



NCLINAC

Task 4: BDS



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CERN
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- Objectives
 - ATF2 Tuning and CLIC IR
 - Precision BPMs
 - Laser-wire
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Introduction

Key aspects and sub-systems of the ILC/CLIC beam delivery system will be developed and tested. The projects proposed here are new initiatives emerging from the results of the FP6 scheme (EUROTeV) with particular emphasis on developing and exploiting existing infrastructure at ATF2, CTF3, and PETRAIII.

ATF2 will be the main international test facility for beam delivery studies over the period of FP7. Tuning procedures will be developed and tested at ATF2 and they will provide essential input into optimizing the CLIC IR region, which will also be performed in this context. Advanced BPMs will be employed and tested at the ATF2 and their integration with other systems optimized.

Laser-wire measurements will also be made at PETRAIII, where a fast scanning system will be tested and the challenges of integrating a laser-wire as a reliable machine diagnostic tool will be met.

Objectives

- Develop tuning strategies at ATF2
- Optimize the Linear Collider interaction region,
- Develop advanced beam instrumentation and test at ATF2 and PETRAIII

Deliverables & Milestones

Deliverable	Description/title	Nature	Delivery month
9.4.1	ATF2 tests and CLIC IR study	R	M42
9.4.2	Laser Wire and Beam Position Monitor tests	R	M46

Milestone	Description/title	Nature	Delivery month	Comment
9.4.1	Training at ATF2	O	M18	Commissioning at ATF2
9.4.2	LW and BPMs installed	D	M18	Hardware at ATF2 and PETRAIII

Sub-Tasks

Sub task 1 : ATF2 tuning and CLIC IR

Institute responsible persons

Robert Appleby (UMAN)

Deepa Angal-Kalinin (STFC)

The CI at Manchester (UNIMAN) and STFC at Daresbury will test the tuning procedures at the ATF2 and use this knowledge to optimize the designs of the interaction region of both ILC and CLIC. Different tuning procedures and tuning knobs will be tested at ATF2 to achieve the vertical beam size down to 35 nm; the proposed local chromaticity correction final focus system will be tested experimentally for the first time and various tuning procedures will also be applied to ILC and CLIC to optimize the interaction region (IR). The CLIC IR will be studied in detail, and the impact and mitigation of CLIC detector solenoid effects on the beam orbit, coupling and extraction will be considered. A further goal is to strengthen the computing infrastructure for tracking tools to be used at ATF2/ILC/CLIC and validate them experimentally.

More detailed and modified list of deliverables (27/03/2009)

List of Sub Tasks (ST), including Coordinating Institute:

ST2: Tuning and Interaction region optimization for ILC and CLIC, Cockcroft Institute.

Goal 1 - Participation in ATF2 commissioning (all the dates below assume that ATF2 commissioning goes as planned)

Milestones :

1. Ongoing – October'09 : Deliver dispersion correction and extraction line orbit correction software and test it with beam
2. Ongoing – April'11 : Take part in commissioning shifts of ATF2

Goal 2 – Testing of different tuning procedures and knobs in ATF2

Milestones :

1. October 2009 : Work out the details of testing different tuning procedures at ATF2 for necessary hardware and software
2. April 2011 : Test different tuning procedures to achieve 35 nm vertical beam spot size and document the results

Goal 3 – Give design feedback from ATF2 results to ILC/CLIC BDS FFS and IR design

Milestones :

1. October 2011 : Suggest appropriate design changes to the FFS of ILC and CLIC on the basis of comparison of simulations and experimental tests at ATF2

Goal 4 - IR design studies for CLIC (this work will be done in parallel with Goals 1-3)

Milestones :

1. December 2009 : Development of CLIC extraction line and integration to IR region.
2. September 2010: Calculation of the impact of a candidate CLIC solenoid field on the IP beam orbit and beam size growth arising from coupling of the beam.
3. March 2011: Study the required compensation of detector solenoid orbit effects, including the necessary orbit corrections (using DID or anti-DID for incoming or outgoing beams) as required for CLIC. A comparative study of anti-solenoid against skew quadrupole coupling correction schemes
4. November 2011 : Assessment of impact of IR solenoid and compensation fields on extraction line power losses and required orbit correction

Deliverables :

Report on experience with ATF2 commissioning and tuning procedures :
April'11

Report of design and development of CLIC IR region and extraction line
(Dec'11)

Final Deliverable :

Report on ATF2 tuning tests and CLIC IR study – October'2012 (in 42
months (3.5 years) from start of the project)

Sub task 2 : High Precision BPM

Institute responsible persons

Stewart Boogert (RHUL)

Sub-task 2: At RHUL, high precision BPMs will be developed and tested at the ATF2 with particular emphasis on systems integration. The implications for ILC and CLIC beam diagnostics will be determined via full simulations using these experimental results.

