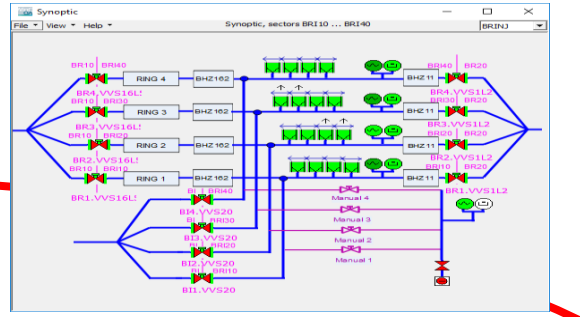
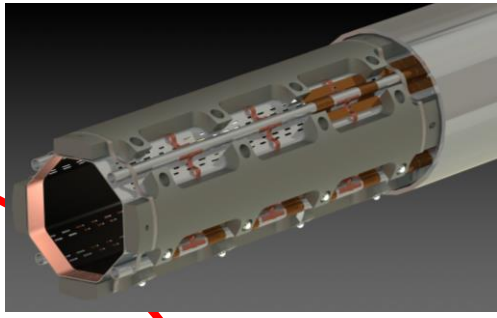
Vacuum Technology at CERN

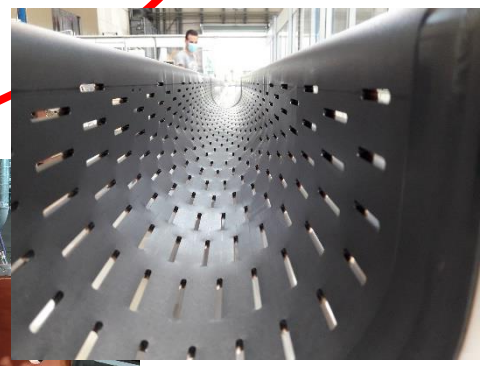
Operation
Maintenance
Consolidation



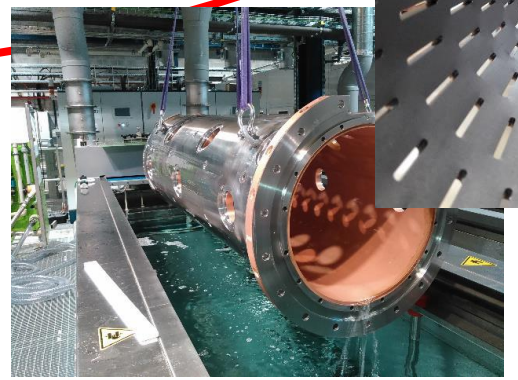
HL-LHC triplet BS



HL-LHC Project



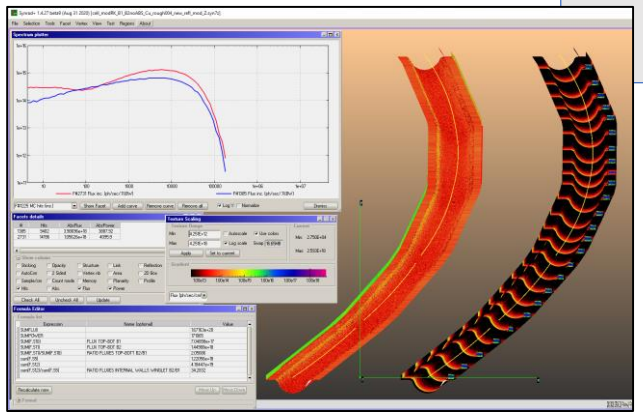
a-C coated RF shield of TDI



DTL tanks for ESS

Services for the Physics Community

Studies

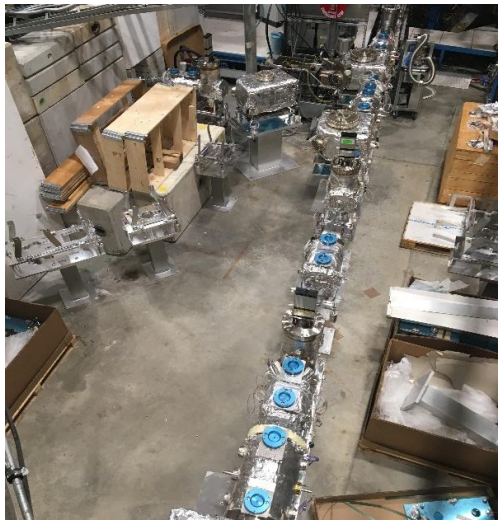


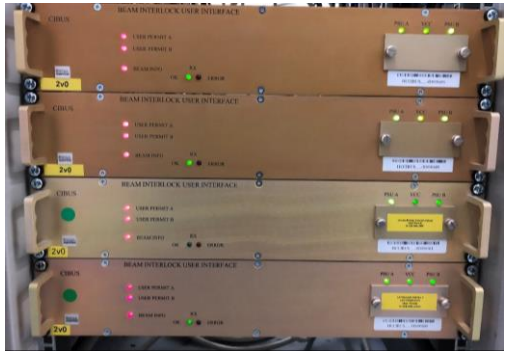
FCC-ee photoadsorbers positioning

Collaborations

Vacuum of CERN's accelerators

Machine	Type	Year	Energy	Bakeout	Pressure [mbar]	Length
Linacs, Booster, ISOLDE, PS, n-TOF and Antimater						**2.6 Km**
Linac 4	linac	2018	160 MeV	ion pumps	10^{-7}	40 m
ISOLDE	electrostatic	1992	60 keV	_	**10^{-6}**	150 m
REX-HIE ISOLDE	linac	2001-2016	5.5 MeV/u	partly	10^{-7}-10^{-12}	50 m
MEDICIS		2017	_	_	10^{-6}	10 m
Linac 3	linac	1994	4.2 MeV/u	ion pumps	10^{-8}	30 m
LEIR	accumulator	1982/2005	72 MeV/u	complete	10^{-12}	78 m
PSB	synchrotron	1972-2020	1-2 MeV	ion pumps	10^{-9}	157 m
PS	synchrotron	1959	26 GeV	ion pumps	10^{-9} -10^{-10}	628 m
AD	decelerator	1999	100 MeV	complete	10^{-10}	182 m
ELENA	decelerator	2016		complete	**10^{-12}**	31 m
PS to SPS TL	transfer lines	1976	26 GeV	_	10^{-8}	1.3 km
SPS complex						**15.7 Km**
