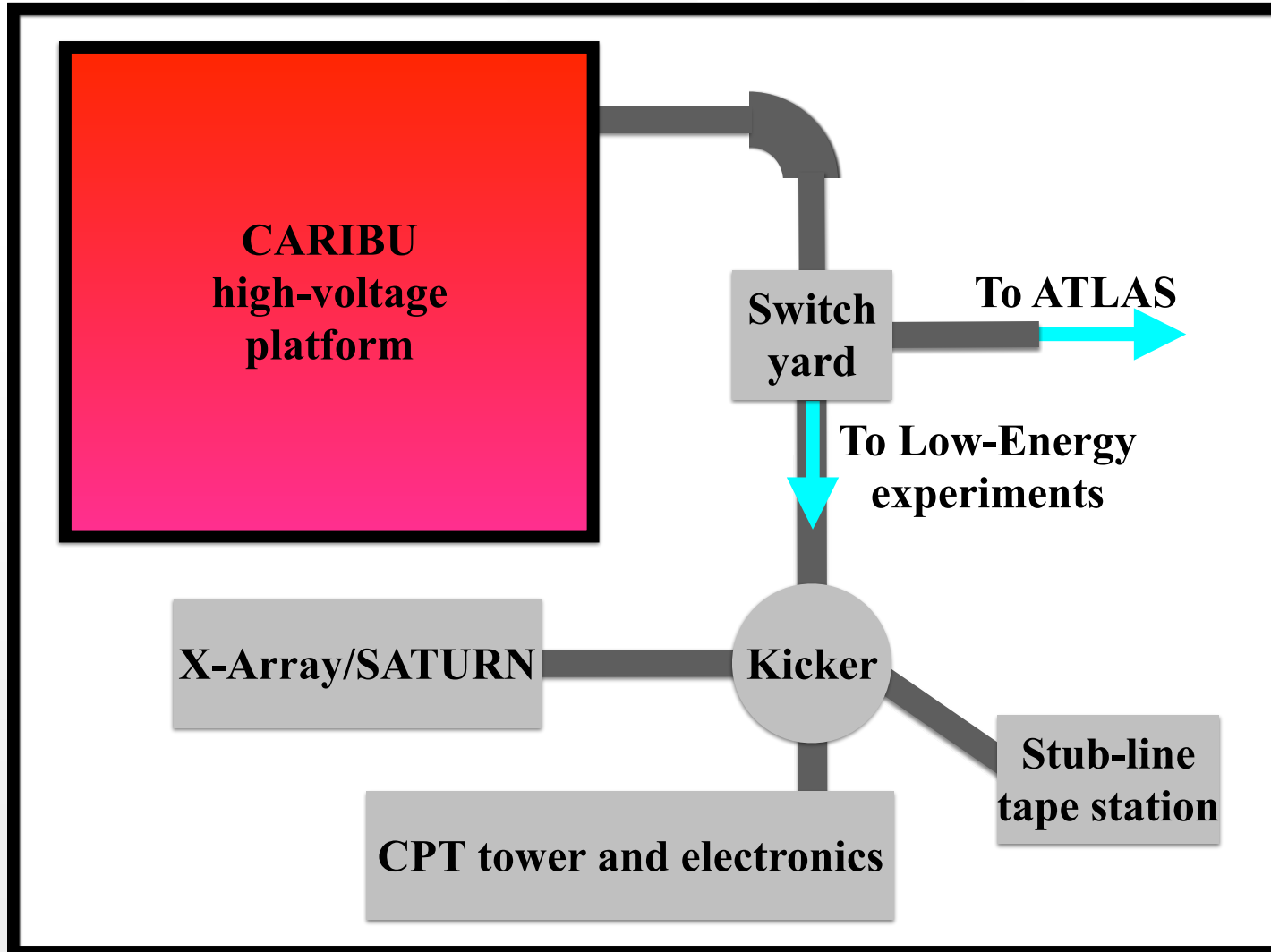# The X-Array and SATURN:
A new decay-spectroscopy station for CARIBU

