

APEX 09

Instrumentation Update

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Hardware Update and Plans

- BPM feedthru repair
- BBQ system
- IPM hardware
- Laser Profile Monitor
- Spin Flipper

BPM hardware

- Existing feedthrus develop loose pins and corrosion – manufacturing flaw of the solder connection?
- New design is much more robust.... We hope...Welded center pin
- Last year 75 feedthrus were replaced – 64 bad, 11 preemptively
- 81 additional feedthrus replaced this year for a total of 145 in two years.
- Almost all of these were preemptive, rotators, triplets and stochastic cooling
- 25% of all feedthrus have now been replaced

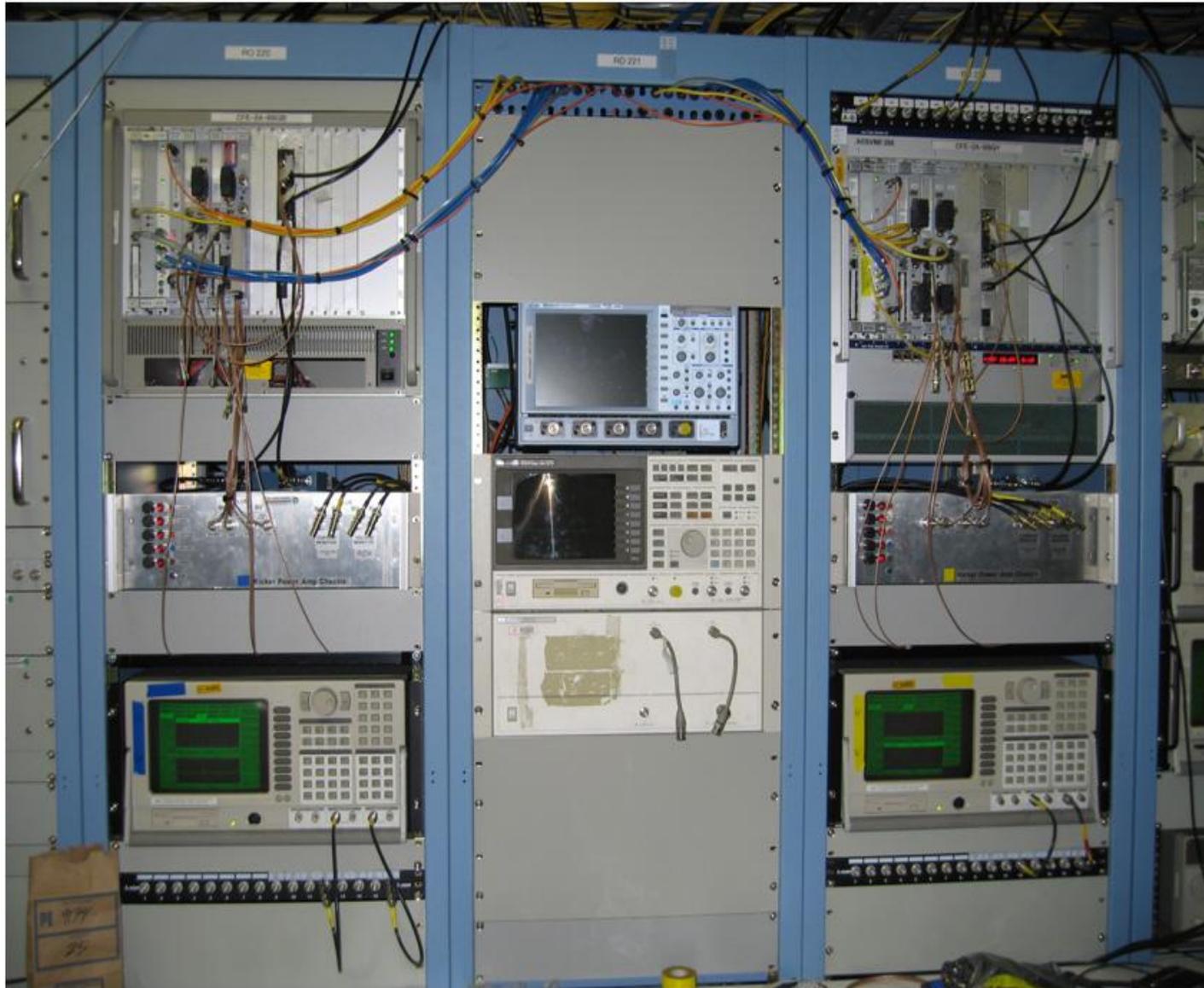
BPM feedthru picture – comparing new and old



