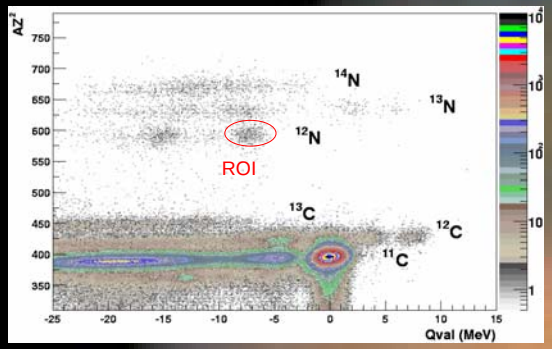
Re-commissioning MARS

Samuel Zenobia

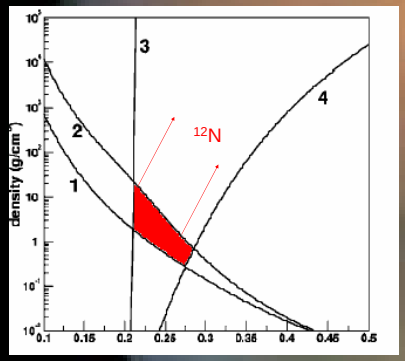
Why is MARS useful?

Astrophysical Application: Secondary Reactions using Purified Radioactive Beams.

MARS measures the ANC for $^{12}N \rightarrow ^{11}C+p$, and the S-factor and reaction rate are calculated.

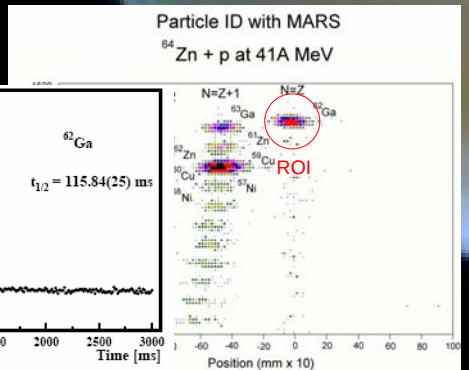


MARS data improves on S-factor measured by GANIL, showing a higher reaction rate than previously determined.



Beta Decay Application: Uses Purified Radioactive Beams to determine half-lives and branching ratios.

The half-life and branching ratio for ^{62}Ga are determined to improve the value of the weak coupling constant for up-down quarks.



How Does MARS Work?

MARS works by inverse kinematics and provides a filter of magnetic rigidity—p/q, mass focus—m/q, and engergy—E.

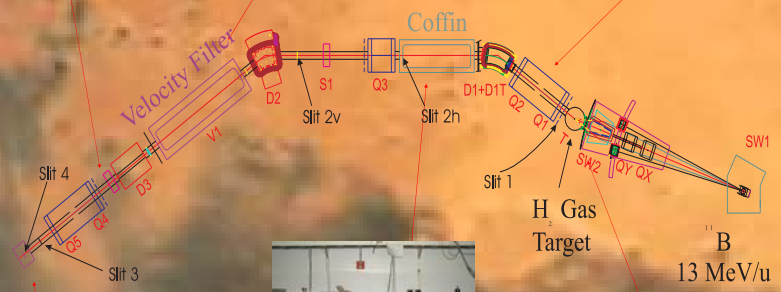
MARS uses the following optical elements: Dipoles (3), Quadrupoles (5), Sextupoles (2), a Velocity Filter and Filtration Slits (4).

Quadrupoles 4 and 5, Sextupole-2, Dipole-3

Velocity Filter, Dipole-2

Dipole-1, Quadrupoles 1 and 2

Momentum Achromat Recoil Separator



The "Coffin"

Detection Chamber

MARS's Silicon Detector

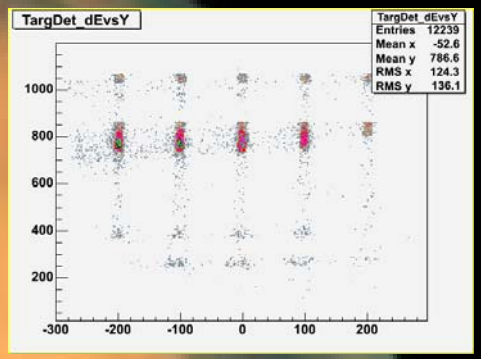
Primary Target Chamber (gas cell)

MARS was partially disassembled in early March 2004 so repairs could be made to a cooling coil in the Velocity Filter's magnet.

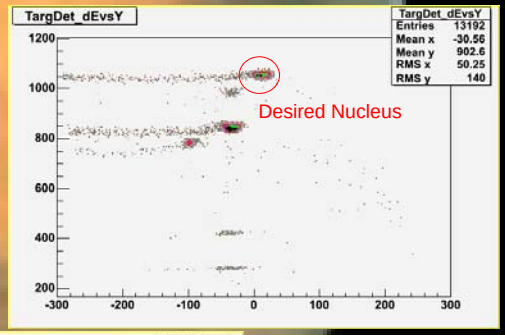
Each element of MARS after Dipole-2 had to be removed. After repairs, each element was put back in place and realigned using a transit system and previously aligned points.

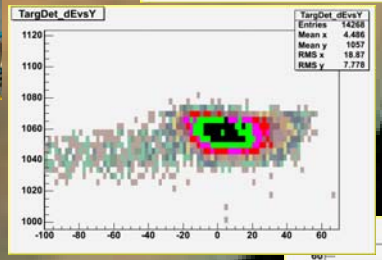
My Research on MARS

The Calibration of the MARS Detector used a five finger mask with each finger spaced 10 mm apart. After calibration the resolution of the detector at FWHM was 0.96 mm.



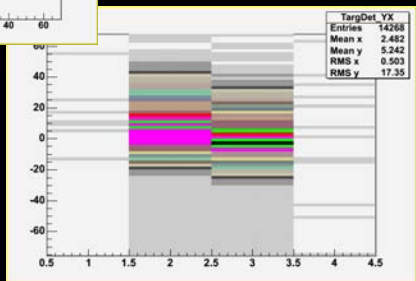
A diagnostic run using a test nucleus (^{13}N) was performed in late July 2004. The preliminary data shown was taken with the polarity reversed on quadrupoles 4 and 5 and detector slits 3 and 4 open. This demonstrates an "unclean" beam before purification.





With the polarity of the quadrupoles corrected and the filtration slits closed the beam is focused to an area ~6 mm wide and ~9 mm high.

After focusing, the final beam consists of more than 99% of our desired nucleus, ^{13}N.



Special thanks to the Cyclotron Institute at Texas A&M, along with the D.O.E. and National Science Foundation Grant PHY-0354098.