

SUMMARY FOR FAST RAMPING MAGNET MEASUREMENT SESSION.

IMMW-15

FERMILAB

AUG. 21 – 24, 2007

4 TALKS IN THIS SESSION.

1) FIELD QUALITY MEASUREMENTS AT HIGH RAMP RATES – ANIMESH JAIN, BROOKHAVEN NATIONAL LABORATORY.

- Making fast measurements with an array of fixed coils
- To study time decay and snap back
- To study eddy current effects during fast ramping
- BNL had some projects where this was necessary; Dipoles for a Biomedical project which included data from a rat with a sensor on it's head while it was moving in the field and fast ramping superconducting dipoles for FAIR project at GSI. These magnets are ramping 10x faster than most storage ring magnets.
- Coil set uses 16 tangential pickup coils
- Precise calibration is critical
- Coil is 300 mm long and made on printed circuit boards
- Early measurements used 16 bit ADC's for data acquisition but these were not good enough so replaced by 17 HP3458A voltmeters! HP may like a photo of this data acquisition system for their advertising!
- With 16 signals, only a few lower order harmonics can be measured. May need more coils and more HP3458A voltmeters!
- One scheme is to measure at another angle to double the data available
- Data was presented which shows this technique works
- Multiple orientations of the probes may be more desirable than more coils due to complexity and cost
- Results in a prototype GSI dipole look good
- Noise in harmonics measurement is ~ 0.1 unit at 25 mm.

2) FAST RAMPING MEASUREMENTS WITH A SLOWLY ROTATING COIL.

G. V. VELEV, FERMI NATIONAL ACCELERATOR LABORATORY.

- Built this system to measure new corrector magnets for the Booster Synchrotron
- Quadrupole and sextupole elements should swing through the full current range in 1 ms during the transition crossing
- Fast Digital Signal Processor (DSP) used
- No new hardware needed
- Coil rotates at .25 hz.
- Presented data showing results of measurements for normal and skew dipole, quadrupole and sextupole elements in several of these corrector packages
- AC measurements at 16 hz. compared well with DC measurements
- Small eddy current effect noted
- Results in PAC2007 proceedings

3) A MOLE FOR MEASURING PULSED SUPERCONDUCTING MAGNETS PIERRE SCHNIZER - GSI

- Need to measure many magnets for FAIR
- Two rings are pulsed operation superconducting magnets and other rings are running in DC mode
- Need a method to measure both
- It was decided to build a mole
- The mole is based on the rotating coil for DC measurements and on the step coil for AC measurements
- Piezo motors are used to rotate the coil and level the mole. Slip rings and encoders are also used for the mole. Piezo motors allow for precise positioning. Encoders are the limiting factor for angular accuracy (.5 mrad possible)
- Mole is almost finished and preliminary tests are good. Piezo motors can do angular steps, harmonic results are good but main field measurement requires improvement

4) AC MEASUREMENTS OF BOOSTER CORRECTOR MAGNETS WITH A FIXED COIL ARRAY – JOE DIMARCO FERMI NATIONAL ACCELERATOR LABORATORY

- This system developed to measure the rapidly changing field in the new corrector magnets for the FERMILAB Booster.
- The coils are fabricated on printed circuit boards and have windings to buck the dipole, quadrupole and sextupole fields so that sensitive measurements of strength and higher harmonics can be made
- The array of coils are all sampled at once at up to 100 kHz with a 10 kHz bandwidth using 24 bit ADC's
- Measurements are done very quickly. The time is in preparation to measure and set up
- Disadvantages of this system are complexity, the large number of channels to read, cost and trying to get large printed circuit boards made successfully
- Advantage is that very fast field snapshots can be achieved
- PC boards are low cost in smaller sizes but get expensive and hard to make as they get larger
- Finally decided to pursue large 1 meter long boards as the best option
- One company made these after much difficulty and 47 were shipped, mounted and wired
- In July 2007 the probe is ready
- Wiring electronics is complex due to 40 channel outputs
- Software is Labview and can acquire 100 cycles of data in 6 seconds
- Basically working, but still need to spend some time understanding the data better