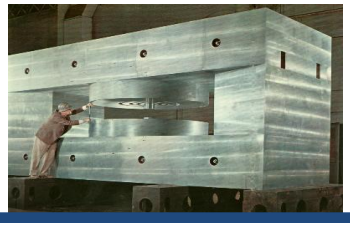
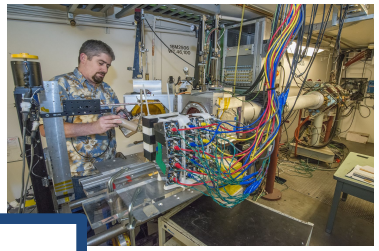
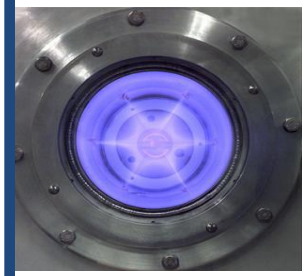
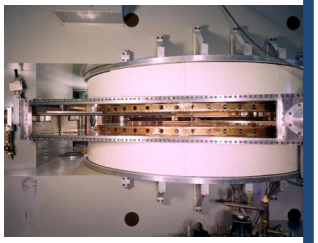
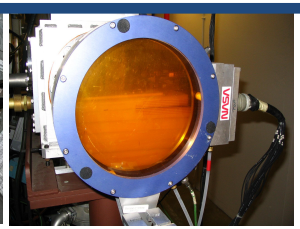
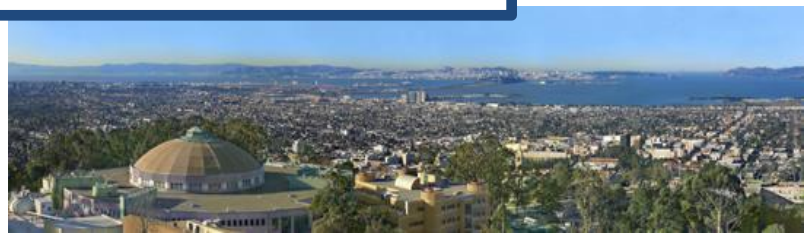
Berkeley Lab 88-Inch Cyclotron Status



Mike Johnson

Research Coordinator

Lawrence Berkeley National Laboratory

BASE Facility Layout & Capabilities

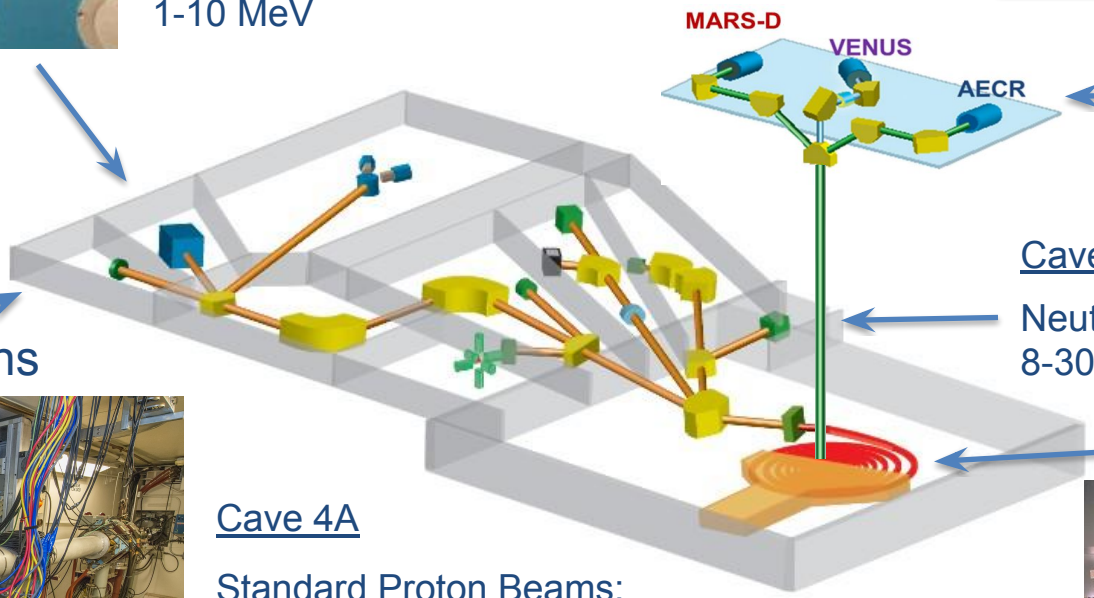
Heavy Ions, Low Energy Protons, Microbeams

