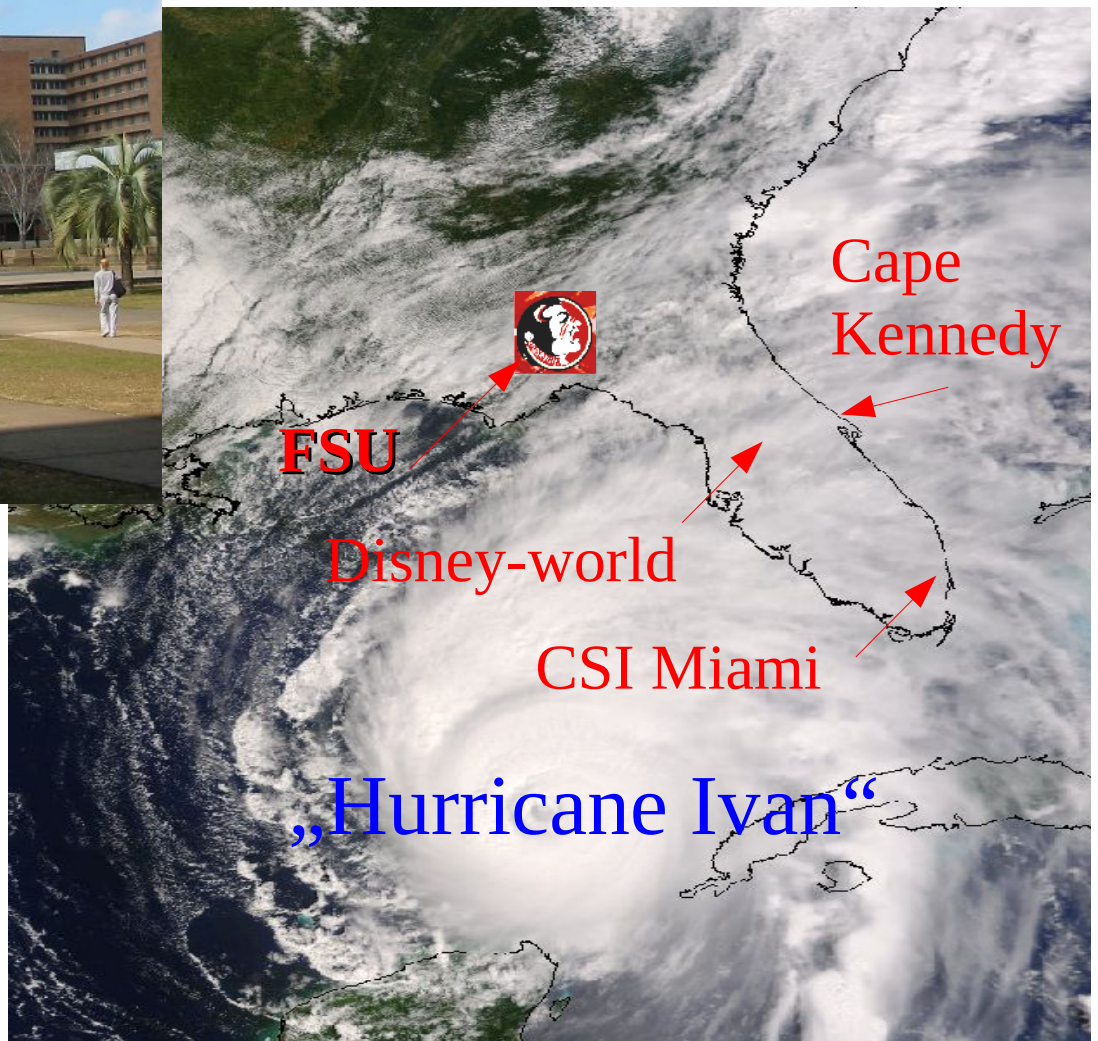
The Offspring of Atlas

- The FSU Linac and RESOLUT
- The early days
- The good life
- What's to come

Florida State University
Tallahassee

A typical day in Winter

A typical day in Summer

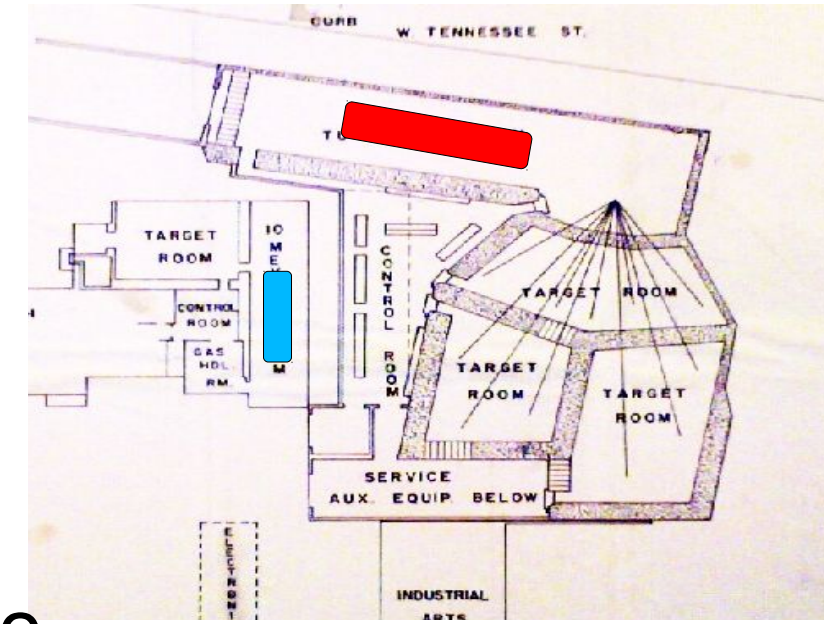


FSU Linac Timeline: The early years

- 1959 6MV EN tandem accelerator
  1964 … Precision is king:
  Investigation of
  isobaric analog states
- 1970
  9MV FN tandem accelerator

FSU: to TAN or to LIN ?

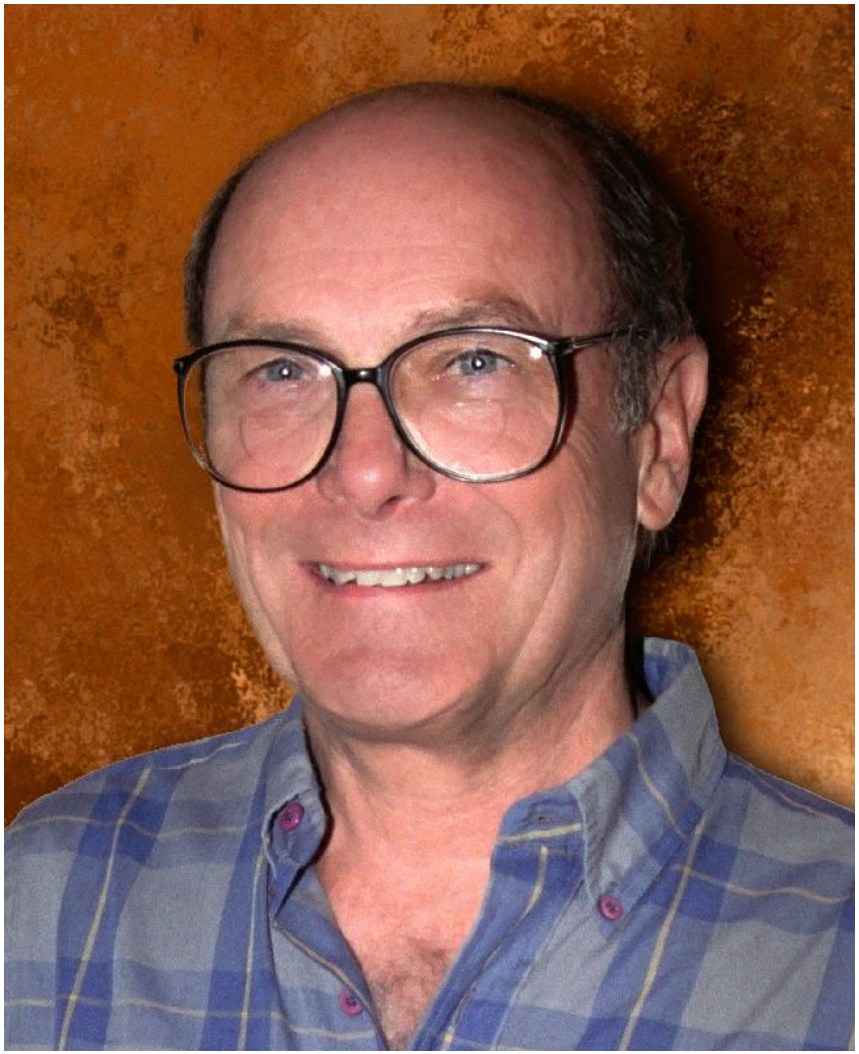
- Upgrade plan 1966 ("TU" tandem)



- Upgrade plan ~1980 (upright 15 UD Pelletron tower ?)

