RF dipole Cold test results

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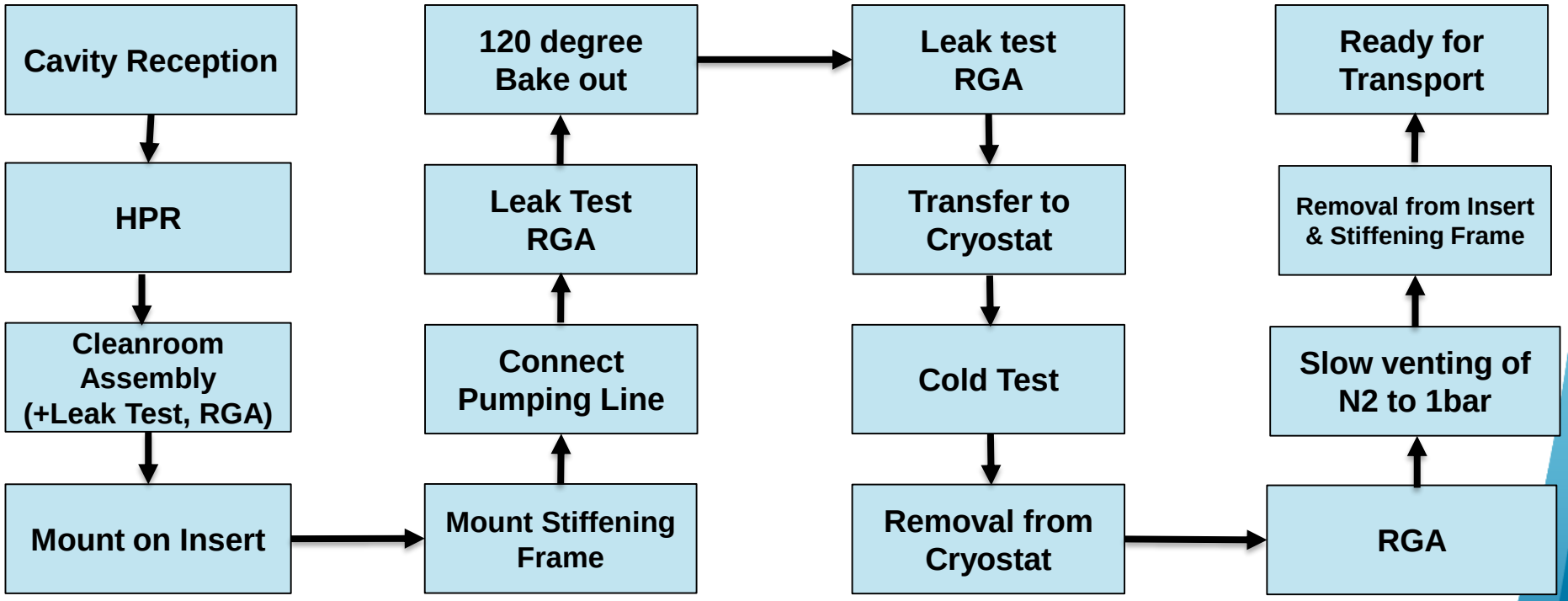
RF testing of bare RFD1 and RFD2 cavities

- RF tests performed in July/August in V4 cryostat
- The same preparation and testing process was used for both cavities (slight differences on the next slide)

