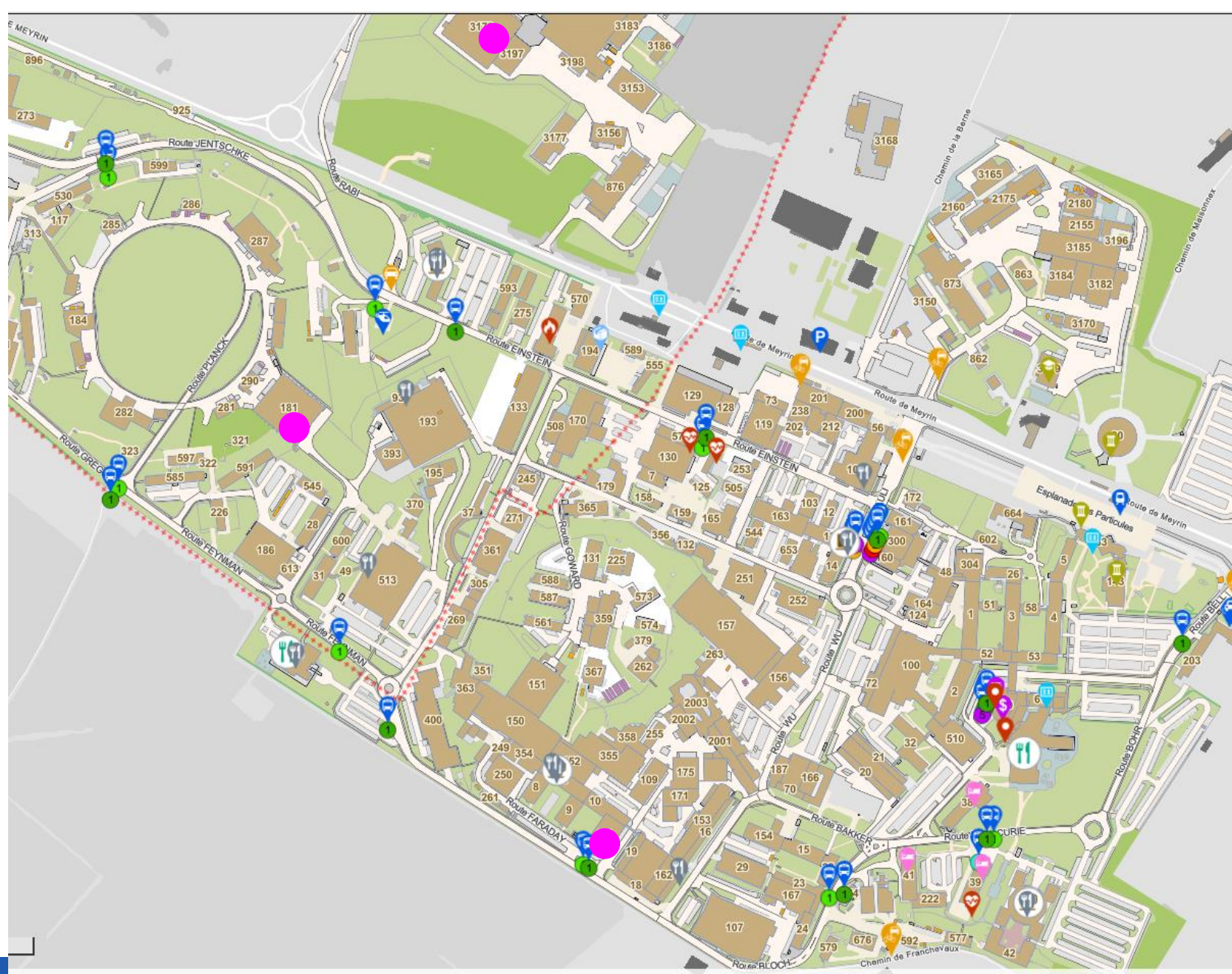


Thin films vacuum coating

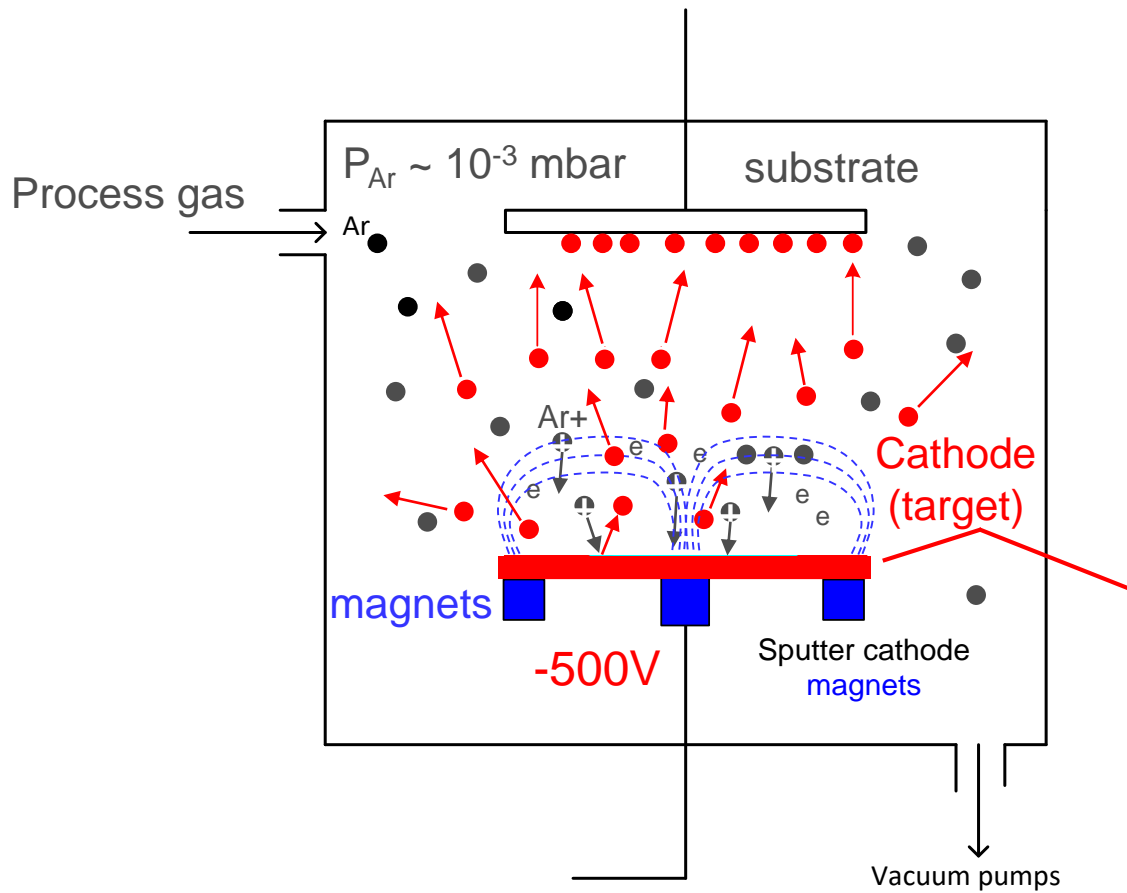
M.Taborelli on behalf of the
TE-VSC-SCC section