SPS	synchrotron	1976	450 GeV	extractions	10^{-9}	7 km
SPS North Area	transfer line	1976		_	10^{-3}-10^{-8}	1.2 km
SPS HiRadMat		2011		_	10^{-8}	1.4 km
SPS to LHC TL		2004/06		_	10^{-8}	2 x 2.7 km
AWAKE	wakefield acc	2017		_	10^{-8}	730 m
LHC						**109 Km**
LHC Arcs (Beam vacuum)	collider	2007	2 x 7 TeV	_	<10^{-8}	50 km
LHC Arcs (insulation vacuum)				_		50 Km
LSS RT separated beams				complete	<10^{-10}	2 x 3.2 km
LSS RT recombination						570 m
Rxperimental areas						180 m
Beam dump lines TD62/68	transfer lines	2006	7 TeV	_	10^{-8}	2 x 720 m
				High Vacuum		**≈ 12**
				UHV-XHV		**≈ 65**
				Insulation vacuum		**≈ 50**
						≈ 127 km



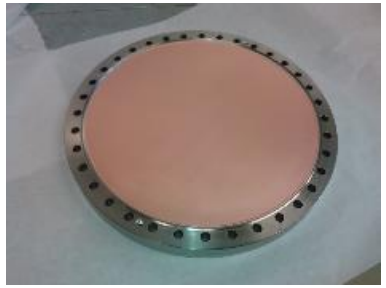


Services for the Physics Community
Chemical surface treatments

The new CERN's workshop for chemical surface treatments and printed circuit boards

Services for the Physics Community
Chemical surface treatments

The new CERN's workshop for chemical surface treatments and printed circuit boards



Services for the Physics Community
Chemical surface treatments

The new CERN's workshop for chemical surface treatments and printed circuit boards

Thinning to 150 μm of the VELO LHCb RF box window

Chemical polishing of Nb crab cavities

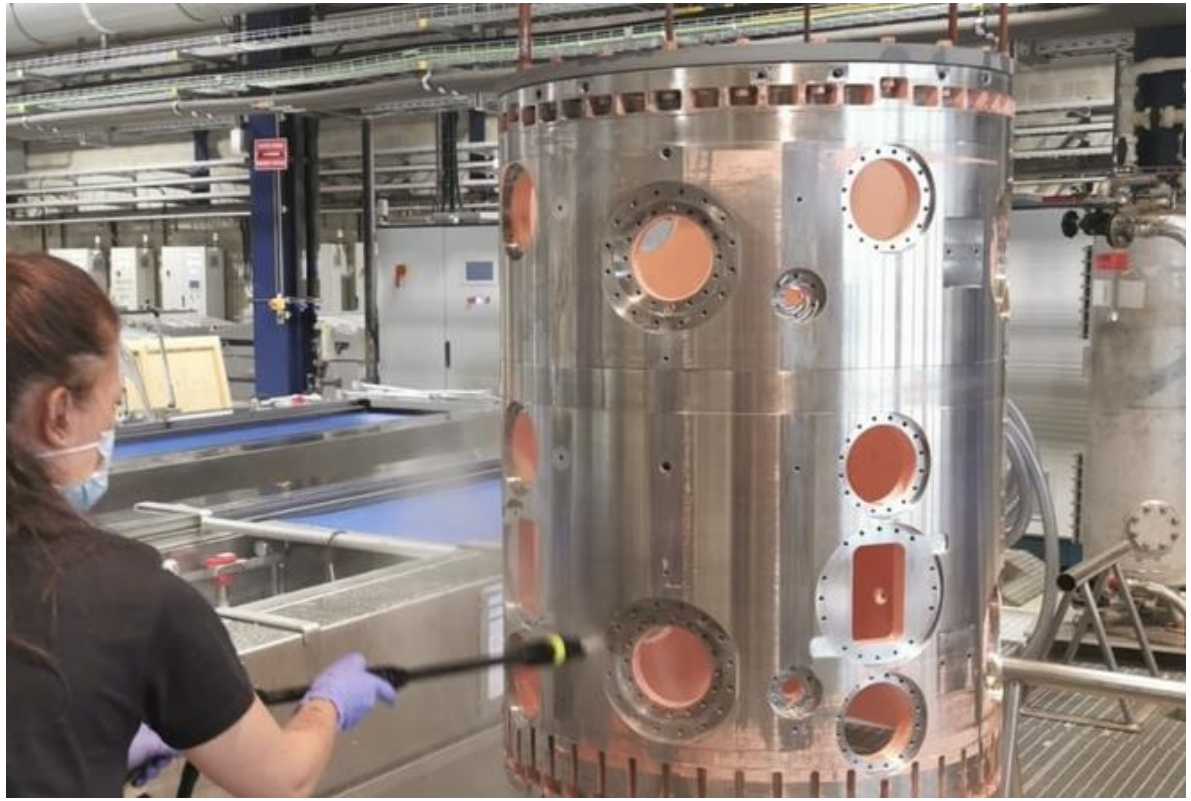
Electroplating of Cu, Ag, Rh, Pd, Ni and Au

