Status of the TSR@ISOLDE Project

Klaus Blaum, MPI for Nuclear Physics, Heidelberg
for the TSR@ISOLDE Collaboration

CERN, Geneva, April 27th 2015

The idea

A storage ring at an ISOL facility

Advantages

With respect to in-flight storage rings

- High intensity
- Cooler beams
- Much faster

With respect to "direct" beams

- Less background (target, beam dump)
- Improved resolution
- CW beam

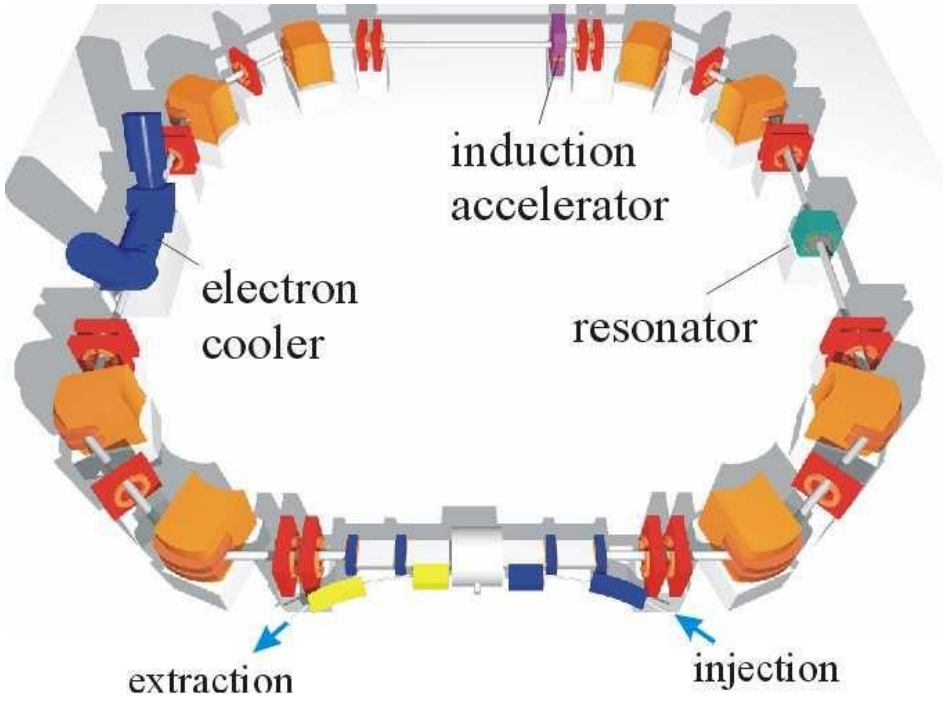
→ A world-unique installation!

Physics programme

- Astrophysics — **Woods**
  Capture, transfer reactions
  ^{7}Be half life — **Litvinov**
- Atomic physics — **Wolf**
  Effects on half lives — **Schippers**
  Di- electronic recombination — **Lestinsky**
- Nuclear physics — **Raabe**
  Nuclear reactions — **Page**
  Isomeric states — **Walker**
  Halo states — **Borge**
  Fission studies — **Jurado**
  Laser spectroscopy — **Cocolios**
- Neutrino physics — **Zuber** **Volpe**

The history: 02/2012

Submission of TDR to the INTC in Jan'12



EUROPEAN ORGANIZATION FOR NUCLEAR

Proposal to the ISOLDE and Neutron Time-of-Flight

[Technical Design Report]

Storage ring facility at HIE-ISOLDE

January 13, 2012

02.02.2012: „*The INTC strongly endorsed the TSR-TDR*"

The history: 04/2012

Eur. Phys. J. Special Topics
207, 1-117 (2012)

K. Blaum, Y. Blumenfeld, P.A. Butler, M. Grieser, Yu.A. Litvinov,
R. Raabe, F. Wenander and Ph.J. Woods (Eds.)

Storage Ring Facility at HIE-ISOLDE

A photograph of the ion storage ring TSR at the Max-Planck Institute for Nuclear Physics in Heidelberg. It is proposed to install this ring at the HIE-ISOLDE facility in CERN, thus enabling a variety of unique experiments in nuclear-, astro- and atomic physics.

edp sciences Springer

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THE EUROPEAN PHYSICAL JOURNAL SPECIAL TOPICS

Review

Storage ring at HIE-ISOLDE

Technical design report

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[a] The members of the GSI Helmholtzzentrum für Schwerionenforschung will exploit the synergies with the FAIR physics program and concentrate on R&D activities relevant for FAIR.