Physical Vapour Deposition by planar magnetron sputtering

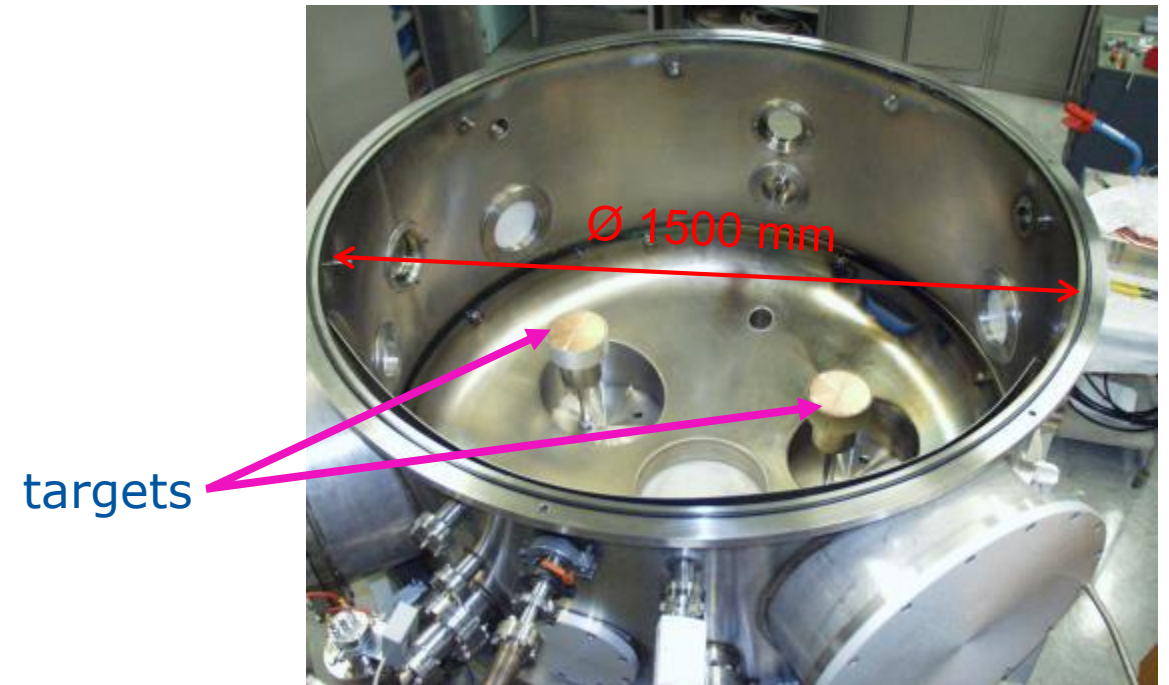
DC Magnetron sputter deposition:
-evacuate at p in $1e-8$ mbar range and inject Ar (Kr) in 10^{-3} mbar range
-**target at negative potential**
-noble gas ionization by electrons
-**magnetic field** confines electrons and helps to sustain plasma

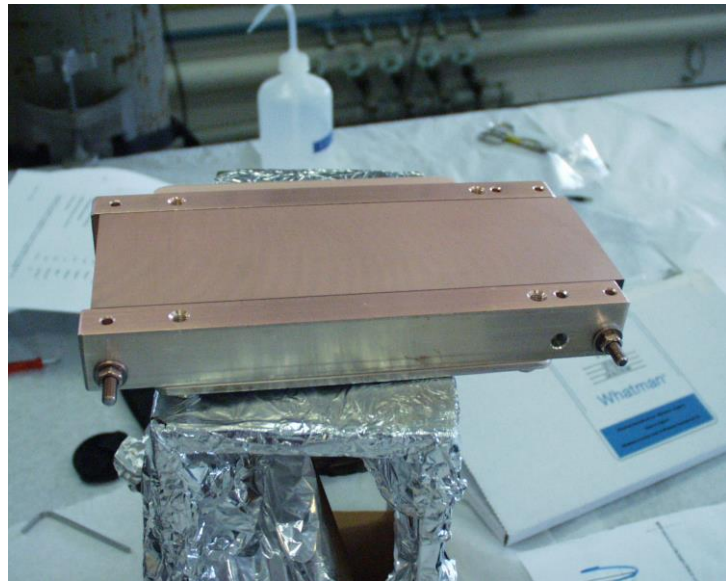
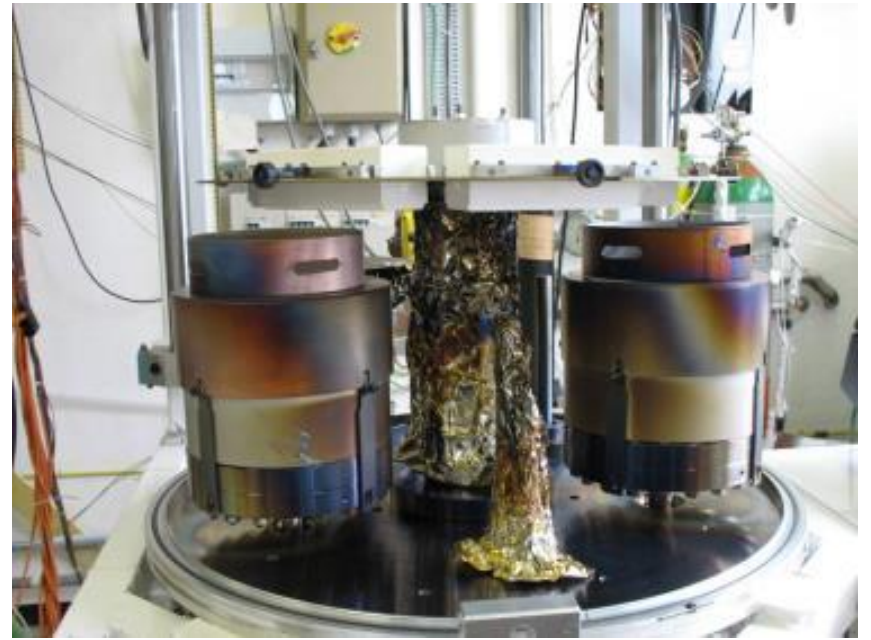
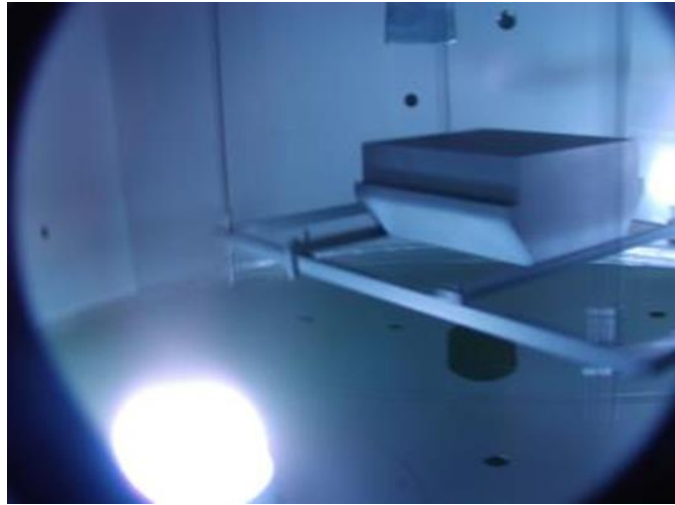
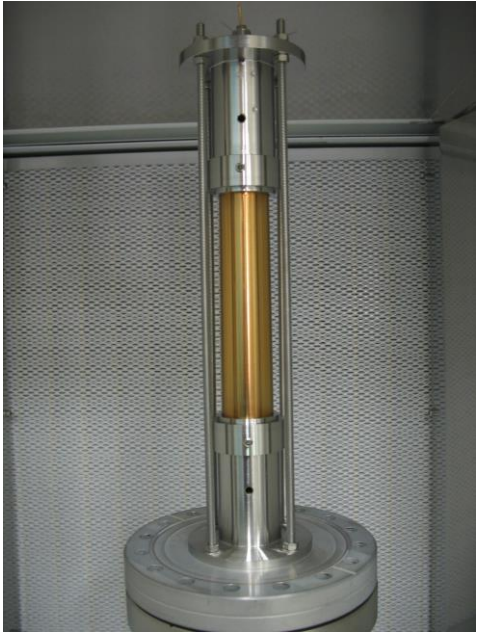
HIPIMS (High Power Impulse Magnetron Sputtering):
Same configuration, but pulsed high voltage (current) leading to ionized target species



