DEPOSITED POWER STUDIES FOR THE MC/NF TARGET STATION

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MUON COLLIDER TARGET STATION

- PROTON BEAM IMPINGE ON LIQUID TARGET/JET.
- INTERACTION PARAMETERS ARE OPTIMIZED FOR MAXIMUM MESON YIELD.
- MAGNETIC FIELD OF ~ 20 T ALONG STATION AXIS, NEAR TARGET REGION, SIPHONS CHARGED PARTICLES DOWNSTREAM WHERE B ~1.5 T.
- NbSn SUPERCONDUCTING COILS (~15 T) AND Cu COILS (~ 5T) WILL CREATE THE MAGNETIC FIELD AROUND INTERACTION AREA.
  NbTi SUPERCONDUCTING (SC) COILS FOR DOWNSTREAM MAGNETIC FIELD.
- MOST OF BEAM ENERGY WILL END UP IN TARGET STATION. SHIELDING MATERIAL TO PROTECT SC COILS.
- SHIELDING VESSELS TO CONTAIN SHIELDING MATERIAL.
- SC SOLENOIDS CRYOGENIC COOLING COMPONENTS.
- LIQUID TARGET COLLECTING TANK (+ BEAM DUMP) AND REMOVAL CONFIGURATION.

SHIELDING MATERIAL OPTIMIZATION (TYPE/QUANTITY)

- MINIMIZE DEMAND ON SC CRYOGENIC OPERATIONS.
- AVOID QUENCHING.
- RADIATION DAMAGE WITHIN "ACCEPTABLE" LIMITS.
- SATISFY ENGINEERING REQUIREMENTS FROM STRUCTURAL/MECHANICAL LIMITS

 # DEPOSITED POWER (DP) AND DEPOSITED POWER DENSITY (DPD) PEAK VALUES ARE USED FOR THE ANALYSIS.
 # MARS1510+MCNP USED FOR SIMULATIONS.
 # MCNP CROSS SECTION LIBRARIES USED FOR A MORE DETAIL STUDY OF LOW ENERGY NEUTRONS (< 0.1 MeV).

TARGET STATION STUDIES.

>mars1510/MCNP

>10^{-11} MeV NEUTRON ENERGY CUTOFF

>SHIELDING: 60%WC + 40%H_2O , 60%W + 40%He
(WITH STST VESSELS)

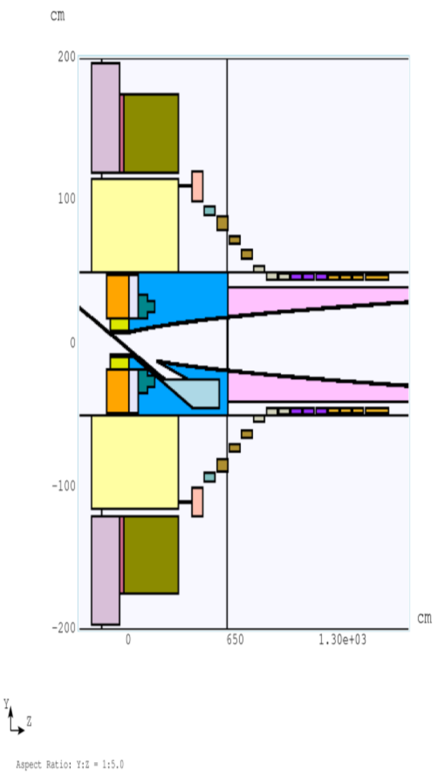
>PROTON BEAM POWER: 4 MW.

>PROTON ENERGY: 8 GeV.

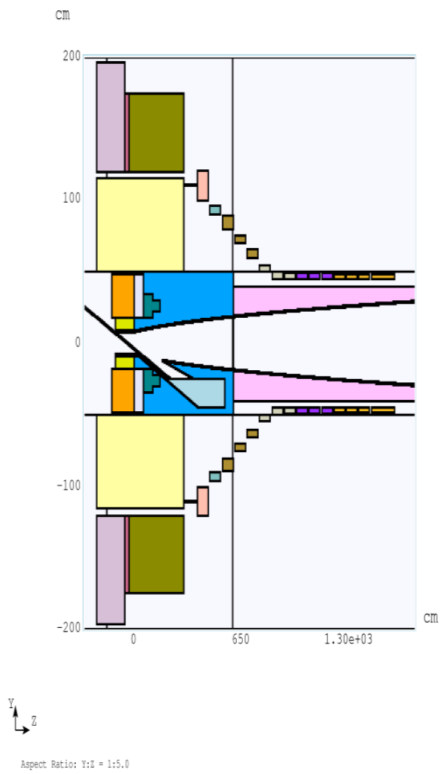
>GAUSSIAN PROFILE: $\sigma_x = \sigma_y$ = 0.12 cm(Hg)/0.132 cm(Ga).

IDS120 EVOLUTION.

