

Cooling a front end

ERAC Congress 2009

University of Applied Science

Heidelberg

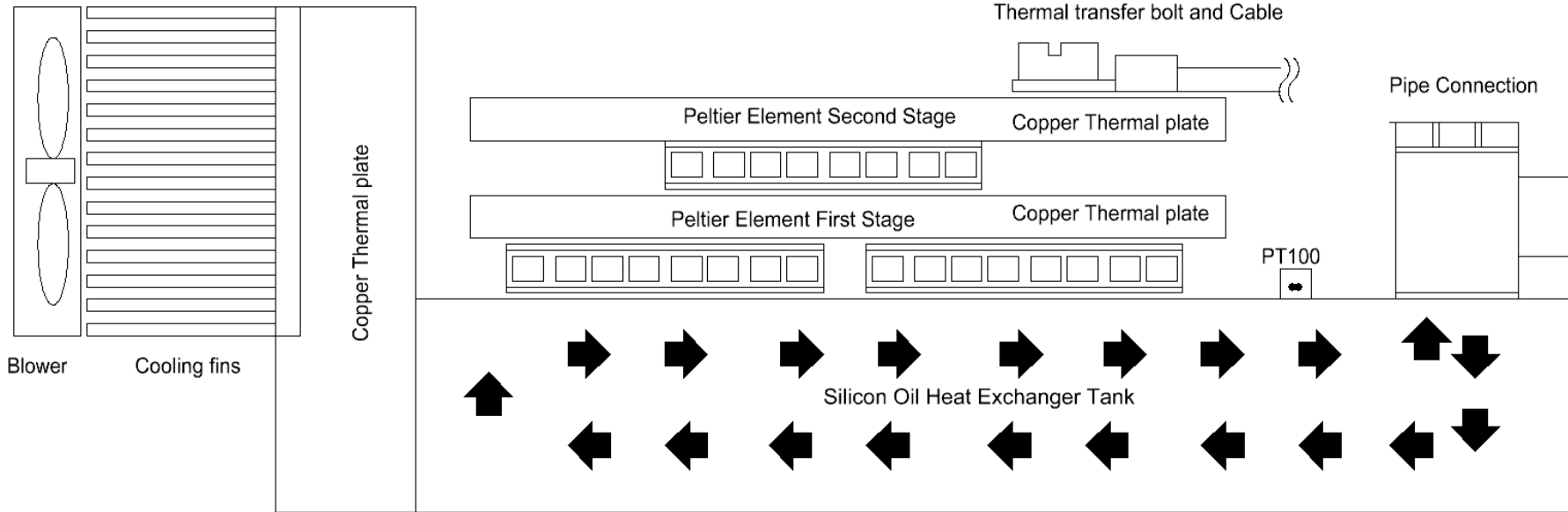
Peter Wright

ERAC President

The Thermal blocks Job

- A Cascade cooling block providing Super Cold Via “Cold fingers” directly to Semiconductors in Gain stages (Conduction)
- General cooling to the rest of the Electronics in the housing (AIR Convection)
- Slow cooling down to avoid mechanical stress to the LNA

Air cooling to Temperature of the primery cooling
Silicone oil of the Lauda Cryostate



Thermal Cooling Block In the New Design front end 21cm

Thermal Transfer Bolt and Cable

- From the cooling block cold needs to get to the Cold finger on the LNA this works wonderfully with thick copper cable fitted with e crimp Eyes Soldered to the ends then wrapped up in an Armourflex Tape Multi-layer blanket to “make a sausage role”
- The LNA End is fitted also with a PT100 Sensor with all 4 leads inside the Armorflex Tape

The LNA Cold Finger

- Is a small 15mm Cylinder Turned on a lathe made out of brass with on one end an M6 Thread.
- The other end needs to be Tinned then soldered behind the First Gain element on the Rear Substrate Ground plain.
- Use Armorflex tape in this area to insulate well .
- This allows Easy connection of the cold cable with PT100!

Important parts used

- 12mm Standard Industrial Pneumatic pipe.
- Only Screw thread pipe fittings not Quick fit
- Armourflex Pipe insulation +GLUE
- Insulate long runs in in the Focus with Rescue Blanket Material “Silver side outside”
- 4mm Armourflex Tape with adhesive.





