

REDUCE THE EFFECTS OF FLUX GRADIENTS IN TRIGA CENTRAL THIMBLE

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TRIGA Reactor (GSTR)

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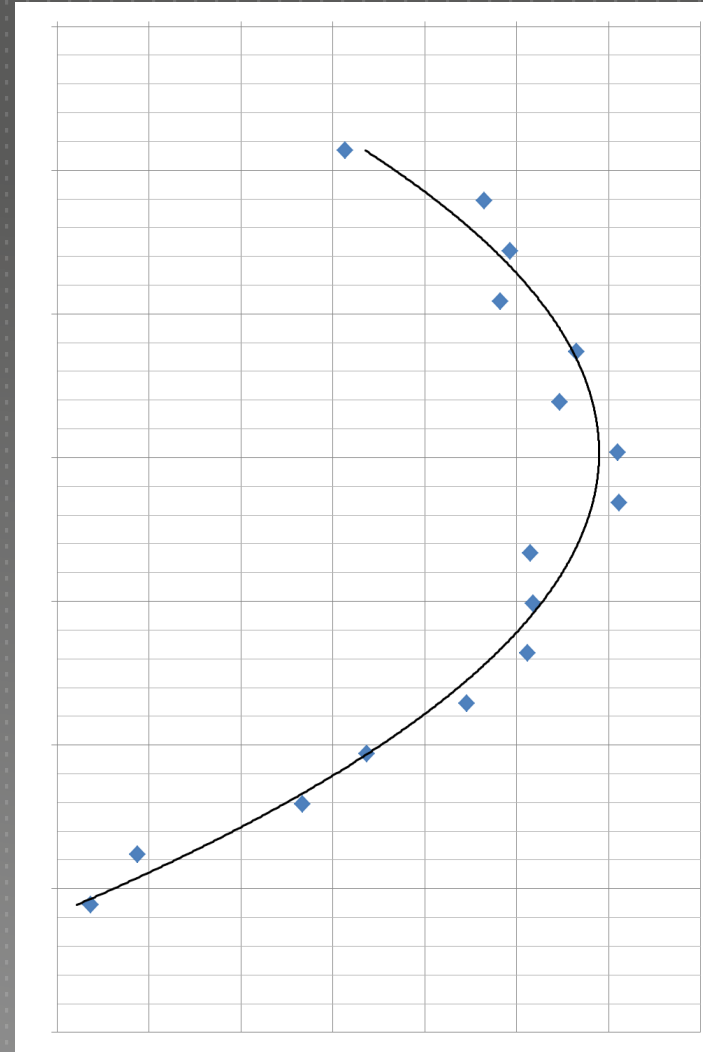
August 7, 2014

MOTIVATION

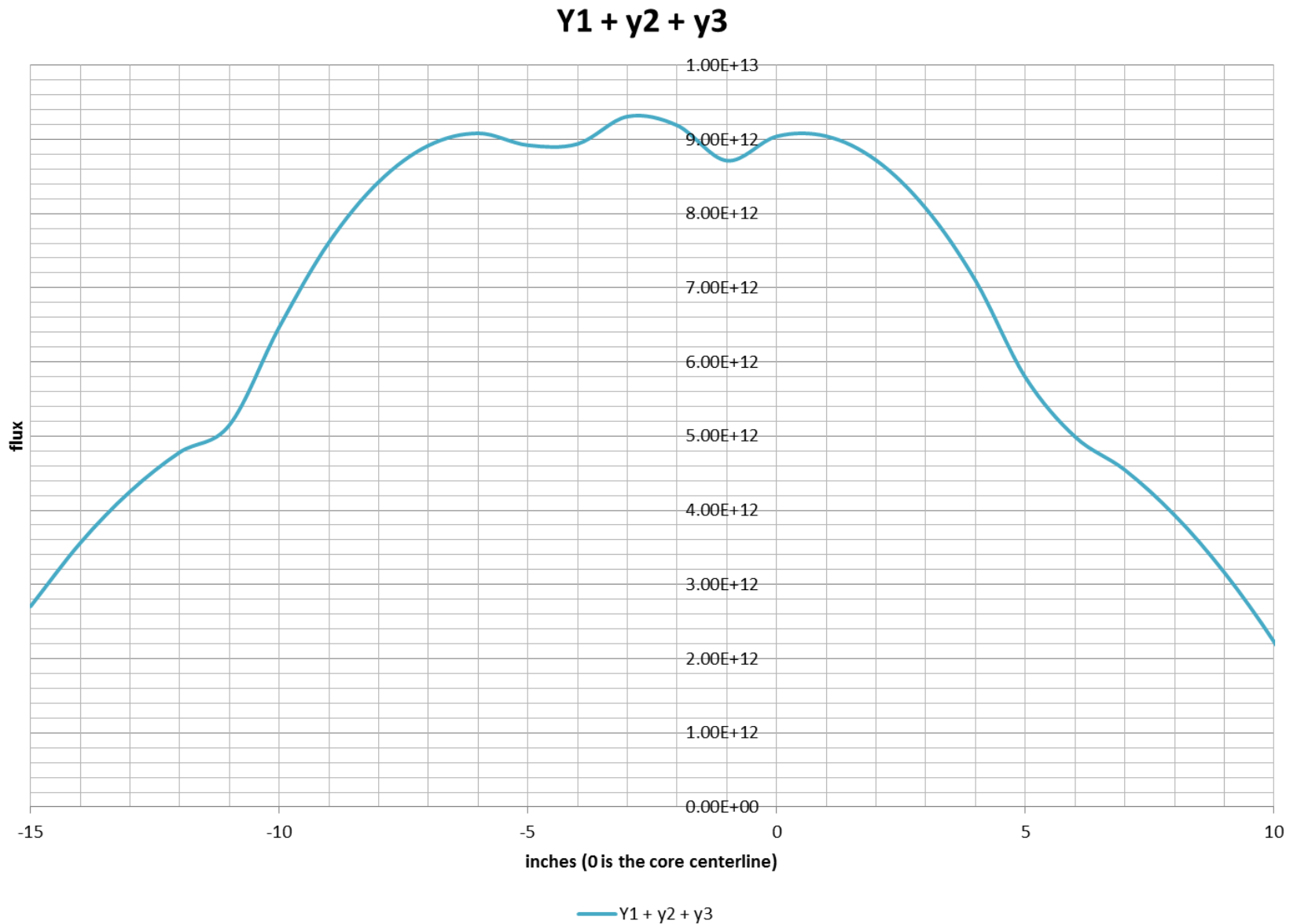
- ▶ Project to produce glass beads with a tracer (Au)
- ▶ Limiting factor was concentration of Au in glass
- ▶ Not enough time to irradiate all material to required activity

