Argonne NATIONAL LABORATORY

… for a brighter future

NORTHWESTERN UNIVERSITY

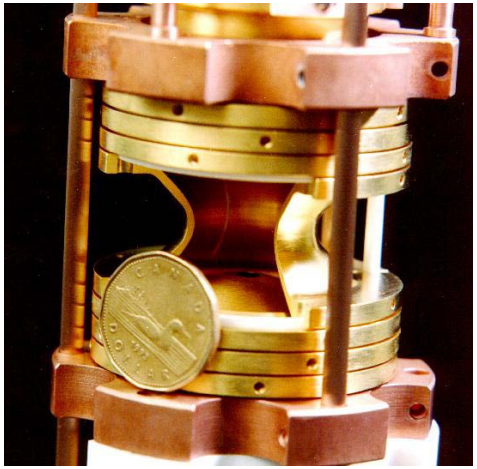
U.S. Department of Energy

UChicago ▶ Argonne LLC

Office of Science U.S. DEPARTMENT OF ENERGY

A U.S. Department of Energy laboratory managed by UChicago Argonne, LLC

CPT Mass Measurements at *CARIBU*



Daniel Lascar

d-lascar@northwestern.edu

Frontiers 2010 Workshop

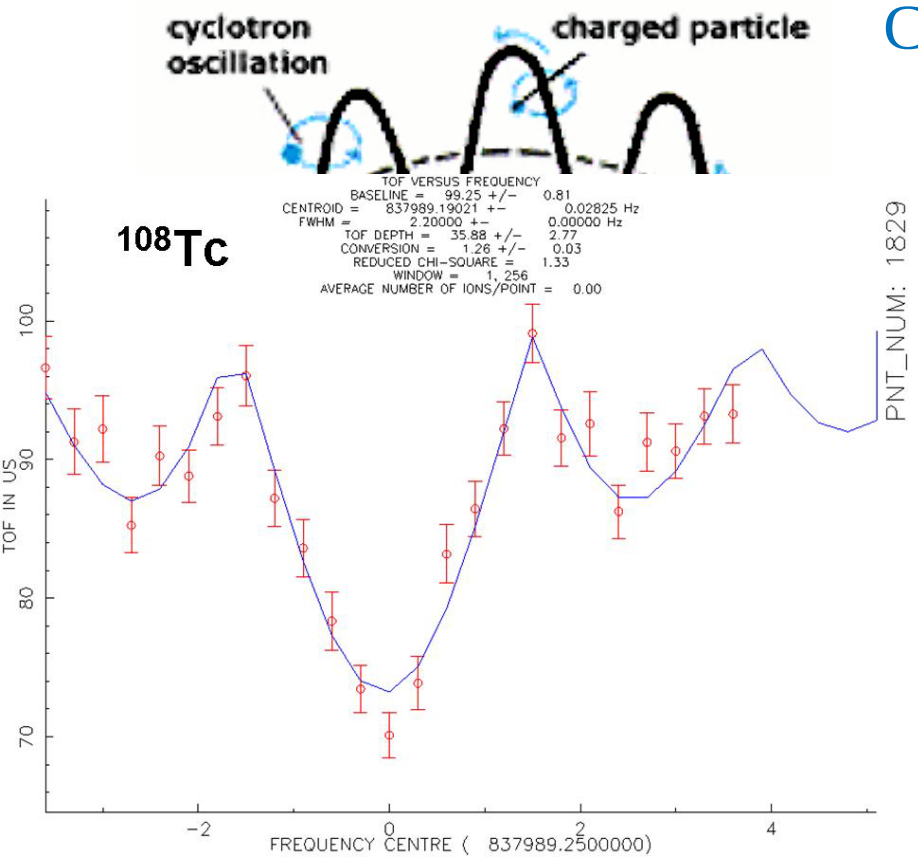
October 21-23

Lake Geneva, WI

CPT Vital Statistics

- The Canadian Penning Trap
- 5.9 T superconducting magnet confines the ions radially.
  - Upper limit field drift $<10^{-9}$/day
- Electrodes create a harmonic trapping potential in the axial “Z” direction
- Center ring is split into 4 equal segments so that both dipole and quadrupole excitations can be performed.