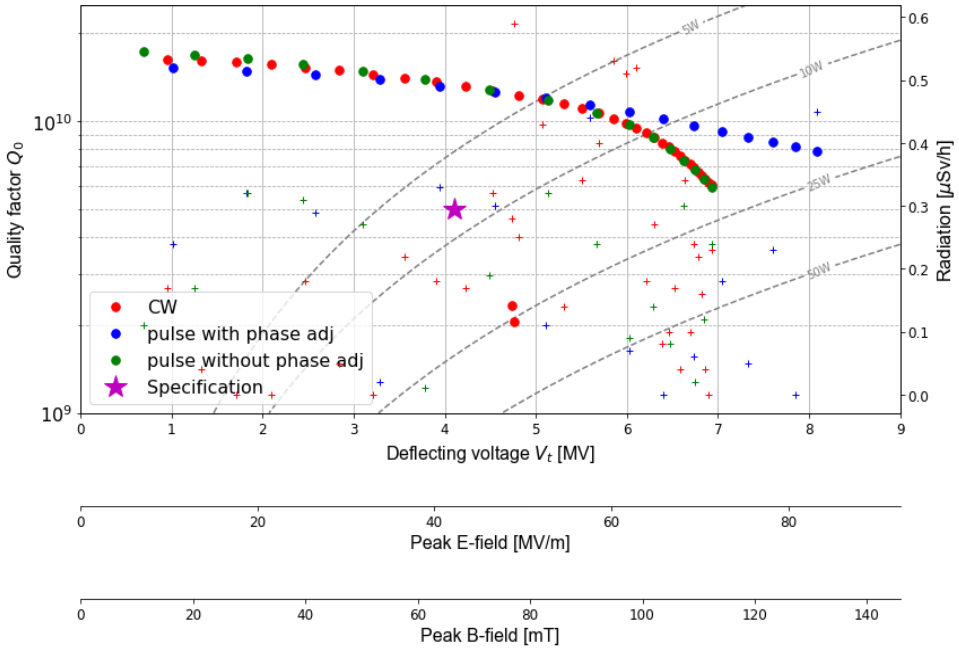


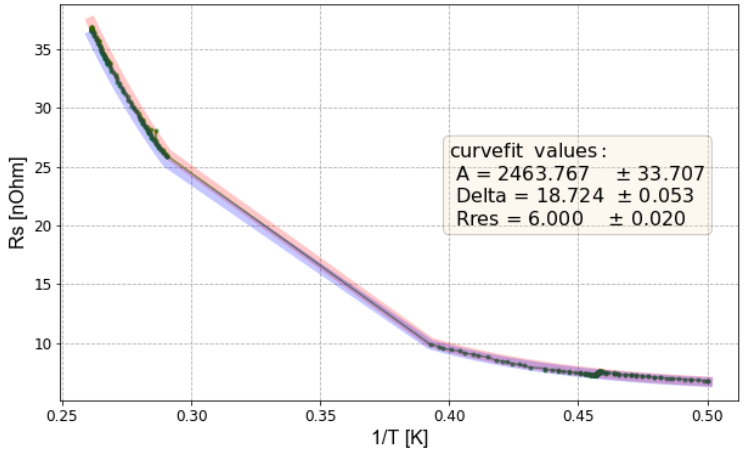
Differences in the preparation and testing process

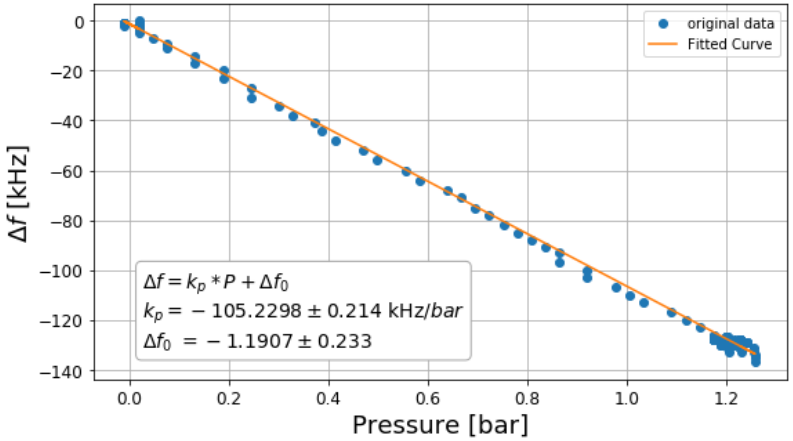
- Cool down (see spare slides)
  - RFD1: slow cooldown until 130K with ΔT<10K, fast cool-down below 130K (~5K/min),
  - RFD2: slow cooldown until 250K, fast cool-down below 250K (~1.2K/min) ΔT>>50K
- Magnetic field compensation
  - RFD1: ~1μT
  - RFD2: 0.5μT

Results of the RF cold test of RFD2 (10.07.20 -17.07.20)

- Multipacting at the following Vt (i.e. 1MV, 1.9MV (stronger than the previous one)) → RF conditioning (pulse on =5s and pulse off= 15s) for ~10hours
- Surface resistance=7nΩ, Rres = 6nΩ
- Various measurements (pulse, CW, pressure sensitivity, LFD, Rres)

