

CARIBU Decay Station(s)

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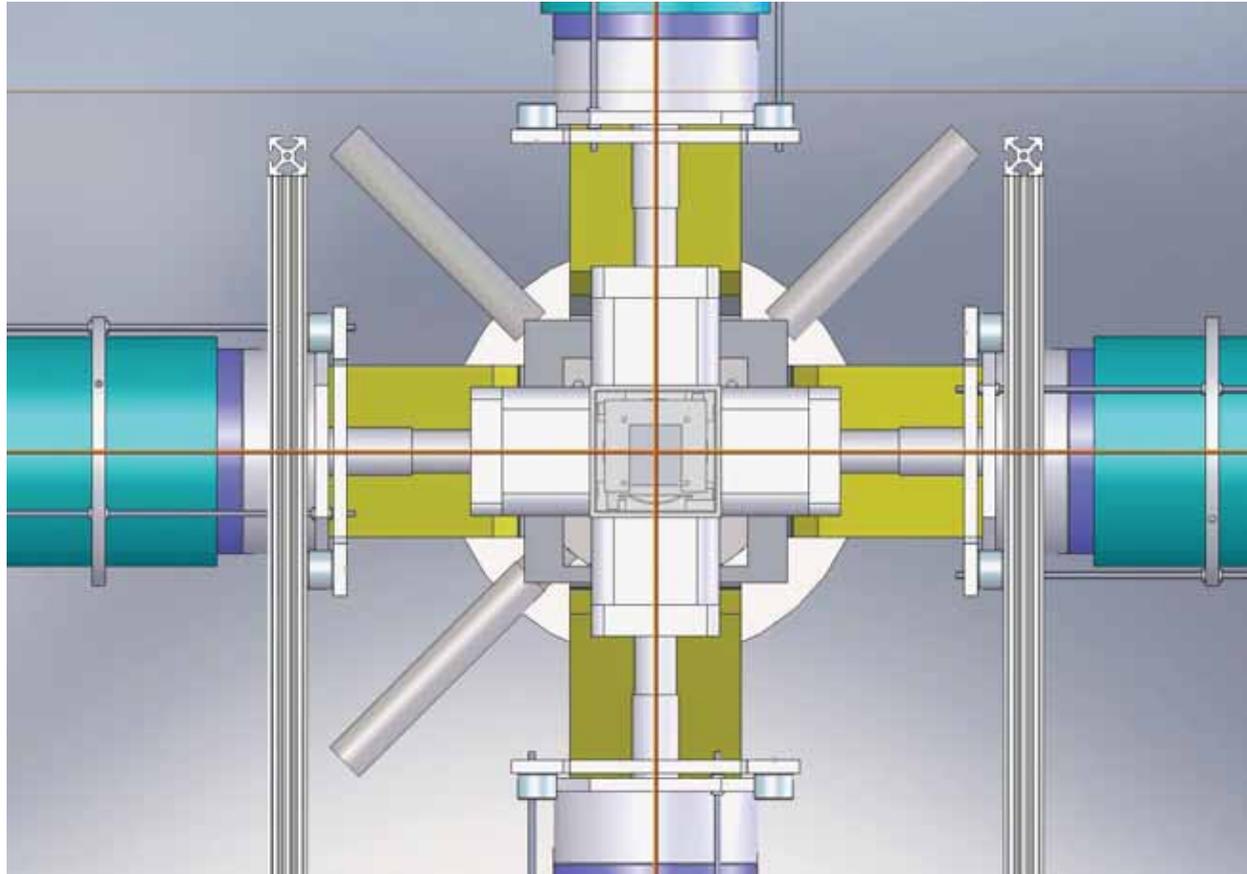
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CARIBU decay station(s)

CARIBU offers a unique opportunity to study beta decay of isobarically pure neutron rich ^{252}Cf fission products

