The d(30Mg, 31Mg)p transfer reaction at REX-ISOLDE: Results from IS454

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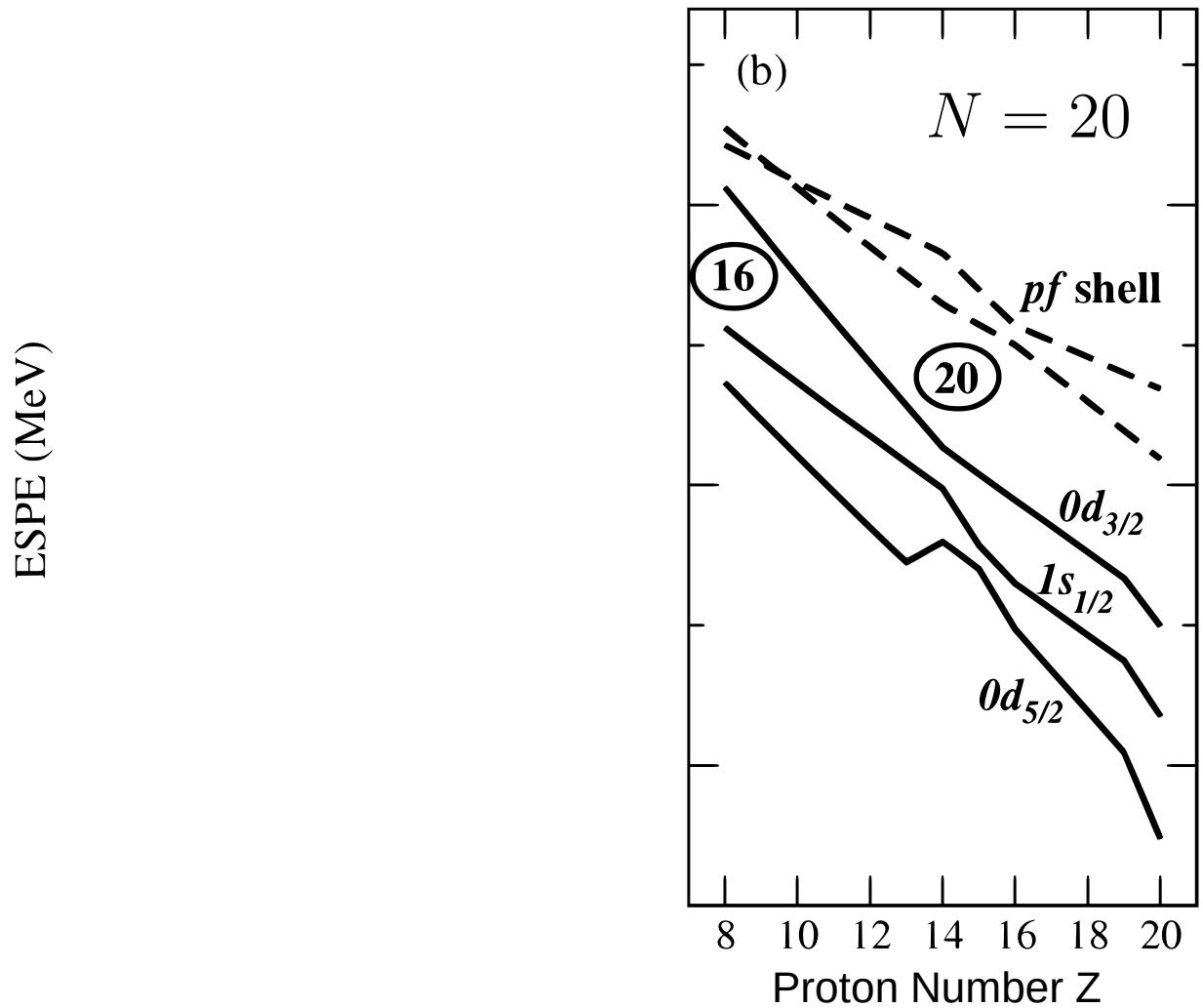
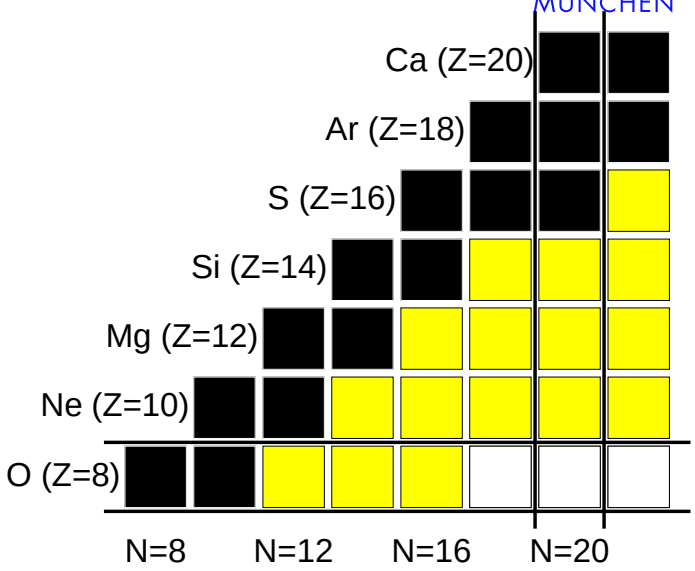
Island of Inversion

Frontiers and challenges of nuclear shell model

T. Otsuka *et al.*, Euro. Phys. Journal A **15**, 151 (2002)





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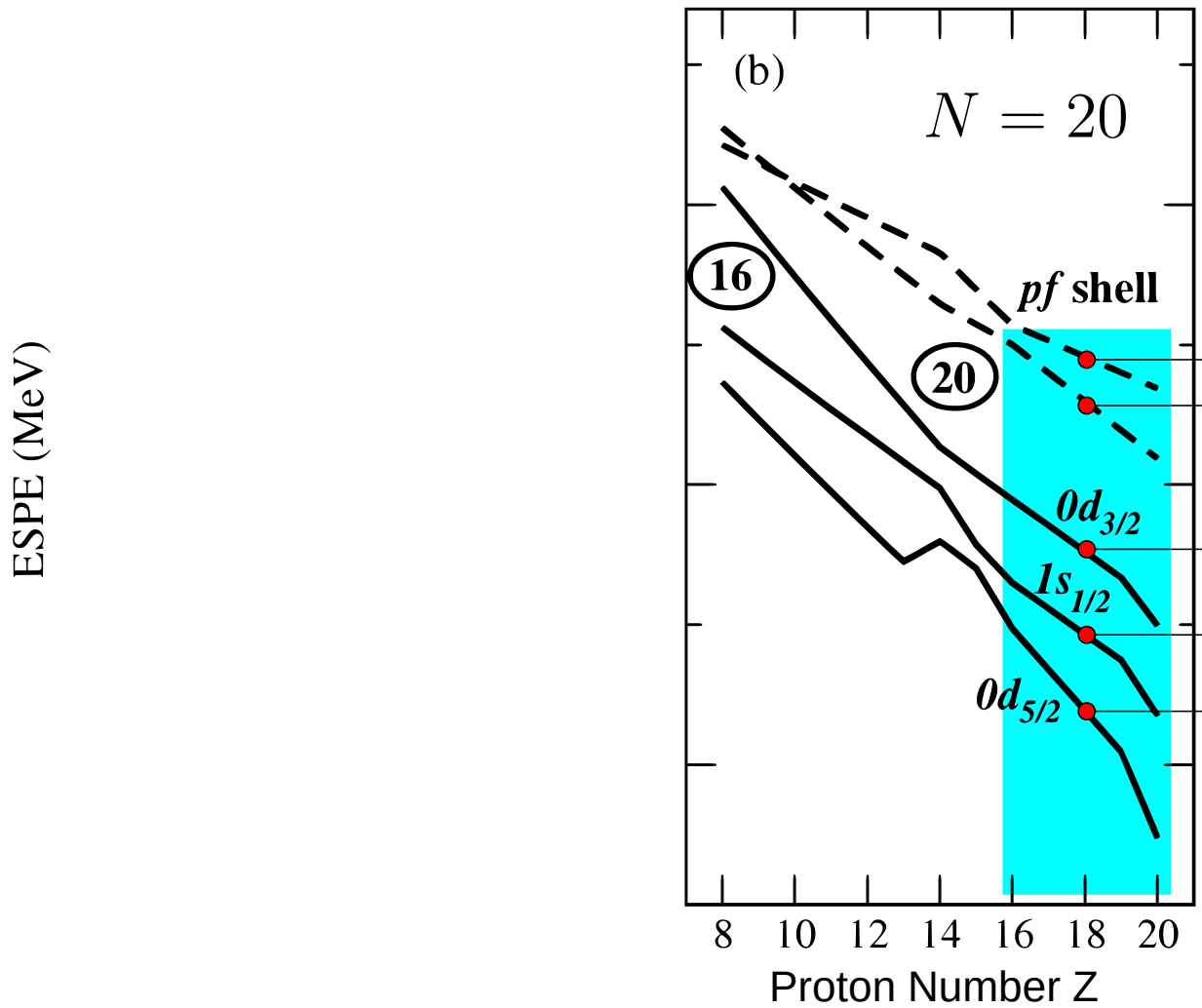

