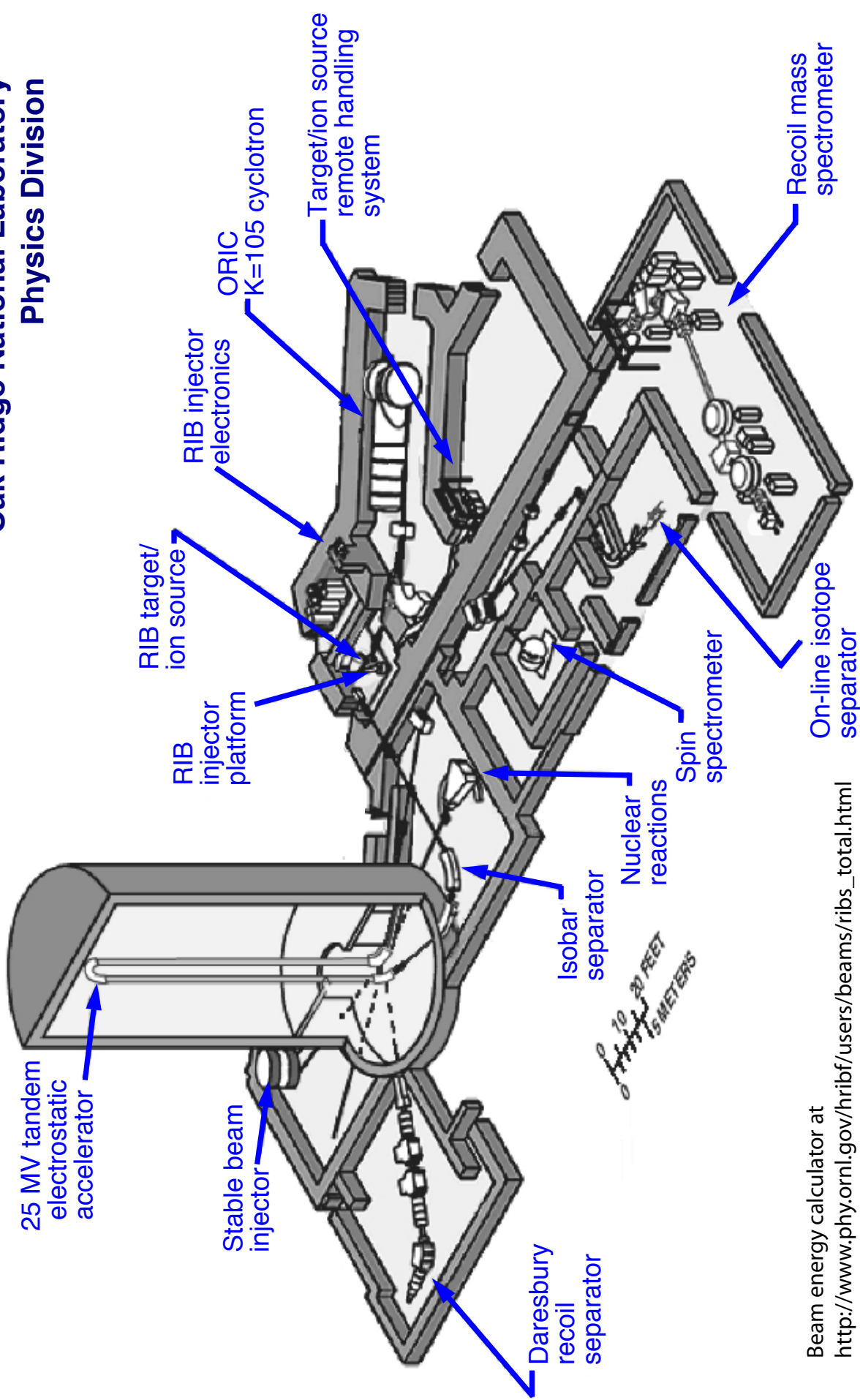


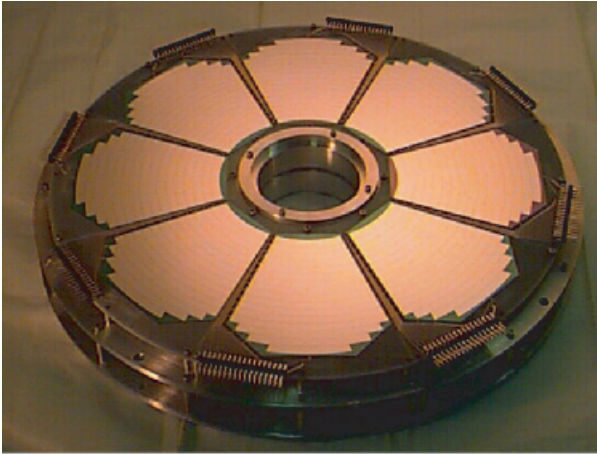
The Holifield Radioactive Ion Beam Facility

