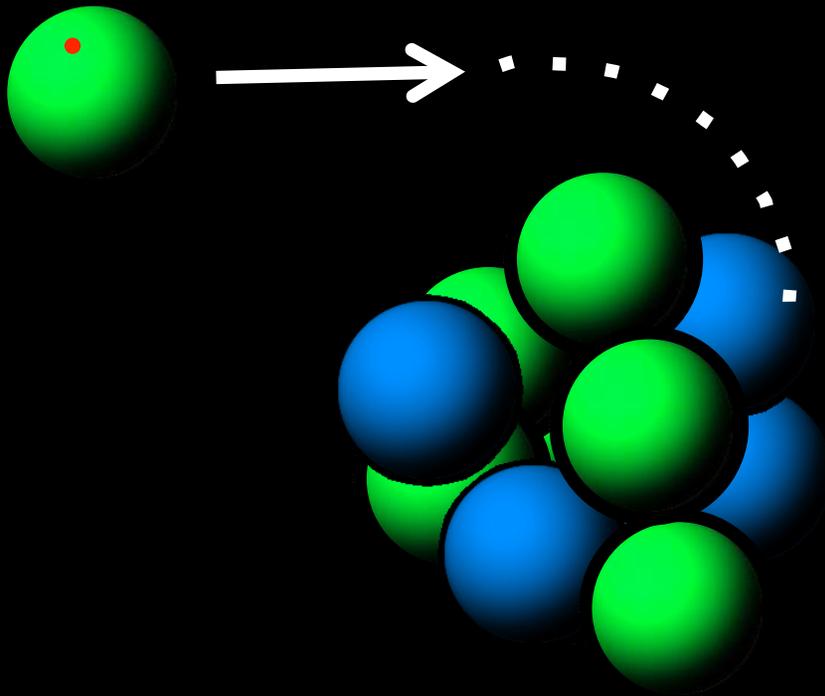


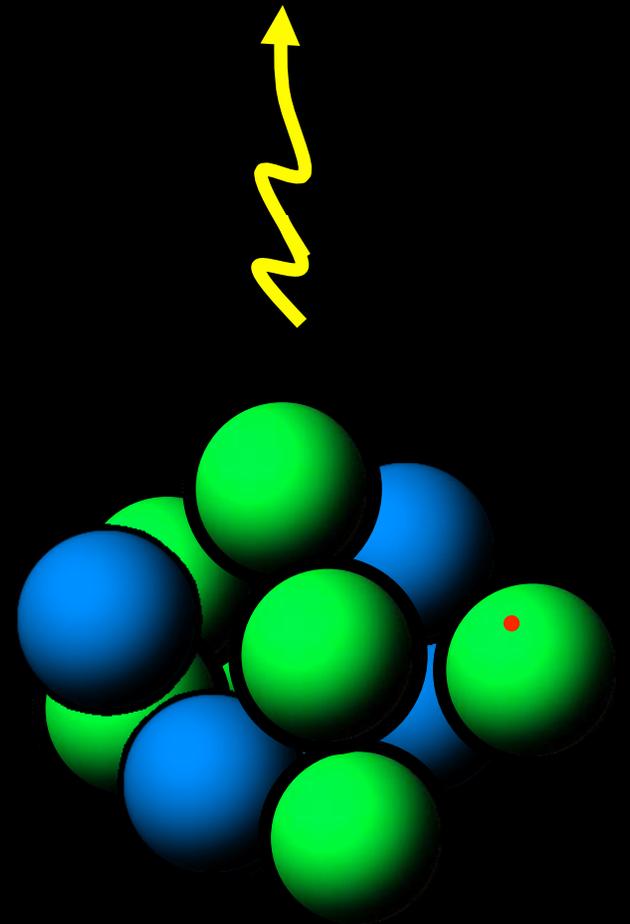
Transfer Reactions

**we measure transfer reactions that “mimic”
proton or neutron capture –
taking advantage of their higher yield
to fool the nucleus into revealing
the rates of weaker capture reactions**

