

Image provided by Dave Pushka

PS end cap MARS model

Radiation dose rates for SS316 vs T-6061 materials 365 days irradiation, 7 days cooling time

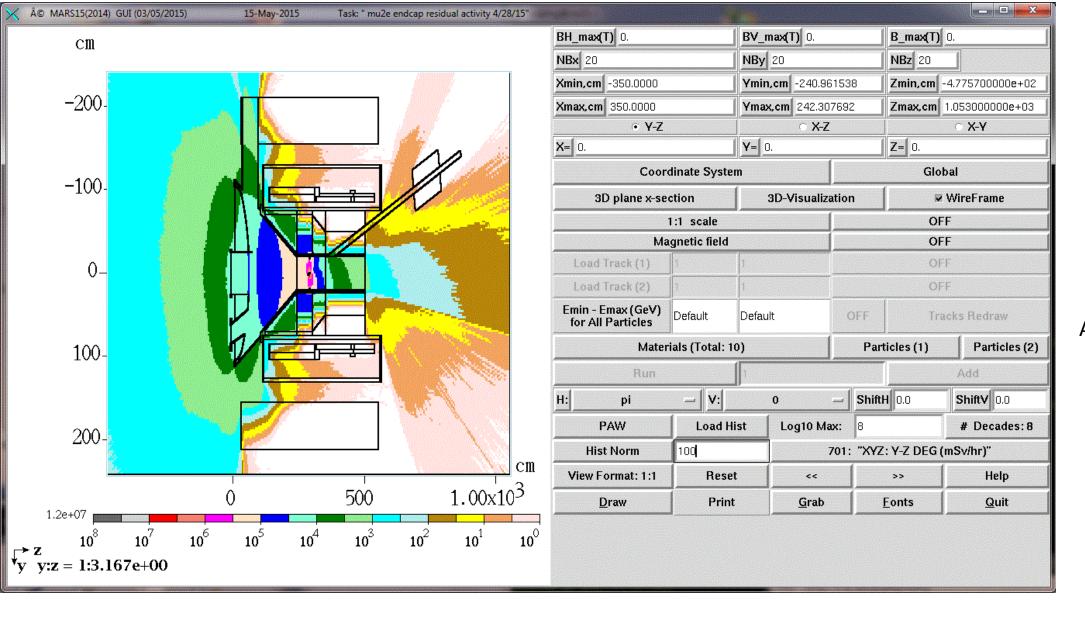
> T. Leveling 5/18/15

Short Term Work Plan - completed

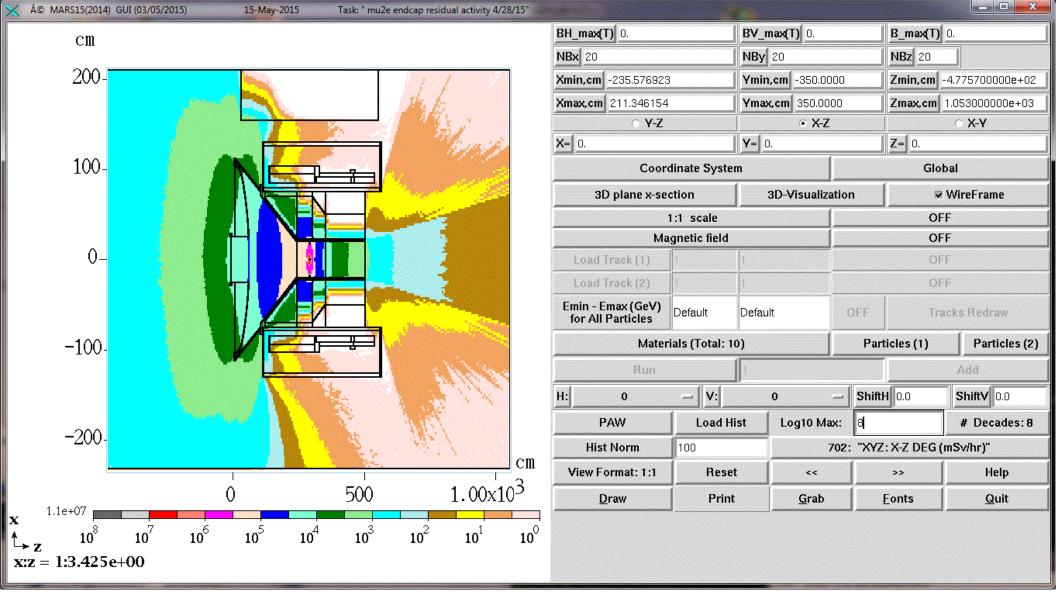
- Assembled the Al model and SS model photon sources
 - Verified source terms
 - Listed source term lines by material/model
- Corrected weighting factor used for source terms in stage 2 run
- Did several DETRA problems to verify understanding of header file features
- Reran SS and Al end cap jobs
- Added histogram for vertical slice between RHR concrete shield
- Compared residual dose rates as function of distance for 2 materials
 - 365 days irradiation, 7 days cooling

Material number	part	Al endcap Bq	SS endcap Bq	% AI / SS	SS % total	Al % total
5	target	1.09E+13	1.09E+13	100.1%	48.20%	49.17%
8	Target_extraction_tube_window	4.83E+08	4.95E+08	97.6%	0.00%	0.00%
9	Beam_pipe_vacuum_window	1.59E+08	1.70E+08	93.8%	0.00%	0.00%
10	Extinction_tube_vacuum_window	1.27E+07	8.42E+06	150.4%	0.00%	0.00%
15	Extinction_tube_flange	5.15E+09	5.11E+09	100.7%	0.02%	0.02%
23	HRS_section_1_bronze_section	2.14E+12	2.14E+12	100.1%	9.47%	9.65%
51	HRS_section_1_inner_S316	3.70E+12	3.70E+12	99.9%	16.37%	16.66%
60	HRS_flange	5.36E+10	5.70E+10	94.0%	0.25%	0.24%
61	Target_extraction_tube	1.04E+09	3.58E+10	2.9%	0.16%	0.00%
62	Target_extraction_tube_window_flange	3.95E+09	3.85E+09	102.5%	0.02%	0.02%
63	Target_extraction_tube_flange	1.96E+10	1.81E+10	108.0%	0.08%	0.09%
64	Beam_pipe_window_flange	6.07E+09	6.12E+09	99.1%	0.03%	0.03%
65	Beam_pipe_flange	2.05E+10	2.05E+10	100.0%	0.09%	0.09%
66	Spherical_dish	4.51E+09	1.71E+11	2.6%	0.76%	0.02%
67	Main_flange	9.70E+08	4.79E+10	2.0%	0.21%	0.00%
68	Torus	1.17E+09	5.06E+10	2.3%	0.22%	0.01%
69	Torus_entry_cylinder	1.18E+08	5.15E+09	2.3%	0.02%	0.00%
70	Outer_cone	7.95E+08	4.58E+10	1.7%	0.20%	0.00%
71	Vacuum_port_pipe	4.85E+07	3.12E+09	1.6%	0.01%	0.00%
73	Extinction_tube_window_flange	1.35E+09	1.45E+09	92.9%	0.01%	0.01%
74	Extinction_tube	4.55E+08	1.53E+10	3.0%	0.07%	0.00%
75	Beam_tube	1.69E+09	5.65E+10	3.0%	0.25%	0.01%
76	HRS_section_2_bronze	4.72E+12	4.72E+12	99.9%	20.89%	21.26%
77	HRS_section_3_bronze	5.51E+11	5.52E+11	99.8%	2.44%	2.48%
78	HRS_section_4_bronze	5.14E+10	5.13E+10	100.3%	0.23%	0.23%

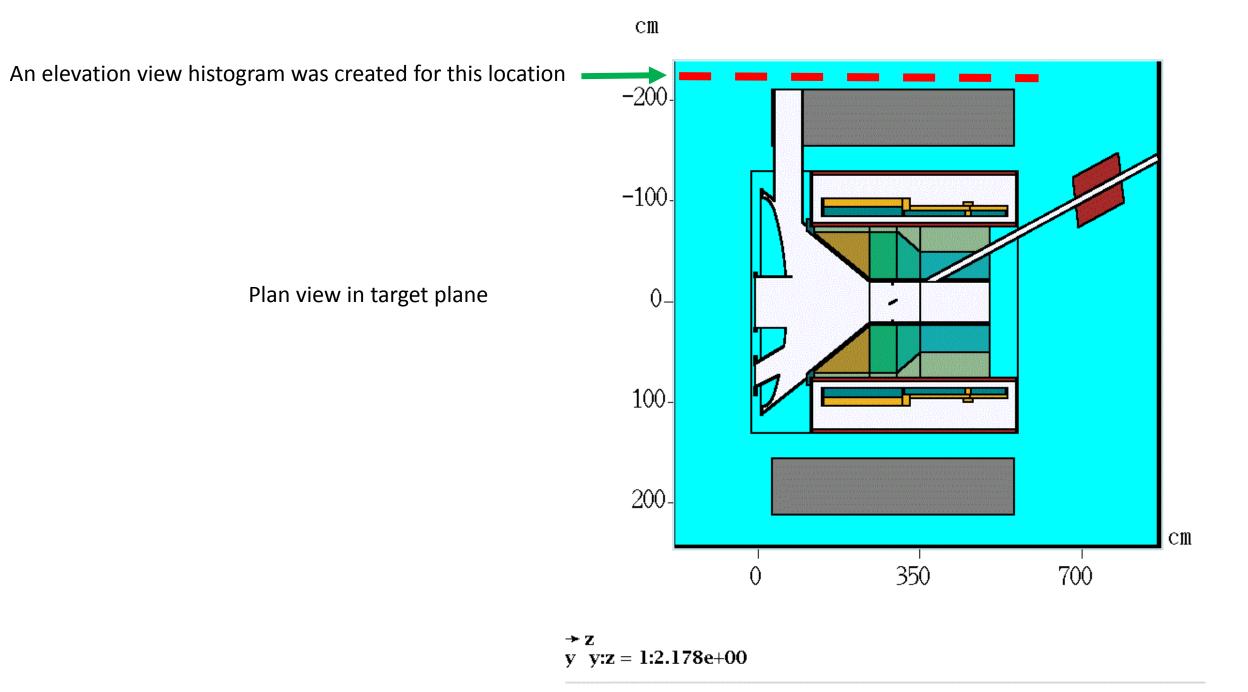
item	part	Material	SS – photon source lines	Al – photon source lines
5	target	W	222	222
8	Target_extraction_tube_window	Ti	9	10
9	Beam_pipe_vacuum_window	Ti	10	7
10	Extinction_tube_vacuum_window	Ti	4	4
15	Extinction_tube_flange	SS316	72	74
23	HRS_section_1_bronze_section	bronze	76	76
51	HRS_section_1_inner_S316	SS316	201	197
60	HRS_flange	SS316	99	98
61	Target_extraction_tube	SS316 or T-6061	120	30
62	Target_extraction_tube_window_flange	SS316	67	61
63	Target_extraction_tube_flange	SS316	96	104
64	Beam_pipe_window_flange	SS316	81	83
65	Beam_pipe_flange	SS316	98	110
66	Spherical_dish	SS316 or T-6061	159	35
67	Main_flange	SS316 or T-6061	117	31
68	Torus	SS316 or T-6061	127	29
69	Torus_entry_cylinder	SS316 or T-6061	75	3
70	Outer_cone	SS316 or T-6061	102	25
71	Vacuum_port_pipe	SS316 or T-6061	43	1
73	Extinction_tube_window_flange	SS316	52	43
74	Extinction_tube	SS316 or T-6061	92	8
75	Beam_tube	SS316 or T-6061	141	32
76	HRS_section_2_bronze	Bronze	77	77
77	HRS_section_3_bronze	Bronze	57	57
78	HRS_section_4_bronze	bronze	44	45

