SuperDAFNE Dipoles first evaluation

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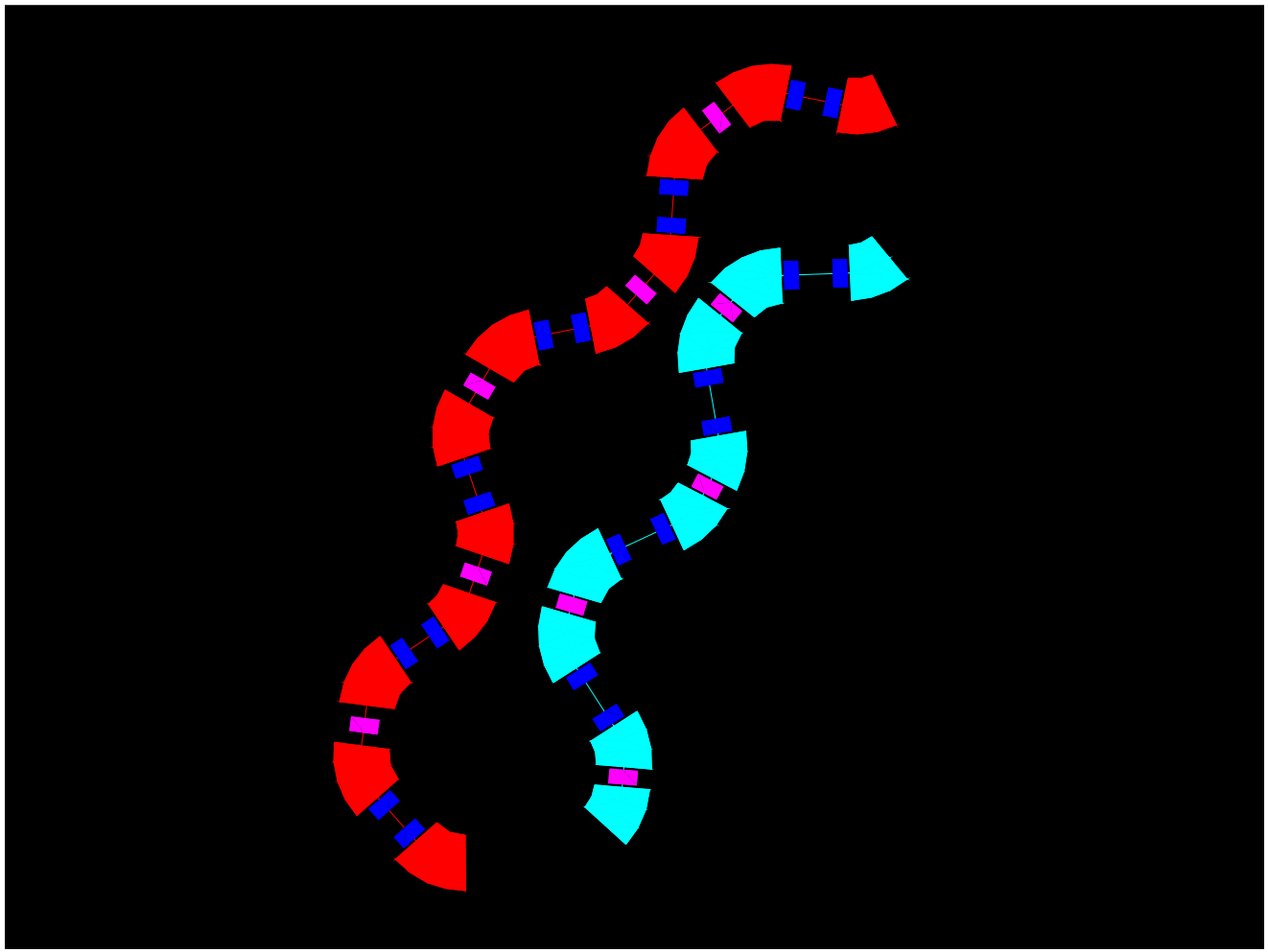
INFN-LNF

