17TH ADVANCED BEAM DYNAMICS WORKSHOP ON
FUTURE LIGHT SOURCES

New IDs for Circularly Polarized Radiation

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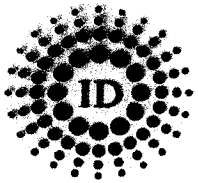
ARGONNE NATIONAL LABORATORY, ARGONNE, IL U.S.A.

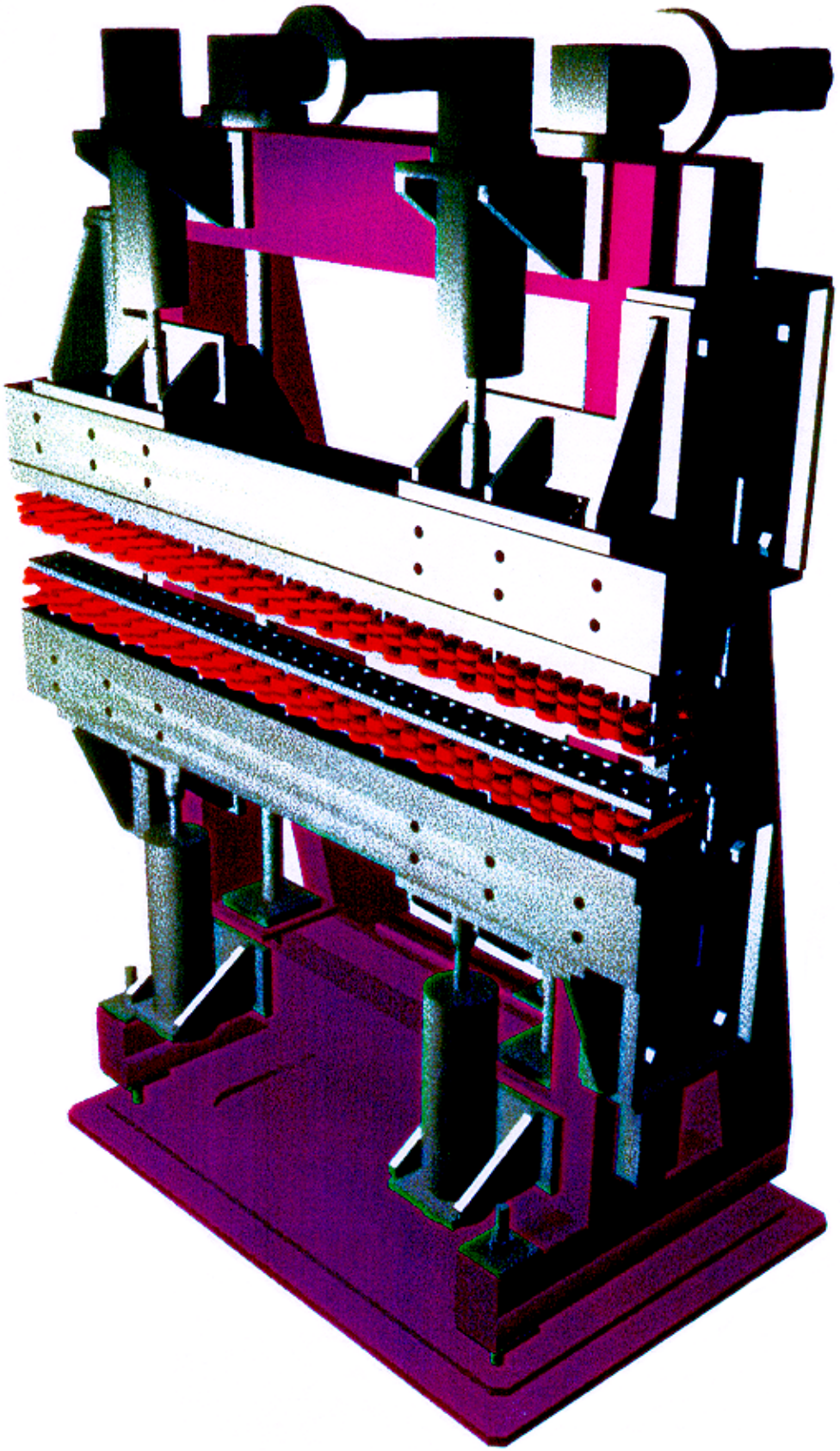


ESRF IDs in short

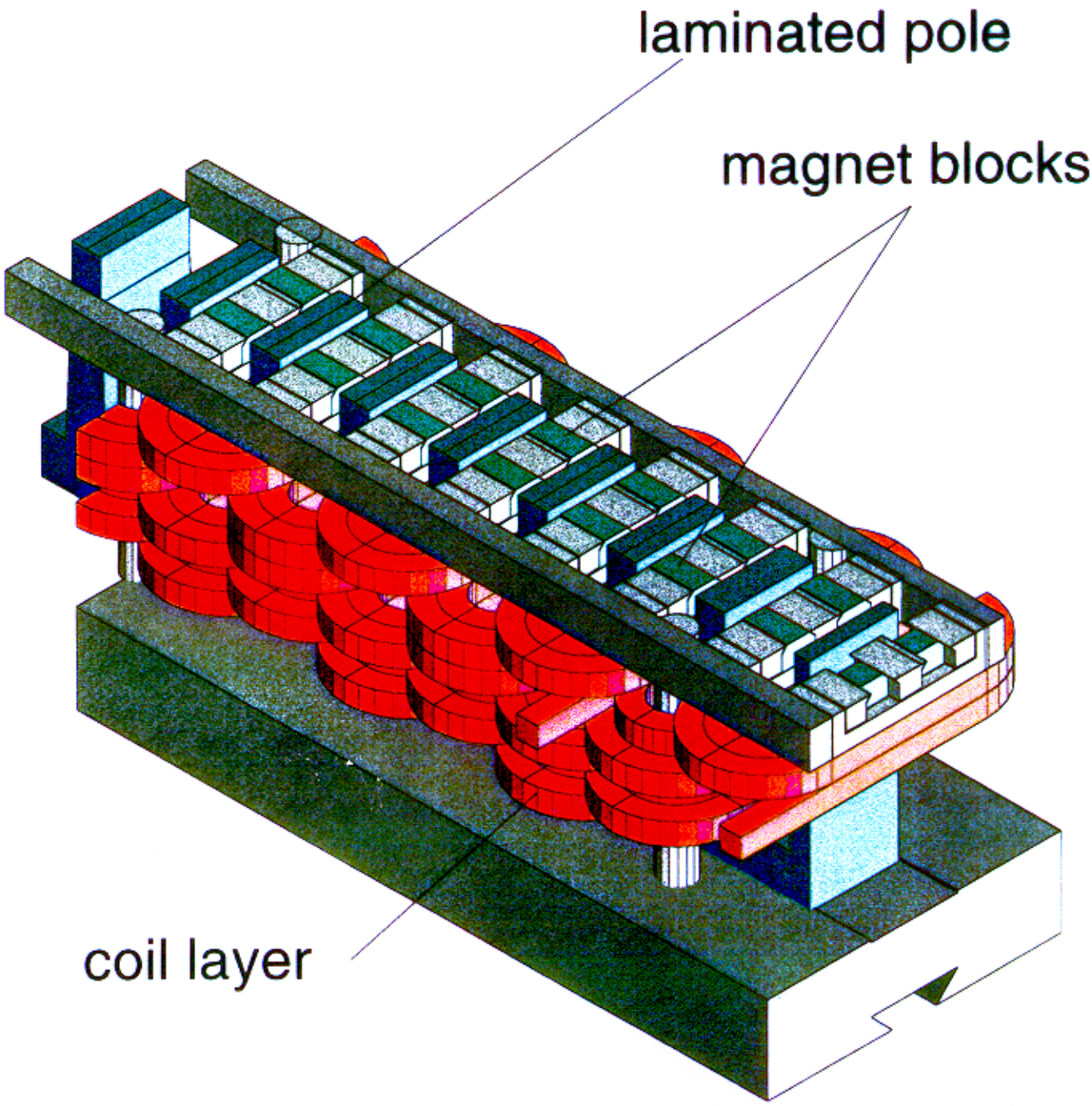
- Use segmented approach (3 segments / Straight)
  - Flexibility of combining different Ids (Und., Wiggler, Helical Und.)
  - Phase the undulator segments when needed
- 57 segments in Operation (85 m)
- > 30 different magnetic designs
- 4 Und. & 3 Wigglers generating Circularly Polarized Radiation
- Large use of Multipole and Phase Shimming (Mechanical & Magnetic).
- All Undulators are freely operated by the users (Gap scan…)