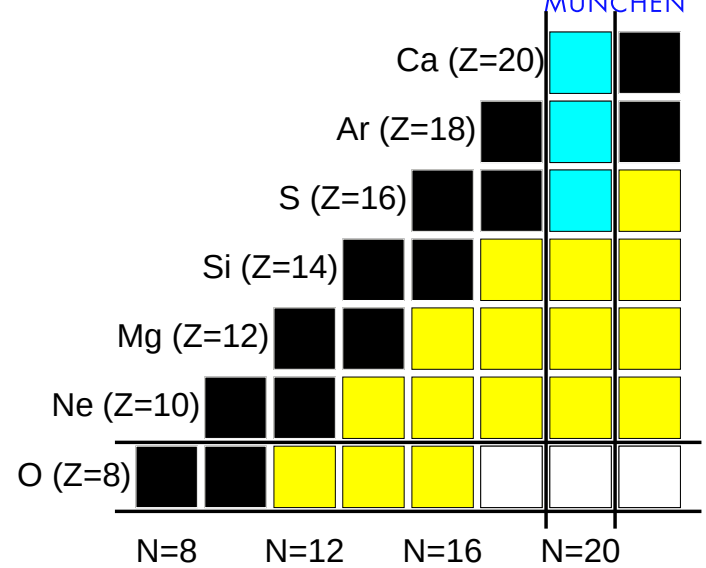

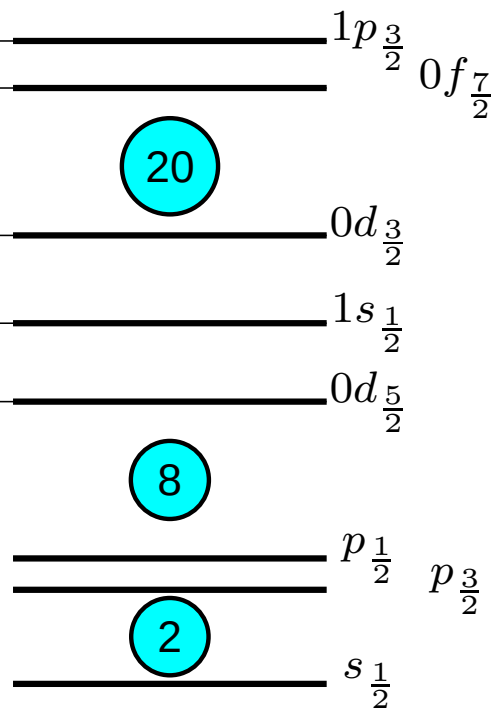

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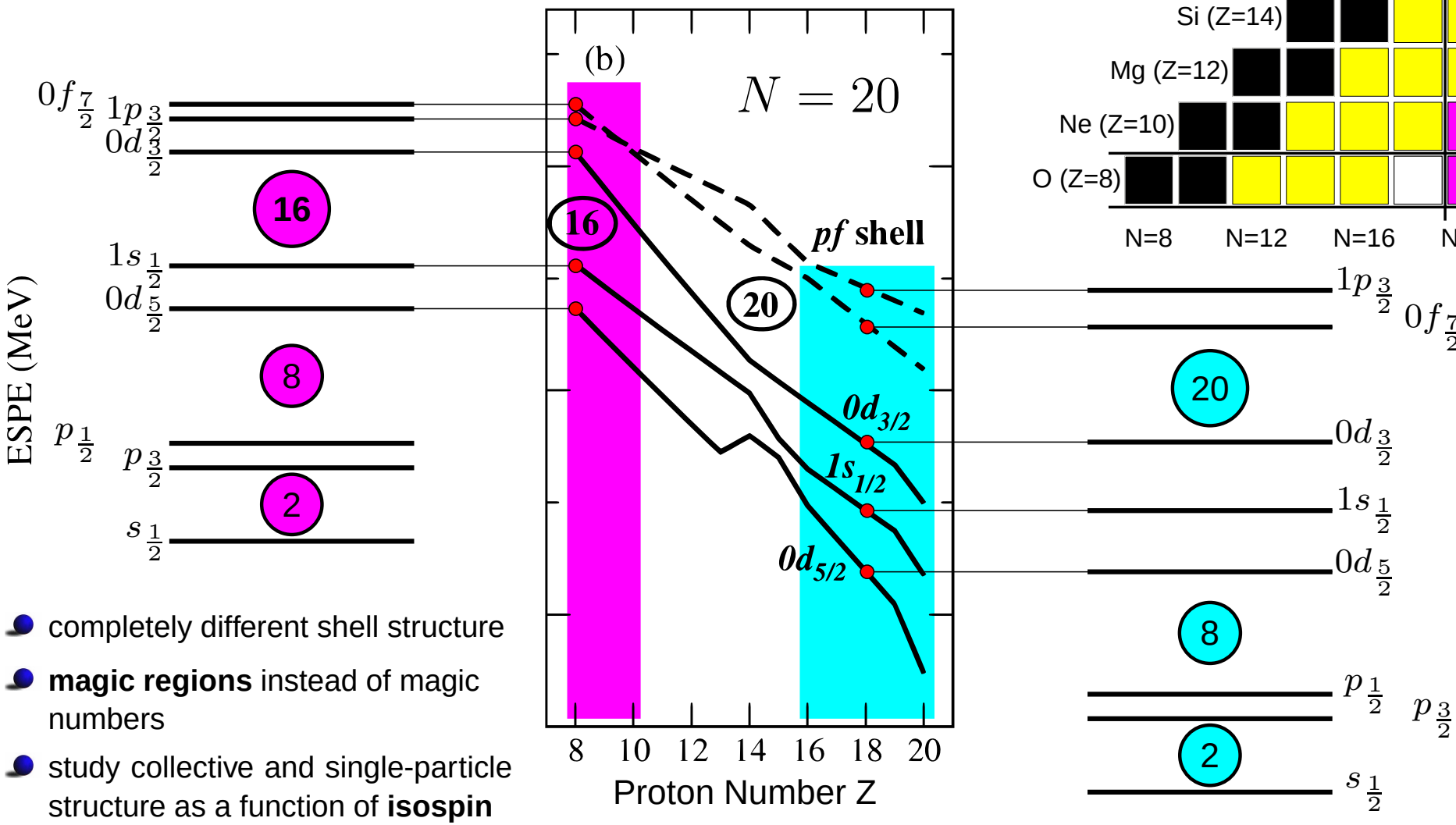

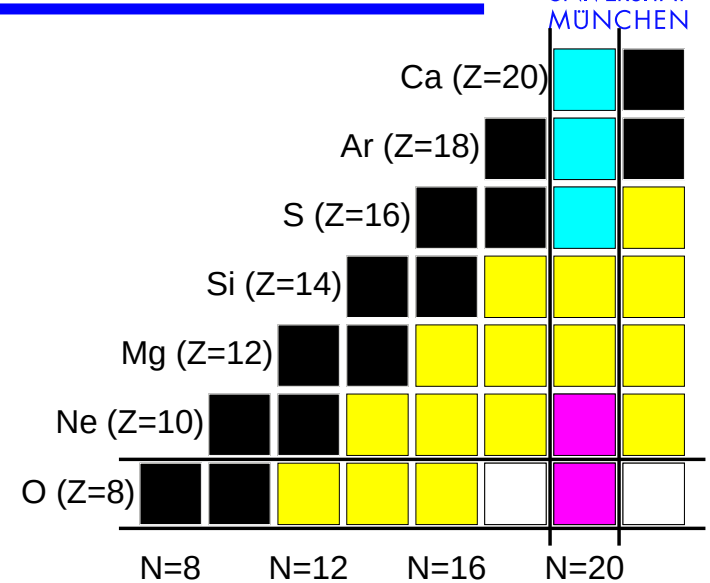

- completely different shell structure
- **magic regions** instead of magic numbers
- study collective and single-particle structure as a function of **isospin**

Current Status of ^{31}Mg

TECHNISCHE UNIVERSITÄT MÜNCHEN

IS410 @ REX-ISOLDE: "safe" Coulex
^{30}Mg is OUTSIDE
and
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of the
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O. Niedermaier et al.,
PRL 94, 172501 (2005);

