The Heavy Ion Guide Gas Handling System: Calculations and Execution

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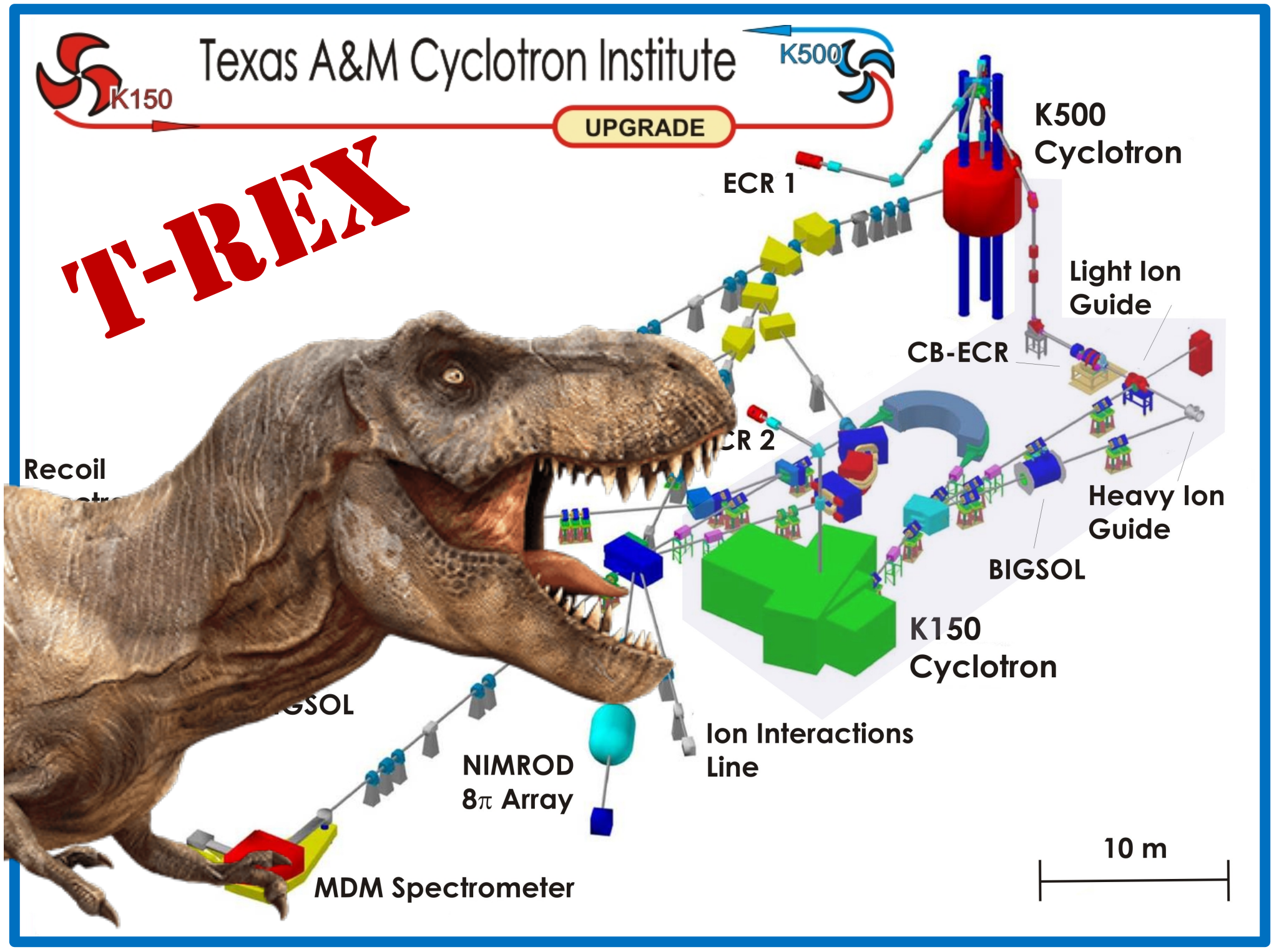
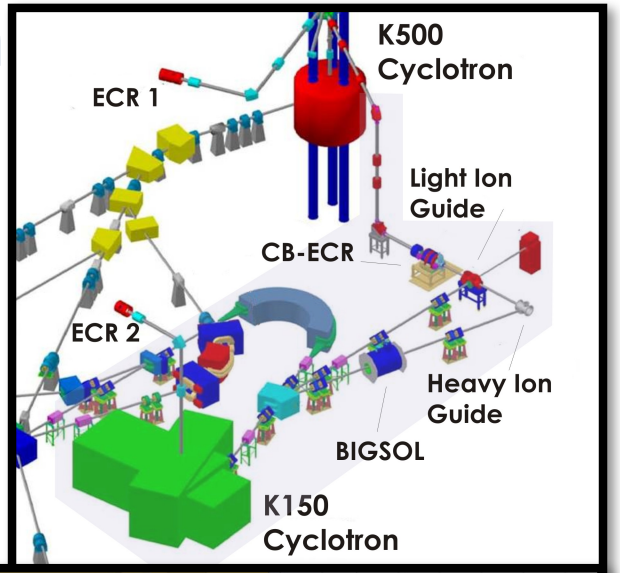
CYCLOTRON INSTITUTE

