Brookhaven National Laboratory

Jefferson Lab

U.S. DEPARTMENT OF ENERGY

Barrel Outer Tracker / MPGD (μRWELL)

Triple I Engineering Meeting Update (06232025)

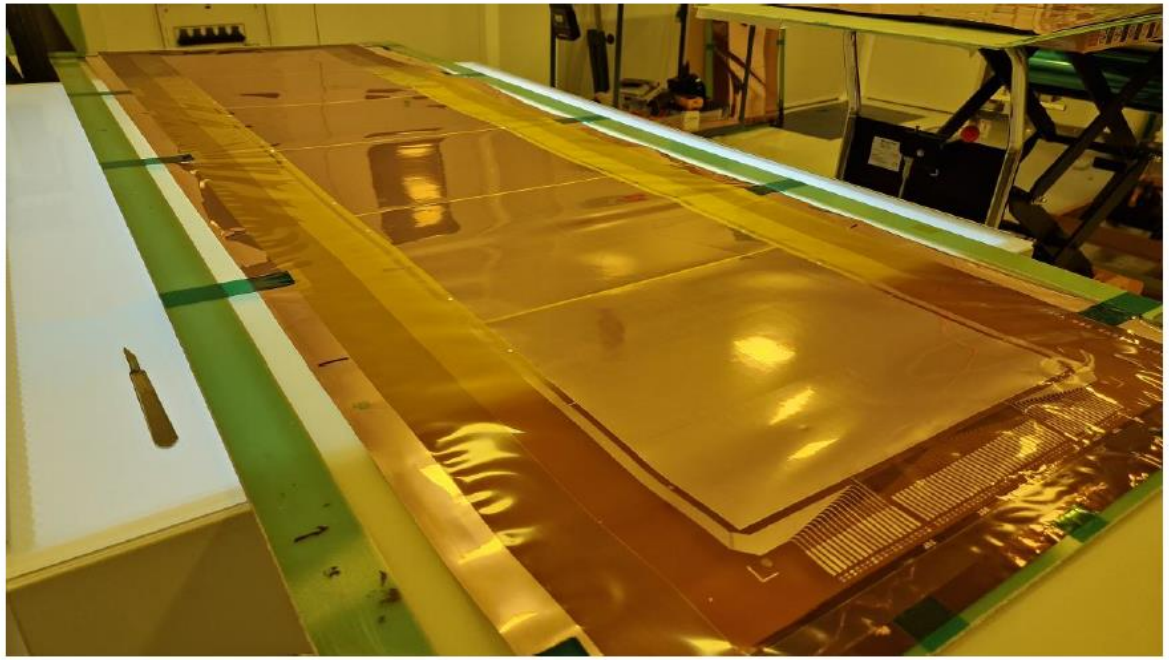
Seungjoon Lee (Jlab)

Electron-Ion Collider

Update

- Jlab MPGD Facility is moving foreword.
- Most of purchased items delivered.
- MPGD frames delivered
- uRWELL PCB and GEM foils are ready to be tested at CERN

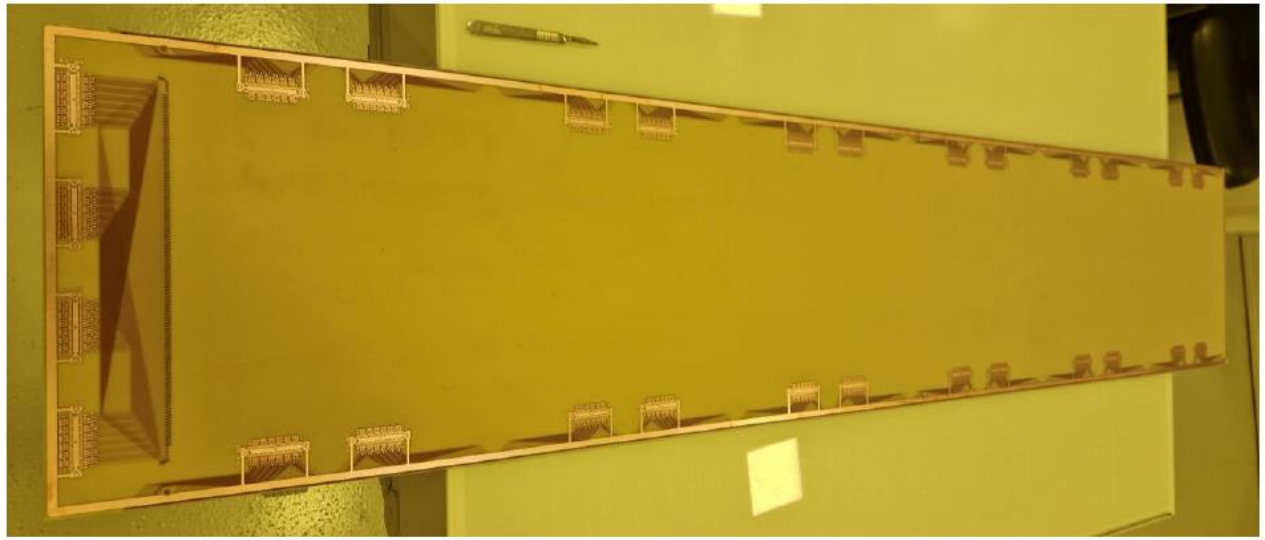
µRWELL-BOT Test Article: µRWELL & GEM from CERN