Sector of SuperDAFNE rings



Dipoles for SuperDAFNE

- Nominal Energy: 510 MeV
- B= 1.8 T
- Bρ=1.7 T*m ρ= 0.944 m
- Entrance and output angle= α/4

Type	A	B	C
Quantity	22	22	4
α [deg]	-37.5	48.9	30
Mag Lenght [m]	0.618	0.805	0.494

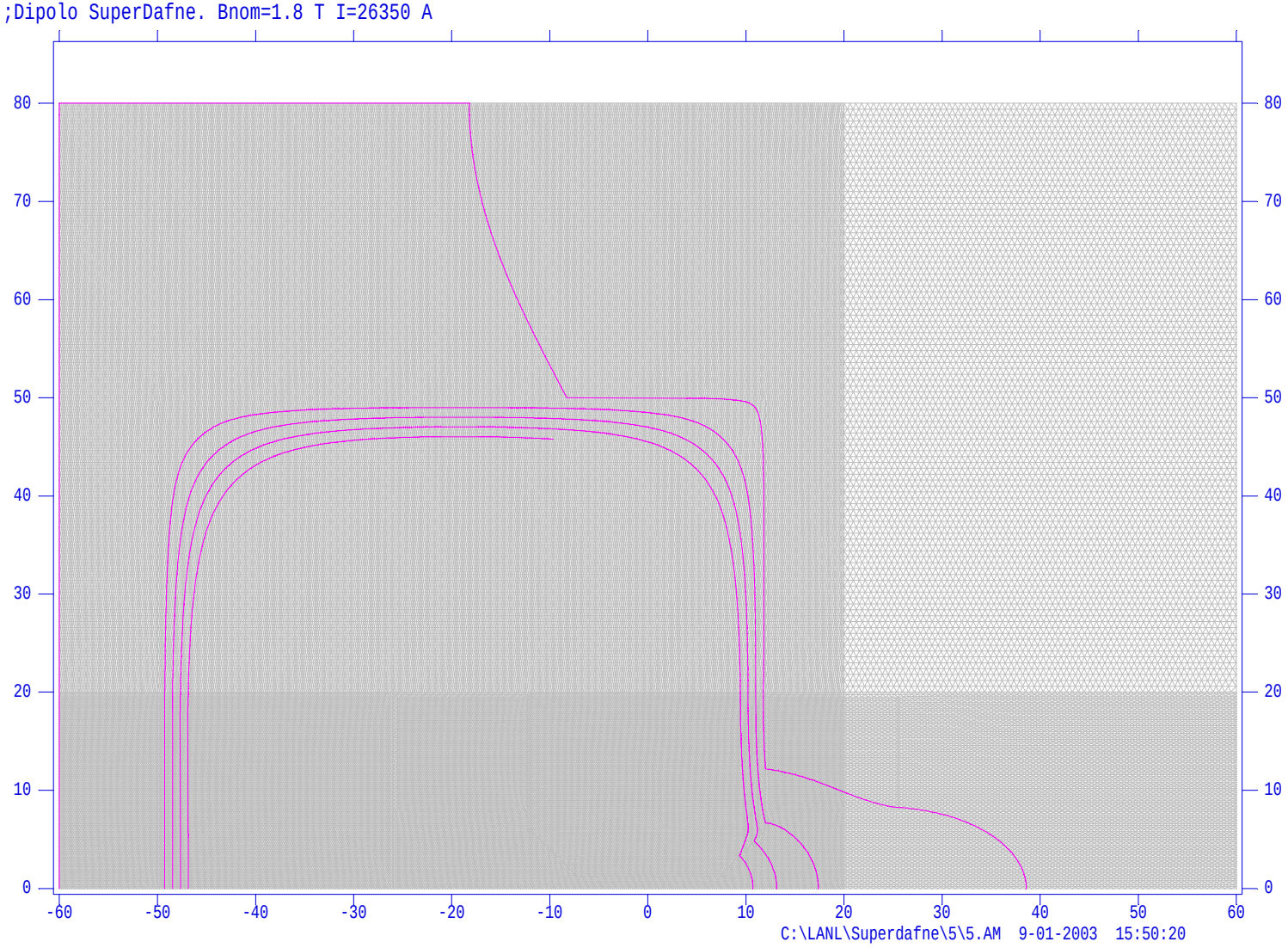
Magnetic requirements

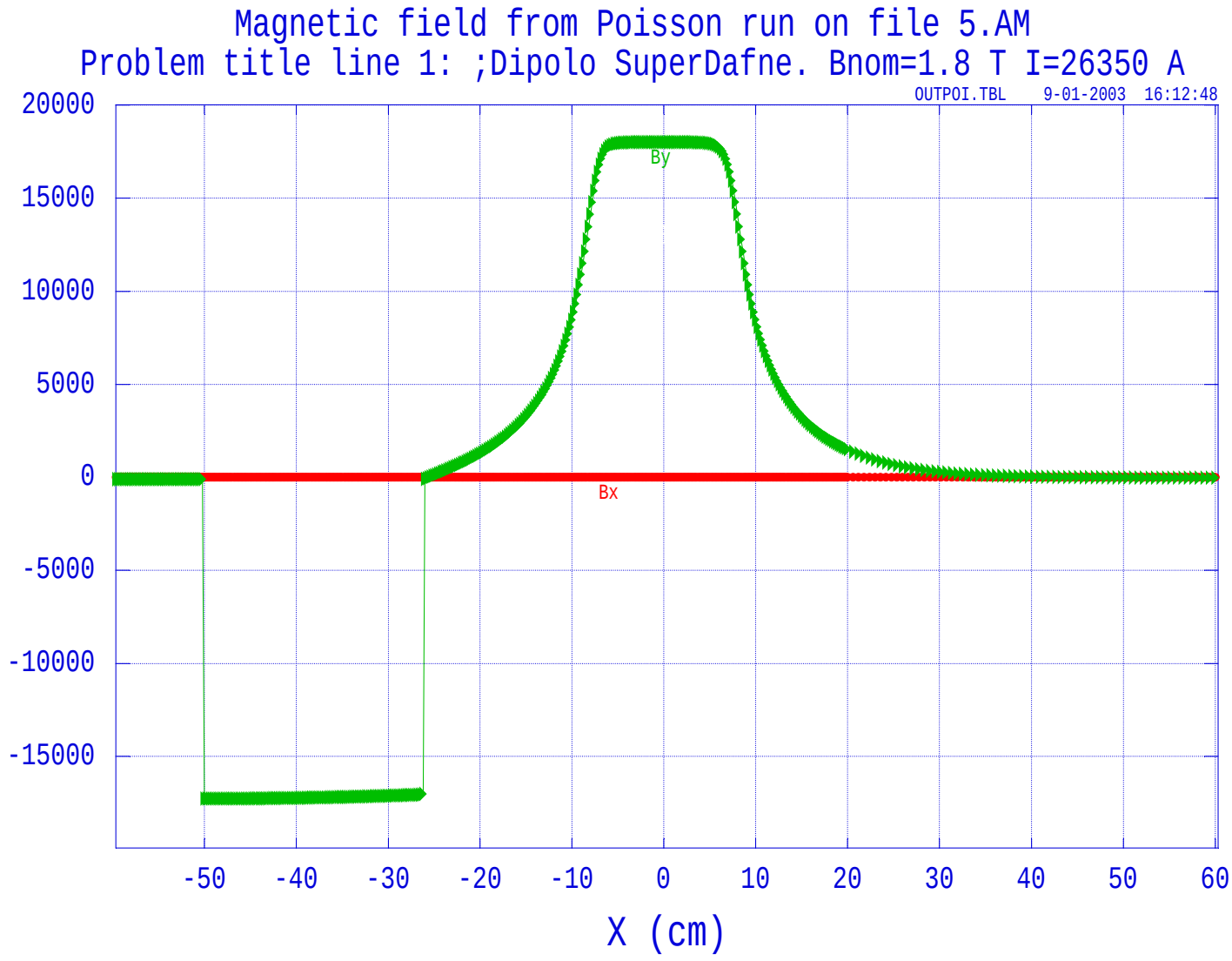
- Nominal Field 1.8 T
- Gap 30 mm
- Good field region ± 25 mm
- Low fringing field

