AN INTRODUCTION

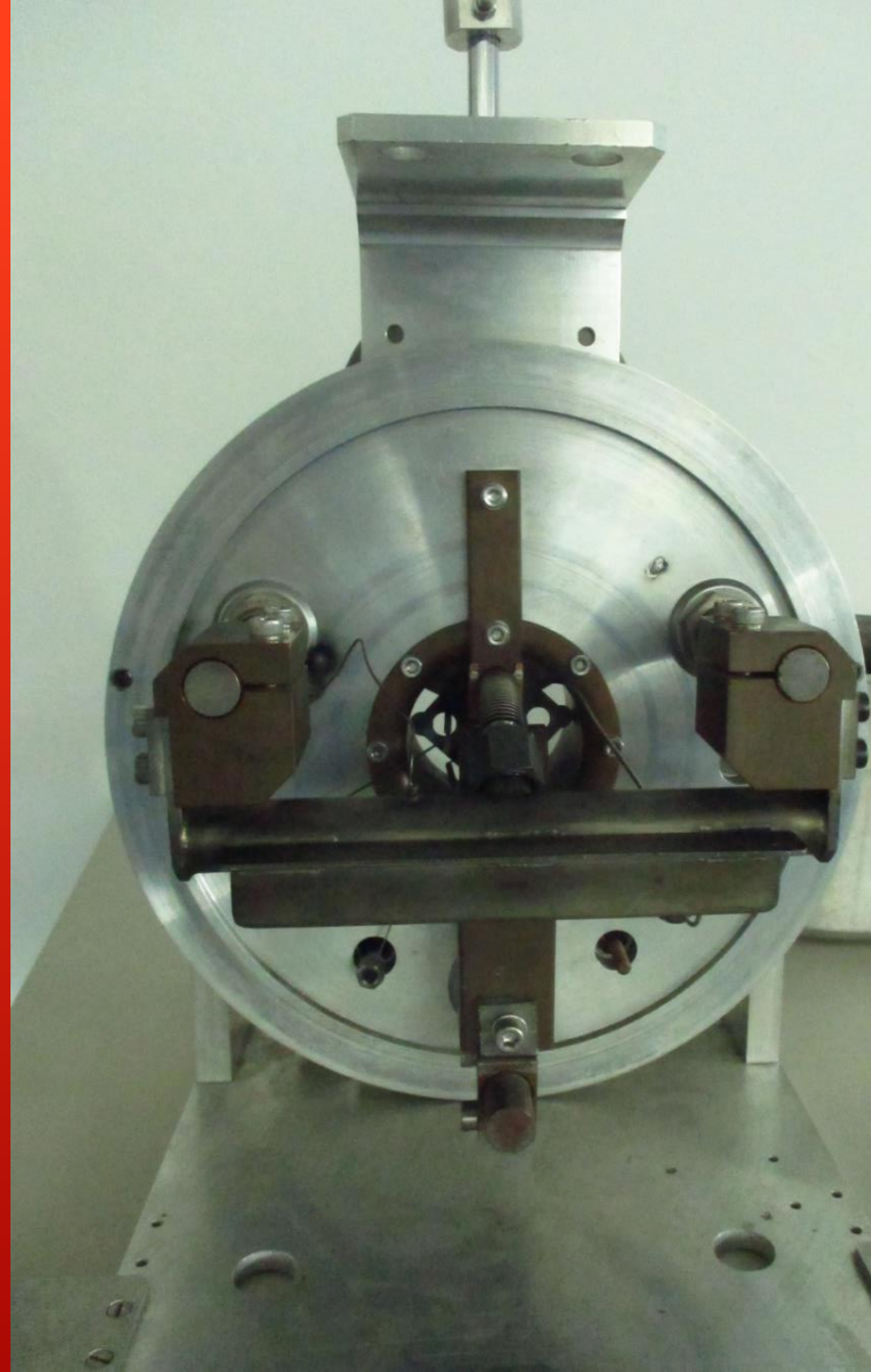
Jaime Avilés Acosta

WHAT IS ISOLDE?

- **I**sotope **S**eparator **O**n-**L**ine **DE**vice
- Dedicated to producing radionuclides
- Applications in nuclear physics, biophysics solid-state physics, atomic physics, and astrophysics.
- Over 50 experiments are done at ISOLDE per year, with over 600 visiting users.