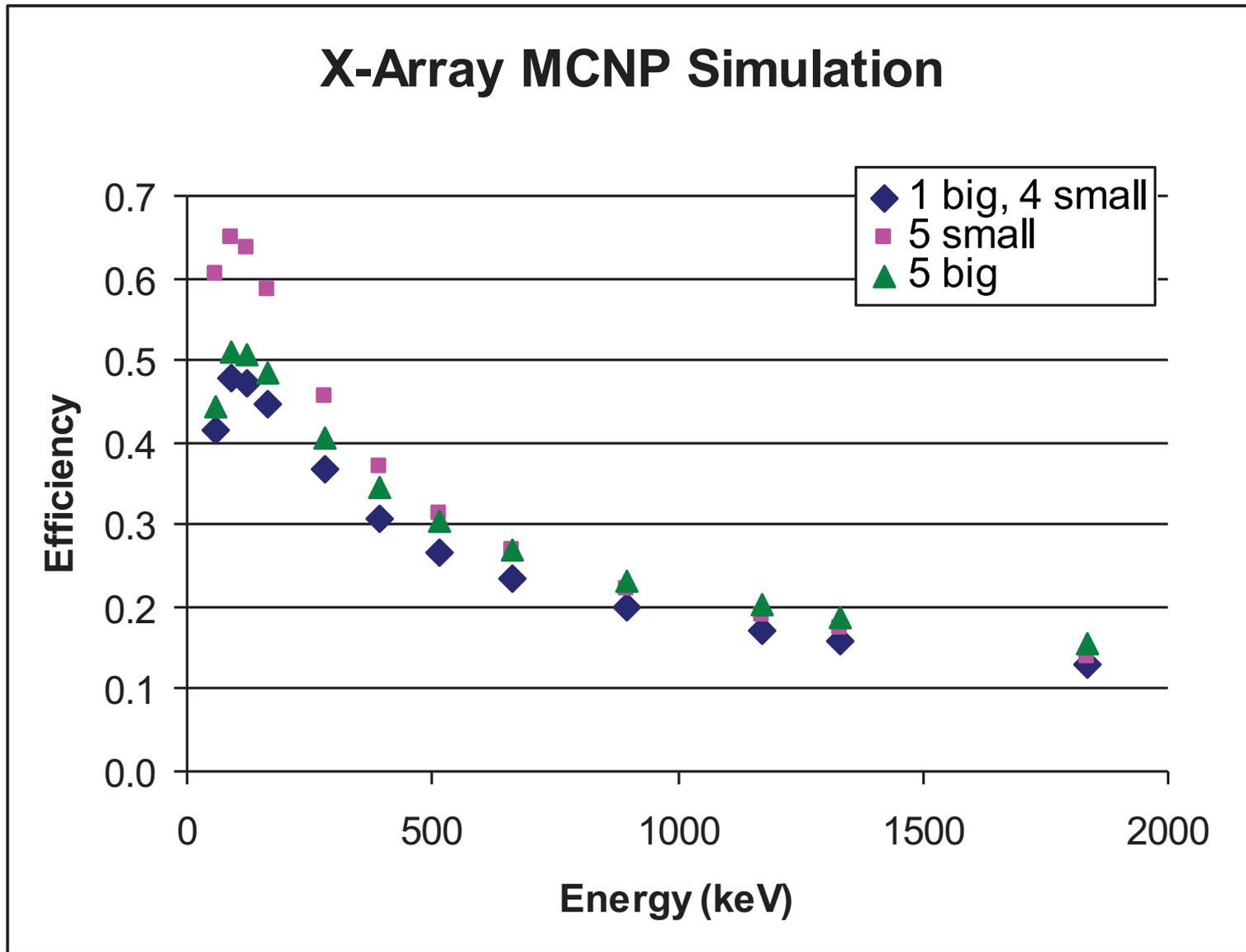
- **Ge detectors** – high-resolution gamma ray spectroscopy
- NaI - high-efficiency gamma-ray spectroscopy (M.L. Smith)
- LaBr – short life times, decent energy resolution
- **Si/Plastic detectors** – beta particles
- Neutron detectors - beta-delayed neutrons
- **Moving tape collector** – background reduction (P. Bertone)
- ...

