Update on cooling and mechanics of the luminosity detector

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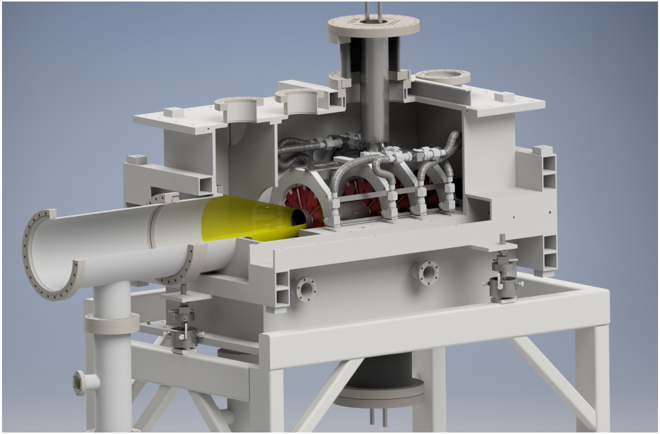
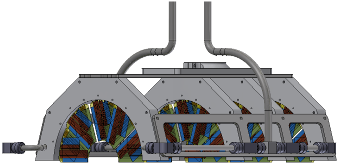
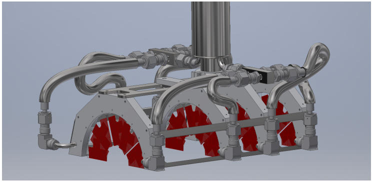
Overview



- status of the cooling system
- update on mechanical structure

Cooling system: General setup

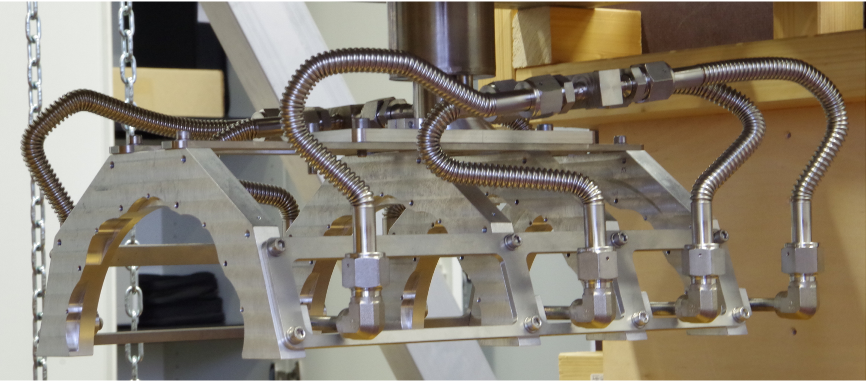




	sensors	LDO Voltage regulator	resistance in flexcables	Multiplexer etc.
worst case	1120 W	320W	160W	$\sim$100W
likely case	370 W	110W	20W	$\sim$100W

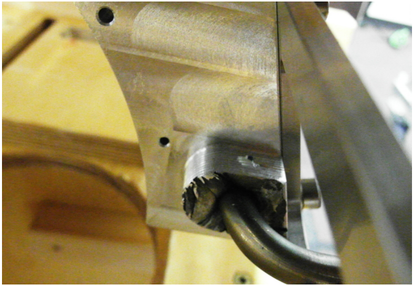
- Total estimated heat load per half detector: ~~$\sim$1 kW~~ $\sim$350 W
- For cooling test: copper dummys and high power resistors

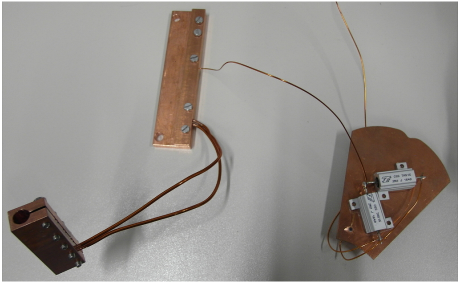
Half detector prototype



- production of halfplanes is finished
- First full half detector under preparation for cooling test
- First test in vacuum seems ok

