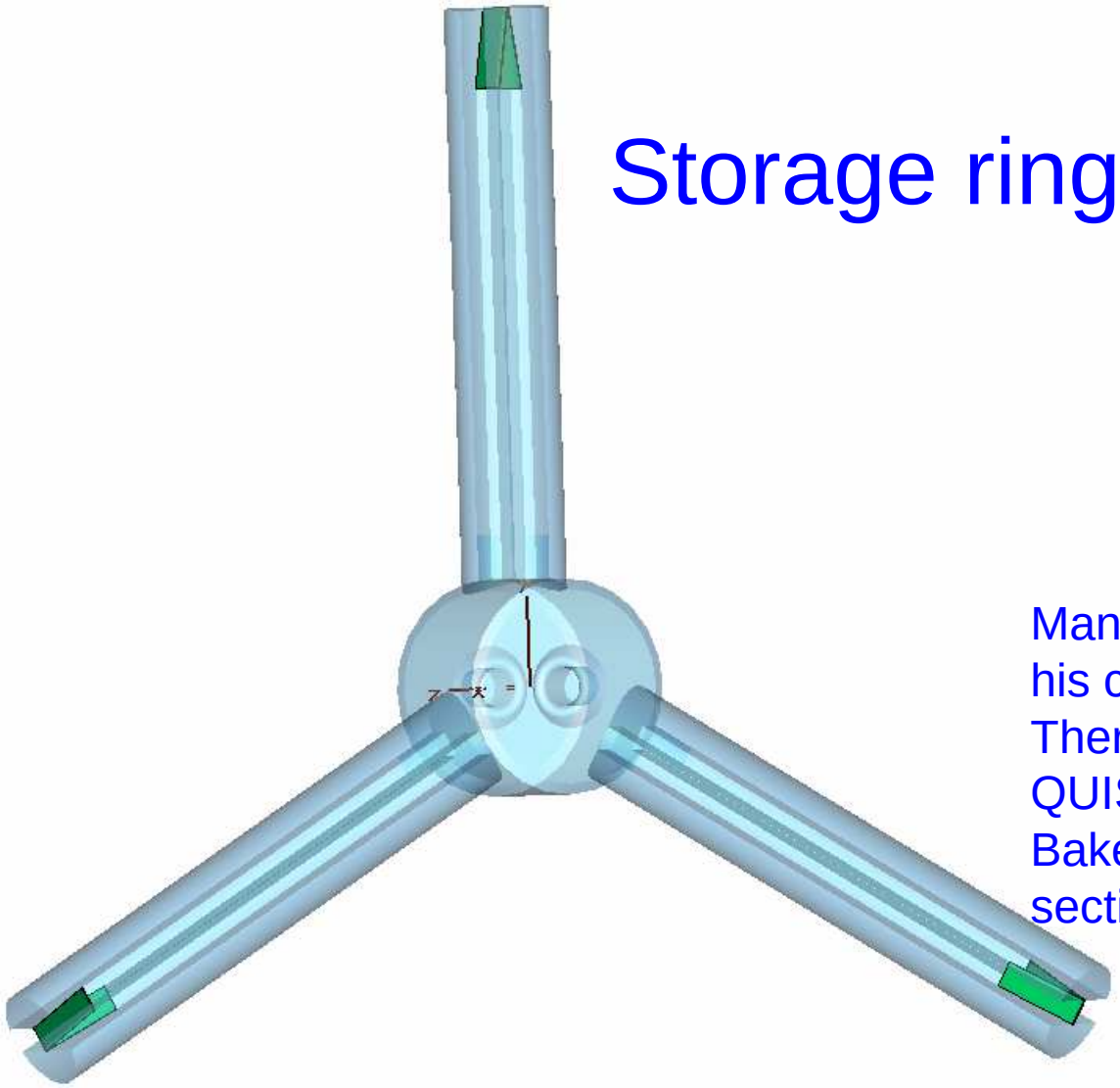


Storage ring DAMPY cavity

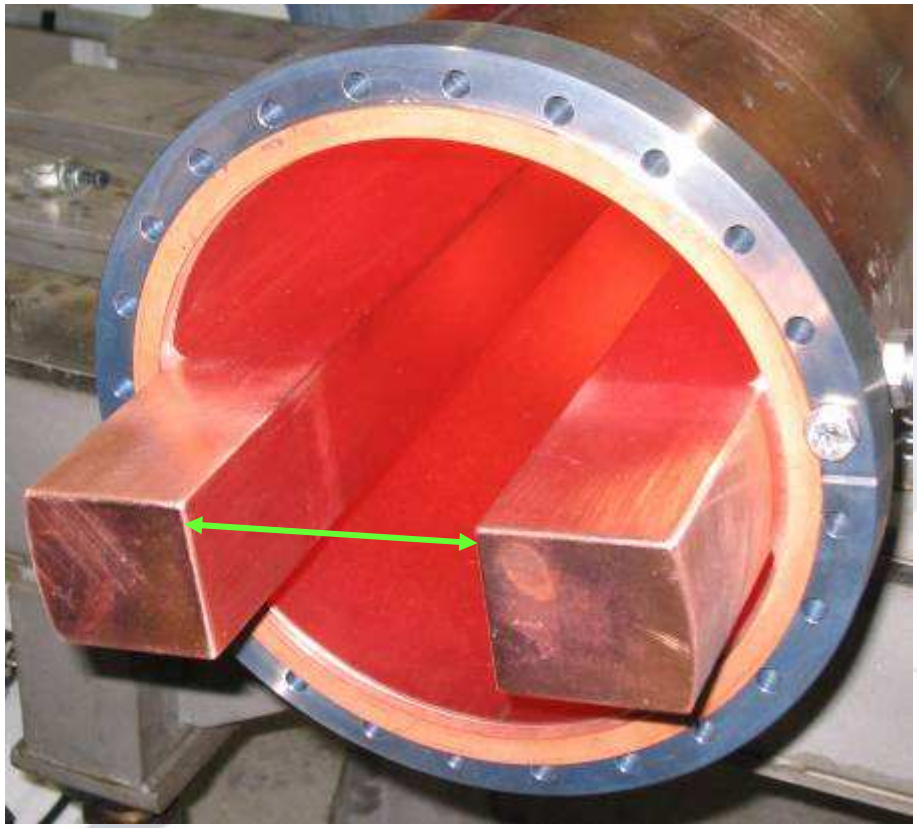
Michel LANGLOIS

Many thanks to Ernst Weihreter for his continuous help
Thermal simulations from Marcos QUISPE
Bake out in cooperation with vacuum section and workshop technicians

Storage ring DAMPY cavity

- Bead-pull impedance measurements
- RF overheating at MLS
- Bake-out
- Next steps

