

ORISS Isomer and Isobar Spectrometer and Separator for Study of Exotic Decays

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for the



UNIRIB Consortium

- The purpose is to provide a nuclear research facility at ORNL for consortium members
- Consortium members:



- **Our Deliverable is Science – Nuclear Physics**
- We do research
- We give scientific reports at meetings
- We train students
- **UNIRIB, with ORISE and ORAU, provides a university atmosphere in a national laboratory**

Motivation to build ORISS – Oak Ridge Isomer/Isobar Spectrometer and Separator:

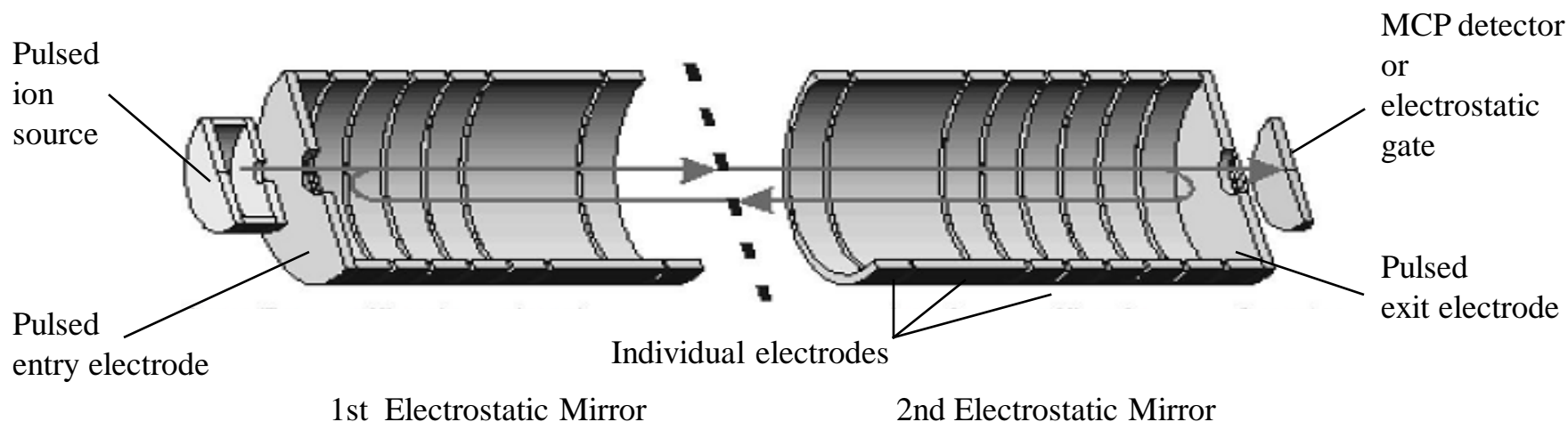
- Decay studies often possible from yield considerations, but limited by background from isobaric/isomeric contamination
- Need high resolution separator for background suppression

ORISS predicted performance:

- High mass resolving power, $M/\Delta M$ up to 400,000 (FWHM)
- Almost complete Suppression of neighboring isobar
- High efficiency ~ 50%
- Chemistry independent
- Transportable
- Cost effective

... use Multi-pass Time of Flight principle!

