Additional Installations for a Nuclear Physics Facility

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- Introduction
- Disgression
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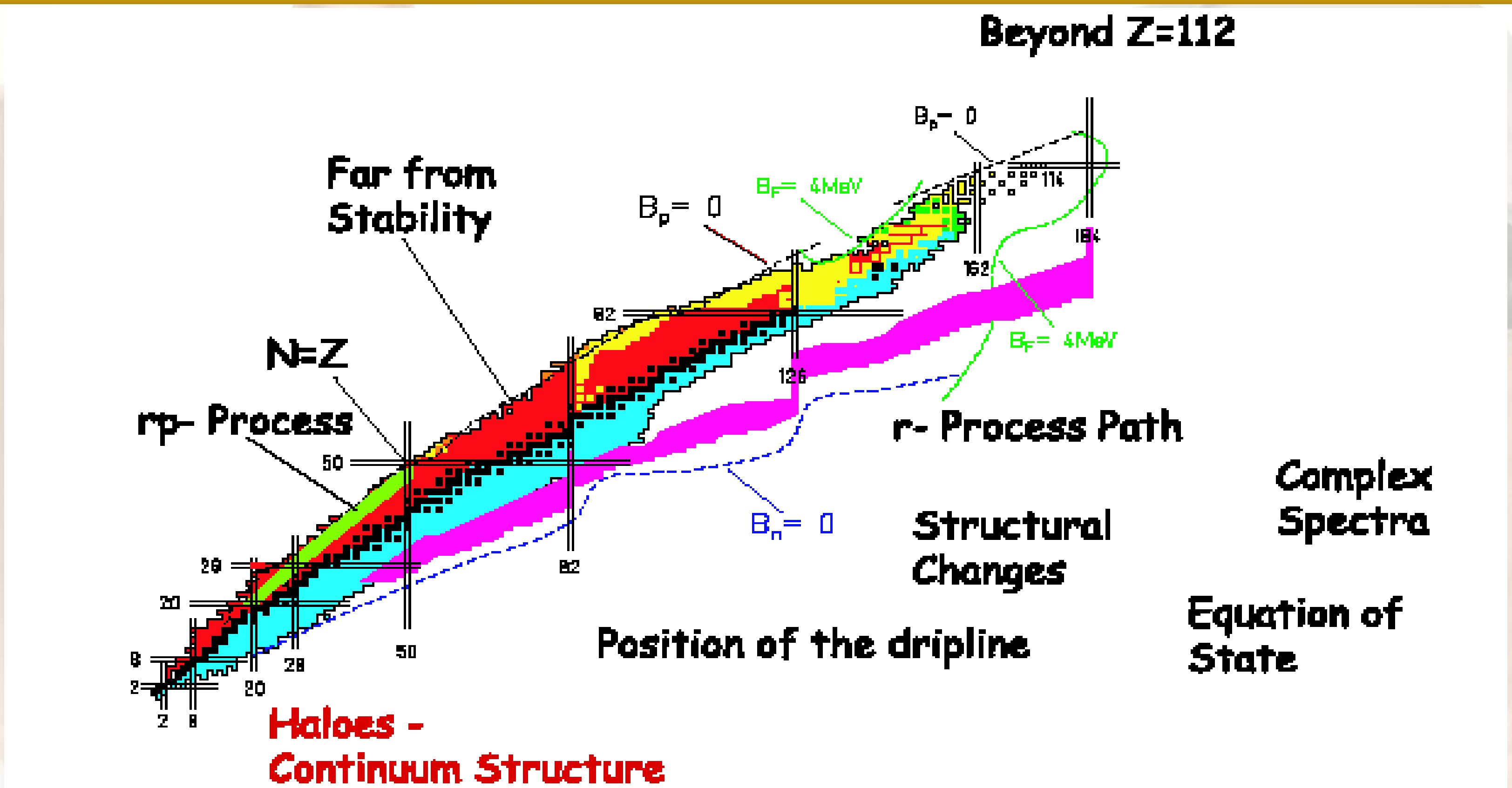
- Multi-Beam & Multi-User Aspects
- EURISOL Base-line Layout
- Possible Upgrades in the Context of a β-Beam Facility
- Summary for Chairs and on R&D

Understanding the Nuclear Many Body Problem…….
……. by Exploring the Nuclear Landscape



…Indeed, in order to understand the full extension of the nuclear many-body problem we must study the majority of the possible combinations for this quantum system, in particular because the proposed constituent nuclear forces contain terms which only will reveal their true character for very disequilibrated neutron-to-proton ratios…

ACM, Nucl.Phys A 654 (1999), 215c

Disgression on: Tools for studying complex objects

Here: Structural Analysis of Macromolecules

Complementarity between Synchrotron Radiation & Spallation Neutrons!