GEM foil

- CERN is working on basic test and PCB connector assembly.
- ETA to Jlab is July 2025.

µRWELL / CapaSh readout PCB: Front view

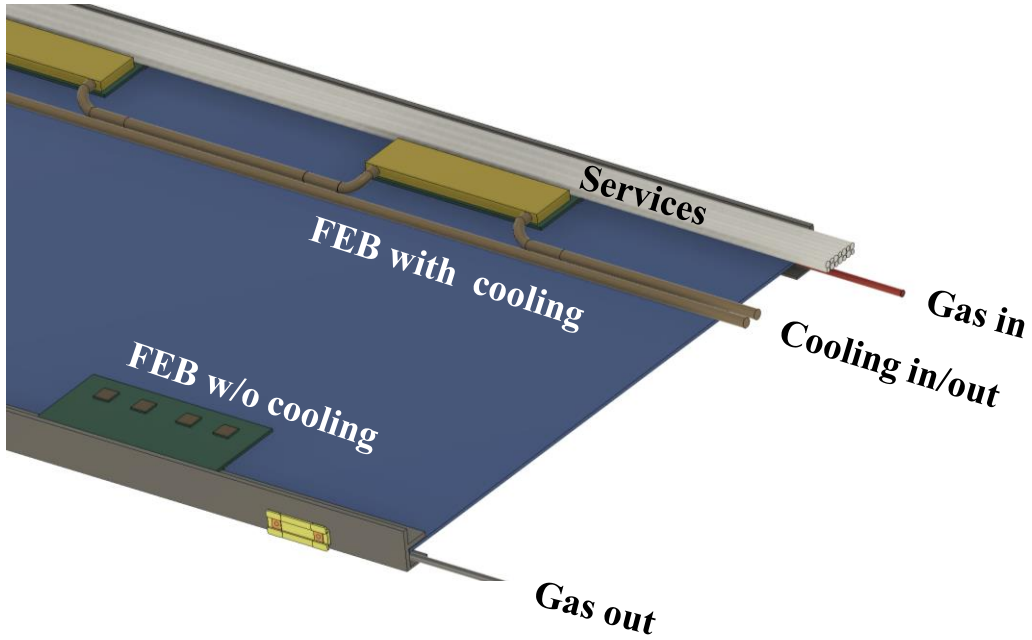


µRWELL / CapaSh readout PCB: back view

µRWELL-BOT: Front End Readout (FEB) & Services Requirements

Readout electronics:

- ASIC: SALSA (under development @ Saclay): 64 chs / ASIC
- FEB: 4 ASICs optical fiber communication via lpGPT + VTRx
- 14 FEBs / modules; 256 chs / FEB ➔ Total: 3,584 chs / module
- FEB: 4 ASICs / board, optical fiber communication via lpGPT + VTRx



Service/Parts	Per Module	Total	Parameter
Frontend Board	14	336	256 Channel / FEB
High Voltage	1 (resistive divider)	24	3.2 mm OD
Low Voltage	14	336	6 mm OD
Gas	2	48	3 mm ID, 4 mm OD
Cooling	4	96	6 mm ID, 8 mm OD
Data Cable	14	336	Optical Fiber
Sensor	2	24	Temp. & Humidity
Ground			Depends on grounding plan

Services & cabling:

- The volume & diameter of the service line are subject to change as the FEB design progresses.
- The cooling requirement has not yet been finalized ➔ The current cooling approach utilizes water cooling with a heatsink.
- All three subsystems BOT, ECT, and CyMBaL will collaborate on the cooling system design.

