



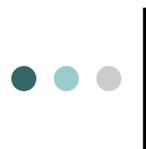
Spring 2005 SULI Internship:  
Remote Handling and Solid  
Modeling Design Experience.

Adam Carroll  
University of Arizona

**Mentor: Craig Bradley**  
Nuclear Science and Technology Division  
Remote System Group Led by Tom Burgess

My name is Adam Carroll and I am currently a junior in mechanical engineering at the University of Arizona.

I am part of the Nuclear Science and Technology division in the Remote Systems Group, where I work with my mentor Craig Bradley



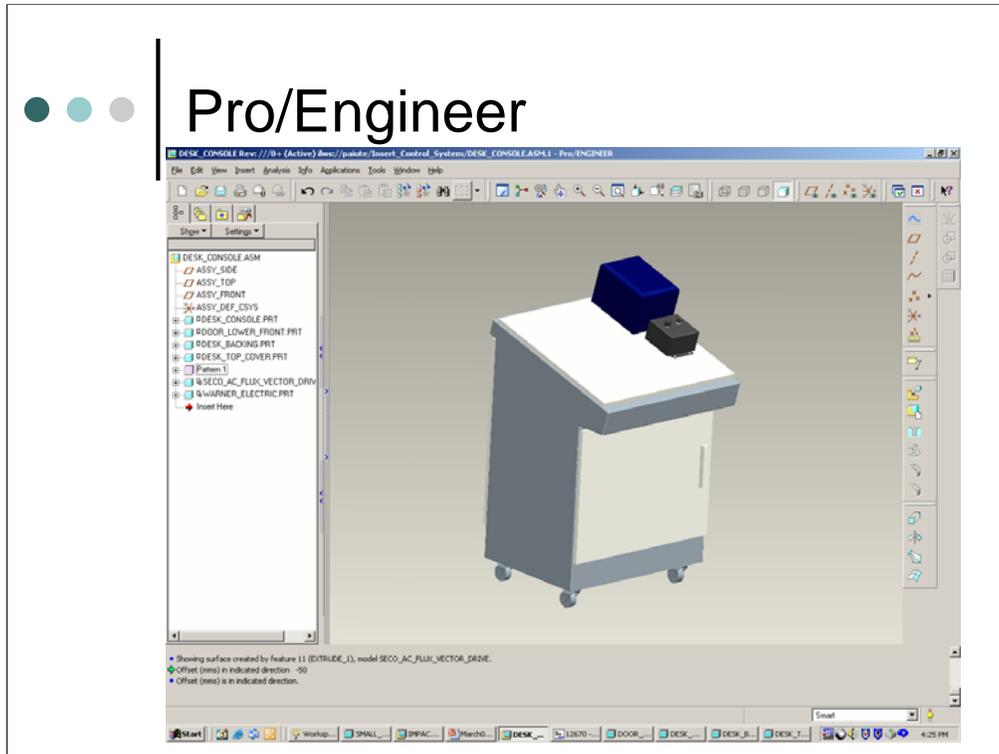
## SULI Experience

- Pro/Engineer
  - 3D Drafting Software
- Rare Isotope Accelerator
  - Conceptual Designs
- Spallation Neutron Source
  - Fabricated Designs

I spend about half my time working on RIA doing conceptual design work, and the other half designing parts to be fabricated for SNS.



# Pro/Engineer

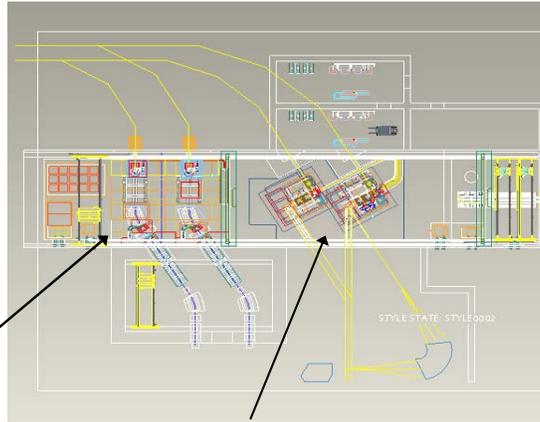


This is a screen shot of Pro/E, the software I use in all my projects. Also my first project when I came to ORNL was to learn it.

