sPHENIX Director's Review:
EmCal Cooling R&D Slides

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BNL

Power

SiPM Board– .250Watts each MAX
PreAmp --- 5watts each
Interface Board -5 watts each

Per Sector

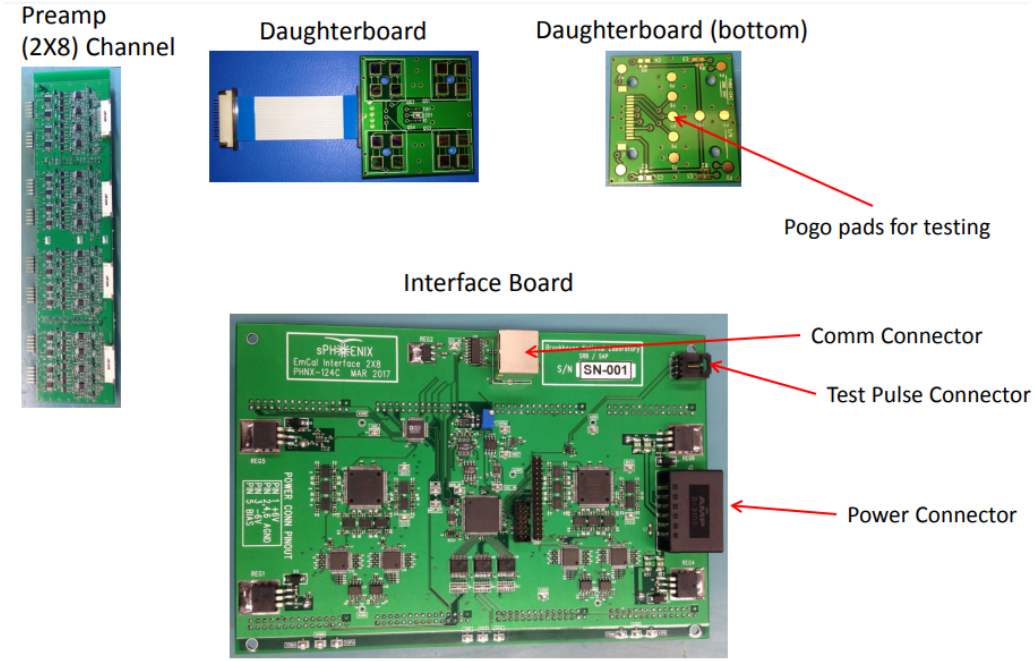
SiPM – 96 boards
Pre-Amps-- 24 boards
Interface– 6 boards

Total per sector

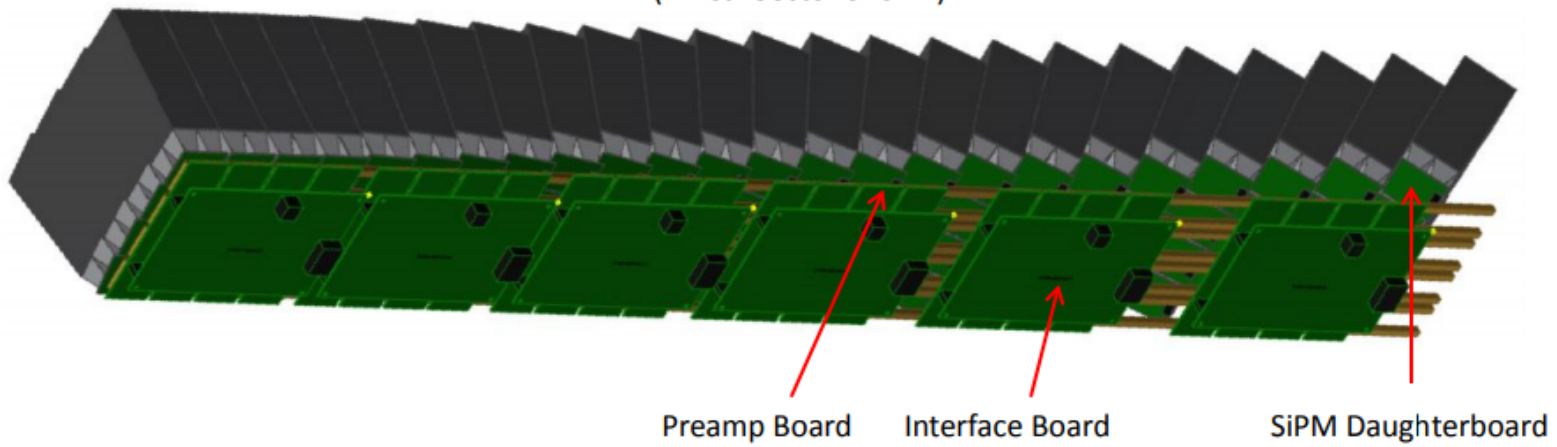
SiPM– 6 watts
PreAmps– 120 Watts
Interface– 30 Watts