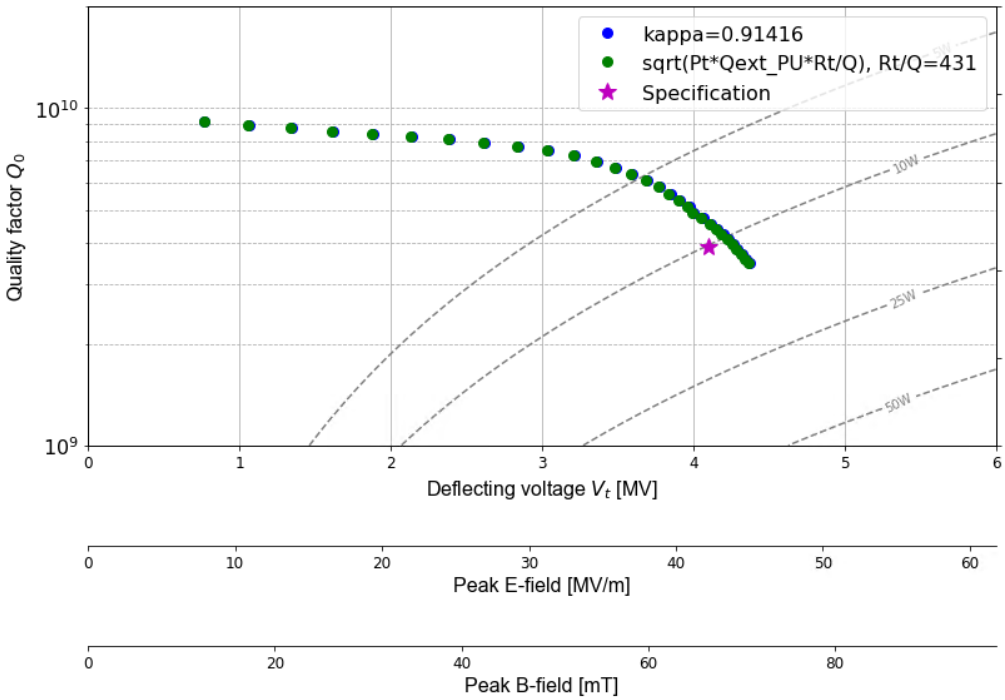


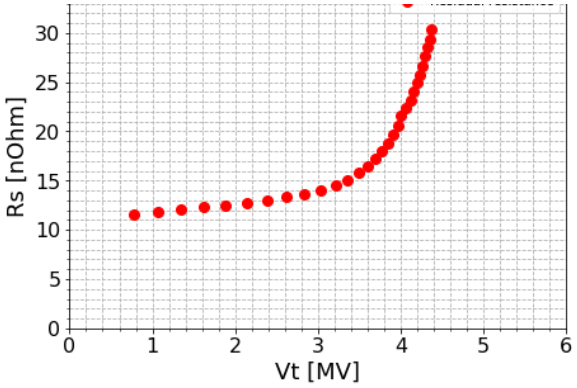




Results of the RF cold test of RFD1 (04.08.20 - 07.08.20)

- Multipacting much more difficult to be process appeared at the same Vt as for RFD2→ RF conditioning using pulse and AM* method
- Surface resistance ~12nΩ
- only CW measurement →to prepare the cavity for light BCP as soon as possible

