



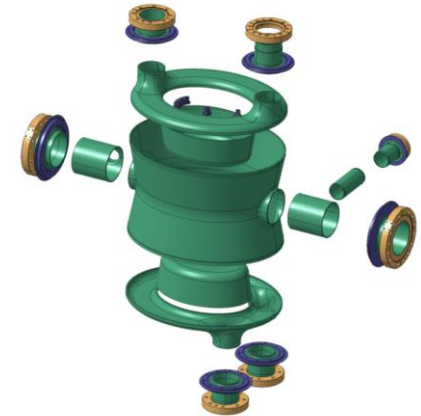


HL-LHC Crab Cavities: Industrial DQW pre-series status

A. Castilla and N. Valverde
on behalf of CERN-SY-RF-SRF and WP4

Outline

- Fabrication @  research instruments
- Activities @ 
- Documentation and QA status
- Remarks



DQW Pre-Series Fabrication @RI

Single parts: Manufacturing and control of individual pieces of the assy. (started ~Q3-2019).

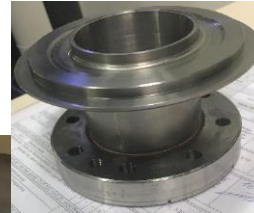


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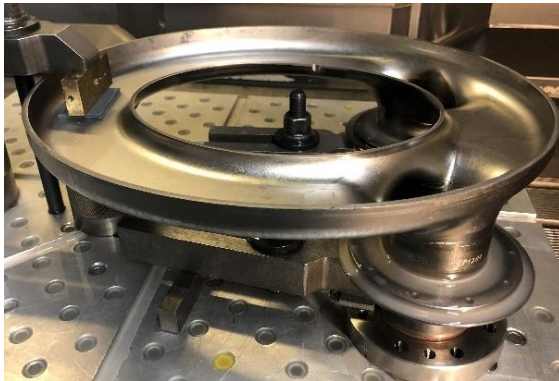


DQW Pre-Series Fabrication @RI

Assemblies: Complex manufacturing*
(~Q2-2020). *see also S. Barriere previous talk

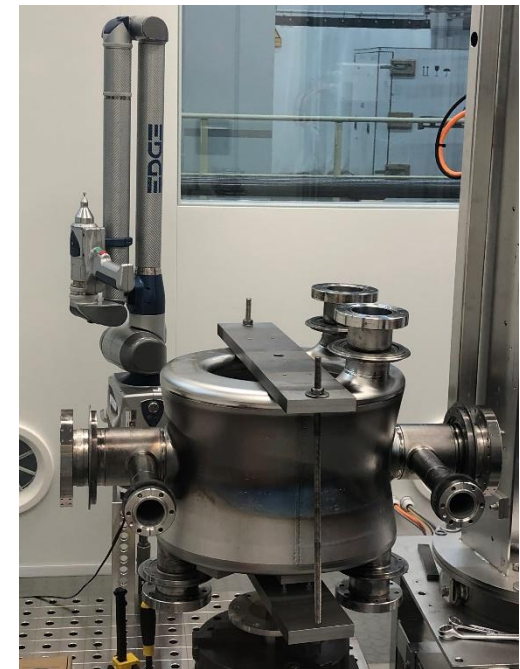
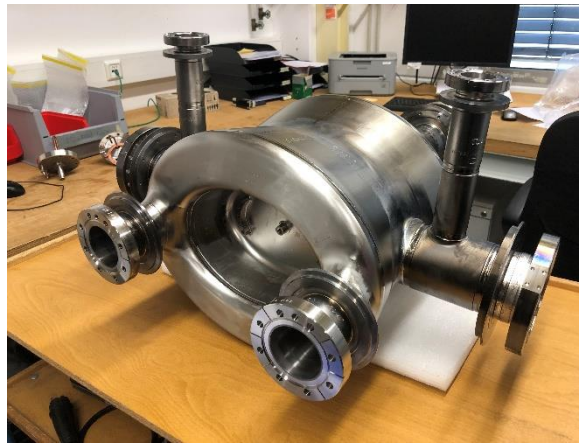
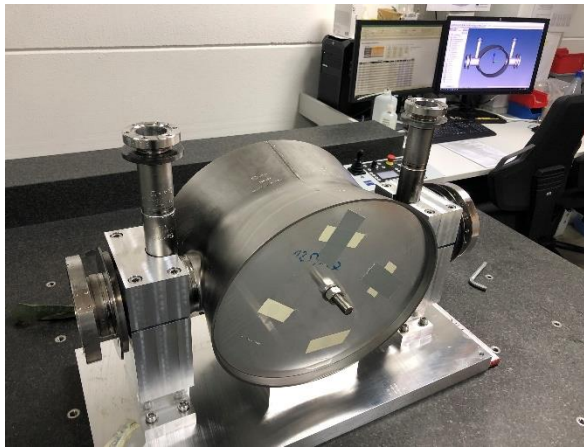


