



Quantum Systems and
SYMPOSIUM

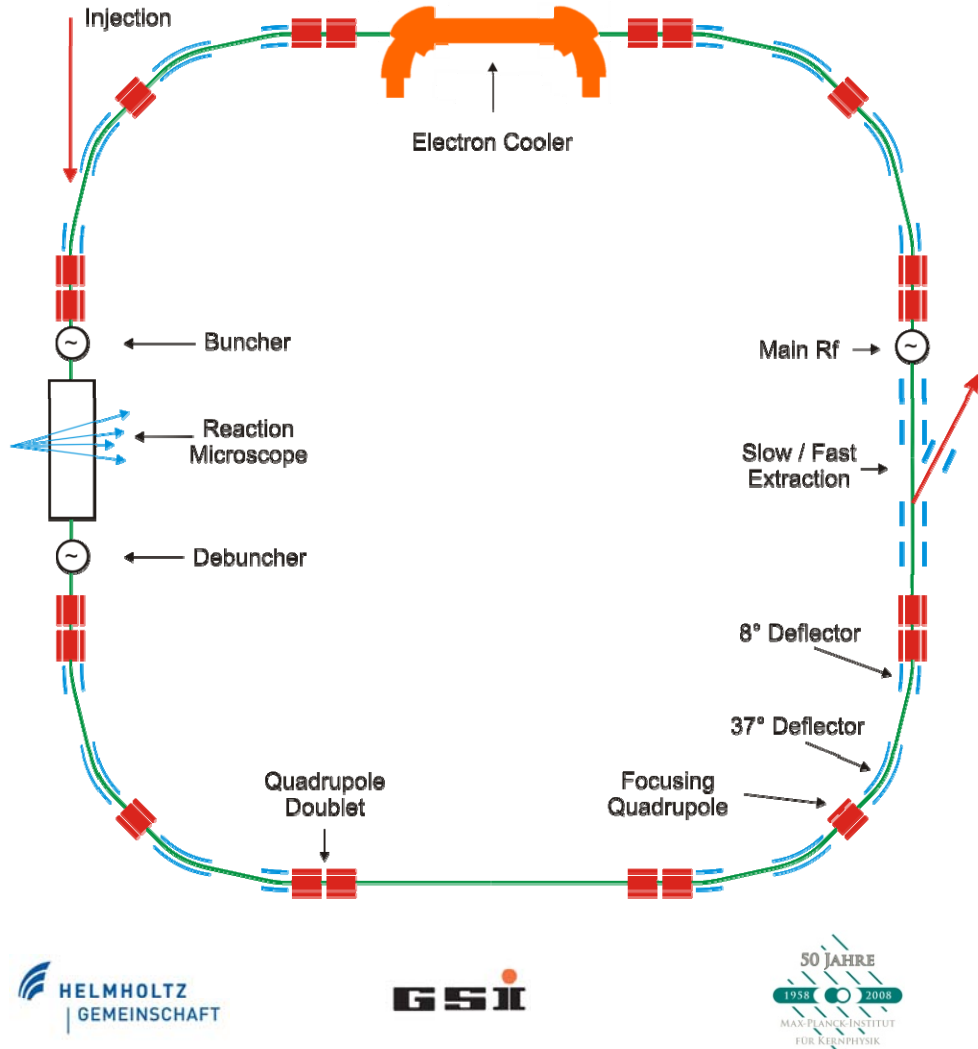
Researchers at Accelerators

Cockcroft Institute, UK - May 16th 2012 (p.m.)

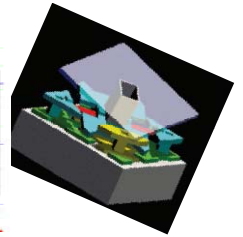
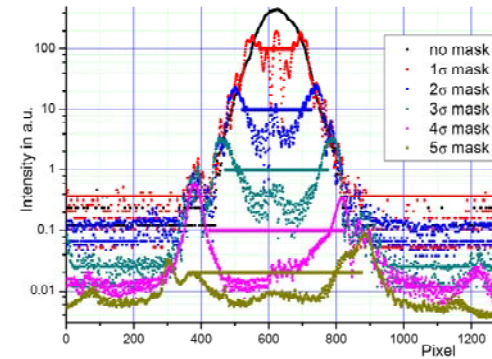
Carsten P. Welsch