AJ Mitchell

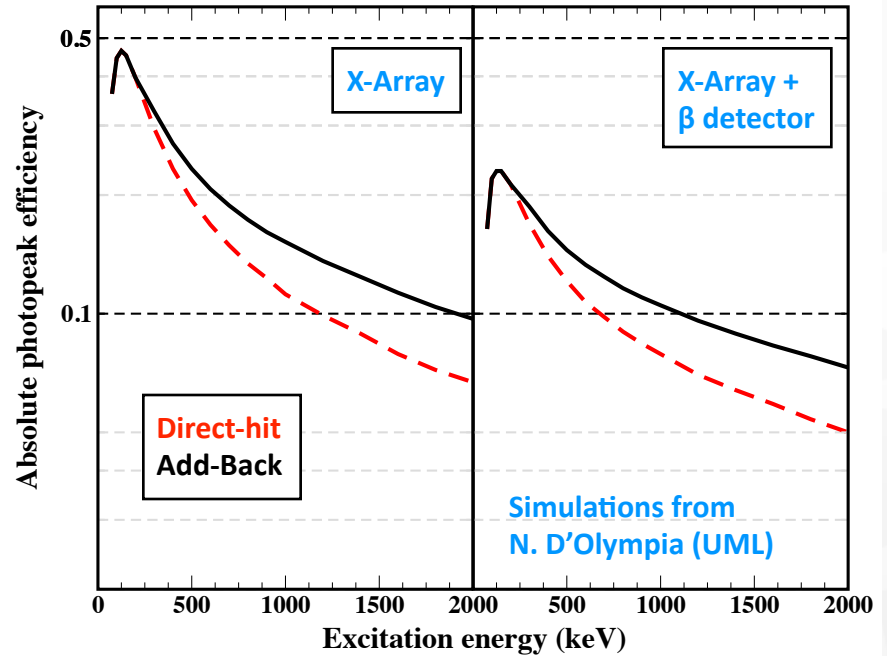University of Massachusetts Lowell

ATLAS Users' Meeting 15 May 2014

Email: Alan_Mitchell@uml.edu

Learning with Purpose

The CARIBU hall

The "X-Array" @ CARIBU

- **Five HPGe clover detectors**
  4 of 60x60 mm and 70x70 mm SuperClover
- **Large solid-angle coverage**
  ~ 65 % of 4π
- **High photopeak efficiency**
  ~50 % @ 122 keV, ~10% @ 1332 keV