# ● ● ● | Rare Isotope Accelerator

- Particle Accelerator for Rare Isotopes
- Up to 400Kw beam
- Four Beam lines

**Beam  
Fragmentation**

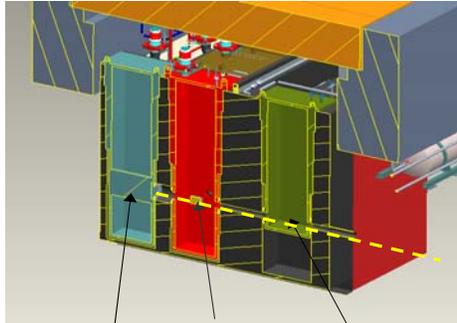


**Isotope Separation  
On-Line**

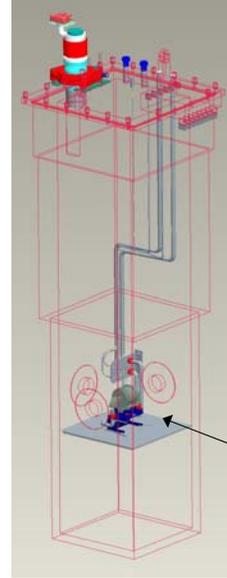
The Rare Isotope Accelerator will have a primary beam line of ions from hydrogen to uranium. There will be four targets, two being isotope separation on-line (ISOL) and two will be beam fragmentation lines.

# ● ● ● | Rare Isotope Accelerator

## ○ ISOL Target Module



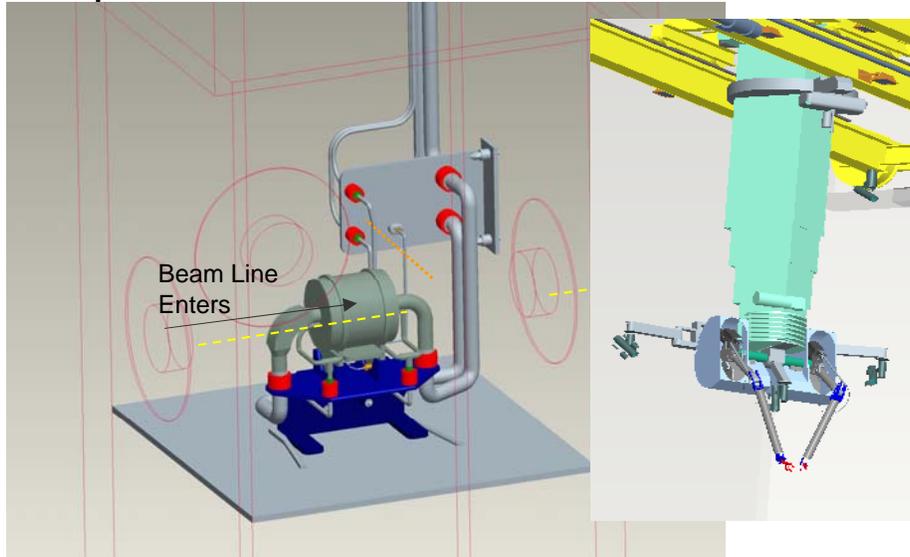
Beam Dump    Target Module    Beam Diagnostic



