Hybrid In-Vacuum Mini-Gap Undulator of the X9 Beamline to support BNL's Center for Functional Nanoscience

Brookhaven National Laboratory

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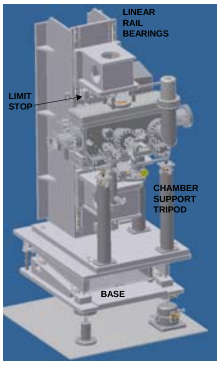
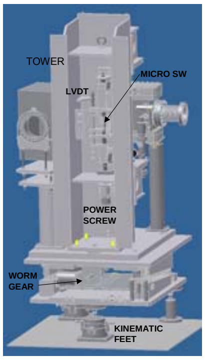
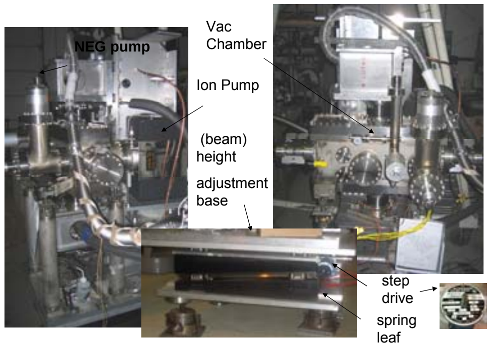
Solid Model: views from front/back





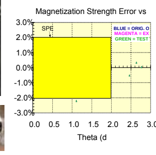
MGU assembly: view from outside ring

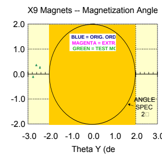


X9 Specs, Permanent Magnets, Vanadium Permendur Poles:

Neomax 42AH NdFeB

Location	X9
Device	MGU
Installed	(2008)
Type	Hybrid PM [illegible]
Period (mm)	14.3
Length (m)	0.36
No. Periods	23
Min Gap (mm)	3.3
Peak Field (T)	1.28
K_{eff}	1.63
E_{3rd} @ 2.8 GeV	2.2

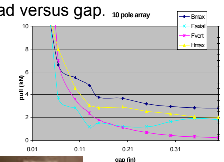


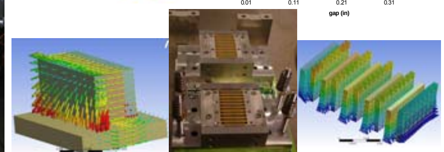


Magnets were individually measured with a 3-axis Fluxgate Magnetometer in a fixture, in 4 orientations. Obtained Bx, By and Bz far field components proportional to magnetization components Mx, My and Mz.

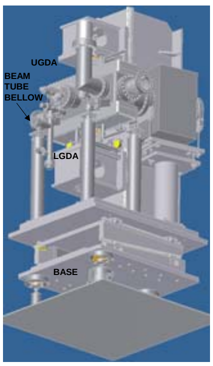
Systematic angle error |θy| ~1.3° (Blocks sliced at an angle to easy axis?)

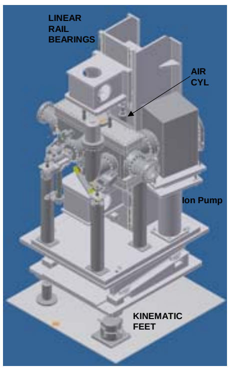
Halbach Array: Magnetostatic FEA vs. bench test magnetic load versus gap.