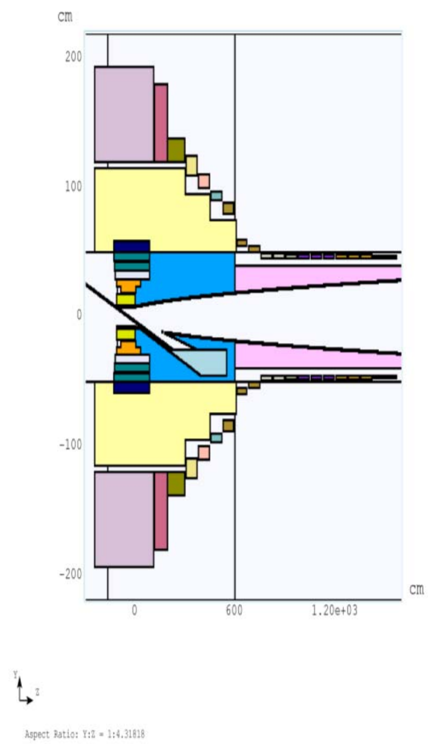
IDS120f



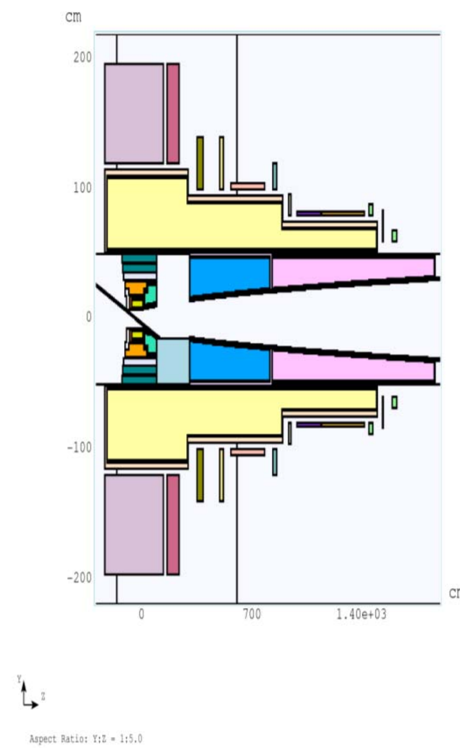
IDS120g



IDS120h



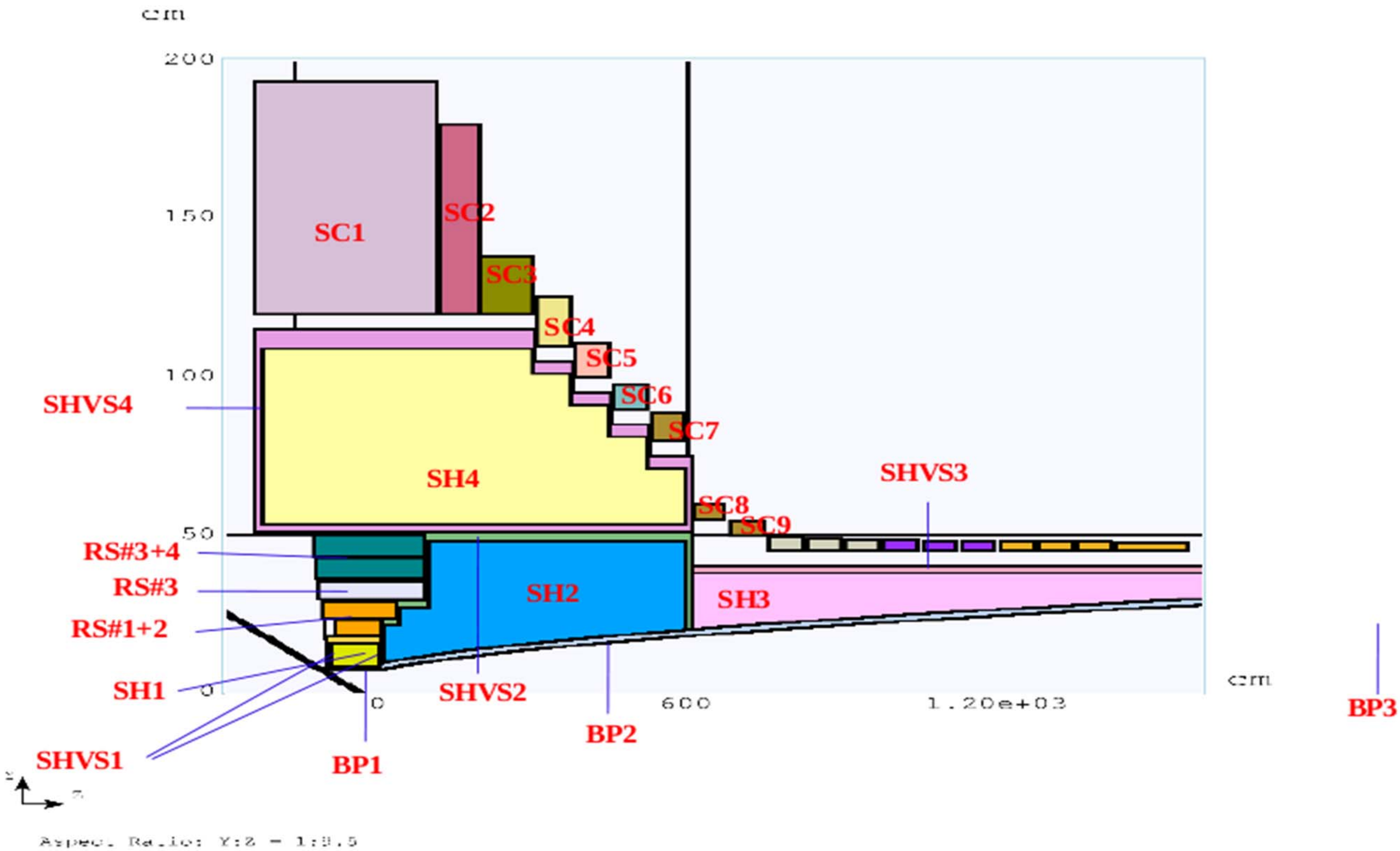
IDS120i



SC TOTAL DP: 0.97 0.96 0.82 0.46 (kW)

PEAK DPD SC7: 0.07 SC9: 0.08 SC8: 0.07 SC1: 0.04 (mW/g)

IDS120h: SHIELDING VESSELS DETAIL PLOTS



DIFFERENT CASES FOR THE VESSELS AND SHIELDING EXPLORED.

SHIELDING	SHIELDING VESSELS
1. $60\ \%\ WC + 40\ \%\ H_2O$	NO VESSELS
2. $60\ \%\ WC + 40\ \%\ H_2O$	STST VESSELS (2 W TUBES IN SH#1)
3. $60\ \%\ WC + 40\ \%\ H_2O$	W VESSELS (STST: 2 SH#1 FLANGES, BP#2,BP#3)
4. 80 % WC + 20 % He	W VESSELS (STST: 2 SH#1 FLANGES, BP#2,BP#3)
5. 80 % W + 20 % He	W VESSELS (STST: 2 SH#1 FLANGES, BP#2,BP#3)

- **DEPOSITED POWER IN SC#1 DECREASED FROM 0.516 kW TO 0.06 kW AND TOTAL POWER IN SC COILS FROM 0.825 kW TO 0.184 kW WITH W/He SHIELDING AND W VESSELS.**
- **PEAK DP DENSITY (DPD) IN SC COILS <<0.15 mW/g FOR ALL CASES EXCEPT SC#8 IN CASE 2.**
- **SC SHIELDING IS MAXIMIZED WITH W/He SHIELDING AND W VESSELS.**

VARYING THE W CONTENT IN (W/He) SHIELDING FOR W SHIELDING VESSELS

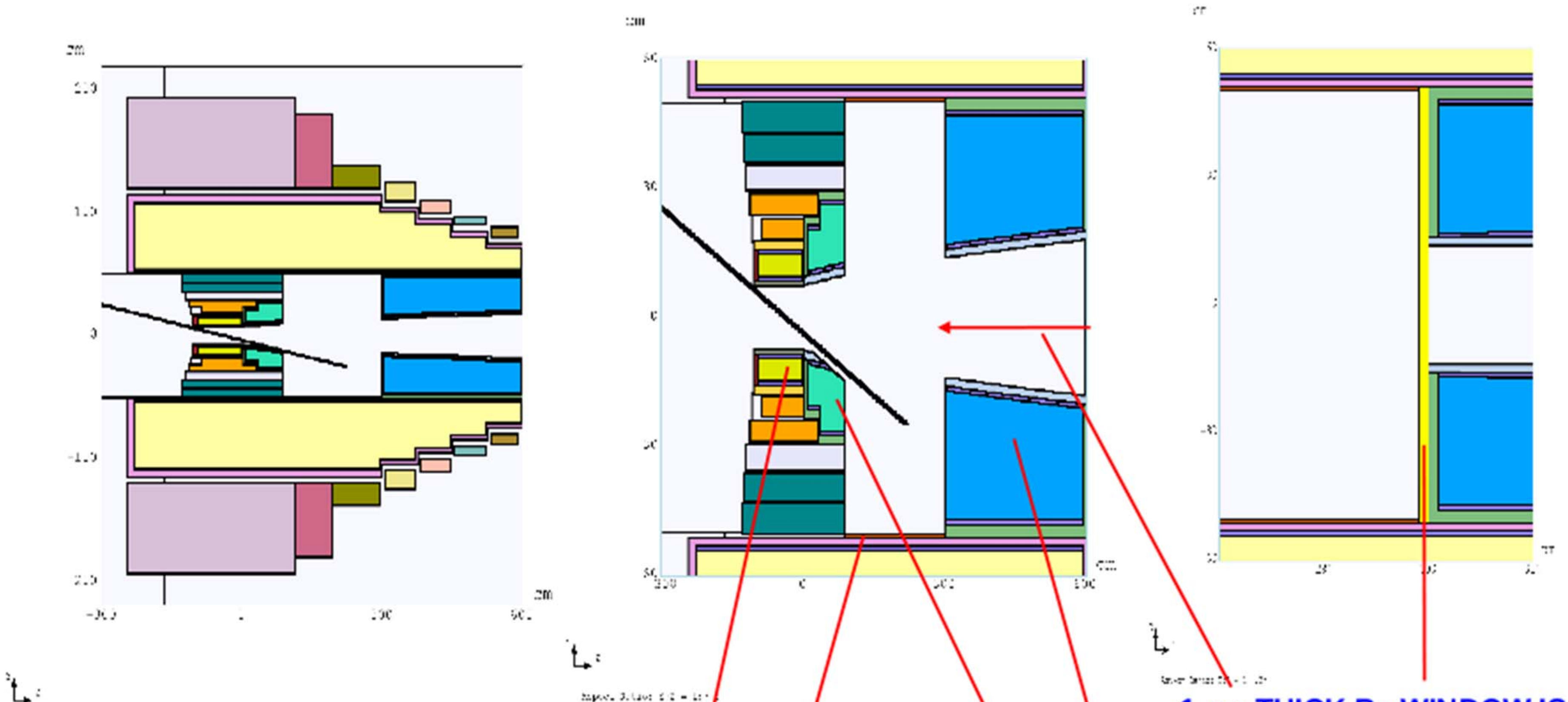
FROM 60 % W+ 40 % He TO 88 % W+ 12 % He

- DP (kW) SC#1: 0.128 -----> 0.047, SC#1-6: 0.160 -----> 0.056, SC#1-19: 0.316 -----> 0.165

SMALL GAIN IN COILS DP WITH INCREASING W IN SHIELDING.

- W VESSELS DUE TO ENGINEERING LIMITATIONS PROVED NOT POSSIBLE.
- W PELLETS CAN BE USED FOR THE SHIELDING CONFIGURATION.
- 60 % W + 40 % He WAS ADOPTED AS NEW SHIELDING.

IDS120hm GEOMETRY=IDS120h WITH MODIFIED Hg POLL VESSEL AND SHIFTED Be WIDOW FROM 600 cm (0.6 cm THICK) TO 300 cm (1 cm THICK).



SH1-->SH1A

SH2-->SH1B + SH2

1 cm THICK Be WINDOW IS LOCATED AT 300 cm (ORIGINALLY 0.6 cm THICK PLACED AT 600 cm)

MODIFIED Hg POOL EXTENTS FROM 86 cm TO ~300 cm ALONG THE z-AXIS AND UP ~50 cm RADIALLY

1 cm THICK STST WALLS USED FOR THE Hg POOL VESSEL

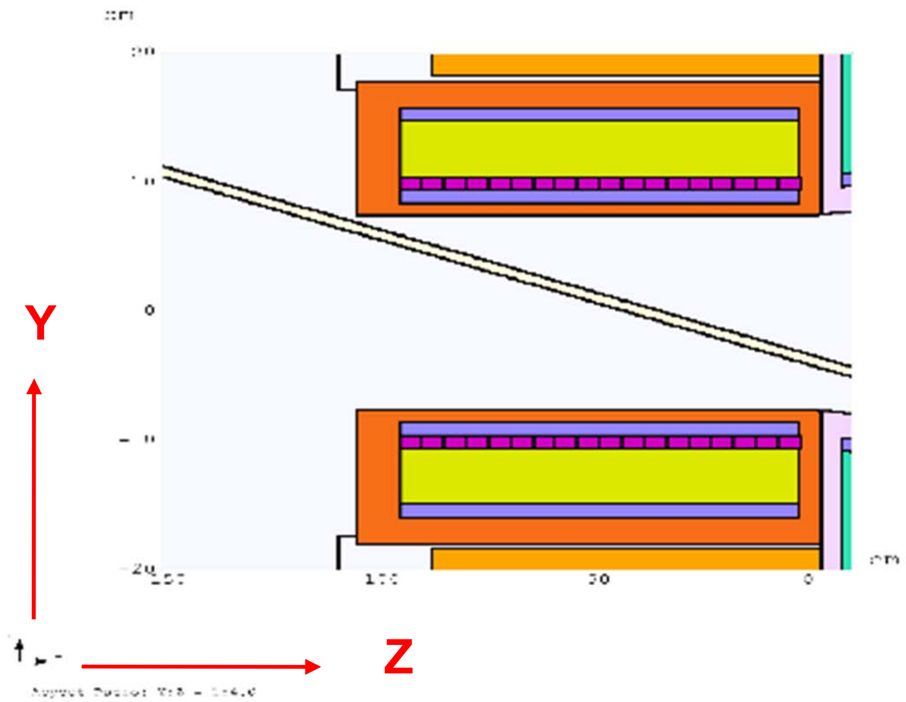
DIFFERENT CASES EXPLORED WITH MODIFIED POOL VESSEL.

