

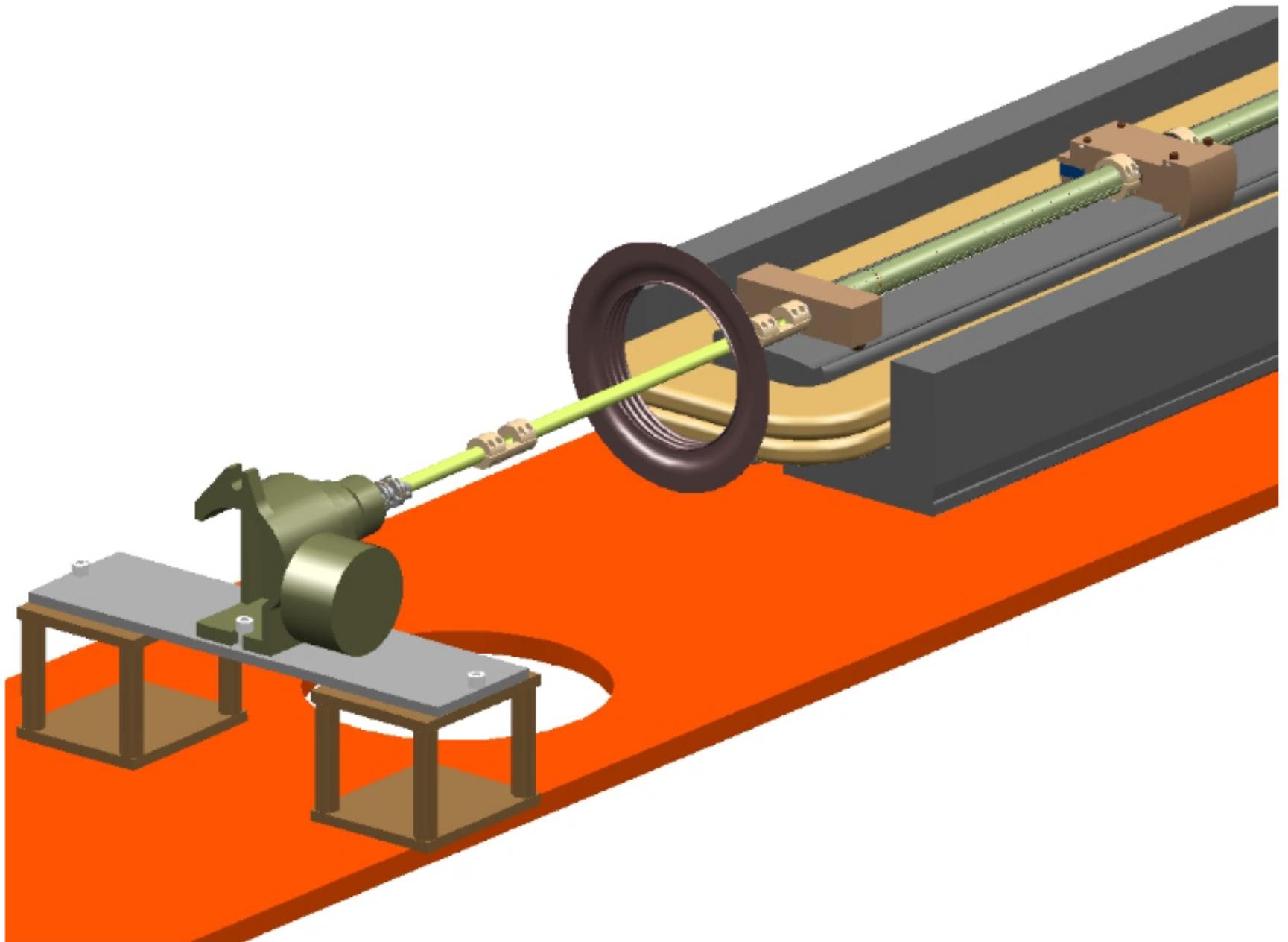
Ac booster magnet measurements with an indexed rotating coil