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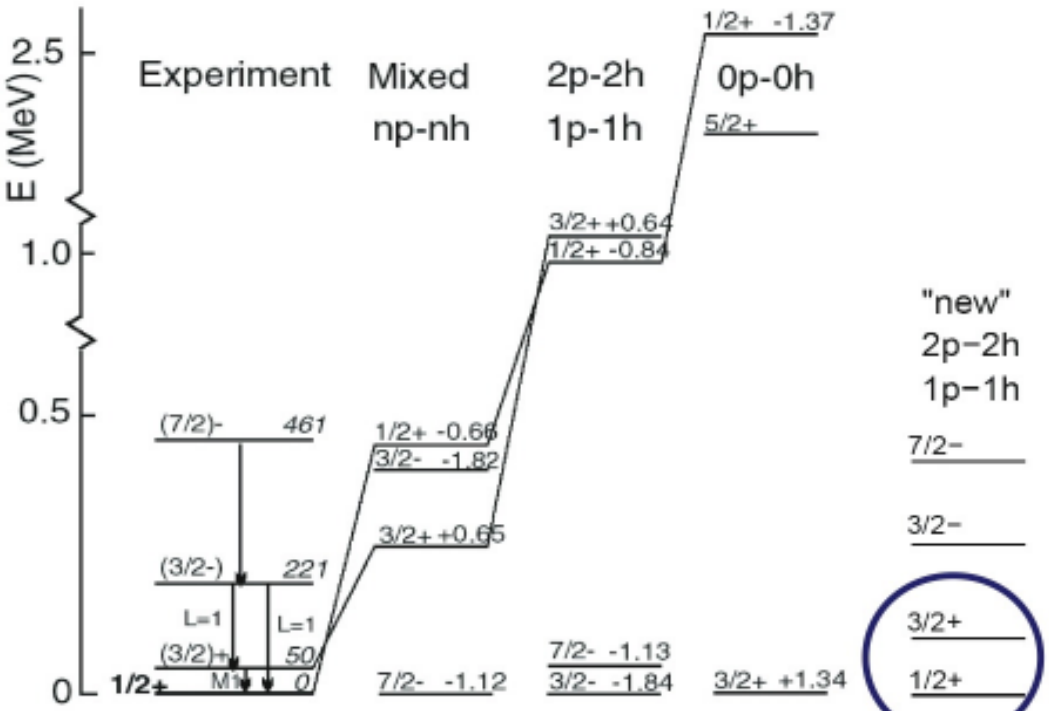

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> 90% intruder configuration

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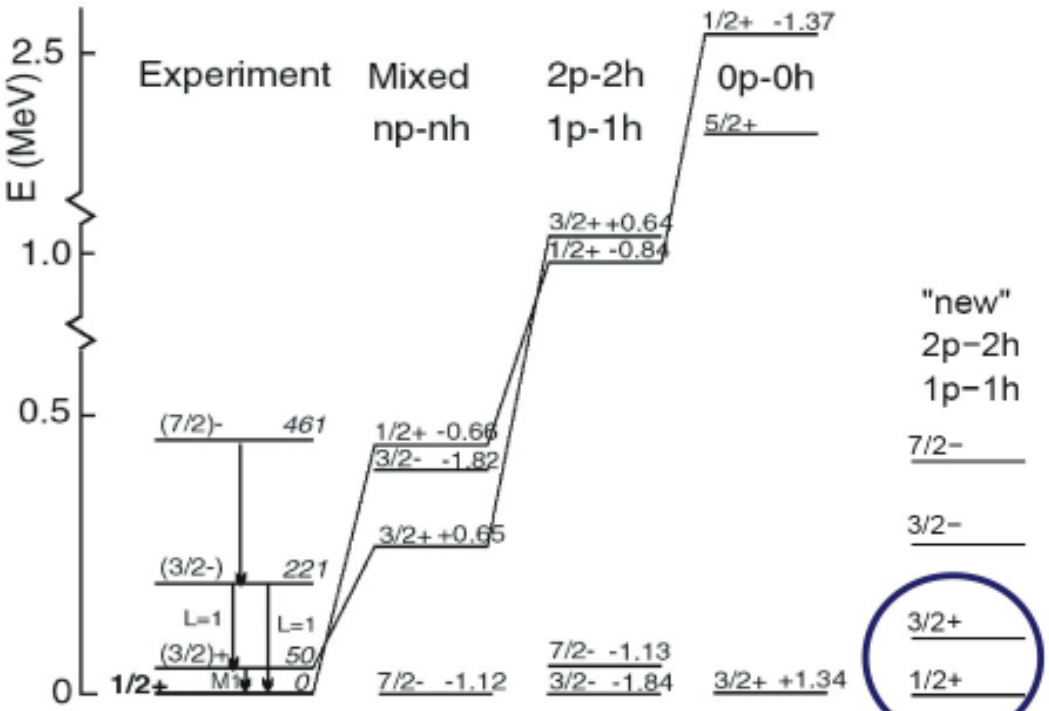

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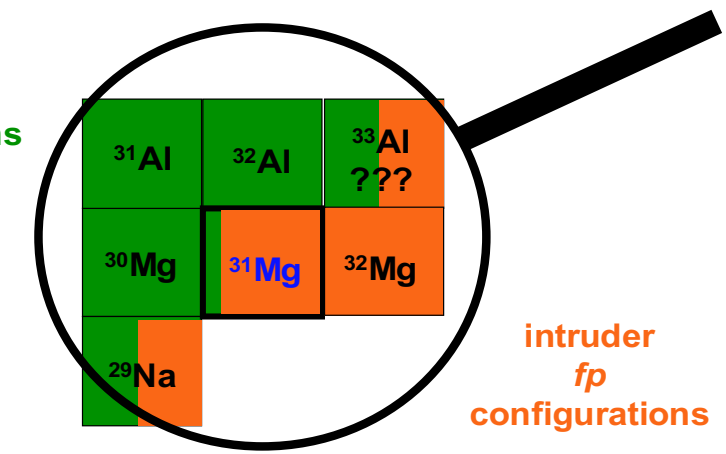
normal *sd* configurations



intruder *fp* configurations

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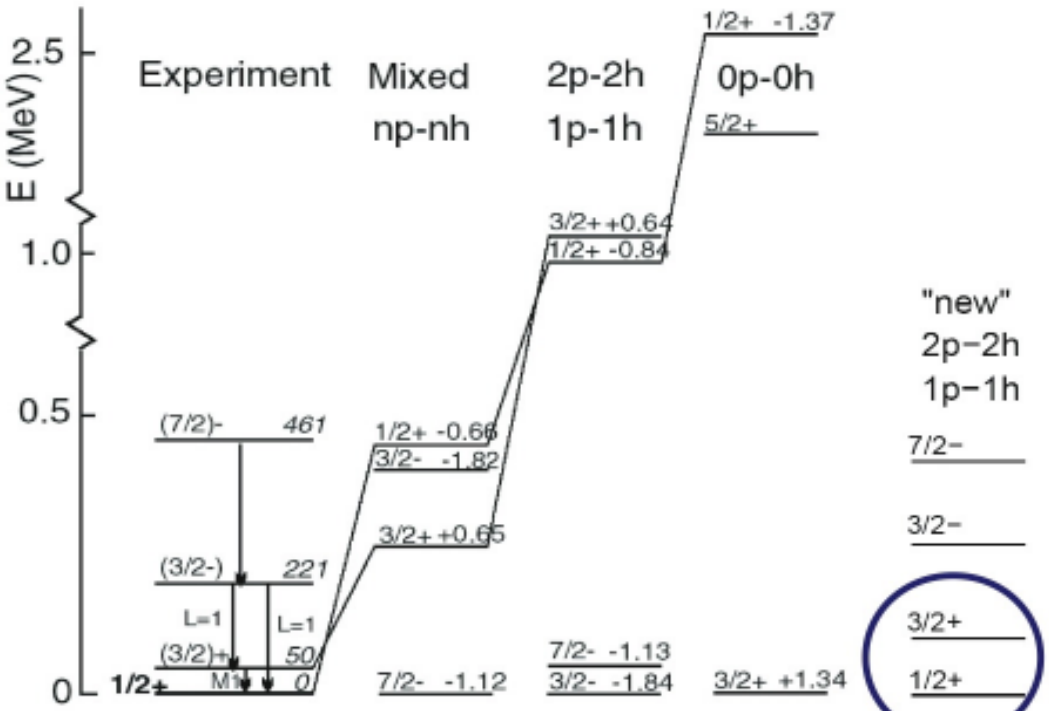
Check the configurations of the *excited* states with (d,p) transfer reaction in inverse kinematic.



