Bob Weggel Particle Beam Lasers, Inc. March 9, 2015

Magnet "15to2T120cm": Winding-pack X-sections, field profile & parameters

Figure 1 shows the coil cross sections and field magnitude, direction & streamlines of a magnet with solenoids of 120-cm I.R. to z = 10 meters; Fig. 2 plots the on-axis field profile. Table I lists selected parameters, identical to those of the superconducting coils of magnet "20to2T120cm4pDL". In the table, dimensions are in centimeters, and current densities are in A/mm^2. Downstream of superconducting coil #2 is a huge axial gap of 238 cm that will be very convenient for facilitating assembly and disassembly, which must be robotic, because of activation by radiation during operation.

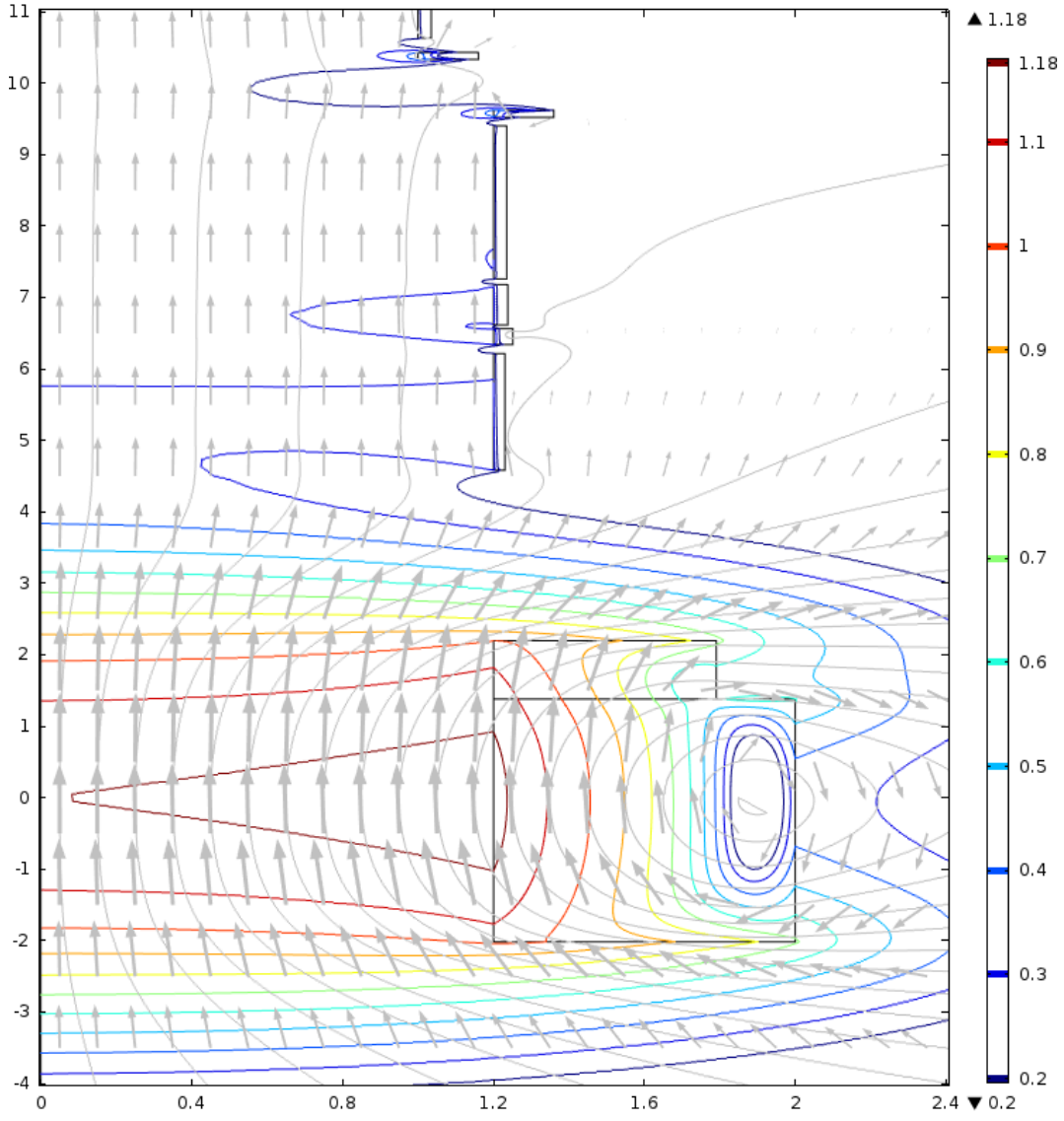

Fig. 1: Target Magnet "15to2T5m120cm," whose on-axis field B(z) tapers from 15 T at z = 0 to 2 T at z ≈ 5 m: winding-pack cross sections, field direction (arrows), streamlines (grey), & field magnitude $\log_{10}|B|$ (contours). Consecutive contours, in teslas, are [$10^{0.2}$ = 1.6 (navy), 2, 2.5, 3.2, 4, 5, 6.3, 8, 10, 12.6, 15 (maroon)].

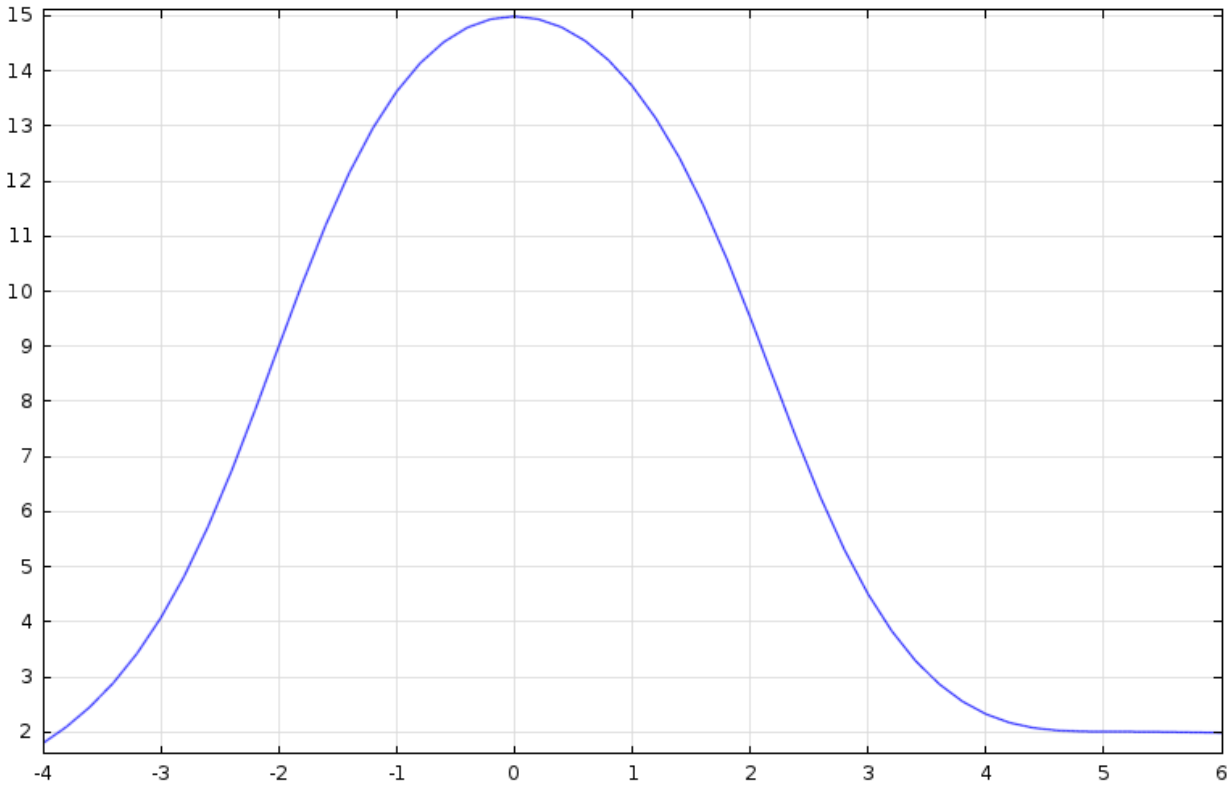

Fig. 2. On-axis field profile of Target Magnet "15to2T5m120cm". B ≈ 2 T at z = 4.6 m; B ≈ 2.4 T at z = 4 m.