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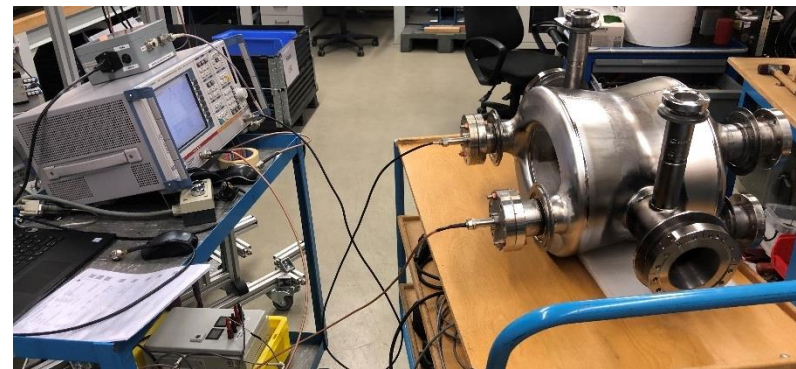


DQW Pre-Series Fabrication @RI

Full cavities: tight metrology and RF controls
(done ~Q1-2021).

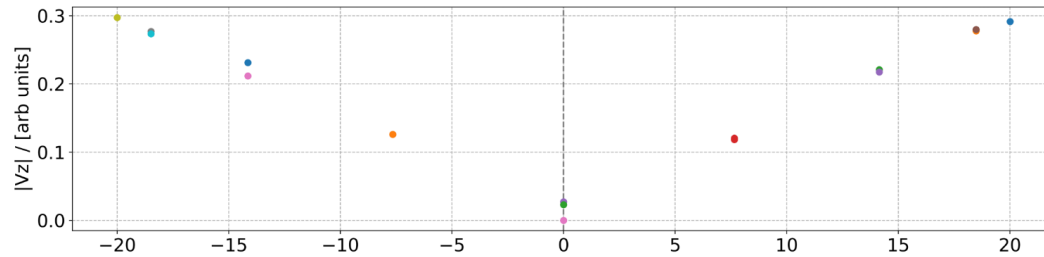
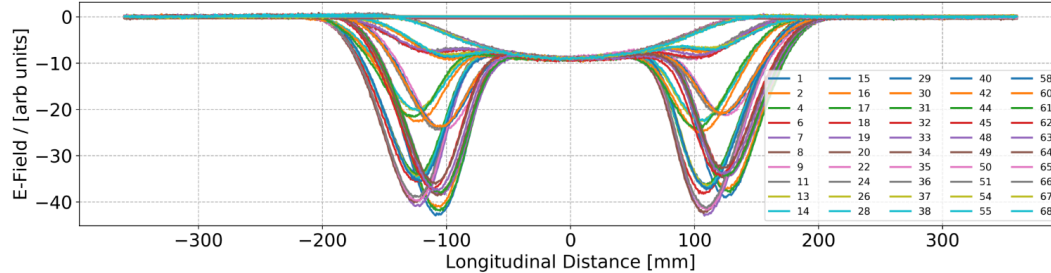


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DQW Pre-Series Fabrication @RI

Working closely with CERN to keep QC and traceability to the HiLumi's standard.



Crab Cavity Beadpull Controller

version 2.0

MOTOR STATUS

Position X [mm]: 7.7475

Position Y [mm]: 0

Position Z [mm]: 0

Endstop Reached:

ACTIVITY

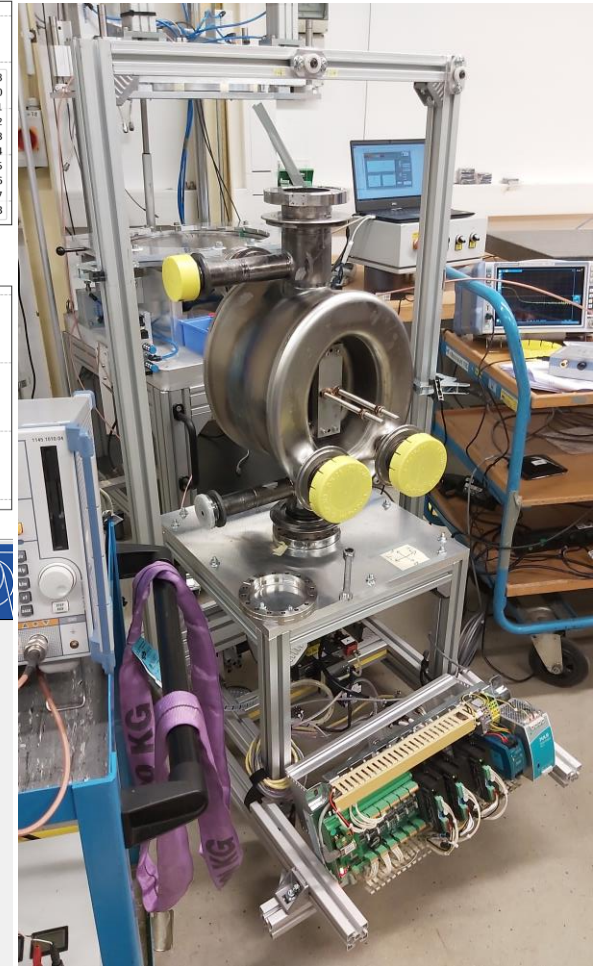
- VNA: 128.141.212.38
- Mover: 128.141.212.250
- VNA
- Motors
- Analysis

