Nuclear accelerators

- 6 GeV Continuous Electron Beam Accelerator Facility (CEBAF) at Jefferson Lab
  goal: measure quark structure in nuclei

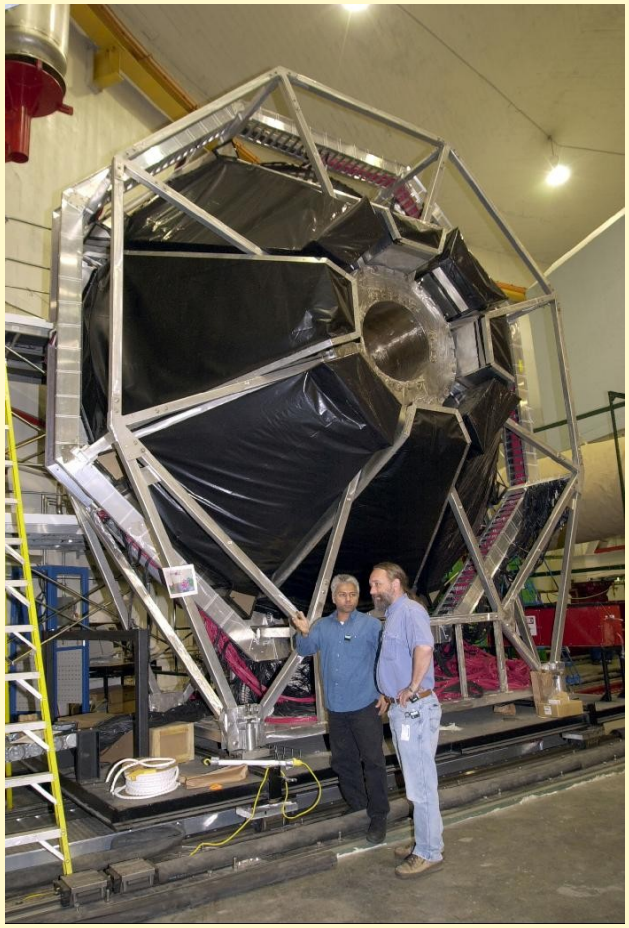
- Relativistic heavy-ion accelerators (RHIC, LHC)
  goal: measure properties of quark-gluon plasma
  this is focus of Phys-340B (Prof. Velkovska)

- Low-energy heavy-ion accelerators and Radioactive Ion Beam (RIB) facilities
  goal: measure nuclear structure and reactions
  this is focus of Phys-340A (Prof. Oberacker)

Continuous Electron Beam Accelerator Facility (CEBAF) at Jefferson Lab

http://www.jlab.org/

CEBAF beam-line and detectors



Relativistic Heavy-Ion Collider (RHIC) at Brookhaven Nat. Lab.

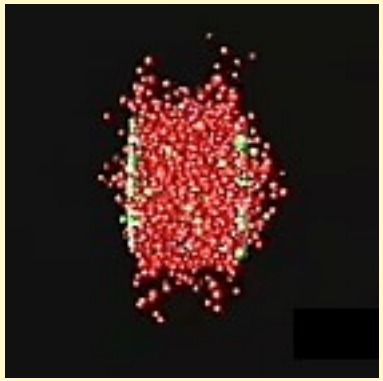
RHIC, aerial view

PHENIX detector

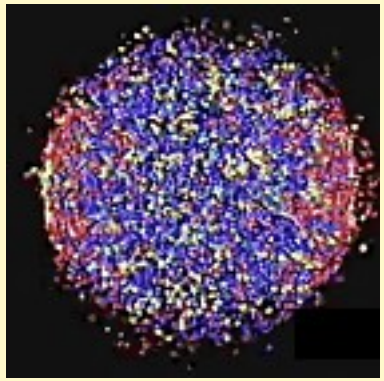
Relativistic Heavy-Ion Collider (RHIC) at Brookhaven Nat. Lab.

nuclei before collision, note huge Lorentz contraction (“pancakes”)

nuclei collide



quarks and gluons are freed



quark-gluon plasma created

Large Hadron Collider (LHC)
at CERN, near Geneva (Switzerland)

Low-energy nuclear accelerators in the U.S.

