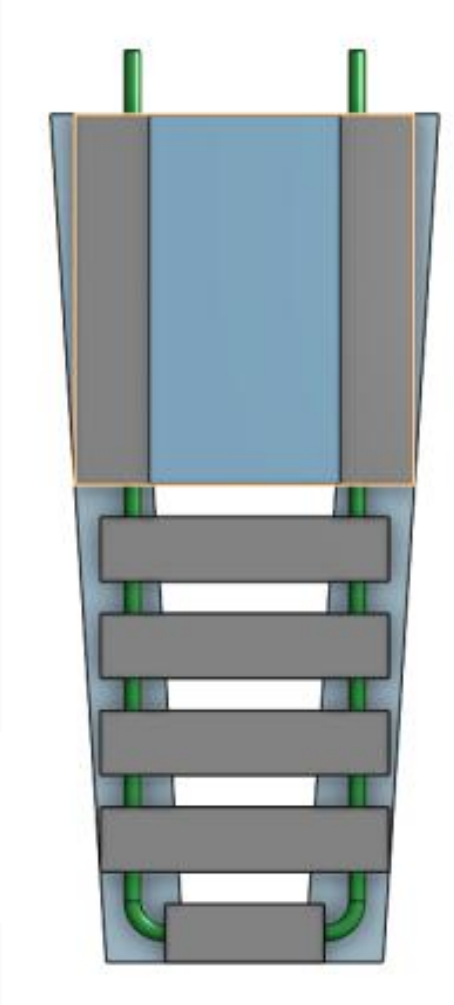


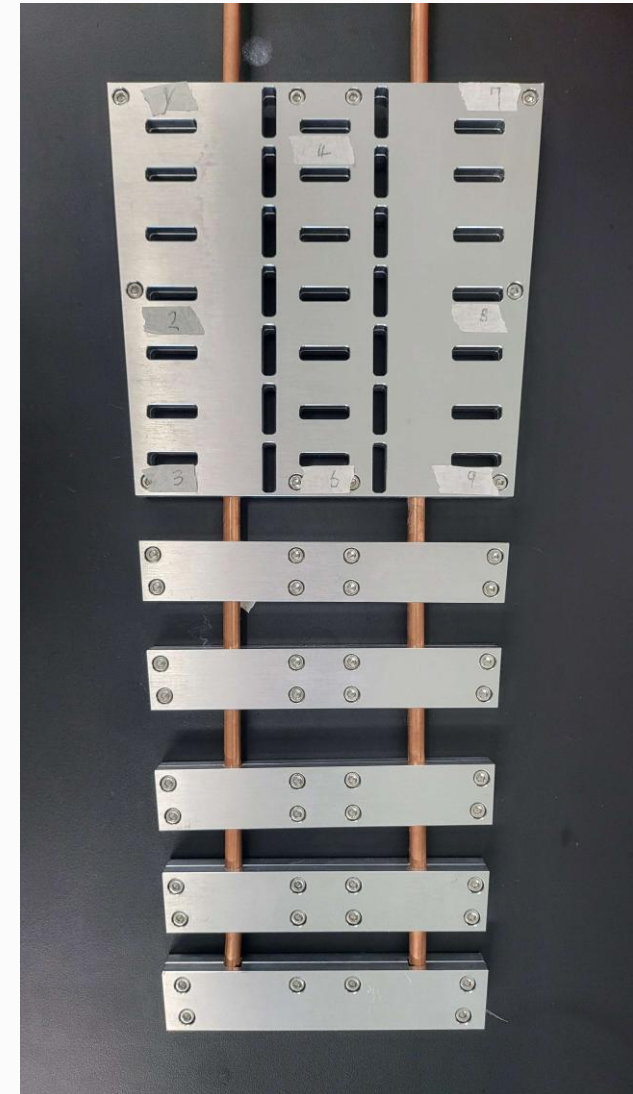
ESB Cooling & LMS

Junseop SHIN, Bogyong SEO, Junhyung PARK, Shinhyung KIM
Kyungpook National University Department of Physics