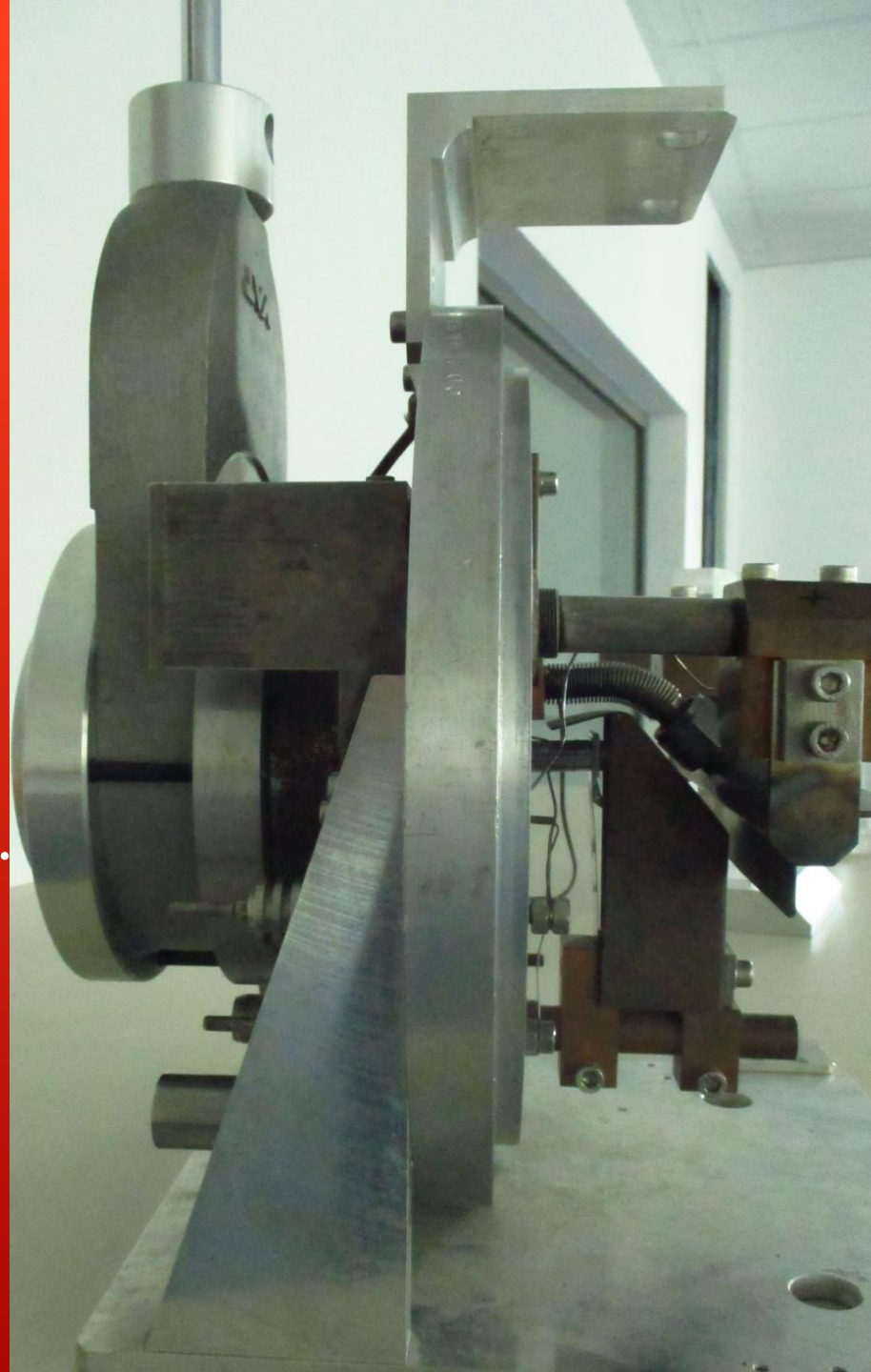
PRODUCING RADIONUCLIDES

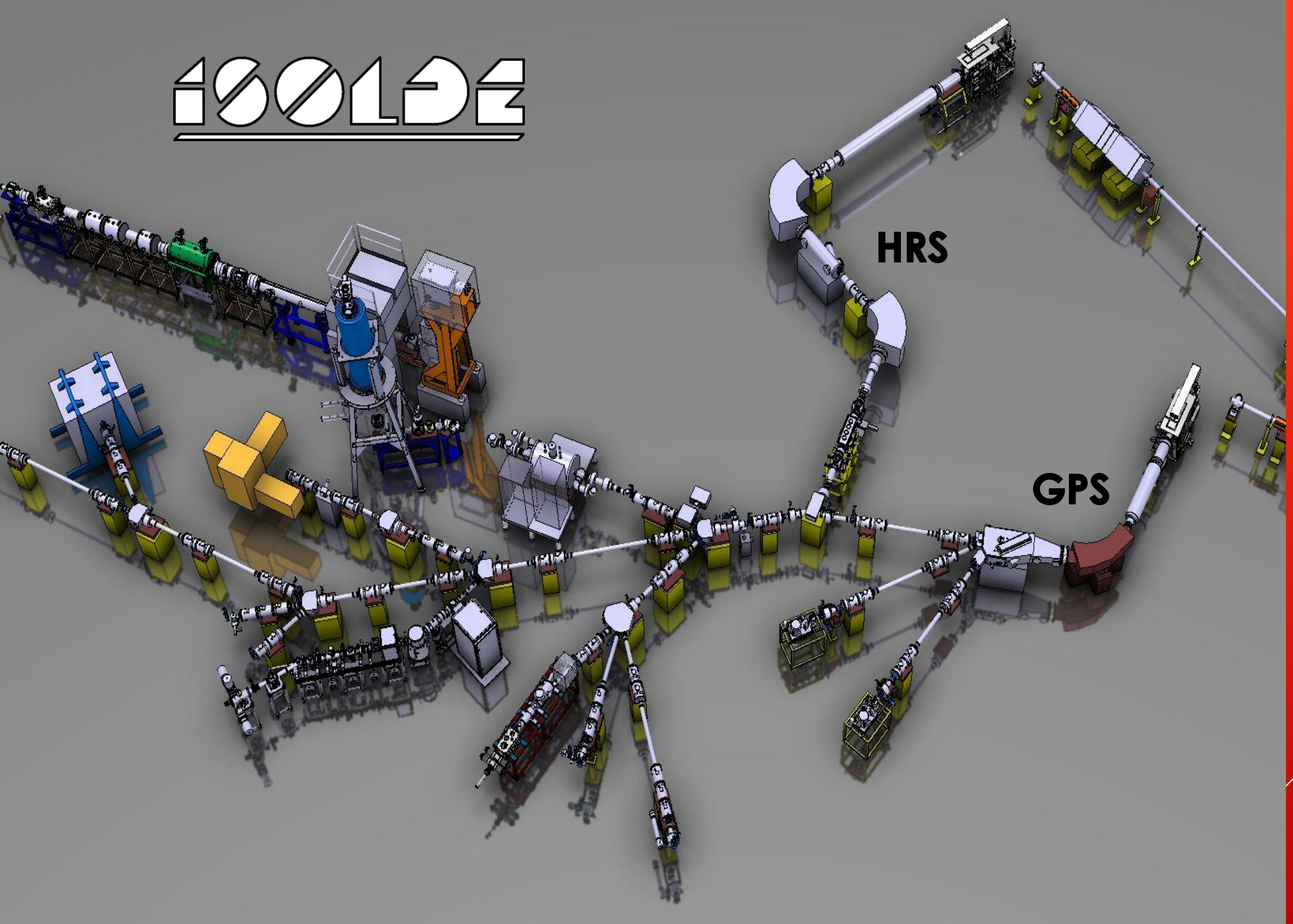
- A target is struck by a high-energy proton beam from the Proton-Synchrotron Booster. Target undergoes spallation fission.
- The composition and form of the target is chosen based on the desired radionuclides.
- Heat is used to release the desired radionuclides as vapor and then it is ionized.