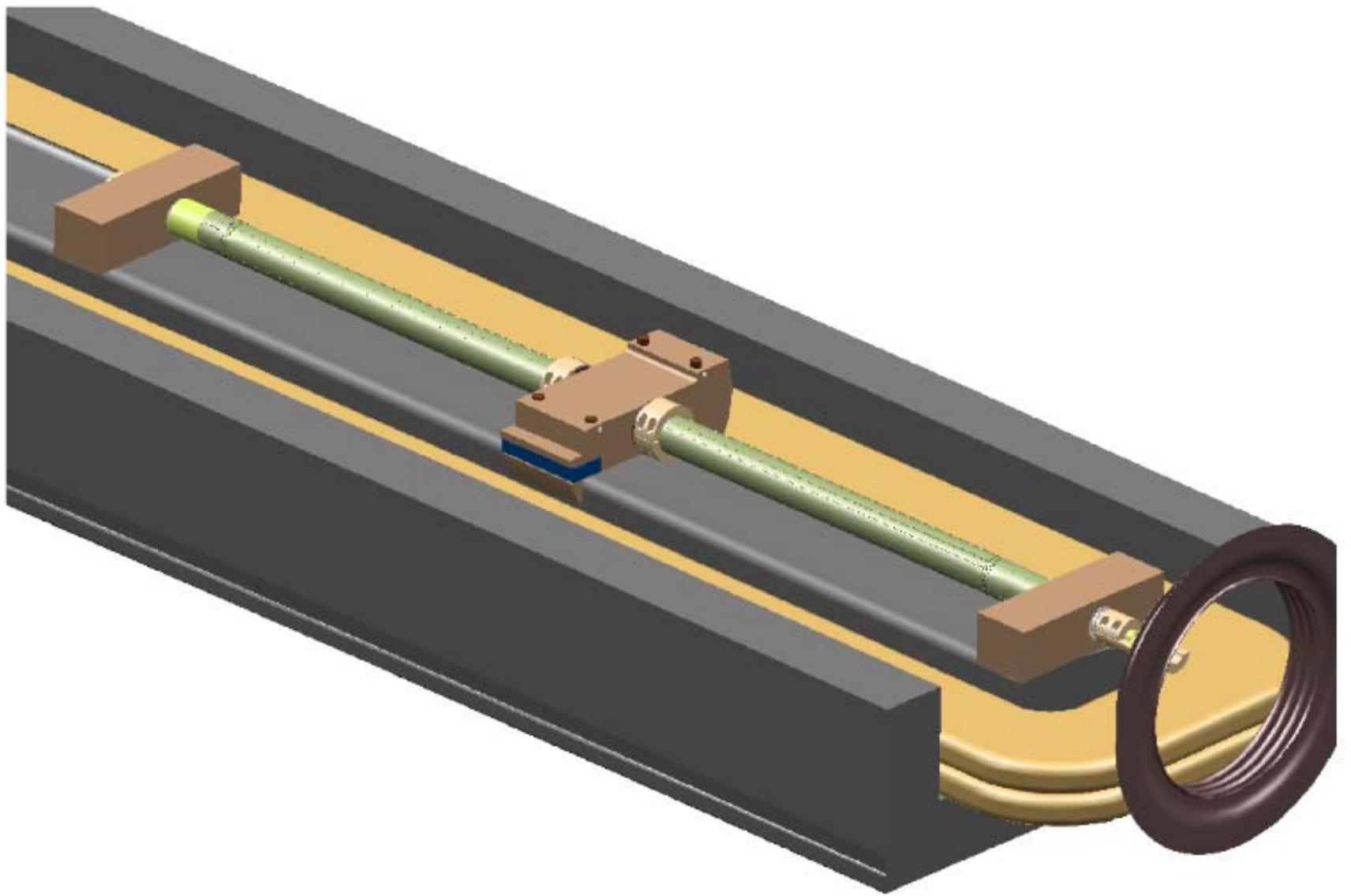
- ◆ Alternate technique to SSW
- ◆ Integrate signal at fixed angle from t_1 to t_2
 - Index by fixed angle, repeat
 - Fourier analyze results
 - ◆ Extract $b_n(t_2)-b_n(t_1)$, $a_n(t_2)-a_n(t_1)$
