

17th ATF2 Collaboration Meeting

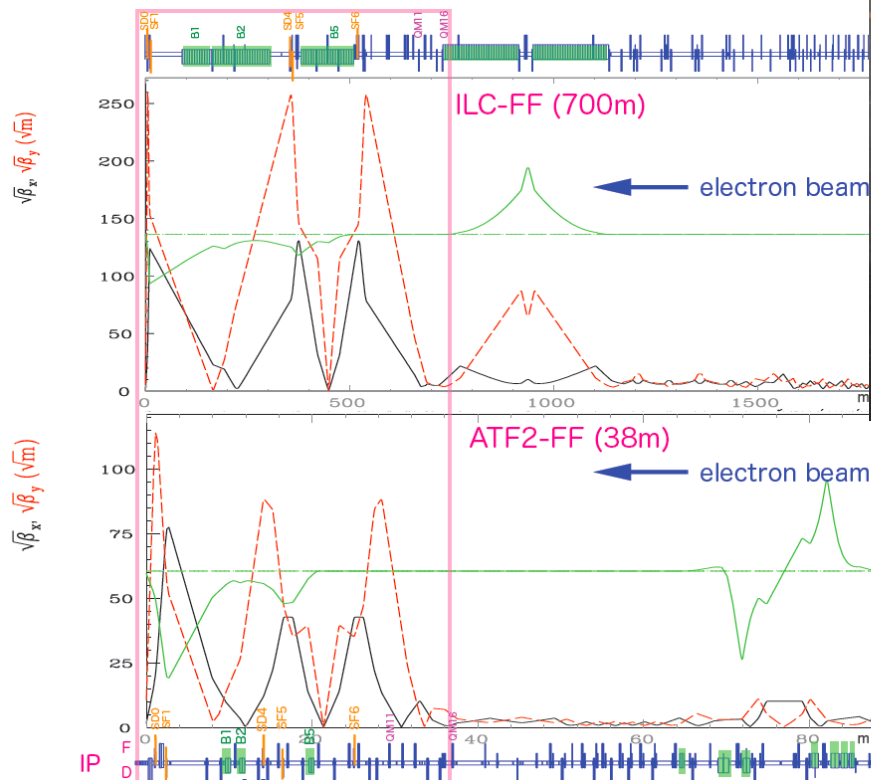
Summary

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ILC Simulations...

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...mountain site simulation added!

LINAC, DR, Alignment

- Considerable improvements in beam delivery to EXT through numerous improvements since summer:
 - Modulator replacement
 - Cooling water regulation system updated
 - Klystron replacement
 - DR air temperature regulation
- Corrective maintenance
 - DR injection kicker HV
 - Gun laser problems (5.6ns -> 2.8ns system restored)
 - DR XSR monitor Si mirror replacement
- New device: MS1X YAG:Ce screen
- Radiation inspection passed Oct/Nov 2013
 - 40mA stored in DR and extracted with acceptable radiation loss
- Alignment [DR, EXT, FFS]
 - EXT, FFS alignment stable
 - DR changes due to temperature fluctuations
 - Desire to find a way to align with magnets ON

DR Tuning Studies

- Fast & automated tuning techniques utilising turn-by-turn DR BPM system implemented by Yves being taken over by Jurgen
- Steady improvements in robustness of software, more work planned
- Beta, tune measurement and correction well in hand
 - Extend to dispersion and coupling correction
 - Hope to recover $\sim 5\text{pm}$ emittance results achieved in earlier tests
- Work planned for non-expert (GUI) interface
- Some problems reported with 8 DR BPMs
 - Should be looked at by Fermilab?

EXT/FFS Optics Corrections

- Optics measurements & corrections in EXT as before
 - Dispersion correction with EXT quads/skew quads
 - Coupling correction by removing OTR tilts
 - Matching using data from mOTR system & Q1-10X
 - Looking to extend to “intrinsic” emittance measurements
 - Non-expert correction possible via mOTR GUI interface
 - Still see weekly drifts in extracted dispersion & coupling conditions
 - Need more work with DR studies to hold EXT channel stable?
- Improvements to mOTR CAL system investigated
- OTR3X target mis-alignment identified and fixed
- Studies continuing to link EXT & FFS optics corrections to IP, including image waist conditions

FFS/ATF2 Goal 1 Progress

- Highest priority is restoration of stable 174-degree mode operations and tuning below 60nm.
 - Experience strongly suggests limiting factor is jitter/drifts in IPBSM laser system
 - Many studies and improvements of laser stability, mainly involving cooling water & air stability
 - Discovery of strong sensitivity of temp. control of harmonic generator identified
 - Hope that situation is now improved for next run, but monitoring of this situation most important aspect of next operations period.
- Continuing statistical analysis of impact of IPBSM signal jitters including simulation work
 - Desire to understand large variation observed during different runs
 - Analysis indicates as much as ~15nm contribution during March period
 - Discussions on presenting estimates of systematic errors due to drifting behaviour during fringe scans (e.g. apparent sudden jumps)