IDs for Circular Polarization

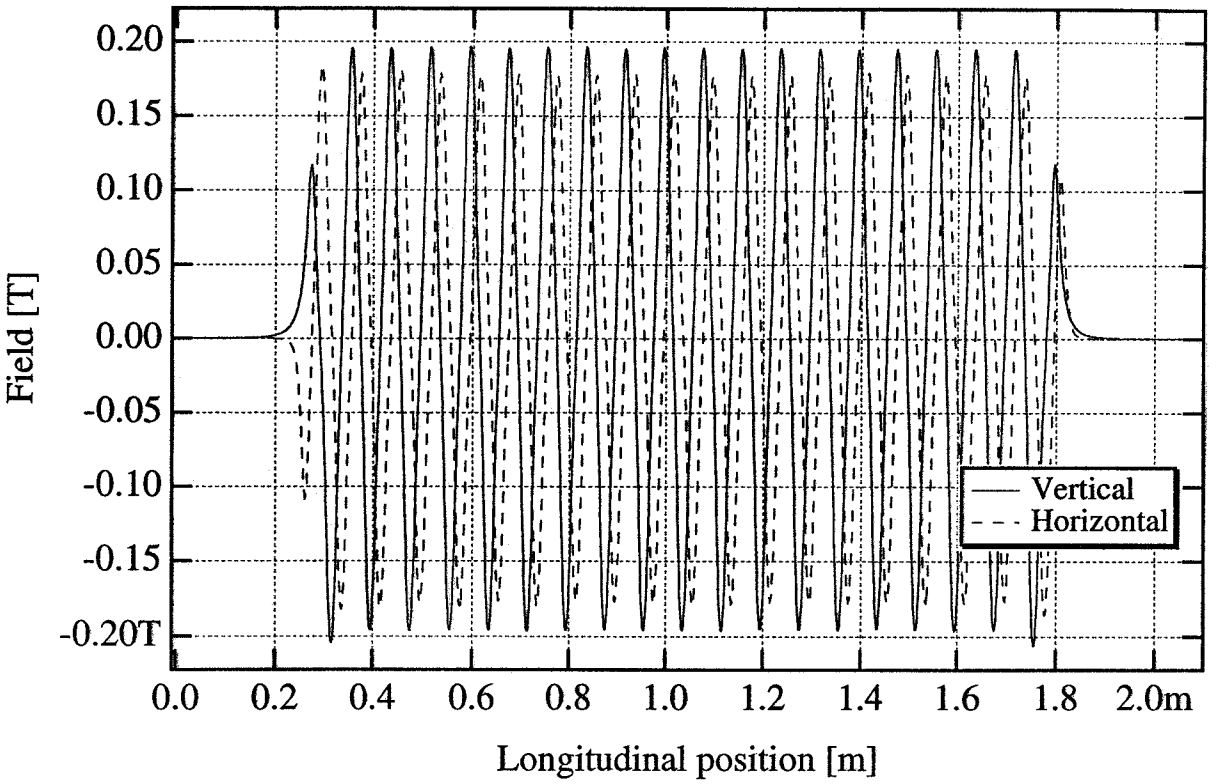
- In Operation since 92-93
  - Three Helios Type Helical/Linear Undulators
  - Three asymmetric wigglers
- New Devices built in 98
  - A Fast Switching Helical Undulator (Permanent Magnet and Electro-magnet).
  - A 3T permanent magnet asymmetric wiggler

