

Status of Insulation and Cooling of the First Slice

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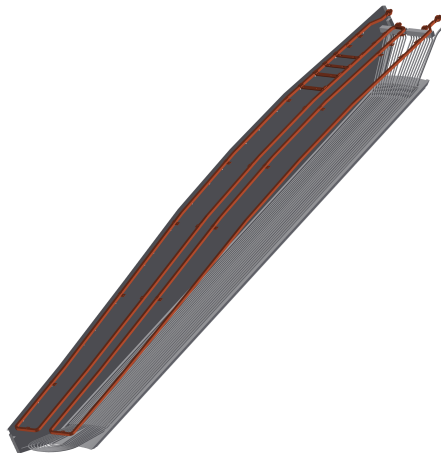
RUB



Back Cooling Testslice

- Profile had to be changed from rectangular to circular

Before: One pipe with 10x10x1 mm



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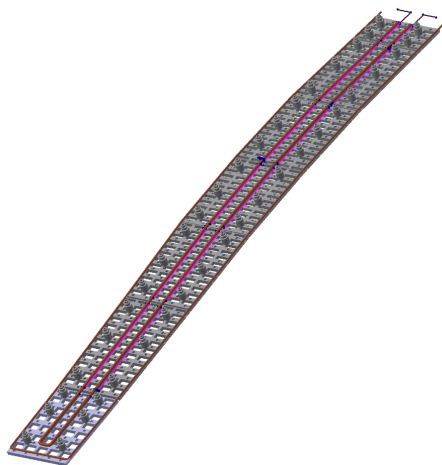
Before: One pipe with 10x10x1 mm

Now: 2 copper pipes with 10(12) mm
outer cycle and 7(8) mm
inner cycle

- Outer circuit collides with Flex-PCBs

→ Foreseen pipe diameter had to be decreased

- Both cycles are made of two pipes each
- Pipes are connected by crimp style connectors by VIEGA
- Connectors are certified for a temperature range of -30–110°C



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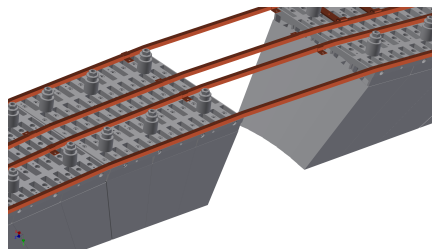
Open questions:

- Enough flow possible?
- Under pressure system possible?
- Which Conjunctions should be used?



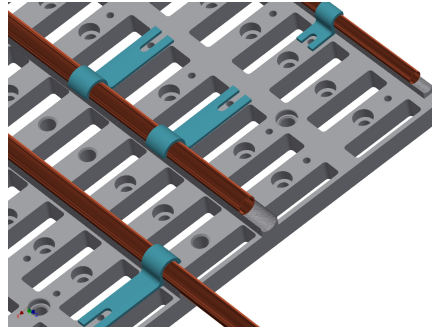
Mechanical and Thermal Contact

- Rectangular shaped pipes provide a good thermal contact to supermoduleplates
- Circular shaped pipes need some kind of adapter



Mechanical and Thermal Contact

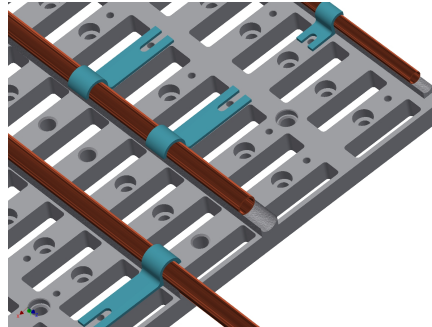
- Rectangular shaped pipes provide a good thermal contact to supermoduleplates
- Circular shaped pipes need some kind of adapter
 - Rectangular aluminum parts with semicircle milling
 - Thermal contact is enhanced by Keratherm KP98 adhesive
 - Adhesive thermal conductivity $W = 6 \frac{W}{Km}$
- Both parts are held by 2 clamps per super module plate



Mechanical and Thermal Contact

- Rectangular shaped pipes provide a good thermal contact to supermoduleplates
- Circular shaped pipes need some kind of adapter
 - Rectangular aluminum parts with semicircle milling
 - Thermal contact is enhanced by Keratherm KP98 adhesive
 - Adhesive thermal conductivity $W = 6 \frac{W}{Km}$
- Both parts are held by 2 clamps per super module plate
- Pipes available
- Aluminum parts with semicircle drilling made
- Clamps are in production

⇒ Foreseen installation in about 2 weeks

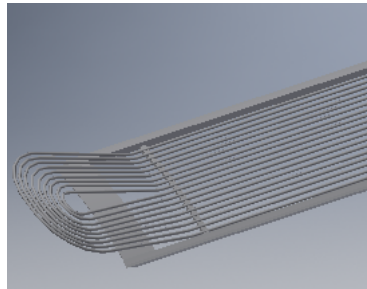
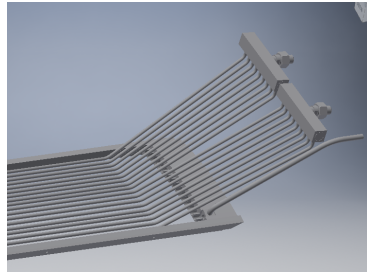