Services for the Physics Community
Chemical surface treatments

SPES RFQ for INFN

Just after plating

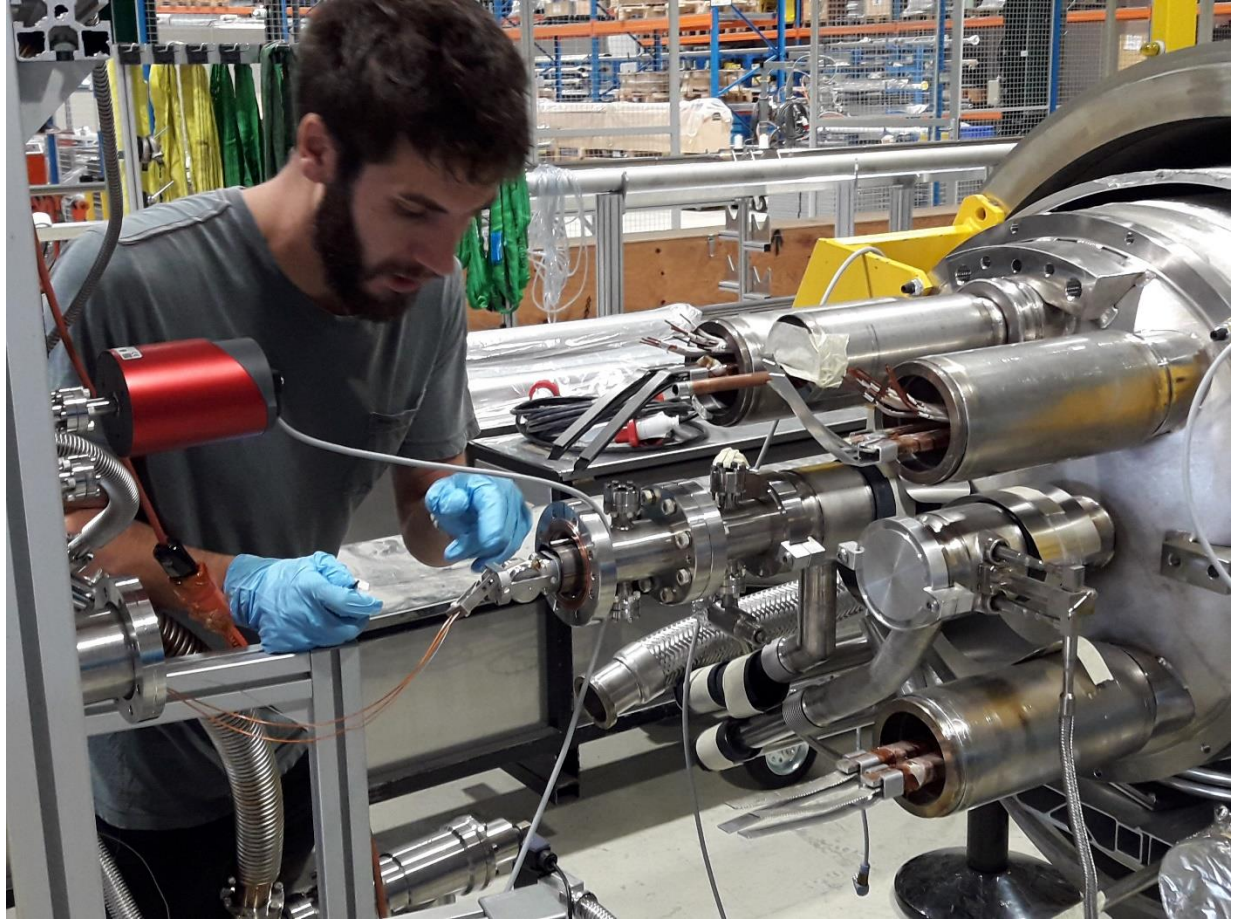
Finishing

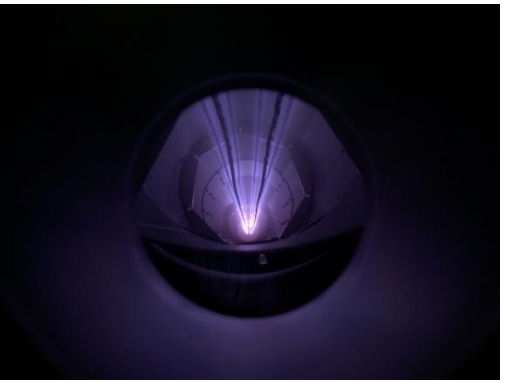


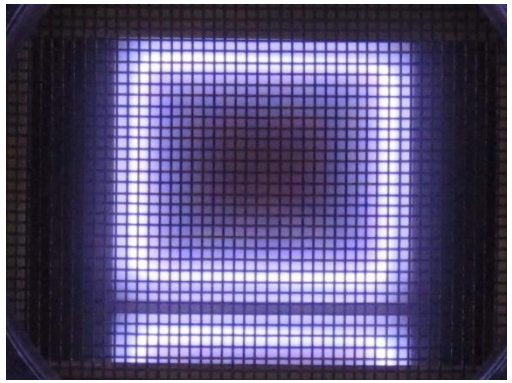
Services for the Physics Community

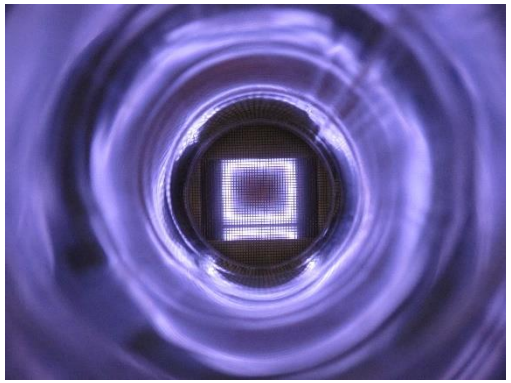
Thin-film coatings

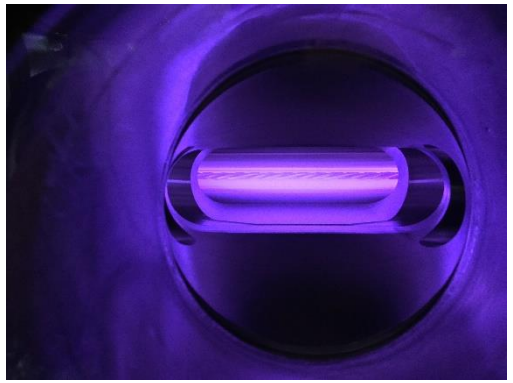
Thin film coatings for CERN’s accelerators