Bead-pull impedance measurements

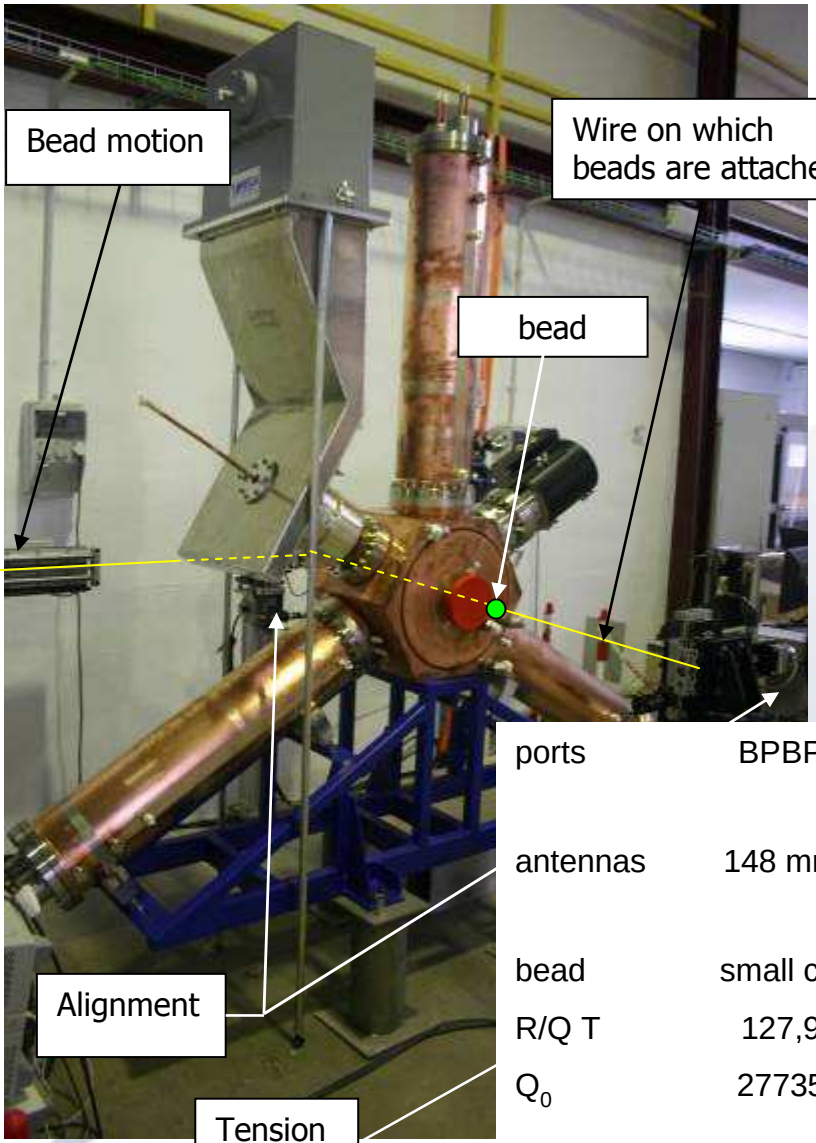


The gap between ridges was modified : from 87.9 mm (MLS) to 85.1 mm (DAMPY 0)

The computed cut-off frequency drops from 629 to 619 MHz

The impedance of the fundamental mode E010 was supposed to retain its former value of 3.3 MΩ

The impedance of E011 was supposed to drop significantly



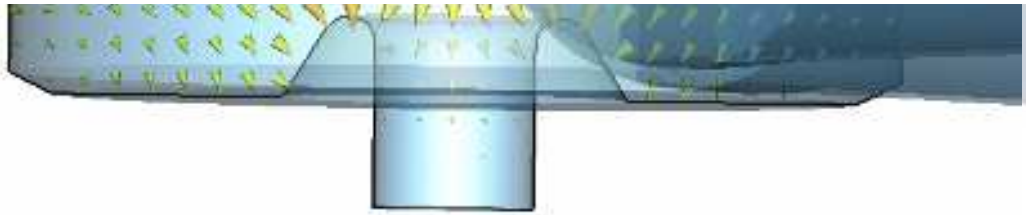
- The bead-pull system was lent by DARESBURY lab
- The dielectric perturbations were calibrated with a pill-box cavity from BESSY. We used 2 alumina cylinders
- The phase method was used. It calls for 2 ports: BP means beam port, RF means the input coupler, PU means pick-up

E010 results

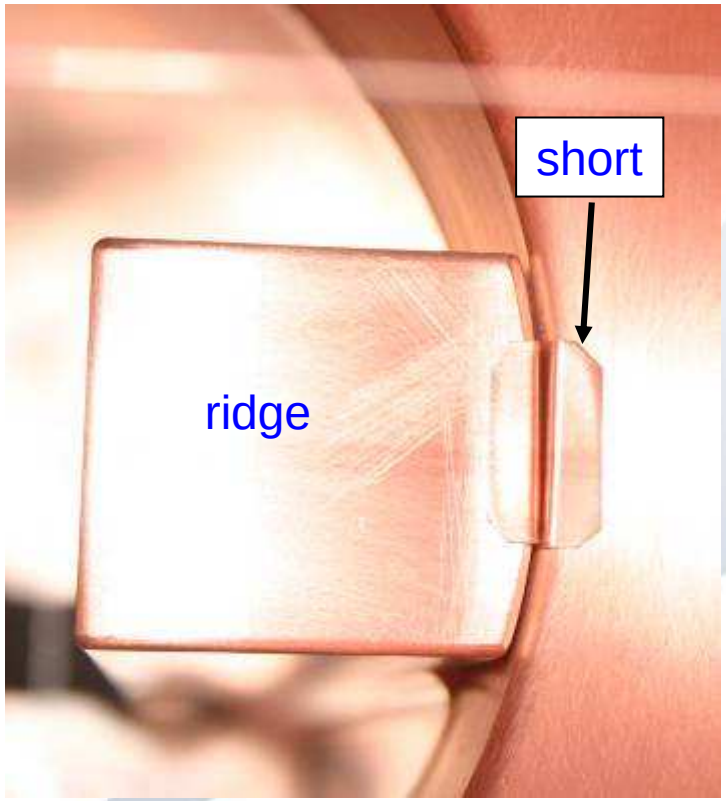
ports	BPBP	BPBP	BPBP	BPBP	RFPU	MWS
antennas	148 mm	148 mm	148 mm	150 mm		
bead	small cyl	big cyl	big cyl	small cyl	small cyl	
R/Q T	127,9	120,8	115,7	125,7	116,9	111,3
Q_0	27735	27735	27751	26435	28330	32608
R T	3,55E+06	3,35E+06	3,21E+06	3,32E+06	3,31E+06	3,63E+06

E011 impedance measured values

ports	BPBP	BPBP	BPBP	BPCF	BPCF	MWS
antennas	148 mm	148 mm	150 mm	148 mm	148 mm	
bead	small cyl	big cyl	small cyl	small cyl	big cyl	
$\Delta\varphi$ max º	0,4	8,8	0,3	0,4	-9,1	
R/Q T	31,6	31,1	31,6	26,3	30,9	27,46
Q_0	389,3	391,3	292	379,9	379,9	98,6
R T	1,23E+04	1,22E+04	9,23E+03	9,99E+03	1,17E+04	2,71E+03