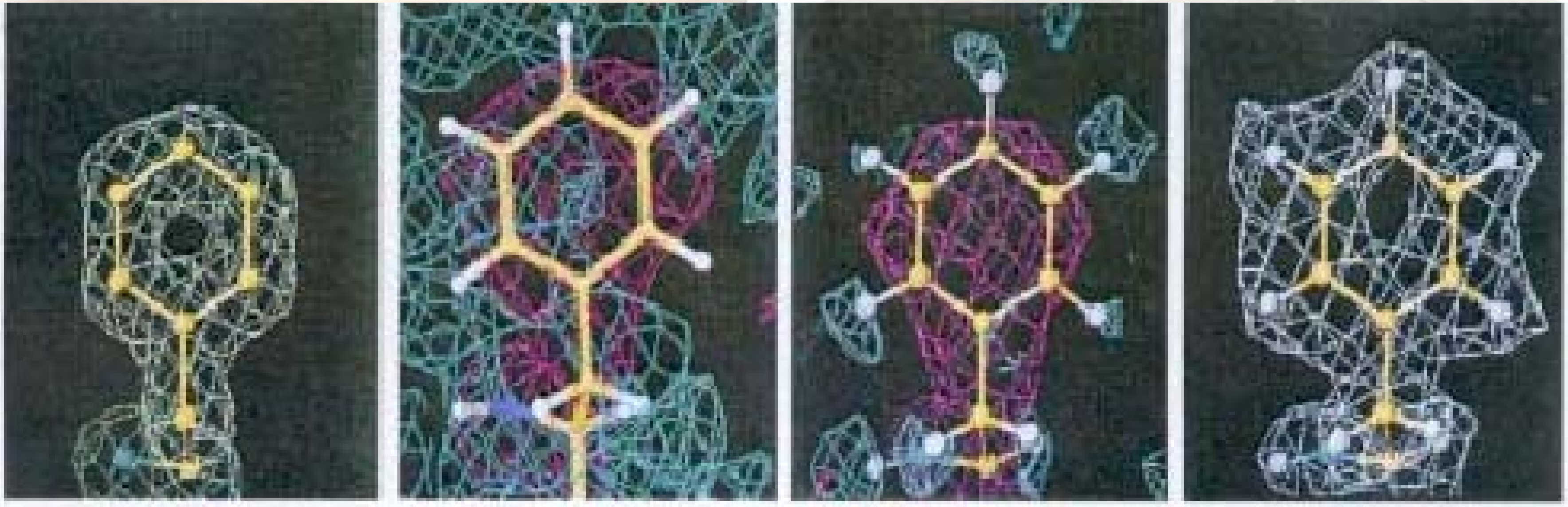
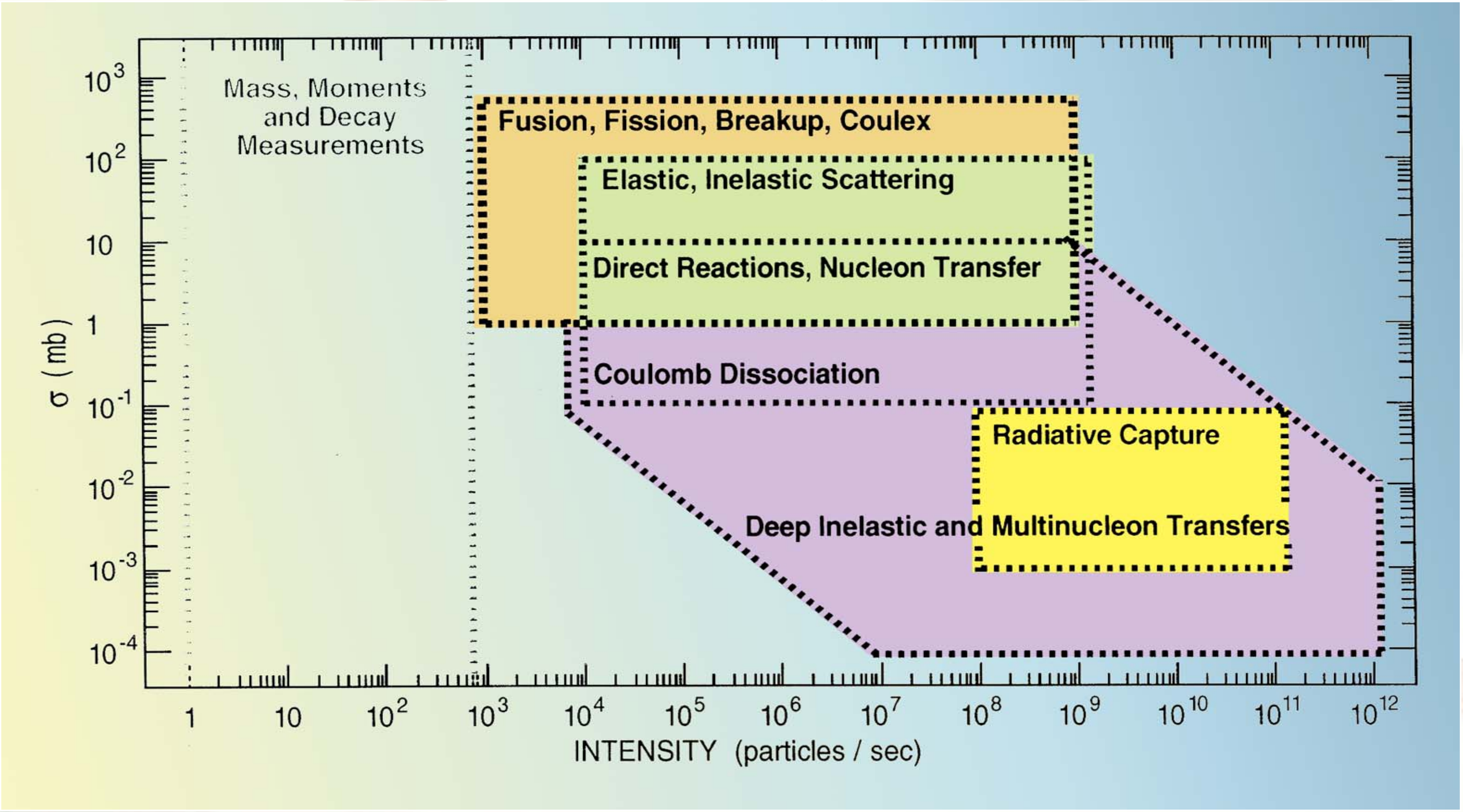


