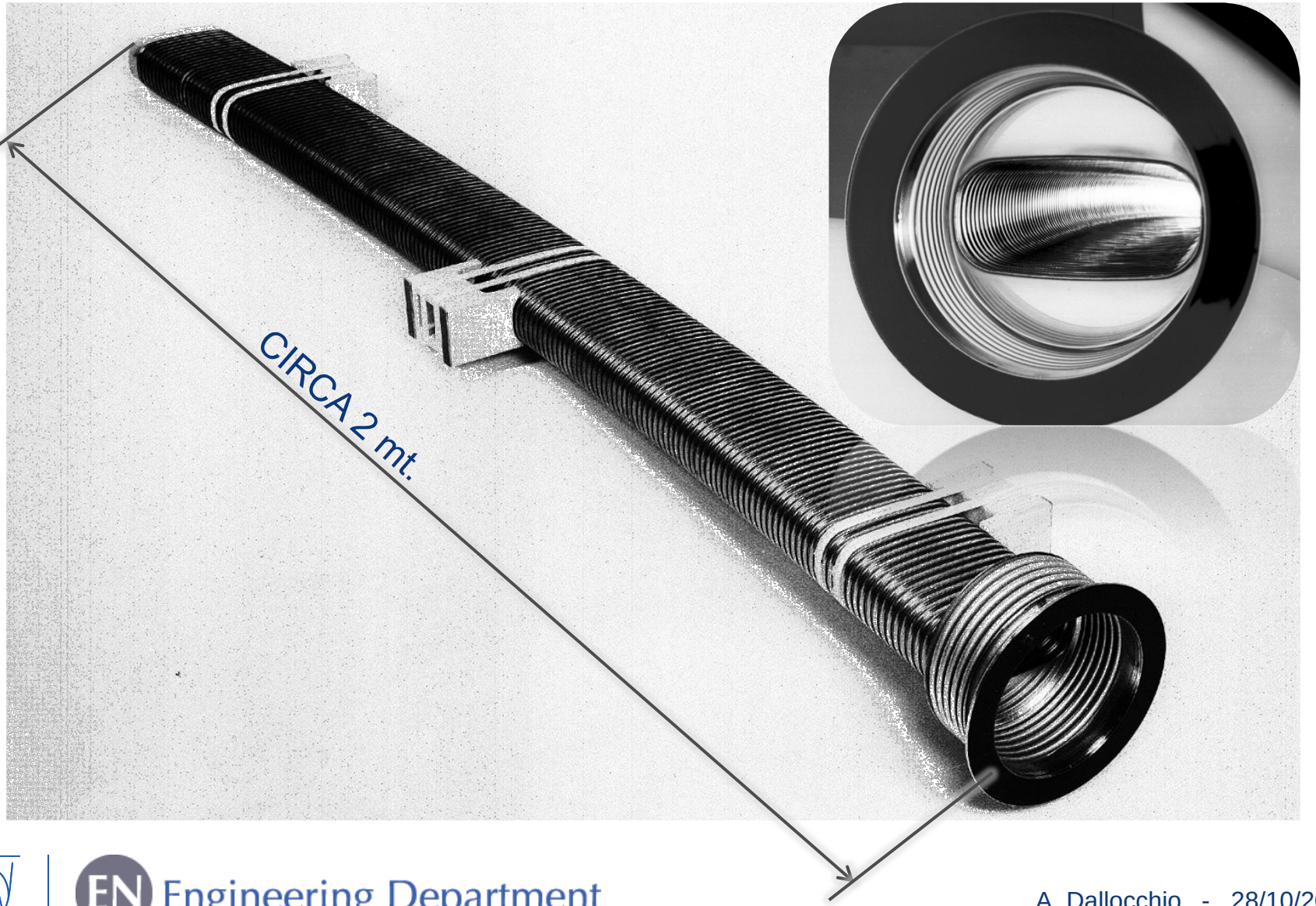
Beam Lines





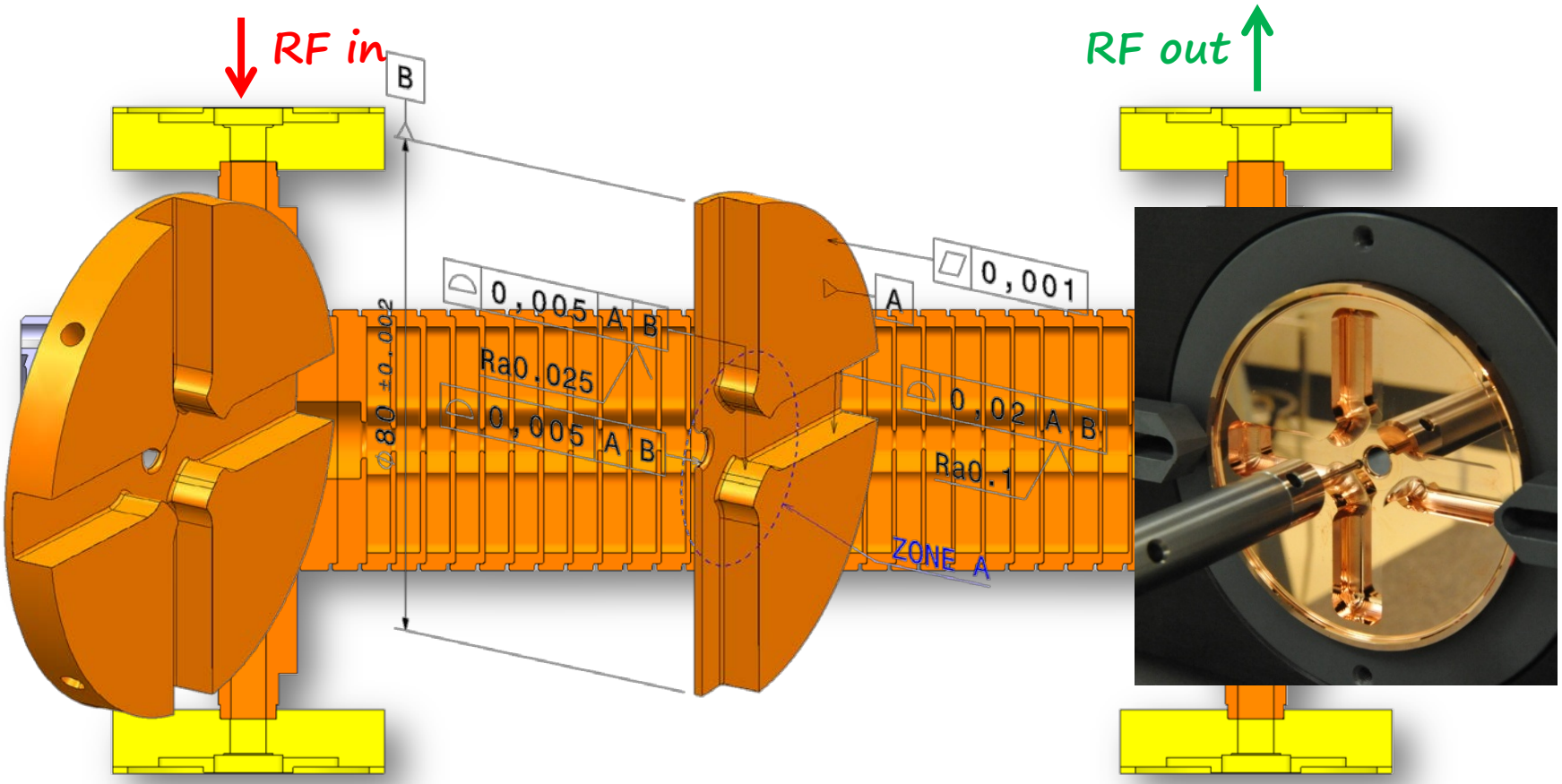
Warm RF Cavities

Vacuum Chambers



CLIC

The design involves coupled RF cavities to transfer energy from a high-current, low-energy drive beam to a low-current, high-energy beam to be used in collisions.



MME Subcontracting Service:
~1000 contracts/year in close collaboration with FP Dept.

		Réels	*Réels*	*Réels*	*Réels*		*Estimés*
		Facturé 2010	**Facturé 2011**	**Facturé 2012**	**Facturé 2013**		**Charge restante 14/01/2014**
Activités de:							
Bureau d'Etudes	(MCHF)	2.4	2.7	3.1	2.8		1.8
Soustraitance	(MCHF)	3.8	5.9	7.0	7.9		5.7
Fabrication	(MCHF)	2.6	3.5	4.3	5.7		3.7
Totale	**(MCHF)**	**8.8**	**12.1**	**14.4**	**16.4**		**11.2**

MME Subcontracting Service:
what kind of company are we looking for?

