

MME Mechanical
& Materials Engineering

Engineering Department

EN

The EN/MME Group

Diego Perini – EN/MME

19 May, 2015

A&T Sector : Accelerators and Technology

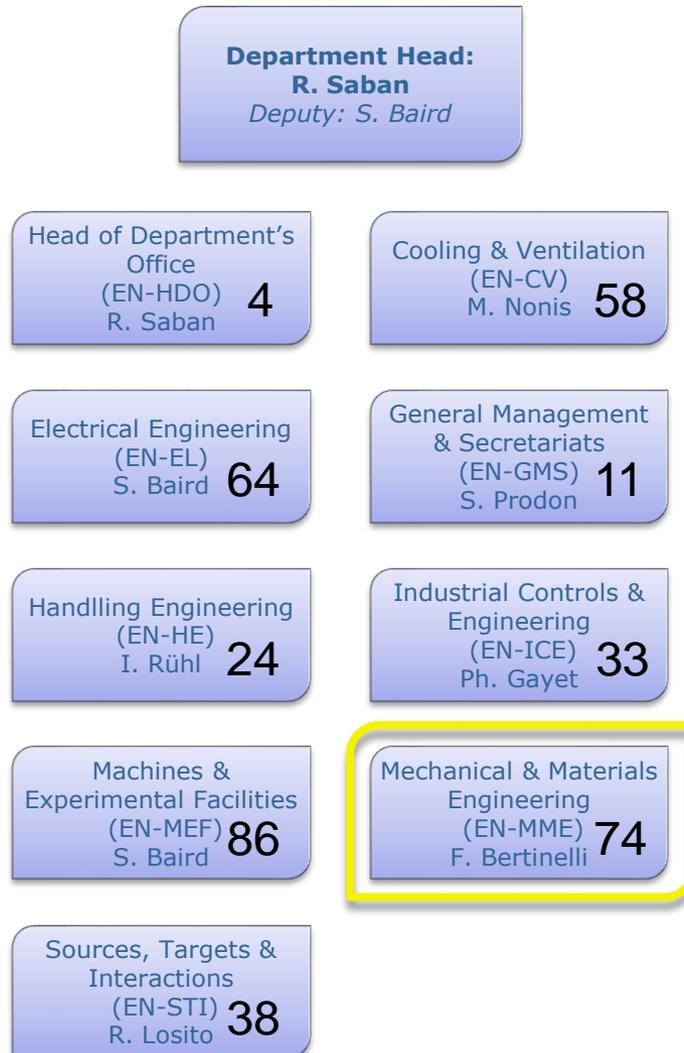
Directorate in 2014

Director-General	Rolf Heuer
Director for Research and Computing	Sergio Bertolucci
Director for Accelerators and Technology	Frédéric Bordry
Director for Administration and General Infrastructure	Sigurd Lettow

Heads of departments in 2014

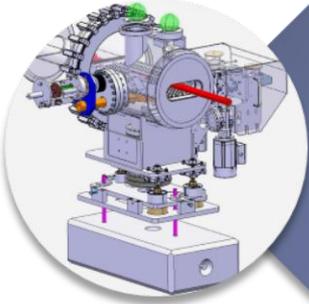
Beams – BE	Paul Collier
Engineering – EN	Roberto Saban
Finance, Procurement and Knowledge Transfer – FP	Thierry Lagrange
General Infrastructure Services – GS	Lluís Miralles Verge
Human Resources – HR	Anne-Sylvie Catherin
Information Technology – IT	Frédéric Hemmer
Physics – PH	Livio Mapelli
Technology – TE	José Miguel Jiménez

EN : Engineering Department



- Operation
 - Infrastructure
 - Accelerators
 - Experimental Areas
- Projects
 - Consolidation
 - Upgrades
 - New facilities
 - Design & Manufacturing
- Studies