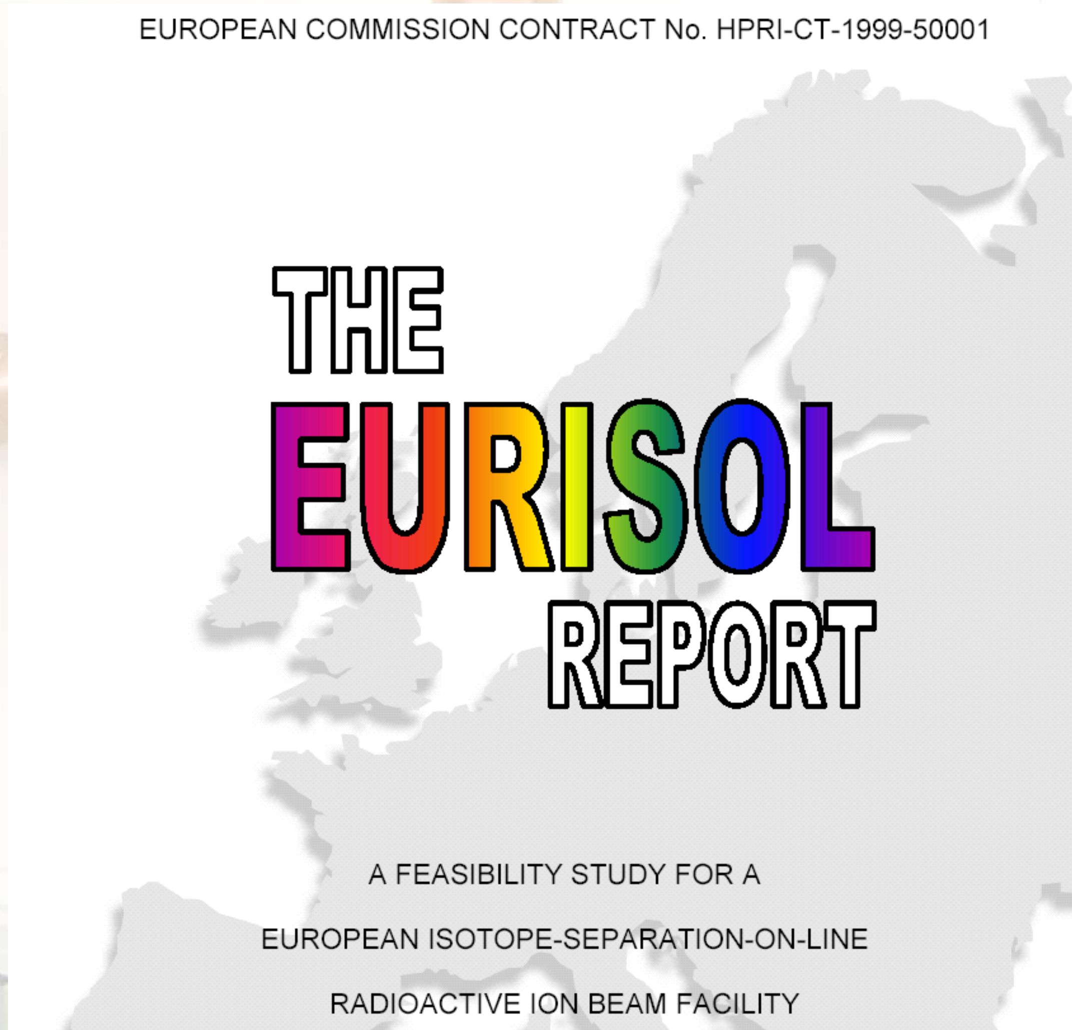
Figure 3. Locating hydrogen positions in a residue of myoglobin, (A) using X-rays, (B) using neutrons and an unlabelled sample, (C) the calculated map equivalent to (B), and (D) using neutrons and a fully deuterated sample. (from Shu, Ramakrishnan and Schoenborn, Proceedings of the National Academy of Sciences, 97(8), 3872-3877, (2000)).