John D. Fox (1929-2007)

- Decision to go with LINAC rather than larger Tandem
- CalTech resonators ?
- Argonne Atlas project ?
- Go with ANL technology because of long-standing scientific collaboration



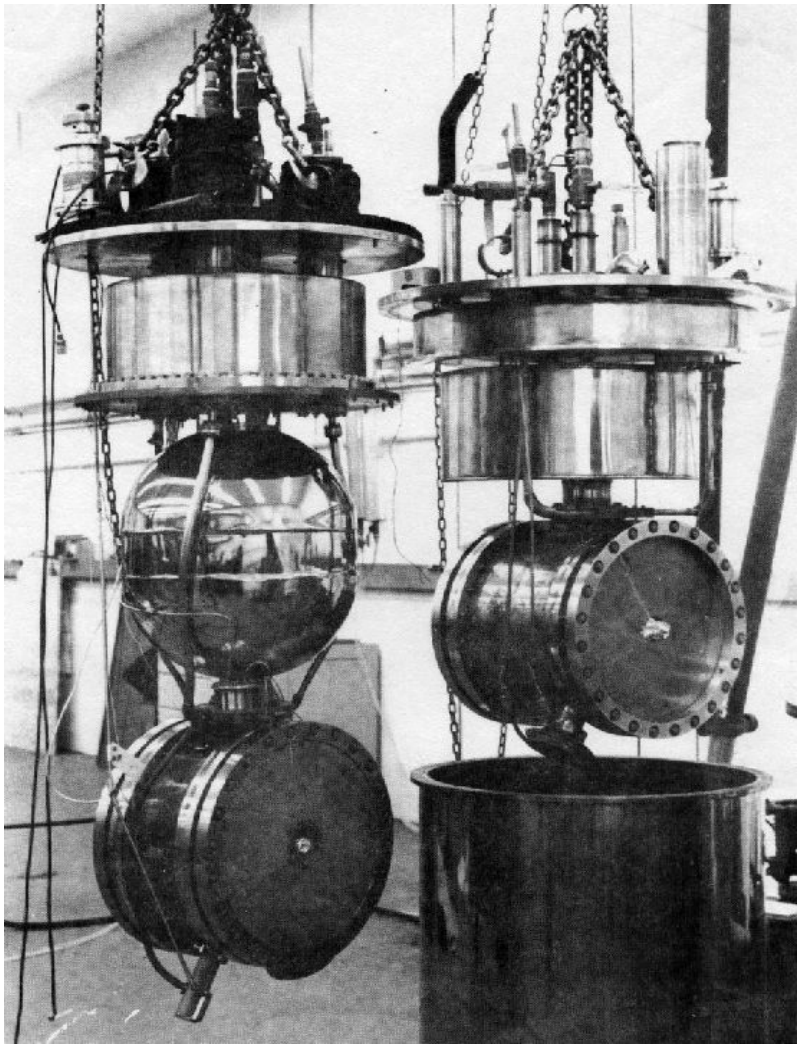
More Offspring of Atlas Tandem+Booster timeline

- ANL – Atlas (1985)
- FSU (1986)
- KSU (1988)
- Sao Paolo (?)
- New Delhi
- Daresbury - Canberra
- MPI Heidelberg,
  TU Muenchen
  NBI Riso,
  ...

FSU: Learning to say “Lin-ac”

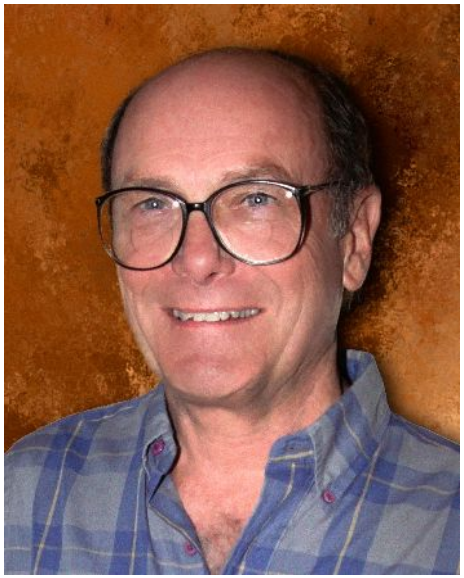
1980... Prove that FSU can

- bunch a beam through tandem
- operate a superconducting resonator, bunch the beam
- Close collaboration with ANL