SEPARATING AND USING RADIONUCLIDES

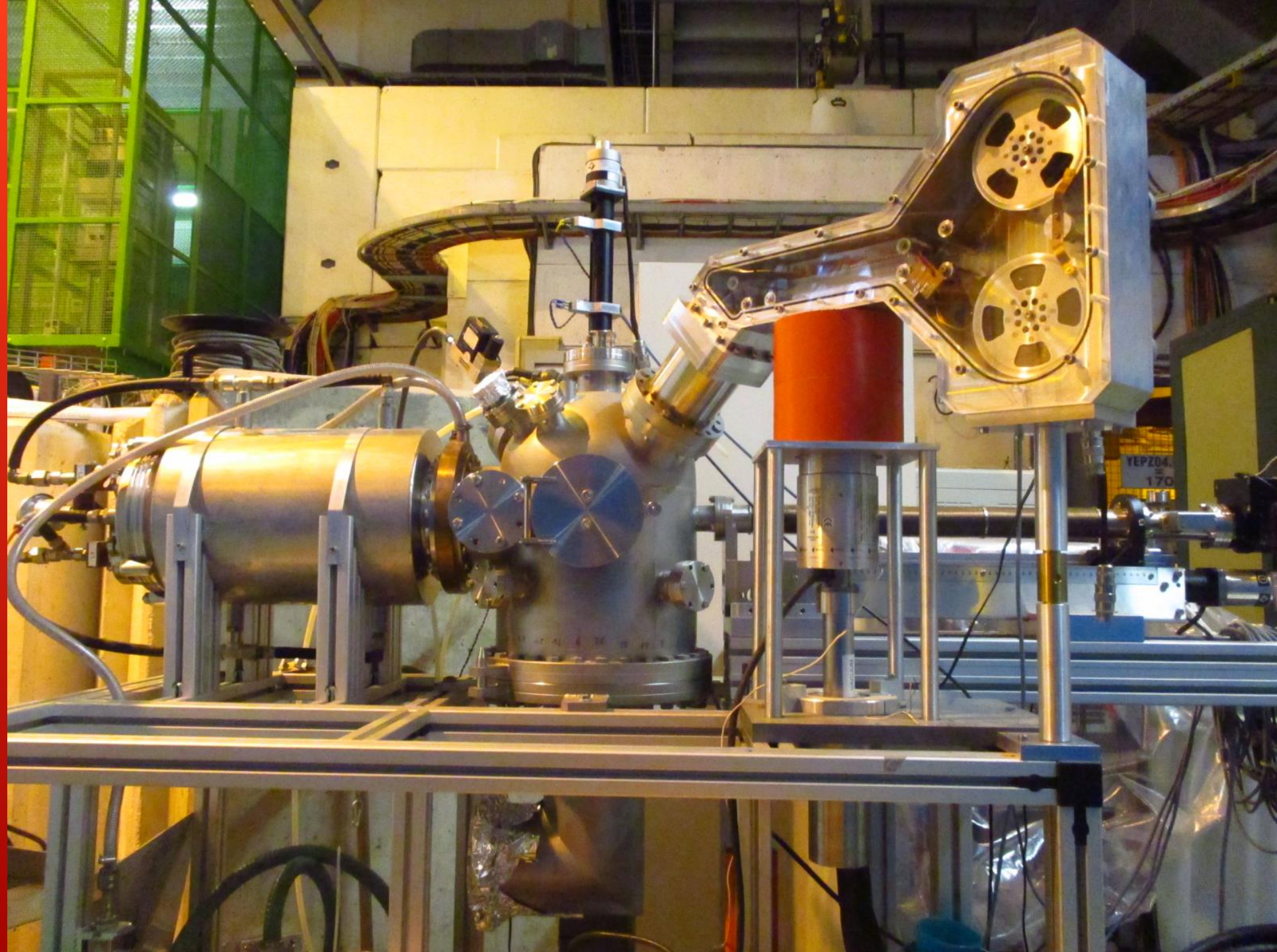
- Ionized radionuclides are guided into a mass separator system by a 60 kV accelerating voltage.
- The system use bending magnets to separate the ion beams into up to three isobaric beams.
- From here, radioisotopes can be used for different experiments (ISOLTRAP, MINIBALL, WITCH…).