Taken from the report: Neutrons in Biology, Workshop Juillet 2001, School of Biochemistry and Molecular Biology, University of Melbourne, Australia

Most relevant Nuclear Structure Experiments



By the way, the technical information presented here, comes essentially from the EURISOL report


EUROPEAN COMMISSION CONTRACT No. HPRI-CT-1999-50001

THE EURISOL REPORT

A FEASIBILITY STUDY FOR A

EUROPEAN ISOTOPE-SEPARATION-ON-LINE

RADIOACTIVE ION BEAM FACILITY

An European ISOL facility at the highest power level

- 2-3 order of magnitude higher luminosity than existing or nearly completed ones
- EU-5th Framework Design study (2000-2003) funded 1.2M€
- Carried out by a network of 10 major european laboratories.

Energy Range of the EURISOL Post-accelerator

Quotation from the EURISOL study:

Three energy regions have been chosen for the post-accelerator:

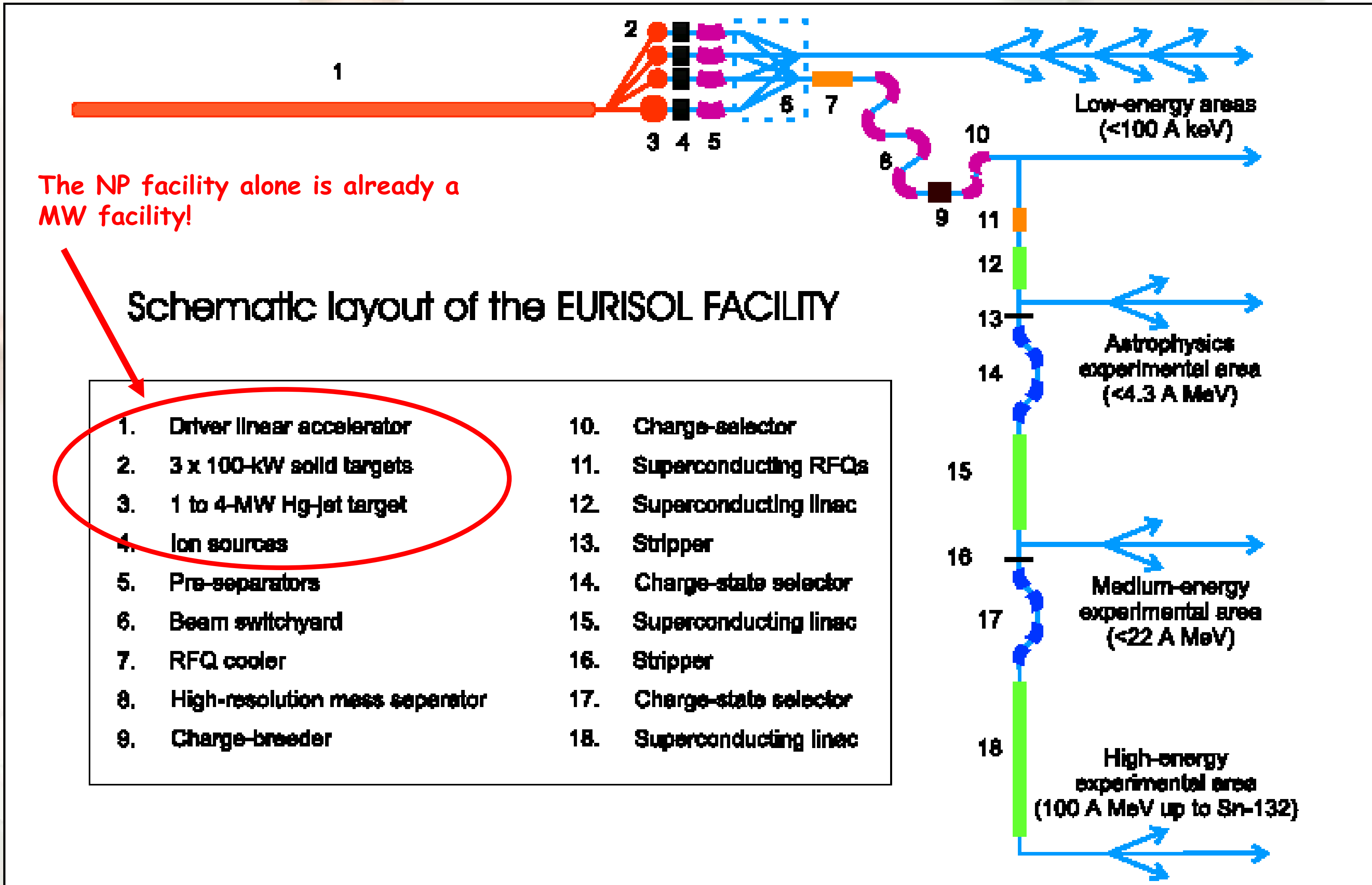
- The first covers low-energy RIBs, i.e. tens of keV (à la ISOLDE), for experiments investigating ground-state properties, half-lives, decay modes, masses, electromagnetic moments, etc., and for Fundamental Interactions experiments.

- Another region, up to about 10 A MeV, will allow experiments around the Coulomb barrier, for spectroscopic studies, high-spin investigation through fusion-evaporation reactions, etc.

