



**ATF2**

**Magnets**

Summary of the Session on Magnets,  
Movers and Magnet Installation.  
ATF2 5<sup>th</sup> Project Meeting, at KEK

Cherrill Spencer, Magnet Designer  
and member of ATF2 Magnet Group



**ATF2**

**Magnets**

Spencer provided overview of magnet fabrication & measurement.

- **Three Final Focus dipoles**, B1, B2 & B5: designed by Spencer, made and measured at IHEP, Beijing, delivered to KEK ~ 3 weeks ago
- **Two Final Doublet quads** : QD0 & QF1. Old FFTB quads: aperture been increased to 50mm; working on improving multipole content- solution been found to reduce 12-pole: new “side-shims” along poletip
- **Two Final Doublet sextupoles**: SD0 & SF1: old FFTB sextupoles, solid wire coils. Have added water-cooled copper plates to reduce their temperature rise
- **Three Final Focus sextupoles**: old SLC water-cooled sextupoles, about to be refurbished and re-measured.
- **Some vibration measurements** on the QD0 & “SD0”



**ATF2  
Magnets**

Spencer's Conclusion having looked at all IHEP data and the raw Hall probe data [their LCW system not available again until Dec20th]

- I have looked at all the data from all 3 dipoles, Based on all the data I proposed that :
- The 3 DEA dipoles made and measured by IHEP are meeting all our requirements: mechanical, thermal, integrated strength at expected currents and field quality and therefore
- **I TOLD IHEP on 29<sup>th</sup> November TO SHIP THEM to KEK** as soon as convenient (with the 2 spare coils). The shipping crate arrived ~7 Dec at KEK



## ATF2 Magnets

We saw these 3  
dipoles during  
our tour of  
ATF2 Thursday  
afternoon.



21st December 2007

Spencer:Magnets etc Session  
Summary

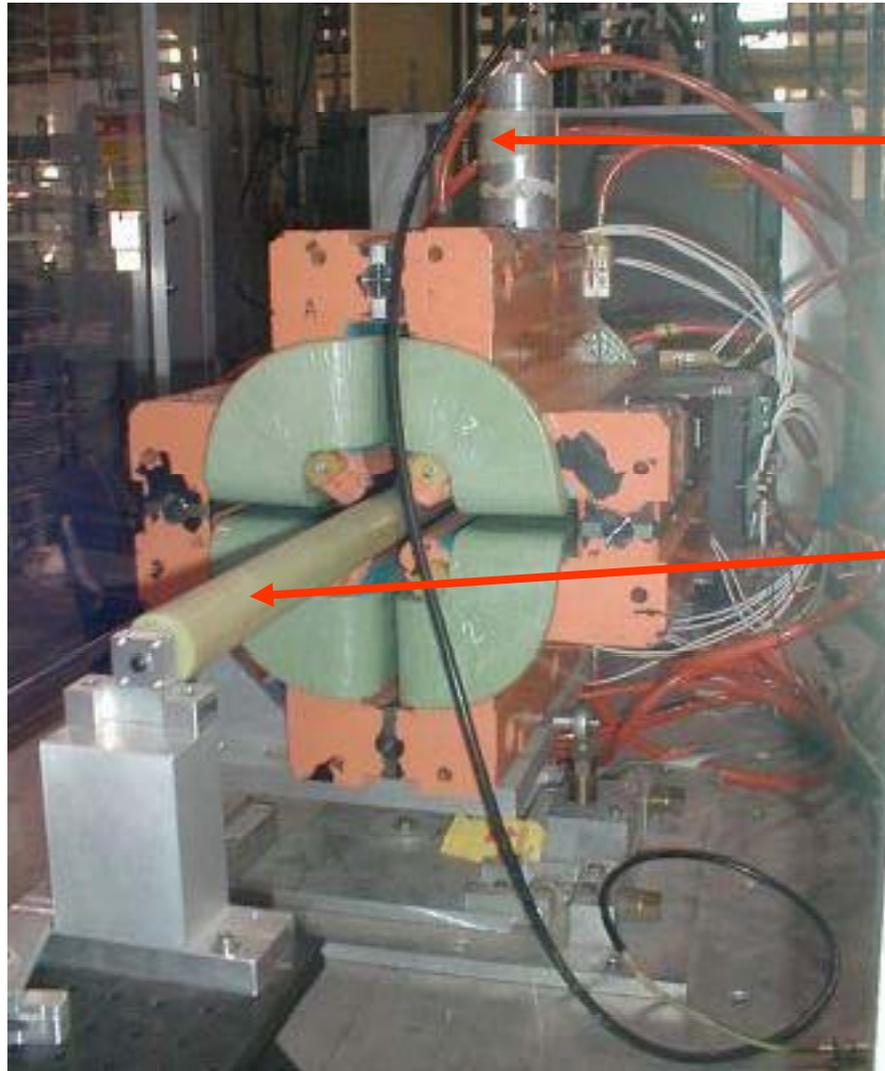


**ATF2  
Magnets**

Modified quad, with 50mm aperture on  
rotating coil measurement stand at SLAC

Increased bore  
quad meets  
strength and  
thermal  
requirements.