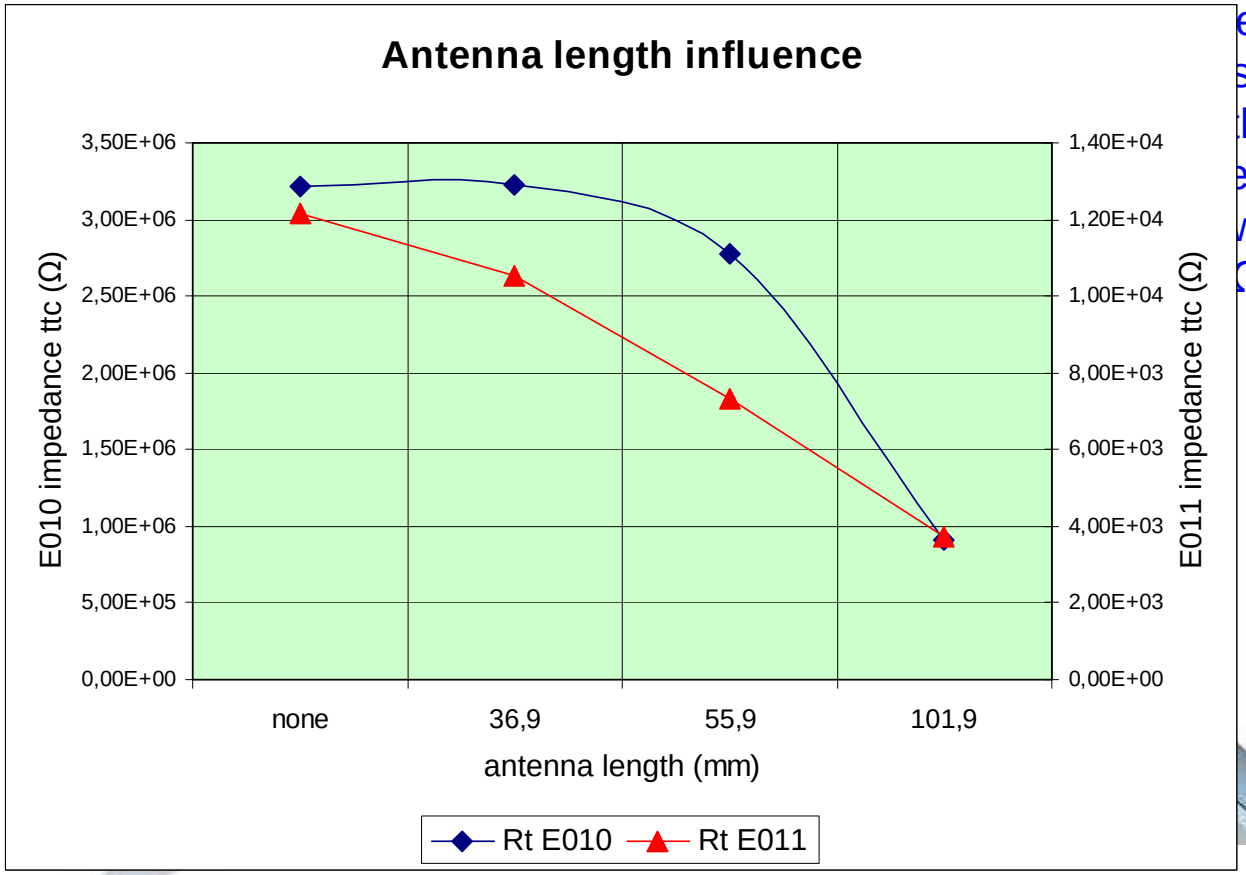


E011 impedance : short circuits on ridges



ridges	1mm space	shorts
MWS	gap 87,9mm	gap 87,9mm
R/Q ttc (Ω)	34,8	25,5
Q lossy	589	205
R ttc (Ω)	20497	5228
Bead-pull	gap 85,1mm	gap 85,1mm
R/Q ttc (Ω)	30,9	26
Q lossy	380	209
R ttc (Ω)	11739	5424

Damping E011 with an antenna

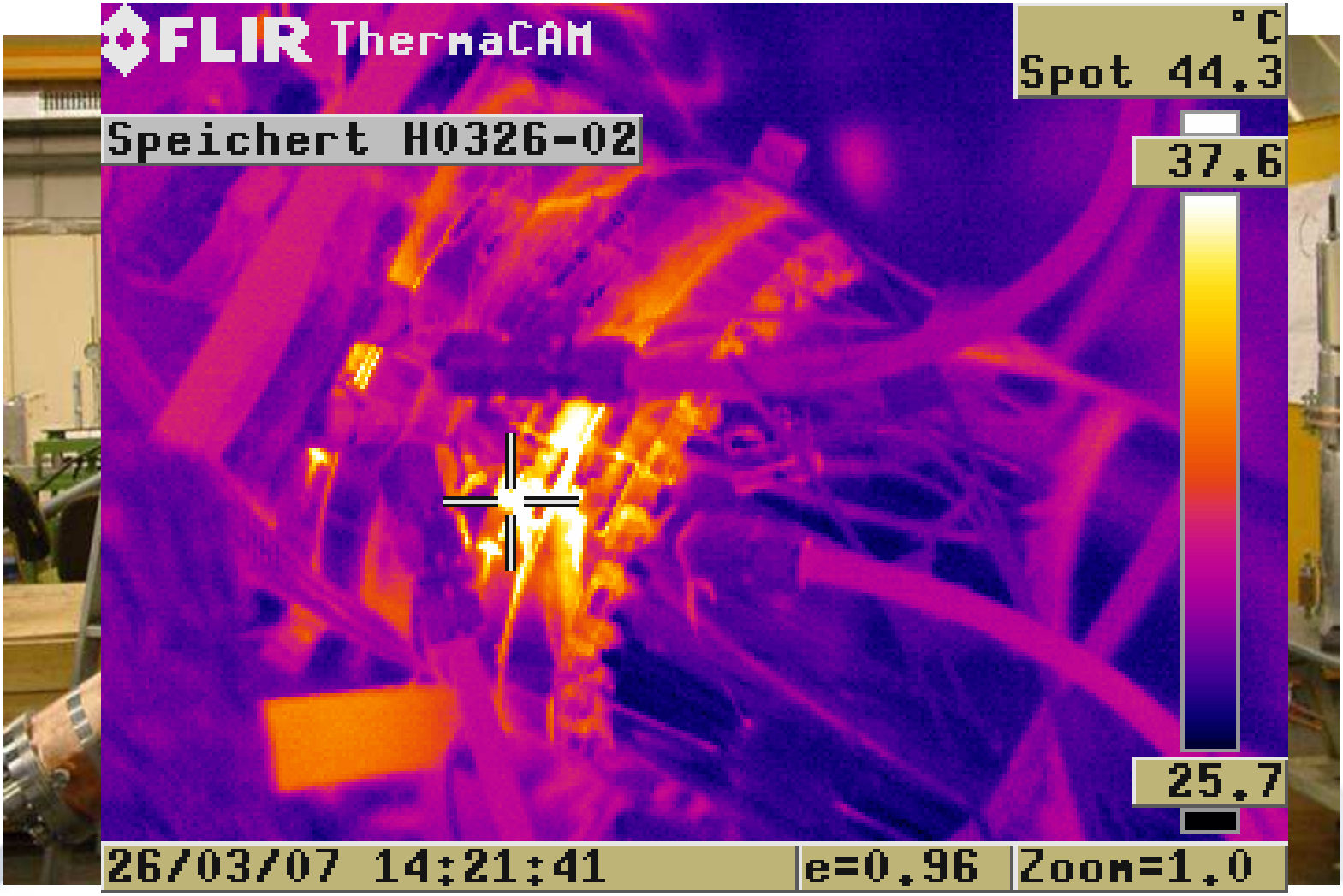


e modifications implemented serie cavity, a CF 16 port was he symmetry plane of the e cavity.

