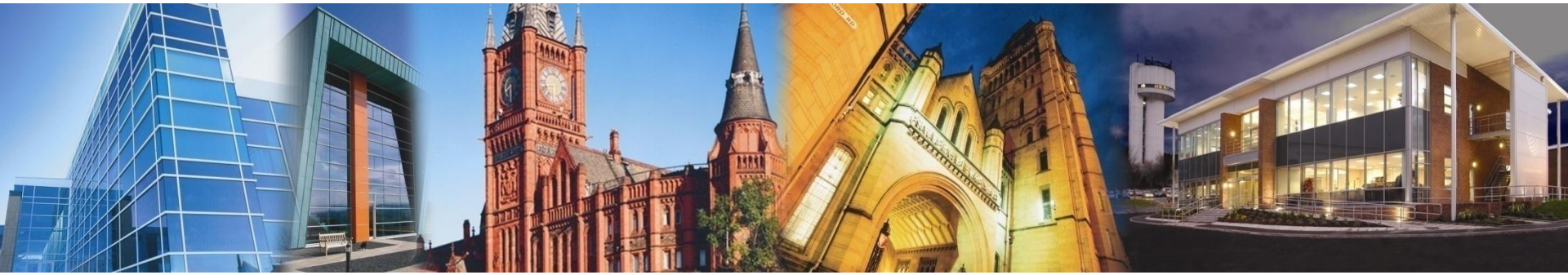
The Cockcroft Institute
of Accelerator Science and Technology

C.P. Welsch

Cockcroft Institute and The University of Liverpool



LANCASTER UNIVERSITY

UNIVERSITY OF LIVERPOOL

MANCHESTER 1824
The University of Manchester

Science & Technology Facilities Council

Inauguration in 2006

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)