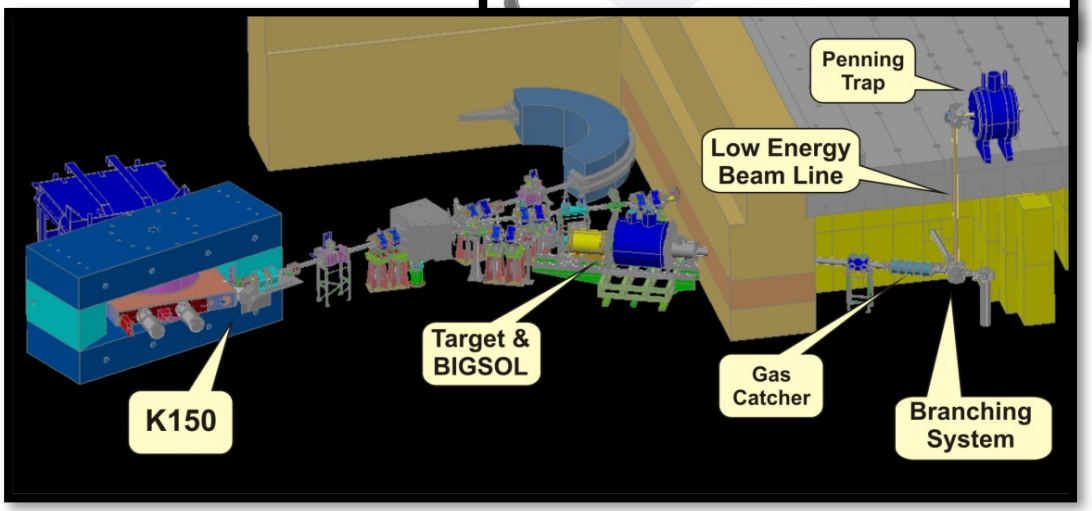
TEXAS A&M UNIVERSITY


Texas A&M Cyclotron Institute
K150
K500
UPGRADE
T-REX
K500
Cyclotron
ECR 1
Light Ion
Guide
CB-ECR
ECR 2
Recoil
Heavy Ion
Guide
BIGSOL
K150
Cyclotron
GSOL
Ion Interactions
Line
NIMROD
8π Array
MDM Spectrometer
10 m

T-REX Upgrade Project

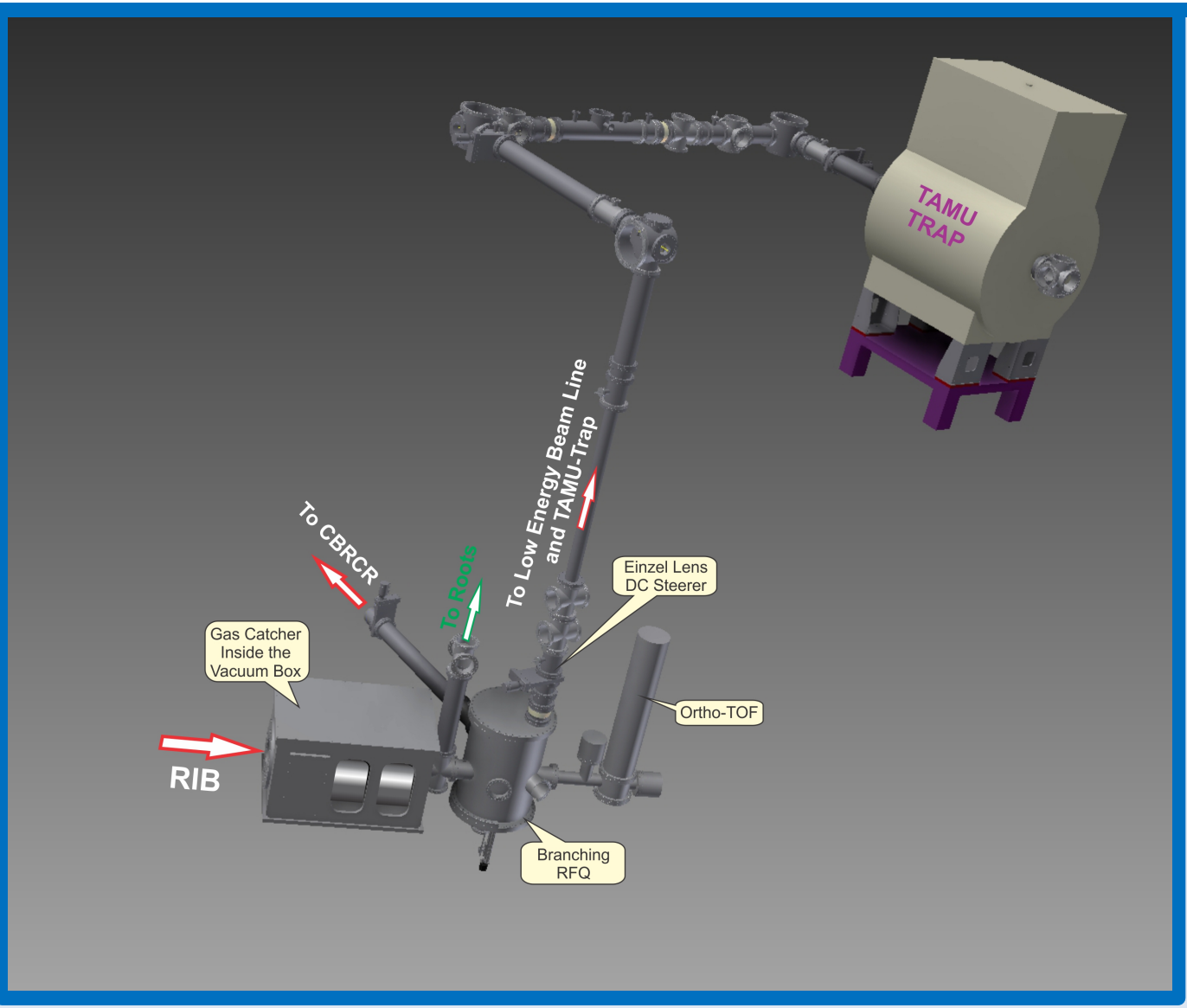
- Recommission K-150 Cyclotron
  - High-intensity beams
  - Secondary RIBs
    - Reacceleration by K-500 cyclotron
- Install ion guides
  - Heavy ion guide
  - Light ion guide