Cave 4B

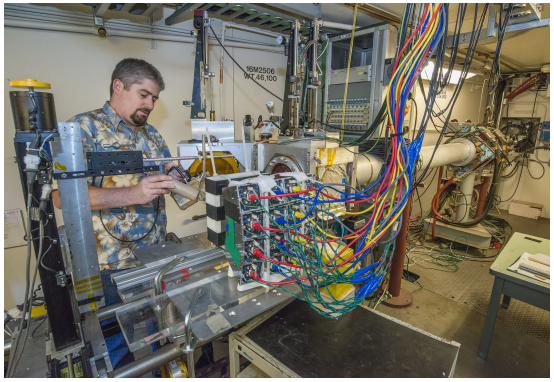
Standard Cocktail Beams:
4.5, 10, 16, & 20 AMeV

Low Energy Protons:
1-10 MeV

BASE Facility Beams:
- Heavy Ions
- Light Ions
- Protons
- Low Energy Protons
- Neutrons
- Microbeams



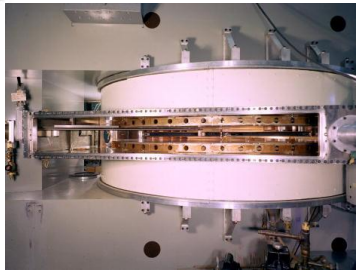
Light Ions, Protons



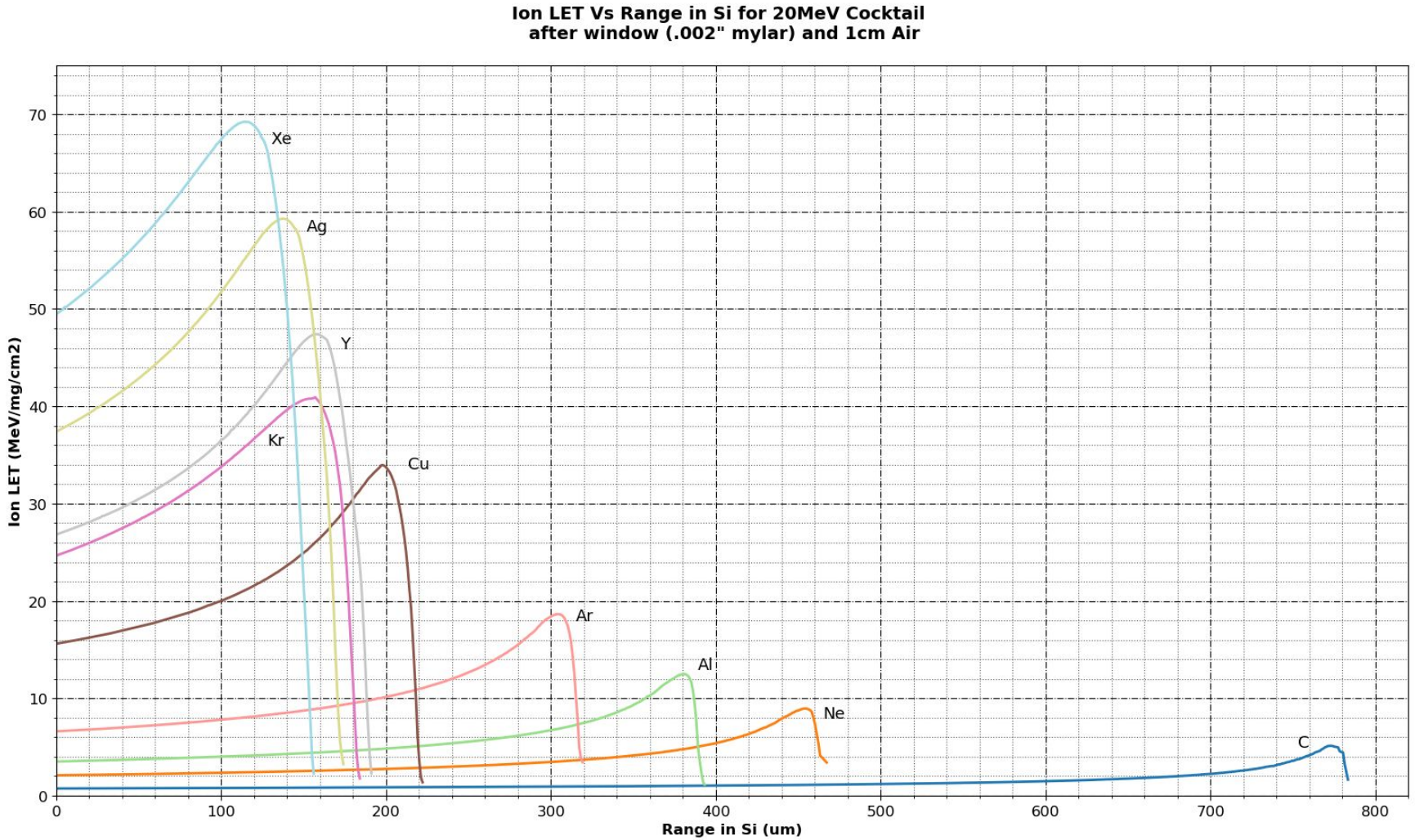
Cave 4A

Standard Proton Beams:
10-60 MeV

Light Ion Cocktails:
30 and 32.5 AMeV



Bragg Curves - 20 AMeV (in-air)



LET (MeV/mg/cm^2)

Range (um)

Beam Time Allocation

1. Determine the total beam time hours for the fiscal year from “Tier 1” funding agencies (DOE, NASA, etc.).
2. Determine if there are any large maintenance items requiring more time (cooling tower replacement).