Table I: Parameters of Target Magnet "20to2T5m120cm"

Cur. density	1.910	2.110	4.358	4.325	4.364	4.333	4.288	4.288	4.288	4.288
Inner radius	120.0	120.0	120.0	120.0	120.0	120.0	120.0	100.0	100.0	100.0
Radial depth	78.00	59.07	3.01	5.10	3.76	3.50	15.98	15.98	3.50	15.98
Outer radius	200.0	179.1	123.0	125.1	123.8	123.5	136.0	116.0	103.5	116.0
Upstr. end	-201.7	137.8	458.1	634.0	661.5	725.8	952.0	1033	1063	1455
Coil length	339.5	82.0	163.3	22.2	56.6	214.4	15.0	15.0	377.0	15.0
Down. end	137.8	219.8	621.4	656.3	717.9	940.2	967.0	1048	1440	1470
Axial gap	0.0	238.3	12.6	5.2	7.9	11.8	66.0	15.0	15.0	60.0

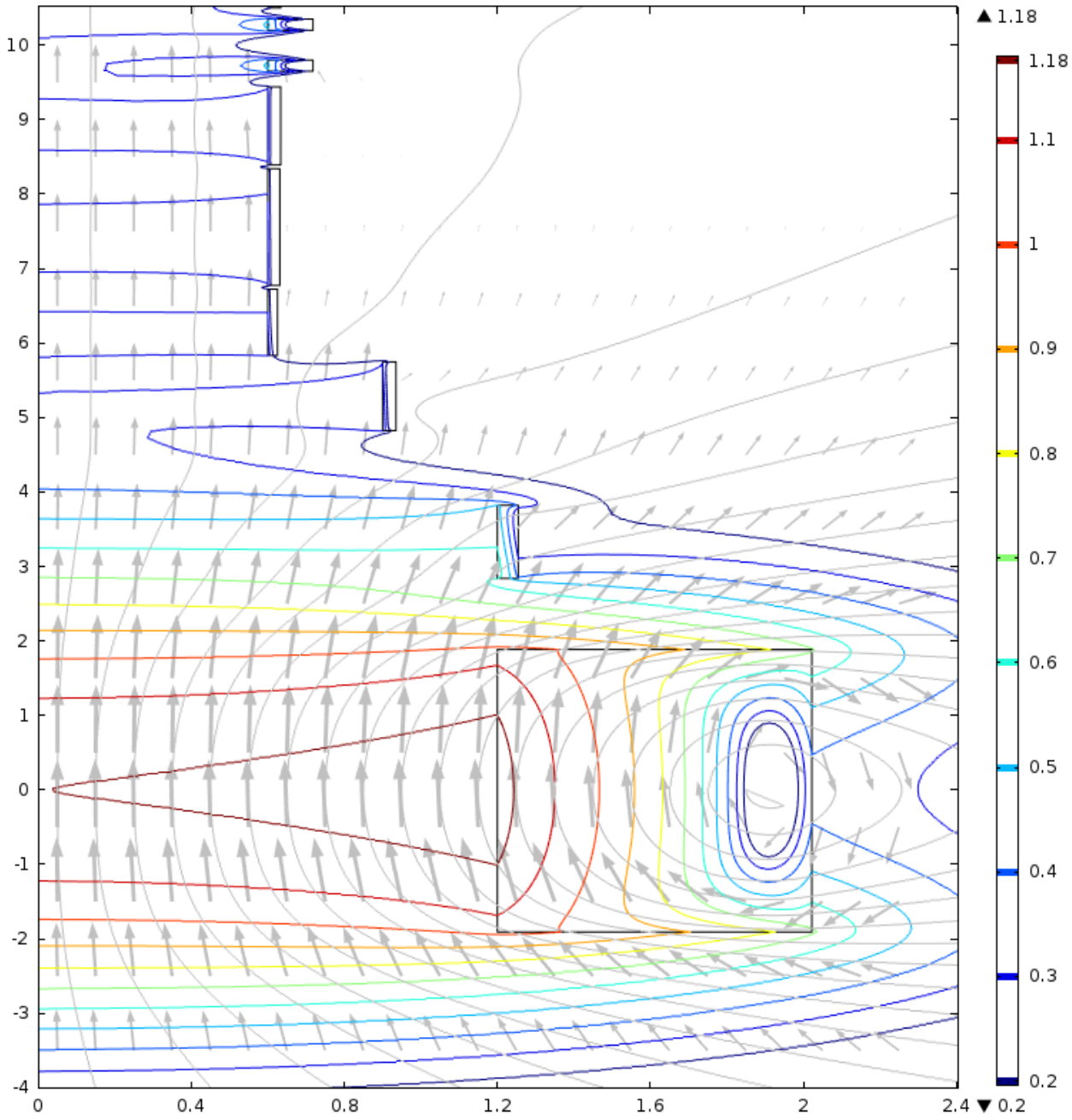

Fig. 3: Target Magnet "15to2T5m'2+5," whose on-axis field B(z) tapers from 15 T at z = 0 to 2 T at z ≈ 5 m: winding-pack cross sections, field direction (arrows), streamlines (grey), & field magnitude $\log_{10}|B|$ (contours): [$10^{0.2} = 1.6$ (navy), 2, 2.5, 3.2, 4, 5, 6.3, 8, 10, 12.6, 15 (maroon)]. Dimensions are identical to those of SC coils of magnet "20to2T5m'2+5".

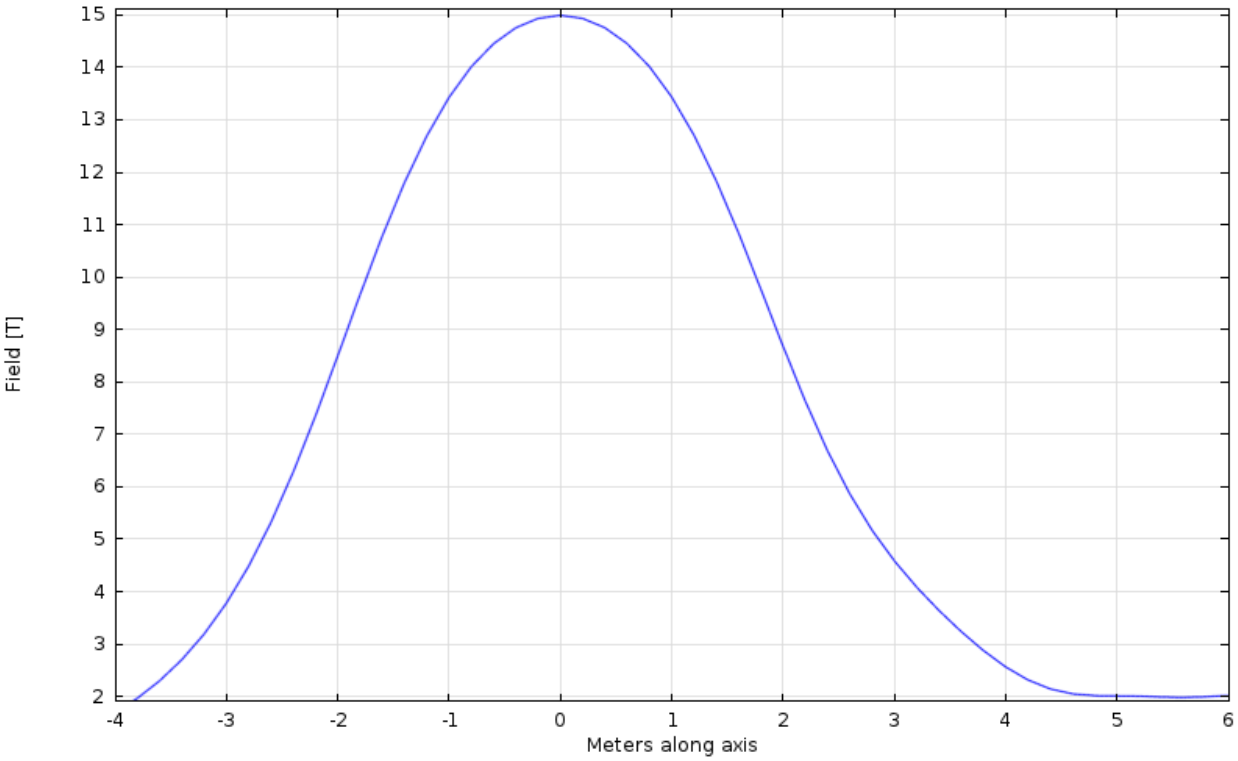

Fig. 4. On-axis field profile of Target Magnet “15to2T5m’2+5”. B ≈ 2 T at z = 4.7 m; B ≈ 2.6 T at z = 4 m.