Core dimensions (in) – 0 is core centerline

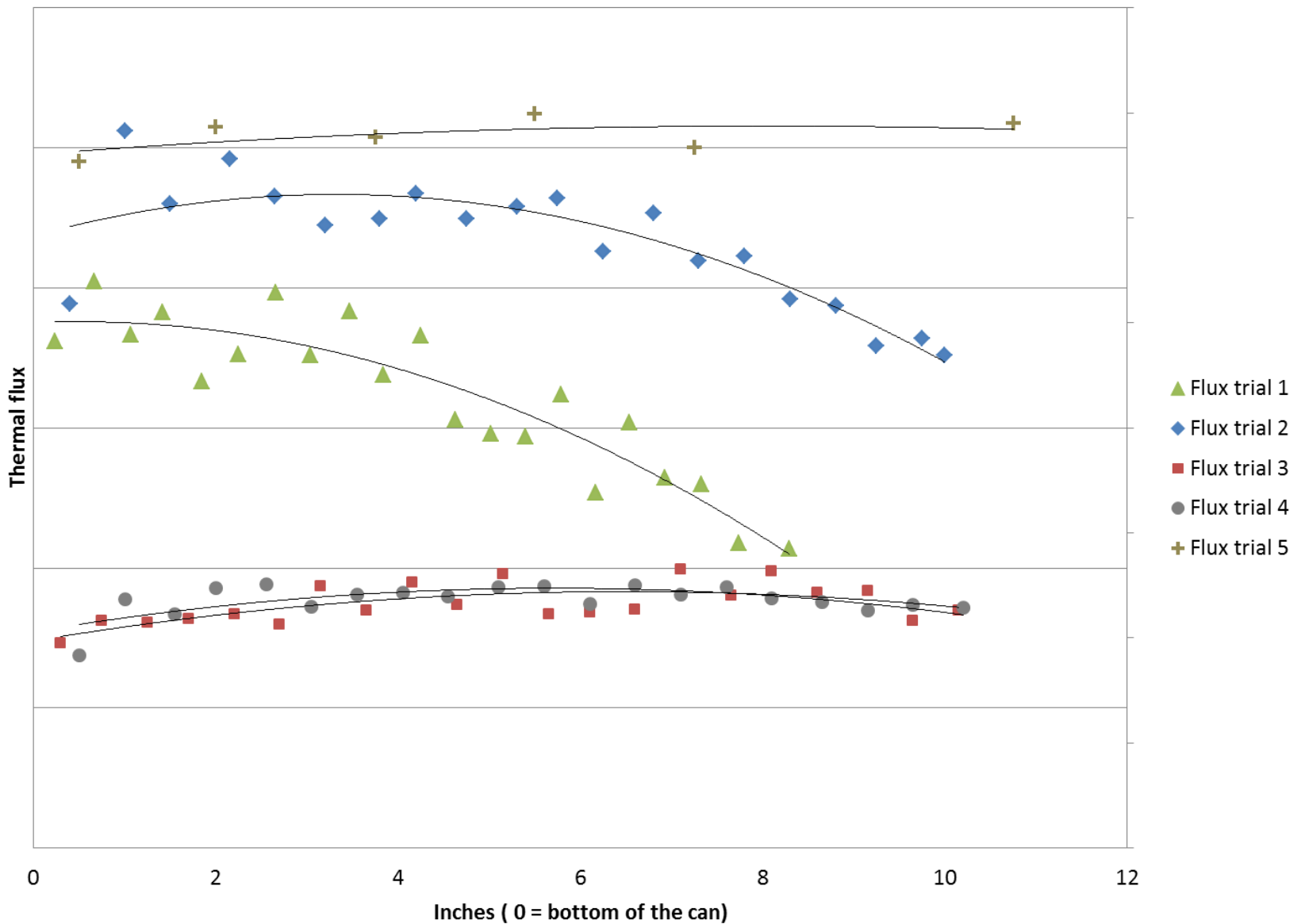
-8
-6
-4
-2
0
2
4
6



3-POSITION THEORY



3-POSITION IN ACTION



$^{40}\text{Ar}/^{39}\text{Ar}$ GEOCHRONOLOGY

- ▶ Researchers want packages centered in flux peak
- ▶ Vertical location of peak flux is variable
 - ▶ Irradiation time
