Exploring the *'island of inversion'* : Coulomb excitation of the neutron-rich Mg isotopes ^{30}Mg and ^{32}Mg

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for the **REX-MINIBALL** collaboration

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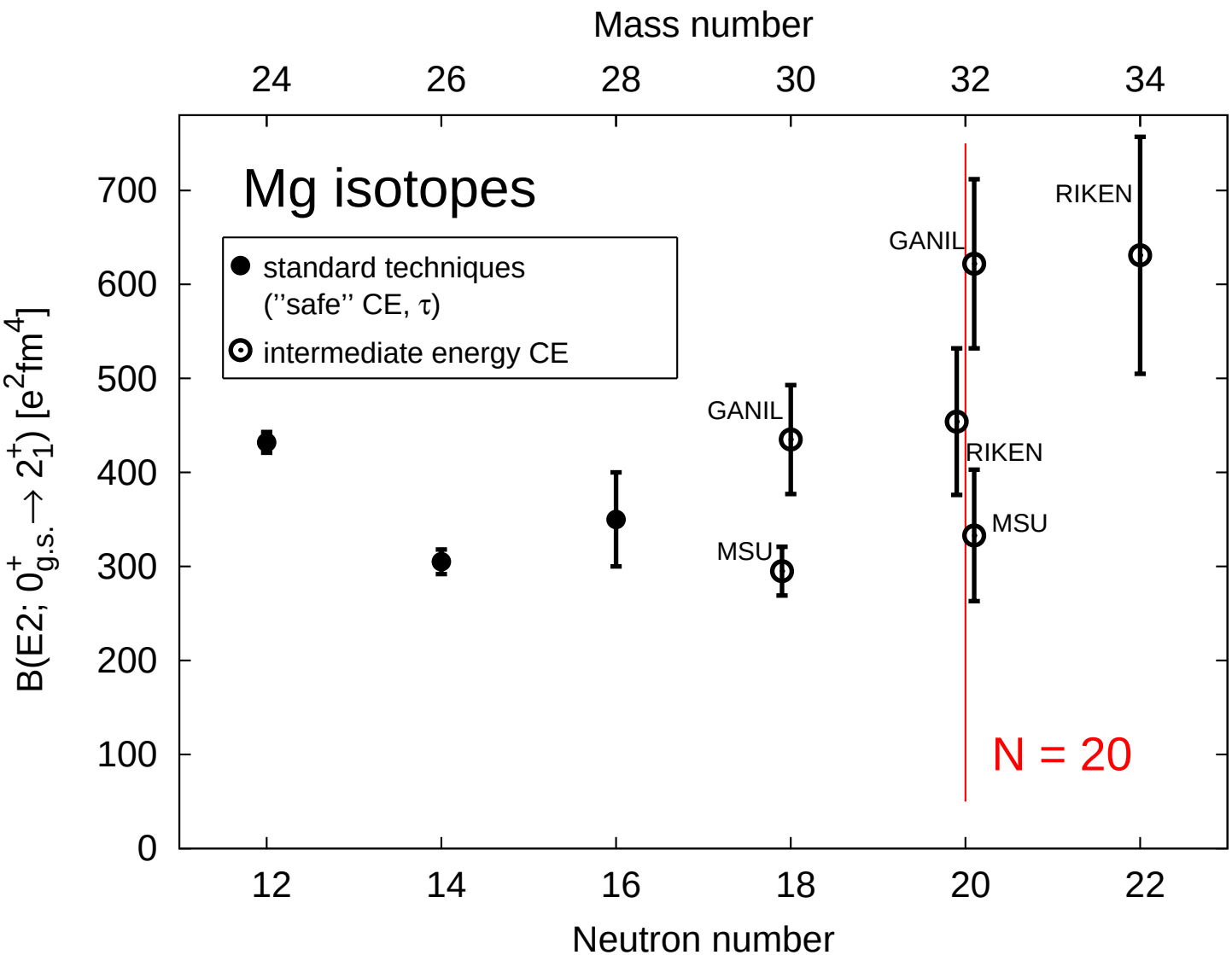
Collectivity of Mg Isotopes