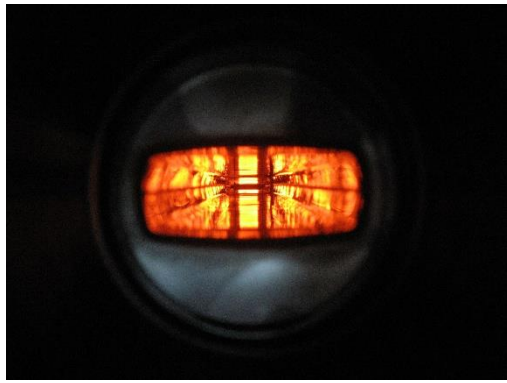






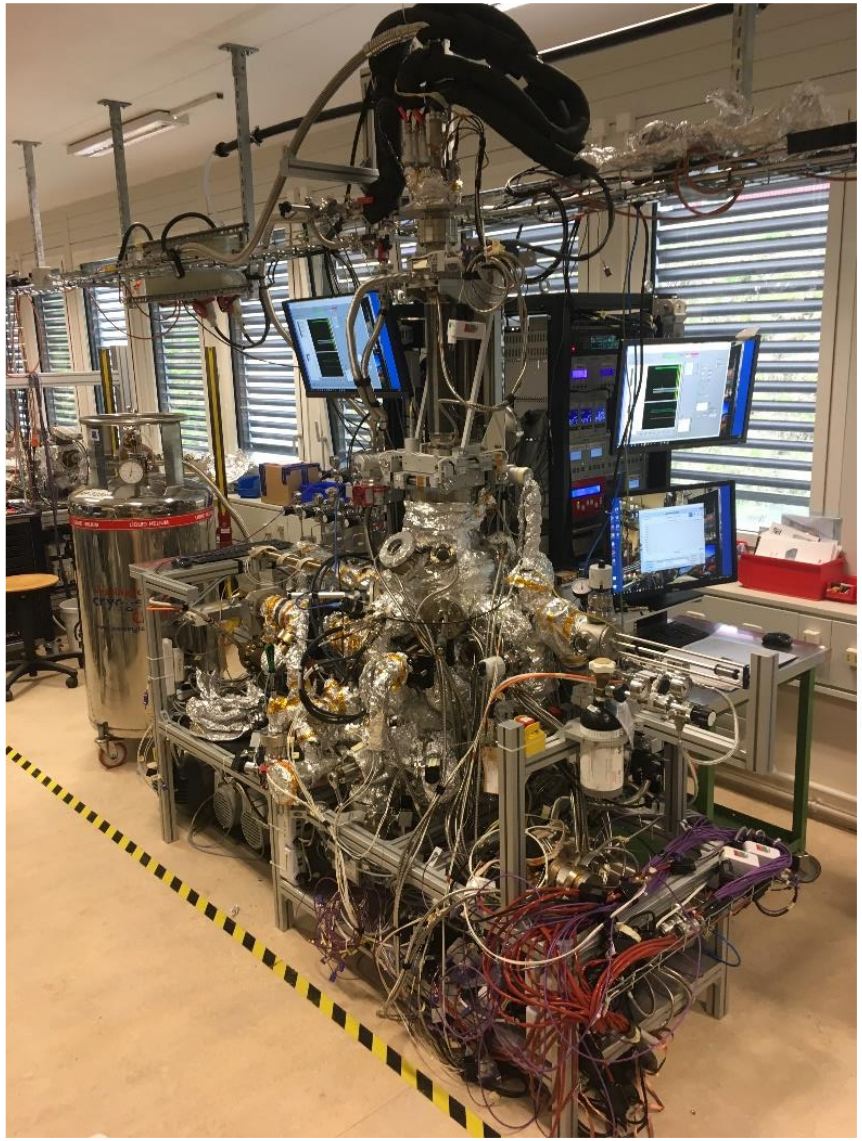


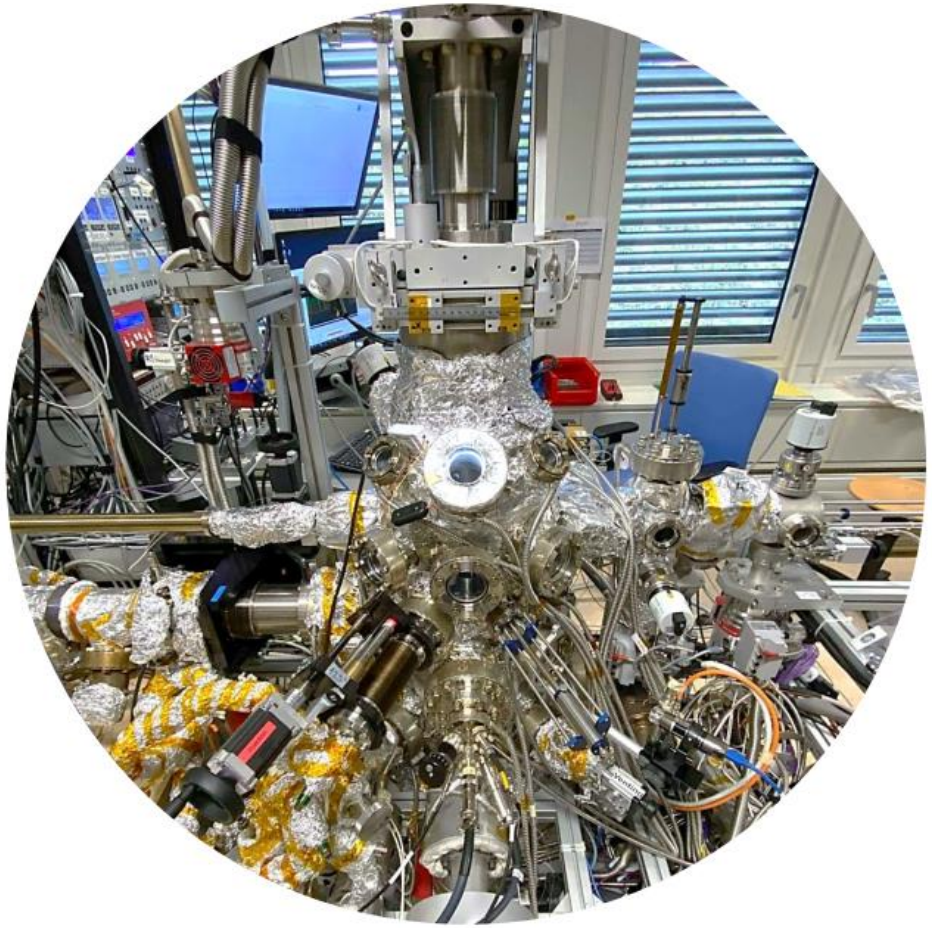


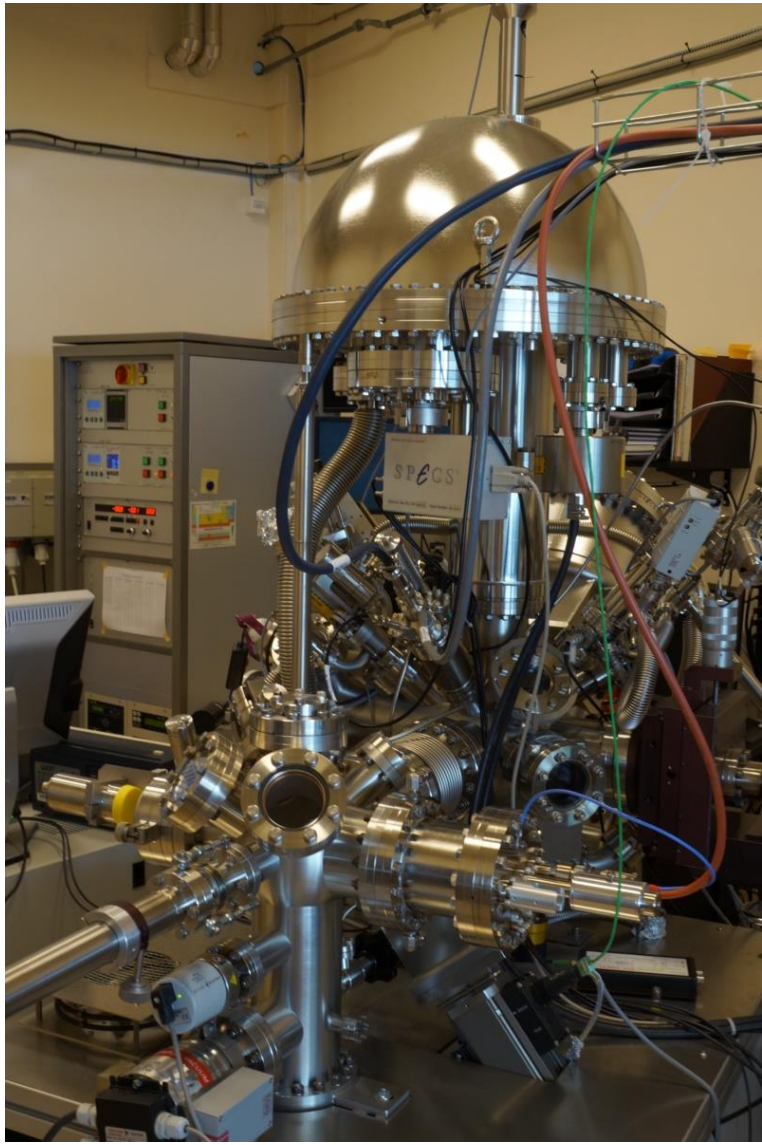


Services for the Physics Community