TSR@ISOLDE Collaboration:
~150 scientists from 47 institutions in 19 countries

Physics programme

- Conveners

Reaction Experiments	Peter Egelhof & Dennis Mücher
Atomic Physics Experiments	Daniel Savin & Stefan Schippers
Astrophysics Experiments	Shawn Bishop & Rene Reifarth
Neutrino Experiments	Thierry Stora & Cristina Volpe
Atomic Effects on Nuclear Lifetimes	Fritz Bosch & Takayuki Yamaguchi
Isomeric Beam Experiments	George Dracoulis & Phil Walker
Dielectronic Recombination on Exotic Nuclei	Carsten Brandau & Andreas Wolf
Laser Spectroscopy	Kieran Flanagan & tba.
Fission Studies	Beatriz Jurado & tba

The history: 05/2012

A major milestone

30.05.2012 Approval of TSR by CERN Research Board

CERN's Research Board gave skeleton* approval for allocating resources to the TSR project (building and transfer line(s)).

*The adjective "skeleton" means that the end date is fuzzy, and no definite resources appropriation is made yet.

Thanks to Sergio Bertolucci, Paul Collier and Steve Myers for their encouraging support!

Start integration study: 08/2012

Mandate of the TSR Integration Study Working Group (Paul Collier)

Membership

The members of the working group are E. Piselli, E. Siesling and F. Wenander. They will involve CERN specialists as and when necessary.

Reporting

The working group will report to the Director of the Accelerator and Technology Sector and for technical matters on progress to the IEFC

Milestones

A report summarizing the integration study will be submitted to the Director of the Accelerator and Technology Sector by Q3 2013.

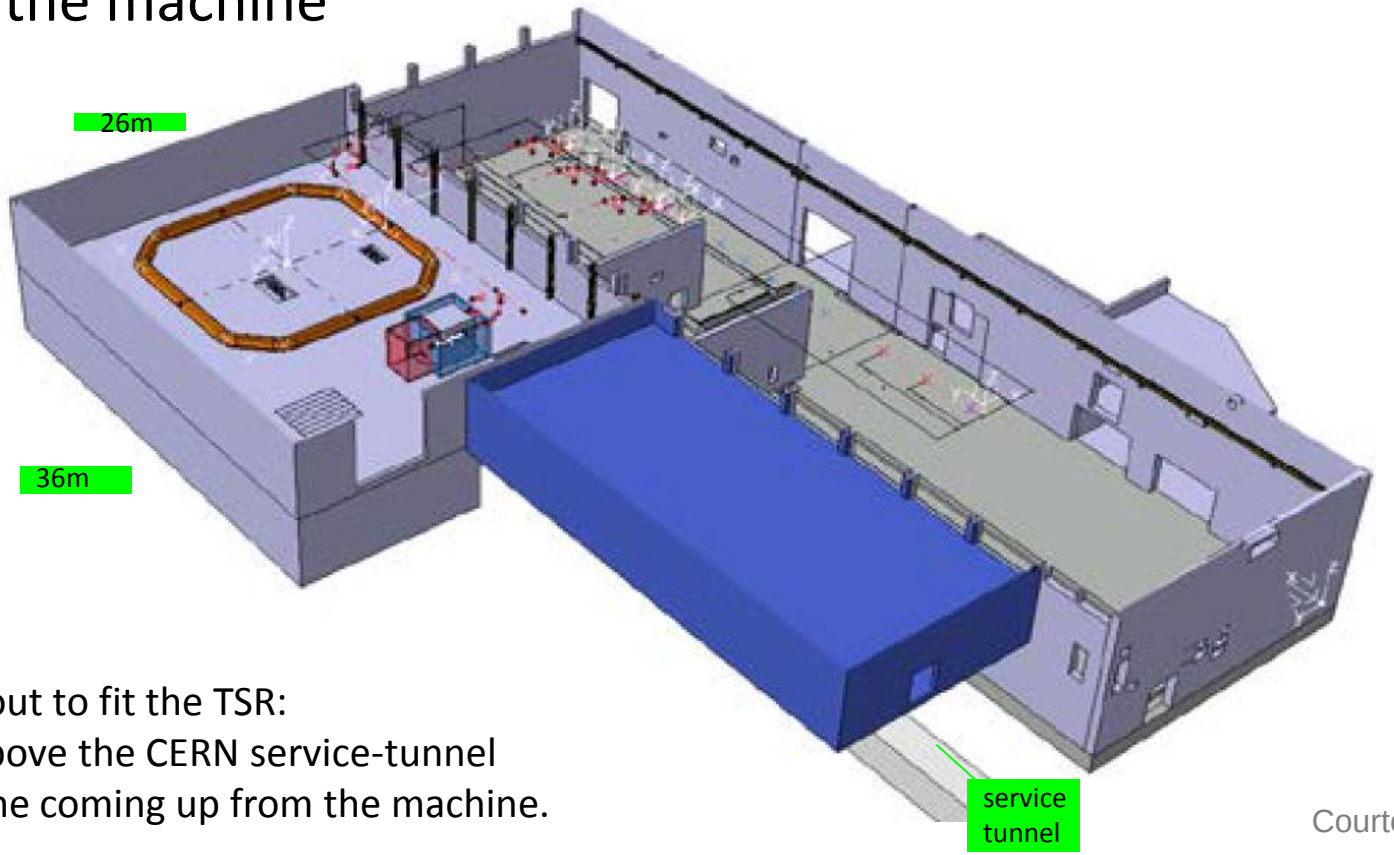
Tremendeous amount of work done by the integration study team!

