C.P. Welsch
Cockcroft Institute and The University of Liverpool
The Opening of the Cockcroft Institute by the Minister of Science, Lord Sainsbury

“When we talk about world-class science we need look no further than the North West and the Cockcroft Institute”

- Prime Minister, Tony Blair (2006)
The Mission

*Navigate by the stars, not by the light of every ship passing by...*

- **Generic R&D at the frontier of Accelerator Science and Technology;**
- **Project-specific R&D in Accelerator Science and Technology;**
- **Leadership and management of national deliverables to international facilities;**
- **Support in design, construction and operation of national and international facilities;**
- **Technology transfer to (and Knowledge Exchange with) industry;**
- **Seamless involvement of the Universities and Research Councils;**
- **Education and training to ensure a flourishing next generation of scientists.**
The Ultra-low Energy Storage Ring (USR) @ FLAIR
USR: First Design in 2005

Welsch, C.P., et al.
Nucl. Instrum. Methods A 546
405–417 (2005)
Modification to USR Lattice

- "Split-achromat" geometry, new concept

- Achromatic section, D=0 in straights

- D never > 0.6 m.

C.P. Welsch, et al., Hyp. Inter. 194 (2009)
How to realize nanosecond bunches?
How to extract the beam?

Steps:
- General feasibility
- 1-D simulation
- Full study

USR - slow/fast Extraction

**Goal:** Combined system, providing highly-flexible extraction

**Motivation:** Nuclear physics-type experiments.
First time in electrostatic ring!

USR – Advanced Studies

- Full 3D ring model, detailed studies
- Explained life time, $\Delta p/p$, etc.

Diagnostics: EU Project Coordination

DITANET

« novel Diagnostic Techniques for future particle Accelerators: A Marie Curie Initial Training NETwork »

Training the next generation of scientists in beam diagnostics.
R&D Program in LE Diagnostics

- Beam position measurements
  - Capacitive electrostatic BPM

- Transverse beam profile measurements
  - Secondary Emission Monitor;
  - Screen developments;
  - Curtain gas jet based 2D monitor;

- Etc.
Profile Measurement and Collision Experiments: Prototype Setup

- Proof-of-principle setup at the CI;
- Gas jet and IPM;
- Designed for use with low energy antiproton beams:
  - Profile Monitor
  - Collision experiments.

M. Putignano, C.P. Welsch, Proc. IPAC (2011)
USR - Challenges

Many of these are shared with ELENA!
Summary: Expertise @ CI

- Ring and beam line design;
- Beam diagnostics, instrumentation and control system;
- Mechanical design and component construction;
- Commissioning (and operation);
- Atomic physics program;
- Liverpool / Manchester / Lancaster & Swansea

Thanks for your attention!