«Small substrates»

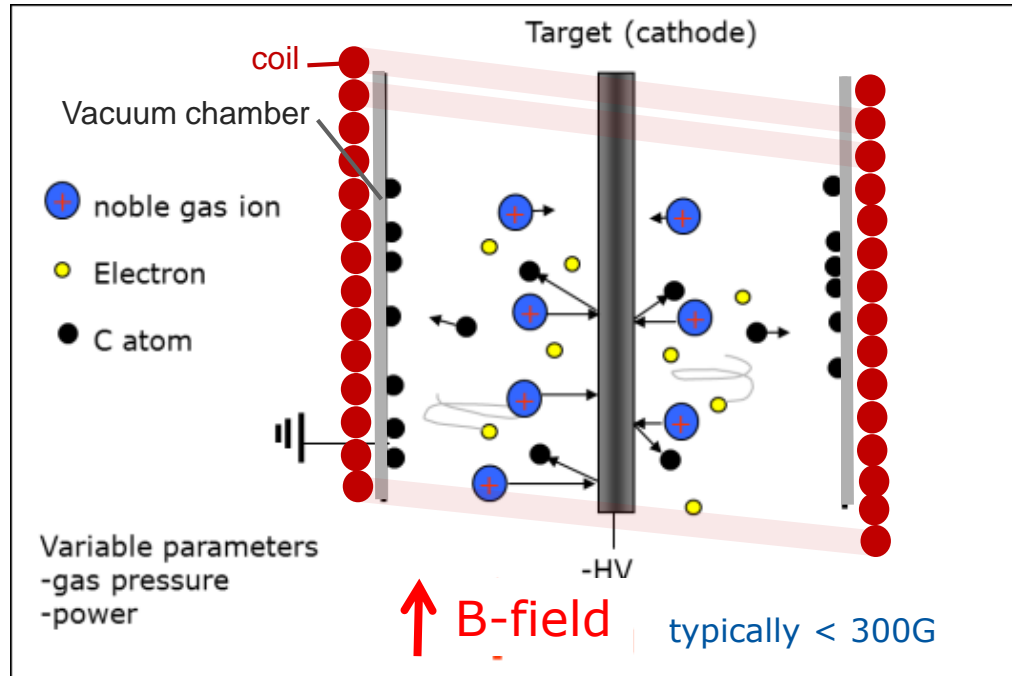
- up to 1 m length, on substrates of copper, aluminium, StSt, MoGr, graphite, alumina, some polymers, coatings of 1-5 μm thickness typically
- coatings to improve static/dynamic vacuum (NEG, a-C), for RF applications or reduction of impedance and charging (Cu , Mo , TiO_x), for superconducting RF (Nb , Nb_3Sn R&D) and more (Au , B_4C , n-tof N and Cl rich target layers...), Al, Re.....
- Thickness test on partially masked witness glass sample and profilometry on step or XRF