µRWELL-BOT: PED Test Article Activities - Where Are We As Of Now?

- Test article module:
  - Support frame delivered
  - GEM, µRWELL / readout PCB, cathode foil – 07/2025
- Assembly of the test article module: 08/2025 – 10/2025
  - Clean room refurbishment ongoing
  - Procurement of major instruments & machine shop job
  - Some instruments in hand (Ultrasonic Bath, oscilloscope ..)
- Test beam with test article
  - Ongoing JLab Test beam for gas choice with small prototype
  - Planned CERN Test beam for full scale test article – 11/2025

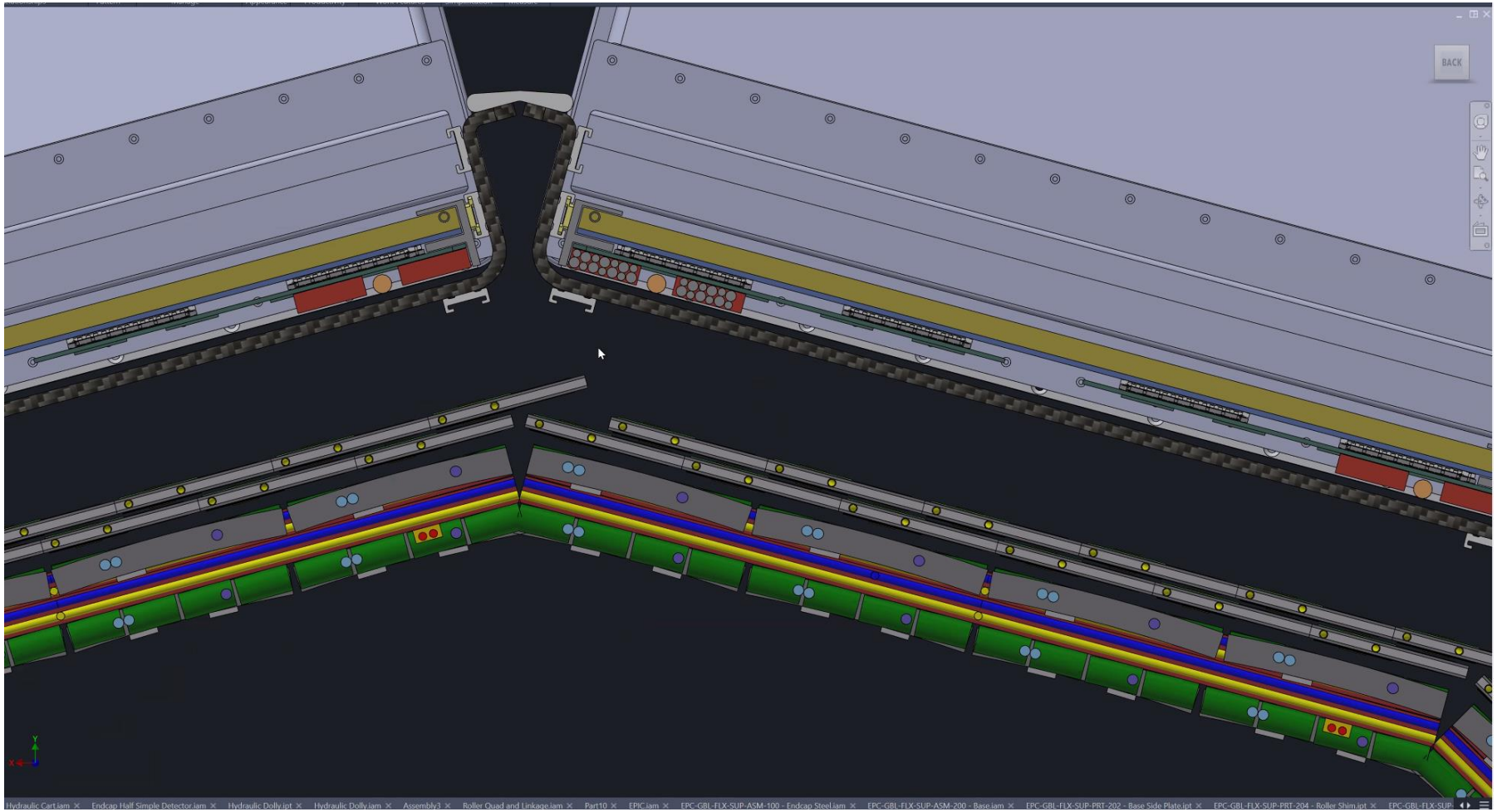
MPGD Clean Room in EEL-121 @ Lab

Large Ultrasonic Cleaning Bath

Support frames set for µRWELL-BOT test article modul

Backup

New Design Draft (from Dan)



