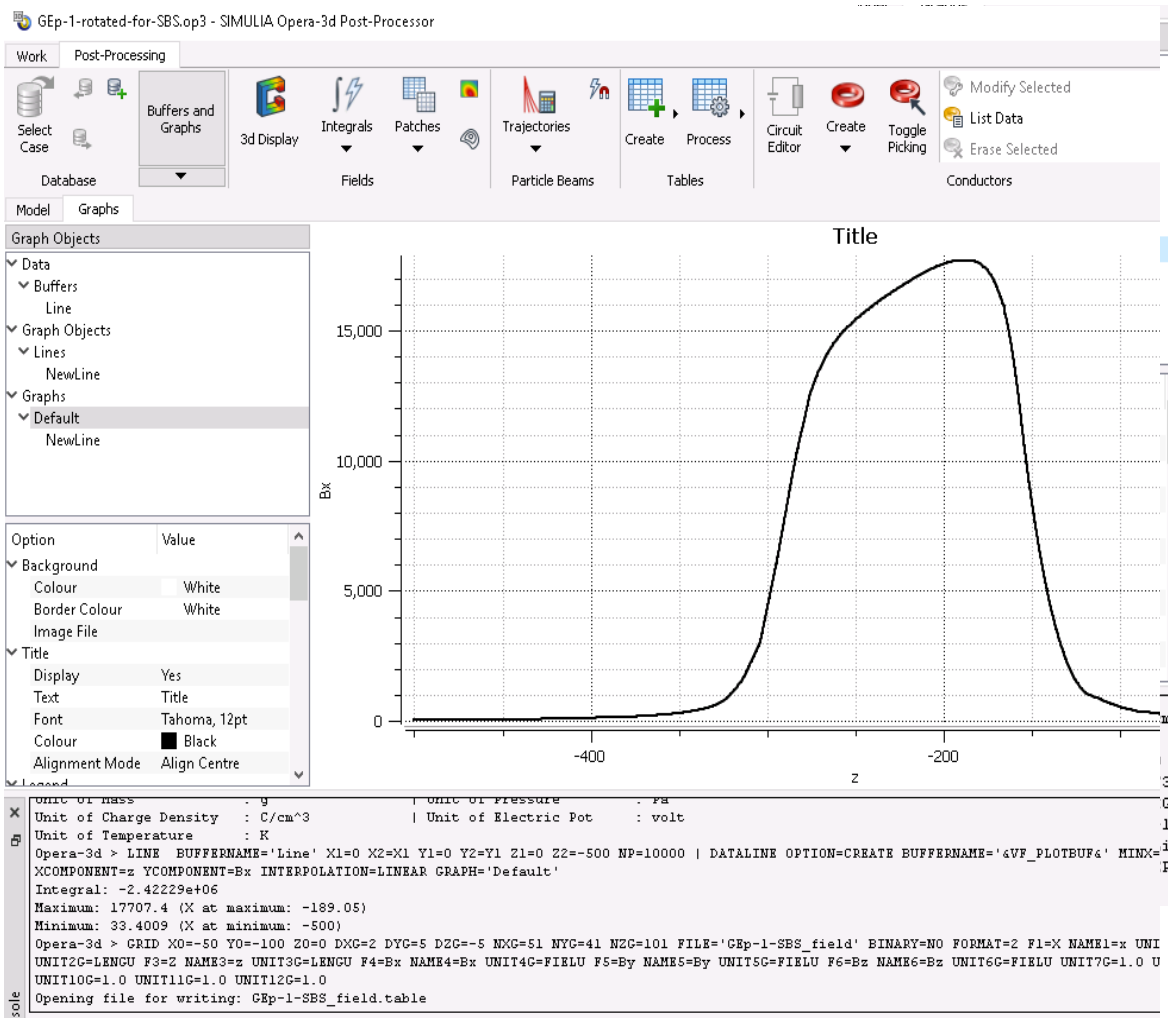
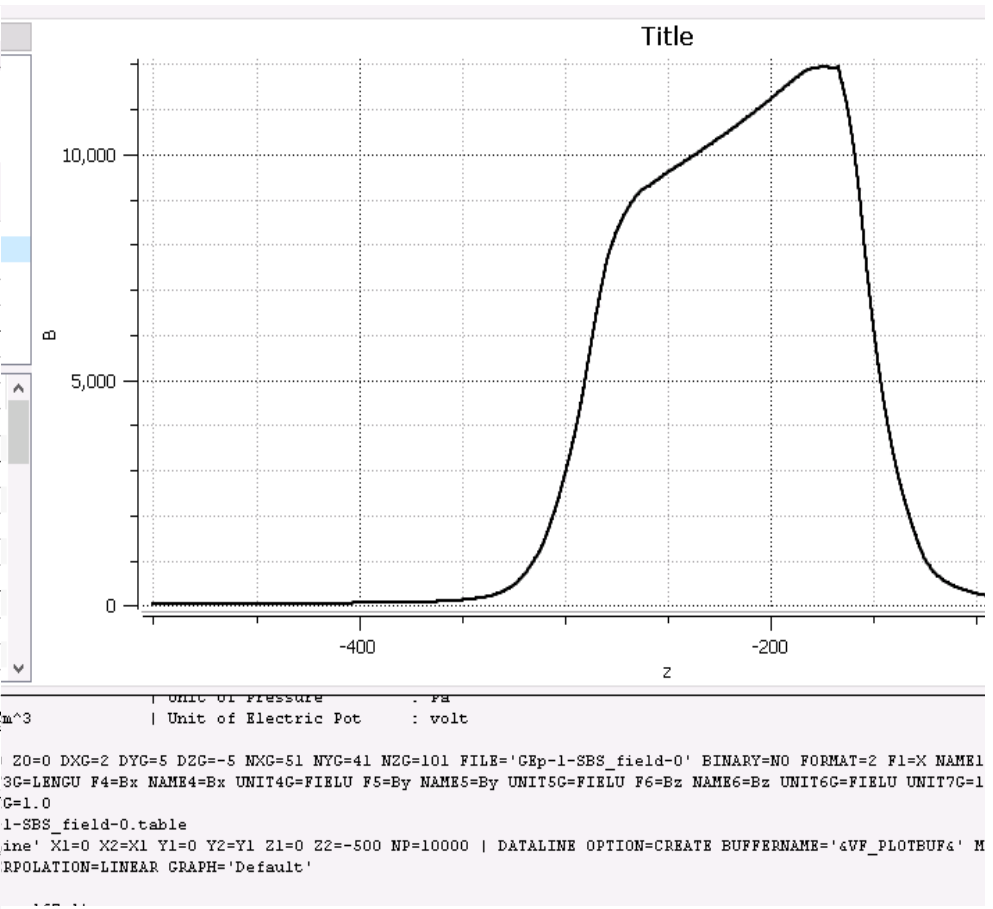
Significant non-linearity of Bdl