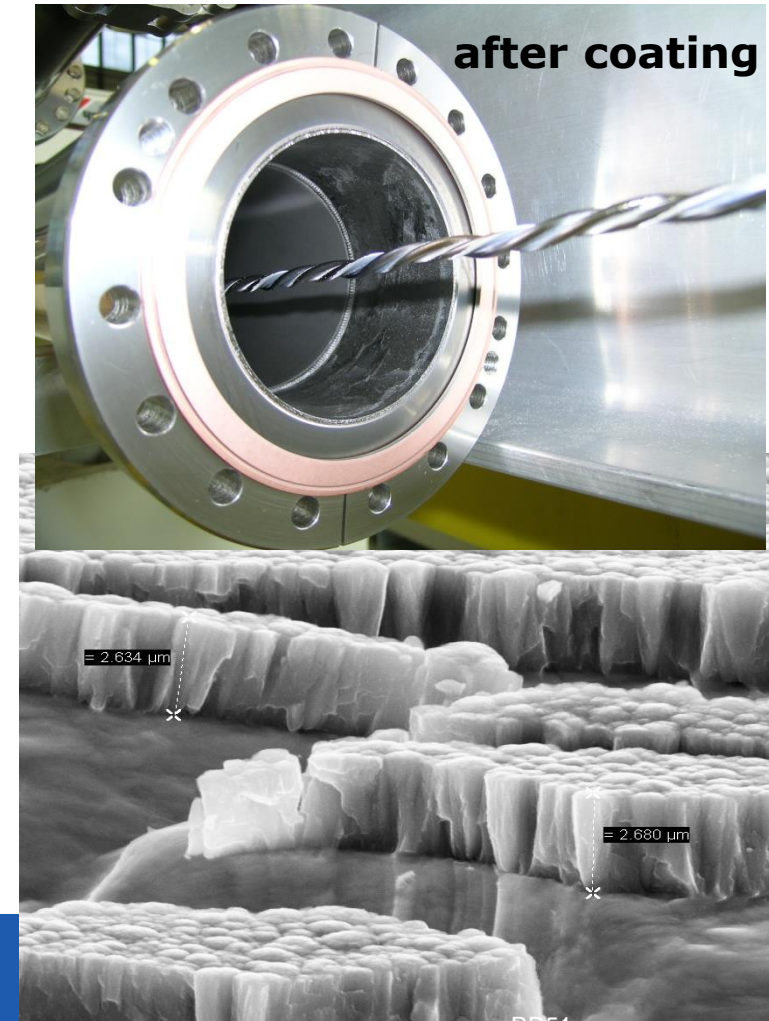


Coating method for long vacuum pipes

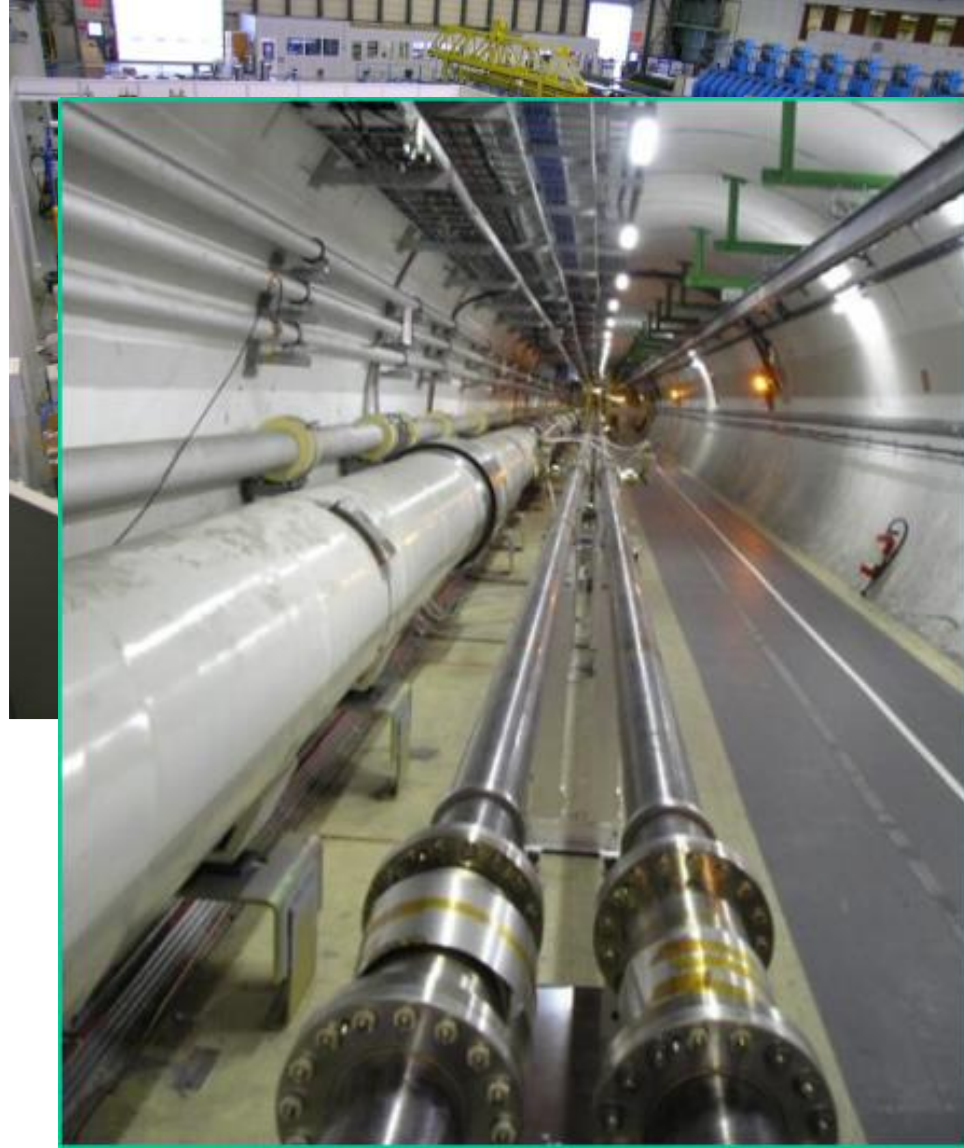
- Up to 7 m length
- Typically for TiZrV (Non Evaporable Getter for pumping) and a-C (low secondary electron yield)
- Target made of intertwined wires or rod, vertical to avoid sagitta



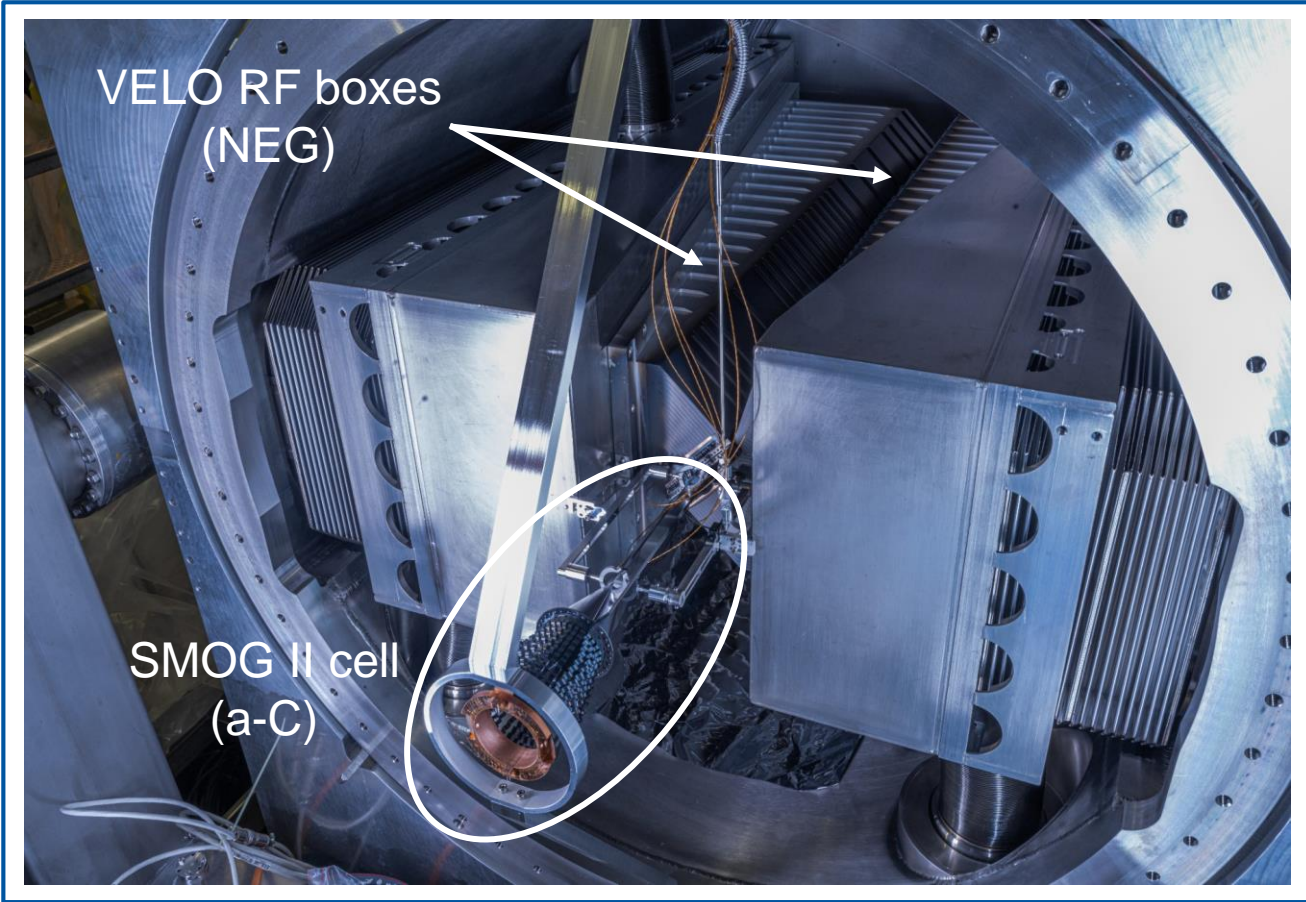
- Coating after pumping and bake out (below 10^{-8} mbar base pressure)
- 0.5-3 μm thickness for NEG and $< 0.5 \mu\text{m}$ for a-C