Texas A&M Cyclotron Institute
K150
K500
UPGRADE

Heavy Ion Guide (HIG)



The Gas Catcher

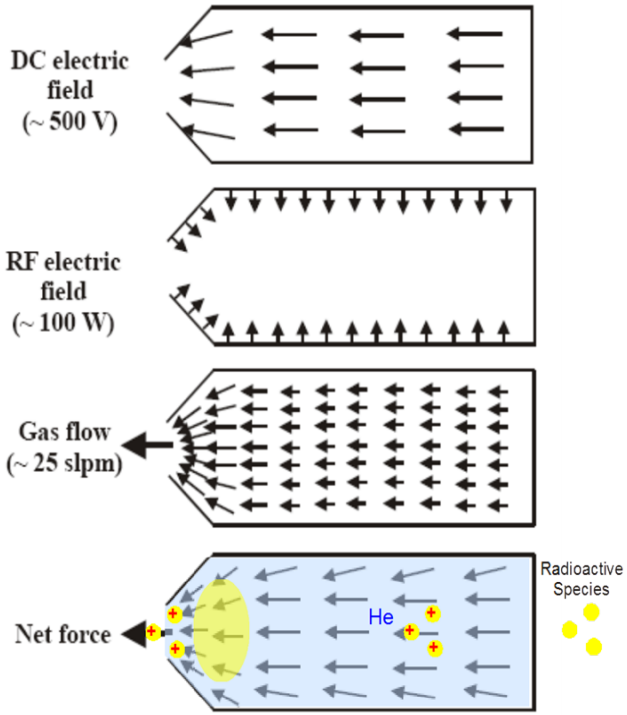
- Designed at ANL
- Central piece of HIG
- Al Degrader first