Surface analysis

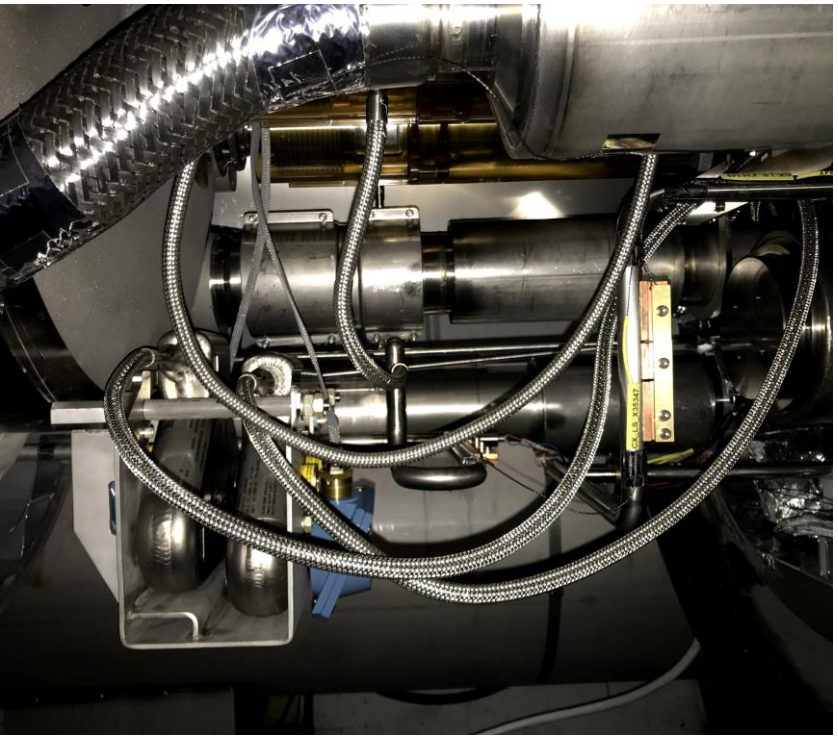


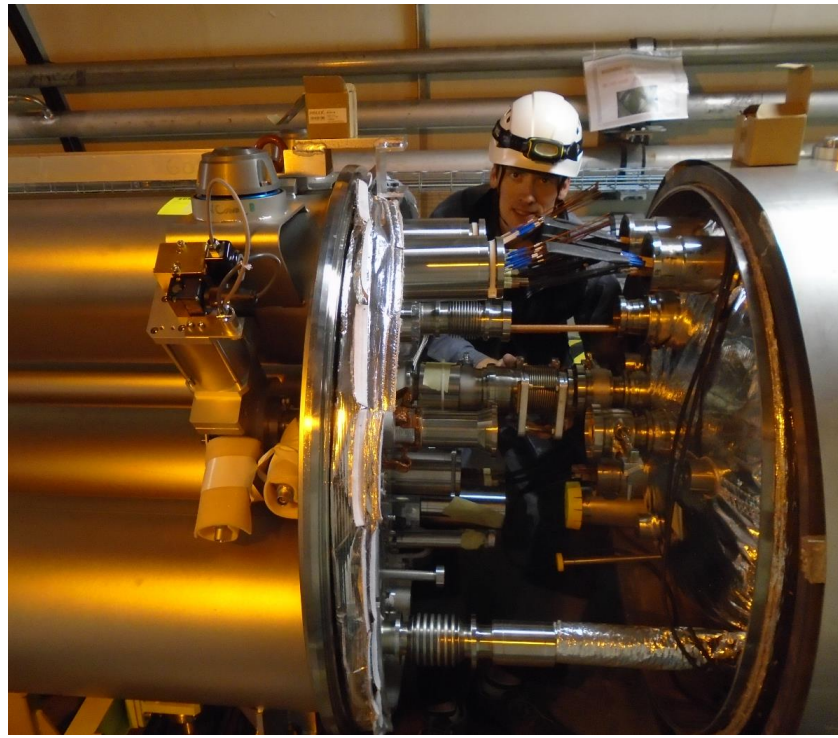




Services for the Physics Community

Leak detection

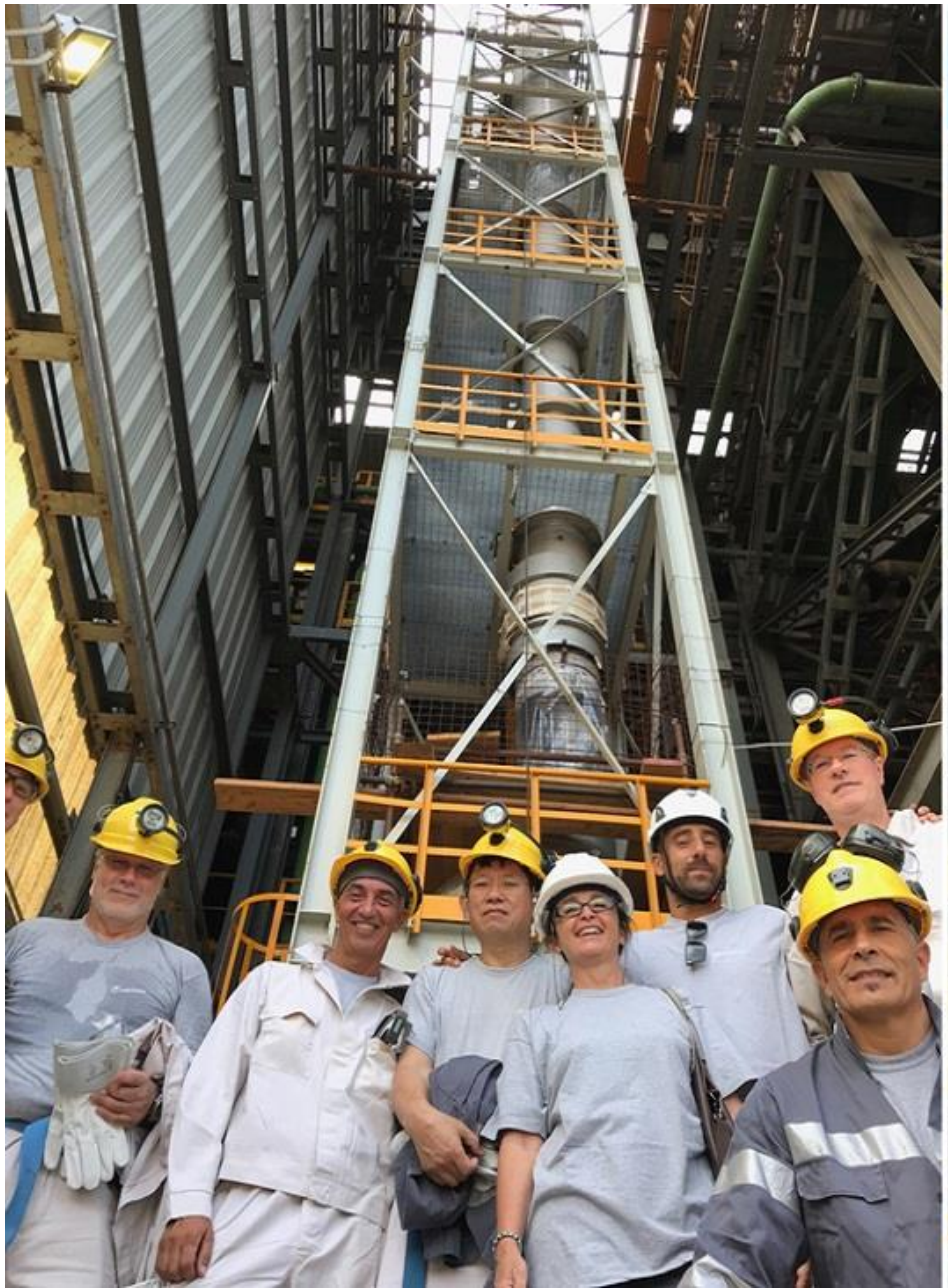




Leak detection for ARIA project