MME : domains of activities



Engineering & Design

- Internal Design Office facilities, 40 designers (Staff and Industrial Support)
- CATIA / SmarTeam, ANSYS
- Mechanical measurements lab



Fabrication

- Machining & Maintenance
- Preparation & Subcontracting
- Assembly & Forming

- 4000 m² of internal workshop facilities, 50 technicians (Staff and Industrial Support): CNC machining, sheet metal work & welding, electron beam & laser, vacuum brazing
- External subcontracting service
- Free access Users workshop



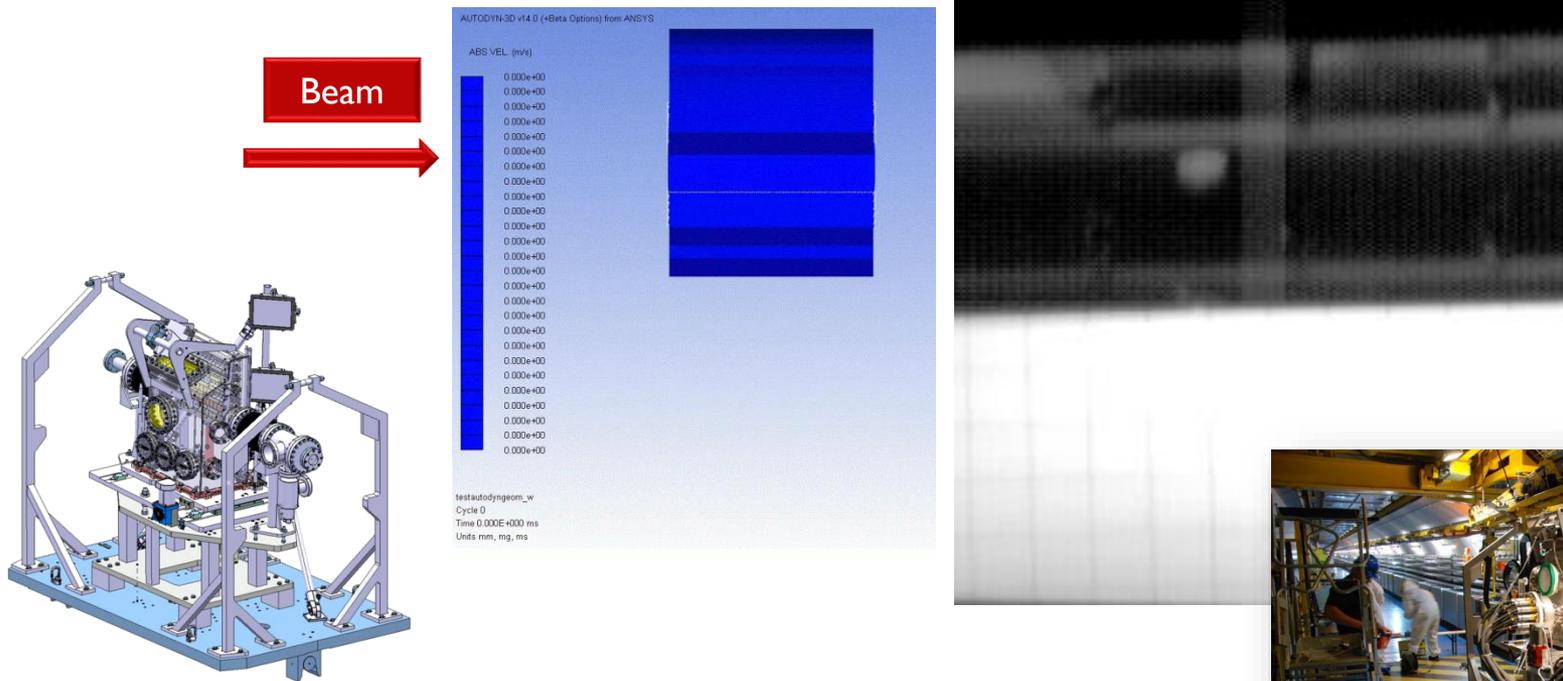
Materials & Metrology

- Material selection, analysis & metallurgy: microscopy, mechanical testing
- NDT: US, radiography, tomography
- 350 m² of internal metrology facilities

MME in one image

Mandate: provide to the CERN community specific **engineering solutions combining mechanical design, production facilities and material sciences.** The group owns, maintains and develops the know-how on the mechanical constructions in accelerators and physics detectors.