Coupling to HIE-ISOLDE

- Possible TSR installation above the CERN service-tunnel
- Tilted beamline coming up from the machine

Jura (west) side

Cost study:
Eliseo Perez-Duenas GS/SE



Proposed layout to fit the TSR:
Installation above the CERN service-tunnel
Tilted beamline coming up from the machine.

Courtesy E. Siesling

External funding

The UK project (ISOL-SRS) received a total of £4.8M (£3.2M new money, £1.6M allocated from existing grants for staff effort). This is for the period Jan 2015 - Jan 2019

The participants are Daresbury, Edinburgh, Liverpool, Manchester, Surrey and York.

See also talks by Phil Woods and Robert Page.

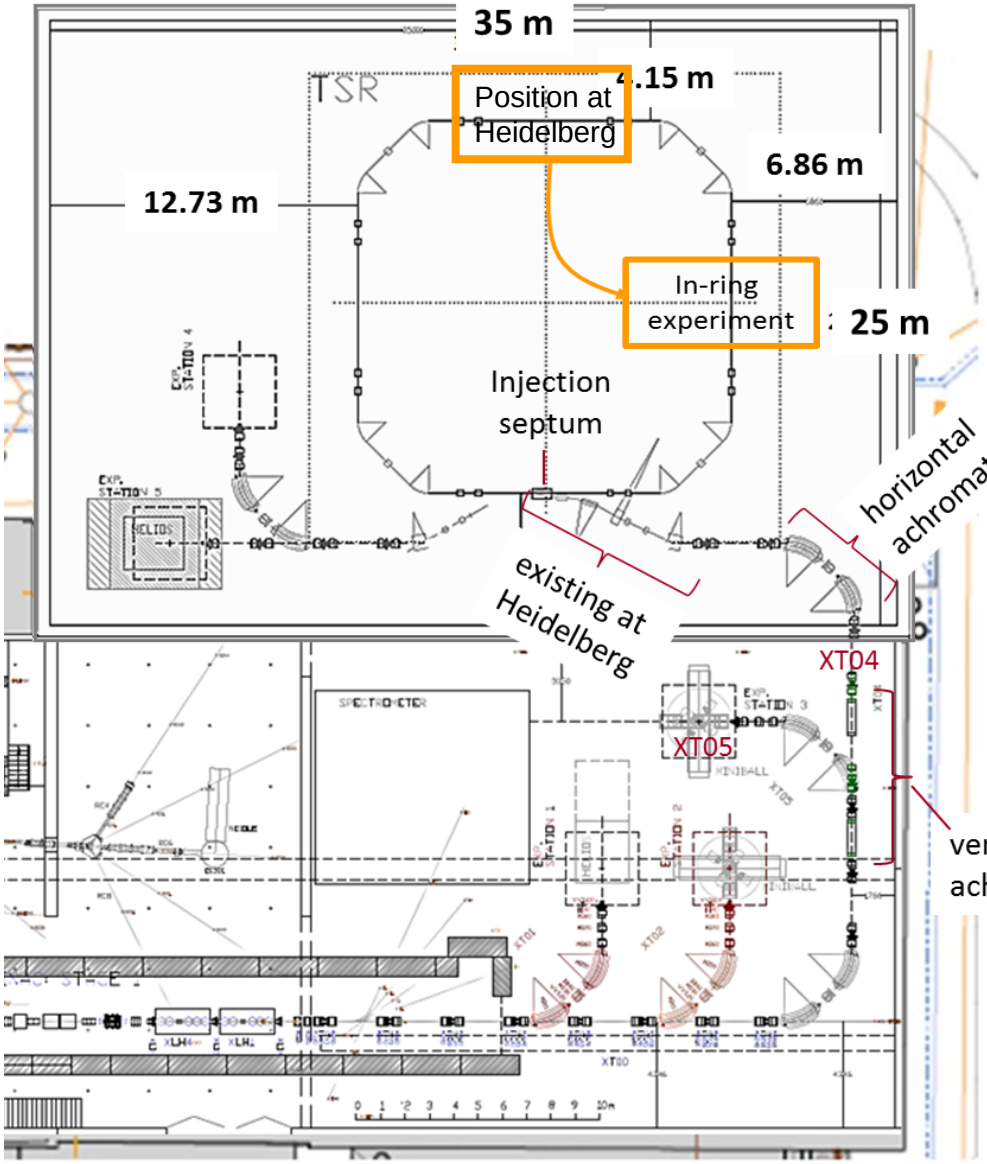
CERN statement (SPC meeting):
… the Management was supporting the installation of a third beam line at HIE-ISOLDE for the HELIOS spectrometer …

Conclusions and next steps

- A storage ring at an ISOL facility: a unique instrument
  First storage ring with ISOL-facility!
- Possibilities in atomic, nuclear, astro- and neutrino physics
- TSR matches the HIE-ISOLDE characteristics
- The technical aspects of the integration have been studied
- Now awaiting official response from the management…
  "*We see the scientific merits of TSR@ISOLDE …. We will now discuss a possible project implementation into the MTP for 2015-2019.*" (Rolf Heuer) → Thanks for his support!
- TSR@ISOLDE becomes hopefully part of the MTP ☺

Thanks a lot for your attention!

Beam-line layout



- Links HIE-ISOLDE to TSR ring via XT04
- Considers HIE-ISOLDE and TSR floor level difference of 4.73 m