Coating plant bldg 181



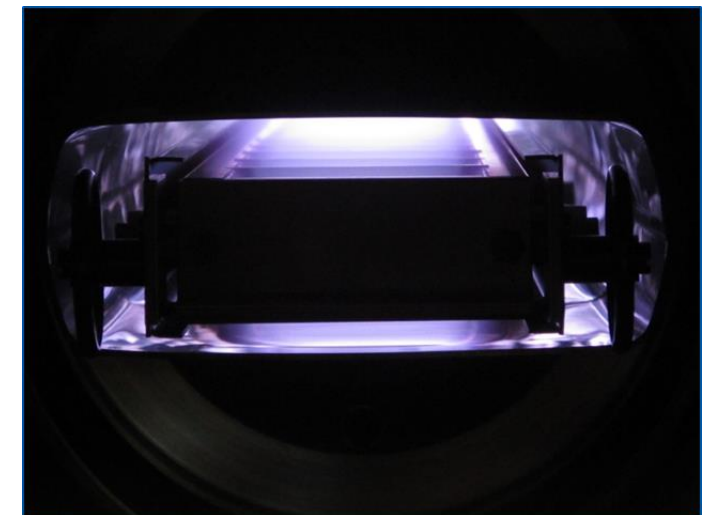
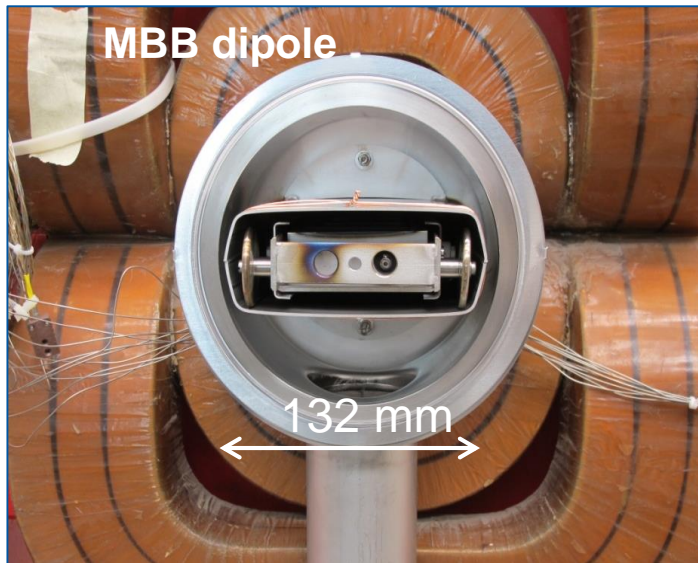
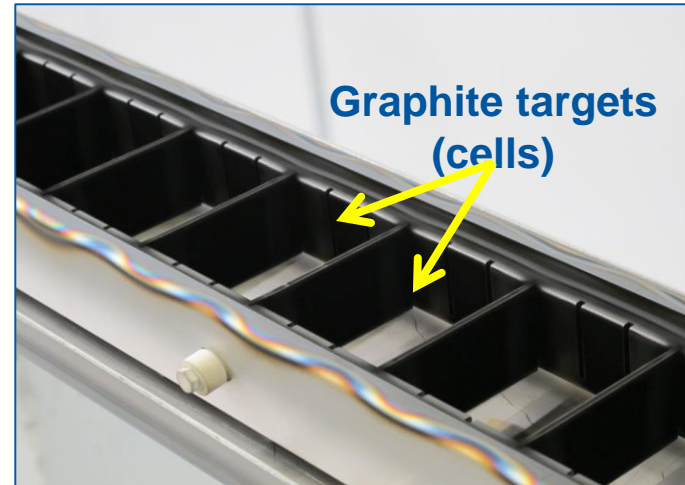
Unusual geometries