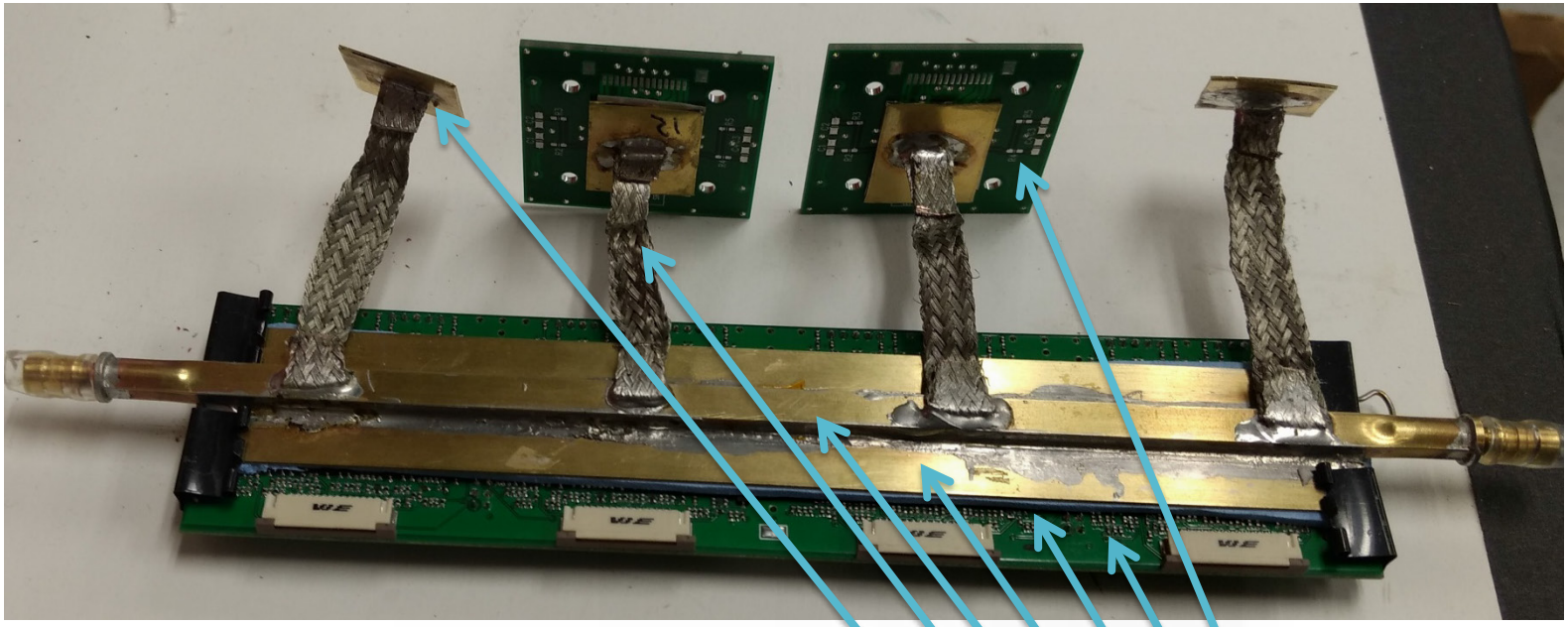
Total per Sector-- 156Watts
Total per Side-- 5kWatts

Components and Power



(EmCal Sector Shown)



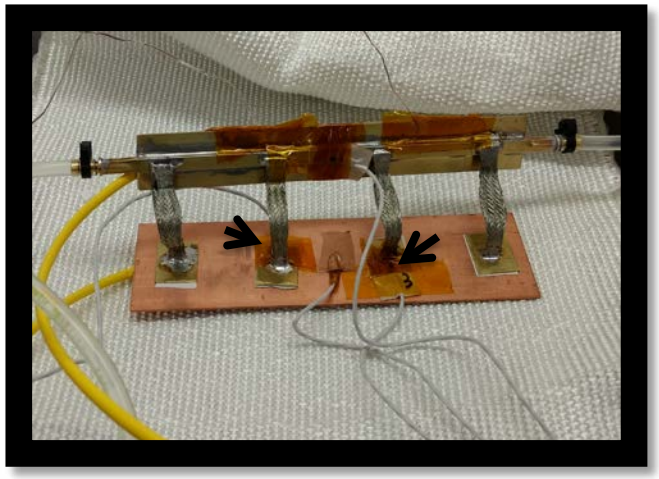


Proof of Principle Test for Thermal Straps to Cool Sipm Daughter Board

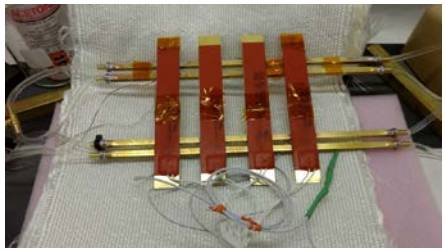
Rev 1

- SiPM Board
- Pre-Amp
- Thermal Gap Pad
- Pre-Amp Cooling Plate
- Cooling Tube
- Thermal Straps
- Sipm cooling foot