Overview of QUASAR R&D



Diag

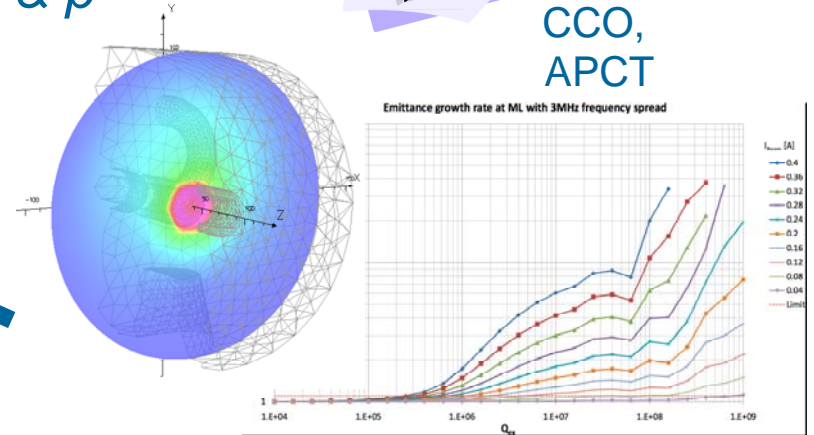


p & \bar{p}

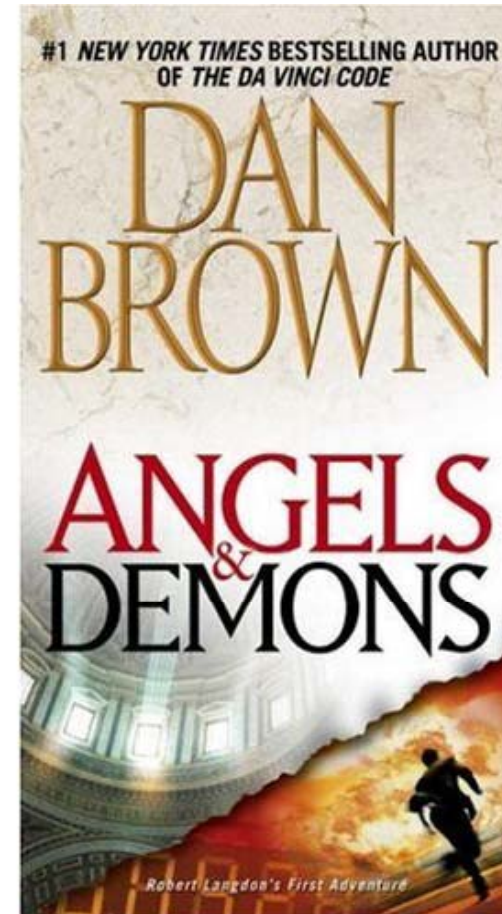
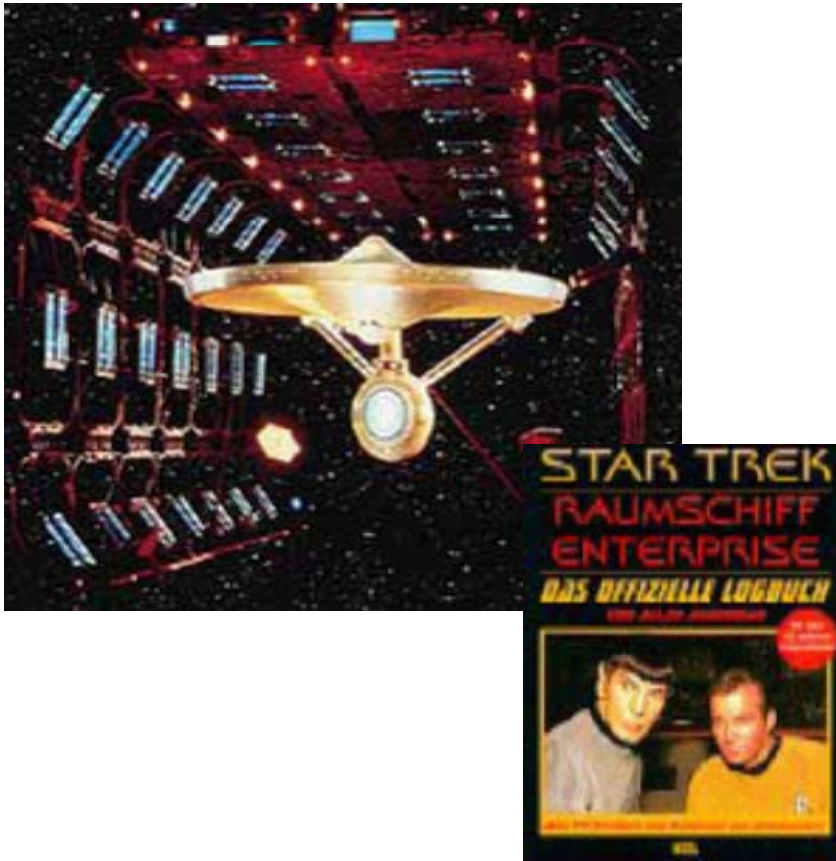
rf



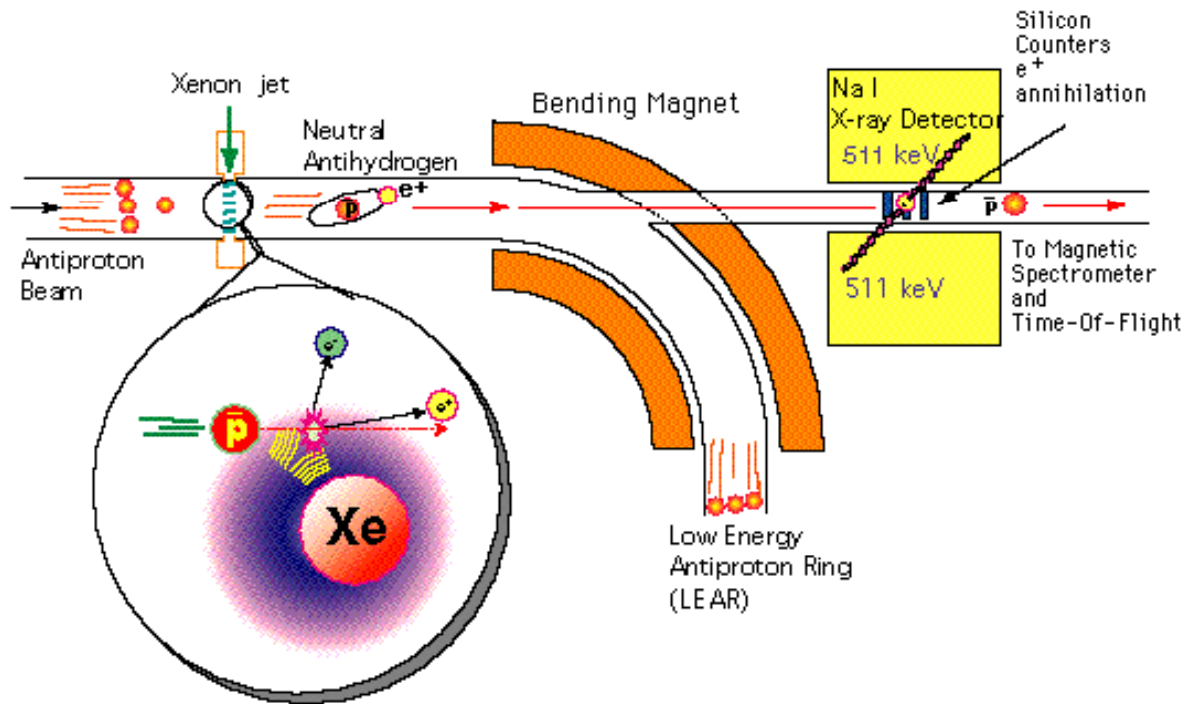
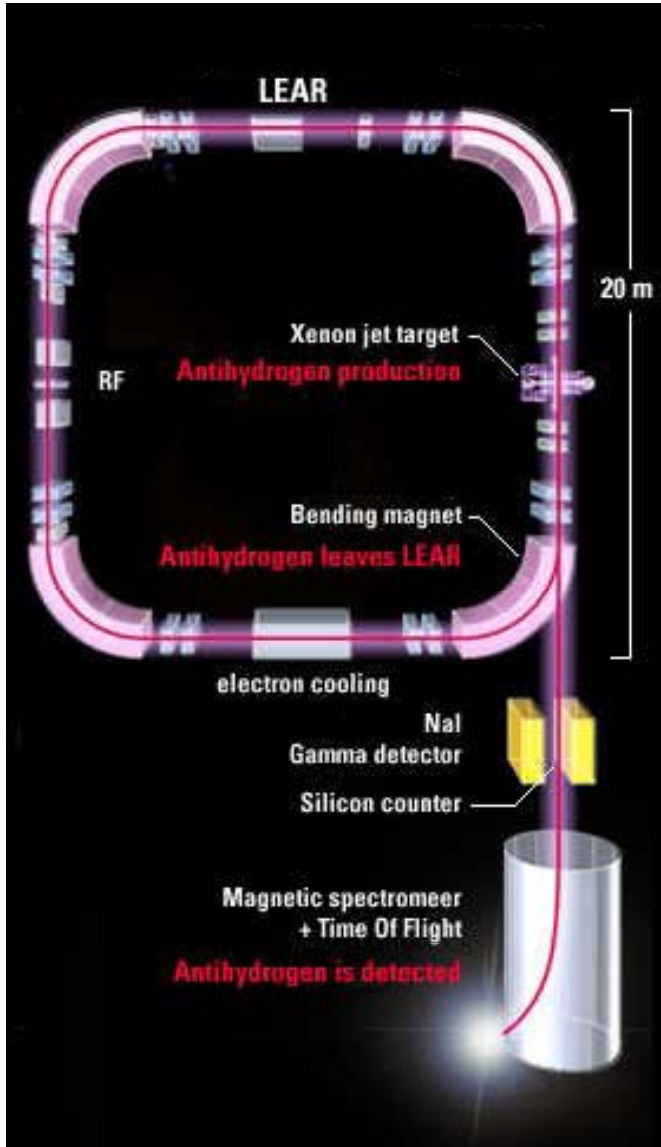
CCO,
APCT