The FSU Linac Project



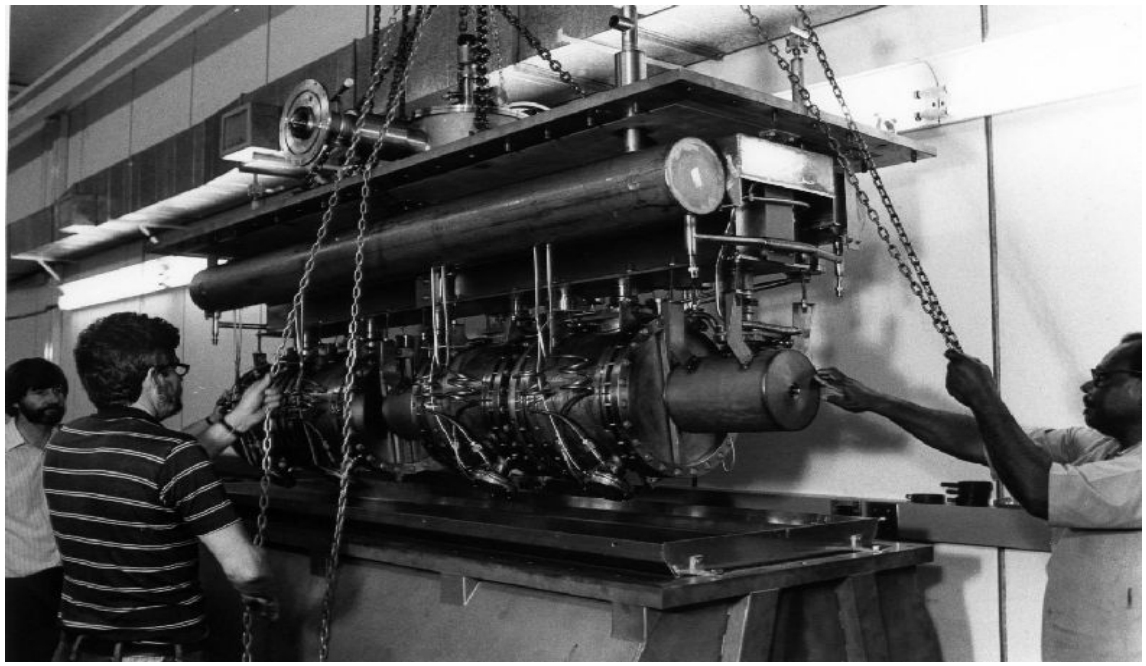



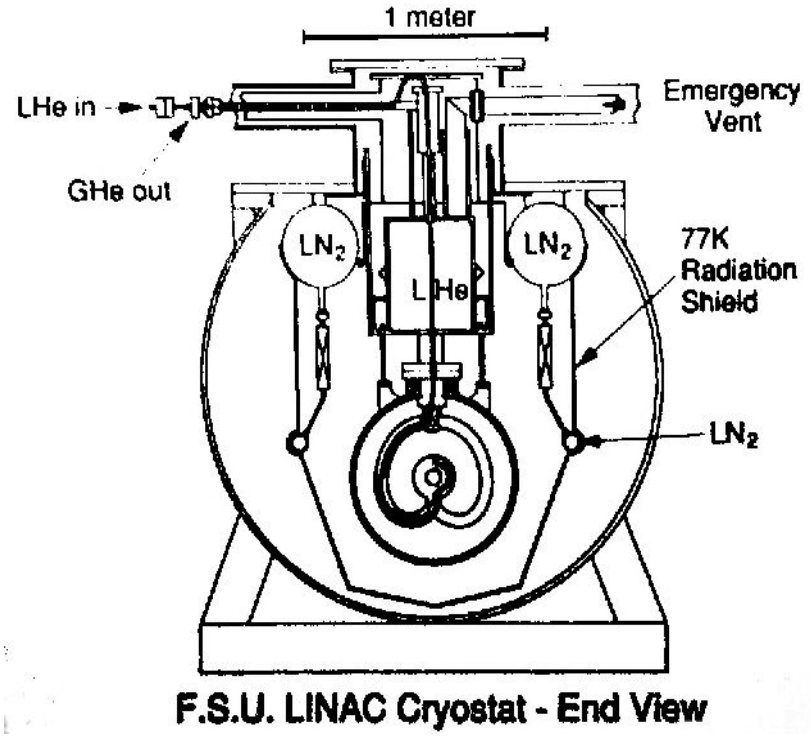
Tony Frawley, Ed Myers, Kirby Kemper, John D. Fox

1981: Addition of the Linac building

1983-1986 FSU linac Design and Construction

- Use ANL resonators and electronics,
- design own cryostats,

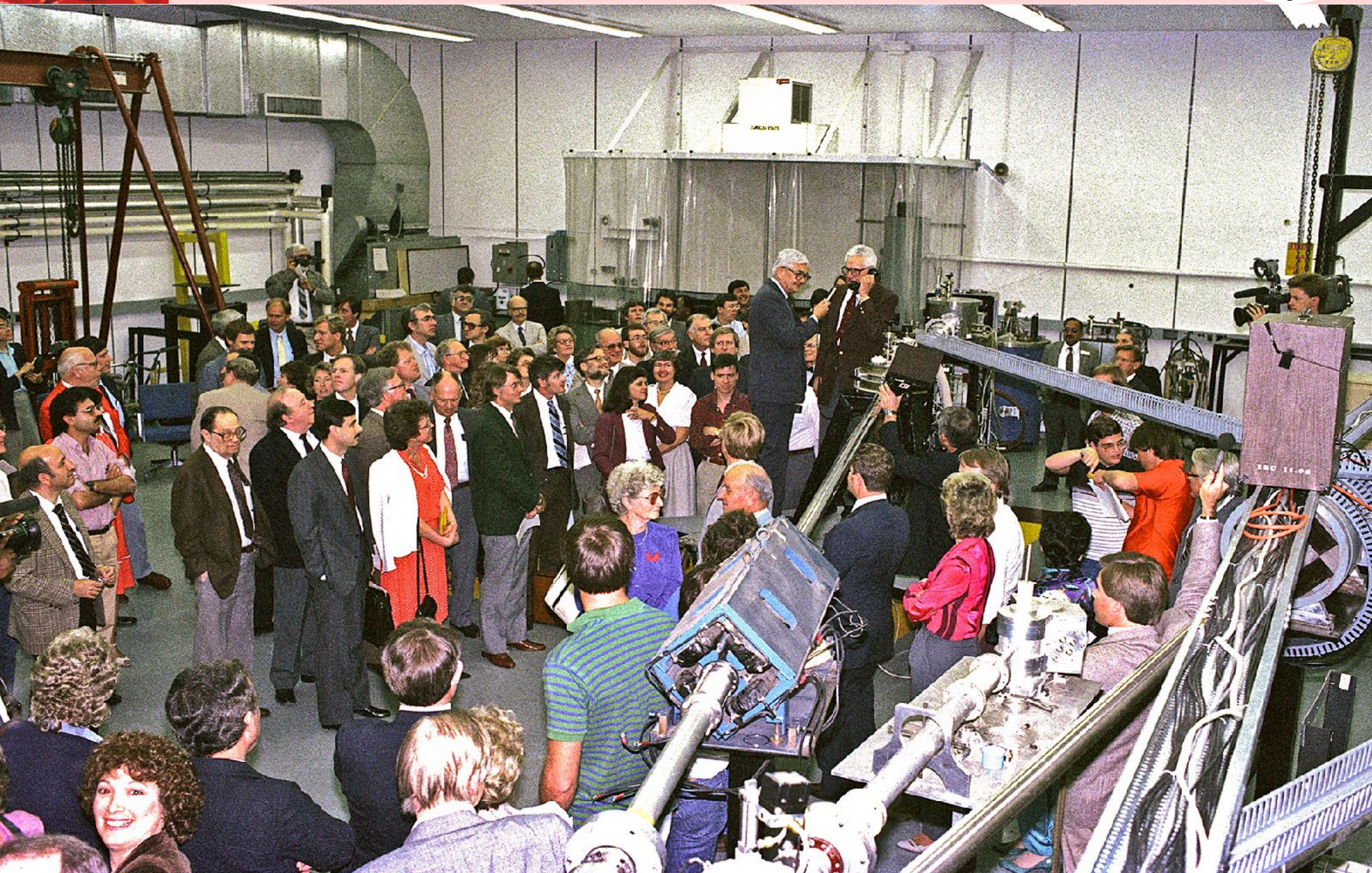




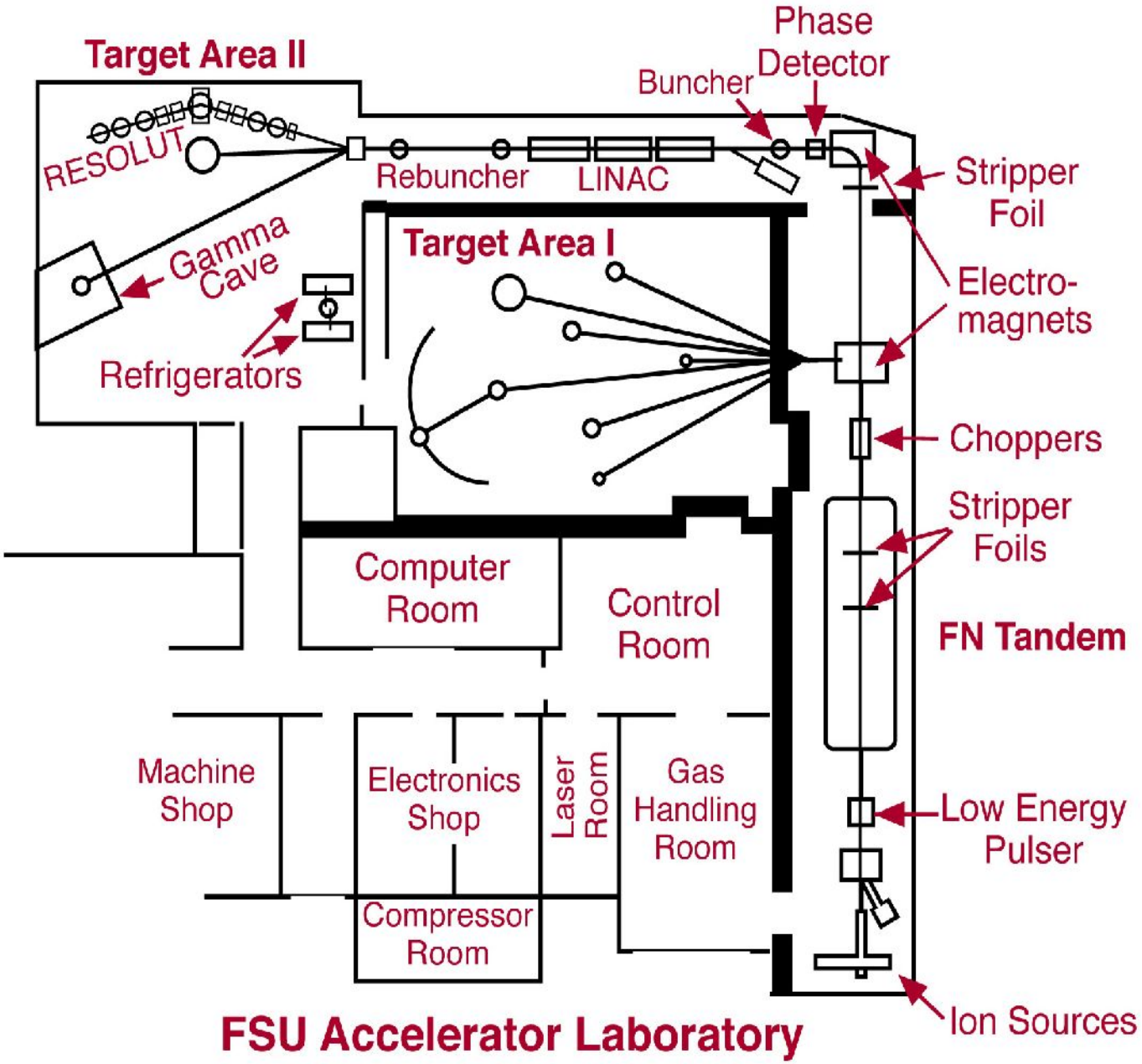
F.S.U. LINAC Cryostat - End View

The Dedication (1986)