Inermet : comparison Autodyn (SPH) between simulation and experiment

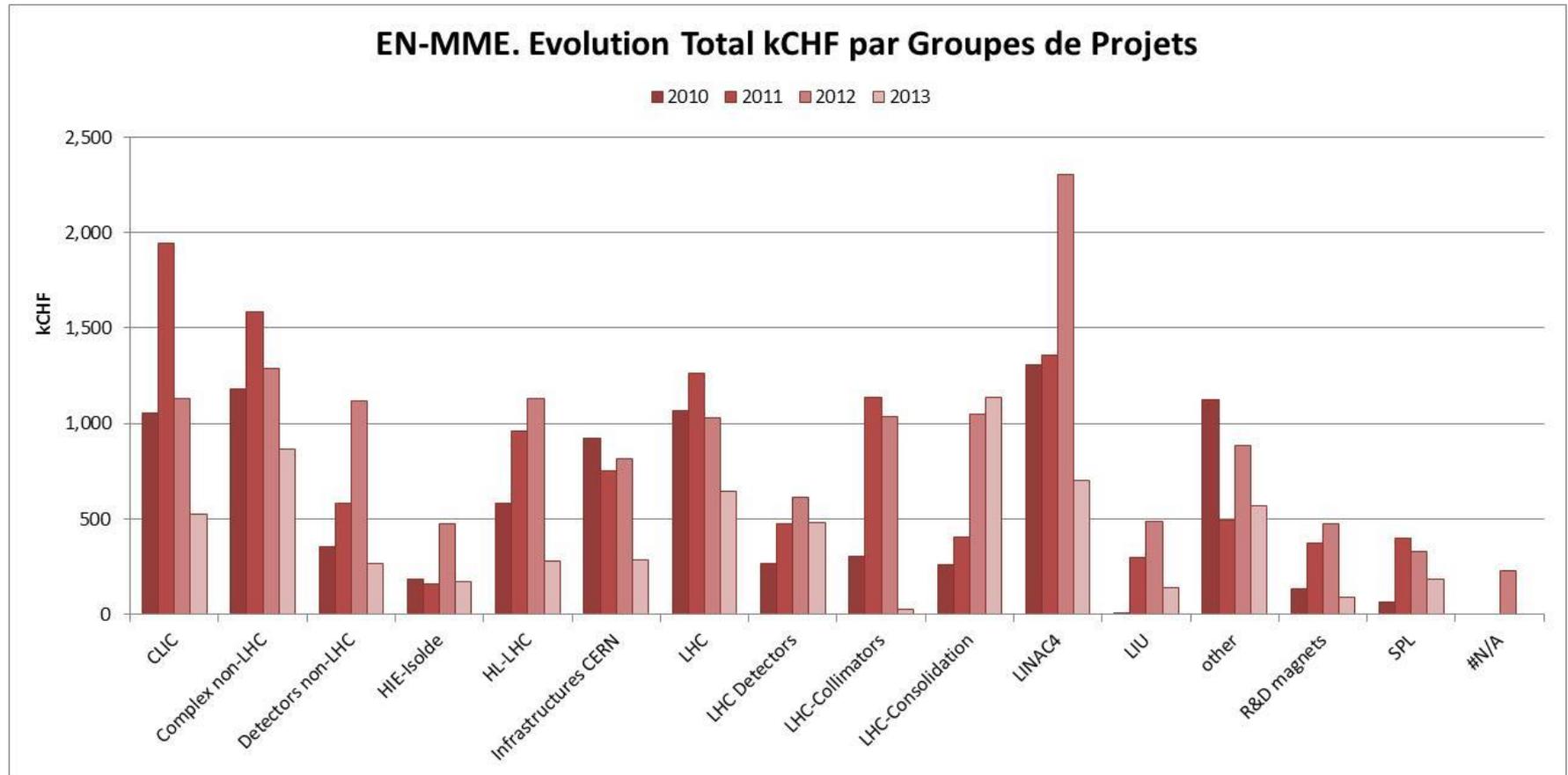


MME au 15 Janvier, 2015

	Staff	Fellows etc.	Industrial Support	total	Staff/total
Group Leadership	2			2	100%
Assistant	1			1	100%
Organisation and Quality	1	1	1	3	33%
Design Engineering	6	8		14	43%
Design Office MME	15		26	41	37%
Design Office non-MME			8	8	0%
Mechanical measurements	1	4	2	7	14%
Preparation fabrication	4.5			4.5	100%
Mecanique, CNC	16	1	8	25	64%
Tolerie-Soudure	8	2	11	21	38%
FE / Laser	3	1		4	75%
Brasage sous vide	1.5	1	1	3.5	43%