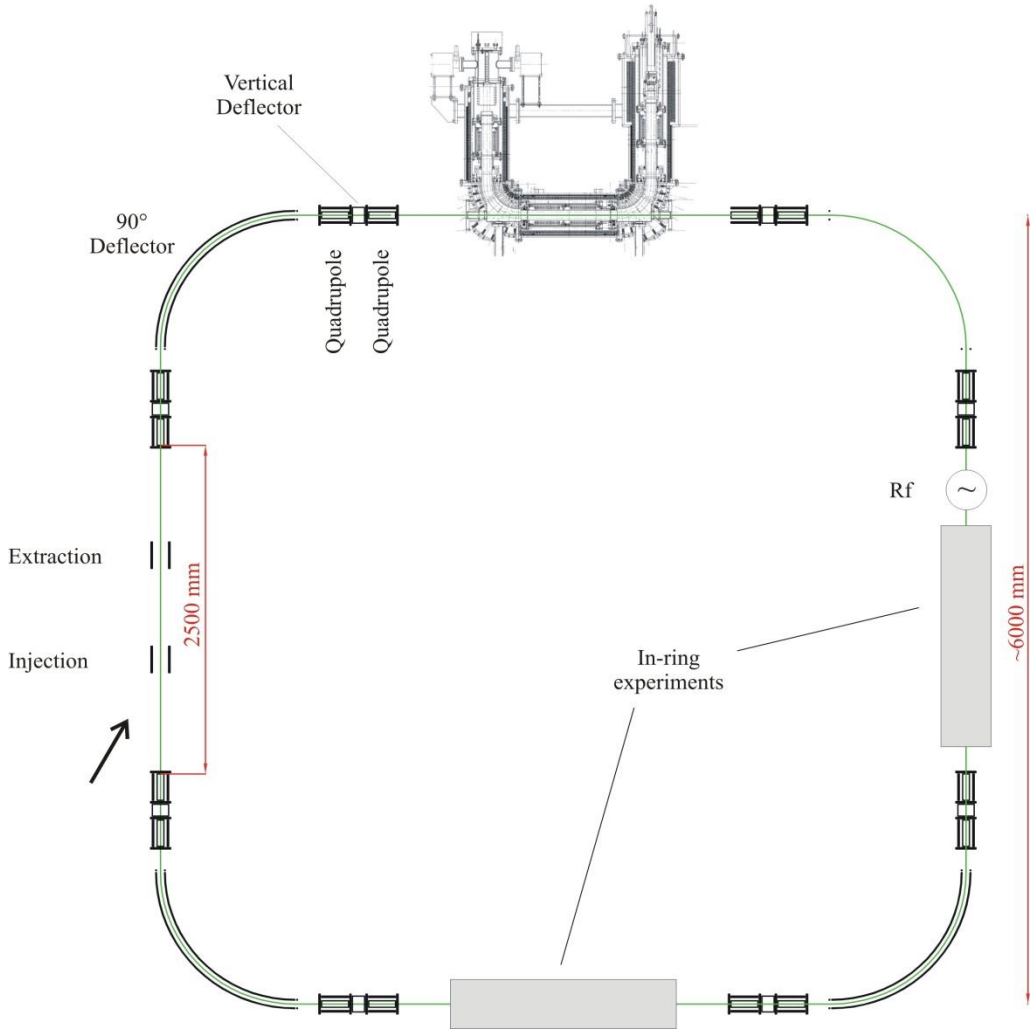
The Mission

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

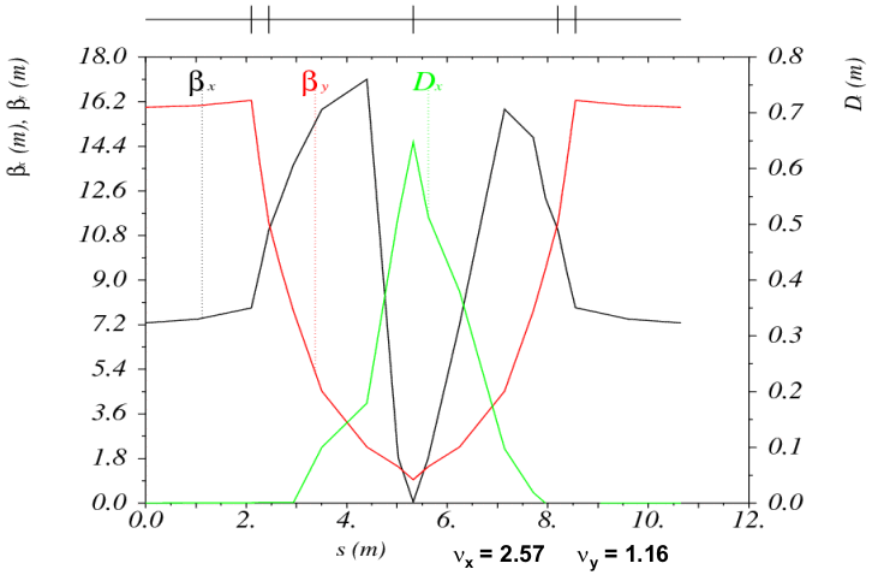
USR: First Design in 2005

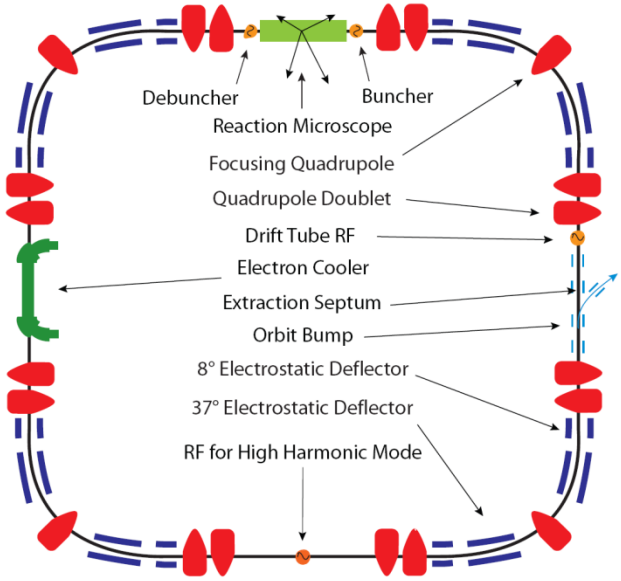


Welsch, C.P., et al.
Nucl. Instrum. Methods A **546**
405–417 (2005)

