

OTK thermal analysis

Jinyu Fu

2024/9/4

OTK冷却方案分析

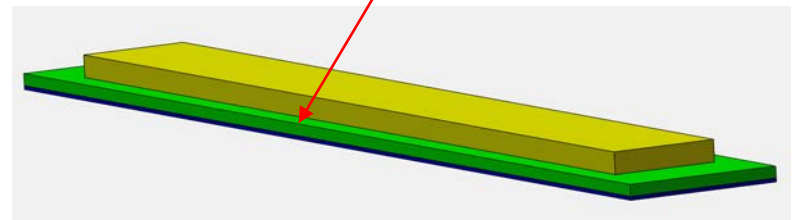
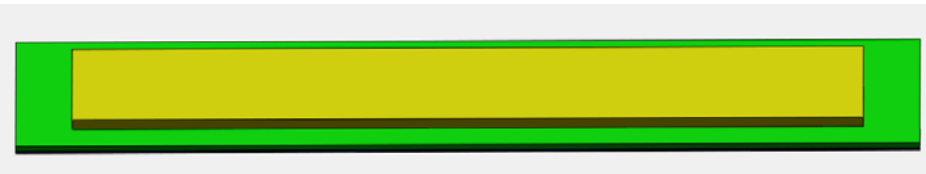
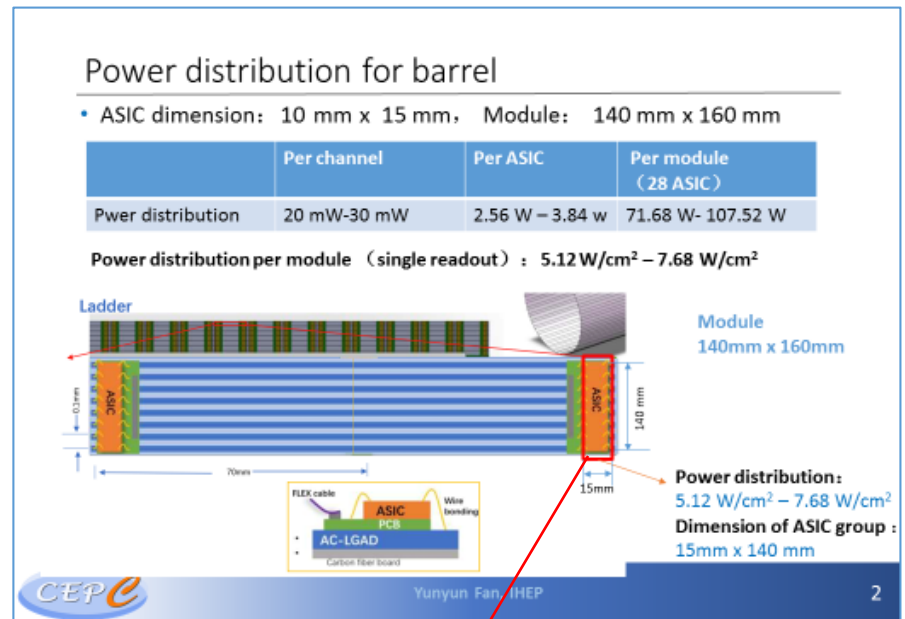
按目前OTK给定的模块电子学初步尺寸和发热量，考虑了不同位置的冷却方案，对冷管布置在芯片一侧和asic一侧，分别作了模拟热分析，判断方案合理性：

ASIC Power: 35.84W (15x140x3 mm)