Cooling System

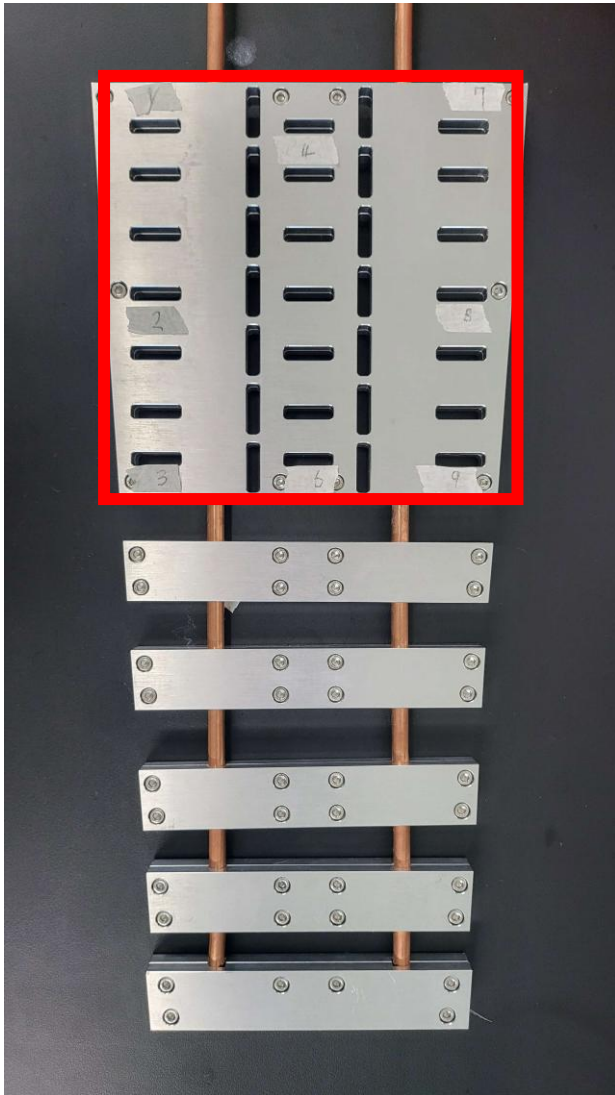


- Simulation cold plate by Manitoba University.
- Side 1 : ESB PCB with SiPMs
- Side 2 : CALOROC and AstroPix ETC
- Design Demension
 - Cu cooling lines $\frac{1}{4}$ " OD
 - Aluminum cold plate thickness $\frac{1}{2}$ "
- Required temp. : $7^{\circ}\text{C} \pm 1^{\circ}\text{C}$ (based on GlueX experience)
- 7°C chilled water
- 0.3 gal/min (~ 1.1 L/min)

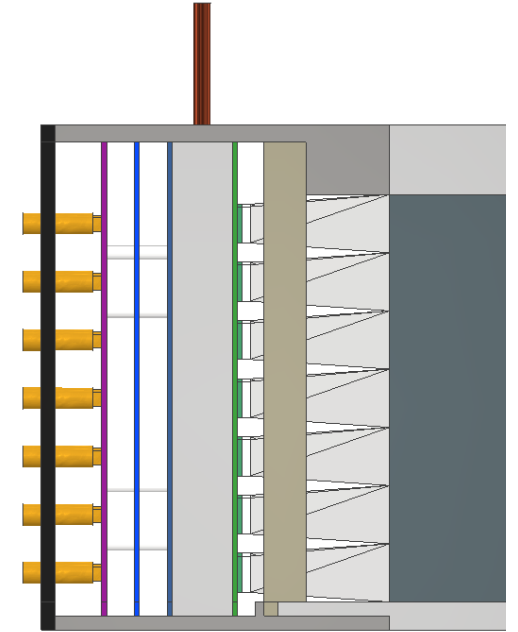
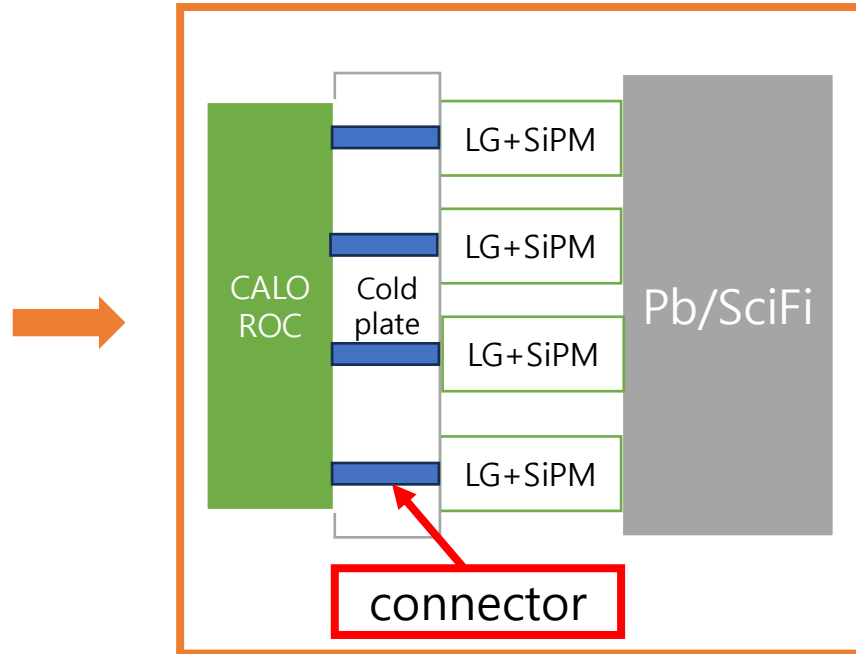


