First Results on In-Beam γ Spectroscopy of Neutron-Rich Mg Isotopes at REX-ISOLDE

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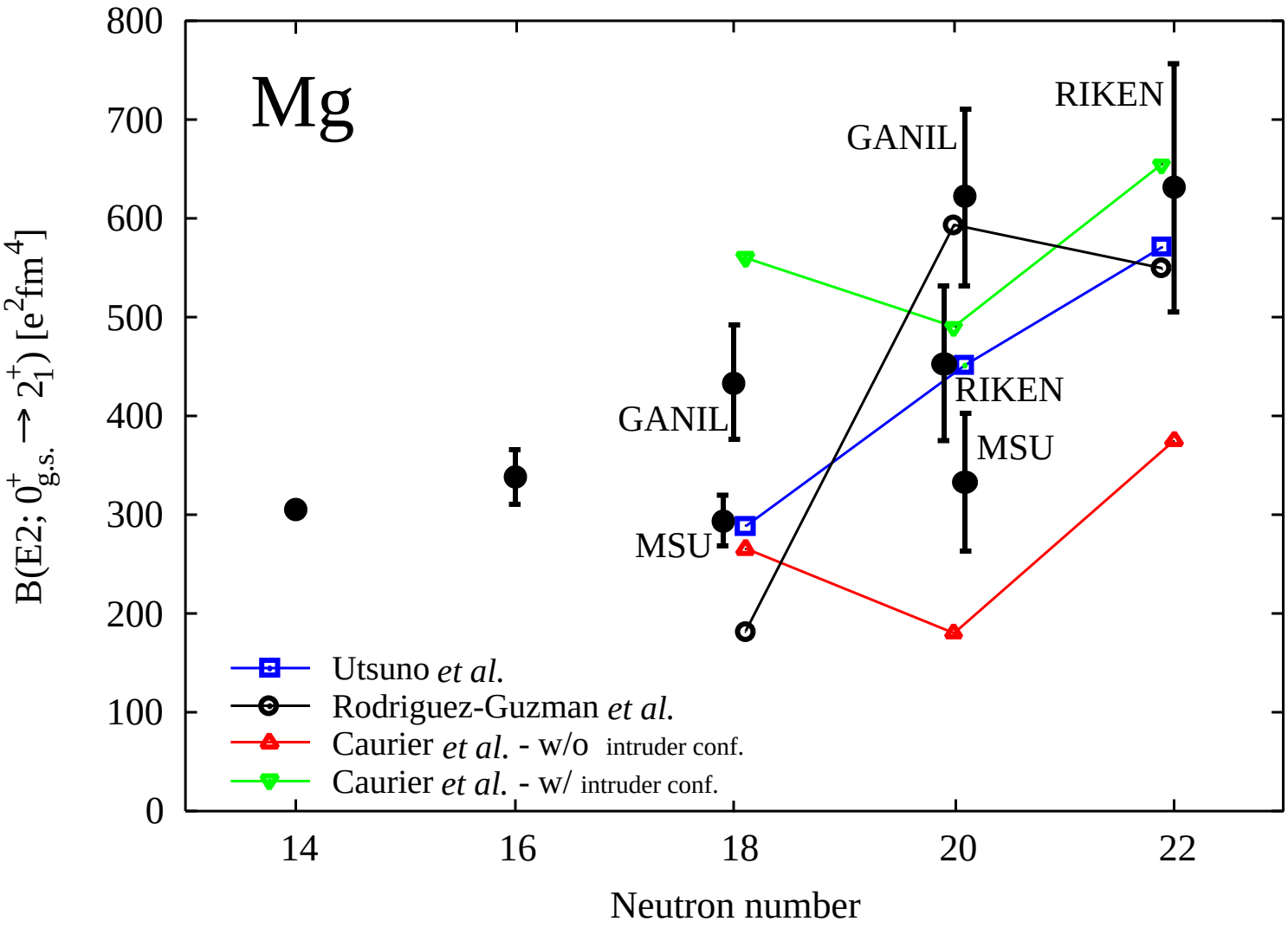
- motivation
- REX facility, experimental setup
- preliminary results: single neutron transfer on ^{30}Mg,

  Coulomb excitation of ^{30}Mg
- summary and outlook

B(E2)-values for the neutron-rich Mg isotopes



References

- Y. Utsuno *et al.*,
  Phys. Rev. **C60**, 054315 (1999)