 - ▶ Sample worth
 - ▶ Fission product poisons
 - ▶ Fuel loading

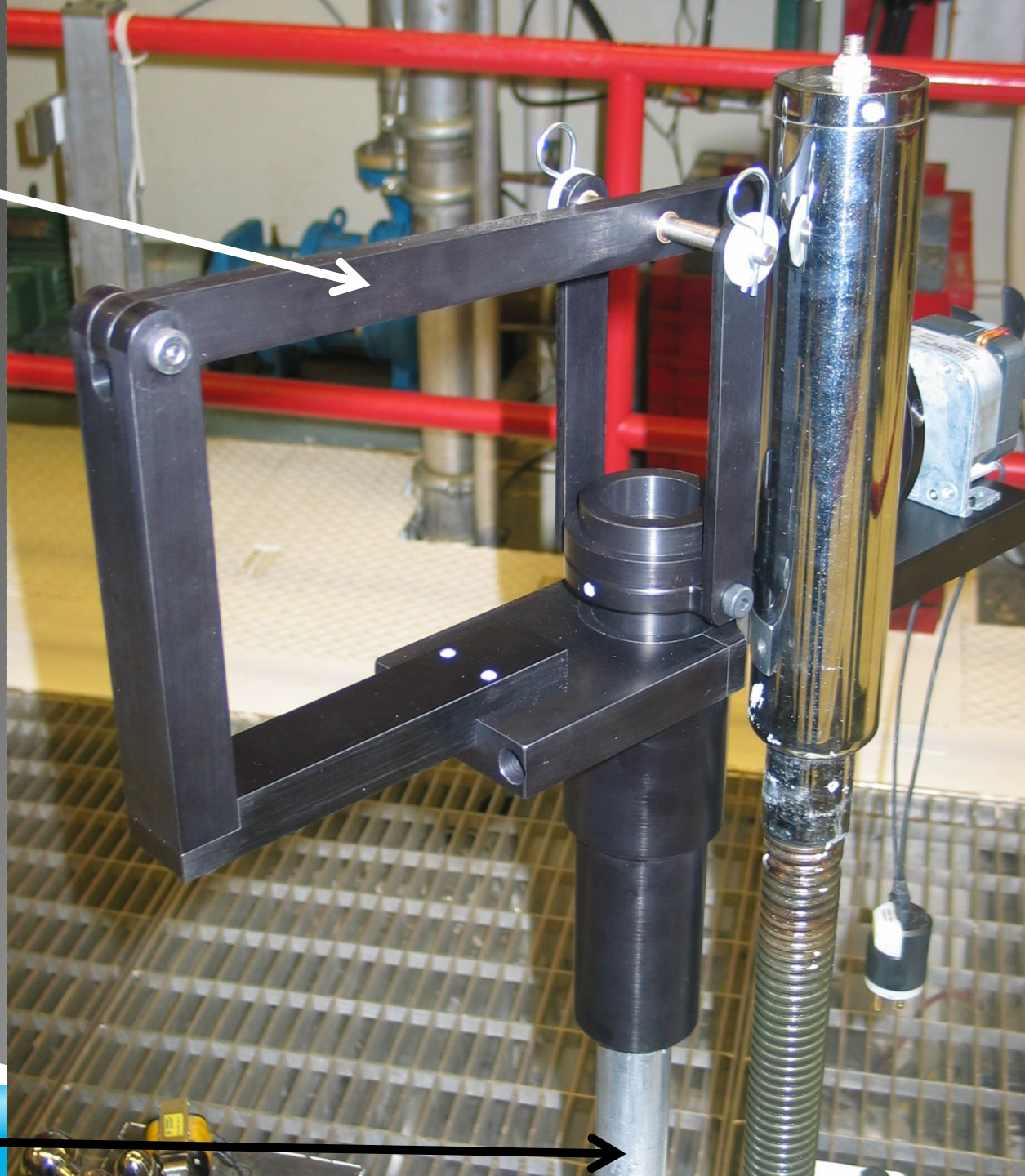
SOLUTION

- ▶ Electric motor-driven oscillator installed at the top of the central thimble tube
 - ▶ Various vertical strokes of 1.5" to 3", in 0.5" increments
 - ▶ Fixed speed
 - ▶ 2 minute cycle time