- KNU cold plate

Cooling System

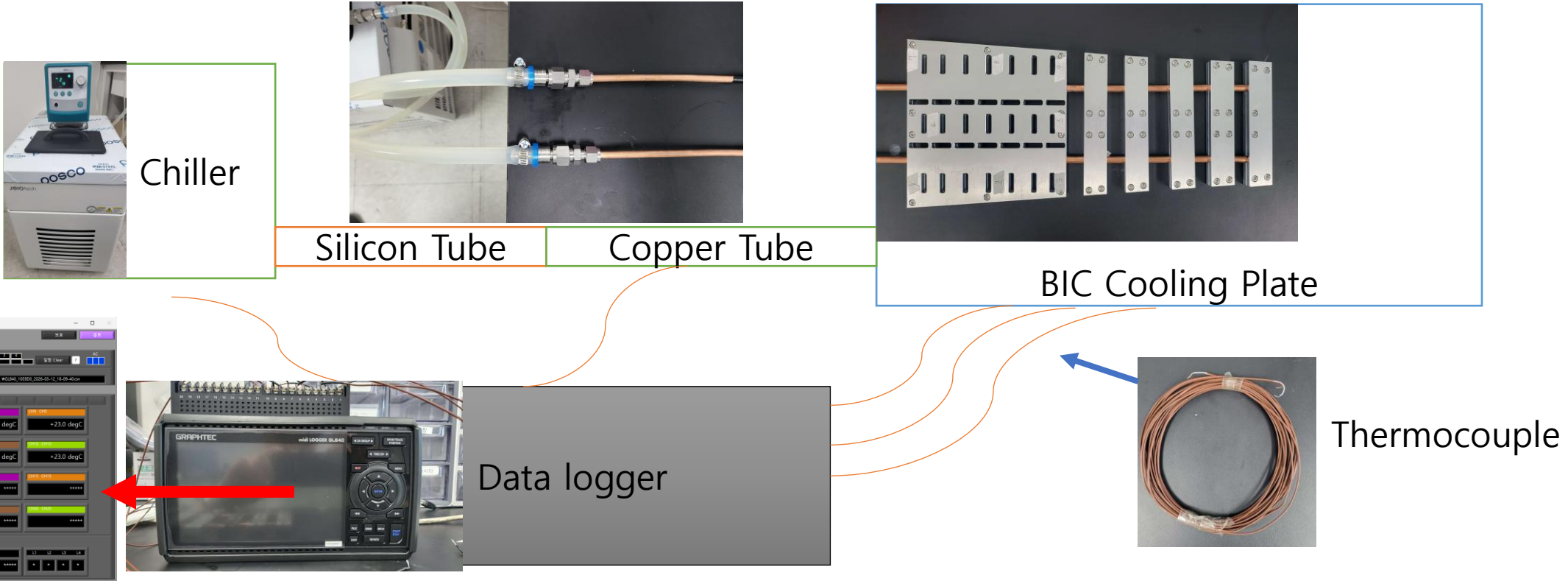


- KNU cold plate



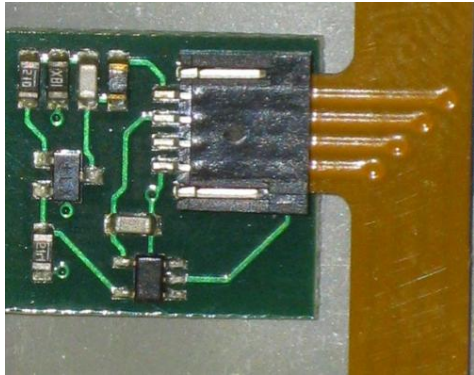
- 35 ea holes in KNU cold plate
- Hole was added for the SiPM connector to insert a cold plate between SiPM and readout board (CALOROC)
- In GlueX...?

Cooling System at KNU