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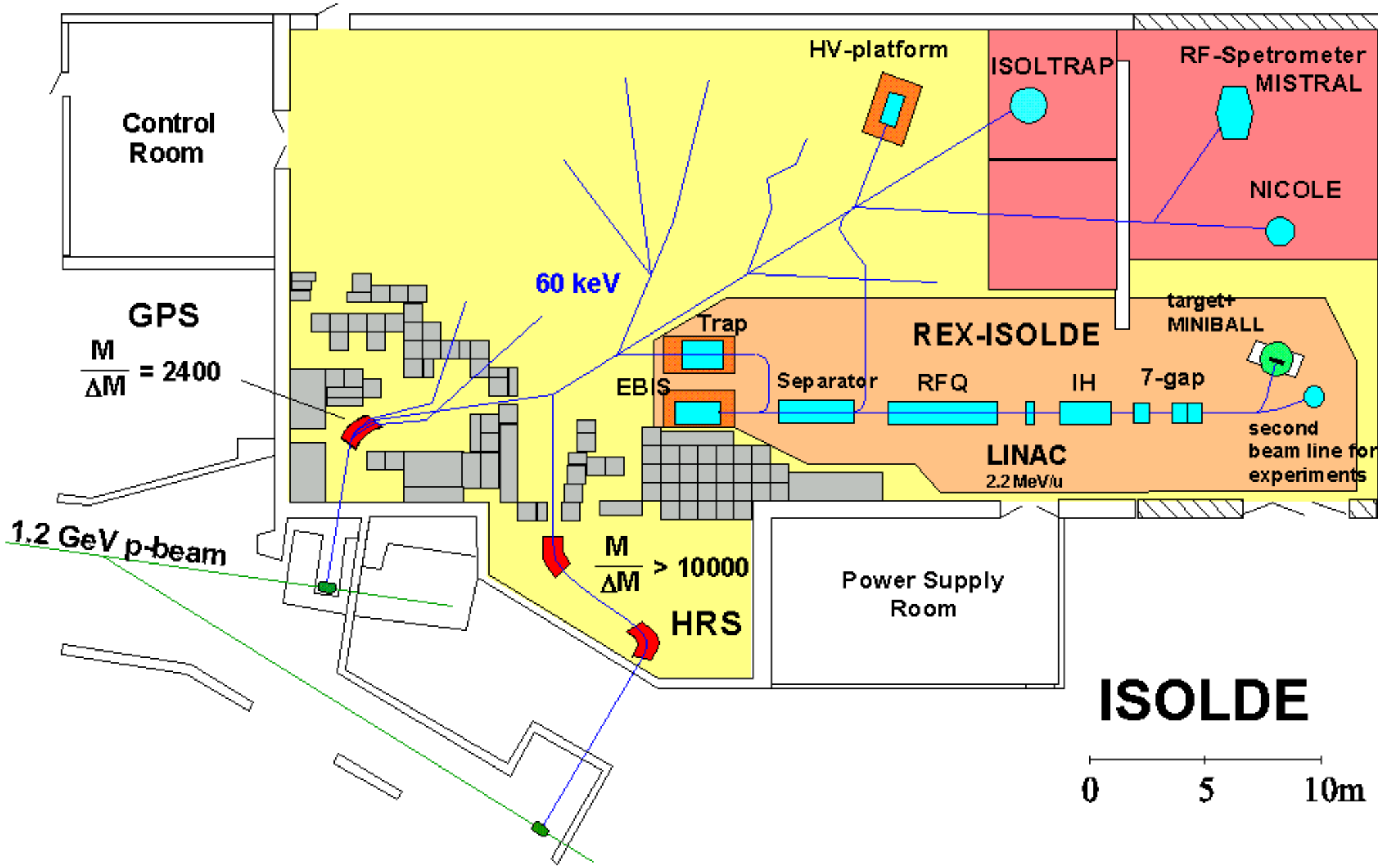
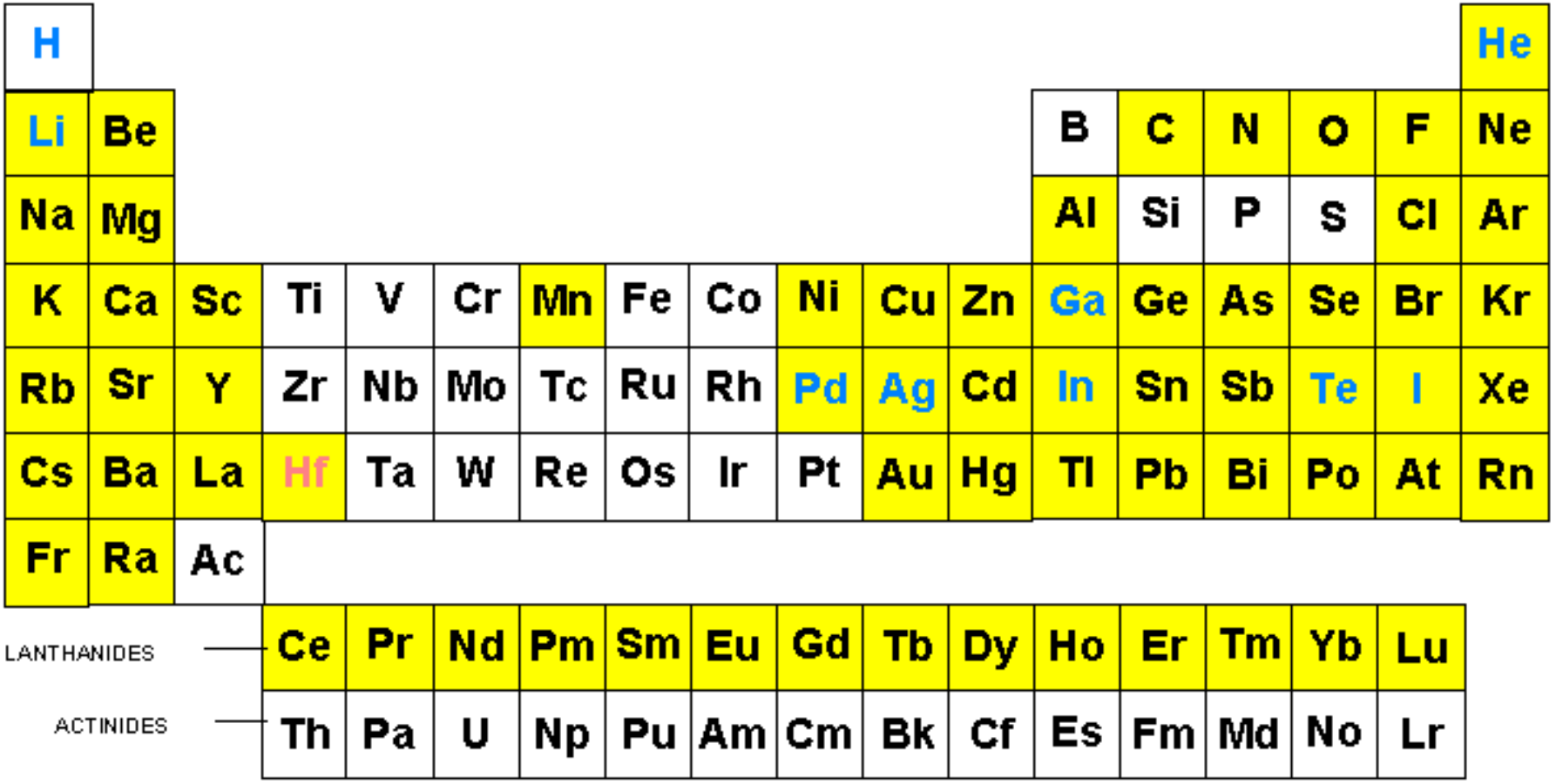
ISOLDE