 - ◆ t_1 , t_2 correspond to I_1 , I_2
 - ◆ If $b_n(t_1)$, $a_n(t_1)=0$, this gives the usual results, instead get the **change** in multipole coefficients up the ramp

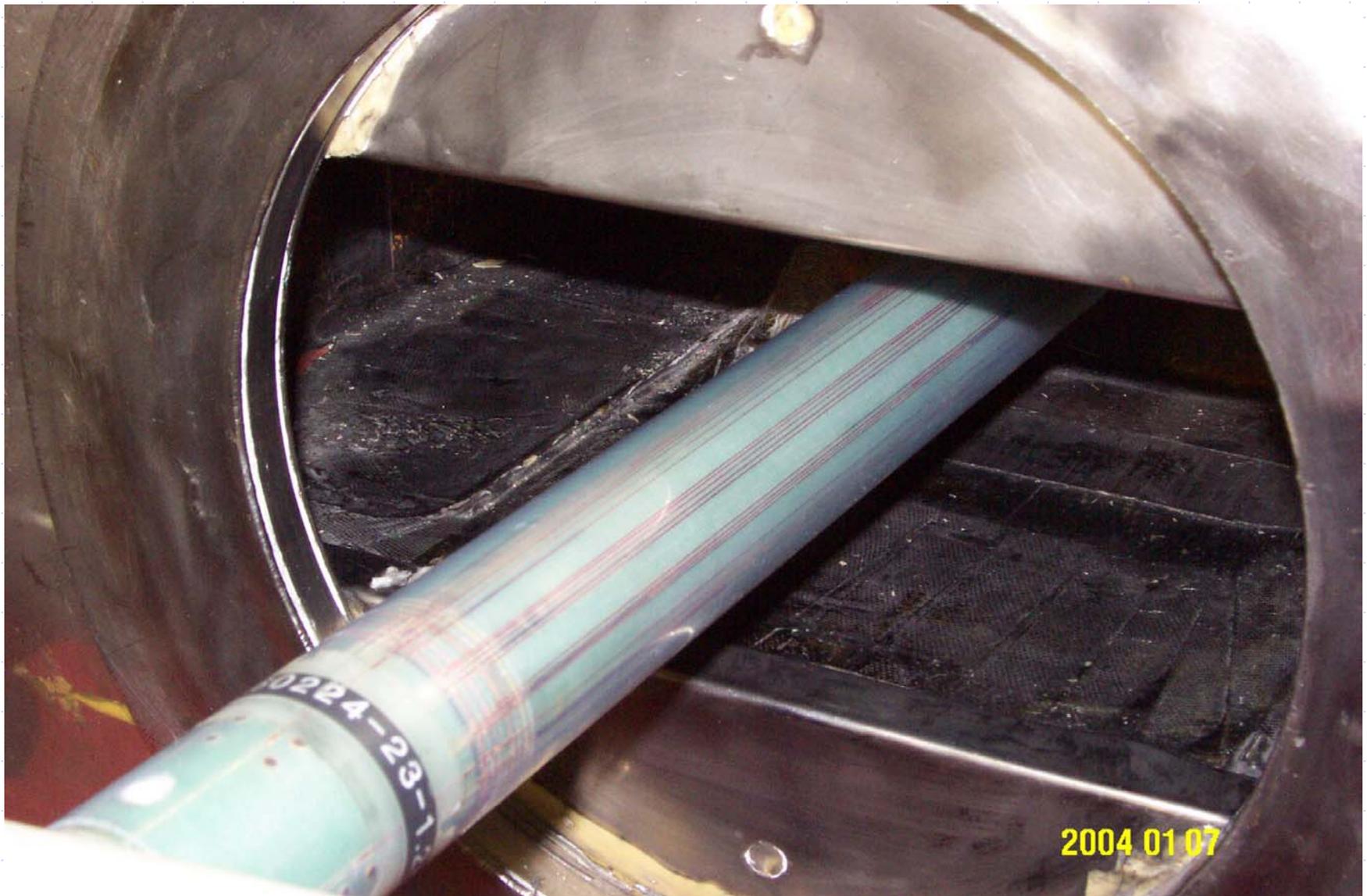
Ac booster magnet measurements with an indexed rotating coil