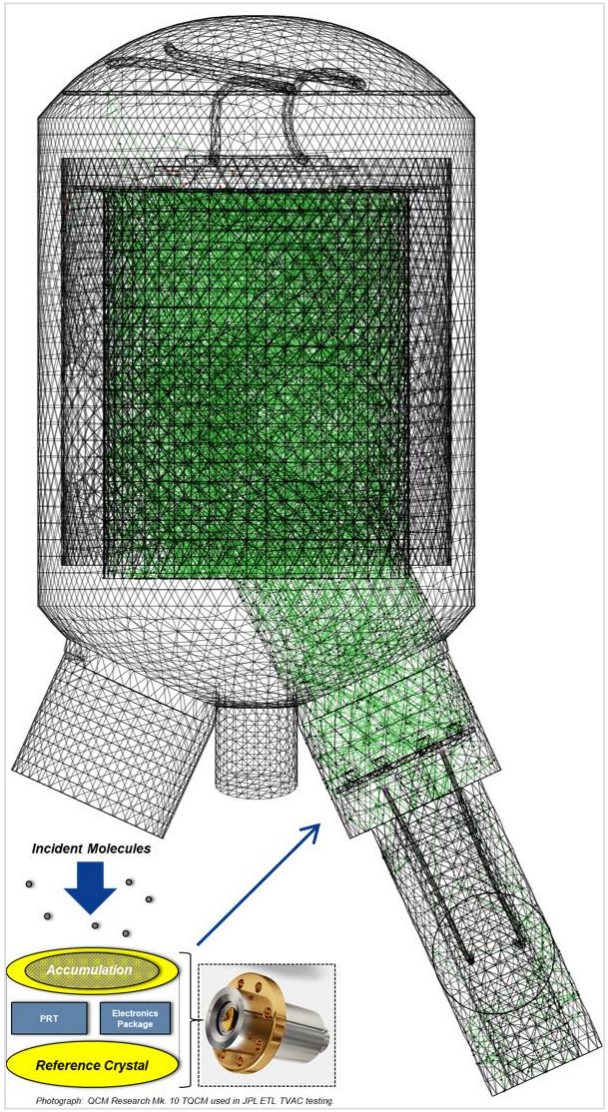
Services for the Physics Community

Leak detection

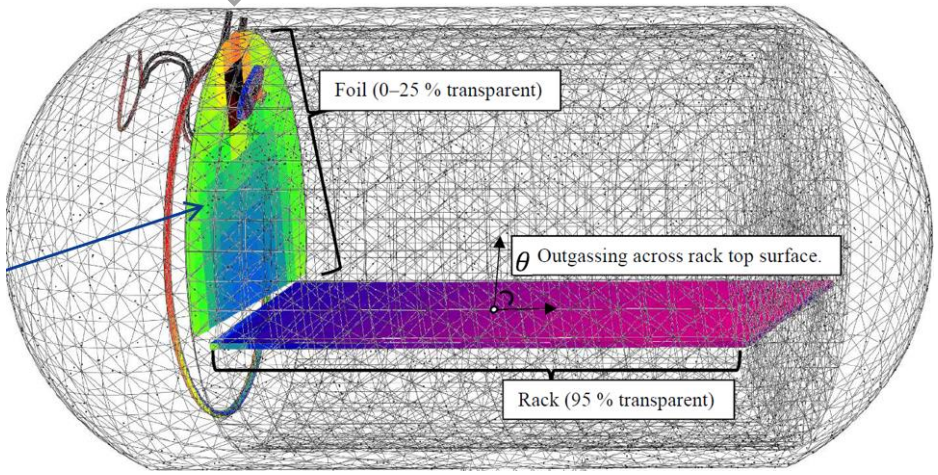


Services for the Physics Community

Simulation of molecular path and distribution



