The Cockcroft Institute
of Accelerator Science and Technology

UNIVERSITY OF LIVERPOOL

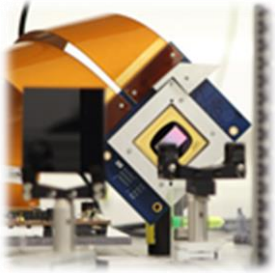
Beam instrumentation R&D in Europe and status of other ITN projects

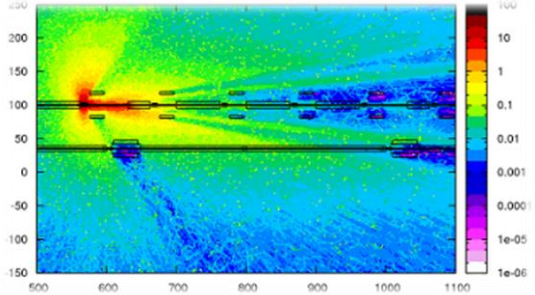
Prof. Carsten P. Welsch

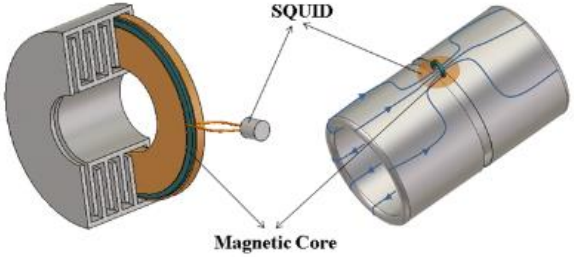
Why me ?

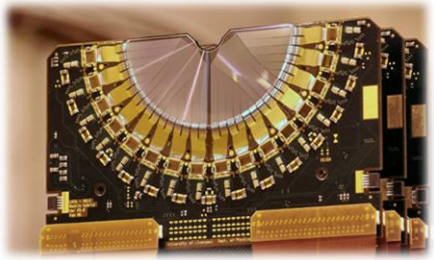
- Full Professor in Physics Department @ U Liverpool
- R&D in Accelerator Physics, focus on diagnostics
- Initiator and Coordinator of 3 ITNs:
  - DITANET *(2008-2012...)*
    4.2 M€, 20 Fellows, 23 partners
  - LANET *Since 2011*
    4.6 M€, 17 Fellows, 23 partners
  - OPAC *Since 2011*
    6 M€, 22 Fellows, 23 partners