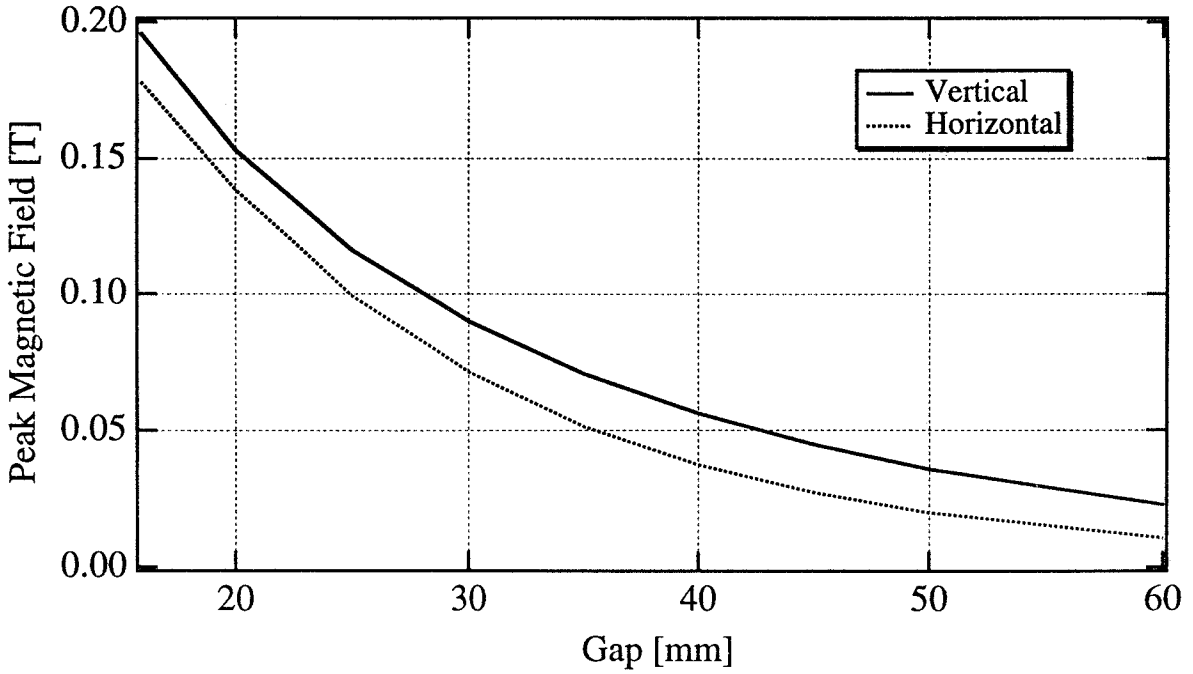


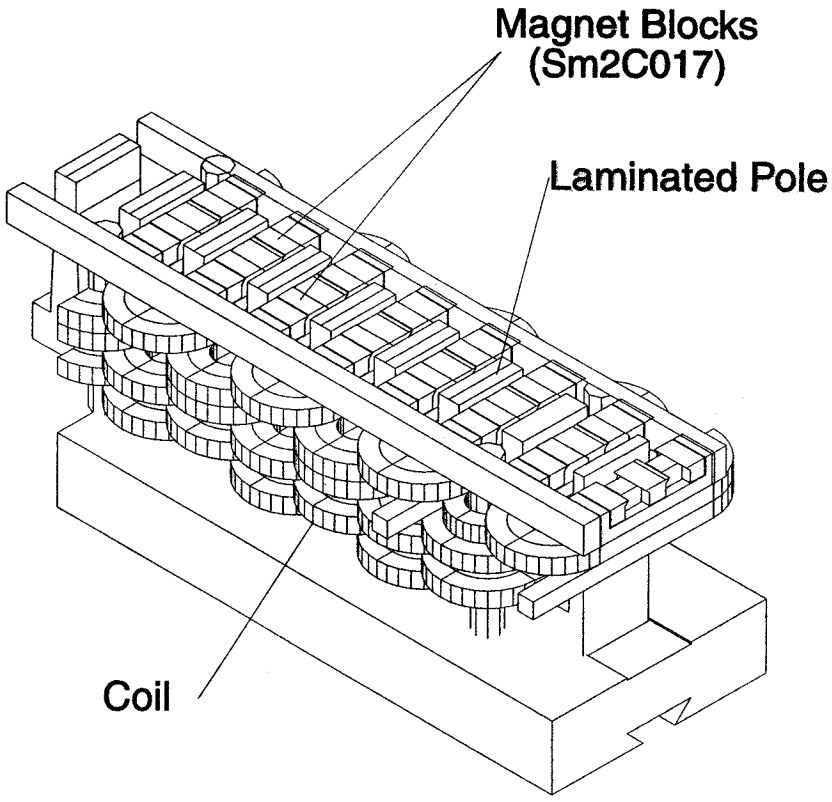
ESRF EMPHU

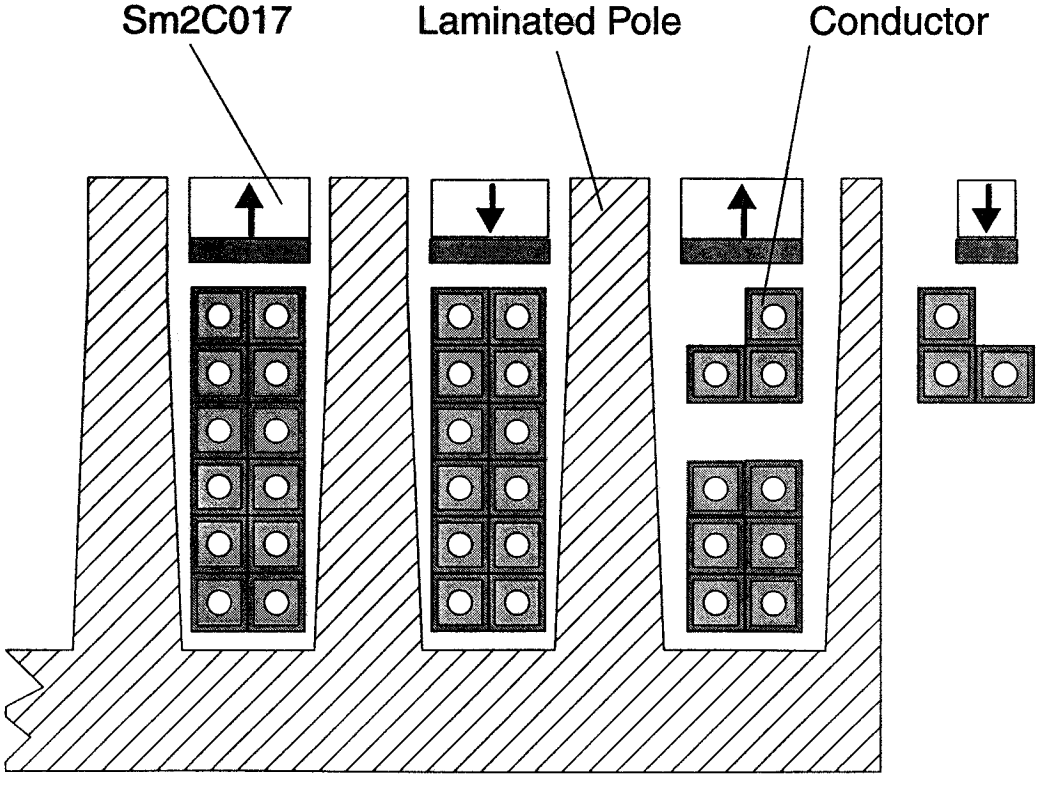


ESRF EMPHU (detail of end structure)

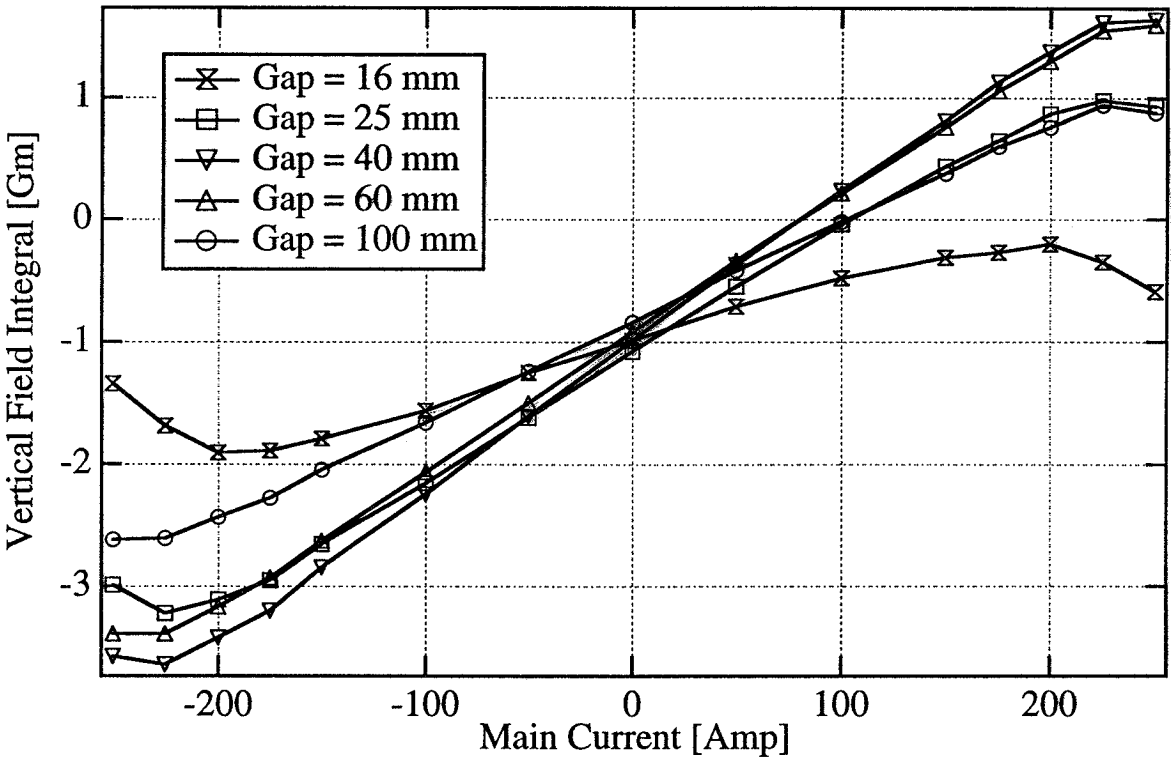

0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20T
Field [T]
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0m
Longitudinal position [m]
Vertical
Horizontal


0.20
0.15
0.10
0.05
0.00
Peak Magnetic Field [T]
20
30
40
50
60
Gap [mm]
Vertical
Horizontal