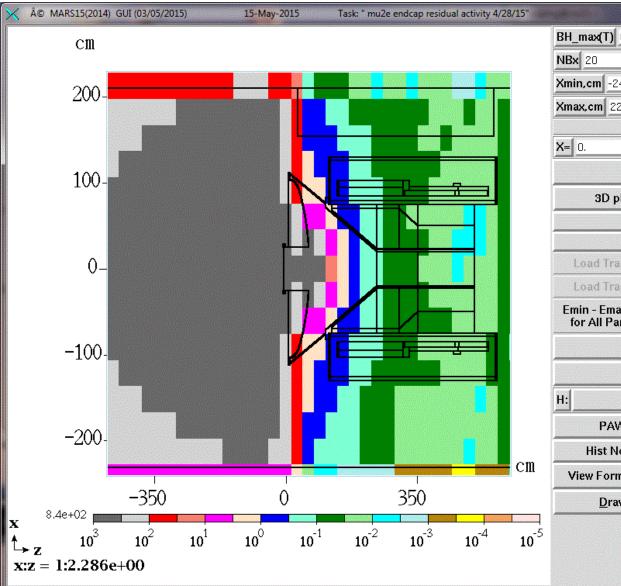


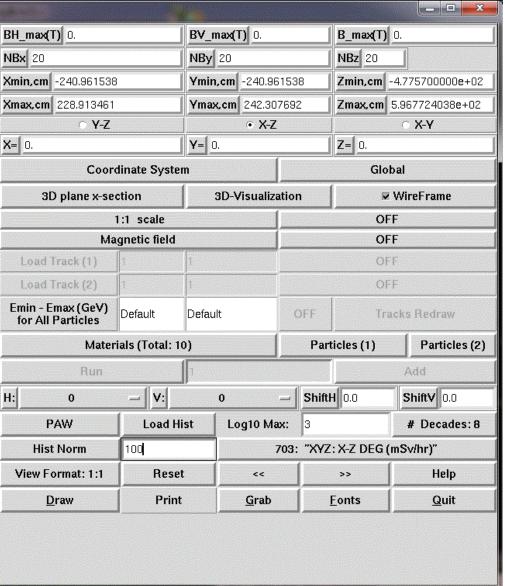
Plan view in target plane



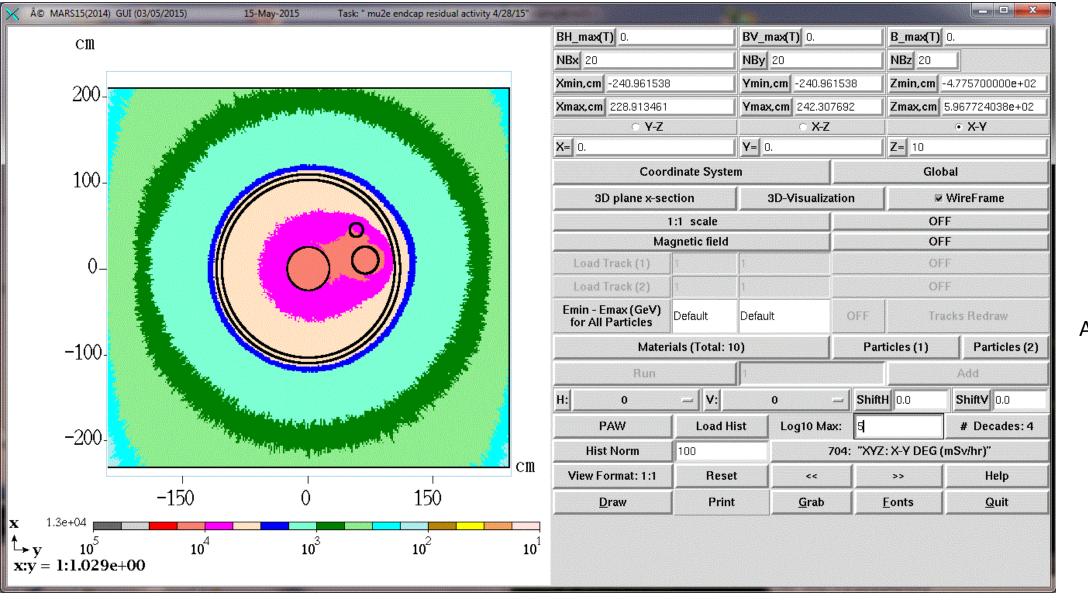
Elevation view in target plane



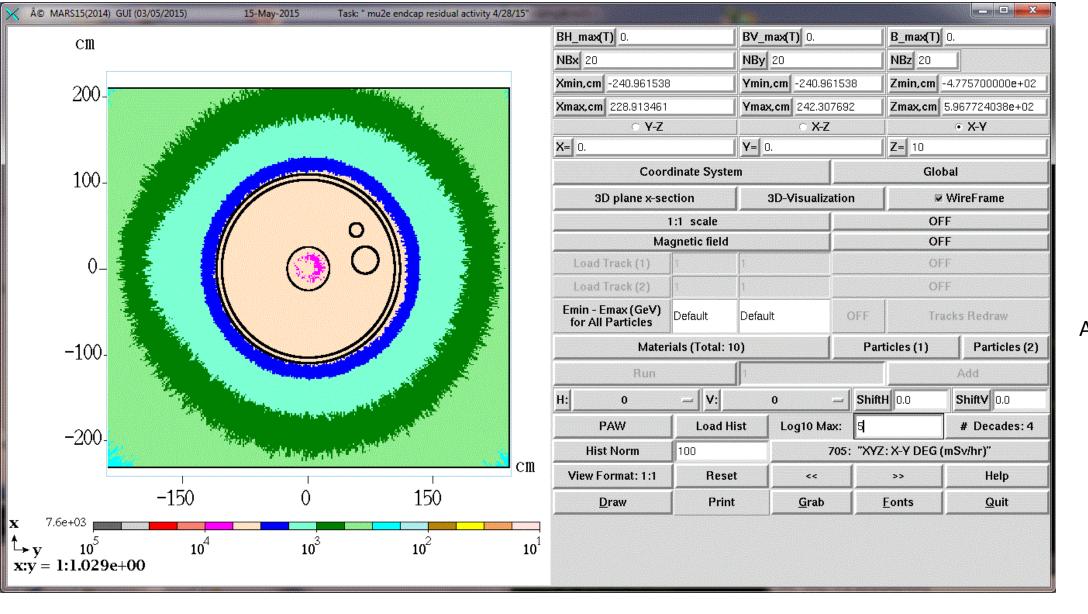




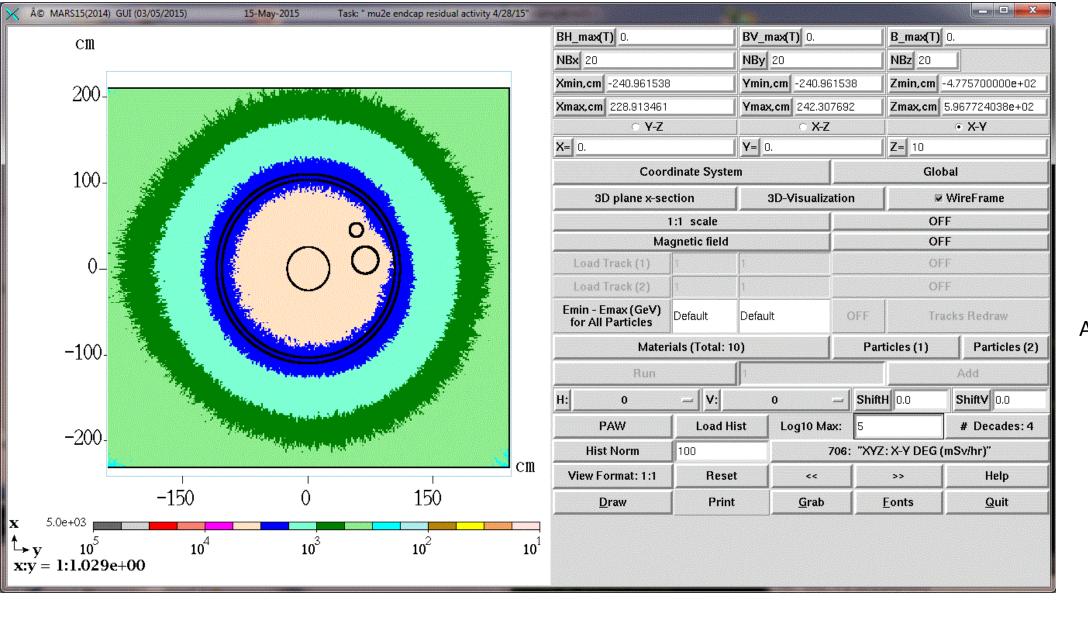
Plan view in aisle plane



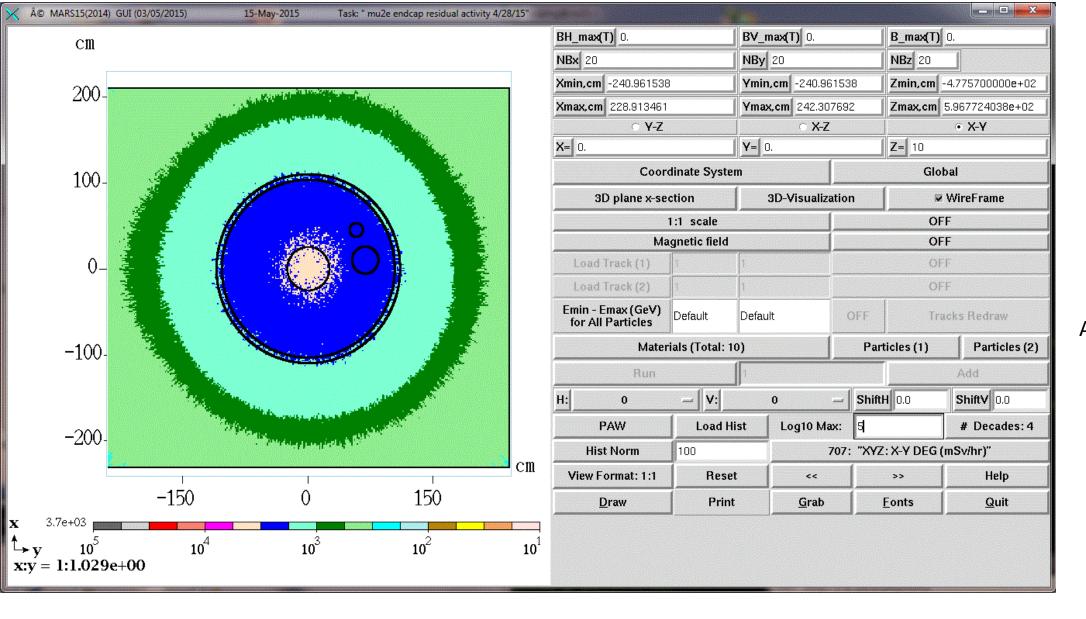
Elevation view at 0' from endcap



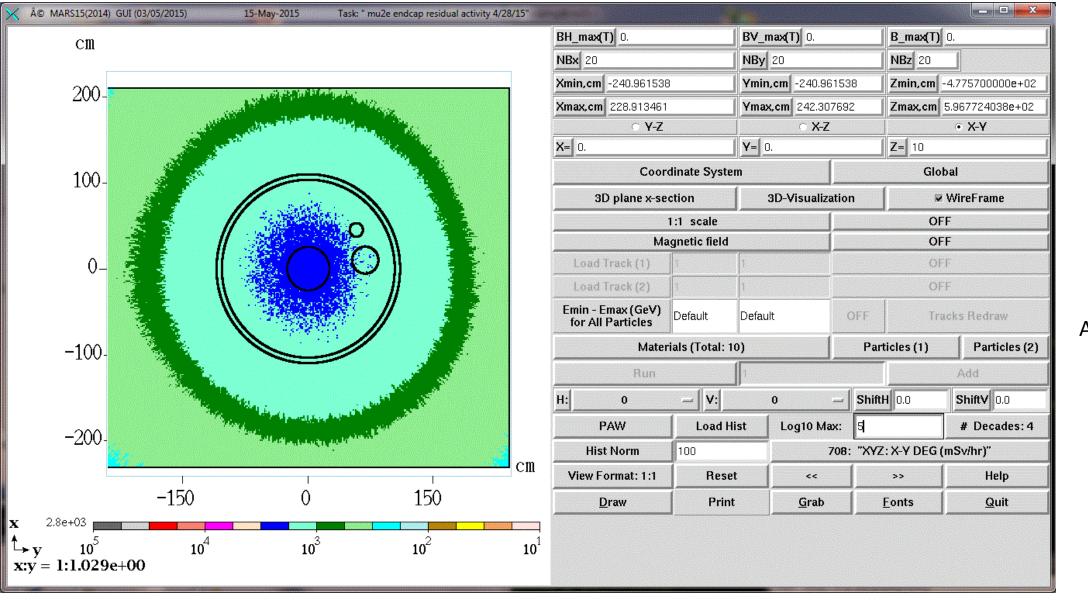
Elevation view at 1' from endcap 365 days in