X-array: decay station for CARIBU and FMA



- 5 clover detectors in a box geometry
- four 60mm x 60mm (~200% each) and one 70mm x 70mm (~300%)
- Funded from Base equipment, ARRA-Funds, ~1\$M total

Efficiency Simulations

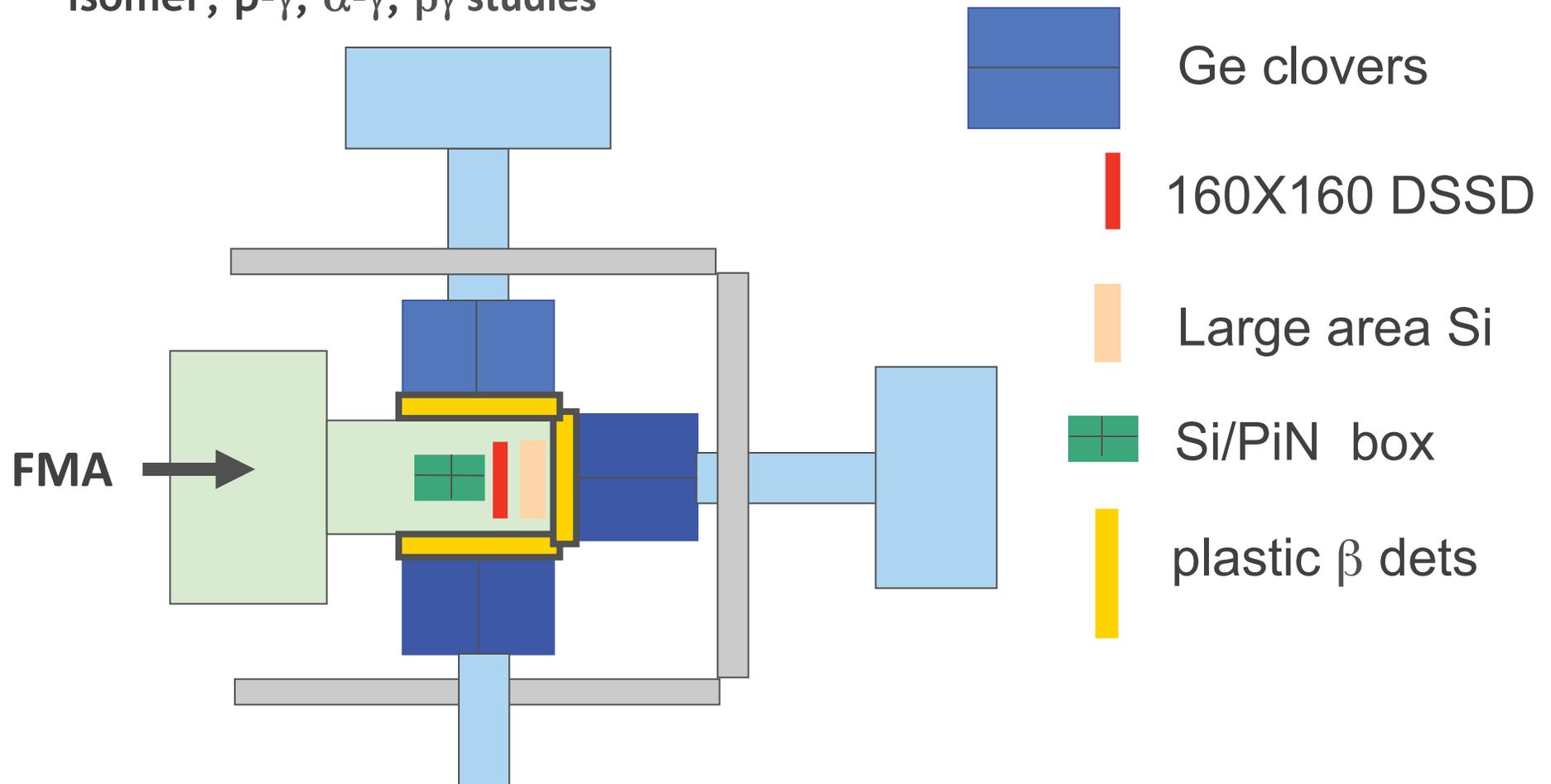


X-array features

- Each detector can be moved in and out independently
- The whole array can be moved in and out
- The whole array can be easily transported between different experimental areas
- All electronics except ADCs are on board
 - Wiener HV
 - Mesytec shaping amps
 - Mesytec CFDs
 - 8k ORTEC ADCs
 - 4k Phillips TDCs 800 ns range
 - 48-bit microsecond latching scaler
- Automatic LN₂ filling system