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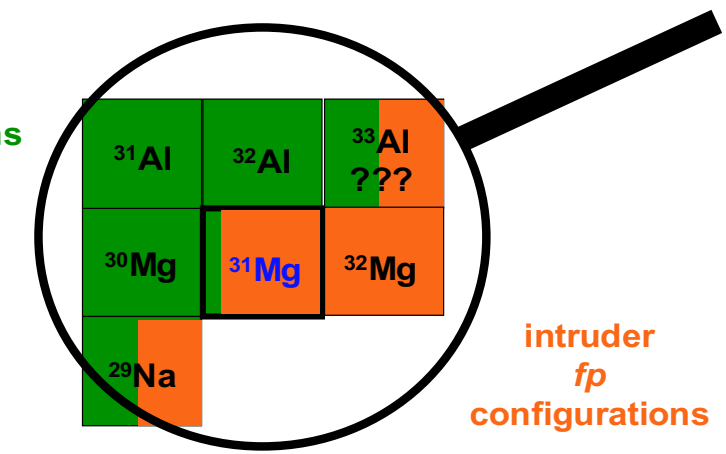
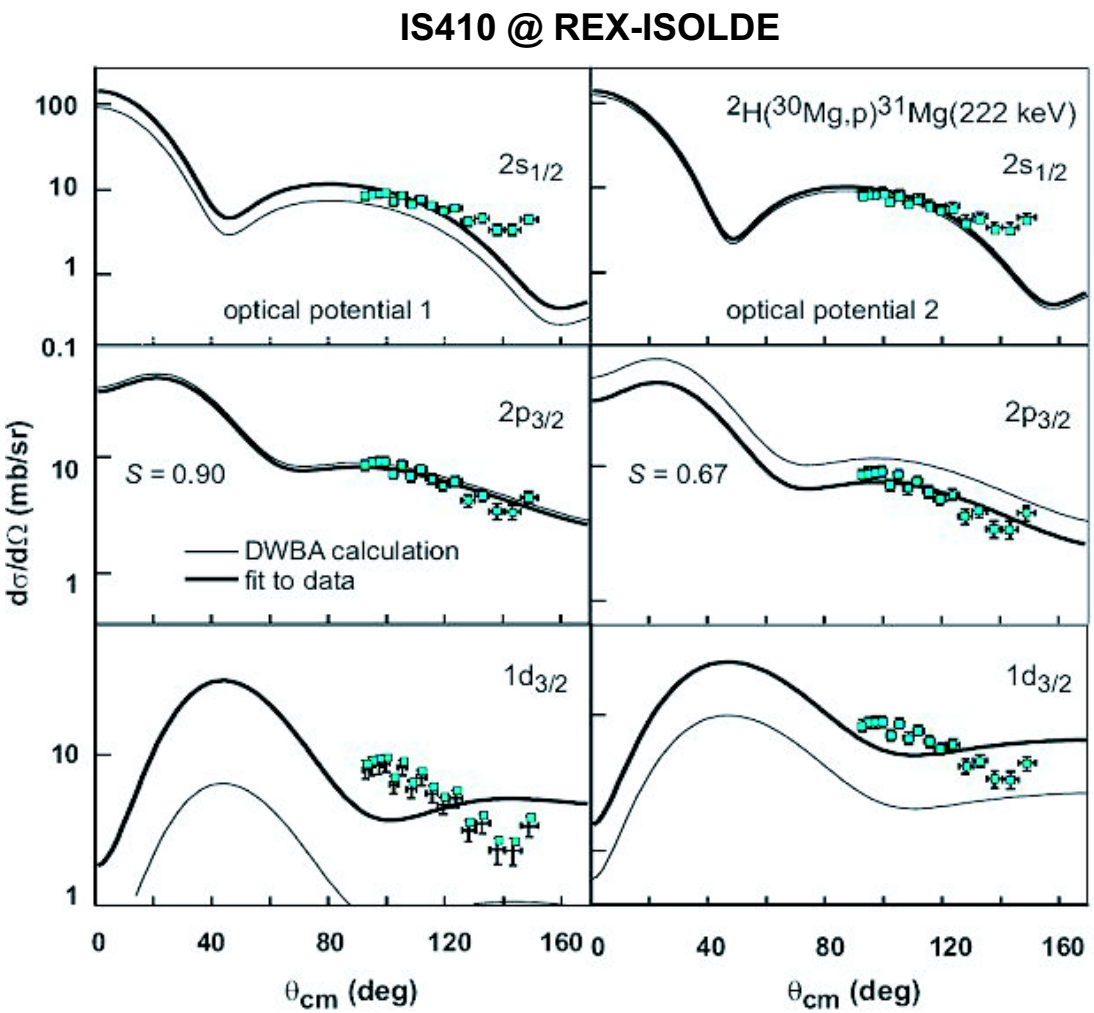


intruder *fp* configurations

Old Setup



- from d(^{30}Mg,^{31}Mg)p:
  - cover larger ϑ_{cm} range
  - determine optical potential from elastic scattered deuterons

M. Pantea, PhD Thesis (Darmstadt, 2005)
ongoing work: E. Tengborn (Chalmers)

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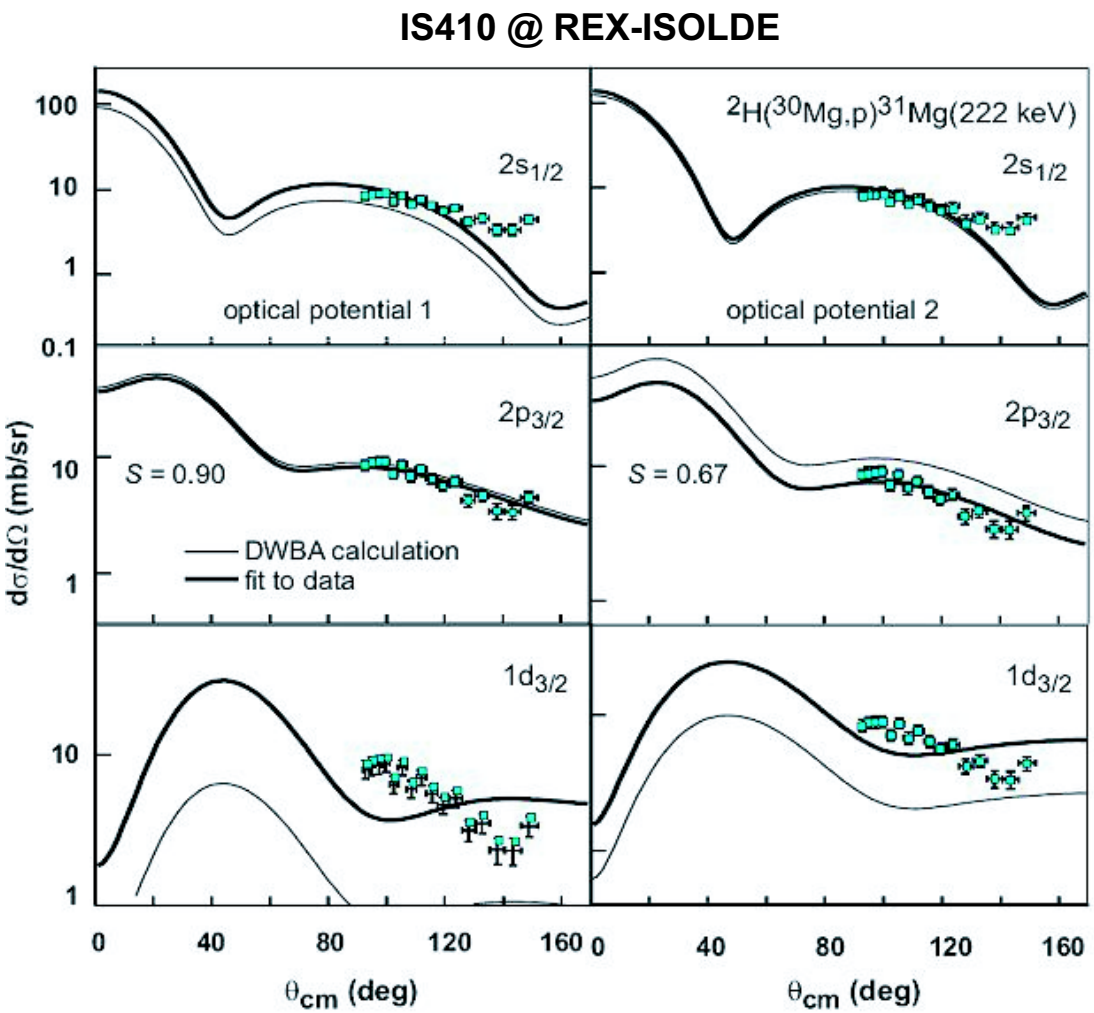