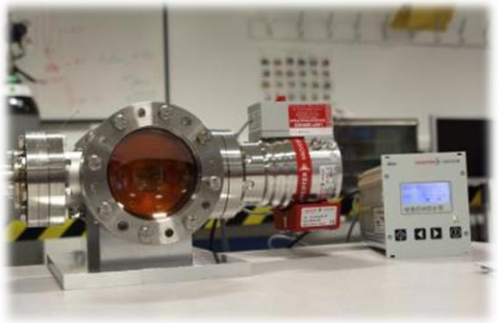
Our R&D into Diagnostics

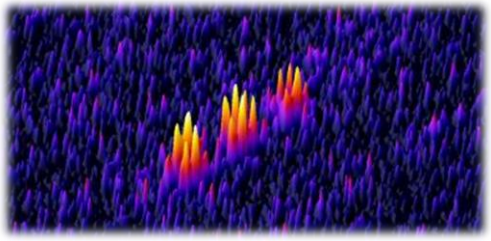










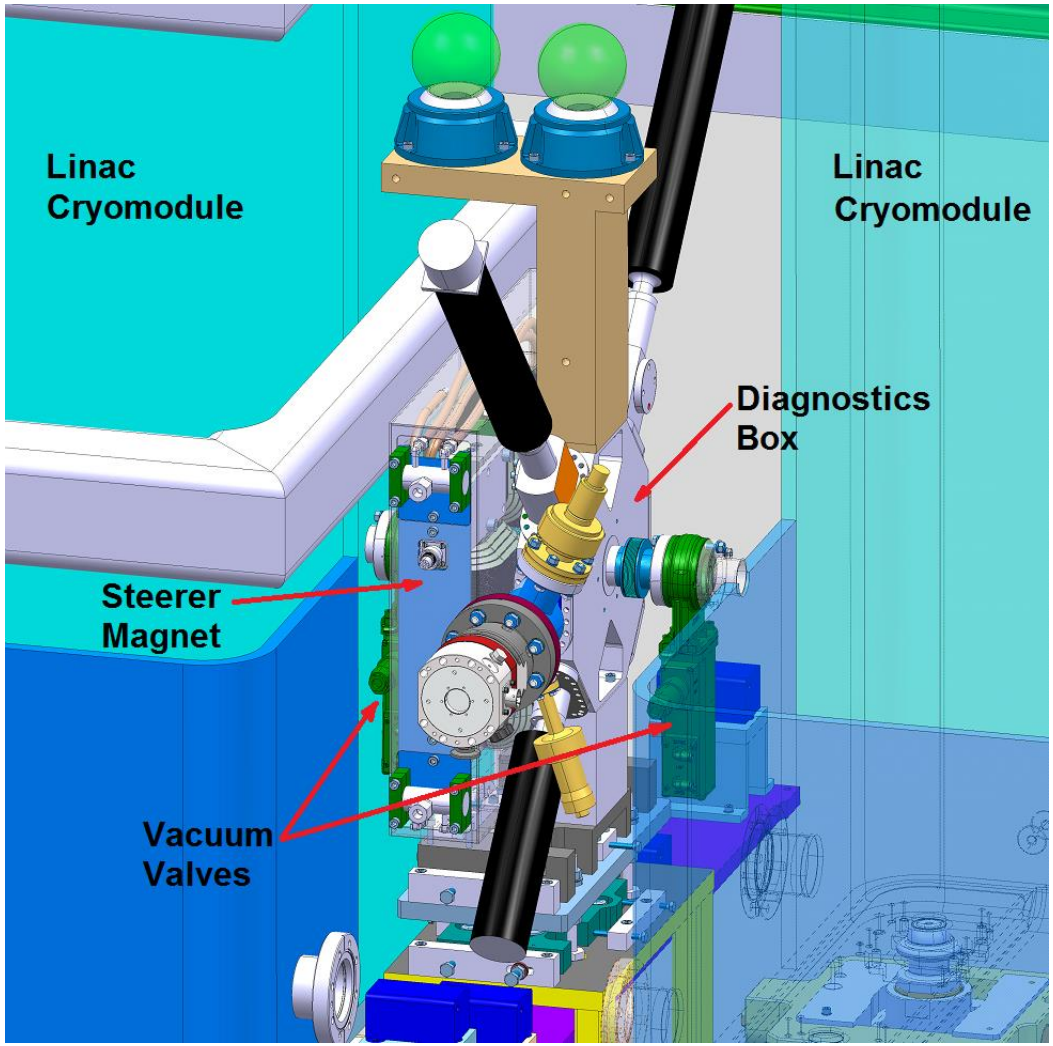


@Cockcroft Institute and CERN
Excellent lab infrastructure

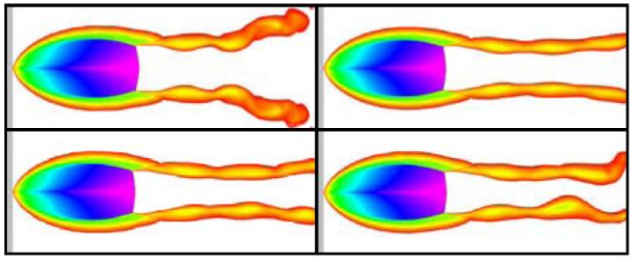
CATHI: Diagnostics Box

- Two projects in beam diagnostics *(ESR and ER)*;
- One a PhD project in Liverpool;
- Simulation and experiment.

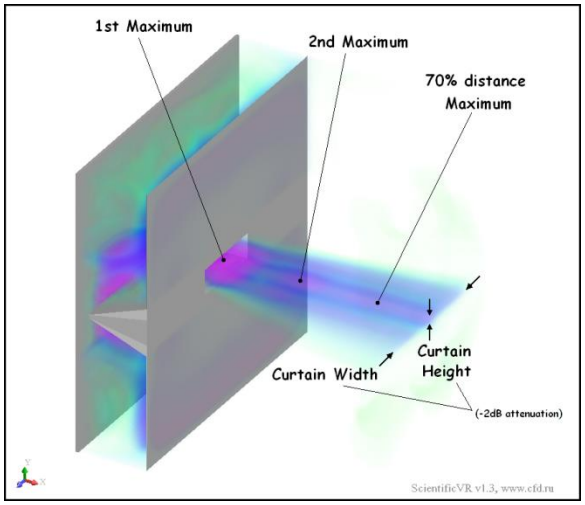
- Details: See Esteban‘s talk.