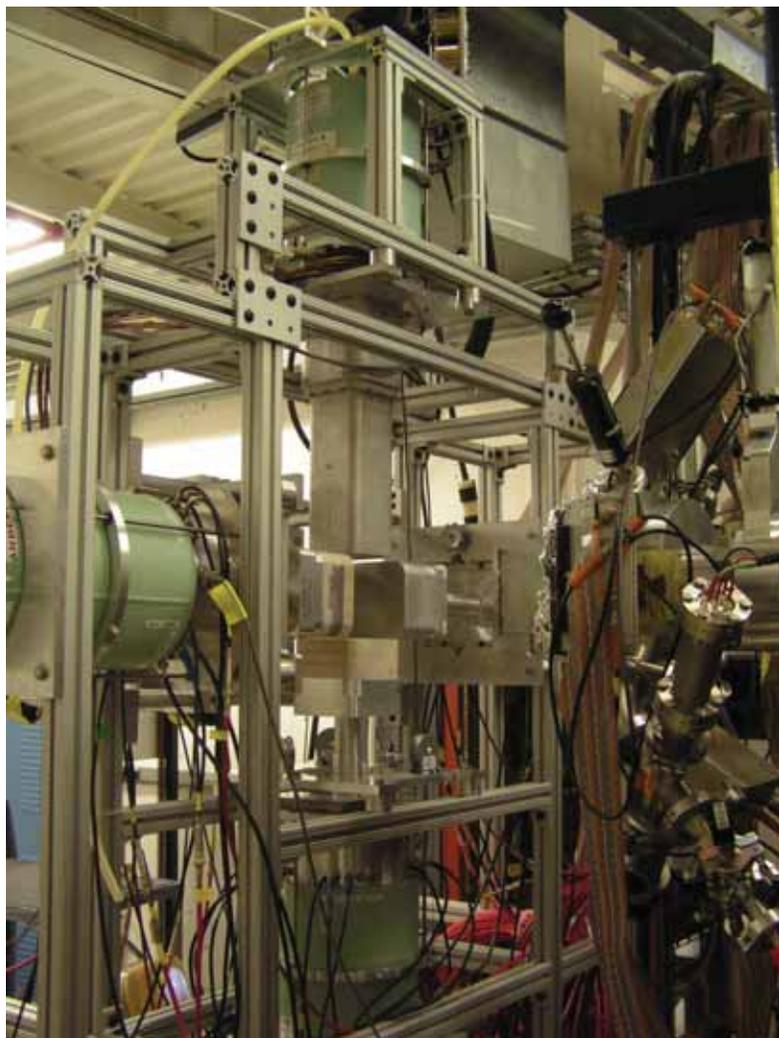
FMA Implantation-decay station

isomer, $p\text{-}\gamma$, $\alpha\text{-}\gamma$, $\beta\gamma$ studies

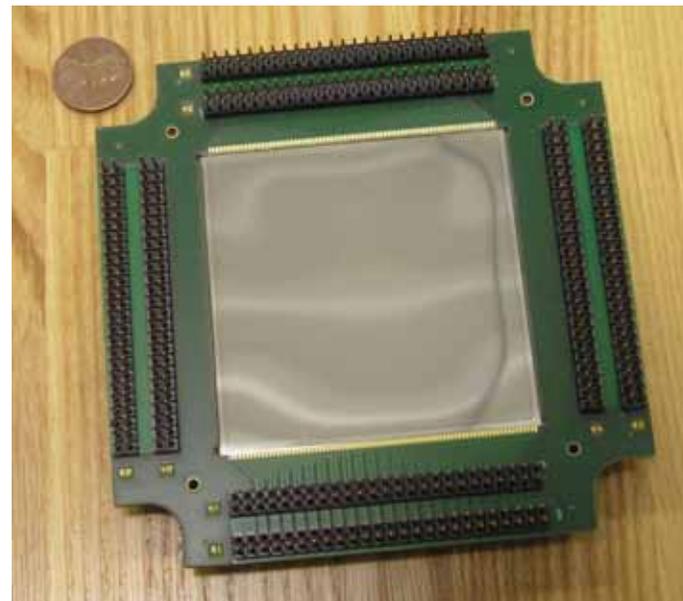


Small implantation area, good solid angle coverage

FMA implantation station