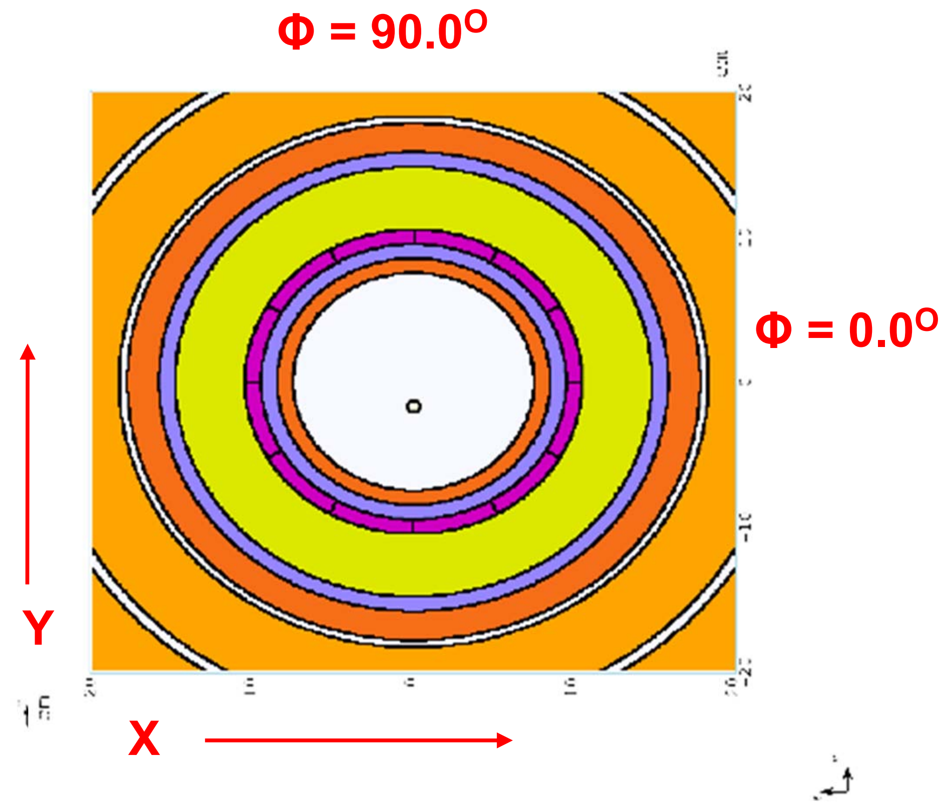
1. WITHOUT Hg IN THE POOL
2. WITH Hg IN THE POOL
3. NO SHIELDING IN SH#1

TWO DIFFERENT PROTON INJECTION POINTS USED FOR EACH CASE TO INVESTIGATE DIFFERENCES IN DP DISTRIBUTION.

- DP(kW) SC#1 ~ 0.160 - 0.274, SC#1-6 ~ 0.282 – 0.413, SC#1-19 ≳ 0.50
- SMALL FLUCTUATIONS IN COILS DP DISTRIBUTION BETWEEN INJECTION POINTS.
- DPD PEAK VALUES FOR CERTAIN SC COILS (NEAR THE END OF THE "STAIRS") SHOW SENSITIVITY ON BEAM'S INJECTION POINT.
- ~ 560 kW IN SH#1. WITHOUT SH#1 SHIELDING POWER WILL INCREASE ~ 587 kW IN RESISTIVE COILS.

IDS120hm:SH#1 AZIMUTHAL SEGMENTATION PLOTS FOR FIRST 1 cm ALONG r DIRECTION





9.5 < r < 10.5 cm   dr=1.0 cm N_r=1 bin

-95.0 < z < - 2.1 cm   dz=5.161 cm N_z=21 bins

0.0 < φ < 360.0 deg   dφ=30.0 deg. $N_φ$=12 bins

Ntot=216 "pieces"

SAME ANALYSIS WAS PERFORMED FOR BP#1, Be WINDOW AND SC#8 (DUE TO ITS HIGH AZIMUTHALLY AVERAGE DPD PEAK VALUE).

TEN HIGHEST DEPOSITED POWER DENSITIES FOR SH#1 (60% W + 40% He).

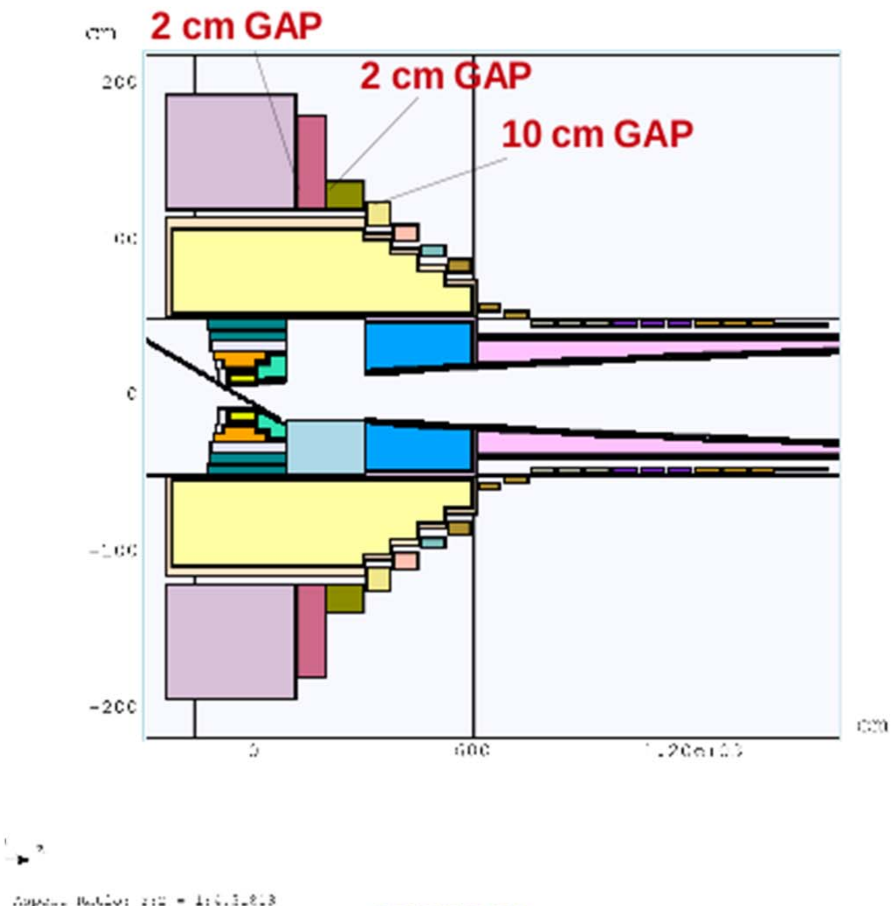
Np=2E05 EVENTS

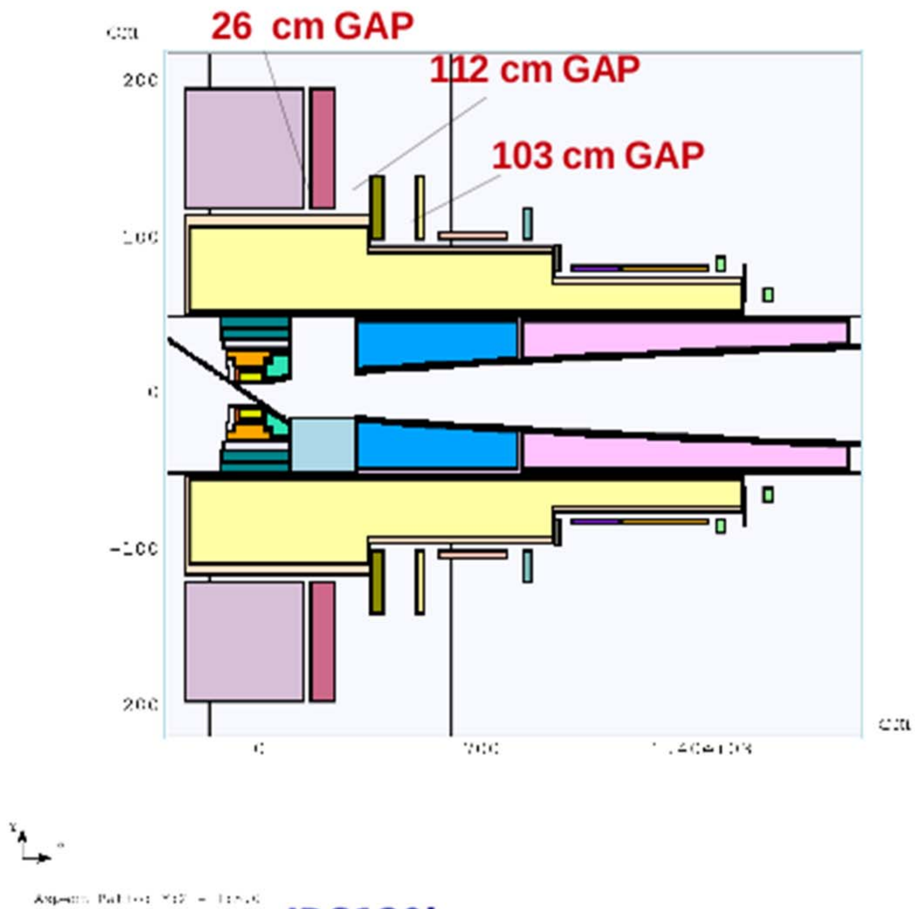
RID	r(cm)	z(cm)	ϕ	DPD(mW/g)
235	10	-20.1639	285	10623
234	10	-20.1639	255	10349
247	10	-15.0028	285	10059
222	10	-25.325	255	10041
246	10	-15.0028	255	10027
223	10	-25.325	285	9962
233	10	-20.1639	225	9647
221	10	-25.325	225	9581
259	10	-9.84167	285	9503
258	10	-9.84167	255	9351