Modification to USR Lattice

- "Split-achromat" geometry, new concept

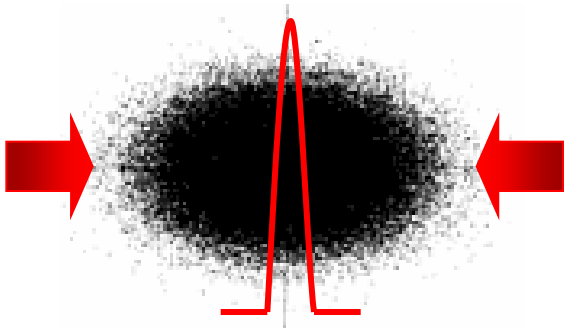




- Achromatic section, D=0 in straights
- D never > 0.6 m.

A.I. Papash, et al, Proc. PAC (2009)
C.P. Welsch, et al., Hyp. Inter. 194 (2009)

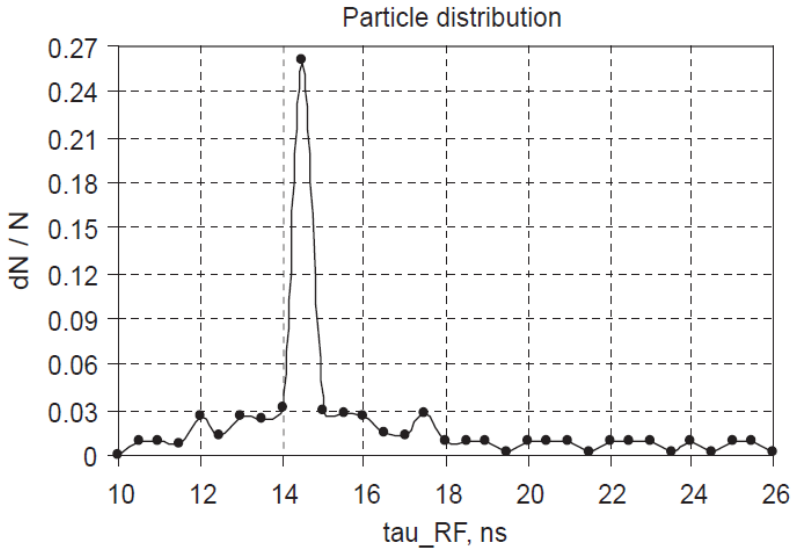
USR – Ring Re-Design



ns Bunching

How to realize nanosecond bunches ?

How to extract the beam ?



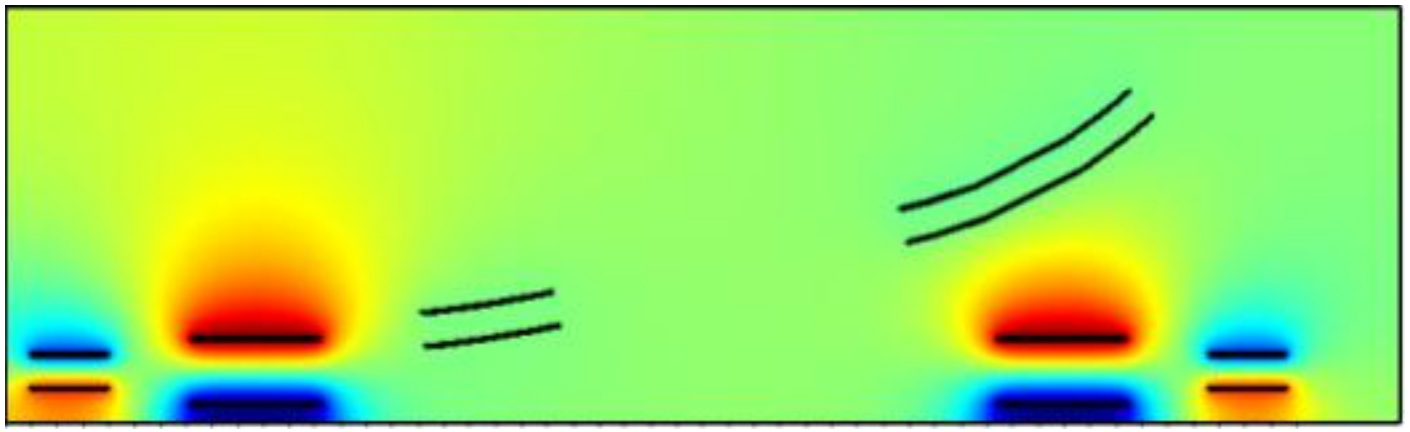
A.I. Papash, C.P. Welsch, Part Phys. Nucl. Letters **3** (2009)
A.I. Papash, C.P. Welsch, Nucl. Instr. and Meth. A **620** (2010)

