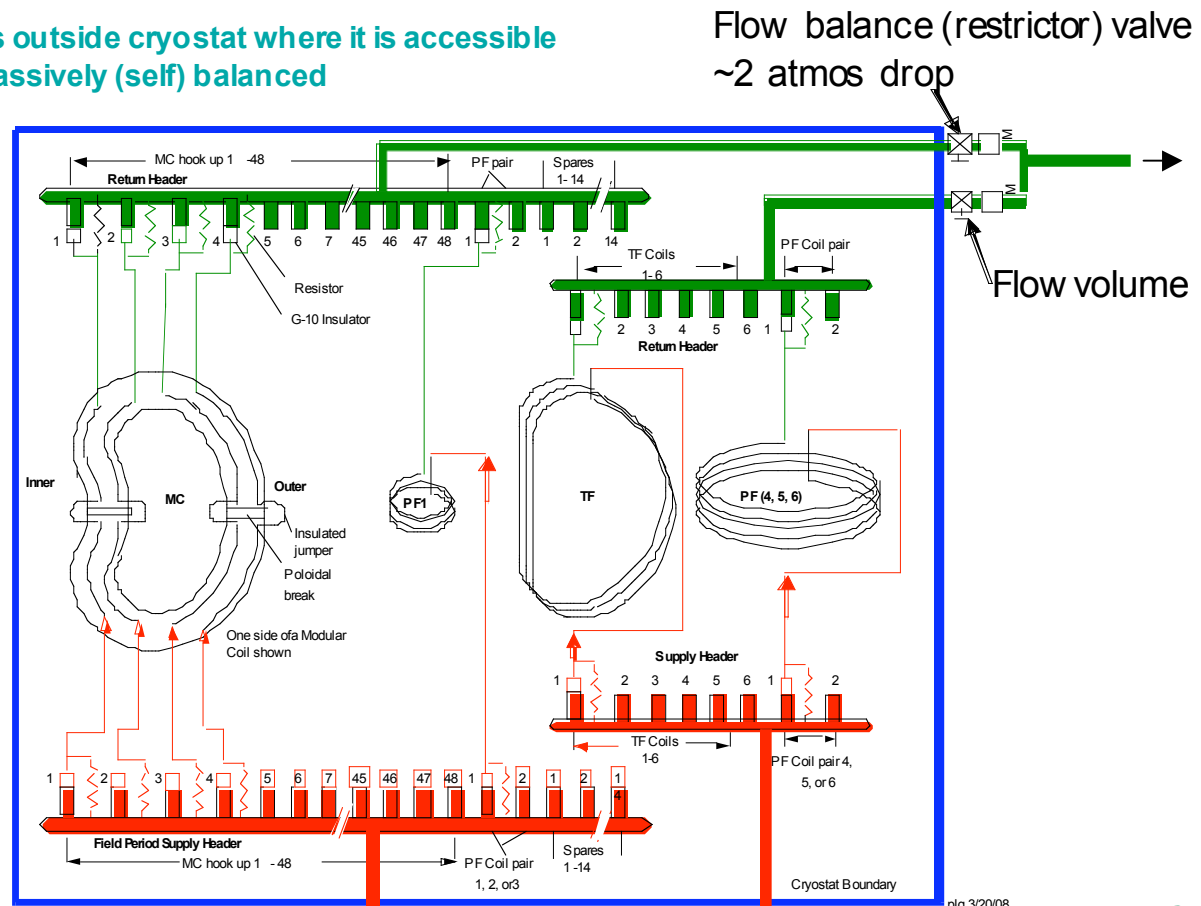


Latest costs reflect design changes in revised Cooling System Diagram shown below



Dual supply and return manifolds

- Individual controls are not required, a single valve in MC return manifold balances both manifolds
- Valve and monitoring is outside cryostat where it is accessible
- Individual circuits are passively (self) balanced



SC Project Review of NCSX, April 8 -10, 2008



Corrugated hose length is total for inlet and outlet.
Inlet/outlet losses ignored.