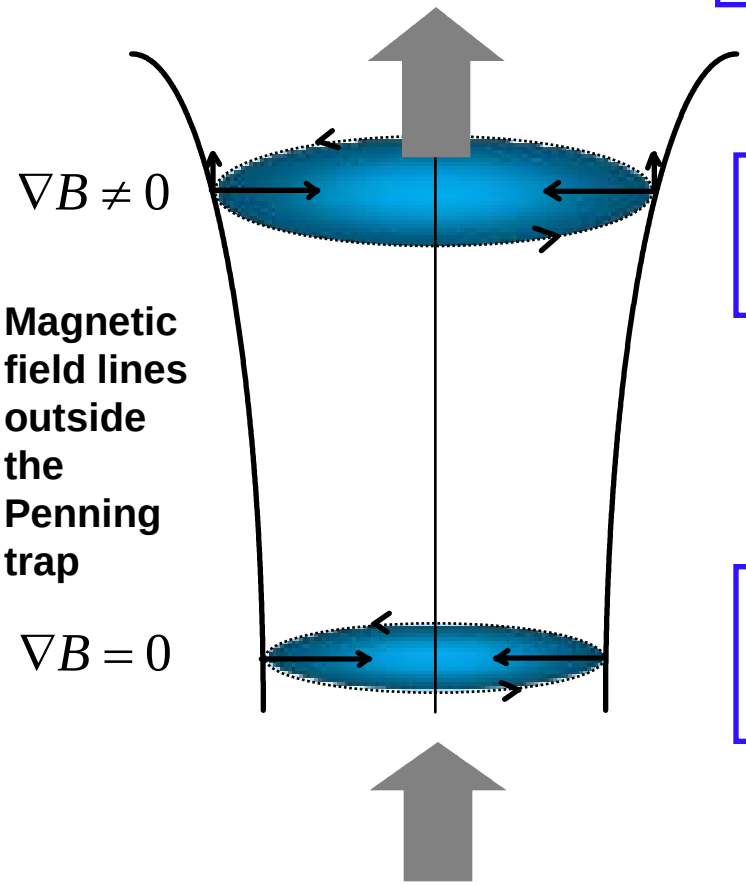
Motion in Trap



$$\omega_c = \omega_+ + \omega_-$$

Chaneltron

