



Marie Curie Training Networks :

oPAC EXPERIENCE

Alessandra Valloni
CERN

'Universities meet Laboratories' Workshop
30th September - 1st October 2014,
Frankfurt, Germany

Marie Curie Training Networks FP7 ITN



MARIE CURIE ACTIONS research fellowship program is a set of mobility research grant schemes funding pre- and post-doctoral researchers in Europe as well as experienced researchers



Fellowships are awarded by the European Commission in various scientific disciplines within the **People programme (FP7)**

Initial Training Network (ITN)

Initial training of researchers to improve mostly young researchers career perspectives in both public and private sectors, by broadening their scientific and generic skills, including those related to technology transfer and entrepreneurship



3 European Network installed within the FP7 Marie Curie Initial Training Network scheme



*started on 1st June 2008
with a duration of 48 months*

Novel **D**iagnostic **T**echniques for future particle **A**ccelerators:
a Marie Curie Initial Training **NET**work



*started on 1st October 2011
with a duration of 48 months*

Exploitation of **L**asers for applications at accelerator facilities for ion beam
generation, acceleration and diagnostics



*started on 1st December 2011
with a duration of 48 months*

Optimization of the performance of any **P**article **A**ccelerators

About oPAC:

OPTIMIZATION OF THE PERFORMANCE OF ANY PARTICLE ACCELERATOR

WHAT?

oPAC is the goal of a new network within the FP7 Marie Curie Initial Training Network scheme

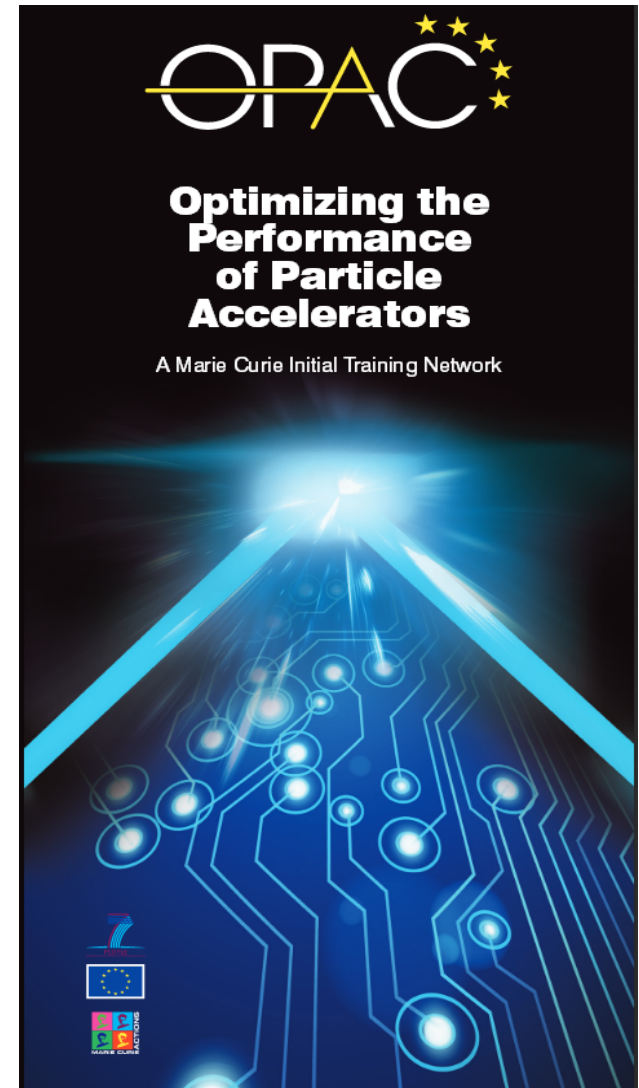
HOW?

The network presently consists of an international consortium of more than 30 partner organizations including universities, research centers and private companies

WHY?

oPAC aims at developing long term collaboration and links between the involved teams across sectors and disciplinary boundaries and to thus help defining improved research and training standards

With a project budget of 6M€, oPAC is one of the largest projects ever funded by the EU within the Marie Curie ITN



oPAC: NETWORK STRUCTURE

oPAC brings together leading research centres, universities, and industry partners to jointly train the next generation of researchers in accelerator science and technology