STATISITCAL FLUCTUATIONS AND UNCERTAINTIES FOR THE MAXIMUM DPD IN SH#1 REGIONS ARE LESS THAN 1 WATT.
PEAK VALUES APPEAR TO BE ALONG THE -y DIRECTION AND – 26 < z < - 9 cm REGION.

INITIAL ESTIMATIONS OF MAXIMUM DPD FOR SH#1 WITH VOLUME DETECTORS~10-11 W/g WERE “ON THE MONEY”

IDS120h (LEFT) vs. IDS120i (RIGHT) [YZ CROSS SECTION] .



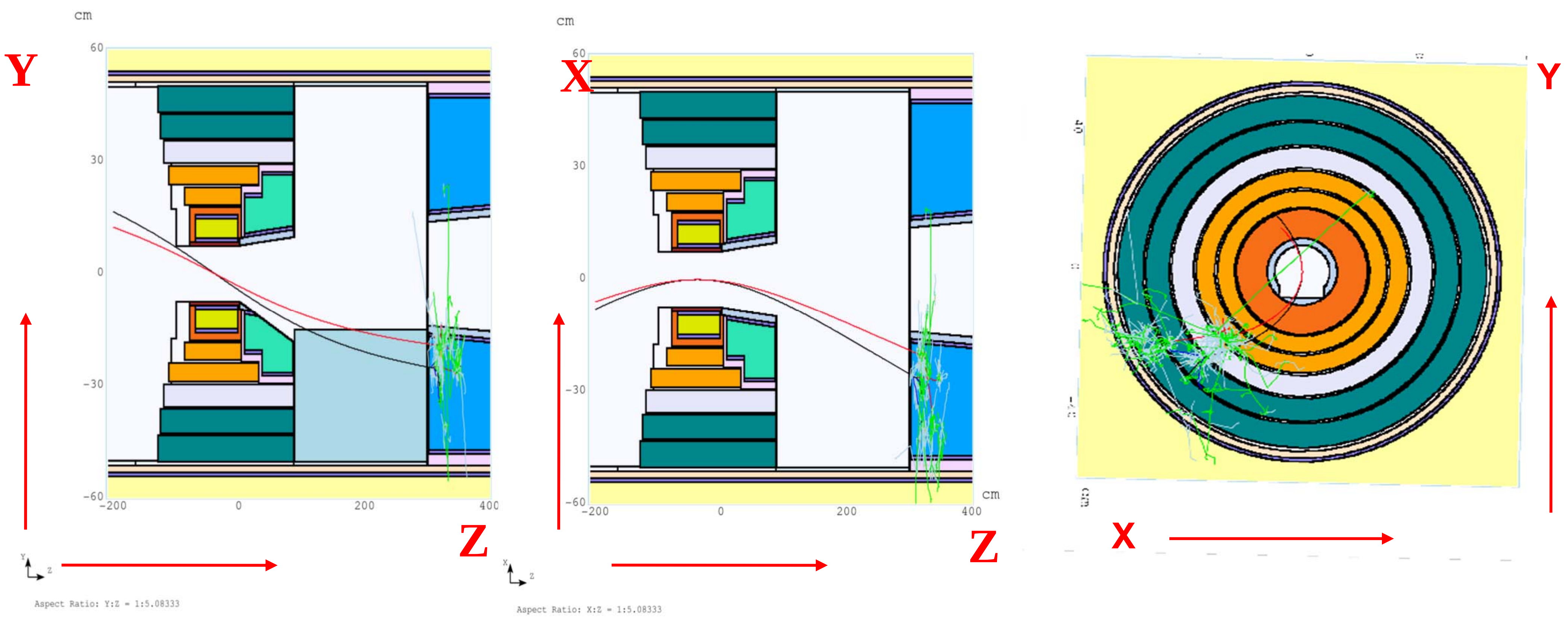


IDS120h		IDS120i
N(SC)=19		N(SC)=12
IR(SC#1-3)=120 cm		IR(SC#1-2)=120 cm
SC#4--->#10:IR=110 cm--->IR=45 cm		IR(SC#3-6)=100 cm
SC#11- 18(IR=45 cm)	----------------------->	SC#7-10(IR=80 cm)
SC#12- 18	~~~~~~~~~~~~~>TWO LONG SC(#8+9)/dZ~156/274 cm	

GAPS BETWEEN THE COILS CREATED AT THE EXPANSE OF RADIAL THIKNESS.

F.E. dR(SC#2/3/4)~60/18/15 cm ~~~~~~~~~~~~> dR(SC#2/3/4)~ 77/40/40 cm

CENTER OF BEAM PROTONS TRAJECTORY FOR Hg(BLACK) AND Ga(RED) TARGETS. (POOL SURFACE IN FIRST PLOT IS AT y = - 15 cm)



Hg TARGET: y= - 15 cm------> l(protons trajectory) > 191.37 cm > 14 IL(protons interaction length in Hg ~ 15 cm)
y= - 20 cm------> l(protons trajectory) > 116.14 cm > 8 IL

Ga TARGET: y= - 15 cm------> l(protons trajectory) > 117.07 cm > 5 IL(protons interaction length in Ga ~ 24 cm)
y= - 20 cm------> l(protons trajectory)= 0.0 cm (protons do not enter the pool)

PROTONS ENTER Ga POOL NEAR THE CENTER AND HAVE A SHORT PATH, ONE WAY TO IMPROVE THIS IS BY SHIFTING THE POOL TO THE RIGHT(~ 100 cm)

DEPOSITED POWER (kW) AND AZIMUTHALLY AVERAGE PEAK DP DENSITIES IN SC COILS (mW/g)

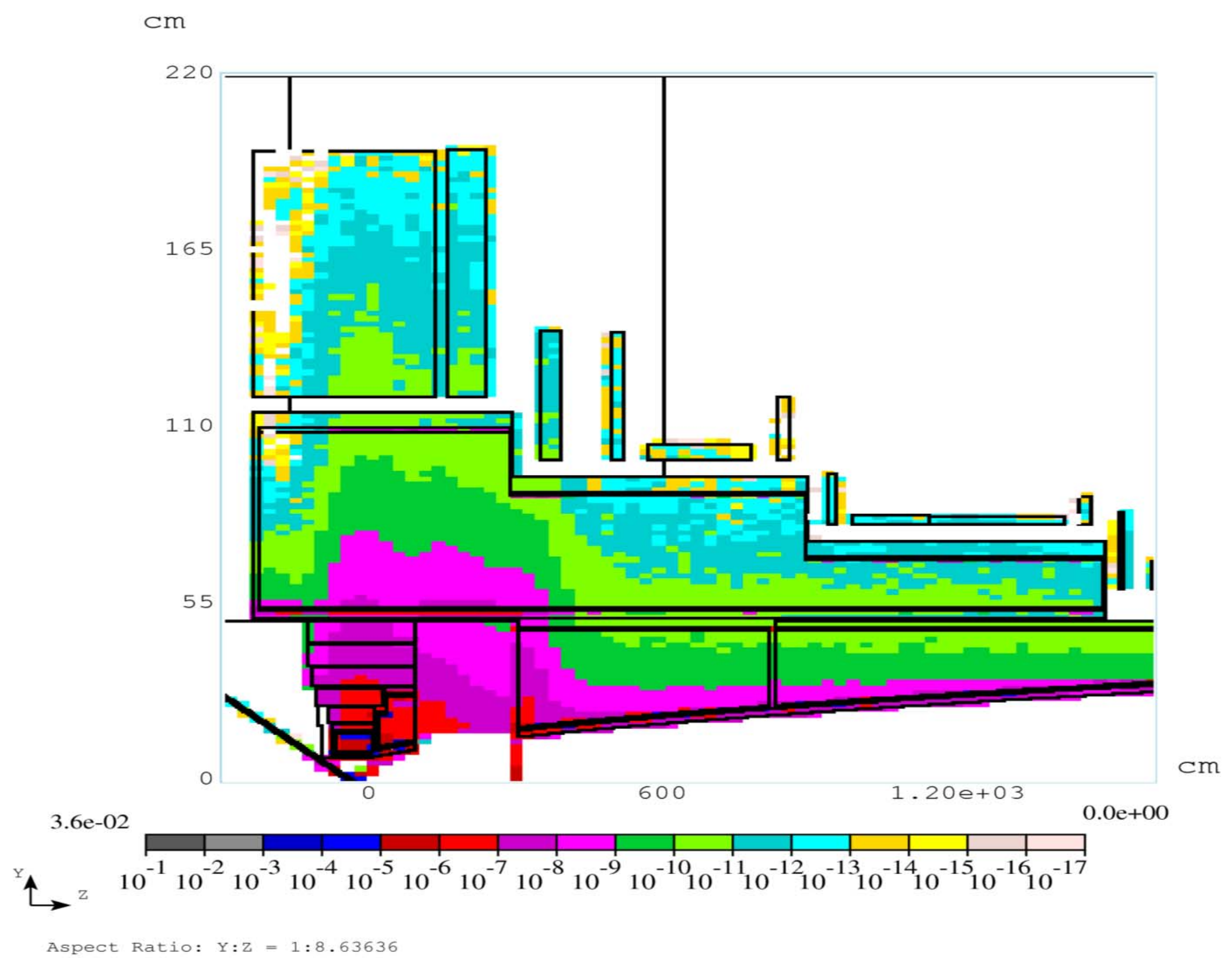
NiSn/NiTi	Hg	Ga
SC#1	0.322	0.274
SC#2	0.079	0.093
SC#3	0.044	0.128
SC#4	0.002	0.006
SC#5	0.003	0.002
SC#6	0.000	0.000
SC#7	0.000	0.000
SC#8	0.001	0.003
SC#9	0.002	0.003
SC#1-9	0.453	0.509
SC#10-12	0.007	0.009
SC#1-12	0.460	0.518