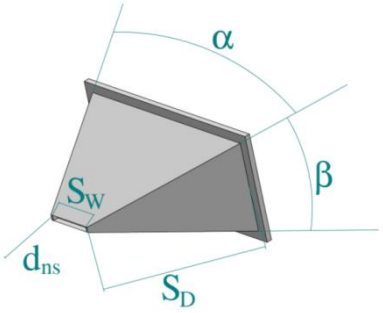


Numerical Investigations



- System optimization and trends analysis

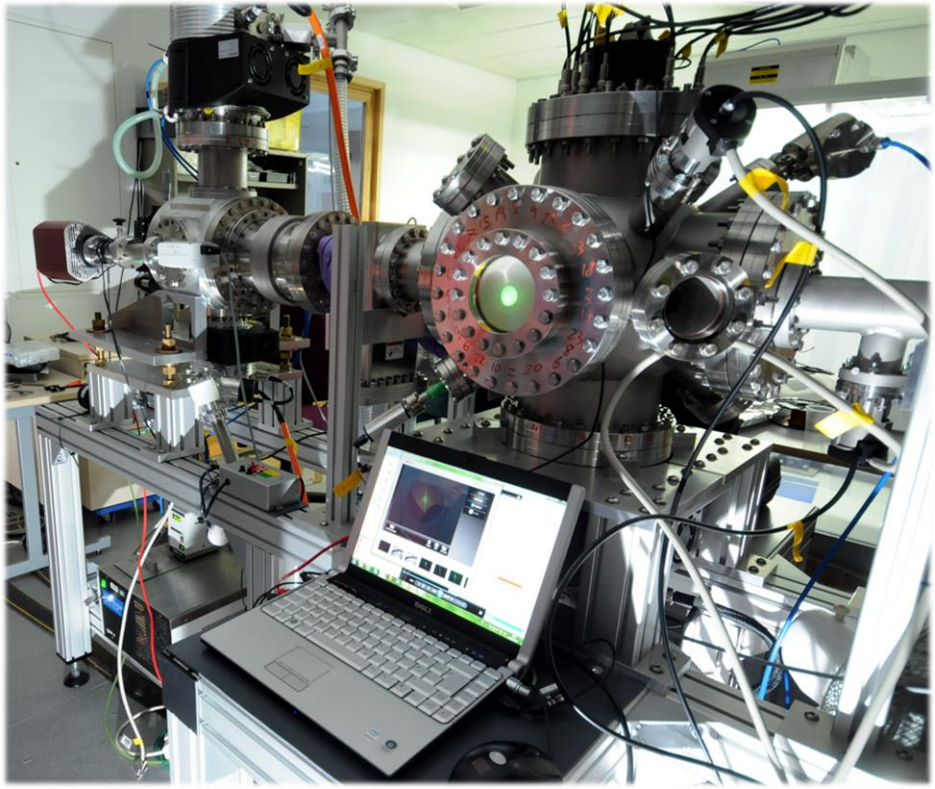


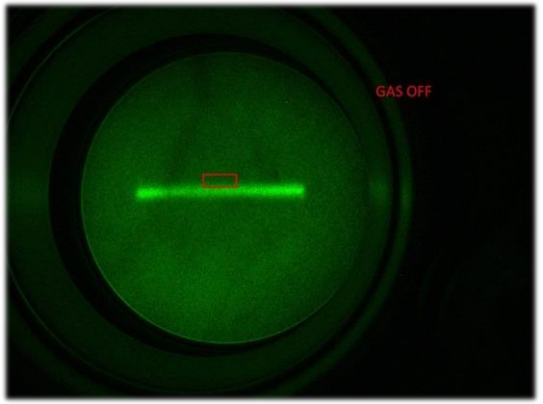


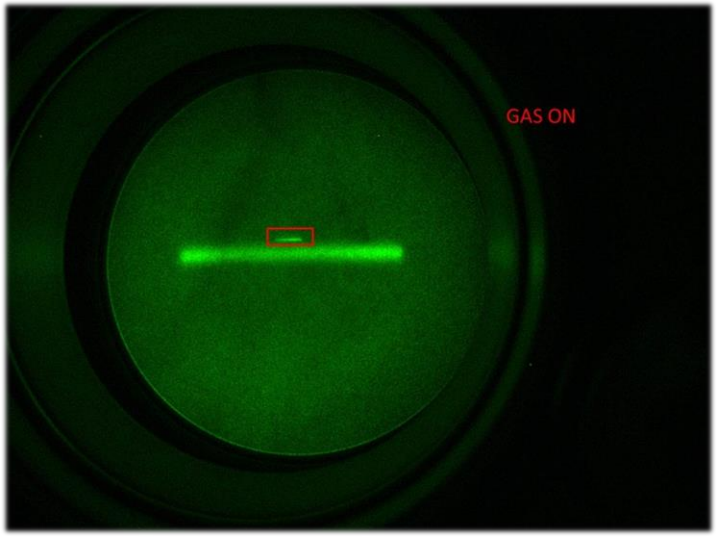
	Mach N.	D	W
α	↘	↘	↗
β	↘	⌒	→
SW	↘	↘	↗
SD	α	⌒	⌒
Dist	↘	α, β	α, β