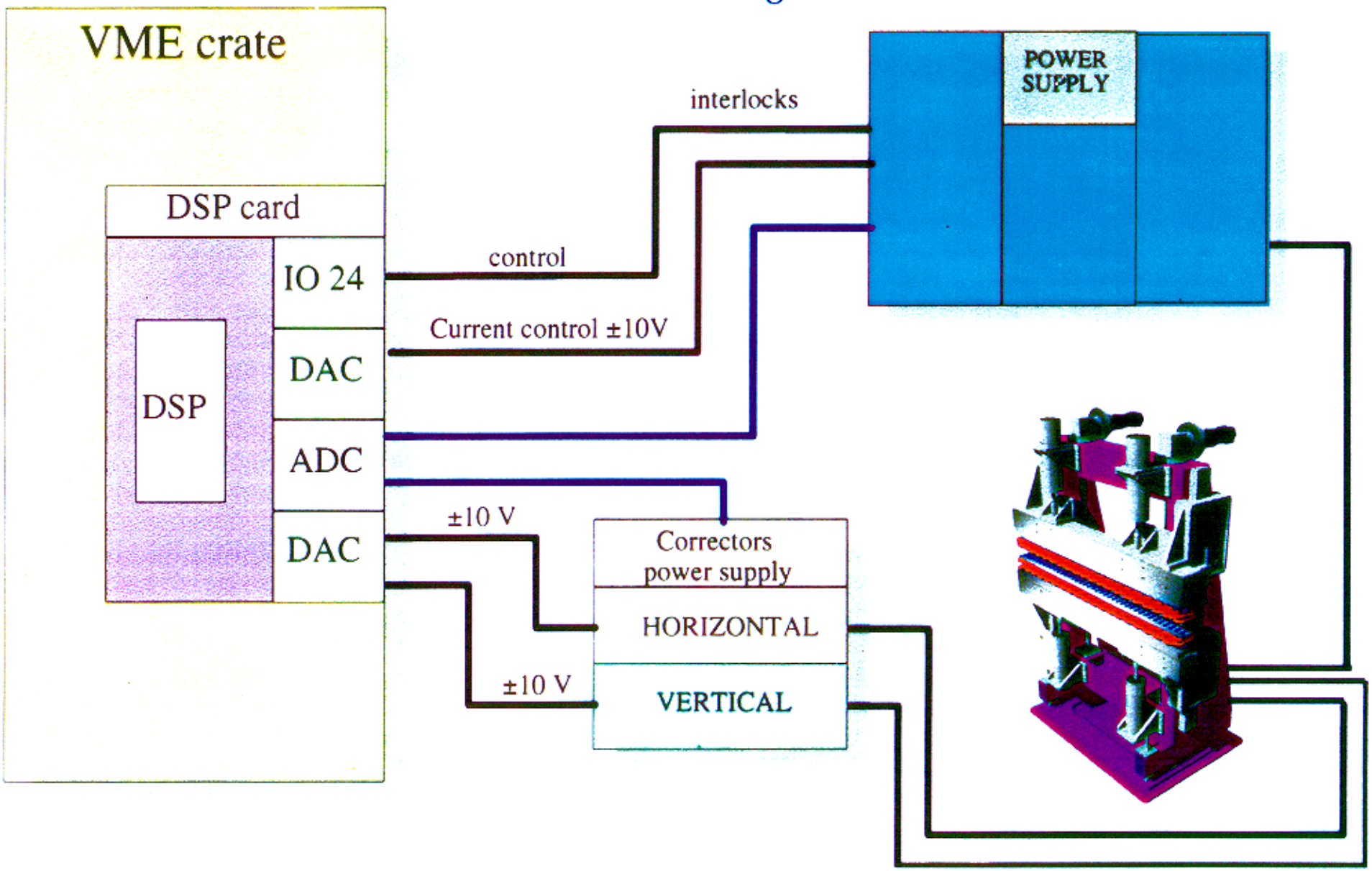

Magnet Blocks
(Sm2C017)
Laminated Pole
Coil


Sm2C017
Laminated Pole
Conductor

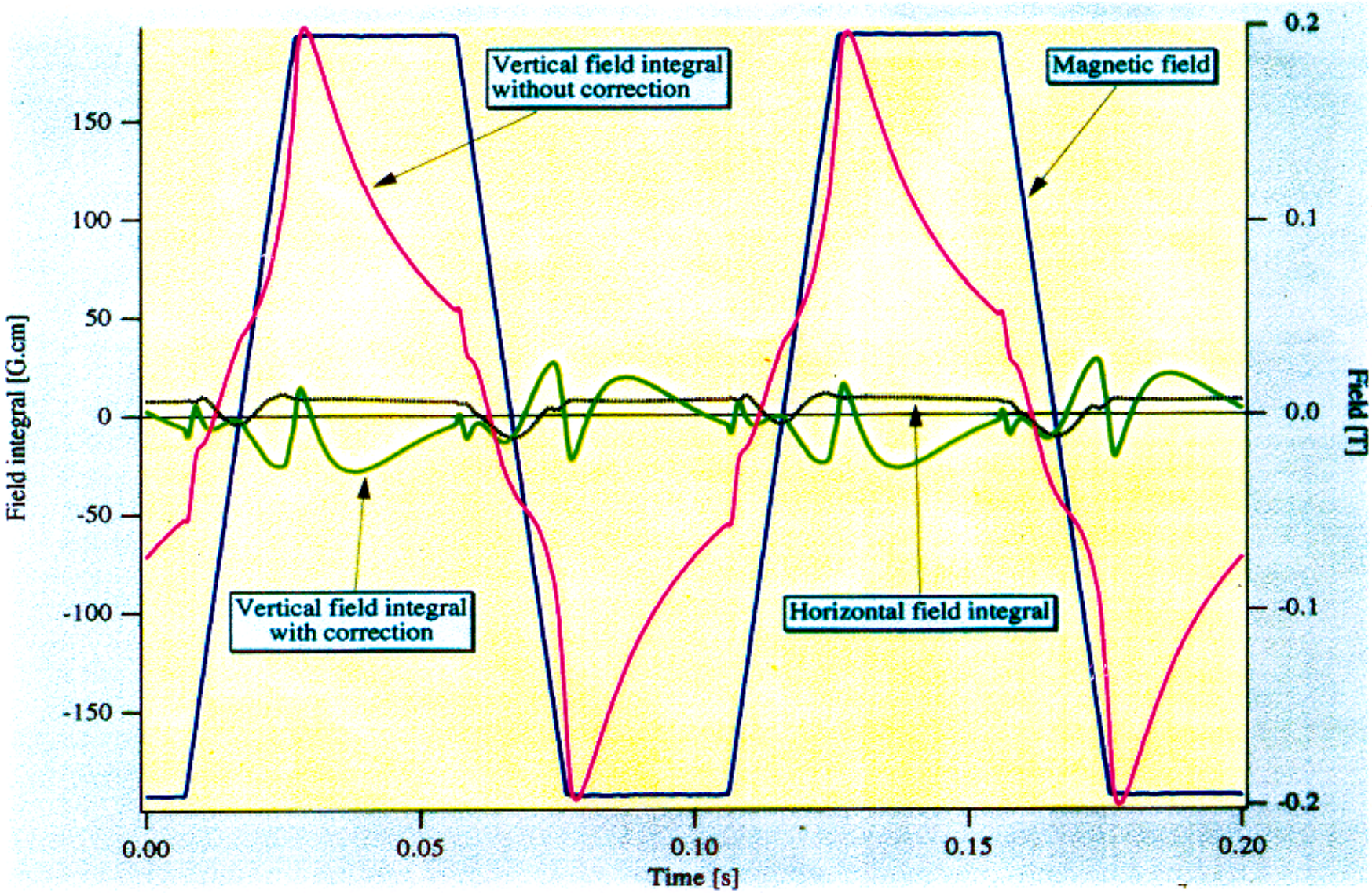
Field Integral vs Current and Gap



Control of electromagnet field

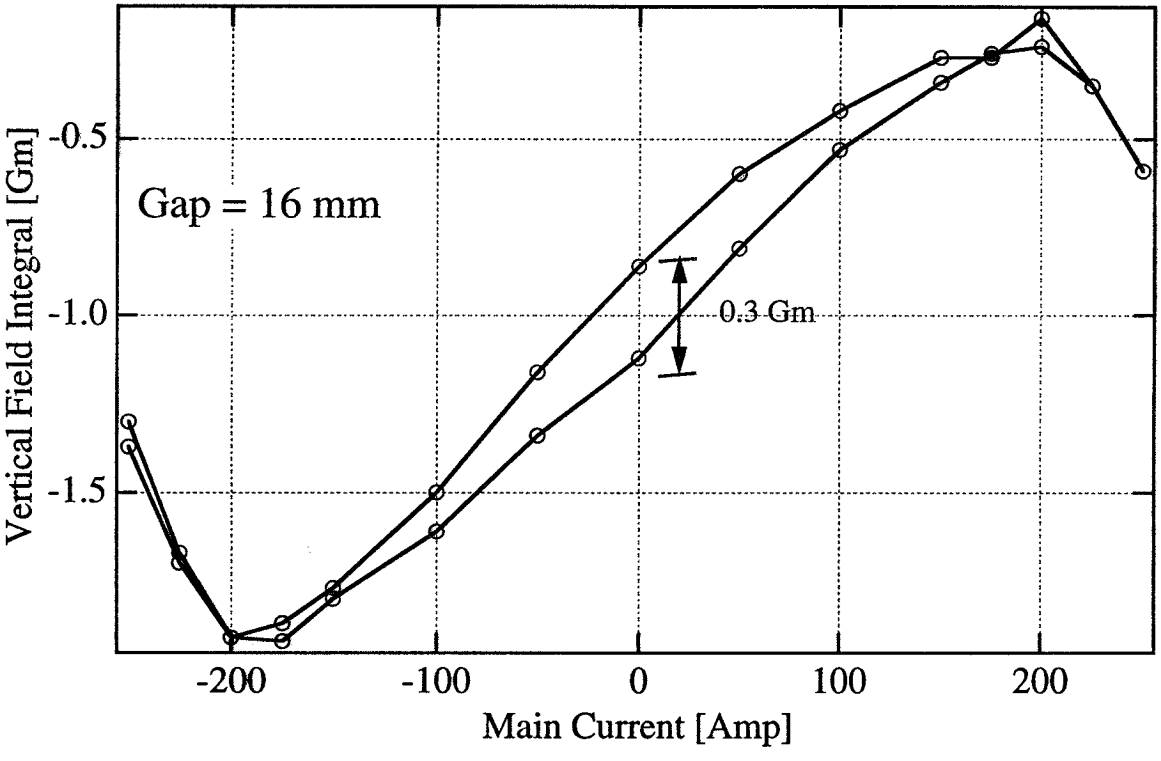


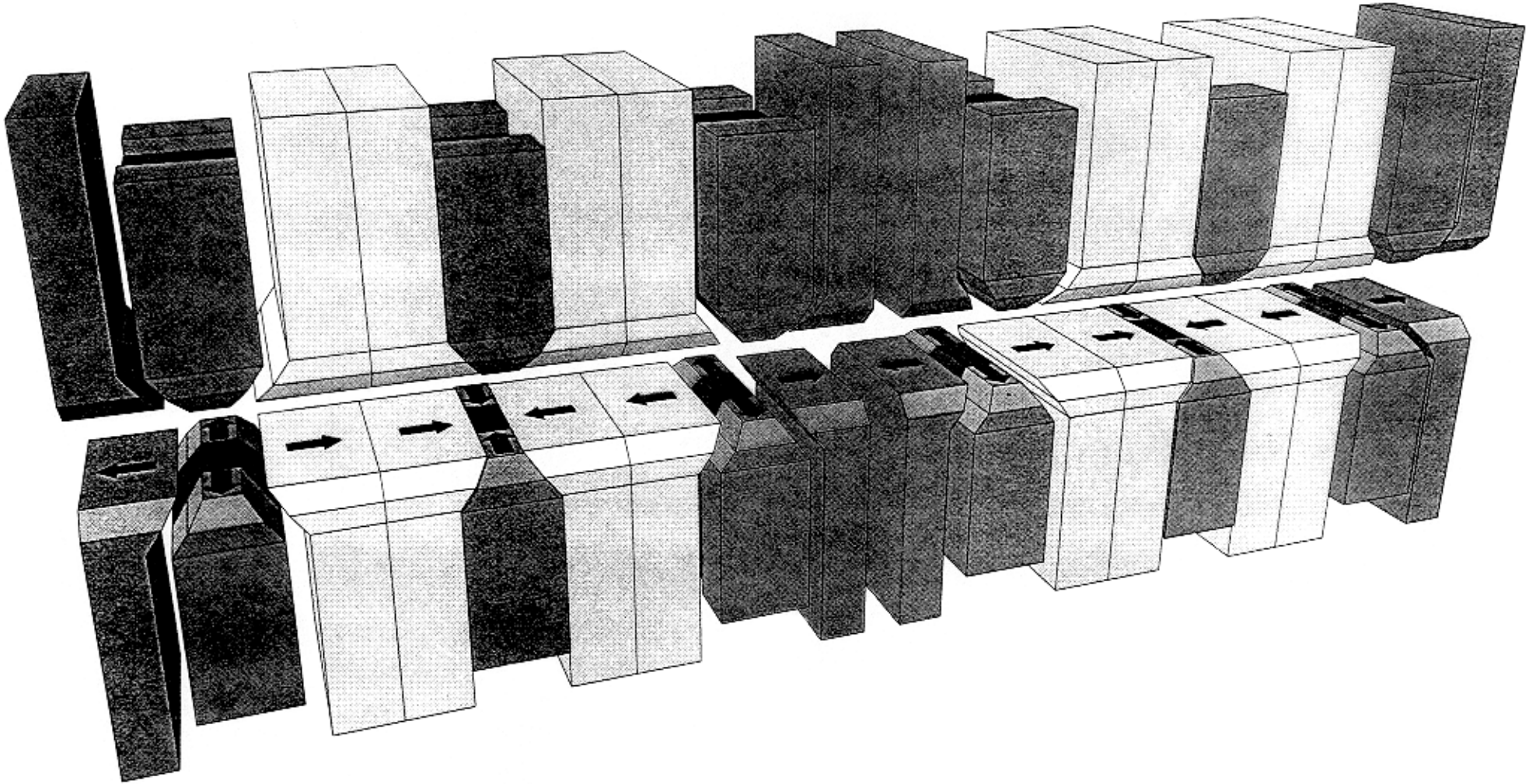
AC magnetic measurements