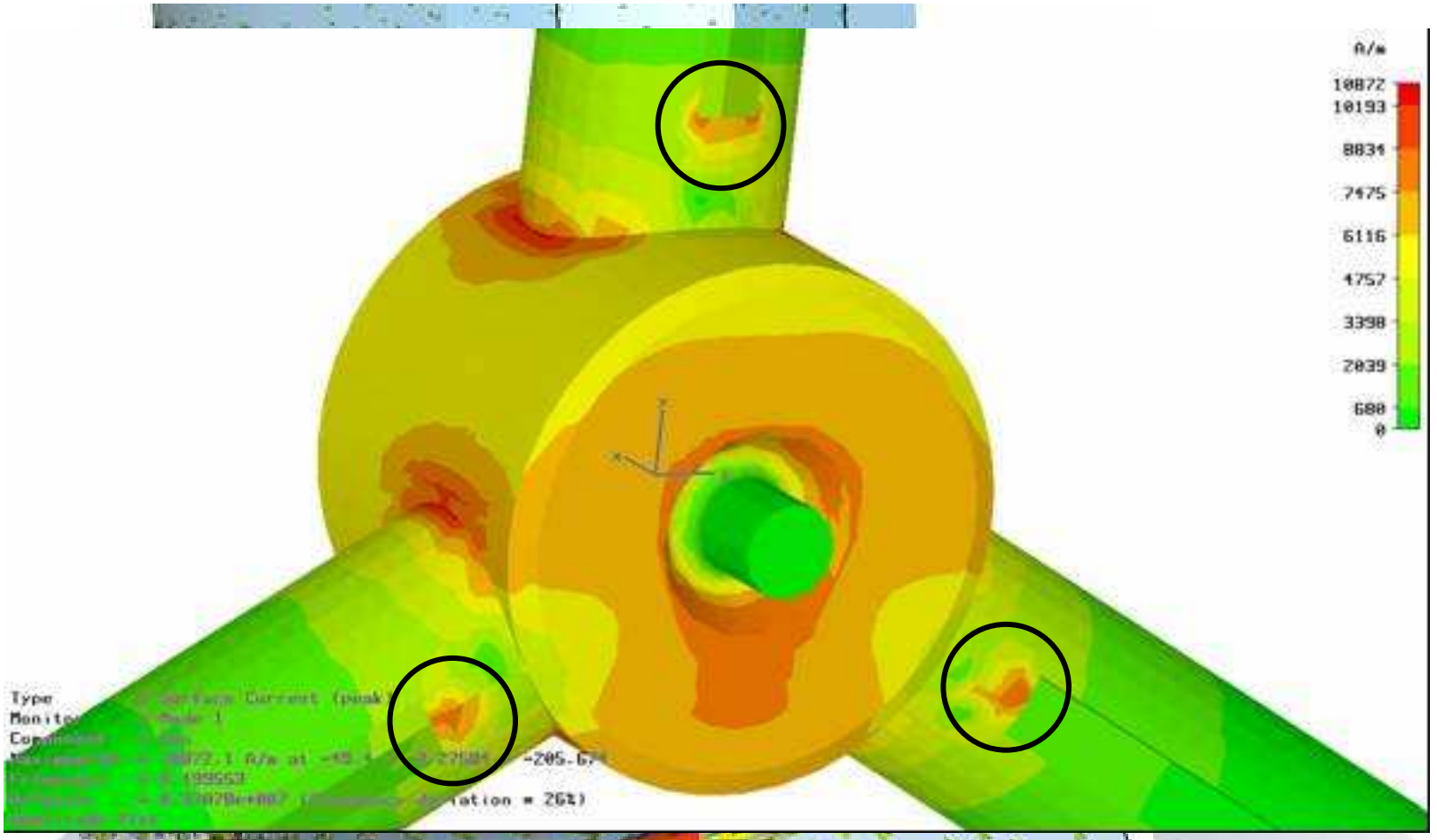
For short antennas, E011 impedance is decreased and E010 impedance unchanged. For long antennas, E011 impedance decreases further but E010 impedance too. This means TX power would go to the load connected to the antenna.

was fitted with an antenna Ω load

Flange overheating at MLS



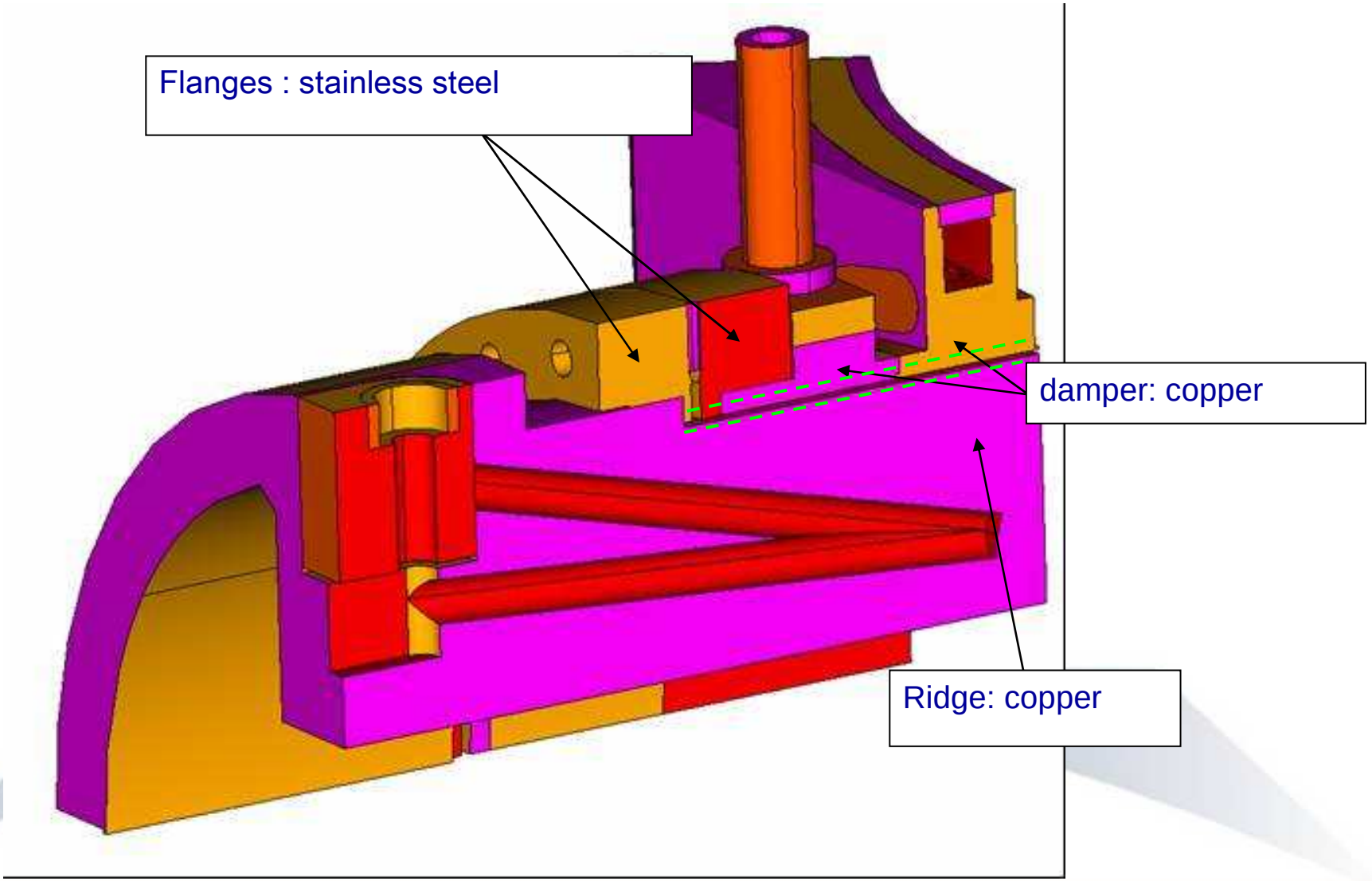
E010 magnetic field in the gap between ridges and cavity body