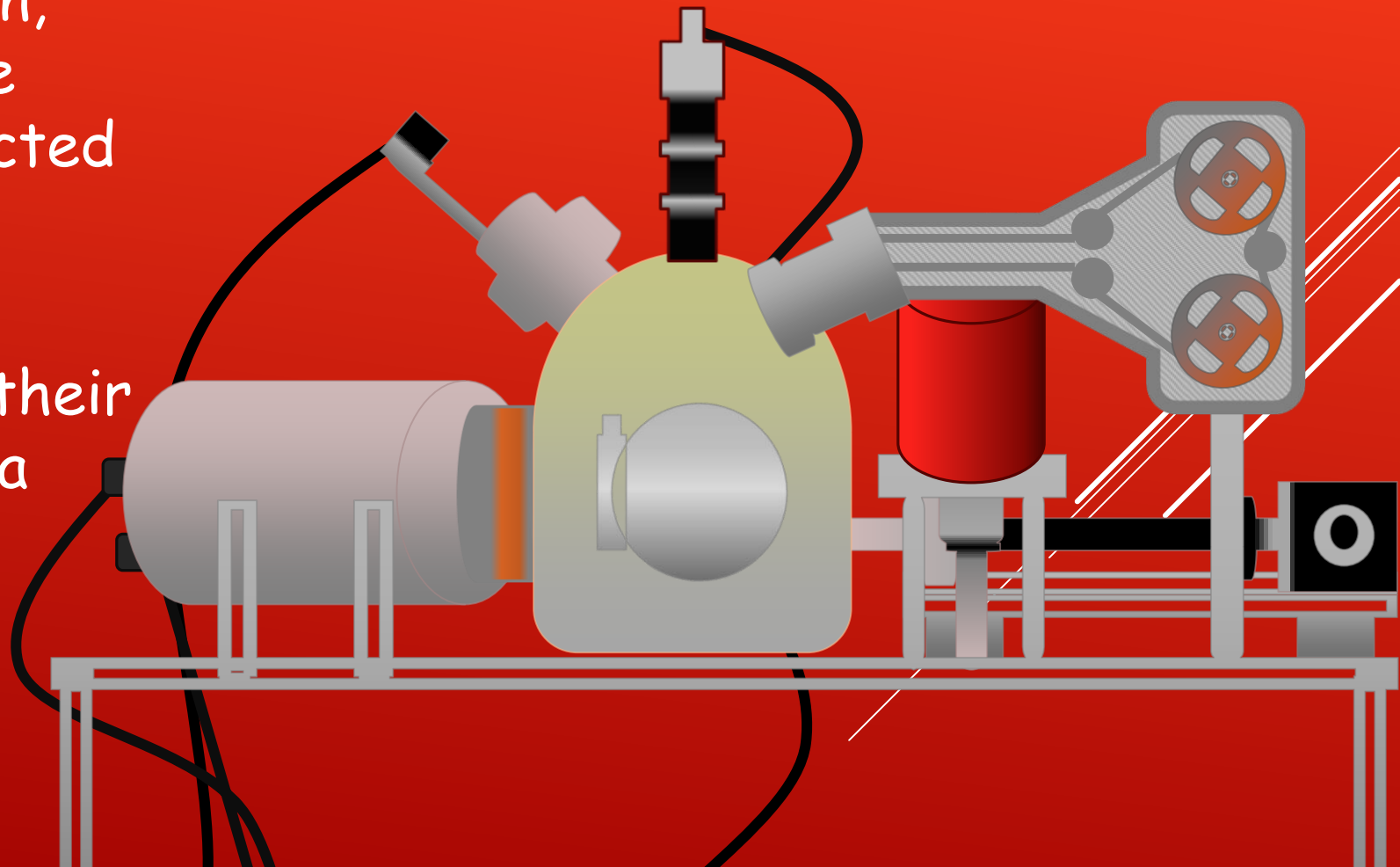
PS Beam

THE PROJECT



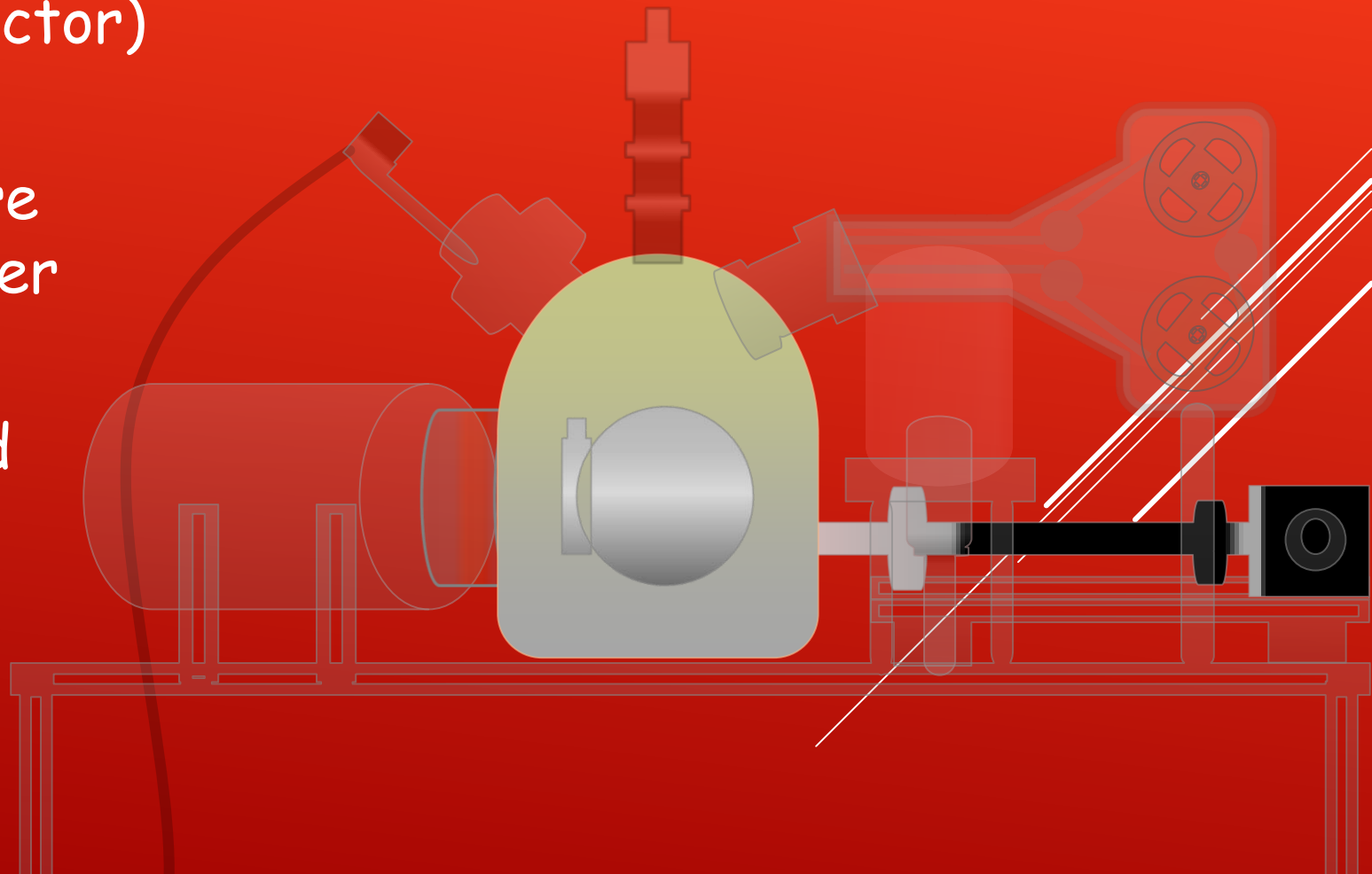
ON-LINE DIFFUSION PROFILING

- On-line: target preparation, and measurement are done while experiment is connected to beam line.
- Diffusion profiling: uses radioisotopes to measure their rate of diffusion through a material