PCB t=1.6mm

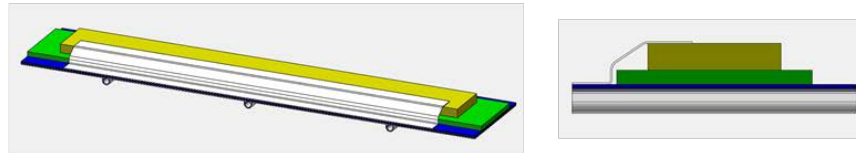
LGAD t= 0.5mm

冷管温度5°C



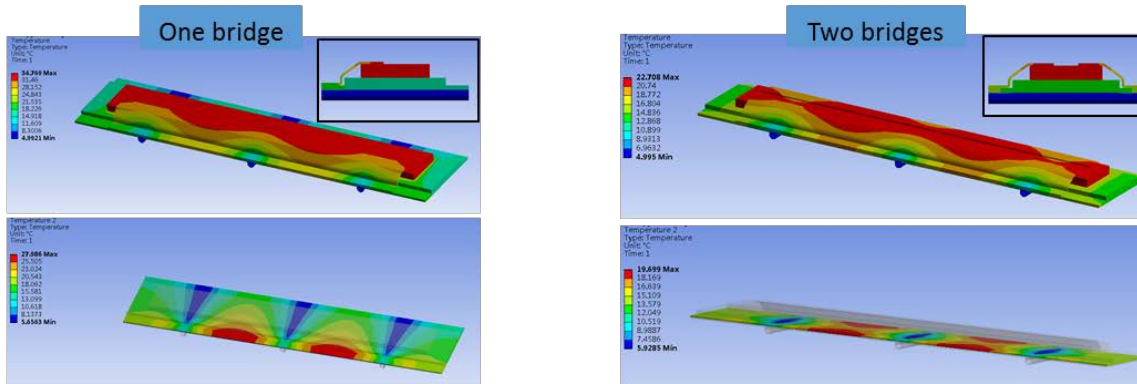
Thermal analysis of OTK ladder

New optimized cooling scheme: add a thermal conductive bridge over the PCB to connect the ASIC and LGAD



One bridge, 0.5mm Cu: ASIC ~ 35 °C, LGAD ~ 28 °C

Two bridges, 0.5mm Cu: ASIC ~ 23 °C, LGAD ~ 20 °C



Better results but more materials. Candidate materials?

物理上优先考虑一个初步的热沉方案

热沉方案分析

与之前条件一致：

ASIC Power: 35.84W (15x140x3 mm)

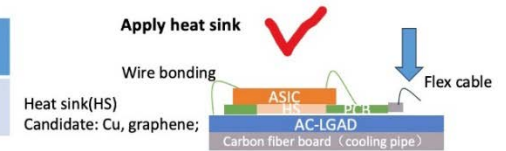
PCB t=1.6mm

LGAD t= 0.5mm

冷管温度5°C

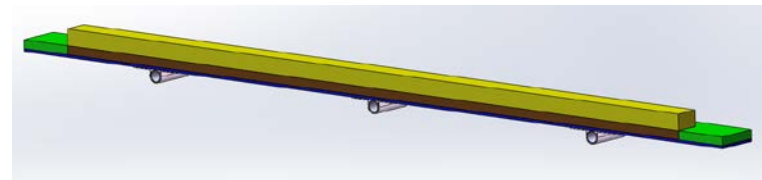
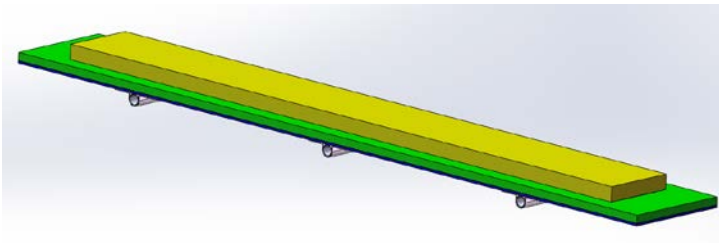
Power consumption

	Per channel	Per ASIC
Pwer distribution	20 mW	2.56 W



The area of the heat sink could be 60% of the ASIC area

ASIC area	Heat sink area	For whole detector
2.68 W/cm ² (ASIC area: 140mm x 15mm)	140mm x 9mm	0.575W/cm ² (dual readout)
2.02W/cm ² (ASIC area: 140mm x 20mm)	140 mm x 10.2mm	
1.61W/cm ² (ASIC area: 140mm x 25mm)	140 mm x 15mm	
1.34 W/cm ² (ASIC area: 140mm x 30mm)	140 mm x 18mm	



初步结果

当前初始尺寸方案已有初步结果：

显示热沉效果比较好。

之前提供的发热量计算有误。后续按更新发热量，分析对比其他配置，优化方案。