Steps:

- General feasibility
- 1-D simulation
- Full study

USR - slow/fast Extraction

Goal: Combined systen, providing highly-flexible extraction



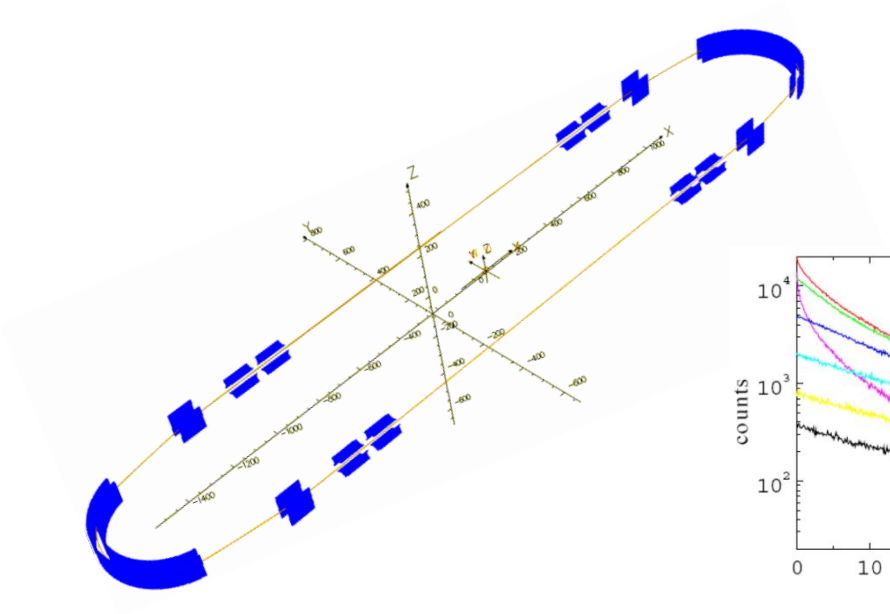
Motivation: Nuclear physics-type experiments.

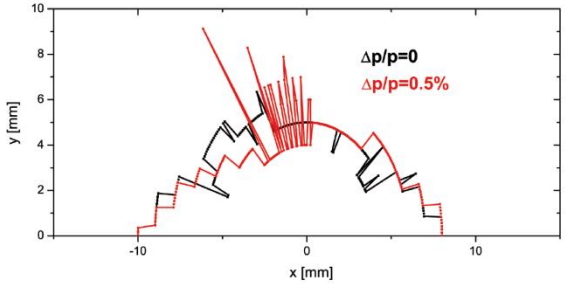
➡ First time in electrostatic ring !