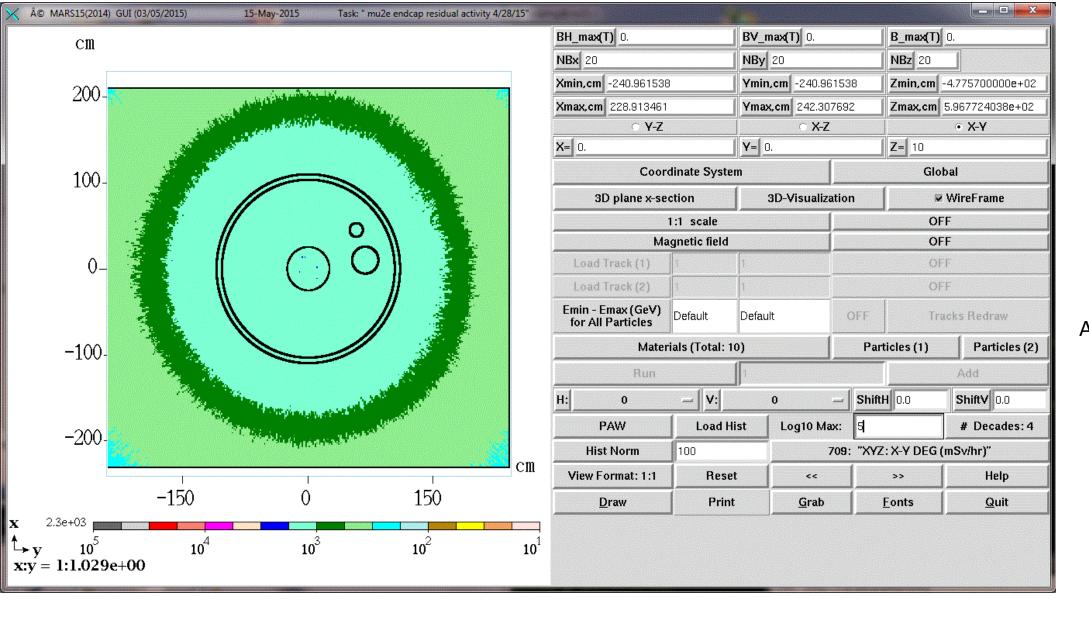
Elevation view at 2' from endcap 365 days irradiation, 7



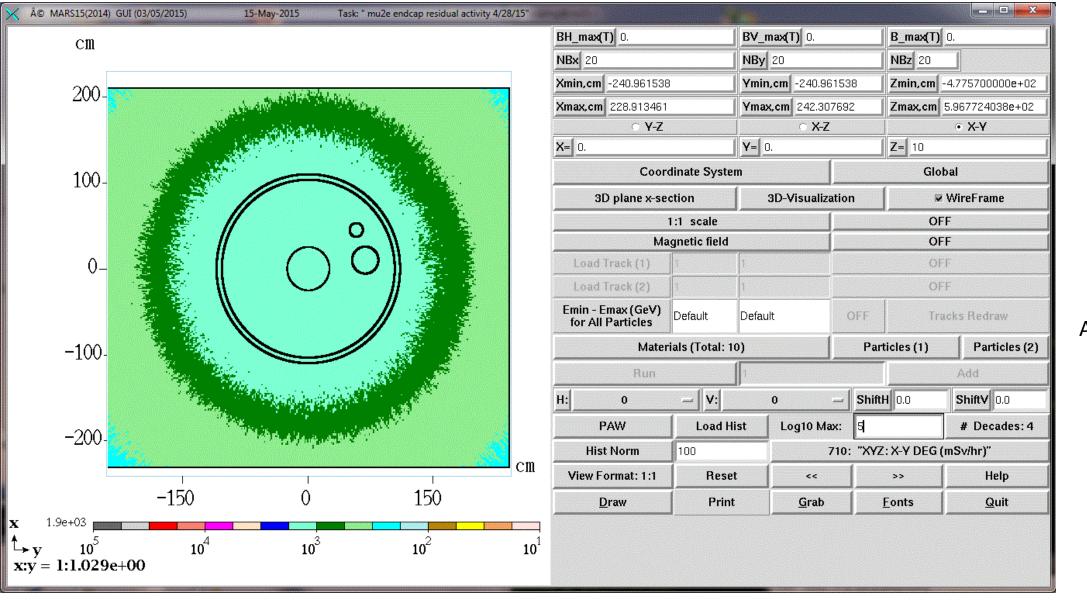
Elevation view at 3' from endcap 365 days irrad



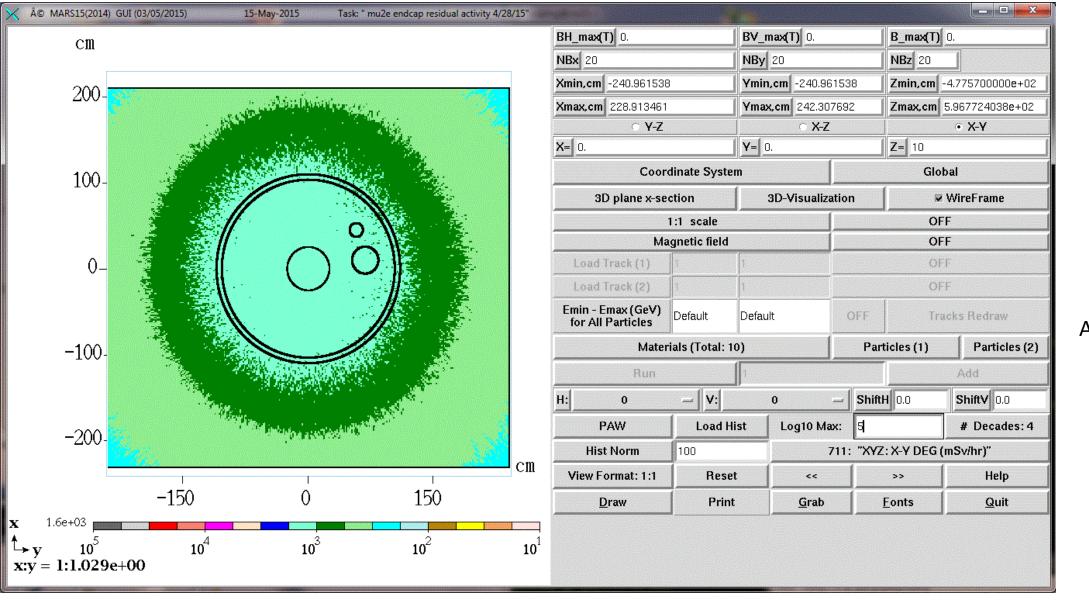
Elevation view at 4' from endcap 36



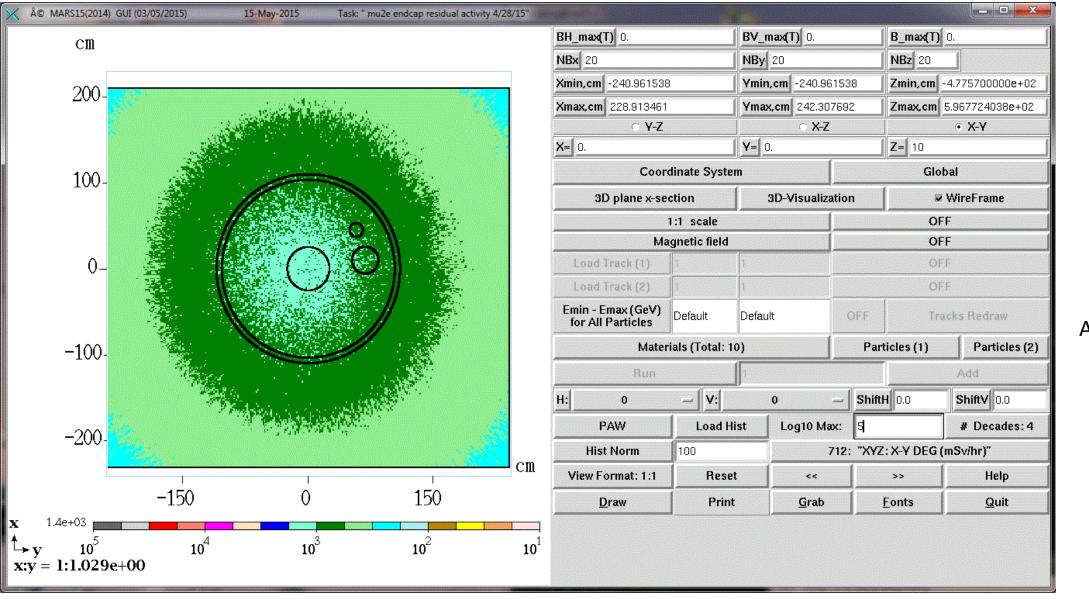
Elevation view at 5' from endcap 36



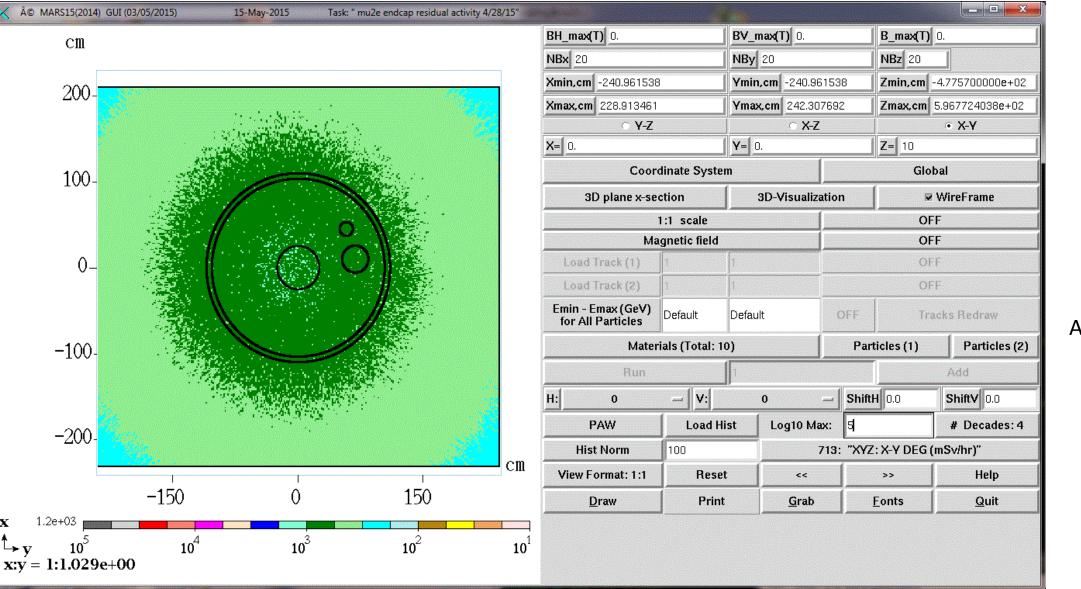
Elevation view at 6' from endcap 365



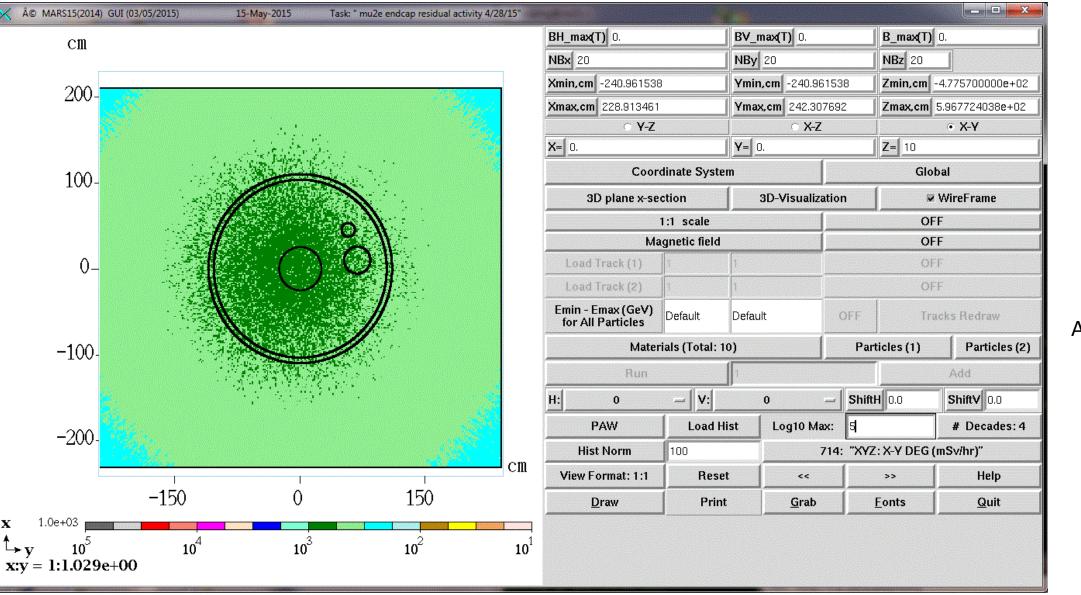
Elevation view at 7' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