Does NOT meet  
some of the  
strict  
multipole  
requirements



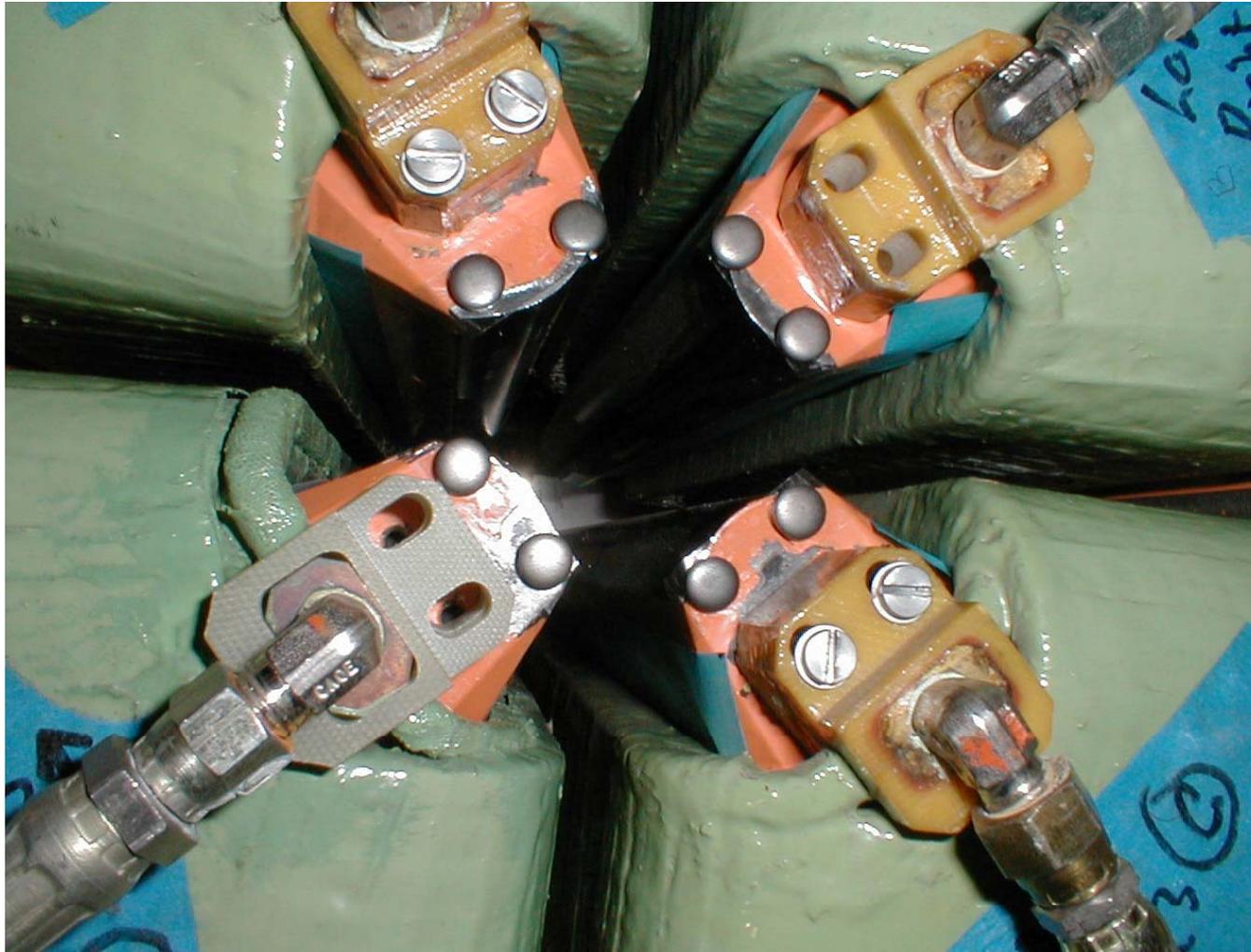
L4 geophone  
placed for  
vibration tests  
(see later)

Fully bucked rotating  
coil, to measure  
integrated harmonics  
and integrated  
strength



