

**Magnet temperature Margin**  
**Operating Current Vs. temperature**  
**Hall D Solenoid Magnet**

Reference - JLab\_HALL D  
(Superconducting Magnet Solenoid)

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The Temperature margin is been evaluated as discussed below-

Assumptions-

1. The Current to field data for  $I_c$  is taken as 1.6kA at 4.2K, 4T (Grade B Conductor) and 2.0 kA at 4.2K, 5T (Grade A Conductor)
2. Fermi Tech data fit is used to evaluate the current scaling with respect to magnetic field and temperature.
3. The Temperature margin is evaluated with respect to the generation temperature at respective field and temperature with Iron as in the system configuration HALL D magnet.

The plots are drawn for the following conditions-

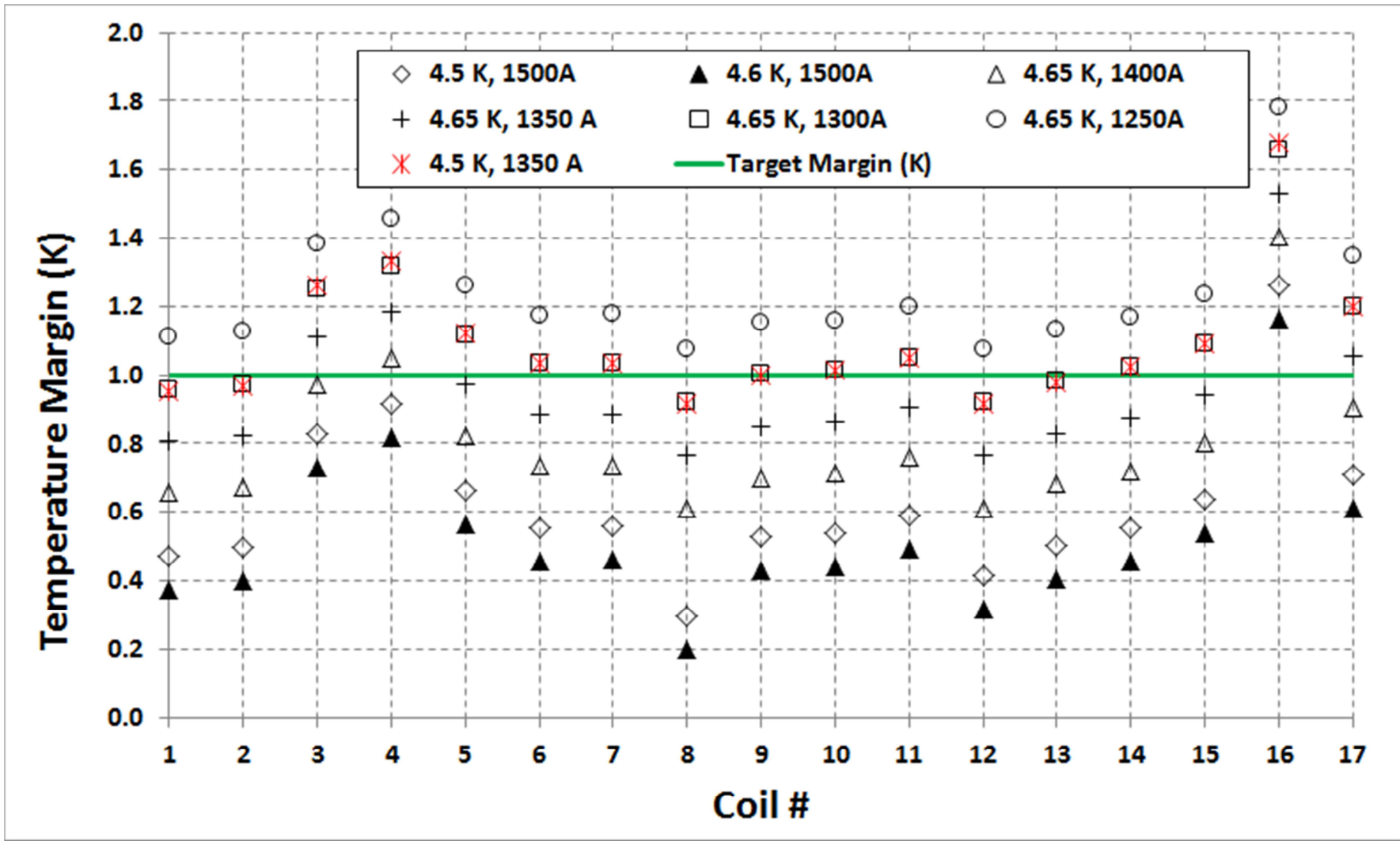
1. Magnet operating current (A)
2. Magnet/Superconductor temperature (K)
3. Field on every conductor at its operating current (T)
4. Temperature Margin of 1K is shown in order to gauge the variation in temperature margin.

Suggestion -

Case 1 - Operating current 1300 A at 4.65 K will provide a good and a reasonable margin to operate

Case 2 - Operating current of 1350 A and 4.5 K will also provide the similar condition as in Case 1.

**Note:** The margin is about 1K in all cases and is reasonable to say based on the measurement or test done here while reaching 1500 A on 1<sup>st</sup> May 2013.