Multi-pass Time-of-Flight system: concept



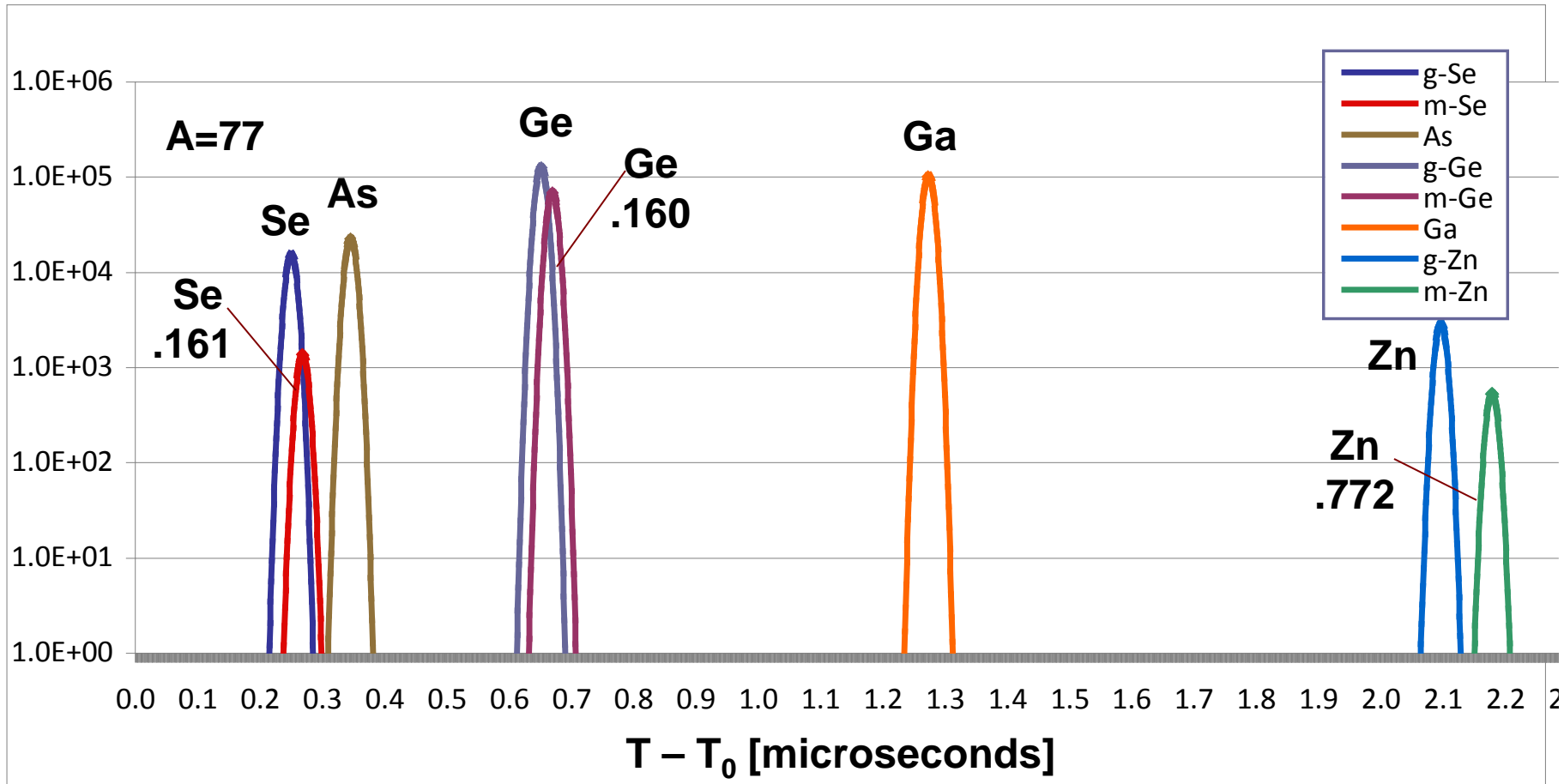
MTOF Spectrometer: Spectrum taken with MCP