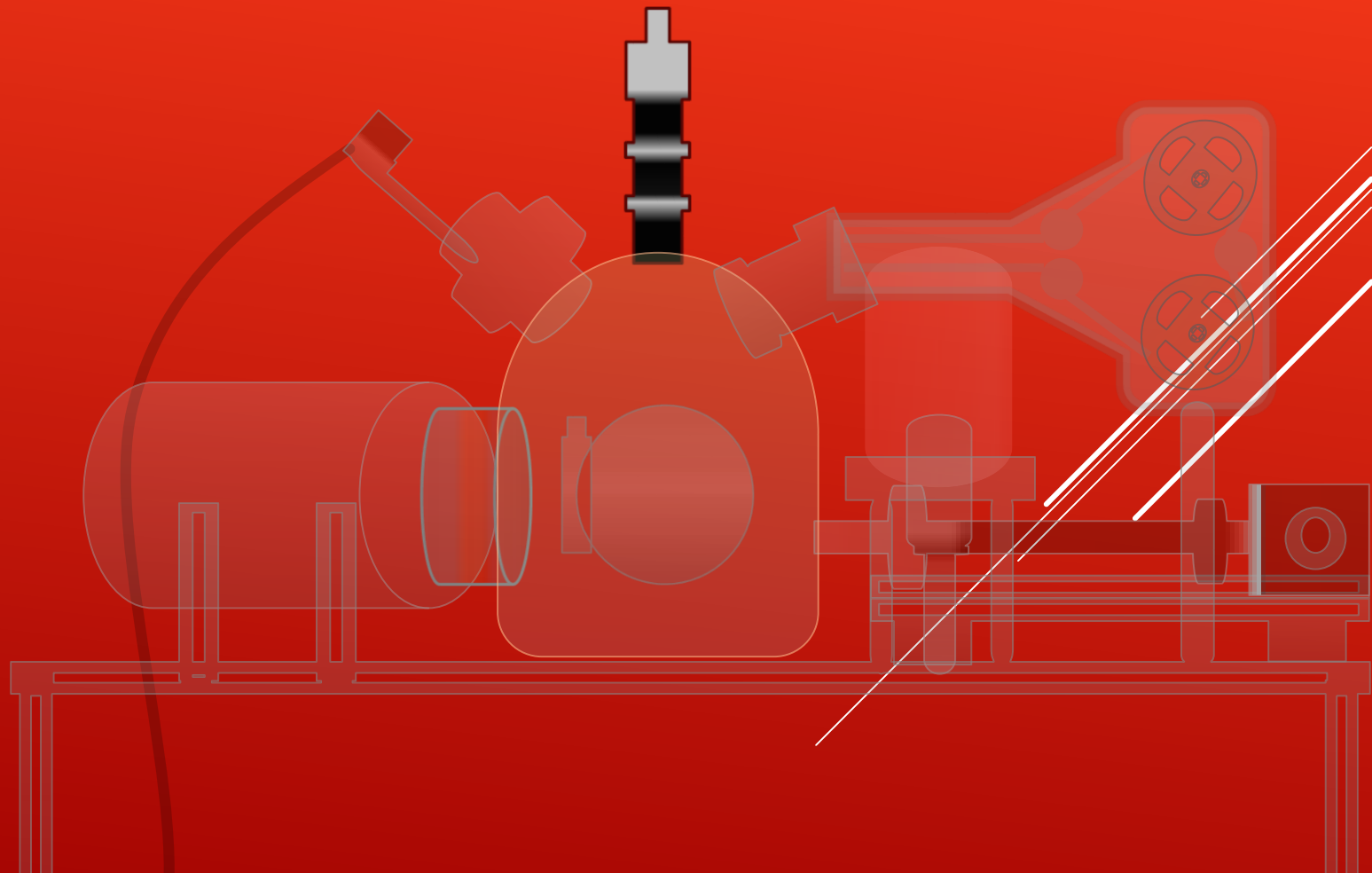
TARGET CHAMBER

- Target (usually a semiconductor) is held by manipulator arm.
- At vacuum, radioisotopes are accelerated into the chamber with a 60 kV potential.
- Radioisotopes are implanted ~100 nm into the target.