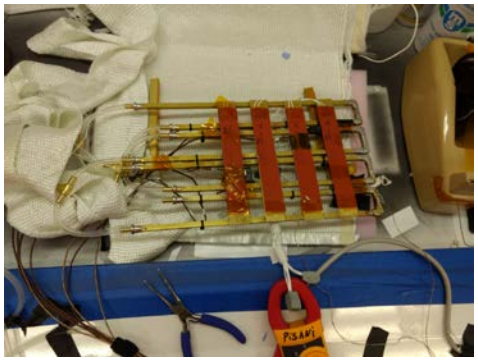
Various EmCal
Cooling System Prototypes



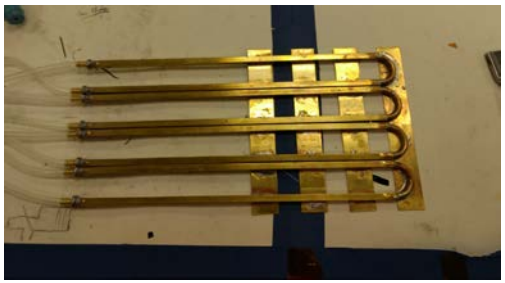
Rev 1



Rev 2



Rev 3



Rev 4

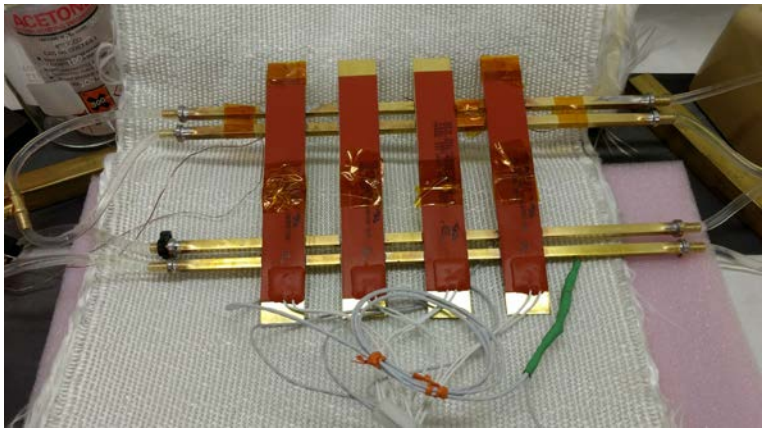
Testing 1/6 Of A Sector Rev 2

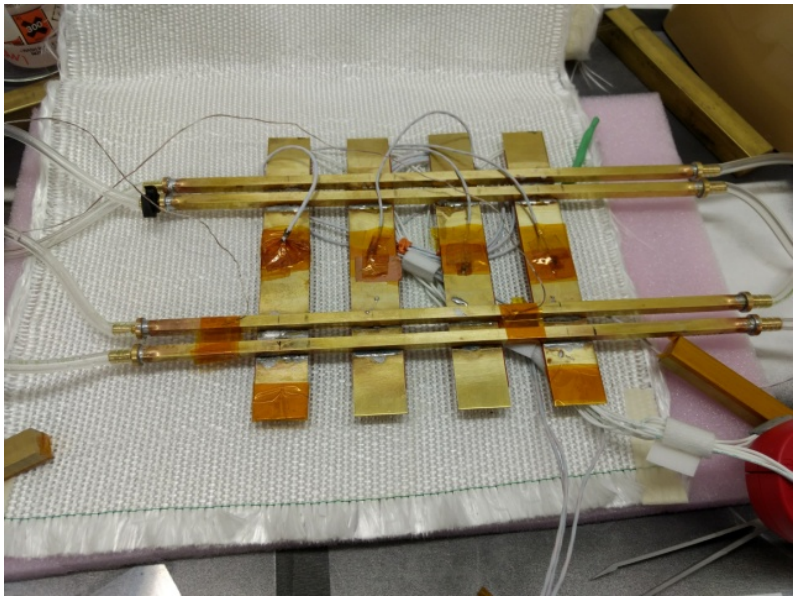
Flow in 4 tubes are in parallel. A different line would be used for the return.

Idea would be to use the cooling manifold as a mechanical support for the pre-Amps as well.

Advantage is no soft connection inside the sector.

Strip heater uses to generate load.