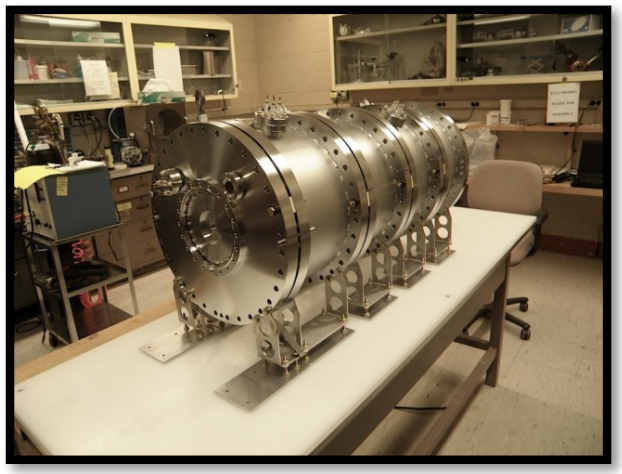
DC Field

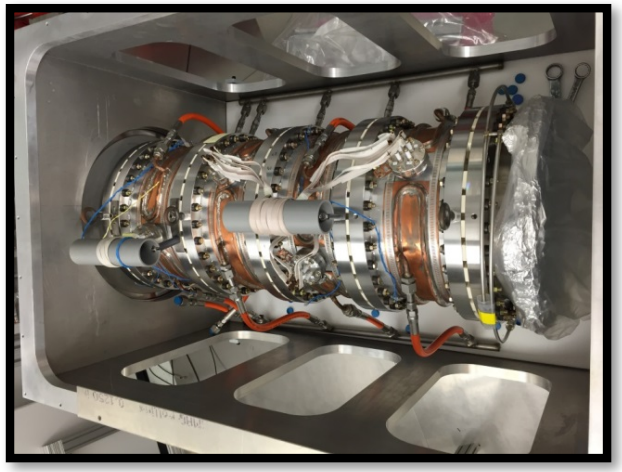
RF Field

\+ Helium Gas Flow

= Most Ions Captured

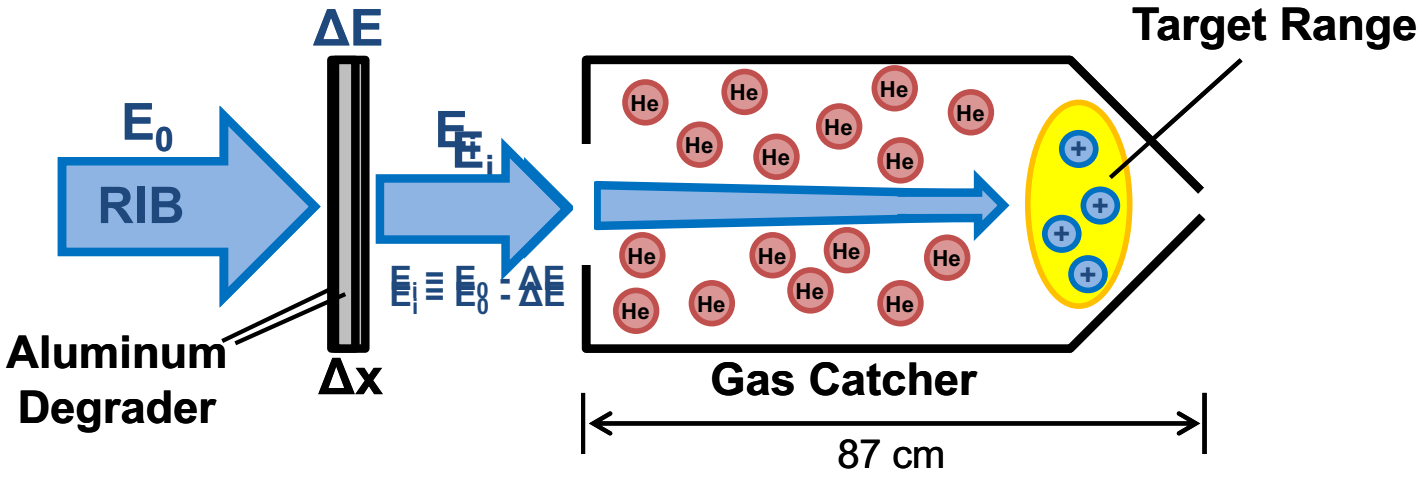






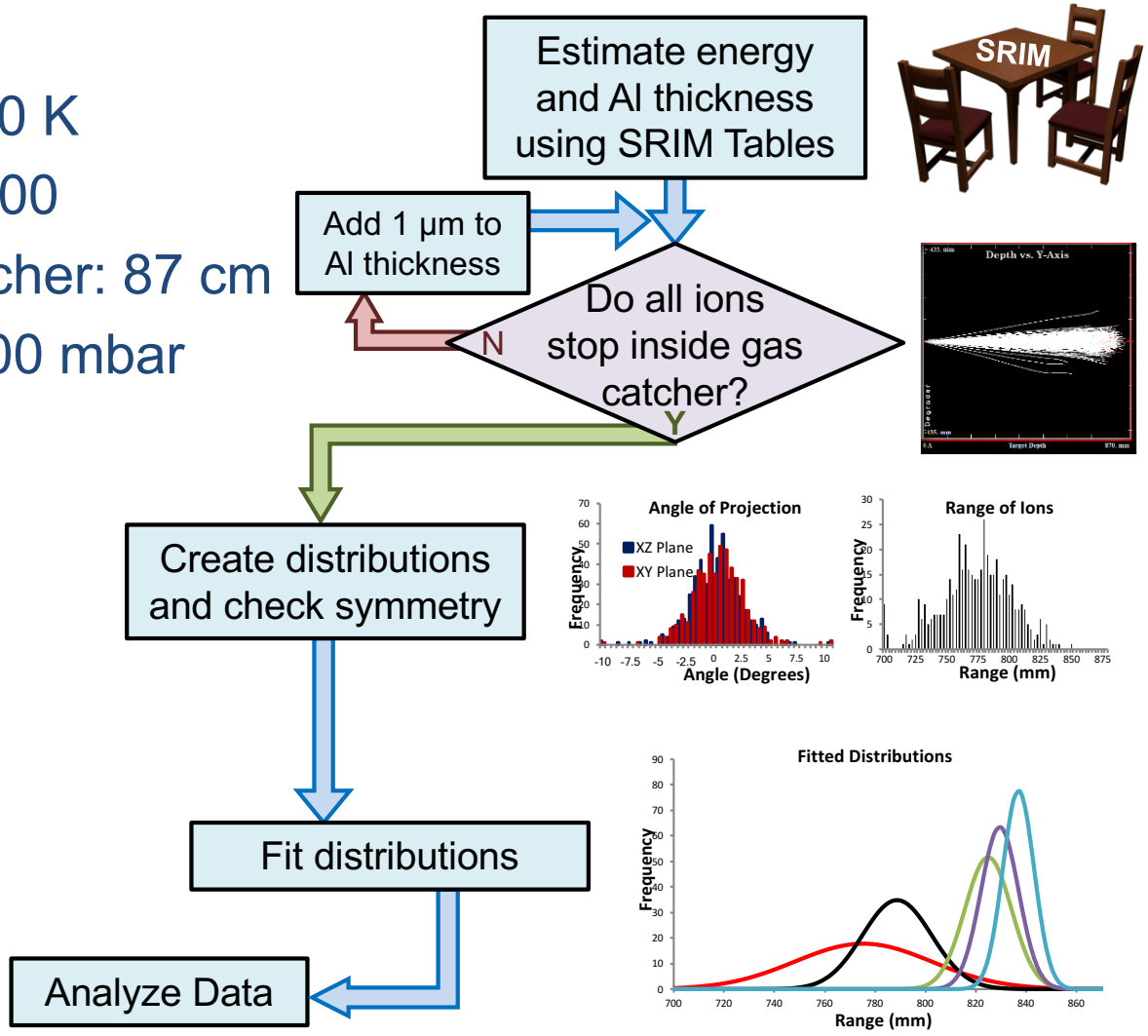
Pressure Effects

- Need to know pressure's effect on:
  - Ability of gas to stop ions
  - Required thickness of Al degrader
- How? – Use SRIM simulations to:
  - Find energy of ions that can be absorbed ($\mathbf{E_i}$)
  - Calculate corresponding Al thickness ($\mathbf{\Delta x}$)
  - Simulate system to find energy and space distributions