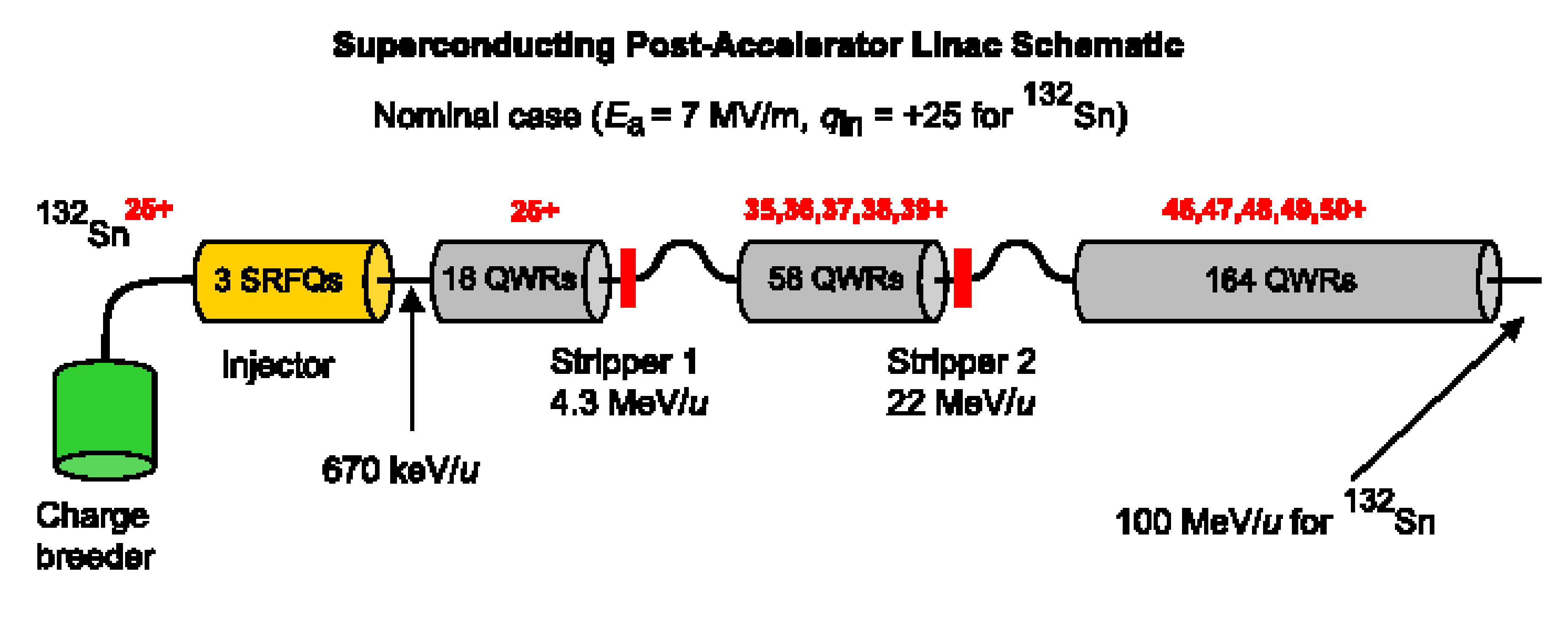
- The third region, up to 100 A MeV up to A ≈ 100, will be devoted to fragmentation of very intense RIBs, study of the Equation Of State (EOS) of Nuclear Matter, etc.