BBQ system

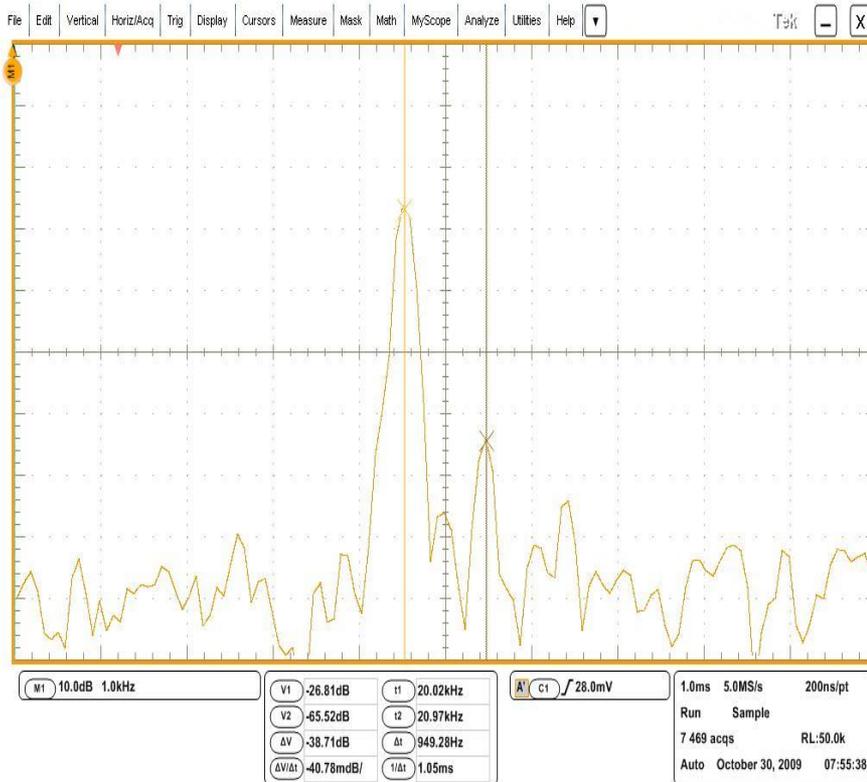
- Cleaned up cabling, added covers and front panels.....
- Removed unused/un-needed equipment
- Added test points to monitor performance and allow remote monitoring of the AFE
- Added Spectrum analyzers as independent monitors of the system
- Installed Hall effect current transducers in the Kicker Amps
- A Data Acquisition System was installed to monitor and record the information from the test points and Spectrum Analyzers during each ramp
- Packaged the resonators as permanent test fixtures
- Added filtering to reduce crosstalk in the Kicker Amplifiers

BBQ Rack Layout (after)



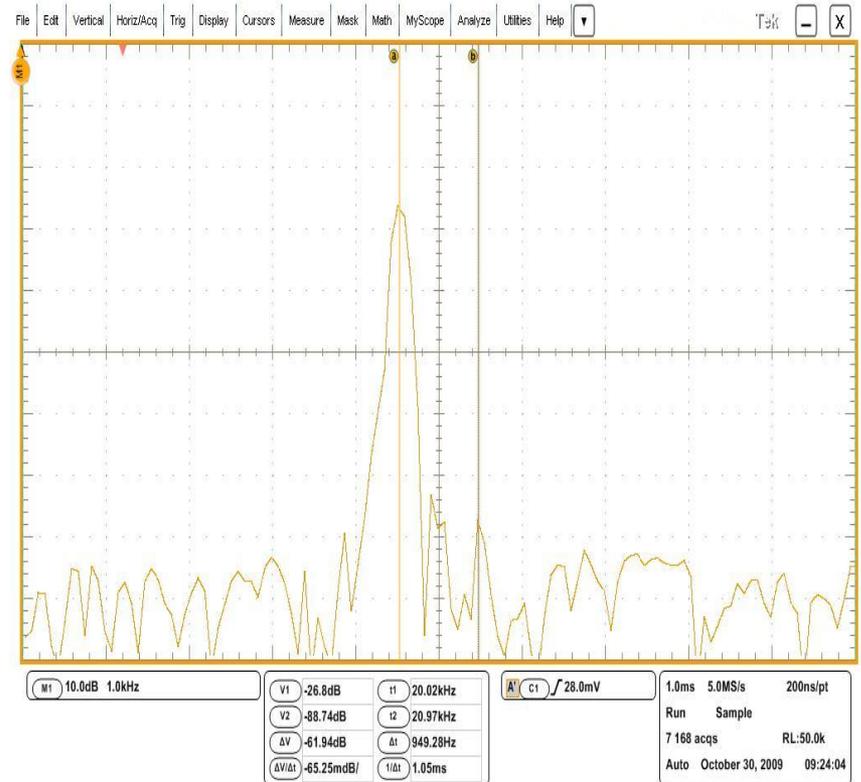
Kicker Amplifier Crosstalk reduced by 23dB

Before additional filtering the channel separation was 38.7dB



	Value	Mean	Min	Max	St Dev	Count	Info
C4	Freq	1.5MHz	792.70142k	17.35k	4.167M	643.6k	7.474k
C1	Freq	20.06kHz	20.035345k	19.8k	20.26k	62.53	7.474k
C4	Pk-Pk	7.2mV	7.6631034m	7.2m	9.6m	466.3μ	7.474k
C1	Pk-Pk	108.0mV	107.39142m	104.8m	167.2m	796.2μ	7.474k