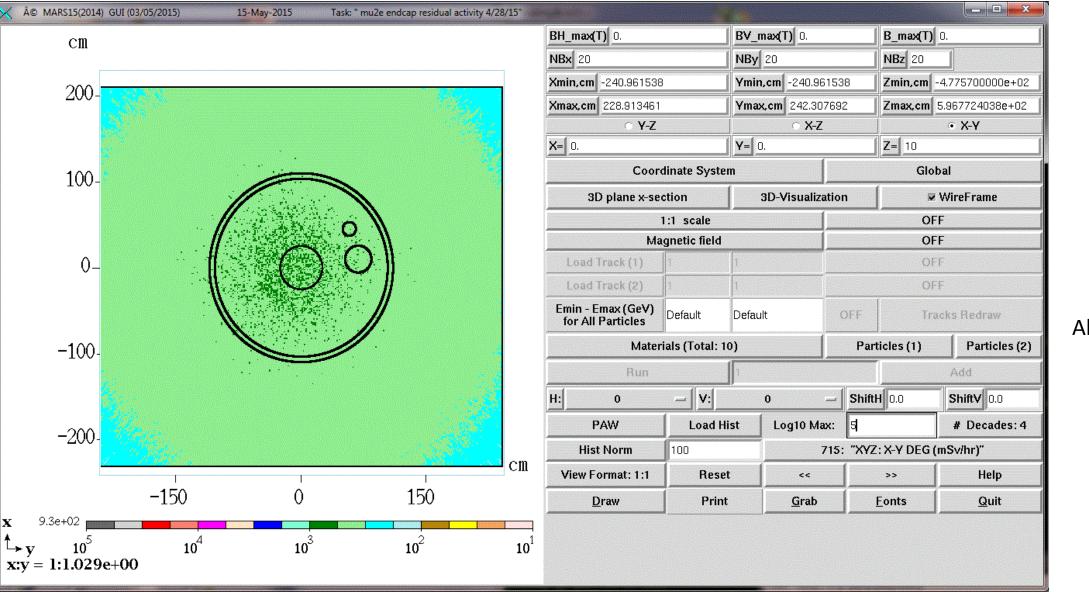
Elevation view at 8' from endcap



Elevation view at 9' from endcap

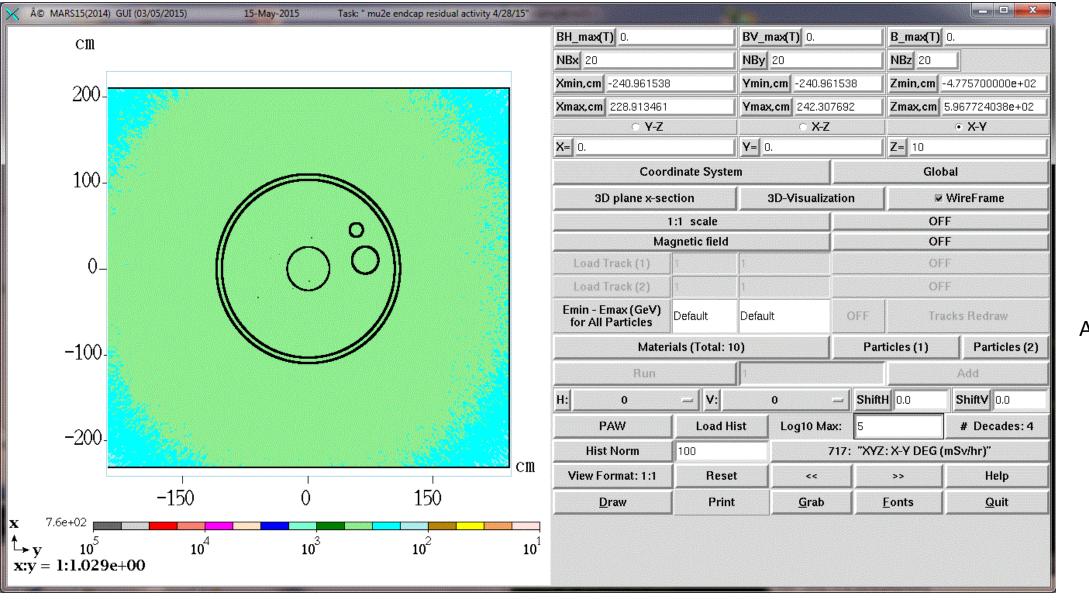


Elevation view at 10' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr

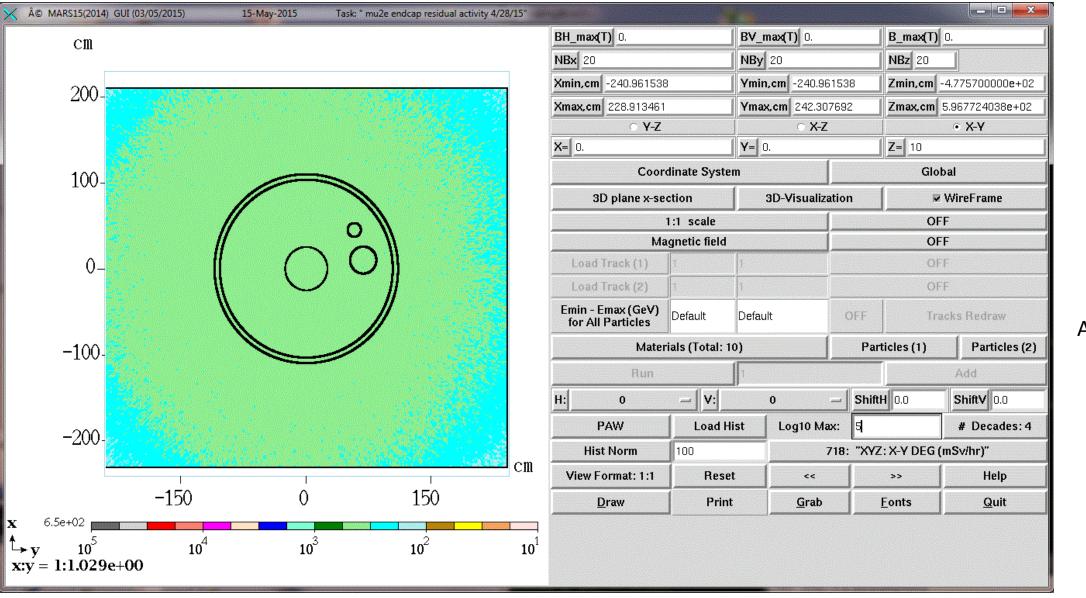


Elevation view at 11' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr

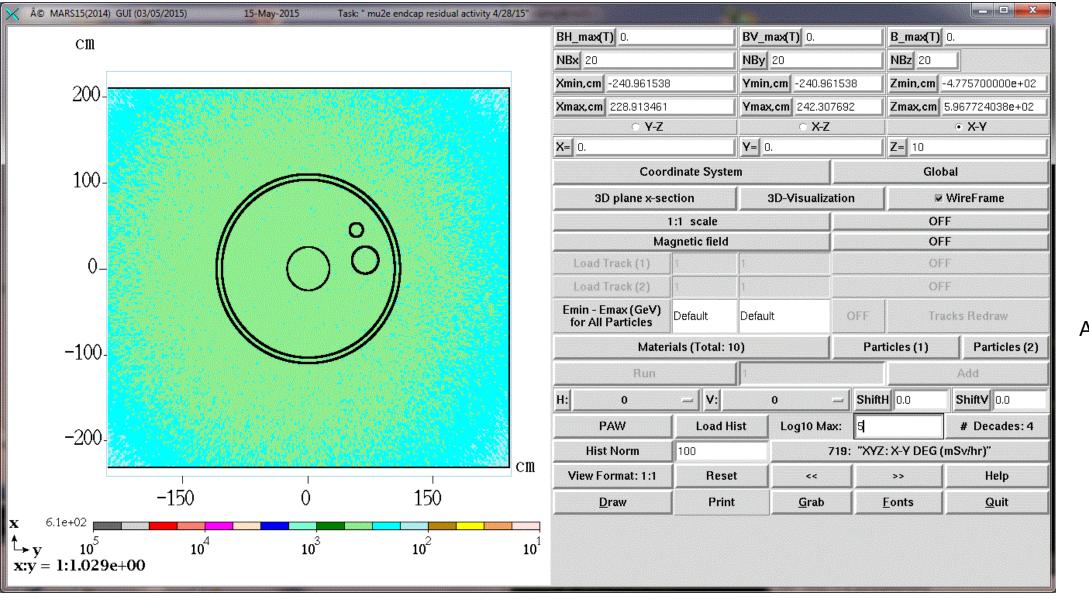
Elevation view at 12' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



Elevation view at 13' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



Elevation view at 14' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



Elevation view at 15' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr

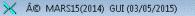
Aluminum end cap assumptions

- All end cap components can be made from aluminum
 - Dish
 - Outer cone
 - Main flange
 - Beam, extinction, and target extraction tubes
 - Vacuum port
- Retain some parts as SS316
 - tube flanges (3) and window flanges (3)
 - HRS flange
- Retain Ti vacuum windows as previously specified

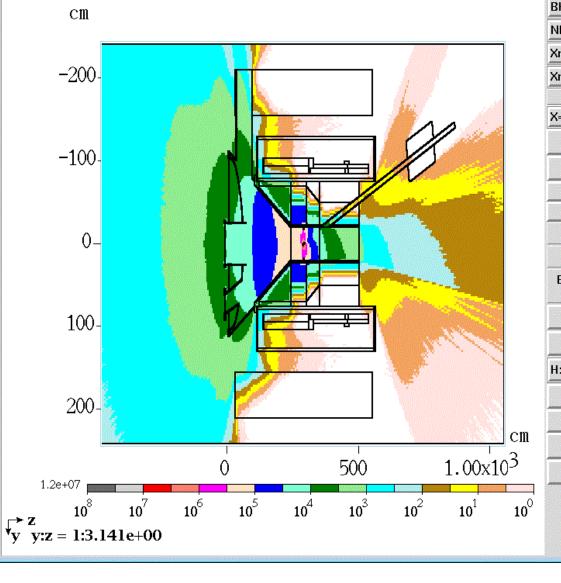
Assumed Aluminum T-6061

- Alloy composition taken from:
- Assuming Al T6061 alloy would be used. Taking the makeup of the alloy from this site:
- <u>http://asm.matweb.com/search/SpecificMaterial.asp?bassnum=MA6061t6</u>

	min	max	average	Weight fraction
Al	95.8	98.6	96.6800000	0.9668
Cr	0.04	0.35	0.1950000	0.00195
Cu	0.15	0.4	0.2750000	0.00275
Fe	0.7	0.7	0.7000000	0.007
Mg	0.8	1.2	1.0000000	0.01
Mn	0.15	0.15	0.1500000	0.0015
Si	0.4	0.8	0.6000000	0.006
Ti	0.15	0.15	0.1500000	0.0015
Zn	0.25	0.25	0.2500000	0.0025
			100.0000	1.0000



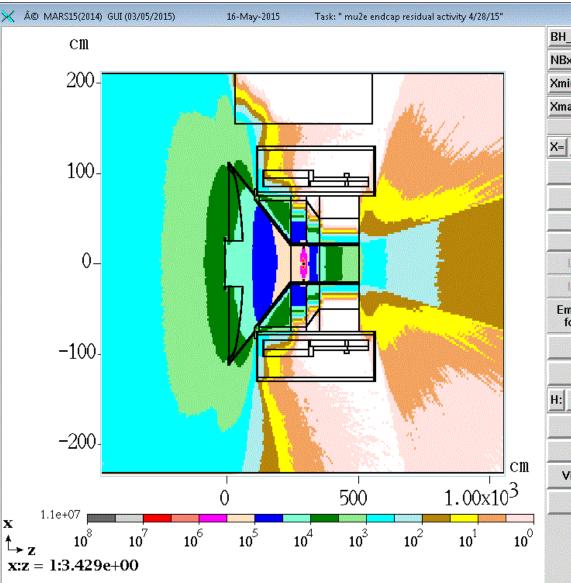
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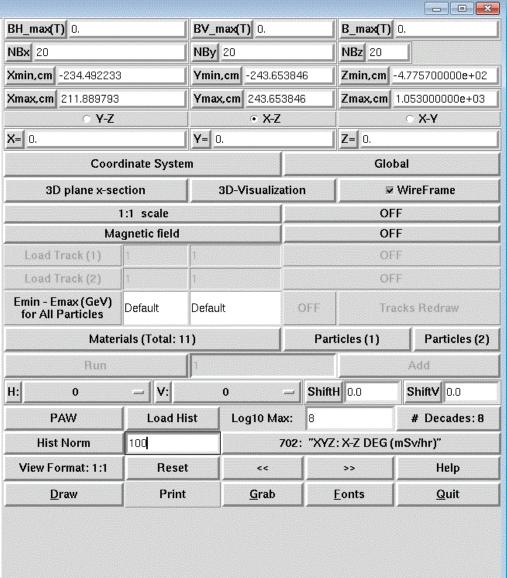


H_max(T	-) 0.		BV	BV_max(T) 0.			B_max(T)	0.		
Bx 20	- <u>-</u>				NBy 20		1	NBz 20		
	-350.0000					65384	16		4.775700000 e+ 02	
max,cm	350.0000	Ymax		x.cm 243.	65384	6	Zmax, cm	1.053000000 e+ 03		
• Y-Z					• X	-Z		• X-Y		
(= 0.				Y = 0.				Z= 0.		
	Coor	dinate	Syste	m				Glot	al	
3D plane x-section				1	3D-Visual	izatio	n		WireFrame	
1:1 scale				al assessments				OF	F	
Magnetic field							OF	F		
Load Track (1) 1				OFF						
Load T	Track (2) 1		1	1		OFF				
Emin - Emax (GeV) for All Particles			Defau	ult	OFF Tracks Redra			cks Redraw		
Materials (Total:			otal: 1	1)		Particles (1) Particl			Particles (2)	
	Run			1					Add	
:	pi		V:		0		Shift	1 0.0	ShiftV 0.0	
PAW Load		oad H	list	Log10 I	vlax:	8		# Decades:8		
Hist Norm 100				1	701:	"XYZ	: Y-Z DEG (mS∨/hr)″		
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Aluminum