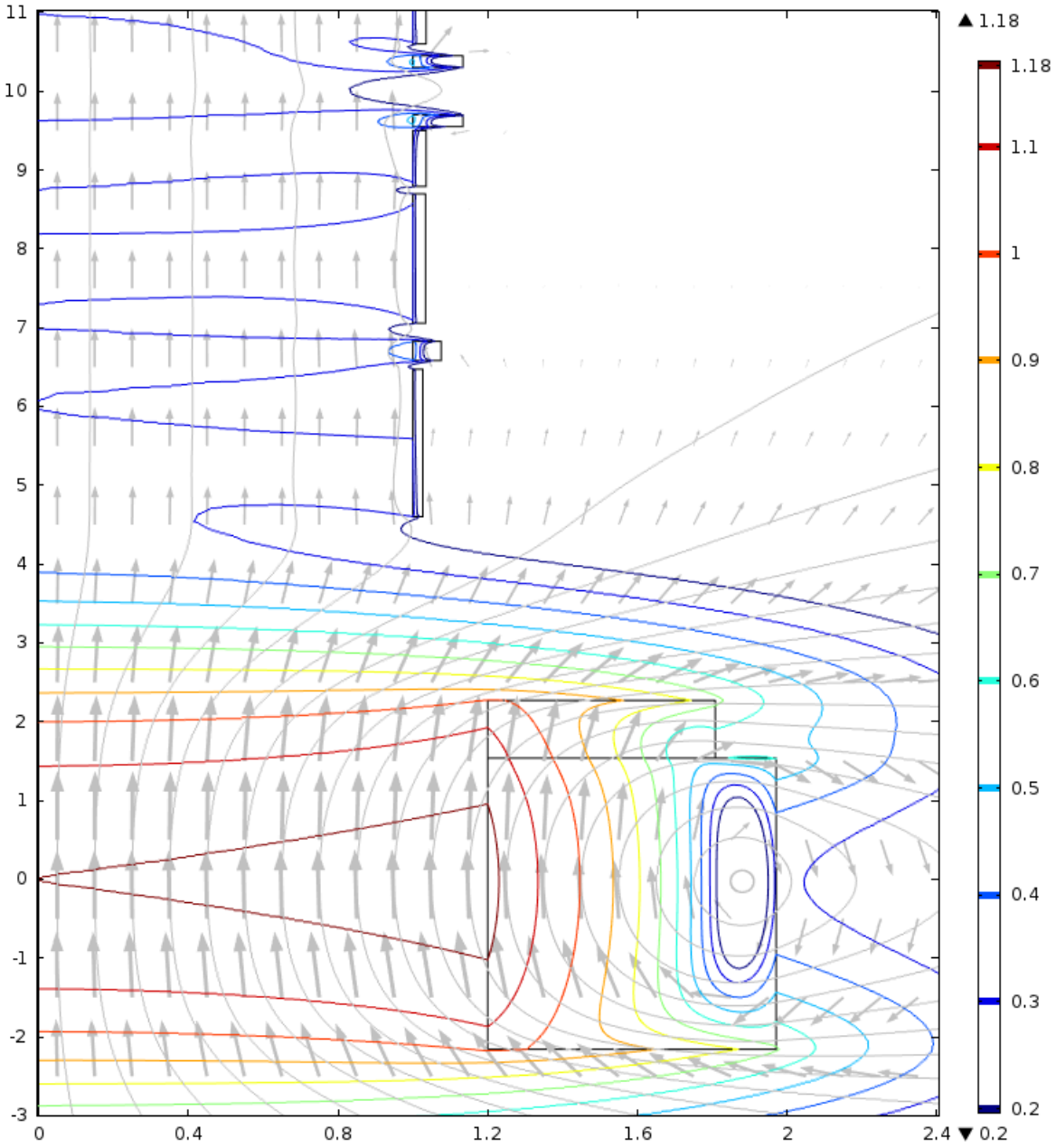

Fig. 5: Target Magnet "15to2T5m100cm," whose on-axis field B(z) tapers from 15 T at z = 0 to 2 T at z ≈ 5 m: winding-pack cross sections, field direction (arrows), streamlines (grey), & field magnitude $\log_{10}|B|$ (contours): [$10^{0.2} = 1.6$ (navy), 2, 2.5, 3.2, 4, 5, 6.3, 8, 10, 12.6, 15 (maroon)].