G. Karamysheva, A.I. Papash, C.P. Welsch, Part Phys. Nucl. Letters **8** (2011)

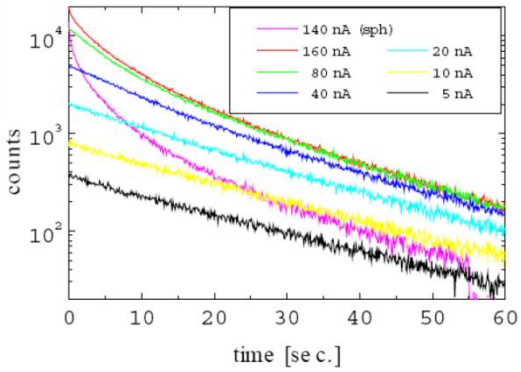
USR – Advanced Studies

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

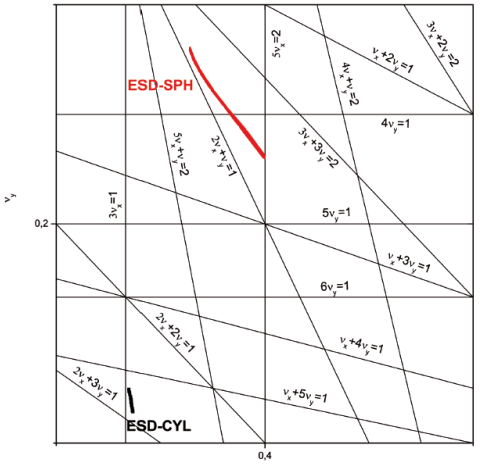




Dynamic Aperture



Beam Loss



Tune Shift

O. Gorda, A.I. Papash, C.P. Welsch, Proc. IPAC (2010)
A.I. Papash, et al., Proc. IPAC (2011)

Diagnostics: EU Project Coordination

DITANET

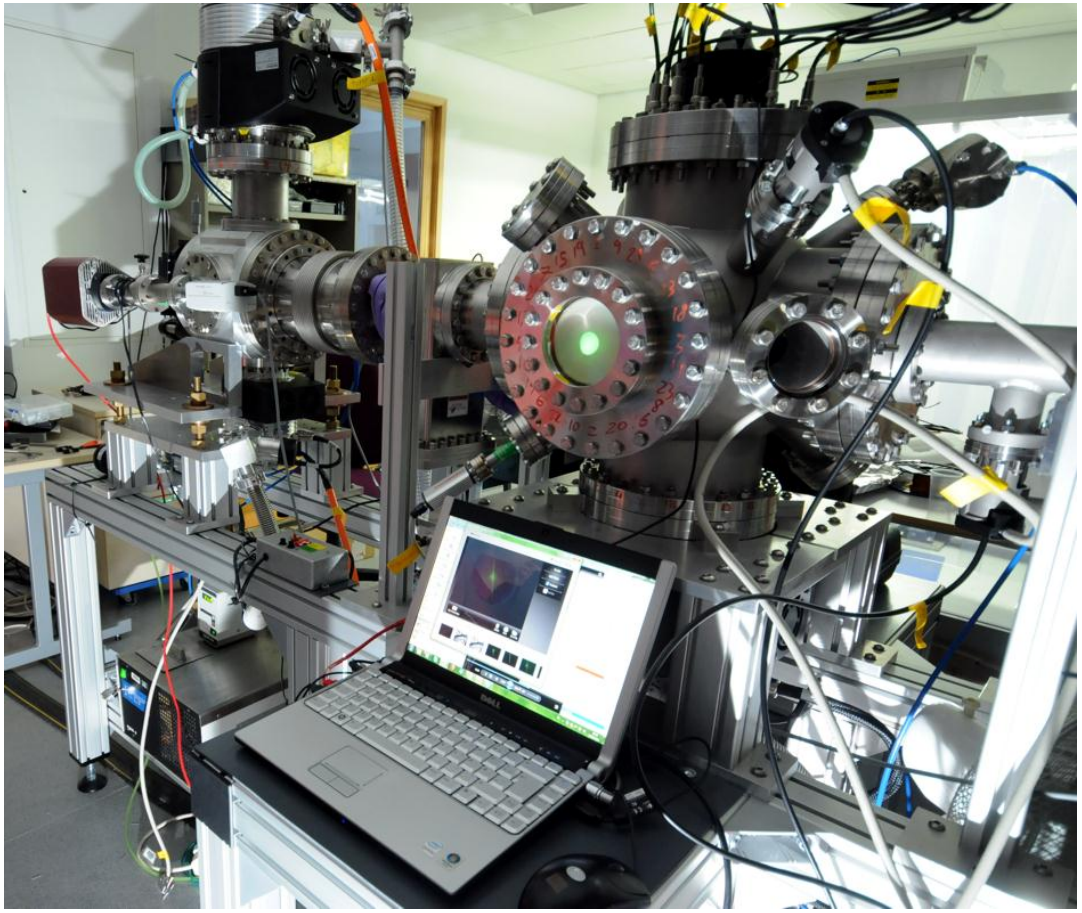
‹‹ novel **DI**agnostic **T**echniques for future particle **A**ccelerators:
A Marie Curie Initial Training **NET**work ››

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.