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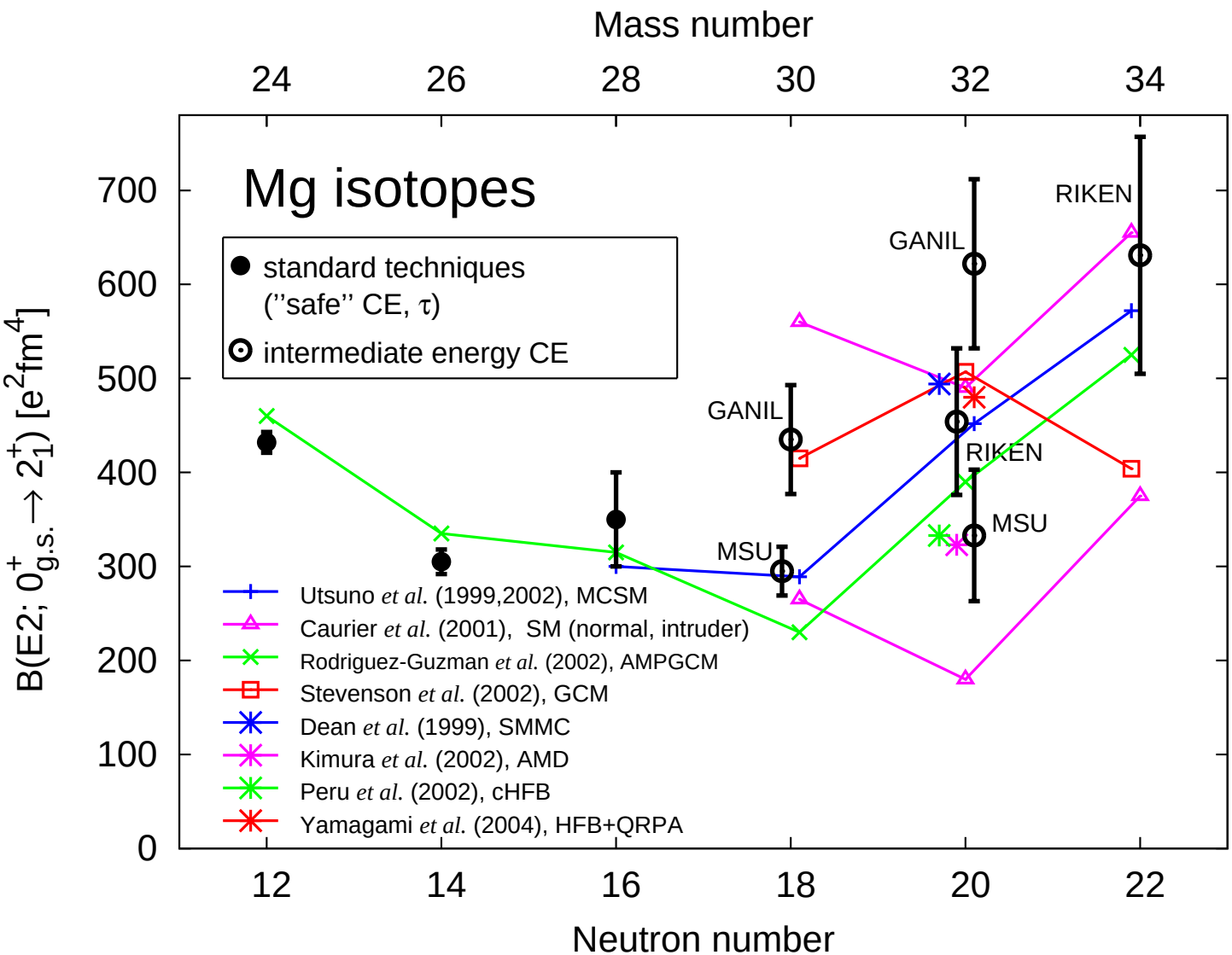
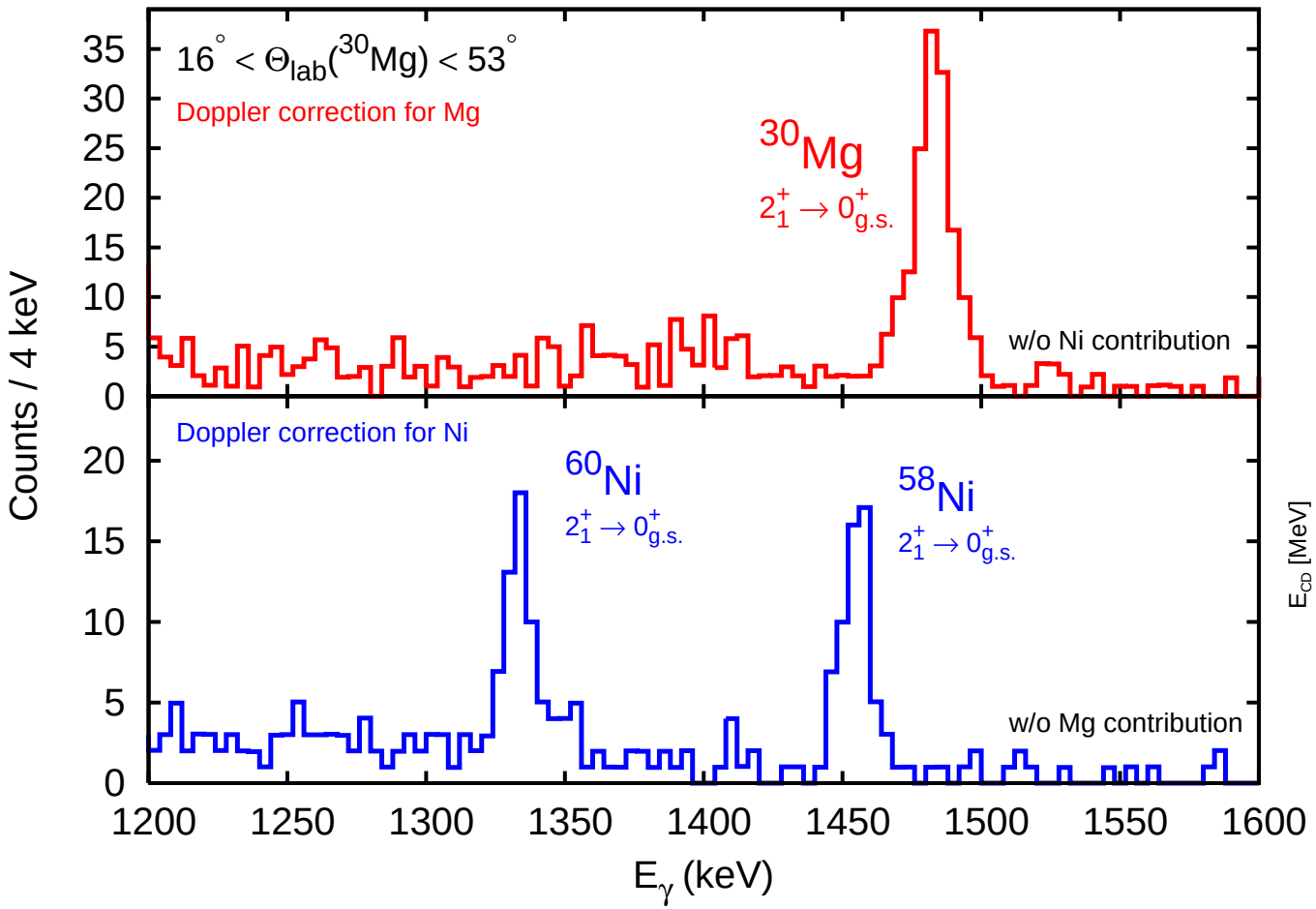


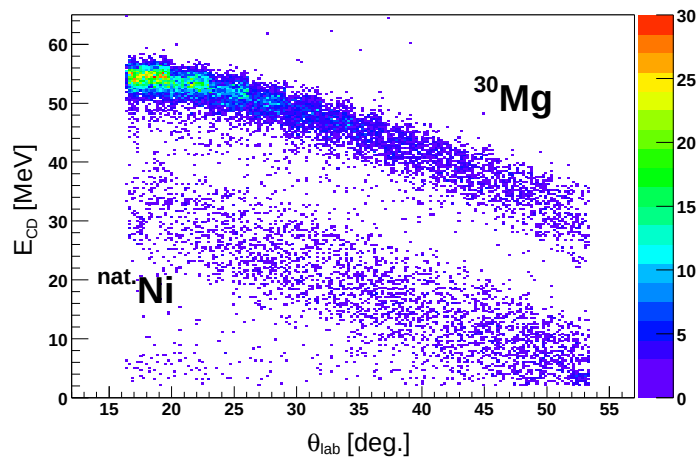
- experimental values are not consistent
- large spread in theoretical calculations (different models)
- nature of excitation still under debate, e.g. in ^{32}Mg (most calculations favor a static prolate deformation)

Coulomb Excitation of ^{30}Mg

^{30}Mg → ^{nat}Ni (1 mg/cm^2), 2.25 MeV/u, I_{Beam}~10^4/s, T~ 3 days



- surface distance D_s for ^{30}Mg in CD:
  22.9 fm > D_s > 6.2 fm



Beam Purity ^{30}Mg

- in principle 3 sources for isobaric contaminations:
  - β decay (during trapping & breeding, $t_{1/2}(^{30}Mg)$ = 335 (17) ms) → 4.5 (0.5) %