reaction in the star

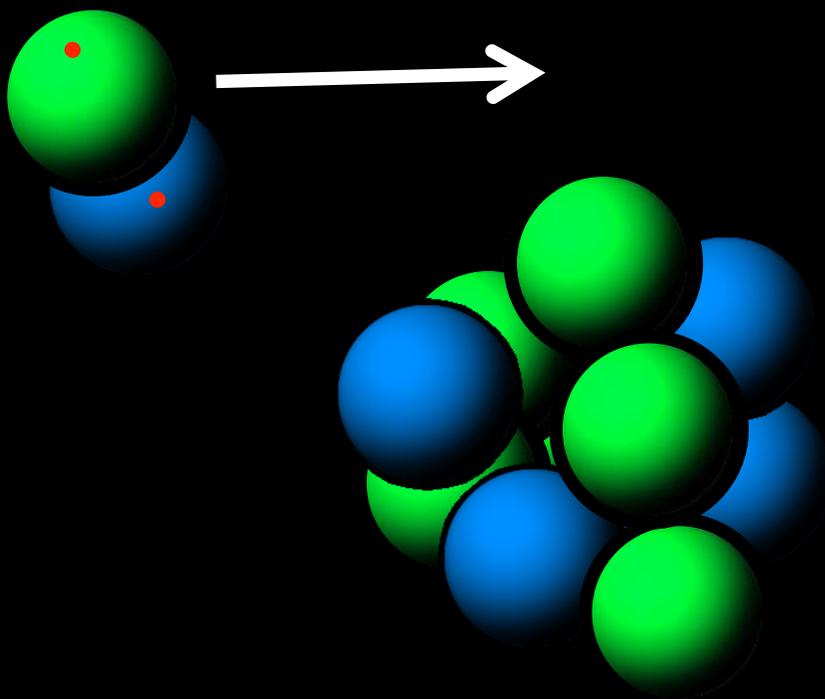


before

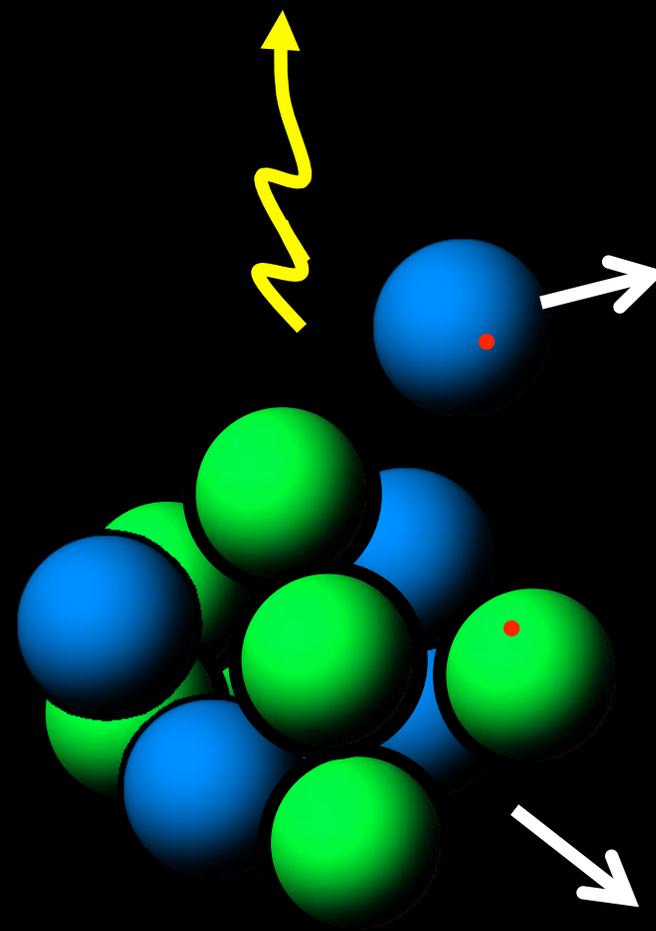


after

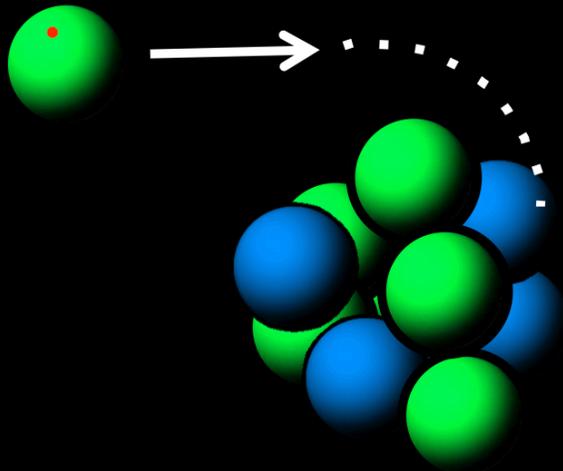
transfer reaction – in the lab



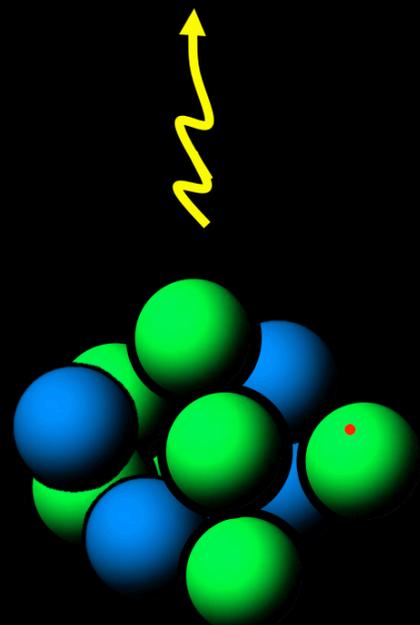
before



after



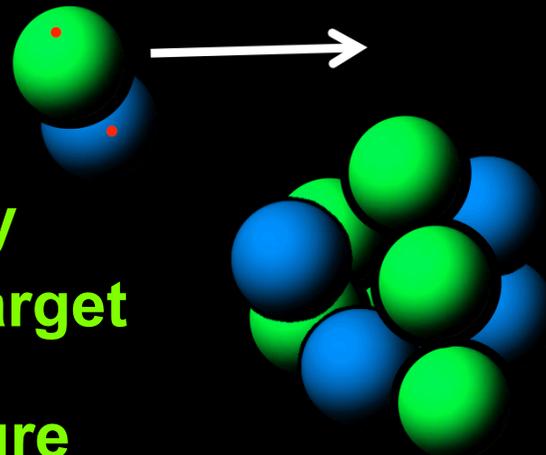
before



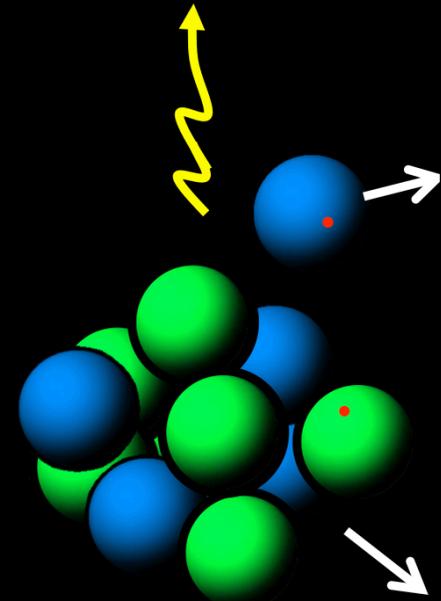
after

in the star
low probability

in the lab
transfer reaction
higher probability
available beam/target
"mimics" capture