Oak Ridge National Laboratory
Physics Division



Beam energy calculator at
http://www.phy.ornl.gov/hribf/users/beams/ribs_total.html

Silicon Detectors



SIDAR - 8 segmented single-sided strip detector array
65, 100, 300, and 500 μm , 16 strips
Edinburgh electronics; Selina ADCS
~140 channels

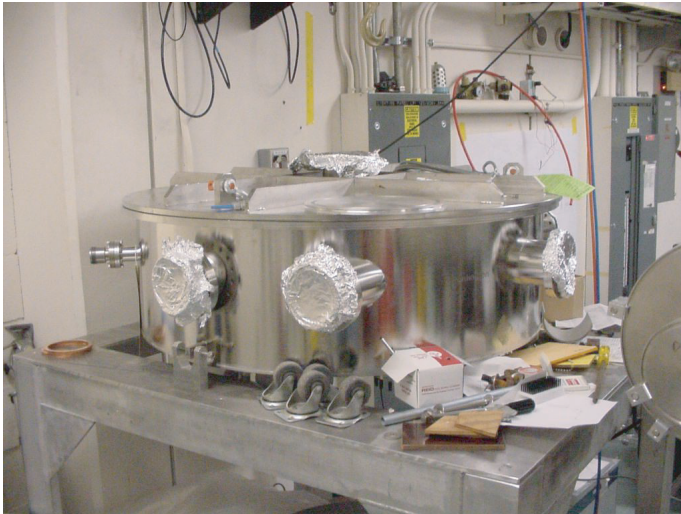
Forward Array - 6 segmented double-sided strip detector array with 16 annular and 8 wedge strips;
140 μm and 400 μm dE-E detectors
Locally designed electronics; CAEN ADCs and TDCs
~300 channels



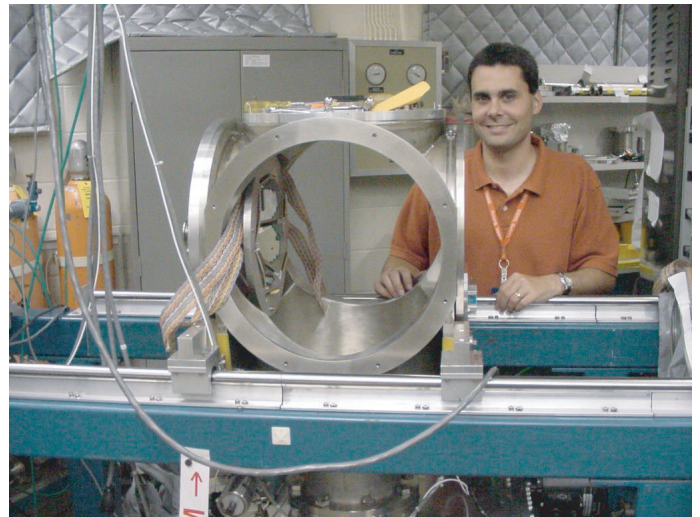
Smaller DSSDs and large area silicon detectors-
Rectangular (16x16, 40x40) and annular (48 annular and 16 wedge) double-sided strip detectors
95-element CsI detector array (PICO electronics and FERA ADCs)
Digital signal processing (XIA~ 100 channels) or analog signal processing