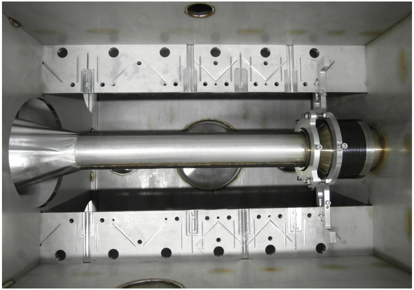
Cooling test preparation

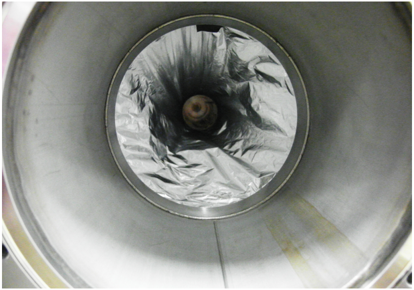




- PT100 sensors glued to half planes and copper dummies
- Resistors glued to copper dummies and connected
- Busbars prepared for installation

Mechanical setup: Beampipe installation





Three options for installing the inner beampipe:

- Glue everything outside, install everything at once
- Glue cone outside, connect cone and metal part in the box
- Install metal part, glue everything in the box.

All tricky.....

Summary and outlook

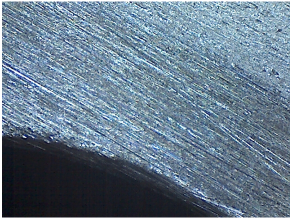
- production of half planes finished
- half plane prototype successfully tested
- new design vacuum box produced, first tests successful

What is next:

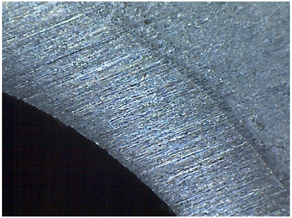
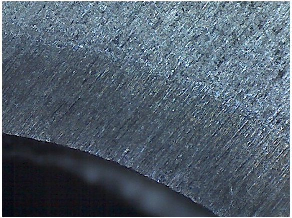
- extended test of new vacuum box
- test of half detector prototype
- extended cooling test
- production of final detector

Aluminum steel contact after cooling

after cutting:

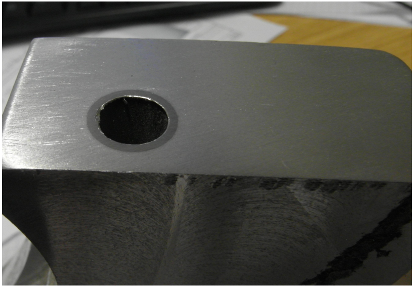
 

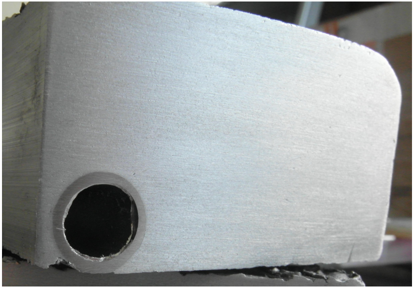
after cooling to -40°C:

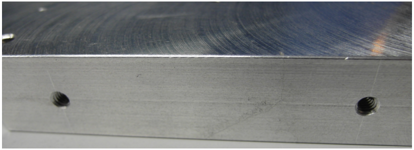
 

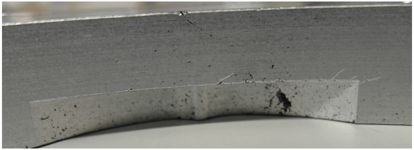
No gap between the materials, very good contact