VNA STATUS

Pre-Resonance [Hz]: 400.159186M

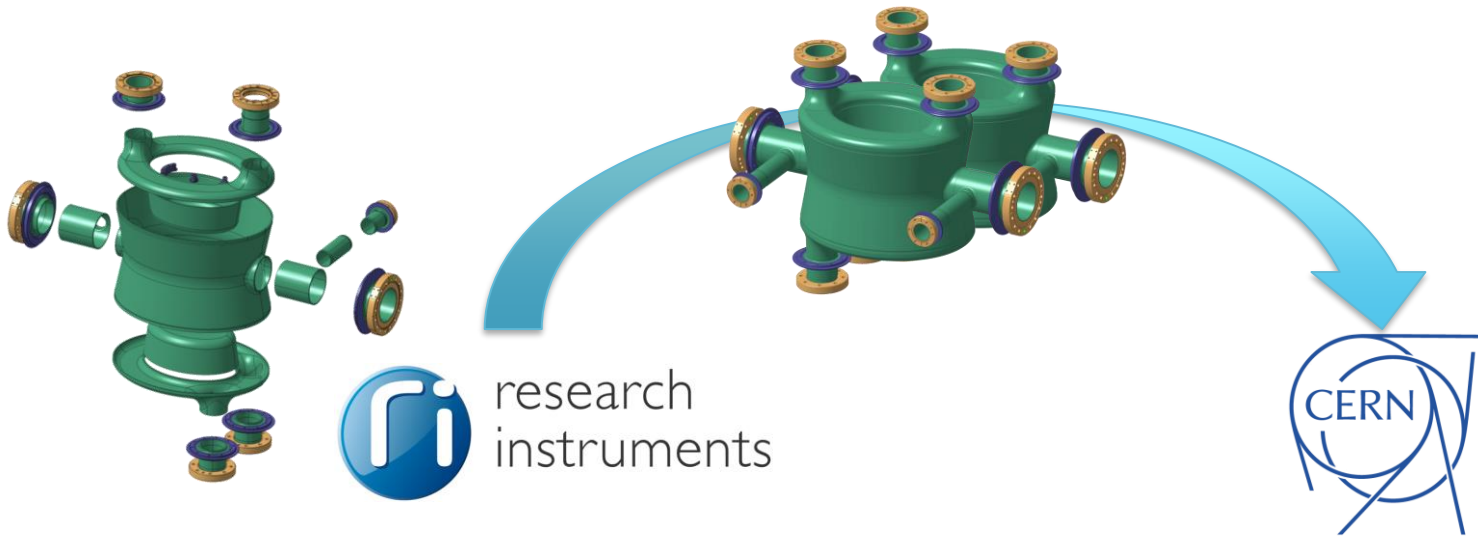
Post-Resonance [Hz]: 400.159090M

Stop Movers!



DQW Pre-Series

Workflow



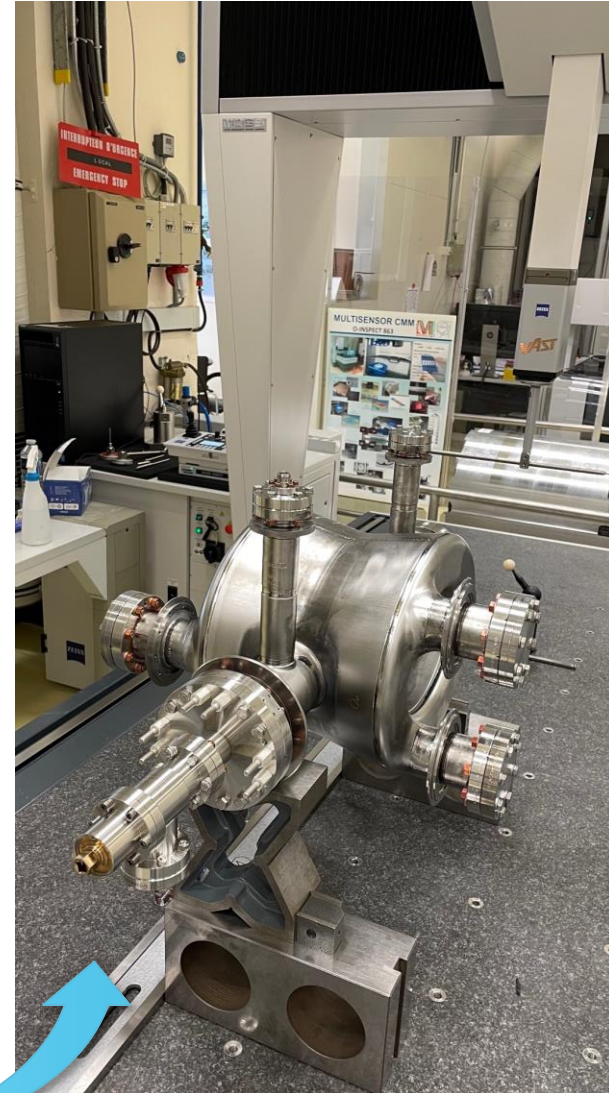
- Pre-series bare cavities.
 - Manufactured in RI.
 - Documentation and traceability
 - Sent to CERN for validation.
 - Reception @CERN Q2&Q3-2021.

