Luminosity Performance Working Group (AC3)

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Suggested Goals

1. “Reassess the performance claims described in the CLIC / ILC Design Reports with special attention to luminosity estimates and feedback system performance.

2. Participate in the discussion of ATF-II ‘lessons-learned’ and should recommend future work to be undertaken at ATF – II and should consider options for experiments at other facilities.”

Overview

- Participants
  - About 10 people
  - More in the joint sessions
    - Injector Systems / MDI-BDS
    - ATF2 day
- Quick survey of the talks
  - Overviews of ILC / CLIC : 3
  - RTML : 3
  - Beam-Based Alignment : 2
  - ATF2 day : 4
  - Interaction Region / Stabilisation : 4
- Ongoing experimental activities and identification of uncovered critical areas
- Recommended steps

Overviews /I

ILC RTML (N. Solyak)

- New TDR lattice for RTML beam-line is now available
- Performances of the RTML resulted satisfactory, however the budget for vertical emittance growth hasn't yet been achieved (reassess the emittance budgets)
- Start-to-end simulation, including dynamic effects and feedback loops are needed

ILC ML (K. Kubo)

- Performance of the ML lattice meet the requirements: BBA, undulator section, couplers - no critical issues found
- Integrated simulations including RTML and BDS are needed

Overviews /II

CLIC RTML (A. Latina)

- A set of lattice files is available, recently completed with : diagnostics section, beam jitter feed-forward, pre-linac collimation. Performance meet the requirements
- Emittance growth budgets need to be reviewed, more resources must be invested in this <<<

CLIC ML (A. Latina)

- Emittance growth budgets have been achieved ; Pre-Alignment specs are met
- Extensive dynamics simulations performed in conjunction with stabilization engineers have achieved the stability goals
- Hardware development programme is being implemented ; more experimental tests are envisaged

RTML

CLIC DR Extraction Kickers (C. Belver-Aguilar)

- Electromagnetic design completed, fulfills the required specifications (field homogeneity, power transmission, impedance)
- Prototypes are being manufactured ; tests without beam are foreseen for September 2013

CLIC RTML collimation systems and beam stabilisation (R. Apsimon)

- A design of the pre-linac collimation system has been outlined, including considerations on the wakefield impact
- A beam-jitter correction feed-forward has been designed: necessary to reduce jitter through collimator, it relaxed stability requirements on DR extraction kicker

Multi-OTR Application to the RTML of ILC and CLIC (A. Faus-Golfe)

- Fast measurement of the emittance, it's being tested at ATF2, preliminary designs of EMS for both ILC and CLIC exist

Beam-Based Alignment

Tests of SYSID + DFS at FACET (A. Latina)

- System Identification algorithms proved to be successful at FACET
- Dispersion-Free Steering, success : emittance growth reduced via dispersion correction

On-line Dispersion-Free Steering (J. Pfingstner)

- Design of advanced feedback loop to simultaneously correct orbit and dispersion in a transparent manner, simulations of the CLIC Main Linac

ATF2 day

Wakefields Studies (J. Snuverink)

- Investigation of wakefields sources in ATF2

Status of lattices (E. Marin)

- Ultra-low beta* for ATF2 lattice

Collimation / Halo (A. Faus-Golfe)

- Pre-proposal for an experiment at ATF2

FFS tuning (G. White)

- FFS tuning is still a tough problem, lessons to learn

Interaction Region

CLIC QD0 and BDS pre-alignment (H. Mainaud-Durand)

- The monitoring of the position of QD0, through a collaboration with NIKHEF
- Survey mini galleries, left-side w.r.t. right-side alignment
- PACMAN project

CLIC QD0 Stabilisation (J. Allibe)

- Very good synergy between LAPP and CERN
- Intense R&D on-going (specifications not yet met, but close)
- Experiments with dummy QD0 foreseen

Two-beam tuning (J. Snuverink)

- Review of two-beam tuning studies for ILC
- Outline of a workplan for reviving and completing these studies

CLIC Post-Collision Line (L. Deacon)

- Sensitive design improvement wrt CDR

Some conclusions from the talks

RTML

- Alignment is difficult, the RTML includes many different systems, longer bunches
- Emittance budgets should be reassessed
- More resources needed

ML

- Emittance budgets have been fullfilled in both projects
- Pre-Alignment and stabilisation have experienced tremendous progress
- Follow-up on the hardware details

BDS

- Tuning is really difficult and slow (review and optimisation of the entire procedure is needed)

Integrated Studies of Luminosity Performance with dynamic effects

- Many tools exists from CLIC, can be used for both projects
- ILC need to revive the dynamic studies
- More inputs needed (stay fields, …)

Experimental Programme

Facilities in use

- ATF2
- FACET
- CTF3

Other facilities that may be used for beam physics studies:

- FLASH (DESY)
- New Muon Lab (Fermilab)
- STF (KEK)

Ongoing Experimental Activities

- **Alignment**
  - Beam-Based Alignment tests at FACET, continue and understand the limitations
  - PACMAN project at CLIC : high precision alignment of components on the girder
  - FFS alignment and beam stabilisation at ATF2
- **Halo and collimation**
  - Halo measurements at ATF2
- **Feedback and feed-forward**
  - Ground motion studies at ATF2
  - Feedback and feed-forward, FONT at ATF2
  - CTF3: Phase feed-forward, current stability, wake monitors, etc.
- **Stray fields**
  - Some activity at Fermilab >>> more consistent effort needed <<<
- **Stabilisation of components**
  - Active and passive stabilisation at LAPP+CERN, very successful, more efforts are needed

Uncovered Critical Areas

- **Alignment**
  - Impact of misaligned cavities on the beam (ILC)
  - Tests of Girder Pitch Alignment (ILC)
  - Wakefield monitors (CLIC)
  - Impact of tilted cavities
  - Alignment of BDS in the Detector Area

- **BPMs**
  - Tests of cold Cavity BPMs
  - Performance . Linearity of BPMs in cryomodules

- **Wakefields**
  - Measurement of long-range wakefields in the CLIC AS
  - Measurement of wakefields in the collimators

- **More on Halo and Collimation**

- **Stray field**s >>> more consistent effort needed <<<
  - Natural field fluctuation is 1 nT over a second
  - Follow the example of the *"LHC Impedance Police"*

Recommended Steps

- Review all ILC luminosity issues and outline a concrete workplan to double-check and reassess the accelerator performance ; optimise the resource for doing so
- Undertake more hardware development (BPMs, …) and more experimental tests
- Start to outline a commissioning strategy
- Additional resources are needed