Measuring Isospin Diffusion with the ZeroDegree Spectrometer

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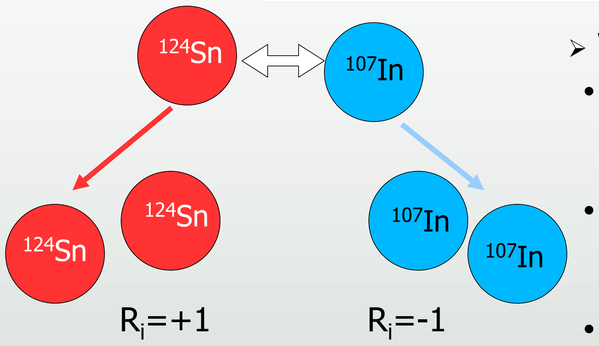
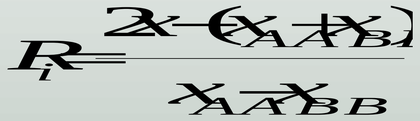
Isospin Diffusion



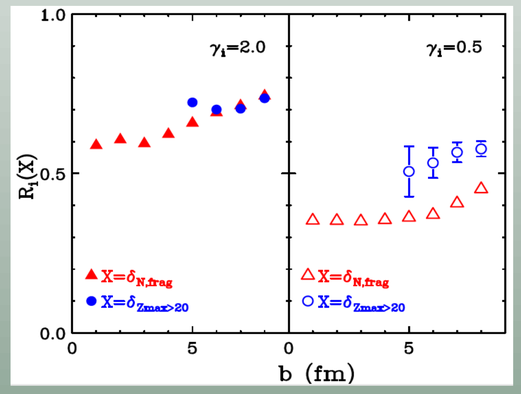
➢ **What is Isospin Diffusion?**

- Asymmetric systems (A+B) move towards isospin equilibrium under the influence of symmetry energy.
- Symmetric systems (A+A; B+B) provide reference values, do not have isospin diffusion
- To measure extent of isospin diffusion: construct isospin transport ratio Ri(X)

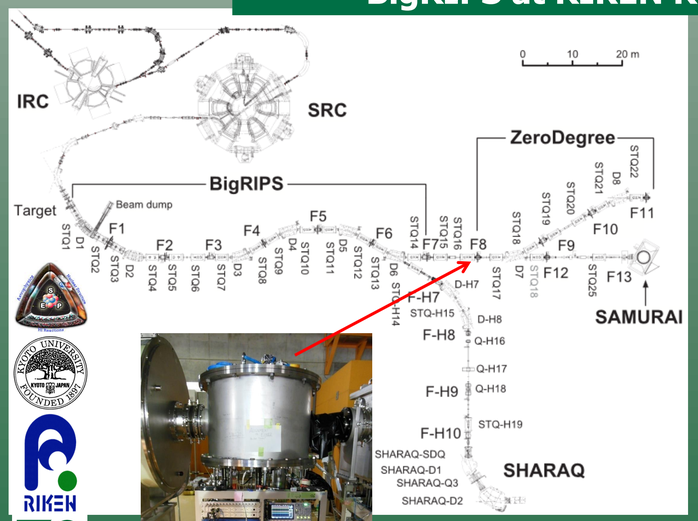


➢ **Heavy Residues**

- Different amount of isospin diffusion for heavy residues, provide another observable sensitive to symmetry energy
- Residues have larger production cross-section values
  - can use unstable beams at lower intensity
  - allow us to probe larger asymmetry difference