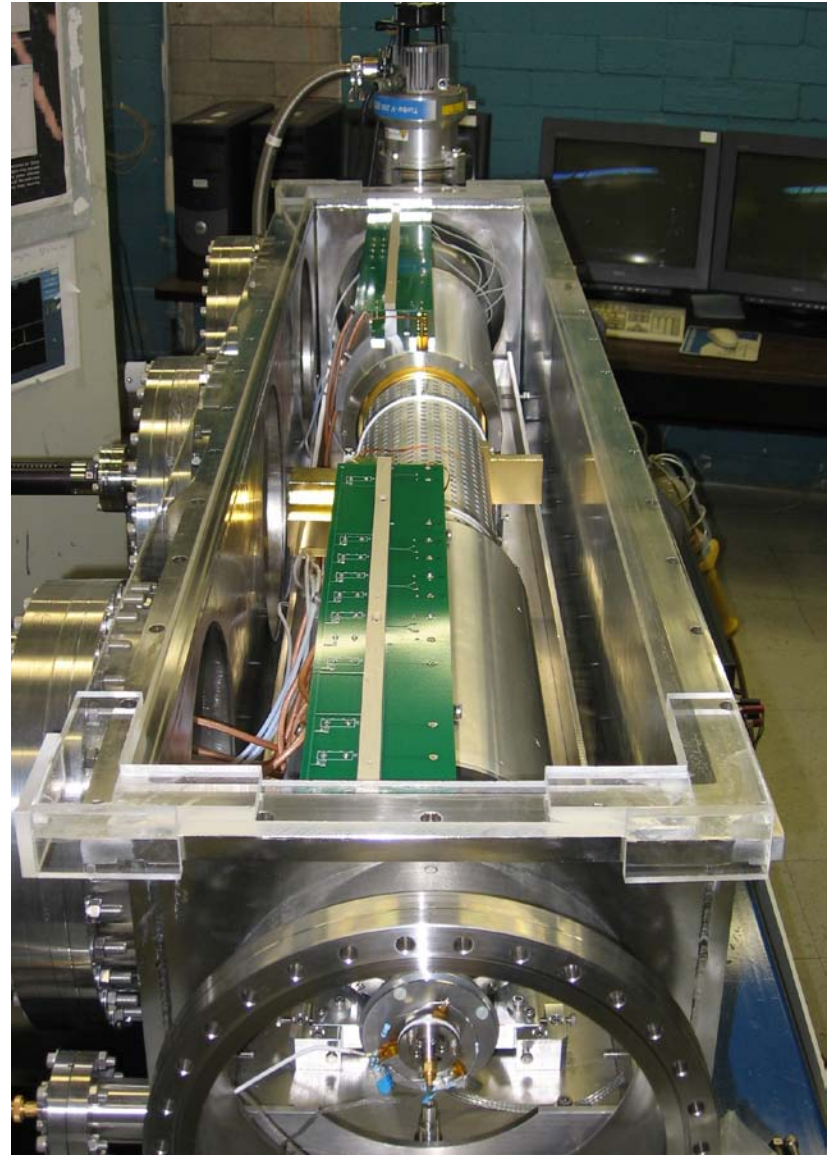
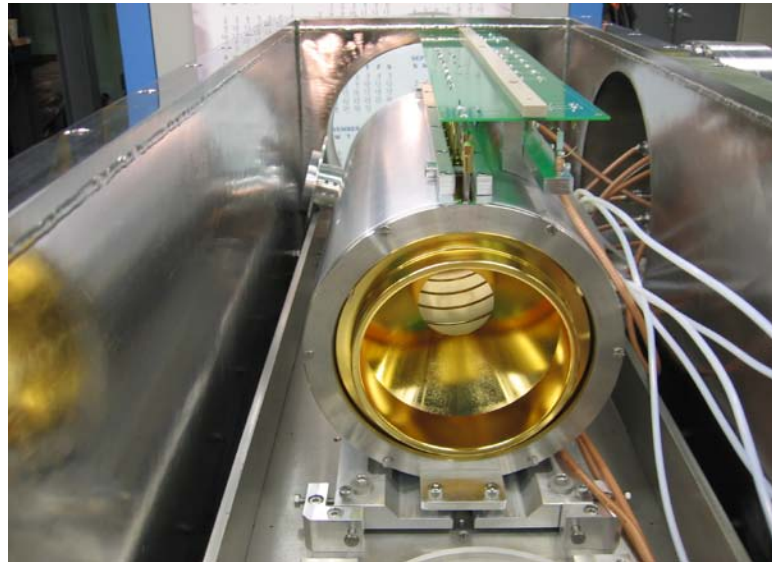
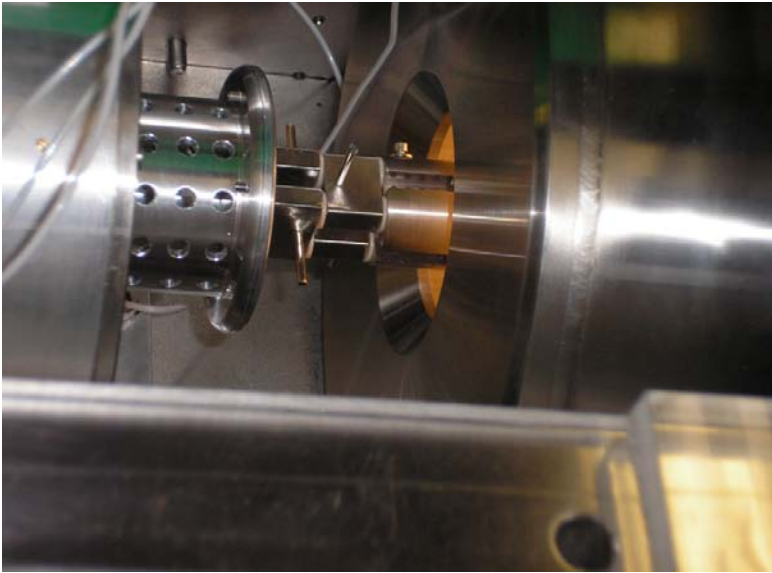
MTOF Separator: Physical separation using fast electrostatic gate (Bradbury Nielsen gate)