Sector	Main products	Tecnology
UHV-XHV (Vacuum)	Vacuum chambers; Flanges	TIG welding; EB welding; Vacuum Brazing
UHV-XHV (Vacuum)	Bellows;	TIG welding; EB welding;
General machining	Frame (construction steel, stainless steel and aluminium)	Welding (at least 3 meter long) Milling Painting
Precision machining (+/- 0.02)	Machined parts (construction steel, stainless steel and aluminium; Cu alloys)	Milling, turning, grinding (500x500x500mm)
Sheet metal forming		Cutting (laser, water, plasma) Welding Bending
Ceramic	Aluminium Oxide Zirconium Oxide Silicon Carbide Silicon Nitride	Machining Surface treatment
Machining	Exotic materials (tantalum, tungsten,molybdenum, carbon)	Milling, turning, grinding

Thank you for your attention

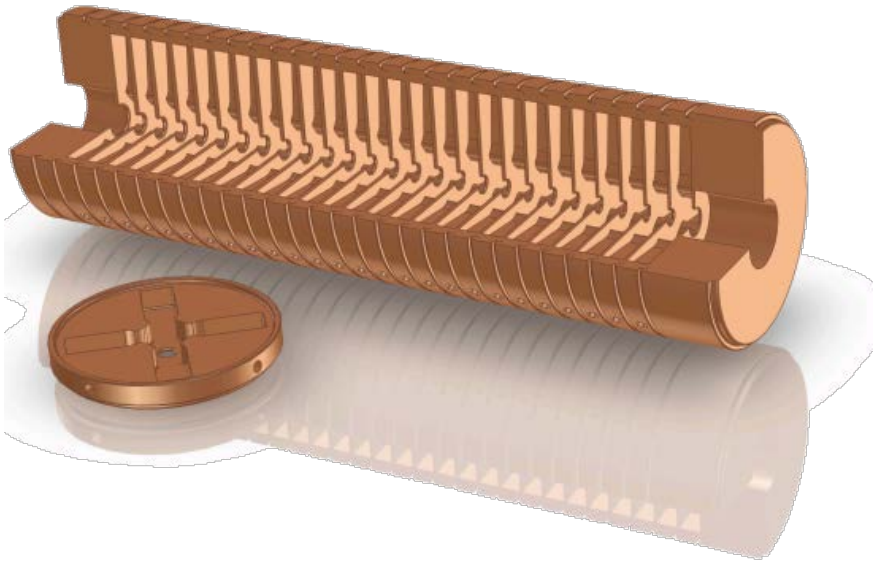
Back-up Slides

CERN Procurement Guidelines

Requests up to 1 kCHF	•1 bid by Technical Officer •Purchase Requisition (DAI)
Requests between 1 and 5 kCHF	•1 written bid by Technical Officer •Purchase Requisition (DAI) •Validated by Procurement Officer
Requests between 5 and 10 kCHF	•Price enquiry by Technical Officer or Procurement Officer •Minimum of 3 bids requested •Purchase Requisition (DAI) made to the lowest compliant bidder
Requests between 10 and 50 kCHF	•Technical specification provided by Technical Officer •Price enquiry made by Procurement Officer •3 to 5 bids requested •Purchase Requisition (DAI) made to the lowest compliant bidder
Requests between 50 and 200 kCHF	•Departmental Request •Price enquiry by Procurement Officer •3 to 5 bids requested •Purchase Requisition (DAI) made to the lowest compliant bidder
Requests between 200 and 750 kCHF	•Departmental Request •Market Survey followed by Invitation to Tender
Requests above 750 kCHF	•Departmental Request •Market Survey followed by Invitation to Tender •Finance Committee approval