Rocker beam
of oscillator

CT sample
oscillator,
mounted on
the central
thimble

Central thimble



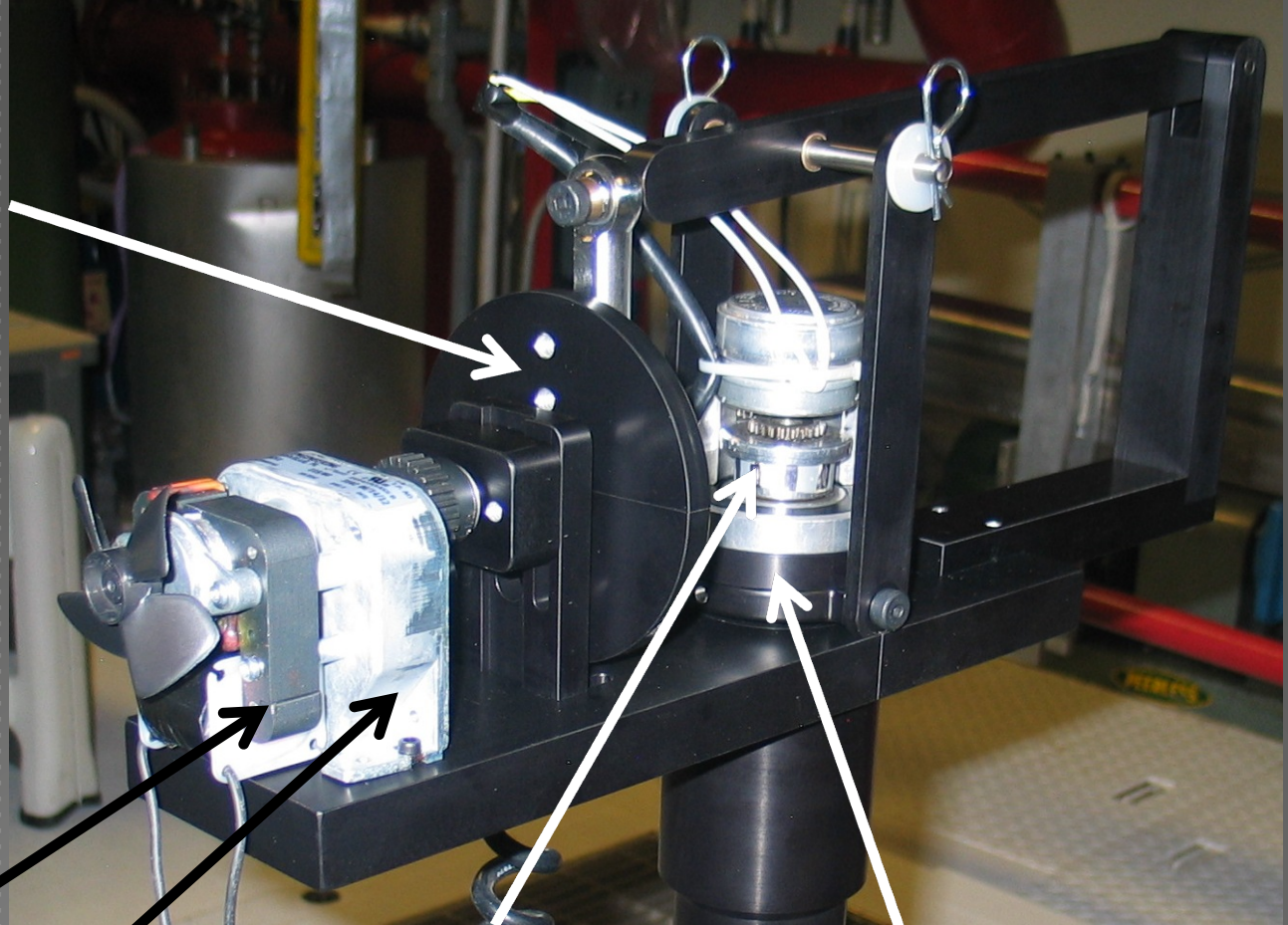
Eccentric disk

Complete
assembly, CT
sample holder,
mounted on the
central thimble

AC
synchronous
drive motor
Reduction
gear
housing

Sample rotating
motor
(unchanged)