$$\Delta\text{ToF} = \frac{1}{2} \text{ToF} \Delta M/M$$

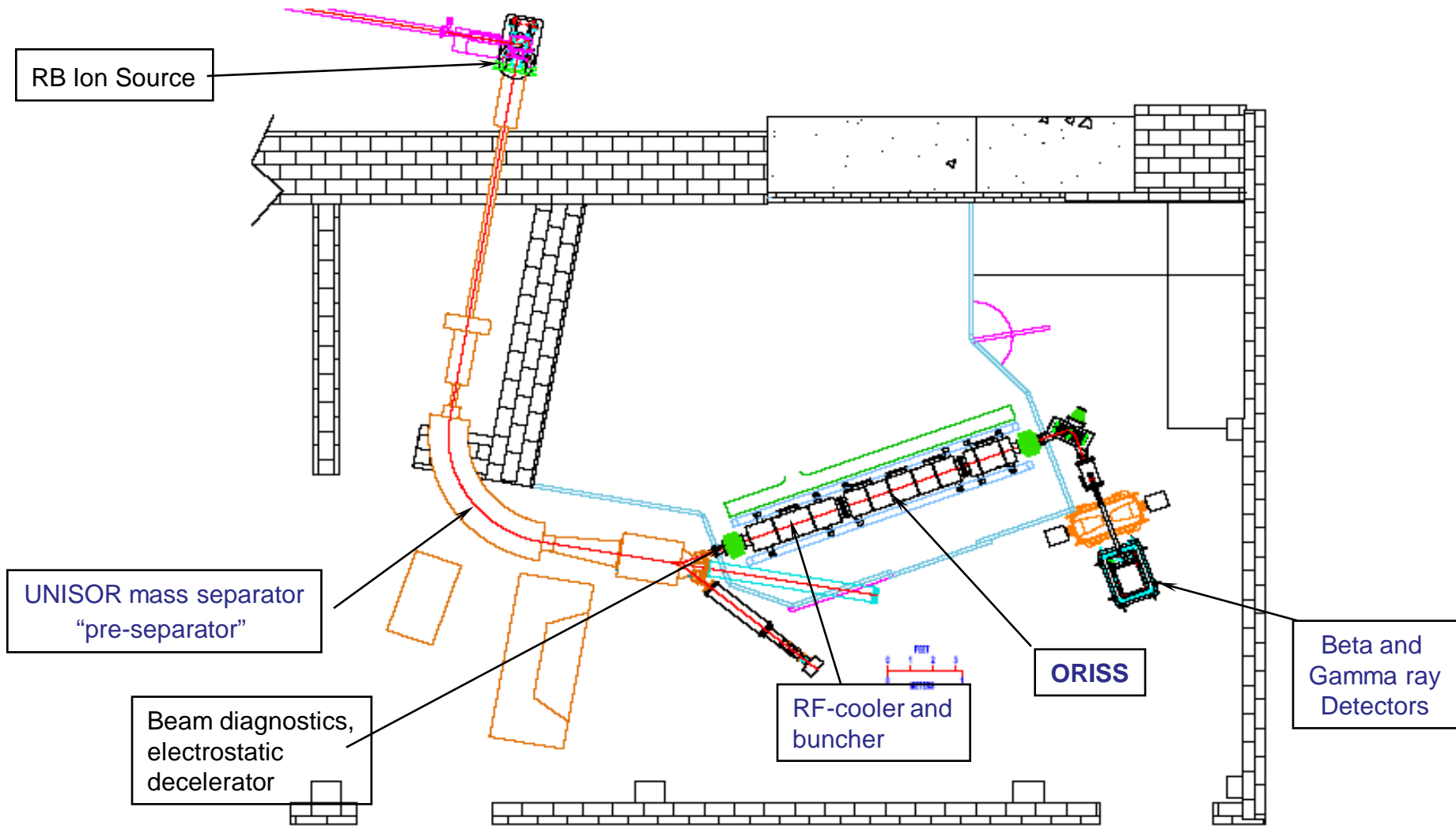
What you could do with mass resolving power of 400,000:

- resolve all isobars
- resolve isomers $M/\Delta M < 200,000$ (470 keV @ $A=100$)