After the filtering was added the channel separation increased to 61.9dB



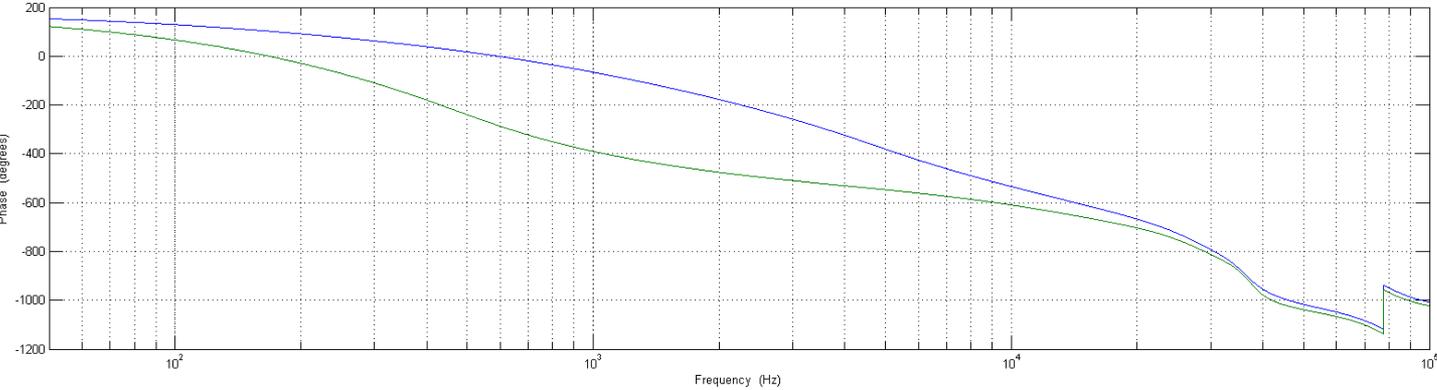
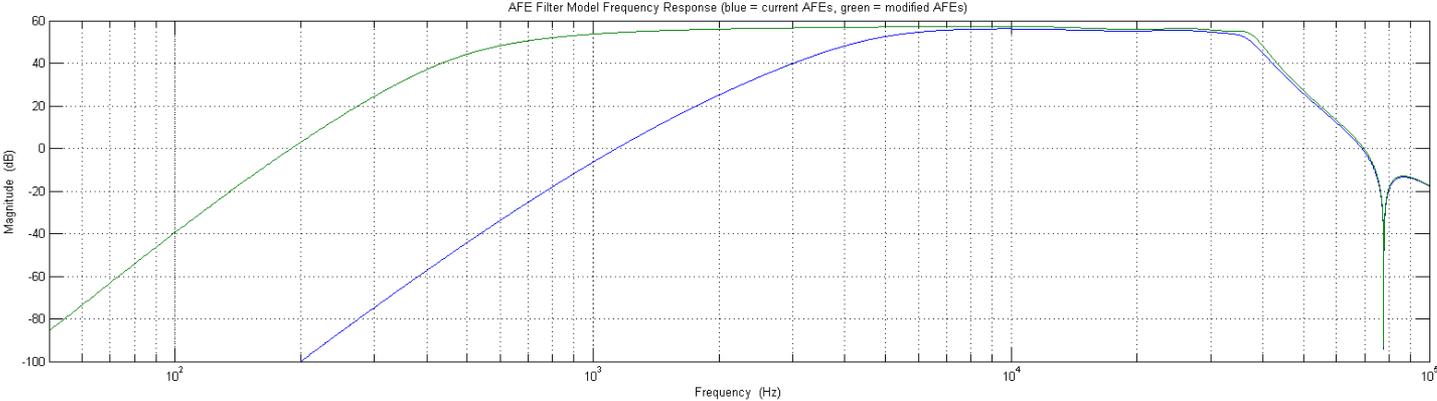
	Value	Mean	Min	Max	St Dev	Count	Info
C4	Freq*	526.3kHz	837.26239k	21.82k	4.167M	767.8k	7.168k
C1	Freq	20.15kHz	20.015198k	19.79k	20.28k	73.33	7.168k
C4	Pk-Pk	7.2mV	7.6734567m	7.2m	9.6m	444.5μ	7.168k
C1	Pk-Pk	108.8mV	107.48665m	104.8m	112.0m	737.3μ	7.168k

BBQ System

- Simulations and bench measurements to verify performance were completed
- Spares ... 4 new AFEs and 8 Diode detectors have been built
- Modified the AFEs for Near-Integer operation

- Identified and corrected some NCO and digitizer noise issues
- Extensive Software / Data processing improvements.....
- All FEC's changed from MV2100 to MV3100 for consistency and improved performance
- Network modifications and upgrades have been completed
- <http://www.cadops.bnl.gov/Instrumentation/InstWiki/index.php/BBQ>