Oscillating
sample mount



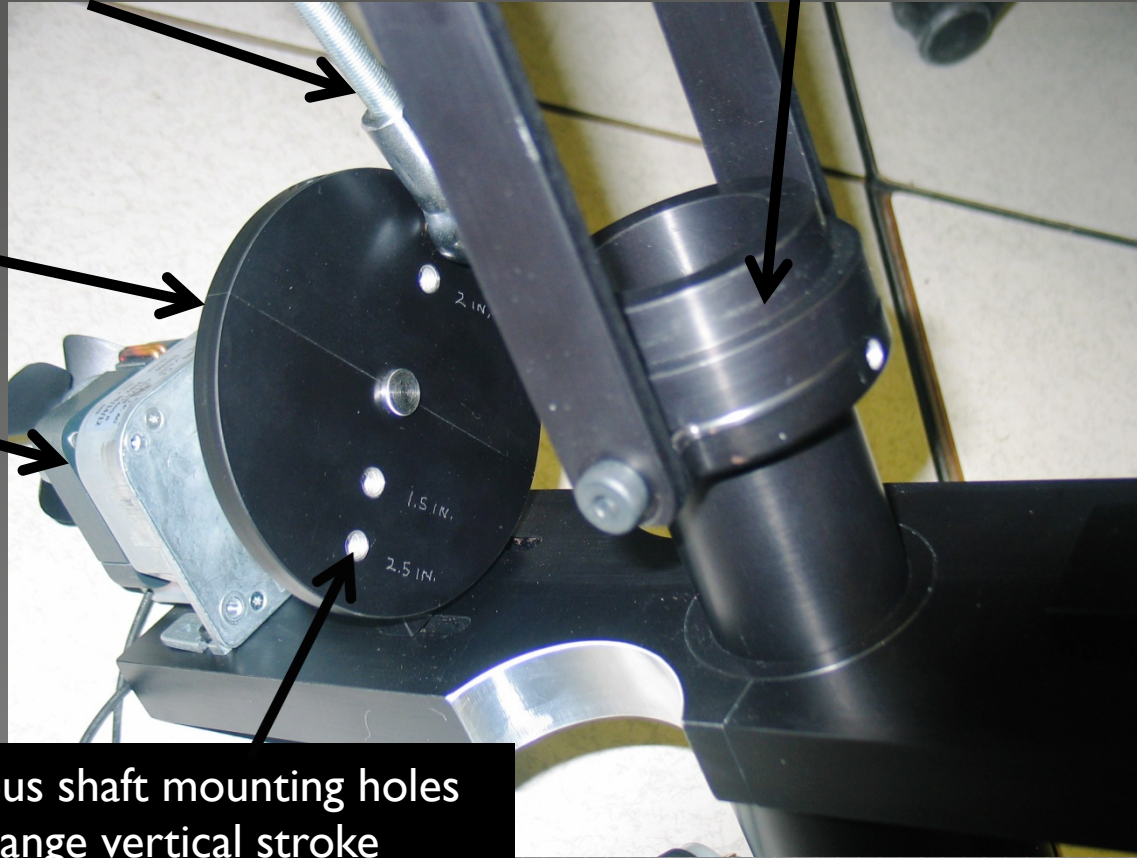
Oscillating
sample mount

Eccentric shaft

Eccentric disk

AC
synchronous
drive motor

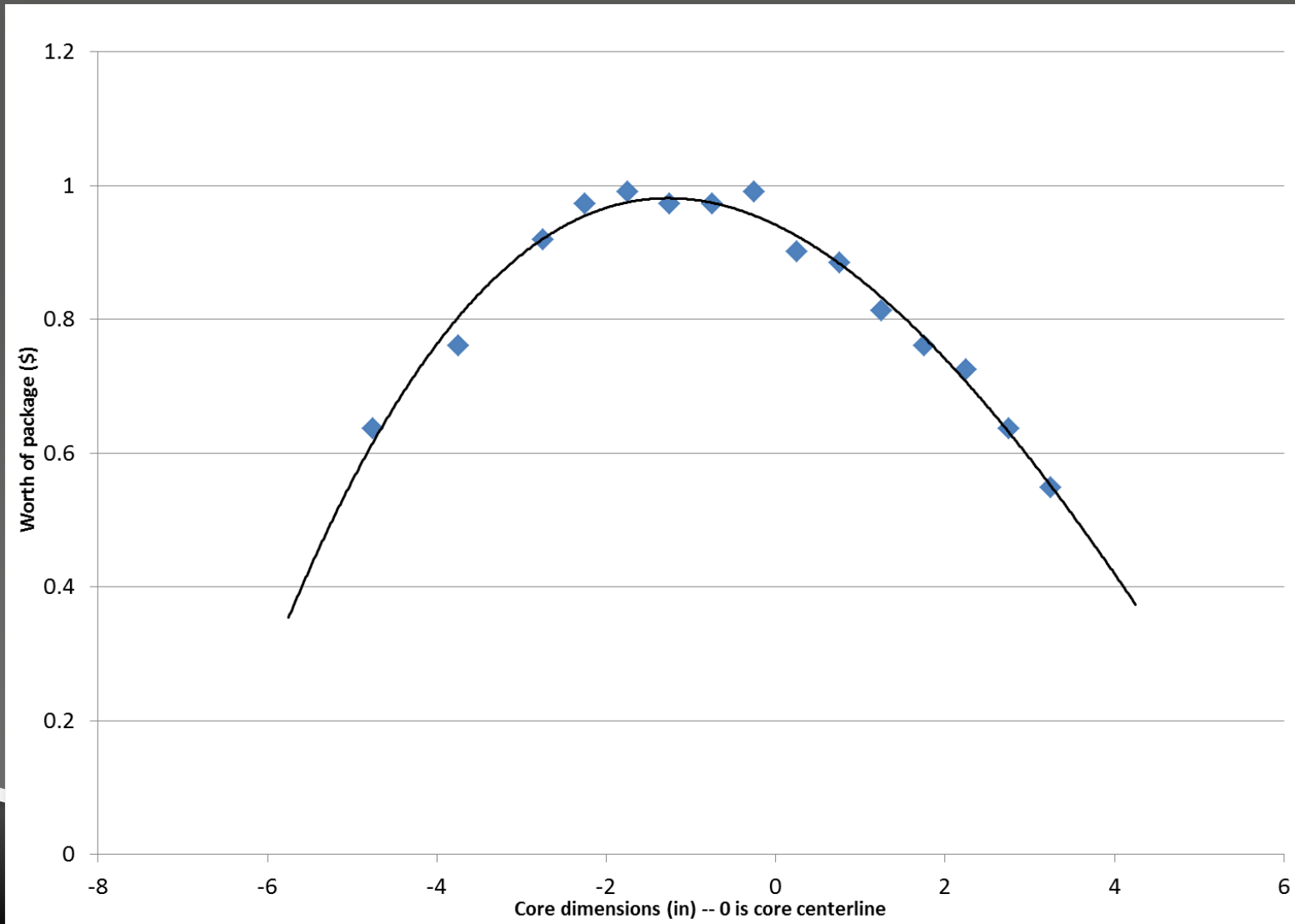
Various shaft mounting holes
to change vertical stroke
between 1.5" and 3"