Control Room
HV-platform
ISOLTRAP
RF-Spetrometer
MISTRAL
NICOLE
60 keV
GPS
M/ΔM = 2400
Trap
EBIS
REX-ISOLDE
target+
MINIBALL
Separator
RFQ
IH
7-gap
LINAC
2.2 MeV/u
second
beam line for
experiments
1.2 GeV p-beam
M/ΔM > 10000
HRS
Power Supply
Room
ISOLDE
0
5
10m

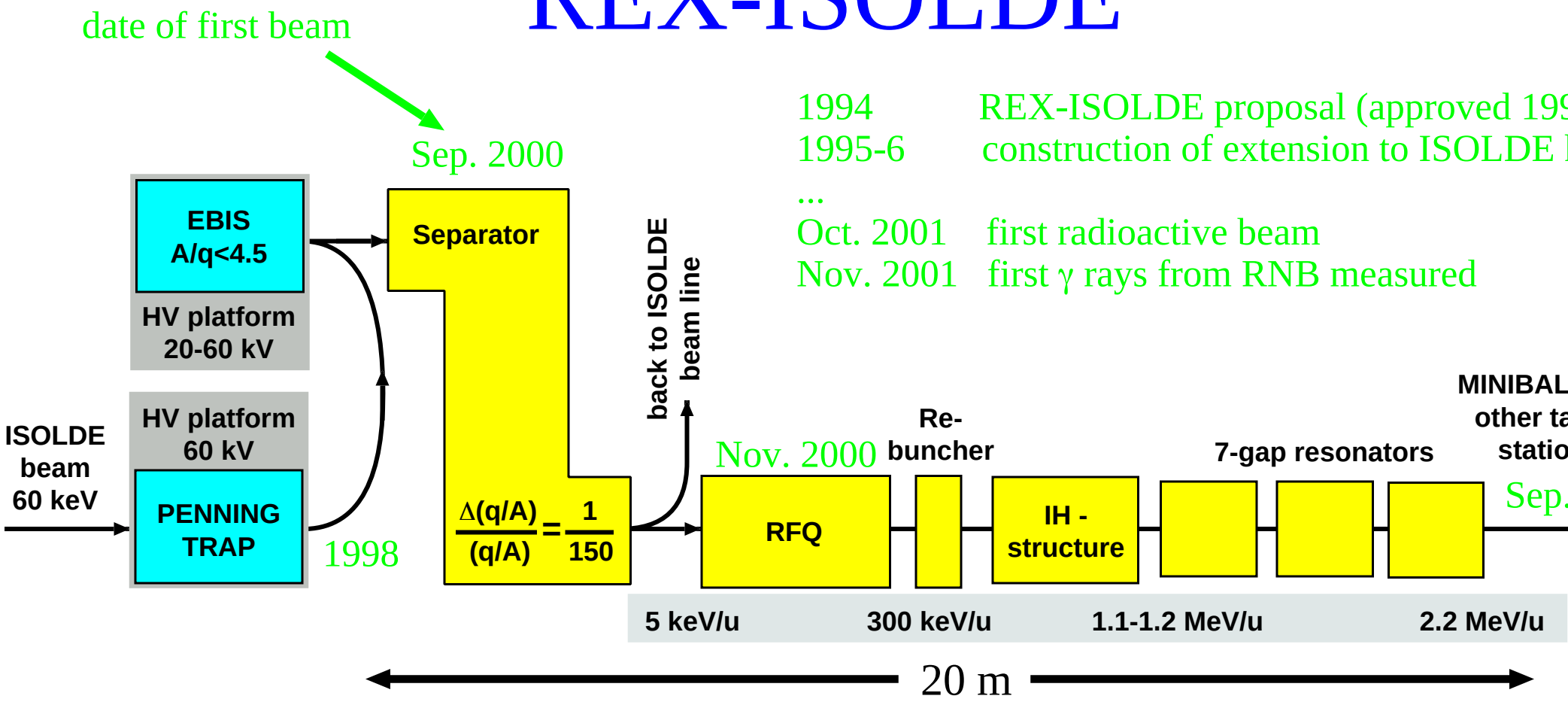
ISOLDE Beam List



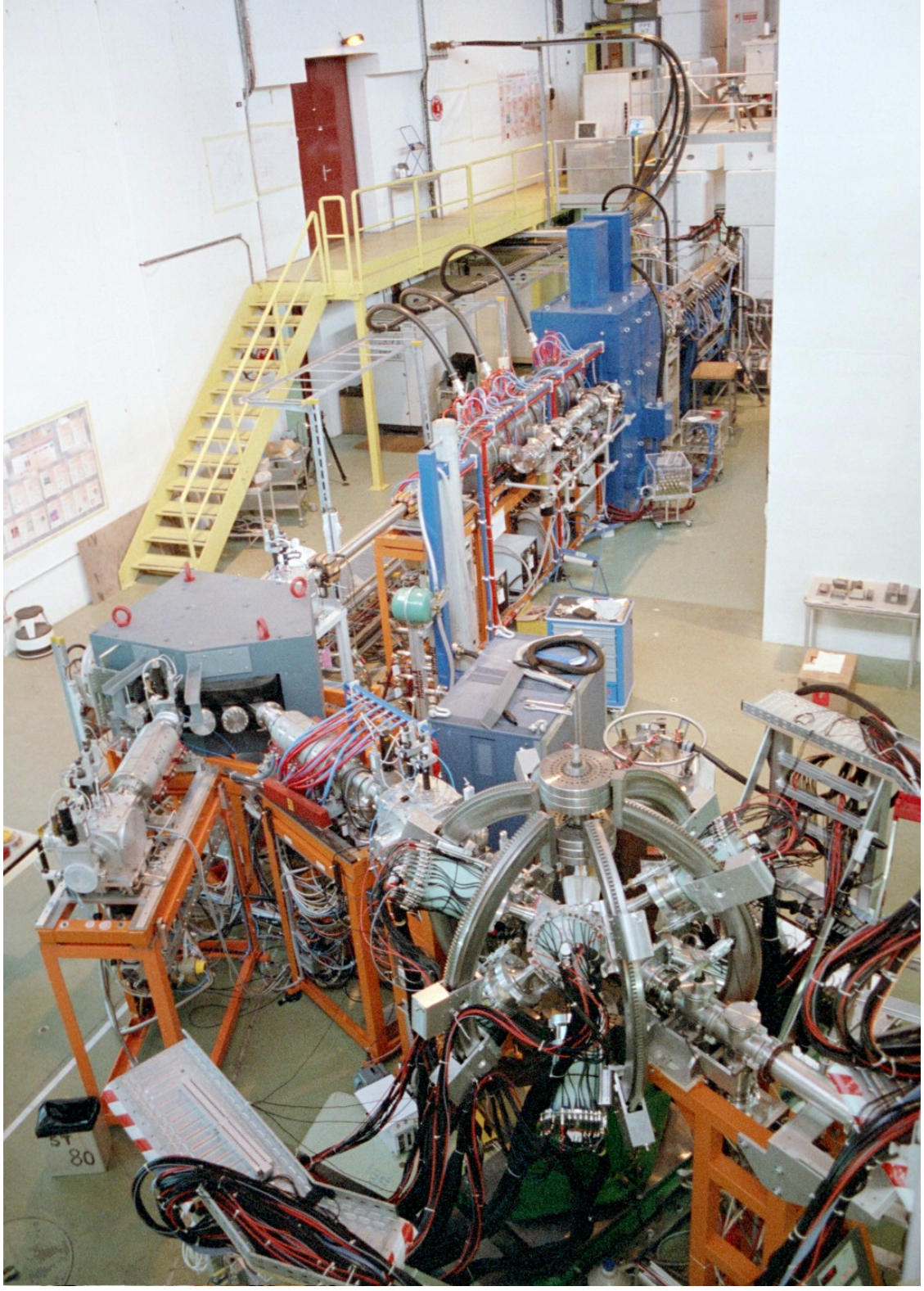
- more than 600 isotopes out of 70 elements
- shortest half lives: ~ms
- highest intensities: ~10^{11} ions/s
- **http://isolde.web.cern.ch/**

- Primary p-beam energy: 1.4 GeV (I ~ 1-2 μA)
- Energy of the radioactive ions: 60 keV
- Examples: 30Mg: ~10^{6} s^{-1},
  32Mg: ~10^{4} s^{-1},
  31Na: ~ 3 10^{3} s^{-1}