- Includes the move of the experimental station XT03 to the XT05 position (pink)
- Additional equipment required
  - 6 dipoles
  - 19 quadrupoles singlets
  - 8 steerers
  - 10 beam diagnostics boxes

CERN input: A. Parfenova, D. Voulot, B. Goddard, M. Fraser

Technical integration study

* Study group E. Siesling, E. Piselli, F. Wenander

Mandate - a report covering the following aspects should be prepared:

An inventory of all equipment to be brought to CERN for installation.

Initial estimates for the infrastructure needed for the ring and it's transfer lines. This should include the overall space, power, cooling and safety needs. It should not include a detailed design of these systems.

For each system a brief study of the equipment to be installed should be undertaken after discussion with the experts in Heidelberg and the concerned CERN groups. This study should include:

- The issues associated with the integration of the equipment into the CERN accelerator environment.
- The spare situation for the equipment together with any issues or recommendation concerning additional spares.
- A radiological assessment of the equipment in collaboration with RP.
- The control system presently used for the system and whether the control hardware must be replaced to meet CERN standards.
- Any specific costs associated with the initial installation, or the modification to meet CERN standards should be estimated.

* Study running Sep 2012 to Aug 2013 **Presented to the RB in Nov. 2013**

Tremendeous amount of work done by the integration study team!