National user facilities

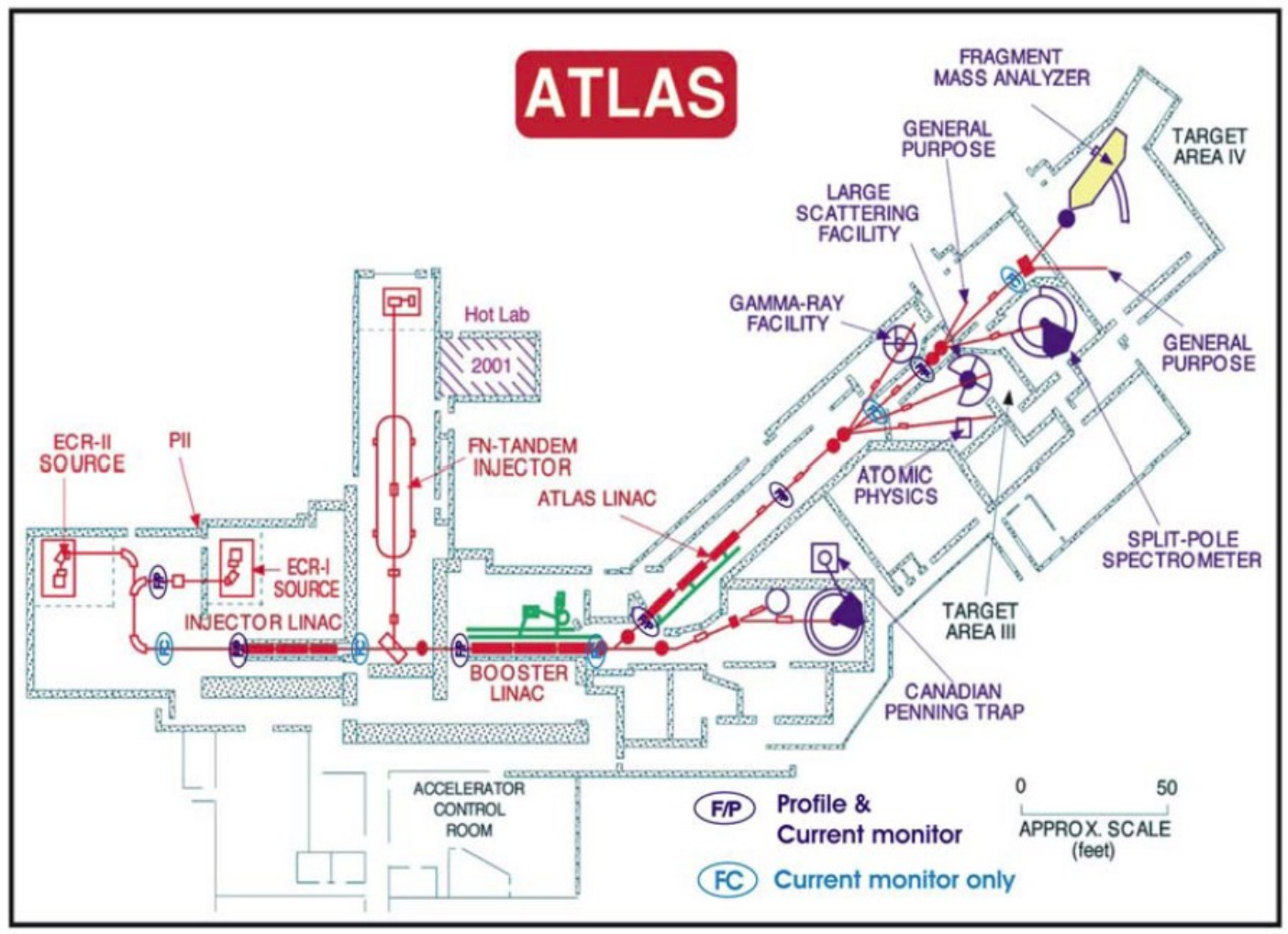
- Argonne Tandem Linac Accelerator System (ATLAS) at Argonne Nat. Lab.
- National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University (site of new FRIB facility, under construction)