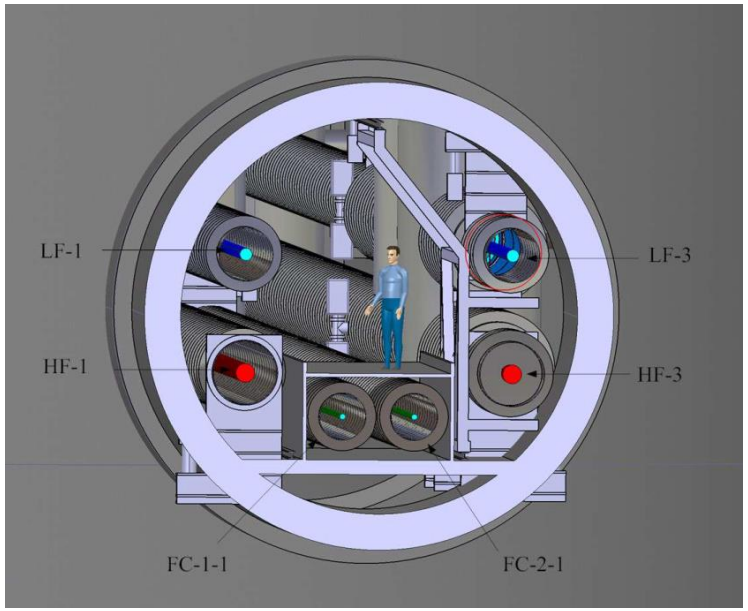
Impermanent foil enclosures can lead to variability in QCM transmission efficiency and therefore on measured outgassing rates; chamber simulations performed for Mars2020