	passage length(m)	passage dia (cm) di	entrance vel (m/s) vi	Mass flow(g/s)	flow gpm	Re	friction coef f	film coef (w/cm^2-K) h	pressure drop (atmos) Pt
MC nominal hose									
tracing	4	0.46	4.52	60	1.18	109,371	0.017	1.016	1.242
corrugated hose	6	0.635	2.35	60	1.18	78,747	0.019		1.174
									2.42
MC shortest hose									
tracing	4	0.46	4.76	63	1.24	114,975	0.017	1.057	1.355
corrugated hose	5	0.635	2.47	63	1.24	82,782	0.019		1.068
									2.42
MC longest hose									
tracing	4	0.46	4.33	57	1.13	104,637	0.018	0.980	1.149
corrugated hose	7	0.635	2.24	57	1.13	75,339	0.019		1.268
									2.42
PF1									
tracing	93	0.90	1.09	56	1.10	51,962	0.021	0.285	1.028
corrugated hose	8	0.635	2.19	5.61E+01		73,578	0.019		1.390
									2.42
PF2									
tracing	93	0.90	1.09	56	1.10	51,962	0.021	0.285	1.028
corrugated hose	8	0.635	2.19	5.61E+01		73,578	0.019		1.390
									2.42
PF3									
tracing	93	0.90	1.09	56	1.10	51,962	0.021	0.285	1.028
corrugated hose	8	0.635	2.19	5.61E+01		73,578	0.019		1.390
									2.42
Spare circuits	ND	ND	ND	26	0.50	ND	ND	ND	2.42
PF1A									
tracing	54	0.90	1.22	63	1.23	58,039	0.020	0.311	0.729
corrugated hose	8	0.635	2.45	6.28E+01	1.23	82,260	0.019		1.690
									2.42
TF									
tracing	108	0.79	2.05	82	1.60	85,755	0.018	0.482	4.21
corrugated hose	6	0.953	1.42	8.17E+01		71,348	0.019		0.293
									4.51
PF4									
tracing	262	0.90	1.35	69	1.36	64,173	0.020	0.337	4.21
corrugated hose	8	0.953	1.20	6.93E+01		60,579	0.020		0.293
									4.51
PF5									
tracing	335	0.90	1.19	61	1.20	56,483	0.020	0.304	4.31
corrugated hose	7	0.953	1.06	6.10E+01		53,320	0.021		0.205
									4.51
PF6									
tracing	240	0.90	1.43	74	1.44	68,070	0.020	0.353	4.26
corrugated hose	6	0.953	1.28	7.35E+01		64,258	0.020		0.244
									4.51

Total flow in device(gpm) = 234
(Upgrade)

Summary

	ID (in)	Length of tracing (ft)	Length of hose (ft)	Minimum flow required (gpm)	Actual flow (gpm)	Pressure drop (atmos)
MC	0.18	12	18	1.04	1.18	2.42
PF1	0.354	304	24	1.1	1.1	2.42
PF2	0.354	304	24	1.1	1.1	2.42
PF3	0.354	304	24	1.1	1.1	2.42
PF1A	0.354	178	24	1.1	1.23	2.42
spares				0.5	0.5	2.42
PF4	0.354	861	21	1.1	1.36	4.51
PF5	0.354	1100	21	1.1	1.2	4.51
PF6	0.354	786	18	1.1	1.44	4.51
TF	0.312	355	18	1.6	1.6	4.21

LN2 Cooling System Summary

Function

- Cool down coils in 15 minutes between shots
- Not to regulate coil temperature

Cooling Requirements

- Single phase liquid flow
- 5 atmospheres minimum pressure (temperature <95 K)

Operation procedure

- Cool down with cryostat below 80K before LN2 is introduced
- Maintain flow before, during, and after shot

System Description

- System is passively balanced
 - flow precision not required ($\pm 25\%$ OK)
 - geometry kept symmetric to encourage flow balance
- Valving/gauging on every hose in cryostat is not practical
 - no room to install
 - no access to adjust
 - no way to monitor
 - remote operation too expensive