Partners



Full Partners
Associated Partners
Adjunct Partners



Steering Committee



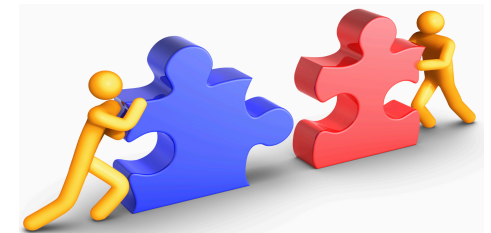
Joaquin Gomez Camacho
Erich Griesmayer
Andreas Jansson
Rhodri Jones
Pavel Karataev
Meghan McAteer
Nika Vodopivec
Carsten Welsch



Fellows



23 fellows from 14 countries,
across 4 continents



oPAC: PARTNERS

Full/Beneficiary Partners



Associated Partners



Adjunct Partners (part of the oPAC long term strategy)



oPAC: STEERING COMMITTEE



J. Gomez Camacho



E. Griesmayer



A. Jansson



R. Jones



P. Karataev



M. McAteer



N. Vodopivec



C. Welsch

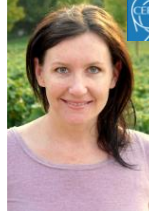
oPAC: FELLOWS



D. Astapovych



M. Bartosik



M. McAteer



A. Valloni



M. Fernandes



M. Sofranac



S. Naveed



E. Cruz Alaniz



B. Lomberg



M. Battaglia



G. Scognamiglio



S. Bruschetta



L. Torino



M. Carla



C. Roose



M. Jarosz



P. Kavrigin



M. Cargnelutti



H. Garcia



K. Kruchinin



P. Maslov



X. Nuel Gavalda



X. Chen

oPAC Objective: **RESEARCH PROJECTS and TRAININGS**

Goals

- ✓ Train the next generation of accelerator experts in best possible way
- ✓ Provide them with ideal skills basis for their future careers
- ✓ Promote collaboration and cross sector exchange
- ✓ Secondments to understand how R&D works at different places



Four R&D work packages:

1. Beam physics
2. Beam diagnostics
3. Simulation tools and accelerator control
4. Data acquisition systems

Trainings

- ✓ Local training by host
- ✓ Network-wide schools on diagnostic techniques
- ✓ Intra-network exchange of researchers
- ✓ Secondments to partners from industry
- ✓ Training in complementary skills



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oPAC R&D Work Packages

Beam Physics

- ✓ Development of designs for possible LHC upgrade options
- ✓ Advanced beam physics problems at light sources
- ✓ Optics and lattice design studies for the interaction region design of the LHC experimental insertions
- ✓ LHeC as a future upgrade option of the LHC
- ✓ Simulation studies into halo generation in high brightness hadron beams
- ✓ Studies into beam loss patterns at ESS
- ✓ Design and development of resonant structures as Schottky noise detectors for various frequencies
- ✓ Optimization of the layout of the LHC collimation system
- ✓ Improvement of the understanding of non-linear beam dynamics effects in light sources

Beam Diagnostics

- ✓ Beam halo monitor development
- ✓ Optimization of beam instrumentation for light sources
- ✓ Cryogenic SQUID-based beam current monitor
- ✓ Beam Loss Monitors for use in Cryogenic Environments
- ✓ Methods for measuring the beam profile in high intensity beams
- ✓ Laser-wire beam profile monitor for measuring the transverse beam profile of an H- beam
- ✓ Optimization of ^{10}Be detection
- ✓ Design a detection system for verifying a 3D method of image reconstruction for Intensity Modulated Radiotherapy Treatment (IMRT)

Simulation Tools

Included in most R&D projects, plus:

- ✓ Development of a simulation suite based on the **multilevel fast multipole method**
- ✓ Development of a **GPU-based PIC solver**

Control Systems

Links all R&D projects, plus:

- ✓ Adaptation of existing **open-source control systems** from compact accelerators to large scale facilities
- ✓ Improvement of the process to identify the **needs for accelerator instrumentation**



oPAC Trainings: Schools

oPAC SCHOOLS


- ✓ CERN Accelerator School, Granada
- ✓ Joint Universities Accelerator school, Archamps
- ✓ 2nd oPAC School - Complementary Skills, Liverpool
- ✓ Advanced School on Accelerator Optimization, London
- ❖ 4th oPAC School, Advanced Researcher Skills School, Liverpool

CERN Accelerator School & the University of Granada will organise a course on





Introduction to Accelerator Physics

28 October - 9 November 2012
Granada, Spain

This basic introductory course will be of interest to young staff from laboratories, universities and companies manufacturing accelerator equipment. The course will focus on the basics of Accelerator Physics such as transverse and longitudinal dynamics, beam measurements and an introduction to multi-particle dynamics. A series of topical seminars and tutorials will complete the programme.



