Brookhaven National Laboratory

Jefferson Lab

U.S. DEPARTMENT OF ENERGY

Barrel Outer Tracker / (μRWELL-BOT)

Triple I Engineering Meeting Update (10/20/2025)

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Electron-Ion Collider

Update

- JLab MPGD Facility (Clean room) setup is moving forward. Not completed yet.
  - A couple of infrastructures items need to be completed by JLab facilities
  - We are been severely delayed with the shutdown
- First steps of μRWELL-BOT PED test article assembly is ready to go.
- Preparing thermal simulation for cooling (Girish, BNL)

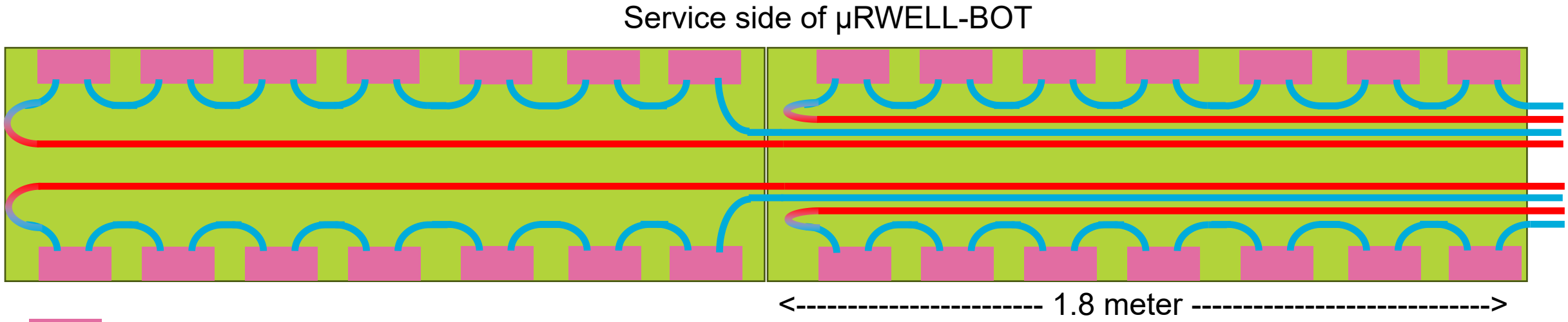
µRWELL-BOT PED test article assembly – Honeycomb Frame





- Visual inspection for µRWELL-BOT frames => OK.
- Ready for the first vacuum gluing for honeycomb structure.
- Ventilation setup for epoxy gluing is under review by ES&H.