3. Layout the draft calendar with run and shutdown slots.
4. Determine the number of hours of allocated beam time for each funding agency & their priorities (BGS, medical isotopes, BASE, etc.).
5. Adjust calendar layout for researchers needing extended runs (2-month runs for BGS).
6. Obtain buy-in from all funding agency stakeholders.
7. Sell any remaining available beam time to “Tier 2” pay-by-the-hour users.

Tier 1:

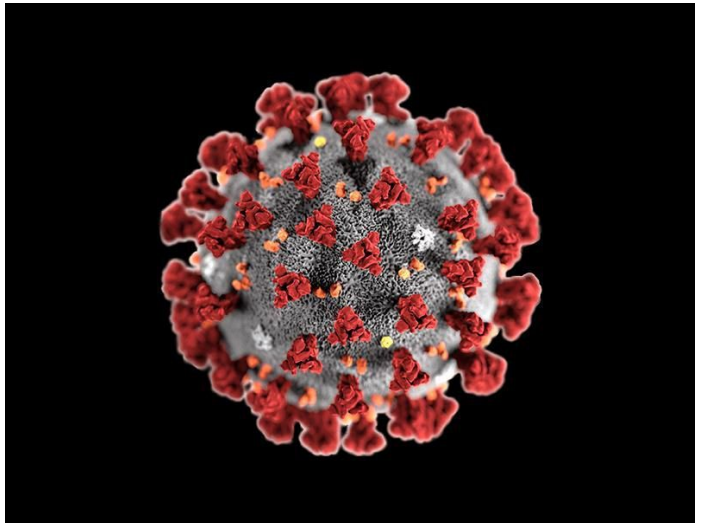
Commit to a minimum number of hours before the start of the fiscal year and have high priority.

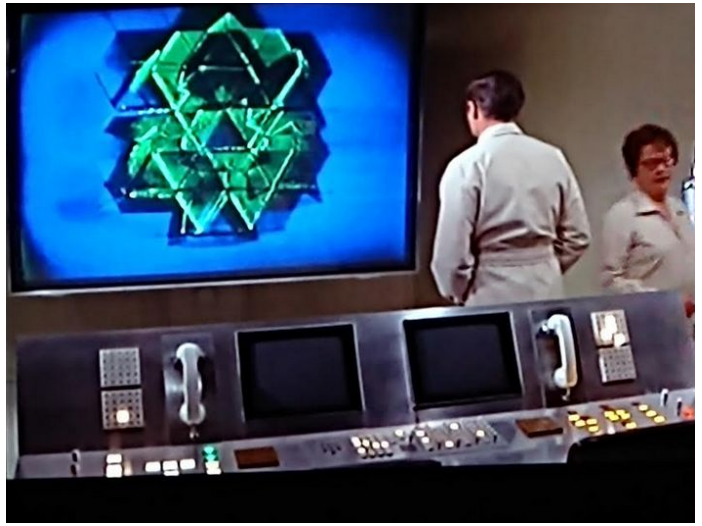
Tier 2:

Pay-as-you-go utilizing available beam time if and when it becomes available.