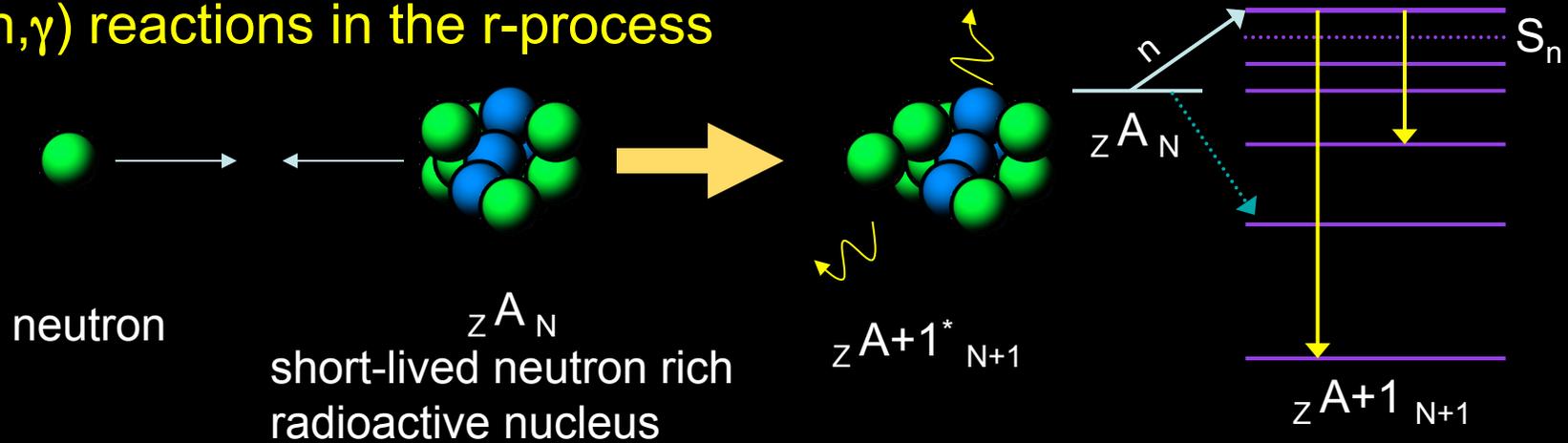
before



after

Probing structure & reactions of r-process nuclei

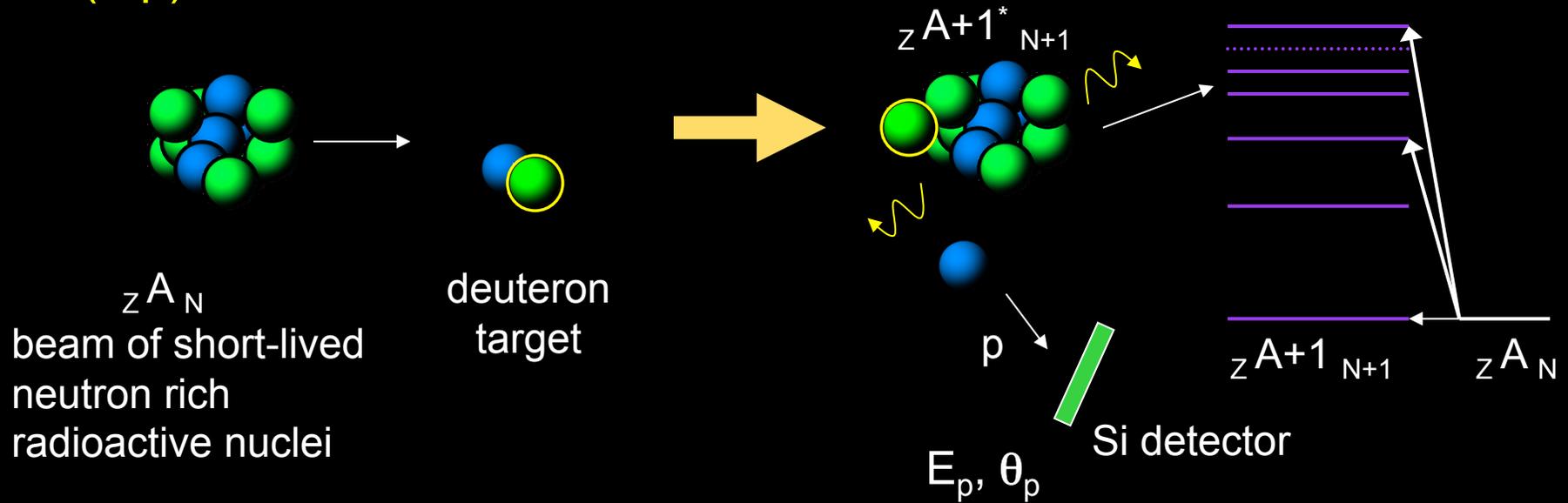
(n, γ) reactions in the r-process



- neither neutrons or heavy radioactive nuclei suitable for targets
- cannot directly measure in laboratory
- use an indirect technique to probe the same nuclear levels