◆ more details

- Record analog bucked tan winding or summed (series connected) Morgan coil windings (analog bucking for free)
 - ◆ Use DVMs with external triggering and script to record winding voltage and magnet current
 - Synchronize first external trigger to cycle current and record "n" triggers up the ramp
 - cycle current synchronization imperative



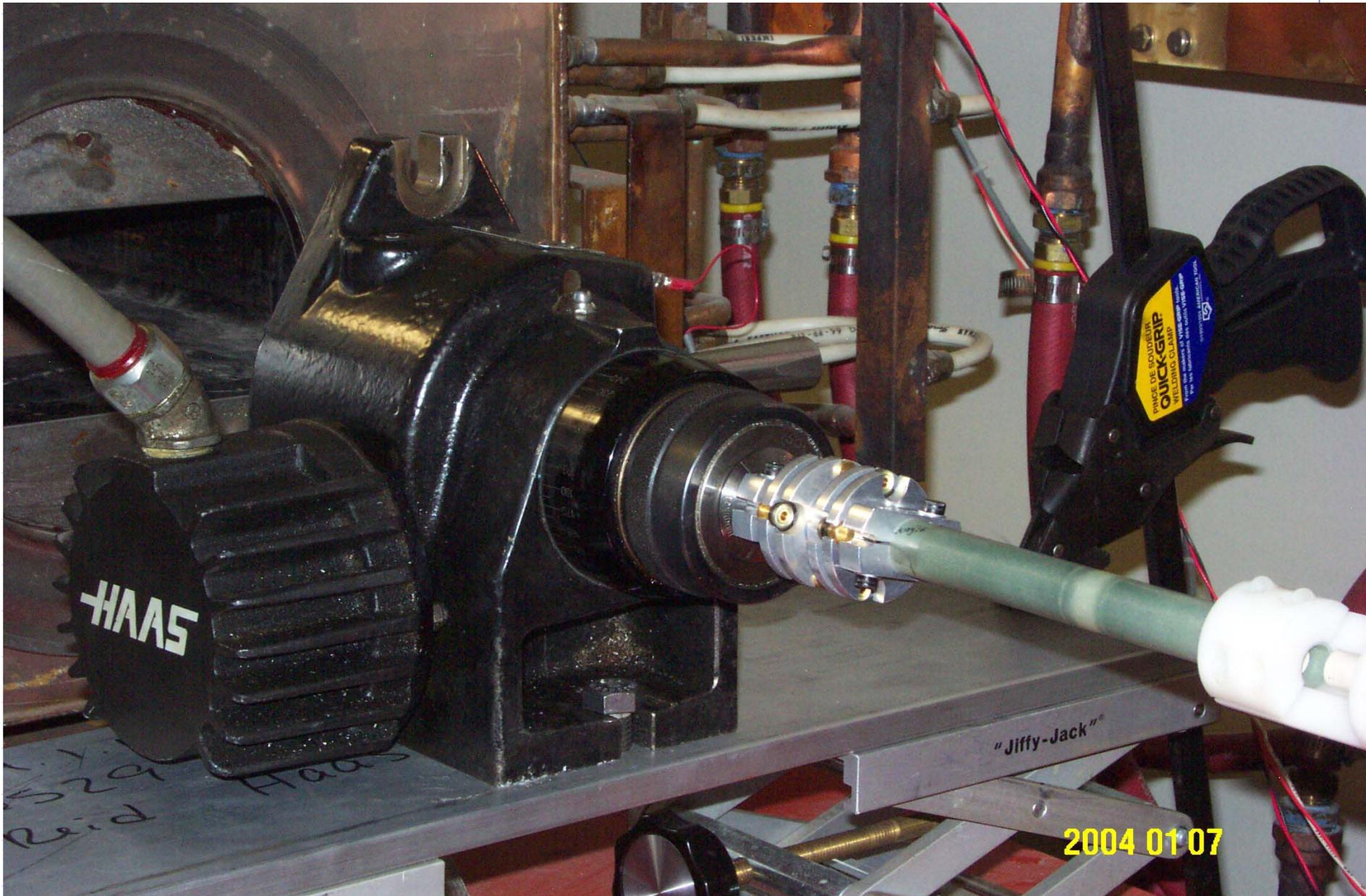






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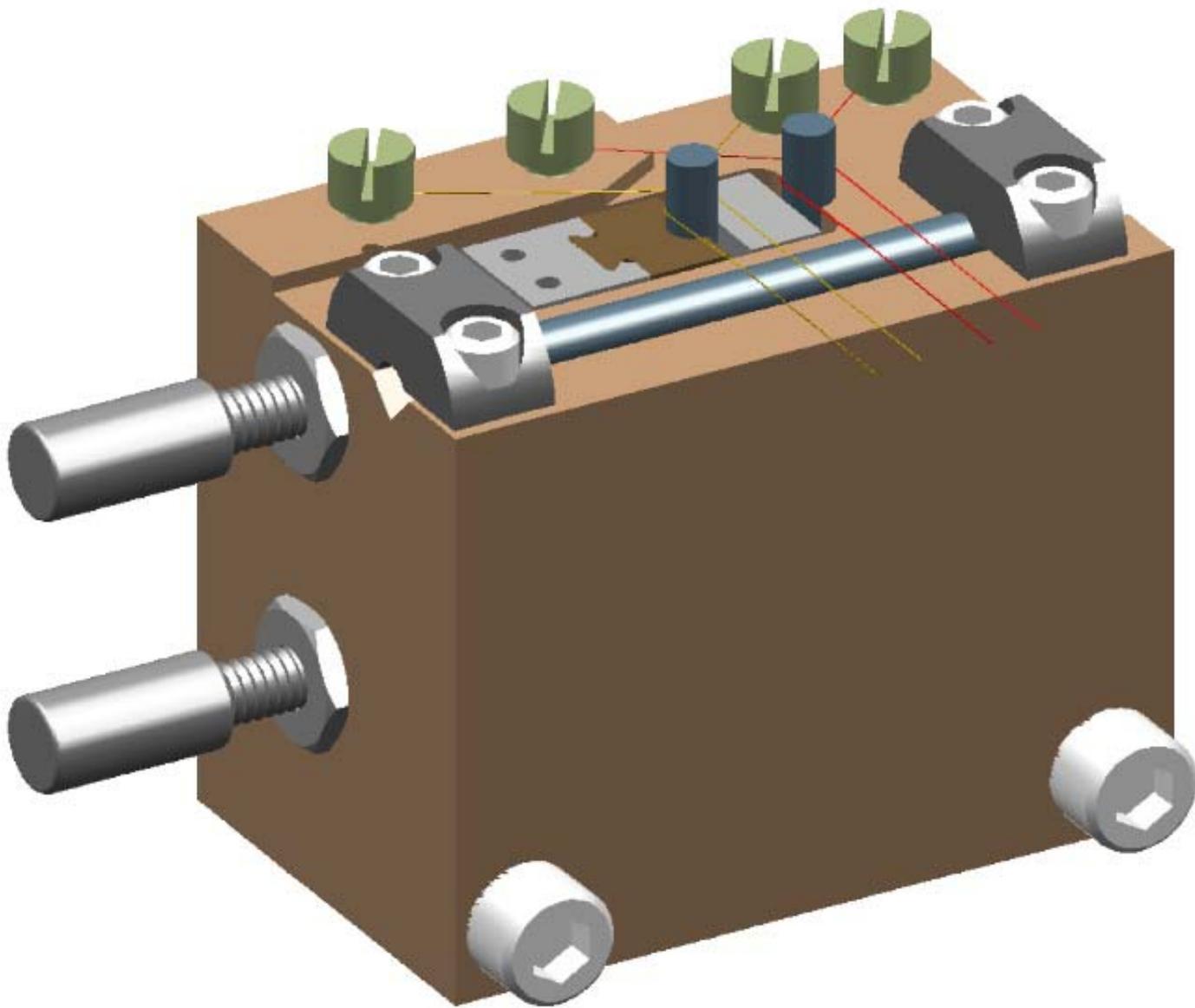


