Is Nickel-56 doubly magic?

Two shell structures for unstable $^{56}$Ni nucleus:

- $^{56}$Ni as inert core
- All 28 protons and 28 neutrons are inside the core

- $^{40}$Ca as inert core
- 8 valence protons and 8 neutrons are outside the core

Classical tool: To use transfer reaction such as $(p,d)$ to pick up a neutron from the $^{56}$Ni nucleus. Comparison of the data to model predictions will distinguish the two models.

Two for the price of one: Since $N=Z=28$ in $^{56}$Ni, we can test the mirror symmetry of $^{56}$Ni nucleus by using $(d,^{3}$He) reaction to pick up a proton in the same experiment and compare the neutron and proton pickup mechanisms.

Performance of HiRA in previous transfer reaction experiments

$^{66}$As$(p,d)^{65}$As, $^{65}$Ge$(p,d)^{64}$Ge, $^{69}$Se$(p,d)^{68}$Se – important for Nuclear Astrophysics

Position Resolution:

- 32 vertical strips on the front side and 32 horizontal strips on the back side of Si detector → 1024 pixels
- Each pixel is 1.8mm x 1.8 mm → Good angular resolution
- At a distance of 35cm, the angular resolution for one pixel is 0.15° degree