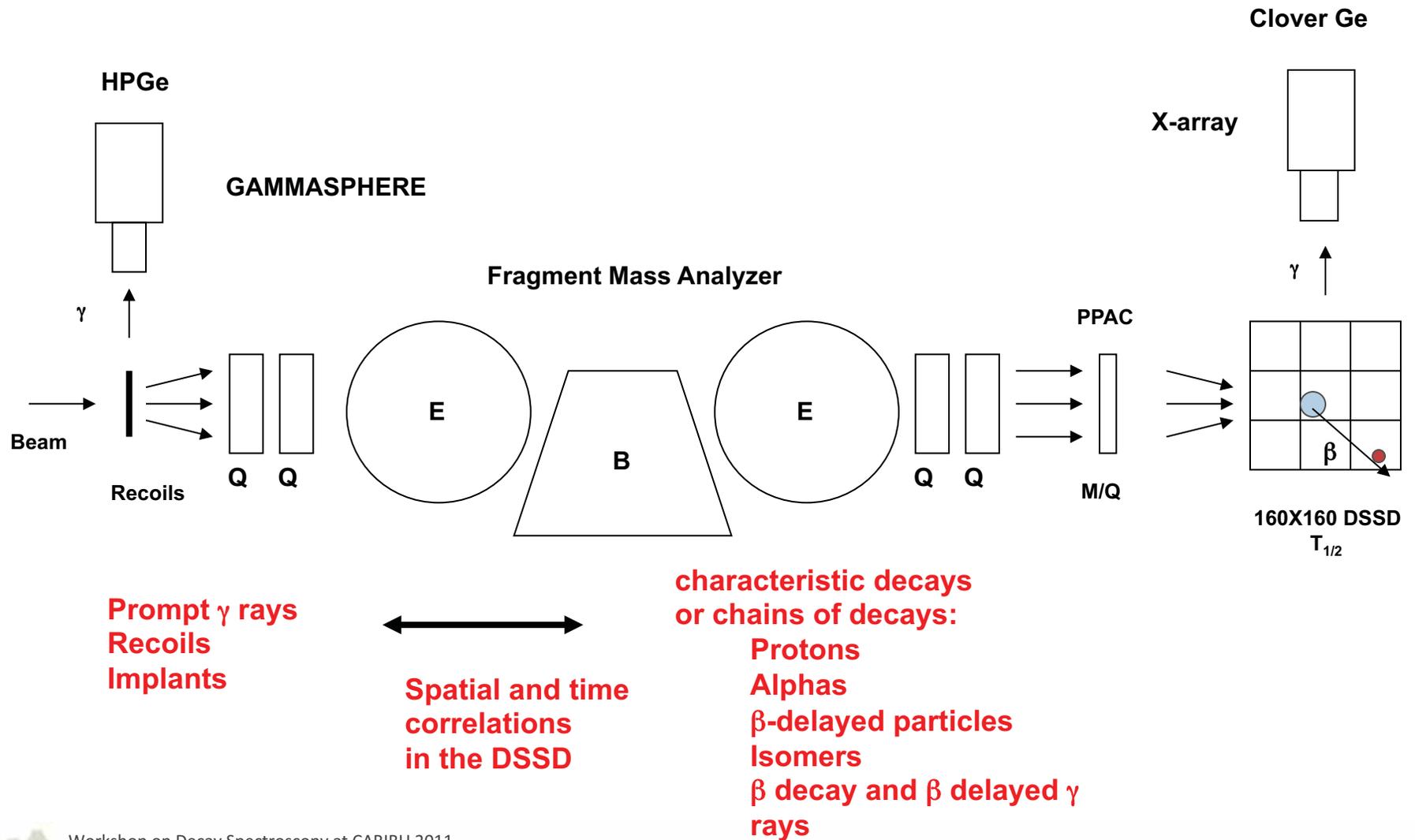


X-array - 5 clovers in box geometry

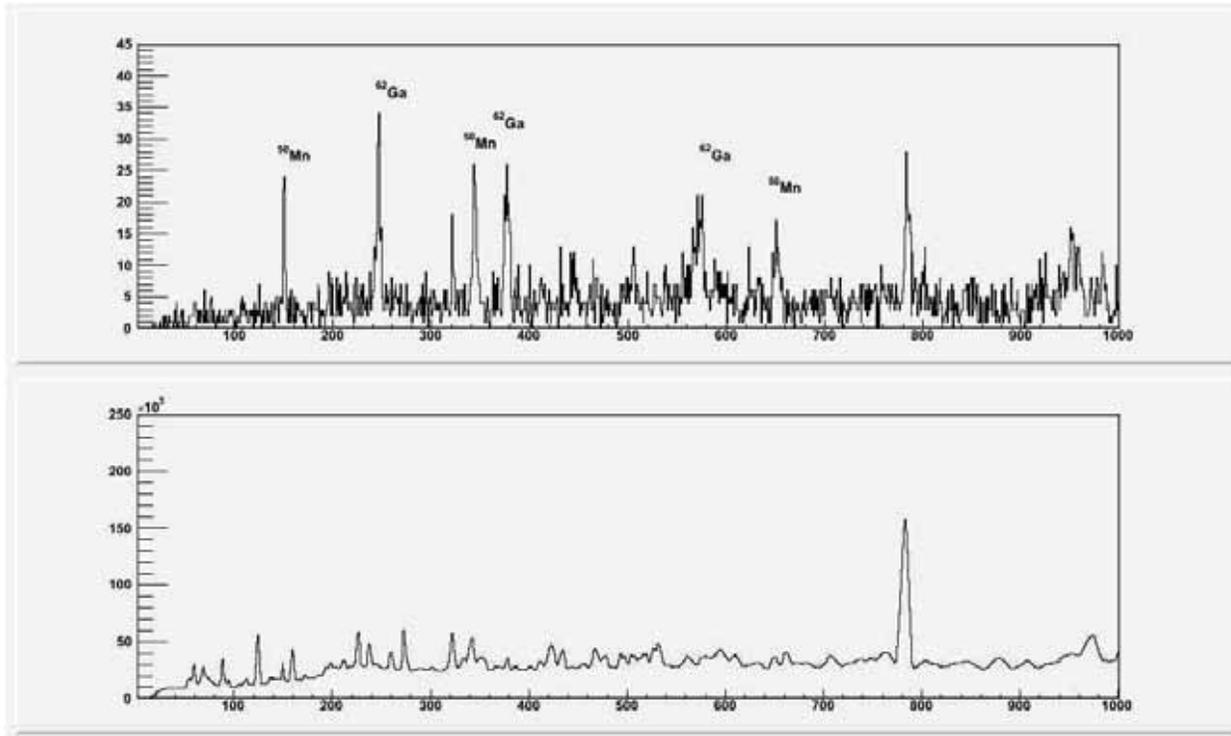


DSSD 160X160, 64X64mm²

Recoil-Decay Tagging



Recoil Beta-Gamma Tagging GAMMASPHERE-FMA-X-array



^{62}Ga 116 ms
 ^{50}Mn 283 ms

Total
projection

Prompt γ rays from the $^{40}\text{Ca}+^{24}\text{Mg}$ reaction

Tagging prompt γ rays in GAMMASPHERE with “fast” proton-rich β emitters, by correlating implants with betas in the DSSD and β -delayed γ rays in X-array at the FMA focal plane