Overall cooling scheme

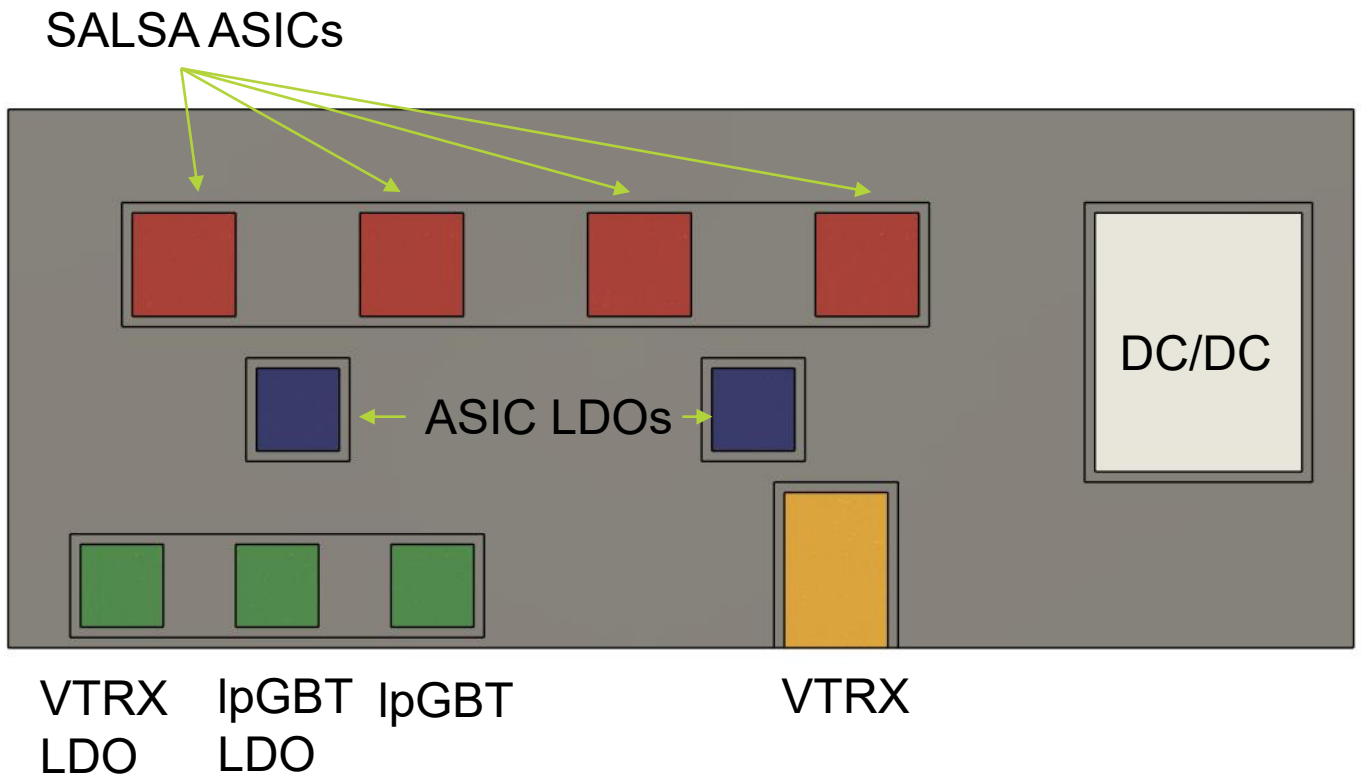


- Current estimation
- 7W (FEB) + 5W (DC/DC) = 12W per FEB
- Total 84W per cooling line
- 6 mm OD tubing (copper)
- V = 1 Liter/min
- Delta T < 1 ^{o}C (estimation)
- T_{in} = 22~25 ^{o}C (depends on humidity)

Aluminum or copper heatsink
with copper tubing for the initial design

Backup

Components – estimated, all-in-one board



parameters

Component	Voltage(V)	Power (mW)
SALSA1	1.2	1200
SALSA2	1.2	1200
SALSA3	1.2	1200
SALSA4	1.2	1200
LDO SALSA12	1.5	600
LDO SALSA34	1.5	600
lpGBT	1.2	500
VTRX+	1.2 & 2.5	200
LDO lpGBT/VTRX	1.5	130
LDO VTRX	2.8	20
Sum(FEB)		~7000
DC/DC converter	24V to 2.8 & 1.5	5000 (need confirm)
Total		12000

Target temperature of ASIC: 30±3 ^{o}C

Water temperature: 22~25 ^{o}C
Water flow rate: 1 liter/min
7 FEBs per cooling line: total 84 W

Feasibility study

- Q = m x Cp x dT
- Q = 84 watt
- m = 1 L/min = 1 kg/min = 0.0167 kg/s
- Cp (water) = 4180 J/kgC
- dT = 0.83 C

- Tin = 22 degree C , Tout = 22.83 degree C

Thermal resistance

- Most heat comes from DC/DC (5 watt)
- Most resistance comes from thermal grease or tape or pad
- Pad is easy to use for covering multiple components. Taking care of misalignment, uneven surface, etc.
- Typical pad has 0.5 C/W
- https://www.digikey.com/en/products/detail/leader-tech-inc/TGF60-07870787-039/7203520

- DC/DC temperature: 5 W x 0.5 C/W = 2.5 degrees higher than cooling block which is fine.
- ASICS and other components => less hot. Unless the component is very small.