Smaller, university-based accelerators

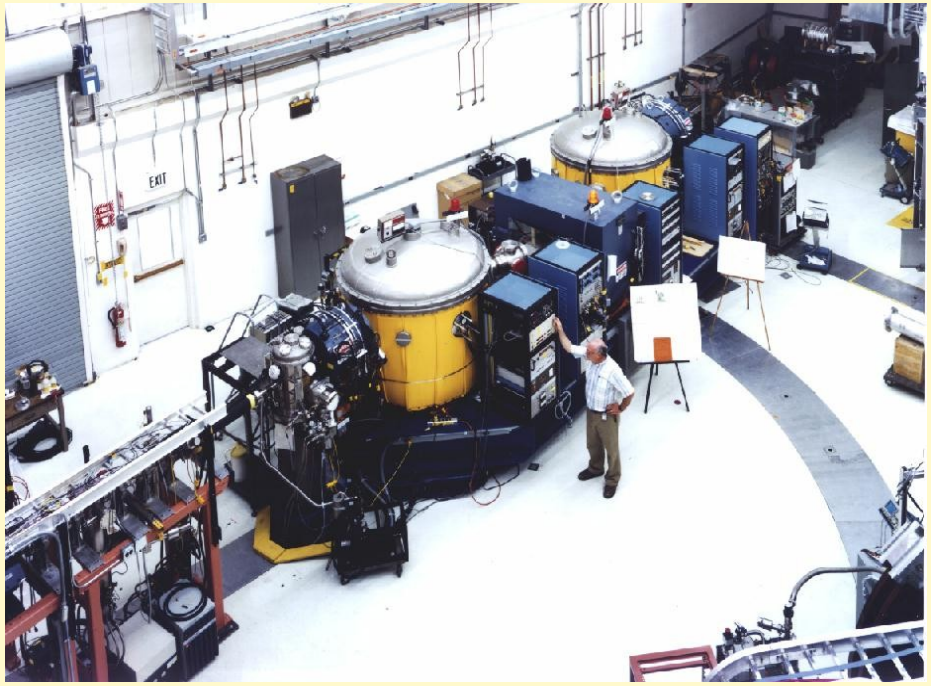
- Berkeley 88-Inch Cyclotron (new ECR source for U-beams)
- Superconducting accelerator at Florida State University
- Notre Dame Nuclear Science Laboratory (mostly nuclear astrophysics)
- Texas A&M K500 superconducting Cyclotron
- Triangle Universities Nuclear Laboratory at Duke
- University of Washington tandem accelerator