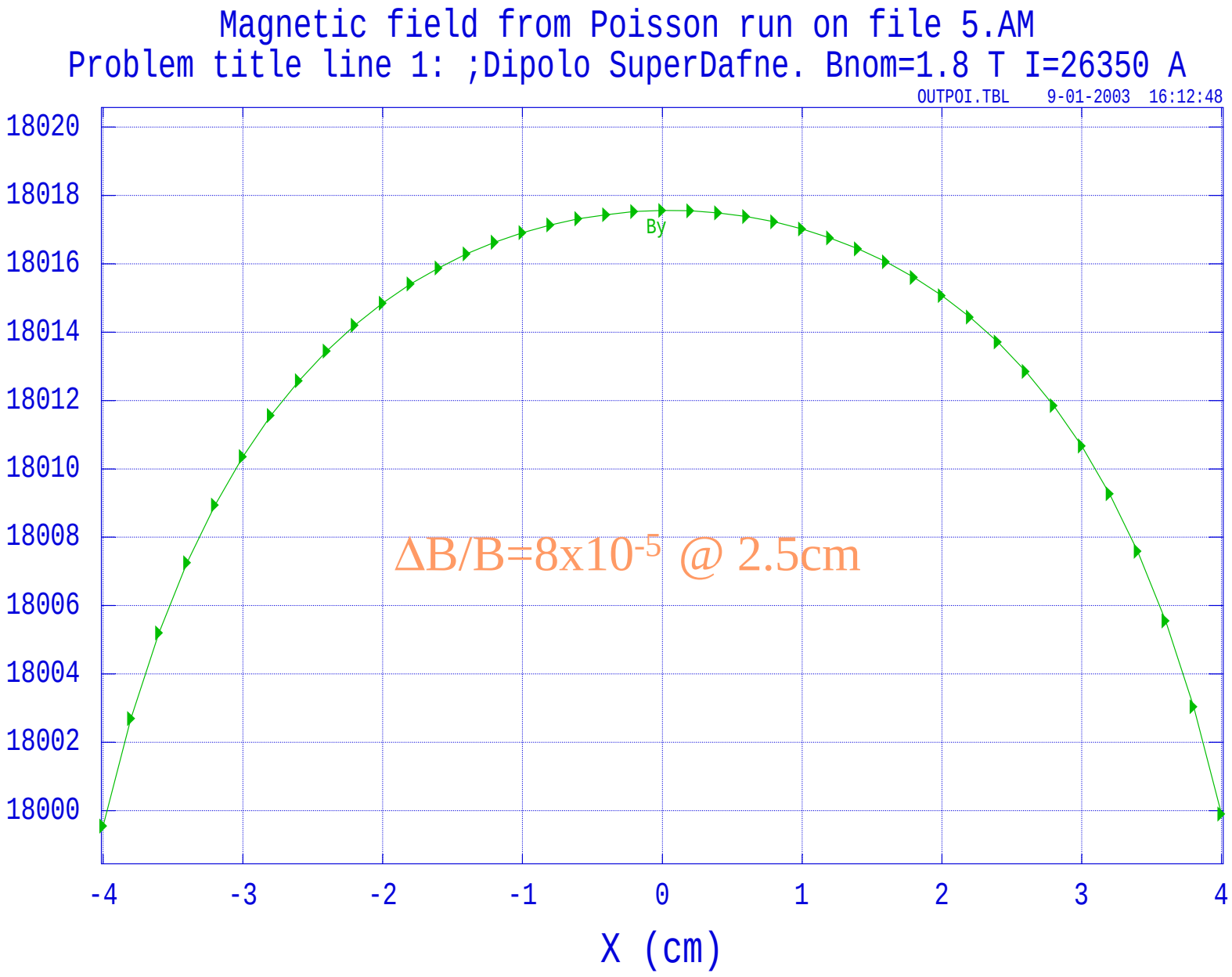
Bidimensional Analysis

- Poisson Superfish 2D FEM code
- Pole profile optimization not yet developed
- 3D analysis to do