Design, production and operation of custom made coating systems: in SPS

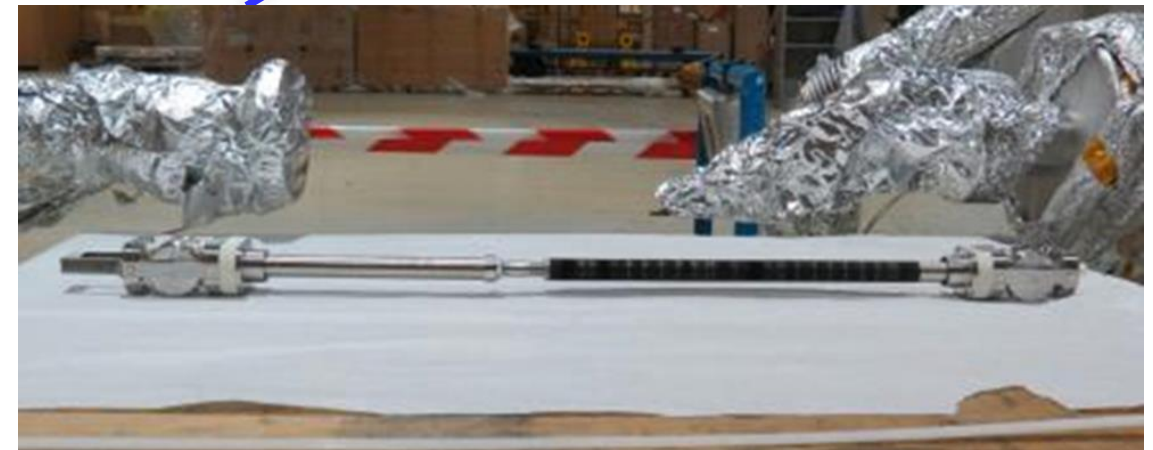
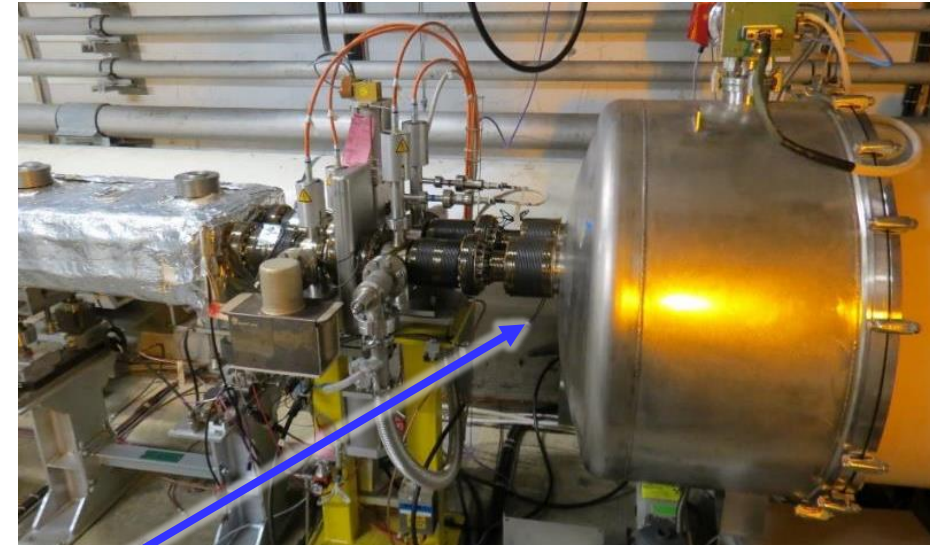
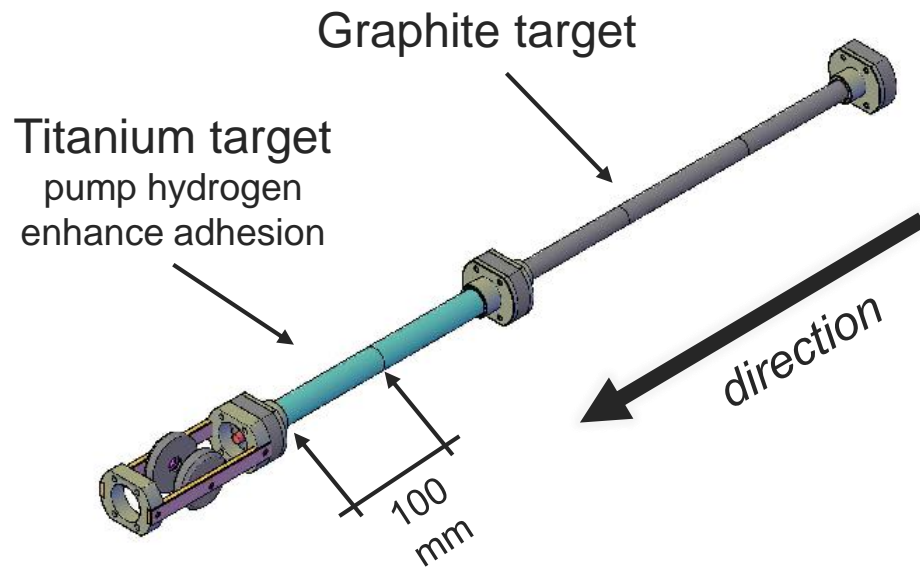
-“train” (modular in several coaches and moved along the pipe) with hollow cathode

-coated in LS2 **95** QF quadrupoles of SPS and several dipoles “in situ”

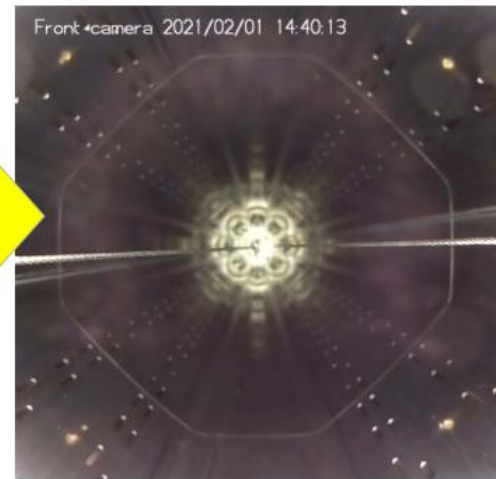
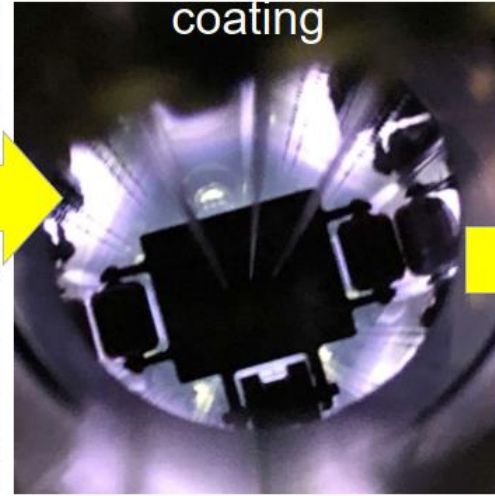
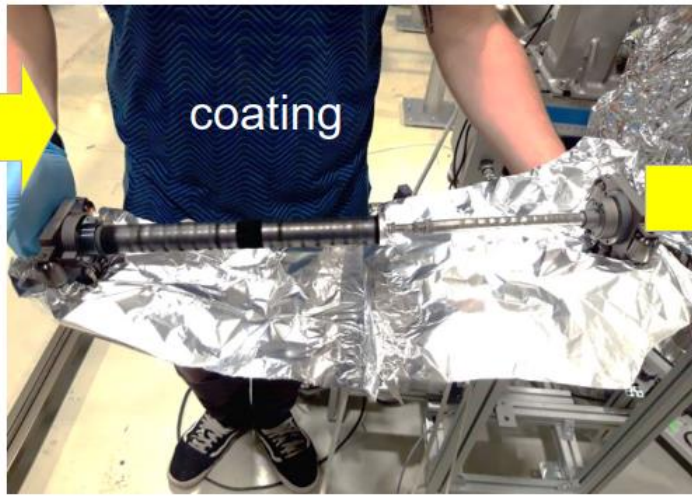
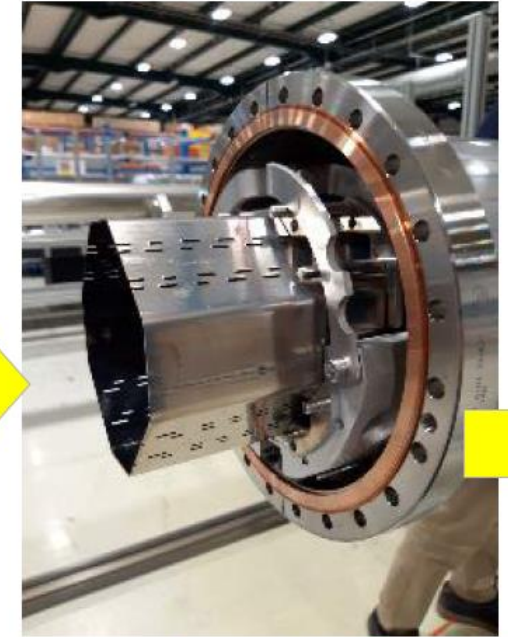
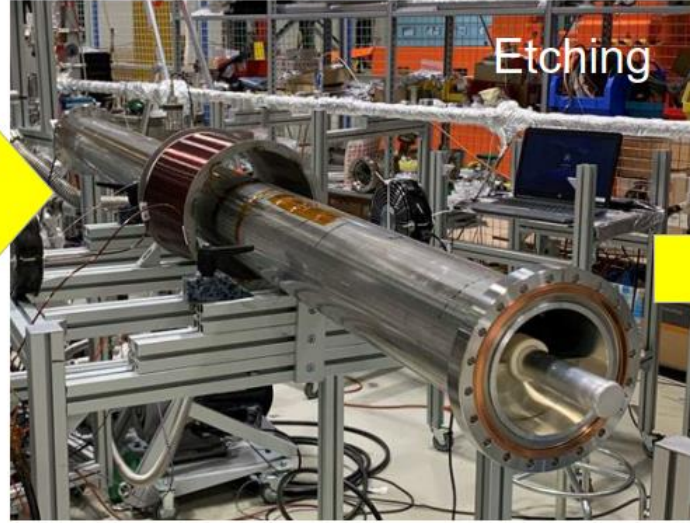