EURISOL Overall Baseline Layout

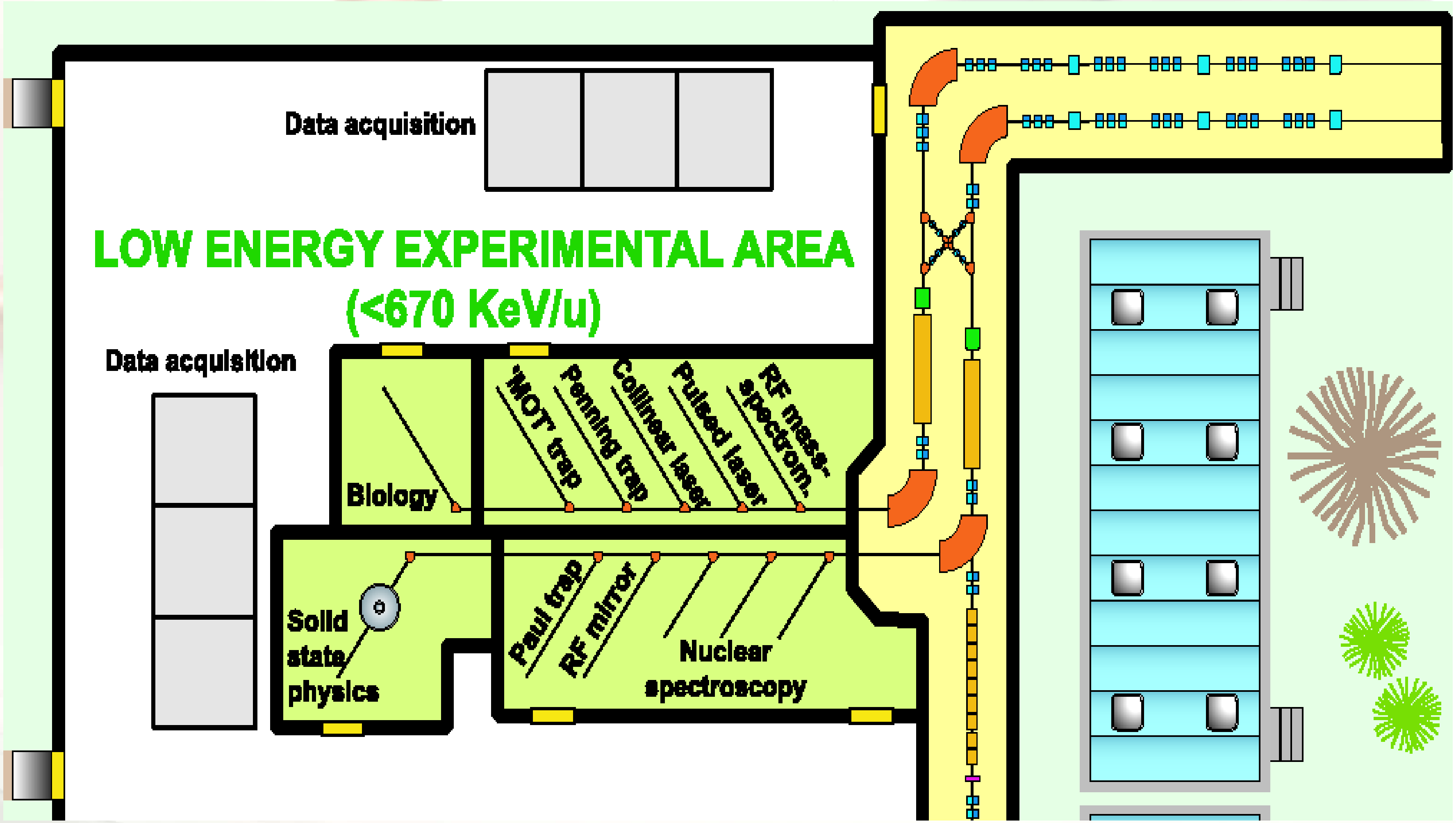
The NP facility alone is already a MW facility!



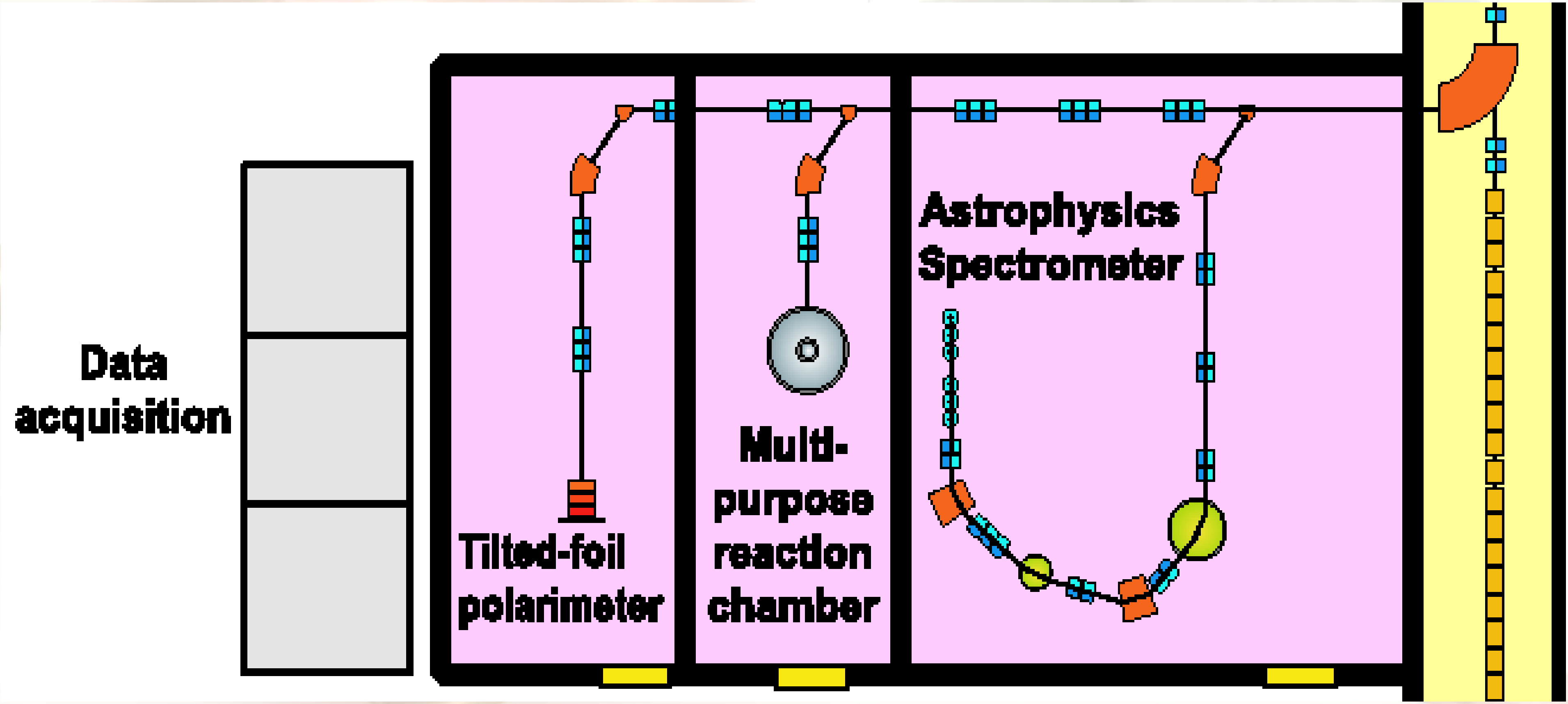
Baseline Design of the EURISOL Postaccelerator