**ATF2  
Magnets**

Some 12.7mm steel buttons stuck on poletip ends: to reduce 12-pole



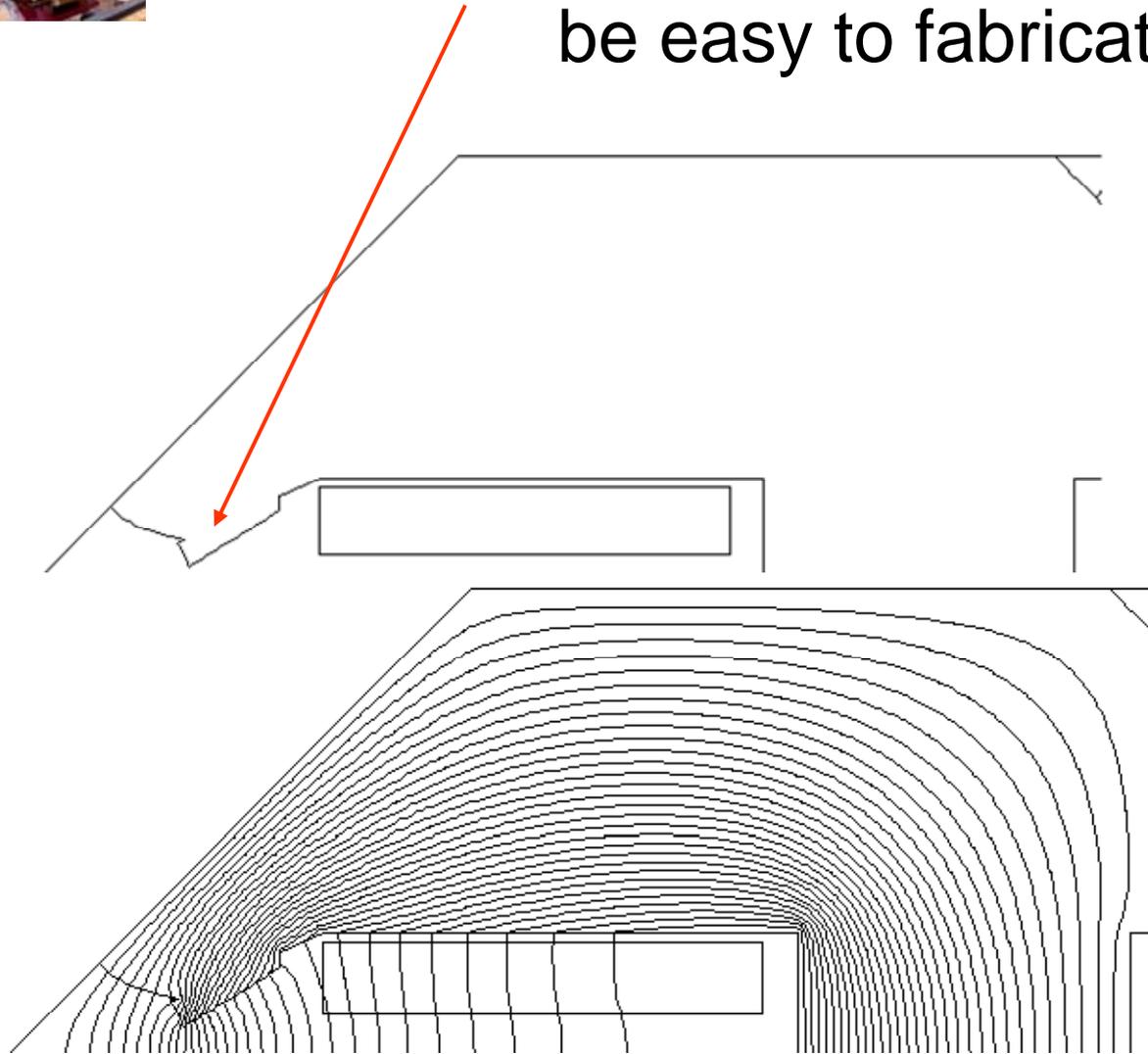
This technique did not work well enough on this quad.

Need a technique that modifies the pole shape throughout the length of the magnet.



**ATF2  
Magnets**

# Modelled different shapes of steel shims with POISSON-ones that would be easy to fabricate & install



This shape gives  
12pole/quad =  
0.02% at 1cm  
Better than  
Glen's revised  
tolerance of  
0.05%



**ATF2  
Magnets**

# Cross-sectional view of new side-shim : to reduce 12-pole



Width of shim carefully chosen so does not interfere with adjacent coil [which vary a little in size from

coil to coil]

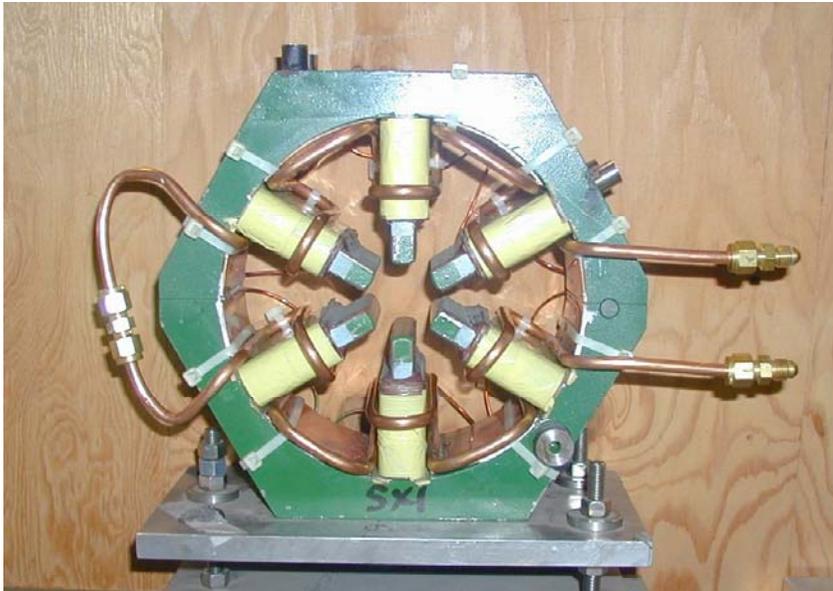
Request to fabricate 16 shims been submitted to SLAC shops.

Will be made in January, Steel in house.



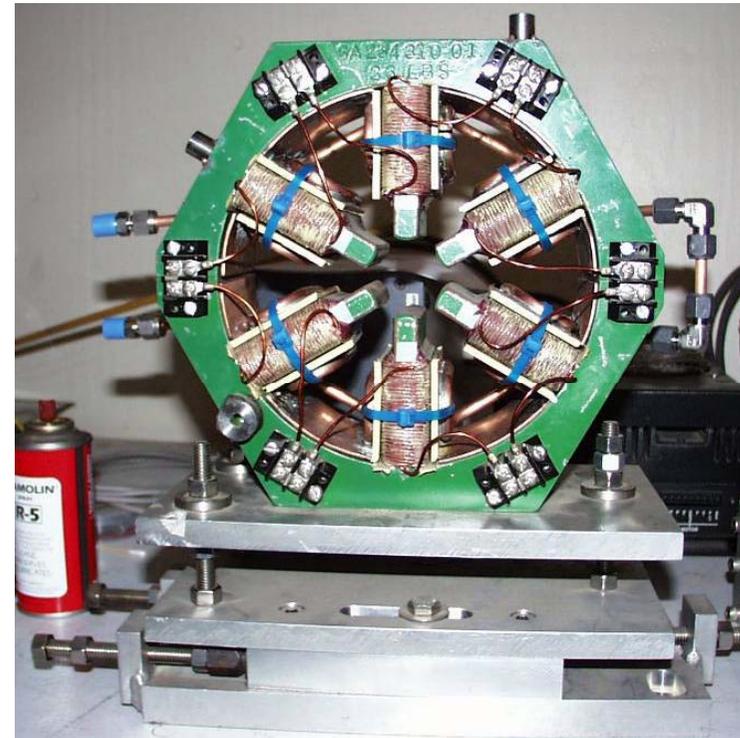
**ATF2  
Magnets**

# Added external cooling: copper pipes and some copper plates



The cooling circuit is one assembly and it all slides into the magnet from one side.