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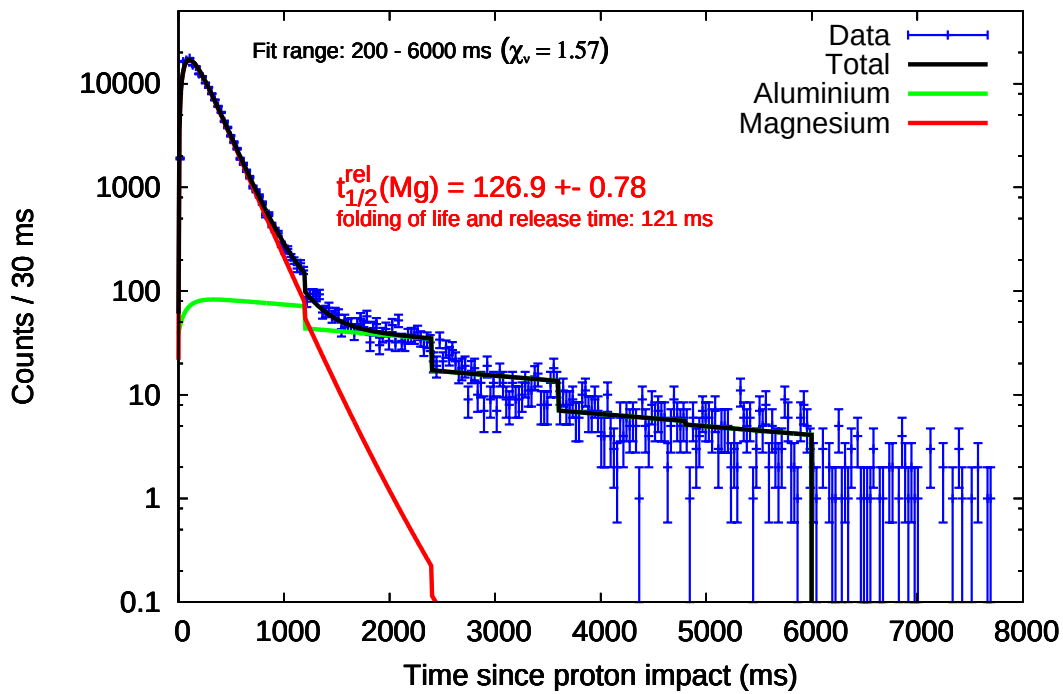

(confirmed by Laser ON/OFF measurement)

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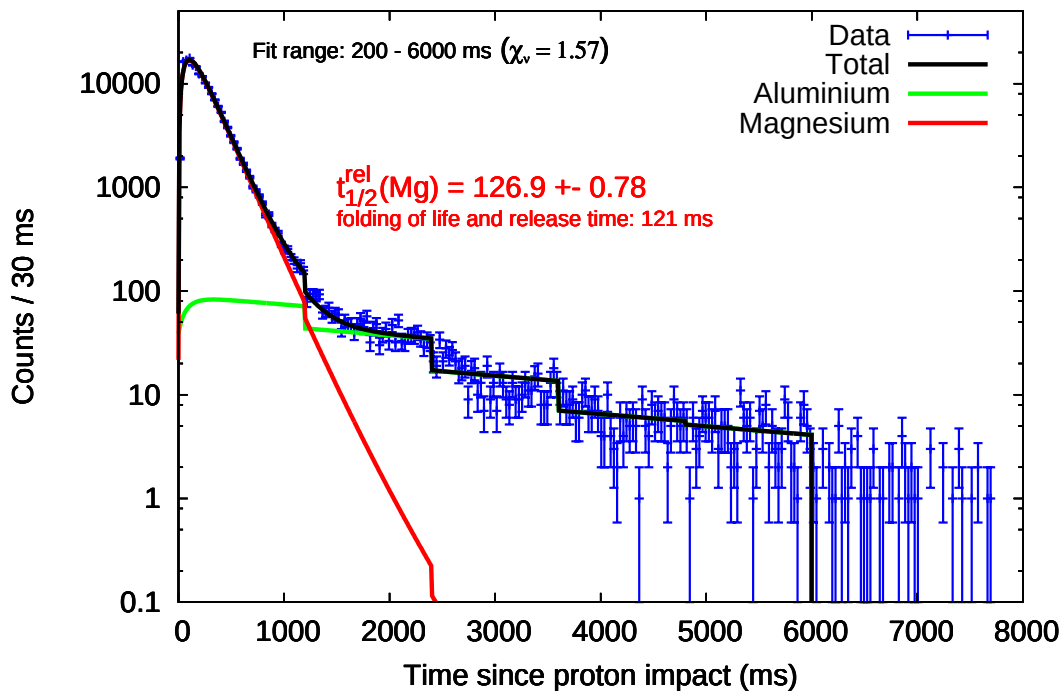
- → for IS410, October 2003:

$$\frac{N(^{30}\mathrm{Al})}{N(^{30}\mathrm{Mg} + ^{30}\mathrm{Al})} = 6.5(1.0)\%$$

(t < 1.2s)