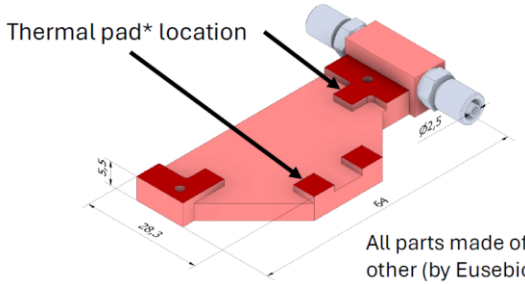
- CF housing encapsulates MPGD, removing extra space for service
- It would be a good chance to review MPGD envelope

Other parameters

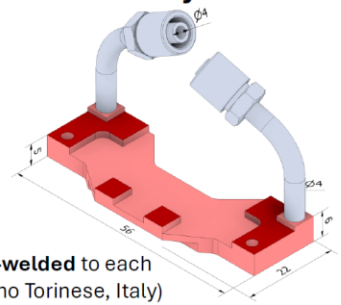
- Should DSC provide cooling or ePIC?
- Water chiller location (distance)
- ePIC operation temperature/humidity (drew point)

Heat Exchanger and FEB Geometry Pt. 2

Layer 1/ Layer 2



Layer 3



All parts made of copper and **laser-welded** to each other (by Eusebio SALD S.r.l., Settimo Torinese, Italy)

All heatsinks **tested for leaks at 4 bar**

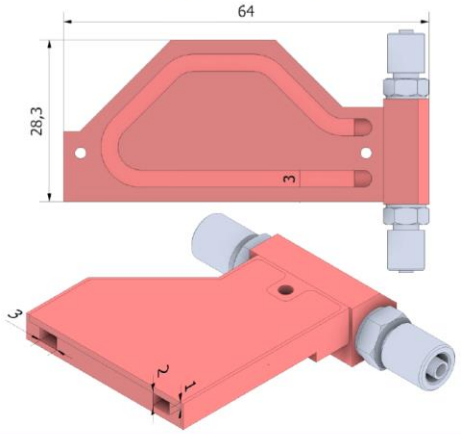
Brazing

Laser Welding

*RS PRO Thermal Interface Sheet, 0.5mm Thick, 8W/m-K, Silicone, 150 x 150 mm, RS Stock No.: 915-6073

Heat Exchanger and FEB Geometry Pt. 3

Layer 1/ Layer 2



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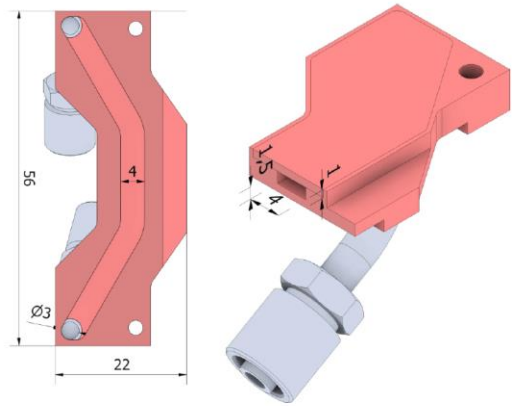


