



Welcome !!
to the CAoPAC Workshop
Carsten P. Welsch



What is oPAC ?



- Optimization of Particle Accelerators
 - 23 ESRs
 - >30 Partner Institutions
 - 6 M€



www.opac-project.eu

OPAC

OPEN POSITIONS WITHIN THE OPAC PROJECT

The optimization of the performance of any particle accelerator critically depends on an in-depth understanding of the beam dynamics in the machine and the availability of simulation tools to study and continuously improve all accelerator components. It also requires a complete set of beam diagnostic 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 9th 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.

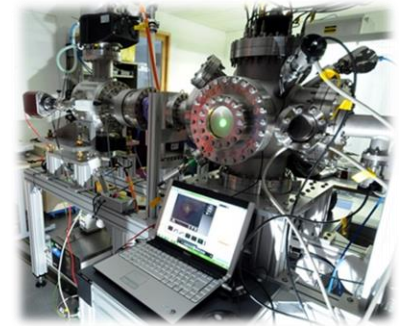
You will find more information about oPAC, all research projects and the application details at:
<http://www.liv.ac.uk/opac>

Contact and further detail:
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This project is funded by the European Union under contract PITN-GA-2011-289485

Why needed ?

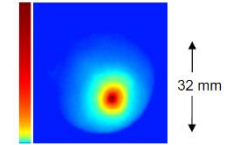
- Well suited as cross-sector collaboration is key to our research.
- Essentially all large-scale experiments require international cooperation



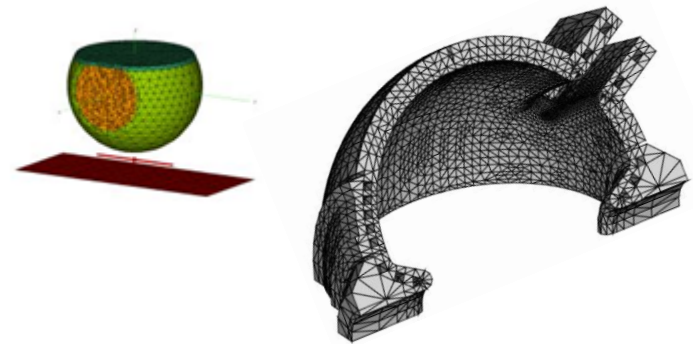
- Research area needs significantly more trained accelerator experts;
- Few universities in EU provide structured courses – oPAC drives innovation in researcher training

- 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 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)



- Included in essentially all R&D projects, 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 under how R&D works at different places

➔ Motivation: *Ideal* Training.



‘Success stories’ (EC)

- Fellow R&D
- Researcher skills training
- Dissemination and Outreach
- Project Coordination & Management



➔ Also recognized as ‘best practice’ by HEA, UKRO, etc.

Stay tuned !!



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

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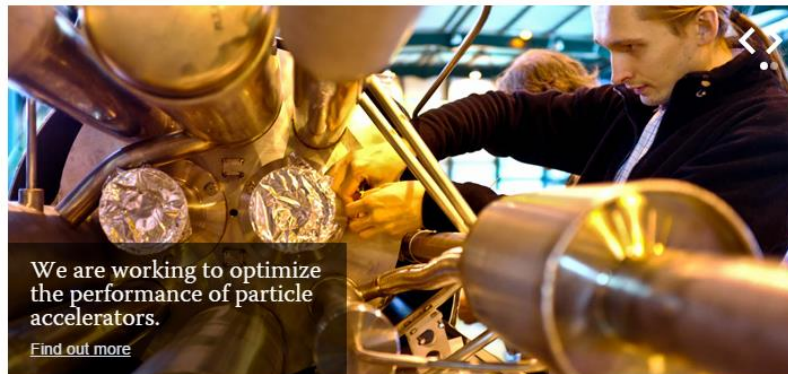
Downloads

Links

EU Project T.E.A.M.

Contact

Part of the School of Physical Sciences



We are working to optimize the performance of particle accelerators.
[Find out more](#)



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](#)

News

[oPAC's bid for the Academy Awards](#)

[A particle accelerator made of Lego bricks](#)

[Breaking the ice with DFSIRFF](#)

LASERS AND ACCELERATORS FOR SCIENCE & SOCIETY SYMPOSIUM

Liverpool Convention Centre, June 20th 2015 (p.m.)

