#### **Simulation beamline**



- The original beam pipe has been parametrized by Juliette (https://ace.phys.virginia.edu:80/HAPPEX/ 2722)
  - She also has a webpage describing the conditions (with pictures) for PREX1 (<u>https://userweb.jlab.org/~crowder/PREx\_beamline/</u>)
- I have found the technical drawings from the JLab document repository and created a new configuration

#### **Dump implementation**





#### **Old configuration**

#### New configuration

- Ran radiation study with the entire simulation
- Old dump configuration had a thick Stainless Steel cover at the entrance of the dump tunnel (to mimic splash back from the dump!?)
- The new configuration has the updated dump, donut and stainless steel divider behind beam pipe
- Both configurations have updates to the target region made by Adam

## **Radiation damage - PREX2**

summary histogram per electron on target| neil



Red: with donut Blue: w/o donut

 As expected we see the largest effect on the HRS platform and under the the dipole

# **Radiation damage - PREX2**



## **Radiation damage - PREX2**



- hall height vs angle from the z axis
- Looked at the hall detector and selected the particles going out of the hall and coming lacksquareinto the hall

# **Radiation damage - CREX**

summary histogram per electron on target | neil



Red: with donut Blue: w/o donut

• The effect is smaller for CREX

#### Radiation damage - CREX Hits/(5000 ev) hits for det 1001 part: e| neil Hits/(5000 ev) hits for det



#### **Radiation damage - CREX**



• As expected we see the largest effect on the HRS platform and under the the dipole

## Conclusions





- Bob did a cross check of the current on the face of the donut and he finds reasonable agreement with my G4 simulation
- There is a significant radiation increase in the hall from the new beam line configuration
- The radiation inside the hall will be increased for both PREX and CREX (for PREX the increase will be more localized around the beam dump opening)
  - overall it seems to be a bigger problem for PREX

#### Backup

#### New beam pipe features





- gate value: from drawings it seems that it's a 8" gate value joining two 8" pipe sections
- neck down: at the hall wall (before going into the dump tunnel) the beam pipe is reduced in size
- diffuser donut: in order to protect the edge of the diffuser from beam mis-steer an AI donut is placed in front with ion chambers close behind

# **Dump region**



- For PREX2/CREX we will not need to use the diffuser
- The donut is removable in the Hall C design
  - not sure how difficult it would be to remove/ redesign it for Hall A
- I have only implemented the beam pipe until the vacuum window



# Beam pipe comparison

side by side gdml comparison: whole pipe



side by side gdml comparison: telescoping beam pipe



• Now there is a discontinuity in the beam pipe to allow for a stainless steel object as a stand-in for the gate valve

Put in Al flanges. The dimensions are from the documents (will need to check thickness of flange and z positioning)

# Beam pipe comparison

side by side gdml comparison: whole pipe

#### side by side gdml comparison: dump region



- Again the dimensions are from the drawings
- The grey disks are detectors

#### **Donut - as implemented**





 From what I can tell the donut is 2 cm thick and has an opening of radius 4.13 cm at position ~3021 cm away from the target



















x:y {volume==10001 && kineE>1}





x:y {volume==10003 && kineE>1}







 The only panel that divides by the area is the right most one

10006 10007



 The only panel that divides by the area is the right most one