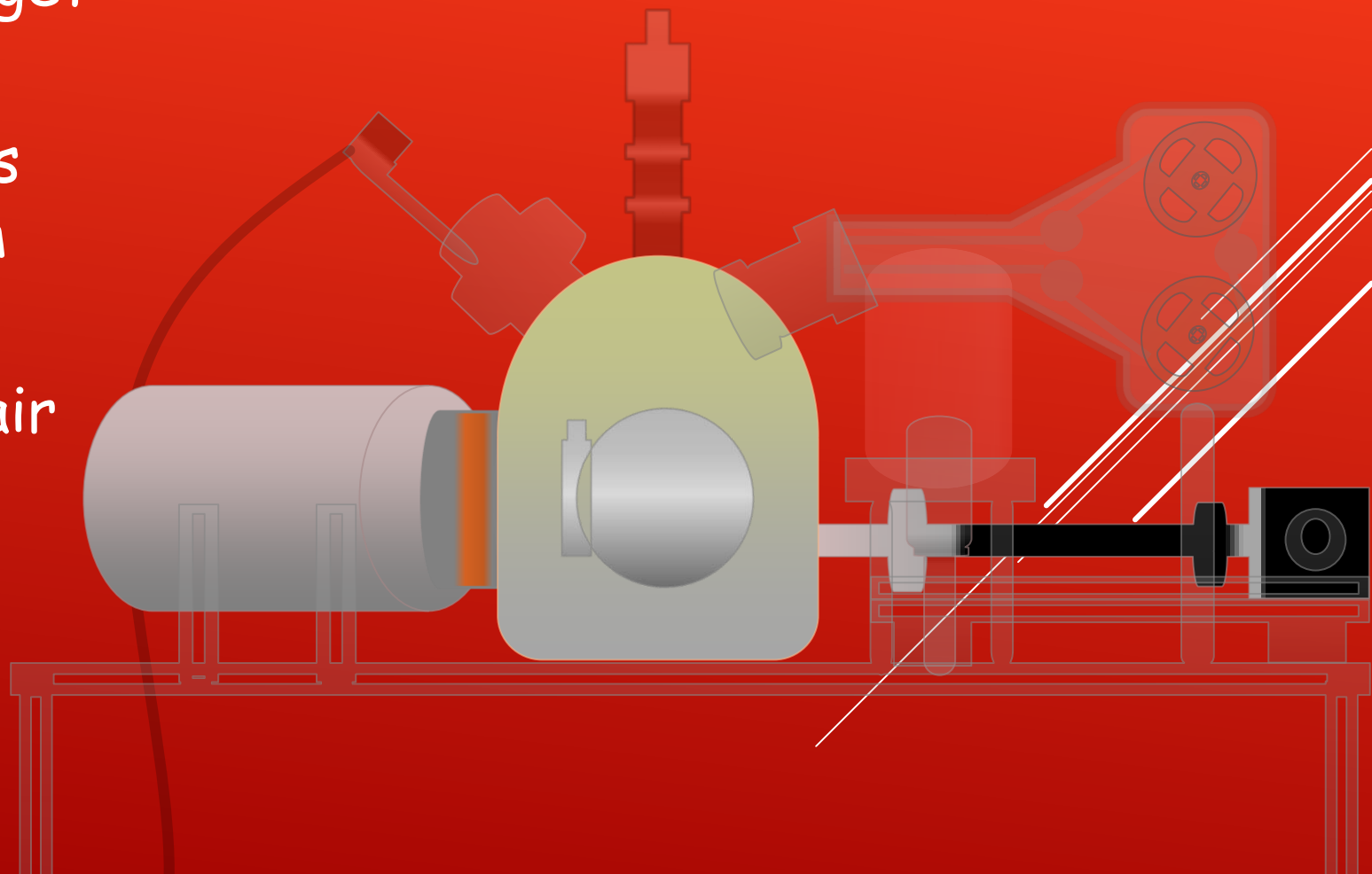
FARADAY CUP

- Measures current from radioisotope ions
- Ions per second = I/e



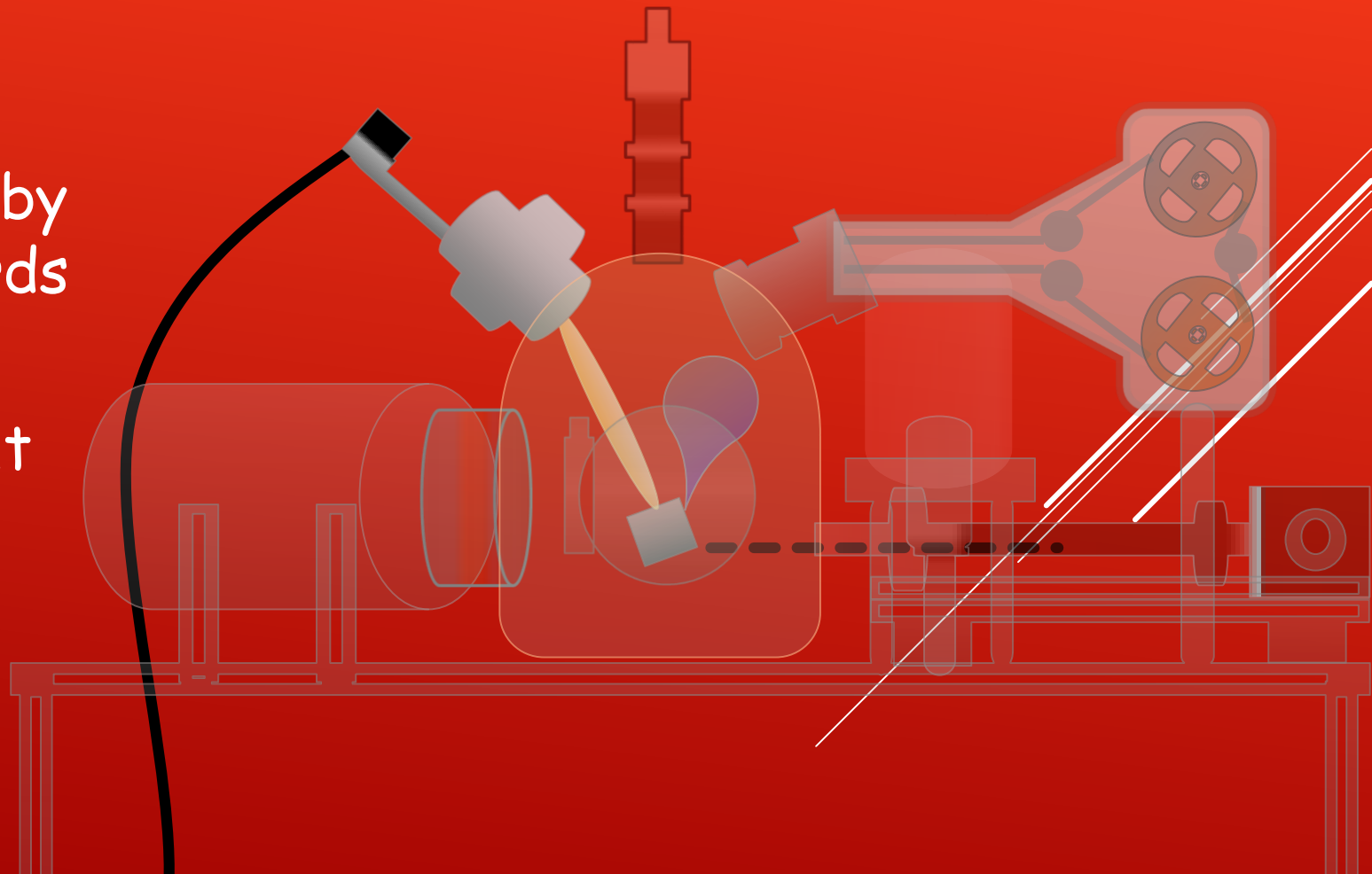
ANNEALING (OVEN)

- Oven is separated from target chamber by a shutter.
- Post implantation, shutter is opened and manipulator arm introduces target to oven.
- Oven anneals target to repair lattice damage from implantation.