Soustraitance	3.5		2	5.5	64%
Machine maintenance and conformity	1		5	6	17%
Atelier Libre	1			1	100%
Metallurgie	5	4		9	56%
Controles NDT	2.5		1	3.5	71%
Metrologie	3	2	3	8	38%
15 January, 2015 total	75	24	68	167	45%
	45%	14%	41%	100%	

Jan. 2012: ~145
 Jan. 2013: ~165
 Jan. 2014: ~175

MME contributes to projects CERN-wide

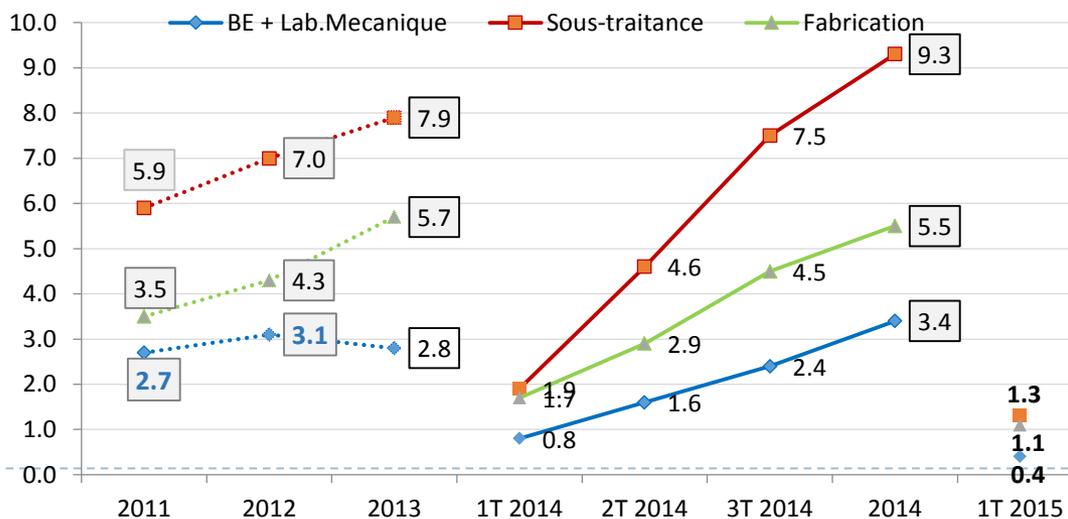


	2011	2012	2013	1T 2014	2T 2014	3T 2014	2014
BE + Lab.Mecanique	2.7	3.1	2.8	0.8	1.6	2.4	3.4
Sous-traitance	5.9	7.0	7.9	1.9	4.6	7.5	9.3
Fabrication	3.5	4.3	5.7	1.7	2.9	4.5	5.5
TOTAL	12.1	14.4	16.4	4.4	9.1	14.4	18.2