The circuit can be split into 2 separate parts when the magnet is split.



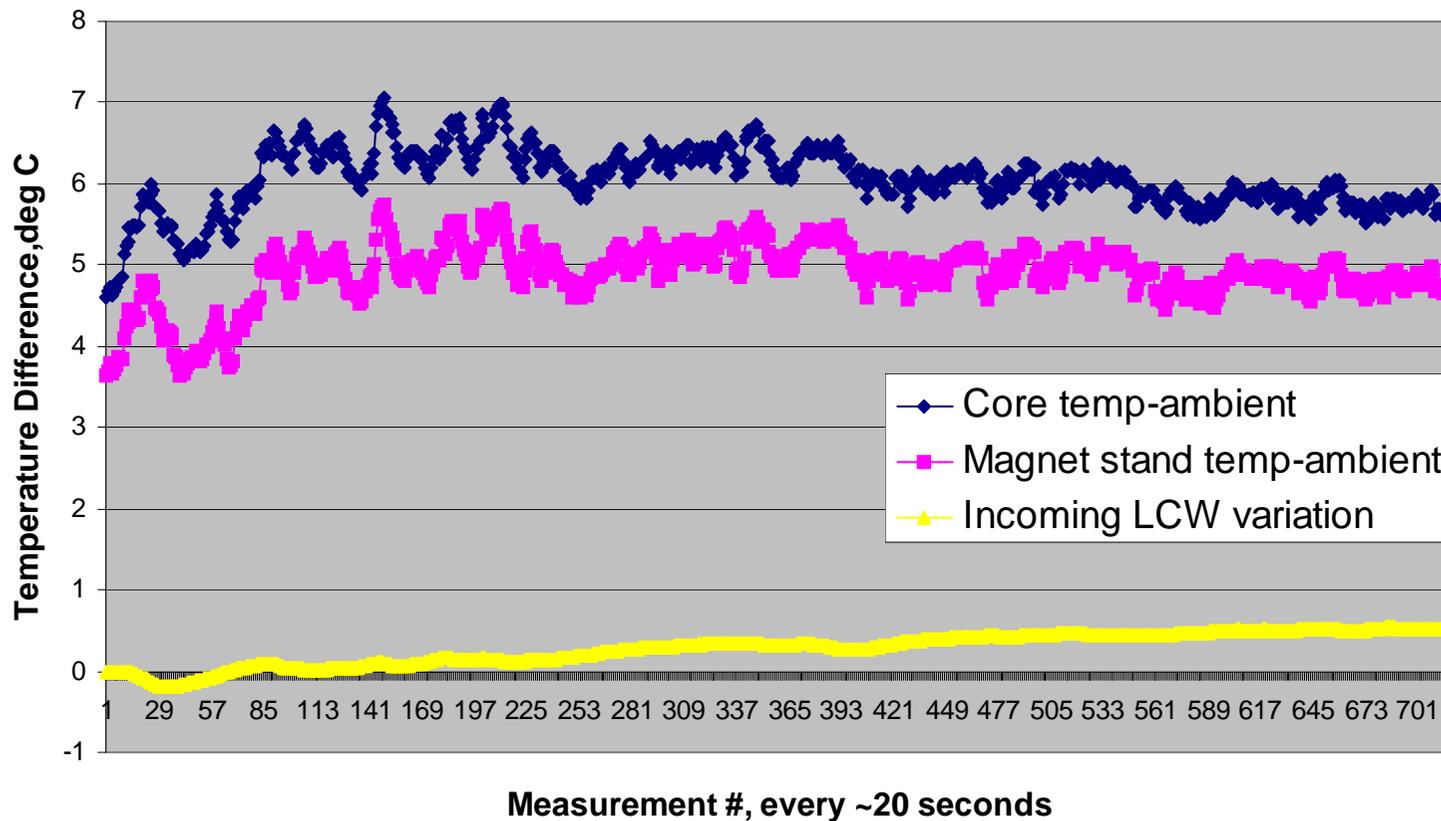
2<sup>nd</sup> version: copper plates on sides of coils, under copper pipes