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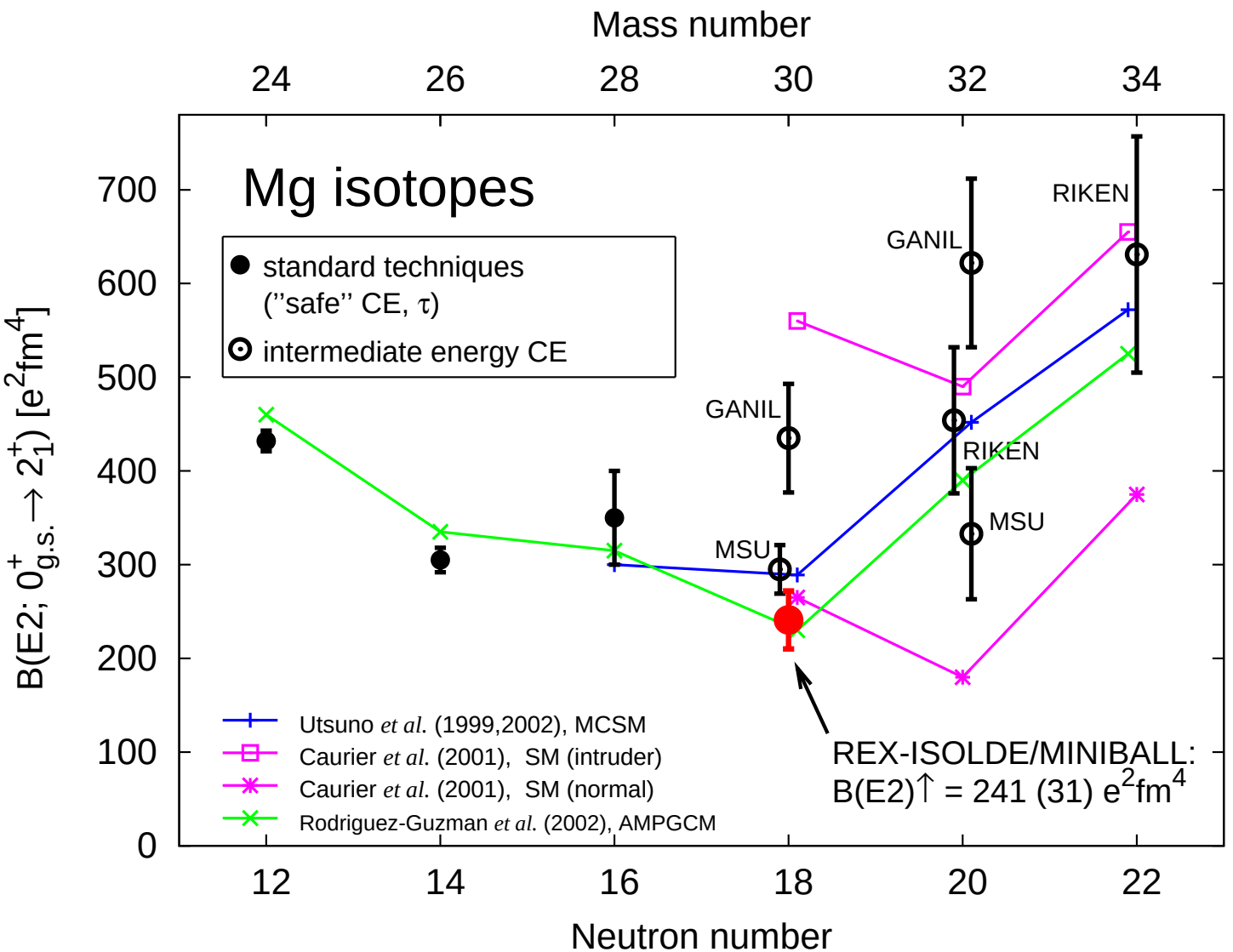
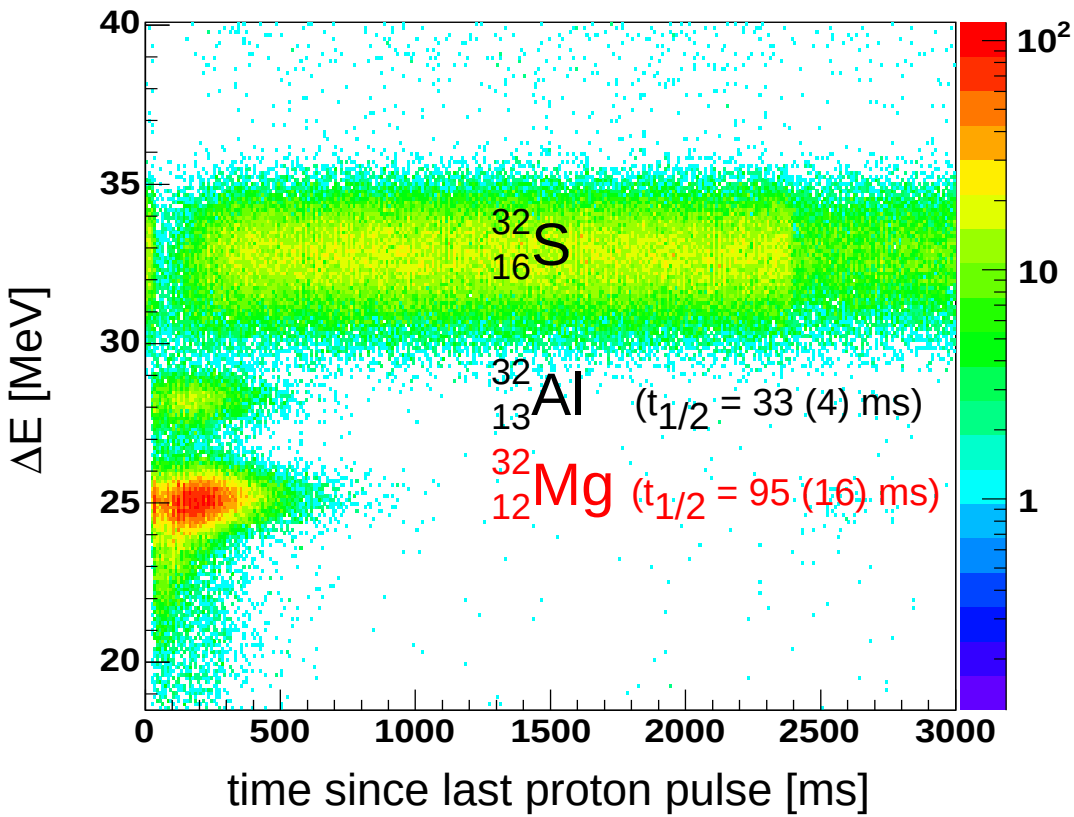


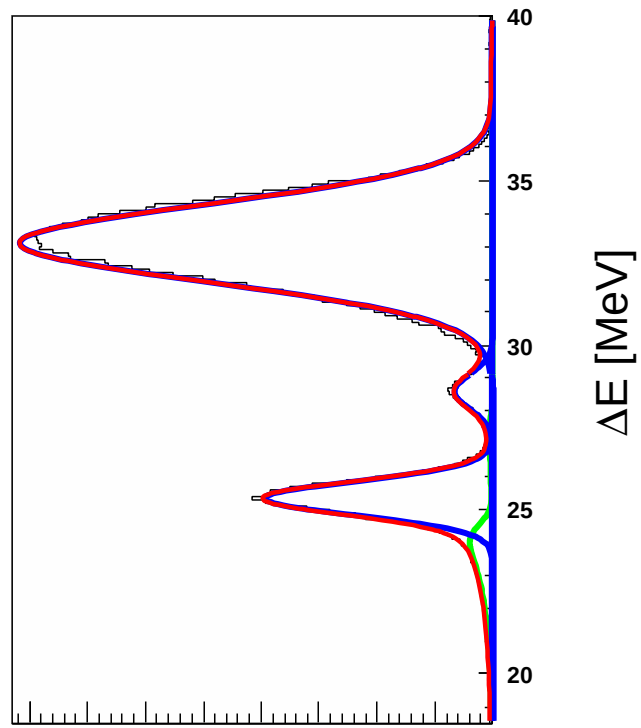
O. Niedermaier, H. Scheit, *et al.*, to be submitted