Particle accelerators have revolutionised medicine across many fields including fundamental research, medicine, electronics, environment and energy.

As the limits of performance are reached new methods for particle acceleration and beam optimisation are needed.

Lasers will play a key role in the improvement of acceleration by increasing the precision of particle beams, increasing the maximum acceleration gradient, and advanced beam diagnostic methods.

World-renowned scientists will present highlights in medicine and their research at this Symposium and the numerous related events have been held on science and society.

They will be joined by visitors from all European networks oPAC and CAOPAC and will present the results of their research and their contribution to science.

This event is free of charge - advance registration is required.

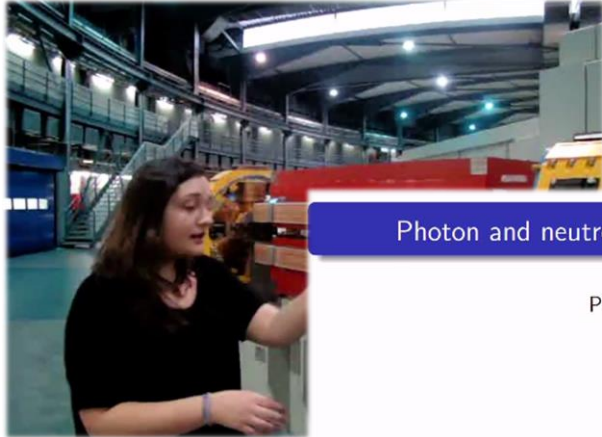
Registration deadline: May 15th 2015
www.opac-project.eu
www.liverpool.ac.uk



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Enjoy the movies !



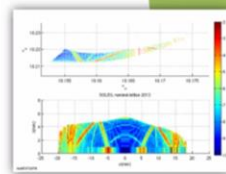
Photon and neutron detection with diamond



Pavel Kavargin

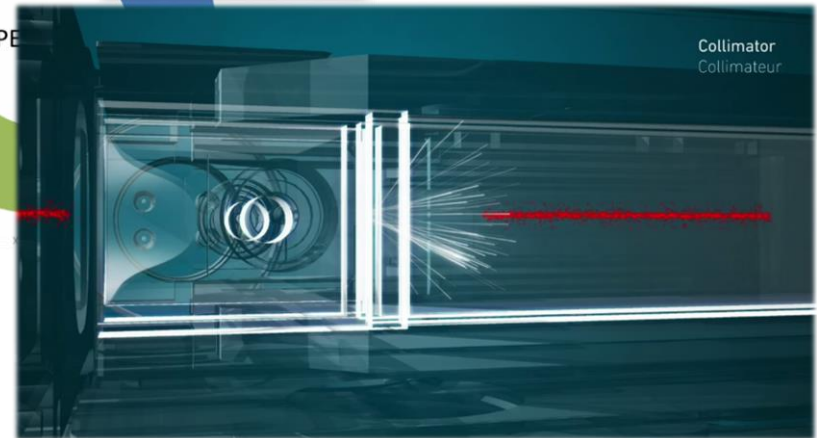


Tools for MOGA



February 2015

EXPE



Examples – many more on
www.opac-project.eu

Bringing the community together

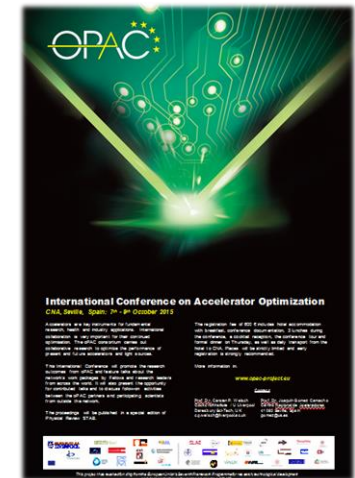


➔ Still growing - join us !

Upcoming Events



- **Symposium** „Lasers and Accelerators for Science and Society“, Liverpool, UK – 26 June 2015
- **Conference** on Accelerator Optimization, Seville, Spain, 7-9 October 2015
- **Meet the TEAM @ IPAC, USA**



This Workshop...