PEAK(mW/g)	Hg	Ga
SC#1	0.040	0.040
SC#2	0.026	0.017
SC#3	0.018	0.090
SC#4	0.003	0.003
SC#5	0.012	0.007
SC#6	0.001	0.001
SC#7	0.001	0.001
SC#8	0.002	0.007
SC#9	0.005	0.001
SC#10	0.001	0.004
SC#11	0.008	0.004
SC#12	0.007	0.004

ABOUT SAME TOTAL AMOUNT OF DP FOR BOTH Hg AND Ga. NOTICEABLE DIFFERENCE IS THE SC#3 DP: ABOUT 3 TIMES MORE DP IN SC#3 FOR Ga TARGET.

MOST SIGNIFICANT DIFFERENCE IN DPD PEAKS IS THAT OF SC#3.

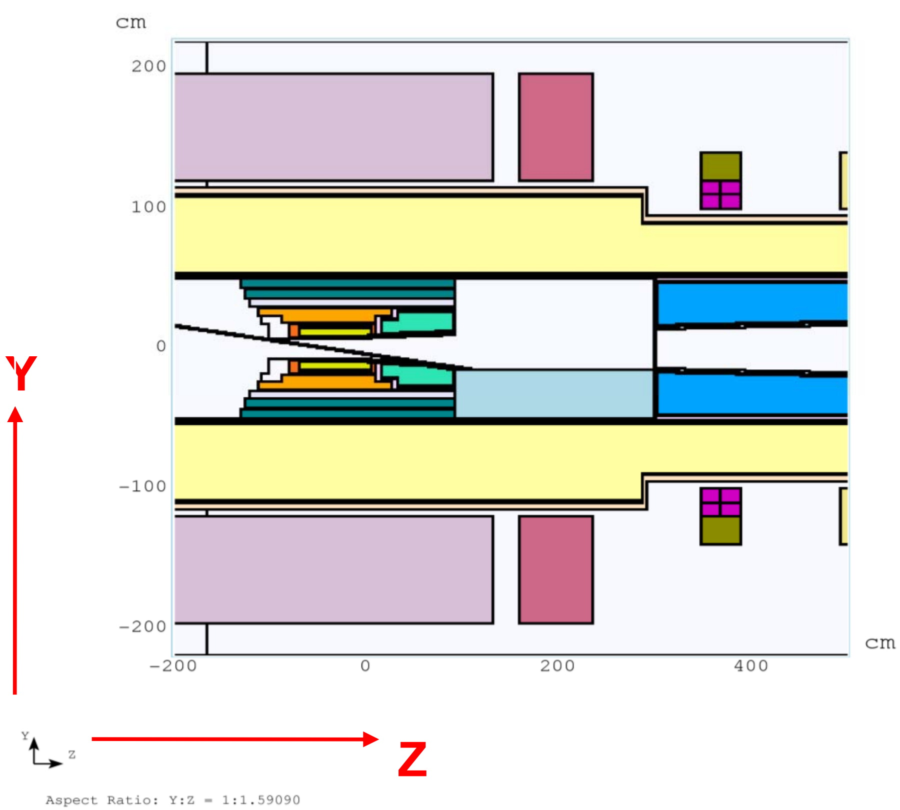
IDS120i: AZIMUTHALLY AVERAGE DEPOSITED ENERGY DISTRIBUTION FROM Np = 400,000 EVENT SIMULATION

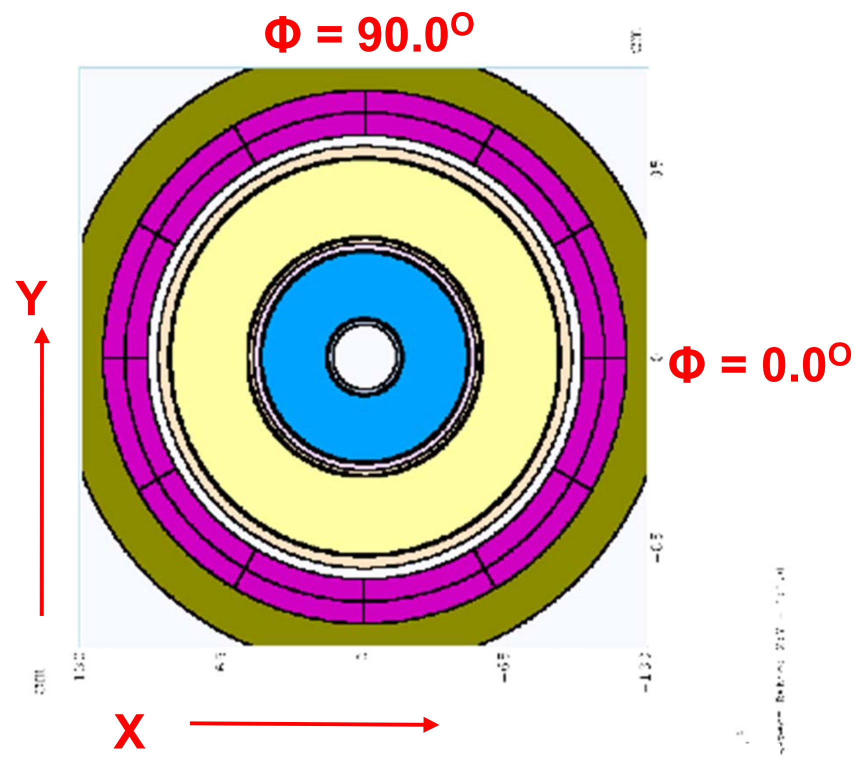


THE MARS PLOT FOR THE AZIMUTHALLY AVERAGE DEPOSITED ENERGY DISTRIBUTION WILL BE USED TO ISOLATE THE SCs AREAS OF INTEREST AND PERFORM A SEGMENTATION STUDY.

OTHER AREAS MAY HAVE ISOLATED SPIKES IN THE DPD, IN SOME DIRECTION, AND OVERALL SMALL AVERAGE AZIMUTHAL DPD BUT WE START WITH THE MOST OBVIOUS AND HIGHT RISK AREAS DETERMINED FROM THE ABOVE PLOT.

IDS120i SC#3 PARTIAL SEGMENTATION: YZ CROSS SECTION y=0.0 (LEFT) AND YX CROSS SECTION z = 348 cm (RIGHT)