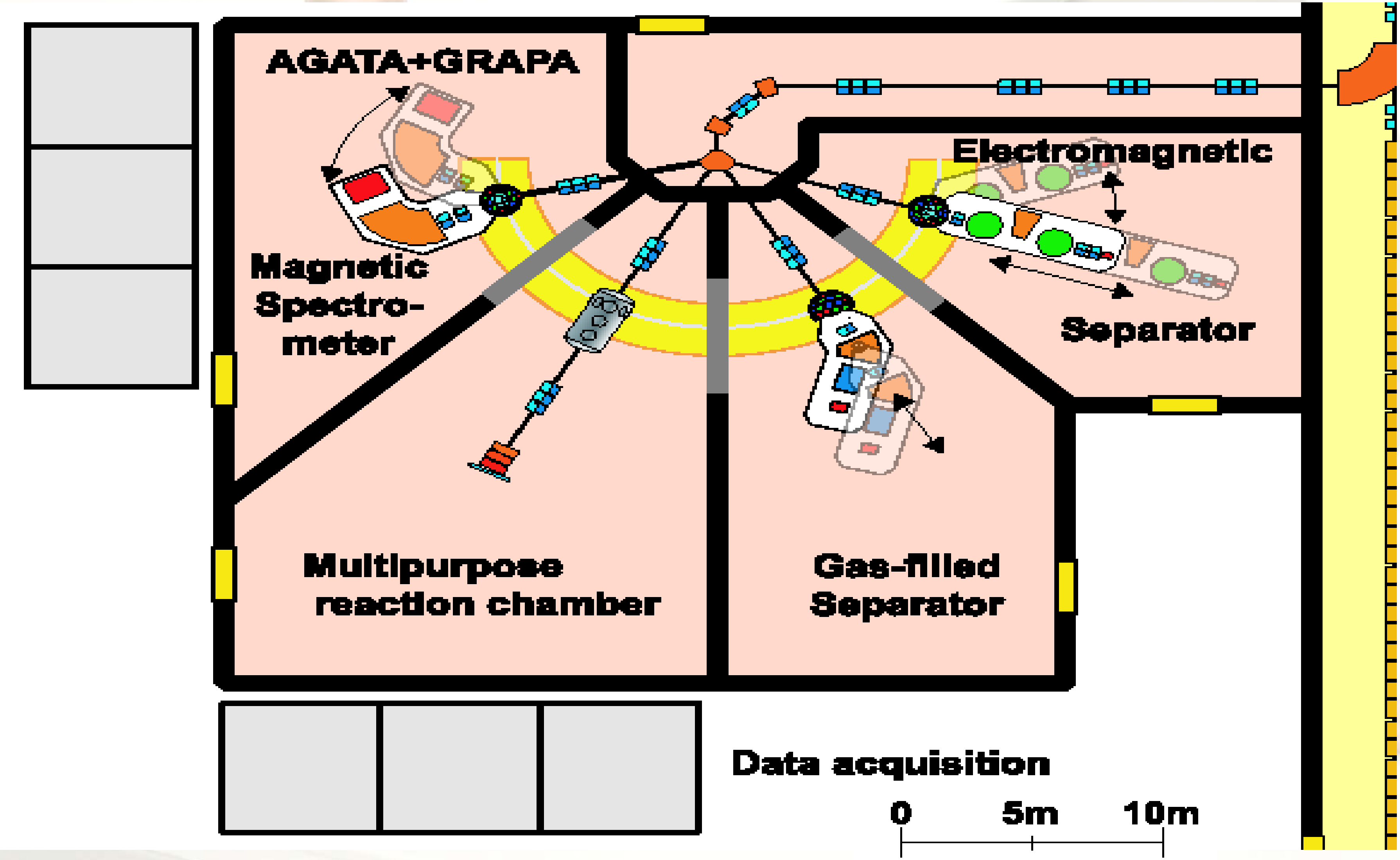
Low energy area "à la ISOLDE"