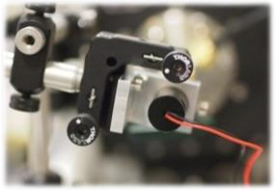
M. Putignano, C.P. Welsch, Proc. BIW, IPAC (2010-2012)
M. Putignano, C.P. Welsch, Nucl. Instr. Meth. A (2012)

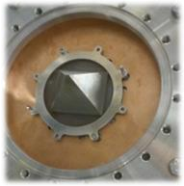
Installation at CI

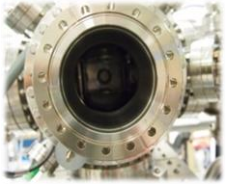








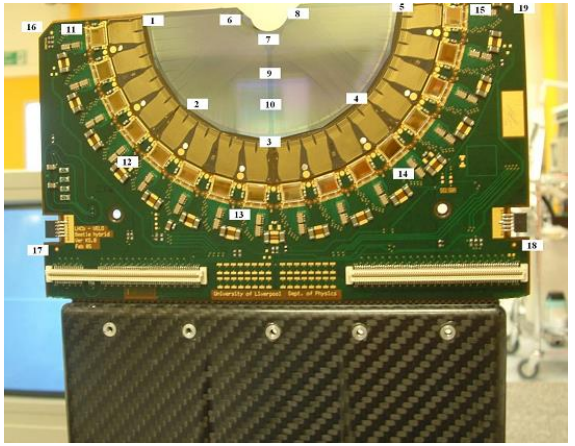


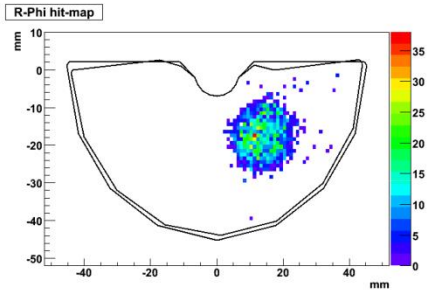


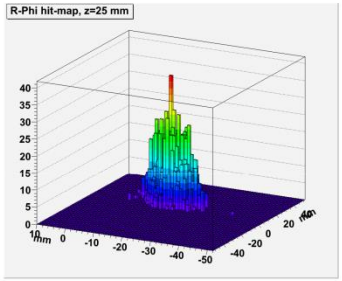
V. Tzoganis, C.P. Welsch, APL (2014).
V. Tzoganis, A. Jeff, C.P. Welsch, VACUUM (2014).

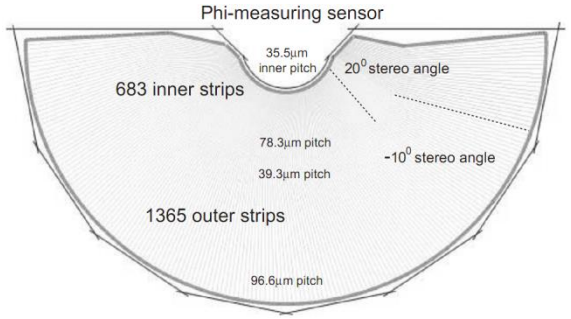
Medical Applications

- Aim: Non-destructive measurement of beam tails;
- Idea: Use LHCb Velo detector to correlate between halo signal and beam current;
- Study halo – dose relationship.