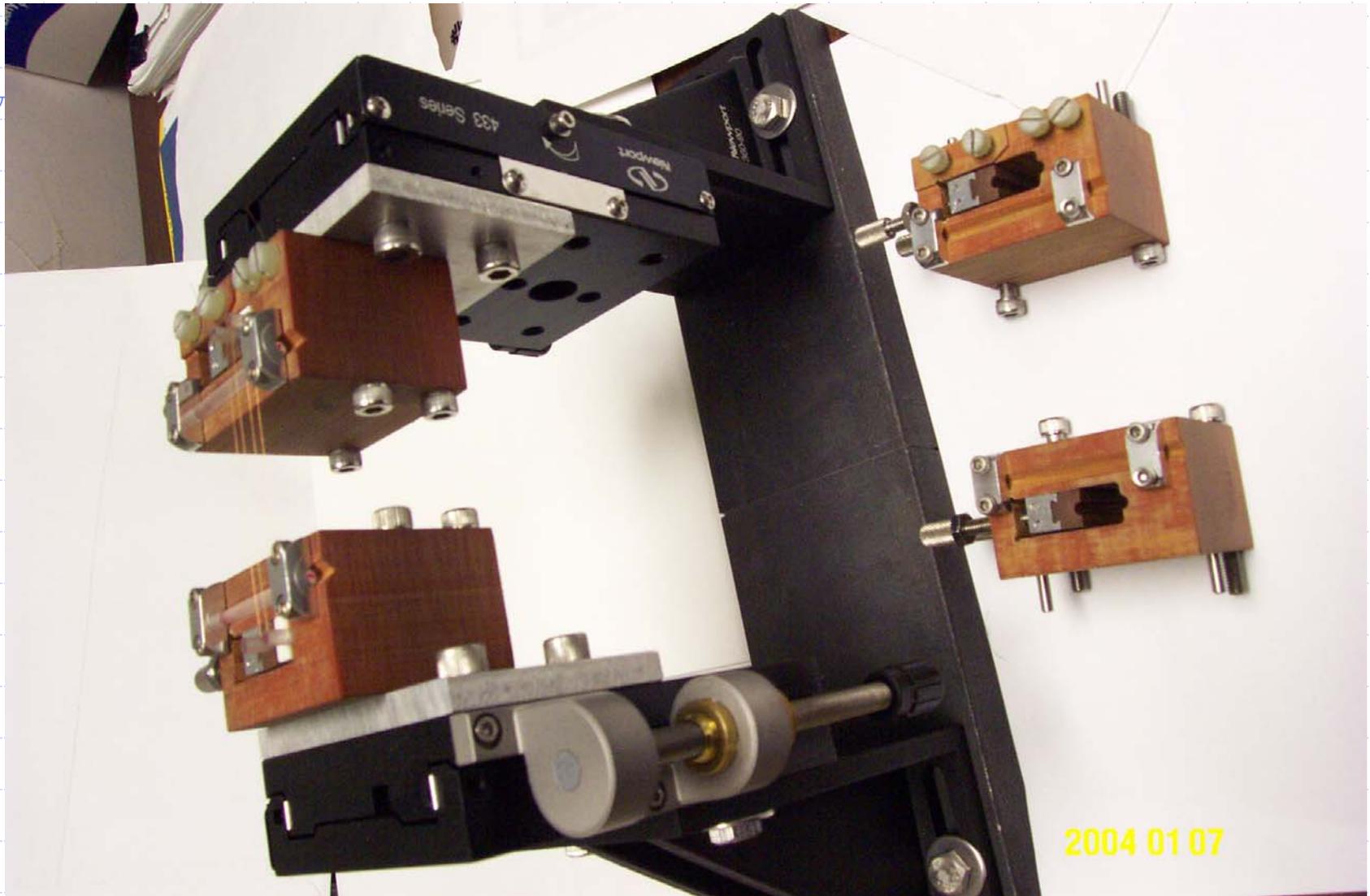


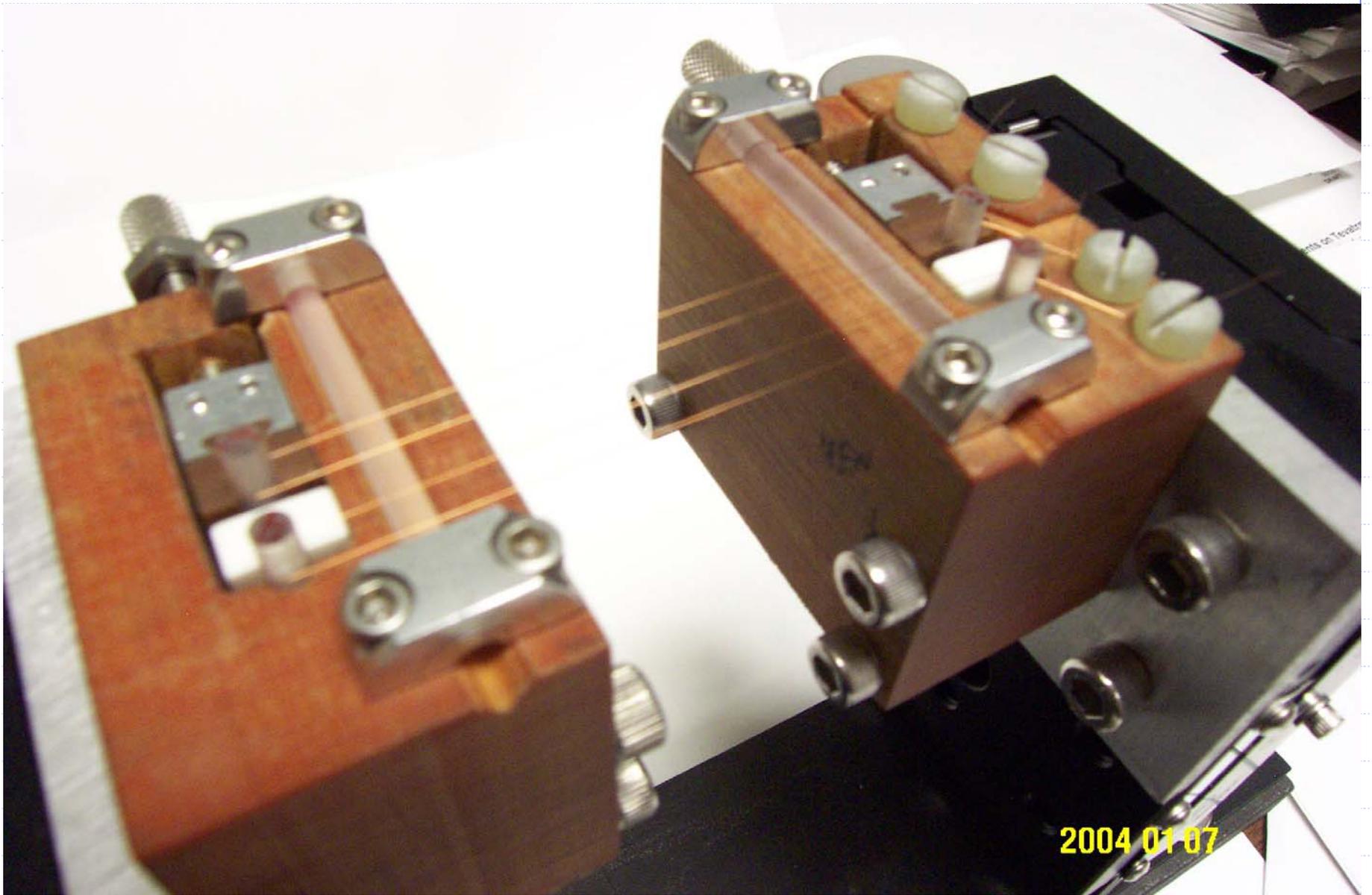


Booster AC measurements with SW

- ◆ SW gradient fixtures mounted on SSW stages, translated across aperture with AC measurements at each position.
- ◆ Simultaneously sample current, gradient, and bucked gradient changes due to ramping (use 3 similar devices 3458's or PDI's (internal triggering with external sync from power supply)).
- ◆ Normalize the measure flux changes in bucked (i.e. moving–fixed) combination with the (fixed) gradient flux change (obtain change in gradient normalized by reference gradient).
- ◆ Assemble normalized Δ flux vs x-position “snap-shot” at each current (might also normalize to current change) – fit to extract field coefficients during each snap-shot.
- ◆ Stationary fixtures could be mounted near center so that gradient would be bucked as well as dipole. In principle bucking should be very good.







Harmonics

Flux in reference gradient winding (DataAcq)

$$B_0(I) \frac{b_1(I)}{R} DWL_m$$

Flux in moving winding

$$B_0(I) \frac{b_1(I)}{R} DWL_m - B_0 \frac{b_2(I)}{R^2} 2x DWL_m + \dots$$

D distance
between loops,
W is width of
loops

Bucked flux (moving – ref) (DataAcq)

$$B_0(I) \frac{b_2(I)}{R^2} 2x DWL_m + \dots$$

Bucked flux normalized to ref. grad (calculated)

$$\frac{b_2(I)}{R b_1(I)} 2x + \dots$$

SW gradient probe

- ◆ 2 pairs of sw-grad fixtures: one mounted on stages, the other fixed near magnet center
- ◆ SW gradient fixtures mounted on stages are translated across aperture: AC measurements at each position.
- ◆ Simultaneously sample current, gradient, and bucked gradient changes due to ramping (use 3 similar devices 3458's or PDI's (internal triggering with external sync from power supply)).
- ◆ Gauge blocks 2, 5mm distance (D), rods are 3mm width (W).
Minimize D,W to reduce harmonics error terms
Maximize D,W to reduce errors terms from differences in W's
 - ➔ Sapphire rods have diameters same to $<1\mu\text{m}$. Ceramic gauge blocks also with sub-micron dimensional accuracy. Still may need to calibrate against DC measurement...