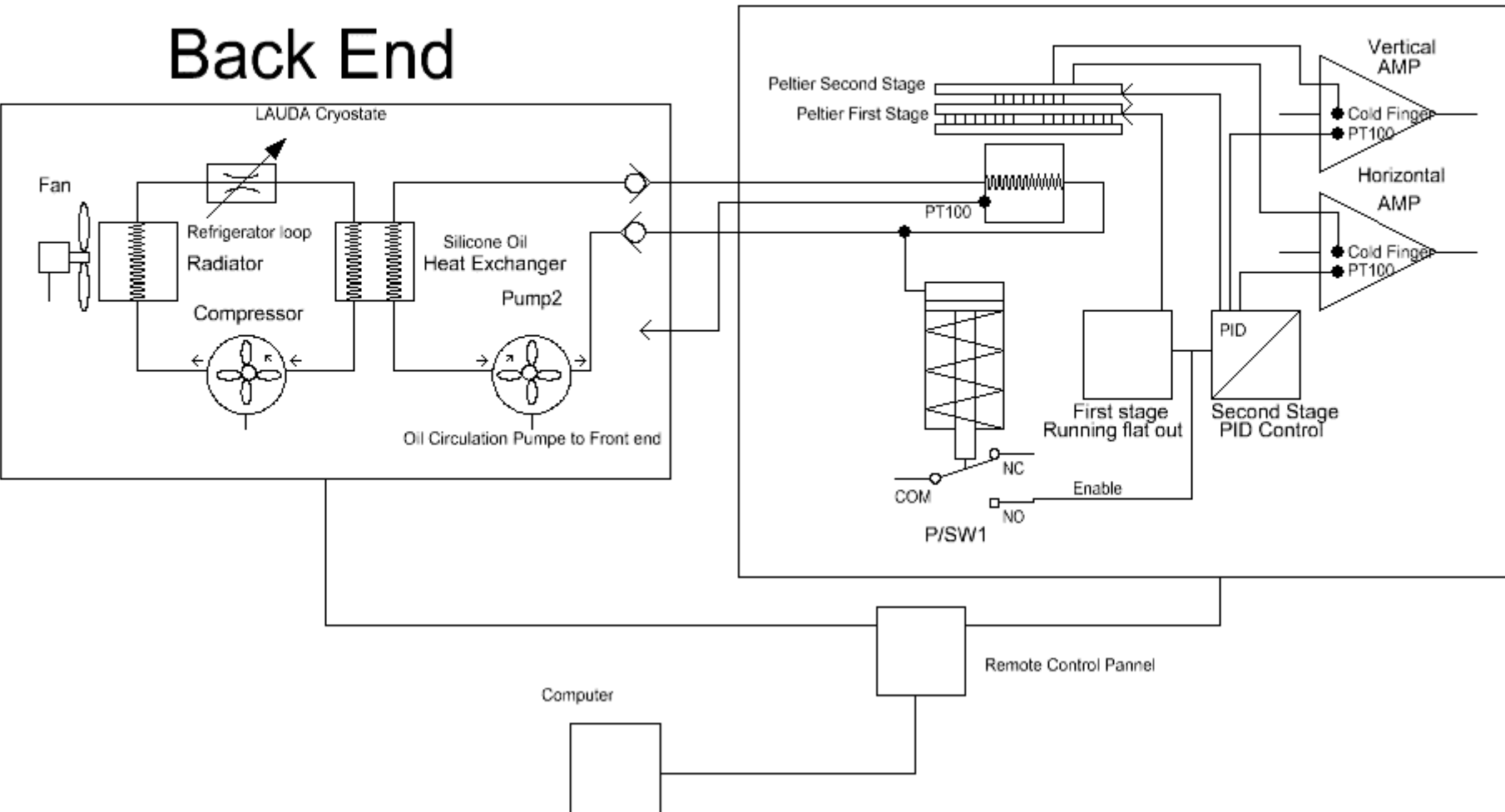
Important Considerations

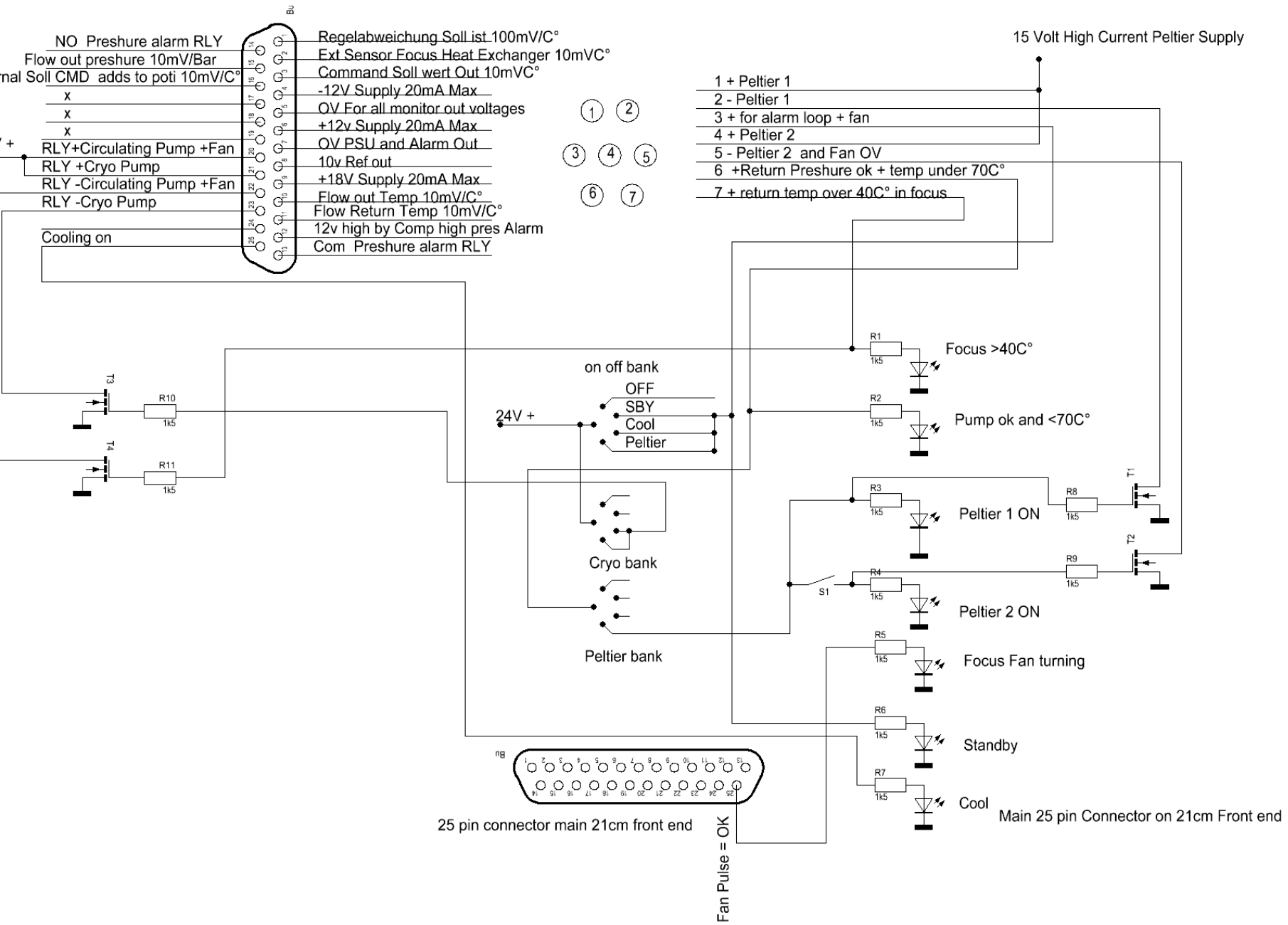
- If the Peltier stage is turned on without coolant Circulating everything gets incinerated.
- The Size of the cooling unit in the Front end needs to be small.
- Temperature Cycling kills Electronics
- Condensed Water !