ATLAS accelerator at Argonne National Laboratory

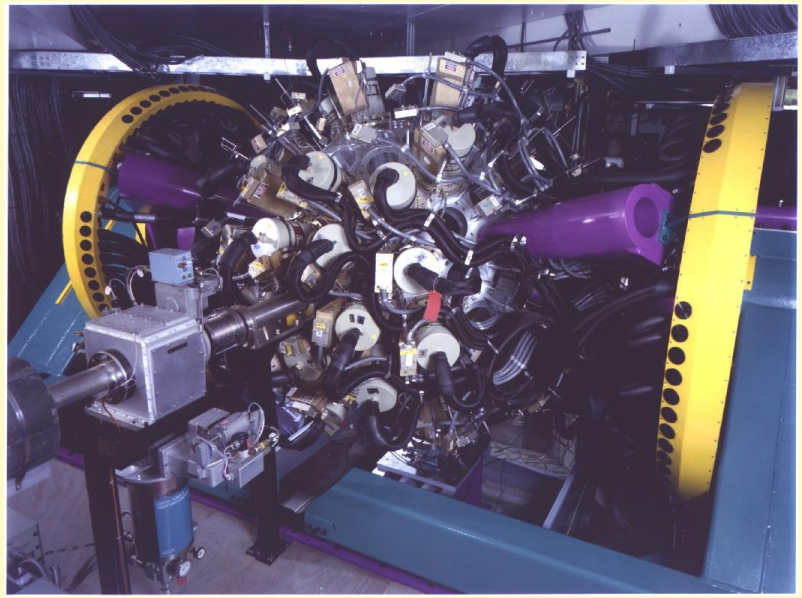
http://www.phy.anl.gov/atlas/index.html



ATLAS accelerator at Argonne National Laboratory



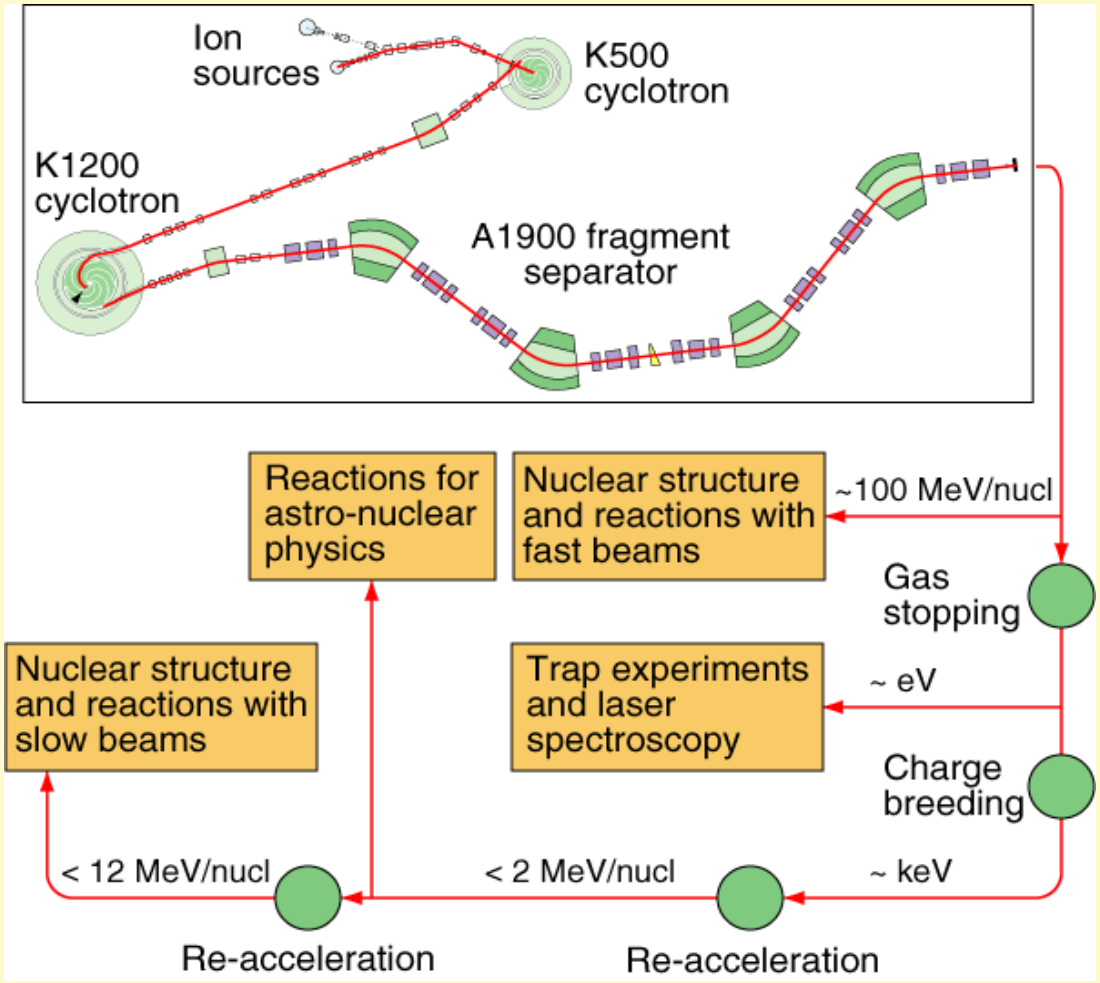
Fragment mass analyzer



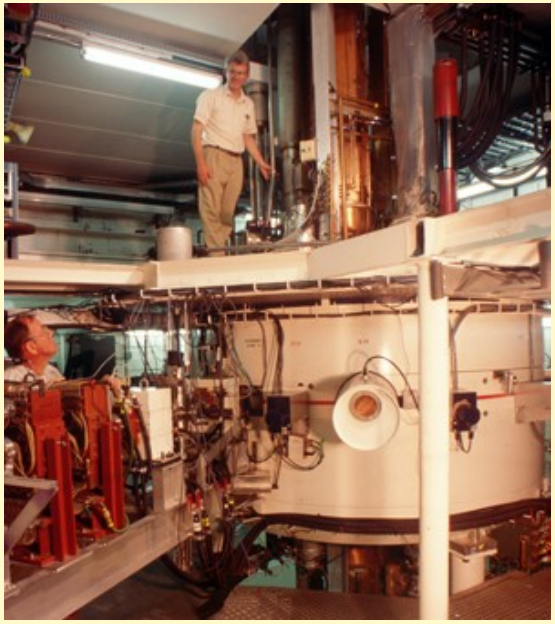
Gammasphere

National Superconducting Cyclotron Lab (NSCL) at Michigan State University

http://www.nscl.msu.edu/tech/accelerators



National Superconducting Cyclotron Lab (NSCL) at Michigan State University



K500 cyclotron

K1200 cyclotron

Overview of the FRIB Facility