- Cooling system with data logger & thermocouple.
- Chiller flow rate : 5.6 L/min (minimum) -> additional pump will come at Friday (flow rate 0.006 ~ 3400 mL/min)
- Cooling test with dummy board

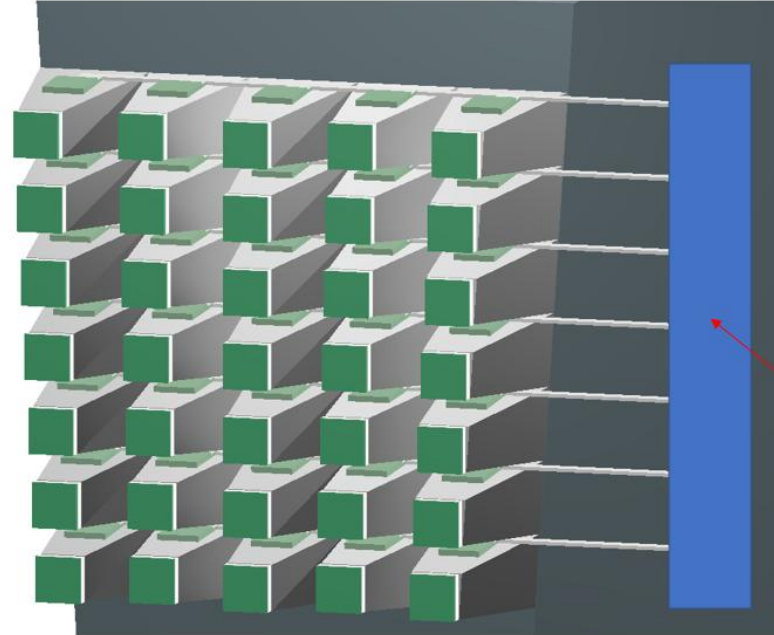
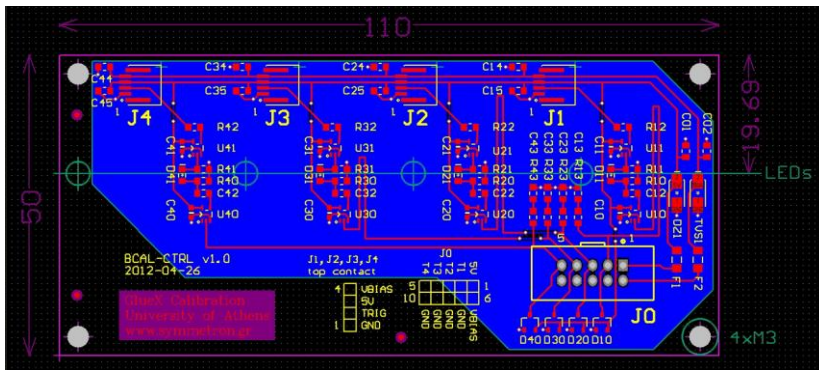
LED Monitoring System (LMS)