Beam Purity ^{32}Mg

- two Si detectors (A = 1 cm^2, d = 10 μm)
- installation and analysis: V. Bildstein, MPI-K, Heidelberg

$$-\frac{\mathrm{d}E}{\mathrm{d}x} \propto Z^2 \times \mathrm{f}(\beta)$$





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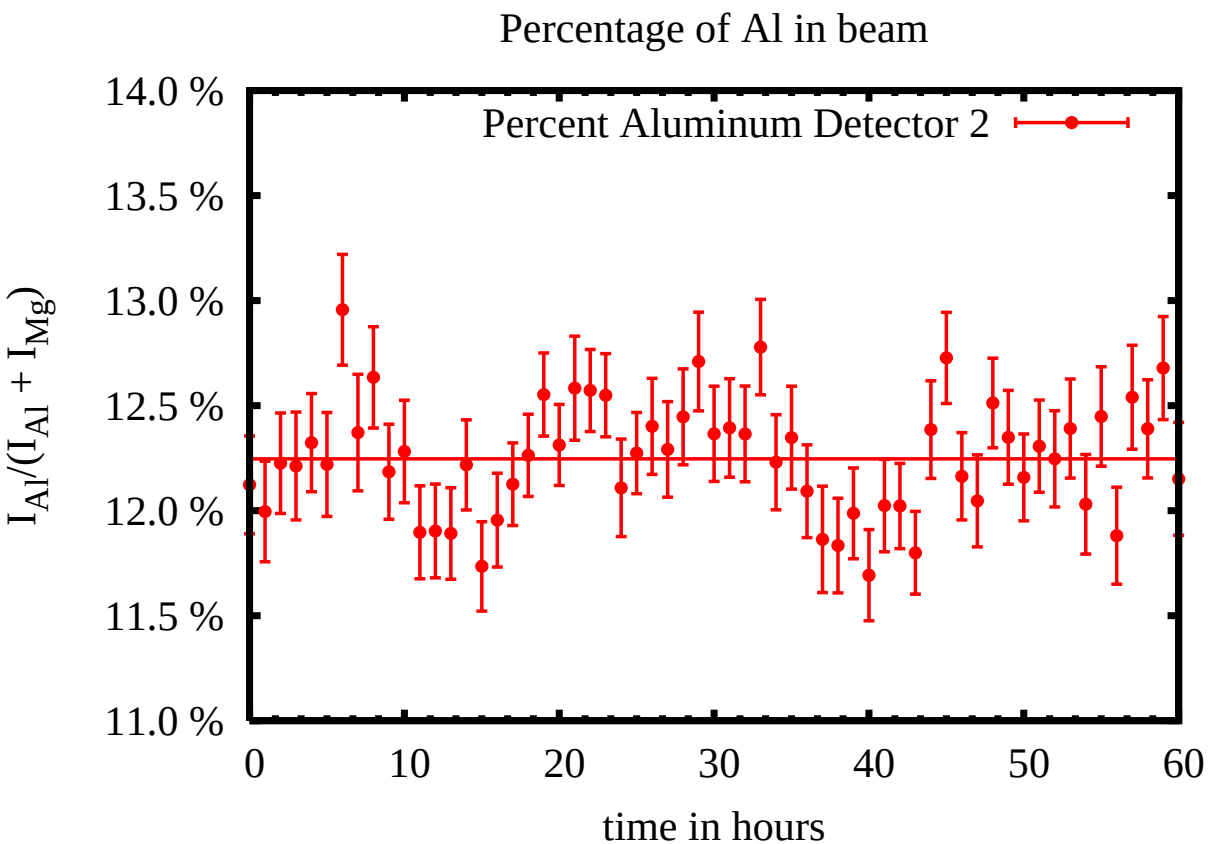


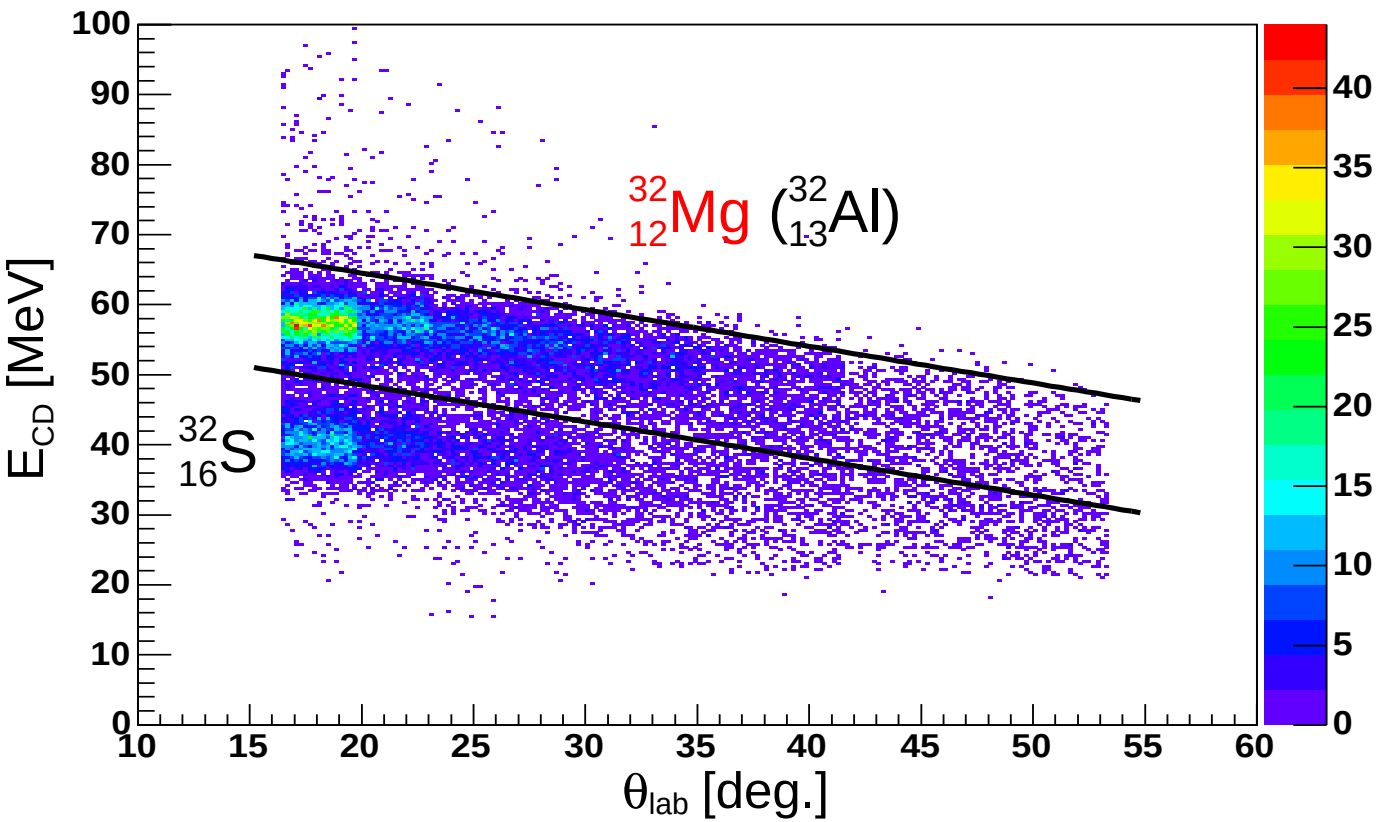
- expected from β decay: 13.7 (1.9) %
- → for IS410, October 2004:

$$\frac{N(^{32}\mathrm{Al})}{N(^{32}\mathrm{Mg} + ^{32}\mathrm{Al})} = 12.3(1.0)\%$$