Contact:
CERN Accelerator School
CH - 1211 Geneva 23
Fax: +41 22 767 54 80
www.cern.ch/schools/CAS



 JOINT UNIVERSITIES
ACCELERATOR SCHOOL  



TWO COURSES ON PARTICLE ACCELERATORS
JUAS 2013
7 January to 15 March



Course 1. SCIENCE & PHYSICS (January 7th to February 8th)
Course 2. TECHNOLOGY & APPLICATIONS (February 11th to March 15th)

Intensive programme for graduate students and PhD
Modular Courses for Professionals
Credits available from the 14 European Universities (ECTS)

Organised with the support of 14 major European Universities:

- Universitat Politècnica de Catalunya
- Universitat Autònoma de Barcelona
- Technische Universität Darmstadt
- Universitat de València
- Institut National Polytechnique de Grenoble
- Karlsruhe Institut für Technologie
- Università degli Studi di Napoli "Federico II"
- Università degli Studi di Roma "La Sapienza"
- Technische Universität Berlin
- Universität degli Studi di Genova
- Universität de Valencia
- Universität Heidelberg
- University of Liverpool
- Université Paris Sud - Orsay

Information: JUAS - JUAS
Centre Universitaire de Formation de Recherche
Savoie le 1501, rue Ada Byron
13000 Aix-les-Bains
France +33 (0)4 50 31 50 10
www.cern.ch/juas



oPAC SCHOOLS

2nd oPAC School - Complementary Skills June 3rd - 7th 2013, University of Liverpool, UK

- ✓ Presentation skills
- ✓ Scientific writing
- ✓ Project management
- ✓ Generic skills through outreach project
- ✓ Team working
- ✓ Proposal writing
- ✓ Peer review

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8.30 – 9.30	Introduction <i>Paired Introductions: Participants generate flip chart poster of interview partner then present them to whole group.</i>	Career Prospects in Industry & Academia	Presentation skills <i>Introduction</i>	Advanced Project Management Independent Team Work <i>Teams work on the project according to their plan</i>	Introduction to Peer Review
9.30 – 10.30		Independent Teamwork Dreamer, Realist, Critic <i>Teams to come up with a response to the challenge. Teams choose their project topic and plan the team-working process.</i>	<i>Participants will give 5 minute presentation in small groups about their PhD projects</i> <i>All presentations will be video recorded</i> <i>Feedback by:</i> (1) presenter, (2) (2) fellow students, (3) Tutor	Chairs meeting <i>Present summary of report structure</i> <i>Teams review project following feedback</i>	The Presentation <i>(Followed by Questions)</i>
10.30 - Break	Presentation skills <i>Basics of research presentations – an introduction to the Do's and Don'ts of conference presentation</i>	Target Setting Milestones & deliverables <i>session – assessment of targets for the project</i>		International collaboration	Peer Review preparation
11.00 – 12.30					Peer Review <i>Teams present assessment and feedback</i>
12.30 – 13.30			Lunch		Forward Planning
13.30 – 15.00	Introduction to Project Management	Scientific Writing <i>Focus on writing research papers.</i> <ul style="list-style-type: none">• The writing process and structure• Thinking about the audience• Target journals• Tips <i>Writing for the general public.</i>	Visit to Cockcroft Institute <i>Introduction</i> <i>Tour of facilities</i>	Network diagrams <i>(Understanding dependencies)</i>	
15.00 – Break	<i>Theoretical Background</i>			Independent Team Work <i>Teams continue collaborating on project.</i> <ul style="list-style-type: none">• Produce report• Create presentation	
15.30 – 16.30	<i>Action: Plan PhD project</i>				
16.30 – 17.30	<i>Update description</i> <i>Stakeholder analysis</i> <i>Milestones</i> <i>Deliverables</i>			Assessing Risks	



oPAC SCHOOLS



Advanced School on Accelerator Optimization

7th July to 11th July 2014, Royal Holloway University of London, UK

GOAL of the SCHOOL:

- ✓ Cover accelerator optimization through beam physics studies, instrumentation R&D and charged particle beam simulations at an advanced level

- ✓ Particle beam characterization
- ✓ Sourcery
- ✓ Accelerator Magnets
- ✓ Lattice Design
- ✓ Beam Profile/Position Measurements
- ✓ High(er) accelerating gradients
- ✓ Beam Loss Monitoring
- ✓ Beam Cooling Techniques
- ✓ Particle Tracking Codes
- ✓ 3rd generation Light source
- ✓ Next generation Light Sources
- ✓ LHC Optimization
- ✓ Numerical Optimization
- ✓ Accelerator Control System
- ✓ Compact ASM Systems
- ✓ Future Accelerators