DQW Pre-Series @CERN

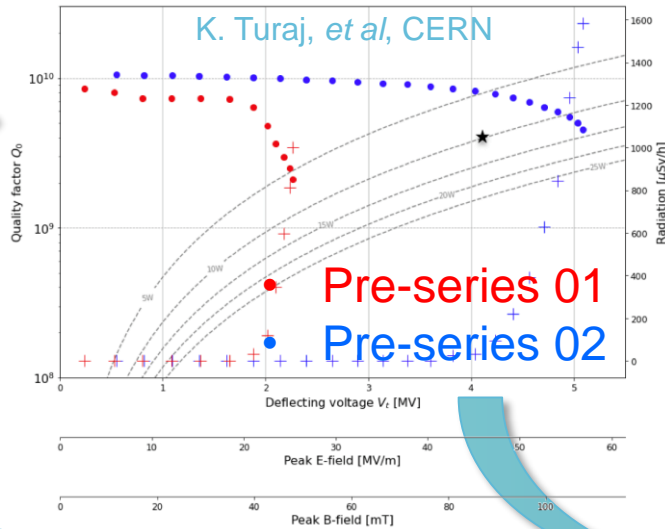
Reception and control



Metrology



Vertical cold test



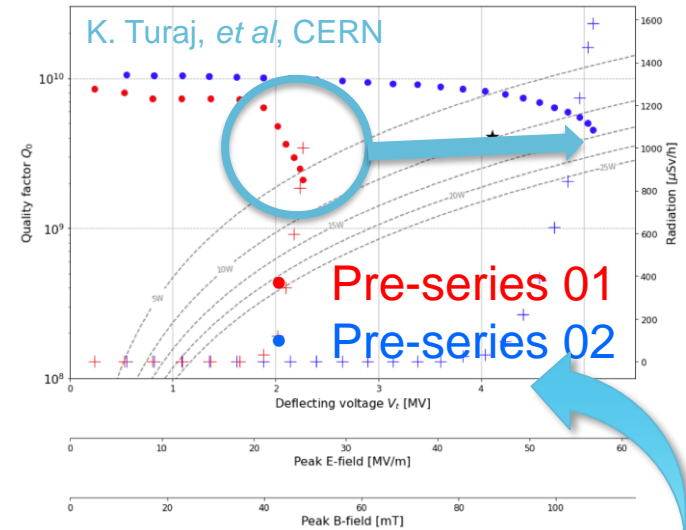
DQW Pre-Series 1 Reprocessing @CERN

Preparation for CR



HPR

Re-testing (week 45/46)