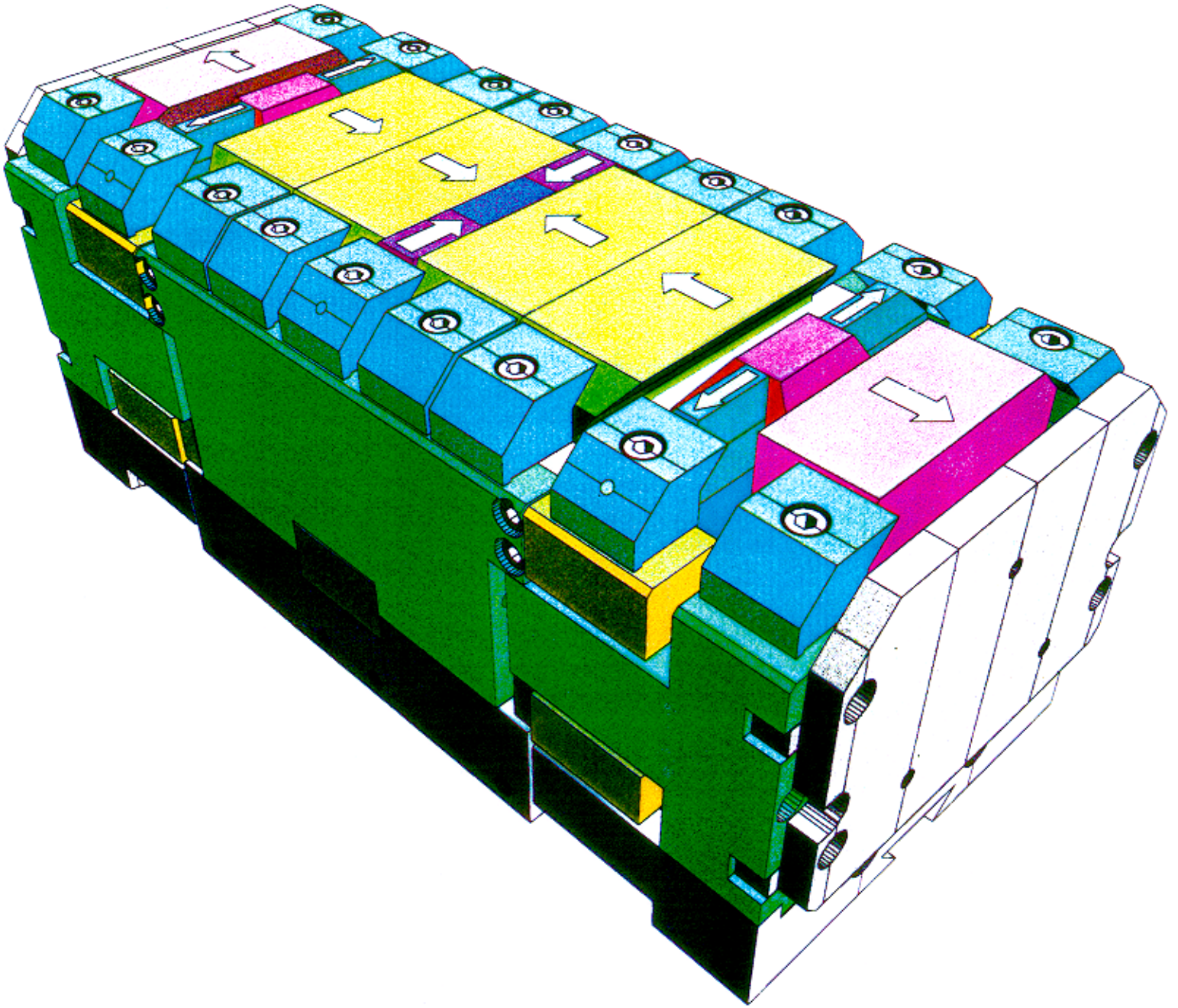


F=10 Hz flip. time 20 ms

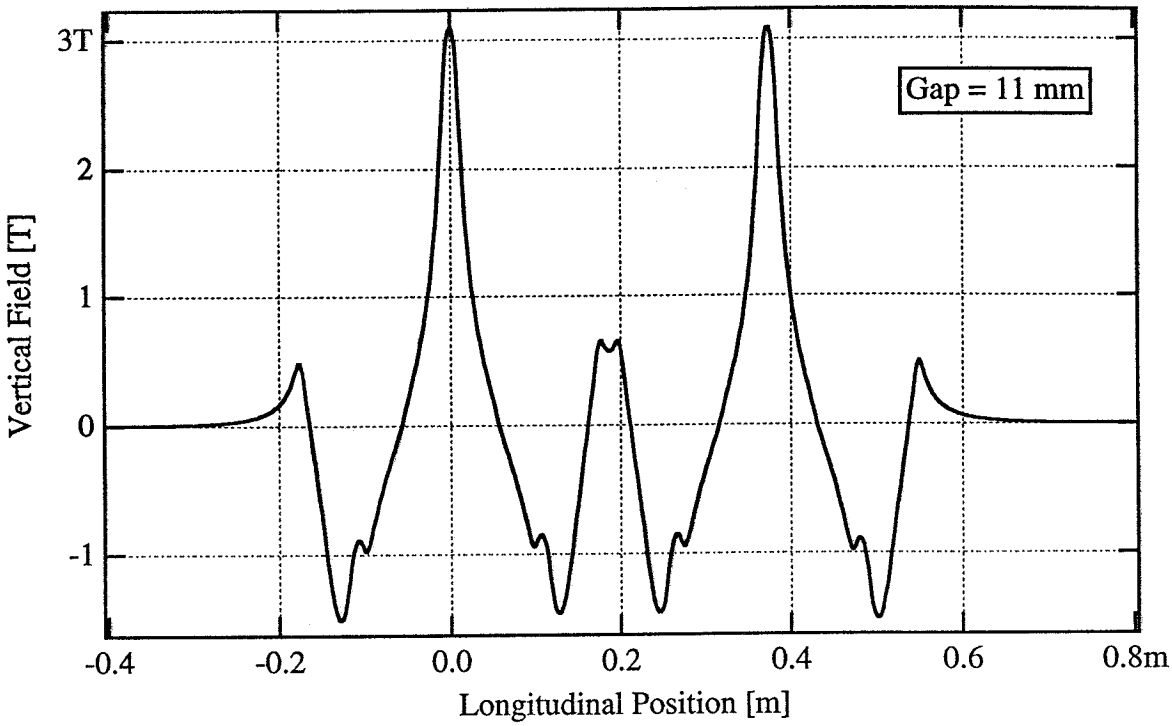
Hysteresis of the Field Integral

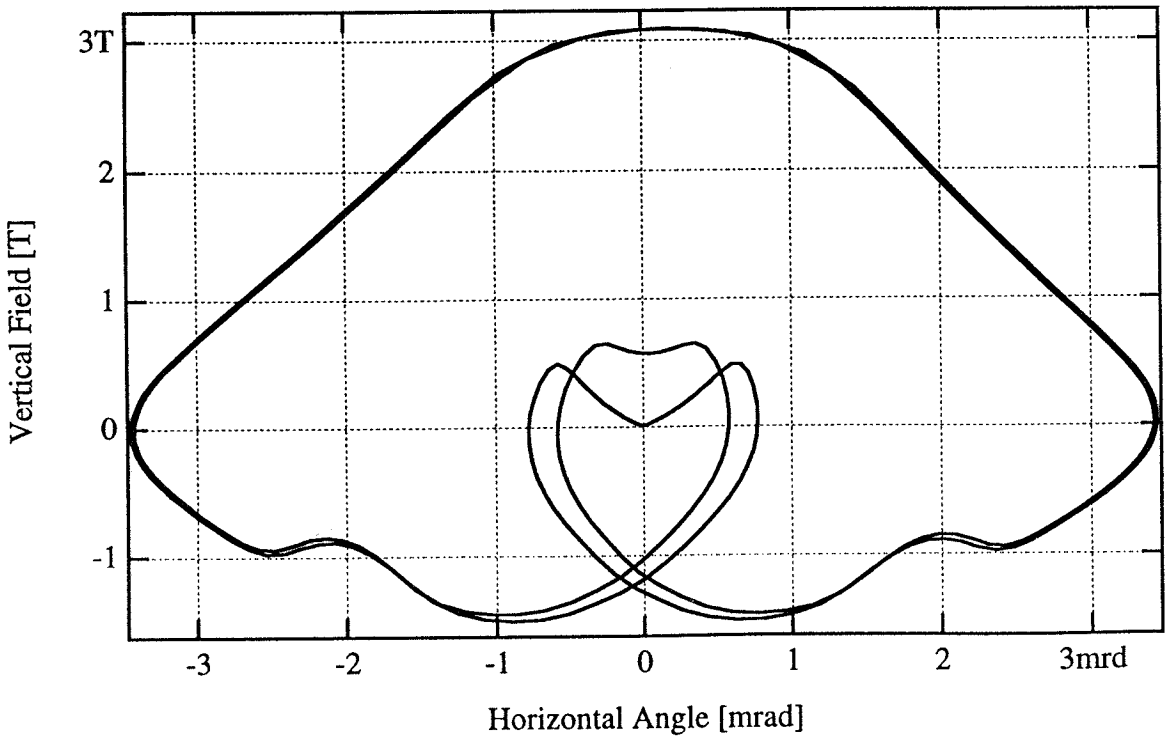


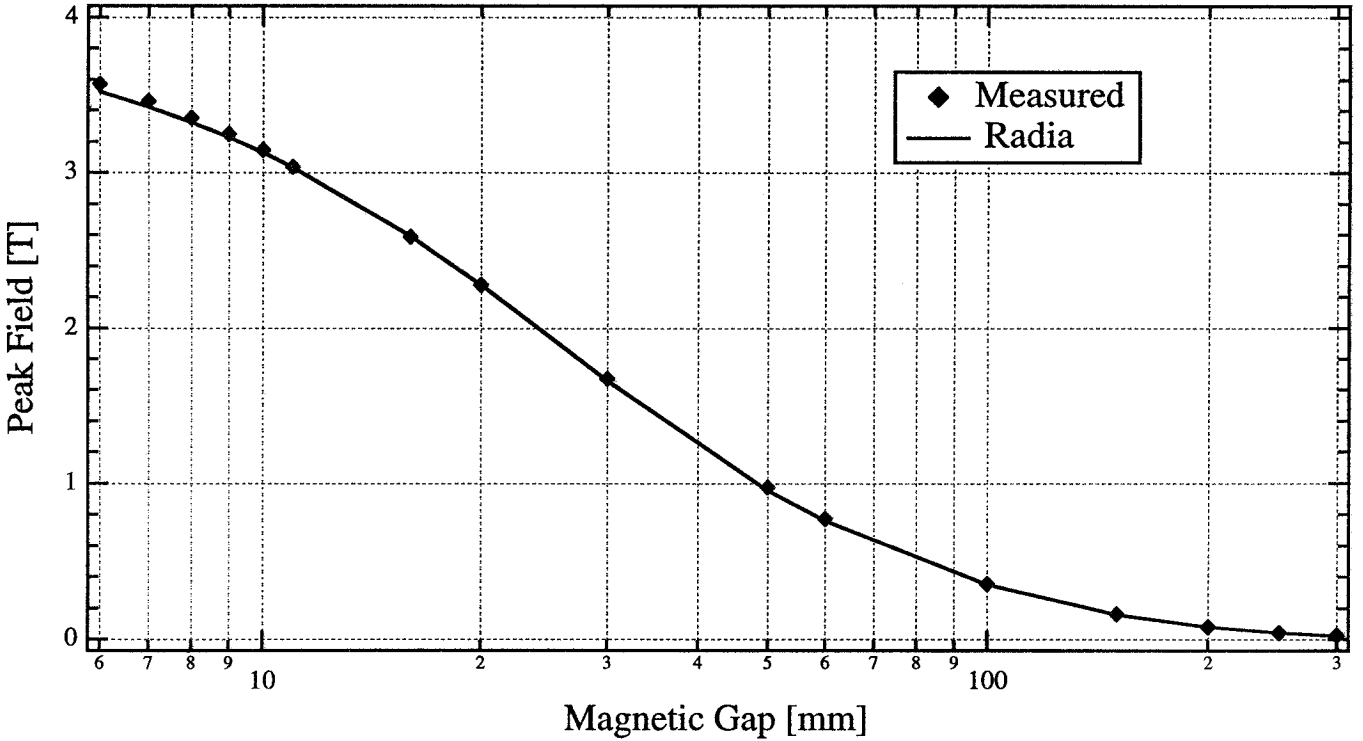


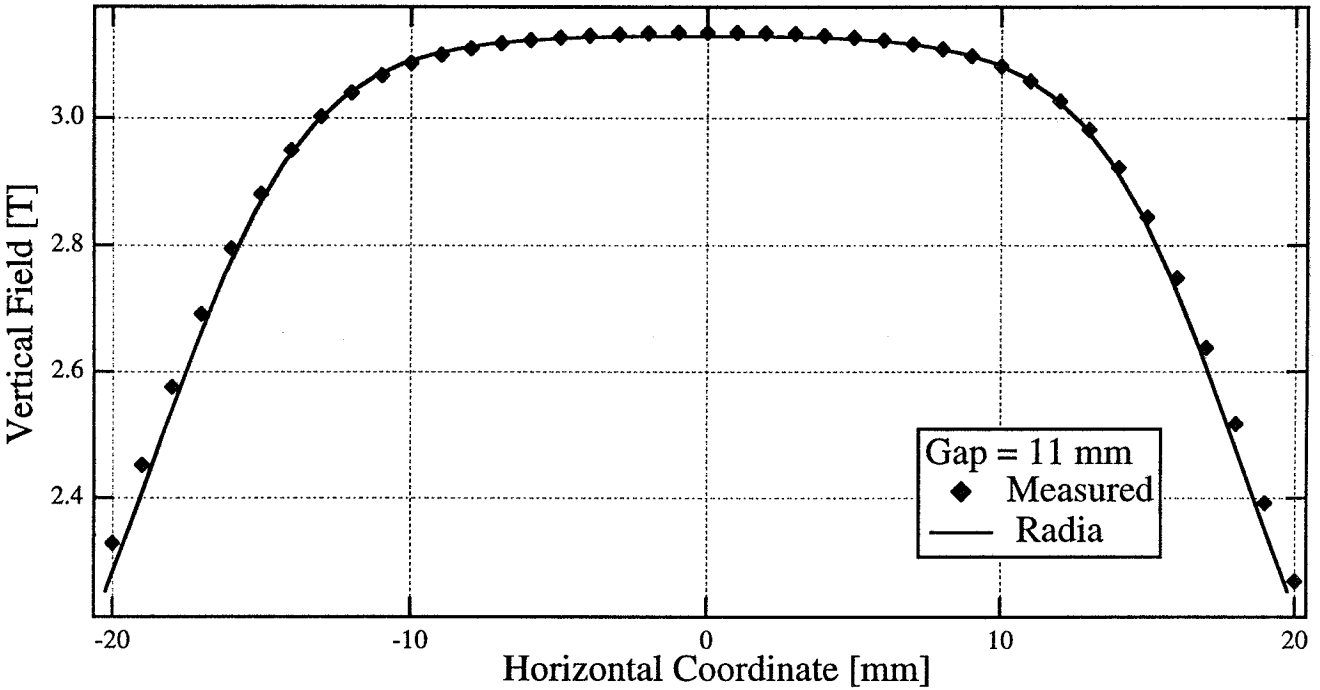


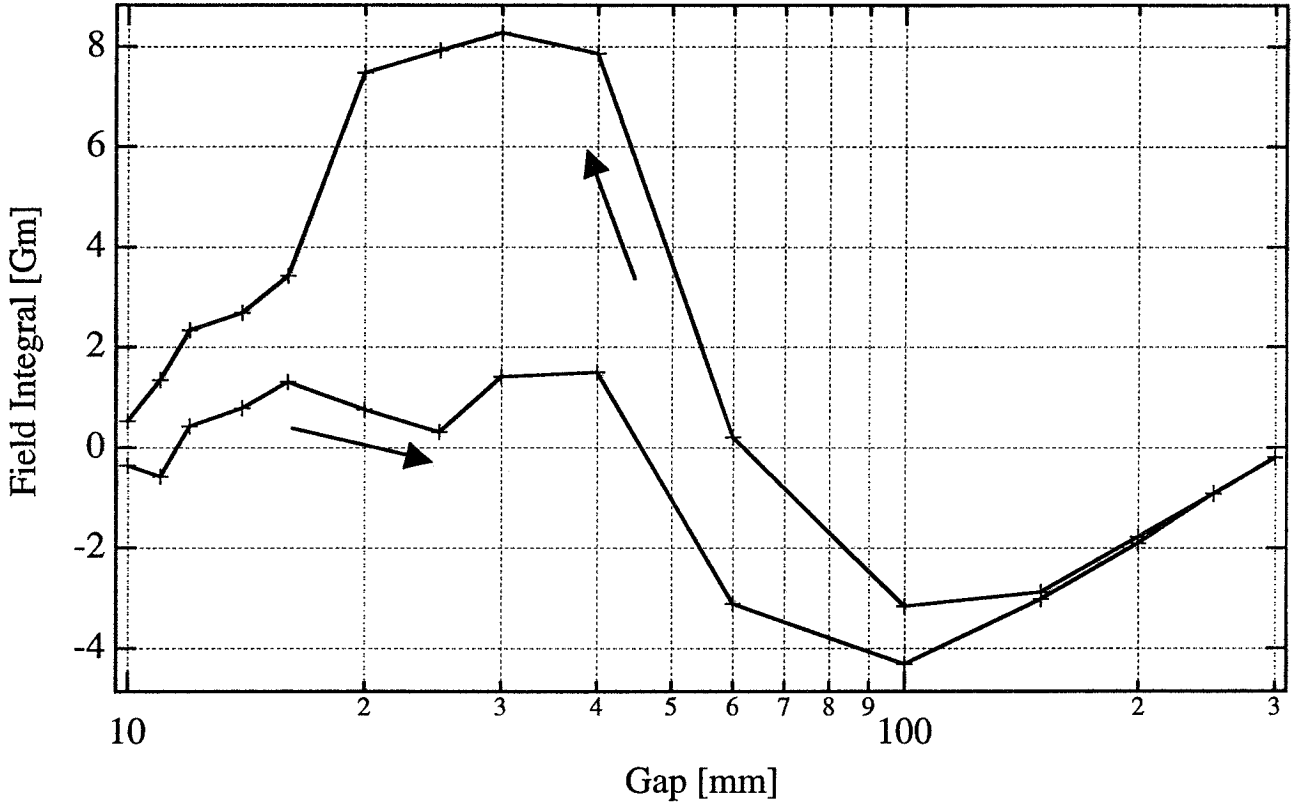
3T Asymmetric Wiggler