Antimatter: Good for Hollywood



...and for science...PS210 (1996)



W. Oelert, D. Grzonka et al.

Further media coverage

“Blick” (Switzerland)



“Liberation” (France)



«C'est mille fois plus puissant qu'une réaction nucléaire normale»

Le Pr Oelert ne nie pas un possible usage militaire des antiatomes.

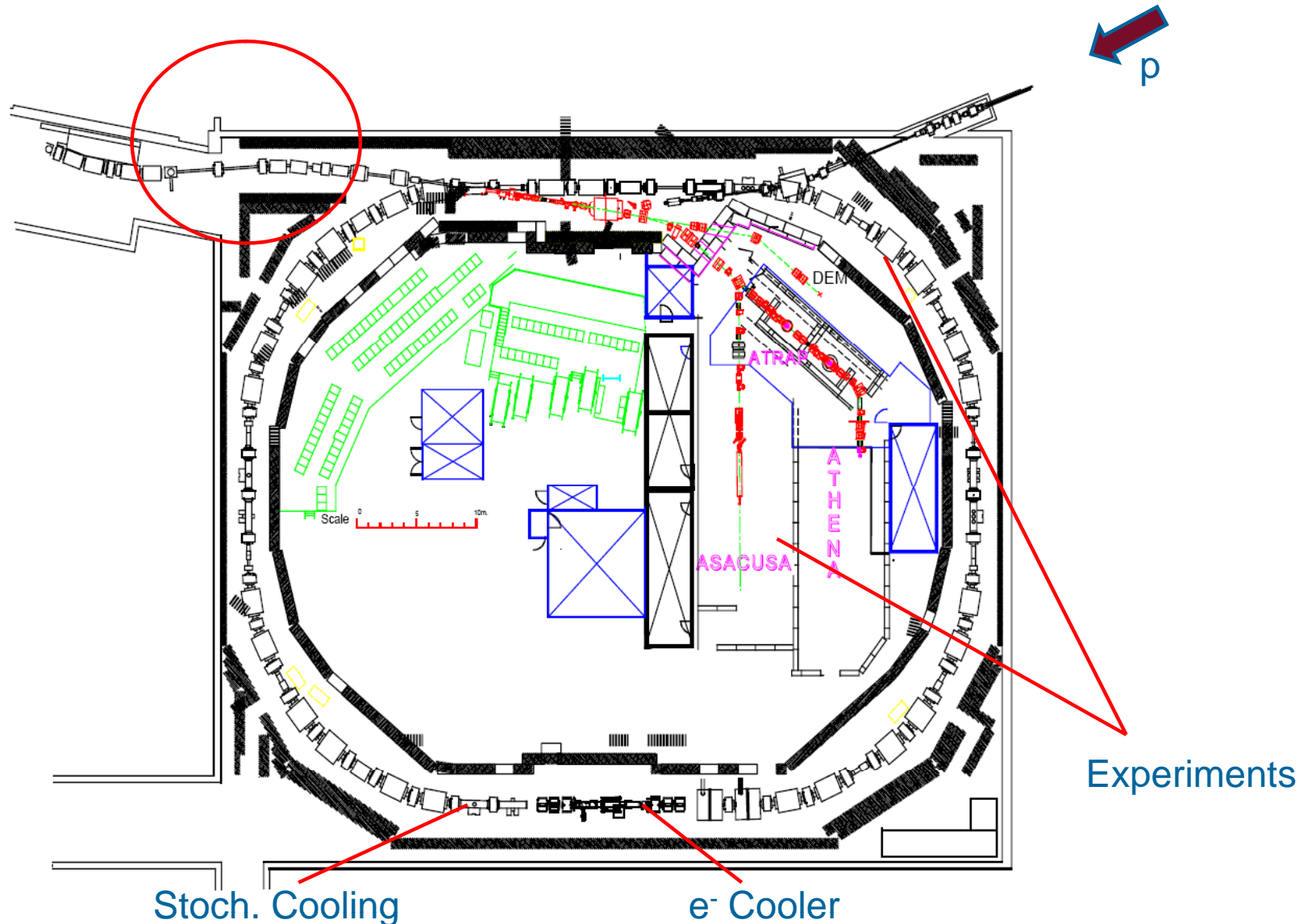
Walter Oelert, professeur à l'Institut de recherches nucléaires de Jülich en Allemagne, dirige la petite équipe germano-italienne réunie en 1993 qui a obtenu neuf antiatomes d'hydrogène. puis se sont déchirés en tombant sur le détecteur de silicium, l'antiproton d'un côté, l'antiélectron de l'autre. Pourrait-on faire une bombe avec cette antimatière?