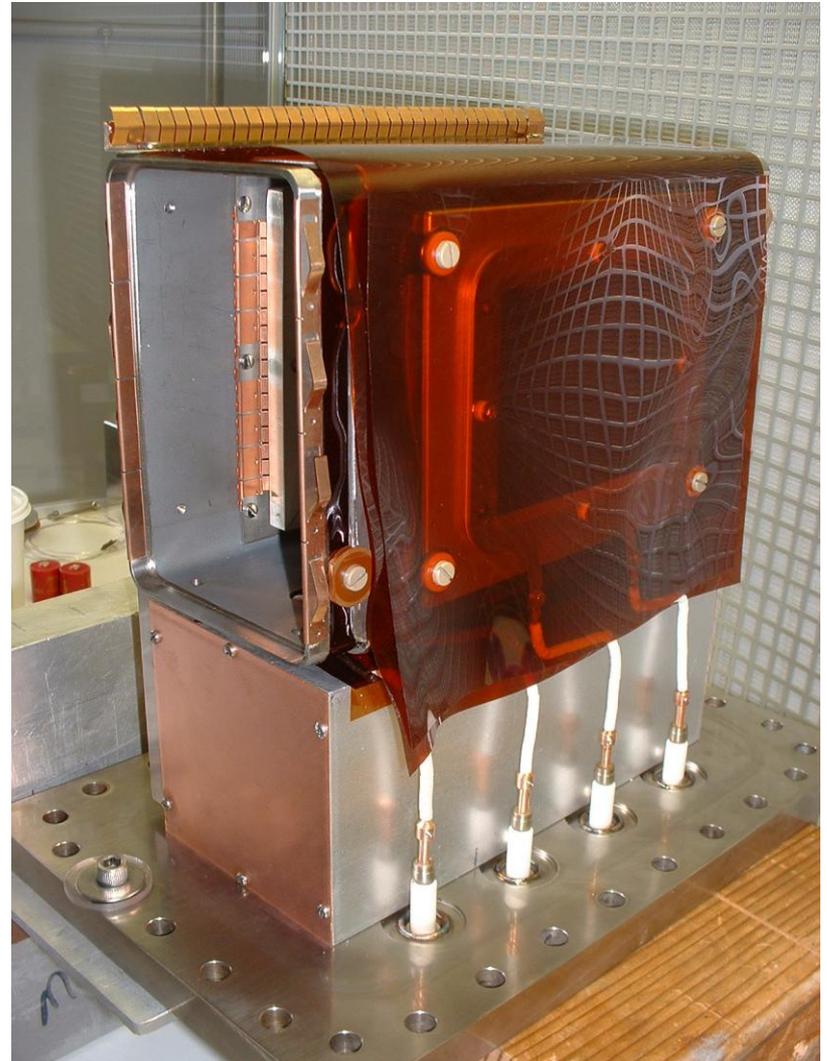
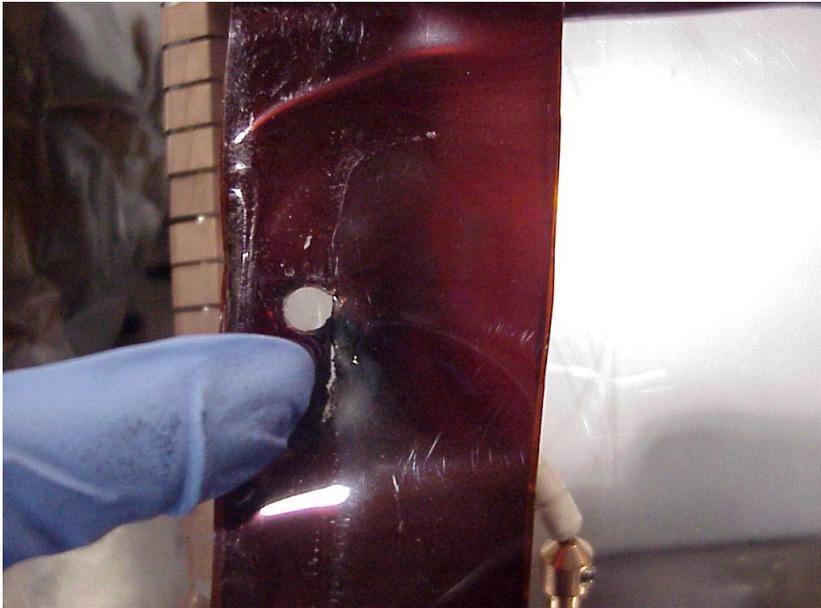
AFE Frequency Response Modified for Near Integer Operation