The Linac Dedication (1986)



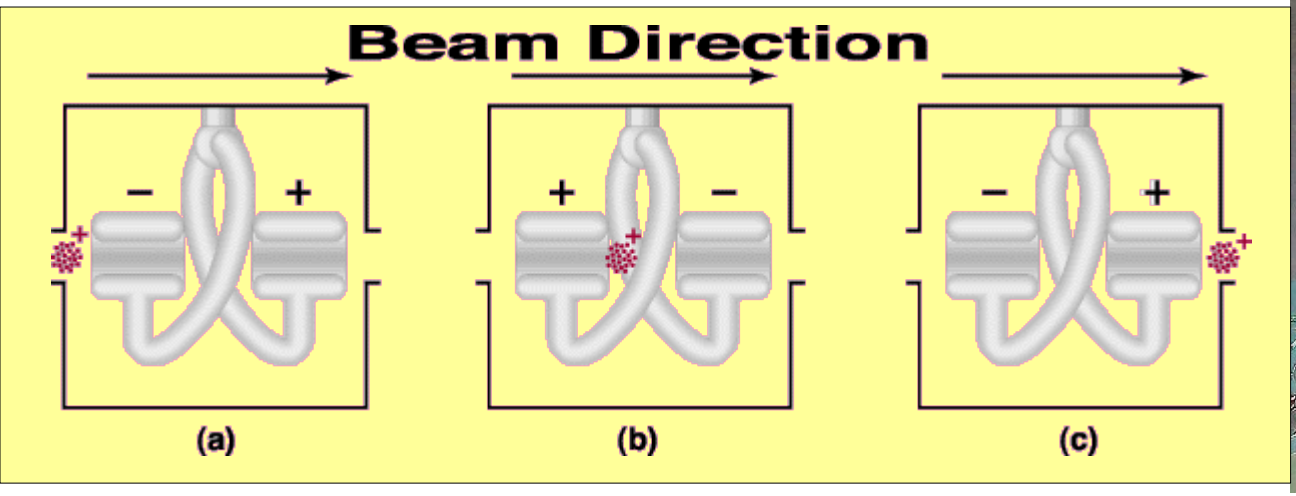
The John D. Fox FSU Laboratory today



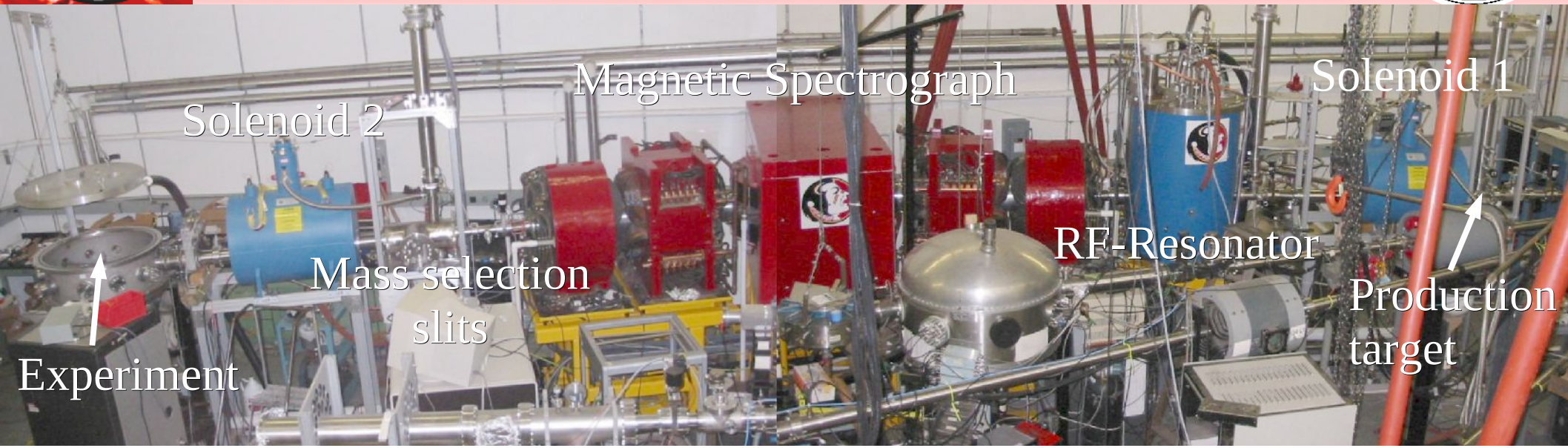
FSU FN Tandem Accelerator

Superconducting Linear Accelerator

- Superconducting Linear Accelerator: Commissioned in 1986
- Superconducting Resonators of Atlas v/c~0.1 Resonators
- Beams up to Ca, 4-8 MeV/u



RESOLUT: a radioactive beam facility at FSU

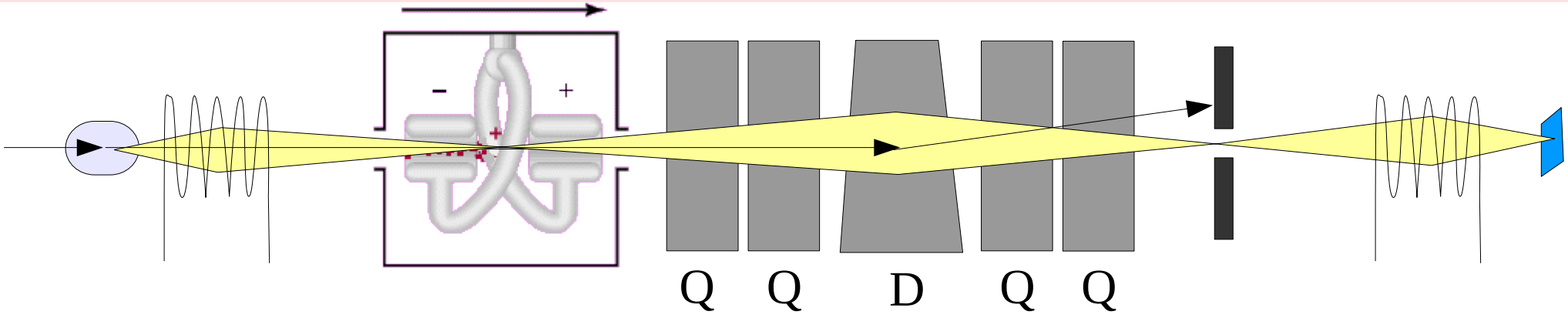


- In-flight production of radioactive beams in inverse kinematics, mass <=30

Beams used in experiments:

- $^{24}Mg(d,n)^{25}Al$, 98 MeV, ~2· 10^4 pps (35% pure)
  $^{7}Li(p,n)\ ^{7}Be$ 25-35 MeV, ~2· 10^5 pps (80% pure)
  $^{7}Li(d,p)^{8}Li$ 20-30 MeV ~5 · 10^4 pps (90% pure)
  $^{18}O(d,p)^{19}O$ 95 MeV ~5 · 10^4 pps (90% pure)

