

# oPAC Conference

## Optimization of Particle Accelerators

*Prof. Carsten P. Welsch*



# What is oPAC ?



**OPAC**

**OPEN POSITIONS  
WITHIN THE  
OPAC PROJECT**

The optimization of the performance of any particle accelerator ultimately depends on an in-depth understanding of the beam dynamics in the machines and the availability of simulation tools to study and continuously improve all accelerator components. It also requires a complete set of beam diagnosis methods to monitor all important machine and beam parameters with high precision and a powerful control and data acquisition system.

Within the oPAC project these aspects will be closely linked with the aim to optimize the performance of present and future accelerators that lie at the heart of many research infrastructures.

The network is currently aiming to recruit a pool of talented, energetic, strongly motivated, early stage researchers with a degree in physics, electrical engineering or a closely related field. Possibilities for enrolling into a PhD program exist. Women are especially encouraged to apply.

Deadline for applications:  
March 9<sup>th</sup> 2012

Each researcher will benefit from a wide ranging training program that will take advantage of both local and network-wide activities, as well as of schools, conferences, and workshops. Excellent salaries will be offered. Most positions are for starting in summer 2012.

You will find more information about oPAC, all research projects and the application details at:  
<http://www.liv.ac.uk/opac>

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- Optimization of Particle Accelerators
  - 23 ESRs
  - 40 Partner Institutions
  - 6 M€



[www.opac-project.eu](http://www.opac-project.eu)

# Overview of Consortium



- Beneficiary partners



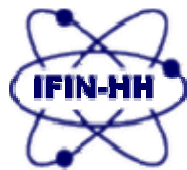
- Associated partners



# Adjunct Partners



- Part of the long term strategy – oPAC is growing



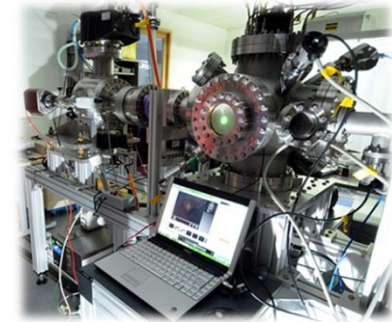
ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA



# Why needed ?



- Well suited as cross-sector collaboration is key to our research.
- Essentially all large-scale experiments require international cooperation



- Research area needs significantly more trained accelerator experts;
- Few universities in EU provide structured courses – oPAC drives innovation in researcher training

# WP2 – Beam physics



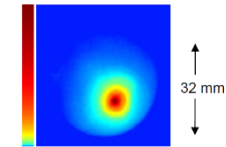
- Development of designs for possible LHC upgrade options
- Advanced beam physics problems at light sources
- Optics and lattice design studies for the interaction region design of the LHC experimental insertions
- LHeC as a future upgrade option of the LHC
- Simulation studies into halo generation in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



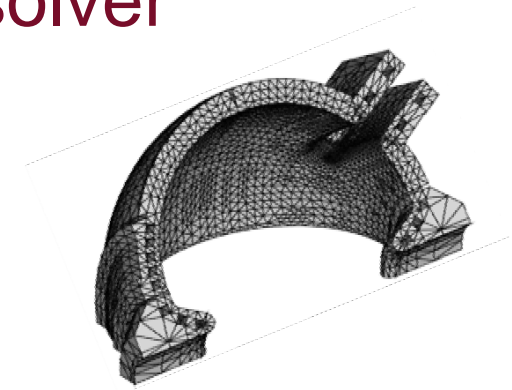
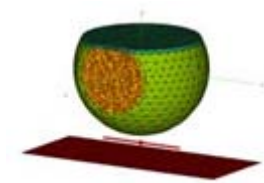
# WP3 – Beam Diagnostics



- 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  $^{10}\text{Be}$  detection
- Design a detection system for verifying a 3D method of image reconstruction for Intensity Modulated Radiotherapy Treatment (IMRT)



- Included in most R&D project, plus:
- Development of a simulation suite based on the **multilevel fast multipole method**
- Development of a **GPU-based PIC solver**





- 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



- Objective: 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

➔ Motivation: *Ideal* Training.