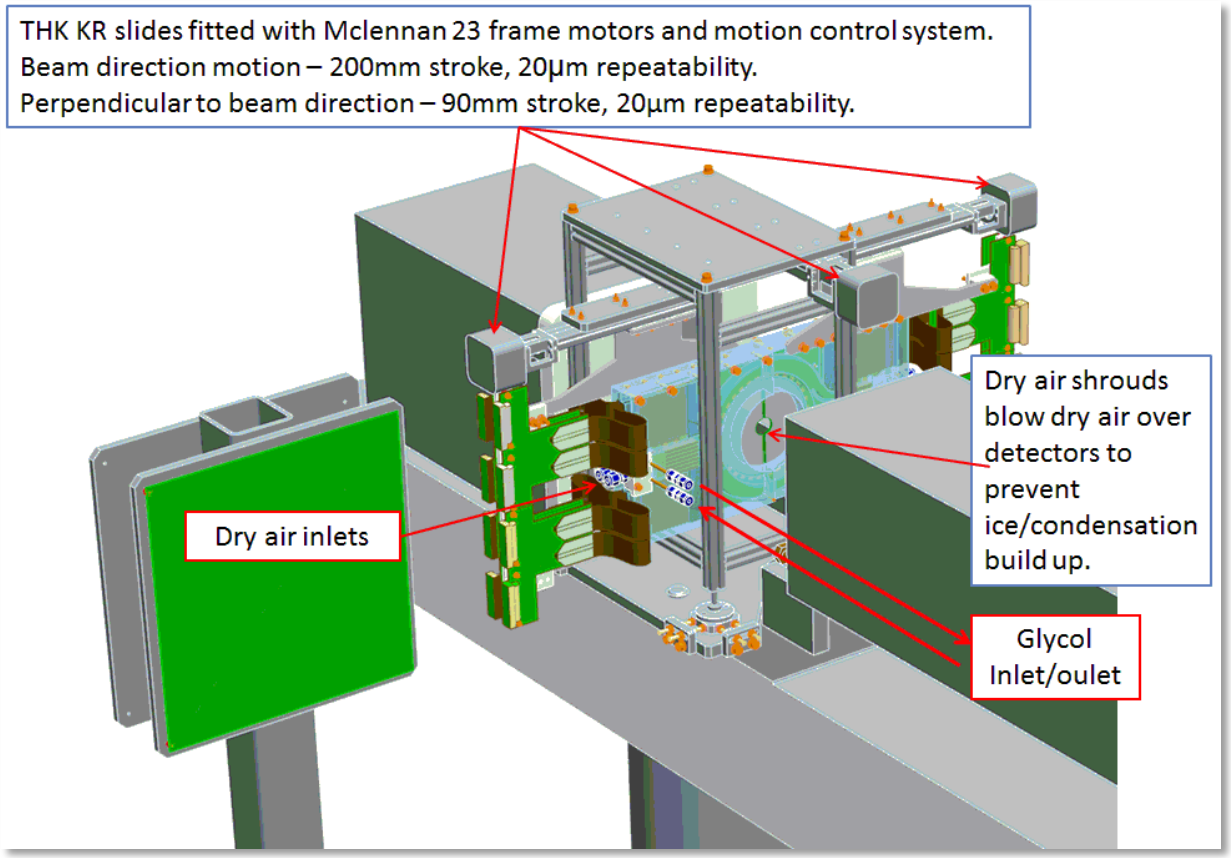




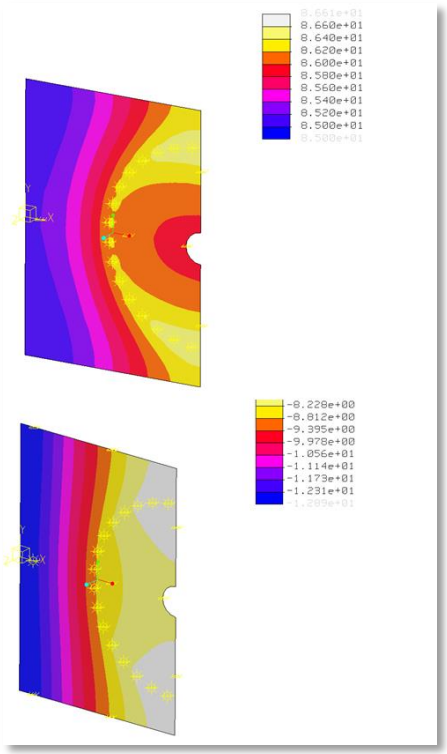


Proof-of-principle: G. Casse, et al., Liverpool

Stand-alone setup



LHCb VELO integration with the CCC treatment beam line.