Rev 1

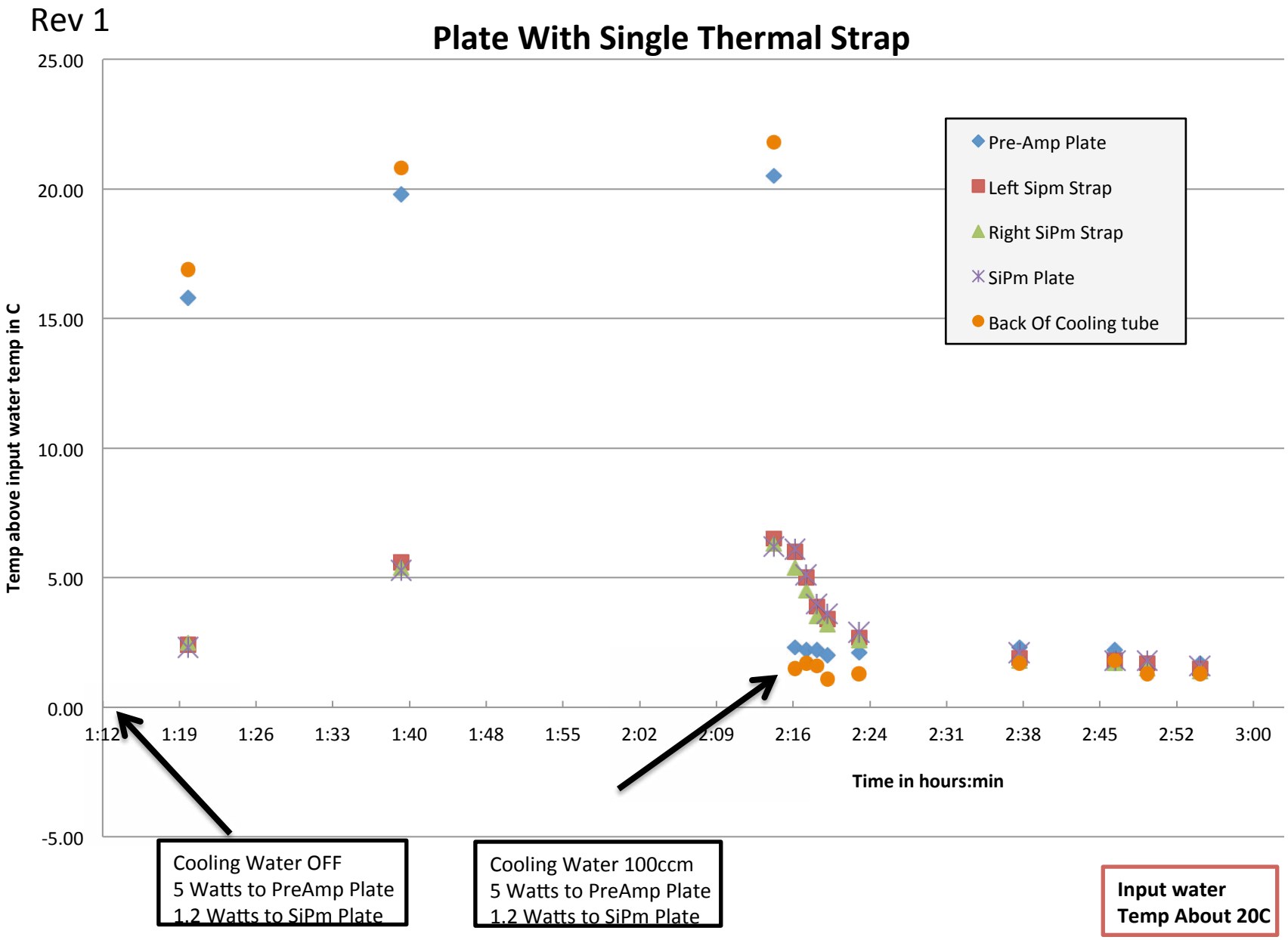
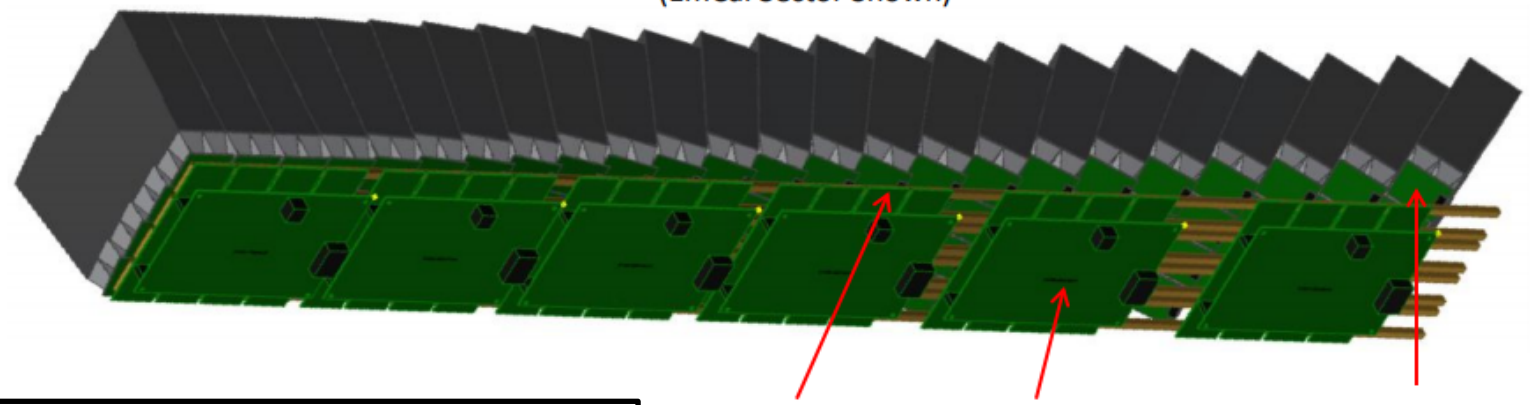
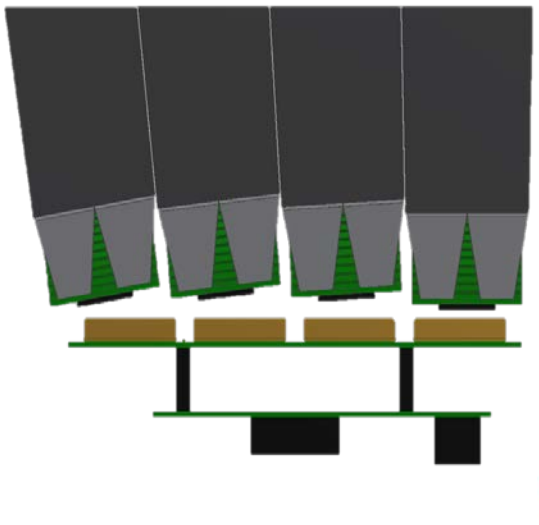


