Collaboration meeting on the Q-BPM of the ATF2 with PAL group

On 10th May 2005

9am-10:20am

We have a TV meeting with SLAC and Kyoto university. T. Tauchi briefly summarized meetings with PAL group at KEK yesterday by presenting a meeting memo. Also, Y. Honda showed the sketch of updated design based on the discussion.

Q: We would like to ask Z.Lee for the estimation of errors at SLAC. Also, Y.Honda and E.Kim will estimated them by using MAFIA. In UK, Alexei Liapine (UCL) already simulated the Q-BPM communicating with Y.Honda.
A: Yes.

Q: There must be a difficulty in precise alignment between the sensor cavity and the waveguide whose shapes are cylinder and square box, respectively.
A: The alignment can be done with two sets of pin-hole. We discussed on this issue with the PAL group in more details after the TV meeting.

Q: How to align the centers of Q-magnet and Q-BPM mounted on the magnet ?
A: Magnetic center of the magnet can be coincident with the mechanical center within 50um. First, the mechanical center of Q-BPM is aligned to that of the magnet. Second, the electrical center can be adjusted with shims by means of beam based alignment (BBA).

Q: However, this method is not still convincing.
A: It is homework for us. Since the alignment might depend on precision of the antenna method for measurement of the electrical center of Q-BPM, the method must be urgently improved.

Q: Shall we consider the operation of Q-BPMs with multi-bunch beam with 2.8nsec separation, i.e. 357MHz ?
A: Certainly, we can test of the BINP cavity-BPMs (SLAC/LLNL Nano-BPM system) with the multi-bunch beam because of its frequency of 6426MHz which is 18th harmonics of 357MHz.
Q: Is there argument against this harmonic frequency?
A: There may be harmonic noise from the RF system at the damping ring. Also, there has been serious problem of RF pickup noise at the CCD vertex detector of SLD experiment (ref. Mike Woods). However, the SLAC/LLNL group never observed this kind of noise in their Nano-BPM system, where major noise source is the kicker pulser and other pulse-devices. The RF pickup noise issue might be different since it is signal in the case of Q-BPM. Very recently, S.Smith reviewed the RF pickup (EMI) on 4th May (http://www.slac.stanford.edu/xorg/lcd/ipbi/monthlymeetings/04may2005/SSmith_Beam%20EMI.pdf) Therefore, there must be no problem in the harmonic frequency of Q-BPM. Since the SLAC-electronics (digital technique) was designed for 6426MHz, it is preferable to have the same frequency while 6550MHz of the KEK Nano-BPM is marginal at the electronics.

Q: The KEK Nano-BPM has the frequency of 6550MHz which is not harmonic one and present Honda's design is also based on the frequency. Shall we change the frequency to 6426 MHz? Tauchi remembers that the 6550MHz has been intentionally chosen for fear of the above noise issue.
A: Yes, we adopt 6426MHz as the baseline design since this frequency change has small effect on the structure itself.

Q: Is the temperature control necessary at Q-BPMs?
A: In previous Russian experiments, the frequency of BPM-cavity has been adjusted by raising the temperature

with electrical heater. Marc personally hates this idea, anyway. After installation of thermal shield in the SLAC/LLNL nano-BPM system, the temperature of BPMs has been very stable within 0.01 deg.C at least for a few hours. The temperature seems to be governed by neighbor magnet-heating. So, the temperature control would not be necessary. Also, after the frequencies of three BINP BPMs were adjusted by "deformation-method" (V.Vogel), the three BPM have the same frequency within +/-100kHz.

Q: In the schedule proposed by Y.Honda, first beam test of prototype will be in November 2005. Can SLAC provide new electronics at the beam test?
A: Yes. Actually, Marc and J.Frisch submitted a request of money for the prototype production in last week, where the electronics will be completed by this October.

Q: Can you provide the electronics to PAL too?
A: Yes, since 4 sets of electronics (prototype) will be made.

10:40am - noon

We continued the detailed discussion with the PAL group. Y.Honda explained the updated design in more details. The major issues were (1) design of feedthroughs in the square waveguide, (2) precise alignment between the sensor cavity and the waveguide, and (3) brazing techniques especially for thin wall between the sensor cavity and the wave guide and 1.5mm thickness of inner bore and slot in the waveguide.

(1) The feedthrough should be modified with a longer signal-needle and change of welding position from bottom to top for sinking the cylinder part into the waveguide.

(2) Front part of 3-5mm thickness of the square waveguide can be cylindrical shape for precise alignment to the

sensor cavity.

(3) The brazing performance will be observed in the prototype by visual scanning and cutting parts. If the 1.5mm thickness is too thin, it can be increased. Performance with thicker cases must be studied by simulation.

Seung-Hwan Kim will make the detailed engineering design and drawing by taking account of the above considerations. Also, he will design "pull and push" adjustment mechanism for the cavity deformation, while V.Vogel saids that the BINP structure requires a very delicate adjustment procedure at first time.

We also discussed about the cost for the production including the prototypes and an complicated interchange between KEK and PAL for the contract etc. .

Finally, we agreed with the schedule of prototype fabrication until this summer as follows;

From now to end of May (this month):
- technical design and CAD drawing by PAL
- estimation of mechanical errors by KEK, PAL, SLAC and UCL to determine the machining errors.

From 1st June for two weeks:
- engineering study of prototypes including the feedthrough and brazing technique by PAL
  i.e. fabrication of proto-prototype

at the 3rd week in June:
- test of proto-prototype for the engineering check by PAL

at end of June:
- KEK group will visit to PAL for finalizing the design of prototype

There are two choices of coupling between the waveguide and the feedthrough, i,e, direct and resonant couplings, for the goal of coupling beta=0,6 with Qext=13000. One coupling method must be determined by prototype performance as well as simulation.

The prototypes will be fabricated for July through September by PAL and KEK.
In September and October, the prototypes will be checked by antenna test. In November, they will be checked by beam test with the SLAC prototype electronics. Finalizing the design in end of this year or in beginning of next year, production of Q-BPMs will start in January 2006. All the Q-BPMs shall be fabricated by end of September 2006.

Final check procedure, i.e. criteria for good Q-BPM, must be well identified. One candidate criterion is x-y isolation with better than -30dB, which can be measured by a network analyzer.