Opportunity for 2023-25

Light Fragment Yields from He, Si, and Fe on C, Al, and Fe Targets with beam energies from 3 to 50 GeV

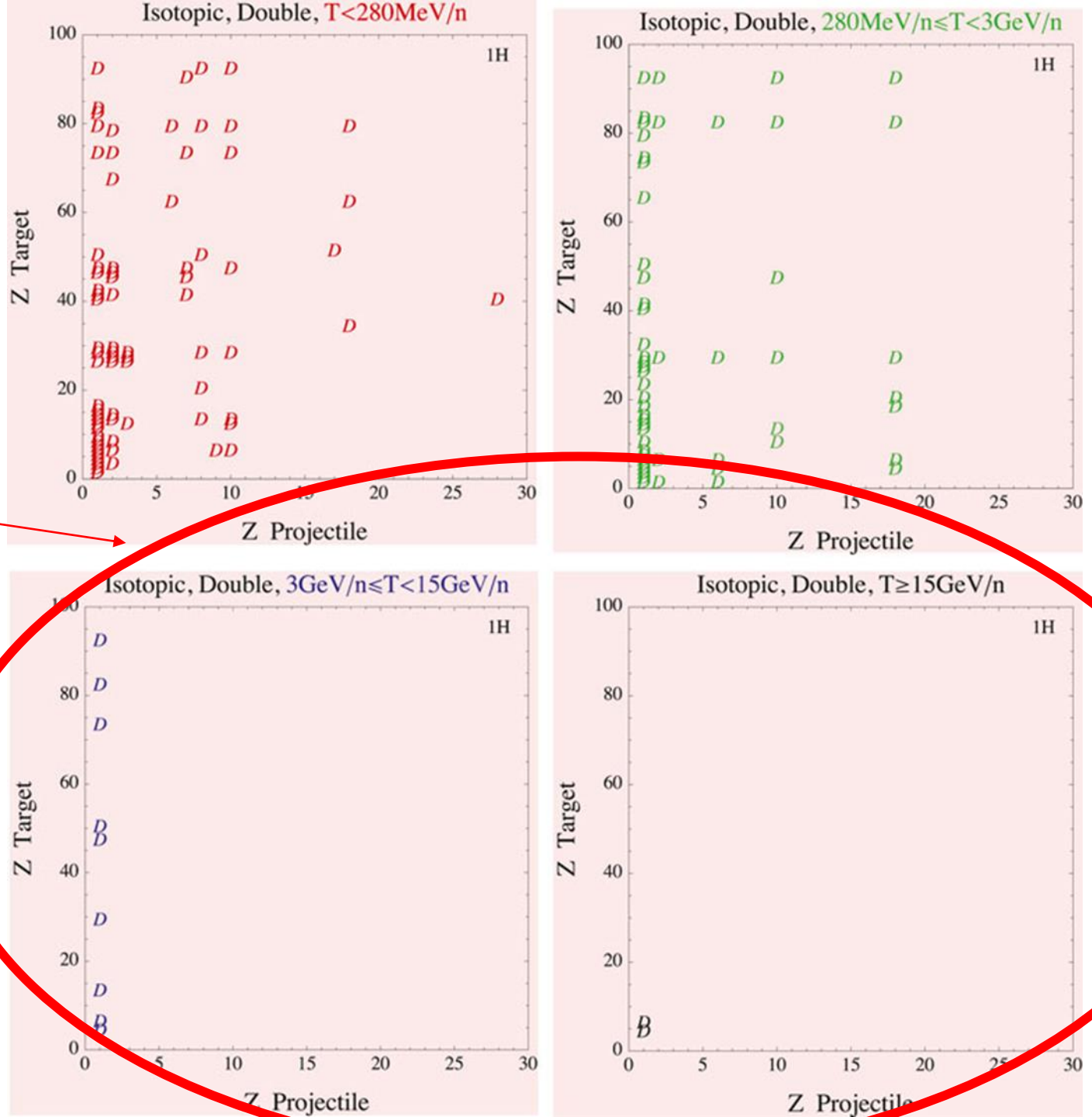
Justification:

- Cosmic rays are a serious concern to astronauts, electronics, and spacecraft.
- The cosmic ray flux is composed of nuclei (90% protons, 9% He, and 1% nuclei up to Fe.
- The damage is proportional to Z^2, therefore the component due to ions is very important
- Damage from secondary production of p, d, t, ^{3}He, and ^{4}He is also significant.
- Extensive double differential measurements for light fragments production have been made for projectile energies below 3 GeV/n.
- No data exist for projectile energies from 3-50 GeV/n.
- The Space Radiation Protection community has identified this high energy regime as an area of need. https://doi.org/10.3389/fphy.2020.565954
- STAR has excellent light fragment capabilities.
- RHIC can deliver the ion beam species (He, Si, Fe) and energies (3-50 GeV/n) of need to the Space Radiation Community. STAR can install the targets of interest (C, Al, Fe).