**ATF2  
Magnets**

Ambient temperature was increasing during test, so subtract ambient and re-plot

**Differences in core or stand temperatures from ambient temperature**

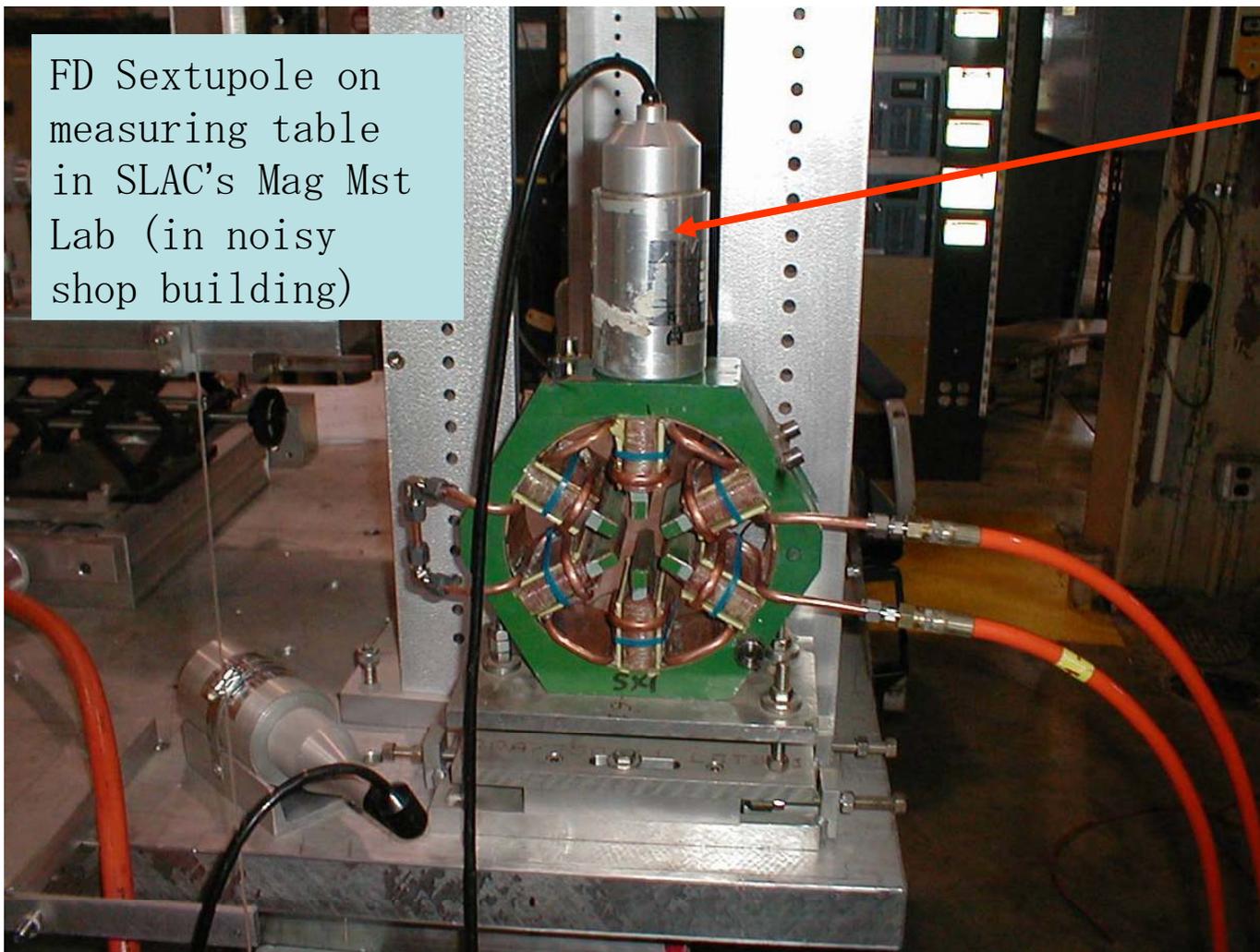


Core & magnet stand temps increase by < 2 C over 4 hour run at 6.5 amps



**ATF2**  
**Magnets**

# Vibration measurements : to see affect of cooling water (only)



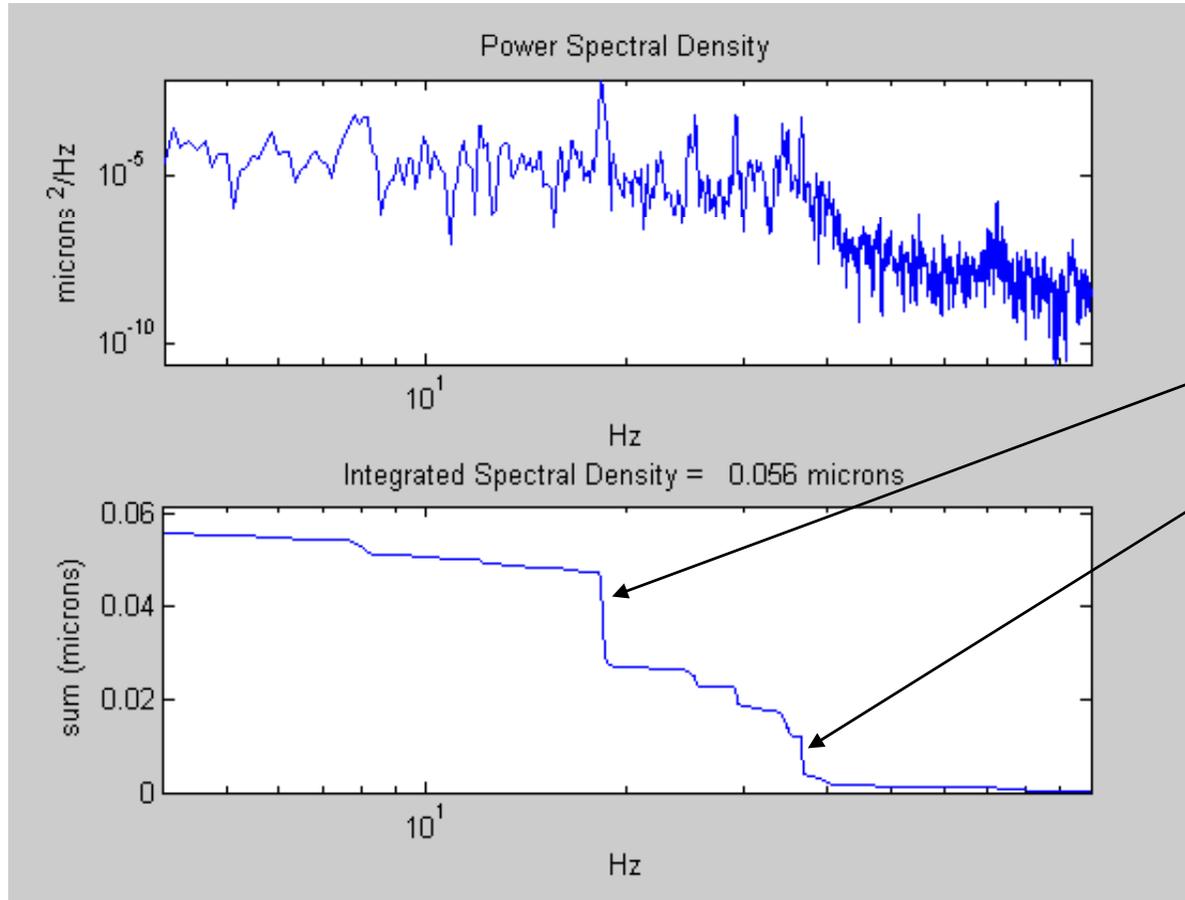
FD Sextupole on measuring table in SLAC's Mag Mst Lab (in noisy shop building)