COVID-19 Impact

1. 88-Inch Cyclotron was forced to shutdown from mid-March through the beginning of June.
2. Restart has been was slow due to COVID-19 restrictions.
3. We have been severely limited as to the number of staff we could have onsite; currently limited to 10 people per day for the 88-Inch Cyclotron.
4. We lost approximately 10 weeks of running due to the COVID-19 shutdown.
5. We were able to restore roughly 6 weeks to the schedule by cancelling our summer maintenance shutdown, but we are still about 4 weeks short.
6. Prior to all of this, we were already booked 11 months out.





COVID-19 User Requirements

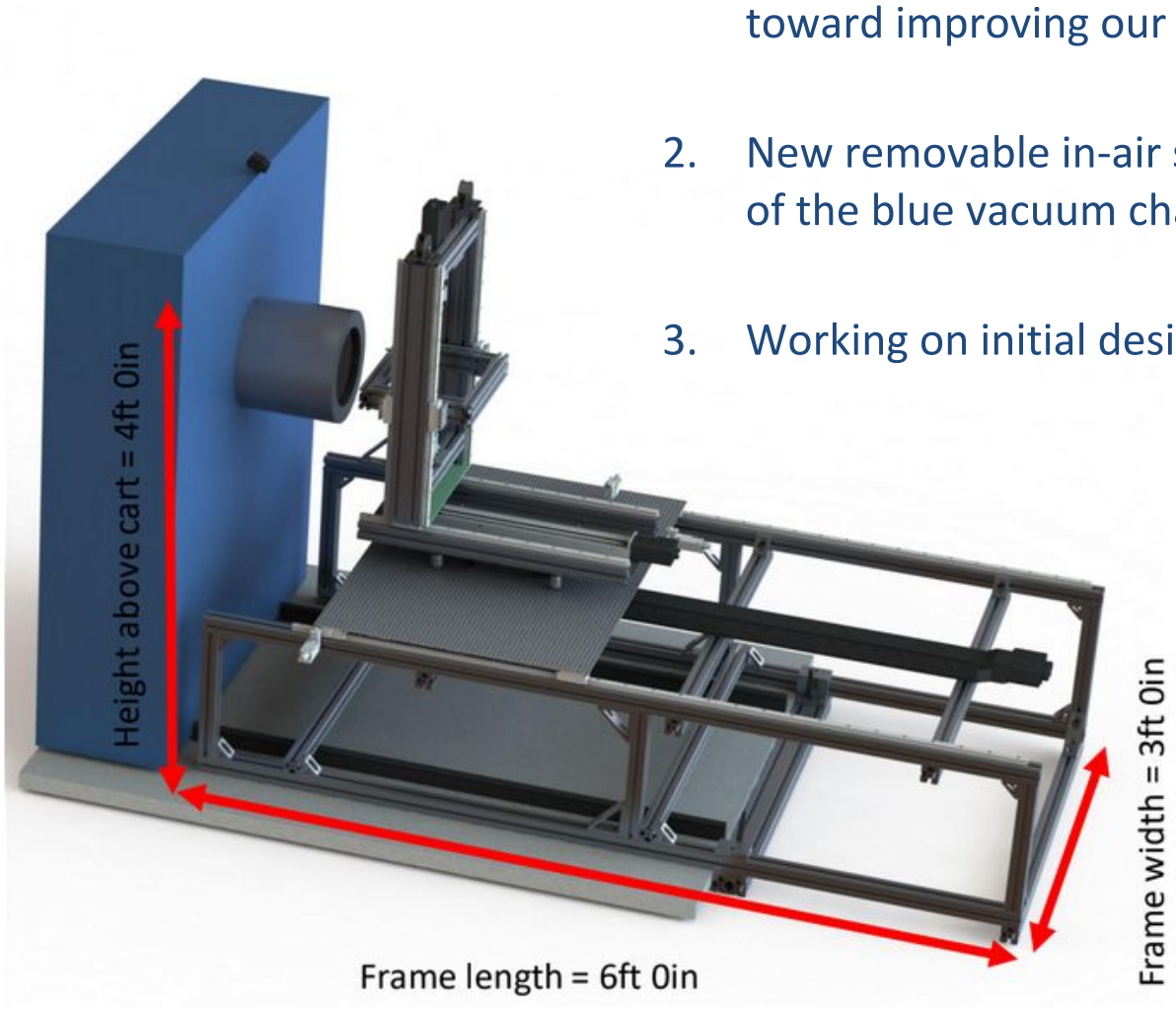
1. New online course for minimizing exposure to COVID-19.
2. Currently limited to 6 users per day. We expect this to increase in July (hopefully).
3. All personnel entering the Lab MUST self-monitoring for symptoms. Anyone with symptoms is NOT permitted at the Lab.
4. Users MUST stay at least 6 feet apart at all times.
5. Cloth masks MUST be used in public common areas (hallways, stairwells, restrooms, etc.) and shared work spaces.
6. No eating or drinking in shared spaces or work/lab areas (this includes the BASE Shack).
7. Hands must be washed frequently. Hand-sanitizer if soap and water are not available.
8. Surfaces MUST be sanitized frequently; when that is not possible, gloves.