Existing proton double differential measurements

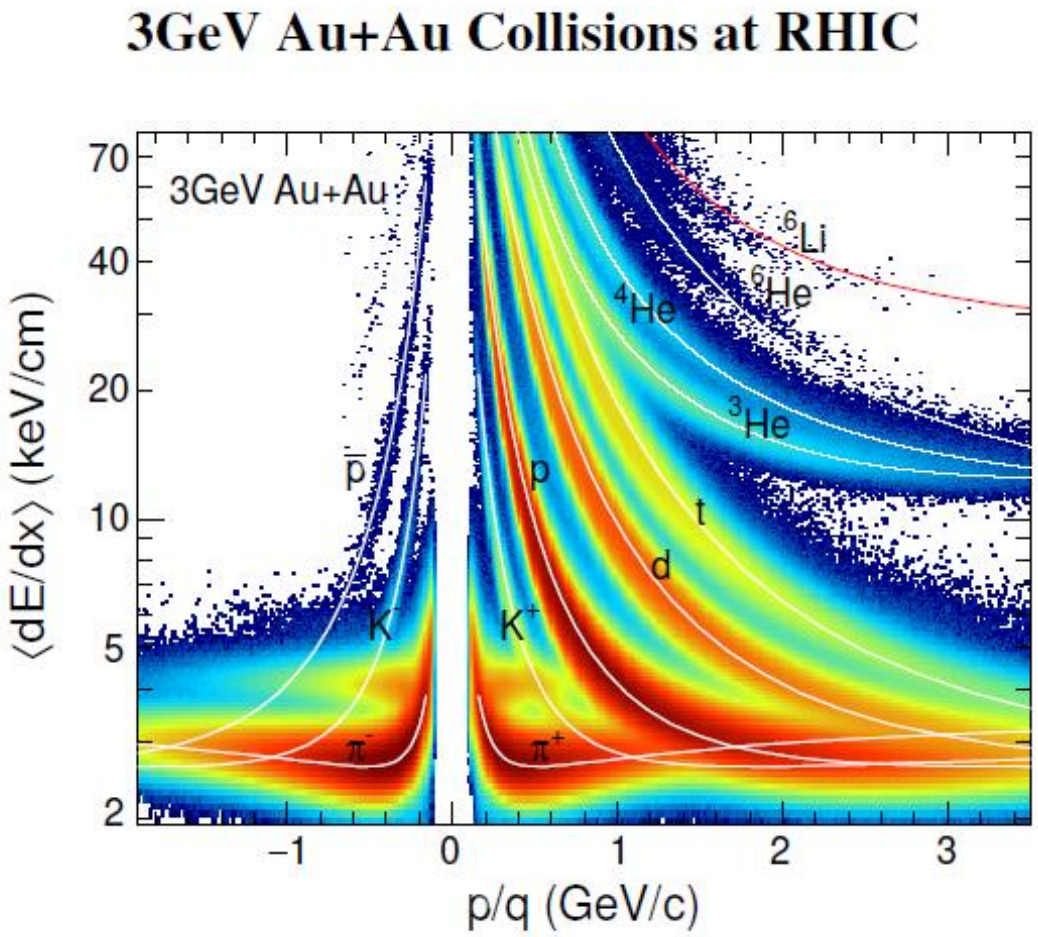
There are no data for beams from 3-50 GeV/n

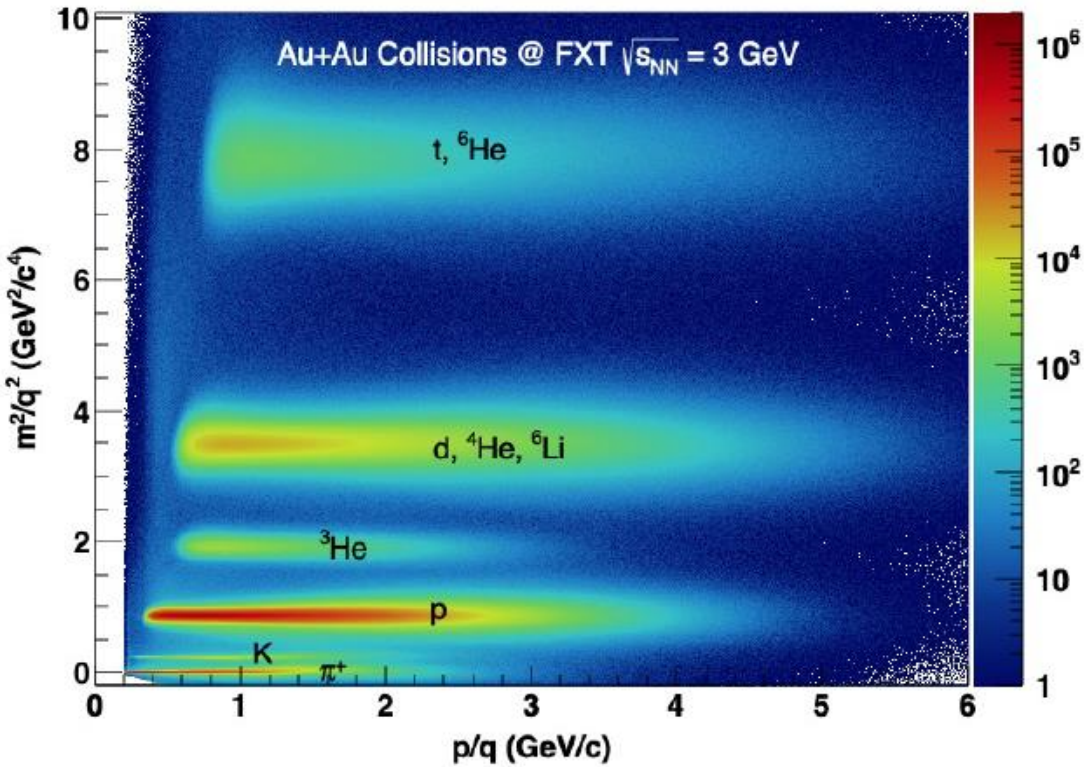
- Identified as a key need for space radiation protection
- Has support at the top level of DOE
- Has support from BNL administration