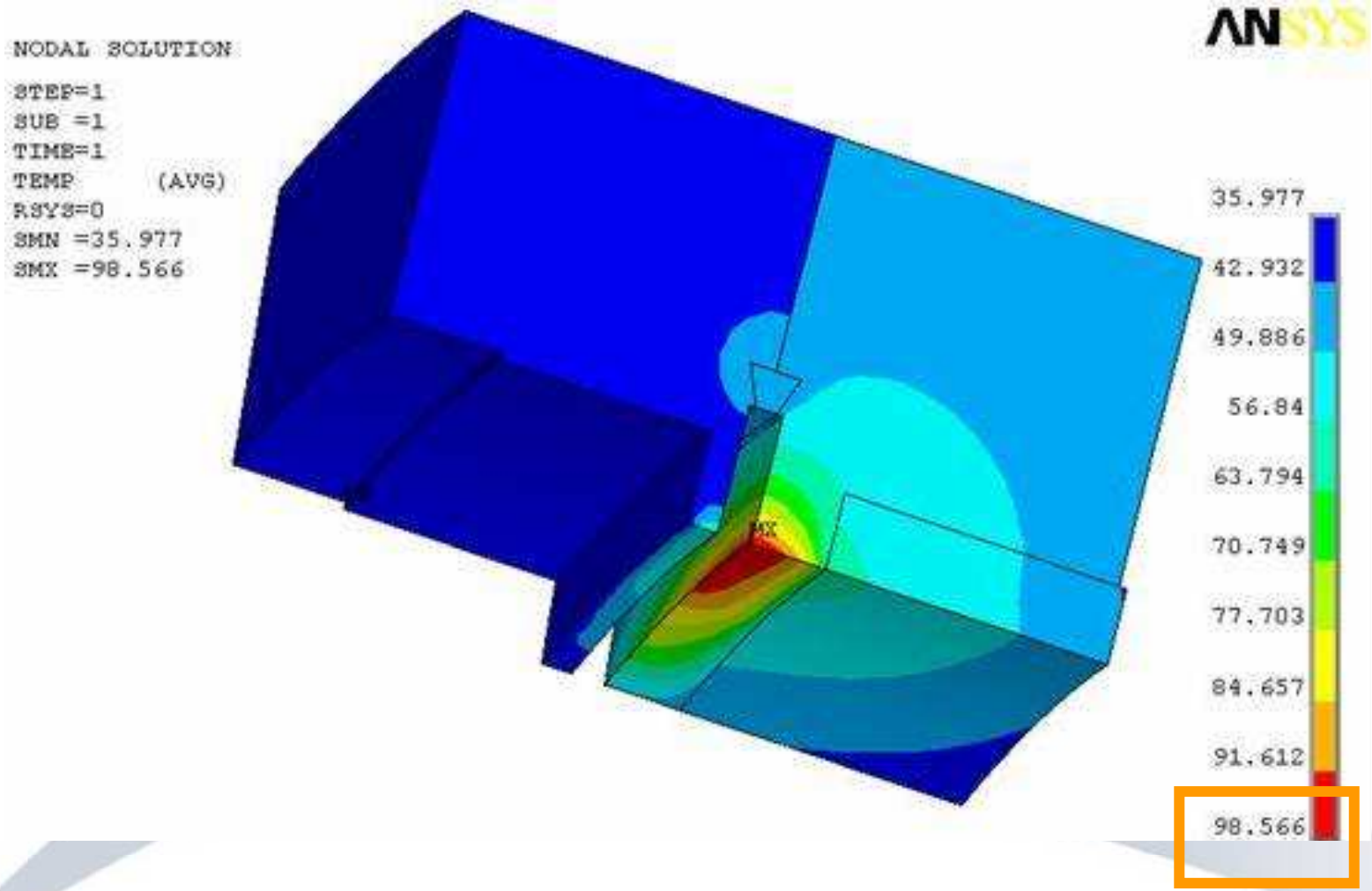
$$Loss = \frac{1}{2}\frac{\rho S H^2}{\delta} \quad \text{with} \quad \delta = \sqrt{\frac{\rho}{\pi \mu f}}$$

244 W with 56 kW dissipation

Thermal simulation with ANSYS



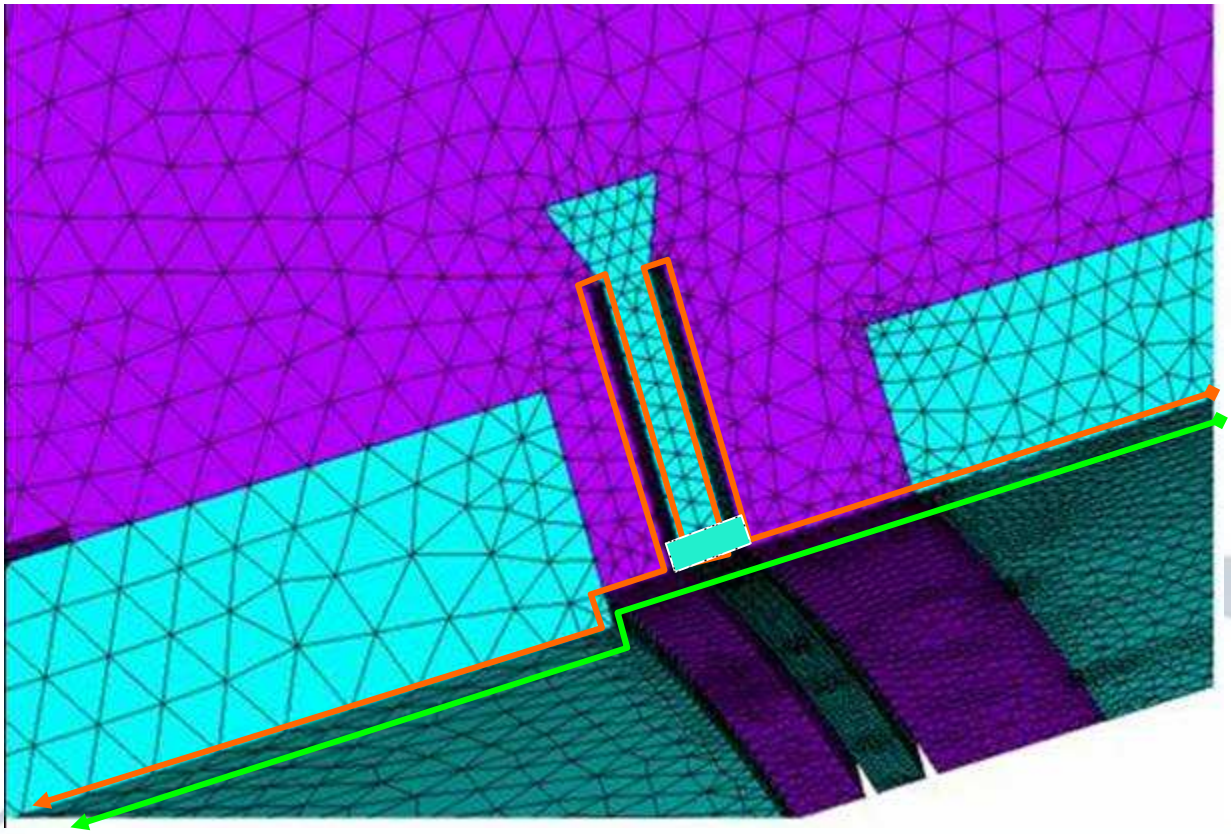
Computed temperature mapping at 56 kW dissipation



Cooling flow has little influence on the max temperature

Possible solutions:

1. Change the quality of the bolts from A2 to A4. It was done at MLS and the cavity can now sustain 40 kW C.W

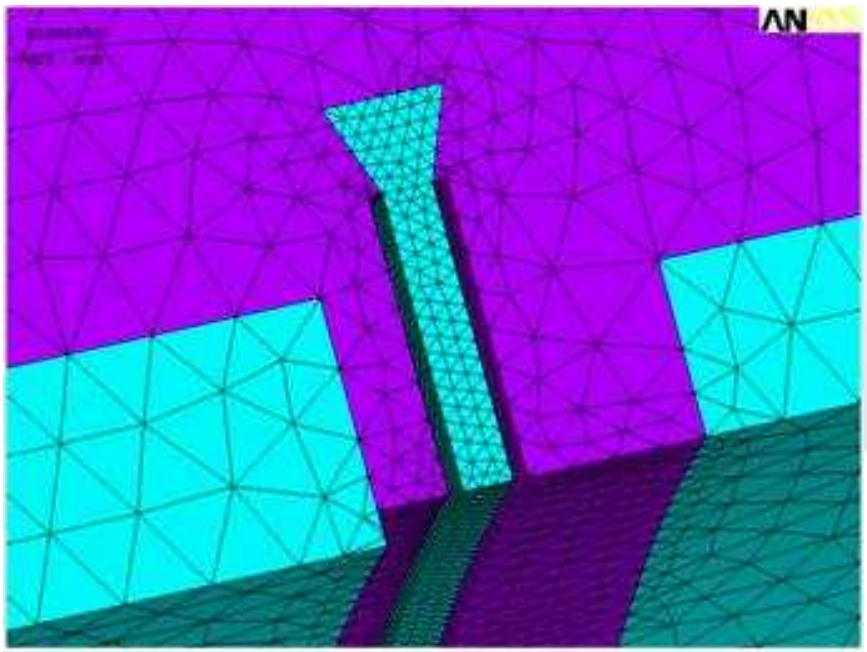


2. Use of fancy gaskets to decrease the length of the current path

Possible solutions:

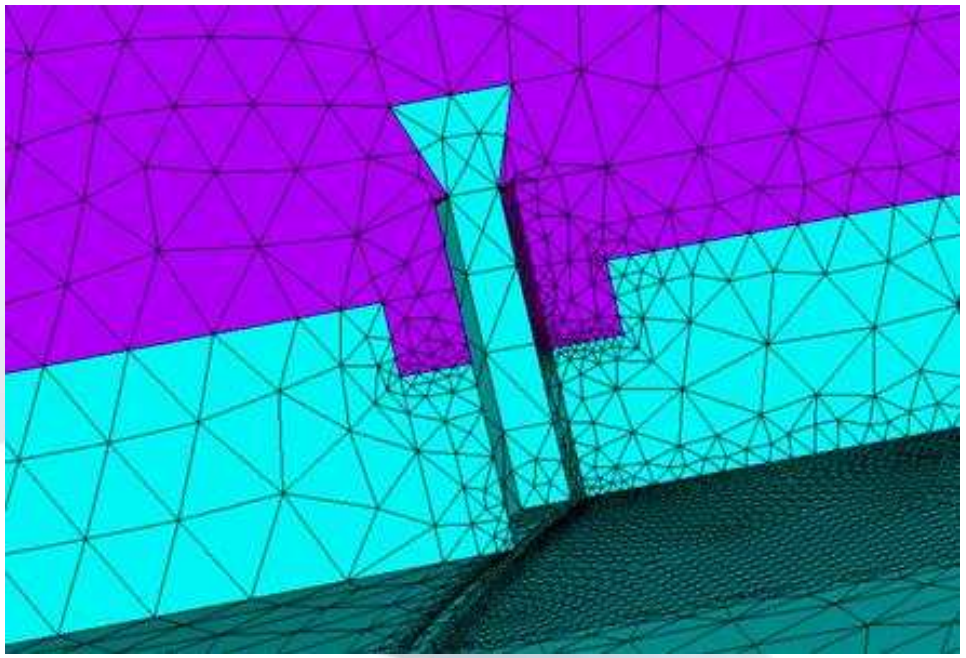
3. Provide copper instead of stainless steel wherever possible