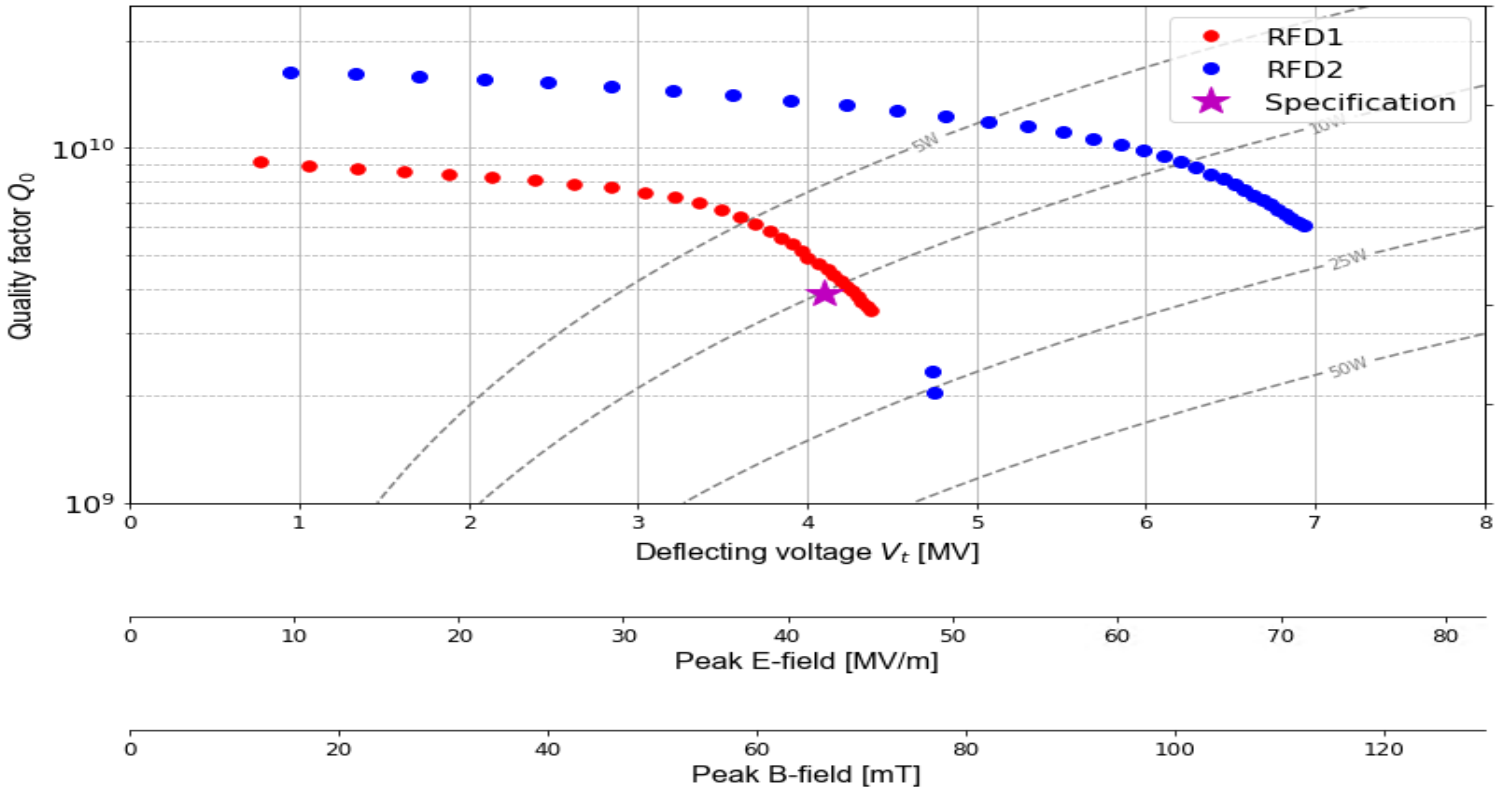




* step function

Results of the RF cold tests (at 2K, CW)

	RFD1	RFD2
Frequency [MHz]	400.949	401.167
Max V_t [MV]	4.36 MV	6.91 MV
Q_0 at max V_t	3.5×10^9	6×10^9
E_p [MV/m]	44.9	71
B_p [mT]	70.7	112



Results of the RF cold tests (at 2K, CW)

	Spec. (**)	RFD1	RFD2
Resonant frequency [MHz] (at 4.5K)	400.79±0.15	400.949 (400.764)	401.167 (401.041)
Max V_t [MV]	≥4.1	4.36 MV	6.91 MV
Q_0 at 4.1 MV	$\geq 3.9\times10^{9}$	4.6×10^{9}	1.3×10^{10}
Lorentz Force Detuning Coefficient [Hz/MV^2]	≤865	719.53 ± 3.48	734.74 ± 8.83
Sensitivity to LHe pressure fluctuation dF/dp [Hz/mbar]	≤300	No data	105.23 ± 0.21
P_{diss} at 4.1 MV [W]	≤10	8.6	2.08

** EDMS1389669

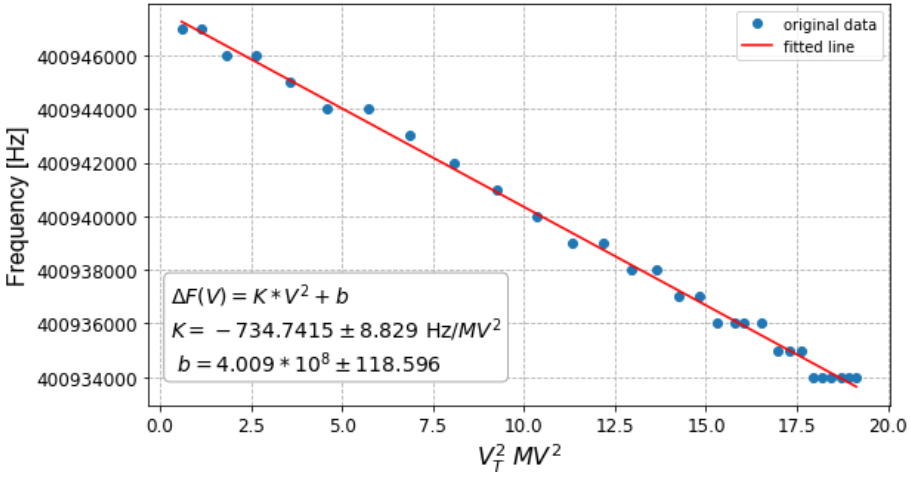
Conclusion

- Infrastructure and processing procedures are verified and tested; some modification need to be implemented
- Both cavities met the specification** (excellent results of RFD2)
- Cavities successfully prepared and tested within 6 week (cold test 1week).
- Due to a broken detector, radiation measurements were not possible (some data available for RFD1) →new device ordered