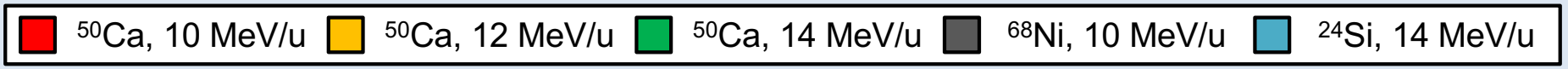


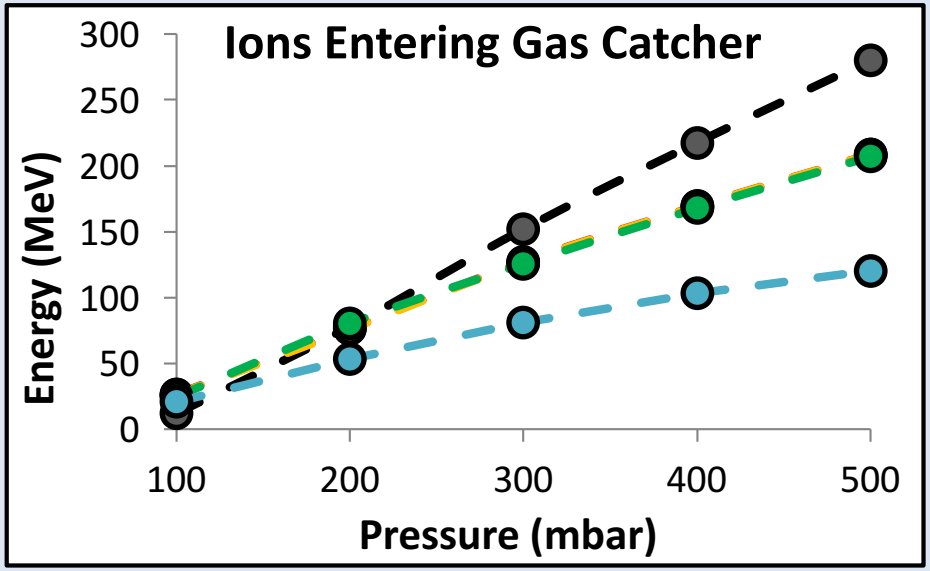
SRIM/TRIM Simulations

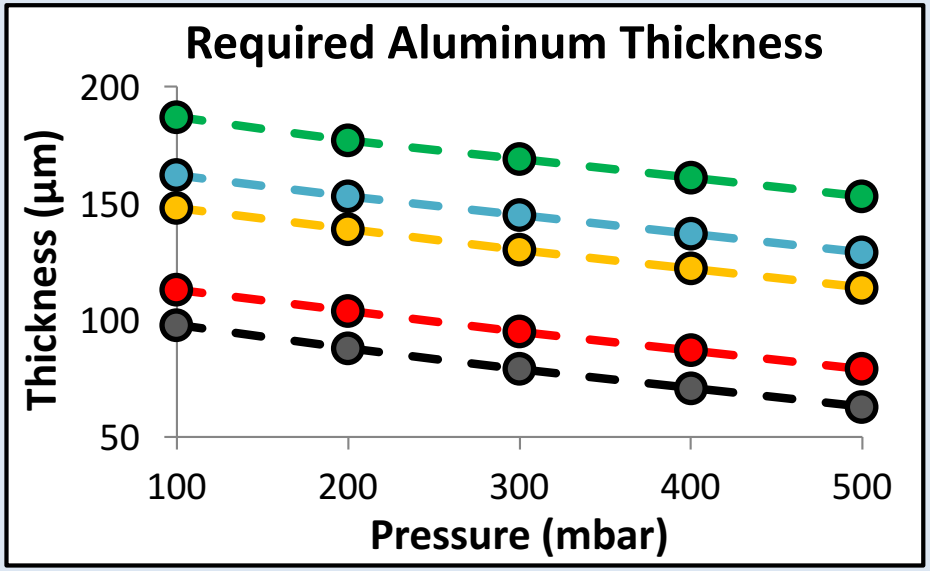
- Conditions:
  - Temperature: ~300 K
  - Number of ions: 500
  - Length of gas catcher: 87 cm
  - Pressures: 100-500 mbar
- Ions:
  - ^{50}Ca at:
    - 10 MeV/u
    - 12 MeV/u
    - 14 MeV/u
  - ^{68}Ni at 10 MeV/u
  - ^{24}Si at 14 MeV/u