Probing structure & reactions of r-process nuclei

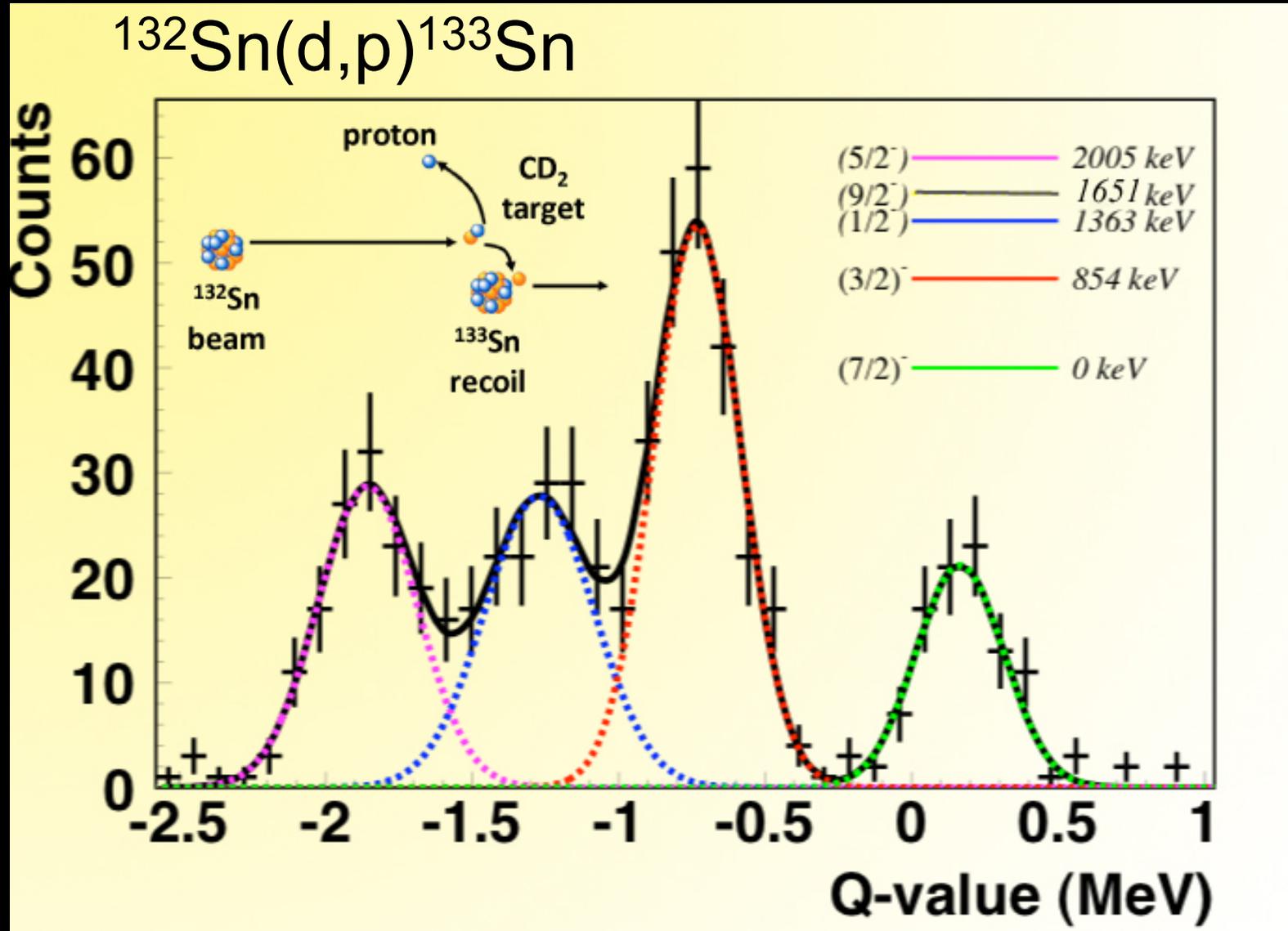
(d,p) reaction in inverse kinematics



- (d,p) reaction “mimics” (n, γ) by transferring a neutron 
- direct reaction mechanism selectively populates single particle states
- proton angular distributions sensitive to transferred angular momentum
- determine spectroscopic factors, J^π , Q values (E_x & masses)

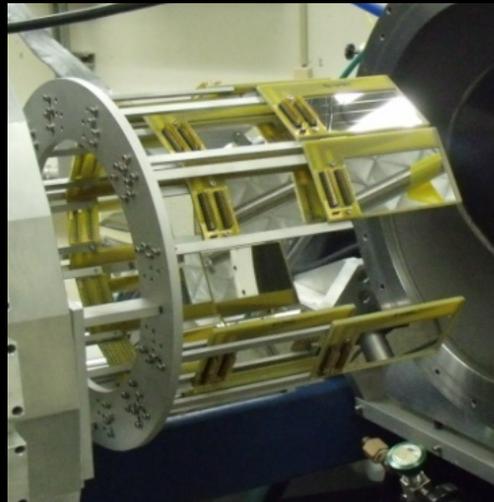
Recent Example: $^{132}\text{Sn}(d,p)$

Jones et al. 2010

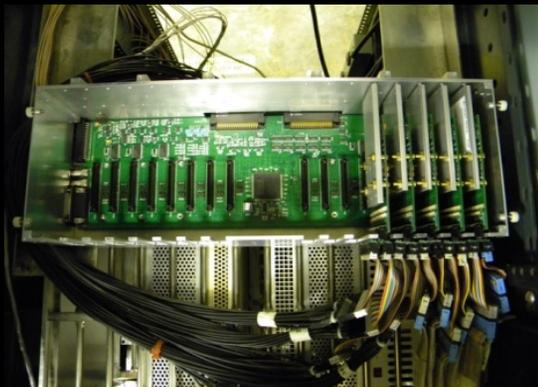
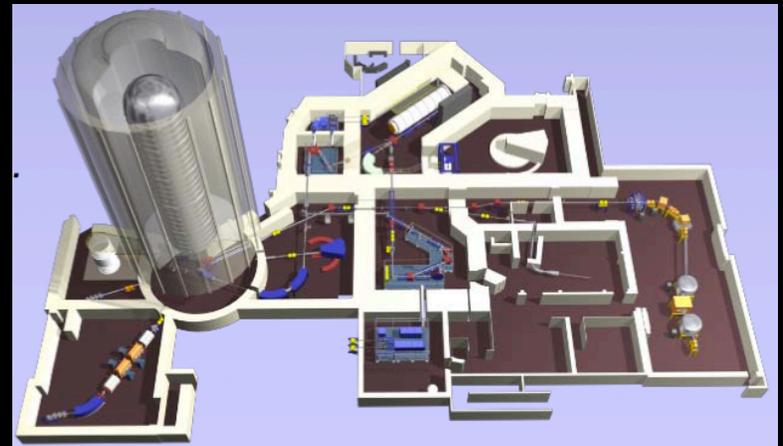


we measure (d,p) and $(d,p\gamma)$ reactions on neutron-rich unstable nuclei to mimic neutron capture in the r-process in supernovae