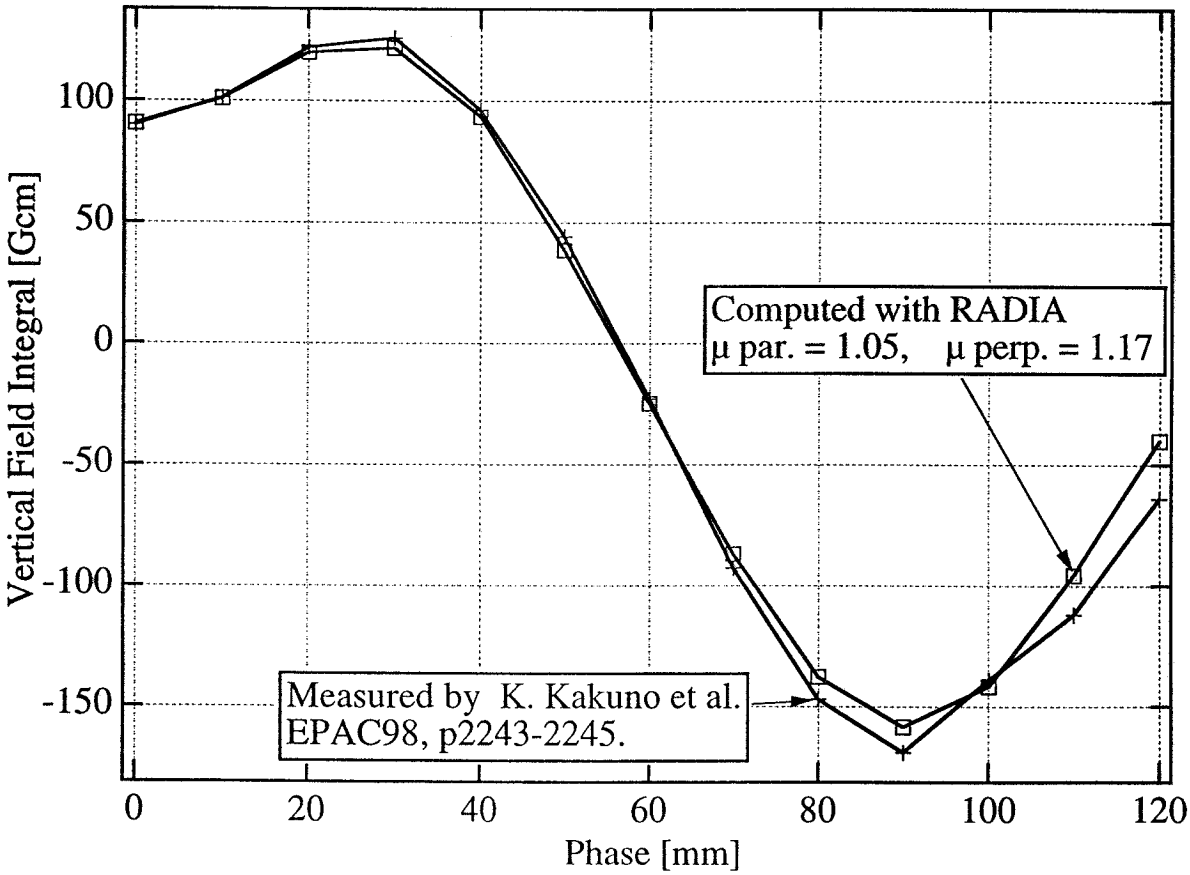



Measured
Radia
Peak Field [T]
Magnetic Gap [mm]
0
1
2
3
4
6
7
8
9
10
2
3
4
5
6
7
8
9
100
2
3


Vertical Field [T]
3.0
2.8
2.6
2.4
-20
-10
0
10
20
Horizontal Coordinate [mm]
Gap = 11 mm
Measured
Radia

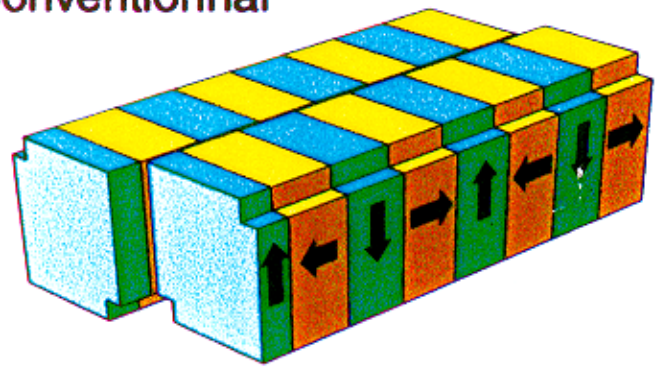

Field Integral [Gm]
8
6
4
2
0
-2
-4
10
2
3
4