In-air Testing

1. Based on user feedback, we have taken steps toward improving our in-air capabilities.

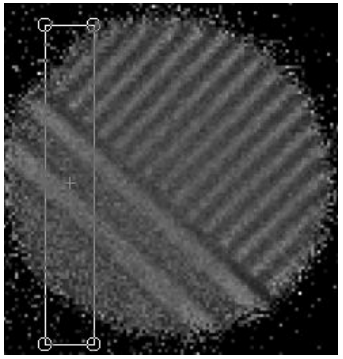
2. New removable in-air stage will mount to the back of the blue vacuum chamber in Cave 4B.

3. Working on initial design now!

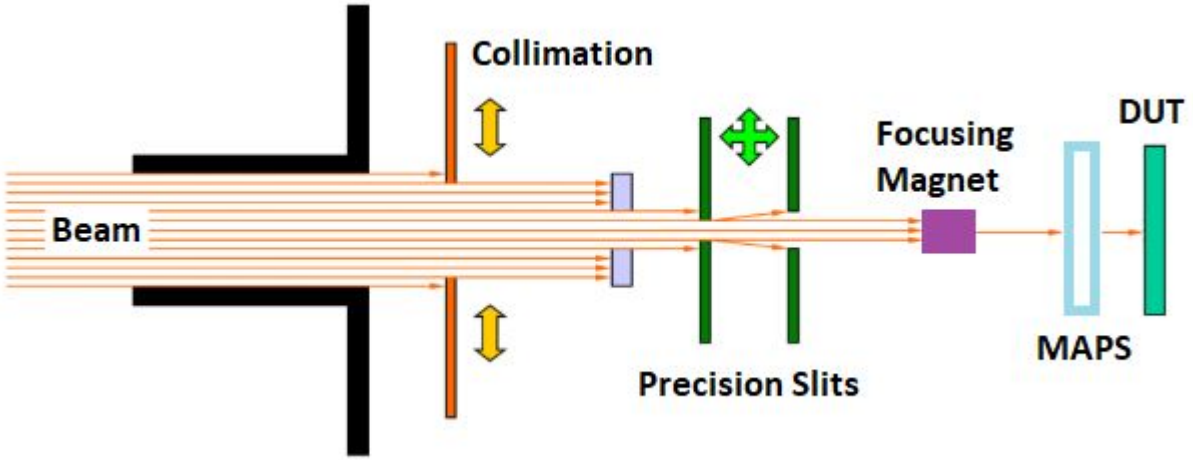


BASE Microbeams & MAPS

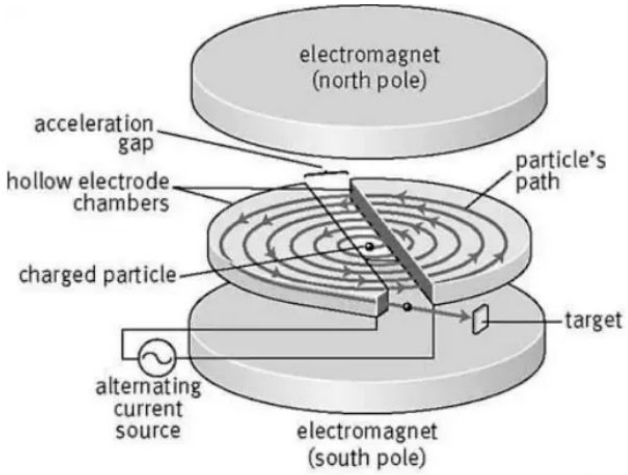
- Semiconductor parts are becoming more miniaturized; microbeams allow users to isolate and probe small sections chips.
- UC Berkeley grad student currently working on the design.
- Combines collimator, precision slits, and focusing magnet efforts to produce a submicron beam.
- Monolithic Active Pixel Sensor (MAPS) to be used for positioning microbeams. This was developed for STAR Heavy Flavor Tracker at Brookhaven's Relativistic Heavy Ion Collider (RHIC),.



5 um resolution



MARS Ion Source



$$m\,v = q\,B\,r$$

We can change this one!