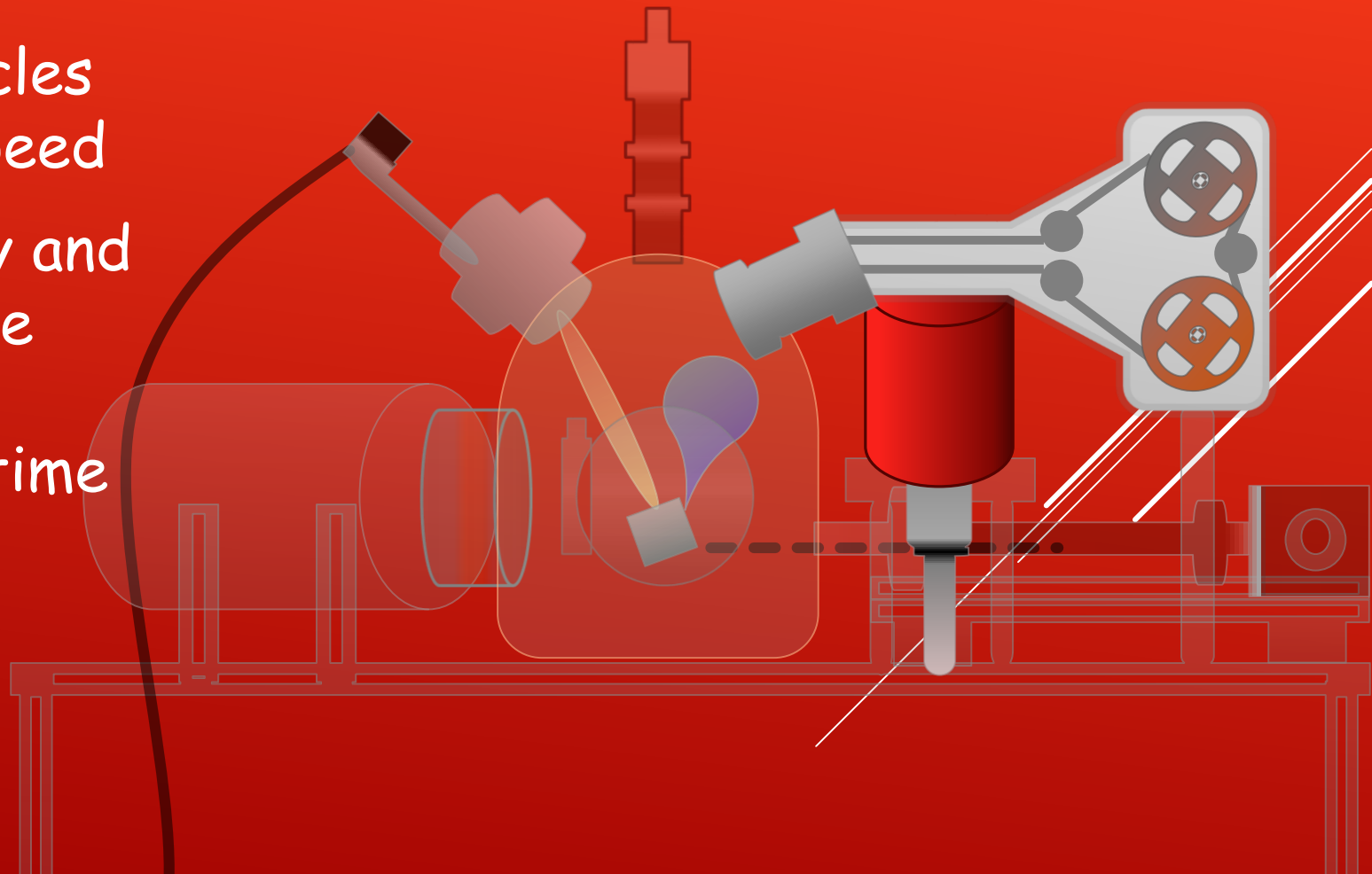
ABLATION (ION GUN)

- Constant flow of argon gas ionized by a cathode.
- Argon ions are accelerated by an electrostatic field towards surface of target.
- Ablated particles are caught by a tape system



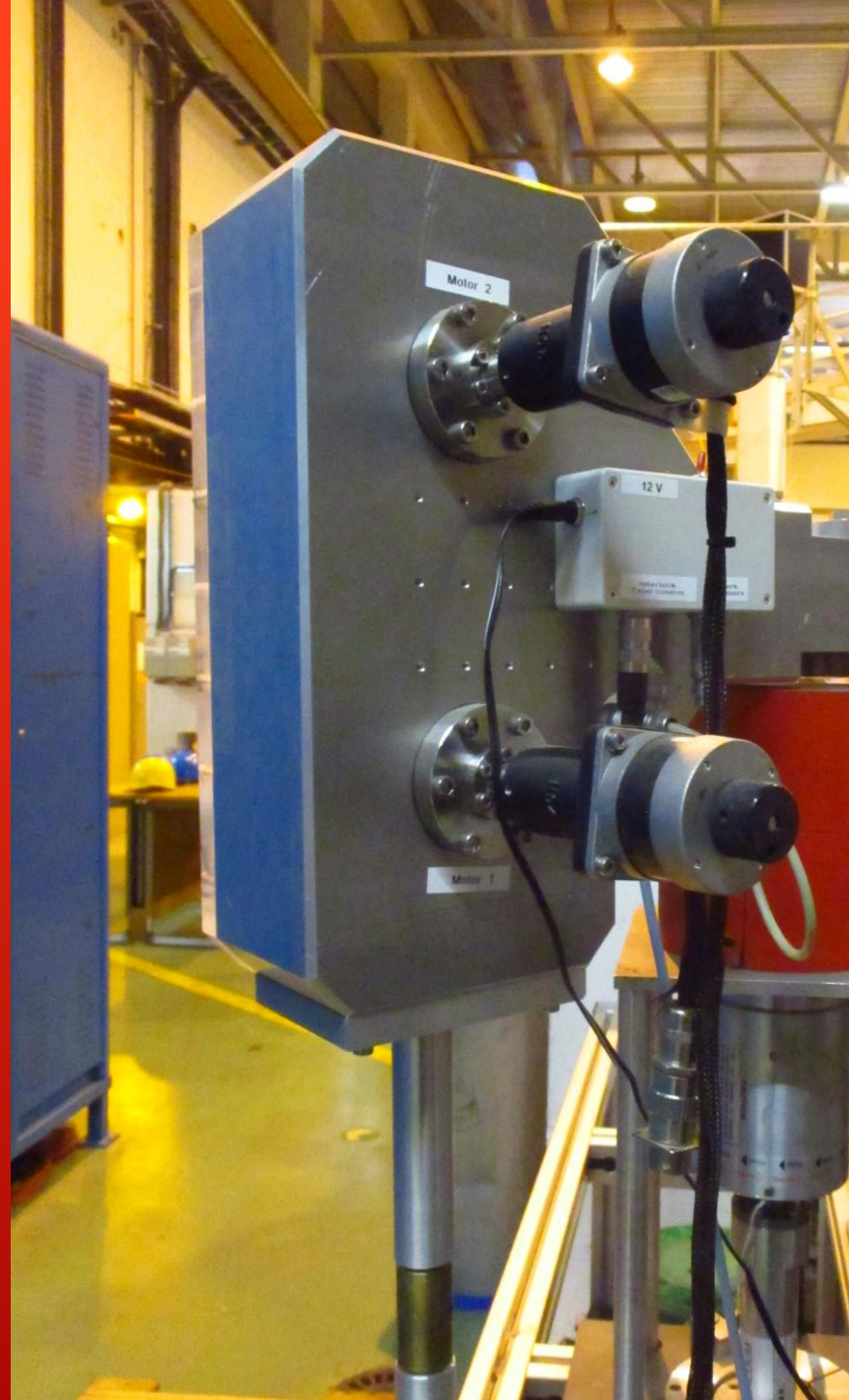
TAPE TRANSPORT SYSTEM + GAMMA SPECTROMETER