$$\sum \vec{F} = F_z$$



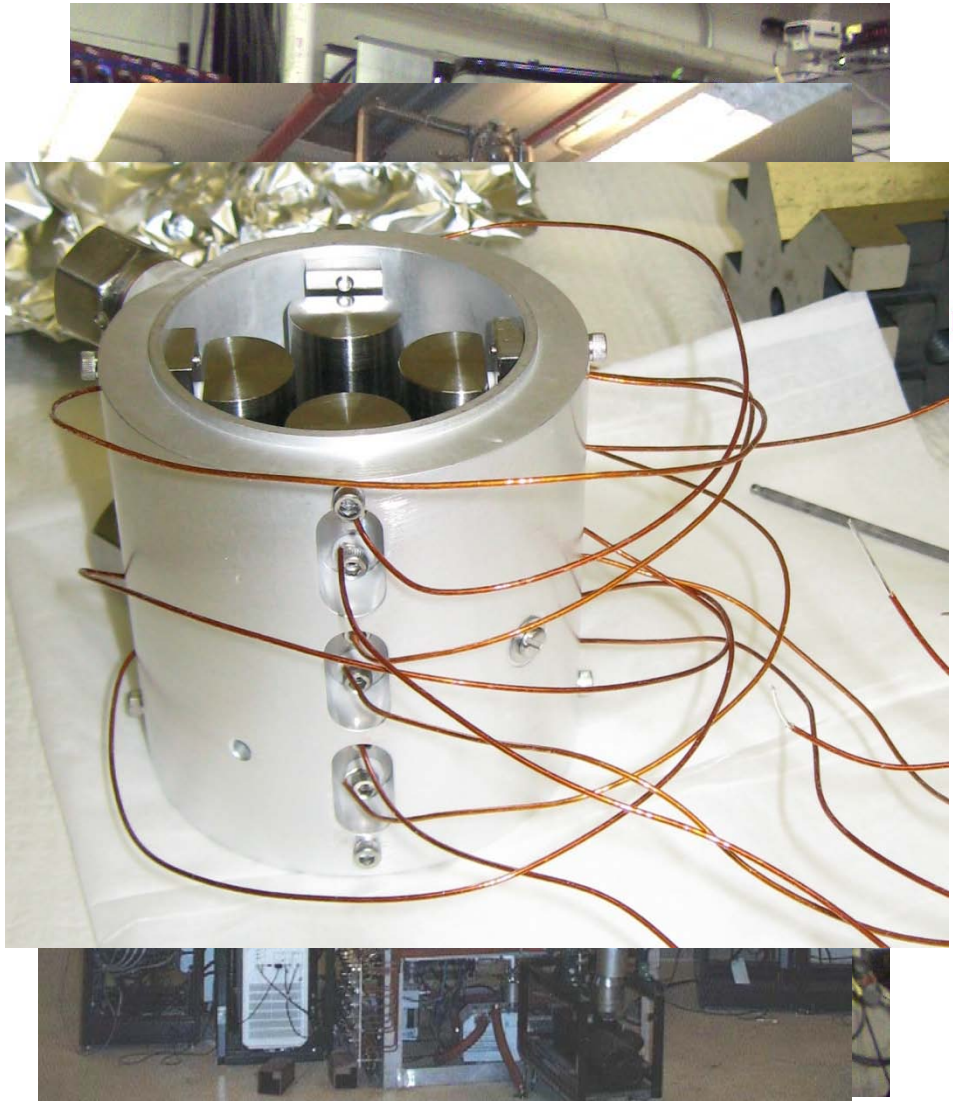
Magnetic field lines outside the Penning trap