MarkL4 geophone. Measures vibrations between 4 and 100 Hz. Took data for 16 seconds: water off and then water on at required flow rate.



**ATF2**  
**Magnets**

FD quad measured with **LCW off** .  
Hoses are connected to water system.



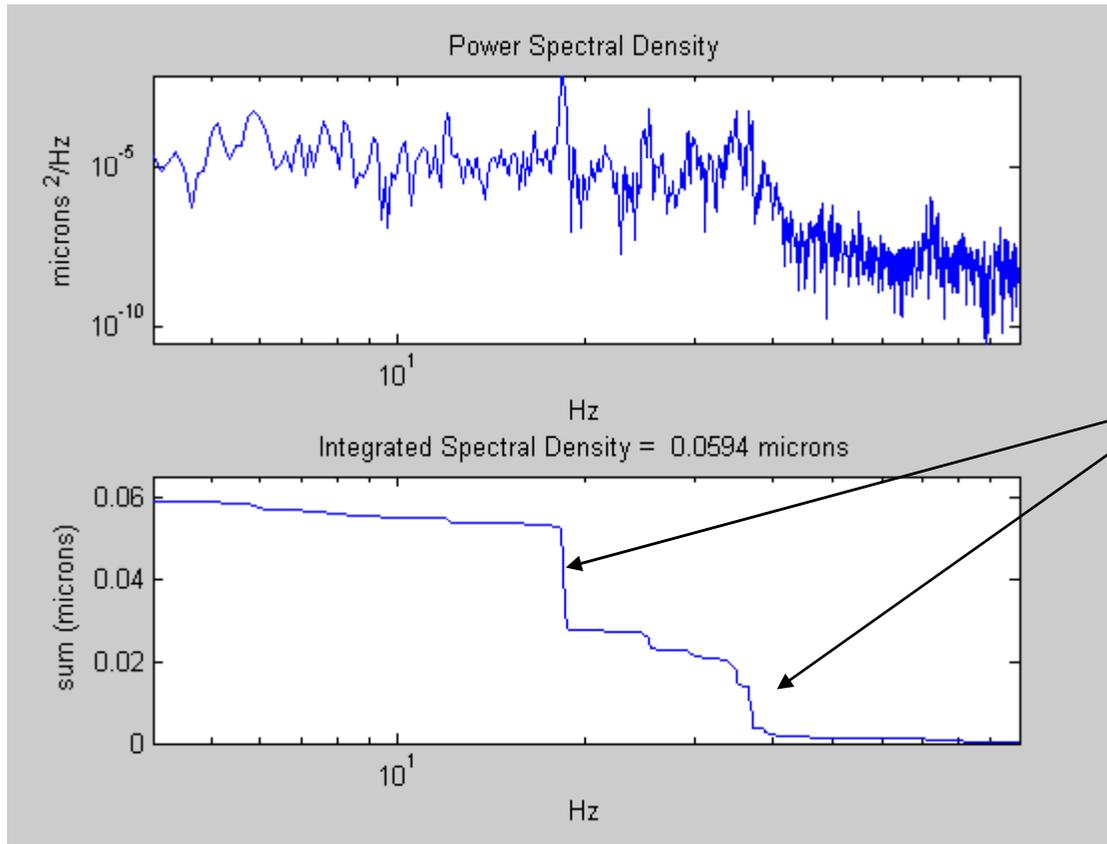
Overall vertical  
"movement" is 56  
nanometers.

Noticeable  
frequencies are  
 $\sim 19$  Hz and  $\sim 33$   
Hz



**ATF2  
Magnets**

**FD quad measured with LCW on at 2.8  
gpm total. Similar data for sextupole**



Measured vertical  
"movement" is 59.4  
nanometers.

A 2<sup>nd</sup> measurement  
showed 54 nm with  
water on.

19Hz & 33Hz  
oscillations are  
there.

Later- measured the  
large table under  
the quad- it had  
19Hz effect. So the  
33Hz signal was  
present for both  
quad & sextupole, 13  
water On and Off.