- An exciting program has been put together by our Fellows
- Engage in discussions – find out about new tools, latest upgrades and advanced computation techniques

Simulation techniques in beam instrumentation	<i>Adam JEFF</i>
<i>GSI main auditorium</i>	09:00 - 09:30
RF cavity simulations using CST	<i>Beatriz BRAVO</i>
<i>GSI main auditorium</i>	09:30 - 10:00
Beam cleaning in experimental IRs in HL-LHC for the incoming beam	<i>Hector GARCIA MORALES</i>
<i>GSI main auditorium</i>	10:00 - 10:30
Coffee Break	
<i>GSI Helmholtz Centre for Heavy Ion Research</i>	10:30 - 11:15
Simulation of Accelerator Components with CST Studio Suite	<i>Maryam KIYANI</i>
<i>GSI main auditorium</i>	11:15 - 12:15
Contributed talk	
<i>GSI main auditorium</i>	12:15 - 12:45



Numerical Tools for Accelerator Optimization

Carsten P. Welsch



Looking back 2 years...



- Workshop @ CERN
- IndicoID: 243 336
- Several talks about numerical tools between ,big science‘ experiments



Grand Challenges in Accelerator Optimisation

CERN, Switzerland: 26th/27th June 2013

Speakers include

- Green and Compact Magnet Technology for Optimisation of Particle Accelerators
Dr. Glenn Rogier Heston, CEO, Cernyx
- Challenges of High Intensity Accelerators
Dr. Mala Livshits, Head of Accelerator Division, ESS
- Research on Ultra-short Timescales – FELs
Dr. Daniel Richter, SLAC
- Laser Acceleration – Towards Highest Gradients
Prof. Luka Rossi, Director, CLPU
- Unravelling 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

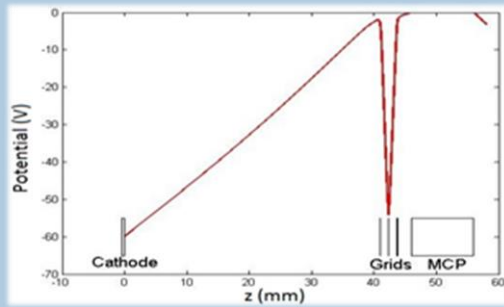
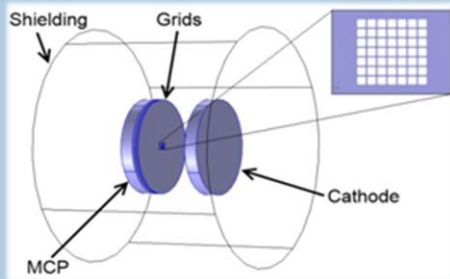
Contact:
Prof. Dr. Carsten P. Welsch
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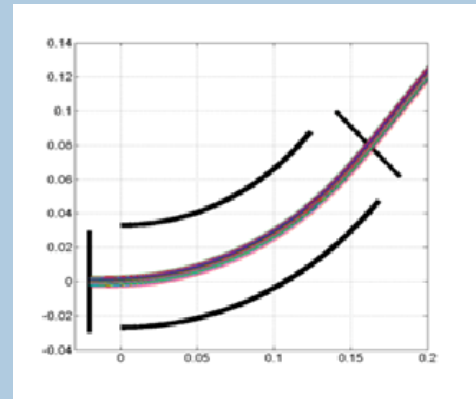
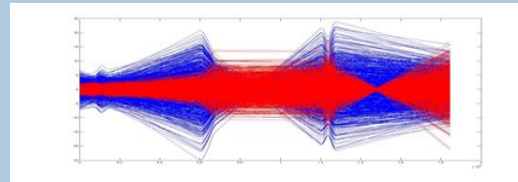
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Computer-aided design...

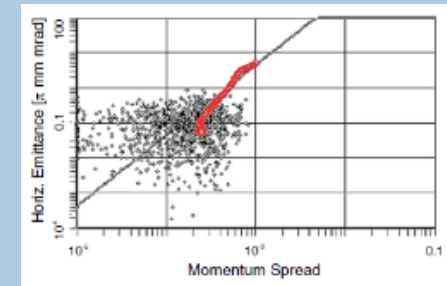
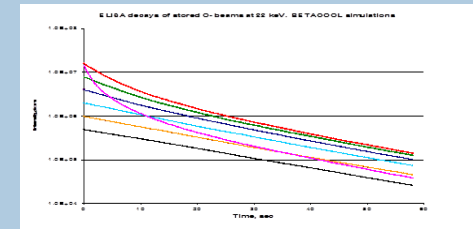
...we can't do without it! (all examples from www.quasar-group.org)