Poisson FEM simulation



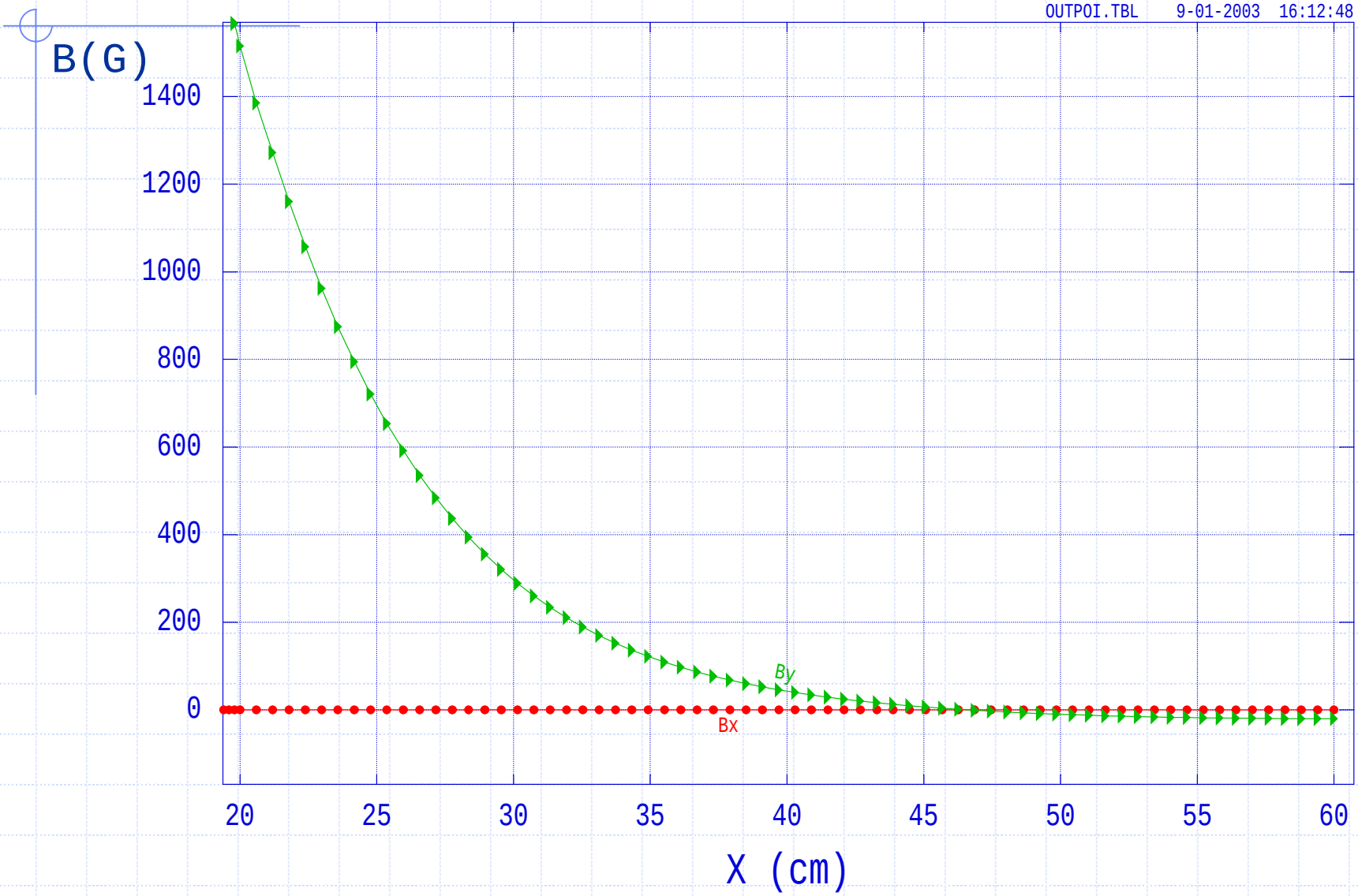

Magnetic field from Poisson run on file 5.AM
Problem title line 1: ;Dipolo SuperDafne. Bnom=1.8 T I=26350 A
OUTPOI.TBL 9-01-2003 16:12:48
By
Bx
20000
15000
10000
5000
0
-5000
-10000
-15000
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
X (cm)