Target Chambers

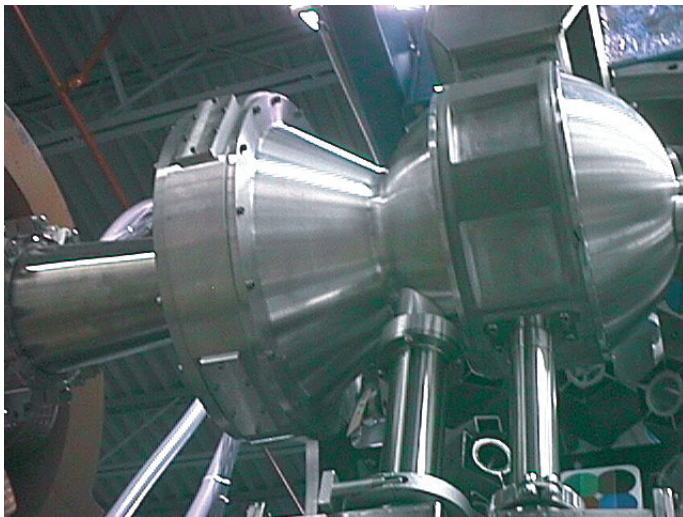
Scattering Chamber
1 m diameter; 30 cm deep



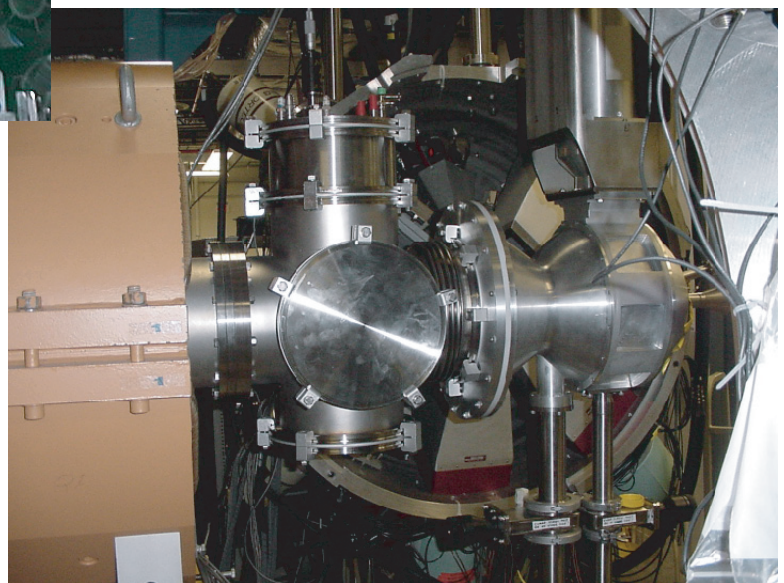
DRS scattering chamber



RMS target chamber

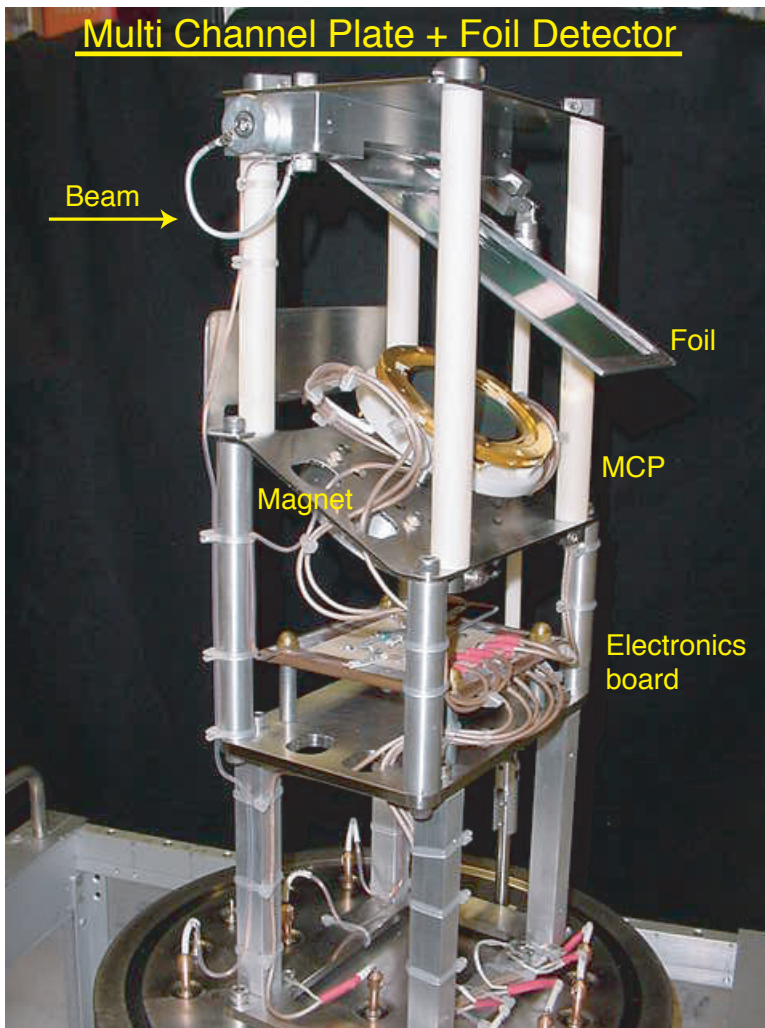


**RMS target chamber
with 8-in ID cross**



8-in ID crosses may be stacked in a row to create ToF system. MCPs were designed for crosses