TOF Detection

Linear Energy

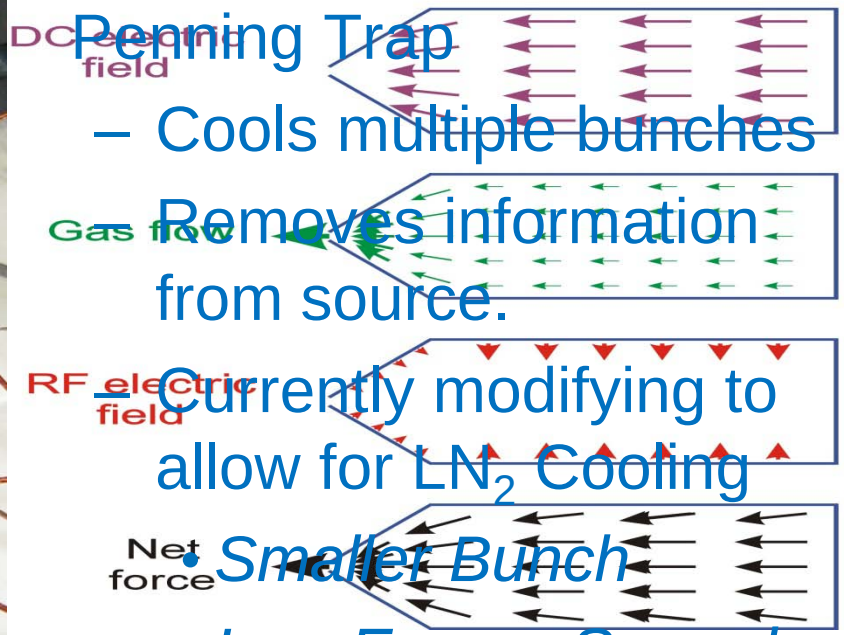
Orbital Energy

Ions from the Penning trap



Forces on Ions in Gas Cell

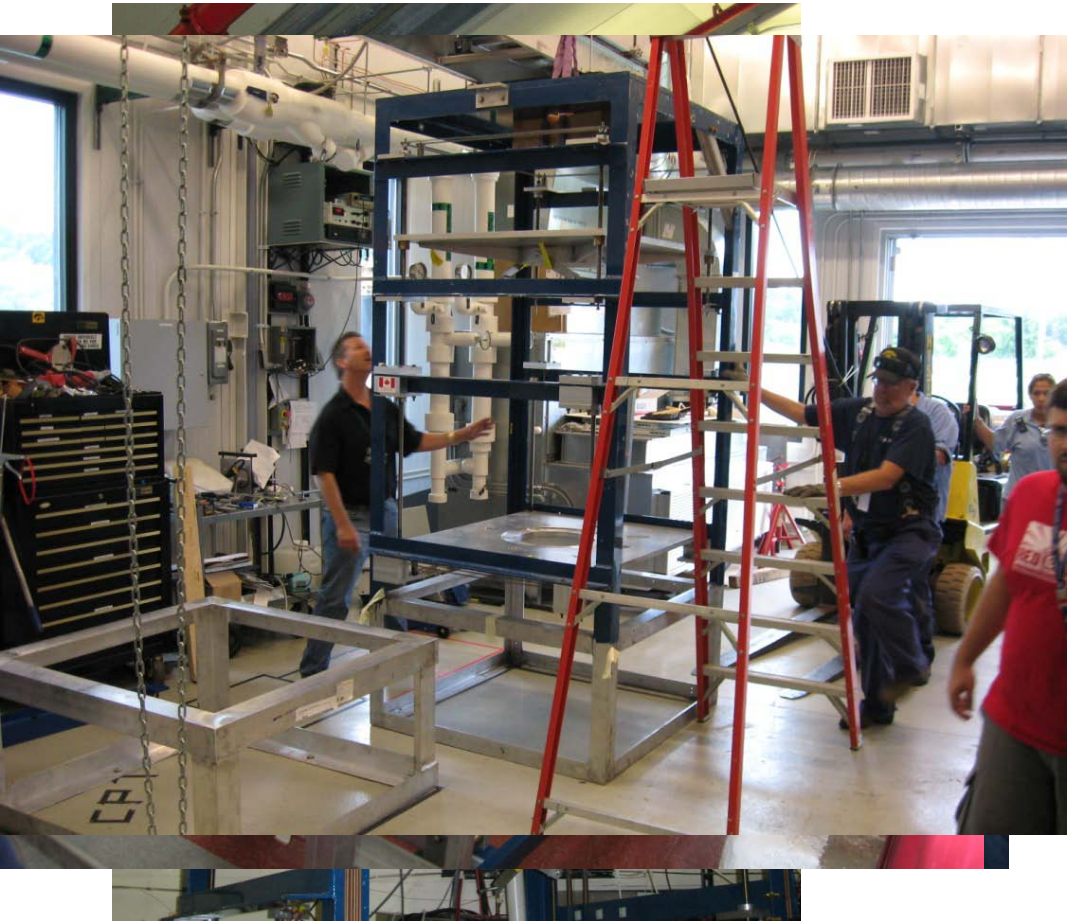
- RFQ Paul Trap below Penning Trap
  - Cools multiple bunches
  - Removes information from source.
  - Currently modifying to allow for LN_2 Cooling
    - *Smaller Bunch*
    - *Low Energy Spread*