FFS/ATF2 Goal 1 Progress

- Identified requirements for goal 1 instrumentation
 - IPBSM M fluctuation <5%
 - IPBSM C > 0.9
 - IPBPM res. ~20nm
 - IPBPM dyn. range +/- 30um
- Desire to continue in immediate future with 10x1 FFS optics
 - Comparative studies with ILC
 - Similar tuning difficulty in Y
 - Easier in X -> desire to move to 1x1 optics in future...
 - Octupoles may help here with tail folding
- Priority further studies identified
 - Jitter studies
 - Intensity dependence

IPBPM Progress

- System critical for Goal 2 but also very likely to be of importance to Goal 1
 - Strong desire to have fully implemented system asap
- Installation of IP BPM triplet & mover systems complete
- IPBPM system still in commissioning stage
 - First resolution estimates $\sim 30\text{nm}$
 - Discrepancies with different analysis methods need to be solved
 - Worries about dynamic range
 - Appears to be $\sim 3\mu\text{m}$, require $30\mu\text{m}$
 - Suspect gross misalignments of doublet block
 - Hindering resolution calculation efforts
 - May need to re-fabricate or live with 2 BPM system and uncertainties over resolution?
 - Mover setting adjustment presented to clarify situation
- Continuing studies to directly measure vibration stability of mover systems...
- Immediate action required on:
 - Implementing permanent readout to controls system
 - Understanding of linearity limitations restricting dynamic range
 - Clarify BPM co-alignments

Intensity Dependence / Wakefields

- Measurements this run confirm still strong dependence of IPBSM modulation on beam intensity.
- Beam orbit through EXT & FFS better than ever (~100um offsets measured by BPM systems). Also <200um alignment of beamline devices.
 - Cannot explain intensity dependence with studied wakefield sources even with 2X experimentally determined wake potentials for known sources (require 5-6X)
- Emittance growth vs. charge measured in DR and EXT -> small compared with IP measurements.
- Longitudinal wakefields considered -> found to be insignificant
- Many things improved in beamline, has not made significant difference
 - bellows shielding, change to symmetric ports, moving devices from high-beta regions...
- Proposal to implement “wake-free steering”
 - May be difficult to implement due isolating small orbit effects due to wakes from other jitter sources
 - Orbit-based study important however and very welcome
- New proposal to study pitch of beam (head-tail offset)
 - Use tilt signal from IPBPM
 - Pitch needs to be large compared to incoming beam angle -> better to use multiple BPMs
 - Consider direct manipulation of pitch with deflecting RF cavity
 - C-band RF cavity exists at ATF but need C-band RF source
- Proposal to shield vacuum ports in Feb/March timeframe
- Also some possibility to address flange gaps- fill some of them on the above timescale.

Beam Stability / Goal 2

- Blurring lines of distinction between goal 1 and 2 due to desire for stable beam operations for maximum fringe modulation stability.
- Start thinking about moving to 2-bunch operations and upgrading beam diagnostic systems to routinely work in this mode.
- EXT/FFS orbit jitter studies continuing
 - Try to isolate jitter sources
 - 1 main source somewhere in early EXT -> need higher res. orbit analysis in that area to pinpoint.
 - Another source possibly close to FFS beginning
- 2-bunch feedback
 - Factor 3 jitter reduction with u/s FB confirmed @ MFB1FF
 - System becoming more “turn-key”
 - Need to understand reduced FB performance at IP
 - Check optics of U/S system and model propagation to IP and investigate improvement possibilities
 - Need to start work implementing FB system @ IP
 - How to mesh with ongoing IPBPM commissioning effort?
 - Efficient to split signals and proceed in parallel?

R&D Items / New Proposals

- Halo/collimation studies
 - Progress on characterisation of halo & design of new collimation system
 - Looks promising to reduce backgrounds at IP
 - Further work to calculate wake estimates and perform more sophisticated background propagation simulations with showering processes.
- Ground motion FB studies
 - Primary difficulty lies with incoming jitter removal
 - New jitter subtraction technique shows promise, plus inclusion of U/S FONT FB yields further improvements
 - Requests for higher-resolution beam monitoring in EXT and intentions for further FD jitter studies
- OTR/ODR systems
 - <1um OTR measurements presented @ old LW IP
 - New proposals on combined OTR/ODR system to find ultimate limit on spot size measurement capability
- Positron source R&D
 - Optical cavity work by KEK and LAL groups
 - Shown ability to store high beam power in cavity
 - DR beam lifetime dependence on stored power demonstrated
 - Fundamental studies required to understand limitations in stored power and laser profile
 - New conventional positron source R&D effort proposed (test of beam-loading compensation scheme @ ATF)

Immediate next (technically driven) steps are clear...

- Solve IPBSM laser stability issue
- Restore stable 174-degree mode fringe scan operations.
- Try and tune <65nm and find beam size limit with all 1st and 2nd order tuning knobs
 - 10x1 optics, 1E9 Q
- In parallel, continue IPBPM commissioning which may be critical for next steps
- Also in parallel, pursue solution to intensity dependence issue
- Next steps depend upon what we learn... what is the limiting factor for spot size?
 - Beam jitter?
 - Go directly to 2-bunch, jitter studies, b-b feedback etc -> need IPBPM
 - Need high charge -> wake issues
 - IPBSM systematics?
 - Something more fundamental with optics/tuning system?

finally...

- どうもありがとうございました!
- Many thanks to our hosts here at ATF2 and KEK for supporting this meeting and the research activities of all foreign collaborators.