β-particle detection

"Mark 1" chamber

Collimation

4 PMT modules

6-mm Al chamber

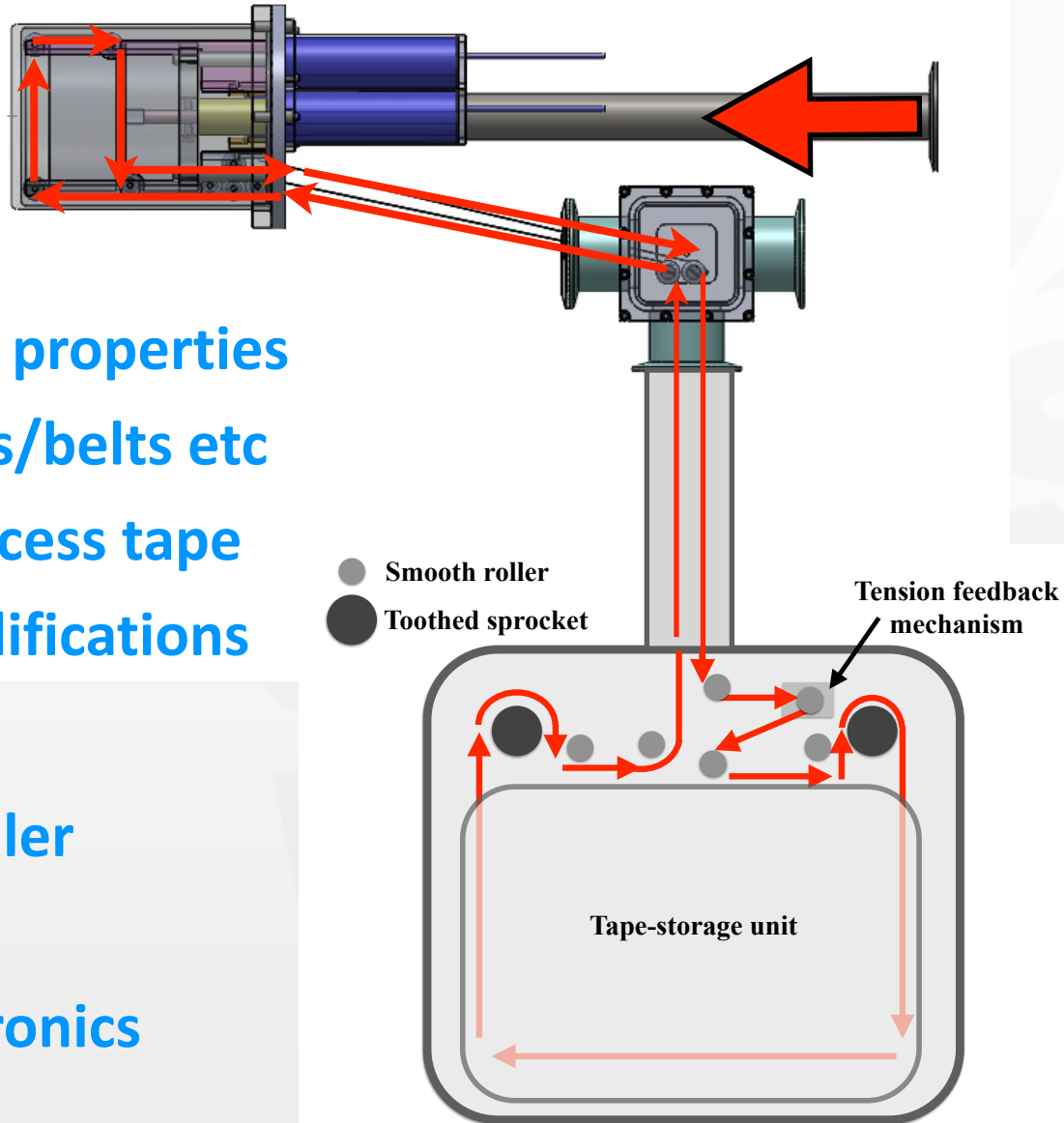Light guides

10-cm dia. x 10-cm long BC-408 plastic scintillator

6-mm thick BC-408 plastic "paddles"