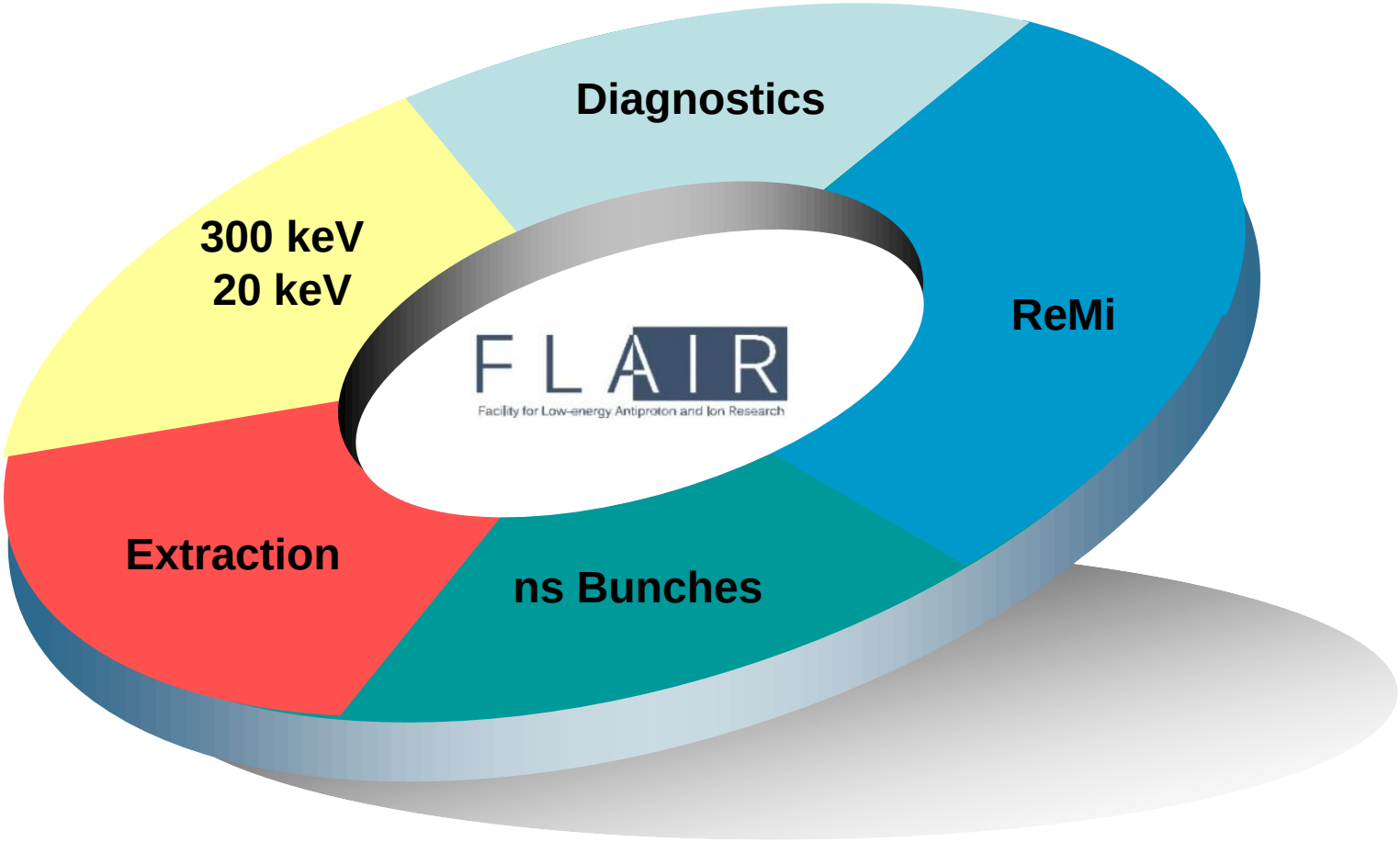
Profile Measurement and Collision Experiments: Prototype Setup



- 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, Hyperfine Interact. (2009)
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 !