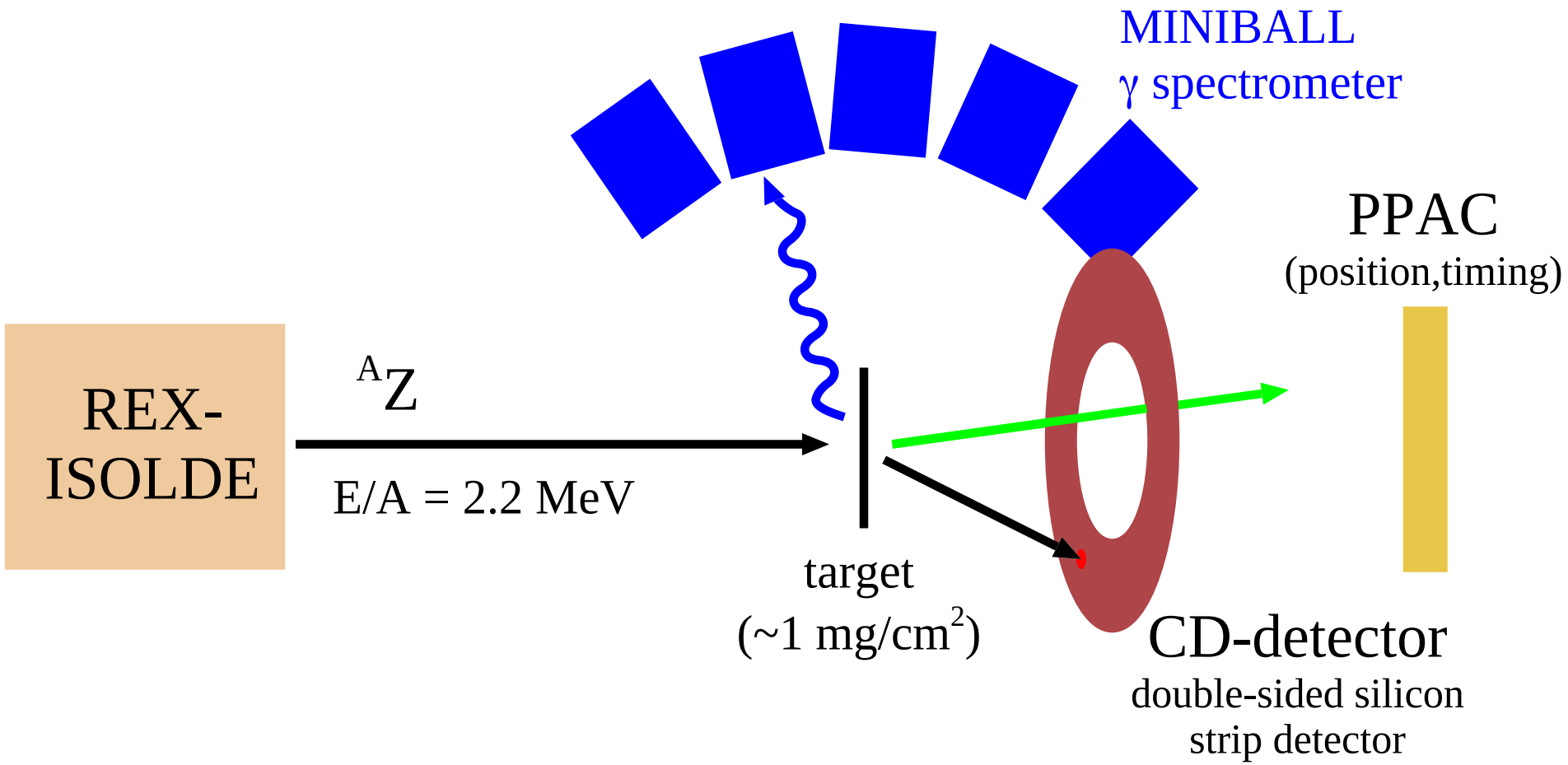
REX-ISOLDE



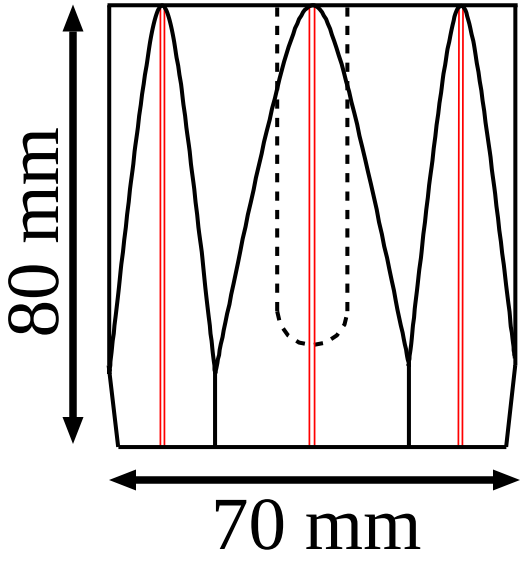
- accumulation and charge breeding in a Penning trap - EBIS combination
- acceleration of radioactive isotopes from ISOLDE to 0.8 - 2.2 MeV/u
- several experimental stations foreseen (2 operational in spring 2002)
- reliable operation
- ε = **N**(REX-target)/**N**(ISOLDE) = 1% (5%), ε(EBIS) = 15%