UMASS LOWELL
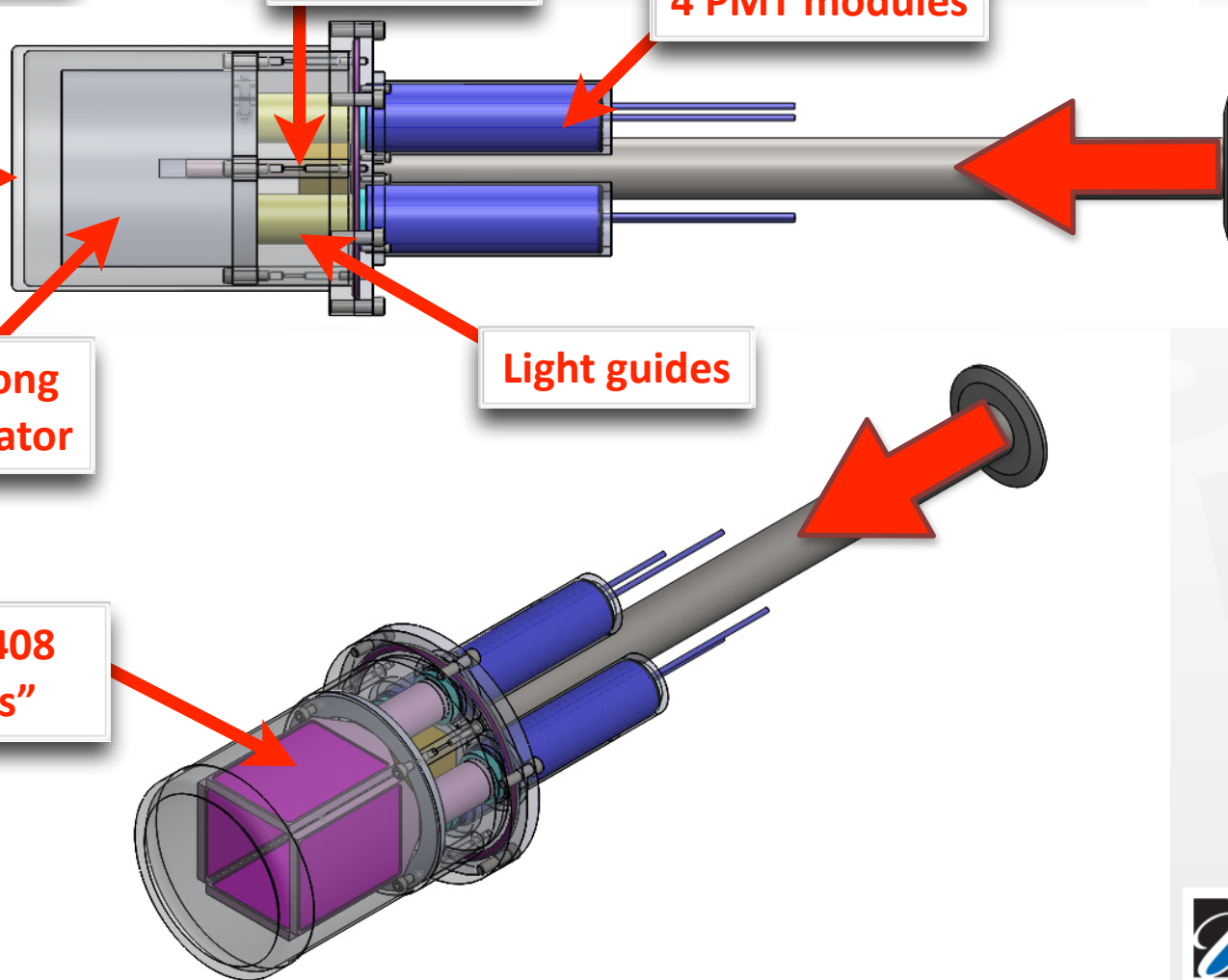
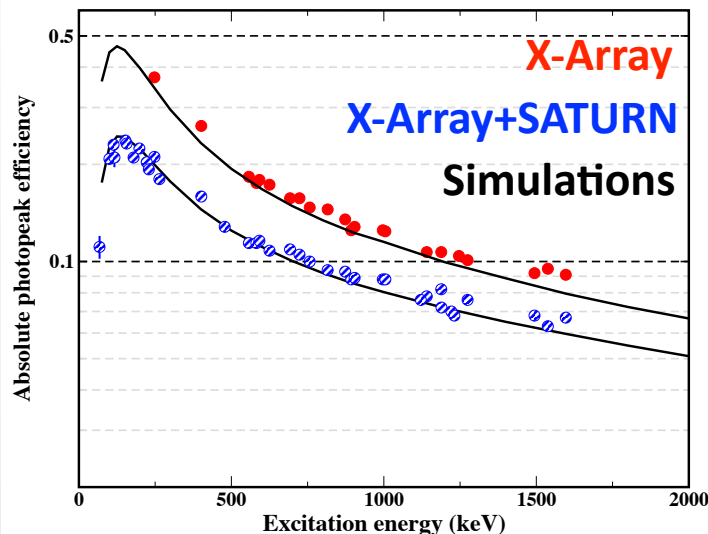