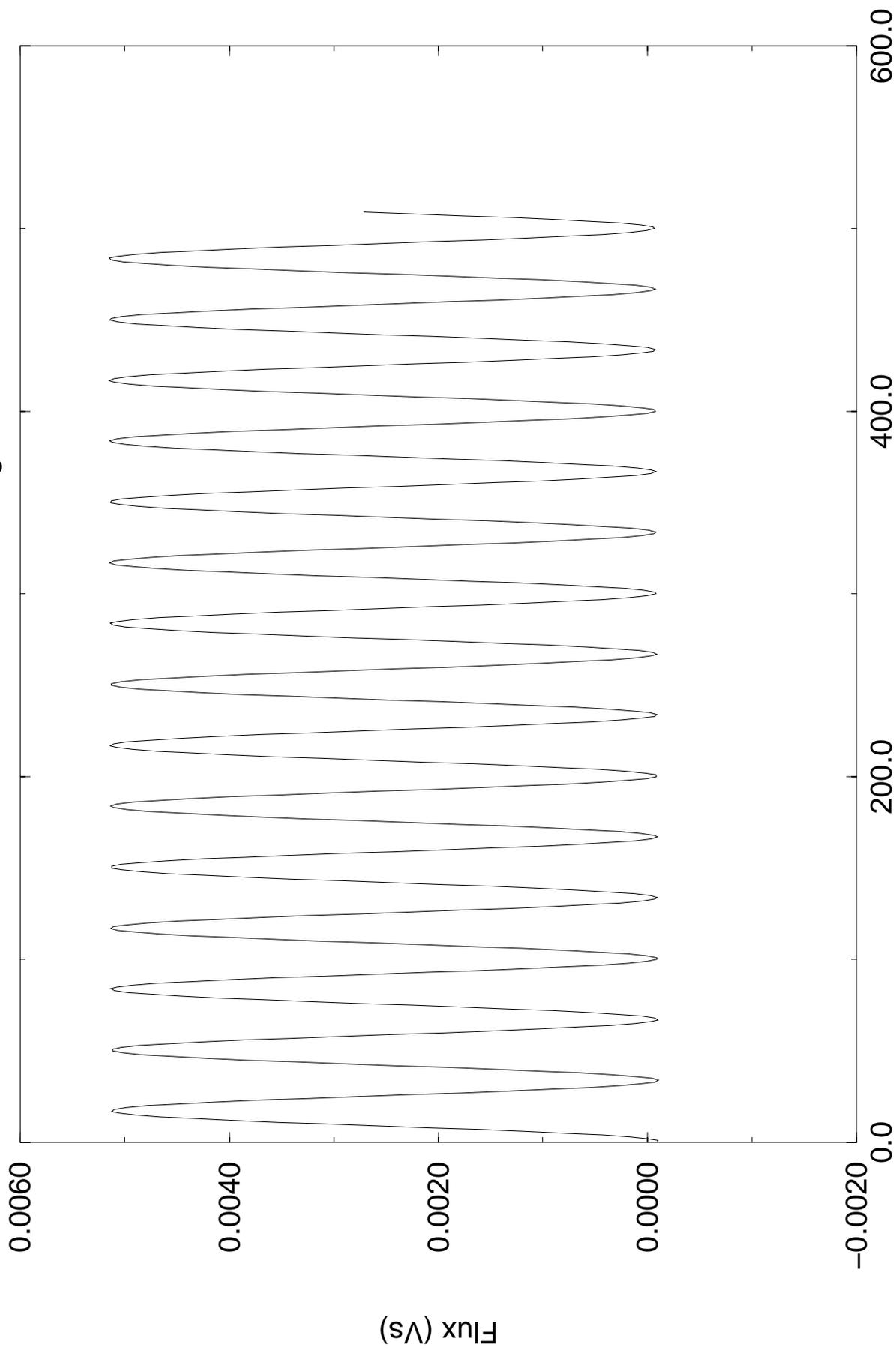
Status

- ◆ Indexed rotating coil completed and assembled in D10 at E4R.
- ◆ Data acquisition has started.
- ◆ SW-grad fixtures completed (including mounting on stages).
- ◆ Power supply runs in voltage regulation mode for AC meas.

Current is obtained from Holec transducer; consecutive cycles may not have same timing of synch trigger. Trigger module with adjustable threshold and delay being used to try to match current start cycle to cycle.