Focal plane and time-of-flight detectors



~6 cm x 6 cm foil

4 cm diameter MCP

Position sensitive for focal plane and tracking

Excellent timing for coincidence measurements

Beam counters for low-intensity RIBs

Magnetic imaging for image compression or expansion

Efficiency at 1 MHz: ~100% for 370 MeV Sn

~ 60% for 170 MeV F

Working on 8 cm x 10 cm version for RMS focal plane

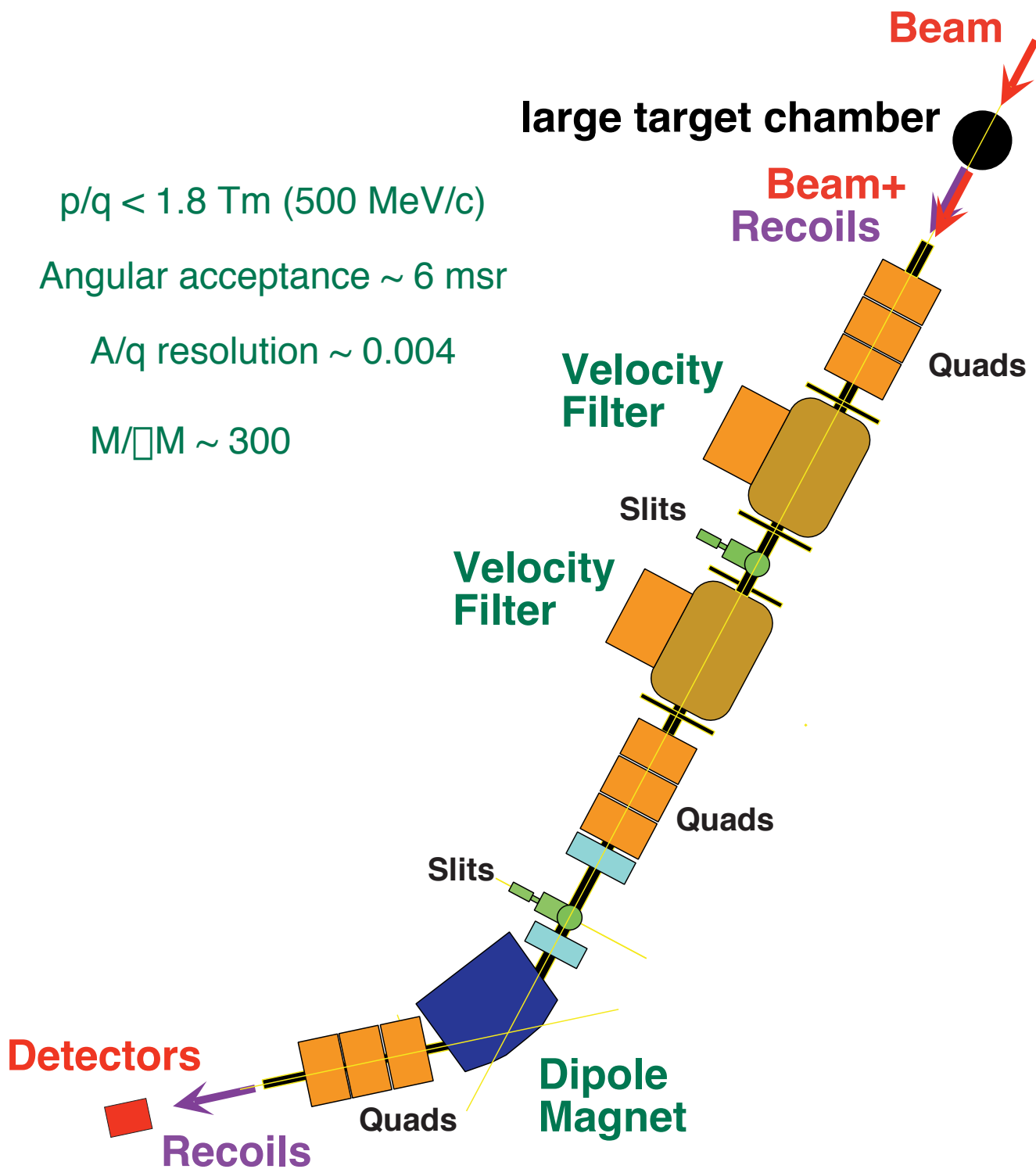
Daresbury Recoil Separator

