



CDF Silicon Cooling

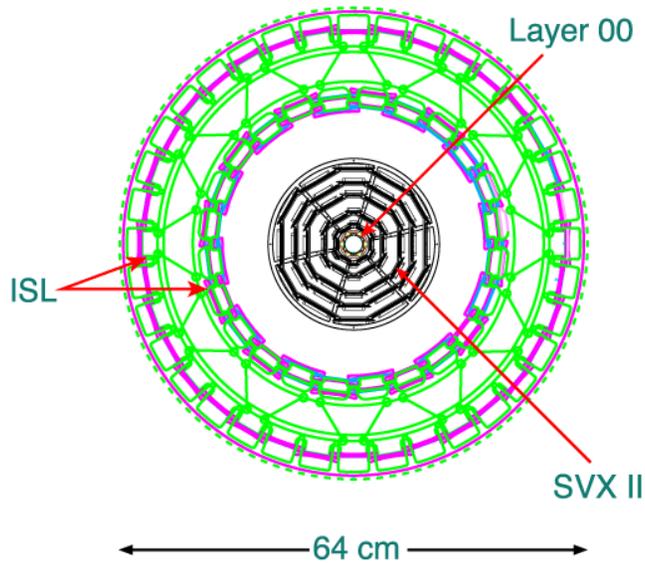
Mary Convery

Peter Wilson

All Experimenters Meeting

March 19, 2007

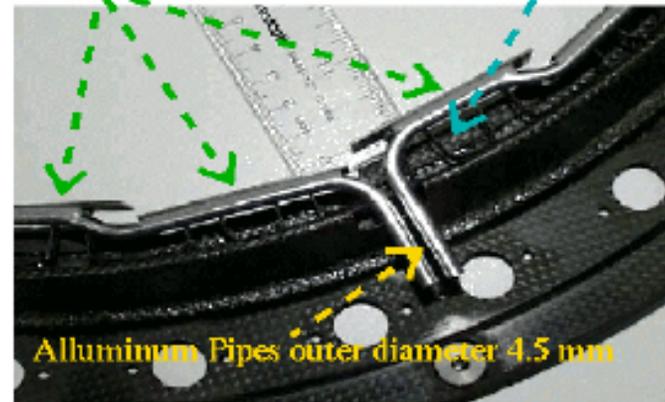
Intermediate Silicon Layer Cooling



Space Frame Cooling System

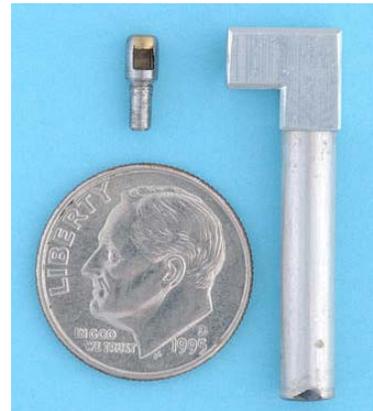
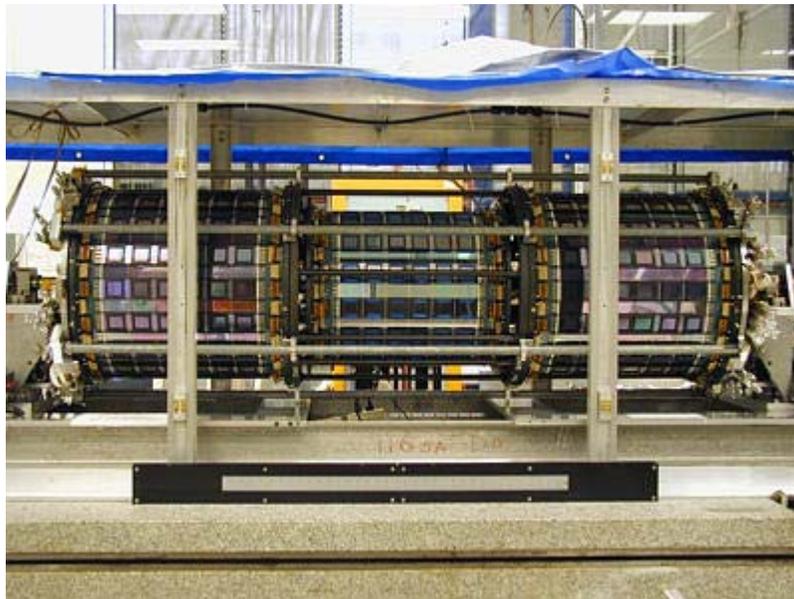
Beryllium Ledges

Carbon Fiber Ribbon



Maximum of 9 ladders in one cooling channel
 $\Delta T(\text{IN-OUT}) \sim 1^\circ\text{C}$

coolant flowing in aluminum tubes attached to beryllium ledges mounted on space frame



Recent History

- SVX and Intermediate Silicon Layer have different cooling systems, but linked
- Conductivity of ISL coolant after 2006 shutdown 3 orders of magnitude too high
- Recent problems with valves in the ISL cooling at the detector
 - Suspect related to the high conductivity
- Measured pH of coolant pH=2
 - SVX coolant pH=4
 - Fresh mix of deionized water with 10% ethylene glycol pH=6
 - Now suspect warming up last shutdown caused formation of glycolic and formic acids from the glycol
- Concern about corrosion, especially of aluminum pipes on detector

Flushing the entire system

- Flush the system and start over
- Go back to pure deionized water
 - Non-trivial change to interlocks to prevent freezing of cooling lines
- Air in the system during its commissioning was a significant problem
 - Big risk



Dilution

- Dilute the current coolant with a fresh solution
- pH is logarithmic
- Can only exchange relatively small quantities at a time (10-20%)
- Even getting to a pH of 3 or 4 takes ~2-5 volume exchanges
 - System volume is 1000L
- Any amount of glycol makes the fluid removed special waste
- 20 55-gallon drums

Chemical treatment

- Adding chemicals to bring up the pH
- Consulted first with FNAL chemist Anna Pla-Dalmau and then water system specialists GE Betz
- Recommend sodium hydroxide caustic to bring pH up to 7-8 and borate buffer (aluminum pipes)
 - Existing resin would clear up the conductivity from that point
 - Concern about precipitate: some cooling lines were blocked by epoxy and drilled through with a laser → 0.5-2.0mm orifice
- GE Betz will do chemical analysis of coolant samples (SVX as well as ISL) before and after proposed treatment
 - Measure size of particulates
- Will also test for bacteria

Plan

- Studying feasibility of pushing new coolant in while pumping out old
 - More like flushing than dilution but not with air
 - Less mixing → fewer volume exchanges
 - Likely still 5-10 drums of special waste
 - Will valve off detector loop to keep isolated
 - Avoid riskiest area for problems with air in the system
- Replace with deionized water with no glycol
 - Will still have ~1% glycol due to portion in detector loop
 - Also ISL shares a spare chiller with SVX cooling (30% glycol)
- Monitor pH and follow up with chemical treatment if needed