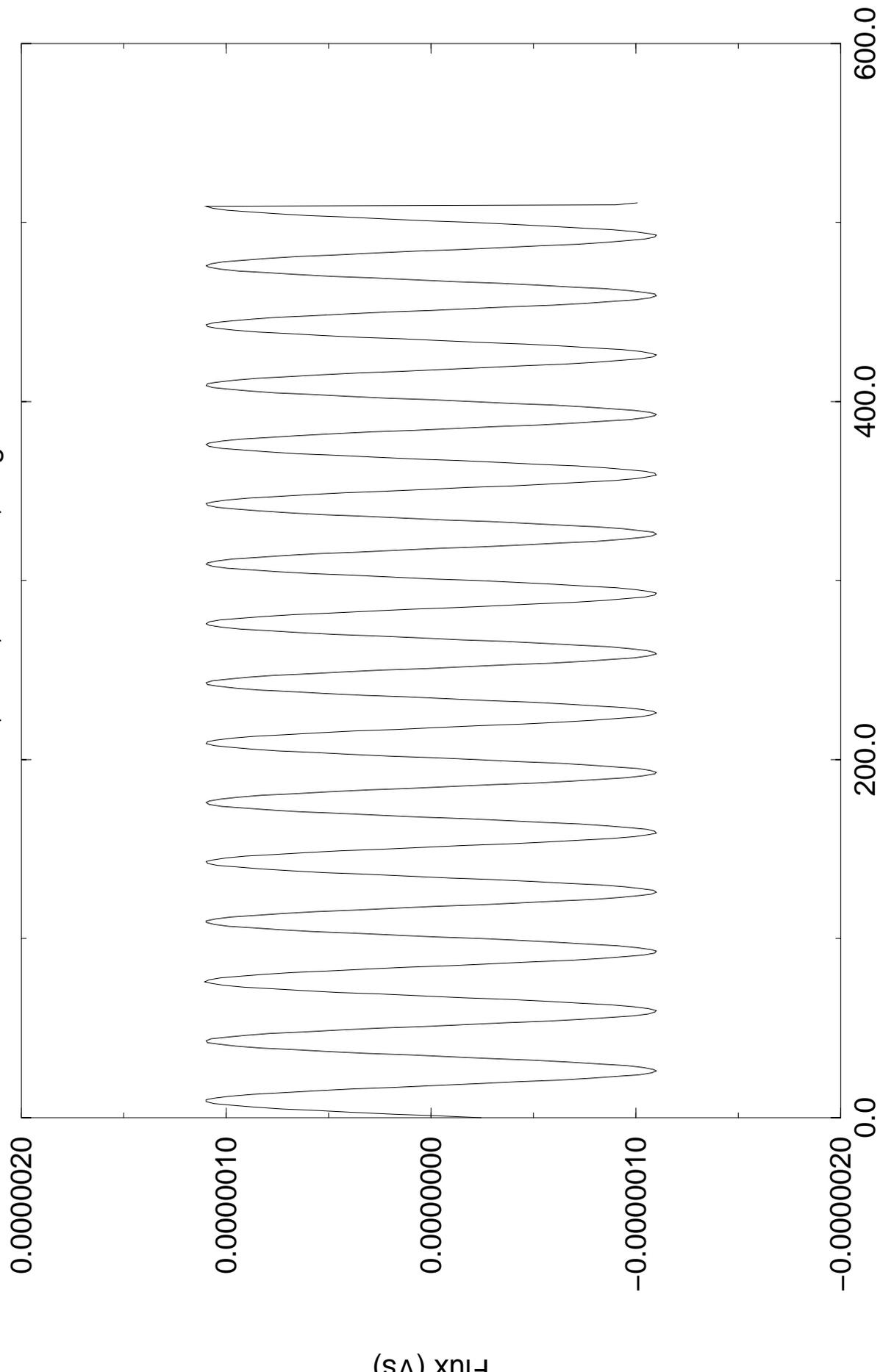
Dipole Winding Integrated Voltage

D10, test1, 09Jan04, Angle 90



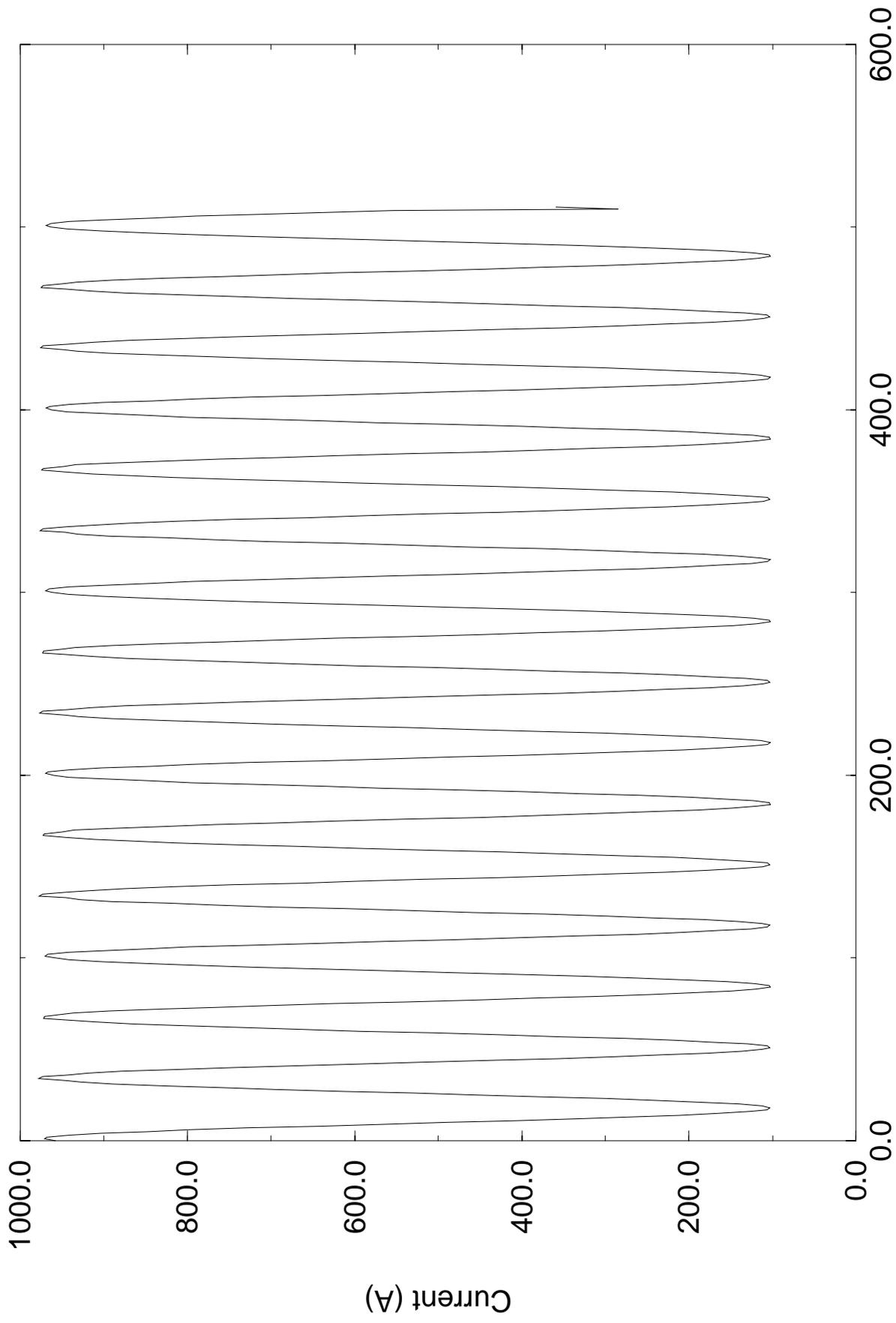
6p Winding Integrated Voltage

D10, test1, 09Jan04, Angle 90



Current vs. Sample

D10, test1, 09Jan04



Current Difference

D10, test1, 09Jan04, two consecutive data sets at 0 deg.