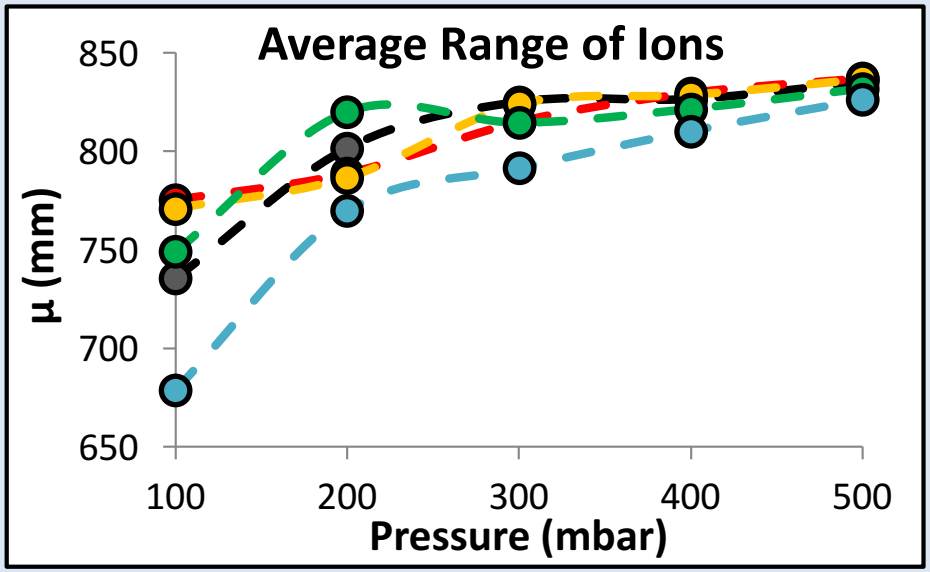


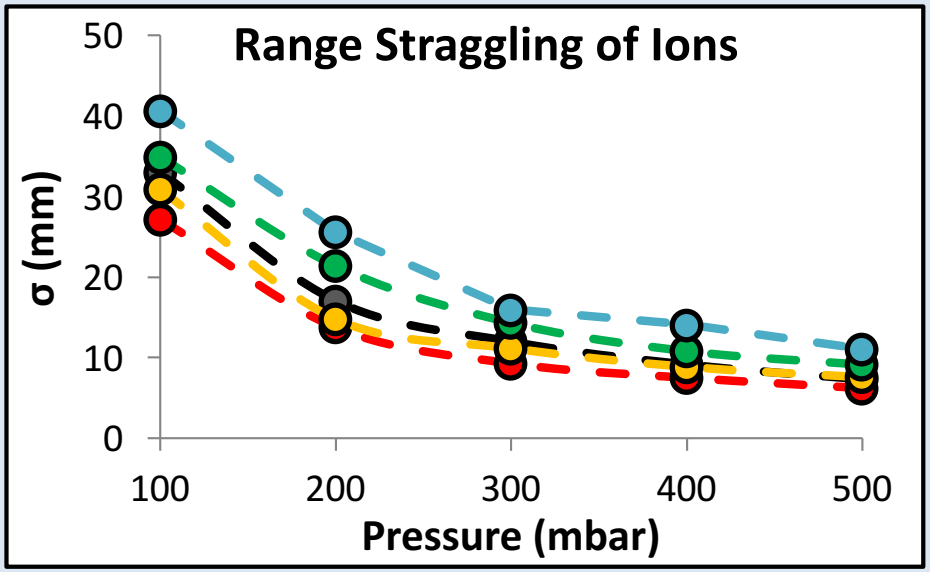
Results of Simulations











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