TECH SPEC ISSUES

- ▶ Reactivity limit of \$1.00 for non-fixed samples
- ▶ Reactivity insertion rate limit of \$0.286/second for control rods

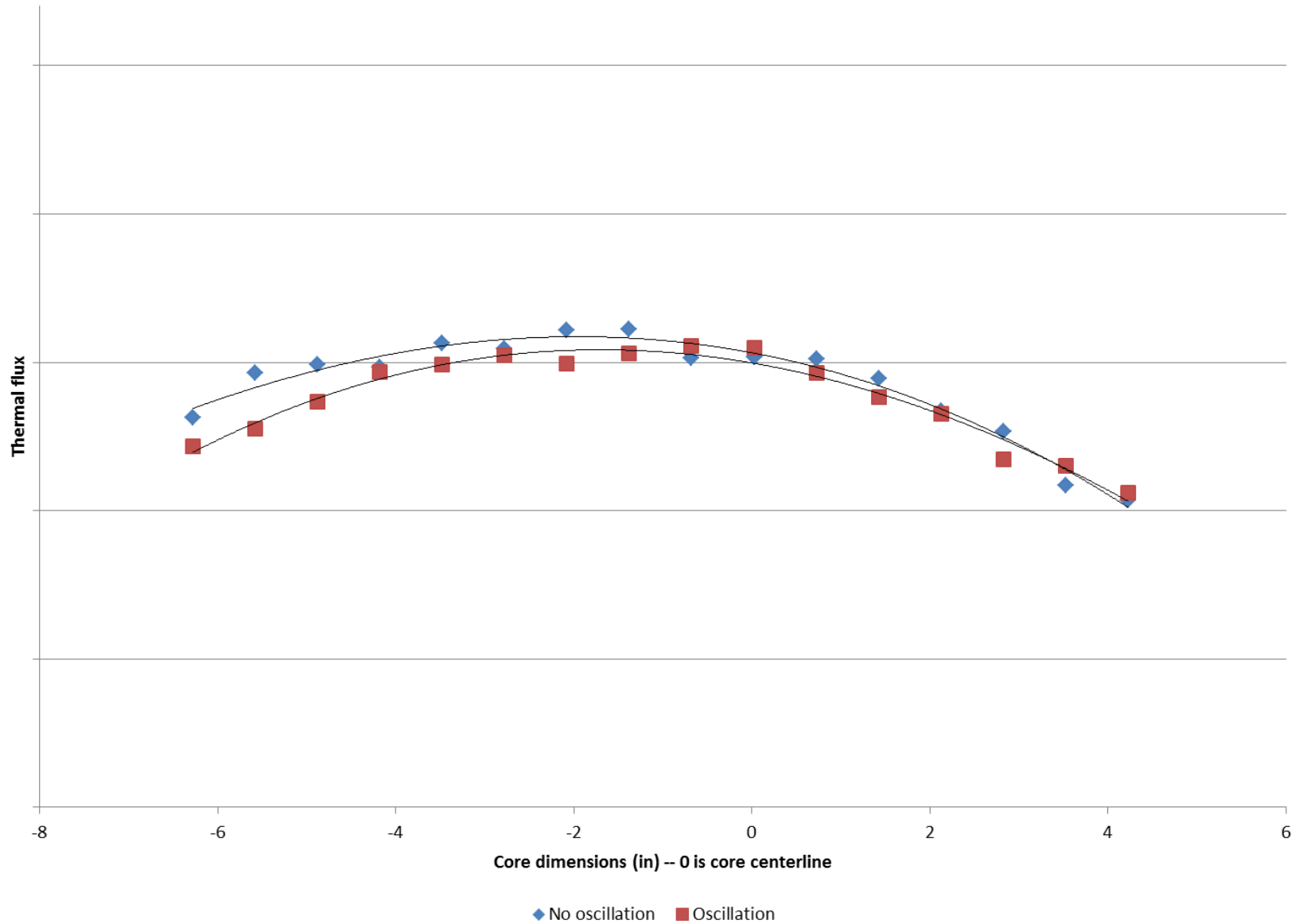
CADMIUM EXPERIMENT



INSERTION RATE

	Reg rod reactivity insertion rate (cents/s)	Oscillator maximum reactivity insertion rate (cents/s)
Reg rod above 950 units	0.56	1.22