SuperORRUBA detector system



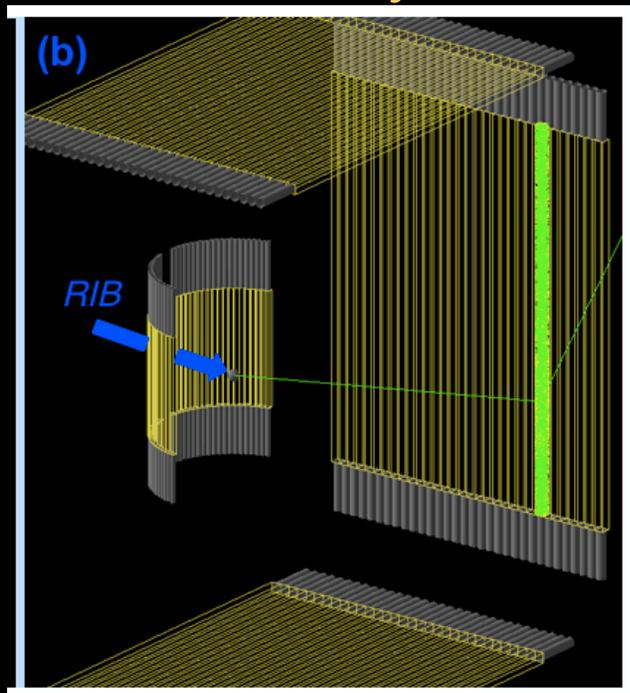
Radioactive beams at HRIBF



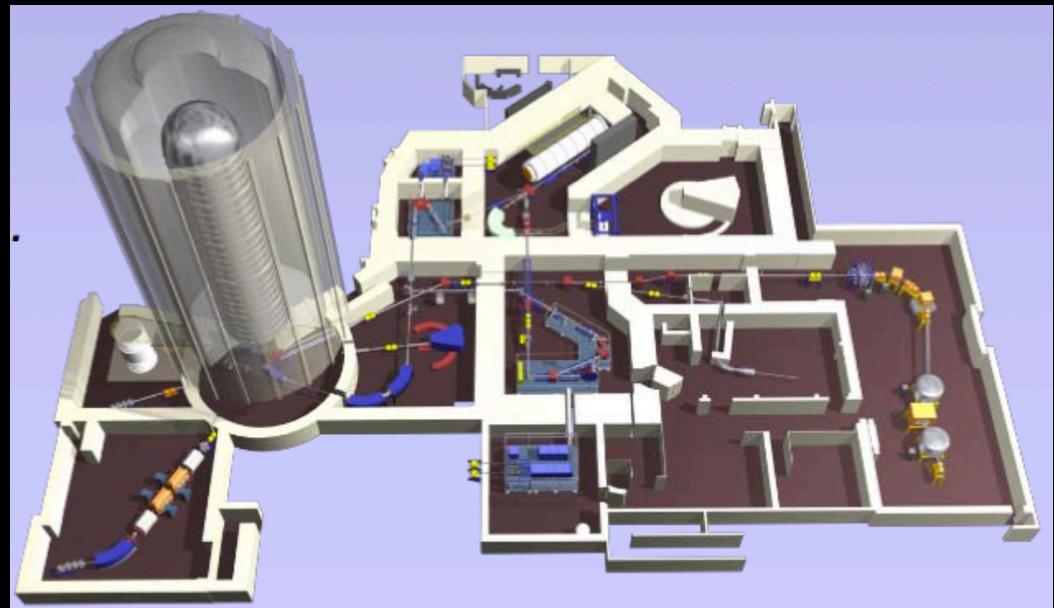
ASICs electronics

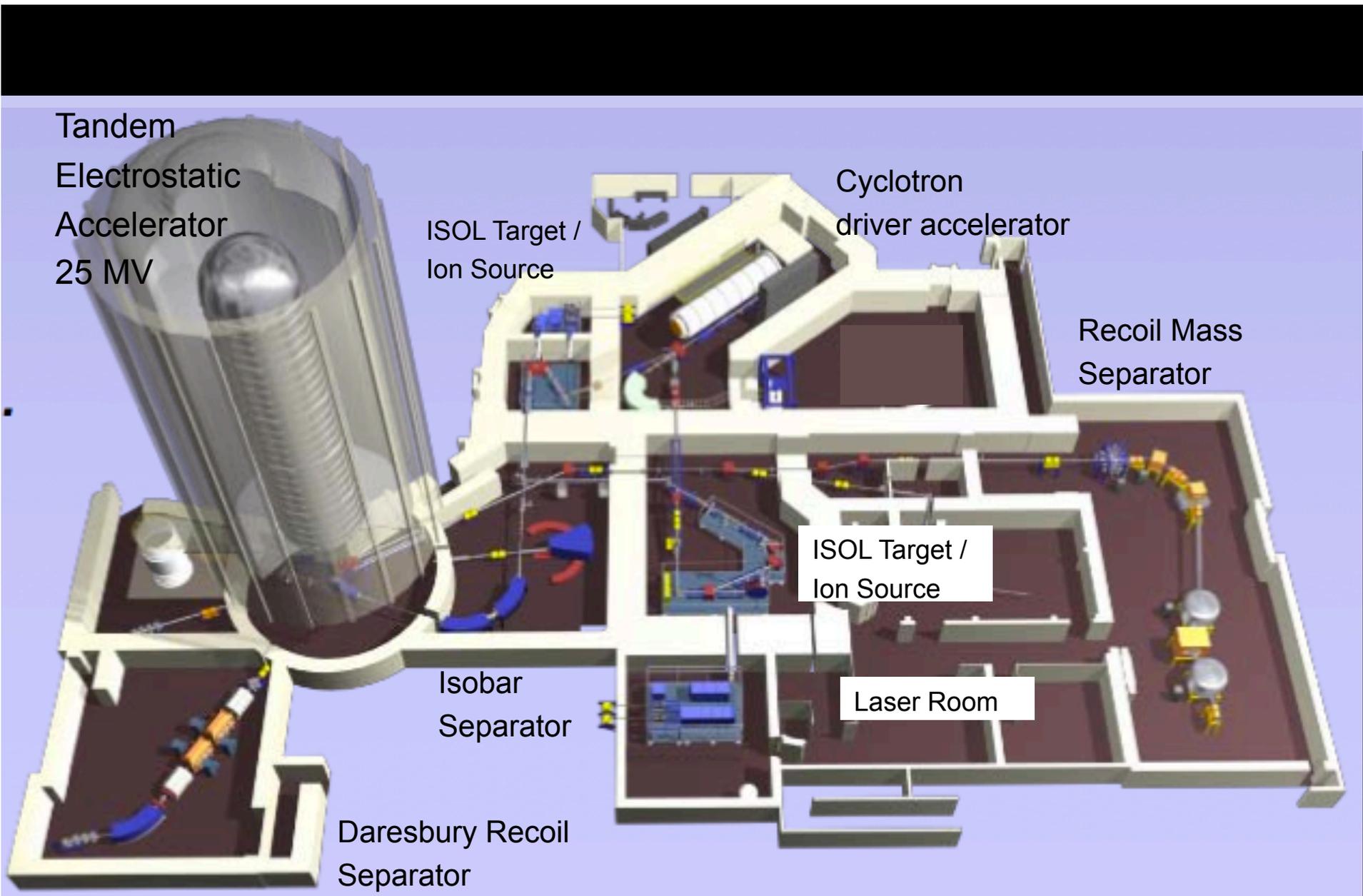
we WILL measure (d,n) reactions on proton-rich unstable nuclei