Front End Cooling Concept

Front End

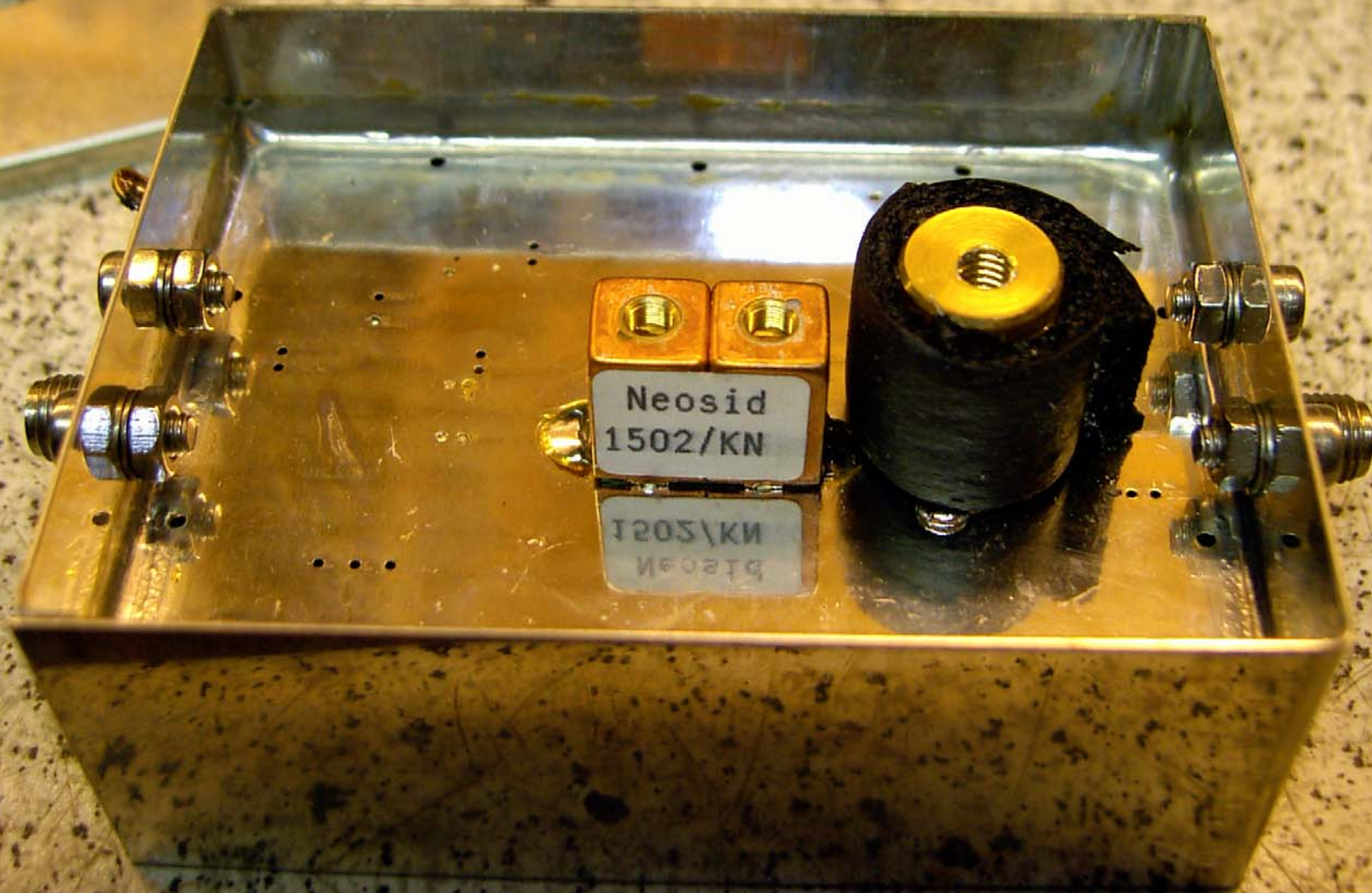
Back End





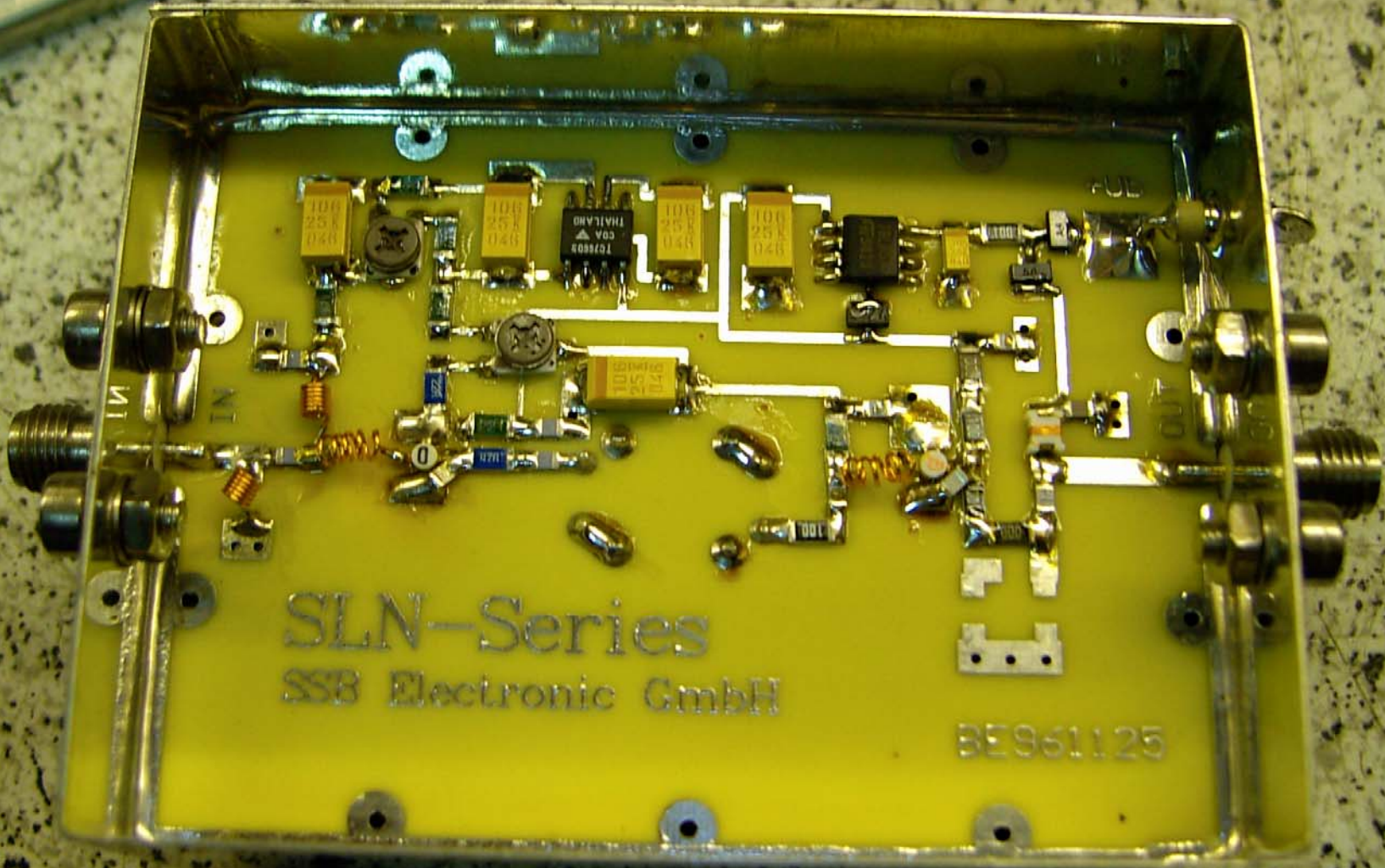
Thermal Plan

- The Silicon oil Cooling Unit runs down to -60° from T Ambient
- T Ambient is -10°C in winter and up to +50°C in Somer..
- The first Peltier stage cools down -60°
- The Second at its best cools down another -40°C
- “-100°C is possible in Winter”
- “ -10°C in Somer.”