Deliverable: Beam Position Monitor tests Month 46

More detailed Milestones: ATF2 BPM

- July 2009: Commissioning of ATF2 BPM systems
- September 2010: Complete stable BPM operation for times scales of 5 days.
- July 2011: Study of BPM stability and utility for ILC/CLIC beam tuning applications
- July 2012: Complete study of electromagnetic and mechanical stability of BPM systems
- Oct 2012: Complete system design for ILC BPM systems
- Jan 2013: Final report on ATF2 beam position systems

Precision BPM Deliverables

- Report on ATF BPM diagnostics commissioning July 2011
- Report on ATF BPM diagnostics stability and utility, July 2012
 - Including application for beam tuning applications
 - Simultaneous use with other diagnostics, laser-wire, interference monitors, etc
- Final report on ATF BPM diagnostics as prototypes for the ILC and CLIC, Jan 2013

Sub task 3 : Laser-wire

Institute responsible persons

Grahame Blair (RHUL)

At RHUL, Laser-Wire systems will be developed and tested at the ATF2 and PETRAIII with particular emphasis on high-speed operation. The implications for ILC and CLIC beam diagnostics will be determined via full simulations using these experimental results.

Deliverable: Laser wire tests

Month 46

More detailed Milestones: ATF2

- October 2009: First tests at ATF2
- September 2010: Integration of BPM system
- Apr 2011: Verification of micron scale scans, including BPM jitter subtraction
- Oct 2011: Integrated operation within ATF2 diagnostics system
- Oct 2012: Completed beam studies using LW at ATF2
- Jan 2013: Final report

More Detailed Milestones: PETRAIII

- Aug 2009: First tests at PETRAIII using vertical scans
- Oct 2009: Inclusion of horizontal scans
- Sep 2010: First results of two-dimensional scans
- Apr 2011: Measurement of phase space using LW at PETRAIII
- Oct 2011: Integration of LW in PETRAIII diagnostics suite.
- Oct 2012: Completion of beam studies using LW.
- Jan 2013 Final report.

Budget

EuCARD - WP9 NCLinac - Task 9.4: BDS										
Beneficiary short name ^a	Average direct monthly salary * (€)	Rate for personnel indirect costs (%)	Rate for material and travel indirect costs (%)							
UNIMAN	5,769 €	60	60							
ASTEC	6,367 €	105	0							
RHUL	7,310 €	60	60							
RHUL	7,310 €	60	60							
Beneficiary short name (all costs in €)	Person-Months	Personnel direct costs	Personnel indirect costs	Consumable and prototype direct costs	Travel direct costs	Material and travel indirect costs	Total direct costs	Total indirect costs	Total costs (direct +indirect)	EC requested funding ¹
UNIMAN	23	132,687.00	79,612.20	9,100.00		5,460.00	141,787.00	85,072.20	226,859.00	68,200.00
ASTEC	16	101,872.00	106,965.00	0.00	13,500.00	0.00	115,372.00	106,965.00	222,337.00	67,800.00
RHUL	25.5	186,405.00	111,843.00	24,000.00	5,400.00	17,640.00	215,805.00	129,483.00	345,288.00	104,000.00
RHUL	25.5	186,405.00	111,843.00	0.00	4,200.00	2,520.00	190,605.00	114,363.00	304,968.00	92,100.00
...		0	0			0	0	0	0	
Totals:	90	607,369	410,263	33,100	23,100	25,620	663,569	435,883	1,099,452	332,100

Summary

- NCLinac: BDS WP has defined milestones
 - ATF Tuning and CLIC IR
 - Precision BPMs
 - Laser-wire at ATF2 and PETRAIII
- Well defined programme; we're ready to go!