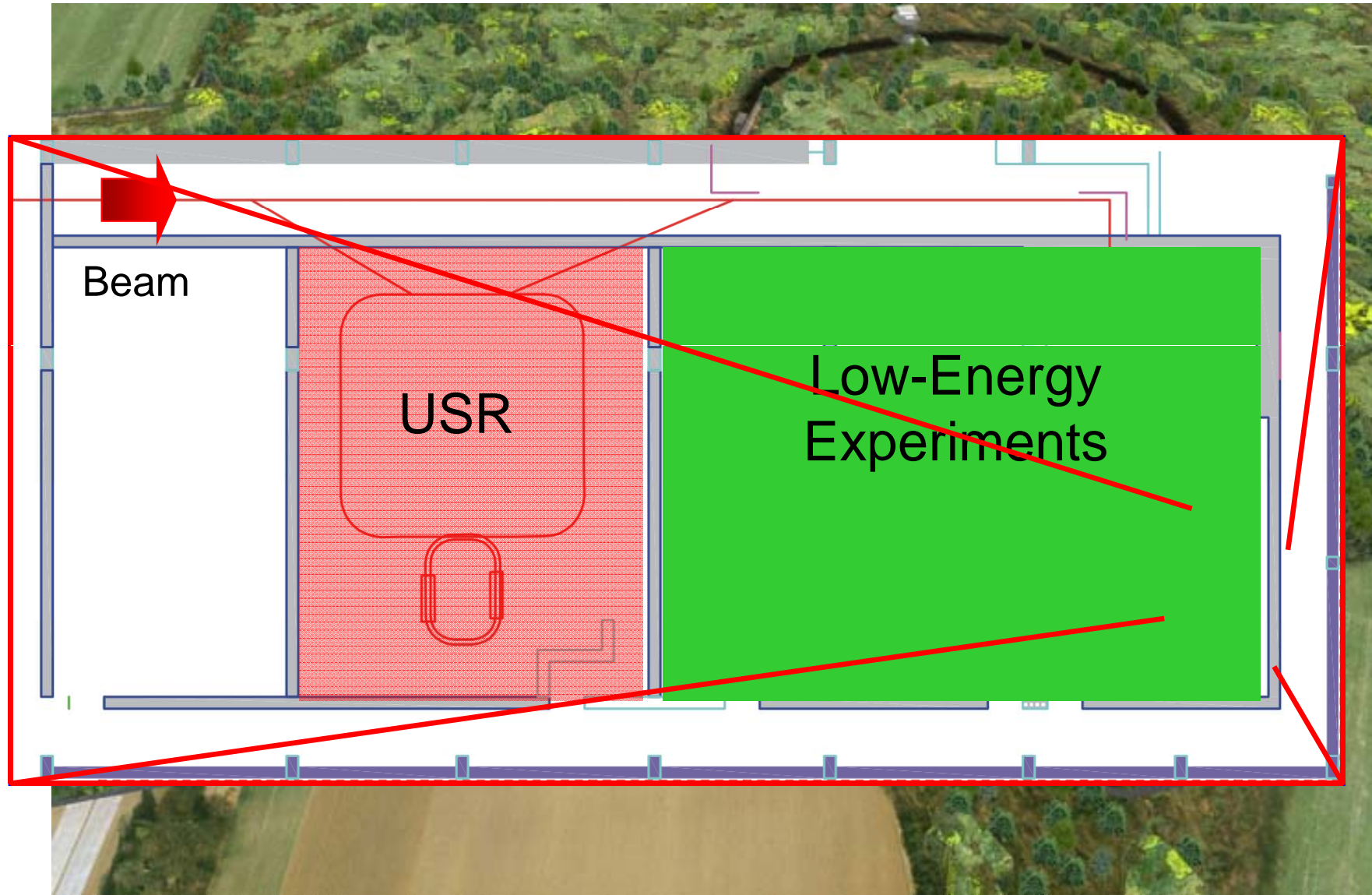
Present Situation: AD @ CERN

Target

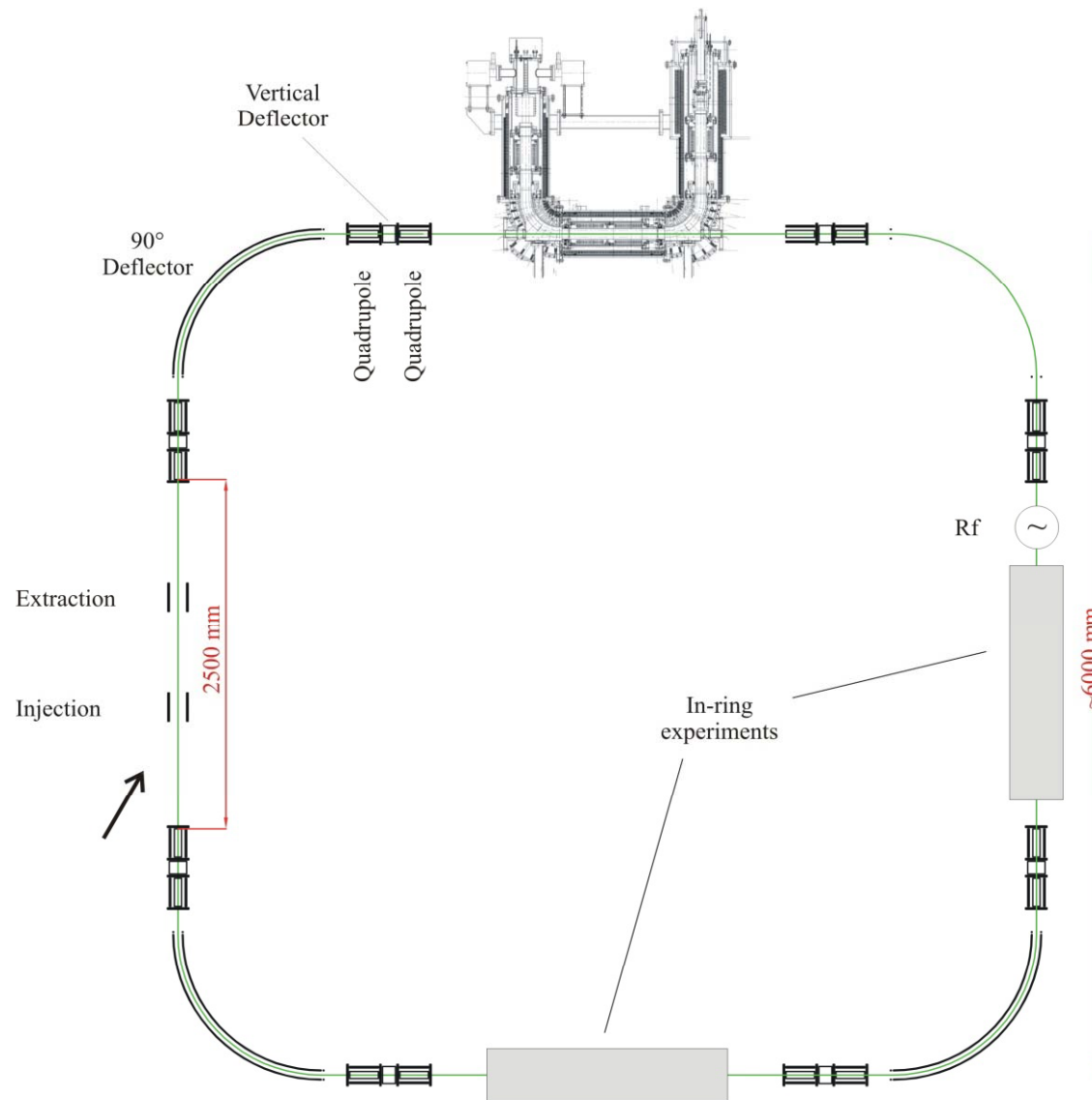
26 GeV/c p
 → 3.57 GeV/c p

Yield: $4 \cdot 10^{-6}$





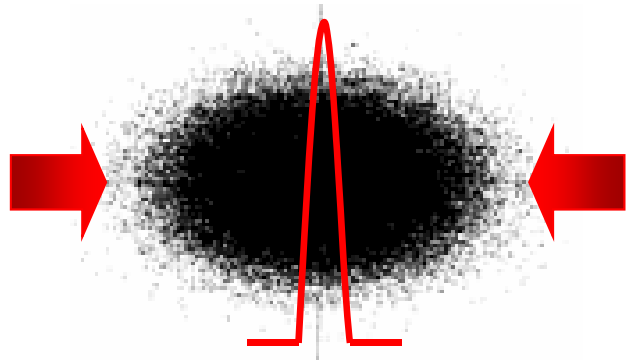
USR: First Design in 2005



*Eierlegende Wollmilchsau
~Egg-laying-wool-milk-pig*

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

USR – Ring Re-Design



ns Bunching

Steps:

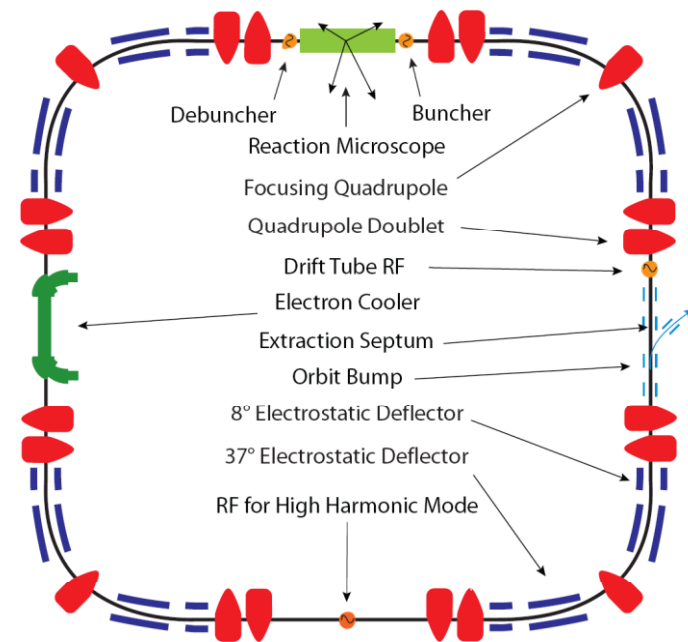