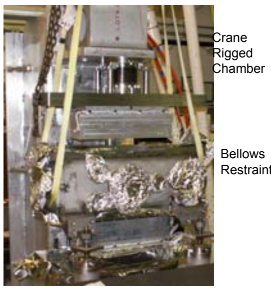


Solid Model: views from beneath/above

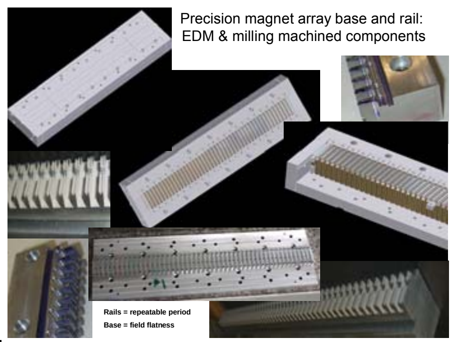




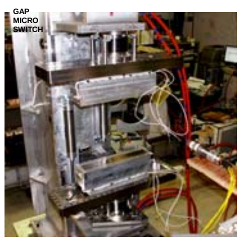
vacuum system build-up/pump down



Precision magnet array base and rail: EDM & milling machined components

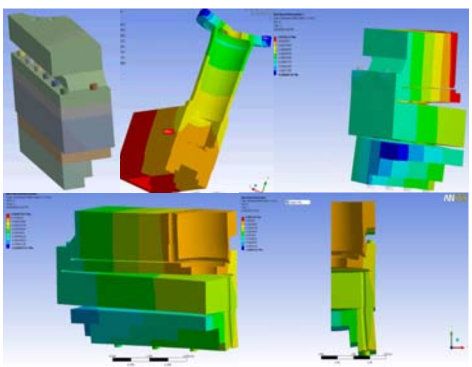


Open gap/vacuum chamber extracted: UHV Thermometry shown

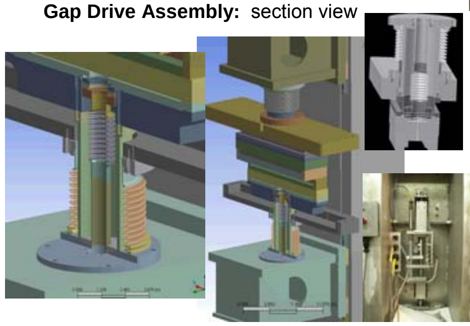


Structurally reinforced magnet core assembly:

¼ section model and FEA of array deformation

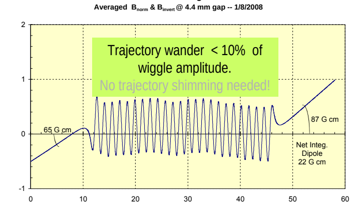


Gap Drive Assembly: section view

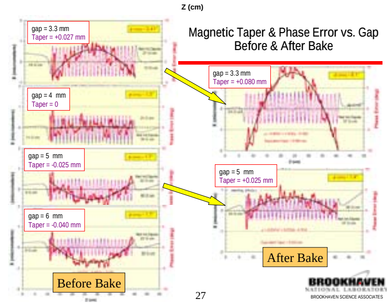


X9 2nd Integral

Averaged B_{horiz} & B_{vert} @ 4.4 mm gap -- 1/8/2008

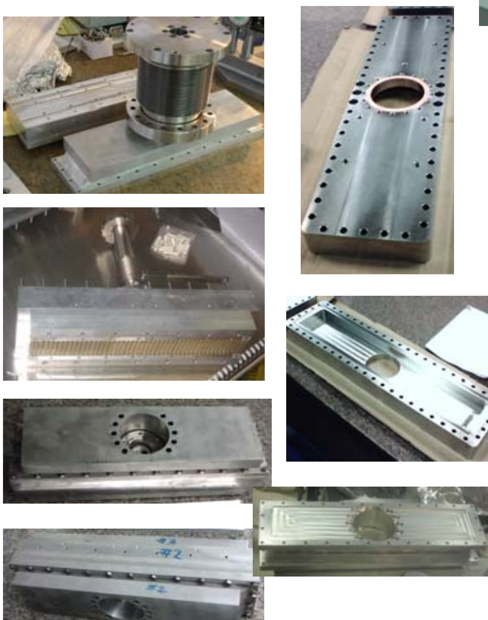


Magnetic Taper & Phase Error vs. Gap Before & After Bake

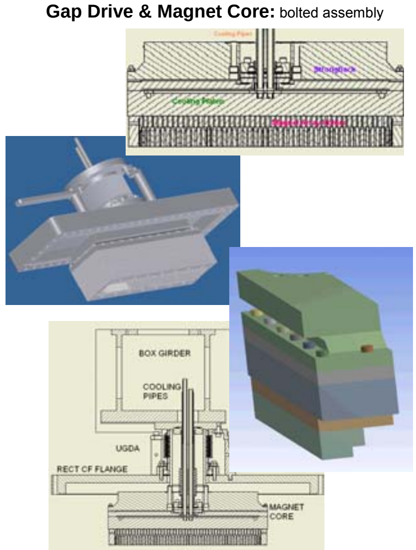


Gap Drive Structural Components:

Strongback, Cooling Platen, Magnet Array Base, Deep Rect. Flanges



Gap Drive & Magnet Core: bolted assembly



Thermal FEA analyses:

1) Normal operation with water cooling: U/S dipole radiation dominant;
2) Temp. limited bakeout: magnets deGauss just above 90*C