88-Inch Cyclotron - Isotopes Used and Produced

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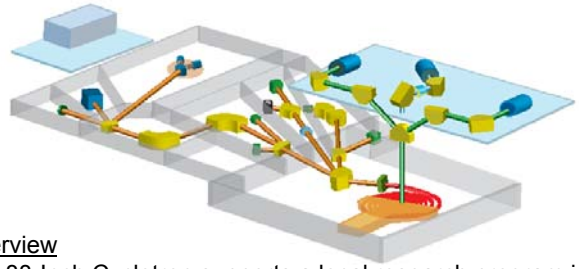

Overview

The 88-Inch Cyclotron supports a local research program in nuclear science and is the home of the Berkeley Accelerator Space Effects (BASE) facility. Operated by the Department of Energy's Office of Science, the Cyclotron is now jointly funded by the DOE and the National Security Space Community.

Cyclotron Beams

The 88-Inch is a K=140 sector-focused cyclotron with both light- and heavy-ion capabilities. **Protons and other light-ions are available at high intensities (10-20 pμA) up to maximum energies of 55 MeV (protons), 65 MeV (deuterons), 135 MeV (3He) and 140 MeV (4He).** Most heavy ions through uranium can be accelerated to maximum energies which vary with the mass and charge state.

Research

The 88-Inch Cyclotron supports ongoing research programs in nuclear structure, astrophysics, heavy element studies, fundamental interactions, symmetries, and technology R&D by LBNL and U.C. Berkeley. Education of the next generation of scientists is an important mission. Major instrumentation under development at the 88-Inch Cyclotron includes GRETINA, the next generation Gamma Ray Energy Tracking Array, and VENUS (above), a third-generation superconducting ECR ion source.

Stable Beams From Separated Isotopes

Element	mass	mass	mass
Li	6		
B	10		
C	13		
N	15		
O	17	18	
Ne	21	22	
Mg	25	25	
Si	29	30	
S	34	36	
Ar	36	38	40
Ca	44	46	48
Ti	46	50	
Cr	52	54	
Fe	54		
Ni	64		
Ge	70		
Kr	78	80	86
Zr	96		
Xe	124	129	136
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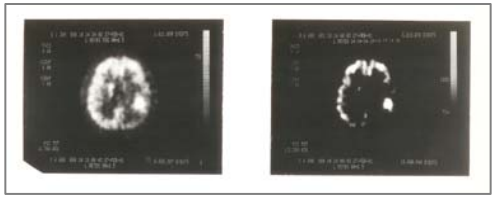
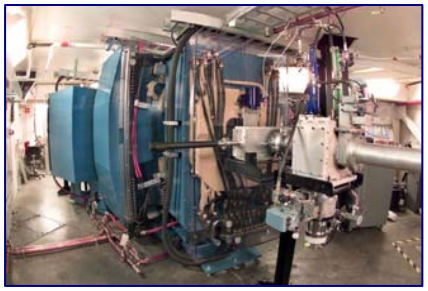
Nd	146		
Sm	154		
Dy	162		

Important, rare and or expensive



Fluorine-18 produced at the 88-Inch Cyclotron (above) was used to study metabolic rates in healthy and malignant brain tissue. Dr. Tom Budinger's group at LBL in the 70's and 80's did pioneer PET R&D.

Other isotopes produced ^{11}C ^{14}O, ^{15}O, ^{56}Co, ^{76}Kr

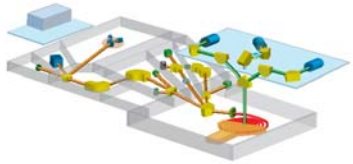


The Berkeley Gas-Filled Separator (above) is the latest tool in studies of the chemistry and physics of the heaviest elements.

VENUS is one of the world's most powerful ECR Ion Sources and a prototype for FRIB

Gretina is a powerful gamma-ray tracking array under construction at LBNL.

88-Inch Cyclotron
Stable Beams From Separated Isotopes
101 Stable Isotope Beams Accelerated



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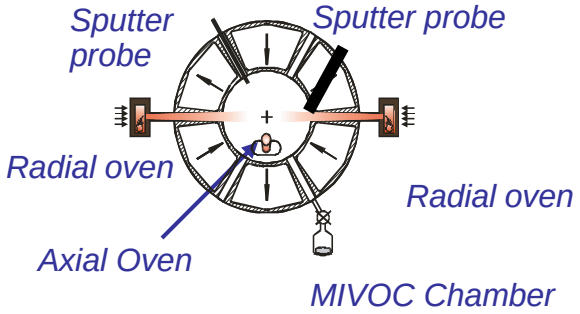
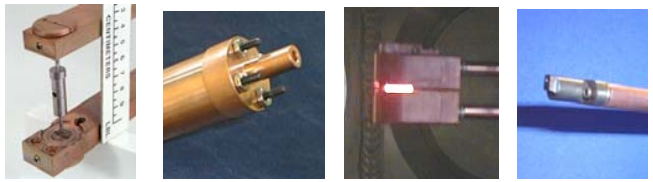
Oven technology



Oven Capacity 400 to 1000 mg

Max. Temp. 2100 Deg C | Max. Temp. 650 Deg C | Max. Temp. 2100 Deg C | Max. Temp. 650 Deg C



Standard Radial Ovens | Miniaturized Ovens

Metal Ion Beam Production in the AECR-U

Heavy-element research

≤1 pμA on target

Beams from solids

Ovens
Sputtering
MIVOC (compounds)
Gases (SiH_4, SO_2, Ne…)

Ion Source Efficiency (Ovens)

Gases 5 to 10%
Solids (HiT) .1 to .2 %
Solids LoT .1 to .4%
Solids with liner 2-4%

Cyclotron Efficiency

5-25%

Overall Efficiency

.05% to 1.25%

Usage rates .01 to 1 mg/hr

Usage up to 1 gram/year

High usage isotopes

^{48}Ca, ^{50}Ti, ^{26} Mg, ^{64}Ni

Important, rare and or expensive