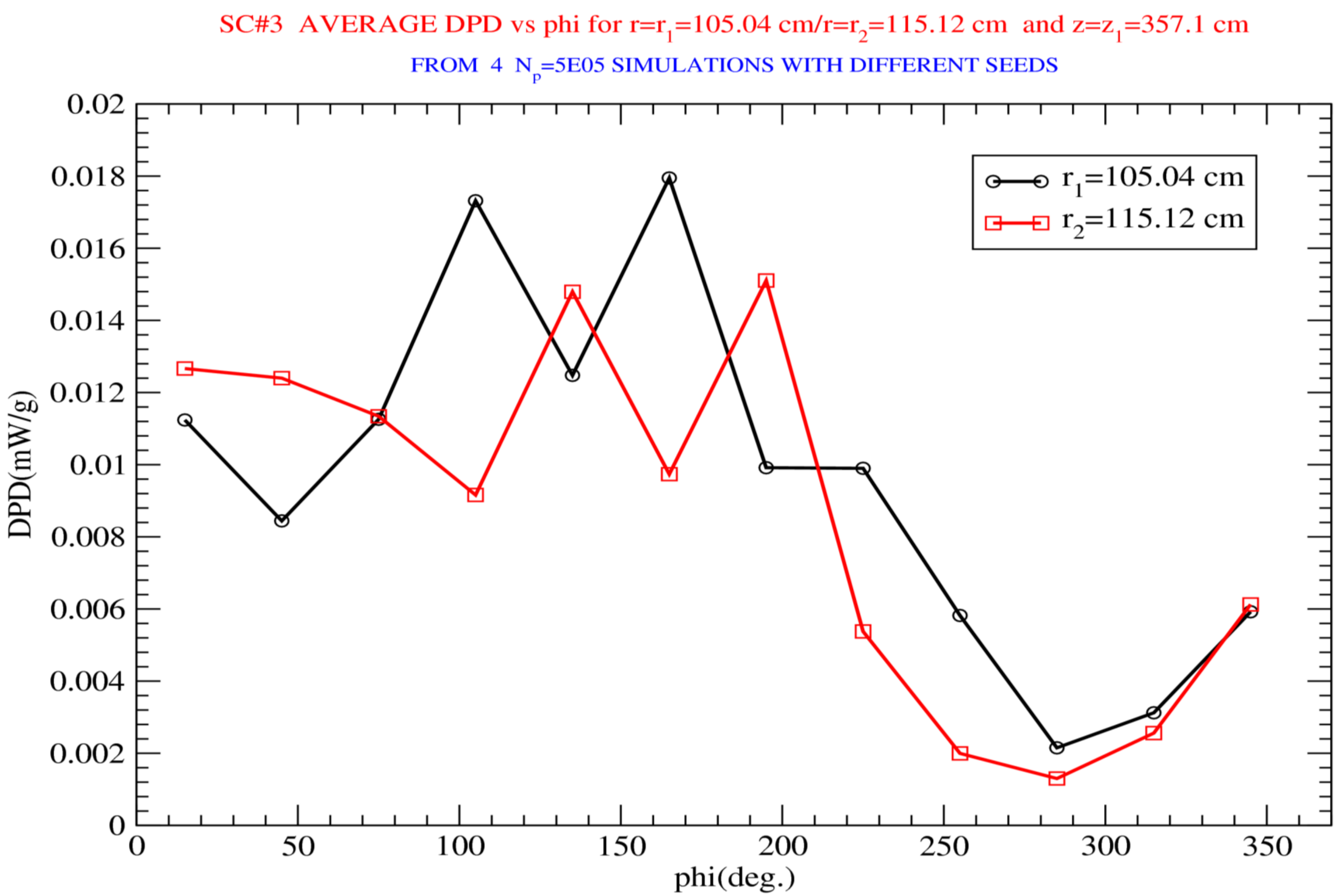




$100.0 < r < 120.16$ cm	$dr = 10.08$ cm	$N_r = 2$ bins
$346.7 < z < 388.3$ cm	$dz = 20.8$ cm	$N_z = 2$ bins
$0.0 < \varphi < 360.0$ deg.	$d\varphi = 30.0$ deg.	$N_\varphi = 12$ bins

$N_{tot} = 48$ "pieces"

SC#3 DP DENSITY AZIMUTHAL DISTRIBUTION FROM 4 5E05 SIMULATIONS. (LEFT SIDE REGION)



PEAK VALUE OF ~ 0.018 mW/g APPEARS TO BE IN THE UPPER HALF, LEFT SIDE OF THE COIL AND NEAR ITS INNER RADIUS.

PROGRESS SUMMARY:

IDS120 EVOLVED AND REFINED.

SHIELDING VESSELS INTRODUCED. ALTHOUGH W VESSELS PROVED MUCH BETTER OPTION FOR SC SHIELDING THAN STST, W ENGINEERING LIMITATIONS PREVENT ITS USE FOR THAT PURPOSE.

IMPROVEMENT ACHIEVED IN SC SHIELDING BY REPLACING 60% WC + 40% H_2O WITH THE MORE EFFECTIVE AND EFFICIENT 60% W + 40% He.

Hg POOL VESSEL WAS MODIFIED TO SATISFY ENGINEERING DEMANDS. MORE WORK TO REFINE THE DESIGN.

STRESS FORCES ANALYSIS INDICATED PROBLEMS WITH VESSELS DEFORMATION IN IDS120h. IDS120i WAS INTRODUCED WITH GAPS BETWEEN CERTAIN SUPERCODUCTING COILS FOR CRYOGENIC COMPONENTS.

PEAK POWER DENSITY ANALYSIS FOR SHIELDING (SH#1), BEAM PIPE (BP#1), Be WINDOW (USING TWO APPROACHES) WAS PERFORMED TO DETERMINE THE He GAS FLOW FOR COOLING.

Hg vs. Ga TARGETS DEPOSITED POWER ANALYSIS.

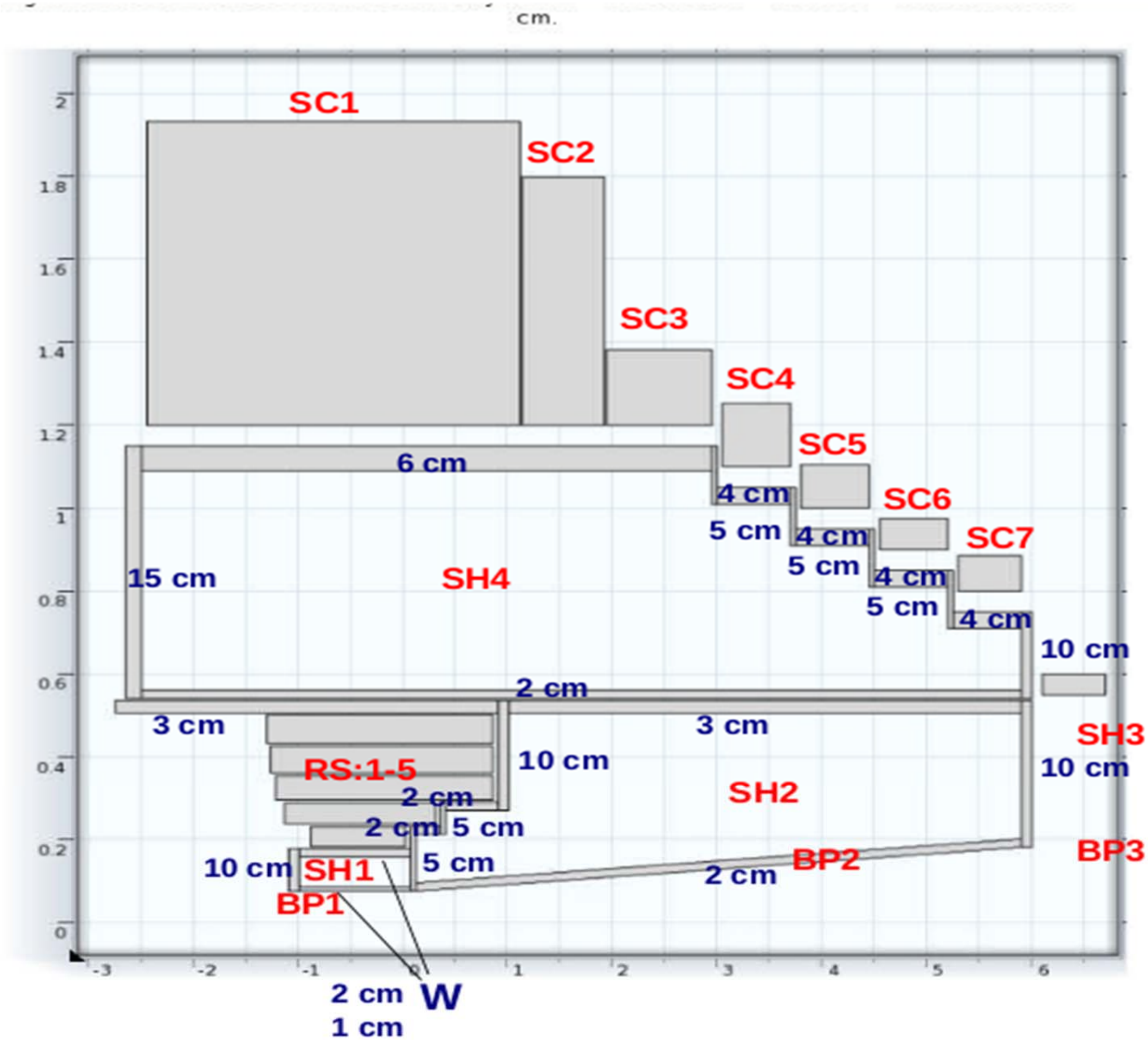
POWER DENSITY AZIMUTHAL DISTRIBUTION ANALYSIS FOR SC COILS IS IN PROGRESS (MANY THANKS TO SERGEI STRIGANOV).

MANY THANKS TO: BOB WEGGEL, DING XIAOPING, HAROLD KIRK,
KIRK MCDONALD, SCOTT BERG, VAN GRAVES.

SPECIAL THANKS TO JIM KOLONKO.

IDS120h:INTRODUCING SHIELDING VESSELS.