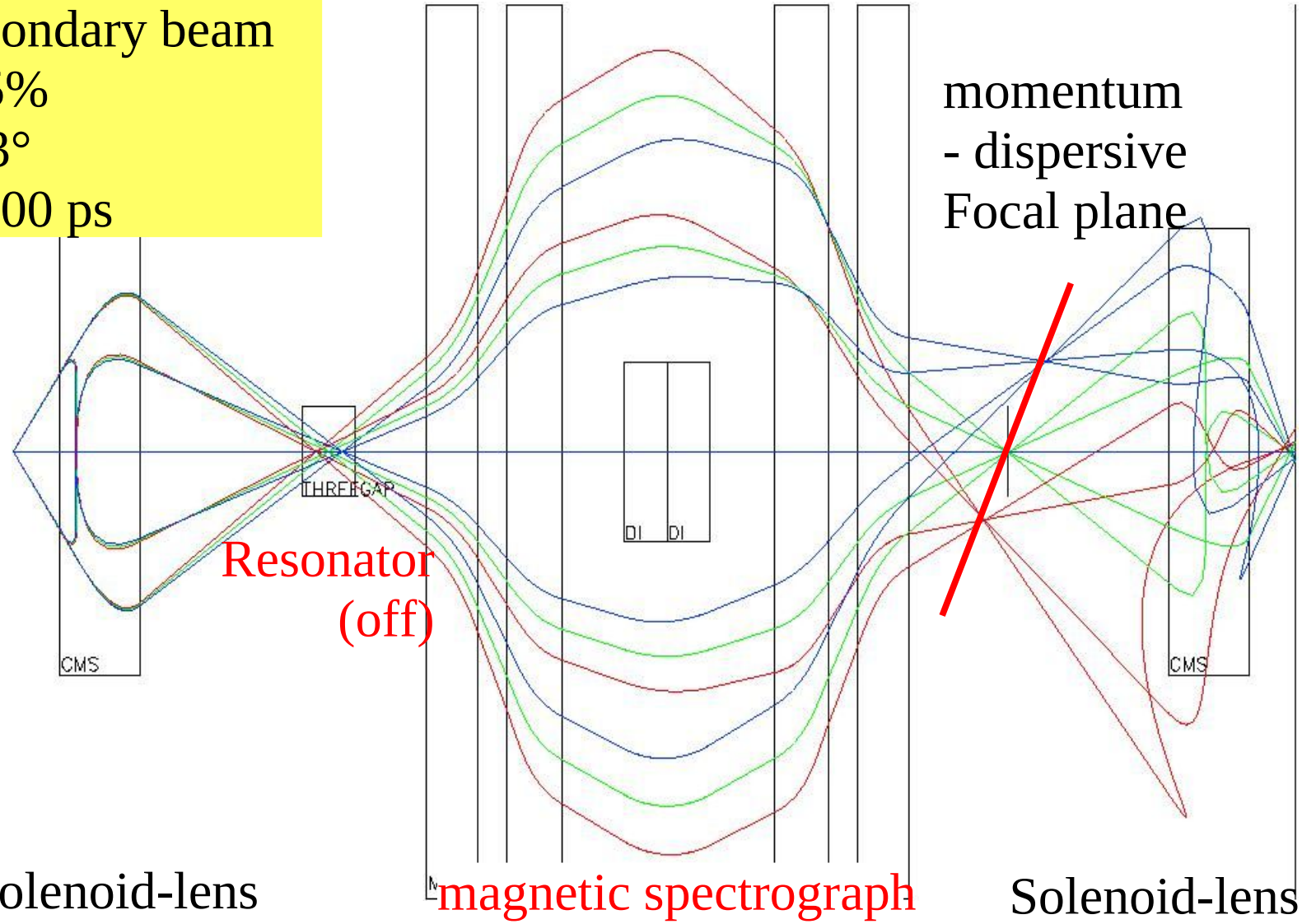
RESOLUT: In-flight production of radioactive beams



- Production target: gas cell (H_2, D_2, He^3, He^4)
- Production reaction: inverse kinematics
- E.g. $(^{24}Mg(d,n)^{25}Al)^{-1,}$ ^{24}Mg at ~6 MeV/u
- ^{25}Al: angles +/- 3º, energies +/- 5 %
- RESOLUT acceptance: θ+/- 3º, energy +/- 2%

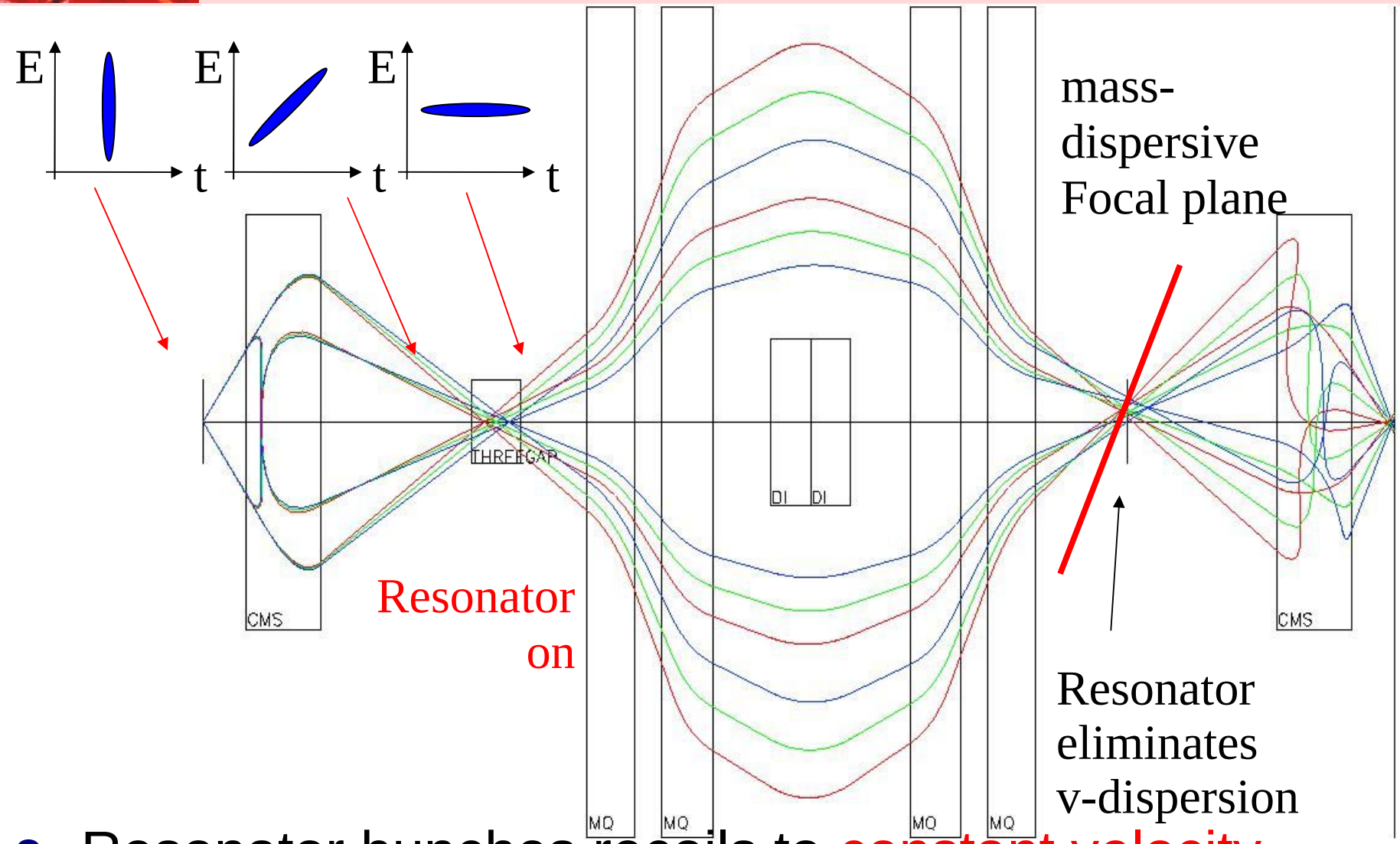
RESOLUT: an RF-mass spectrometer

^{18}Ne secondary beam
E= +/- 5%
Θ= +/- 3°
t = +/- 200 ps



- magnetic spectrograph separates particles in mv/q.