Neosid
1502/KN

1205\KN
NEOSID



SLN-Series
SSB Electronic GmbH

BE961125

M1

M2

M3

M4

M5

M6

M7

M8

M9

M10

M11

M12

M13

M14

M15

M16

M17

M18

M19

M20

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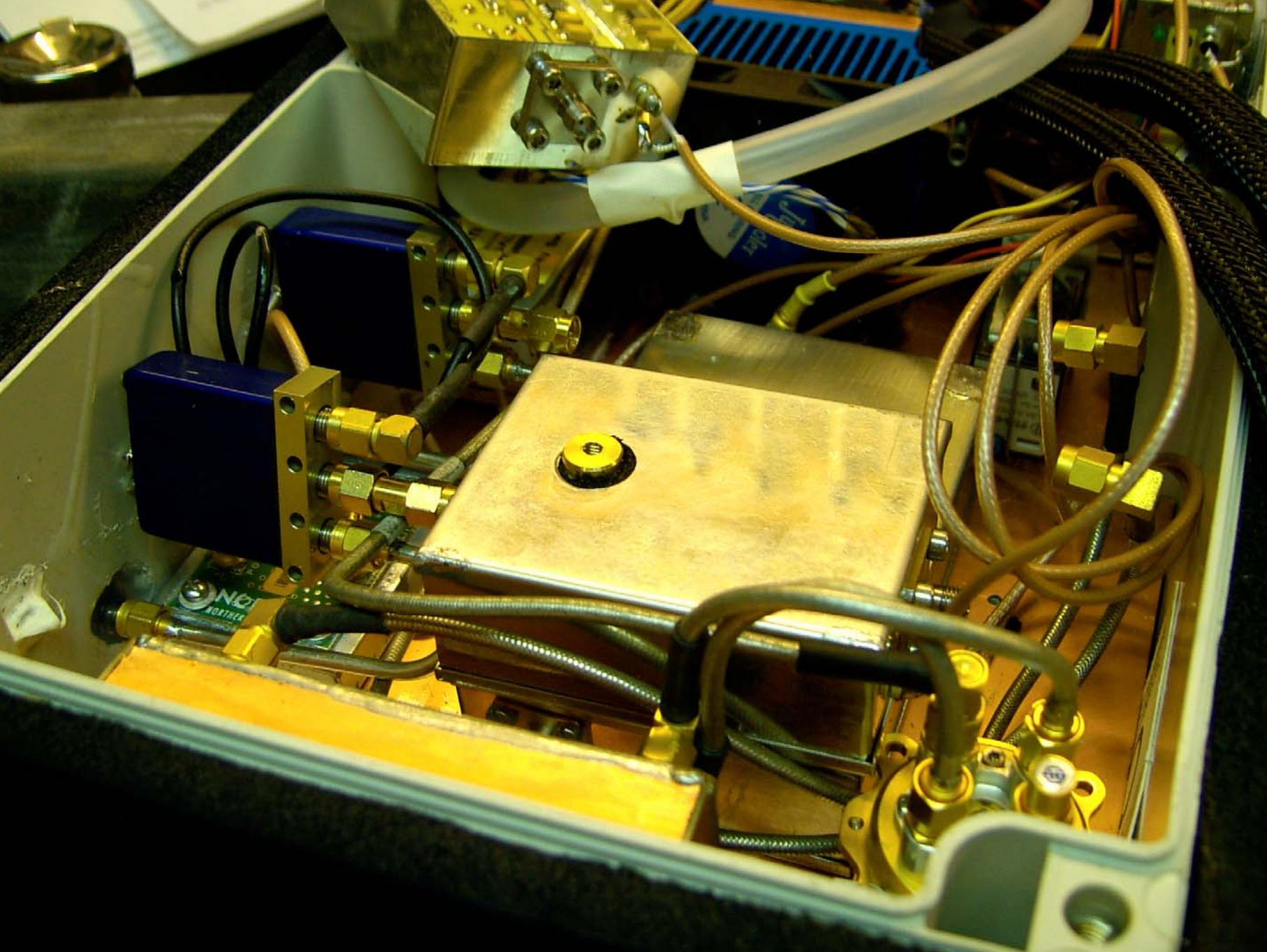