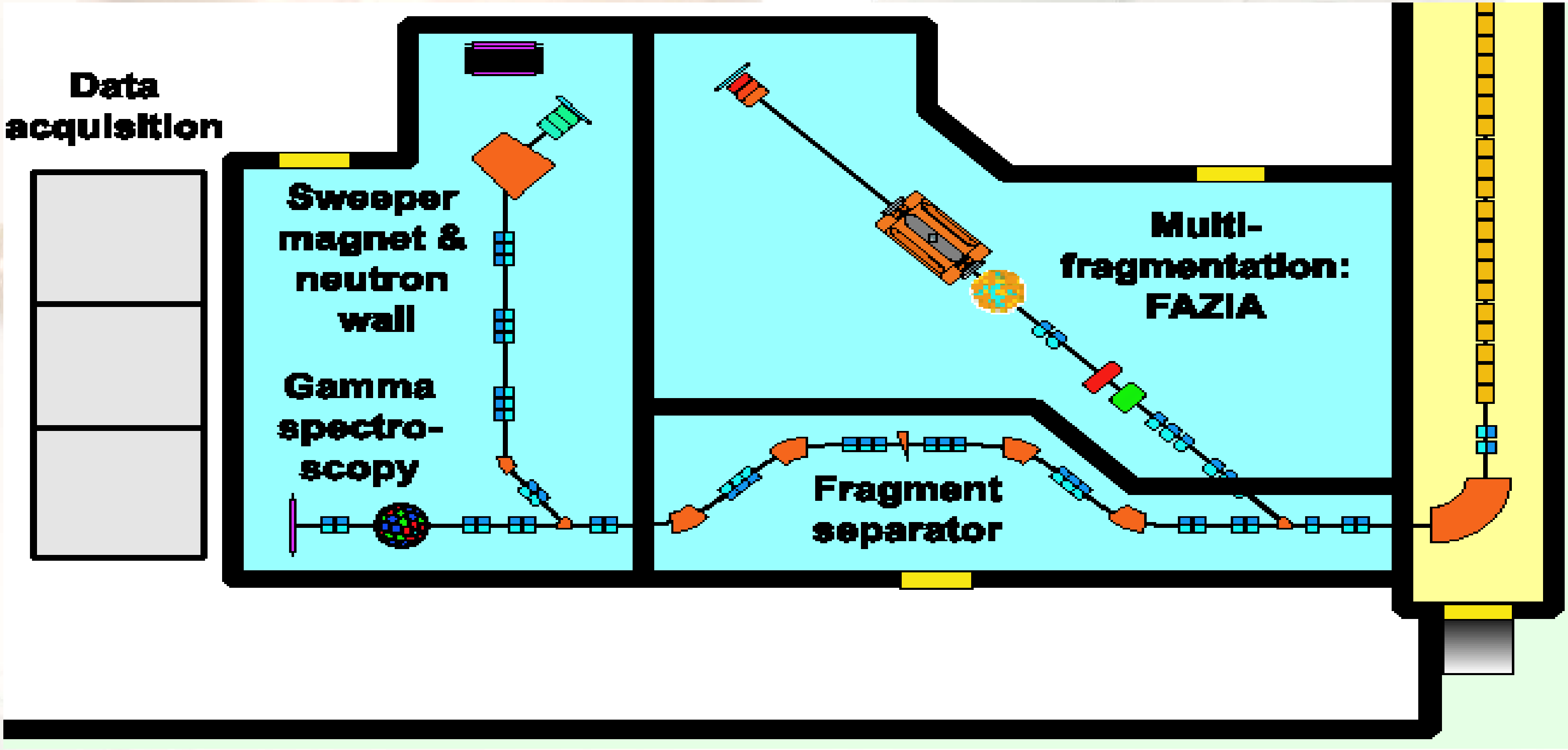
The experimental Area for Astrophysics (<3MeV/nucleon)



Medium Energy Experimental Area (up to ≈20 MeV/nucleon)



High-Energy Experimental Area (<100MeV/nucleon?)



Most Salient Features for the NP part

- CW driver beam preferred (may include β-beam production, but pulsed operation possible if thermal effects are "whashed out" (high repetition frequency)
- Very broad parameter range and very high efficiency for target ion source system, separation and transport systems and the post-accelerator.
- Concerning Energy,
  - the range up to 20 MeV/nucleon requires rapid tunig of the energy for "excitation fuctions (hence linac), beyond, other solutions can be evisaged
  - the linac of the preliminary EURISOL study was limited in energy for budgetary reasons, optimum physics requirements would go to up to, say, 300 MeV/nucleon
- multi-user operation because of low cross section phenomena a must
- Medical isotope production strongly recommanded (unique research posssibilities and operations cost contribution)

Most Urgent Required R & D (for the NP part)

- The Spallation Neutron Target
- Efficient, Rapid & Robust Targets for RNB production
- Efficient and Selective Ionization
- Isobar Separation
- Charge State Boosting for Efficient Post-acceleration
- Beam Dynamics (multi-beam transport) in the Postaccelerator
- Development of SC-cavities
- Development of solid-state RF power transmitters
- Development of Nuclear Physics Instrumentation
- Multi-user operation, including β-beams
- Radiation Safety

All these items are already taken into account by the Nuclear Physics Community in a well-coordinated manner at European level, in particular within the Integrated Infrastructure Initiative EURONS and the Design Study EURISOL.

However,

- *the resources within these Projects will only allow an efficient start of R&D*
- *coordination with other communities and pooling of resources will become increasingly important (and has actually started !!)*

Last but not least………

Good luck for such a facility!

The ADS accelerator people are interested too

Congratulations to CERN for its 50th birthday
from another one born in 1954!