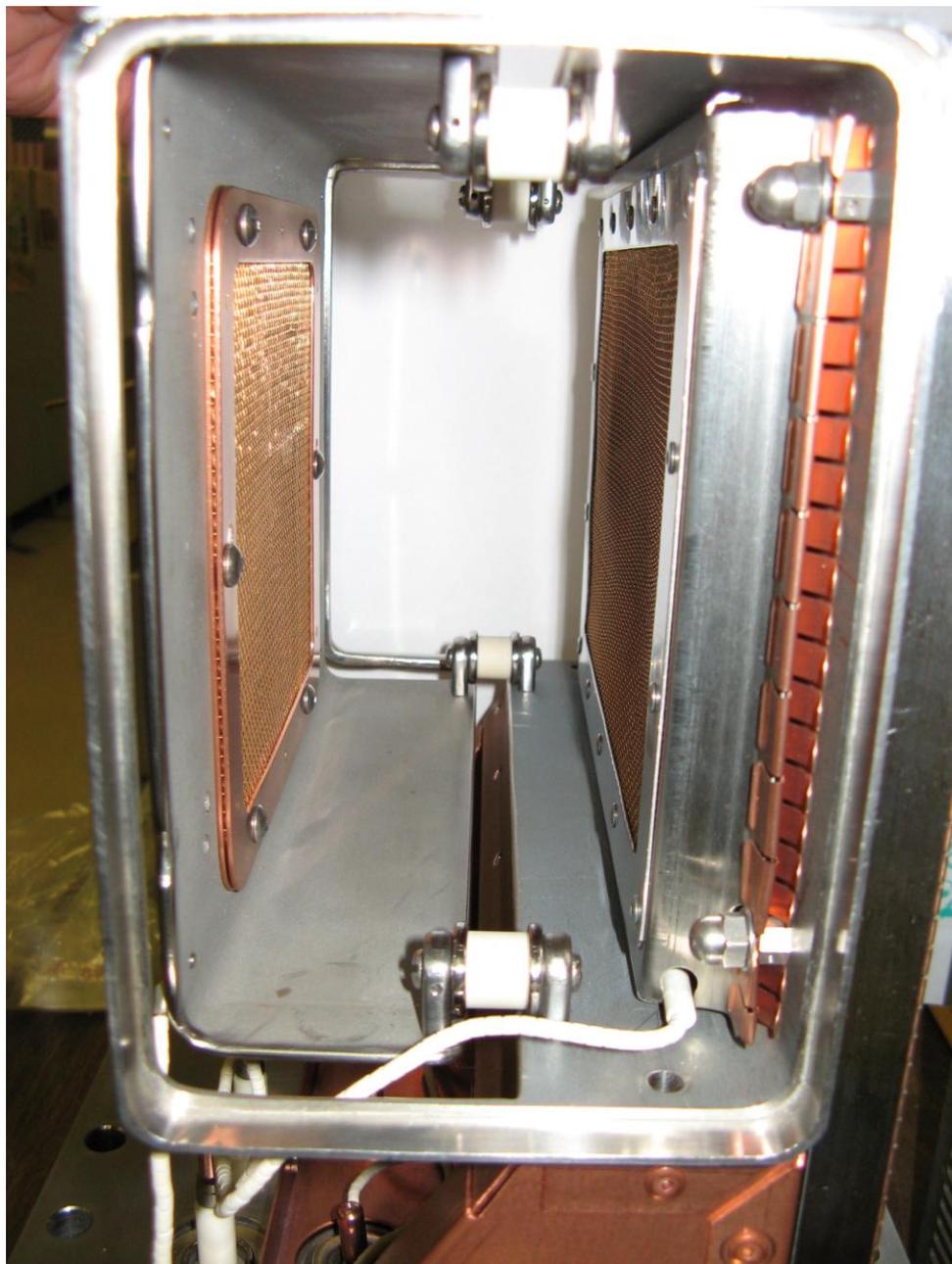
IPM upgrade

- HV failure about three years ago motivated changes....
- Two years ago we built a more robust device – remove kapton as much as possible
- New high voltage standoffs were used....
- Placed in YV. Ran well two years...
- Jesse/Roger developed the “final” version – places ceramics out of the beam path, fully shields micro channel plate...
- We are now using alumina circuit boards that can be baked to 200 C...
- We will be building two units – horizontal only.
- One is done, ready for installation in the chamber installed in sector 1, the second to be completed late next week.