- General feasibility
- 1-D simulation
- Full study



Alexander

How to realize nanosecond bunches ?

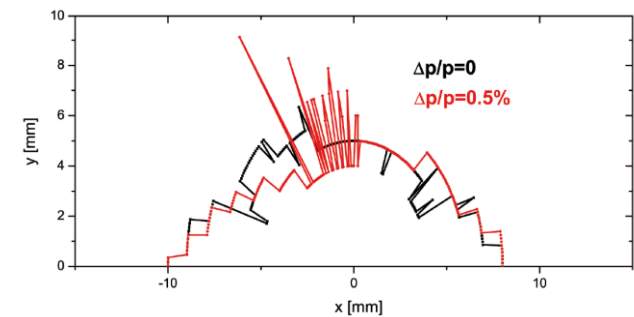
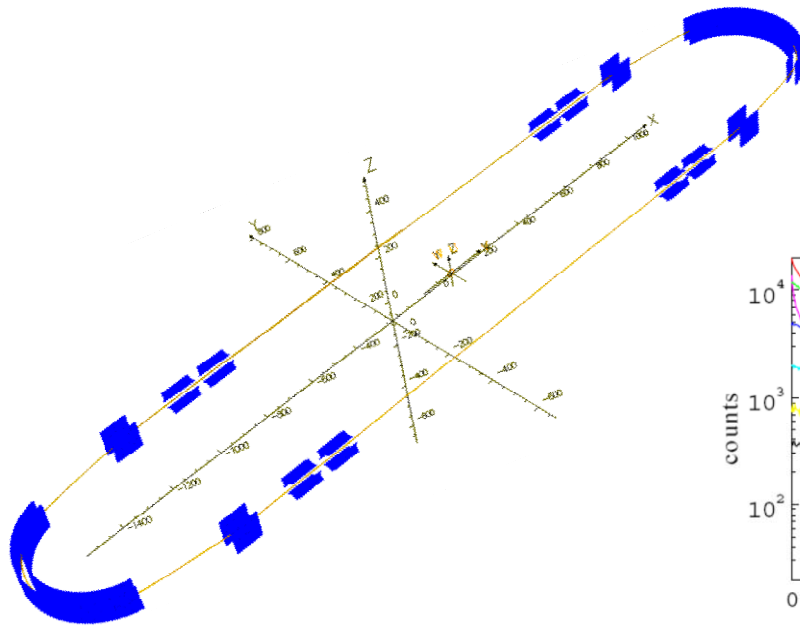
How to extract the beam ?



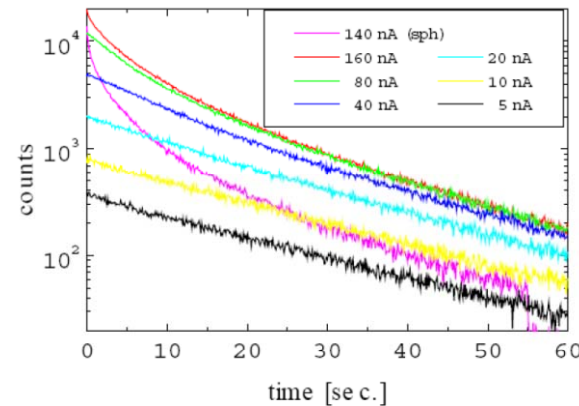
A.I. Papash, et al., Part Phys. Nucl. Letters **3** (2009)
G. Karamysheva et al., Part Phys. Nucl. Letters **8** (2011)
A.I. Papash, et al., Phys. Rev. (2012)