Strawman layout of ORISS at UNISOR



Applications of ORISS

**Decay spectroscopy with pure sources for
p-rich and n-rich**

**Decay spectroscopy of isomers with
sufficient excitation**

Survey searches for isomers

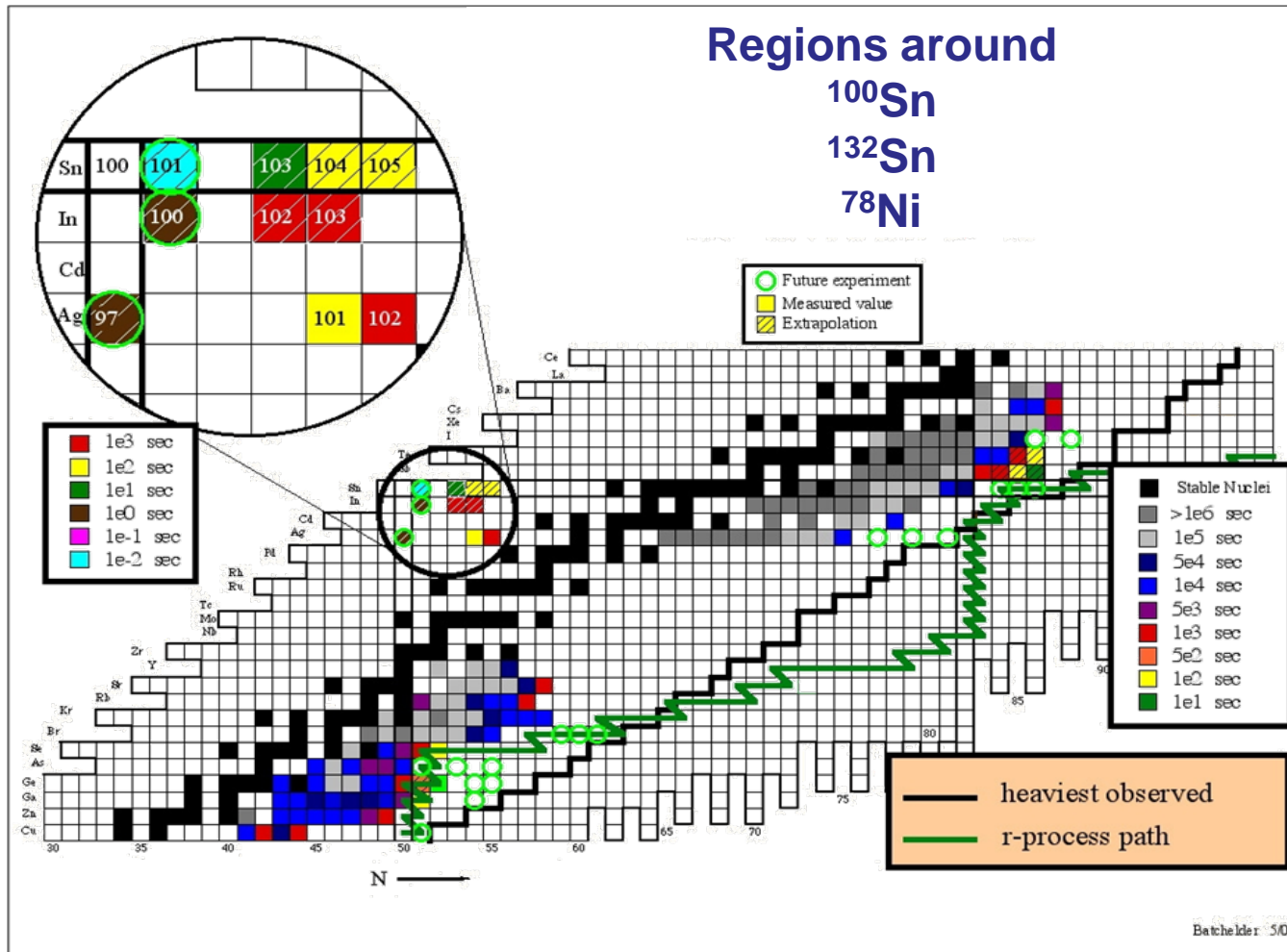
**Modular Total Absorption Spectrometer
– GT strength functions**

Future: masses/mass differences

Future: RIB injector

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Physics...



Physics application:

Decay Heat and spectroscopy for advanced nuclear fuel cycle

Many critical measurements can be performed at UNISOR with ORISS

All critical measurements can be performed at UNISOR with ORISS and He-Jet ion source

Yield of Fission Fragments at ORISS
with 40 MeV p + UC, thick target, (50 nA)