to mimic proton capture in the rp-process
in novae and X-ray bursts

VANDLE neutron
detector array



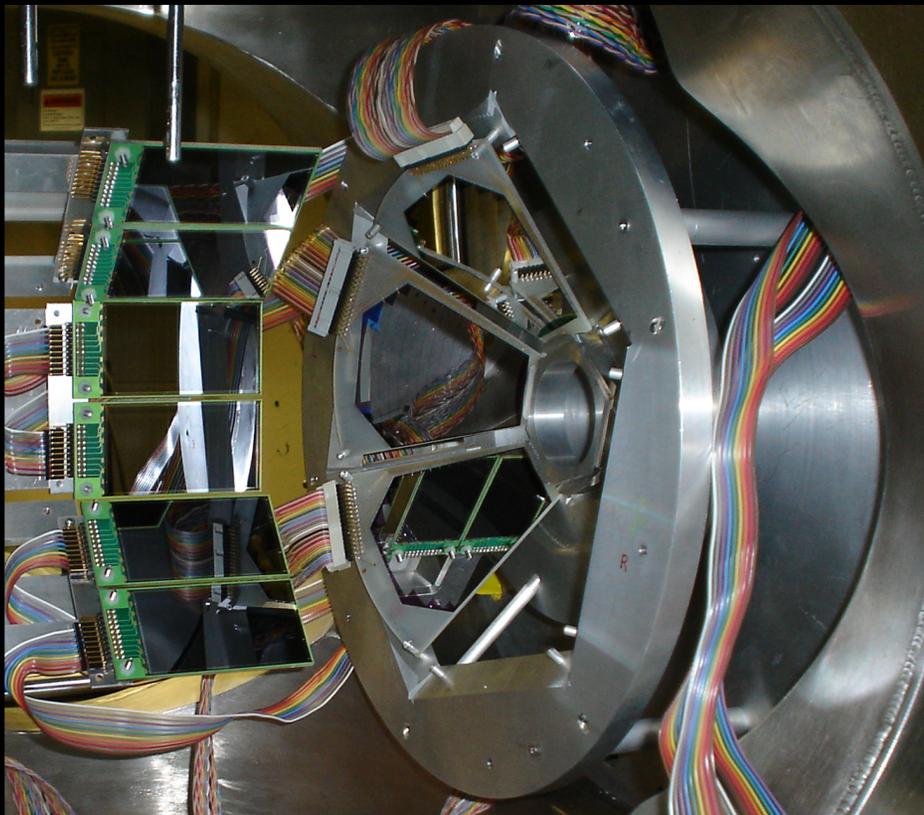
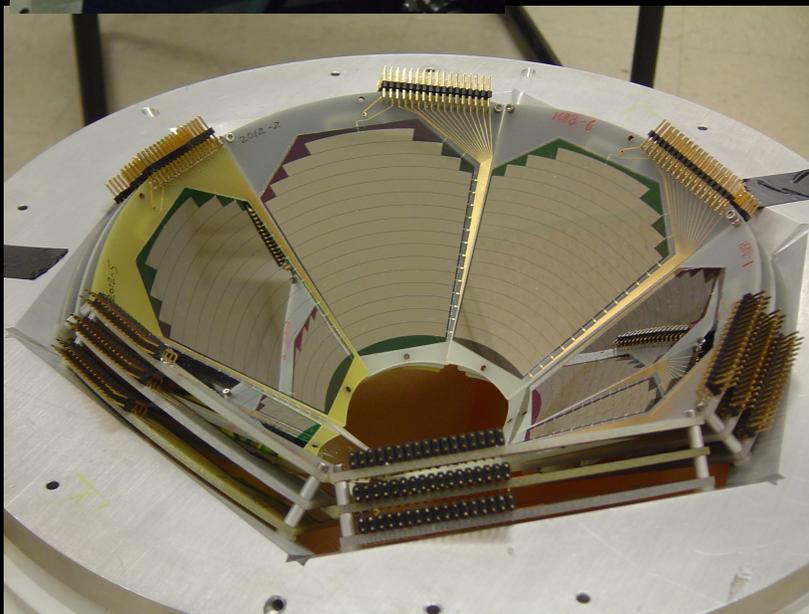
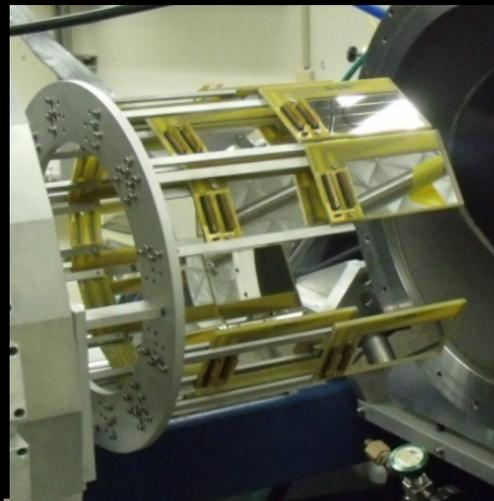
HRIBF