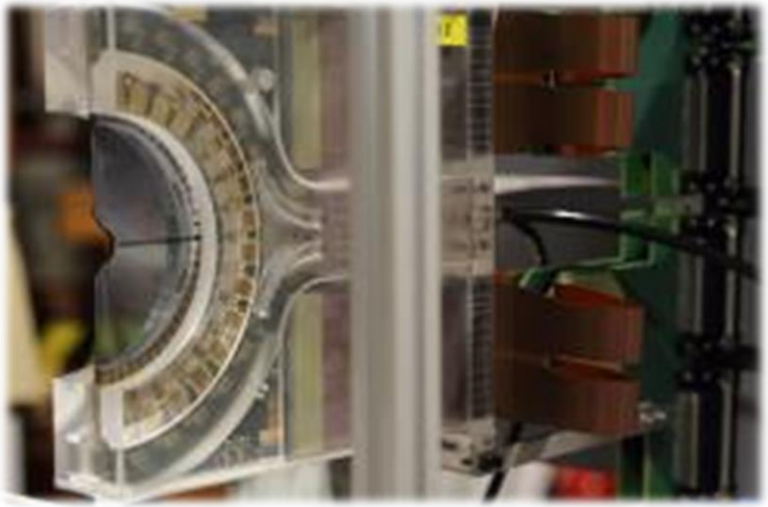


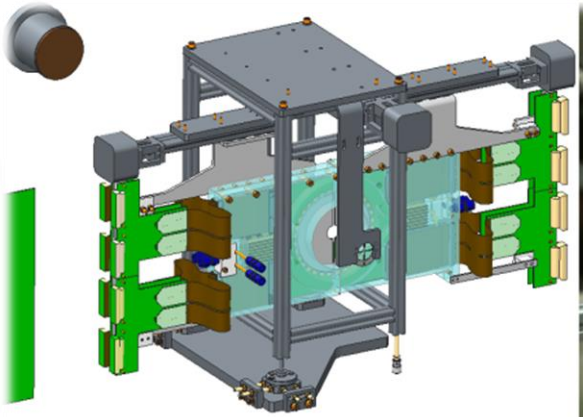
Heat distribution with out and with 40W cooling of the detector.

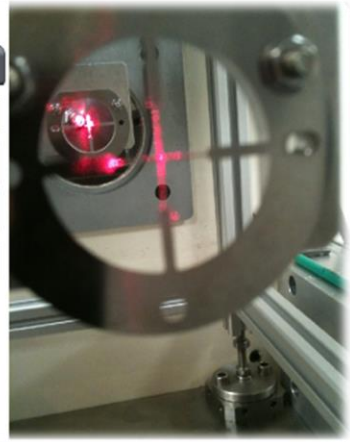
T. Cybulski, C.P. Welsch, et al., Proc. IBIC (2013)

Present situation

- Cooling System



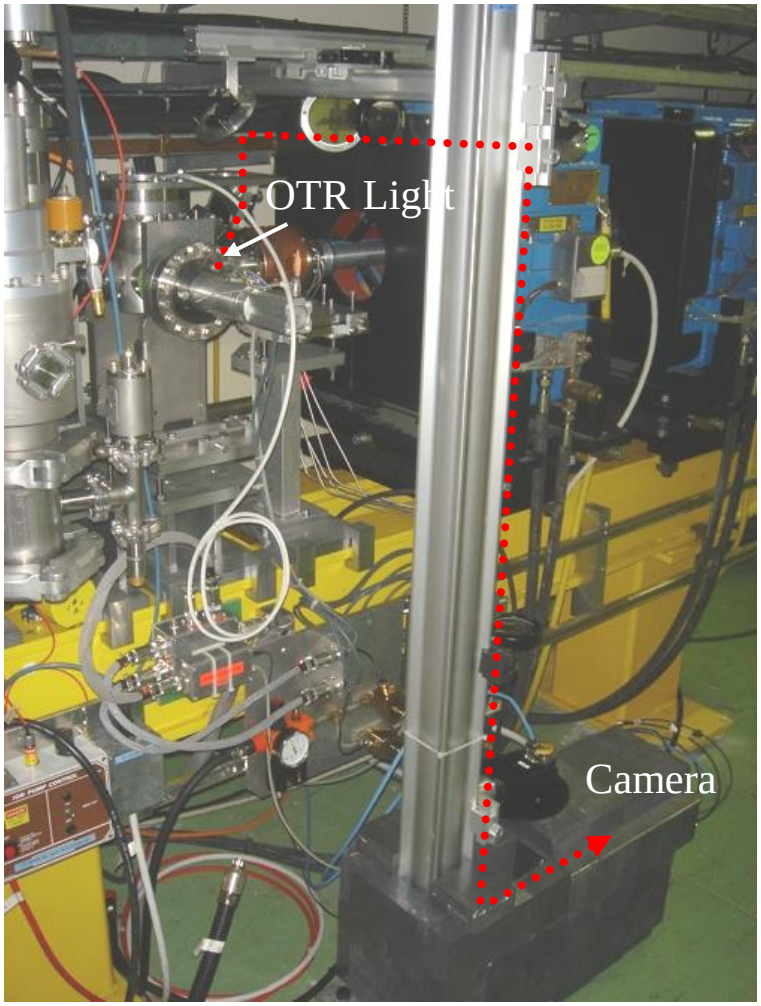




- Alignment System Beam measurements at CCC in 2014.