HALL D	HALL D	4.5 K, 1500A				4.6 K, 1500A				4.65 K, 1400A				4.65 K, 1350 A				4.5 K, 1350 A				4.65 K, 1300A				4.65 K, 1250A				
Coil	Coil	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Bmax (T)	lc (at Bmax) (A)	% of SSP	Temp Margin (K)	Target Margin (K)
1A	1	2.97	1723	87.05	0.47	2.97	1677	89.46	0.37	2.72	1714	81.69	0.66	2.63	1736	77.77	0.81	2.63	1806	74.74	0.95	2.53	1760	73.84	0.96	2.43	1785	70.03	1.11	1
1B	2	2.91	1737	86.37	0.50	2.91	1690	88.75	0.40	2.69	1721	81.34	0.67	2.6	1743	77.44	0.82	2.6	1814	74.44	0.97	2.5	1768	73.54	0.97	2.4	1792	69.74	1.13	1
1c	3	2.25	1900	78.95	0.83	2.25	1852	80.97	0.73	2.08	1871	74.83	0.97	2	1891	71.40	1.11	2	1962	68.80	1.26	1.93	1908	68.14	1.25	1.86	1925	64.93	1.38	1
1D	4	2.07	1944	77.16	0.92	2.07	1896	79.09	0.82	1.92	1910	73.29	1.05	1.85	1928	70.04	1.18	1.85	2000	67.52	1.33	1.78	1945	66.85	1.32	1.71	1962	63.71	1.46	1
1E	5	2.58	1818	82.53	0.66	2.58	1771	84.71	0.56	2.38	1797	77.89	0.82	2.29	1819	74.20	0.97	2.29	1890	71.41	1.12	2.21	1839	70.69	1.11	2.12	1861	67.16	1.26	1
1F	6	2.80	1764	85.05	0.55	2.80	1717	87.36	0.46	2.564	1752	79.90	0.73	2.47	1775	76.05	0.88	2.47	1846	73.14	1.03	2.38	1797	72.33	1.03	2.3	1817	68.80	1.17	1
1G	7	2.79	1767	84.89	0.56	2.79	1720	87.19	0.46	2.56	1753	79.86	0.74	2.47	1775	76.05	0.88	2.47	1846	73.14	1.03	2.378	1798	72.31	1.03	2.29	1819	68.70	1.18	1
2A	8	3.30	1641	91.44	0.30	3.30	1595	94.07	0.20	2.81	1692	82.76	0.61	2.71	1716	78.66	0.77	2.71	1786	75.57	0.91	2.61	1741	74.68	0.92	2.51	1765	70.81	1.07	1
2B	9	2.85	1753	85.59	0.53	2.85	1706	87.92	0.43	2.63	1736	80.65	0.70	2.54	1758	76.79	0.85	2.54	1829	73.83	1.00	2.44	1783	72.93	1.00	2.35	1805	69.26	1.15	1
2C	10	2.83	1756	85.41	0.54	2.83	1710	87.74	0.44	2.6	1743	80.31	0.72	2.51	1765	76.47	0.86	2.51	1836	73.53	1.01	2.42	1787	72.73	1.01	2.33	1810	69.08	1.16	1
2D	11	2.73	1781	84.21	0.59	2.73	1735	86.48	0.49	2.51	1765	79.30	0.76	2.43	1785	75.63	0.90	2.43	1856	72.75	1.05	2.34	1807	71.94	1.05	2.25	1829	68.33	1.20	1
3A	12	3.07	1696	88.42	0.41	3.07	1650	90.90	0.32	2.81	1692	82.76	0.61	2.71	1716	78.66	0.77	2.71	1786	75.57	0.91	2.61	1741	74.68	0.92	2.51	1765	70.81	1.07	1
3B	13	2.90	1739	86.25	0.50	2.90	1693	88.62	0.40	2.67	1726	81.11	0.68	2.58	1748	77.22	0.83	2.58	1819	74.23	0.98	2.48	1773	73.33	0.98	2.39	1795	69.64	1.13	1
3C	14	2.80	1764	85.04	0.55	2.80	1717	87.35	0.46	2.59	1746	80.20	0.72	2.49	1770	76.26	0.87	2.49	1841	73.33	1.02	2.4	1792	72.53	1.02	2.31	1815	68.89	1.17	1
3D	15	2.63	1806	83.08	0.64	2.63	1759	85.29	0.54	2.43	1785	78.43	0.80	2.35	1805	74.81	0.94	2.35	1876	71.98	1.09	2.26	1827	71.16	1.09	2.17	1849	67.61	1.24	1
4A	16	3.46	2377	63.11	1.26	3.46	2309	64.96	1.16	3.15	2388	58.64	1.41	3.04	2428	55.61	1.53	3.04	2531	53.34	1.68	2.92	2471	52.60	1.66	2.81	2512	49.77	1.78	1
4B	17	4.53	1981	75.71	0.71	4.53	1916	78.30	0.61	4.16	2019	69.33	0.90	4.01	2074	65.09	1.05	4.01	2174	62.10	1.20	3.86	2129	61.07	1.20	3.71	2183	57.25	1.35	1



Cals sheet