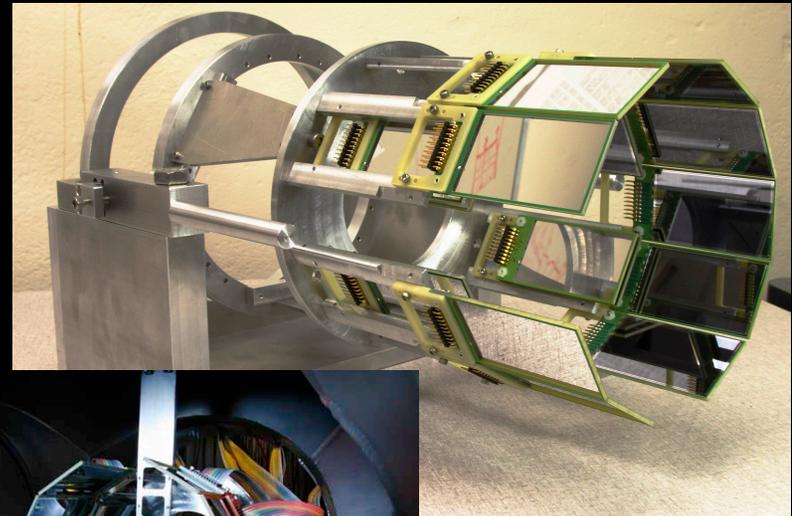
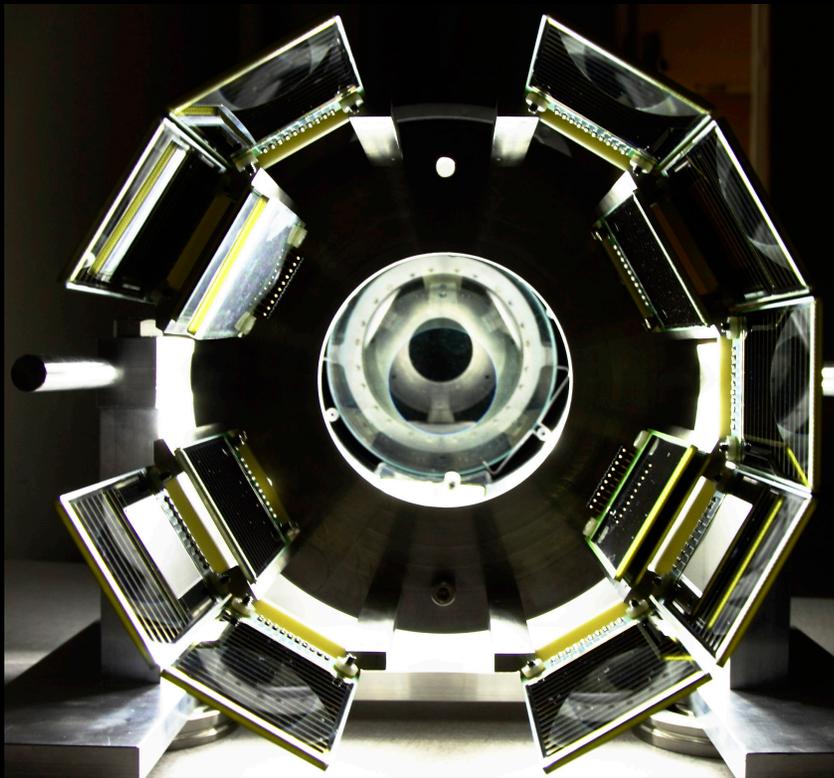