T. Cybulski, C.P. Welsch, et al., Proc. IPAC (2014)
T. Cybulski, C.P. Welsch, et al., Phys. Rev. STAB, *in prep.*

A „typical“ setup



- Material sciences
- Thermodynamics
- Electro-Magnetism
- Optics
- Mechanics
- Electronics
- Nuclear Physics
- …

➡ Multi-disciplinary field !

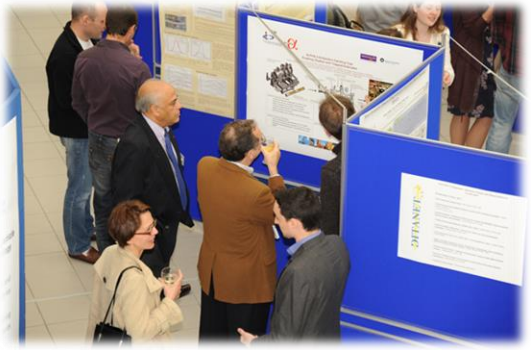
EU-funded Research & Training

The Cockcroft Institute of Accelerator Science and Technology

UNIVERSITY OF LIVERPOOL

DITANET

‹‹ novel **DI**agnostic **T**echniques for future particle **A**ccelerators:
A Marie Curie Initial Training **NET**work ››



MARIE CURIE ACTIONS

PEOPLE

What is/was DITANET ?

- Largest-ever EU funded training network in beam instrumentation and diagnostics;
- Aim: Training of early stage researchers (19 ESRs, 3 ERs)
- Gives industry an important role;
- Presently 32 partners *(and still growing...!)*
- Recognized importance of beam diagnostics at European level !
  (only 68 from 905 selected - with 11 in physics)

C.P. Welsch, Proc. BIW, IPAC

Continuing Success

Additional Initiatives:

DITANET

LANET

OPAC

APCT

SiPM

DITA-IIF

BeaPhy

Largest Marie Curie networks in accelerator community.

Event organization

- International Schools in specific research area and complementary skills;
- Topical Workshops on focused research topic;
- Final Conference to summarize project results.
- To date: More than 30 events.

International Events

International **Schools**
London, Stockholm, Caen, Salamanca, etc.
Indico: 112220,…
~ 80 participants and lecturers

Topical **Workshops**
Paris, Soltan, Seville, Hamburg, Mallorca, etc.
Indico: 145063, 145066, 145070, 135829, …
40-120 participants

Conferences and **Symposia**
Seville, CI, Mallorca, Liverpool
Indico: 135831,181600,…

Reseacher Skills Training

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8.30 – 9.30	**Introduction** *Paired Introductions: Participants generate flip chart poster of interview partner then present them to whole group.*	**Career Prospects in Industry & Academia**	**Presentation skills** *Introduction* *Participants will give 5 minute presentation in small groups about their PhD projects* *All presentations will be video recorded* *Feedback by:* *(1) presenter,* *(2) (2) fellow students,* *(3) Tutor*	**Advanced Project Management**	**Introduction to Peer Review**
9.30 – 10.30		**Independent Teamwork Dreamer, Realist, Critic** *Teams to come up with a response to the challenge Teams choose their project topic and plan the team-working process.* *Target Setting Milestones & deliverables session – assessment of targets for the project*		**Independent Team Work** *Teams work on the project according to their plan*	**The Presentation** *(Followed by Questions)*
10.30 - Break	**Presentation skills**			**Chairs meeting** *Present summary of report structure* *Teams review project following feedback*	**Peer Review preparation**
11.00 – 12.30	*Basics of research presentations – an introduction to the Do's and Don'ts of conference presentation*			**International collaboration**	**Peer Review** *Teams present assessment and feedback*
					Forward Planning
12.30 – 13.30	Lunch				
13.30 – 15.00	**Introduction to Project Management**	**Scientific Writing**	**Visit to Cockcroft Institute**	**Network diagrams** *(Understanding dependencies)*	
15.00 – Break	*Theoretical Background*	*Focus on writing research papers.* • *The writing process and structure* • *Thinking about the audiance* • *Target journals* • *Tips*	*Introduction*	**Independent Team Work** *Teams continue collaborating on project.* • *Produce report* • *Create presentation*	
15.30 – 16.30	*Action: Plan PhD project*		*Tour of facilities*		
16.30 – 17.30	*Update description* *Stakeholder analysis* *Milestones* *Deliverables*	*Writing for the general public.*		**Assessing Risks**	