USR – Advanced Studies

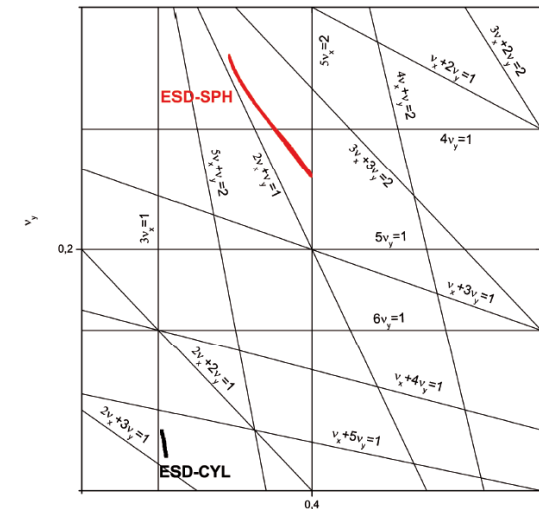
- Full 3D ring model, detailed studies
- Similar approaches are used for most new FAIR rings



Dynamic Aperture



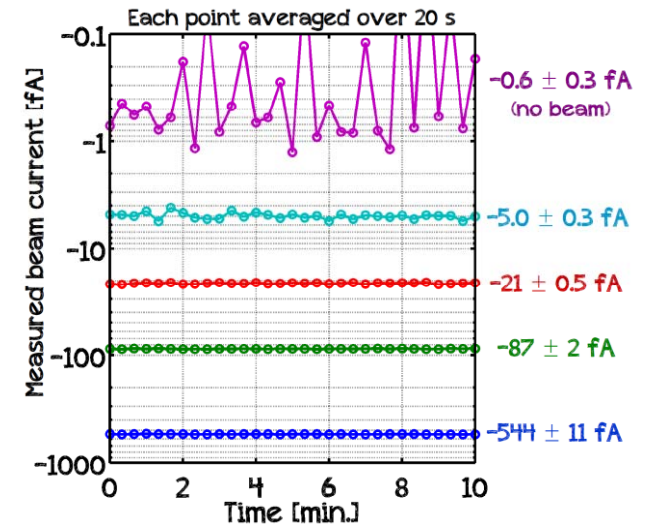
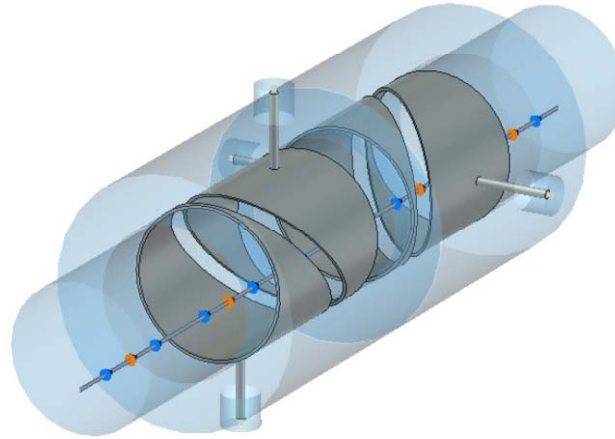
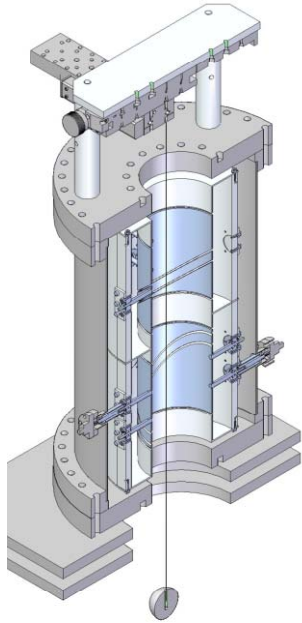
Beam Loss



Tune Shift

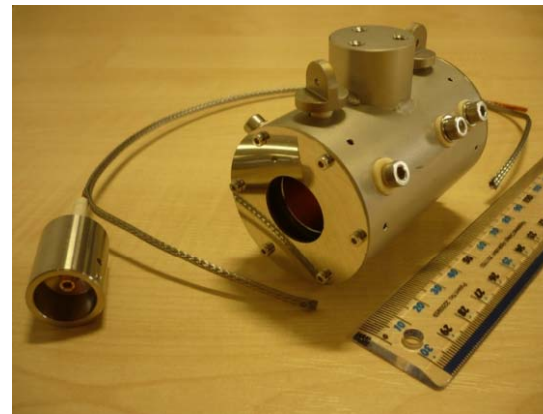
O. Gorda, A.I. Papash, C.P. Welsch, Proc. IPAC (2010)

USR – Diagnostics

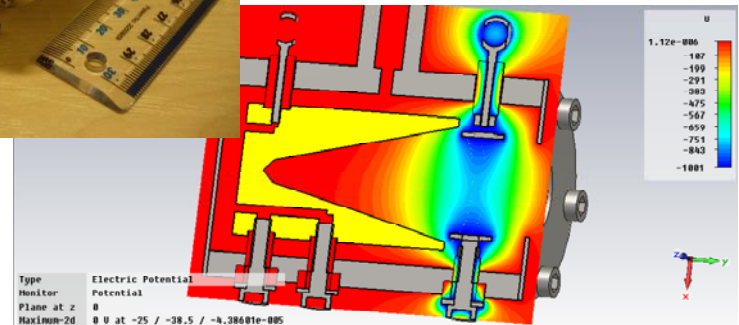


Janusz

- Position
- Profile
- Intensity
- AEgIS Setup
(more info: Alban Kellerbauer)



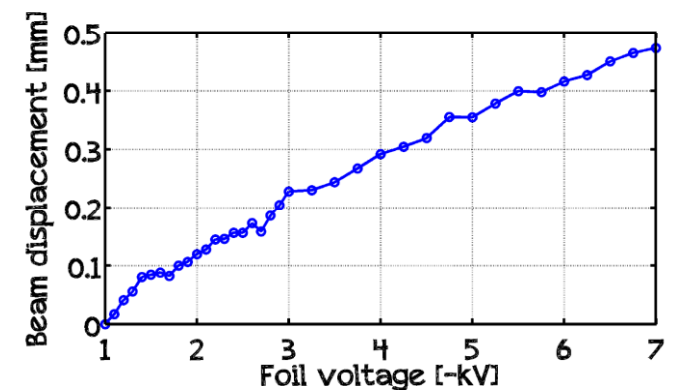
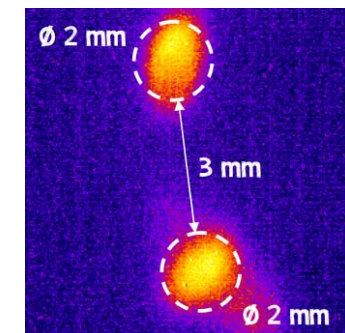
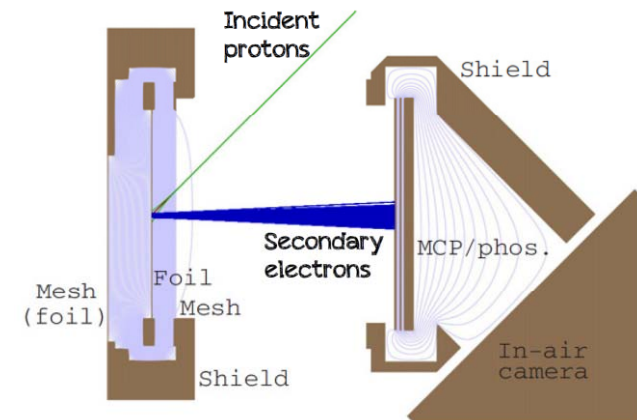
J. Harasimowicz, et al.,
Hyperfine Interact. (2009)
J. Harasimowicz, et al.,
Rev. Sc. Instr. **81** (9) (2010)



