ATF2 Technical Board Meeting Oct. 8-9, 2014

2 x 90min sessions at LCWS2014 workshop, Belgrade, Serbia.
Chair: G. White on behalf of P. Bambade.

ATF2 Summary – T. Okugi

Goal 1 progress reported. Min beam size measured as <44nm June 6, 2014. Of special note is the impressive recovery time from beam shutdown periods: ~32 hours after 3 weeks, ~16 hours after weekend shutdown.
Emittance, twiss parameters estimated from quad scans against post-IP C wire: consistent with ~10pm.rad, 0.08mm (beta_y).
Experimental measurements indicating wakefields induced by vertically offset trajectories in OTRs presented. Simulations show good agreement with measured beam size growth and orbit deviations with OTR vertical offsets (10nm/1e9 sigma_y @ IP) using wakefield estimates from observed orbit errors induced by moving OTR.
IPBSM jitter analysis from fits to modulation signal. Apparent jitter reduced by optimizing detector collimator position.
IP jitter analysis from vibration measurements indicate expected ~15nm contribution from FD jitter. This would result in a 40nm beam size appearing as 43nm.

Questions

R. Tomas: Can a bunch tilt measurement be performed to help diagnose possible wakefield distortions of bunch?
T. Okugi: There is a proposal from Shintake to use quadrature signal from cavity bpms

Hardware status – N. Terunuma

Cooling water refrigeration unit was replaced during summer shutdown. Old system had basic control system that disturbed the 400V power line when switching and had frequent failures. Can expect more stable linac operation with new unit.
EXT kicker controller has exhibited multiple failures since March. Problem was 24V DC supply when 15V required causing logic board to fail. Now fixed and EXT kicker OK for fall operations.
Wakefield mitigation: gate valve was rotated 45 degrees to be symmetric in y dimension. There are no more known vertical asymmetries in the beamline. OTRs were aligned, SLAC to modify OTR chambers in October to shield side-port which is expected to heavily damp wake effects. Noted that currently all EXT wire scanners removed (since spring).
QF1 magnet vibrations characterized reduced by inserting shims under main magnet support. This trick should work on other magnets also.
Beam loading compensation test (R&D for ILC conventional e+ source) completed over Sept/Oct period and RF configuration now restored to normal.

Beam plans for 2014 fall:

- 5 weeks operation until end-Nov.
- Possibility of externally-funded 2 weeks operation in December also, to be confirmed in next month.
    - In which case 1 out of 3 weeks in Nov will be moved to December to make a 3 week run in December.

Plans for fall running:

- Goal 1: continue attempt to reach 37nm IP vertical waist
- Goal 2
    - FB with currently installed IPBPM
    - New BPM installation expected this period to fix misalignment issue
    - LAL plans to install and test diamond halo sensor
    - Dispersion & Wakefield-free steering algorithm tests by CERN in Dec.

Questions

R. Tomas: Requests GM data on known QD10 jitter source
T. Okugi: Points out QF1 shim fix will work there also
S. Mazzoni: What is the plan for FY2015?
N. Terunuma: No discussions yet. Financial status not expected to be so different from 2014. Probably no running after summer.

IP Stabilisation – P. Burrows

Upstream stabilization results from 2013 shown: 3-4:1 level of correction shown locally in EXT and downstream in FFS (@ MQF1FF).
IP FB, June 204 shows jitter reduction 210nm->87nm. This is with current IPBPMs (waist @ BPM and beam waist centred there).
Correlations in jitter seen with charge, phase and angle. If correlations removed offline, this implies 49 nm of jitter, or 44nm with some additional signal averaging. If extrapolate results to zero BPM processing attenuation, this implies as low as 20nm jitter @ IP.

Questions

T. Okugi: Do the offline corrections incorporate multiple BPM sources?
P. Burrows: IP and u/s systems used.
N. Terunuma: Are there plans for continued use of u/s feedback?
P. Burrows: Yes, the system is available for use
N. Terunuma: It is important to try and improve the level of IP jitter
P. Burrows: The u/s feedback will be used with FONT presence in October.
T. Okugi: Can the offline corrections be implemented in the online system?
P. Burrows: Yes, this could be achieved with just a firmware modification.

Octupole Magnets – M. Modena

PM octupole design for use at ATF2 to enable <35nm beam size to be achieved.
Vibration expected to be small, no cooling water required.

Requirements changed for magnet strengths (5284 T/m3 x2 -> 708, 6820). Design changed to use same cross-section coils for both magnets for simple tooling and low costs.
Parameters have been agreed with KEK, plan for summer 2015 completion. Magnet and power supply support to be provided by KEK.

Questions

R. Tomas: Who will supply power supplies? (Requirements are ~30A, 0.5V)
N. Terunuma: KEK can supply.

OTR/ODR – S. Mazzoni

Previous measurements of ODR system at CESR presented. Challenges with beam lifetime issues and SR radiation indicated. ~20um beam size measurements made. For improved resolution @ ATF2, 3 areas identified: moving to non-diffraction limited measurements by observing radiation into uv spectrum (-> ~70nm); reduce slit-width to 100-200um; and improve optics with new 2-lens system. Also improvements to ODR blades and controls planned.
Comments to TB comments from previous proposal: considerations shown for LC context (required parameters etc). Team identified (CERN & RHUL). Cost breakdown and project plan shown (requested shifts starting from 2016).