RESOLUT: an RF-mass spectrometer

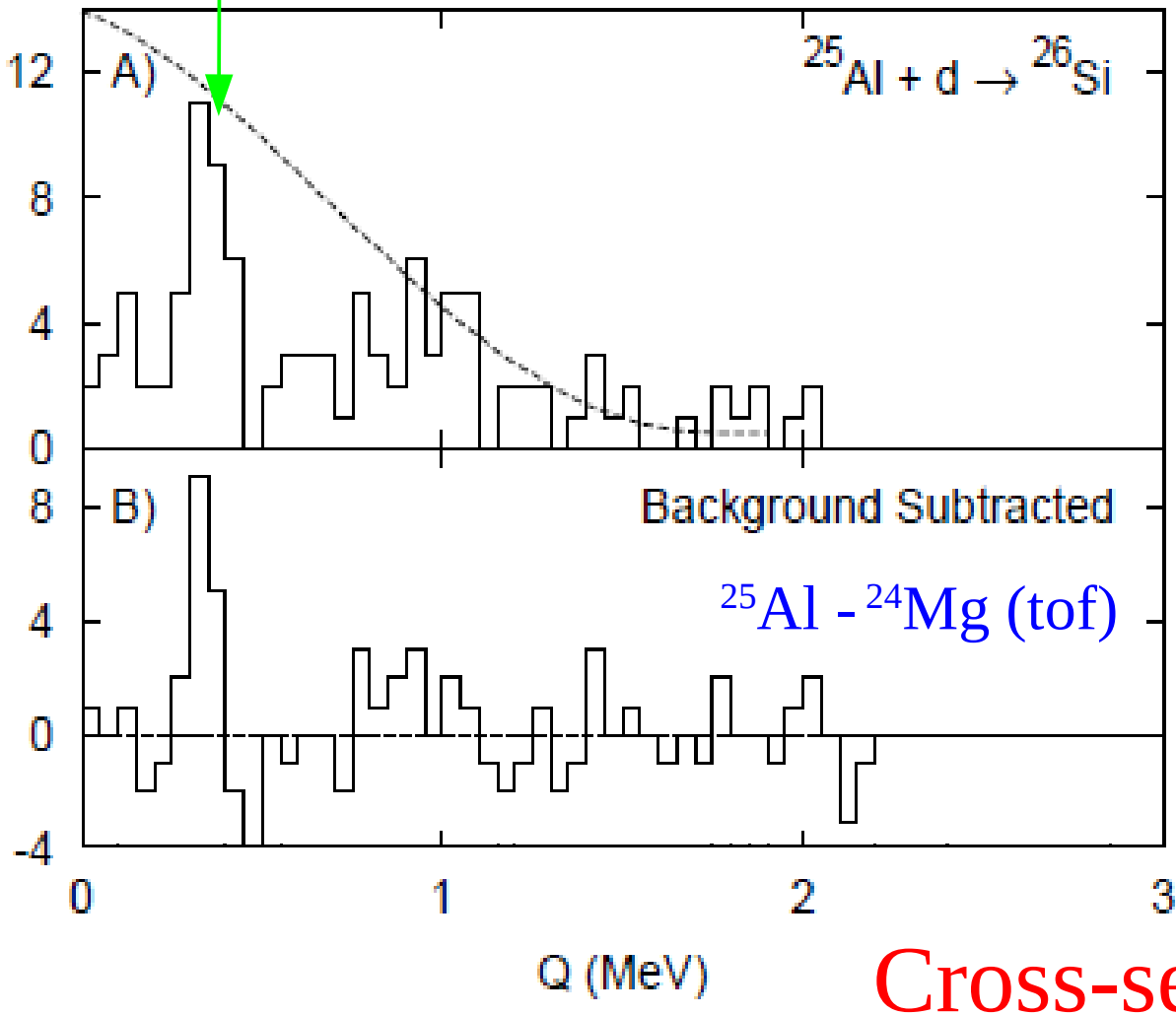


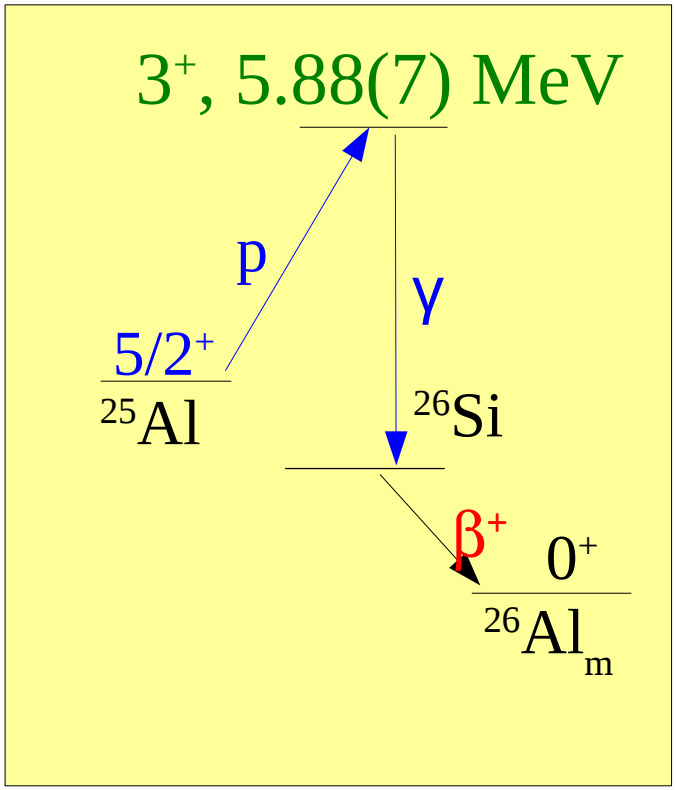
- Resonator bunches recoils to constant velocity
- Spectrograph separates m/q: $B\rho = mv/q$