Magnetic field from Poisson run on file 5.AM
Problem title line 1: ;Dipolo SuperDafne. Bnom=1.8 T I=26350 A
OUTPOI.TBL 9-01-2003 16:12:48
18020
18018
18016
18014
18012
18010
18008
18006
18004
18002
18000
By
ΔB/B=8x10-5 @ 2.5cm
-4
-3
-2
-1
0
1
2
3
4
X (cm)

Stray Field

Magnetic field from Poisson run on file 5.AM

Problem title line 1: ;Dipolo SuperDafne. Bnom=1.8 T I=26350 A

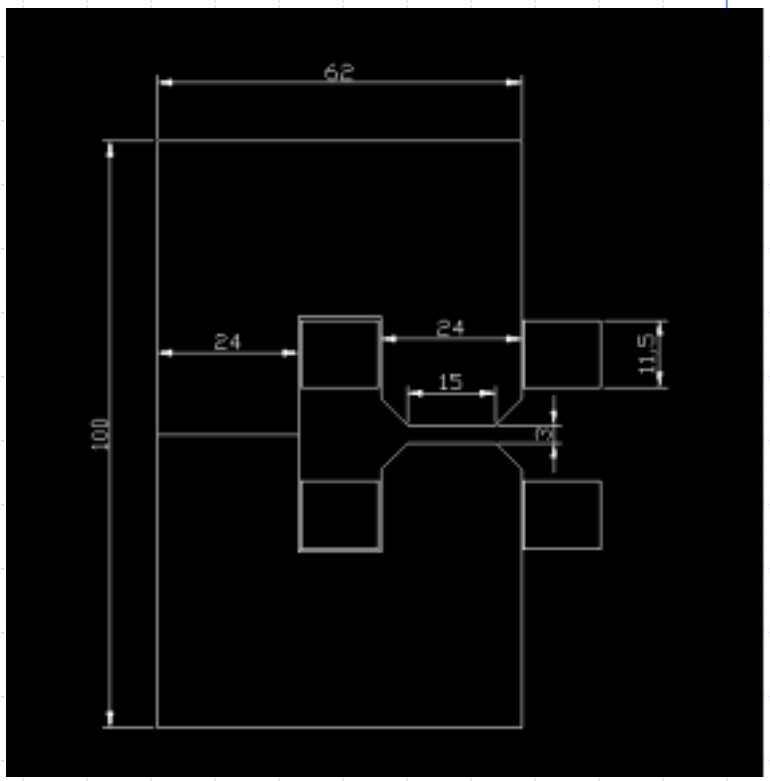


Simulation Results

- Conventional magnet
- Core material: 1010 Steel
- NI=26350 A/turns @ Bn
- J= 3.2 A/mmq using hollow conductors
- Field quality= $\pm 8 \times 10^{-5}$ @ ± 2.5cm before pole profile optimization
- Low Stray Field: <10 G @50 cm

Dipoles parameters

Type	A	B	C
N	22	22	4
Alfa [rad]	0.6545	0.8528	0.5236
Chord [m]	0.607	0.781	0.489
Sagitta [m]	0.050	0.085	0.032
Mag lenght	0.618	0.805	0.494
Vol Fe [mc]	0.282	0.362	0.227
Vol Cu [mc]	0.041	0.047	0.037
Weight Fe [kg]	2222	2859	1789
Weight Cu [kg]	359	410	324
Total Weight [kg]	2581	3269	2113
Power [W]	7234	8260	6537



NI[A]	26350
J[A/mmq]	3.2
Total power [kW]	370

Cost evaluated: 1600 k€