5
6
7
8
9
100
2
3
Gap [mm]

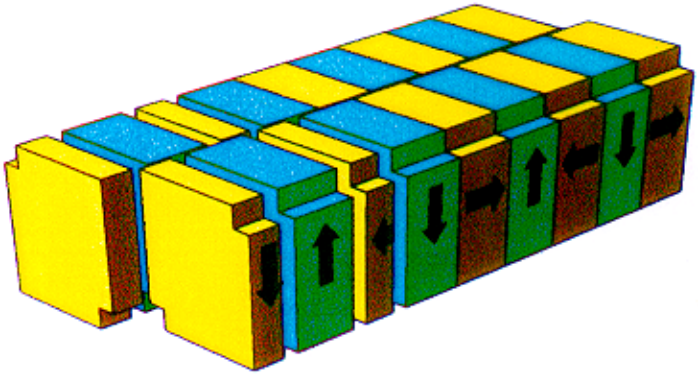
Field Integral vs Phase of an Apple-II Undulator
Period = 120 mm, Gap = 30 mm
Block size 50 x 25 x 30 mm
Material : NdFeB
Conventionnal Termination



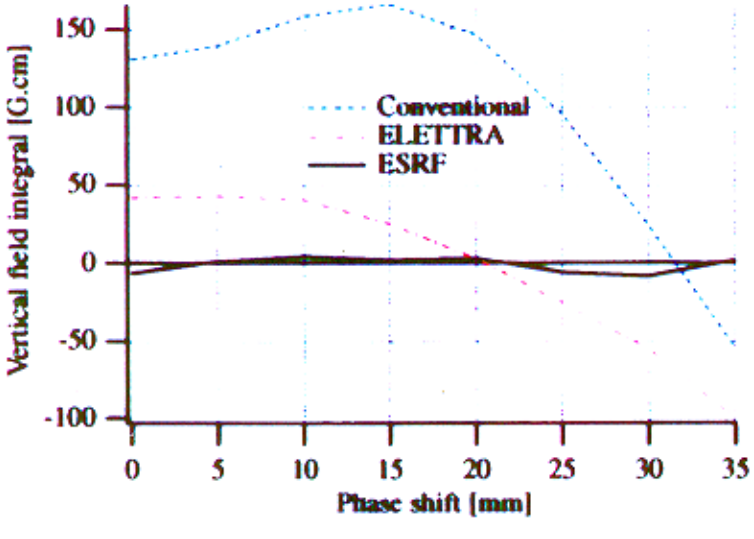
Terminating an Apple II Undulator

Conventionnal

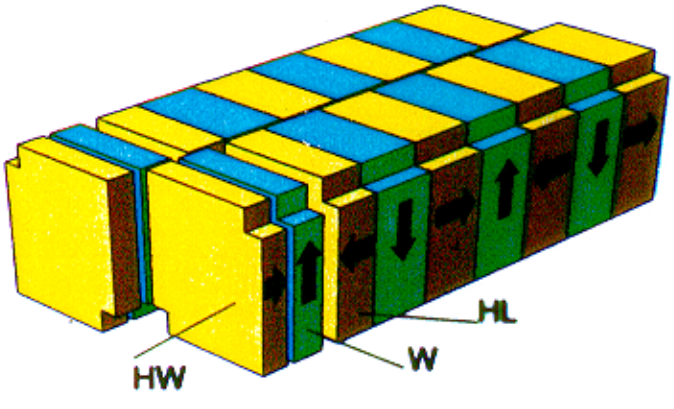