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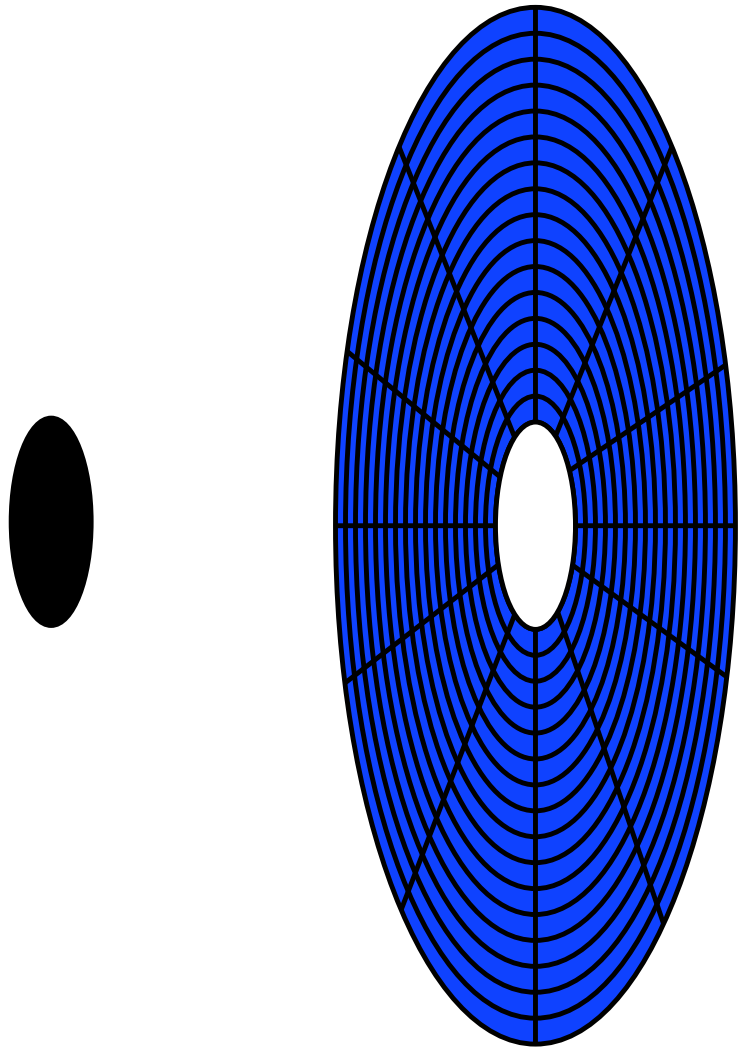
- from d(^{30}Mg,^{31}Mg)p:
  - cover larger ϑ_{cm} range
  - determine optical potential from elastic scattered deuterons
- for $\vartheta_{\mathrm{lab}} < 90^\circ$ mostly elastic scattering
  $\Rightarrow \Delta$E-E$_{\mathrm{rest}}$ telescope is needed to distinguish e.g. protons and elastic scattered deuterons

Setup I



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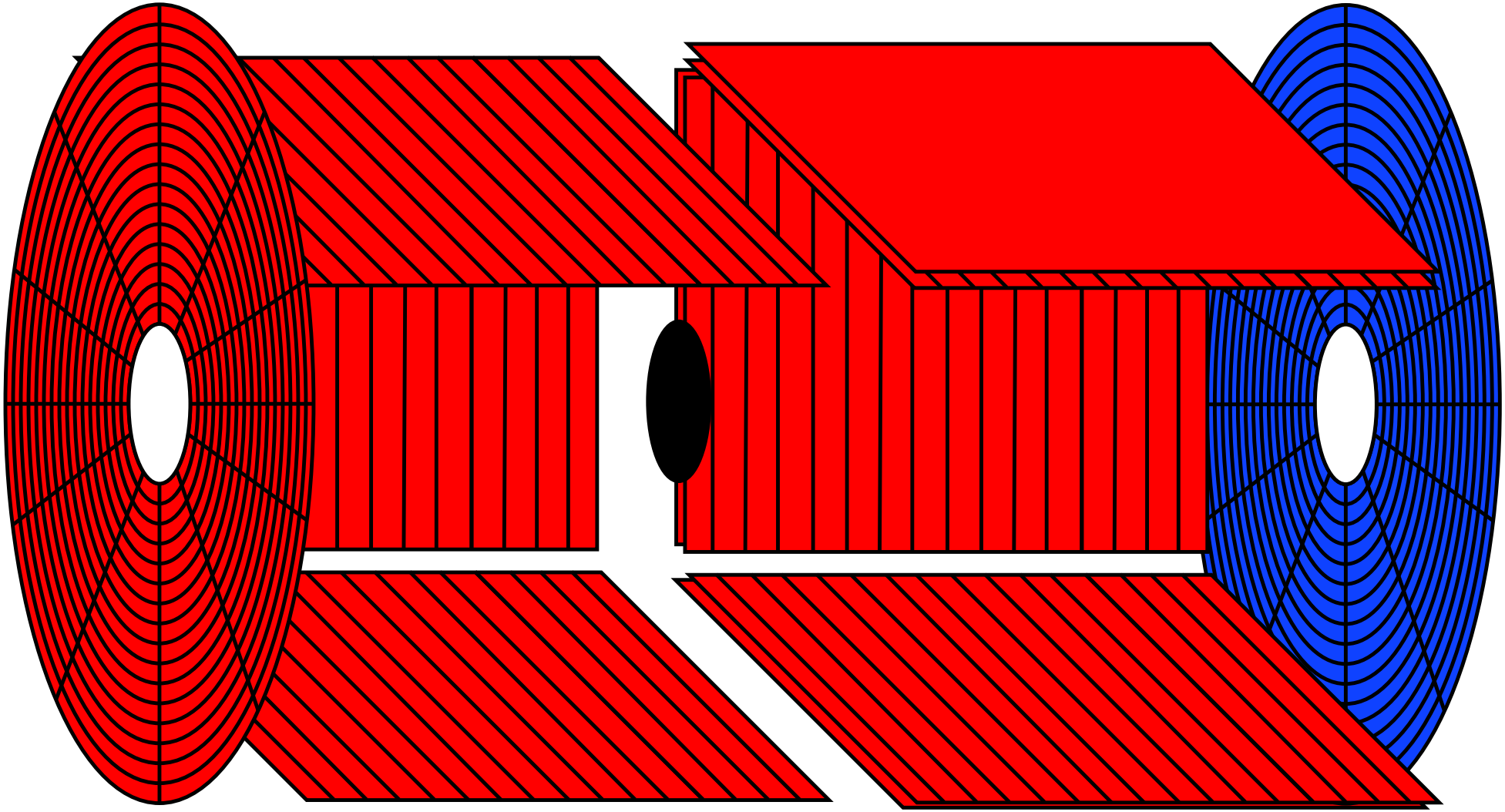

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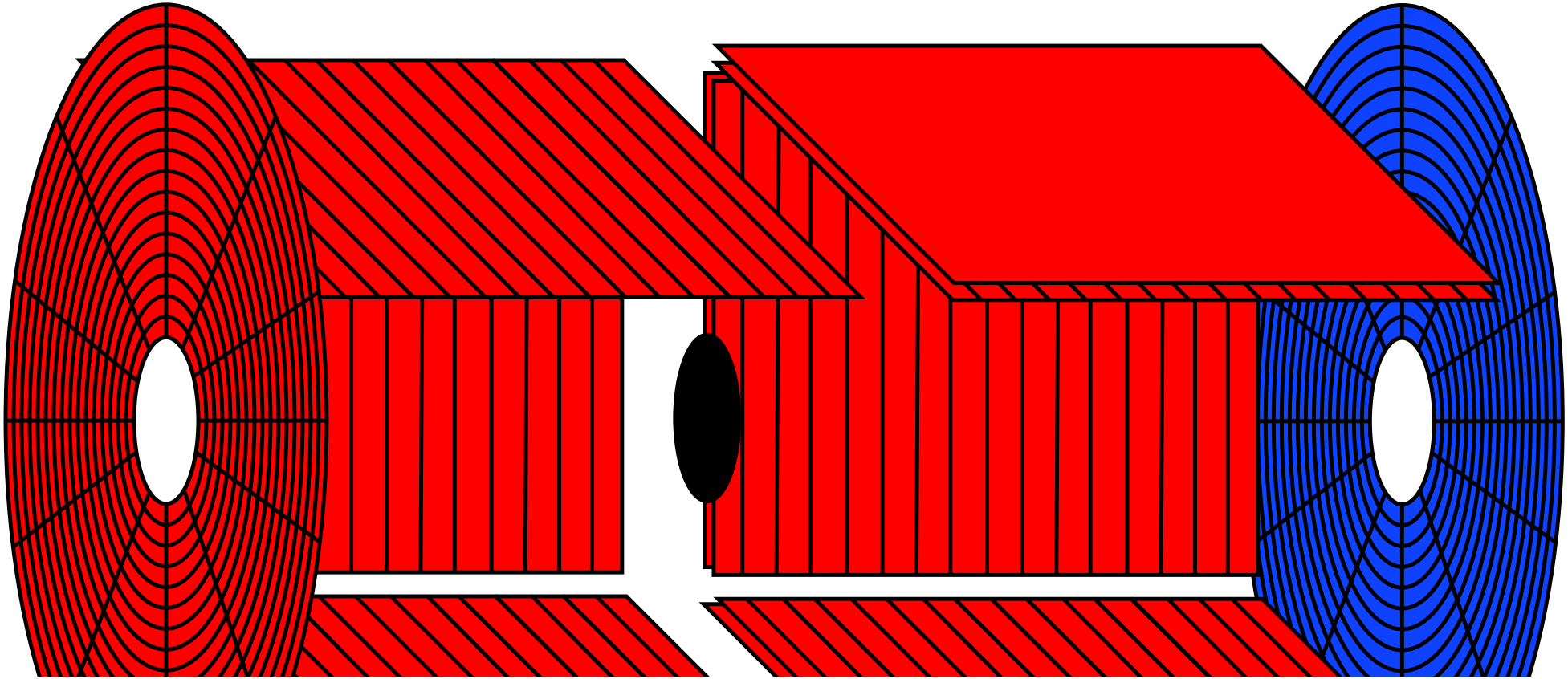