$p/q < 1.8 \text{ Tm (500 MeV/c)}$

Angular acceptance $\sim 6 \text{ msr}$

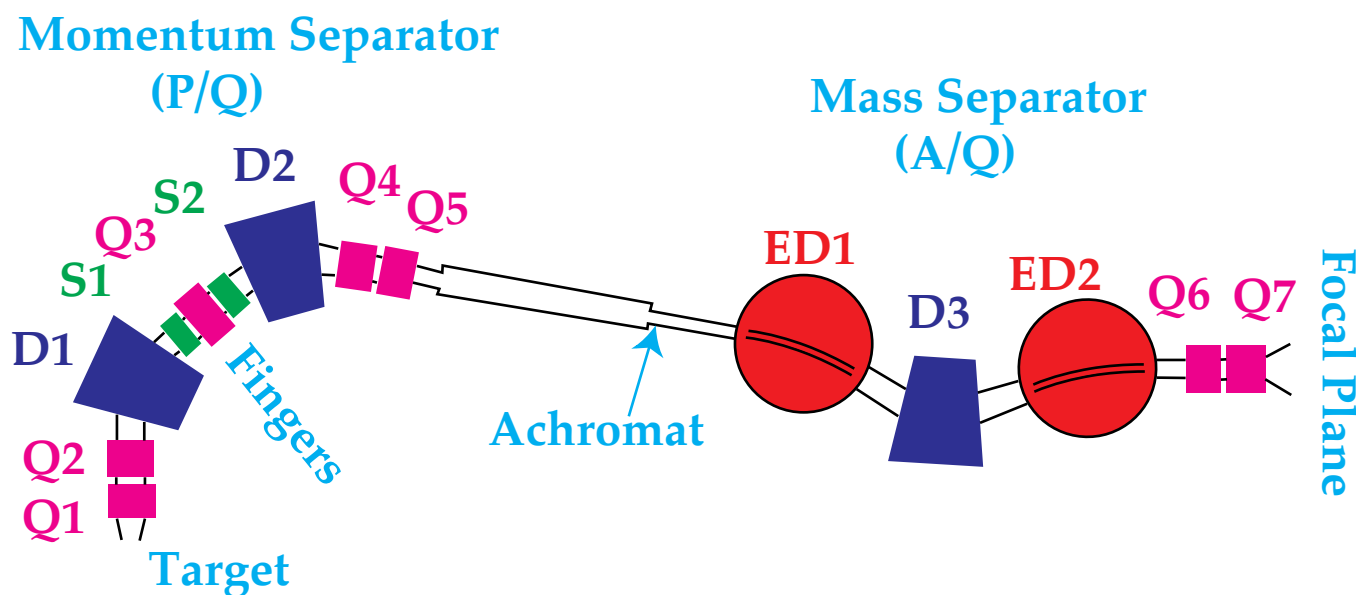
A/q resolution ~ 0.004

$M/\Delta M \sim 300$



HRIBF Recoil Mass Spectrometer

Comprised of two separators, the RMS can offer several measuring stations throughout its 25 m flight path. In transfer applications, the limiting elements are the electric dipoles which can handle ions with electrical rigidity (E/Q) of ~ 12