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oPAC Workshops

oPAC WORKSHOPS

- ✓ Specialist Workshops
 - Computer Simulation Technology 'Particle Studio' (24/06/2013, CERN)
 - Bergoz Instrumentation 'Beam Instrumentation' (25/06/2013, France)
- ✓ 1st oPAC Topical Workshop
 - Grand Challenges in Accelerator Optimisation (26-27/06/2013, CERN)
- ✓ 2nd oPAC Topical Workshop
 - Libera Technology (9-11/04/2014, Instrumentation Technologies, Slovenia)
- ✓ 3rd oPAC Topical Workshop
 - Beam Diagnostics (8-9/05/2014, CIVIDEC, Vienna, Austria)
- ❖ 4th oPAC Topical Workshop
 - Computer Aided Optimization of Particle Accelerators (11-13/03/2015, GSI)
- ❖ 5th oPAC Topical Workshop
 - Technology Transfer (22-23/06/2015, University of Liverpool)

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**Training Workshop
CST Particle Studio
24th June 2013**

The oPAC researchers will be asking from universities, research centres and industry partners from across Europe.

This workshop will provide them with specialist training in CST Particle Studio which will be hosted by oPAC Partner CST AG at CERN, Geneva.

The full day intensive training course will include the following topics:

- Setting up an own structure with the powerful modelling interface in CST Studio Suite;
- Understanding how to define a particle source and apply the available emission models to it;
- Loading different types of pre-calculated fields for the particle simulation;
- Using the different post-processing capabilities to read out field and particle result data.

Parameter setting & optimizing created and imported structures;
Tuning the mesh for optimum speed and accuracy;
Training in how to run Wakefield simulation.

For further details on the oPAC project see the project web site:
www.opac-project.eu

Contact and further details:
Prof. Dr. Carsten P. Welsh
Associate Director
Cockcroft Institute
Sci-Tech Daresbury and
University of Liverpool
Warrington WA4 4AD, UK
c.p.welsh@liverpool.ac.uk

This School is bringing all oPAC Fellows to CERN. A full day intense training course, hosted by oPAC partner Computer Simulation Technology (CST) AG, will provide them with training in CST Particle Studio.



This project is funded by the European Union under contract PITN-GA-2011-239435



**Training Workshop
Beam Diagnostics
25th June 2013**

The training will provide insight into the resources available within typical SME technology partners and will include areas such as:

- Assembly of a large dynamic range, 500-MHz RF receiver, with an opportunity to build your own set of components;
- Optical inspection and filters tuning on a vector network analyzer test stand;
- Retrieval and assembly of manufacturer data sheets for performance critical components;
- Characterizing of circuit for environmental conditions;
- Review of design and simulation tools used for the circuit development; Mechanical 3D CAD (SolidWorks), Circuit analogue design and simulation (Proteus), RF simulation (Agilent Genesys/Momentum);
- Measuring of instruments - a critical approach: Time domain vs. frequency domain;
- Provision of an overview of oPAC oPAC limitations and network analysis limitations.

Beam simulation in the laboratory will be provided together with a demonstration of practical applications.

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Prof. Dr. Carsten P. Welsh
Associate Director
Cockcroft Institute
Sci-Tech Daresbury
University of Liverpool
Warrington WA4 4AD, UK
c.p.welsh@liverpool.ac.uk

This Workshop is bringing all oPAC Fellows together for specialist training in Beam Instrumentation and is hosted by Bergoz Instrumentation, France.



This project is funded by the European Union under contract PITN-GA-2011-239435

oPAC WORKSHOPS

- ✓ 1st oPAC Topical Workshop
Grand Challenges in Accelerator Optimisation (26-27/06/2013, CERN)



Grand Challenges in Accelerator Optimisation
CERN, Switzerland: 26th/27th June 2013

Speakers include:

- Green and Compact Magnet Technology for Optimisation of Particle Accelerators
Dr. Spenser Roger Nelson, CEO, Cardiff
- Challenges of High Intensity Accelerators
Dr. Nils Andersson, Head of Accelerator Division, ESS
- Research on Ultra-short Timescales – FELs
Dr. David Nisner, SLAC
- Laser Acceleration – Towards Highest Gradients
Prof. Luis Robo, Director, CELPU
- Unraveling the Secrets of the Universe
Dr. Richard Hawkins, CERN

Accelerators are key instruments for fundamental research, health and industry applications. International collaboration is very important for their continued optimisation.