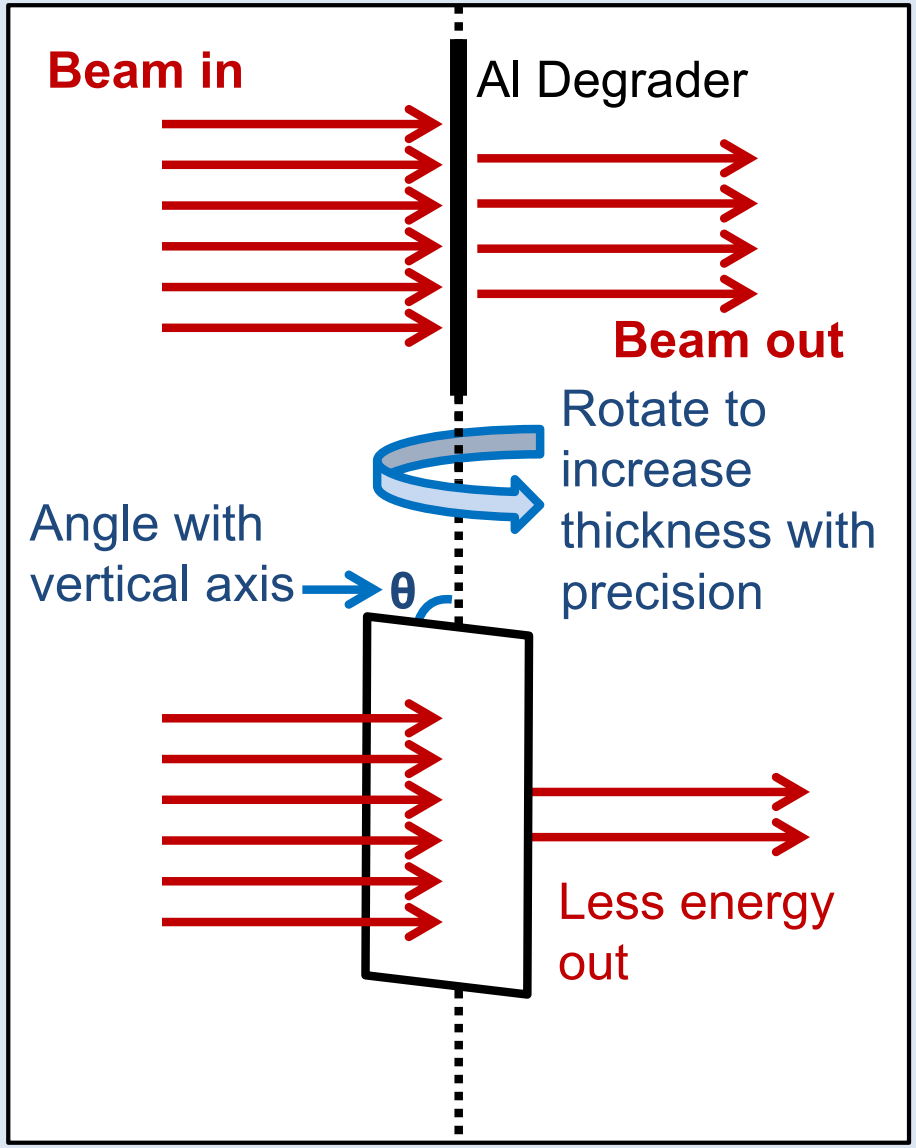
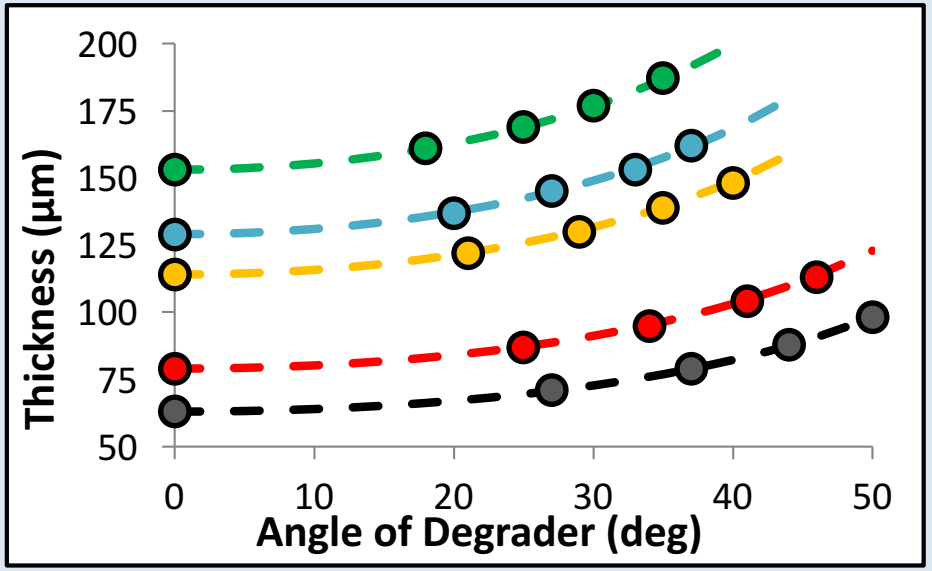
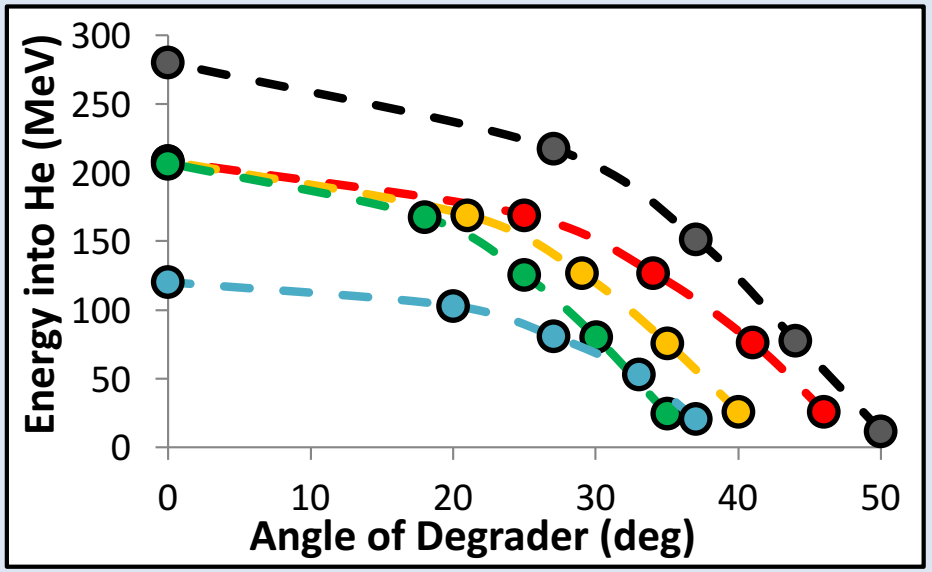