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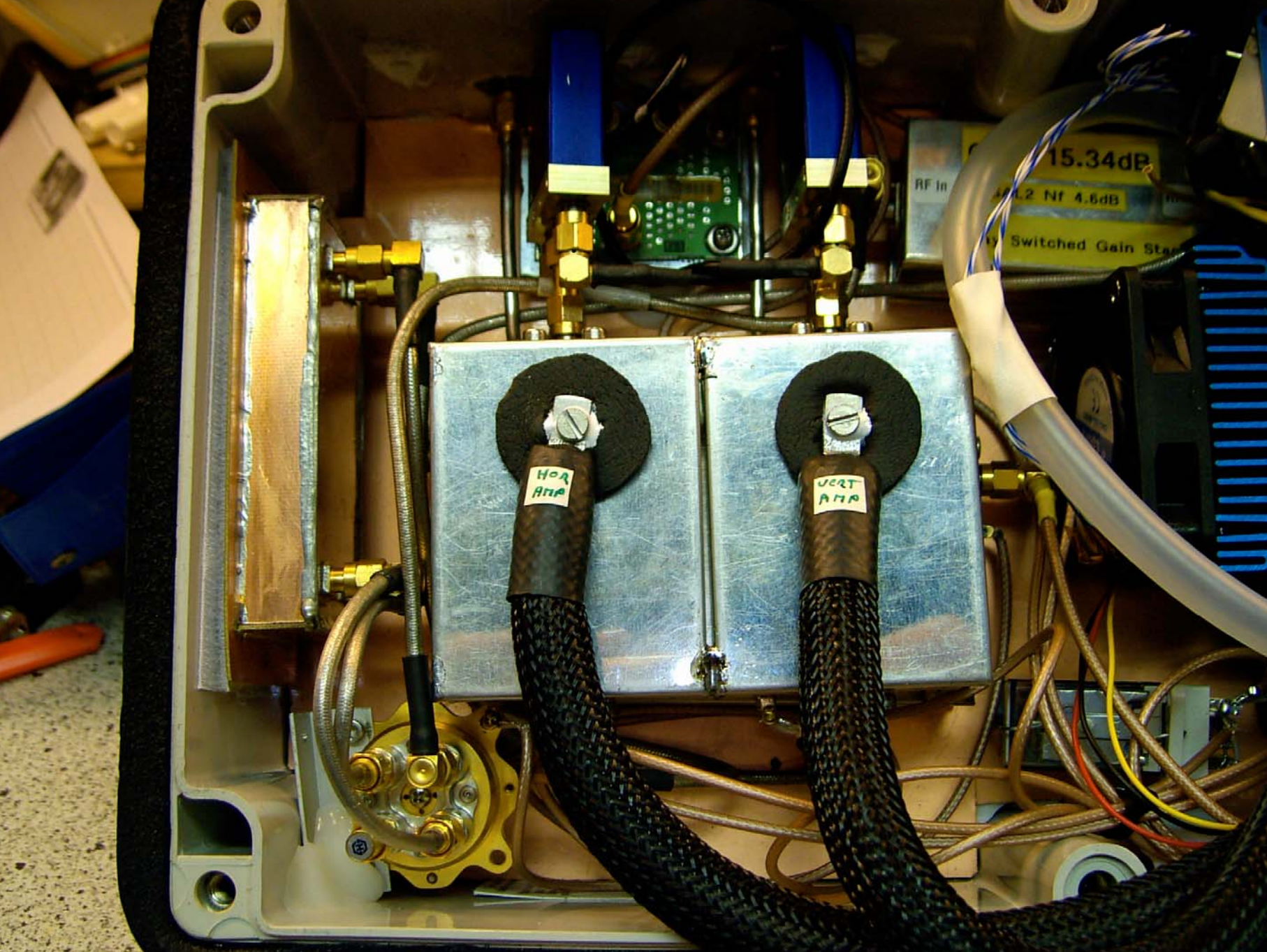
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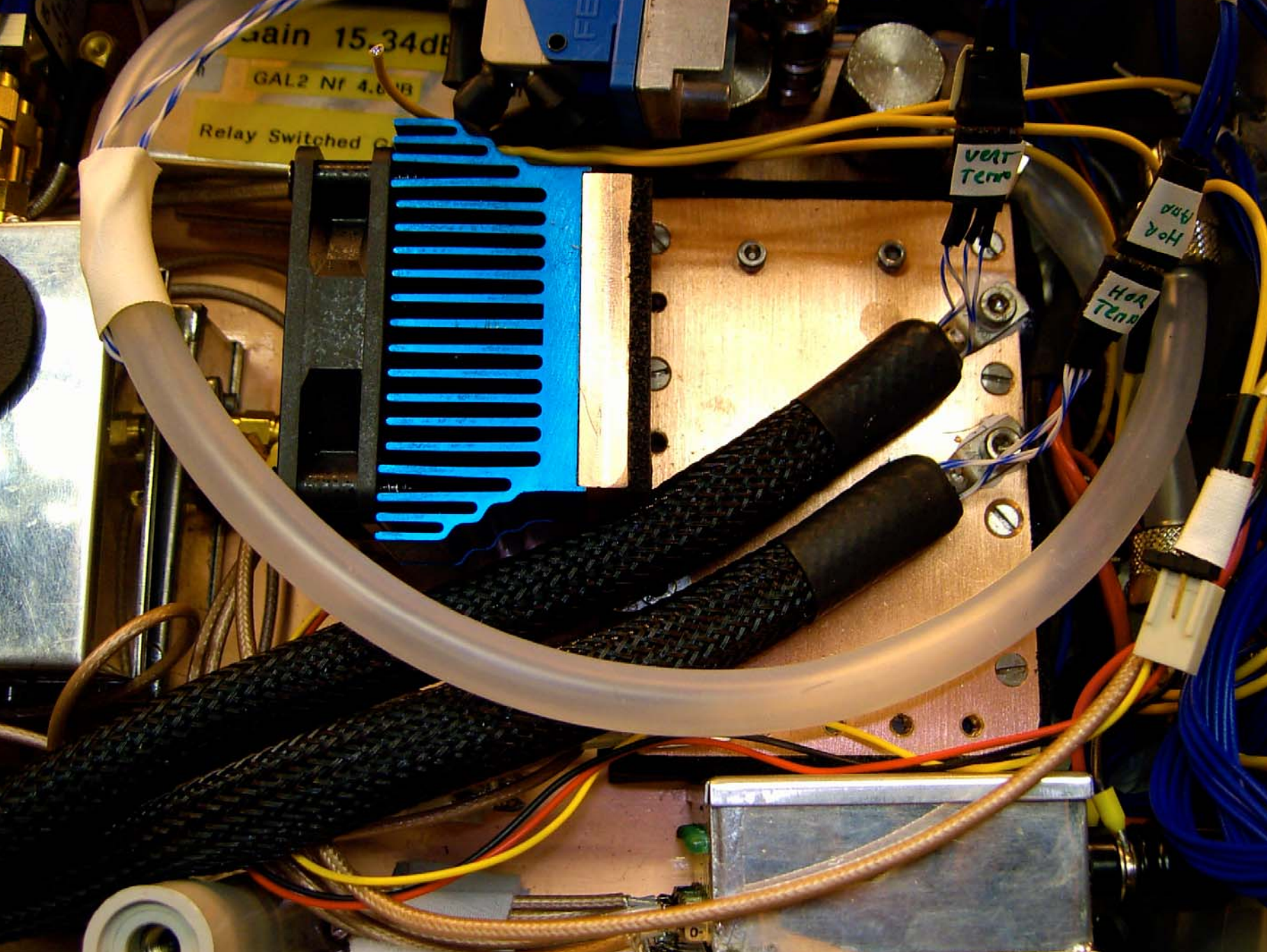
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Gain 15-34dB