This two-day international workshop will provide an overview of the current state of the art in beam physics, numerical simulations and beam instrumentation and highlight existing limitations. It will discuss research and development being undertaken and ambitions to further improve the performance of existing and future facilities.

In addition to invited talks, there will be industry displays and a special seminar covering recent LHC discoveries. All participants will have an opportunity to contribute a poster.

This event is open to all and free of charge. Advance registration is required; places are strictly limited.

Full details and registration:
www.opac-project.eu

Contact:
Prof. Dr. Carsten P. Welsch
Associate Director
Cosmos Institute / University of Liverpool
cp.welsch@liverpool.ac.uk



This project is funded by the European Union under contract PITN-GA-2011-289465.

GOAL of the WORKSHOP:

- ✓ Provide an overview of the current state of the art in beam physics, numerical simulations and beam instrumentation and highlight existing limitations
- ✓ Discuss research and development being undertaken and ambitions to further improve the performance of existing and future facilities



oPAC WORKSHOPS

- ✓ 2nd oPAC Topical Workshop
Libera Technology (9-11/04/2014, Instrumentation Technologies, Slovenia)



Libera
WORKSHOP 2014

- ✓ 3rd oPAC Topical Workshop
Beam Diagnostics (8-9/05/2014, CIVIDEC, Vienna, Austria)



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oPAC CONFERENCE and SYMPOSIUM

- ✓ Symposium on [Accelerators for Science and Society](#)
June 26th 2015, Liverpool, UK
- ✓ [oPAC International Conference](#)
October 7th - 9th 2015, Seville, Spain

oPAC MID-TERM REVIEW MEETING

- ✓ **oPAC mid-term review** meeting
October 14th 2013, Barcelona, Spain



A representative of the European Commission and an expert reviewer examined all aspects of the oPAC project

- ✓ fellow progress in their R&D activities
- ✓ training provided by each host institute
- ✓ the network as a whole, events organized to date and planned, as well as all aspects of project management



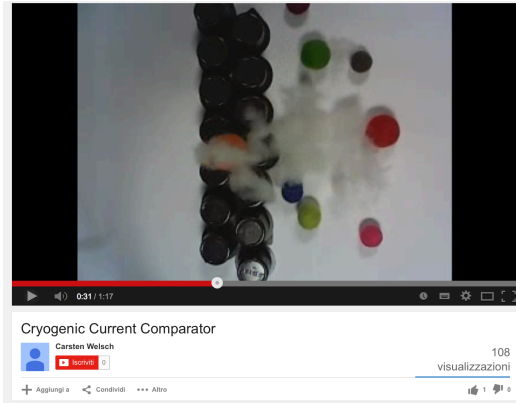
oPAC Dissemination

- ✓ Leaflets and Brochure - distributed internationally
- ✓ CERN Bulletin articles about projects
- ✓ Pan European Networks, Science and Technology 6 (2013)
- ✓ Newsletter
 - Contribution from all network partners
 - Announcement and review of activities
- ✓ Social networking and video sharing

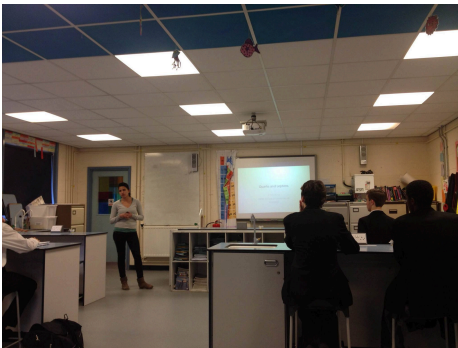


OPAC FELLOWS OUTREACH

✓ Webcasts about projects



✓ Engagement with local schools



Liverpool



Montenegro



Barcelona

✓ Specific opportunities (e.g. CERN guide, STEM ambassadors, etc.)

Summary: GOALS OF oPAC



- ✓ Promote international Collaboration
- ✓ Provide access to world-class research infrastructures
- ✓ Include applied research
- ✓ Strengthen Industry – Academia partnership
- ✓ Organize workshops and conferences as drivers for knowledge exchange



- ✓ <http://www.opac-project.eu>
- ✓ <http://www.la3net.eu>
- ✓ <http://www.liv.ac.uk/ditanet>
- ✓ <http://www.quasar-group.org>



THANK YOU FOR YOUR ATTENTION

Special thanks to

Carsten P. Welsch and Meghan McAteer



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