(no condition on time)

Coulomb Excitation of ^{32}Mg

^{32}Mg → ^{107}Ag (4.4 mg/cm^2), 2.84 MeV/u, I_{Beam}~ 1.5 * 10^4/s, T~ 60 hours



- single particles with condition " t < 1 s " (no coincidence with gamma in MINIBALL)
- surface distance D_s for ^{32}Mg in CD:
  28.2 fm > D_s > 7.3 fm

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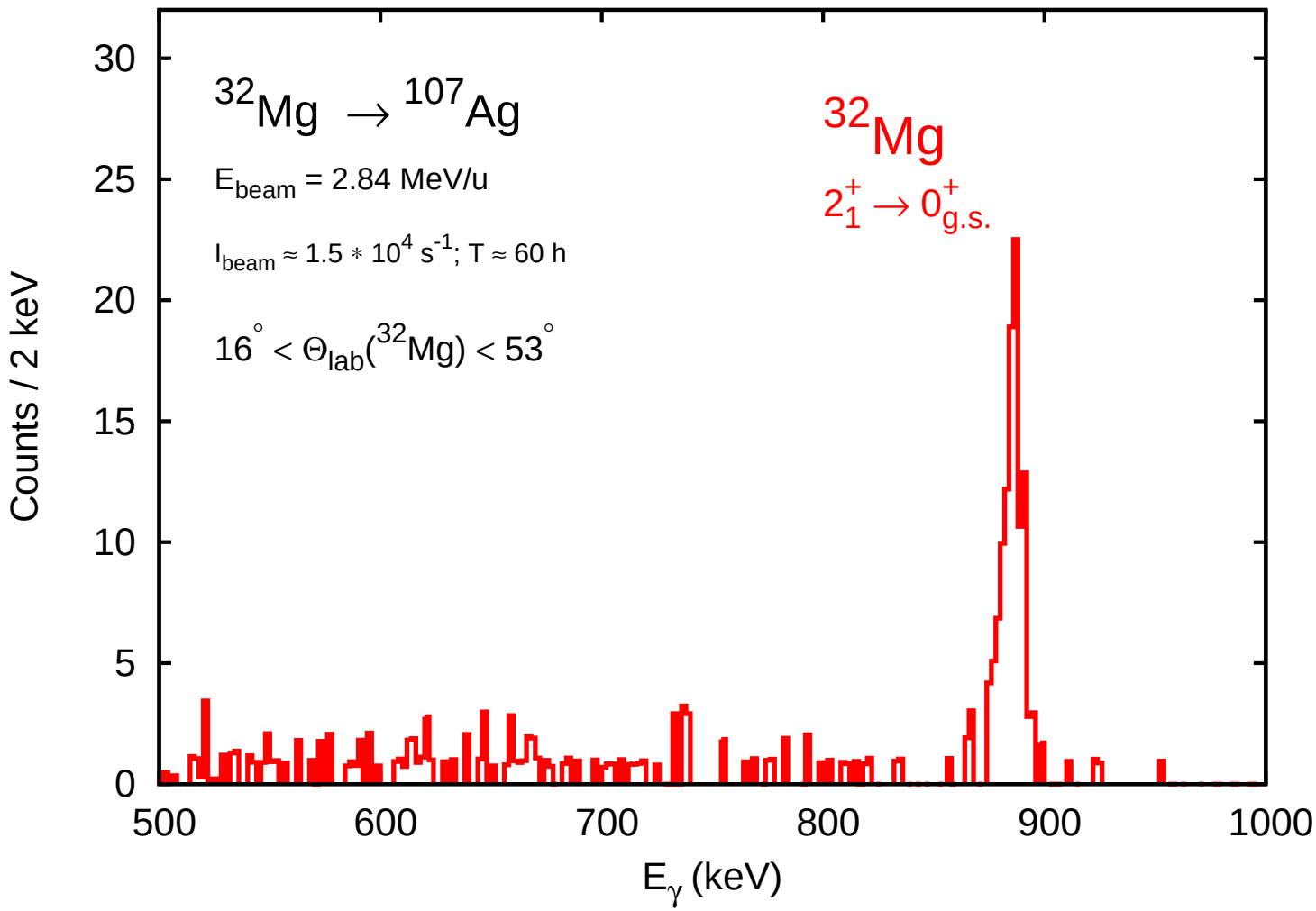

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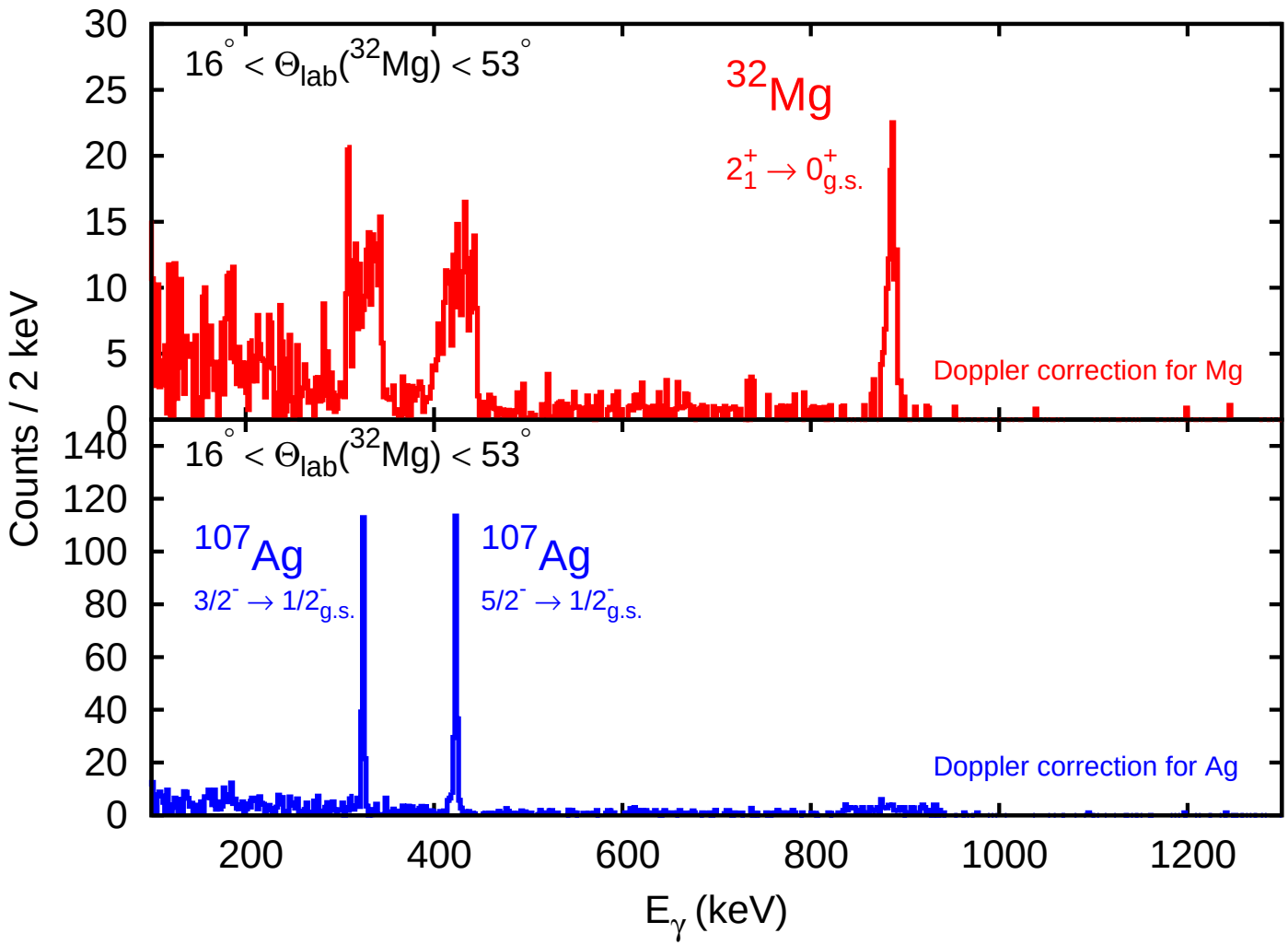

