# Meeting at SLAC on ATF2 magnets

1. **Magnets**
2. **Power supplies**
3. **Magnetic field measurement**
4. **FFTB cam magnet movers**

**Period**: May 10 - 12, 2005

**Attendees**:
from SLAC:
Cherrill M. Spencer ... coordinator, magnet and power supply
Mark Woodley ... beam optics
On FFTB CAM movers
Douglas McCormick, Marc Ross, Peter G. Tenenbaum, Steve Wagner
On magnetic field measurements
Zachary R. Wolf, Scott D. Anderson
from Japan
Ryuhei Sugahara ... coordinator, mover and support
Mika Masuzawa ... magnetic field measurement and magnet
Masayuki Kumada ... magnet and power supply

# 1. Magnets

**Variety and number**

| | Number | L (cm)[given in optics deck] |
|---|---|---|
| B-mag | 9 | 100 |
| Q-mag (except for final doublet) | 25+1 | 20 |
| Final doublet Q-mag | 2 | 40/50 |
| Sextupole-mag | 5 | 20 |
| Octupole-mag | 3 | 10/20/30 --> all 20? |

--> Spaces between adjacent magnets are as tight as only 2.5cm. Are those octupoles really needed? How about some very short permanent magnets?

Steering-mag

--> Some number of steering magnets will be necessary. Beam optics people should study how many magnets are necessary and where, and let us know.

* All the magnets should have some number of spare coils.

- Production of all the magnets except for those reused from SLAC magnets will be ordered to IHEP. Fabrication specification should be sent to IHEP before end of June.

  --> Cherrill and Masayuki are responsible for designing magnets. They will try to make a technical specification before middle of June, and will ask IHEP to make the fabrication drawings that need to be changed from the KEK design.

- Want to make the shape of dipole magnet rectangular (=not poleface rotated).

# 1. Magnets (contd)

-Should the core be lamination type or block type?
--> Lamination type is preferable because of the speed of response says Kamada, but there is not agreement yet on this point- need more discussion, and to talk with IHEP engineers.

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**Tolerances --> Beam optics people are working on this matter.**

Definition of Good field region

B-mag: X = +/- ???mm, Y = */- ???mm
dBL/BL < ??? (we need to know from beam opticians)

Q-mag: r = 10mm

Sx, Octa-mag: r=10mm

on Q-mag

Amplitude of multi-pole component (allowed component)
< ???

Amplitude of multi-pole component (not allowed component)
< 10^-3 for n=3 component in usual Q-mag
< 10^-4 for n=3 component in the final doublet --> may need some correction scheme in beam optics in case we cannot achieve this.

# 1. Magnets (contd)

Stability

Short term stability

Long term stability --> may both be corrected by feed back scheme.

**Restriction from cavity BPM on Q-mag**

Coils should keep out of the area r=100mm.

Edge of coils should not far from the edge of magnets 60mm or more.

Need to install some tapped holes to fix BPM at the end plates of magnets.

# 2. Power supply

- Independent power supply
  Each magnet is supplied with electric power from its own power supply.

- How many PS should we produce newly, and how many PS can be reused from SLAC PS.
  --> SLAC has 34 FFTB power supplies that supply 250A*40V.
  Need to check if those fit to Q-mag except for the final doublets and Sx-mag.
  FFTB has other PS with different A and V specs.
  We have not yet found out if we could take these FFTB PS to KEK or not, depends on whether LCLS wants them or not.

  PS has to be newly produced for final doublets and B-mag.

- Tolerances for PS --> have to be defined by beam optics people
  Ripple
  Long term stability
  The FFTB PS system is very stable – better than 10ppm.

# 3. Field measurement

- All or some number of magnets should be measured at IHEP to check out possible fabrication errors, and feed it back immediately if there are any errors. IHEP has a capability of measurement with rotating coils.

- KEK should have measuring capability to compare IHEP results with measurement of ATF magnets. And interference between Q-mag and adjacent steering magnets may be measured.
- ATF group's rotating coil is available. They have one set.
  Long coil: 400mm long, and 30mm in diameter.
  Short coil: ??? long, and 30mm in diameter.
  Both have no bucking coils or second coil.

- SLAC has three rotating coil rods which have the diameter 25mm and the length ???/???/???. Those have double coils.
  But it is not good idea to send magnets from IHEP to SLAC, then from SLAC to KEK for the field measurement because it is time and money consuming.

- If the tolerance for the amplitude of multi-pole component 10^-3 or looser in the ratio of B(n-1)/B1 at r=10mm, no bucking coil will be necessary.
  SLAC is making a new rotation coil 25.4mm diameter with two coils. If double coil is necessary in ATF2 magnet measurement, SLAC can make extra coils for KEK and IHEP as well.

# 4. Cam-based Magnet Movers

- FFTB cam movers will be reused.
  25（Q)＋5(Sx)+1(spare) are available?
  --> Yes. SLAC has 32 of them, and can send those to KEK.

- Required minimum step < 5 microns. Can SLAC moves satisfy this requirement?
  --> Yes. It is about 0.04 micron with range about +/-1.5mm.

- What is the maximum weight movers can bear?
  --> P.T. had loaded one with a weight of about 750kg, and tested movement many times. He had no trouble at all.

- What is the response time?
  --> One rotation of cam shaft is divided into 40,000 steps, which are driven by 120Hz pulses. Moving speed is about 30 microns/sec at theta=0.

