



PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Antonio Gilardi

XXXIII Cycle

Training and Research Activities Report – First Year

Tutor: Prof. Pasquale Arpaia – co-Tutor: Roberto Corsini



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

1. Information

- a. Antonio Gilardi, Master degree in Electronic Engineering, 2017, Università degli Studi di Napoli Federico II «*Innovative way to damp the resonances into the CERN accelerators, using HOM couplers*»
- b. XXXIII Cycle- ITEE – Università di Napoli Federico II
- c. CERN fellowship
- d. Tutor: Prof. Pasquale Arpaia co-Tutor: Roberto Corsini

2. Study and training activities

- a. Courses (credits in brackets)
 - “Relativity”, provided by Prof. H. Henke. (1)
 - “Electro-magnetism”, provided by Prof. H. Henke. (0.5)
 - “Particle Optics”, provided by Prof. J.M. De Conto (1)
 - “Introduction to Accelerator Design and mini-workshop”, provided by Prof. P. Bryant. (1)
 - “Injection/Extraction”, provided by Dr. T. Perron. (0.5)
 - “Transverse Beam Dynamics”, provided by Dr. A. Latina. (2)
 - “MADX”, provided by Dr. G. Sterbini. (0.5)
 - “Cyclotrons”, provided by Dr. B. Jacquot. (0.5)
 - “Longitudinal Beam Dynamics”, provided by Dr. E. Metral and Dr. B. Salvant. (2)
 - “Linear Imperfections”, provided by Dr. H. Bartosik. (1)
 - “Linacs”, provided by Dr. J. B. Lallement. (0.5)
 - “Non-linear Effects”, provided by Dr. H. Bartosik. (0.5)
 - “Synchrotron Radiation”, provided by Prof. R. Bartolini. (0.5)
 - “Space Charge”, provided by Prof. M. Migliorati. (0.5)
 - “Instabilities”, provided by Prof. M. Migliorati. (1)
 - “Accelerator Design workshop”, provided by Prof. R. Bartolini. (1)
 - “Introduction to RF”, provided by Prof. A. Mostacci (0.5).
 - “Vacuum systems”, provided by Prof. V. Baglin (1).
 - “RF Engineering”, provided by Dr. F. Caspers and M.Wendt (1).
 - “Beam instrumentation”, provided by Prof. P. Forck (1).
 - “Superconducting RF cavities”, provided Dr. F. Caspers and M.Wendt (2).
 - “Accelerator controls”, provided by Dr. E. Zimoch (0.5).
 - “Introduction to magnets”, provided by Dr.A. Milanese (0.5).
 - “Normal conducting magnets and mini-workshop”, provided by Dr. T. Zickler (0.5).
 - “Superconducting magnets and mini-workshop”, provided by Prof. P. Ferracin (0.5).
 - “Cryogenics for superconducting devices”, provided by Prof. P. Lebrun (0.5).
 - “Particle sources”, provided by Dr. T. Thuillier (1).
 - “Low-energy electron accelerators”, provided by Dr. W. Mondelaers (1).
 - “Accelerator for medical & industrial applications”, provided by Dr. W. Kleeven (1).
 - “Life-cycle and reliability of particle accelerators”, provided by Dr. S.Meyroneinc (1).
 - “High-current proton linacs”, provided by Dr. s. Bousson (1).
 - “Radiation safety”, provided by Prof. X. Queralt (1).
 - PhD school “Italo Gorini”, organized by the Prof. Pasquale Arpaia and Prof. Stephan Russenschuck (10/09/2018 - 14/09/2018) (4).