Service de:		Fermés 2010	Fermés 2011	Fermés 2012	Fermés 2013	Facturés jusqu'au 12/01/2015
						2014
Bureau d'Etudes + Lab. Mécanique (88449+88422)	(no. jobs)	102	86	80	79	209
Soustraitance (88639, 88693, 88695)	(no. jobs)	526	772	920	1,094	1,001
Fabrication (88629, 88690, 88699, 88719, 88729)	(no. jobs)	1,397	1,612	1,475	1,440	1,593
Totale	(no. jobs)	2,025	2,470	2,475	2,613	2,803

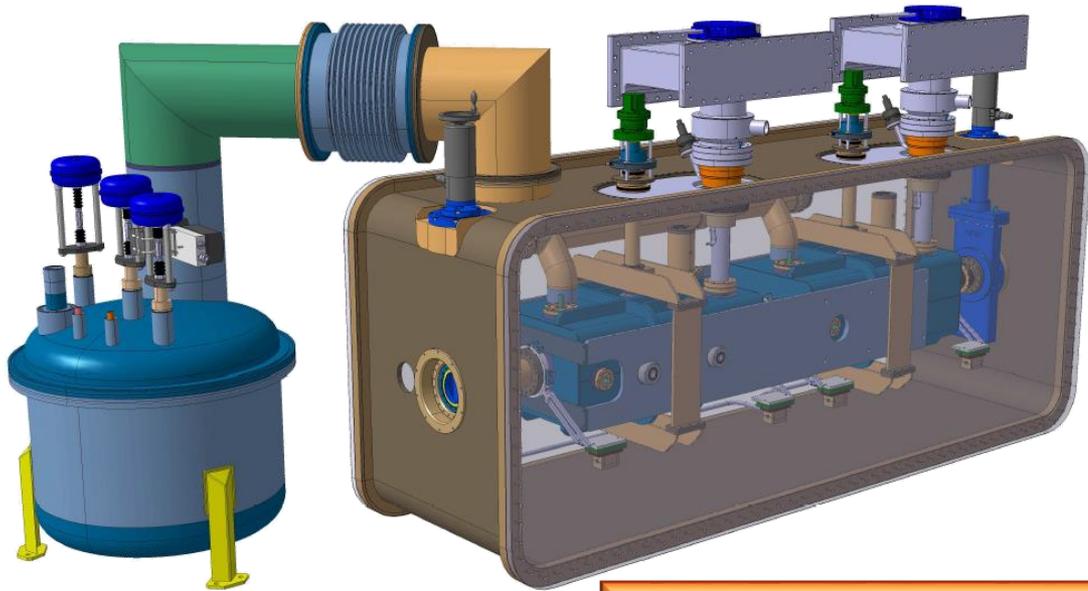
Evolution by activities (MCHF)