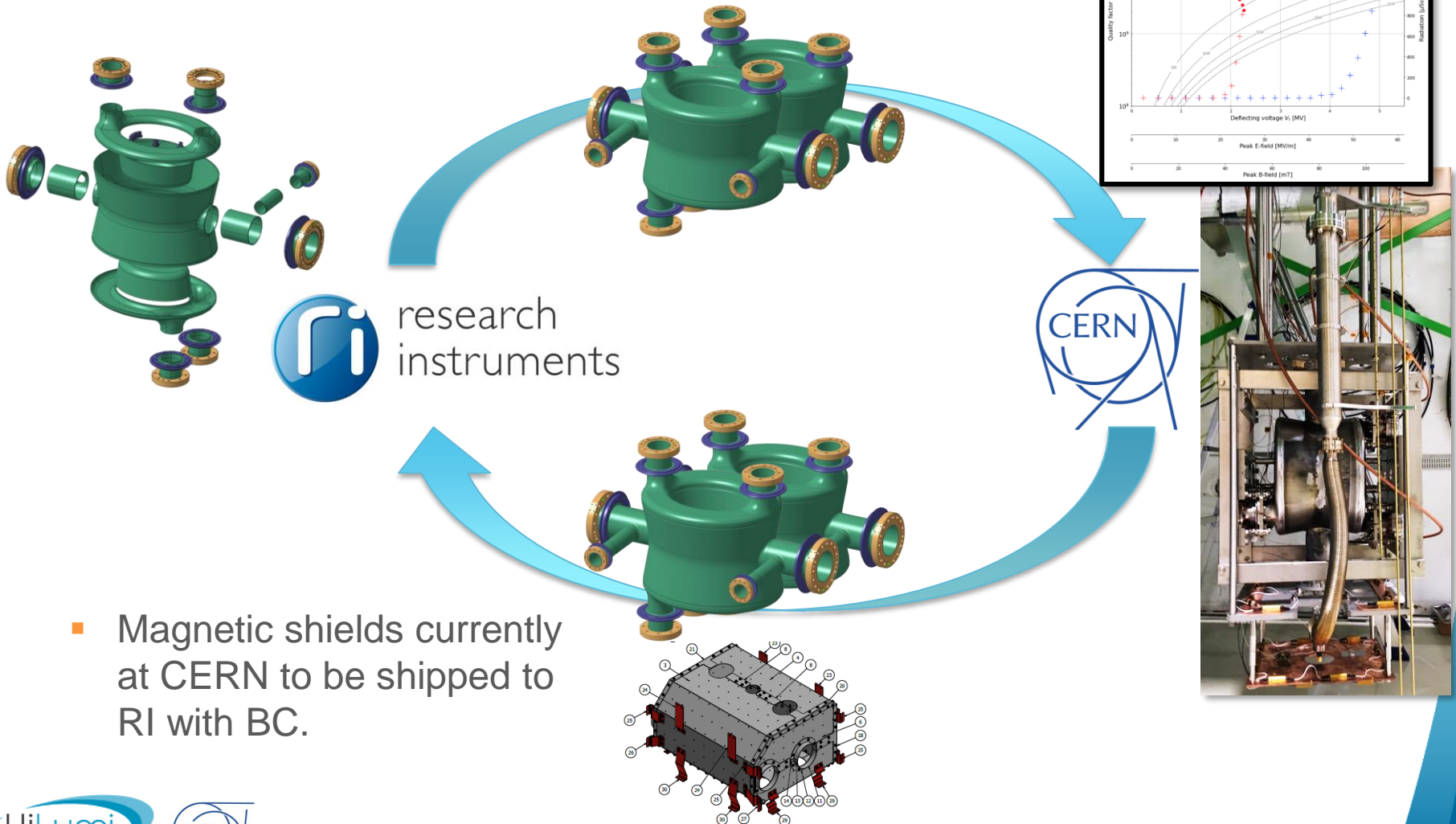


Cleanroom assy.



DQW Pre-Series

Workflow



- Magnetic shields currently at CERN to be shipped to RI with BC.

DQW Pre-Series (bare cavities) QA

Equipment Identifier: HCACFCA001-RN000001

Other Identifier: 4094-P111520-01

Description: DQW Bare Cavity (Variant #1)