GlueX LED board



GlueX controller board

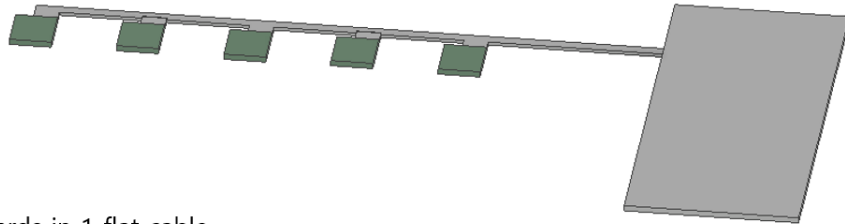


- 35 ea LED board & 7 ea flat cable
- Controller board

Controller board

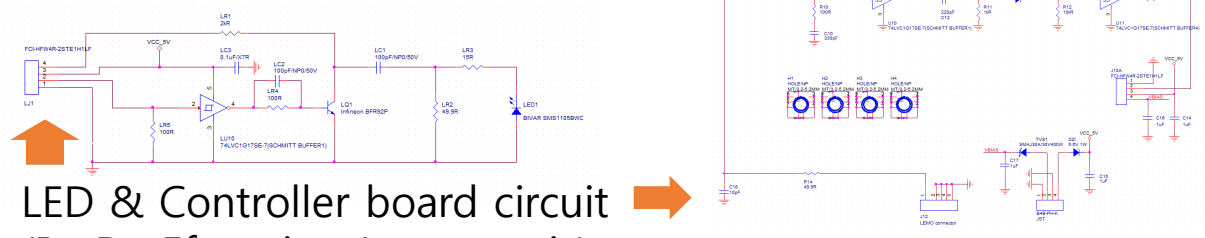
- GlueX LMS System (by Dr. Efstratios Anassontzis & Prof. Zisis Papandreou)
- BIC LMS (5 ea LED board per each layer => total 35 ea LED board)
 - KNU is making BIC bulk prototype (35 ea for bulk + 25 ea for SFIL => total 60 ea)
- Controller board for LED trigger signal

LMS at KNU



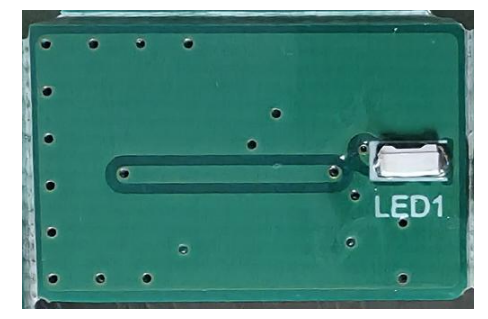
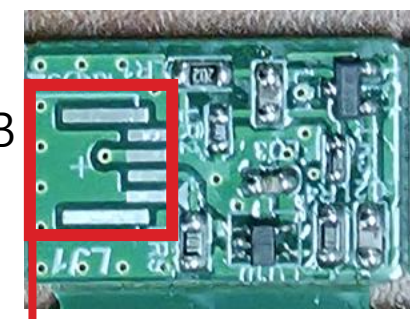
Flexible PCB connector

- 5 ea LED boards in 1 flat cable
- 5(wide) X 7(length) LED boards
- 7 flat cables
- 7 flat cable connectors at controller

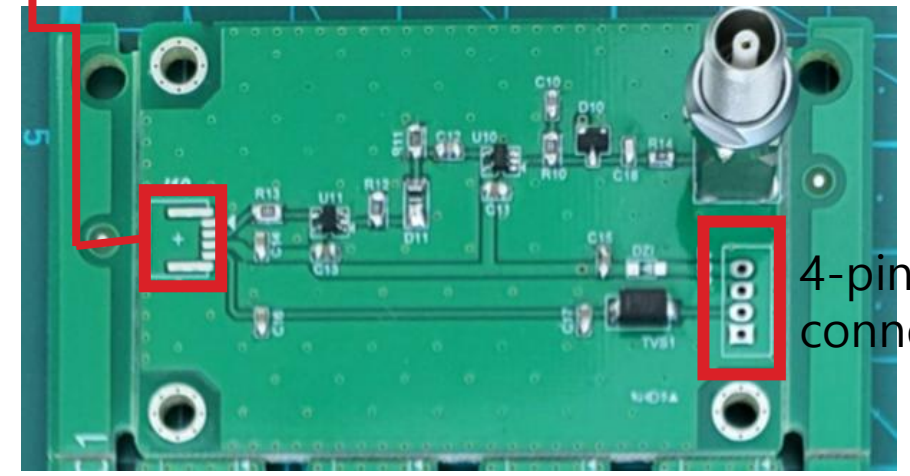


LED & Controller board circuit
(By Dr. Efstratios Anassontzis)