Ref:Date de création de facture

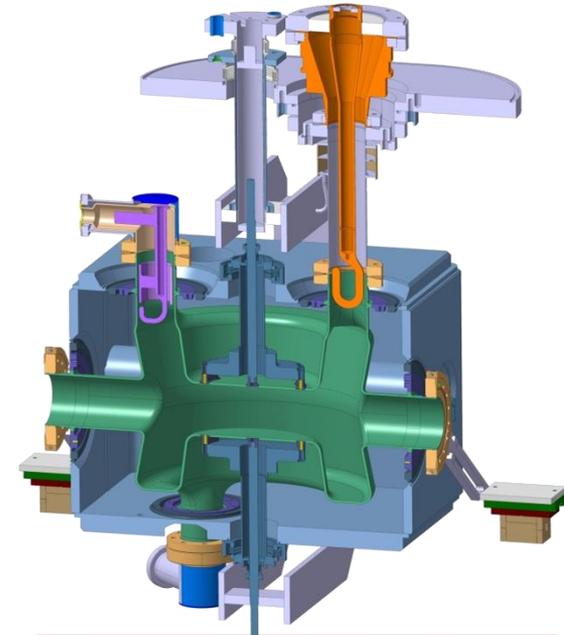


Design & fabrication HL-LHC Crab cavities

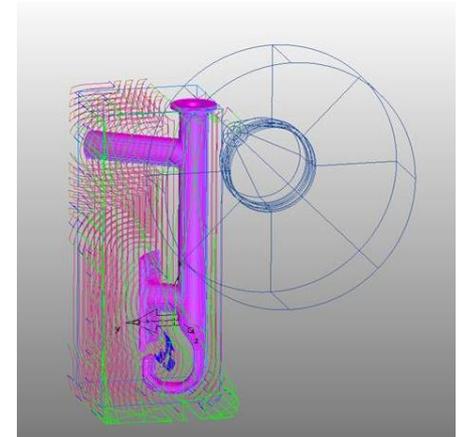
- Development of Crab RF cavities in bulk niobium and corresponding cryomodule for validation tests with beam in SPS, prior LS2
- MME developments in close collaboration with BE/RF, EN/MEF, TE/VSC, TE/CRG and US and UK Institutes



Two crab cavities cryomodule and service module for SPS tests



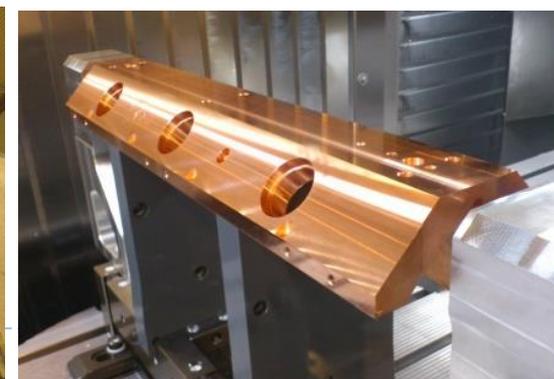
Crab RF cavity equipped with ancillaries



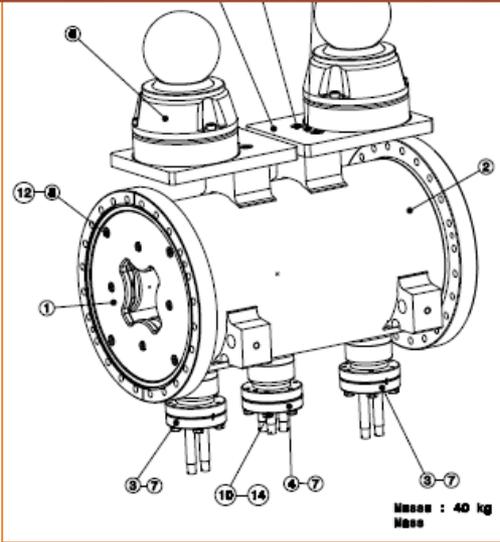
CNC program for the machining of complex shapes in niobium

MME internal fabrication multi-activity

- Aluminium vacuum chambers (ATLAS VJ, NA62)
- First PIMS Linac4 tuning and assembly
- ATLAS condenser repair
- GIF: gas piping installation (5.5 km, 846 welds)
- BASE vacuum chamber
- HF-RFQ ...



ELENA – Series production of electrostatic quadrupoles (x60). Synergy between EN-MME Workshop and NO-RS industrial suppliers.