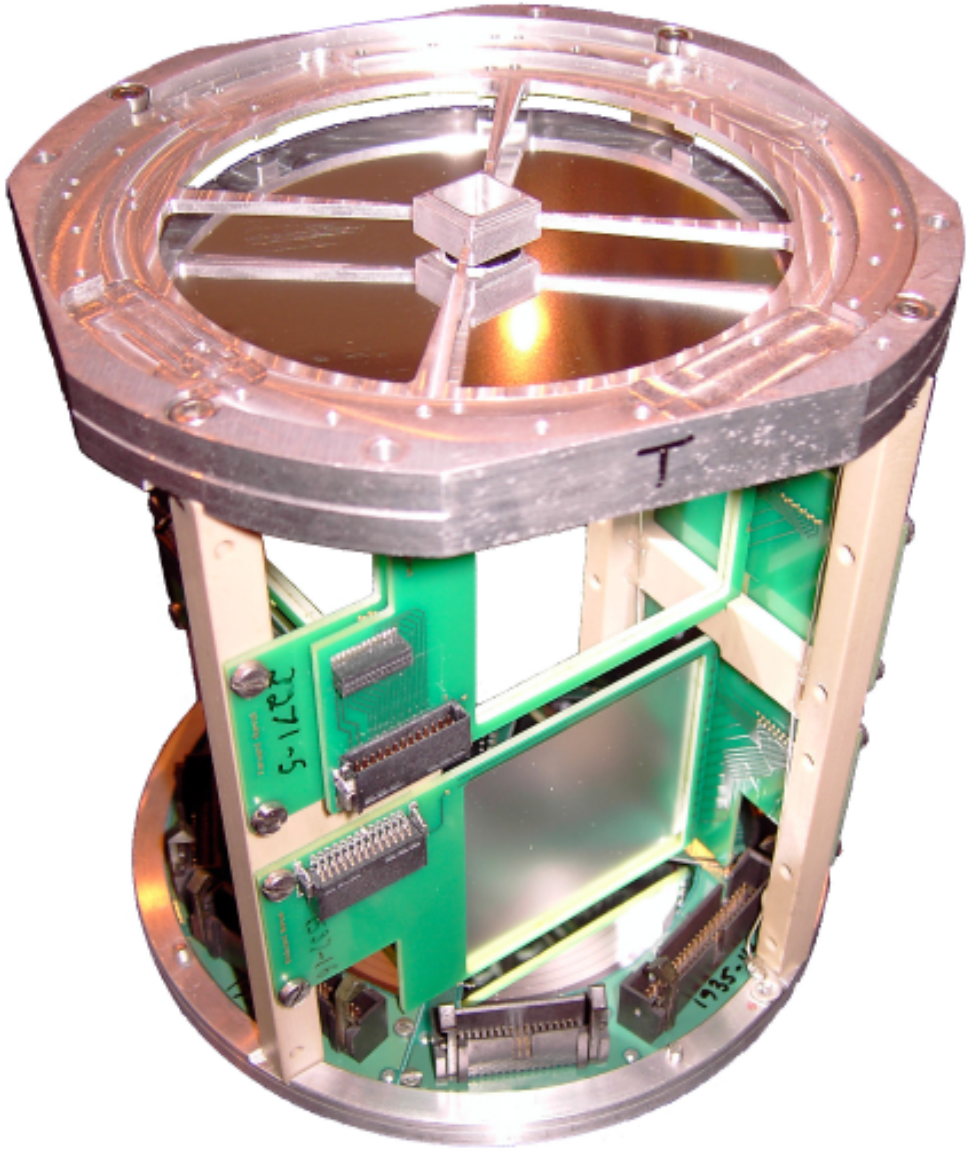
covered $\vartheta_{\text{lab.}}$: $30 - 75/105 - 172°$ (overlap at $\approx$ $150°$)

protons from ≈ 5 to 20 MeV can be identified by ΔE-E$_{rest}$

$\epsilon_{\text{part.}} \approx 62$ %

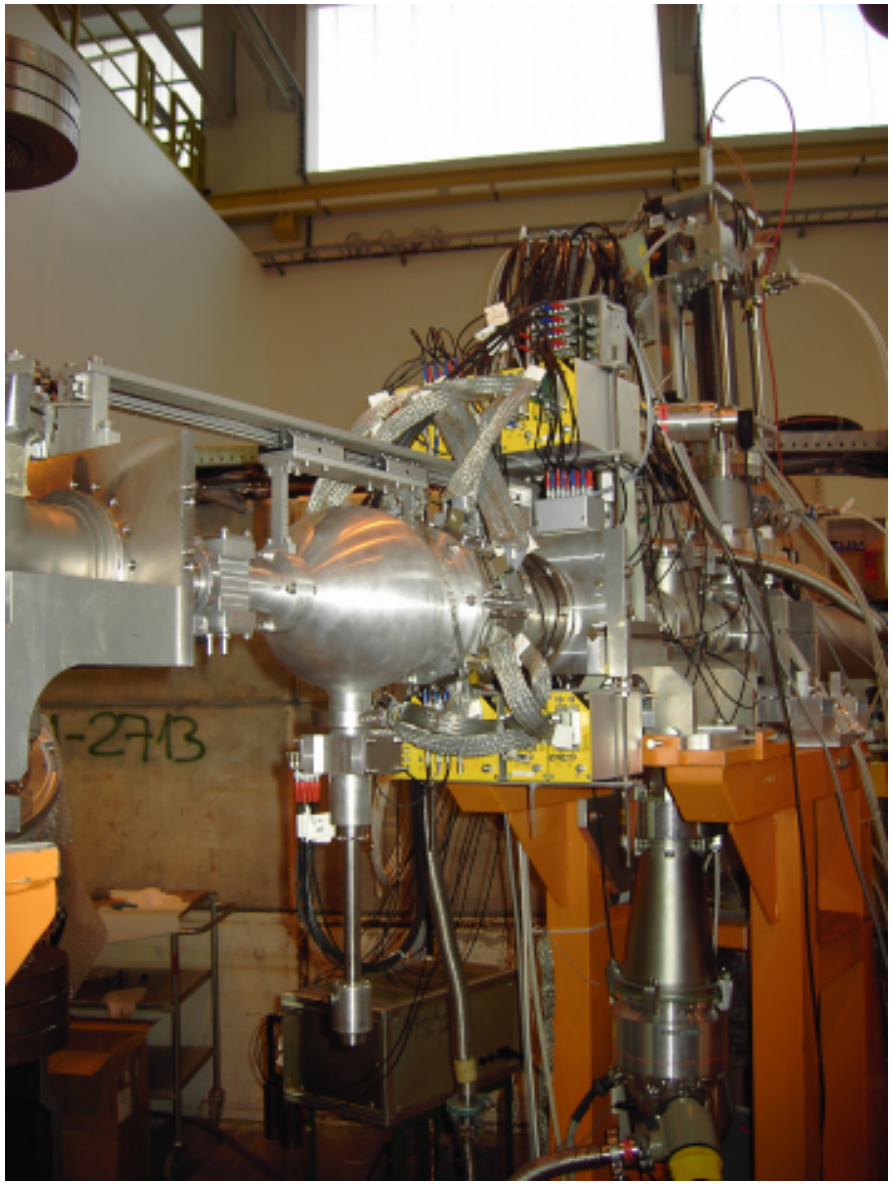
MINIBALL: $\epsilon_{\gamma(1332.5\ \text{keV})} \approx 7$ %

Setup II



Detectors were financed by
IKS, KU Leuven,
E12, TU München and
the **University of Edinburgh**.