Beam generation

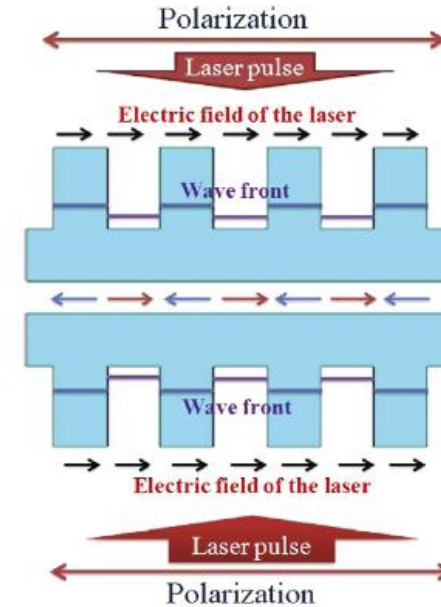
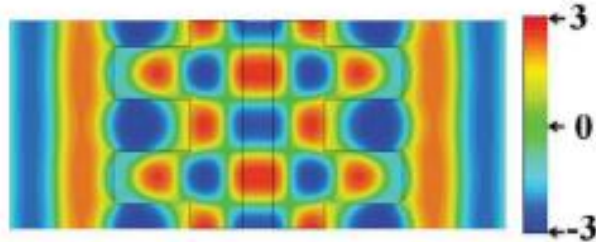


Transport



Storage

■ Dielectric structures



■ Particle-driven plasma wakefield acceleration

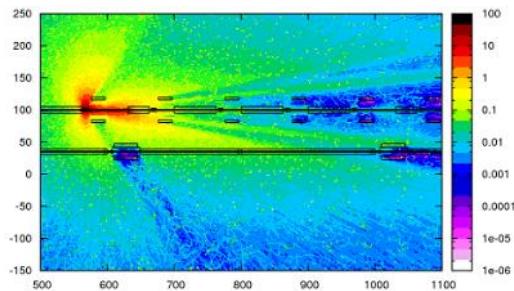
- Beam-plasma interaction
- Diagnostics specification



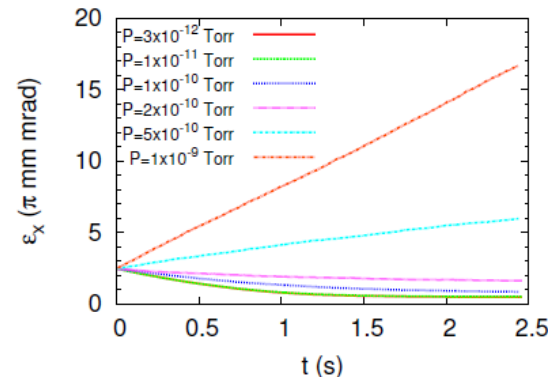
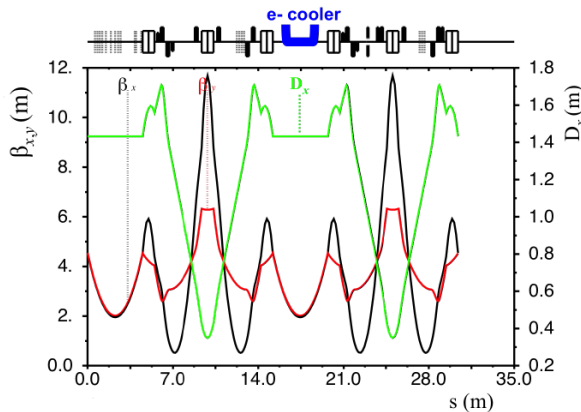
Diagnostics and beam dynamics



- See Adam Jeff's talk for more details
- Examples include: **Beam Loss Monitoring**



- Next generation **low energy antimatter facilities**



Easy to forget:



- Simulations support experiments – they do not replace them !
- Advantages and disadvantages in using purpose-built codes vs. commercial solutions
- Building up a real understanding of the physics of your problem first
- Computer power will only replace careful planning of your simulation to a certain degree.
- This workshop: Overview of various codes, meet the experts, build up a knowledge network !

Goals of oPAC



- Promote international collaboration
- Provide access to world-class research infrastructures
- Include blue sky and applied research
- Strengthen industry – academia partnership
- Organize workshops and conferences as drivers for knowledge exchange



Be part of it !