Reg rod between 900 and 950 units	2.50	1.22
Reg rod between 850 and 900 units	4.27	1.22
Reg rod between 800 and 850 units	5.89	1.22
Reg rod positions below 800 will give even higher reg rod insertion rates, giving an even larger safety margin.		

DOES IT WORK?

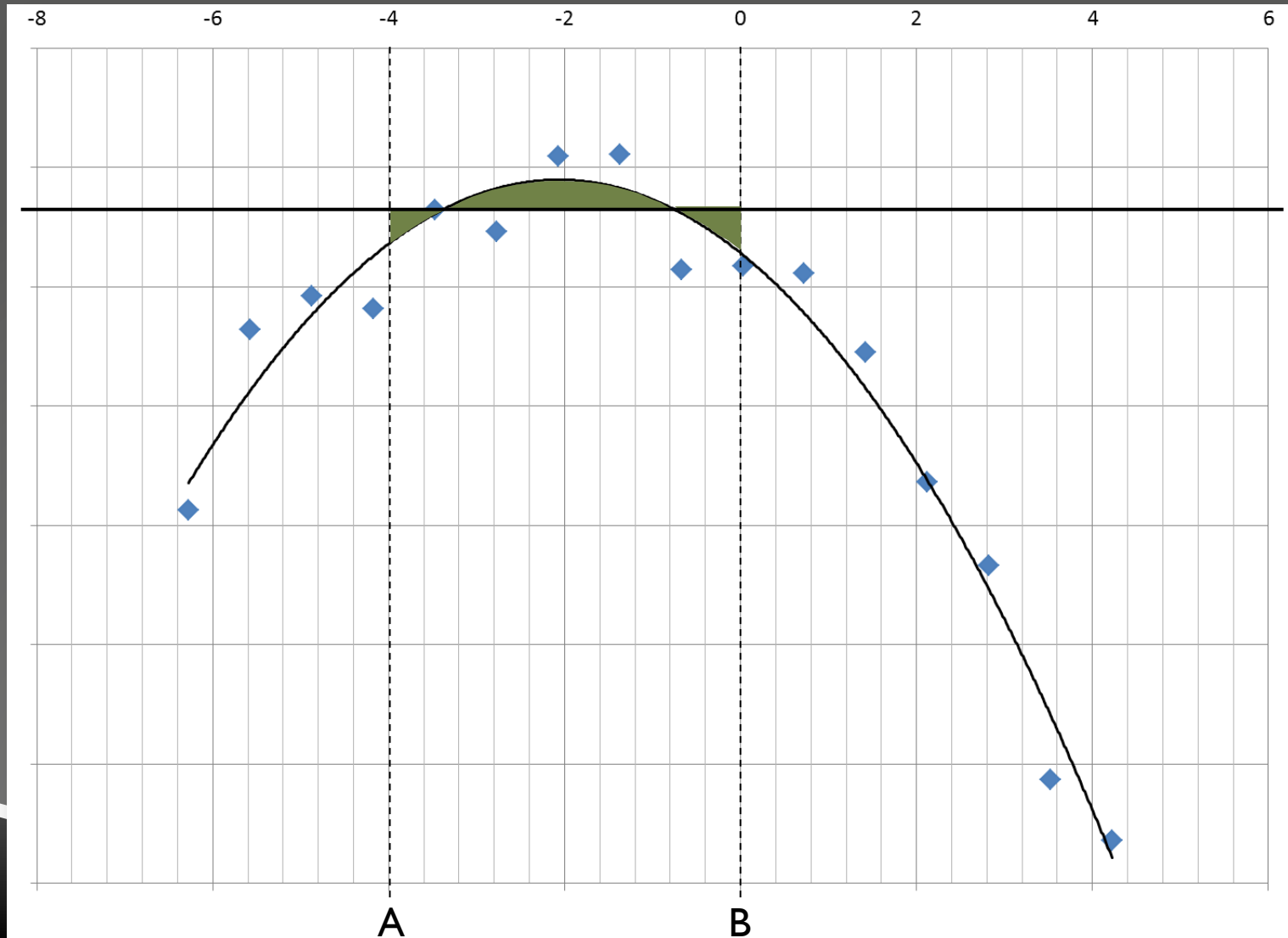


IS IT “FLAT”? IS IT “BETTER”?