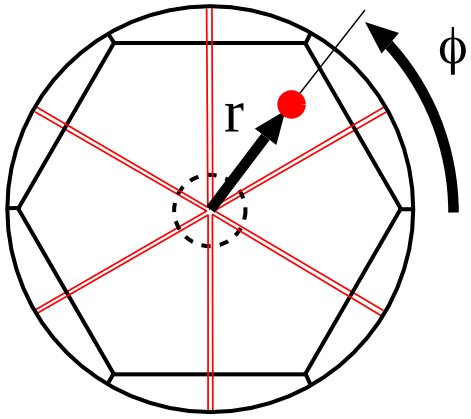

80

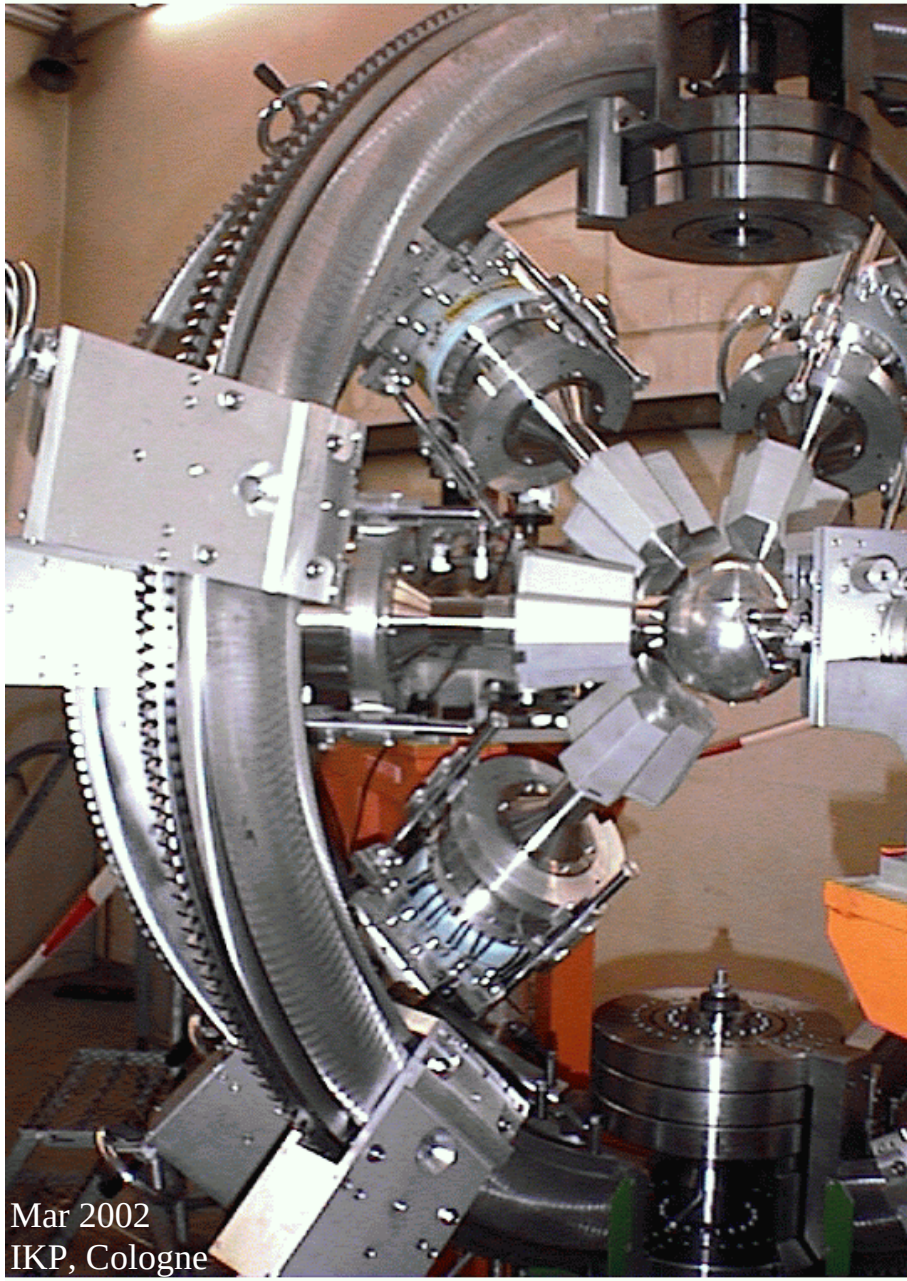
Schematic Experimental Setup



MINIBALL

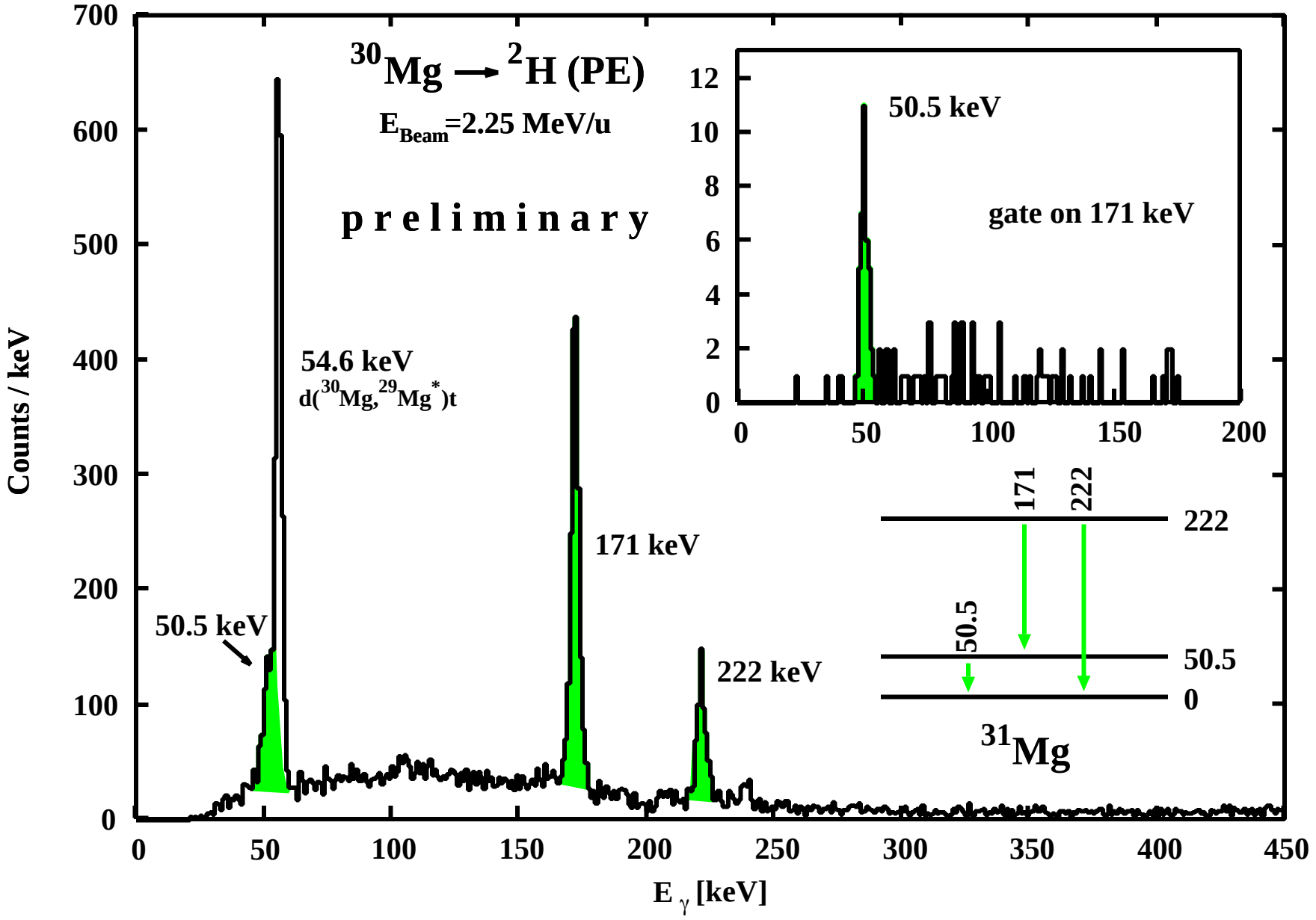




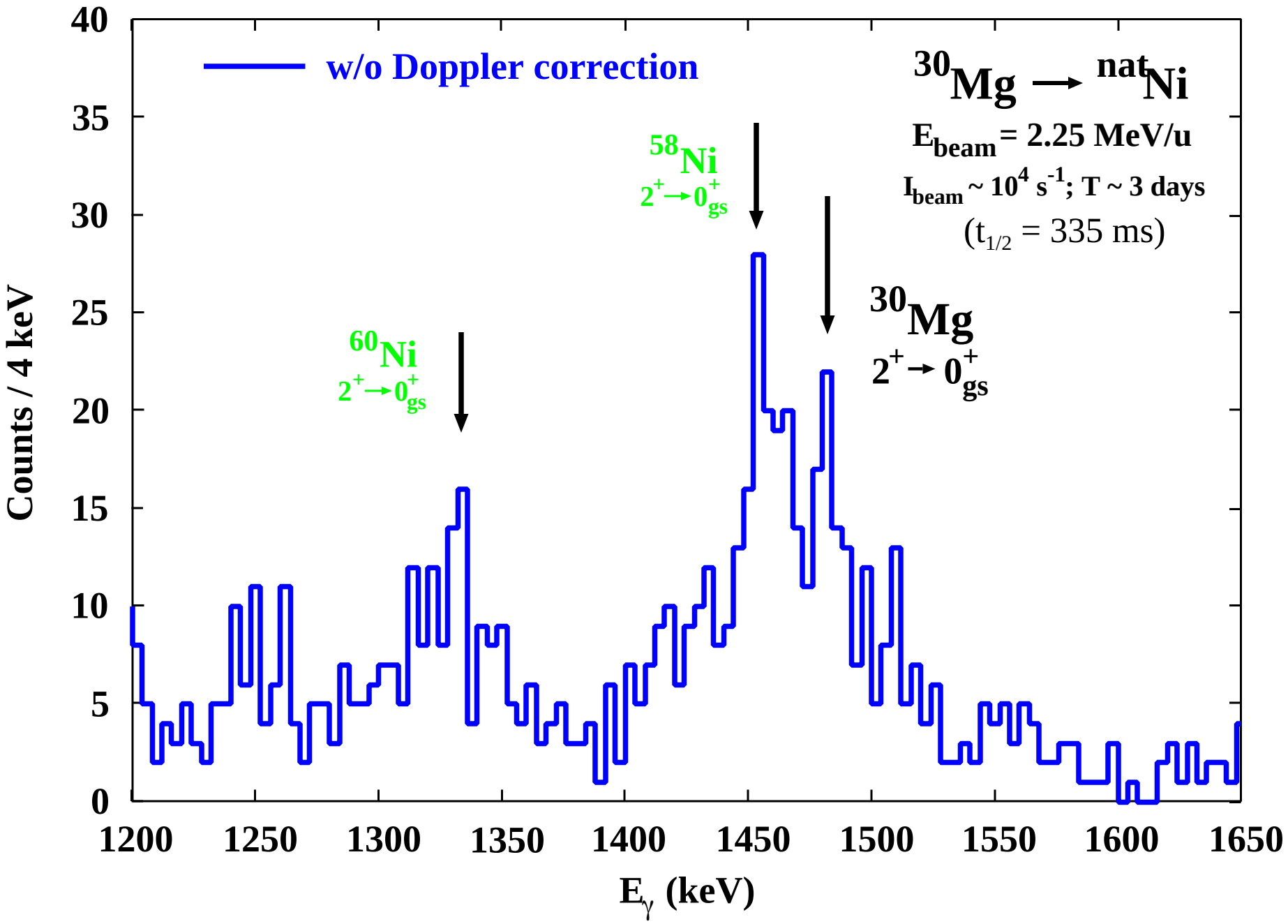


- 40 6-fold segmented HPGe-detectors grouped in 8 3-module and 4 4-module cryostats