Now

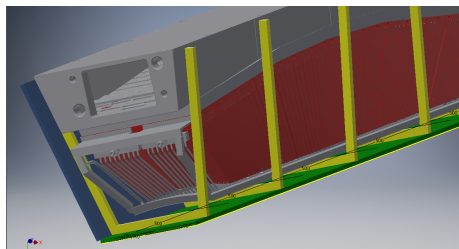
- 9 loops of silicone tubes
- Diameter 4(5) mm
- 2 manifolds for inlet and outlet
- Possible flow 1.5 m³/h

Open questions

- Possibility to increase diameter?
 - Space needed for lightfibres?
- Shared supply for outer loop of back cooling and entire front cooling
 - Leave separated for proper temperature regulation



- Slice is closed up by a perspex box around supermodules
- Box will be attached reversible to support beam
- Shielding can be applied by adhesive copper/aluminum foil
- No air tight separation of support beam from cooled volume possible by now due to Flex-PCBs
- Prespex box and cover of supportbeam form an air tight volume



Open Questions:

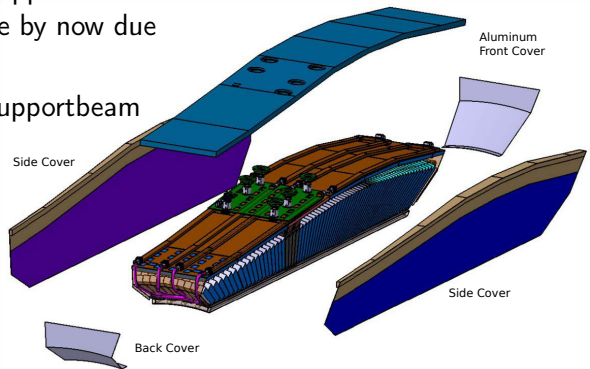
- Feed through of conjunctions
 - Manifolds inside the box and bring two pipes per front and back cooling outside

Air tightness Testslice

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- Box will be attached reversible to support beam
- Shielding can be applied by adhesive copper/aluminum foil
- No air tight separation of support beam from cooled volume possible by now due to Flex-PCBs
- Prespex box and cover of supportbeam form an air tight volume

Open Questions:

- Side covers still an option?



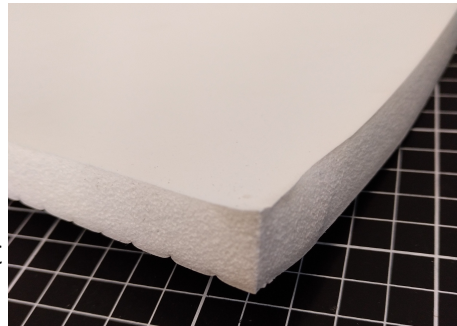
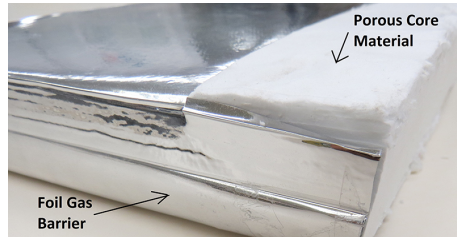
Insulation Testslice

Perspex box will be encapsulated by vacuum insulation panels

- 6-12 mm thick
- $W = 0.004 \frac{W}{Km}$
- Some already in Gießen

Foamed silicone mats in between support beam and slice

- 15 mm thick
- $W = 0.075 \frac{W}{Km}$
 - Holes or slits for feed through of flex PCBs
 - Closed by foamed silicone mat plugs
 - Not fully air tight, because it should be possible to dismantle
 - Possibly not enough insulation to shield $-25^{\circ}C$ from $\sim 30^{\circ}C$ inside support beam
 - VIPs not usable due to cable feed throughs



Summary

- Design of back cooling finished and prototype will be build soon
- Connectors have to be chosen
- Front cooling is designed, final pipe diameter has to be chosen
- Single slice will be enclosed by a box
- Insulation can be established by VIPs and foamed silicone mats

- Every slice has its own cooling circuits and connectors
 - Staged installation of barrel possible
- Insulation an issue for the whole barrel
 - Forward insulation can be realized with VIPs
 - Backward insulation may be realized by foamed silicone mats if they suit our requirements
- Airtightness an issue, as there is nearly no space after the supportbeam
 - Side covers may solve some of the problems
 - No air tight separation of supportbeam and cooled volume possible due to Flex-PCBs
 - Maybe Flex-PCBs can be glued into the insulation for the final slices