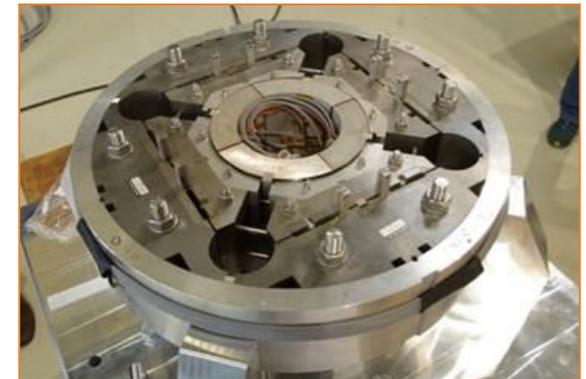
MME subcontracting

- 9 MCHF
- Strong contribution to multi-activity jobs with internal fabrication
- Specific efforts to identify new partners and improve return to poorly balanced states (Serbia, Norway, Denmark, Greece)

HIE-ISOLDE Thermal Shield. Produced by EN-MME (Design TE-MS). Ni-Plating in collaboration with FR firm



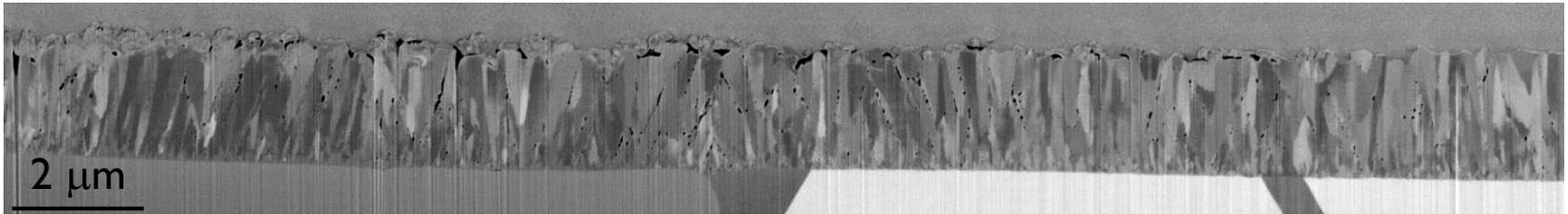
CERN		1373803	0.0	APPROVED
Engineering Department		33016196		
Brazing Procedure Qualification Record				
BPQR (QMOB)				
N° B-2014-01				
DOCUMENT PREPARED BY: Paula Trigoles Perreault	DOCUMENT CHECKED BY: Andreas G. G. G. G.	DOCUMENT APPROVED BY: Eliot Ferra		



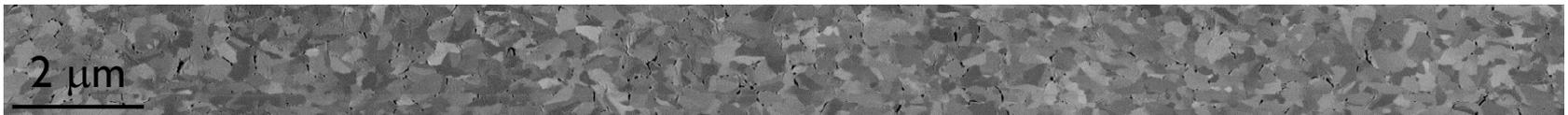
HL-LHC: new SQXF large aperture quadrupole short prototype. Production managed by MME-FS (RO-IT-FR-UK Suppliers)

MME: advanced investigation techniques

3D tomography, Nb coating on Cu substrate for HIE-ISOLDE

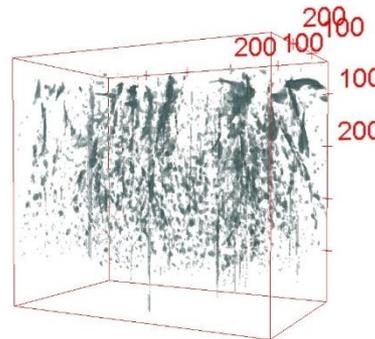


Orthoslice view



courtesy M. Cantoni /EPFL and B. Bartova /EN-MME

New perspectives: **Focus Ion Beam Scanning Electron Microscopy (FIB-SEM)** in collaboration with EPFL



Pore reconstruction in a volume of Nb coating ⇒



Thank you for your attention !