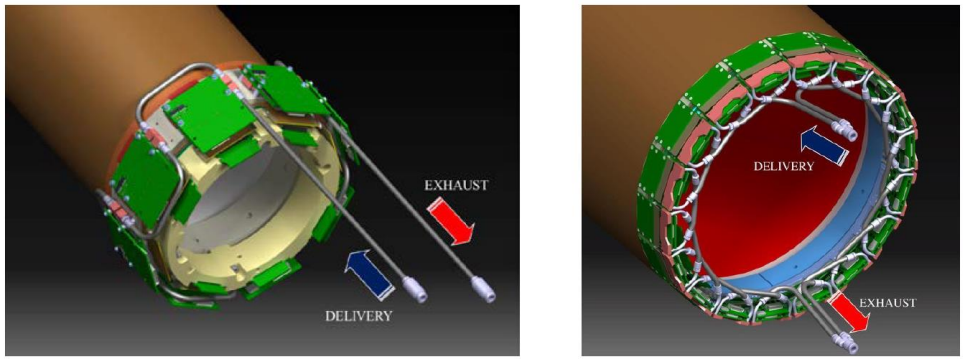
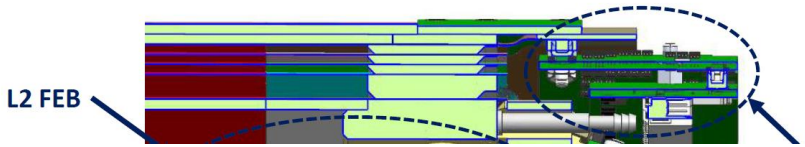
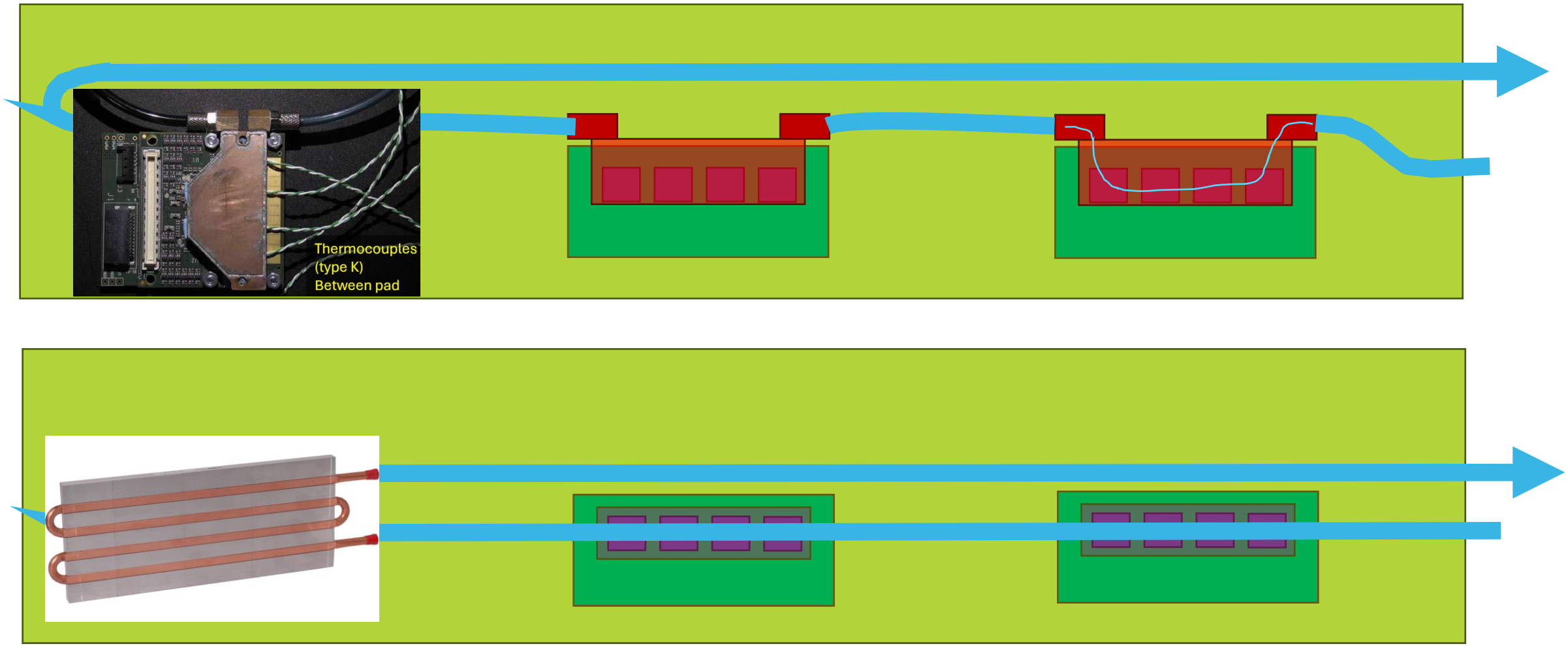


Figure 1.17: 3D view representation of the cooling system for the CGEM-IT Layer 1 (left) and 3 (right).



Comparison of cold plate



Options for heatsink

- Direct heatsink with stainless steel tubing

- simple, smaller tubing
- less bending (lower pressure drop)
- requires insulation

- Custom made heatsink with soft tubing

- complicate heatsink required, larger tubing
- more bending (high pressure drop)
- insulation not required

CyMBaL

BOT