100% current, 2100 Amp, Bdl = 2.42 T-m



50% current, 1050 Amp, Bdl = 1.58 T-m

I just wanted to follow up quickly on this subject. Assuming the calculations are accurate, and that these large apparent saturation effects are real, then we need to develop the table of production current/field settings, and we'll also need separate calculated maps for each current setting. (I suppose this might affect corrector settings too). If the field and/or the field integral aren't linearly proportional to the current, then we obviously can't simply use a scaled version of the GEP-3 field map to generate optics and spin transport models (well, we can, but we shouldn't expect high accuracy of the results).

The field setting that maximizes the coincidence ep acceptance/event rate is basically that which makes the field integral proportional to the proton momentum.

Our existing field map that we've been using to simulate for the last decade-plus is based on the maximum current setting for GEP3 (highest-Q^2). That field map gives about a 2.4 T*m BdL, consistent with your latest calculation.

The table below specifies the needed BdL values, with a very rough cubic spline interpolation of the table of BdL values versus power supply currents that you showed on Tuesday.

If you could confirm these values with your calculation machinery, then I think we can specify the rough working points needed for production (and generate the necessary field maps). If these calculations are correct, then of course we don't need to run at or near the 70% current setting that seemed uniquely problematic during GMN/GEN-RP.

Best,
Andrew

	Pp	BdL	BdL/maximum	Current (A, cubic spline)	Current (% of maximum)
0	2.845	0.94391281	0.390046614	629.76	29.99
1	3.881	1.28763641	0.532081163	870.65	41.46
2	5.185	1.72027694	0.71085824	1126.76	53.66
3	7.294	2.42	1	2100	100

