Progress Towards the Development of Cooling Demonstrator of the CBM Silicon Tracking System

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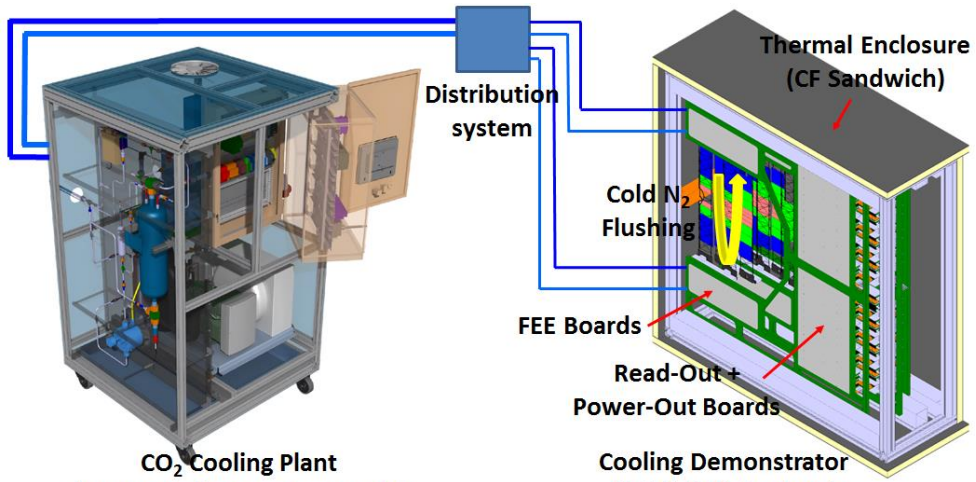
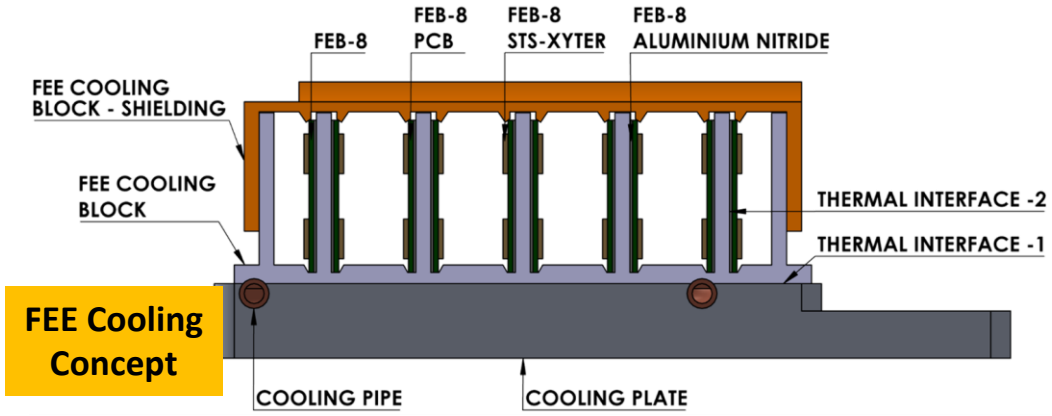


Bi-Phase CO_2 cooling at -25°C for FEE (40kW in ~2m³)

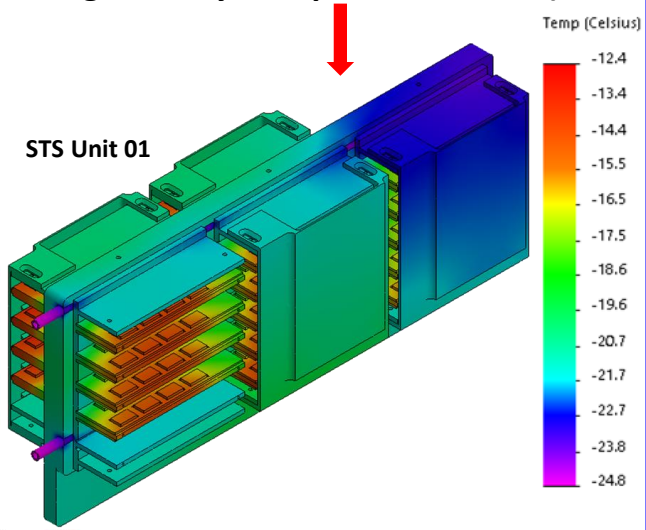
Forced N_2 cooling directly for sensors (aim ≤ -10°C)



FEE Cooling Concept

T-p v/s L Analysis Flow Pattern Map (MATLAB + REFPROP) + **Thermal FEA (SolidWorks)**

Optimal Operation Parameters (Mass Flow, Pressure Drop, Tube geometry, Temp. Gradient etc.)



Max. FEE temp. < -10°C
Computational Characterization

FEE shielding encapsulates higher FEE temp.

TIM Optimisation

T_{H2O} = 15°C, $\dot{Q}$ = 160W, Fr = 11.1g/s

Interface #1	Interface #2	Maximum Fin Temp. (°C)	
		Exp. (PT100)	Thermal FEA
Grease	Grease	29.7	32.0
	C-Foil	29.6	32.0
C-Foil	Grease	33.7	32.1
	C-Foil	33.9	32.1

Viscous TIM (grease) is better
Relative measurements with H_2O

OUTLOOK

- **Commissioning of demo CO_2 cooling plant**
- **Exp. verification of FEE cooling calculations**
- **Thermal characterization of feedthroughs**
- **Mechanical integration, part production → experience from mSTS@SIS18 (Aug-Sep'18)**

Sensor cooling tests under realistic conditions (with least additional X_0/station)