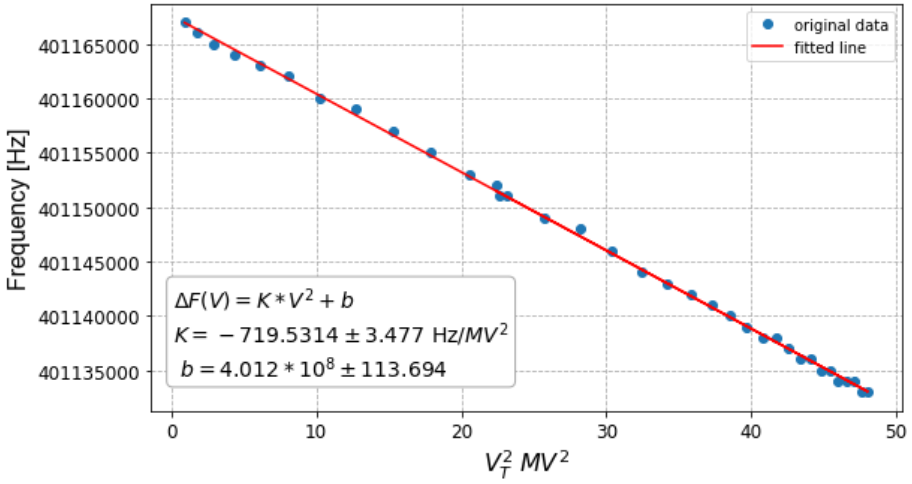
Thank you very much!