CARIBU

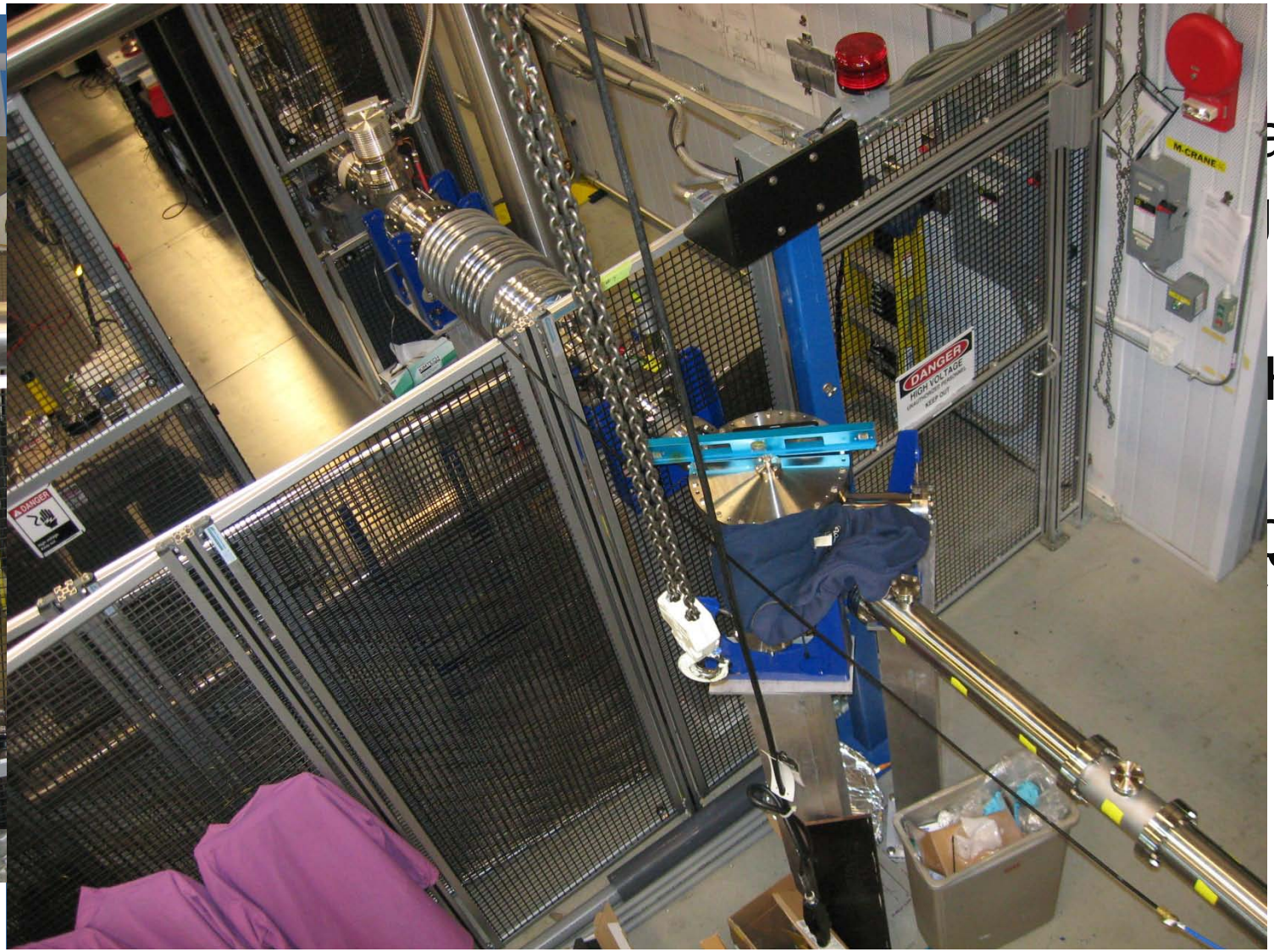
- CAlifornium Rare Isotope Breeder
- Larger Source (1 Ci)
- Upgrade to ATLAS
- Larger Acceptance
- Can feed an ECR
- ~~250~~ 200 cm³ volume source to become a in-flight isobaric separation
- current, neutron-rich beams
  - R~20,000
  - ΔE ± **10 eV**
- ^{252}Cf chosen to allow access to new regions unavailable to ^{238}U

The Move to CARIBU



- Removing all components of the tower.
- Removing the Magnet
- Moving it all.
- Putting it up in CARIBU

Low Energy Beamline Design



atic
n
HV
Q
in
ions

Comparison of Capabilities

Old System	CARIBU
100 μCi source	**1 Ci source**
Isobaric separation done with a gas filled Penning Trap (t~ms)	**Isobaric Separation done in-flight (t~μs)**
Isobaric separation R~3,000	**Isobaric separation R~20,000**
Uncooled bunches in Paul Trap	**Cooled bunches with smaller energy spreads**

FIRST NEUTRON RICH MEASUREMENTS COMING SOON

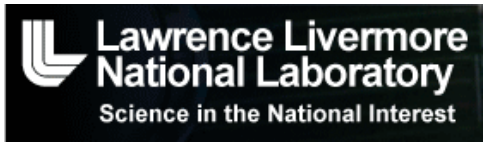
CPT Collaboration

G. Savard, A. Chaudhuri, J.A. Clark, C. Deibel J.P. Greene, A.F. Levand, T. Sun, B.J. Zabransky,

S. Caldwell, M. Sternberg, J. Van Schelt

D. Lascar, R. Segel

J. Fallis, K.S. Sharma



N.D. Scielzo, R. Yee

F. Buchinger, J.E. Crawford, S. Gulick, Gang Li