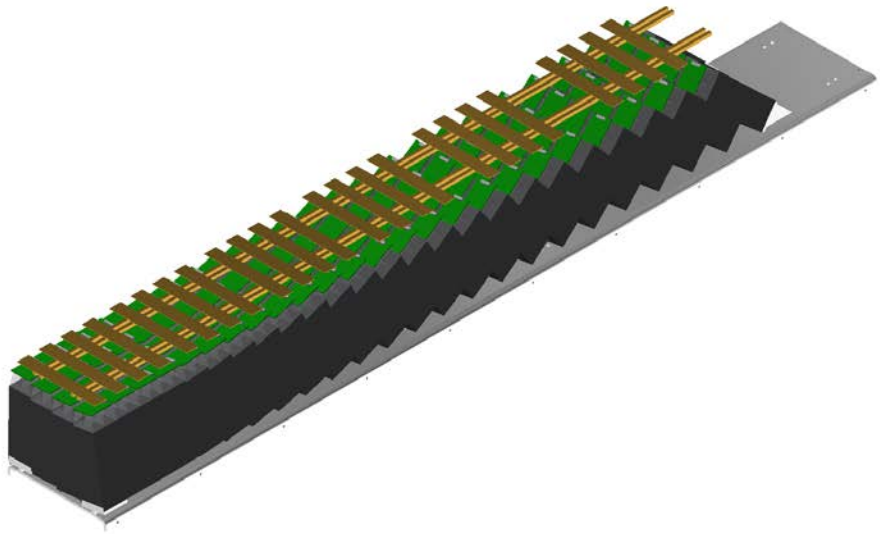
Plate With Single Thermal Strap
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
Temp above input water temp in C
1:12
1:19
1:26
1:33
1:40
1:48
1:55
2:02
2:09
2:16
2:24
2:31
2:38
2:45
2:52
3:00
Time in hours:min
Pre-Amp Plate
Left Sipm Strap
Right SiPm Strap
SiPm Plate
Back Of Cooling tube
Cooling Water OFF
5 Watts to PreAmp Plate
1.2 Watts to SiPm Plate
Cooling Water 100ccm
5 Watts to PreAmp Plate
1.2 Watts to SiPm Plate
Input water
Temp About 20C

(EmCal Sector Shown)

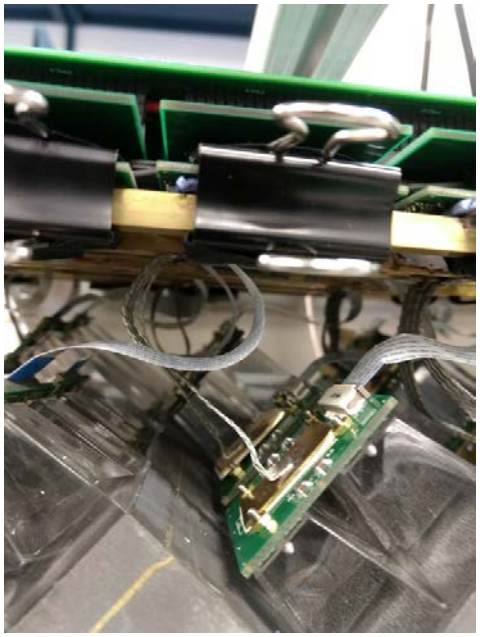


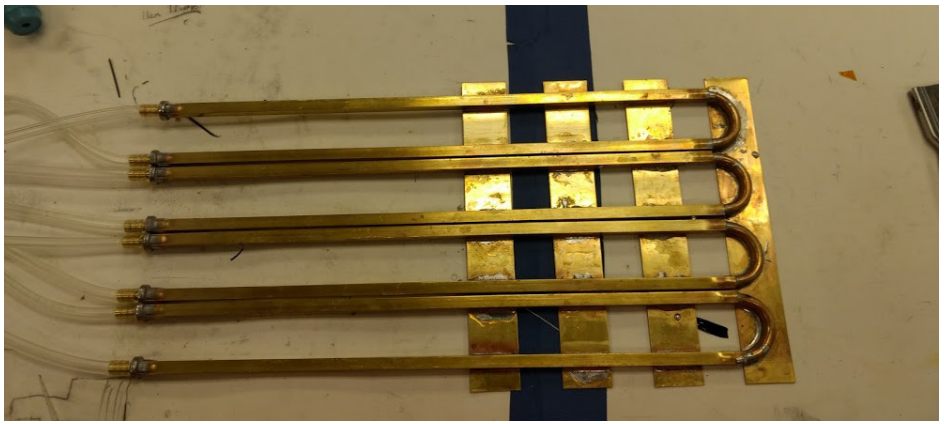
Concept: Use the cooling frame as mechanical support for the preamps and Interface Board.