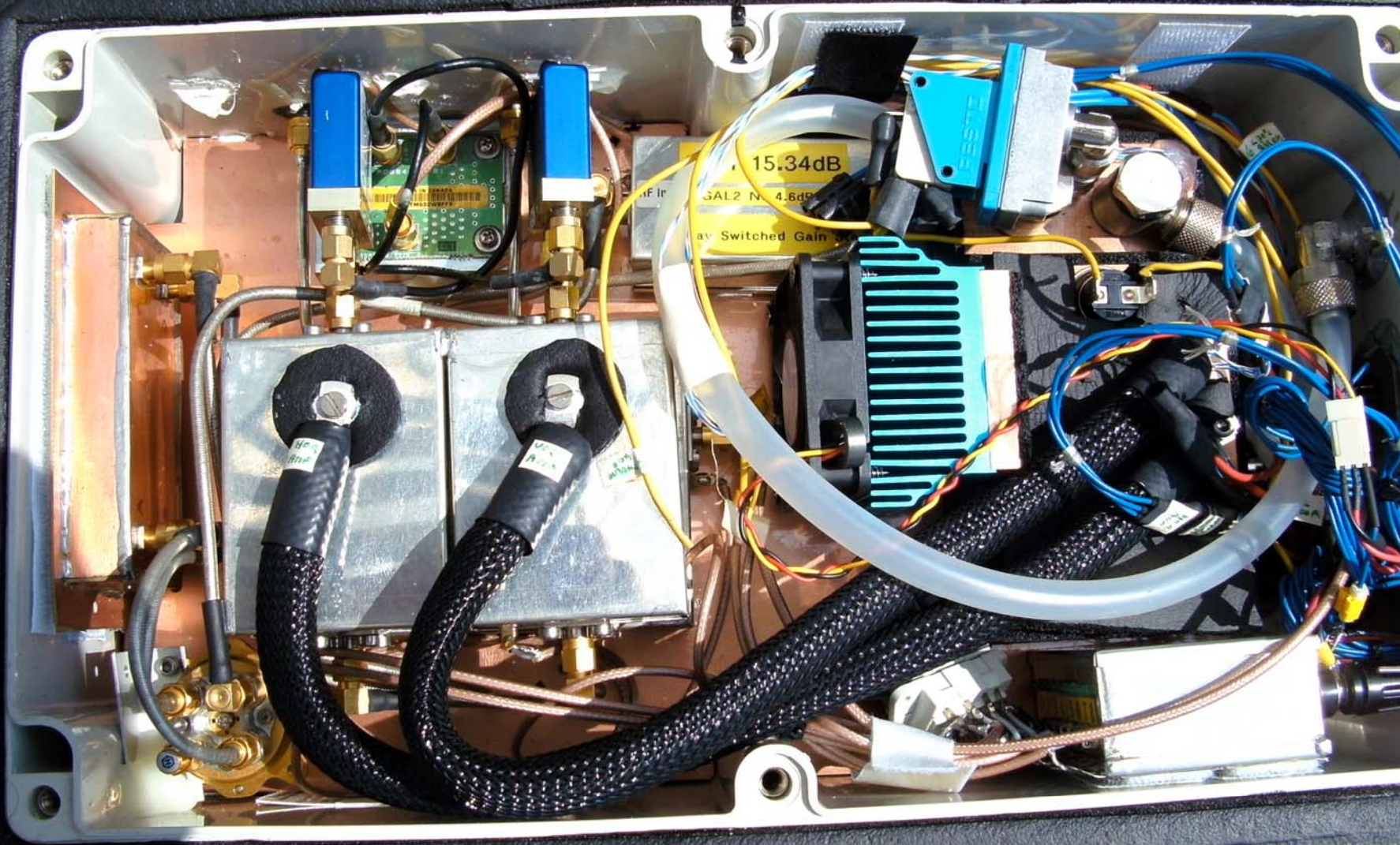
GAL2 NF 4.0dB

Relay Switched

VOLT
TEMP

HOR
TEMP

HOR
TEMP



The Trick

- By Initial cooling the front end is cooled by the first stage Silicon oil First Slowly reducing the Temperature.
- Next both second stage Peltier are turned on till they settle down.
- Then the third stage is turned on, when the maximum temperature is reached one of the Second stage Peltier are turned off meaning that the Temperature and the volume flow of coolant keep the whole system stable.

The weak link

- Is the capacity of the Cryostat and the Ambient Temperature .
- Air is the intake cooling Medium, at a much later date I will be upgrading with a cold water Heat Exchanger and large underground tanks of cold water.

Condensed Water

- This problem is Easy using a Silicon GEL Bag and an air drying unit with a pipe connection to the LNA Box.
- You have not got to forget that the box Breaths with ambient temperature change and this dry air needs to expand with heat , without sucking in moist air to condense

Air Drying unit



The End

Any Questions

Peter Wright 2009