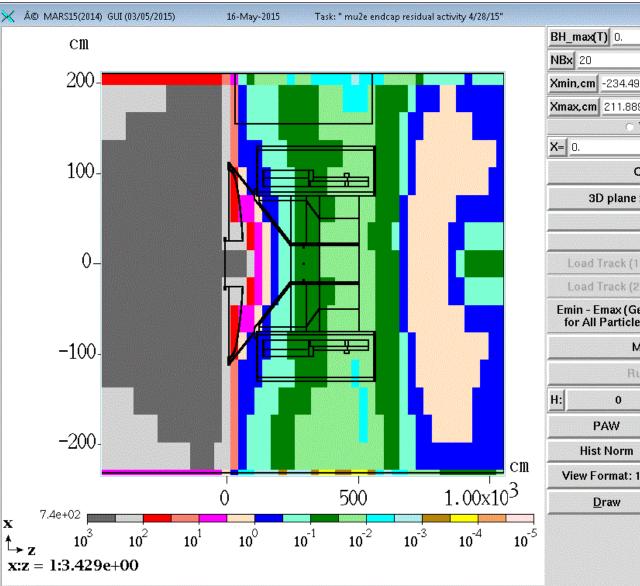
Plan view in target plane

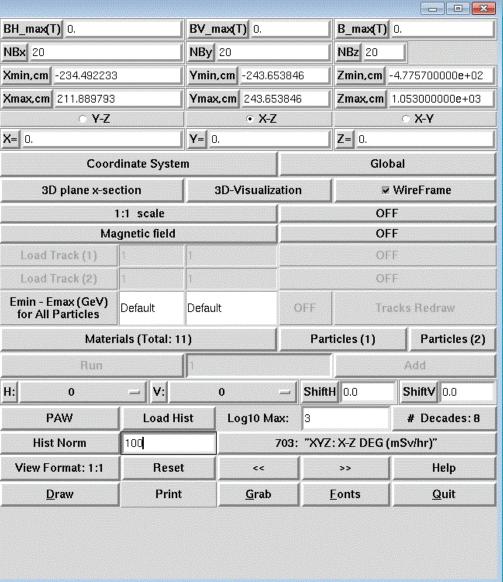




Aluminum

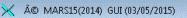
Elevation view in target plane





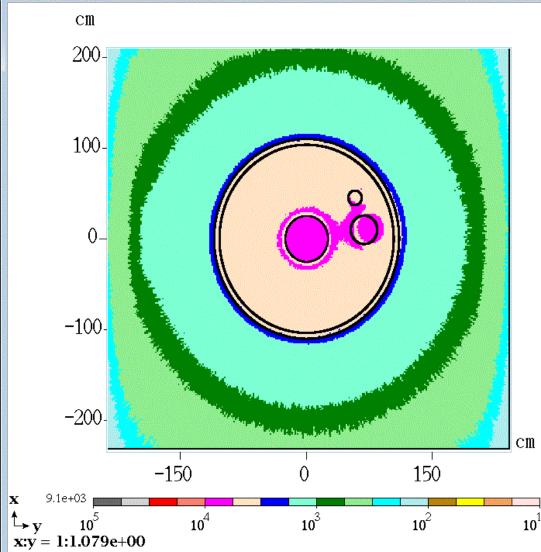
Aluminum

Plan view in aisle plane



X

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		1 m / /		1	D (T)		
BH_max(T) 0.		BV_max(T) 0.			B_max(T)	0.	
NBx 20		NBy 20	NBy 20				
Xmin,cm -234.230769		Ymin,cm	Ymin,cm -236.92307		Zmin,cm	-4.775700000 e +02	
Xmax.cm 210.0000		Ymax,cm	242.30769	2	Zmax, cm	1.053000000e+03	
• Y-Z		• X-Z • X-Y					
X= 0.	Y= 0.			Z = 10			
Coor	dinate Syst	em			Glo	bal	
3D plane x-se	ction	3D-\	/isualizatio	n	V	WireFrame	
	1:1 scale				O	ŦF	
Ma	agnetic field		OFF				
Load Track (1)	1 1			OFF			
Load Track (2)	1			OFF			
Emin - Emax (GeV) for All Particles				OFF	Tracks Redraw		
Mater	ials (Total:	11)		Particles (1) Particles			
Run		1		100		Add	
H: O	- V:	0	-	Shift	1 0.0	ShiftV 0.0	
PAW	Load	Hist Lo	g10 Max:	s		# Decades: 4	
Hist Norm 100			704: "XYZ		Z: X-Y DEG (mSv/hr)"		
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Draw Print		nt	<u>G</u> rab	<u> </u>		Quit	

Aluminum

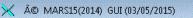
Elevation view at 0' from endcap

Aluminum

Elevation view at 1' from endcap

Aluminum

Elevation view at 2' from endcap



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200-

100-

0-

2.8e+03

 $y = 10^{5}$ x:y = 1:1.079e+00

X ∢t_{≻y} -100--200- $\mathbf{C}\mathbf{M}$ -150 150 0 10³

10²

10¹

BH_max(T) 0.		BV_max(3V_max(T) 0.			B_max(T) 0.		
NBx 20	ionoronoronoronononononon	NBy 20			NBz 20			
Xmin,cm -234.230769		Ymin,cm	-236.92307	7	Zmin,cm	-4.775700000 e +02		
Xmax.cm 210.0000		Ymax,cm	242.30769	2	Zmax, cm 1.053000000e+03			
• Y-Z		• X-Z				• X-Y		
X= 0.	ĺ	Y= 0.	– 0. – – 10					
Coord	dinate Systen	n			Glo	bal		
3D plane x-se	ction	3D-V	/isualizatio	lization 🛛 🖾 WireFrame				
	1:1 scale				0	FF		
Ма	gnetic field			OFF				
Load Track (1)	1		OFF					
Load Track (2)	1	1		OFF				
Emin - Emax (GeV) for All Particles				OFF	Tracks Redraw			
Mater)		Particles (1) Particles (
Run		1				Add		
H: 0 - V:		0	-	Shift	1 0.0	ShiftV 0.0		
PAW Load H		st Lo	g10 Max:	ទ		# Decades: 4		
Hist Norm 100			707:	"XYZ	: X-Y DEG	(mSv/hr)″		
View Format: 1:1 Reset		t <<		>>		Help		
Draw Print			Grab			Quit		

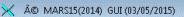
Aluminum

Elevation view at 3' from endcap

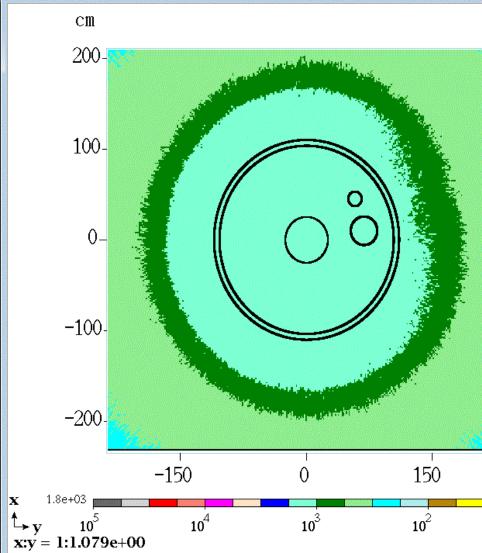
10⁴

Aluminum

Elevation view at 4' from endcap



16-May-2015 Task: " mu2e endcap residual activity 4/28/15"



		1	m a	Constant on the second start	D (T)	[
BH_max(T) 0.		BV_max(T) 0.			B_max(T) 0.			
NBx 20		NBy 20	20		NBz 20			
Xmin,cm -234.23076	3	Ymin,cm	-236.9230	77	Zmin,cm	-4.775700000 e+ 02		
Xmax.cm 210.0000		Ymax, cn	n 242.30769	92	Zmax, cm	1.053000000e+03		
⊙ Y -Z			○ X-Z			• X-Y		
X= 0.		Y = 0.			Z= 10			
Coor	dinate Syste	em		en en en	Glo	bal		
3D plane x-se	ction	3D-	Visualizatio	on		WireFrame		
	1:1 scale				0	FF		
Ma	agnetic field				0	FF		
Load Track (1)	1	1		OFF				
Load Track (2)	1	1 1			OFF			
Emin - Emax (GeV) for All Particles				OFF	Tracks Redraw			
Mate	rials (Total: 1	11)		Part	ticles (1) Particles (2			
Run		1				Add		
H: O	- V:	0		Shift	1 0.0	ShiftV 0.0		
PAW	Load H	list L	og10 Max:	ব		# Decades: 4		
Hist Norm	100		709	: "XYZ	: X-Y DEG	(mS∨/hr)″		
View Format: 1:1 Res		et	~~		>>	Help		
Draw Print		t	Grab		Eonts	Quit		

Aluminum

Elevation view at 5' from endcap

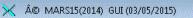
365 days irradiation, 7 days cooling time, results in mrem/hr

CM

10¹

Aluminum

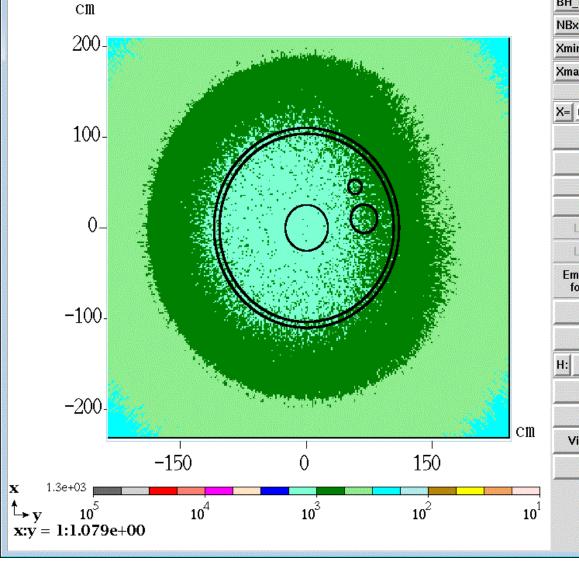
Elevation view at 6' from endcap



X

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В

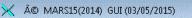


3H_max(T) 0.			BV_max(T) 0.			0.			
VBx 20				1	NBz 20				
cm -234.230769			-236.92307	77	Zmin,cm -4.775700000e				
Cmax,cm 210.0000			Ymax.cm 242.307692		Zmax, cm	1.053000000e+03			
• Y-Z			• X-Z			• X-Y			
i= 0.					Z= 10				
dinate Sys	stem				Glo	bal			
3D plane x-section				n	₩ WireFrame				
1:1 scale					OFF				
Magnetic field					OFF				
1	1			OFF					
1	1			OFF					
Emin - Emax (GeV) for All Particles				OFF Tracks Redra		acks Redraw			
Materials (Total: 1				Part	Particles (1) Part				
Run			1			Add			
- V:		0		Shift	1 0.0	ShiftV 0.0			
PAW Load H		st Log10 Max		x: s		# Decades: 4			
100			711: "XYZ: X-Y DEG (mSv/hr)"						
Re	set	<.			>>	Help			
	int	Grab		1	onts	Quit			
	dinate Sys ction 1:1 scale gnetic fiel 1 Default ials (Total V: Load	NBy NBy NBy NBy NBy Name of the second secon	NBy 20 9 Ymin,cm Ymax.cm Y= 0. dinate System ction 3D-V 1:1 scale ignetic field 1 1 Default Default Default 100	NBy 20 9 Ymin, cm -236.92307 Ymax, cm 242.30769 Y= 0. dinate System - Y= 0. dinate System - gnetic field - 1 1 Default Default 1 1 - V: 0 1 1	NBy 20 9 Ymin, cm -236.923077 Ymax, cm 242.307692 Y= 0. dinate System - ction 3D-Visualization 1:1 scale - ingnetic field - 1 1 Default Default OFF 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 1 - 1 0 - 1 1 - 1 1 - 1 1 - 1 0 <t< th=""><td>NBy 20 NBz 20 9 Ymin, cm -236.923077 Zmin, cm Ymax, cm 242.307692 Zmax, cm Y= 0. Z= 10 dinate System Glo ction 3D-Visualization 1:1 scale OI ognetic field OI Default Default OFF 1 O 1</td></t<>	NBy 20 NBz 20 9 Ymin, cm -236.923077 Zmin, cm Ymax, cm 242.307692 Zmax, cm Y= 0. Z= 10 dinate System Glo ction 3D-Visualization 1:1 scale OI ognetic field OI Default Default OFF 1 O 1			