Comparison of materials and processes

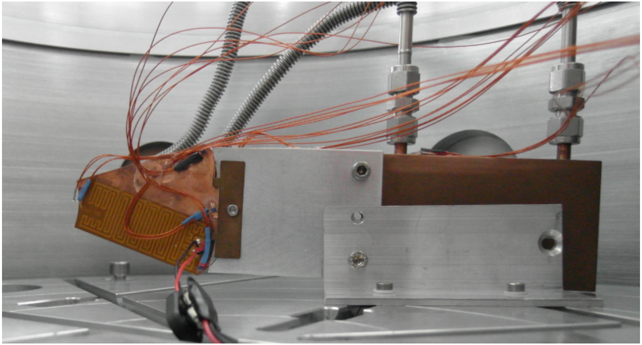






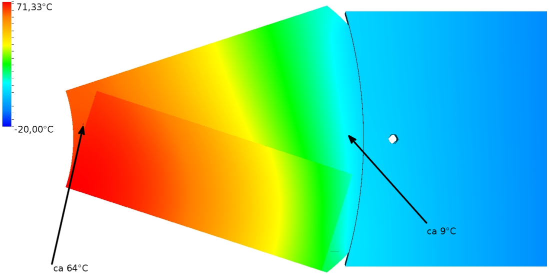


Test of the aluminum-diamond contact



- Setup with copper dummy
- Comparison of FEM results with measurements
- Test and comparison of several contact materials

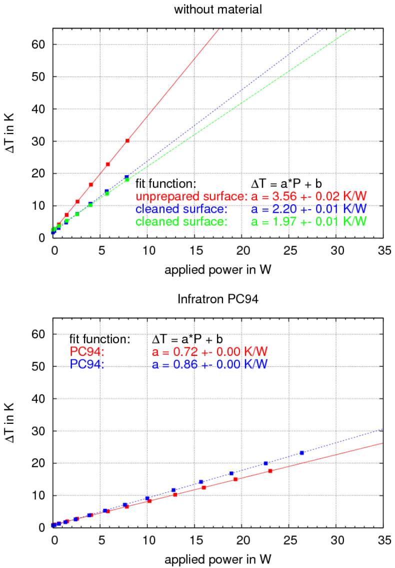
FEM-simulation and measurement



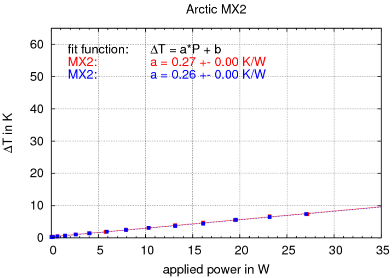
- Simulated temperature difference $\sim 55^\circ\mathrm{C}$
- Measured temperature difference (two Pt100): $50^\circ\mathrm{C}$
- High radial temperature gradient (up to $2\frac{K}{mm}$)

kein Material	Graphitfolie	PC93
$\sim 2,2\frac{^\circ C}{W}$	$\sim 0,88\frac{^\circ C}{W}$	$\sim 0,72\frac{^\circ C}{W}$

Contact materials



Contact materials 2

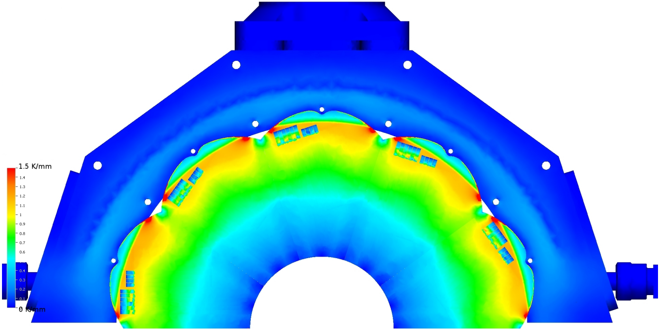


Upper limit for the material transition temperature rise:

no material	graphit foil	PC94	vacuum grease	MX2
$\sim 2,2 \frac{^\circ C}{W}$	$\sim 0,86 \frac{^\circ C}{W}$	$\sim 0,86 \frac{^\circ C}{W}$	$\sim 0,37 \frac{^\circ C}{W}$	$\sim 0,27 \frac{^\circ C}{W}$

These contain $\sim 0,1 \frac{^\circ C}{W}$ due to the measurement setup

Temperature Gradient



- Temperature gradient varies on the diamond
- High values near the cooling structure ($> 1.5\ \frac{K}{mm}$)
- interesting measurements are in region with $> 1\ \frac{K}{mm}$

Melting aluminum around stainless steel pipes

- Casting mould with stop off and cooling pipe
- The pipe can move in one direction to minimize internal stress

Casting mould after first melting process

- First test done under vacuum
- good results, but the vacuum furnace gets really dirty