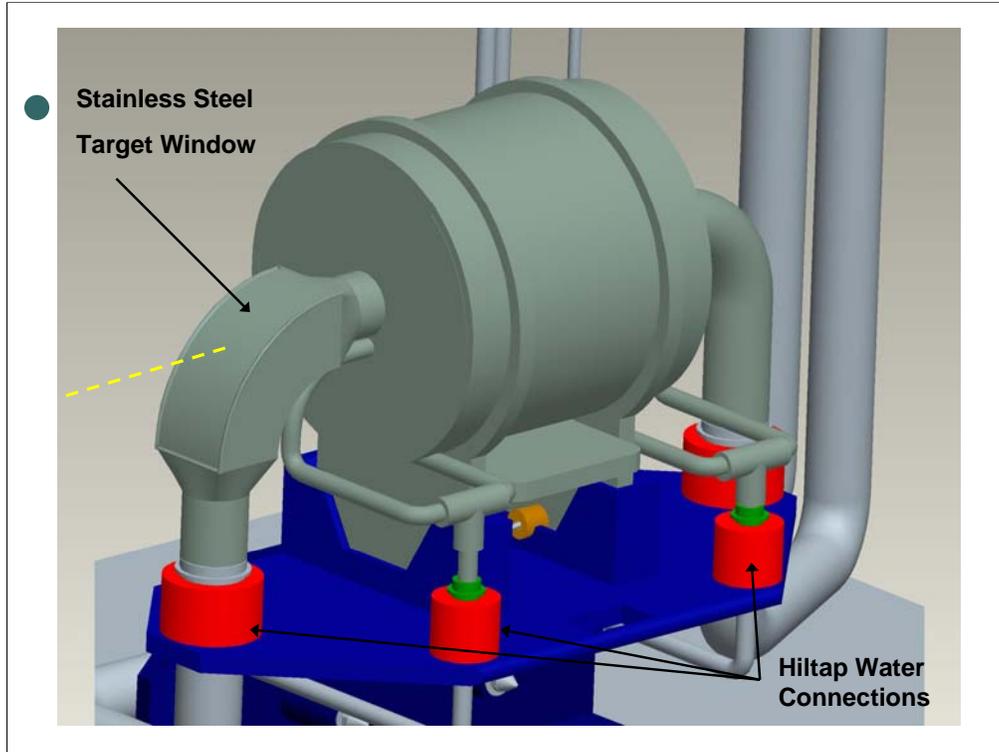
ISOL Target

All my work so far on RIA involves the ISOL Target Module.

## ● ● ● | Rare Isotope Accelerator

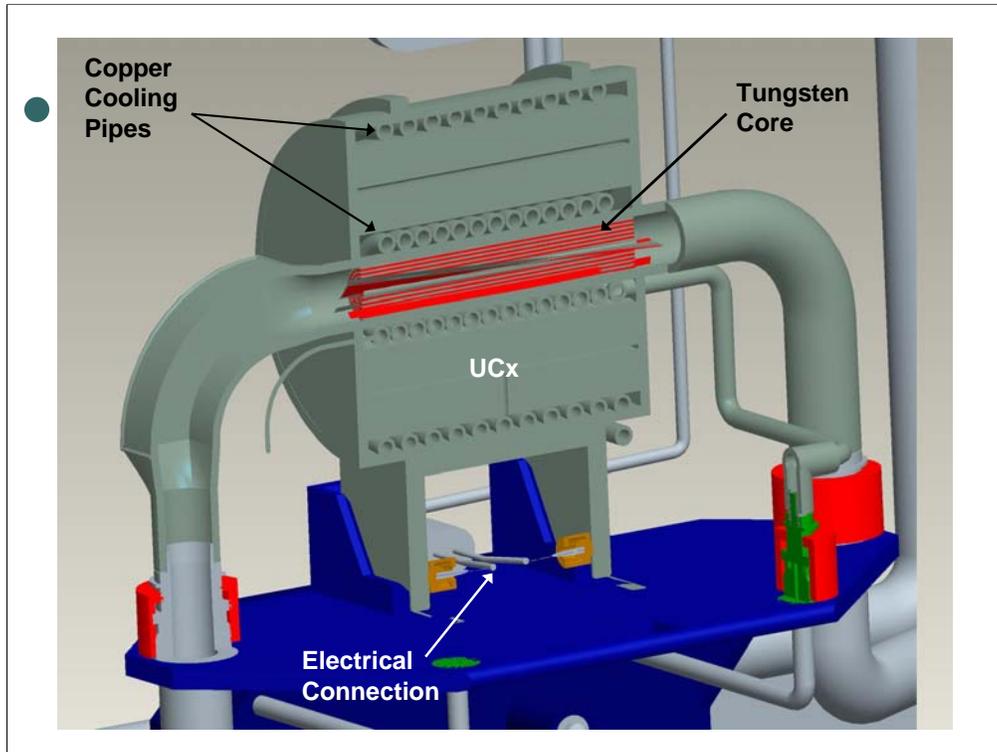


The target will be very hot radioactively forcing all work done in the module to be done remotely with servo-manipulator arms. To make it better for the remote operator the target is designed to be easily replaced.



Hiltaps connect the water pipes to the target.

A rectangular shaped stainless steel target window is used to optimize the amount to ions that reach the target.



The tungsten core is cooled by water flowing through these little channels  
Electricity is used to heat up the Uranium Carbonate to 2000 degrees Celsius before the ions hit the target. Then the copper cooling pipes that spiral around the target keep the temperature from rising after the ions are hitting the target.



## Spallation Neutron Source

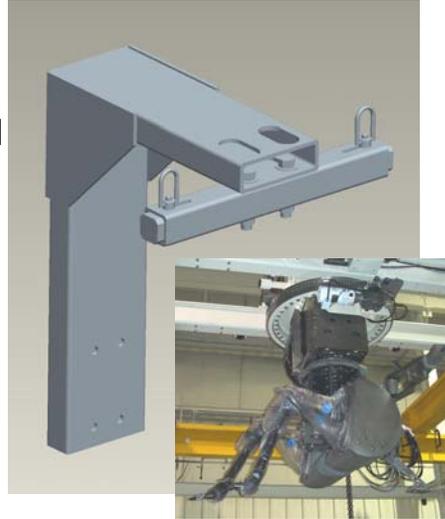
- Servomanipulator  
Arm Lifting Fixture
- Pneumatic Torque  
Wrench  
Attachments
- Insert Tool Control  
System



My SNS projects mostly involve modifying a design and creating fabrication drawings so the part can be created.