Setup III



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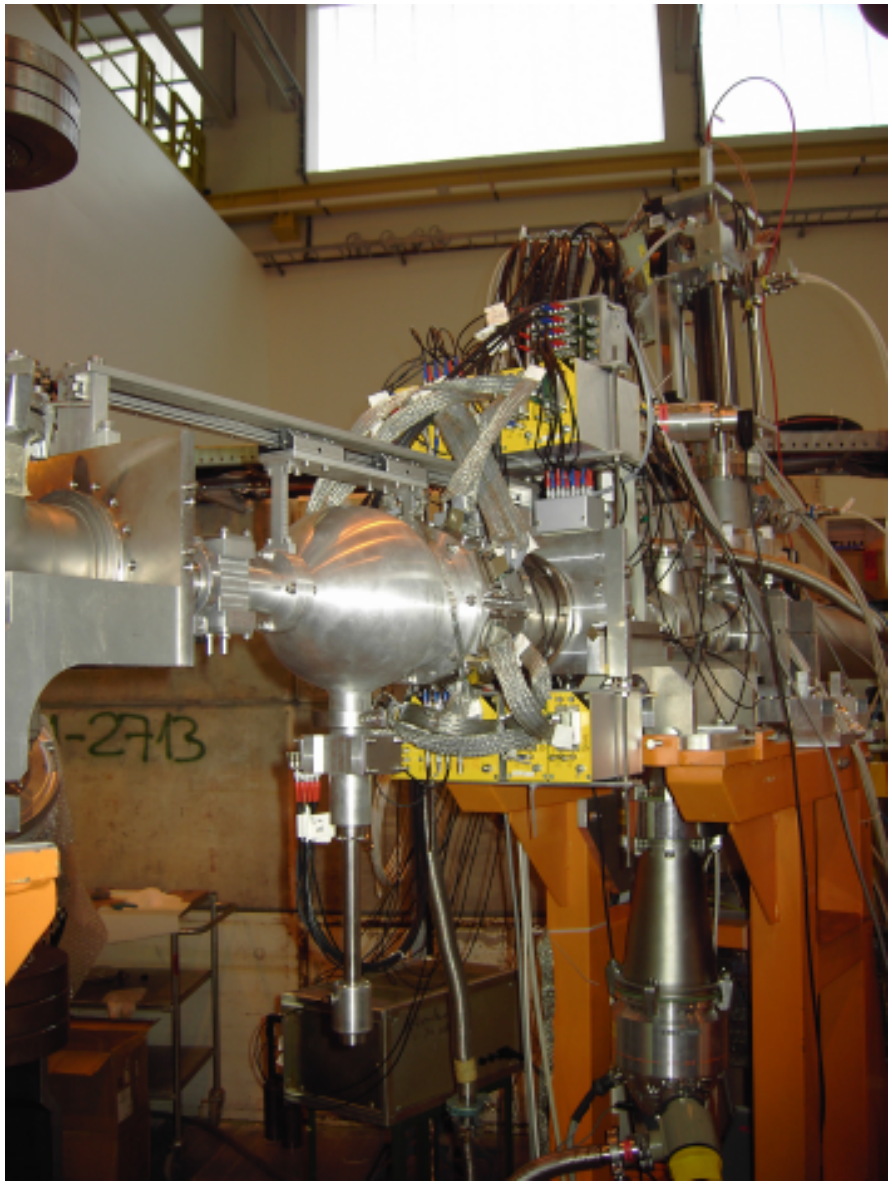
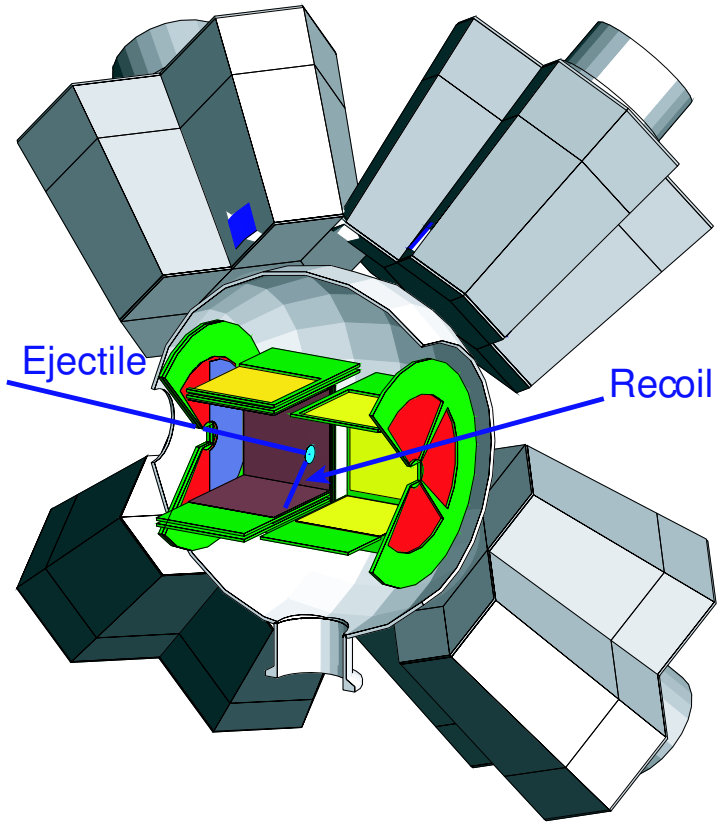
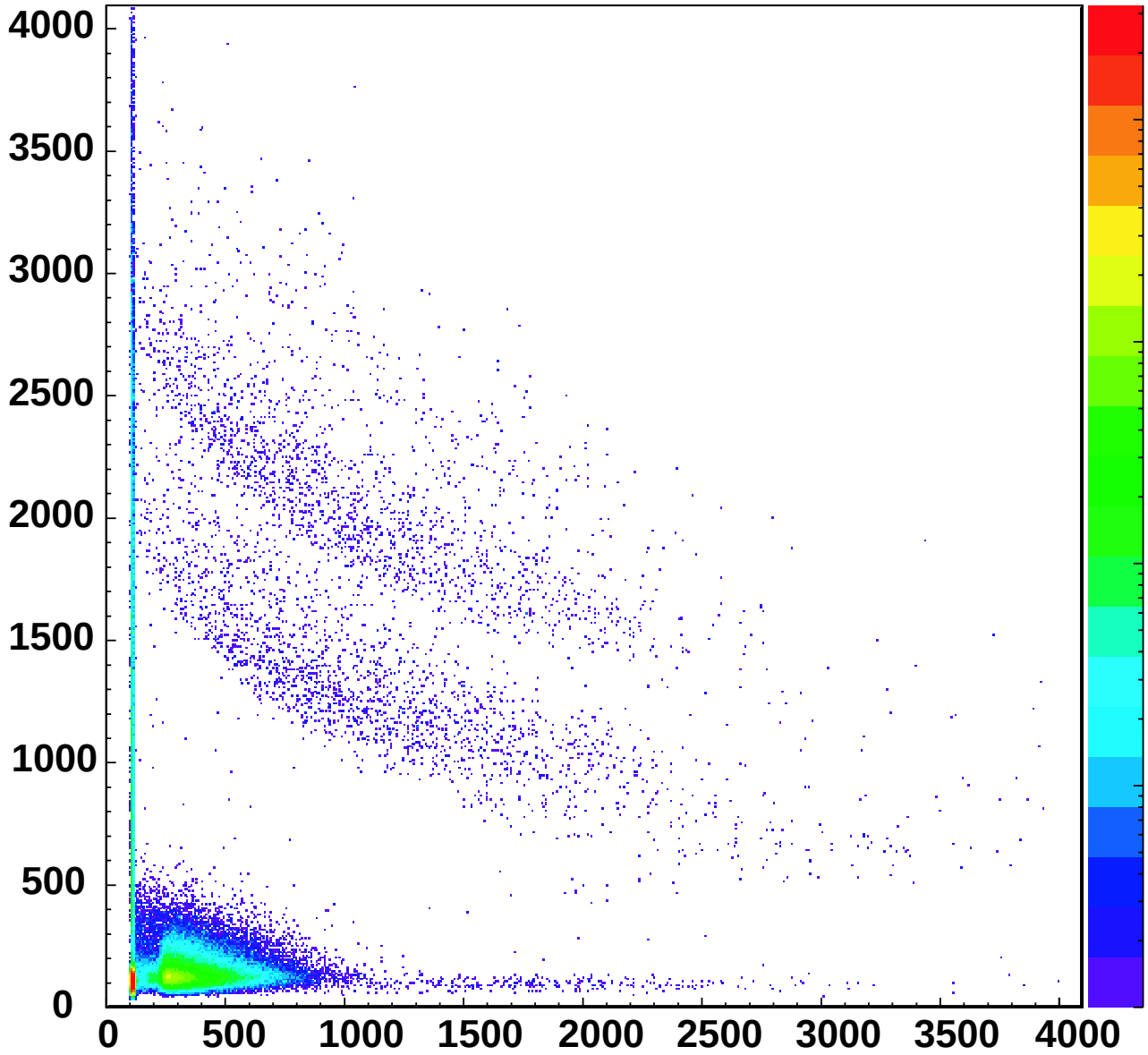
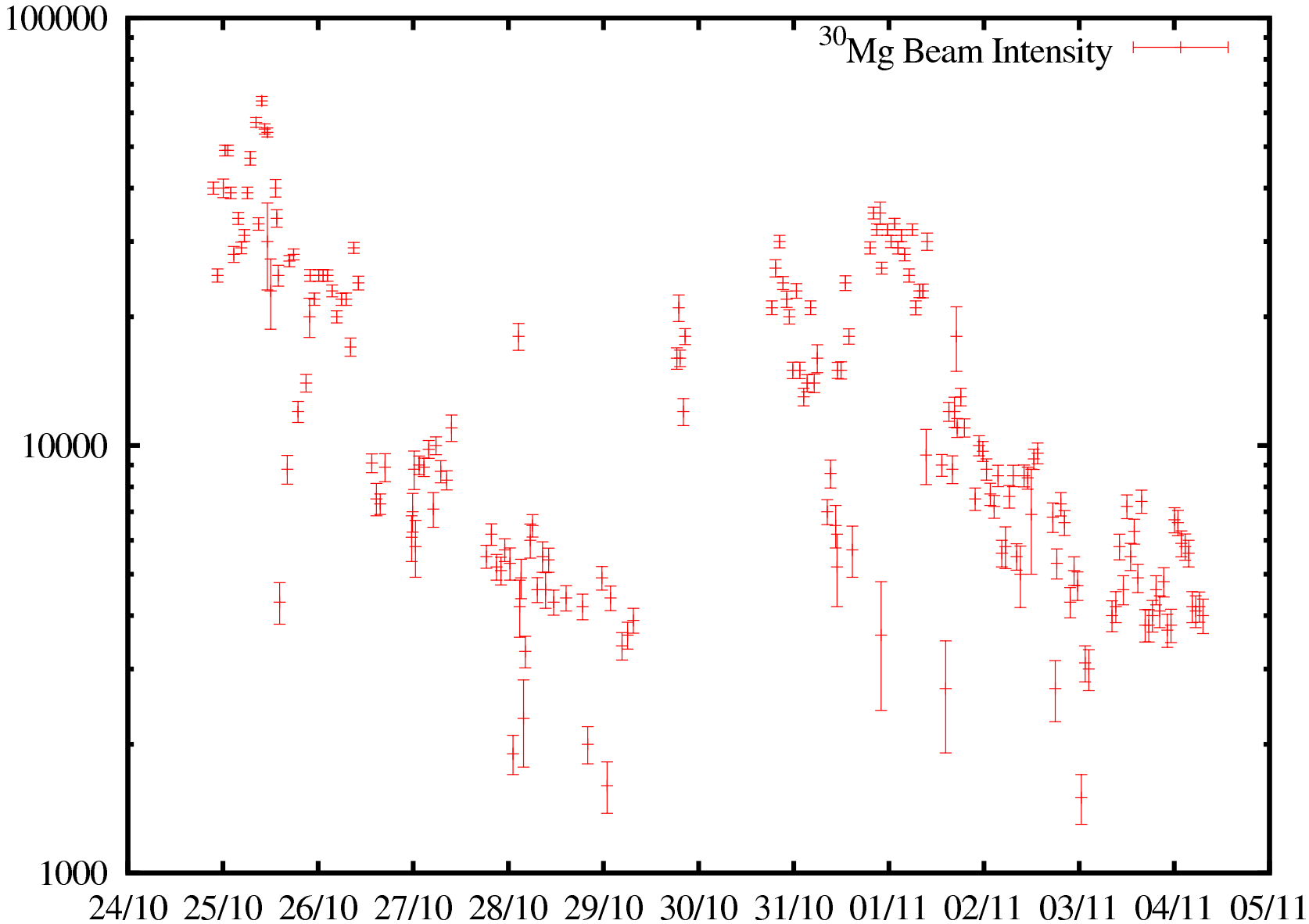