- 1 channel LED & Controller board
- Trigger signal
 - Received through a LEMO connector
 - Delivered to the LED board
- LED voltage & Amp voltage (5 V) => 4-pin connector



- LED PCB board @KNU



4-pin connector

- Controller PCB board @KNU

Future Plan

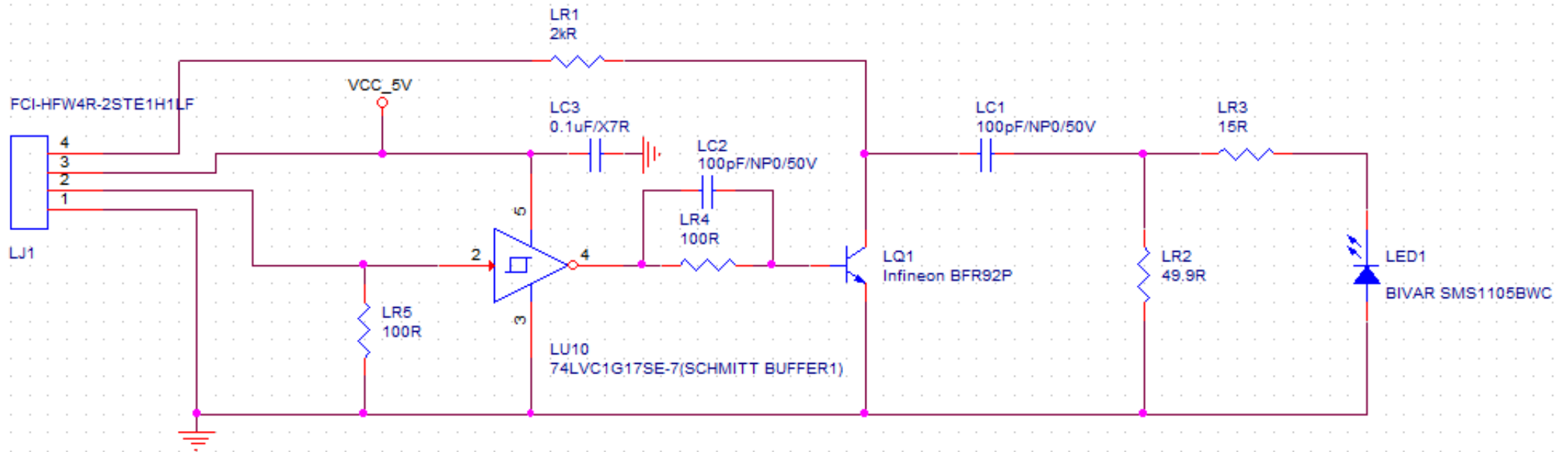
- Cooling test with KNU cold plate
 - Temperature stability test
 - Dummy PCB test
- LED gain calibration
 - 1 channel LED & Controller board
 - Make all channel board soon