original design



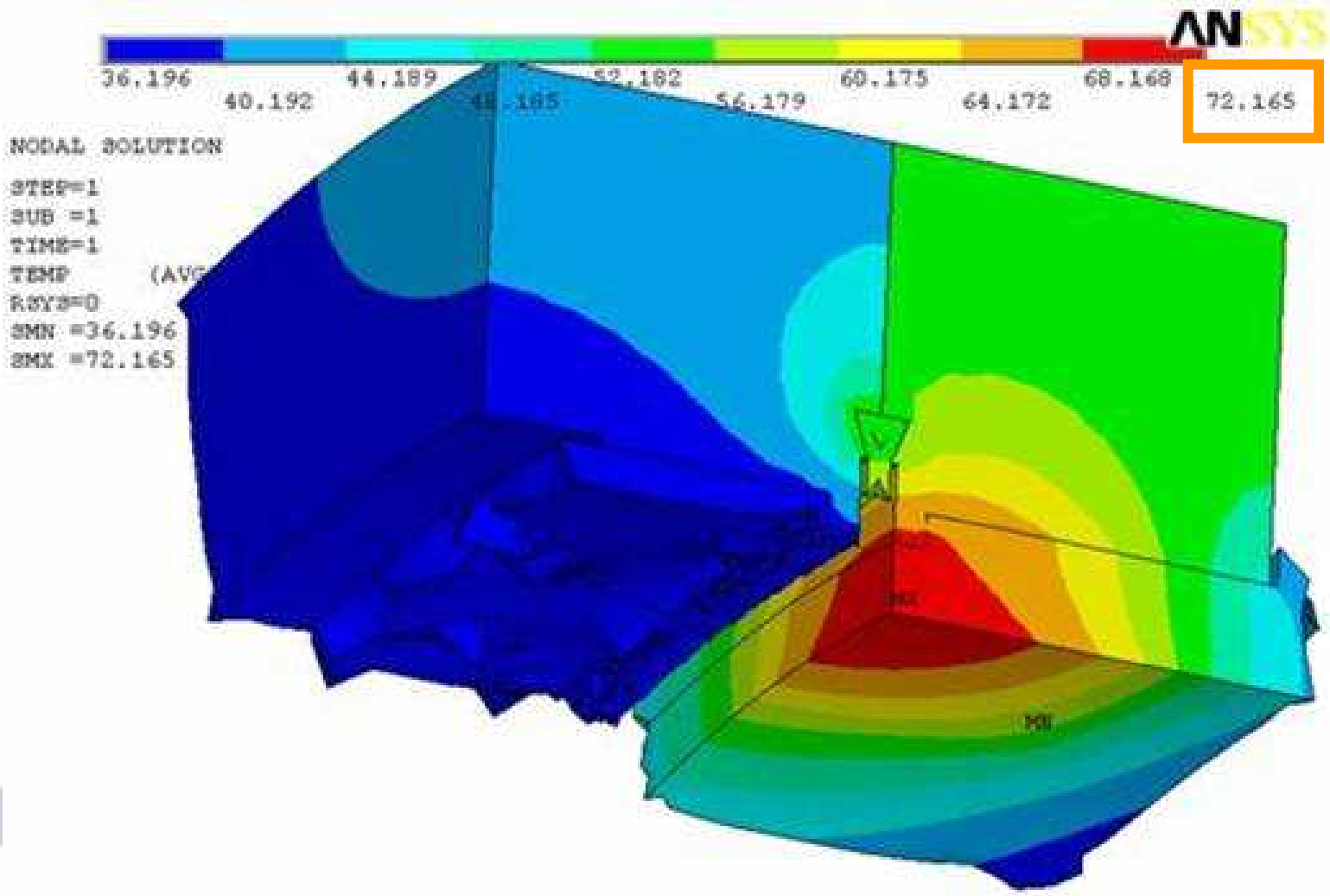
copper

modified design

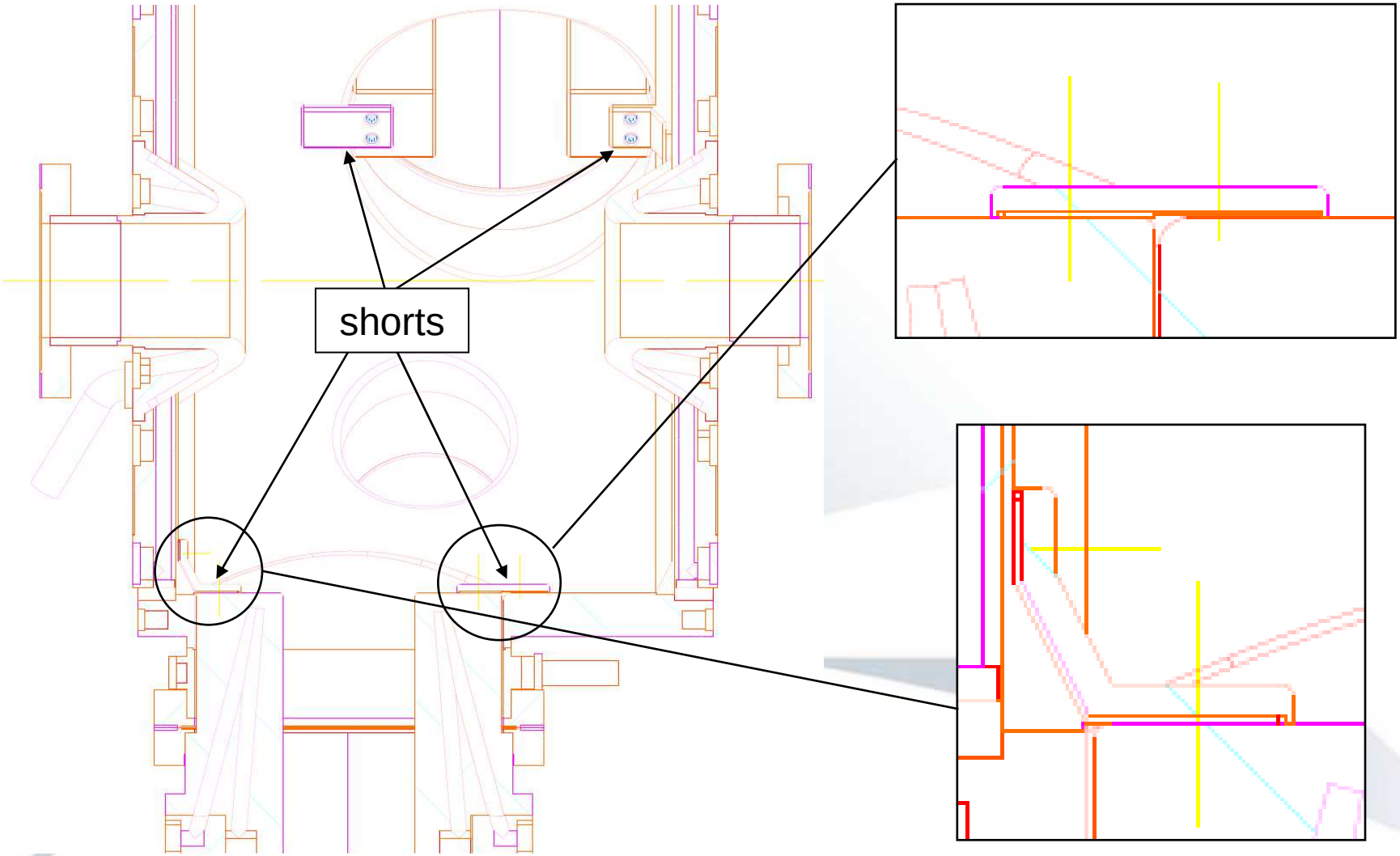


Stainless steel

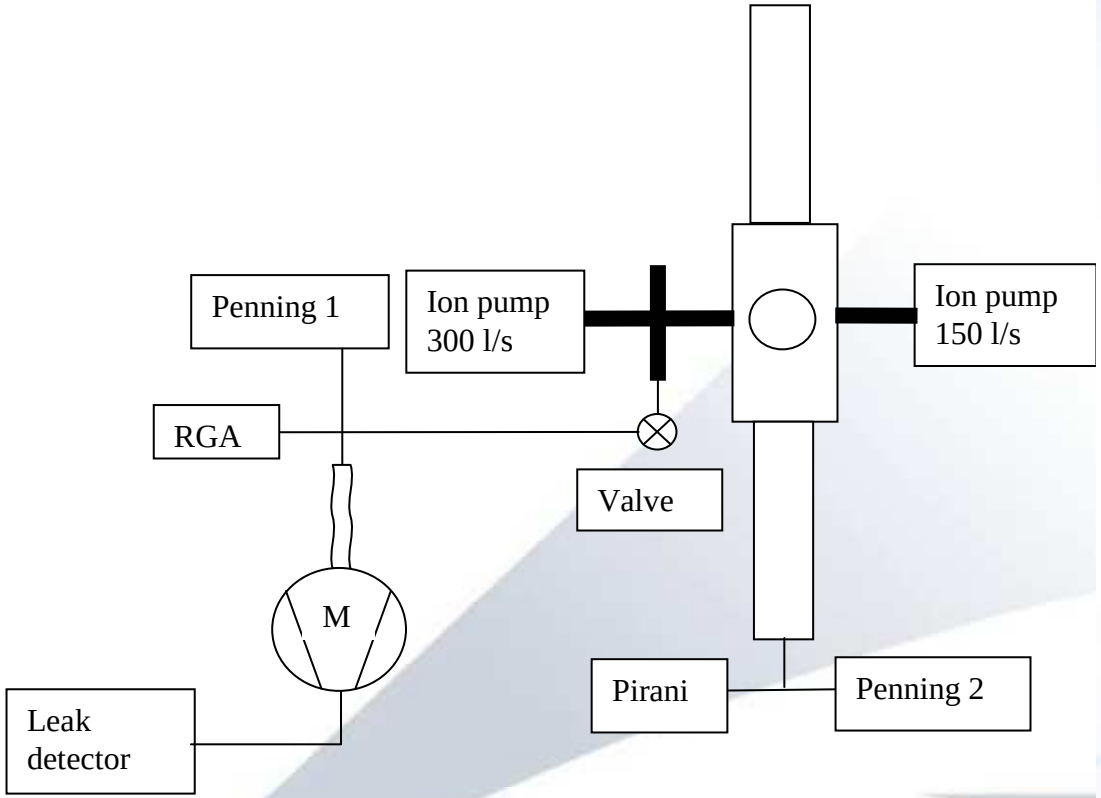
Computed temperature mapping at 56 kW dissipation