X-Array Status



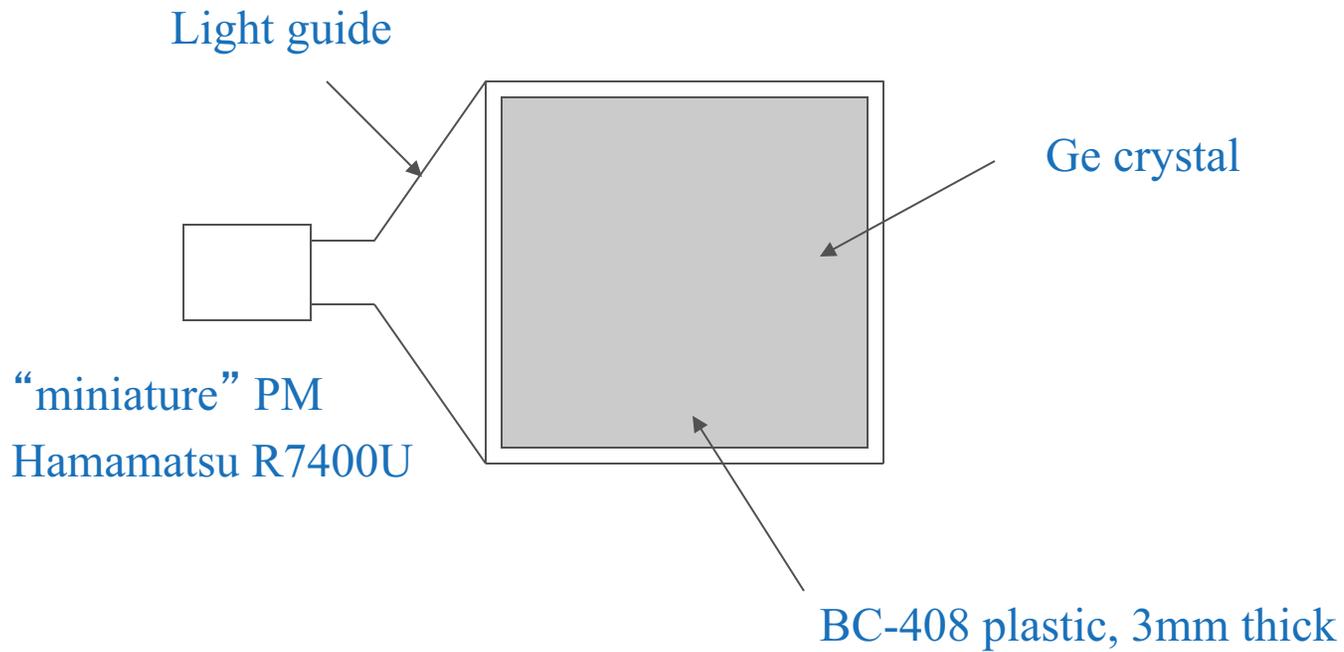
- All detectors working
- Characterization (Efficiency, Resolution, “add-back”, stability etc) in progress
- beta-veto plastic paddles (Seweryniak, Rogers)
- Thick beta detectors
- LaBr₂ fast-timing counters (Zhu, Kondev)

You can see it during the tour.



Plastic “paddles”

to identify beta particles entering a Ge detector



The set of 5 which fit inside the X-array and are mounted in front of each clover.

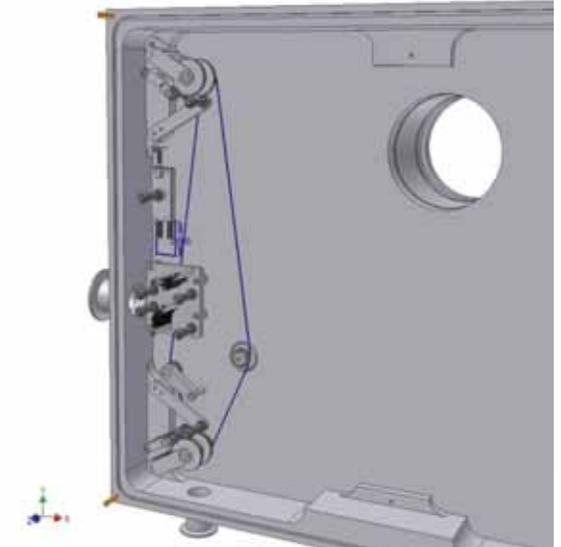
Tape Transport System

Brad DiGiovine, Peter Bertone

Based on LSU design, as used at ISAC, ORNL, Orsay etc, with modifications for high speed motion. ($\sim 5\text{m/s}$)

THREE systems will eventually exist:

- CARIBU diagnostic tool
- ATLAS diagnostic tool
- Research:
 - Decay Beamline for TAGS and X-Array
 - FMA Focal Plane
 - Gammasphere