Design, production, operation of coating systems: Standalone magnet in LHC in situ

-coated the beamscreen of Q5L8 during LS2, to suppress e-cloud related heat load



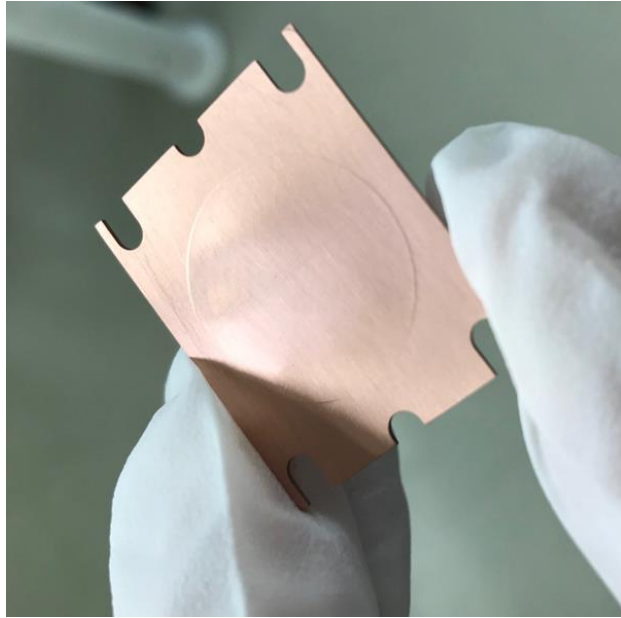
Thin films coating: a-C on HL-LHC beamscreens IP1 and 5



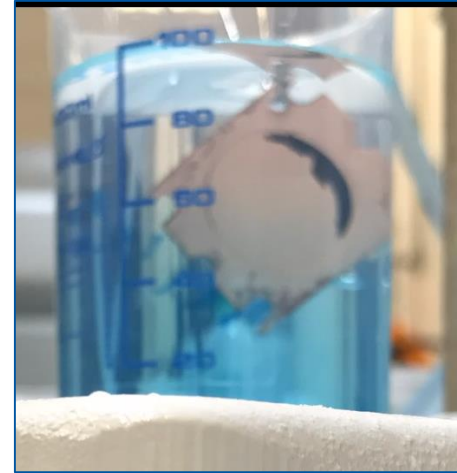
Combine coating and etching: carbon windows as ion stripping foils

400 nm thick carbon foil (about 100ug/cm²)

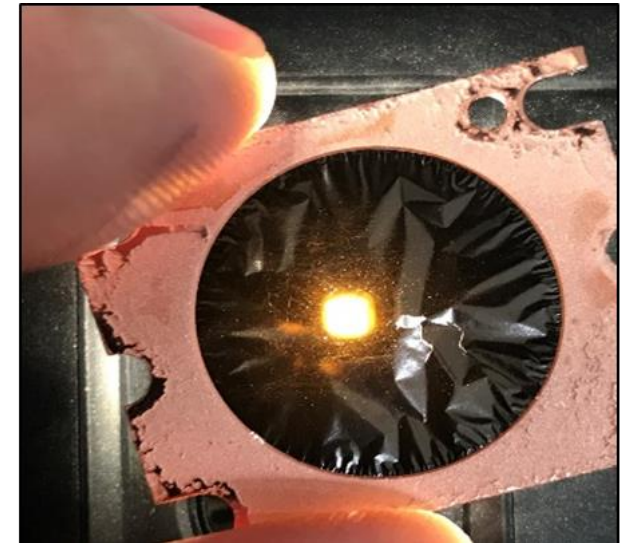
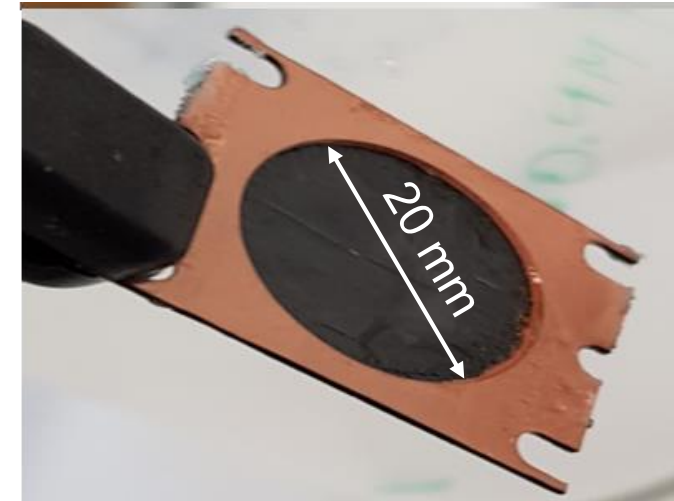
Development in progress as stripper foil for Linac 3



FRAME C COATED



Chemical etching of Cu
(ammonium persulfate)



Thank you!