Questions

T. Okugi: Will you plan on installing a new vacuum chamber for the OTR/ODR installation at ATF2?
S. Mazzoni: Yes, it will be in the previous OTR chamber location.
N. Terunuma: What about compatibility with other experiments?
S. Mazzoni: The experiment will be fully retractable (have a replacement chamber) and will not provide a wakefield source.
N. Terunuma: What is the direction of insertion?
S. Mazzoni: From the top.
N. Terunuma: What are the details of the CESR measurement?
S. Mazzoni: Intensity ~1mA, substrate used: aluminized silica & (molecular adhesion) silicon wafer [worked best]. Size of slit 1mm -> 500um
N. Terunuma: Can the target survive the beam?
S. Mazzoni: Yes.
N. Terunuma: What current is required @ ATF2?
S. Mazzoni: We need to think about this, will follow up.
N. Terunuma: How about CLIC & ILC, is the target really survivable, how will it be aligned etc?
S. Mazzoni: Operation with low-intensity pilot bunch assumed.
N. Terunuma requests more details
T. Okugi: There are a lot of requested shifts (seems too many), please provide more detailed shift plans
S. Mazzoni: We will reply with more details to this and above questions in ~next week.

Diamond sensor/Halo measurement plans – P. Bambade for S. Liu

Project to characterize halo, motivated by knowledge and eventual improvement of background (especially in context of improving IPBSM measurements) outlined. Emphasized that this will be of especial concern for the low-beta progeam. Short term goals presented, of measuring halo using large dynamic range diamond sensor developed by LAL. Alpha-source tests have been done in-lab at LAL as well as in-air and recent in-vacuum tests at PHIL. Modeling work has been performed to understand charge collection, space-charge effect.
Installation plans are: motor to be shipped to ATF next week; further hardware planned to be shipped in November; KEK to provide vacuum chamber and cables etc; installation planned for Nov 3 – Nov 9.

Questions

T. Okugi: Where is the optimal location to perform the installation?
P. Bambade: There are several possibilities. After bend to dump probably a good option although not too close to the dump to avoid neutrons.
T. Tauchi: Do you have to worry about SR from bend?
P. Bambade: Probably not as can separate SR which is on the high E side of the beam from Comptons which are on its low E side.

Wakefield-free Steering (WFS) – J. Snuverink for A. Latina

Plans to perform dispersion-free steering (DFS) plus WFS in ATF2 EXT & FFS, motivated by desire to reduce intensity dependence of beam size at waist observed. Planned measurements were presented: measure orbit + dispersive orbit (DR RF ramp) + wake-induced orbit (by varying beam charge) and applying correction software previously developed and tested at Trieste and SLAC. Simulations have been performed demonstrating expected significant improvement in wakefield-induced beam size dilution.
Experimental plans presented:
2 weeks operations in Dec if funding is finalized.
Implement existing tools in ATF2 system
Measure required response matrices
Perform DFS/WFS correction tests. First by deliberately spoiling emittance by introducing errors and correcting them, later by trying to correct hitherto irreducible errors that pre-exist.
There may be an issue with some/all cavity BPMs which have been seen to have degraded performance whilst unlocking the DR RF for dispersion measurements which will need to be investigated.

Questions/Comments

K. Kubo: Do you directly measure the required transfer matrices?
J. Snuverink: Yes.
T. Okugi: What misalignments do you assume in your simulations?
J. Snuverink: Magnets and BPMs.
T. Okugi: What is the target measurement? What is the goal of the exercise?

J. Snuverink: Look for achieving an intensity-independent orbit and look for improved beam size before->after correction.
T. Tauchi: What sources of wakefields did you consider in your simulations?
J. Snuverink: At cavity BPMs only (as measured)
T. Okugi: Do you assume the same wake function everywhere (in simulations)
J. Snuverink: Yes, for now.
P. Bambade: Can you take into account effects arising from DR orbit changes when the inesity is varied?
J. Snuverink: We expect to be able to use information provided by the DR BPM system to take such effects into account.

Octupoles – simulation and project plans – E. Marin

Presented replies to previous TB concerns regarding this project proposal:
1) Field Errors
MC study performed. Can correct for a random distribution of magnet errors using normal + skew-sextupoles and these planned 2 octupoles. MC study shows uncorrected beam size of 33 +/- 11 nm corrected to 22 +/- 1 nm.
2) Alignment
Vertical alignment of OC1 required to be <25um. Considered too tight for conventional alignment techniques. Instead rely on BBA technique looking for inflection point in downstream BPM cubic response to moving Oct across beam. Simulations show this is achievable assuming 200nm resolution BPMs.
4) Peripheral equipment
Spare mover exists for OC1, KEK will support installation, CERN will provide power supplies required.
3&5) Jitter
This is in reference to a prior consideration of replacing QD0 with a newly manufactured quad which is now not the preferred solution: it is though the introduction of the two octupoles is sufficient for the low-beta program.

Questions

T. Okugi: The simulation results presented indicate sometimes a requirement of up to 10mrad rolls of the octupole, this is beyond the range of the mover system, what to do if this is required?
E. Marin: In this case direct alignment changes to the magnet support by hand will be also required.
T. Tauchi: If large tilts are required can we consider other mover?
… probably not, expensive, manual alignment may be sufficient.