Step #	R/E	Other name	Description	Status	Result	INC
5	()		Traceability of mats (*)	Done	Ok	
10	()		Reception Material from CERN (*)	Done	Ok	
15	()		Related MIP (*)	Accepted	Ok	
20	()		P110937-2.2.2.5 -4094_US_01 -US thick before shaping (*)	Accepted	Ok	
25	()		P110937-2.2.2.6 -4094_VC_01 -VT before shaping (*)	Accepted	Ok	
30	()		P110937-2.2.2.10 -4094_US_02 -US thick after shaping (*)	Accepted	Not Ok	
35	()		P110937-2.2.2.11 -4094_VC_02 -VT after shaping (*)	Done	Ok	
40	()		P111520-2.2.3.5 -4094_US_03 -US thick before shaping (*)	Accepted	Ok	
45	()		P111520-2.2.3.6 -4094_VC_03 -VT before shaping (*)	Accepted	Ok	
50	()		P111520-2.2.3.9 -4094_US_04 -US thick after shaping (*)	Accepted	Ok	
55	()		P111520-2.2.3.10 -4094_VC_04 -VT after shaping (*)	Done	Ok	
60	()		P111523-2.2.4.5 -4094_US_05 -US thick before shaping (*)	Accepted	Ok	
65	()		P111523-2.2.4.6 -4094_VC_05 -VT before shaping (*)	Accepted	Ok	
70	()		P111523-2.2.4.11 -4094_US_06 -US thick before shaping (*)	Accepted	Ok	
75	()		P111523-2.2.4.12 -4094_VC_06 -VT after shaping (*)	Accepted	Ok	
80	()		P110942-2.2.5.11 -4094_EB_01 -VT before welding (*)	Accepted	Ok	
85	()		P110942-2.2.5.13 -4094_EB_02 -VT after welding (*)	Accepted	Ok	
90	()		P110942-2.2.5.16 -4094_EB_03 -VT after welding (*)	Done	Ok	
95	()		P110942-2.2.5.17 --RT after welding (*)	Accepted	Ok	
100	()		P110942-2.2.5.21 -4094_US_07 -UT thick before shaping (*)	Done	Ok	
105	()		P110942-2.2.5.22 -4094_VC_07 -VT before shaping (*)	Done	Ok	
110	()		P110942-2.2.5.24 -4094_US_08 -UT thick after shaping (*)	Done	Ok	
115	()		P110942-2.2.5.25 -4094_VC_08 -VT after shaping (*)	Done	Ok	
120	()		P111300-2.2.6.11 -4094_EB_04 -VT before welding (*)	Accepted	Ok	
125	()		P111300-2.2.6.13 -4094_EB_05 -VT after welding (*)	Accepted	Ok	
130	()		P111300-2.2.6.16 -4094_EB_06 -VT after welding (*)	Accepted	Ok	
135	()		P111300-2.2.6.17 --RT after welding (*)	Accepted	Ok	
140	()		P111022-2.2.7.11 -4094_EB_07 -VT before welding (*)	Accepted	Ok	
145	()		P111022-2.2.7.13 -4094_EB_08 -VT after welding (*)	Accepted	Ok	
150	()		P111022-2.2.7.16 -4094_EB_09 -VT after welding (*)	Accepted	Ok	
155	()		P111022-2.2.7.17 --RT after welding (*)	Done	Ok	
160	()		P111029-2.2.8.11 -4094_EB_10 -VT before welding (*)	Accepted	Ok	
165	()		P111029-2.2.8.13 -4094_EB_11 -VT after welding (*)	Accepted	Ok	
170	()		P111029-2.2.8.16 -4094_EB_12 -VT after welding (*)	Accepted	Ok	
175	()		P111029-2.2.8.17 --RT after welding (*)	Done	Ok	
180	()		P111003-2.2.9.11 -4094_EB_13 -VT before welding (*)	Done	Ok	