b. Seminars

- “Particle accelerators instruments of discovery in physics, European Projects Collaborative Accelerator R&D, accelerators”, Maurizio Vretenar (0,4);
- “Introduction to CERN” Philippe Lebrun 12/01/2018 (0,4);
- “The CERN Accelerator Network”, Reyes Alemany Fernandez (0,4);
- “Superconducting magnet test hall and CERN Control Center”, Philippe Lebrun (0,8);
- “ESRF in Grenoble”, Philippe Lebrun (0,8);
- “LHC & Future High-Energy Circular Colliders”, Frederick Bordry (CERN) (0,6);
- “The neutrino physics programme”, Alain Blondel (0,4);
- “Free-Electron Lasers”, Eduard Prat Costa (0,4);
- “Future High-Energy Linear Colliders”, Louis Rinolfi (0,4);
- “Novel High Gradient Particle Accelerators”, Ralph Wolfgang Assmann (0,4);
- “Accelerator Driven Systems”, Jean-Luc Biarotte (0,4);
- “CERN: LINACs, AD, LEIR, UHV”, Philippe Lebrun (0,4);
- “Accelerators for hadron therapy,” Marco Schippers (0,4);
- “PSI”, Philippe Lebrun (1);
- “Novel accelerators”, Dr Rasmus Ischebeck (0,4);
- “Practical works at CERN”, Philippe Lebrun (0,8);
- “From methodology of inventiveness to applications of plasma acceleration”, Andrei Seryi (0,4);
- “Radiation oncology: biology, physics & clinical applications”, Raymond Miralbell (0,4);
- “Bergoz Instrumentation”, Philippe Lebrun (0,6);
- “Therapeutic applications of accelerators at Geneva University Hospital”, Philippe Lebrun (0,6);
- “GaToroid: A Novel Superconducting Compact and Lightweight Gantry for Hadron Therapy”, Luca Bottura, 22/11/2018 (1).

Full period abroad at CERN, Geneva.

3. Credits summary

	Credits year 1								Credits year 2							
	Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary
Modules	18	14	14	0	0	4	0	32	0	0	0	0	0	0	0	0
Seminars	13	5	5	0	0	0	1	11	8	4	0	4	0	0	0	8
Research	34	0	0	6	6	6	7	25	54	9	9	9	9	9	9	54
	65	19	19	6	6	10	8	68	62	13	9	13	9	9	9	62

4. Research activity

- a. Title: Wake-fields measurements on the CLIC structure
- b. Study: Electromagnetic study on the accelerator
- c. Research description:

- d. I'm involved in the accelerator *CERN Linear Electron Accelerator* for Research. The primary focus for *CLEAR* is general *accelerator* R&D and component studies for existing and possible future machines at *CERN*, based on a broad internal and external user community.
- My main role concerns the study of high-gradient accelerating structure in CLIC (the Compact Linear Collider), a study for a future *accelerator* that will reach unprecedented energies for electrons and their antimatter twins, positrons.
- It is important that the beam passes through the electric center of the accelerating structure, otherwise an additional force component, orthogonal to the reference trajectory, arises. This force kicks the beam by adding a transverse component to the particle momenta.
- If this kick is too strong, it can cause that parts of the beam to get lost on the walls of the machine. My main focusing during the first year is to build a beam-based method to estimate the transverse kick, using a beam screen.
- A beam screen is a device that is inserted into the beam line and emits light when it is struck by the beam, in a pattern identical to the projection of the beam distribution. The idea is used to evaluate the centroid of the beam while changing the displacement between the structure and the beam trajectory.
- e. Collaboration: CLEAR and CLIC working groups

5. Products

a. Publications

- Books, Book Chapters, Journal papers, Conference papers (mark international products):

Conference papers:

I2MTC 2018 – IEEE International Instrumentation & Measurement Technology Conference: “Experimental analysis for the optimal choice of High-order Modes couplers design parameters for resonance damping” P. Arpaia, O. E. Berrig, L. De Vito and A. Gilardi

Technical Report:

The Compact Linear Collider (CLIC) Project Implementation Plan
The Compact Linear Collider (CLIC) 2018 summary report
The Compact Linear e+e- Collider (CLIC): Physics Potential
The Compact Linear e+e- Collider (CLIC): Accelerator and Detector
CLIC Group

Technical Report under review:

Test and calibration of the CLIC structure girder mover in CLEAR
CLEAR Group

b. List those in preparation:

Title: “Reducing parasitic resonances in particle accelerators components by broadband Higher Order Mode couplers” P. Arpaia, O.E. Berrig, L. De Vito and A. Gilardi

Title: “Beam--based alignment of the CLIC high-gradient X-Band accelerating structure using beam screen” P. Arpaia, R.Corsini, A.Gilardi, K.N.Sjobak

6. Conferences

- a. Details (Conference name, place, dates, number of papers)
Conference name: I2MTC
Place: Houston, Texas, USA
Dates: 14-17/05/2018
Number of papers: 1
- b. Presentations made
Poster presentation at the: PhD school Italo Gorini.
Place: CERN, Geneva, Switzerland
Dates: 10-14/09/2018
Number of posters: 1

6. Tutorship

- Assistant during the course of “RF Engineering” at the JUAS, provided by Dr. F. Caspers and M.Wendt, 10 hours

Antonio Gilardi



Prof. Pasquale Arpaia