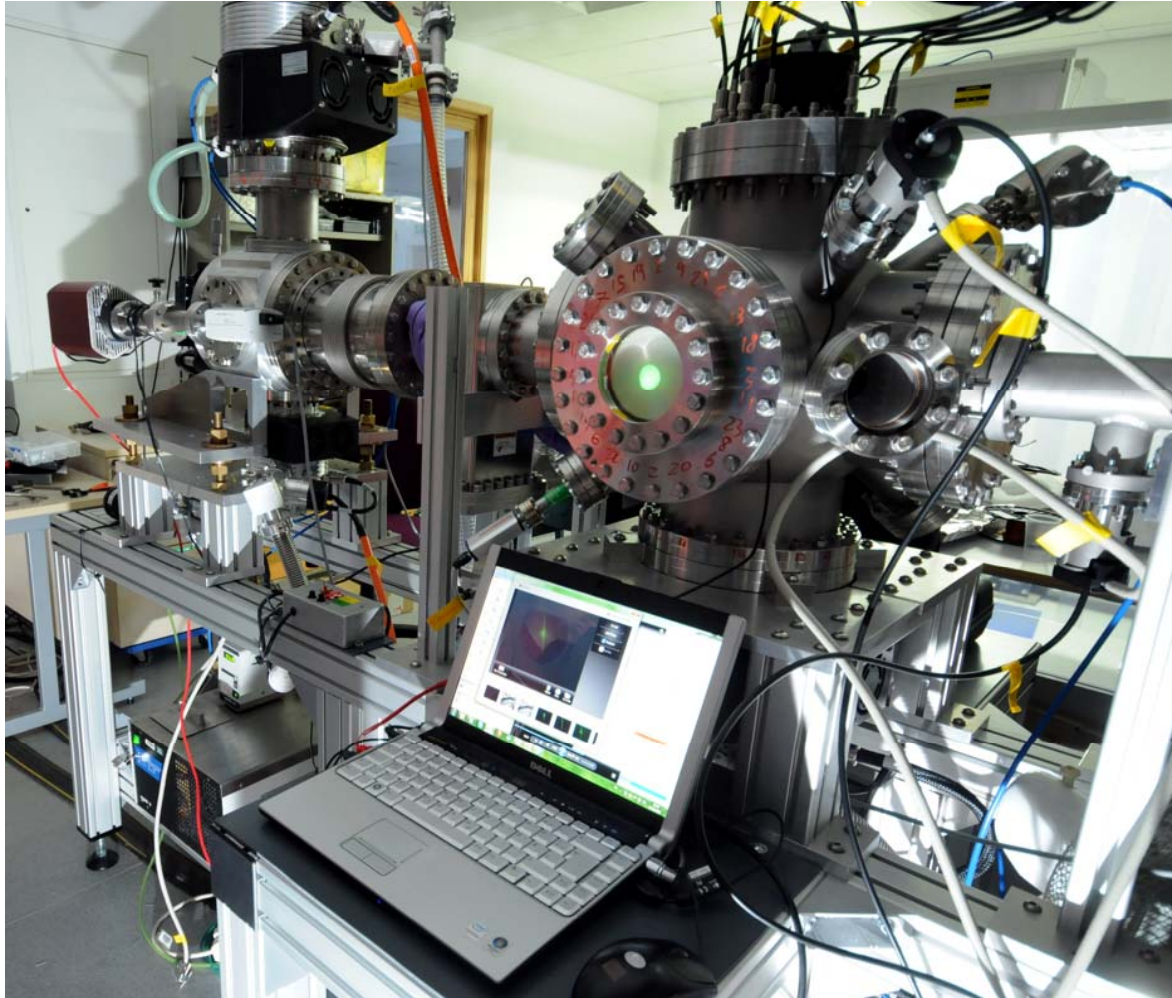
Screens, SEM – AD installation

- Alternative for transverse profile measurement;
- Understand and improve on existing designs
- Measurements with 200 keV proton beams at INFN
- Benchmarked simulations
- AEgIS setup – future !

(more info: Alban Kellerbauer)