Lorentz Force detuning

RFD1

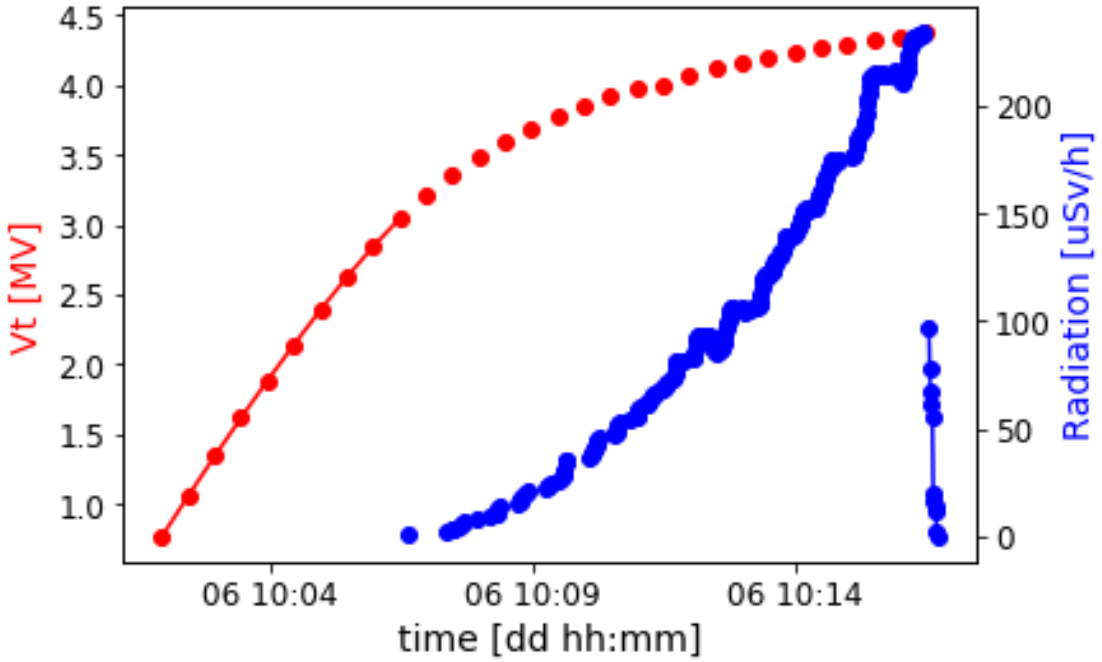


RFD2



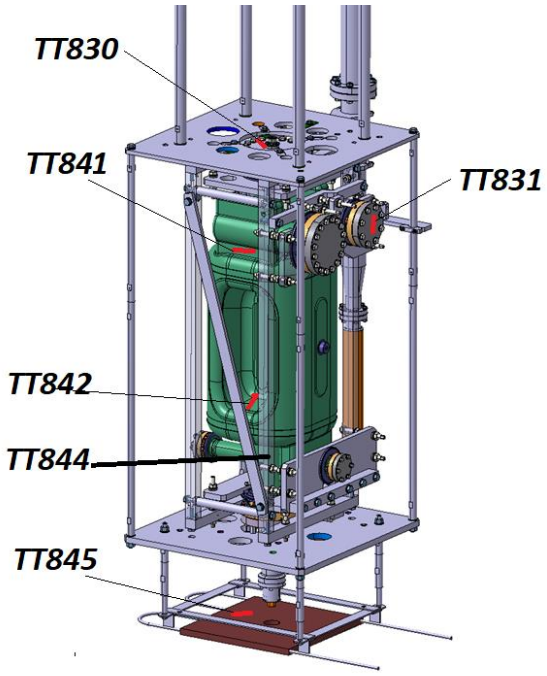
RFD1 (Radiation sensor taken from V3)