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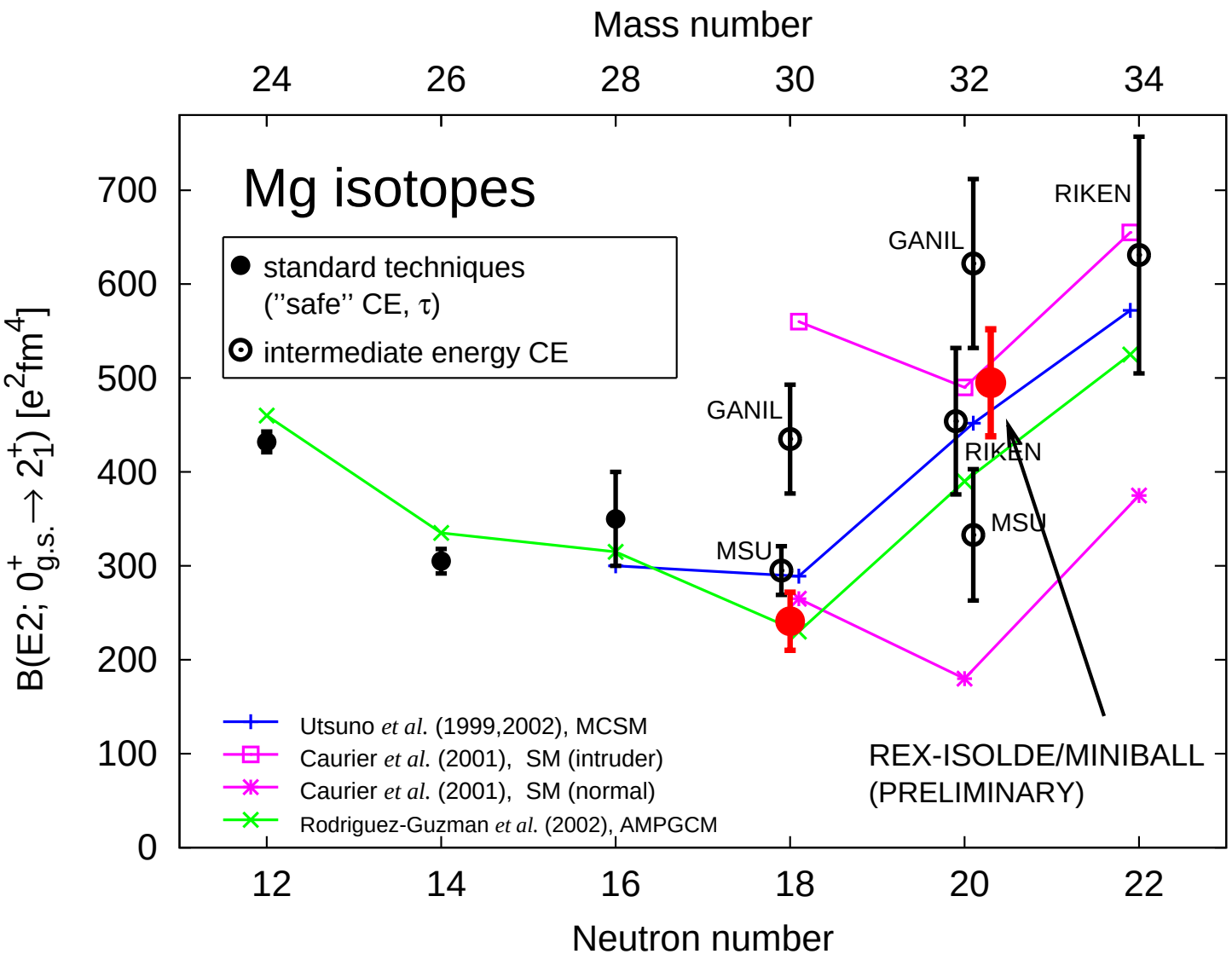