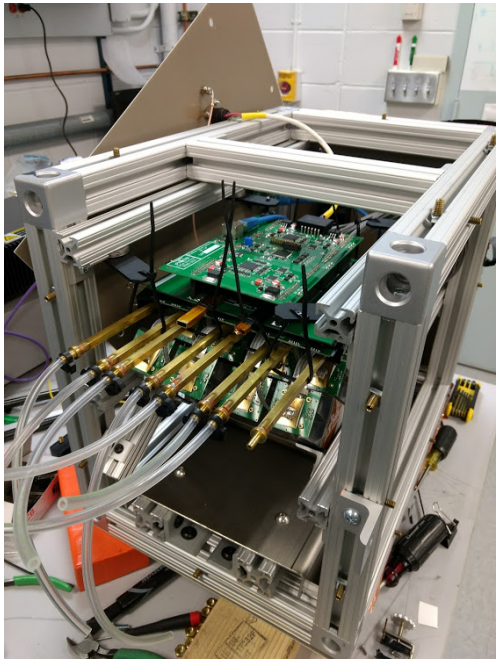


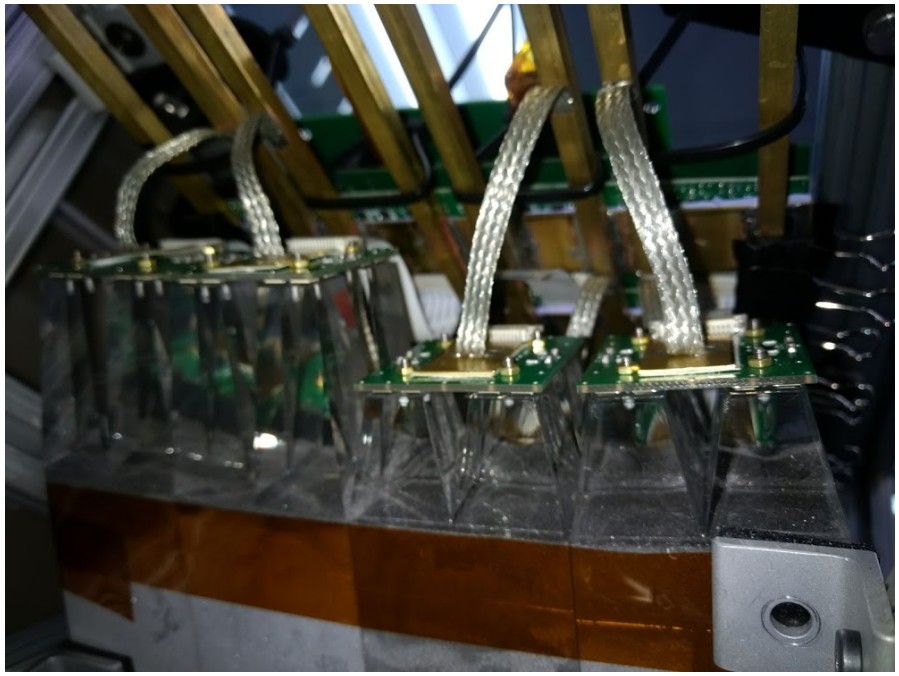


Installed in 1/6 Scale Prototype



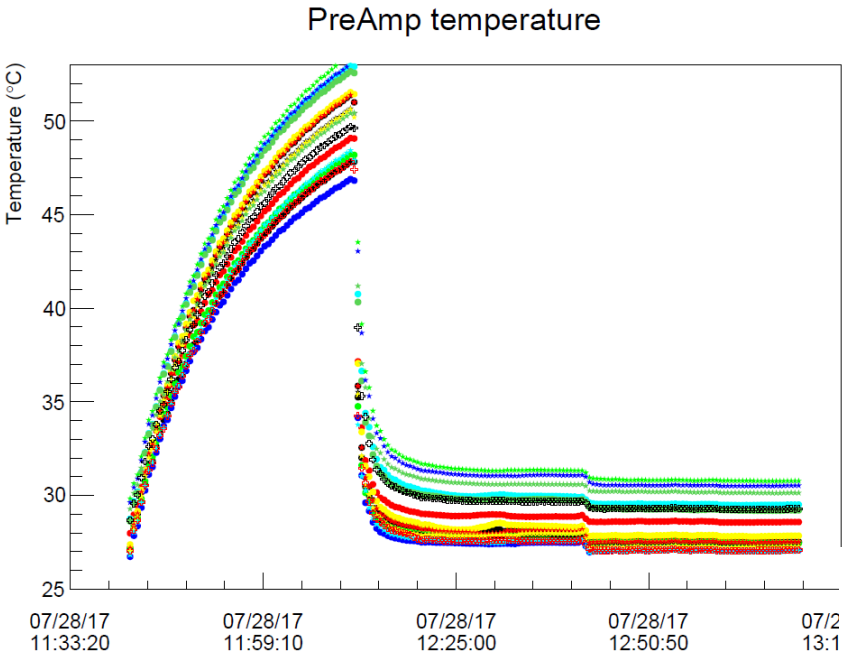


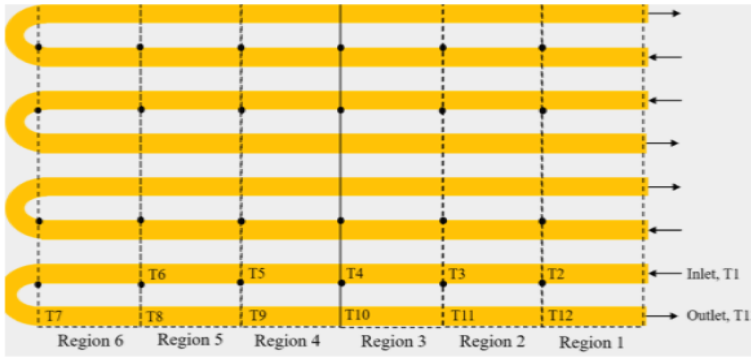


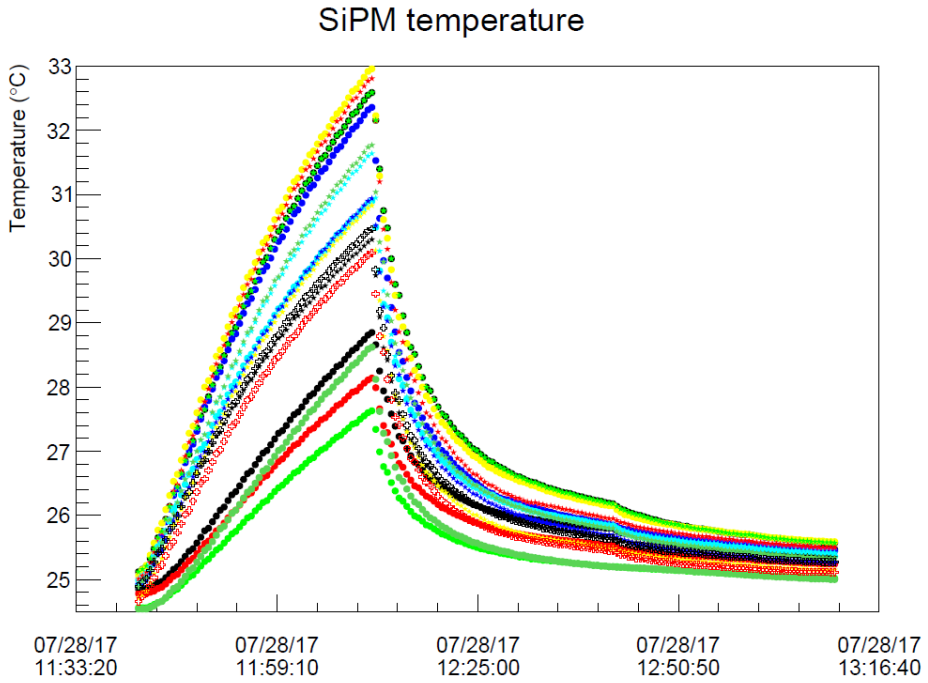


Parallel Loop

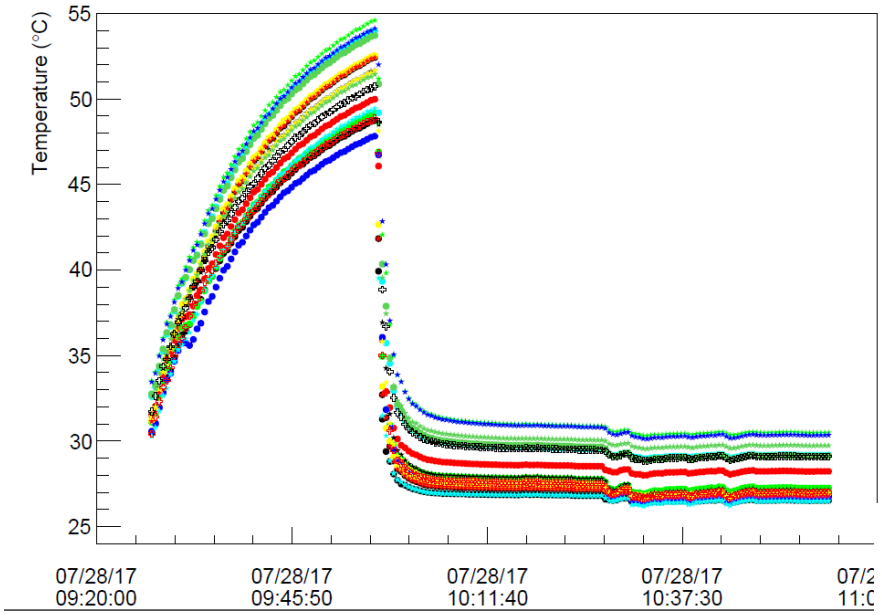
No Chiller
Water is at 23C





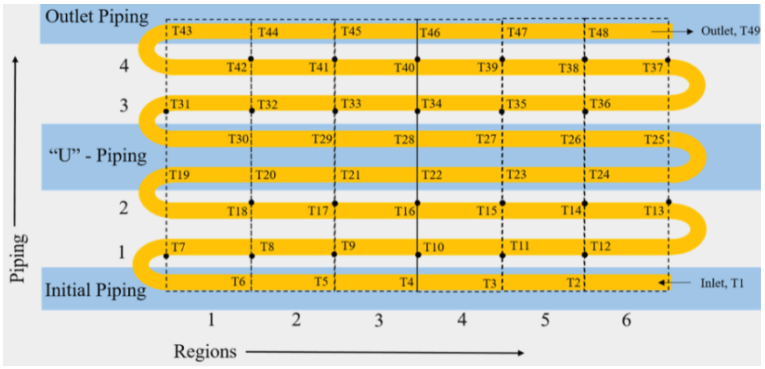