P.N. Peplowski et al.: PRC 79, 032801R(2009): The lowest (l=0) ^{26}Si-Resonance

Proton-decay Q-value spectrum

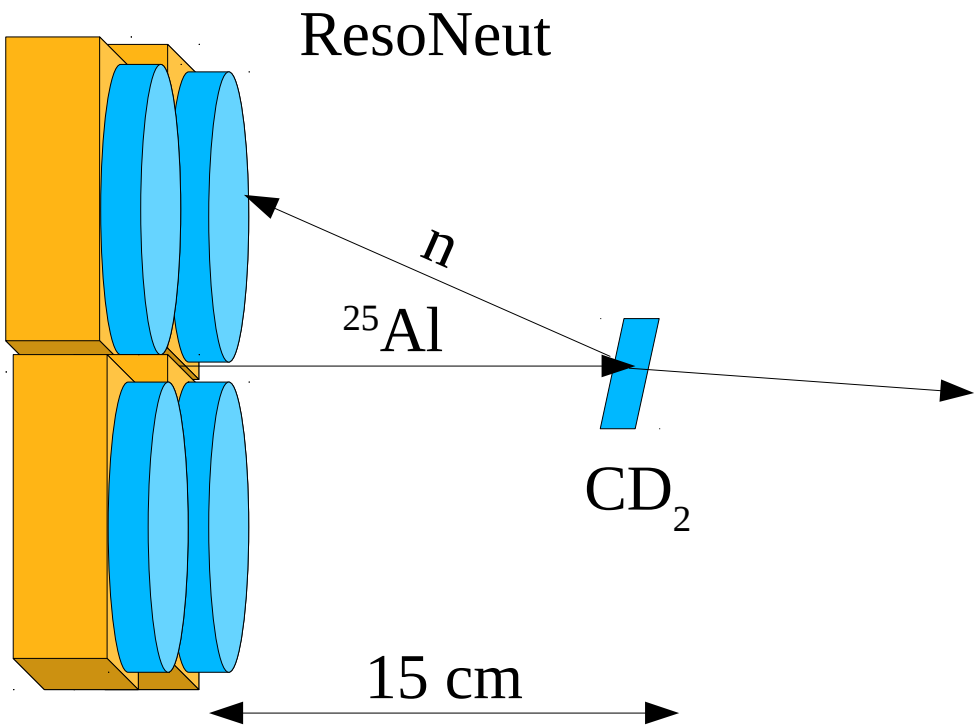
E_R=0.36(7) MeV => E_X = 5.88(7) MeV

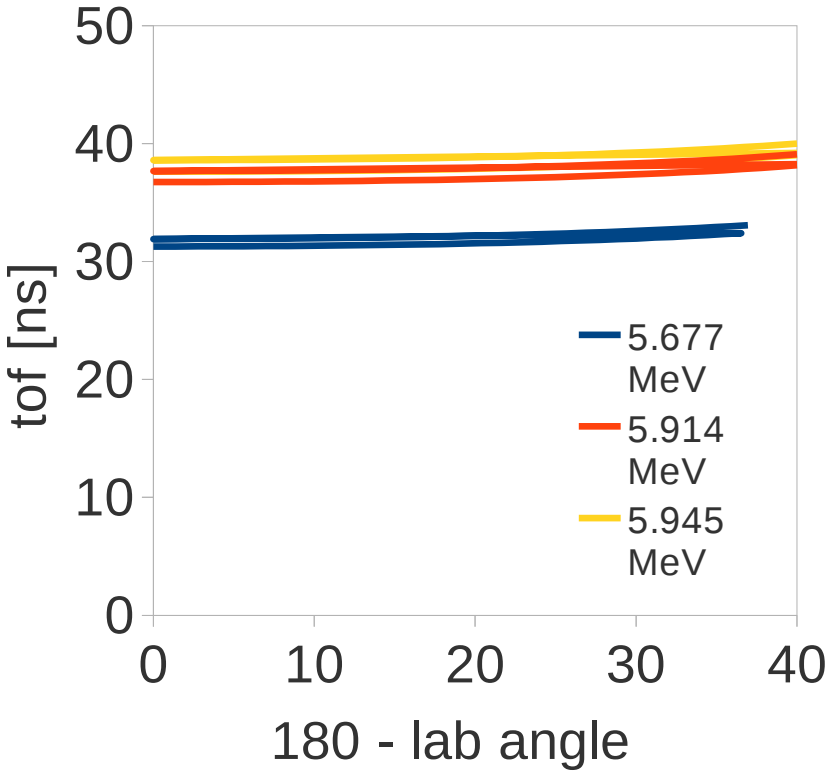




Cross-section σ=8.7±3 mbarn

How to measure (d,n) in inverse kinematics

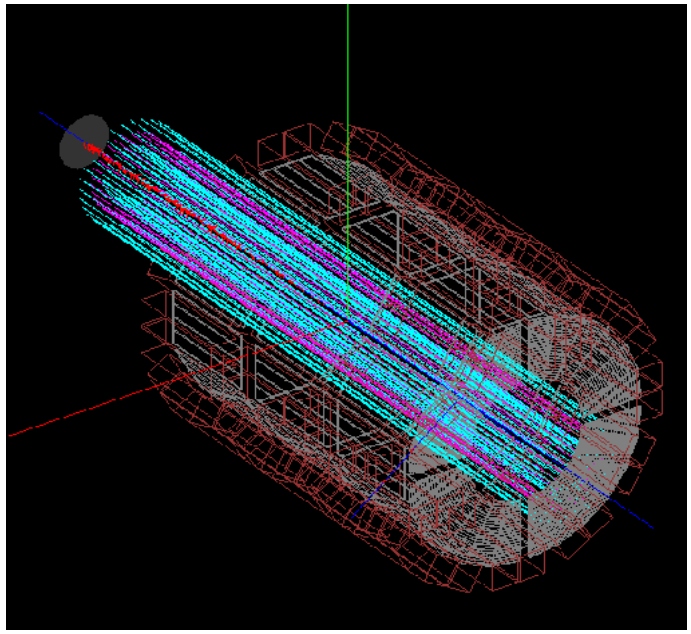


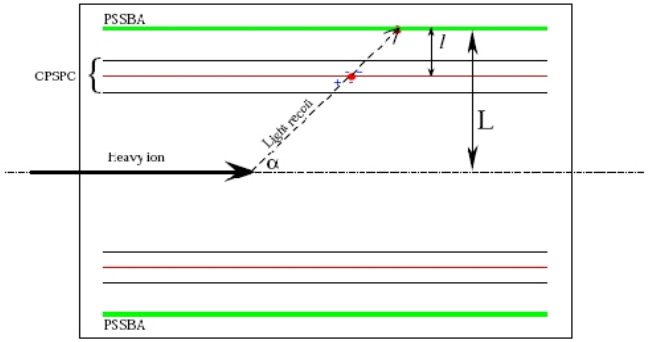


- 89-120 keV Neutrons (5.914 resonance)
- Resolution~30 keV for a 0.1 mg/cm^2 target
- Time of flight is an almost angle-independent signal
- Very compact neutron-setup covers central peak