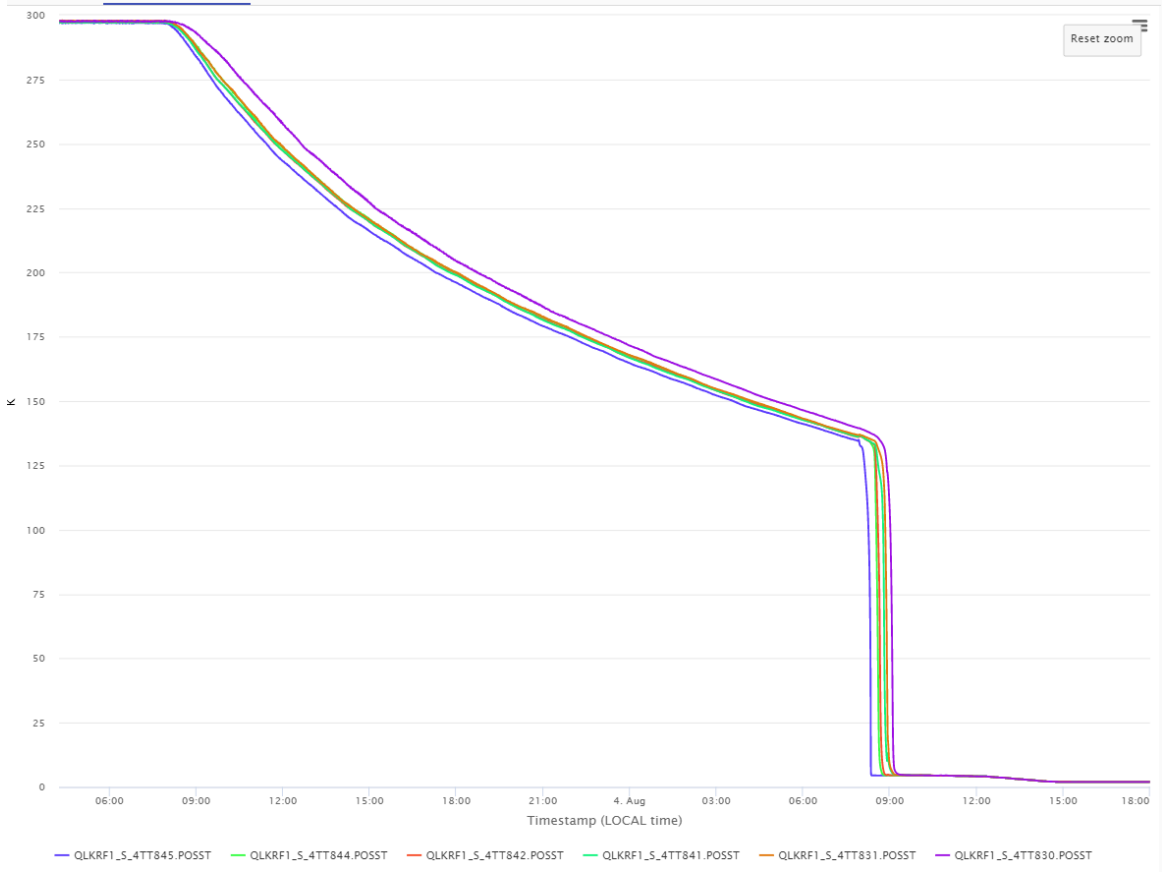
Data need to be synchronised



No field emission were observed below ~3.5MV
At 4.1MV: ~85 µSv/h

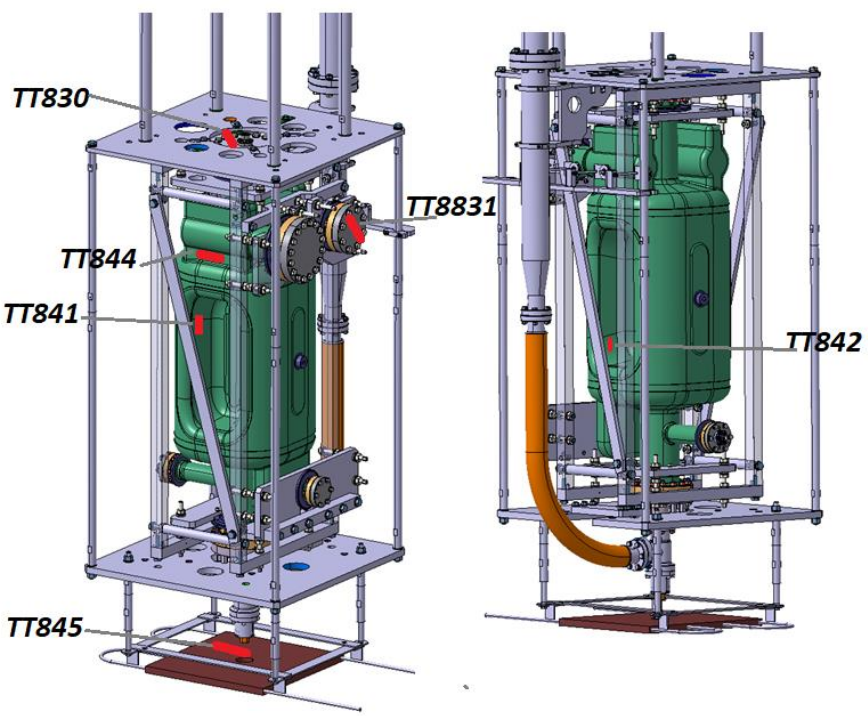
Cooldown of RFD1 (03.08 – 04.08.2020)