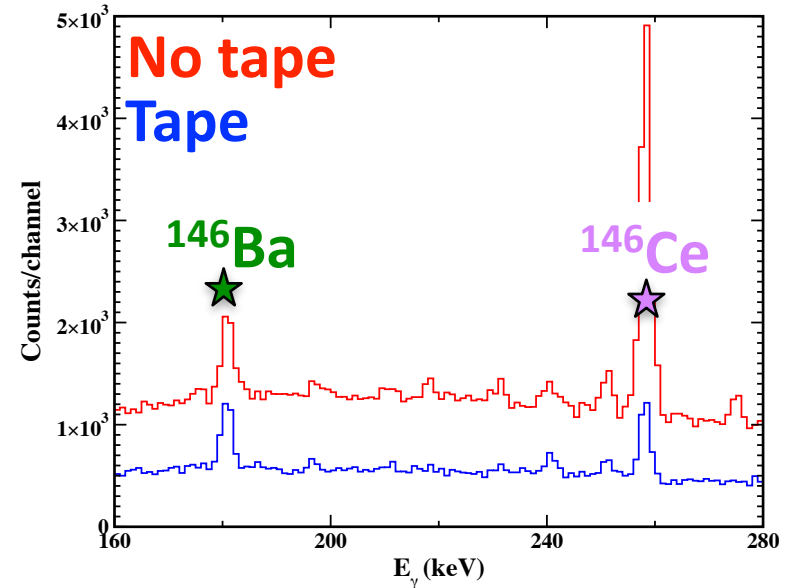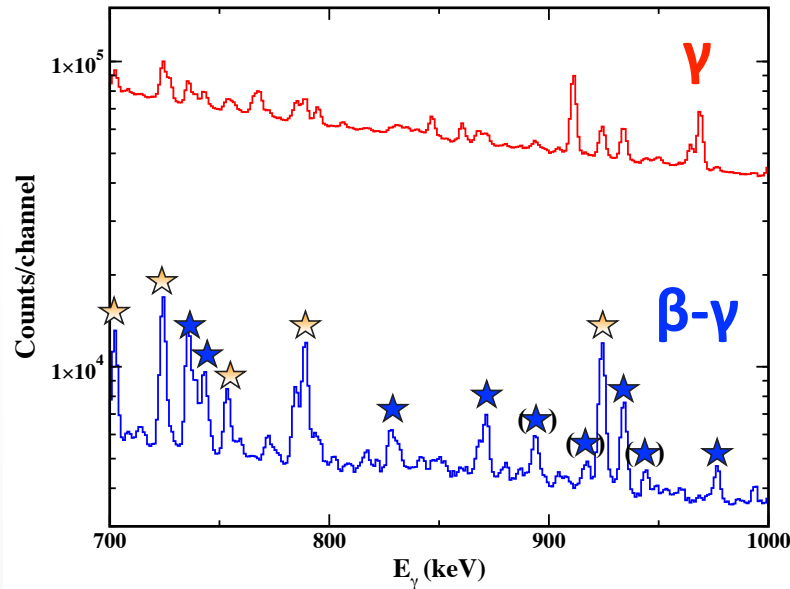# Long-lived radiation removal