Photo of an old SLC “SX3” style sextupole:

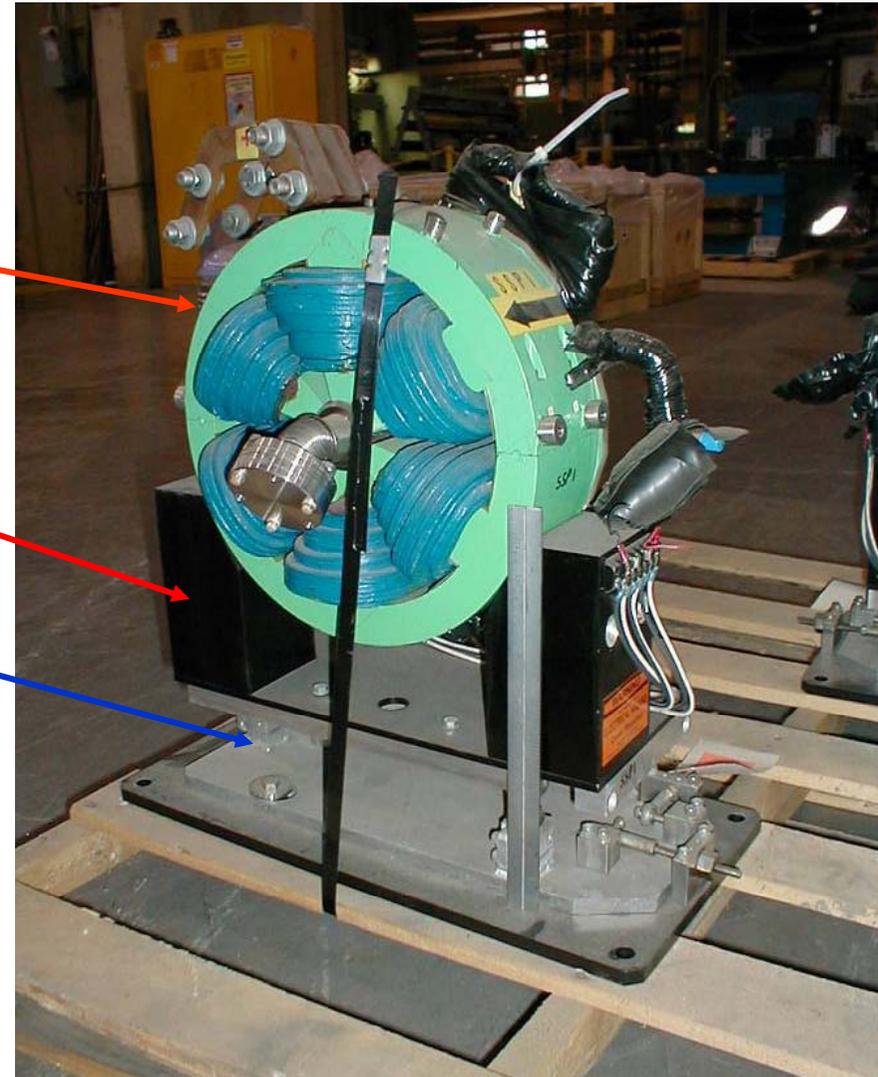
**ATF2** will be used for ATF2 FF sextupoles

**Magnets**

This is a spare sextupole waiting to be re-furbished for ATF2.

This old support is too tall for ATF2.

This T1 support will not be used





**ATF2**  
**Magnets**

## Remaining issues we are also working on

- Magnet supports
  - Extra supports for FD quads and FD sextupoles to get them to correct beam height- LAPP will design and fabricate (with height adjustability)
  - Supports under FF sextupoles, that fit in with the BPM support. Discussions with Honda-san today have established who is designing and fabricating which parts.
- Alignment procedures for all the “re-used” magnets – have been working with Sugahara -san on procedure to use existing SLAC tooling ball installation holes & fiducialization data with the KEK alignment target
- Compatibility of QD0 with MONALISA



**ATF2  
Magnets**

# Sugahara-san gave talk on magnet installation



Sugahara-san and small crew is installing the concrete base blocks in the ATF2 beamline.

How typical QEA quad will look:

Height adjustment plates

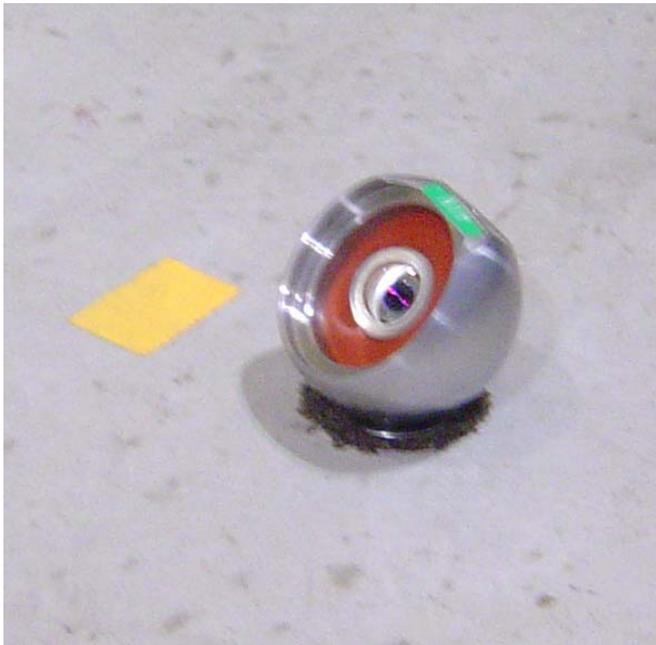
Old FFTB magnet mover

Concrete base block



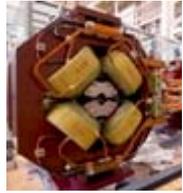
**ATF2**

**In October: installed monuments for horizontal positioning**



Spe

Summary



**ATF2  
Magnets**

# 20 concrete blocks of various styles are being installed in Dec.



Blocks installed as of  
20<sup>th</sup> December 2007

Previously Sugahara-san put layout markers on the floor, having measured the ATF2 floor relative to the ATF floor.