m = ion mass

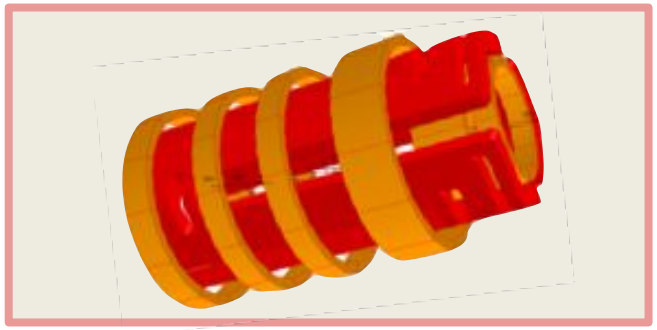
v = ion velocity

r = orbital radius

q = ion charge

B = magnetic field

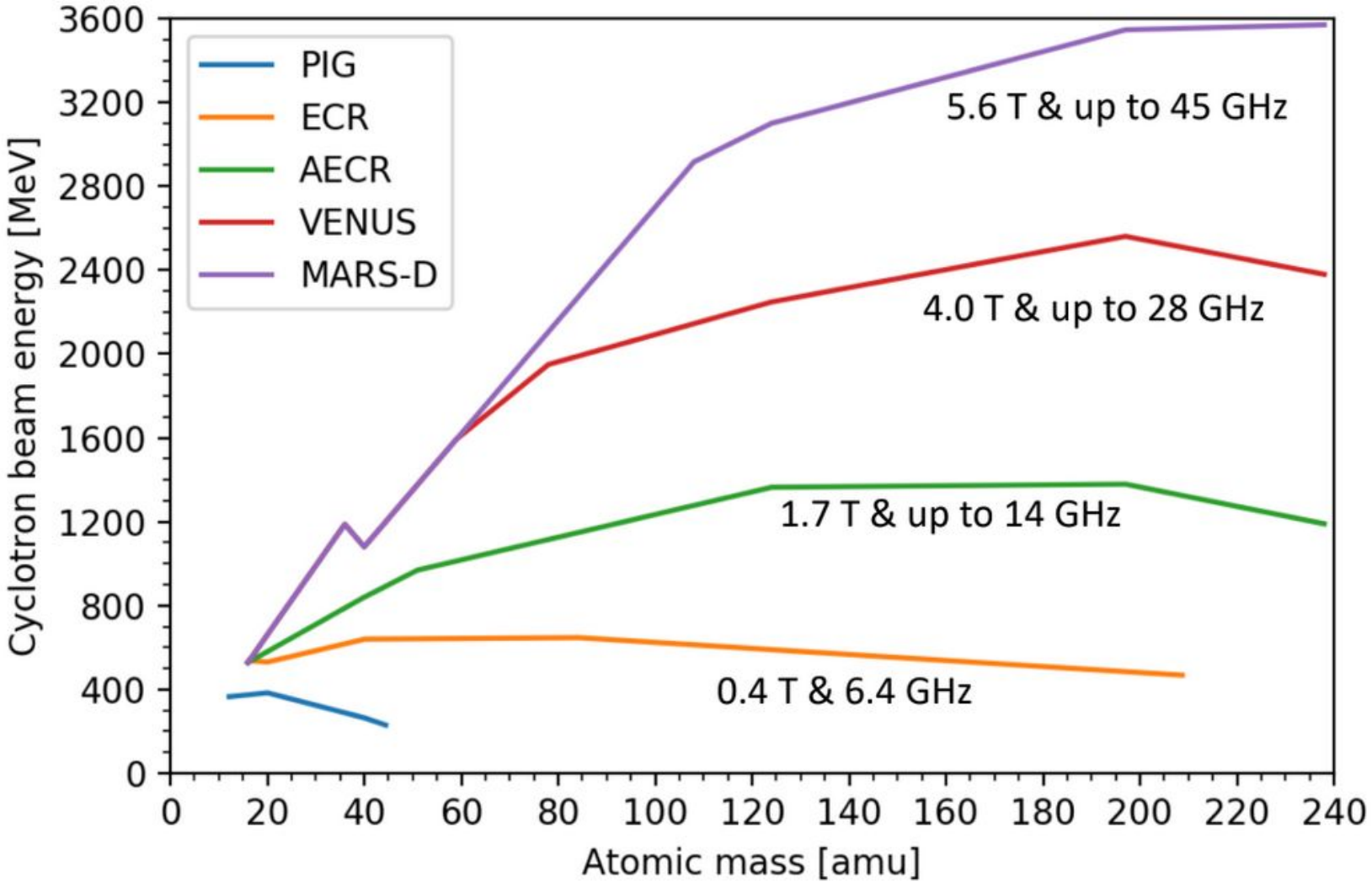
Can't change these easily



MARS windings, constructed from NbTi

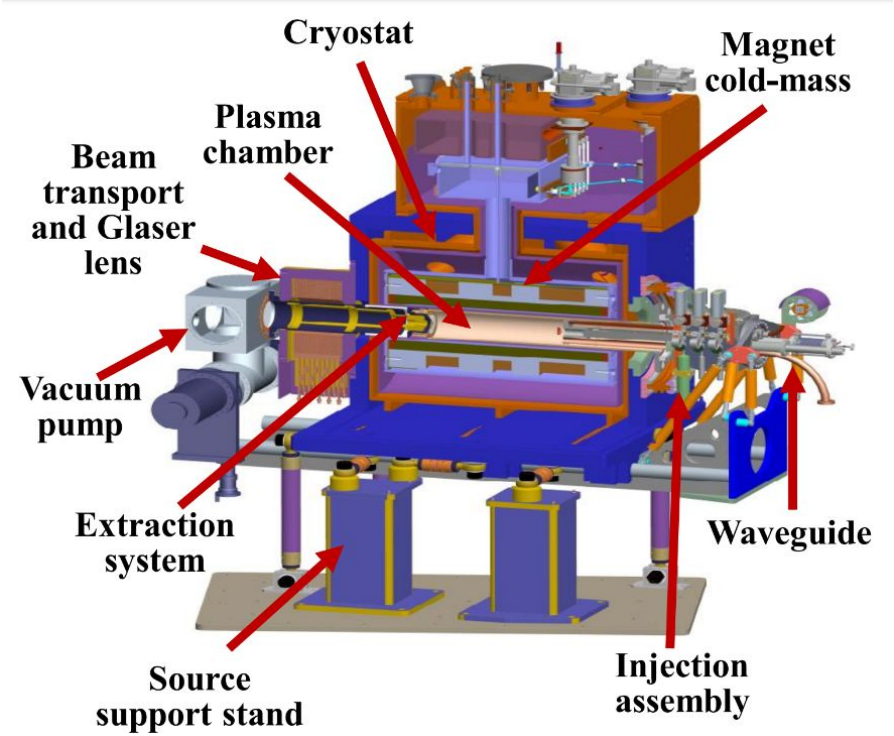
- Reestablishes LBNL as the world leader in ECR ion source design and construction
- Higher current beams for super-heavy element research
- Higher energy beams for BASE Facility (testing at air)
- Second source frees up time for high-performance ion source research and adds redundancy, reducing failure time

Predicted MARS Ion Energies



MARS Ion Source DOE Review

- DOE conducted a review of the MARS proposal last week
- Very positive reception
- MARS was determined to be a sound concept
- Significantly increases the capabilities of current accelerators