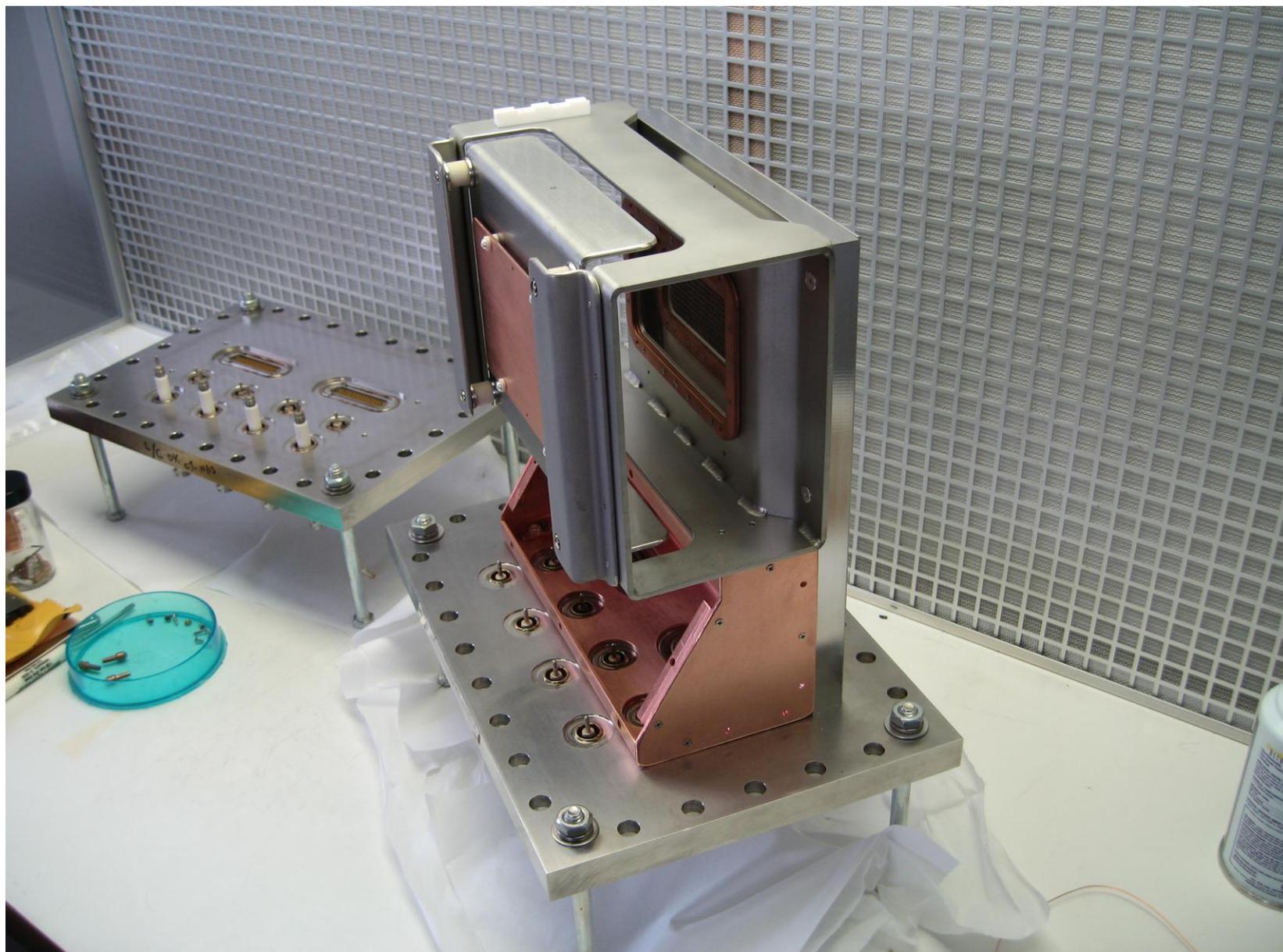
IPM upgrade – original design

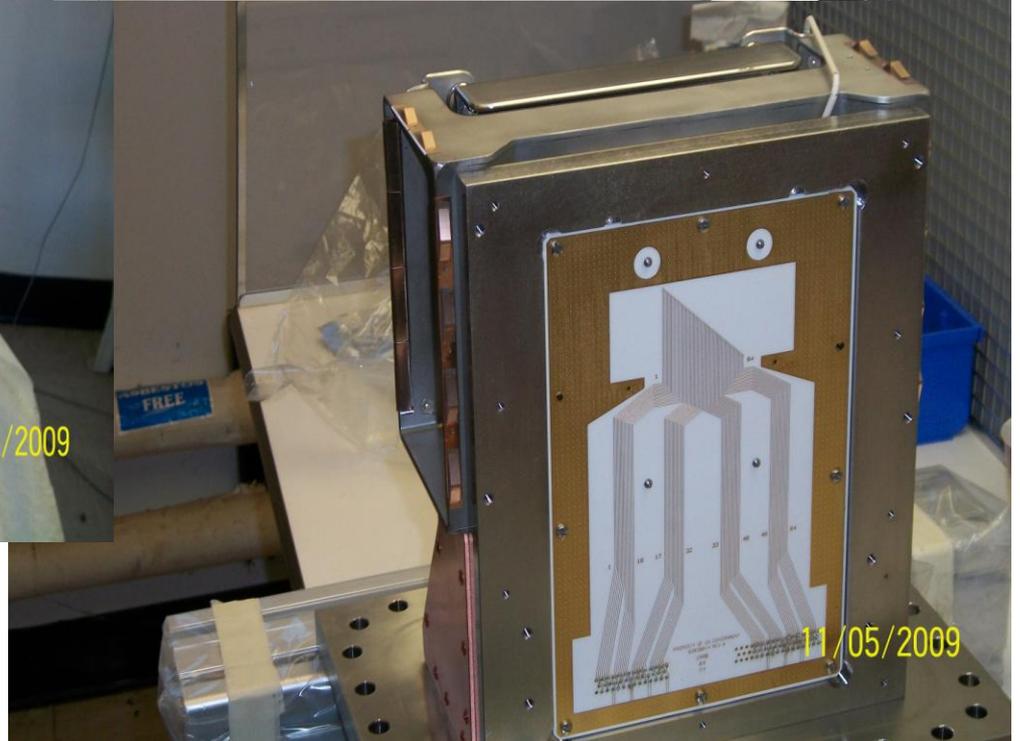
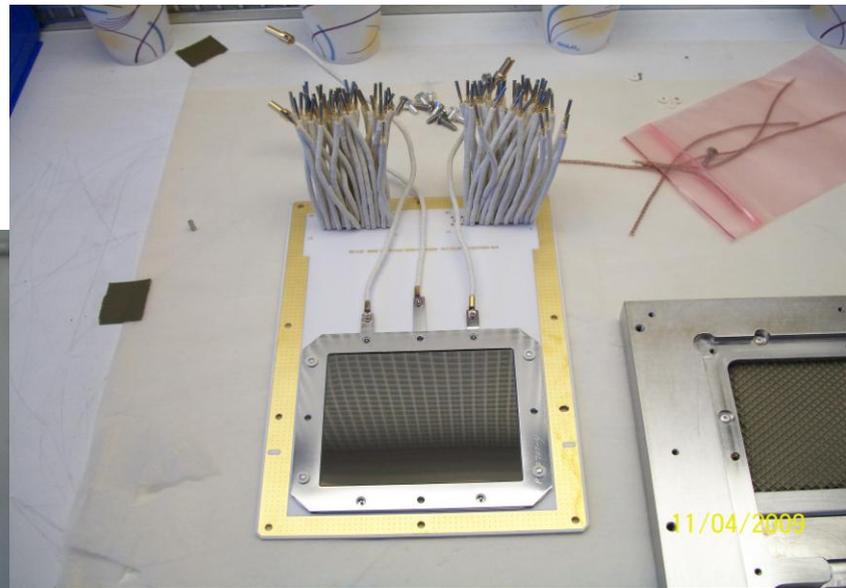