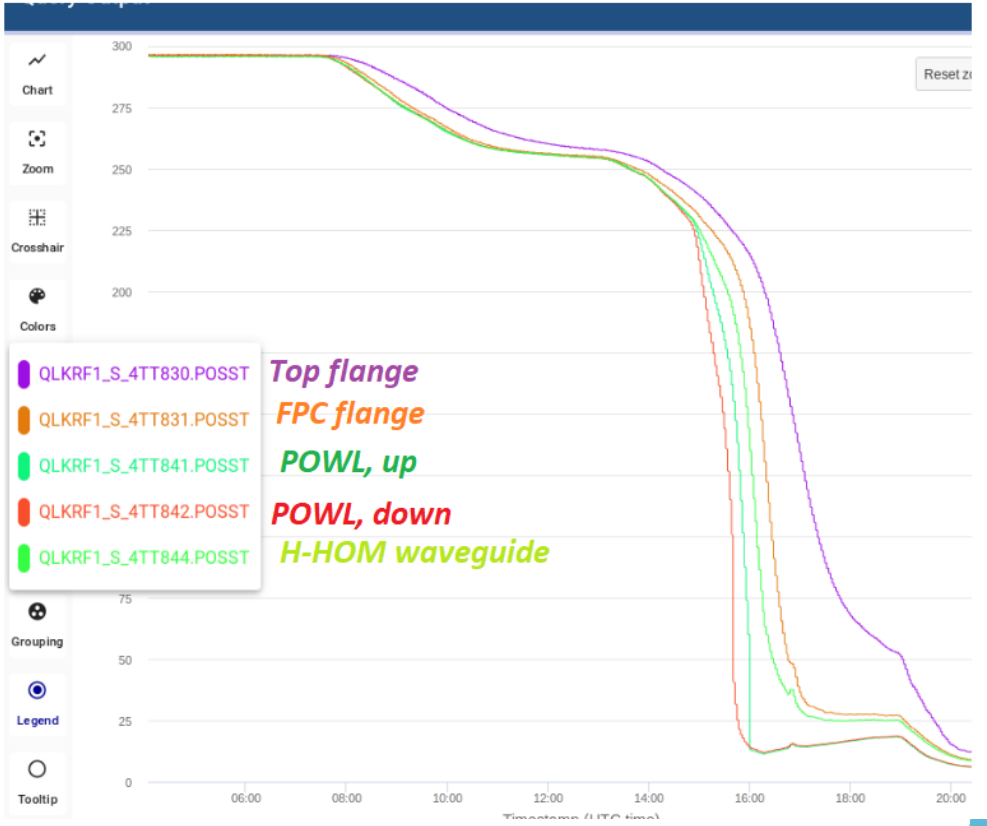


With the cooling of the thermal screen, the temperature inside the cryostat dropped to 130K and the temperature gradient along the cavity was less than 10K during the process. Since T <130K, we asked the cryogenic team to cool down quickly.

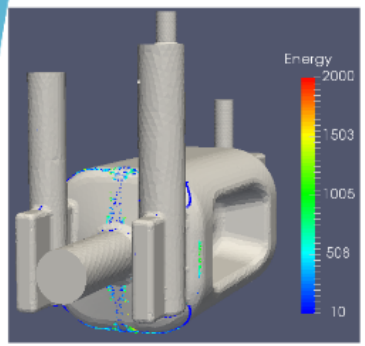
Cooldown of RFD2 (08.07.2020)



Note: TT841 and TT842 take off during the test



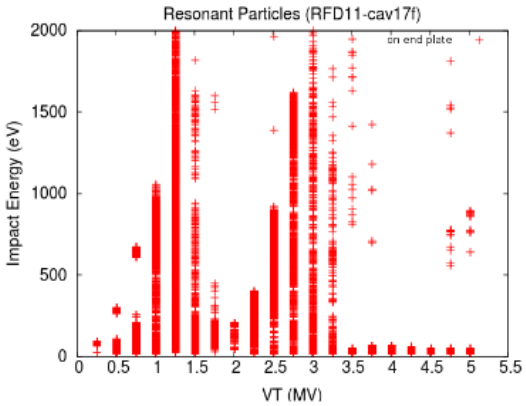
More tan 100K gradient inside the cavity

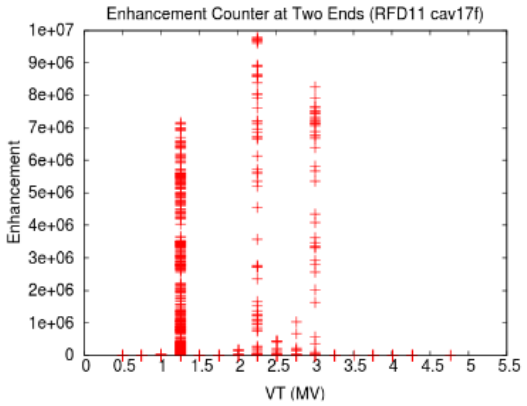


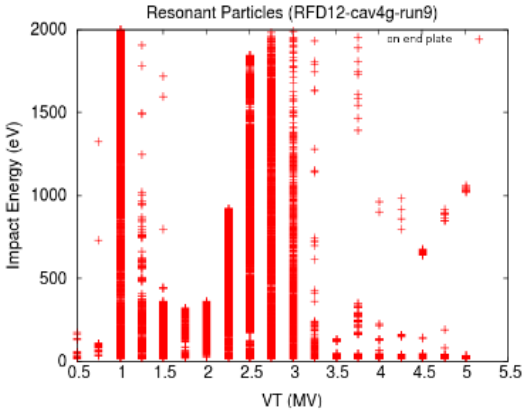
Multipacting mostly on end-plate

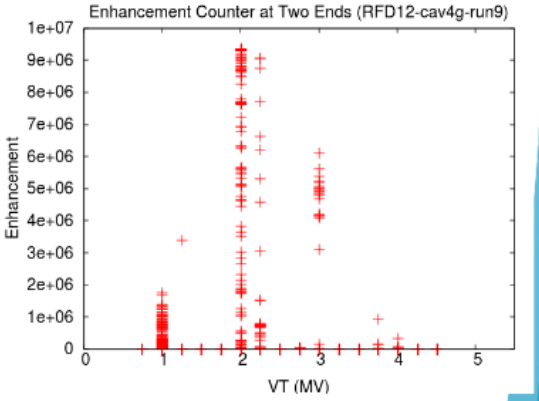
LARP prototype (RFD11-cav17f)

New design (RFD12-cav4g)









Impact Energy

Enhancement Counter