Bob Weggel(7/26/11)



BEAM PIPE
BP1: 1 cm STST → 1 cm W
BP2/BP3: 1 cm STST → **2 cm STST**

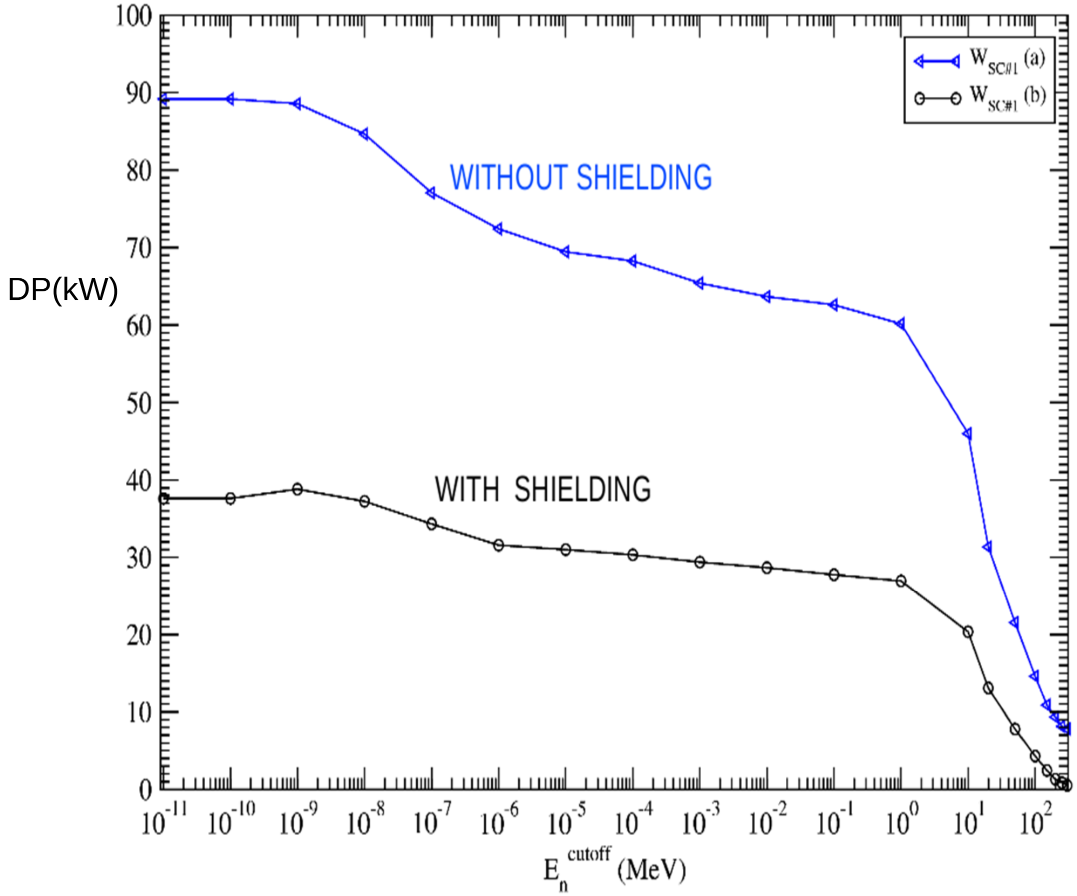
TUBE 1(=BP1) AND TUBE 2 WITH 1 cm AND 2 cm THIKNESS IN THE SH1 VESSEL ARE MADE OF W TO FURTHER REDUCE THE POWER DEPOSITED IN THE RESISTIVE COILS.

5 cm DISTANCE BETWEEN VESSELS AND SC COILS FOR CRYOGENIC COOLING COMPONENTS

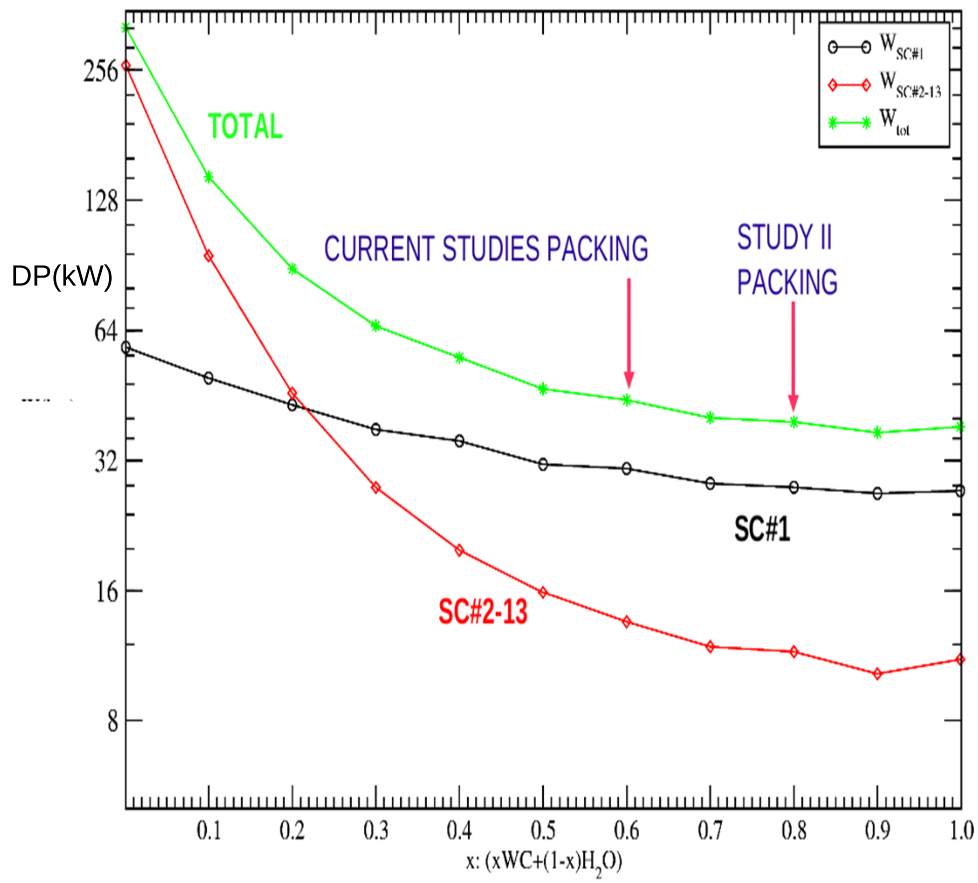
0.5 cm SPACE BETWEEN TUBE 2 OF SH1 AND RS1,
AND 1.0 cm BETWEEN TUBE 1 OF SH4 AND RS5

LAST TIME: FROM STUDY II GEOMETRY SIMULATIONS (WC/H_2O SHIELDING).

SC#1 DP vs. NEUTRON ENERGY CUTOFFS



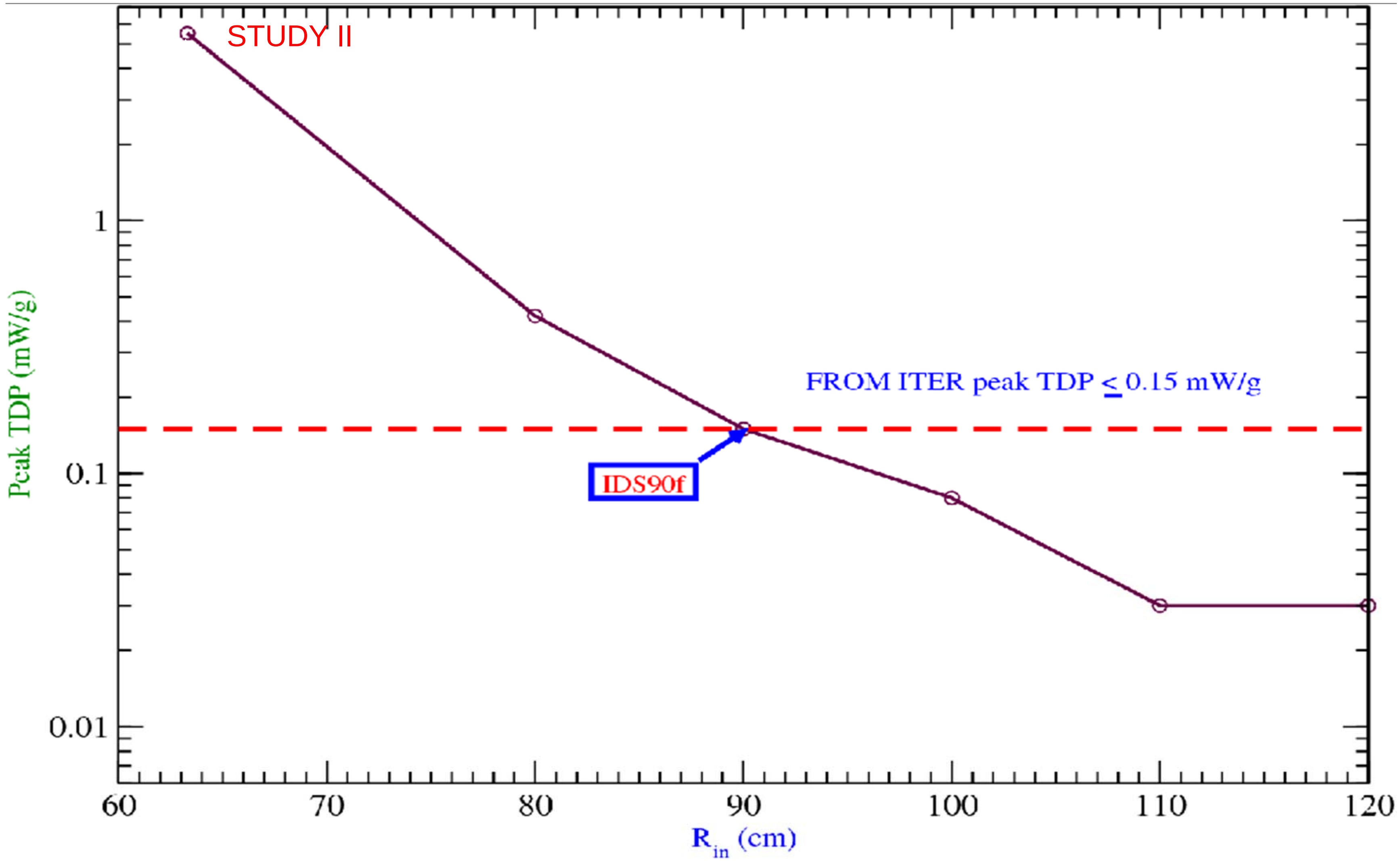
DP IN SC COILS vs x
x=SHIELDING COMPOSITION FRACTION



MOST OF THE DEPOSITED POWER IN THE SC COILS IS DUE TO 1-100 MeV NEUTRONS (LEFT).