- flexible frame
- $\varepsilon_{fe} \approx 15\%$ (E_γ=1 MeV)
- digital electronics, on-board online PSA
- electric segmentation and pulse shape analysis results in a 100 fold increased granularity
  - radius r from central contact signal
  - polar angle ϕ from induced signals on neighboring segments
- ideal for low-multiplicity γ-cascades from RNBs

First Results: ^{31}Mg



Coulomb Excitation of ^{30}Mg



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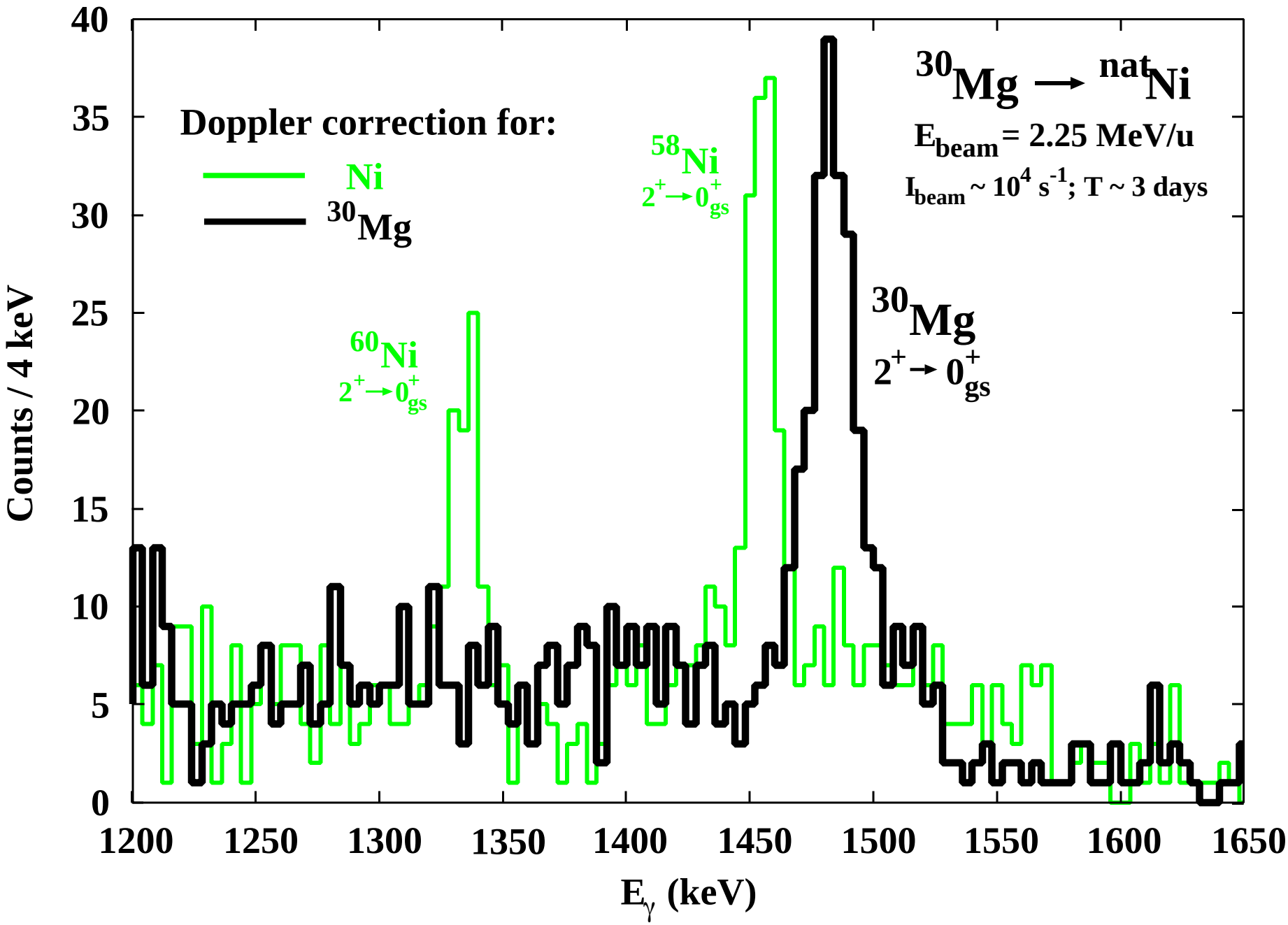