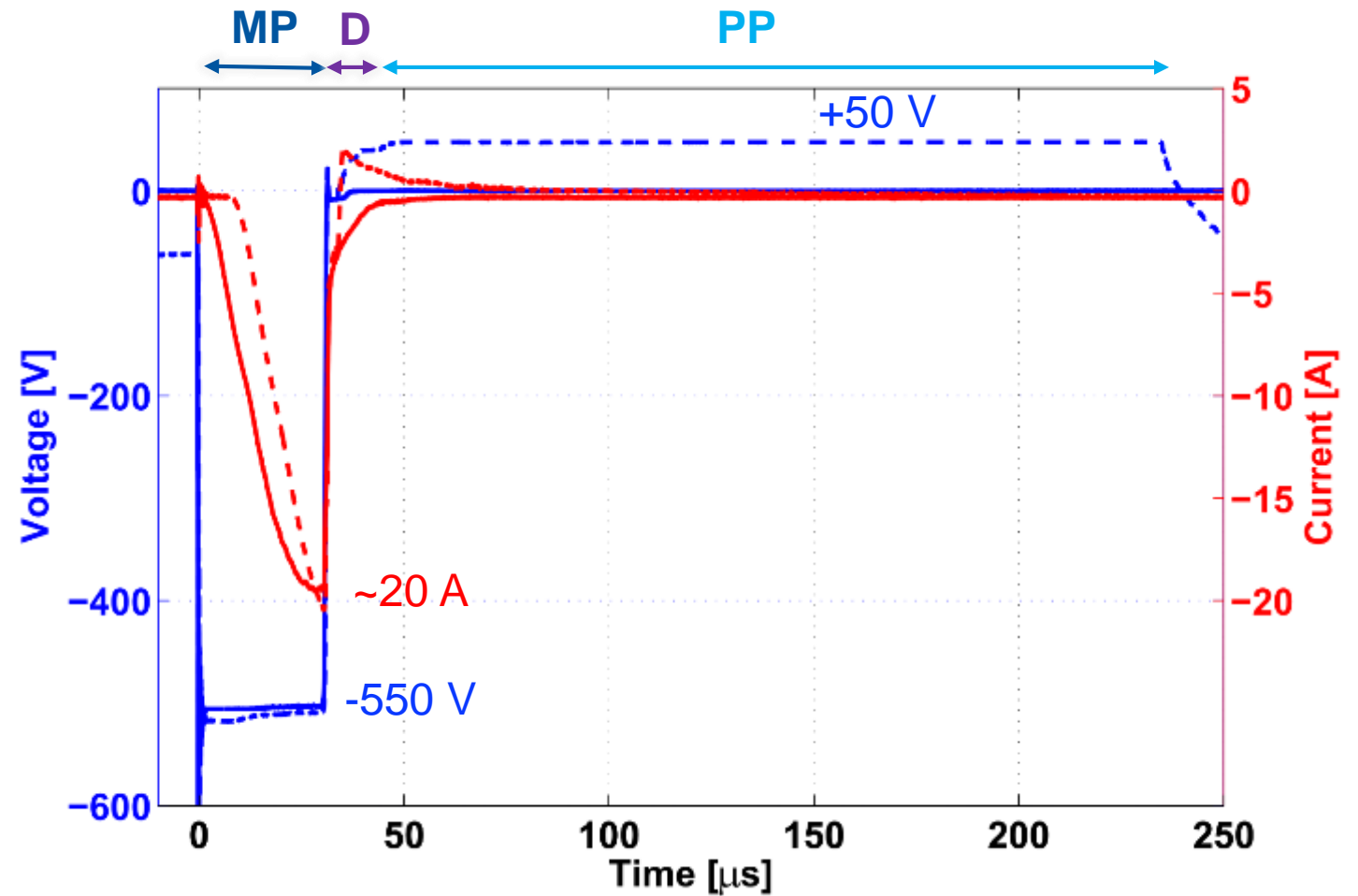
Questions?

Reference: Pedro Costa Pinto, Wilhelmus Vollenberg

HiPIMS configurations

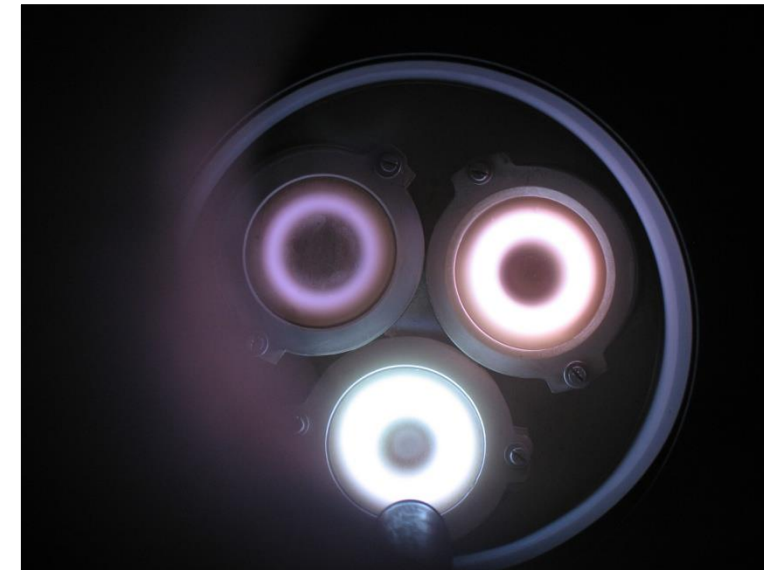
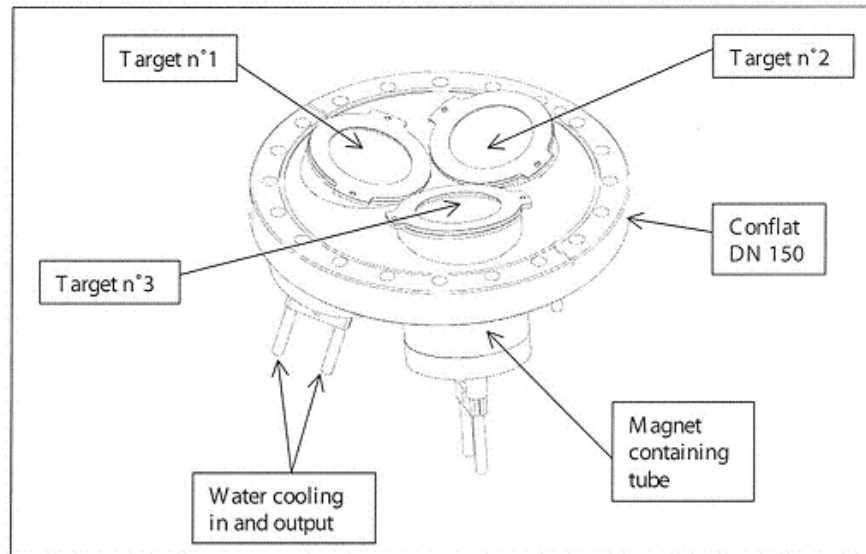
- Duty cycle : 1 kHz
- Main pulse (**MP**) : 30 μs
- Delay (**D**) : 4 μs
- PP duration (**PP**) : 20 – 250 μs

----- +50V PP
————— no PP



Multicathode system

- It is possible to set up a multitarget system to produce coatings of alloys



3* Ø 50 mm targets
For R&D purpose:
Small samples !!