PreAmp temperature

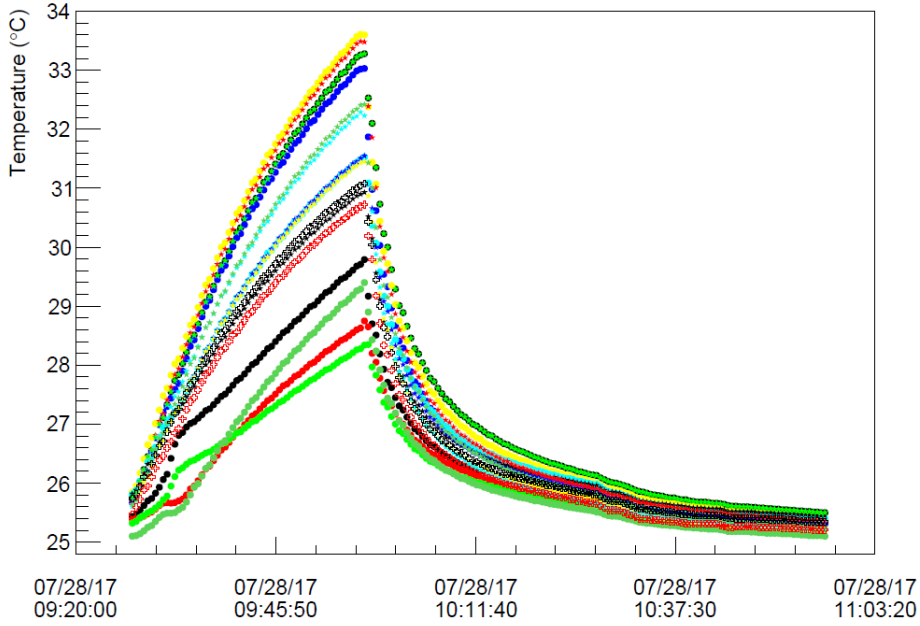


Series Loop

No Chiller
Water is at 23C

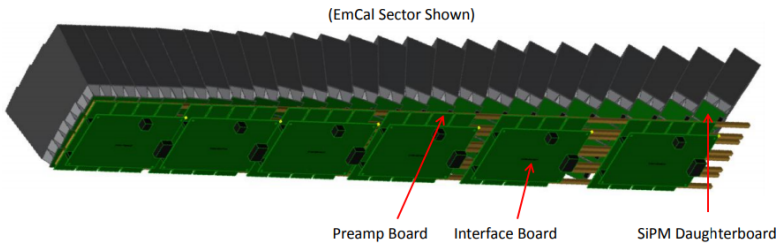


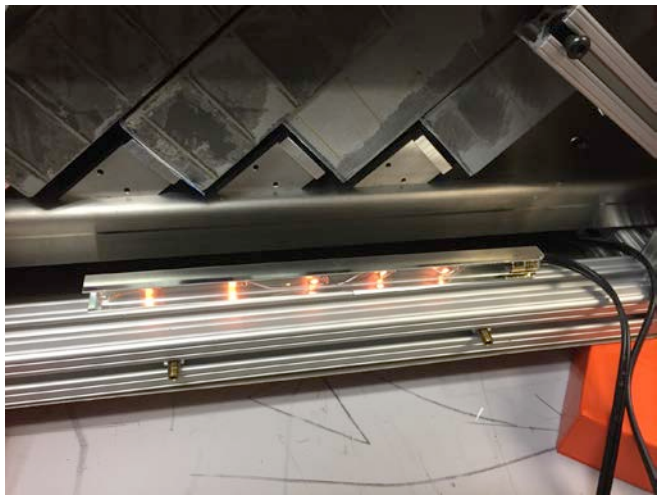
SiPM temperature



Status

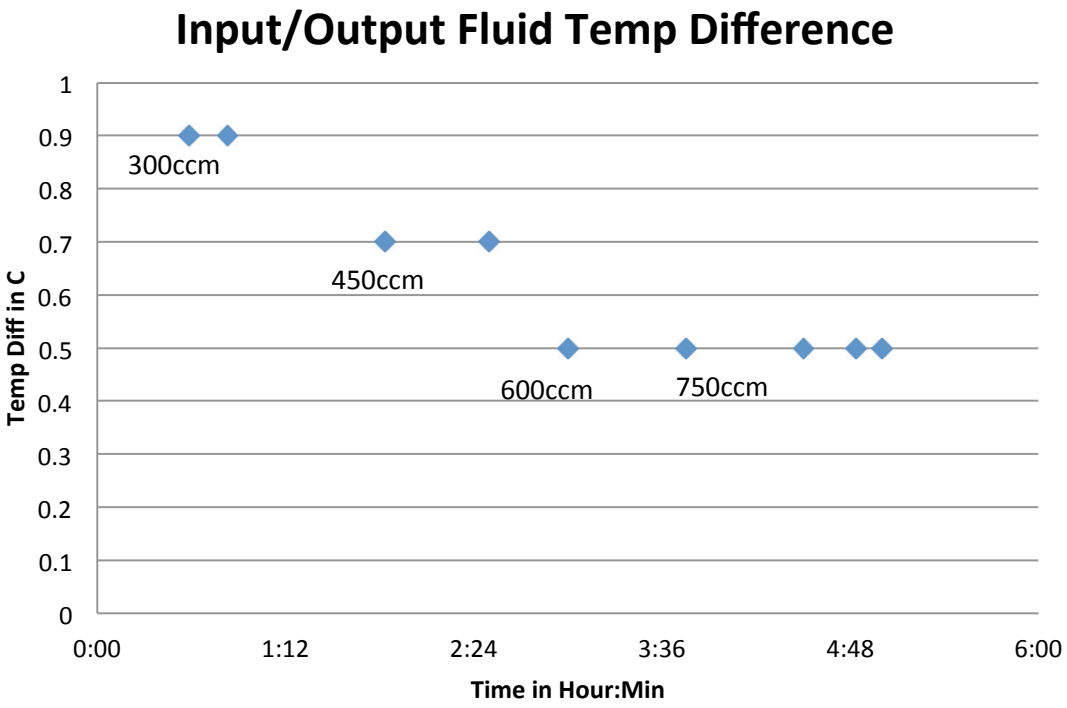
- Use “radiation simulator” to produce current in the SiPm’s and retest for temp stability.
- Calibration of the TC on the prototype
- Work on mechanical supports for PreAmp’s and integrate into sector design.
- Work on interface board cooling if needed.
- Lower temperature of SiPm’s





- Back Up

Testing 1/6 Of A Sector.



Temp on the back of the cooling tube is what is critical here. From previous measurements, the SIPM will be 0.125C-0.25C warmer than the cooling tube.