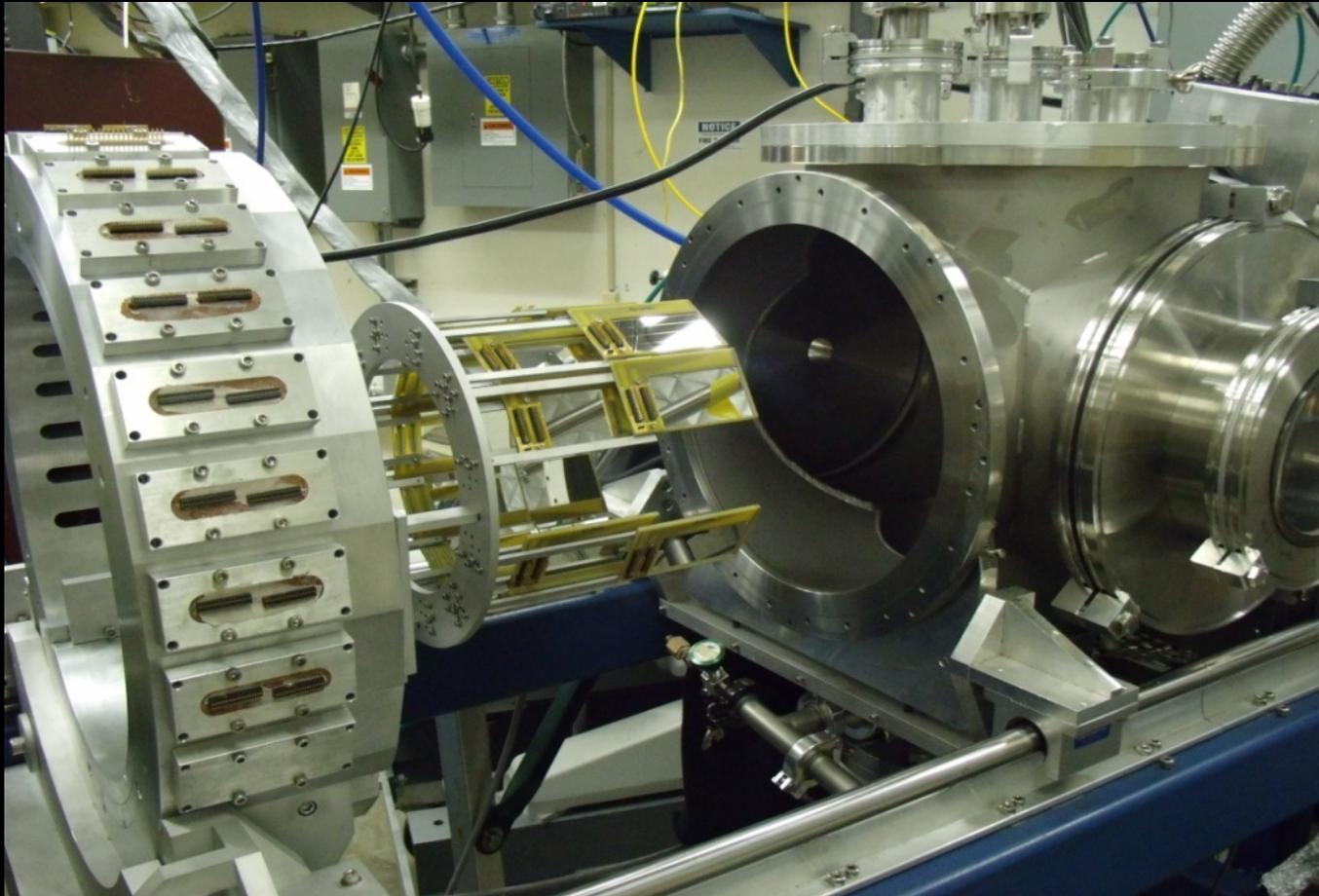
ORNL Holifield Radioactive Ion Beam Facility

to study such reactions, we continually develop detector systems with
more solid angle coverage
lower backgrounds
higher position / angular resolution





Oak Ridge Rutgers University Barrel Array
measurement of light charged particles
from transfer, scattering, (p,α) , (α,p) ... reactions

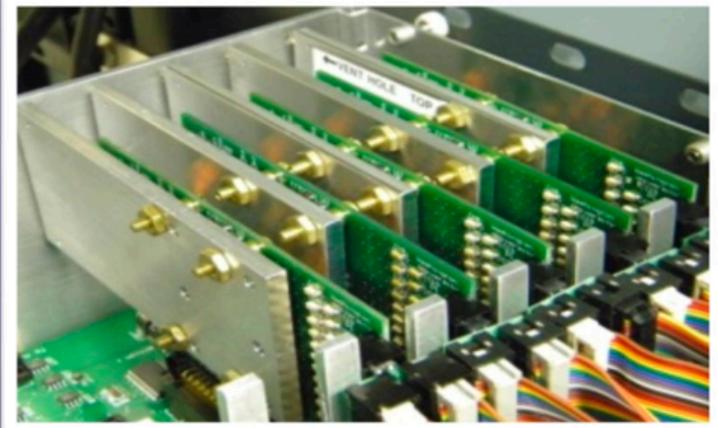


SuperORRUBA

measurement of light charged particles
from transfer, scattering, (p,α) , (α,p) ... reactions

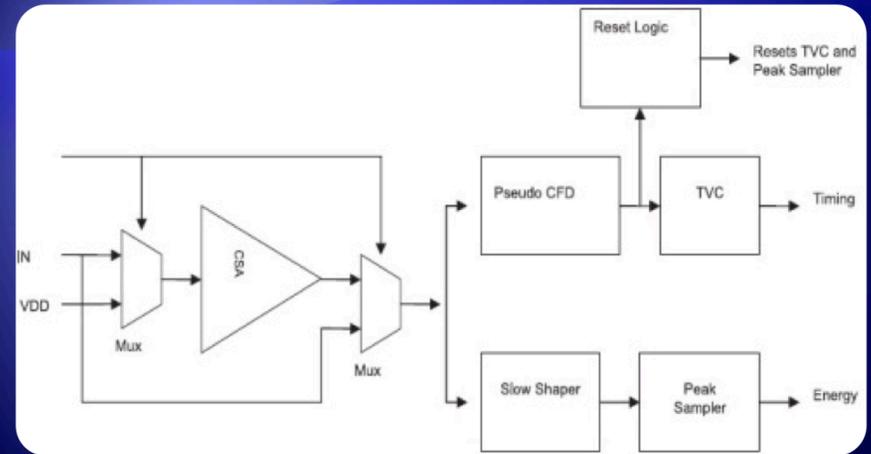


32 Ch Silicon Strip Chip Board



ASICs Array plugged in Motherboard

Application Specific Integrated Circuits ASICs



Block Diagram of a Single Channel in ASICs