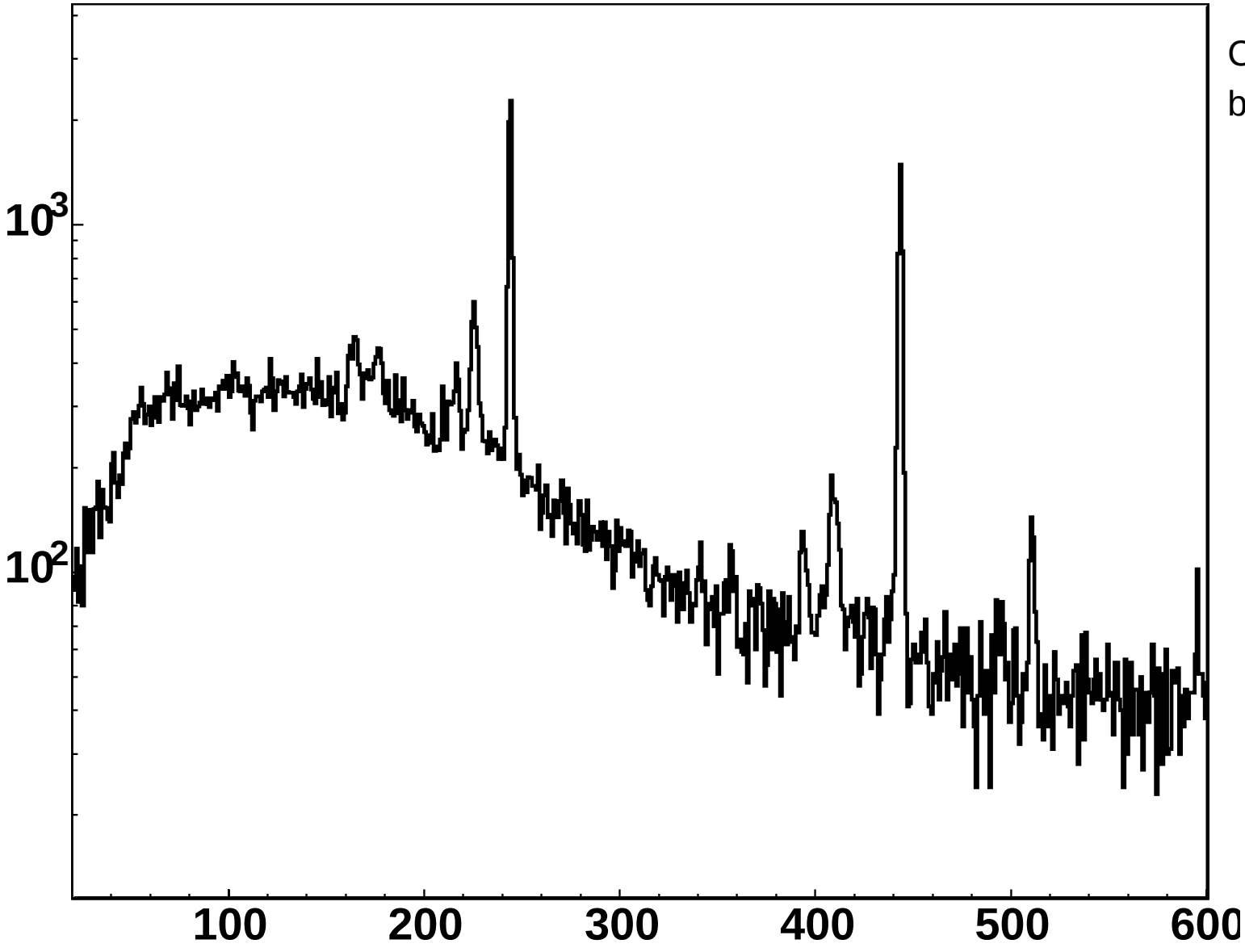
Results I


4000
3500
3000
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
3000
3500
4000

Beam Intensity



γ-Spectra



Cuts on time difference between γ and:

- proton pulse
- EBIS pulse
- particle

Summary & Outlook

- the d(^{30}Mg,^{31}Mg)p experiment has been the first experiment with the new setup for transfer reactions at REX-ISOLDE

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- a proposal for two-neutron transfer reactions using a tritium-loaded titanium foil will be submitted for the next INTC-Meeting

Collaboration

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Physik-Department E12, Technische Universität München, Garching, Germany
Instituut voor Kern- en Stralingsfysica, Katholieke Universiteit Leuven, Belgium
CERN, Genève, Switzerland
Department of Physics and Astronomy, University of Edinburgh, Scotland, United Kingdom
Fundamental Physics, Chalmers Tekniska Högskola, Göteborg, Sweden
Electronic Engineering and Physics, University of Paisley, Scotland, United Kingdom
Sektion Physik, Ludwig-Maximilians-Universität München, Garching, Germany
Nuclear Physics Group, Department of Physics, University of York, United Kingdom
Nuclear Physics Group, Schuster Laboratory, University of Manchester, United Kingdom
Oliver Lodge Laboratory, University of Liverpool, United Kingdom
Institut für Kernphysik, Universität zu Köln, Germany
Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse, Orsay, France
Institut für Kernphysik, Technische Universität Darmstadt, Germany
INRNE, Bulgarian Academy of Sciences, Sofia, Bulgaria
Dipartimento di Fisica, Università di Camerino, Camerino, Italy
CSIS, IEM Madrid, Madrid, Spain

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Thanks for your attention!