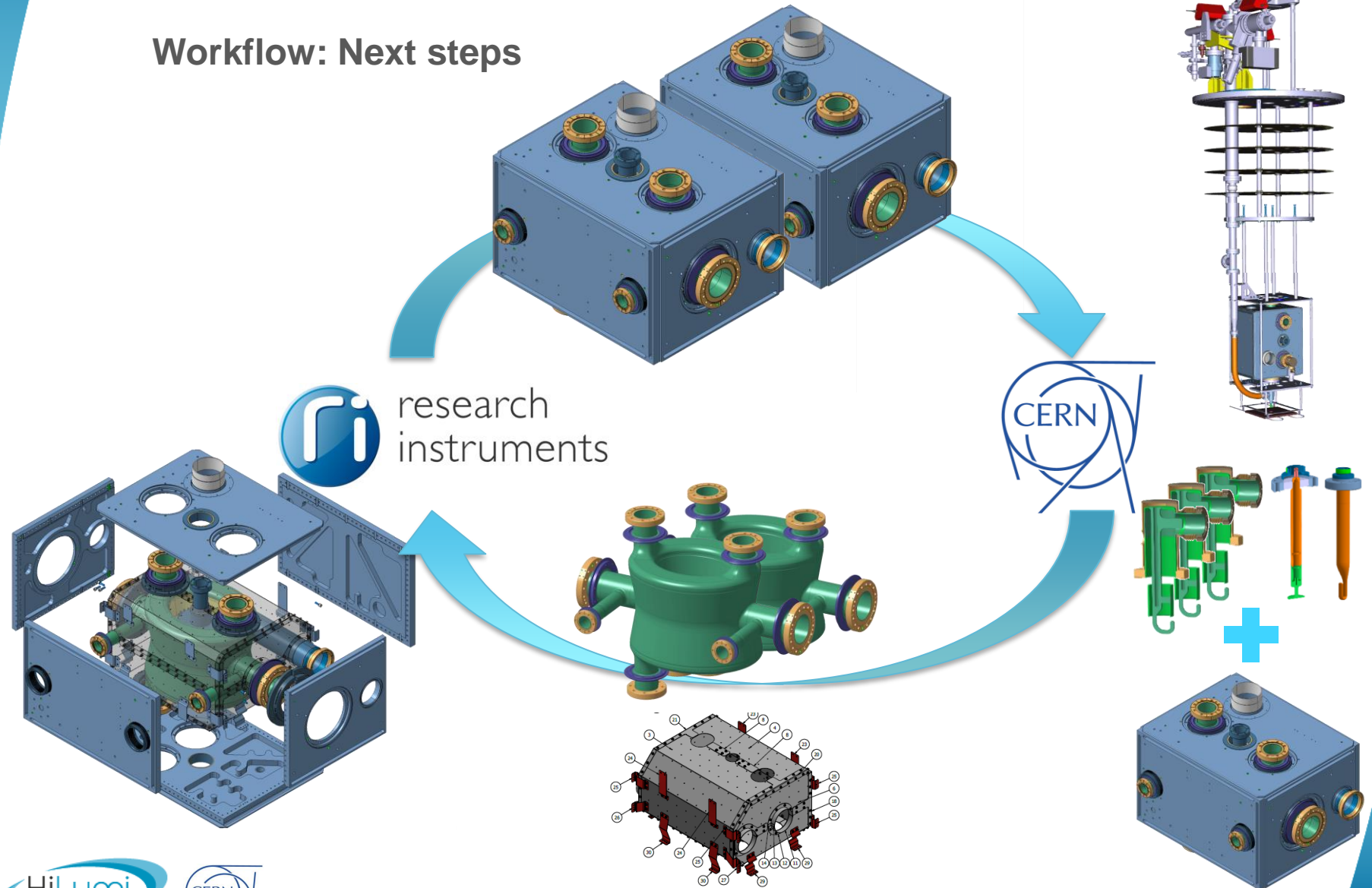
1110	()	P112015 - 300 - (X_USW_03)-UT thck measurement (*)	Pending	
1115	()	P112015 - 310 - (X_F03)- RF measurement (*)	Done	Ok
1120	()	P112015 - 320 -(X_AL2B)- HOLD POINT (*)	Done	Ok
1125	()	P112015 - 380 - (X_BCP_3)- Bulk BCP 3 (*)	Done	Ok
1130	()	P112015 - 400 - (X_PHR_3)- Rinsing (*)	Done	Ok
1135	()	P112015 - 420 - (X_RRI_1)- Rinsing (*)	Done	Ok
1140	()	P112015 - 450 -(X_USW_04)-UT thck measurement (*)	Pending	
1145	()	P112015 - 460 - (X_USD_2)- Ultrasonic degreasing (*)	Done	Ok
1150	()	P112015 - 500 -(X_HPR_1)- HPR (*)	Done	Ok
1155	()	P112015 - 510 -(X_DRY_1)- Drying (*)	Done	Ok
1160	()	P112015 - 540 - (X_F04)- RF measurement (*)	Done	Ok
1165	()	P112015 - 550 - (X_WWF_4)-Weighing (*)	Done	Ok
1170	()	P112015 - 570 - (X_ANL)-(X_ANL_TPR)-(X_ANL_RGASart),(X_ANL_RGAsop)-HT (*)	Pending	
1175	()	P112015 - 580 - (X_F05)- RF measurement (*)	Done	Ok
1180	()	P112015 - 590 - (X_USW_05)-UT thck measurement (*)	Pending	
1185	()	P112015 - 600 -(X_VCO_1)- Visual inspection (*)	Done	Ok
1190	()	P112015 - 610 -(X_AL2)- HOLD POINT (*)	Done	Ok
1195	()	P112015 - 640 - (X_USD_3)- Ultrasonic degreasing (*)	Done	Ok
1200	()	P112015 - 700 - (X_BCP_4)- Light BCP (*)	Done	Ok
1205	()	P112015 - 720 - (X_PHR_4)- Rinsing (*)	Done	Ok
1210	()	P112015 - 740 - (X_RRI_2)-Rinsing (*)	Done	Ok
1215	()	P112015 - 770 - (X_USW_06)-UT thck measurement (*)	Pending	
1220	()	P112015 - 780 - (X_USD_4)- Ultrasonic degreasing (*)	Done	Ok
1225	()	P112015 - 830 -(X_HPR_2)- HPR (*)	Done	Not Ok
1230	()	P112015 - 840 - (X_DRY_2)- Drying (*)	Done	Ok
1235	()	P112015 - 870 - (X_AVT)-Clean room assembly (*)	Accepted	Ok
1240	()	P112015 - 880 -(X_LCC_1)-(X_LCC1_RGA)- Leak test, RGA (*)	Pending	
1245	()	P112015 - 930 - (X_F06)- RF measurement (*)	Done	Ok
1250	()	P112015 - 940 -(X_OUT_1)-Visual inspection (*)	Done	Ok
1255	()	P112015 - 960 -(X_AL3)- HOLD POINT (*)	Done	Ok

- Documentation and QC:
 - Special attention taken to ensure compliance with eng. specs.
 - Continuous CERN/RI feedback.
- An example, BC-pre-series 01:
 - ~174 steps to just before jacketing.
 - 130 done!
 - 24 in revision from CERN and RI.
 - 20 undergoing.