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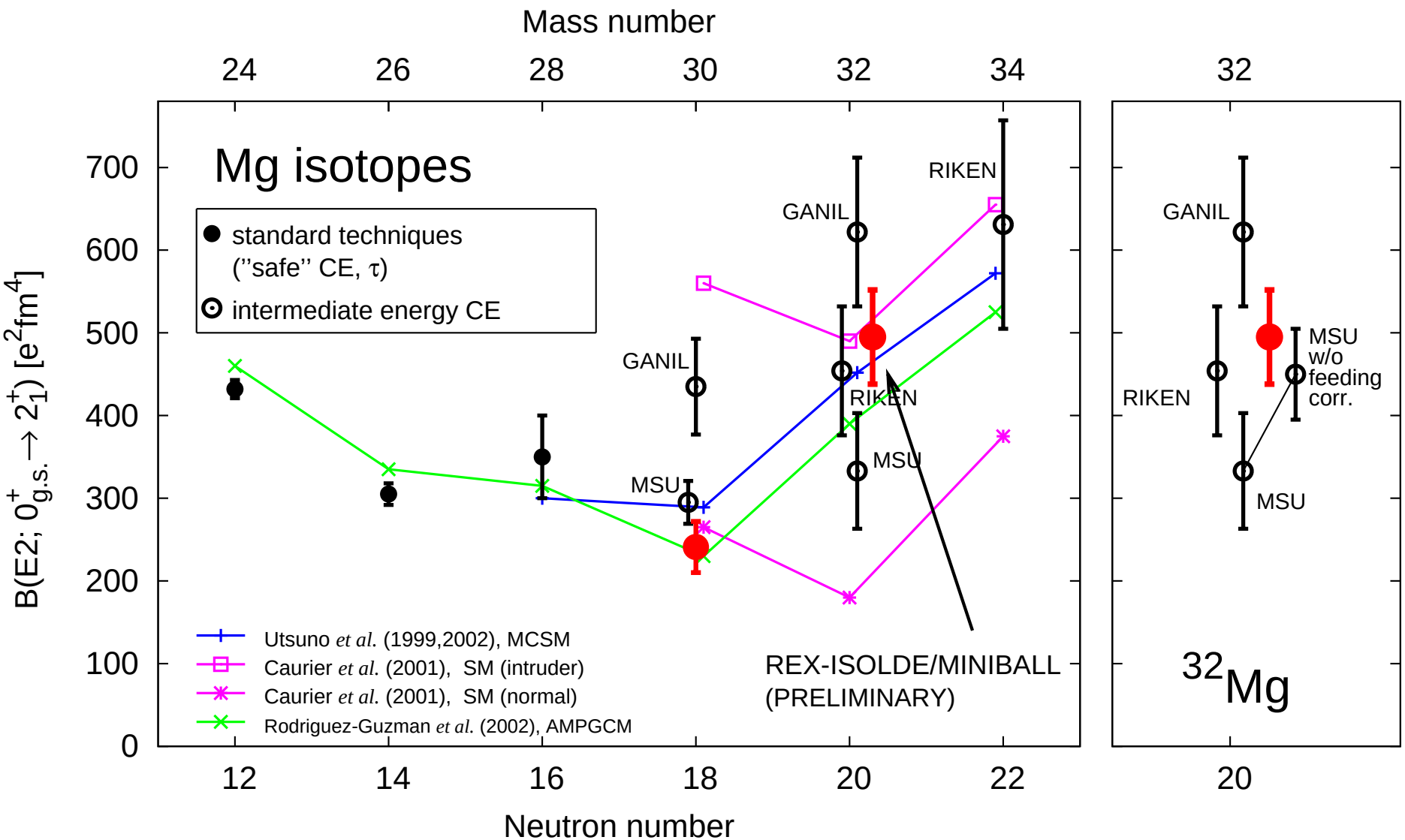

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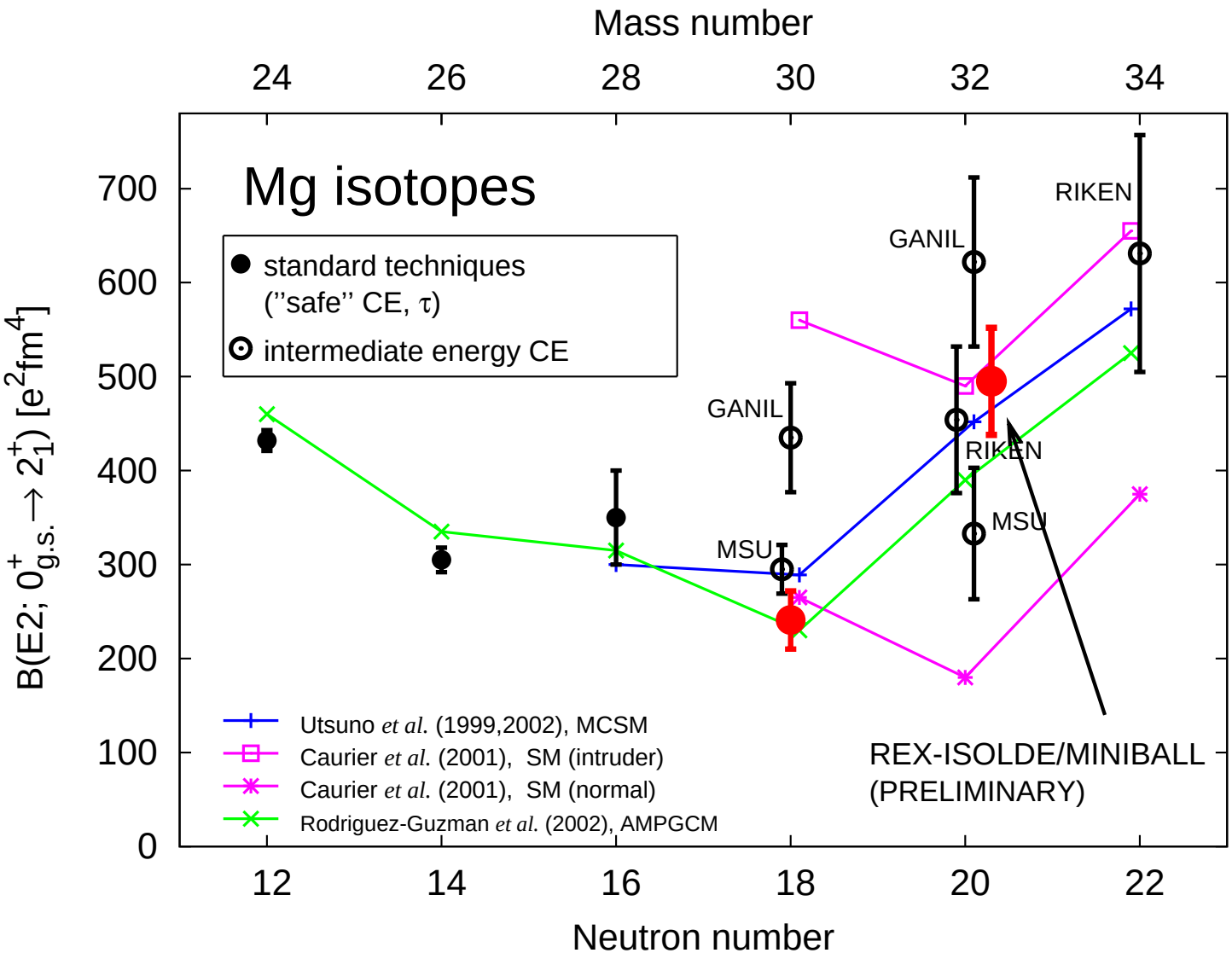

Summary & Conclusions

- **REX-ISOLDE** and **MINIBALL** now in production phase
  - → T. Behrens
  - → J. Iwanicki
  - → J. Van de Walle
- first physics results (and publications)
- IS410, Coulomb excitation of ^{30,32}Mg:
  - B(E2) value of ^{30}Mg ist lower than previously reported
    → still located outside *'island of inversion'*
  - preliminary B(E2) value of ^{32}Mg supports complete intruder configuration

Collaboration

REX-MINIBALL collaboration:

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