- When can FFTB movers be shipped out to KEK?
  --> Doug Mc. will take care of shipping. He will ship out one set next week togerther with driving electronic modules before he leaves SLAC to KEK.
  But at this meeting, it was found that this mover was a proto-type one. So KEK can do some tests with this mover, but it should not bd used in the beam line.
  By replacing ball bearings by roller bearings, which Doug will send later to KEK, it can become a spare.

# 4. Cam Magnet Movers (contd)

- The other movers can be shipped out in July,2006 ( next year).

- The surface of the bearing rings around the cam shafts look rusted. Can SLAC polish the surface before shipping out?
  --> Yes. SLAC will do.

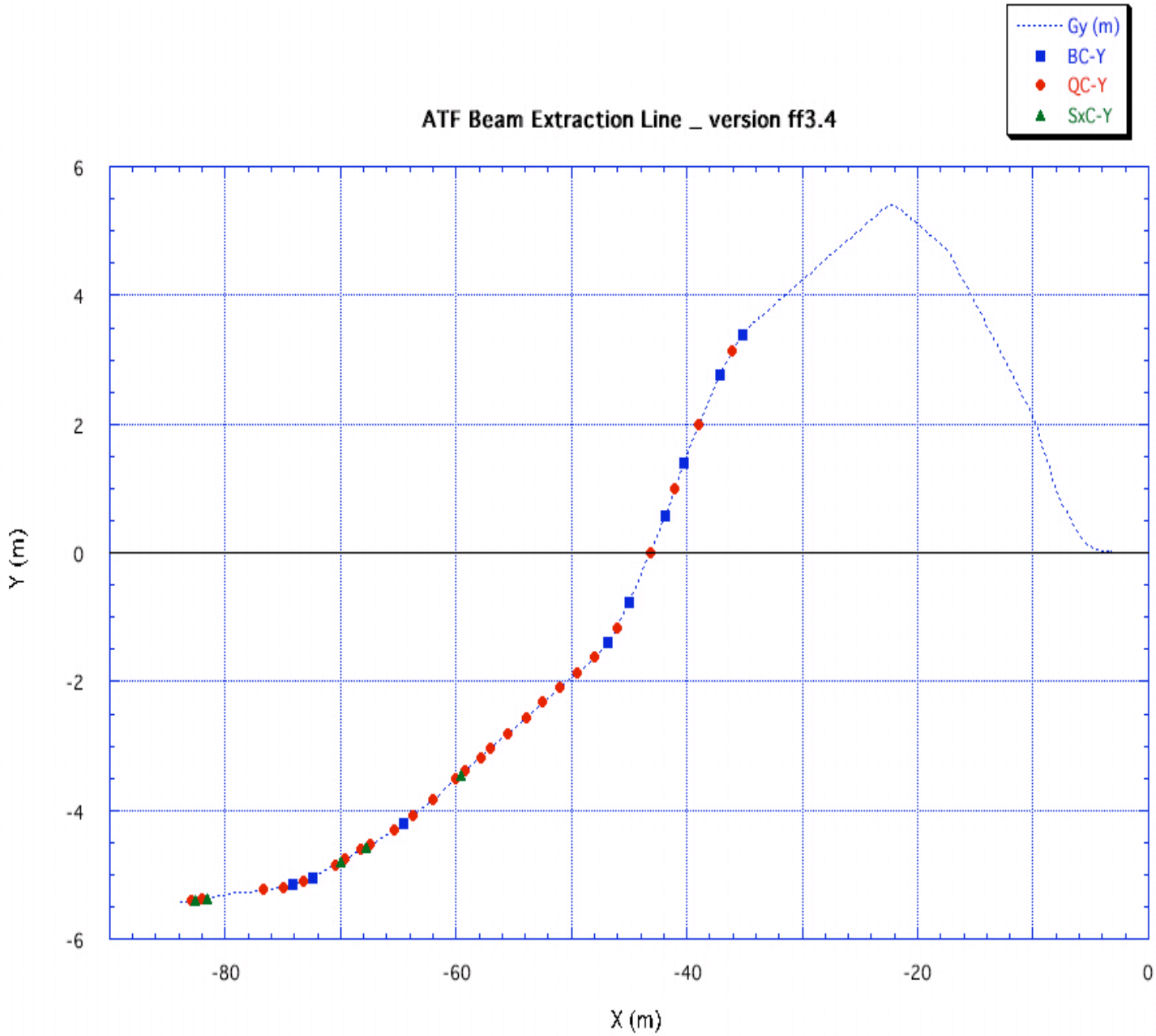
-People should read the SLAC-PUB paper, that Cherrill informed us about, which has many details on these movers.

- SLAC will find the mechanical drawings and send them to KEK.

- Control program is written in FORTRAN and C. SLAC will send source codes to KEK.

- Length of cam movers is 40cm. Because of this length the space between adjacent magnets becomes 15cm (Q - B) and 5cm (Q - Sx) in 10 Q-mag area. KEK will check if this is OK especially for vacuum system.

- Support made of special concrete blocks of fine grain will be preferable. SLAC will try to find documentations about its performance.


ATF Beam Extraction Line _ version ff3.4
Gy (m)
BC-Y
QC-Y
SxC-Y
6
4
2
0
-2
-4
-6
Y (m)
-80
-60
-40
-20
0
X (m)

# 5. Other Topics

- It should be announced that ATF2 beam energy will not be 1.54 GeV as written in some documents but 1.3 GeV and we will design all magnets to run with 1.3 GeV beams.