Aluminum

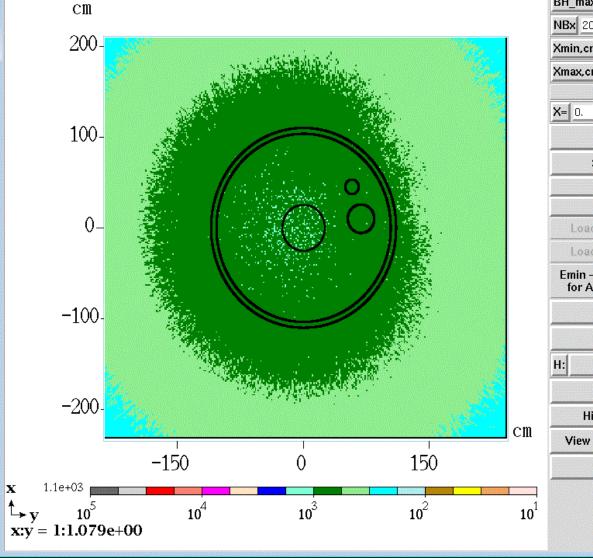
Elevation view at 7' from endcap

365 days irradiation, 7 days cooling time, results in mrem/hr



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В

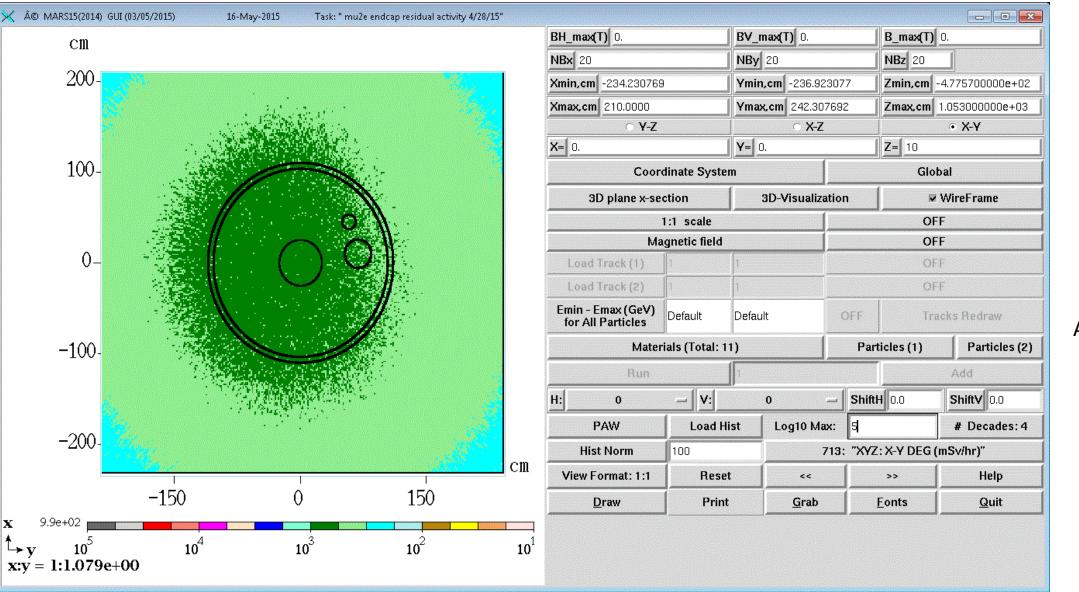


3H_max(T) 0.				BV_r	BV_max(T) 0.				B_max(T) 0.			
IBx 20				NBy	NBy 20				NBz 20			
(min, cm -234.2	230769	aaaaaaaaaa	nanaranana	Ymin,cm -236.92			2307	7	Zmin,cm -4.775700000e			
(max.cm 210.0	000			Ymax.cm 242.30)7692		Zmax, cm	1.053000000e+03			
⊖ Y-Z				O X-Z				• X-Y				
= 0.			Y = 0	Y = 0.				Z= 10				
	Coord	linate	Syste	em			2016		Glo	bal		
3D plane x-section				1	3D-Visualization			n [✓ WireFrame			
1:1 scale						OFF						
Magnetic field					OFF							
Load Track	(1)	1 1							OFF			
Load Track	(2)	1 1					OFF					
Emin - Emax ((for All Partic	GeV) cles	Default Defau			lt		(OFF	Tracks Redraw			
Materials (Total: 11)				11)	Part			Part	icles (1) Particles			
Run				1	1				Add			
l: 0			V:		0			ShiftH	I 0.0	ShiftV 0.0		
PAW		L	Load Hist		Log10 Max:		ax:	র		# Decades: 4		
Hist Norm	n	100					712:	"XYZ:	X-Y DEG	(mSv/hr)″		
View Format	: 1:1	Reset		et	<<		>>		Help			
Draw		Print		t	<u>G</u> rab		<u>F</u> onts		Quit			

Aluminum

Elevation view at 8' from endcap

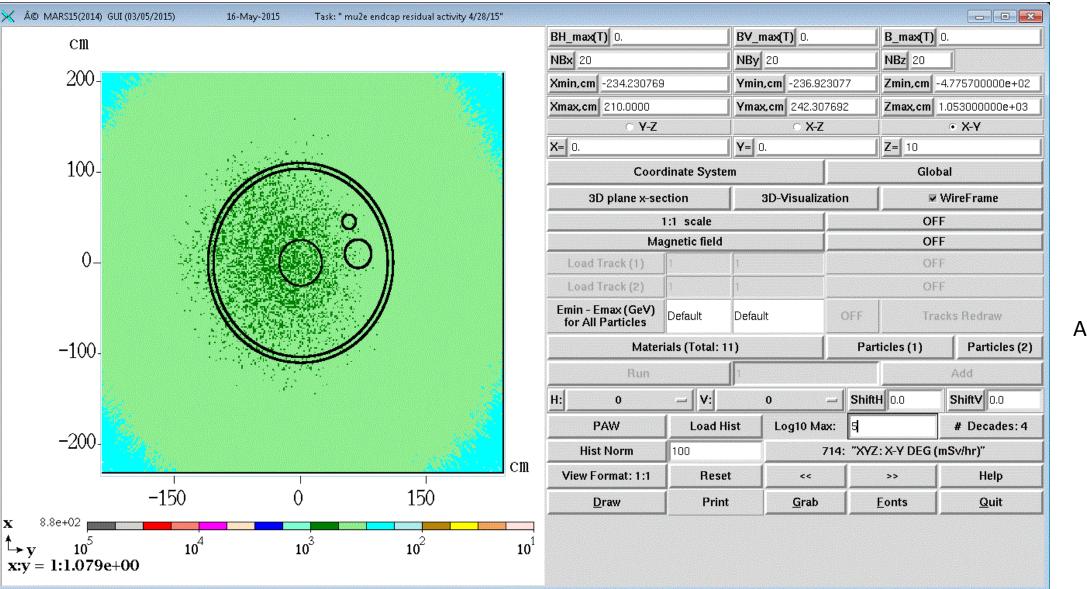
365 days irradiation, 7 days cooling time, results in mrem/hr