DQW Pre-Series

Workflow: Next steps

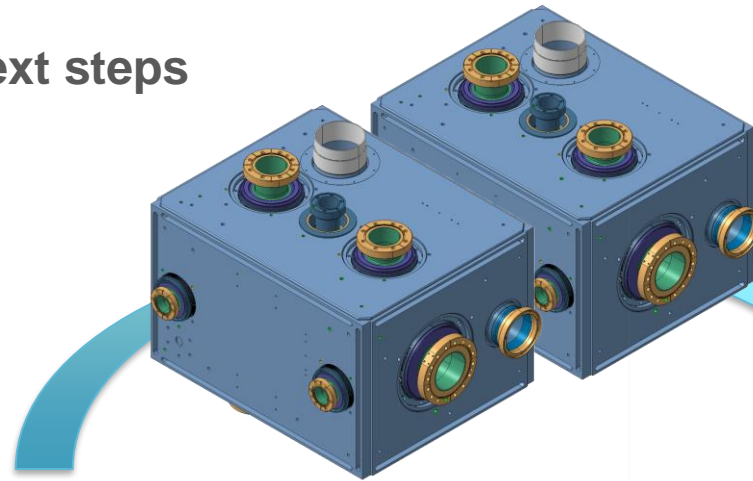
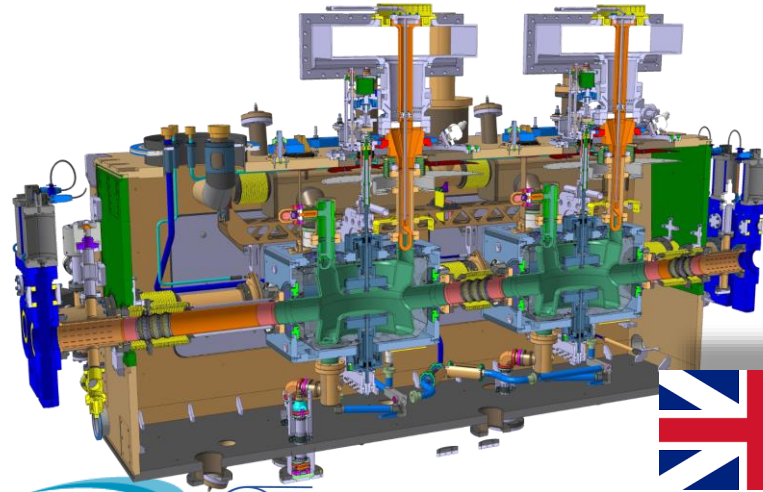


DQW Pre-Series

Workflow: Next steps

 research instruments

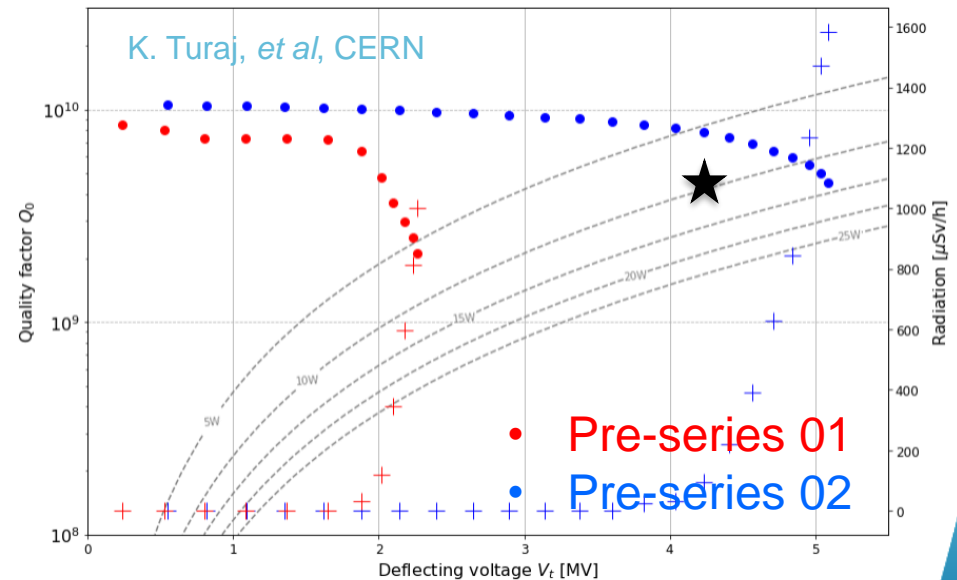
 CERN



Wrapping Up

- Successful manufacturing of 2 pre-series cavities with industry (RI).
 - 1-cavity reaching excellent results, the other waiting re-test.
 - Need to improve surface chemistry & cleanliness of the RF surface.
 - Cavity 1 to be retested in week 45/46 @CERN, metrology done!
 - Cavity 2 currently in metrology @CERN, test done!
- Delays related mainly to conform with eng. specs. aggravated by COVID.
- Now on track for the series phase, primarily thanks to:
 - Invaluable support from CERN-EN-MME design office and main workshop for follow up.
 - All the help from HiLumi-QA team.

DQW-RI



*As seen from Rama's talk on Tuesday



Thank you!

Many thanks to Research Instruments and HL-LHC WP4 colleagues