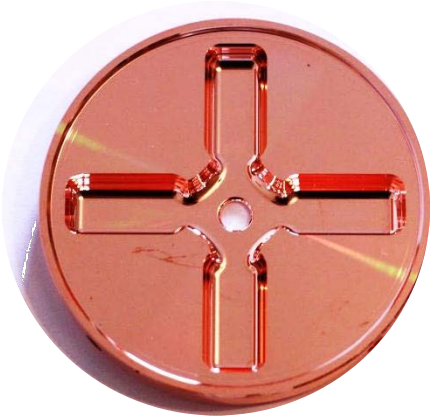
CLIC

Rough-machining
Pre-turning + 100 µm
Pre-milling + 100 µm
Tuning holes
Stress relief ~245 °C (optional)
Finish milling + 10µm
Finish turning + 10µm
Stress relief ~245 °C (optional)



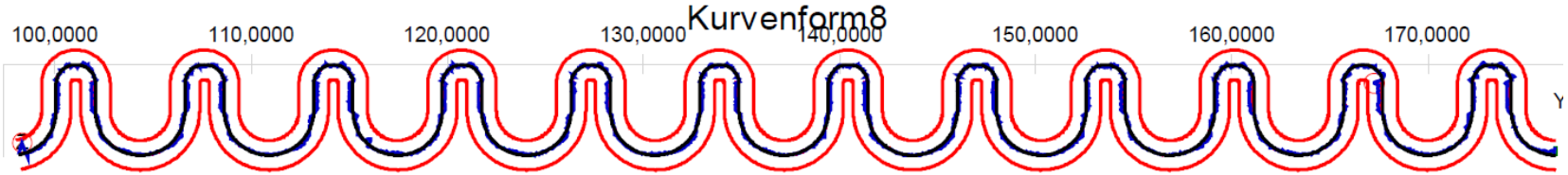
UP-machining:
Mounting of vacuum fixing
UP-turning of the support
Alignment
UP-turning ref. plan A
UP-turning opposite side
Wave guide pocket UP milling
Iris final turning (requested up to the nose)

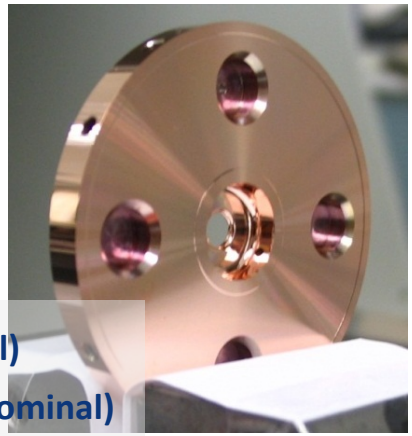
NOTES:
1. Dimensions in this drawing are at 20°C in free state.
2. Lubricant based on Chlorine or Sulfur should be avoided.
No polishing is allowed.
3. No deformations admissible due to stress release or
shocks during and after machining.
4. The product should be marked with present drawing number/column N
from the table, example CLIATCAS0059/1.
5. To be protected against scratches and marks of any nature,
burrs are not allowed.
6. The product must be individually packed inside a main delivery box.
7. * - Evaluation length is equal to (t-2*be) mm.
8. Roughness is according to ISO 1302.
9. The step up to 0.005 mm between milled and turned zones is allowed.

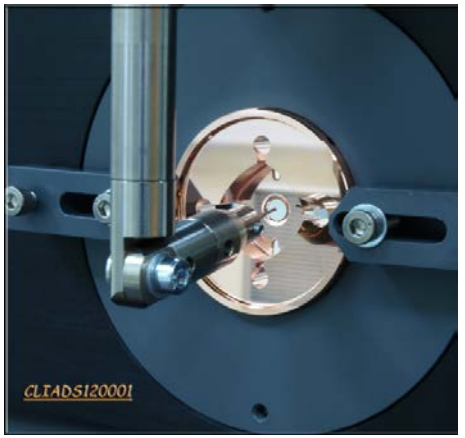


What kind of company CLIC needs

Diamond machining (turning and milling).Companies owners of an ultra-precision combined (TURNING+MILLING) machine like Precitech, Moore-Nanotech, LT- ULTRA will be preferred.
Tight tolerances: roughness of 25nm and shape accuracy of 5µm (companies used to machine optical components should be able to reach the required tolerances) NB: Polishing is not allowed.
High accuracy CMM machine with MPE less than 1µm. Contactless optical measurements. At the moment, we measure all the parts with a CMM of accuracy of 0.3+L/1000, but even if we use a low force head, we leave marks on the parts. We have to avoid an kind of marks on the parts.