Profile Measurement and Collision Experiments: Prototype Setup



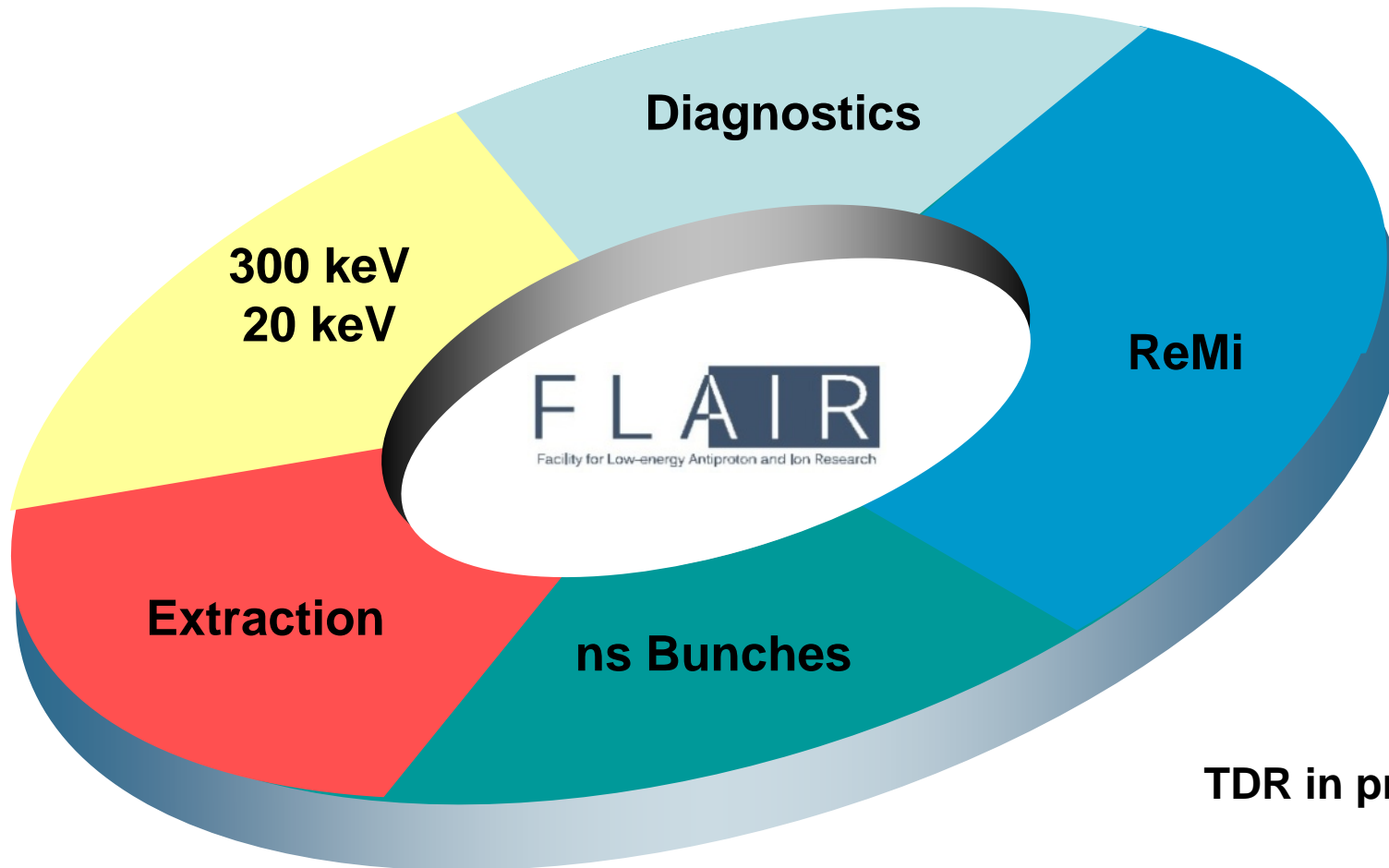
M. Putignano, C.P. Welsch, *Hyperfine Interact.* (2009)
M. Putignano, C.P. Welsch., *Proc. IPAC* (2011)
M. Putignano, C.P. Welsch, *Nucl. Instr. Meth. A* (2012)

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



Massimiliano

USR - Challenges



AD physics: Walter Oelert.

TDR in preparation

Plus: *AD Rec, Asacusa, ELENA, AEGLS, etc.*

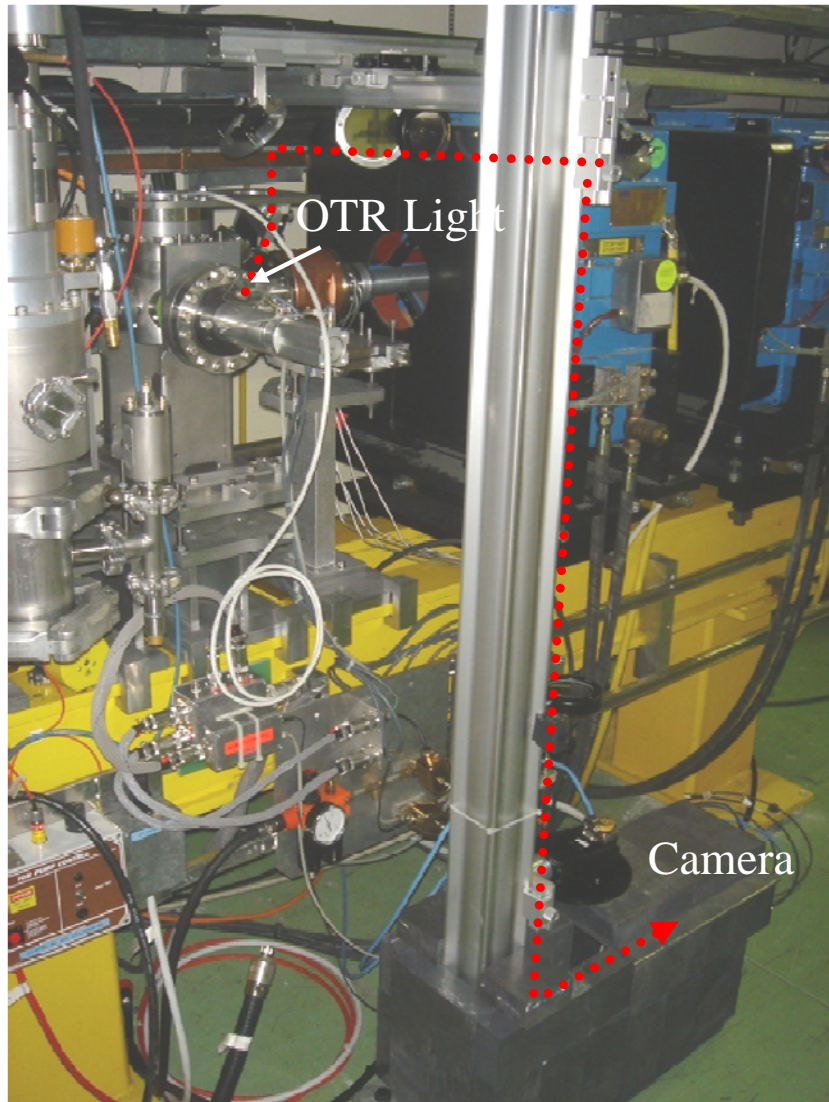
Accelerator Beam Diagnostics

DITANET

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



A „typical“ Accelerator Diagnostics



Beam Diagnostics: Rhodri Jones.

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

 **Multi-disciplinary field !**

What is DITANET ?

- Largest-ever EU funded training network in beam instrumentation and diagnostics (4.2 M€);
- Aim: Training of early stage researchers (*18 ESRs, 3 ERs*)
- Gives industry an important role; **Technology Transfer: Rok Ursic**
- Presently 32 partners (*and growing..., SLAC just joined*)
- Recognized importance of beam diagnostics at European level !
(only 68 from 905 selected - with 11 in physics)

C.P. Welsch, Proc. BIW 2010, IPAC 2011

Researcher Training: 2011



Diagnostics **School**

Stockholm, Sweden – March

Indico: 112220

> 80 participants and lecturers



Topical **Workshops**

CI, France, Slovenia, Seville, Hamburg

Indico: 145063, 145066, 145070, 135829, 154172

~ 40 participants each



Diagnostics **Conference**

Seville, Spain – CNA

Indico: 135831

Proceedings + PRST-AB special edition

PhD training: Janet De Wilde

Researchers: Victoria Llobet

Today...

- Enjoy the talks !
- Benefit from discussions with QUASARs, DITANET partners and other participants in breaks !
- Have a look at the posters !
- Share our excitement for antimatter physics, beam diagnostics and training researchers ! **Get involved.**