- ▶ Eyeball test?
- ▶ Standard deviation?
- ▶ Slope?
- ▶ Curvature?
- ▶ Other...?

HARDER THAN I THOUGHT

Average
value from
A to B



YES IT DOES... MOSTLY

Distance in can	Not oscillated	Oscillated
10.5 in	1.261	1.193
7.7 in	0.579	0.774
5.6 in	0.136	0.099
4.2 in	0.082	0.055
2.8 in	0.058	0.033

OTHER BENEFITS

- ▶ Ability to reposition non-oscillated samples within the stroke of the oscillator

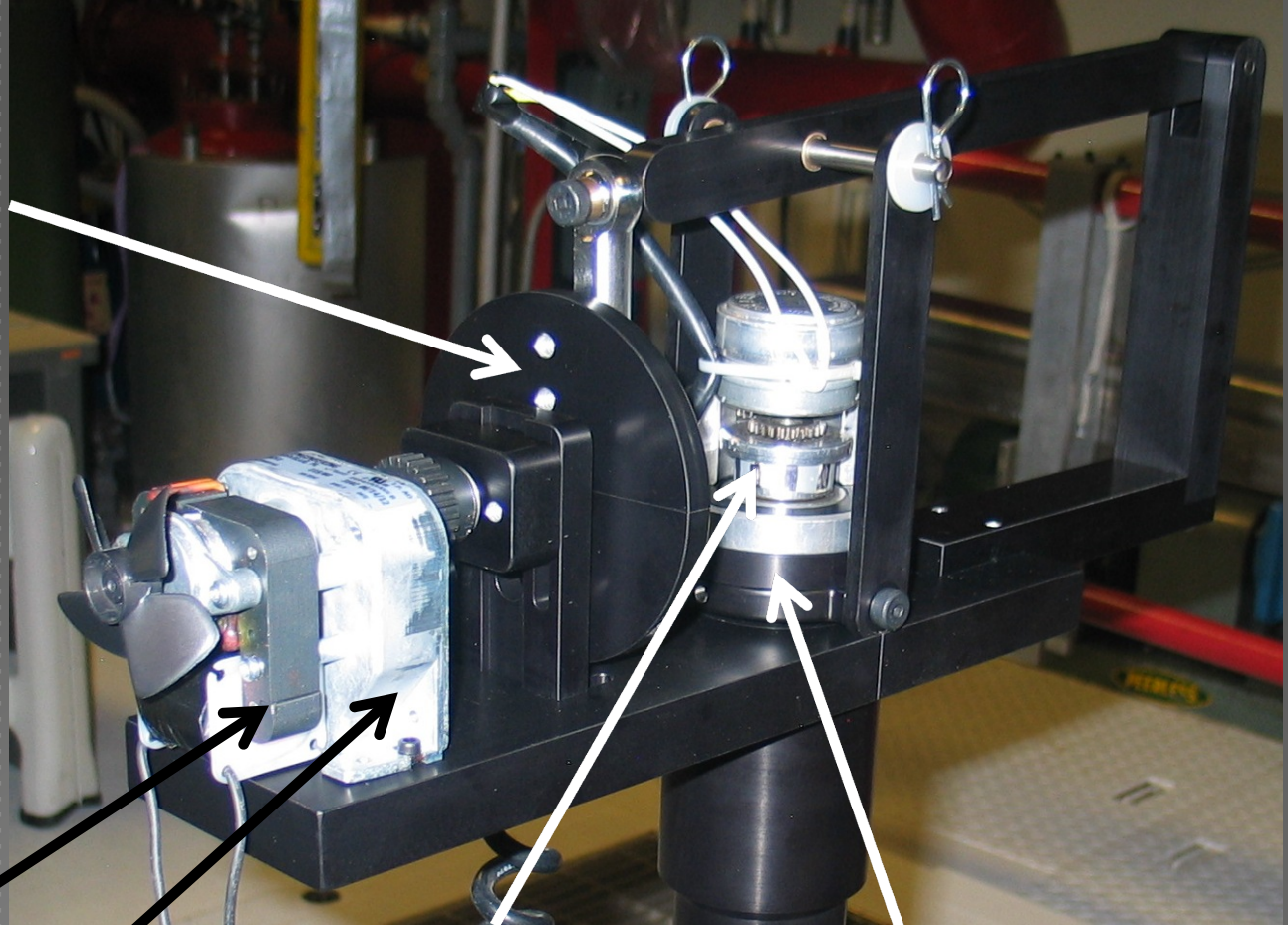
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Sample rotating
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Oscillating
sample mount



RADIAL GRADIENTS

- ▶ Reduce radial gradients
- ▶ Had this capability for years
- ▶ Clock gear motor
- ▶ Works great

CONCLUSIONS

- ▶ Most $^{40}\text{Ar}/^{39}\text{Ar}$ researchers think it is an advantage.
- ▶ The ability to reposition samples without changing rod configurations is a time saver for our facility.