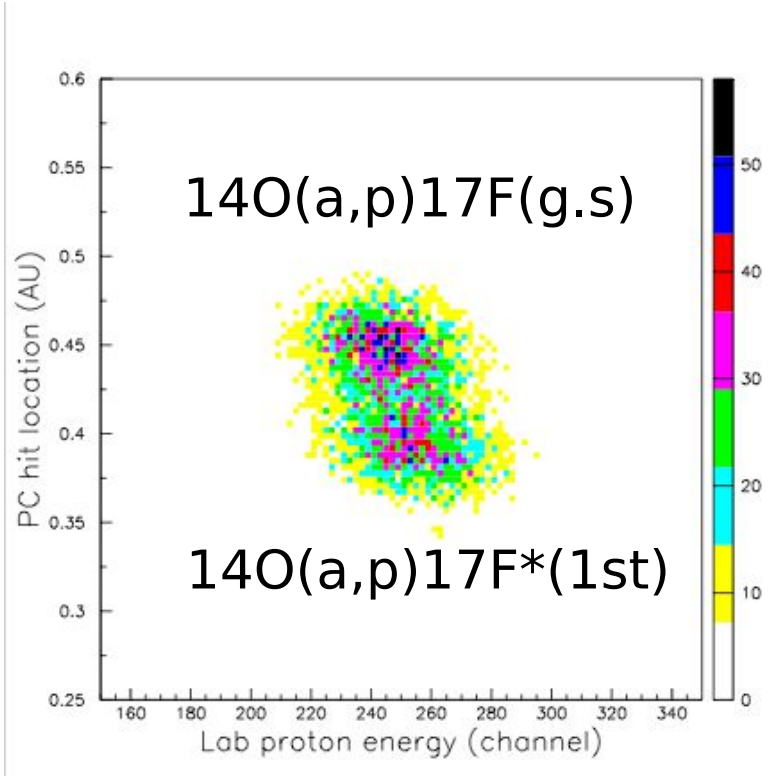
ANASEN: LSU – FSU

J. Blackmon (LSU), G. Rogachev (FSU),
I. Wiedenhöver (FSU), E. Zganjar (LSU)

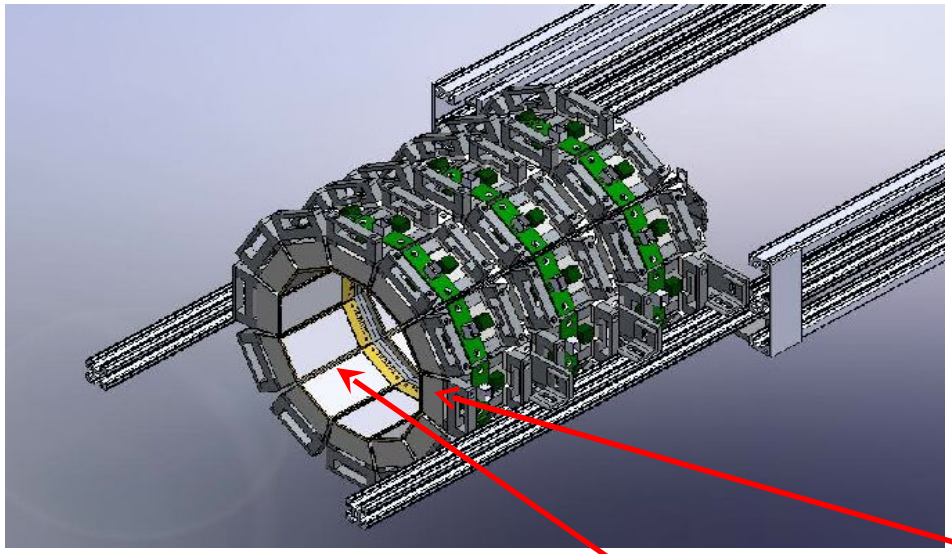


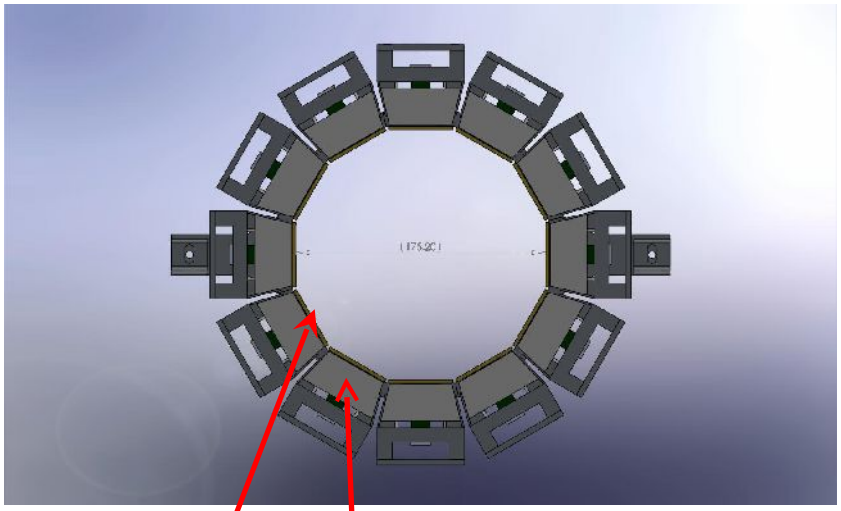


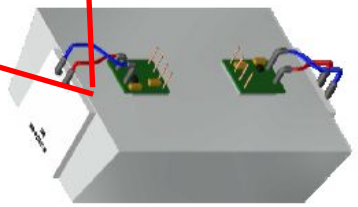
ANASEN is a Silicon Array backed by CsI(Tl) detectors with gas proportional counters tracking.
Funded by NSF through MRI ($720,000)

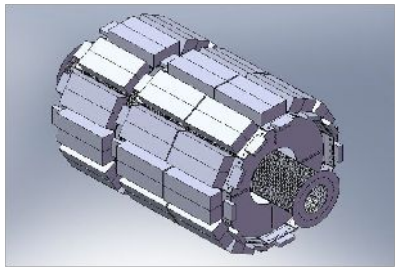


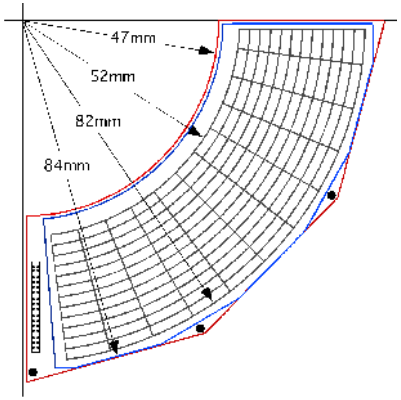
ANASEN: LSU – FSU

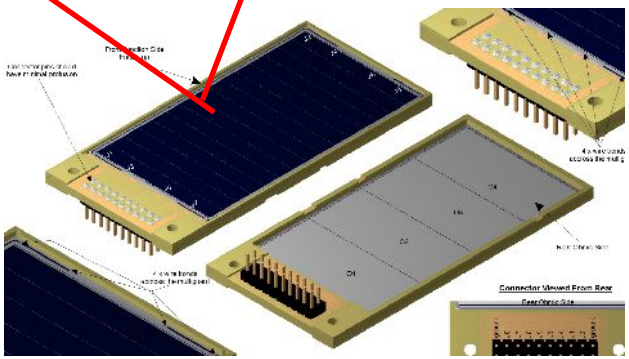








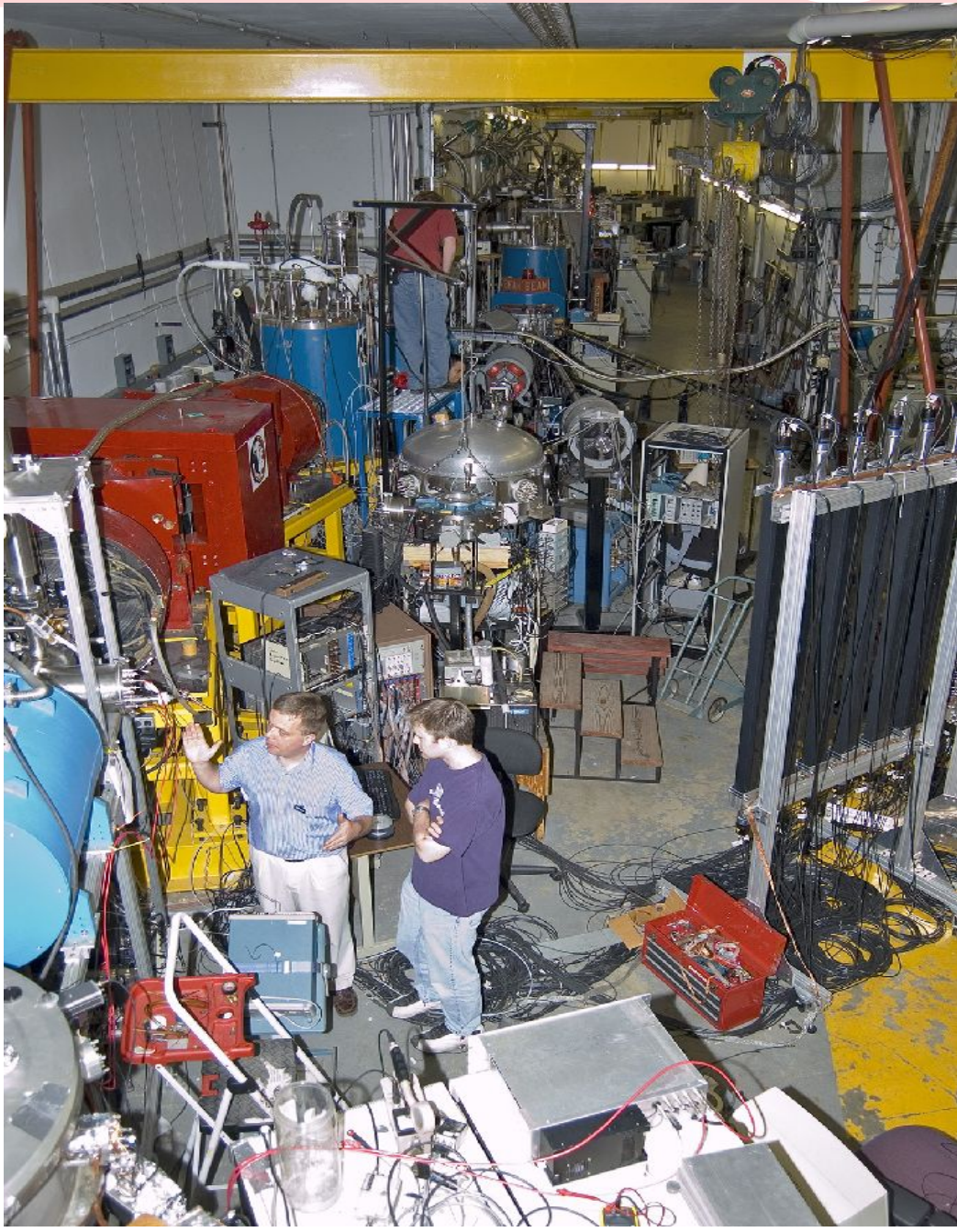




A University Lab at Work

- The Linac has allowed our lab to re-invent itself to become a RIB facility
- Upgrade:

  We have obtained nine more resonators +electronics from KSU
- Our pipeline of well-versed Graduate students continues...



Happy Anniversary, ATLAS

(from your offspring)