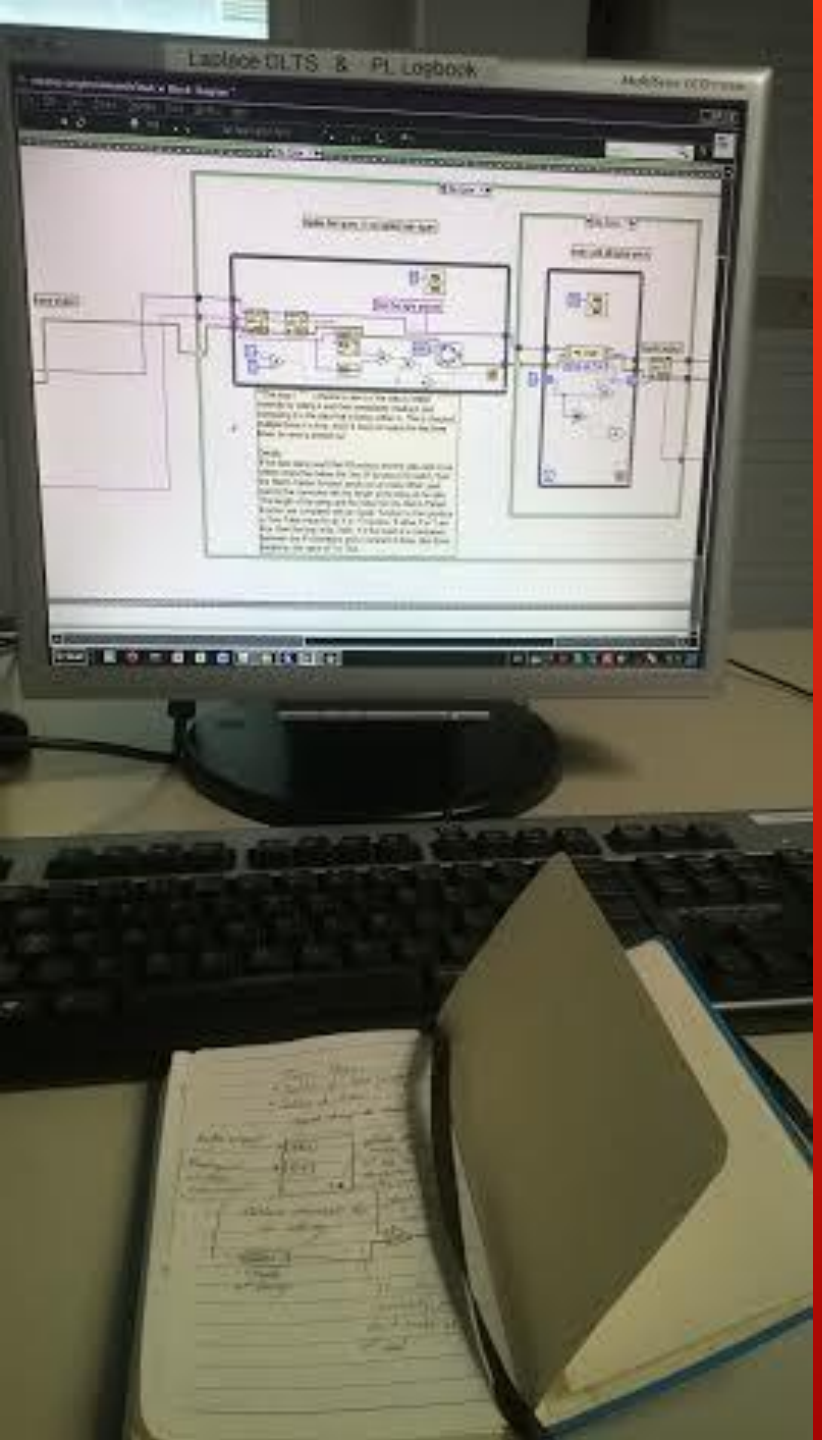
- Tape collects ablated particles as it moves at a constant speed
- Radioisotopes on tape decay and release gamma radiation—Ge crystal detector measures intensity of radiation over time



CHALLENGES…

- ODC is not user-friendly—very heavy, difficult to move, no user's guide.
- Tape transport system lags and stalls.
- Execution timing of LabView Virtual Instrument controlling the devices is too slow.
- Last turbopump was fried (heat damage). Cooling system must be added.





…AND PROGRESS

- New wheels bought to be mounted on the Online Diffusion Chamber (ODC)
- LabView Virtual Instrument has been studied and described—key functions for improving execution timing identified.
- Basic user's guide is being drafted
- Much more left to be done…

GOALS

- Achieve fast plug-in/out of ODC to beam line
- Calibration of ion gun (+ ablation rate), furnace, Ge detector, tape transport system, Faraday cup
- Test ODC with stable and radioactive beams
- Acquire novel data with short-lived radioisotope probes
- Make the acronym "ODC" a thing

Outside of CERN…

Mt. Saleve

Outside of CERN…

Mt. Jura