Performance Numbers

Energy acceptance: $\pm 10\%$

A/Q acceptance: $\pm 4.9\%$

Mass resolution ($M/\Delta M$): ~ 400

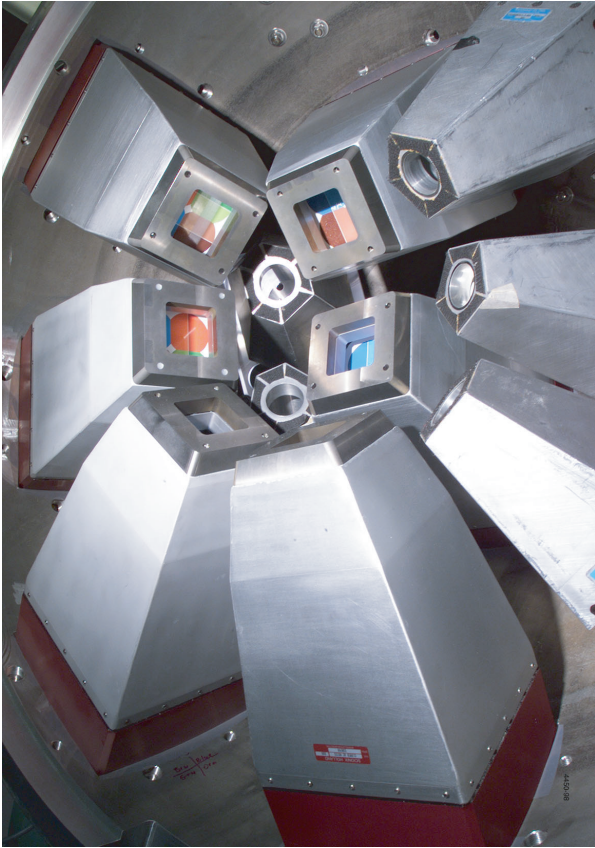
Overall reaction efficiency: Reaction dependent (typically around 5%)

Time-of-flight: 1.5-3 μs

Reference: Gross et al., NIM 450A, 12 (2000)

<http://www.phy.ornl.gov/hribf/research/equipment/rms>

Gamma Ray Detectors



CLARION

11 segmented Clovers

~2.2% efficient @ 1.3 MeV

Higher eff. possible with closer geometry

2.3 keV resolution at 1.3 MeV

Position sensitivity

Chamber has ~15 cm radius

with 30 cm fantail covering
+/- 30 degrees

Spin Spectrometer

70 large volume NaI

~80% efficiency @ 1.3 MeV

~10% energy resolution

Chamber has ~16 cm radius

energy resolution may be

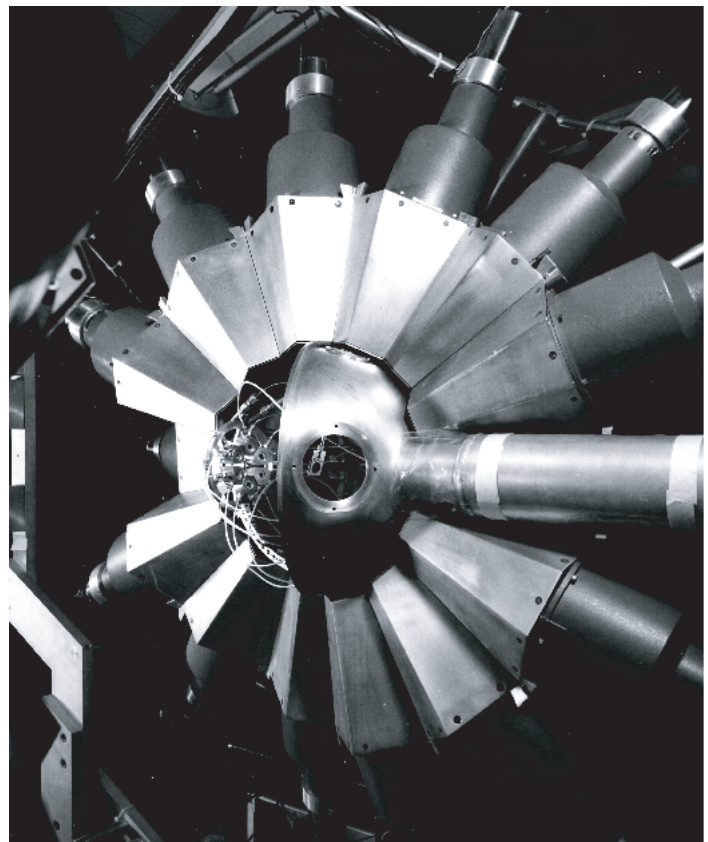
improved with new PMTs

Needs some work to improve

performance and get new

electronics (most should be

in-house)



Enge Magnetic Spectrograph

Traditionally used in normal kinematics transfer
16 kG magnetic field
MCP compatible
Small scattering chamber
PSAC, plastic scintillator or Bragg detector
Gas-filled and vacuum modes