- **Shape accuracy 4.8 µm (15 µm nominal)**
- **Roughness Ra 120 -180 nm (100 nm nominal)**

CLIC Metrology

Measuring Range

10.12.7 1200 x 1000 x 700 mm^3

Accuracy (according to ISO 10360)

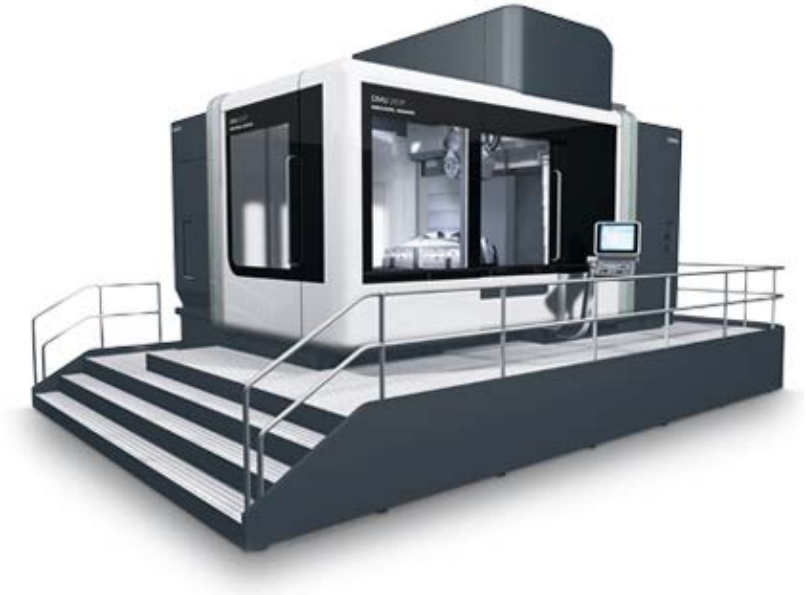
MPE E **0.3 + L/1000 µm**
MPE P **0.4 µm**
MPE THP 1.2 µm / 59s

Some References

- Modus, USA
- Sandia, USA
- Nano Precision Products, USA
- Bosch, Germany

Metrologic Principle:
"Closed frame - moving table"

MME Workshop



MME Metrology

CONTACT PROBE MACHINE
- Ferranti
- Olivetti
- Leitz Infinity

OPTICAL PROBE MACHINE
- Wegu
- Mahr

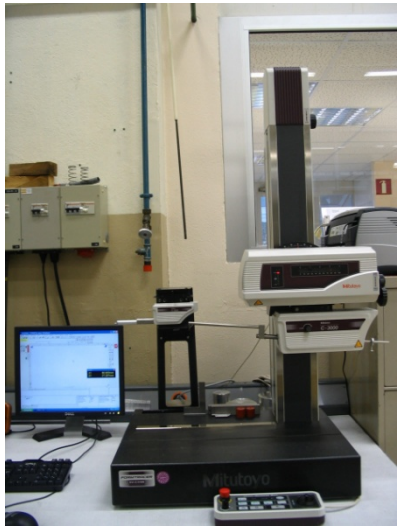
PORTABLE 3D MEASURING ARM
- Romer

ROUGHNESS – TOPOGRAPHY – PROFILE
- MITUTOYO SJ 301 (Portable)
- MITUTOYO FORMTRACER SV-C3100 H4

NON-CONTACT INTERFEROMETRY
- VEECO NT 3300

OTHER MEASURES
- Linear measurements, straightness, flatness, squareness, …

PROFILE PROJECTOR
- BATY R770



MME Metallurgy

Scanning Electron Microscopy
- LEICA STEREOSCAN 360
- LEO (Zeiss) 430

Optical Microscopy
- LEICA Q600 (Quantimet) Image Processing
- LEICA MZ 16 Stereomicroscope

Mechanical Testing
- UTS 200, Tensile Testing at room temp.
- UTS 200, Tensile Testing at 1.9 K.
- Macro Hardness testing
- Micro hardness testing

Siemens D-5000 X-RayDiffractometer

Non-destructive Testing
- Ultrasonic Test (USIP)
- USN60
- USOUND (immersion)
- Radiography

Ultrasonic swinger device