# Training – each Network Node

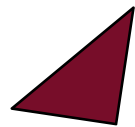


- Provide trainees with broad skills base
- 100% focus on research project
- In accordance with national (PhD) regulations
- Enable secondments between nodes
- Promote knowledge exchange and collaboration across the network
- Initial plan fixed in CDPs, additional opportunities already taken (e.g. JUAS, IPAC, etc.)

# Network-wide Training



- **Schools** in Accelerator Physics (CAS, JUAS) and Complementary Skills
- **Topical Workshops** on focused research areas
- **Training Days** on expert topics
- **Conference and Symposium** to summarize and disseminate research results internationally
- Provision of seminars, contributions to conferences, etc.
- **Secondments** between partners



# Conference contributions



## ■ Conferences 2012

- IPAC stand
- BIW, LAP, etc.



## ■ Conferences 2013

- FEL, IPAC, IBIC, HEA L&T, etc.
- IBIC stand

## ■ Conferences 2014

- IPAC stand, ESOF
- IBIC, IPAC



## ■ Conferences 2015

- IPAC stand, IBIC
- Symposium



# Outreach & Communication



- **Complementary skills training**
  - Communication, project management, IPR
- **Administrator training**
- **HEA seminar, Teaching & Learning**

## Public engagement

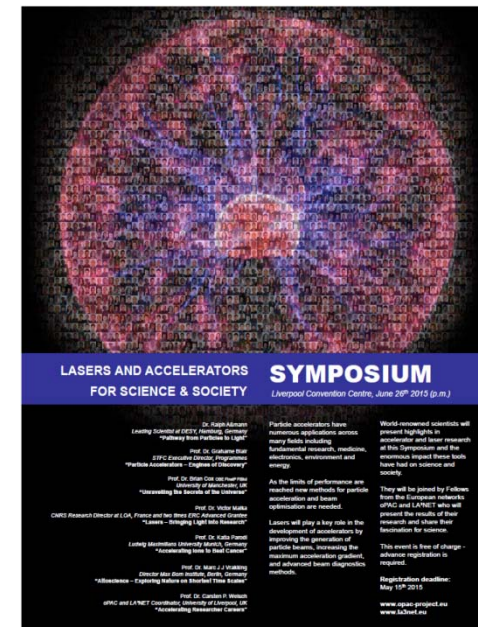
- Fairs & conferences
- Project videos
- Symposium on Accelerators & Lasers for Science and Society, Liverpool Convention Centre, 26 June 2015



Common HW and SW Platform  
for different Particle Accelerators



Manuel Cargnelutti



# Administrative Support



- Promotes oPAC research, training and administration internationally
- Contributions to IPAC, HEASTEM, IBIC, etc.
- ‚Best practice‘ in Europe (EC)



# Stay tuned !!



- URL: <http://www.opac-project.eu>

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## Welcome to oPAC

The optimization of the performance of any Particle Accelerator (oPAC) is the goal of this new network within the FP7 Marie Curie Initial Training Network (ITN) scheme.



## Our Network

We work with the leading research centres, universities and industry partners.

[Find out more](#)



## Upcoming Events

Oct 7<sup>th</sup> - 9<sup>th</sup> 2015

## News

oPAC featured in the Cockcroft Institute

Beam Diagnostics – Down Under

Crowdsourcing effort - The Secrets of the Universe

Liverpool and Seville team up for oPAC's grand finale





# Conference Overview



- Talks will cover entire spectrum of oPAC research;
- Fellows present their research results – invited speakers put work into broader context;
- Poster session for additional discussions;
- Time for Q&A scheduled in – make use of it.

Enjoy the conference !!