## Servomanipulator Arm Lifting Fixture

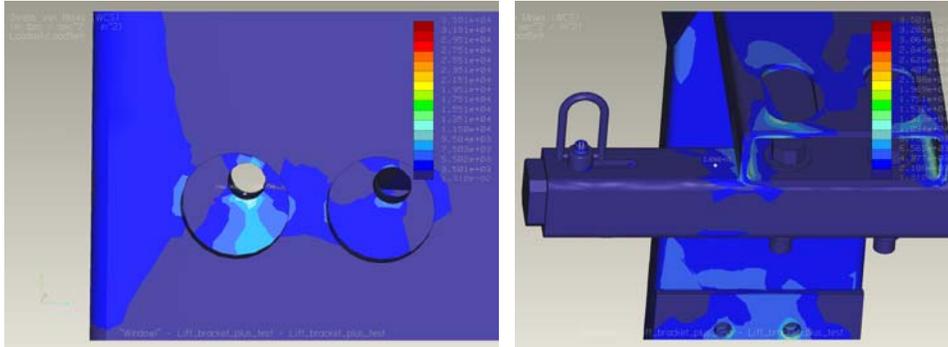
- Transfers a Servomanipulator arm from one stand to another
- ASME B30.20 and DOE 1090



Craig Bradley created the original design and I made a few small changes, then wrote a report proving it will comply with ASME B30.20 “Below-the-Hook Lifting Fixture” which mostly means it has to be capable of holding 3 times its expected load without the metal yielding under the weight.

# Servomanipulator Arm Lifting Fixture

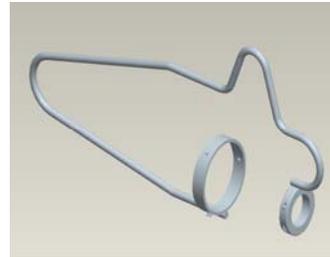
- Mechanics
- High Stress Points



To write the report I employed Mechanics, a finite element software, to do the stress analysis on the lift fixture. Then I did hand calculation of a few point on the fixture to make sure Mechanics was providing accurate results.

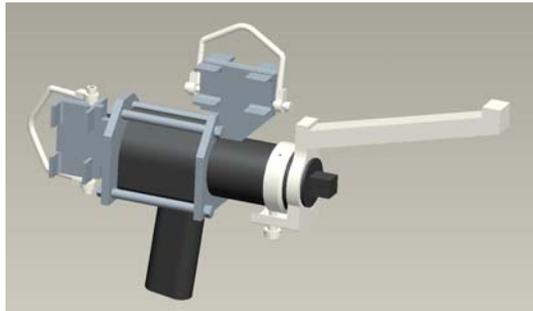
## Pneumatic Torque Wrench Attachments

- Lifting Bail Attachment



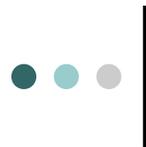
- Reaction Bar

- Rotating Lifting Bail



This lifting bail was created to connect the torque wrench to a hoist hook making it easier for the operator to control the wrench. The wrench can be operated easier horizontally or vertically.

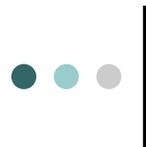
I added some parts onto this smaller torque wrench which is operated using servo-manipulator arms. I added lifting bails to attach to a hoist hook, just like the other wrench, and a longer torque reaction bar.



## SULI Experience

- What I am currently working on.
  - Insert Tool Control System
  - RIA
- What am I learning.
  - Engineering Design
  - Technical Writing

I am working right now on designing a portable control system for an insert tool for SNS, and continuing work on my ISOL target for RIA. By the end of the semester I hope to have completed several more small projects for SNS and finalized my RIA design.



## SULI Experience

- Thank you
  - Craig Bradley
  - NSTD and SNS
  - ORISE
  - DOE Office of Science

I am very grateful for this opportunity and would like to thank my mentor Craig Bradley along with all the wonderful people at NSTD and SNS, the ORISE folks for providing us with educational seminars and support, and DOE for funding this excellent experience.