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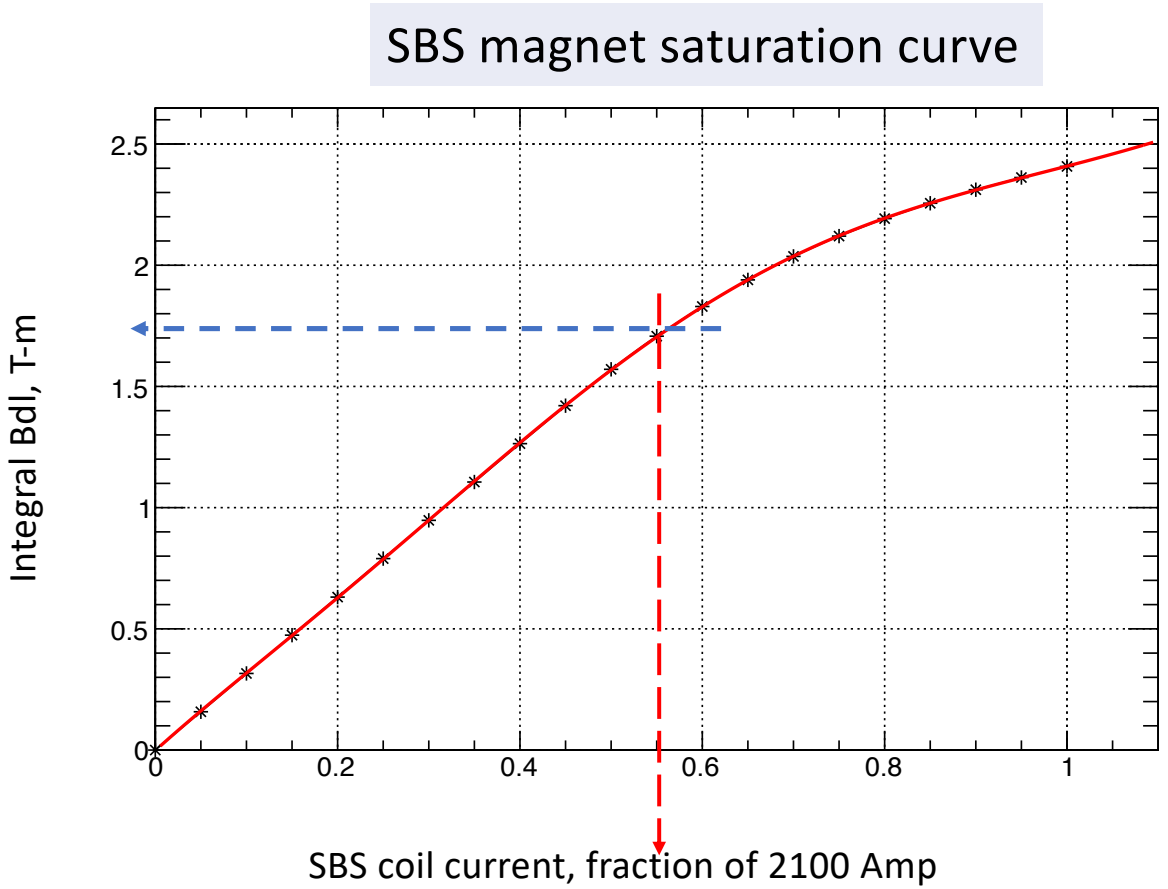
Name	Energy	Program	ECAL	ECAL	SBS	SBS	HCAL	HCAL	P_nucleon	P_elect.	PAC days	Time, days	SBS current	J_in/J_out
		Q2, GeV2	angle	dist., m	angle	dist., m	angle	distance	GeV/c	GeV/c	at full Lum.	calendar	% 2100 amp	
GEP-0	6.40	GEp Comm.	29.8	9.5	25.7	1.60	25.7	10	3.86	3.36	0	2	100%	
GEP-1	6.40	GEp 5.5	29.8	9.5	25.7	1.60	25.7	10	3.86	3.36	2	4	100%	0.79/0.87
GEP-2	8.50	GEp 7.8	27.5	6.5	22.1	1.60	22.1	10	5.15	4.20	11	22	100%	0.76/0.82
GEP-3	10.60	GEp 11.7	30.0	4.5	16.9	1.60	16.9	10	7.26	4.22	32	62	100%	0.56/0.58

%	Current	drive	Itegral Bdl, T-m
100	2100	1.040	2.4076
95	1995	0.988	2.3618
90	1890	0.936	2.3115
85	1785	0.884	2.2556
80	1680	0.832	2.1923
75	1575	0.780	2.1201
70	1470	0.728	2.0364
65	1365	0.676	1.9395
60	1260	0.624	1.8297
55	1155	0.572	1.7073
50	1050	0.520	1.5706
45	945	0.468	1.4206
40	840	0.416	1.2640
35	735	0.364	1.1057
30	630	0.312	0.9476
25	525	0.260	0.7898
20	420	0.208	0.6310
15	315	0.156	0.4740
10	210	0.104	0.3160
5	105	0.052	0.1580



Fine grid for 100% current => Bdl 2.43 T-m