Back up

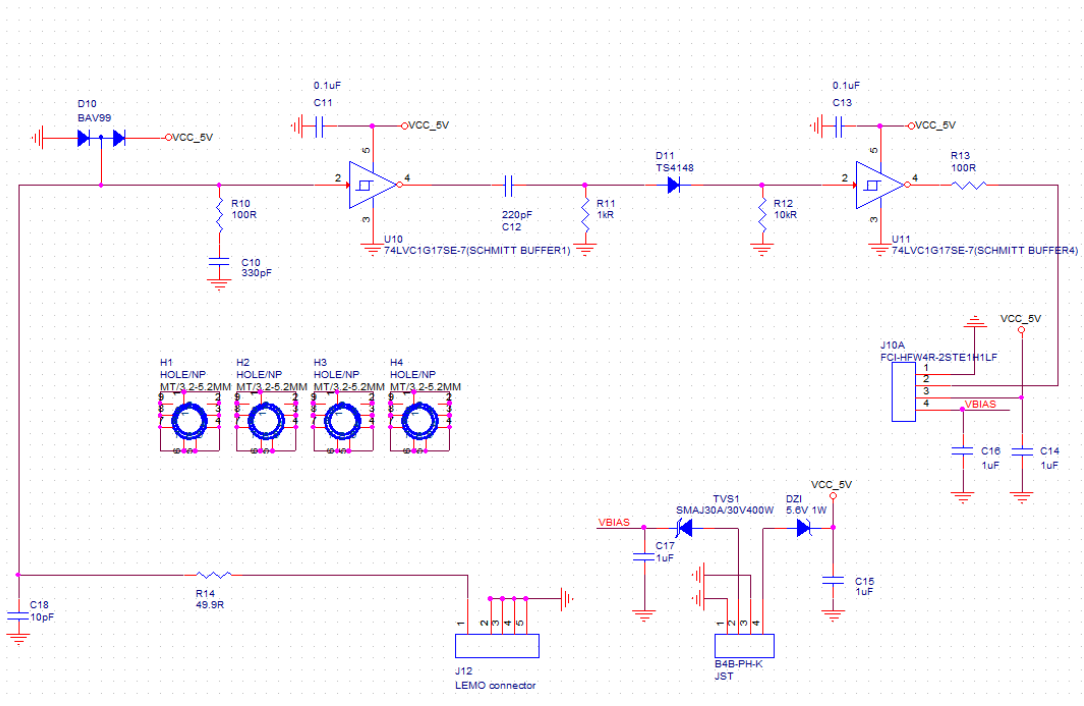
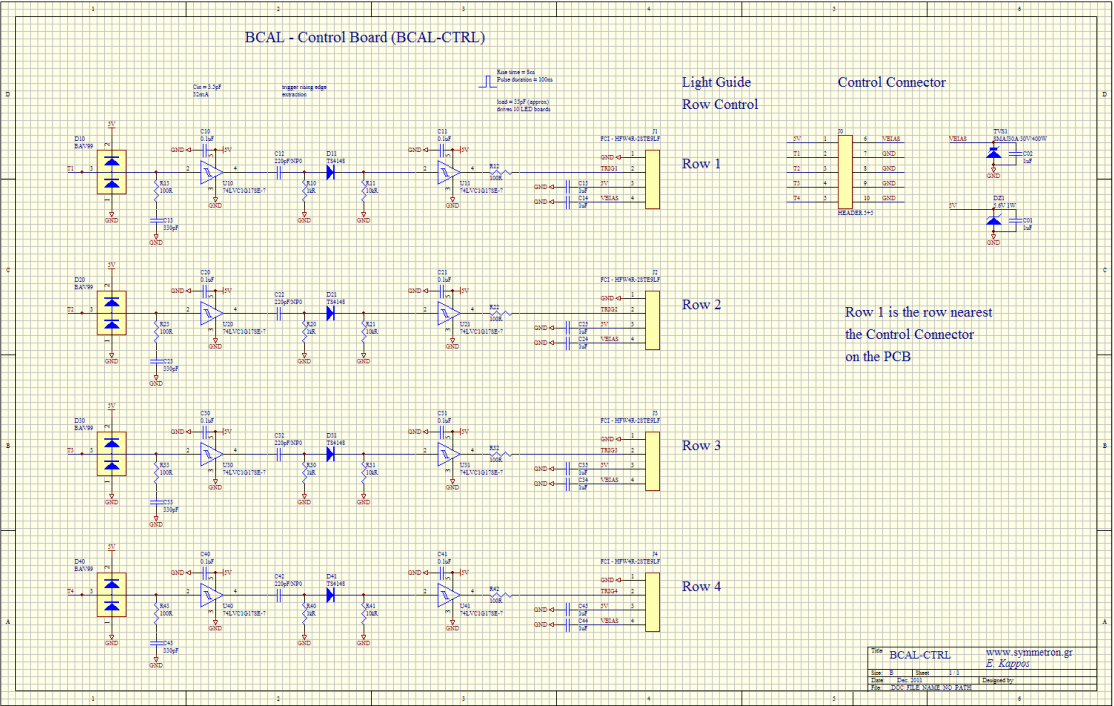


LED circuit



- LED board circuit (By Dr. Efstratios Anassontzis)
- Same as GlueX LED board circuit

LED circuit



GlueX controller board circuit

1 channel controller test board circuit

- Controller board circuit (By Dr. Efstratios Anassontzis)
- Same as GlueX LED board circuit
- 4 channel in GlueX circuit, 1 channel for test circuit (Ultimately 7 channel for BIC bulk)