BigRIPS at RIKEN RIBF



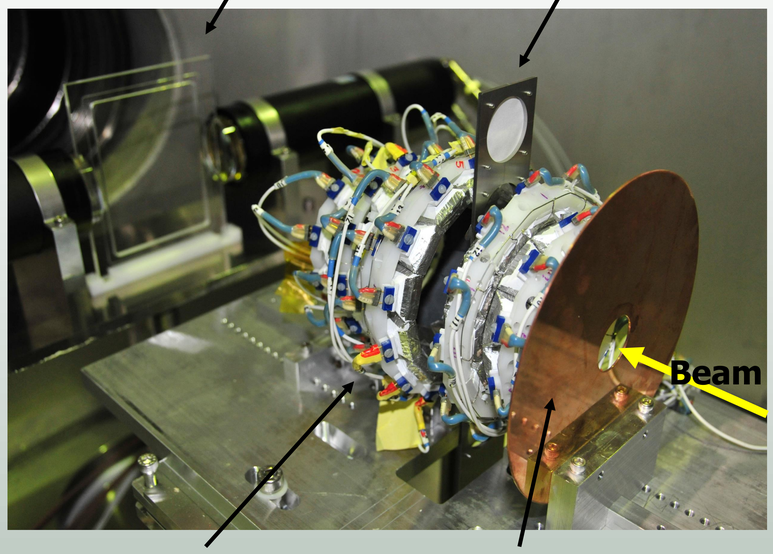
Experimental Chamber located at F8

T. Kubo PTEP 2012, 03C003

➢ **Beam Production**

- Used ^{124}Xe primary beam to produce ^{112}Sn, ^{107}In secondary beams at 70 AMeV
- Chose ^{107}In due to problems with ^{108}Sn purity
- Intensity ~10^5 on target
- ^{86}Zr calibration beam for ZDS, target thickness measurements
- BigRIPS: separator
- ZeroDegree: spectrometer

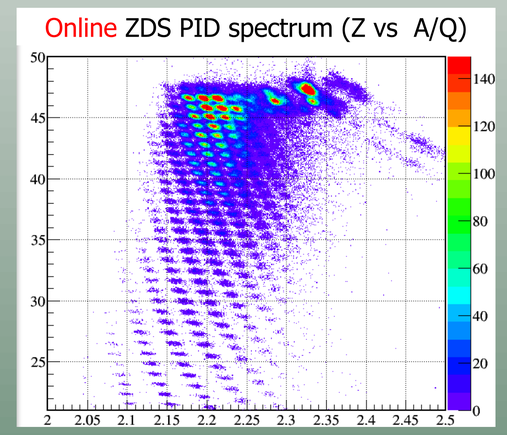
Experimental Setup

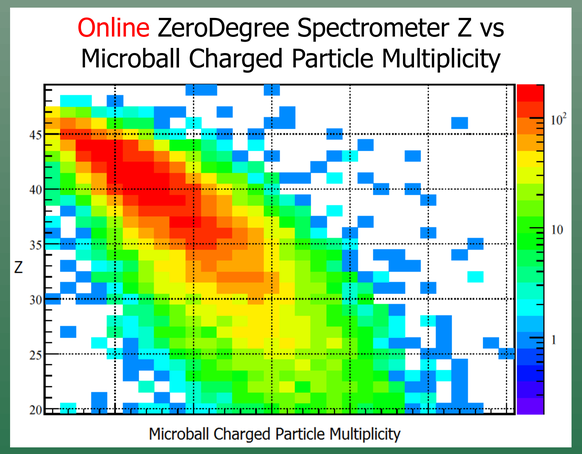


- Experimental goal to measure extent of isospin diffusion in ^{112}Sn+^{112}Sn, ^{107}In+^{124}Sn reactions
  - construct Ri(X) from heavy fragments
- Detected heavy residues in the ZeroDegree Spectrometer
- Detected light charged particles in the Washington University Microball
- Map data from ^{112}Sn+^{112}Sn reaction to previous experiment at NSCL

➢ **ZDS: ZeroDegree Spectrometer**

- Measure 2.5° acceptance
- Selected Bρ=2.45, 2.52 to avoid beam charge states and to map back to NSCL Sn+Sn experiment
- Track reconstruction through BigRIPS from precise TOF measurement
  - Include timing scintillator at F8
- Measure yields of select isotopes with Z~30-40 and compare across reactions





➢ **Microball (WU)**

- Array of 70 CsI(Tl)-photodiode detectors
- Together, they provide coverage from $14° \le \theta_{lab} \le 147°$
- The forward-most and backward-most rings were removed to allow for a large beamspot
- Used to determine impact parameter of events
- In offline analysis: will select data in ZDS from peripheral events

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