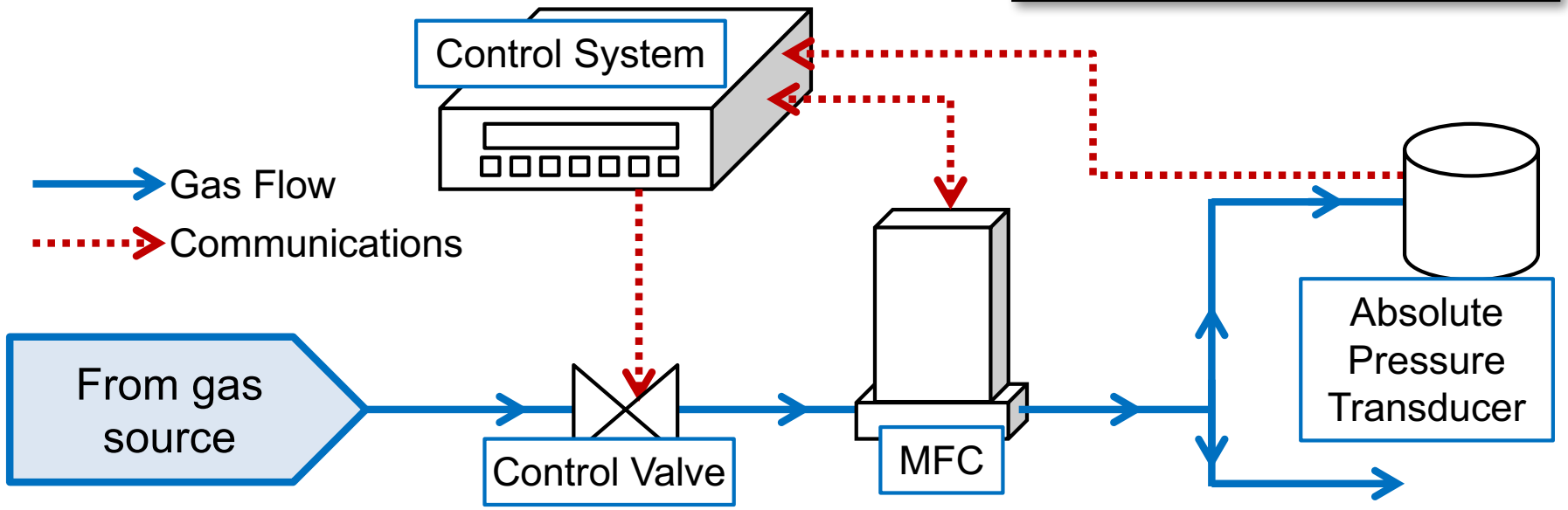


Gas Handling System

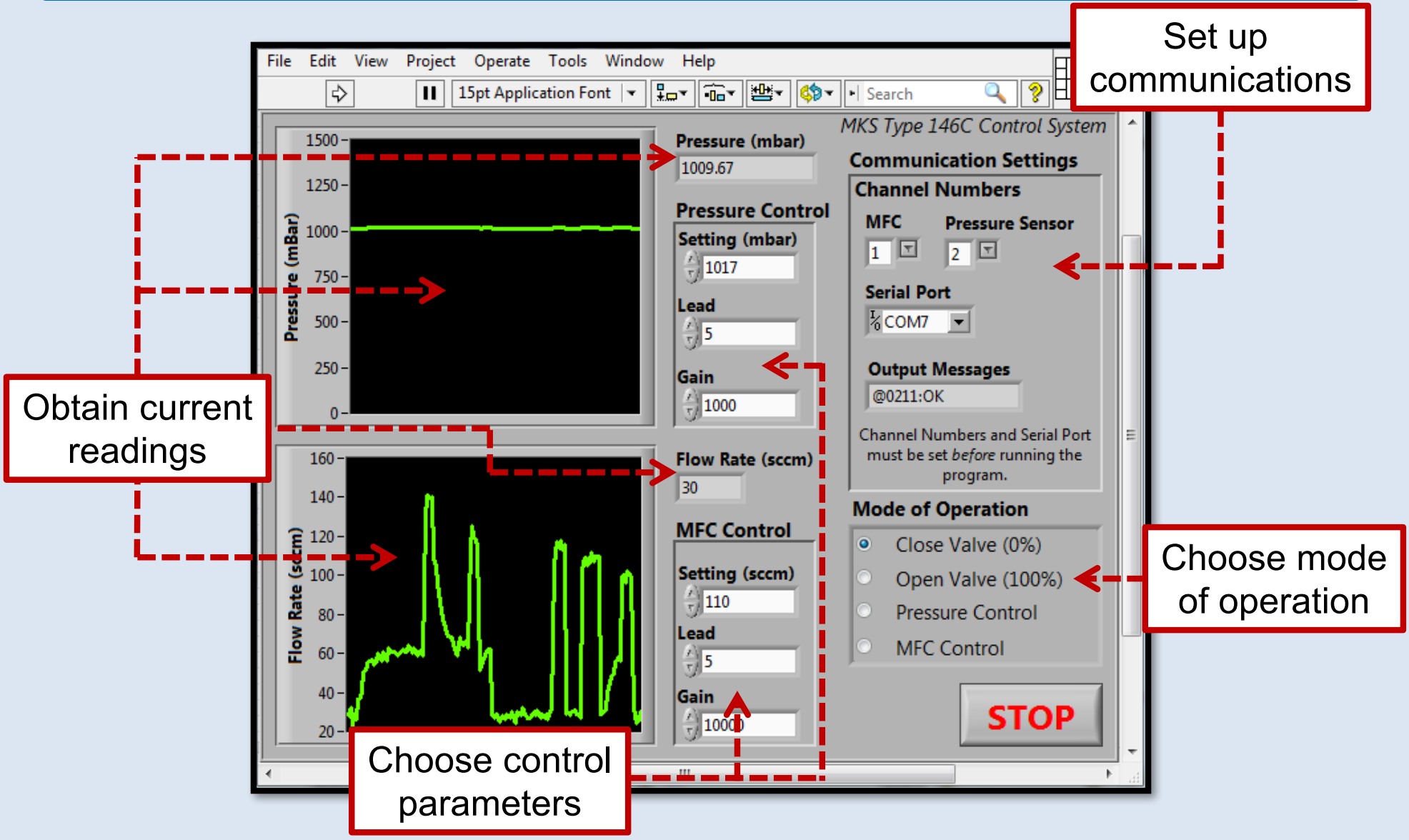
- Need to control pressure and gas flow
- How? – MKS Type 146C Control System
  - Use MFC, control valve, and Baratron Pressure Transducer with control system
  - Program digital interface using LabVIEW
  - Allow user control of pressure and flow rate through interface

Equipment

- MKS Type 146C Control System
- MKS Type 1479A MFC
- MKS Type 148J Control Valve
- MKS Baratron Type 626A Absolute Pressure Transducer



Digital Interface



Outcomes

- General idea of degrader thickness
  - Angle rotation for precision
- Good starting point for in-beam measurements
  - Simulation results can be normalized to experimental data later
- Digital interface ready for use

Acknowledgements

I would like to thank Dr. Greg Chubaryan for taking me on as an REU student this summer and mentoring me through this project.

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References

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