Measurements of the floor height over 3 weeks shows

- It is shrinking.
- It varies over space by several mm

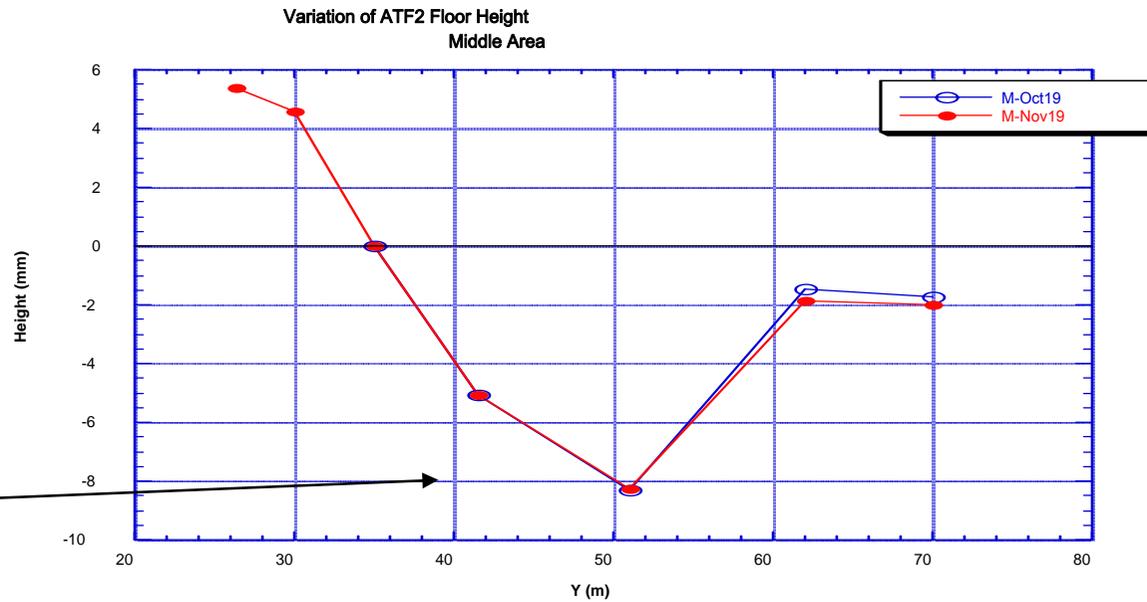
Will start installing movers and magnets in early January—the QEAs & DEAs. Other magnets will be installed as they are available.



**ATF2**

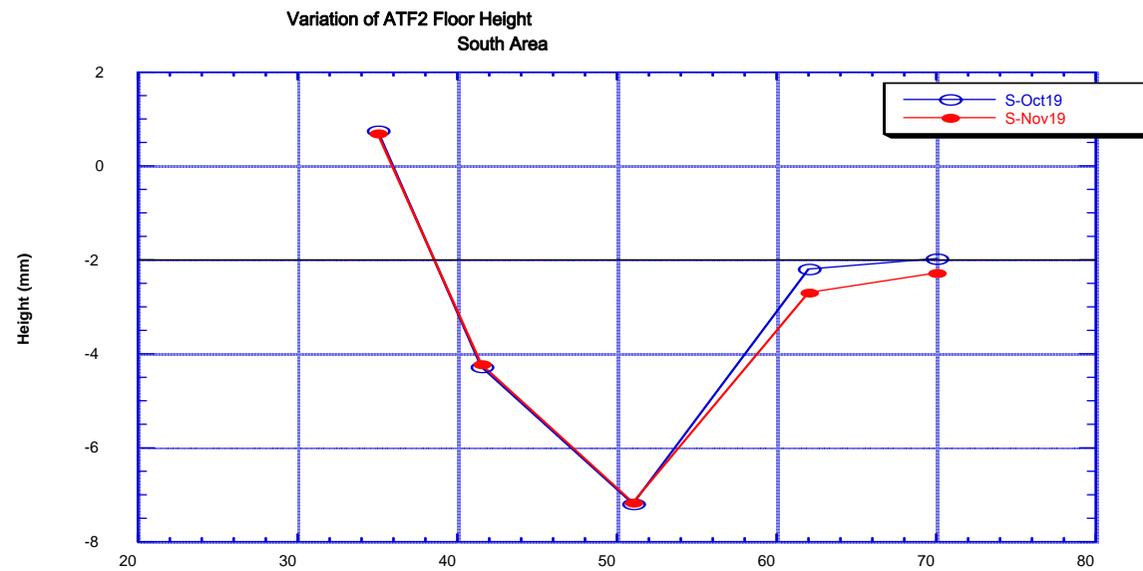
**Magnets**

**Variation of ATF2 Floor Level (a) Middle area- by up to 8mm**



**(b) South area**

Will measure day to night variation of floor tilt with Hydraulic Level Systems.



21st December 2007



**ATF2**

**Magnets**

**Magnet Movers:** Justin May gave talk about the old FFTB movers that will be put under 25 ATF2 magnets

- Theory of operation; will try new approach for stepping the movers to their desired position.
- Software for controlling the movers is largely written
- Need to complete the EPICS (hardware controlling) system
- During magnet alignment process: good if we check the cam rotation value as well as the LVDT
- Hardware installation process will require careful planning as movers will need power to be installed; cable plant may not be installed before the movers need to be installed, so will have to use temporary cables & power supply.