Tape Transport Status

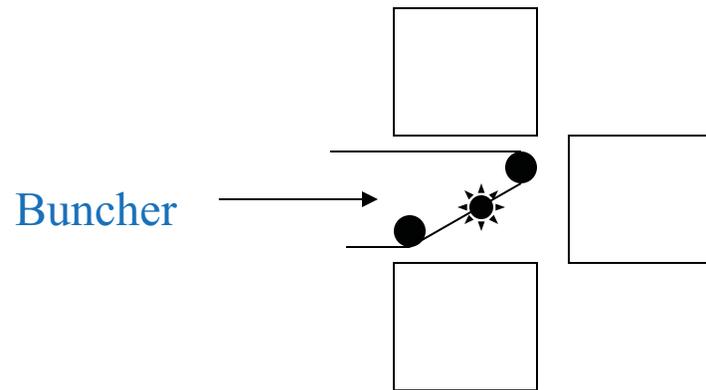


First tape station laboratory tested and now deployed at CARIBU

TASKS

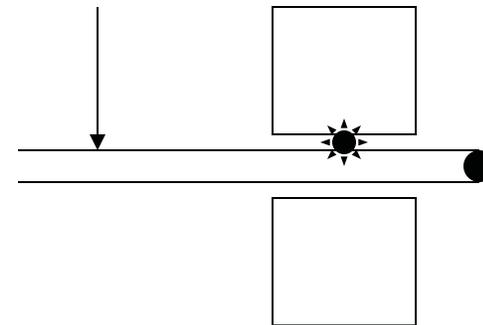
- Test long-running stability in-situ
- Determine ultimate maximum speed
- Install plastic and Si-detectors
- Install germanium counters (TWO)
- Install “Scarlet” data acquisition and collect β - γ coincidences in-situ
- Investigate shielding
- Multi-scale spectra
- Full test of deflector / tape system

X-array + MTC configurations



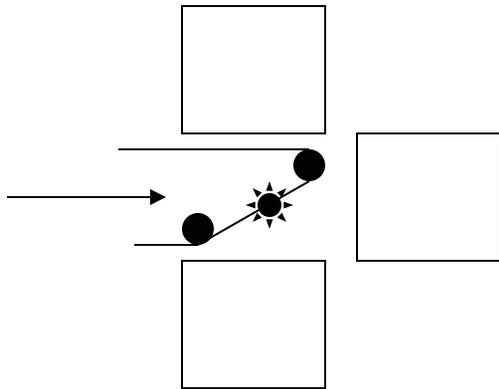
- detectors at the deposition point
- Deposit-measure+accumulate-move+accumulate
- Tape movement can be faster
- Shorter life times
- box geometry to accommodate other detectors

Buncher

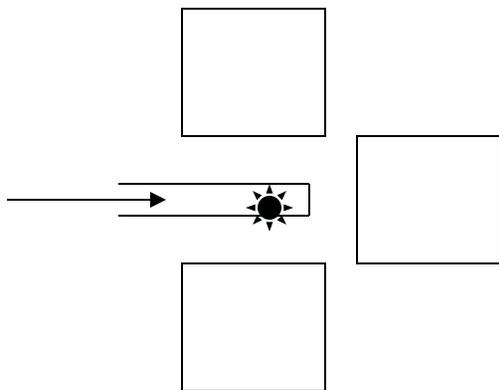


- detectors away from the deposition point
- Deposit-move+accumulate-measure+accumulate
- Longer life times
- close geometry

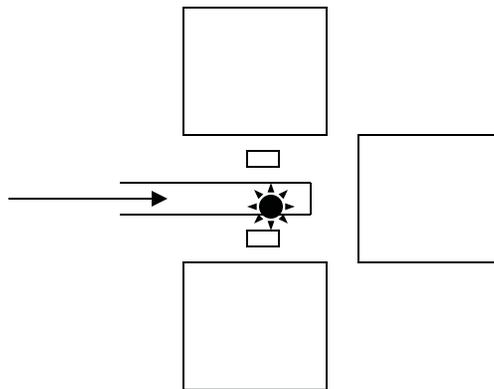
Given that the sample preparation takes place in a buncher
the detection around the deposition point might be sufficient



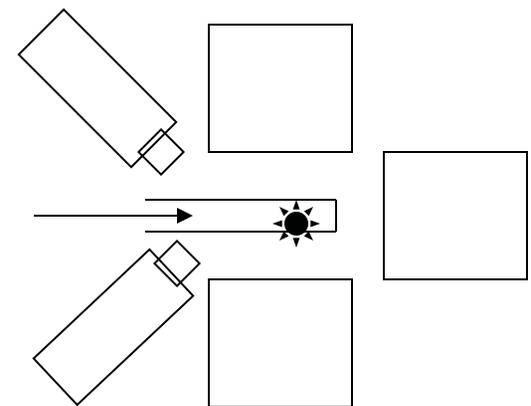
Top view



Ge detectors



Si/Plastic beta detectors



LaBr detectors

Side views

Important experimental considerations

- Fission fragment yields
- Isobaric purity
- Room background
- Transport time
- ...



**Your comments and suggestions
would be greatly appreciated.**

Thank you for your attention!