Elevation view at 9' from endcap

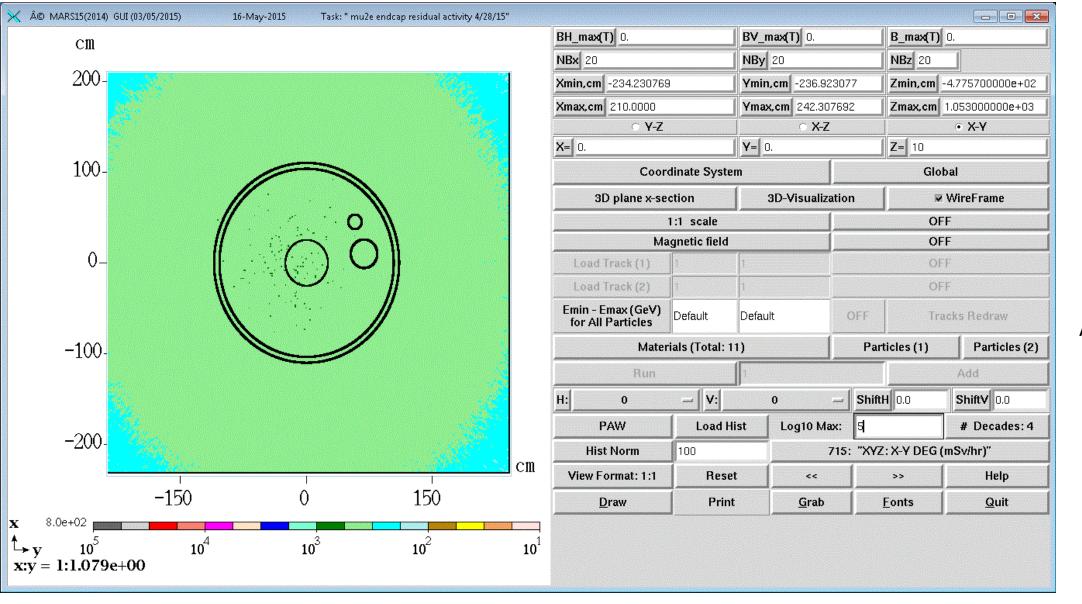
X

365 days irradiation, 7 days cooling time, results in mrem/hr

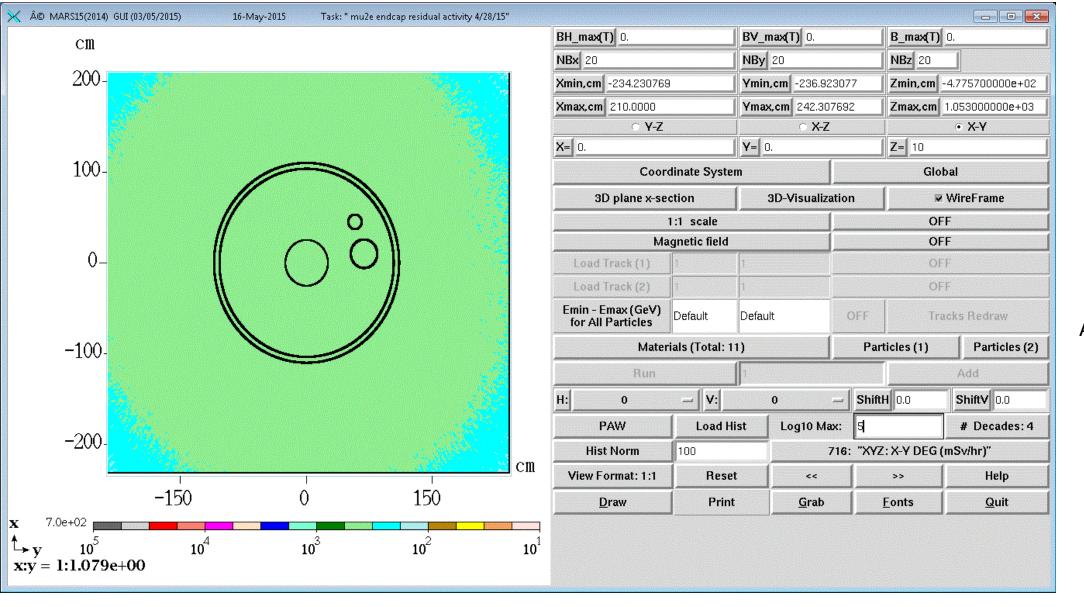


Elevation view at 10' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr

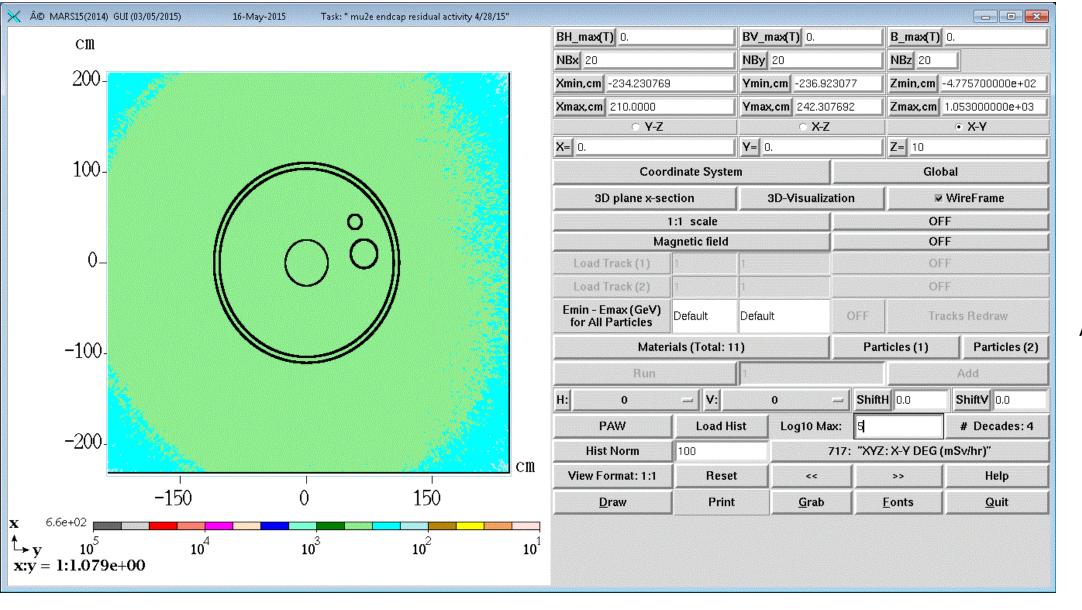
X



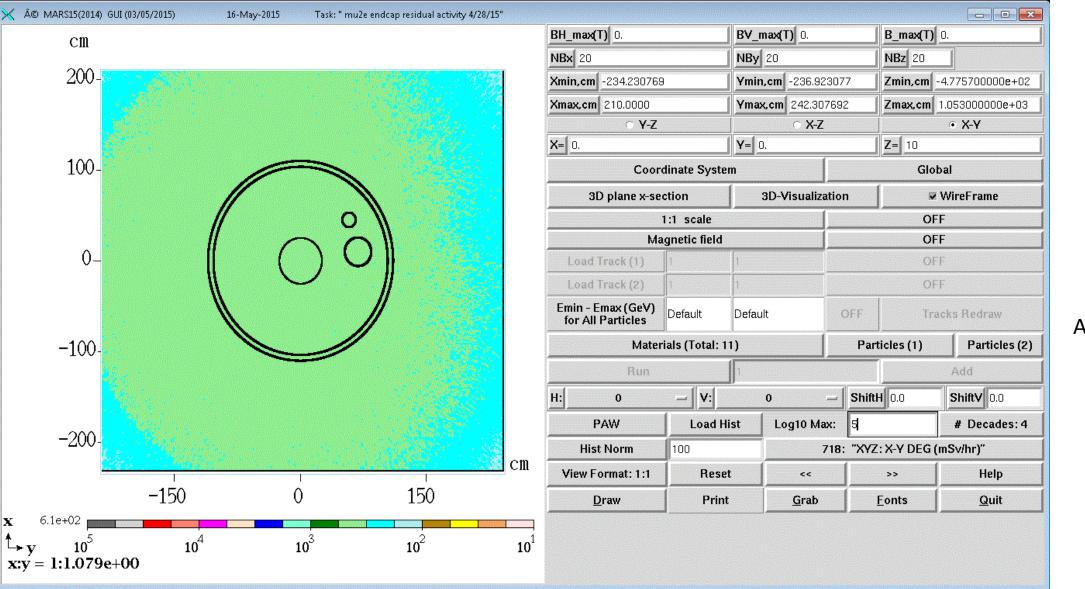
Elevation view at 11' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



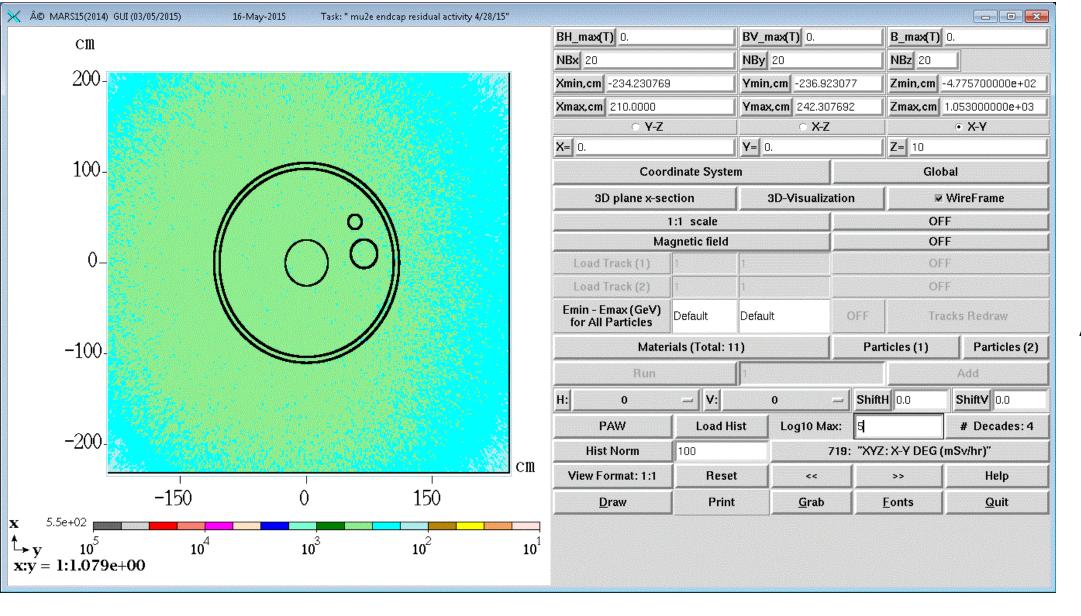
Elevation view at 12' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



Elevation view at 13' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr

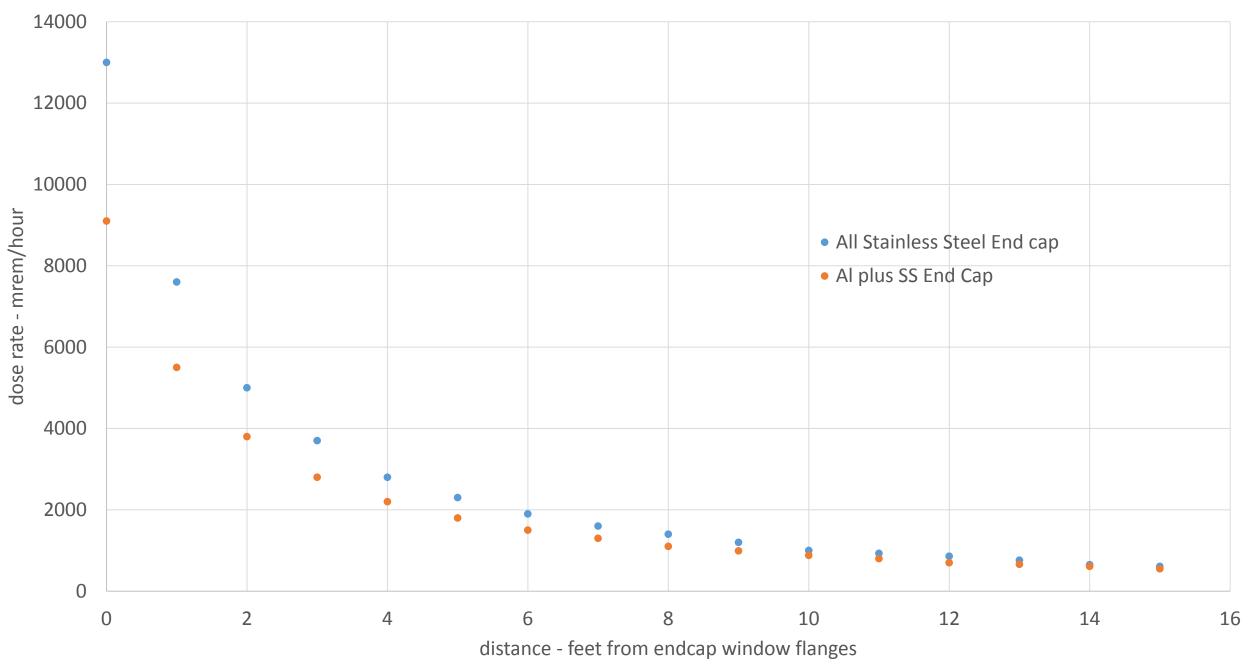


Elevation view at 14' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr



Elevation view at 15' from endcap 365 days irradiation, 7 days cooling time, results in mrem/hr

Peak Dose Rate as function of distance from SS and Al end caps



Conclusions

- SS and Al end caps have been modeled in MARS (extended plus non-standard geometry)
- Activity of 25 end cap components has been determined
 - MARS DETRA
- Photon library with energy and branching ratios was developed
 - Photon energy ~100 keV and higher
- In a second MARS simulation
 - Photon sources distributed uniformly in individual components
 - Unrealistic, but reasonable approximation
 - Only sources greater than ~3MBq are included
 - Essentially 100% of total activity
 - Radiation dose rates determined for SS and Al end caps
 - for 365 days irradiation, 7 day cooling time
 - Allow three working days to determine dose rates for additional cooling times
- Significant dose rate reductions result near the end cap
- No significant reduction at far distances, e.g. 10 feet

Extra slides

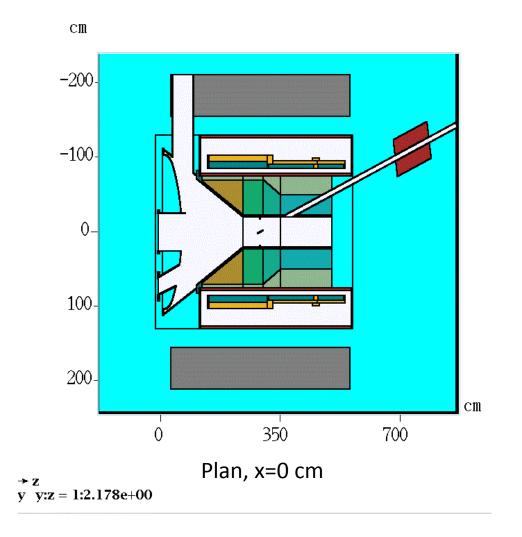
Short Term Work Plan

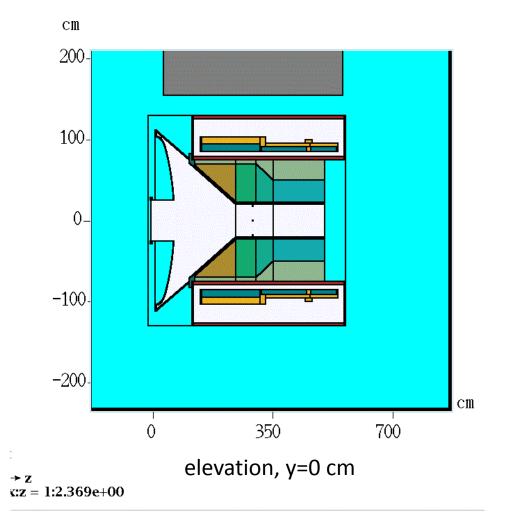
Build end cap in MARS non-standard geometry

• Add the end cap to existing MARS model by Vitaly/Yuri

- Run proton beam through the model with massless target to set beam pipe position and angle
- Added extinction tube and beam tube (overlooked last week)
- Included shower particle crossing surfaces for subsequent stage work
- Struggled with compilation on the grid (root remnant in model) fixed
- Struggled with compilation while grid resources were updated
- Created 25 individual source terms for end cap and HRS components
- Ran 1,000 jobs, 10,000 incident particles/job (1E7 ip total)
- Struggled with detra header lines on input file
 - Warning about "too many decay chains" not really a problem
 - Segmentation fault if one tries to fix the warning
- Determined radionuclide content of SS end cap components for design irradiation and cooling times (e.g., 1 year, 7 days)
- Determine radiation dose rates as function of distance from endcap

Plan and elevation views of MARS model





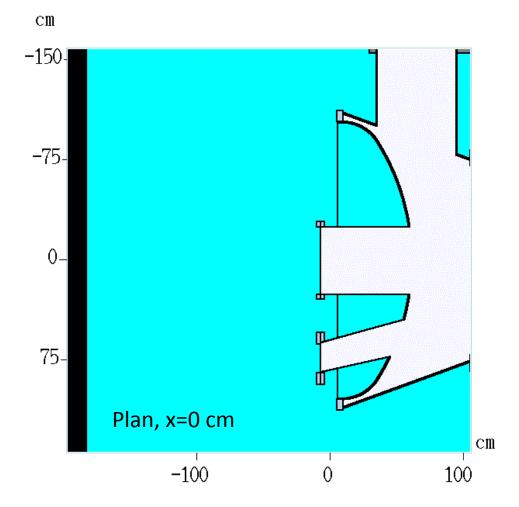
Radionuclide inventory for SS end cap and major HRS parts