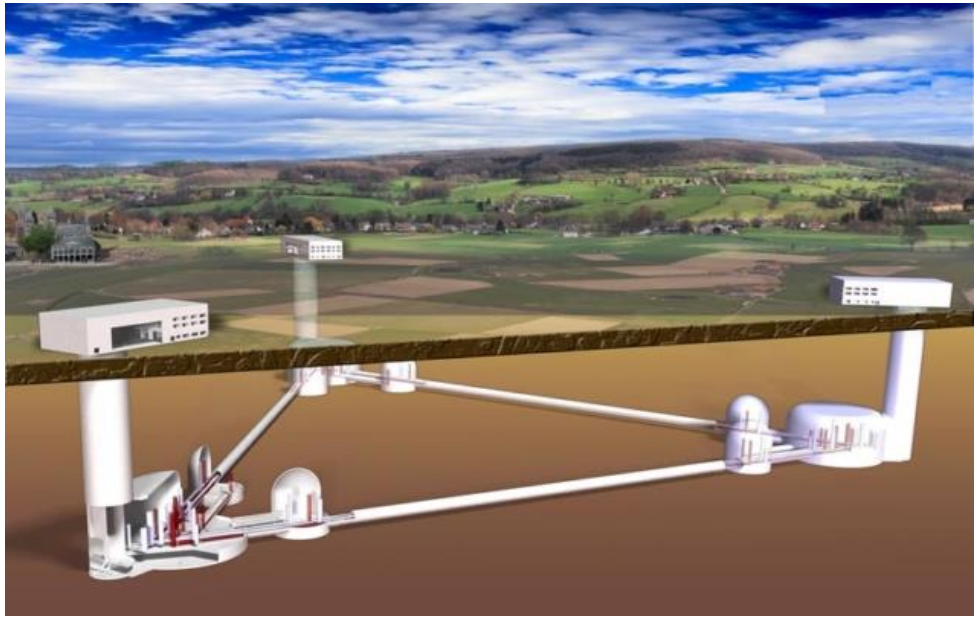


Molflow+: Collaboration with NASA JPL for contamination control

Collaborations
Vacuum for next-generation Gravitational Waves Telescopes

Einstein Telescope (ET)



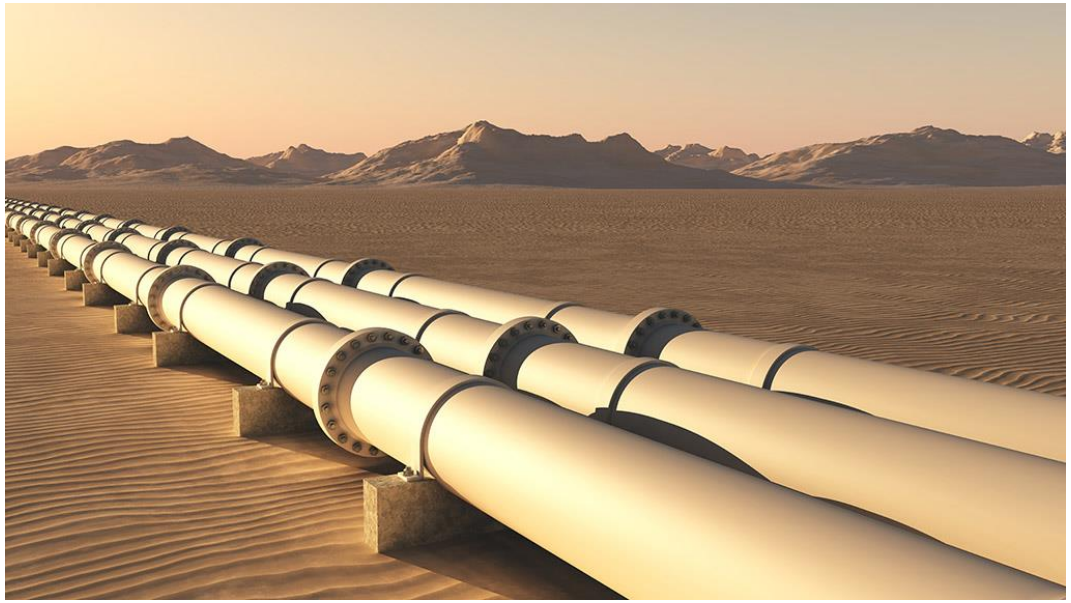


Vacuum & mechanical requirements of the ET's arms

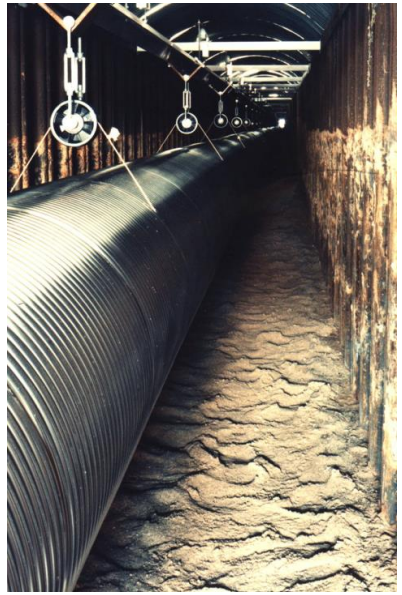
Items	Requirements	Comment
Pipe diameter	**1.2 m**	Exact value not yet decided
Total length	**120 km**	3 arms of 10 km, 4 pipes per arm
Hydrogen partial pressure	**order of 10^{-10} mbar**	
Water vapour partial pressure	< $5x10^{-11}$ mbar	
Hydrocarbon partial pressures	< 10^{-14} mbar	
Lifetime	50 years	

Collaborations
Vacuum for next-generation Gravitational Waves Telescopes

The main challenge is a significant reduction of the costs with respect to the scaled-up solution of the present GWT (LIGO, VIRGO, KAGRA).
Two, among others, possible directions of study:



Adapt gas pipelines to UHV requirements. This implies the use of mild steels and the treatments of surfaces against corrosion.



Use corrugated thin walls