IPM vacuum upgrade yellow vertical - first prototype



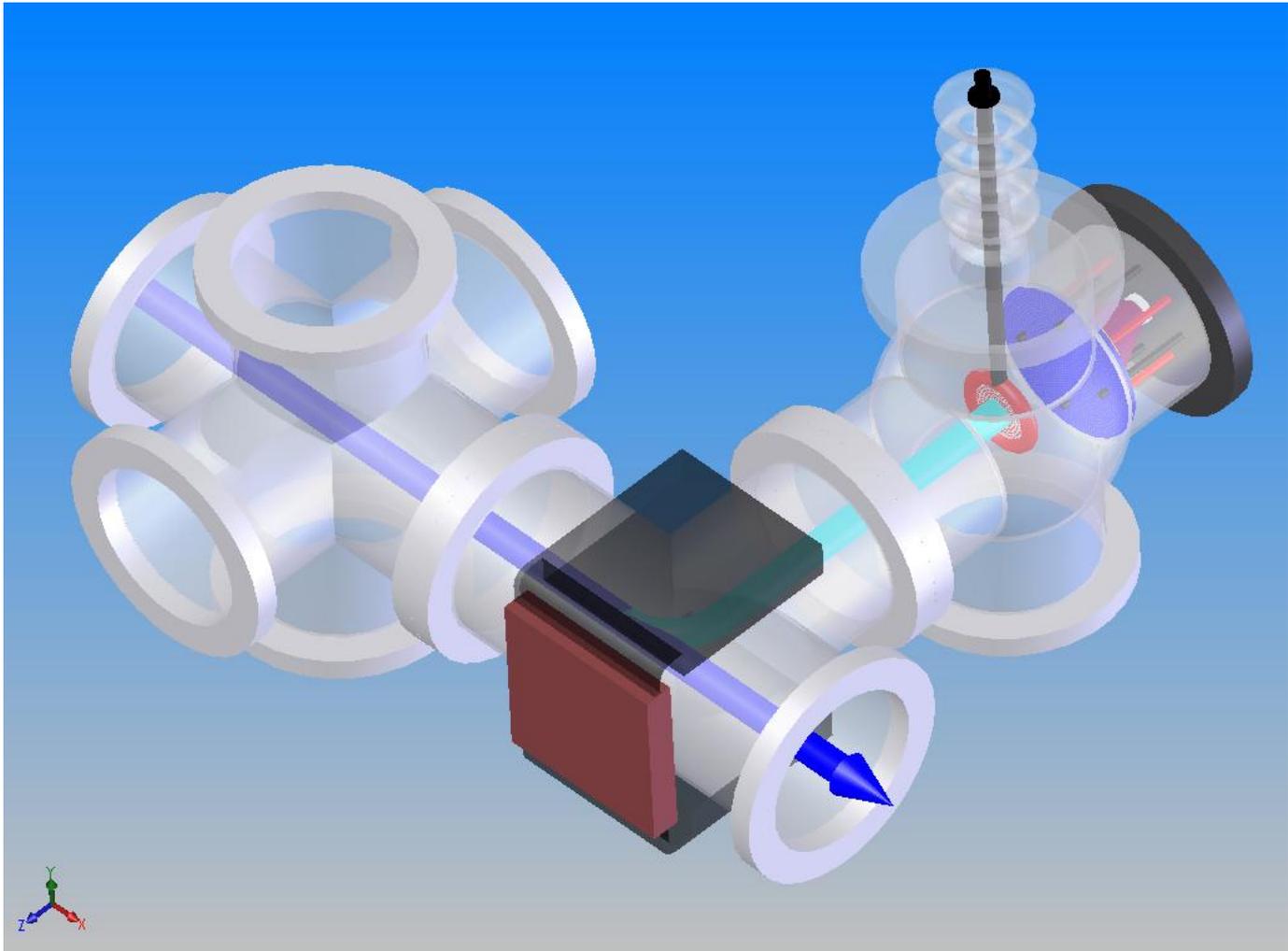
IPM upgrade





Laser Profile Monitor

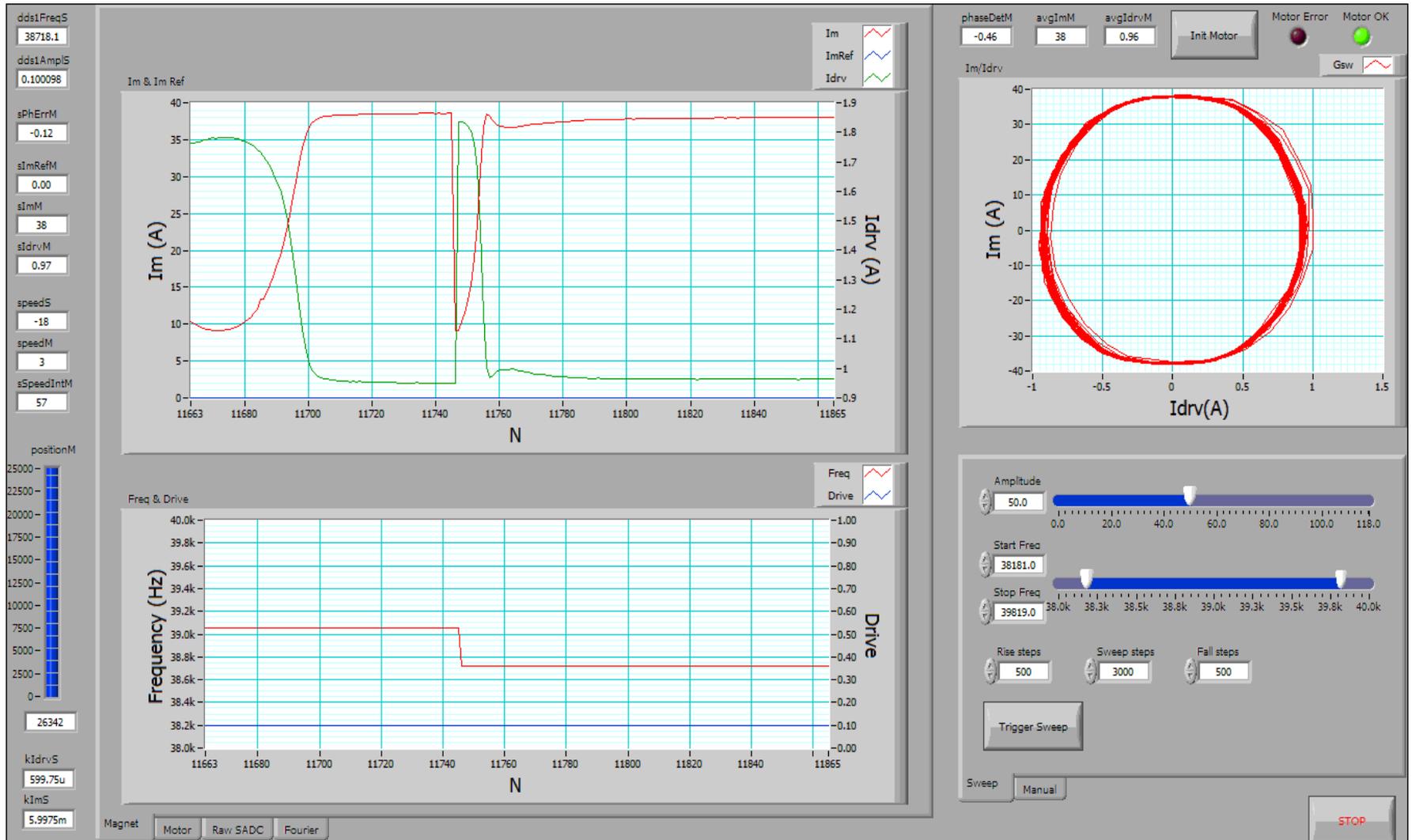
- Roger Connolly developed a device for scanning H- beam at the exit of tank 9 linac.
- Successfully demonstrated profile and energy distribution measurements with a similar device tested in the MEBT at 750keV.
- This was developed for the High Intensity Neutrino Source (HINS) at Fermilab.
- Based on laser photo neutralization.
- Electrons liberated by the laser are deflected into a Faraday cup detector by a DC dipole magnet.
- The profile is measured by scanning the laser across the beam.
- An energy measurement is made by ramping the voltage on a control grid in front of the electron collector.
- Developing this instrument may prove to be very useful in the future for polarized proton work by allowing an improved match between the Linac and Booster.
- Another future goal is to measure Transverse Emittance.



Spin Flipper

- Mechanically tuned inductor system successfully tested at the end of last run.
- Some problems with applications running too slowly or locking up temporarily.
- The FEC is in the processor in the FPGA on the development board used for this application.
- A new system is being developed based on the platform designed by the low level RF group.
- The additional processing power, larger FPGA and expandability will allow it to be adapted as the system grows.

Spin Flipper



Bunch By Bunch Tune ?

- Gated BBQ development... will try to do this without disturbing the existing system.
- We presently “excite” all bunches and “listen” to all the bunches...
- We can try to – parasitically – develop a system that “listens” to one bunch...
- Use either the BBTB monitor or a special AFE....
- We have ideas.. But we need to make a plan....