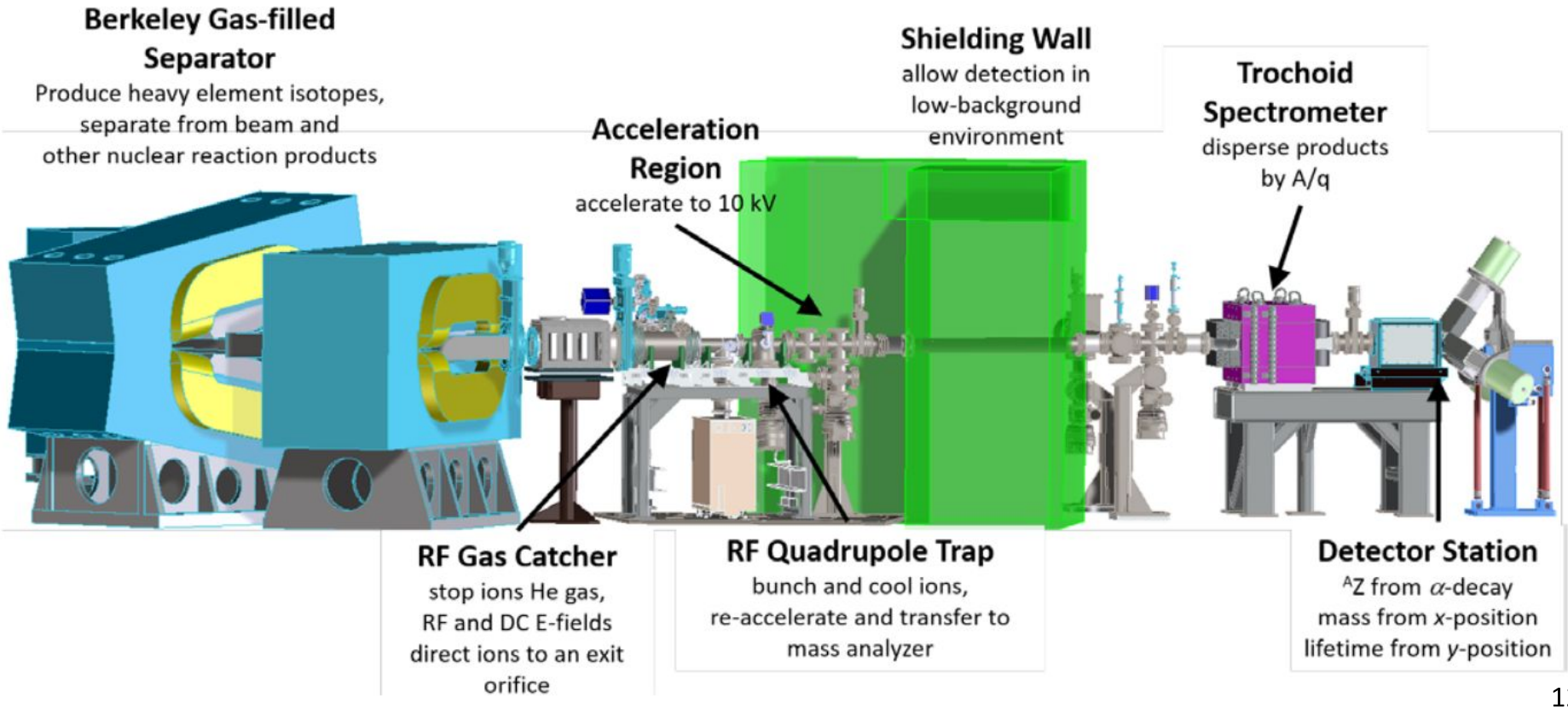


- Allows future heavy ion facilities to achieve higher beam energies and power at a lower cost, as opposed to building a bigger accelerator
- MARS is being considered as an upgrade path for FRIB (Facility for Rare Isotope Beams) at Michigan State

The Search for Element 120

BGS

- DOE review last April: Full speed ahead!
- First milestone has been funded



The 88-Inch Cyclotron

"Instead of an attic with a few test tubes, bits of wire and odds and ends, the attack on the atomic nucleus has required the development and construction of great instruments on an engineering scale."

"No individual is alone responsible for a single stepping stone along the path of progress, and where the path is smooth, progress is most rapid."

"Let us cherish the hope that the day is not far distant when we will be in the midst of this next adventure."

- Ernest Lawrence

Thank you