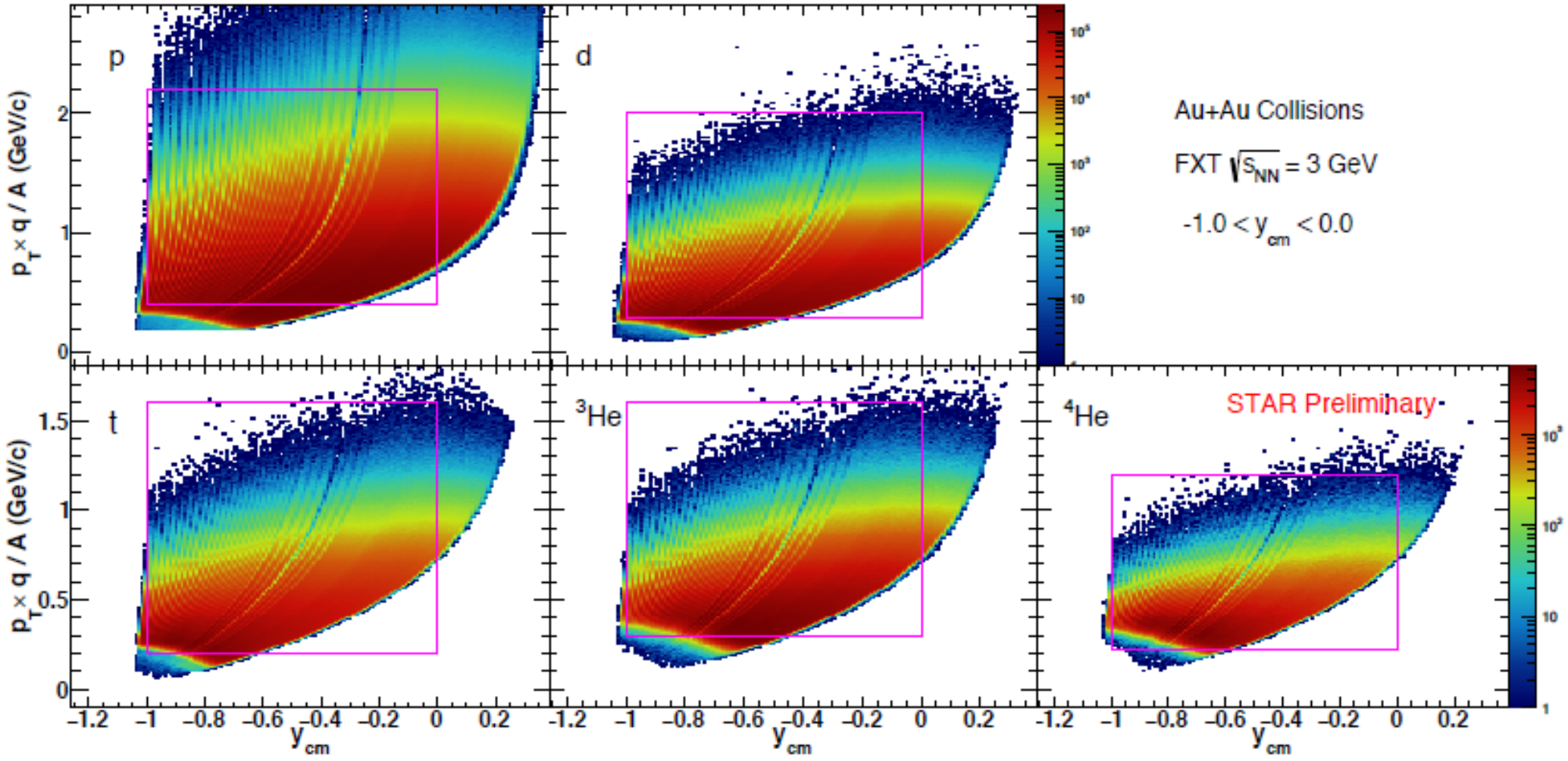
STAR has completed a Au+Au fixed-target program; energies from 3-100 GeV/n

STAR light fragment particle identification





STAR light fragment acceptance



Summary

- **Light fragment cross section data are needed for projectiles in the energy range 3-50 GeV.**
- **RHIC/STAR have capabilities that can fill that need.**
- **We could run this program during the 2023-2025 running periods.**