"SATURN"

- **Hardware:**
  - ▷ **Good vacuum properties**
  - ▷ **Motor/pulleys/belts etc**
  - ▷ **Storage for excess tape**
  - ▷ **Chamber modifications**
- **Control system:**
  - ▷ **Motor controller**
  - ▷ **PLC**
  - ▷ **DDAQ + electronics**

Smooth roller

Toothed sprocket

Tension feedback mechanism

Tape-storage unit

Commissioning (preliminary analysis)

- $^{142\text{-}146}$**Cs -> $^{142\text{-}146}$Ba**
  - ▷ **γ-singles, β-γ**
  - ▷ **γ-γ, βγγ coincidences**
  - ▷ **With/without tape**
  - ▷ **γ-t, β-γ-t**

Determining half-lives

Stub-line tape station

X-Array/SATURN

^{142}Cs

^{144}Cs

Measured: 1.68(2) s
Adopted: 1.684(14) s

Measured: 0.994(4) s
Adopted: 1.00(4) s
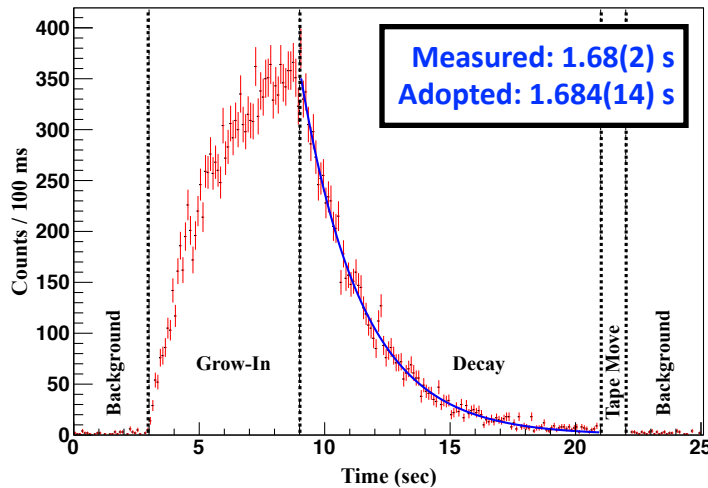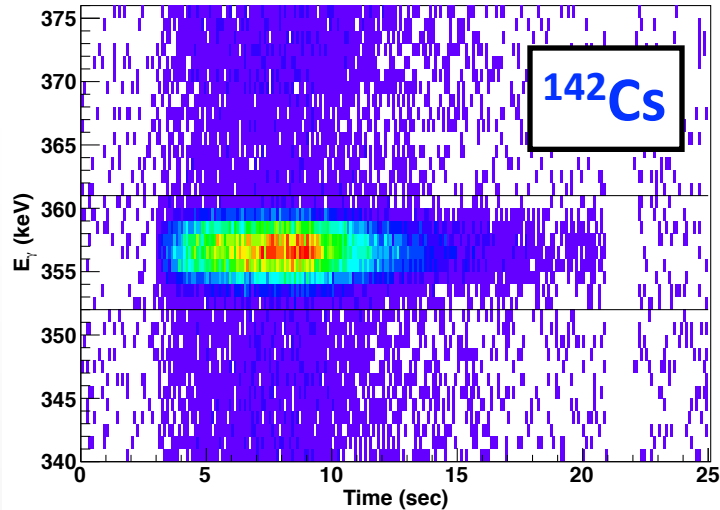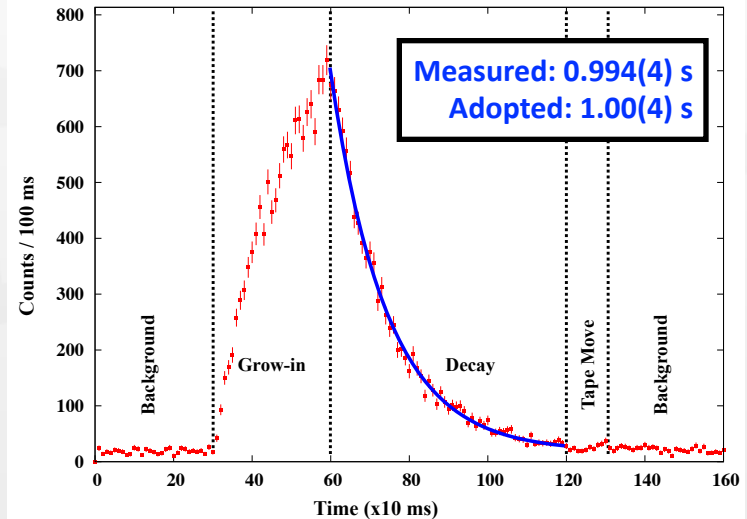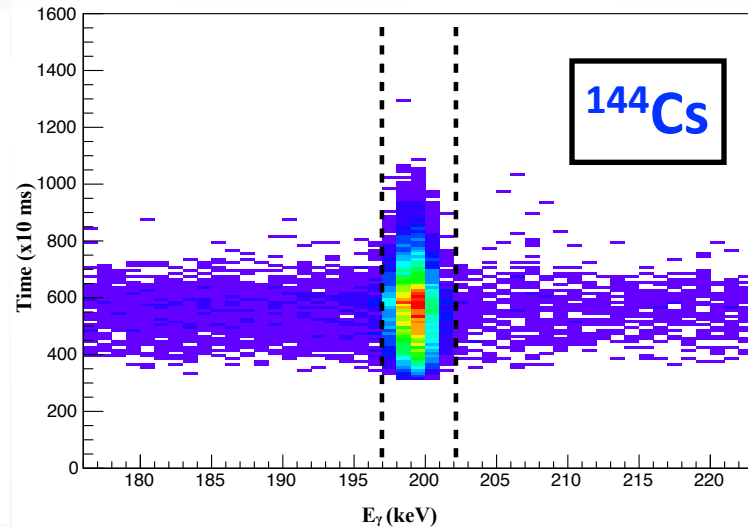
PAC-Approved experiments

01/2012

1423X	P. F. Bertone	Commissioning the X-Array and the Decay Beam Lines at CARIBU

12/2012

1477	A. Sonzogni	Possible low-spin state in ^{104}Tc and its implications for decay heat
1480	F. Kondev	Discovery and Properties of New Isotopes using Mass and Decay Measurements at CARIBU
1457	J. Rissanen	Beta-decay studies of neutron-rich Zr and Y isotopes near the neutron mid-shell
1468	M. Carpenter	Study of Non-Yrast States in ^{100,102}Zr following beta decay of ^{100,102}Y
1471	M. Flores	Study of the beta delayed neutron emission with VANDLE at CARIBU

11/2013

1521	E.Merchan	Quantum Numbers of Single-Particle States of ^{132}Sn populated via b-decay
1526	V.Werner	Sub-shell closure, proton-neutron symmetry and shape coexistence in ^{98}Zr
1533x	C.J.Lister	X-Proposal: Commissioning the INEL TAGS Spectrometer at CARIBU
1535x	N.D'Olympia	X-Proposal: Beta-delayed neutron branching and energy measurements with a novel CYLC detector: A test and physics case in ^{94}Rb

http://www.phy.anl.gov/atlas/pac/exp14Dec12.html

UMASS LOWELL

Collaboration

AJ Mitchell, CJ Lister, P Chowdhury, AY Deo, N. D'Olympia;
PF Bertone, MP Carpenter, JA Clark, B DiGiovine, FG Kondev,
J Rohrer, G Savard, D Seweryniak, S Zhu;
EA McCutchan; SL Tabor, R Dungan;
plus many others…

Learning with Purpose