IM	part	Ci	number of isotopes (PROD)	Activity (PROD)
5	target	298.68	588	1.11E+13
8	Target_extraction_tube_window	0.01	38	5.04E+08
9	Beam_pipe_vacuum_window	0.01	41	1.92E+08
10	Extinction_tube_vacuum_window	0.00	22	1.03E+07
15	Extinction_tube_flange	0.14	142	5.10E+09
23	HRS_section_1_bronze_section	57.91	83	2.14E+12
51	HRS_section_1_inner_S316	99.45	198	3.68E+12
60	HRS_flange	1.55	155	5.74E+10
61	Target_extraction_tube	0.98	160	3.64E+10
62	Target_extraction_tube_window_flange	0.11	125	3.93E+09
63	Target_extraction_tube_flange	0.49	157	1.81E+10
64	Beam_pipe_window_flange	0.01	131	1.92E+08
65	Beam_pipe_flange	0.55	156	2.03E+10
66	Spherical_dish	4.63	185	1.71E+11
67	Main_flange	1.29	158	4.79E+10
68	Torus	1.37	159	5.05E+10
69	Torus_entry_cylinder	0.14	136	5.25E+09
70	Outer_cone	1.24	139	4.60E+10
71	Vacuum_port_pipe	0.08	90	3.10E+09
73	Extinction_tube_window_flange	0.04	101	1.45E+09
74	Extinction_tube	0.42	151	1.54E+10
75	Beam_tube	1.54	170	5.68E+10
76	HRS_section_2_bronze	127.24	82	4.71E+12
77	HRS_section_3_bronze	14.84	77	5.49E+11
78	HRS_section_4_bronze	1.39	69	5.13E+10

Next steps

- Combine 25 activity sets
 - Add photons > 50 keV
 - Start with the library made for the mu2e cask
 - Use top 99% of activity for each end cap/HRS component
 - Create volume index for each element
- Create source term (subroutine beg)
 - Distribute sources within the 25 volume elements
- Run MARS job with dose rate histograms at various distances from the end cap
 - At flanges, 1', 2', 3', . . . 15'
- Then, repeat the process for an aluminum end cap

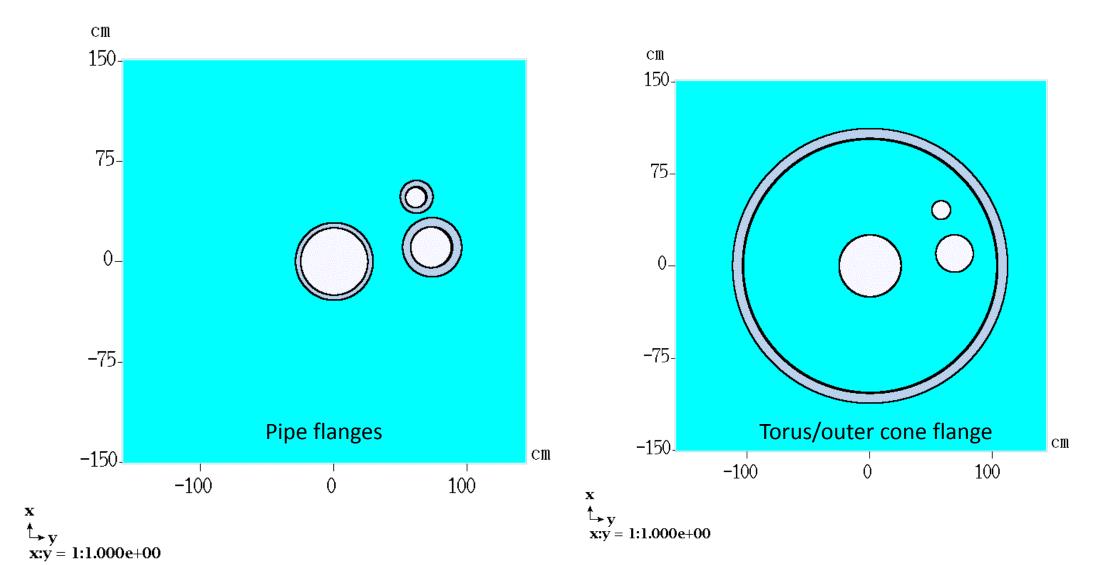
Plan and elevation views of MARS EC model



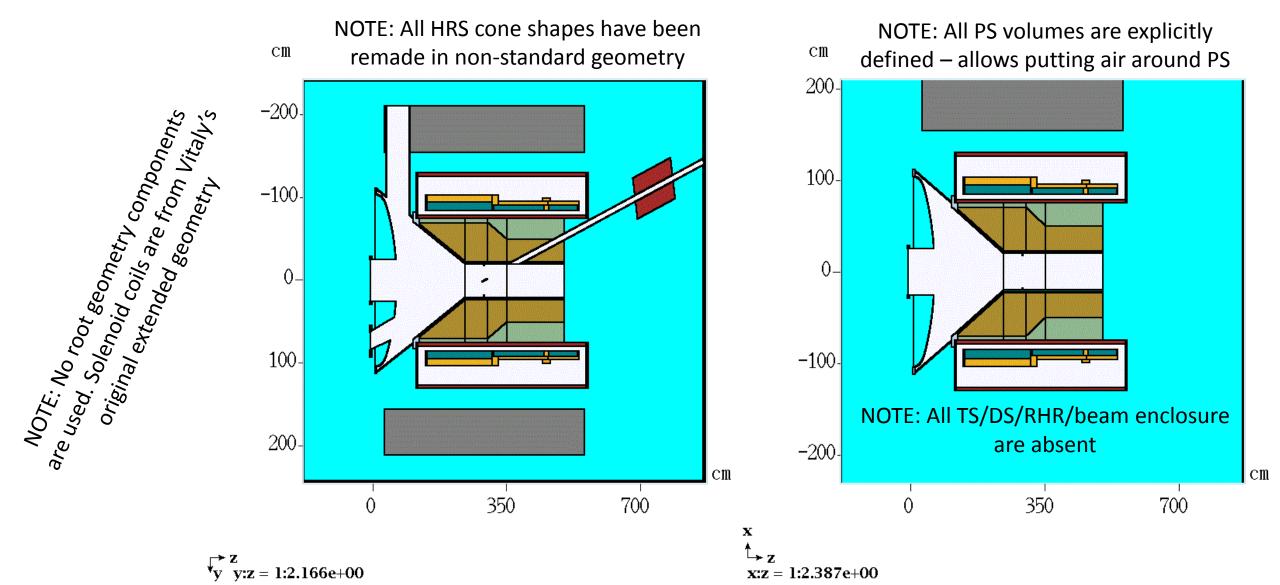
Rotated 14 degrees elevation, y=73 cm

 $\mathbf{v}_{\mathbf{y}} \mathbf{v}_{\mathbf{y}:\mathbf{z}} = 1:1.000e+00$

Cross sections through pipe & main flanges

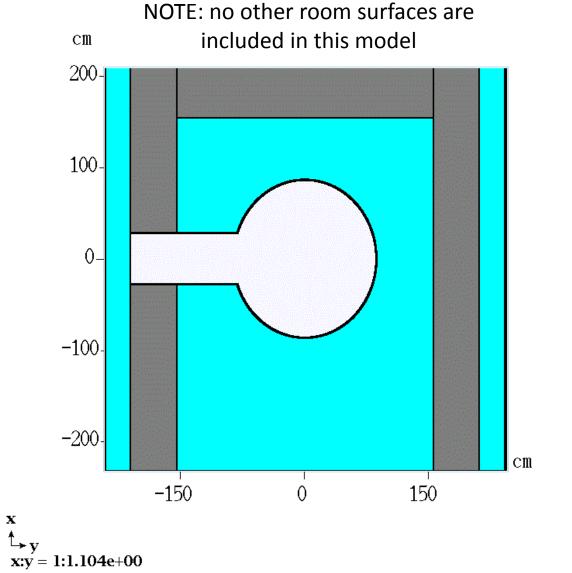


Plan and elevation view of combined models



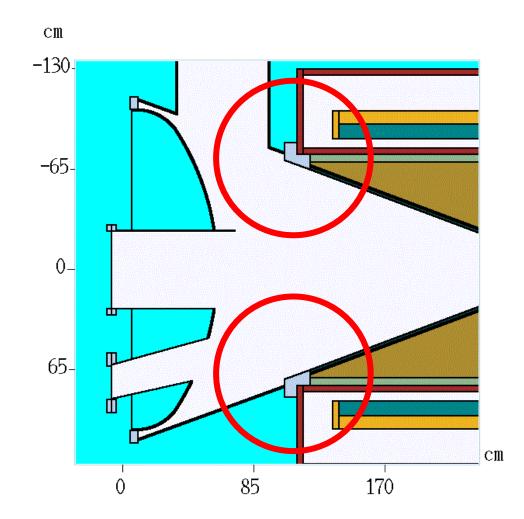
Elevation views through target and vacuum port

NOTE: transposed x/y coordinates +x is up; + y is proton beam left



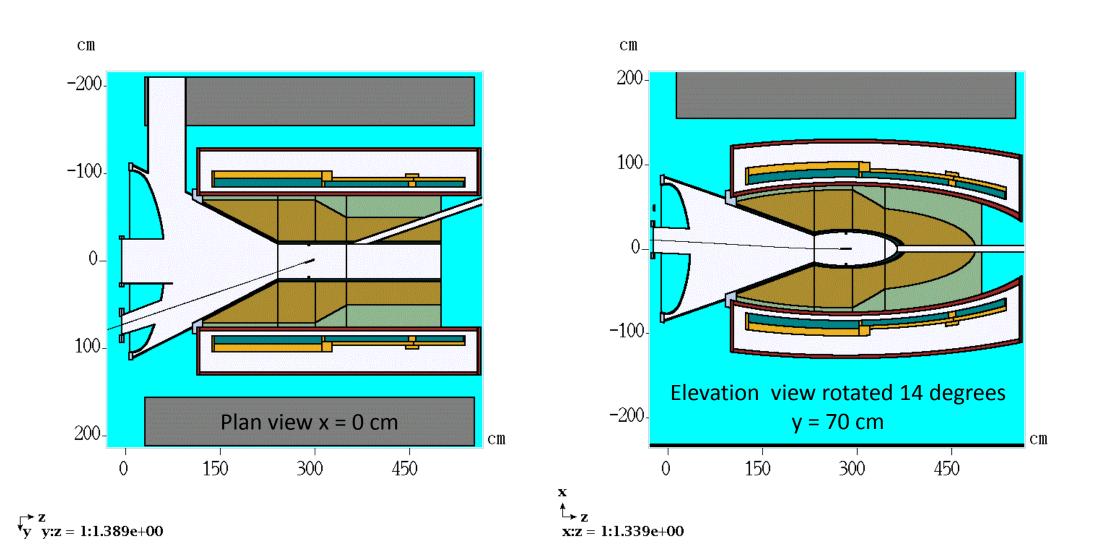
Added HRS flange

Developed based upon discussion with Kurt and PPT presentation by Larry (**Mu2e Document 3449-v2**)

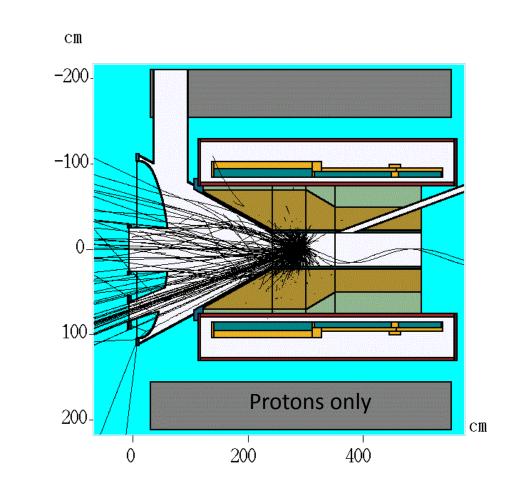


 \mathbf{y} \mathbf{y} \mathbf{y} : \mathbf{z} = 1:1.000e+00

Beam sent through massless target for beam pipe alignment



Plan view with particle tracks, 100 IP





 \overrightarrow{y} z y y:z = 1:1.486e+00

Elevation view through beam pipe

NOTES

- 1. Model is limited to the PS, endcap, concrete yoke, and surrounding air space. Replaced endcap with non-standard geometry version.
- 2. Removed cylout. It is borated poly and the volume is occupied by the HRS bronze, SS, and water.
- 3. In the HRS, changed cwtr1 from cone to cylinder; changed cwt22 from cone to cylinder; changed css2 from cone to cylinder; changed cwtr4 from cone to cylinder; changed ccy14 from cone to cylinder.
- 4. Overlapping is not permitted in conical sections. Verified that the beam pipe through the HRS goes through simple cylinders.
- 5. Ignored the entire TS and CRV sections.
- 6. Removed yoke1 and yoke1v to remove overlap problem. With cone sections. Created hrsv1, hrsv2, and hrsv3 to define the HRS vacuum, presently identified as MOTHER.
- 7. Changed 1st and 3rd sections of HRS to non-standard geometry to remove extended geometry cone sections.
- 8. Added vacuum port extension through the yoke
- 9. Defined PS solenoid around coils as vacuum per discussion with Kurt.
- 10. Added an HRS flange per Larry's talk and after discussions with Kurt.
- 11. Adjusted concrete yoke positions per advice from George and added air to the yoke around the PS.
- 12. Ran some trials to align the beam pipe for protons exiting with target density 0. Here is a result
- 13. Cleaned up material definition errors, conductor warnings, etc.
- 14. Working on nuclide production (detra) now.