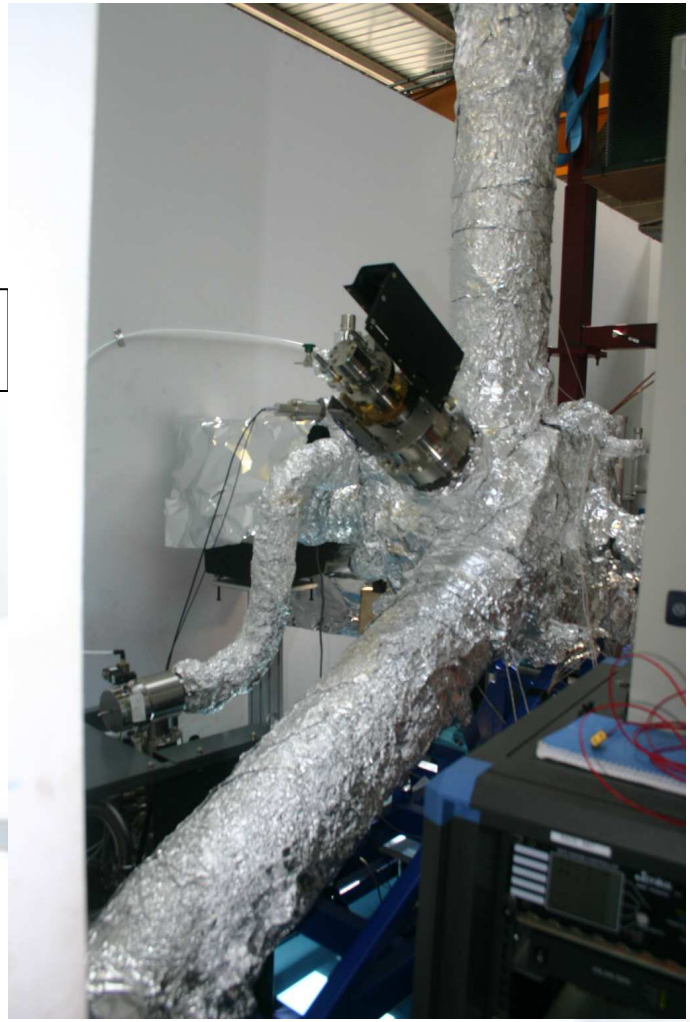


Short circuits possible implementation



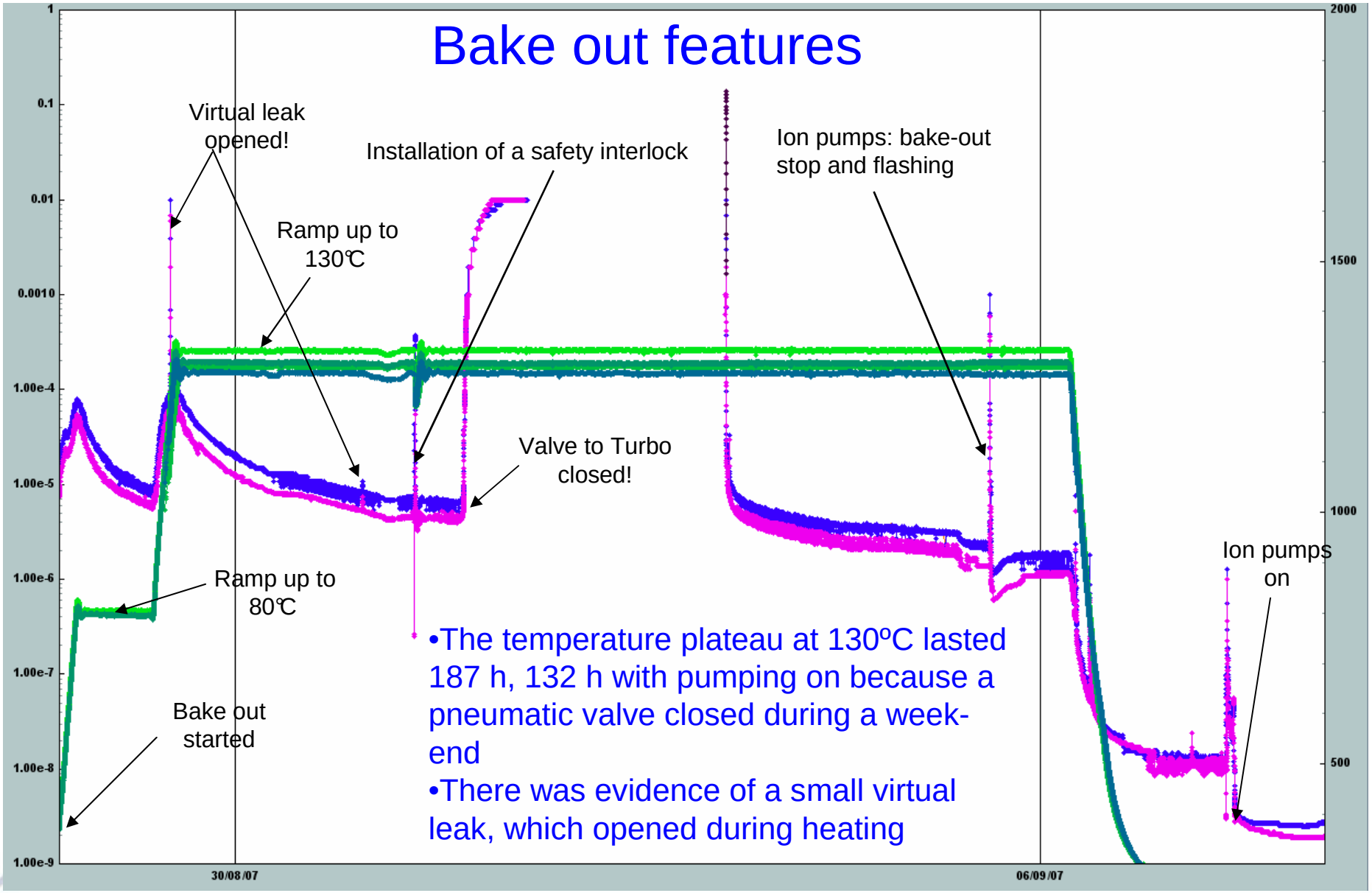
Bake out set-up





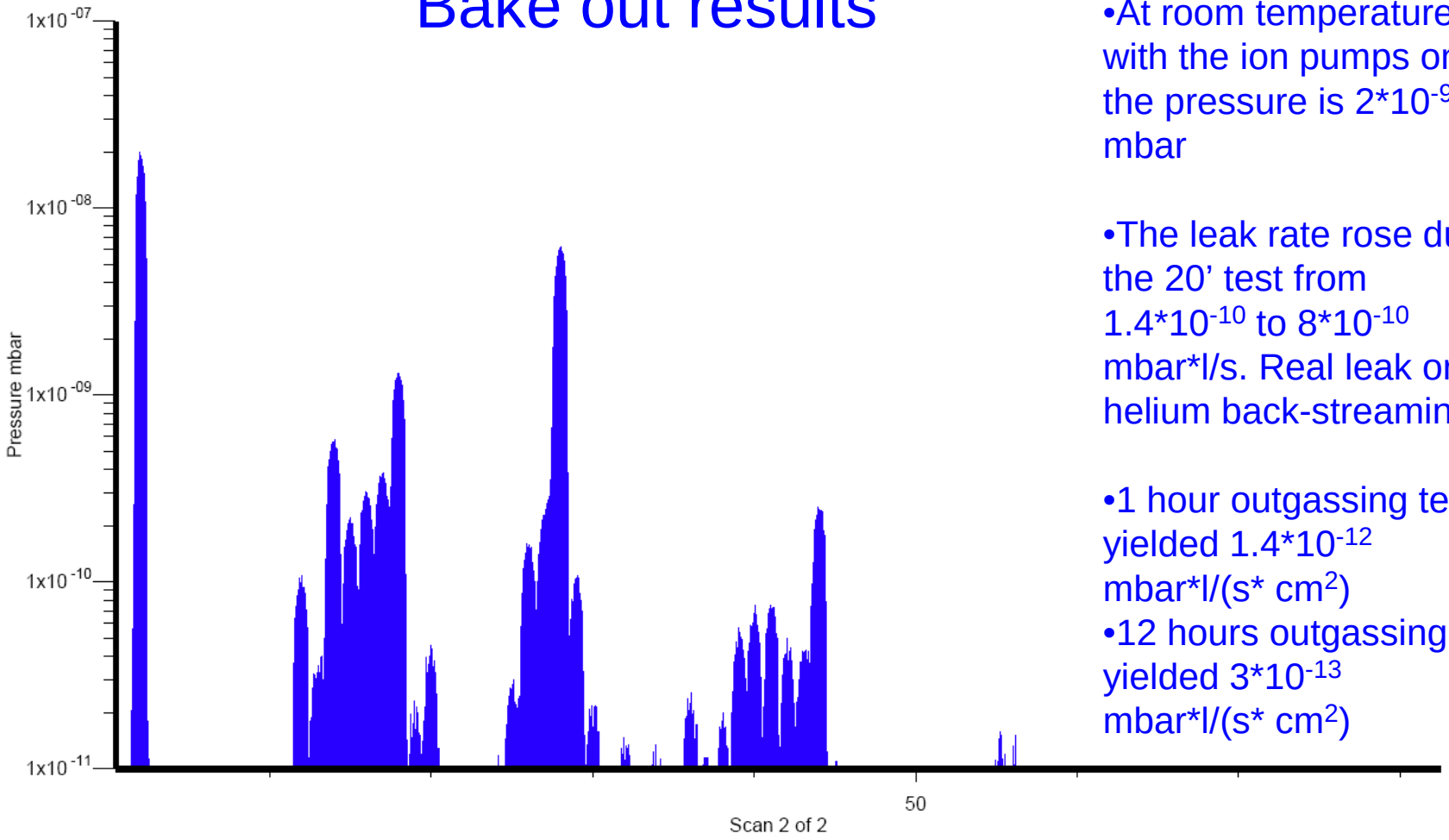
4 independent controllers for the cavity heating strips:
1 for each damper and 1 for the body.

Bake out features



- The temperature plateau at 130ºC lasted 187 h, 132 h with pumping on because a pneumatic valve closed during a week-end
- There was evidence of a small virtual leak, which opened during heating

Bake out results



- At room temperature, with the ion pumps on, the pressure is $2*10^{-9}$ mbar
- The leak rate rose during the 20' test from $1.4*10^{-10}$ to $8*10^{-10}$ mbar*l/s. Real leak or helium back-streaming?
- 1 hour outgassing test yielded $1.4*10^{-12}$ mbar*l/(s* cm^2)
- 12 hours outgassing test yielded $3*10^{-13}$ mbar*l/(s* cm^2)

Ion source configuration: Source 6
Detector: Multiplier 1
Accuracy: 5
Instrument serial number: LM92-00507018

Next steps

- September 07: Pressure test and subsequent leak-test
- October 07: RF conditioning
- November 07: decision on modifications of the damper flanges
  implementation of short circuits
- December 07: bake-out
- January 08: RF power test with shorts