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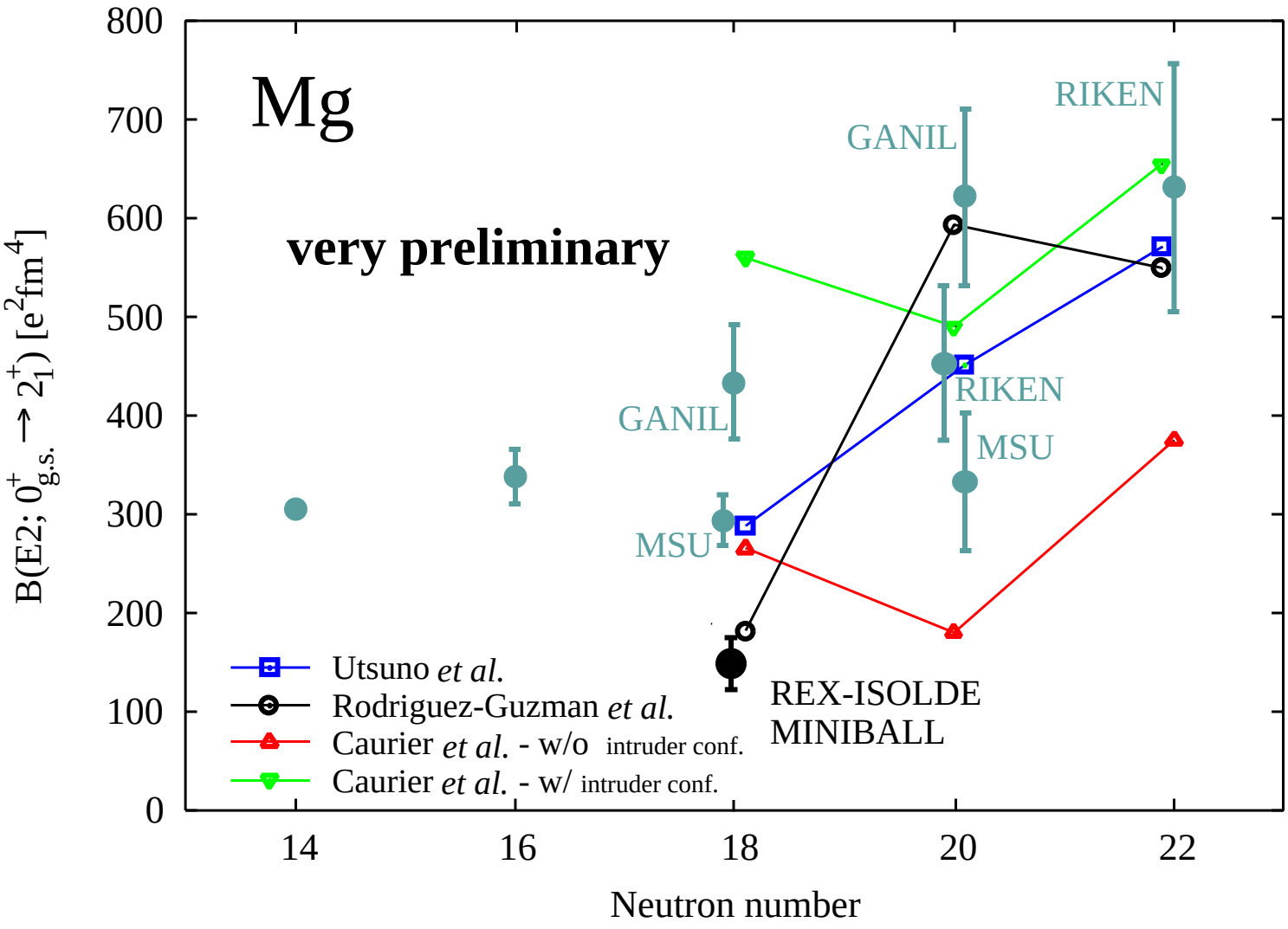

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Analysis by Oliver Niedermaier, MPI-K, Heidelberg

Summary & Outlook

- **MINIBALL** and **REX-ISOLDE** operational (→ ISOLDE beamlist)
  - **several radioactive beams** accelerated
  - first experiments performed at **REX-ISOLDE**
  - problems with contaminants and time structure
- neutron-pickup and Coulomb Excitation observed
  - preliminary B(E2) for ^{30}Mg is surprisingly small
  - correct B(E2) for ^{22}Ne test beam
- Coulomb excitation of ^{32}Mg:
  - loss: 20-30 in production cross section
  - gain: 10-20 in σ_{CE}, γ-, REX-, and RILIS ε

  ⇒ approved experiment (11 days)
- REX upgrade to higher beam energies (3.1 MeV/u) ⟶ higher CE cross sections