Training Model for UK & EU

- PhD project-specific part
  - Presentation skills
  - Scientific writing
  - Project management

- Generic skills through outreach project
  - Team working
  - Proposal writing
  - Peer review
  - Working under (time) pressure

"I hadn't really thought of myself as a project manager until today!"

Excellent Science

The Cockcroft Institute of Accelerator Science and Technology

UNIVERSITY OF LIVERPOOL

ELSEVIER

Numerical

M. Putignano

[a] The Cockcroft Institu
[b] The University of Liv

APPLIED PHYSICS LETTERS **104**, 204104 (2014)

A non-invasive beam profile monitor for charged particle beams

Vasilis Tzoganis[1,2,3,a)] and Carsten P. Welsch[1,2]
[1]*Cockcroft Institute, Daresbury Sci-Tech, Warrington WA4 4AD, United Kingdom*
[2]*Department of Physics, University of Liverpool, Liverpool L69 7ZE, United Kingdom*
[3]*RIKEN Nishina Centre, Hirosawa 2-1, Wako, Saitama 351-0198, Japan*

(Received 26 March 2014; accepted 7 May 2014; published online 23 May 2014)

Non-interceptive beam profile monitors are highly desirable in almost all particle accelerators. Such techniques are especially valuable in applications where real time monitoring of the beam properties is required while beam preservation and minimal influence on the vacuum are of the greatest importance. This applies to many kinds of accelerators such as high energy machines

MS **15**, 122801 (2012)

United Kingdom

a 95123, *Italy*
2012)

AEgIS collaboration

S. Aghion,[a,b] O. A
R.S. Brusa,[h] G. B
F. Castelli,[i] G. Ce
S. Di Domizio,[n] L
P. Genova,[j] M. G
J. Harasimowicz,
A. Kellerbauer,[m]
S. Mariazzi,[i] V.A.
V. Petráček,[x] F. P
A. Rotondi,[s,j] H.
G. Testera,[n] C.P.

AIP | Review of Scientif

Scintillating screens
low intensity beam di

Janusz Harasimowicz, Luigi Coser

Citation: Rev. Sci. Instrum. **81**, 103302 (2010); doi
View online: http://dx.doi.org/10.1063/1.3488123
View Table of Contents: http://rsi.aip.org/resource/
Published by the American Institute of Physics.

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS **15**, 032803 (2012)

Longitudinal density monitor for the LHC

A. Jeff*
CERN, Geneva, Switzerland, and University of Liverpool, United Kingdom

M. Andersen, A. Boccardi, S. Bozyigit, E. Bravin, T. Lefevre, A. Rabiller, and F. Roncarolo
CERN, Geneva, Switzerland

C. P. Welsch
Cockcroft Institute, Daresbury, United Kingdom

A. S. Fisher
SLAC, Menlo Park, California 94025, USA
(Received 6 February 2012; published 23 March 2012)

QUASAR GROUP

‚Success stories' (EC)

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

Also recognized as ‚best practice' by Faculty of Science and Engineering, HEA, UKRO, etc.

EU Project T.E.A.M.

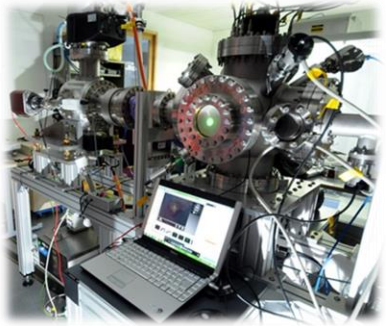
- Day-to-day support for projects
- Organization of events
- Dissemination of all project results
- Project representation internationally.

Joining the community

Where to go...from here ?

Summary

- ITNs excellent for cross-sector collaboration across Europe;
- Major driver for establishing new international cooperations



- ITNs introduced new schemes for training of accelerator experts;
- Role model for innovation in researcher training.