NdFeB Magnets
Period = 70 mm
Gap = 15 mm



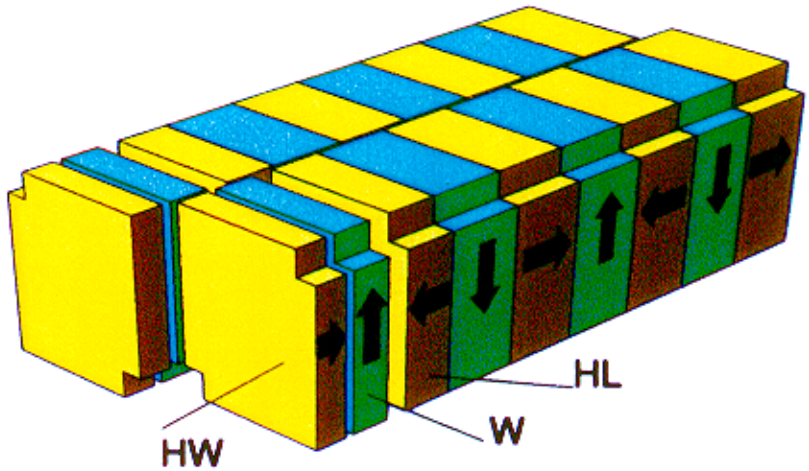
Elettra
(B. Diviacco et al, EPAC 98)



ESRF
(J.Chavanne et al., PAC99)

New Termination for an Apple II Undulator

- J. Chavanne et al., Presented at PAC 99
- Computed with Radia



NdFeB Magnets
Period = 70 mm
Symmetric Vertical Field