THEREFORE SHIELDING MATERIAL SHOULD BE AS DENSE AS POSSIBLE (RIGHT).

FOR SC COIL AT THE TARGET REGION: DPD PEAK VALUE vs. IR .



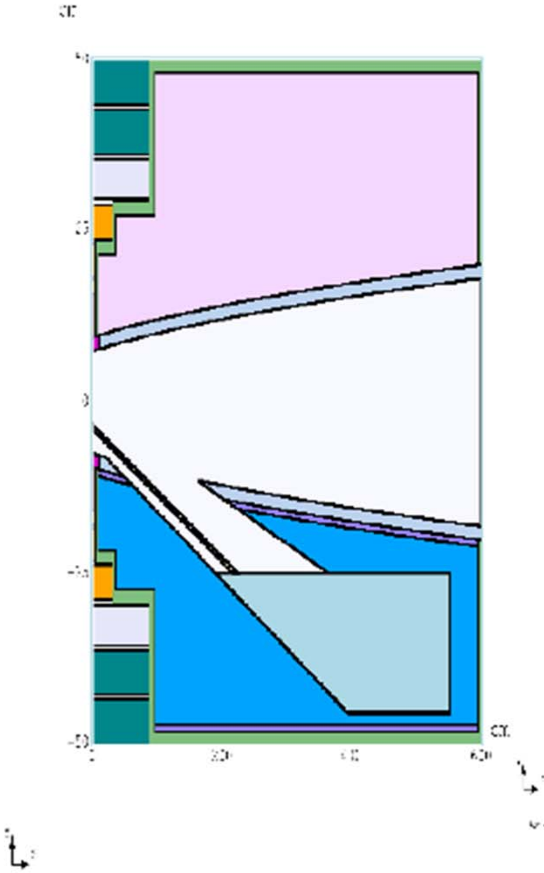
FOR PEAK DPD TO BE LESS THAN 0.15 mW/g: IR > 110 cm.
IDS120f GEOMETRY WAS ADOPTED AND EVOLVED TO THE IDS120i.

STRESS FORCES ANALYSIS INDICATED SHIELDING VESSELS DEFORMATION PROBLEMS(Bob Weggel). SHIELDING VESSELS WITH SUPPORT RIBS ANALYSIS WAS PERFORMED.

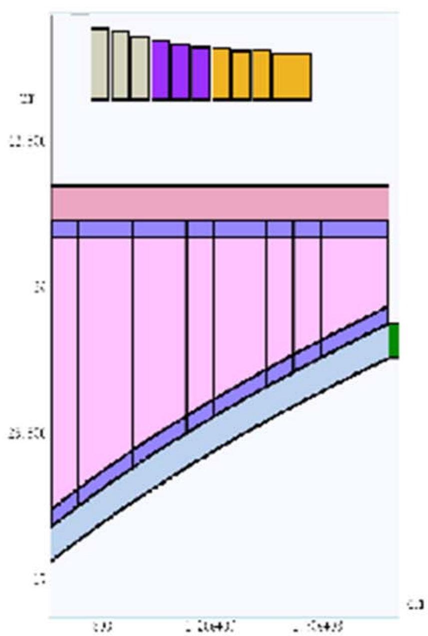
SH2--> 2 cm THICK STST SLAB ALONG yz PLANE.
SH3--> 2 cm THICK STST DISCS EVERY 100 cm.
SH4--> 2 cm THICK STST DISCS EVERY 10 cm.

SH2,SH3,SH4 RIBS DETAILS

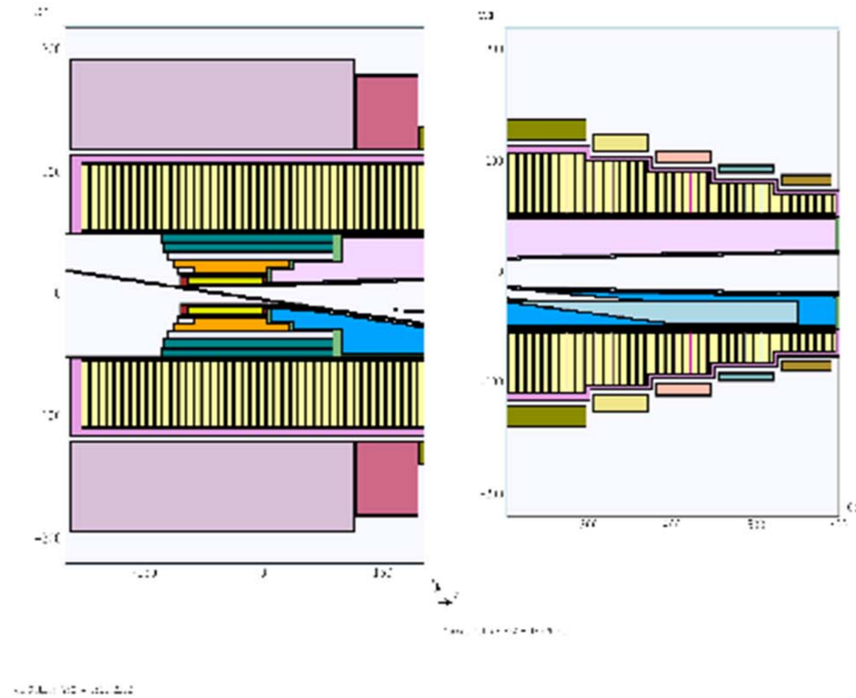
SH2 RIBS DETAILS



SH3 RIBS DETAILS



SH4 RIBS DETAILS



BC4

POWER DEPOSITED IN THE SC COILS.

WOR = WITHOUT RIBS
WR = WITH RIBS

NiSn/NiTi	WOR	WR
SC#1	0.190	0.236
SC#2	0.010	0.012
SC#3	0.012	0.013
SC#4	0.012	0.016
SC#5	0.008	0.008
SC#6	0.049	0.009
SC#1-6	0.286	0.294
SC#7-9	0.029	0.039
SC#10-12	0.041	0.057
SC#13-15	0.042	0.031
SC#16-19	0.059	0.050
SC#1-19	0.459	0.471

SC1:0.190 kW -->0.236 kW SC1-6:0.286 kW-->0.294 kW SC#1-19:0.459 kW-->0.471 kW.
SLIGHT INCREASE IN THE TDP.

CODES FOR THE DIFFERENT CASES

CASE	SHIELDING	SH VESSELS
VS0SH0	60%WC+40%H_2O	NO VESSELS
VS1SH0	60%WC+40%H_2O	STST (SH1=2 W TUBES)
VS2SH0	60%WC+40%H_2O	W (2 SH1 FL,BP2,BP3=STST)
VS2SH1	80%WC+20%He	W (2 SH1 FL,BP2,BP3=STST)
VS2SH2	80%W+20%He	W (2 SH1 FL,BP2,BP3=STST)

POWER DEPOSITED IN SC SOLENOIDS (SC#).

NiSn/NiTi	VS0SH0	VS1SH0	VS2SH0	VS2SH1	VS2SH2
SC#1	0.516	0.366	0.232	0.124	0.060
SC#2	0.041	0.026	0.037	0.007	0.003
SC#3	0.027	0.030	0.017	0.013	0.005
SC#4	0.043	0.022	0.012	0.008	0.003
SC#5	0.017	0.009	0.013	0.007	0.003
SC#6	0.004	0.004	0.002	0.002	0.003
SC#1-6	0.684	0.457	0.313	0.161	0.074
SC#7-9	0.051	0.043	0.044	0.022	0.031
SC#10-12	0.046	0.059	0.040	0.050	0.030
SC#13-15	0.032	0.030	0.033	0.024	0.014
SC#16-19	0.048	0.049	0.043	0.036	0.035
SC#1-19	0.825	0.638	0.473	0.293	0.184

SC1:0.516 kW -->0.06 kW SC1-6:0.684 kW-->0.074 kW SC#1-19:0.825 kW-->0.184 kW.

TOTAL POWER DEPOSITED IN DIFFERENT AREAS AND SC#1-11 PEAK VALUES.

TOTALS	VS0SH0	VS1SH0	VS2SH0	VS2SH1	VS2SH2
SC#1-19	0.825	0.638	0.473	0.293	0.184
SH#1-4	2092.6	1794.03	1755.10	1574.84	1617.22
SHVS#1-4	–	132.35	178.80	148.98	142.77
RS#1-5	213.17	193.78	187.55	169.68	148.90
BP#1-3	385.71	746.32	743.06	707.62	704.51
Hg TARG.	409.5	409.05	408.85	409.60	408.70
Hg POOL	228.85	231.55	229.85	217.85	215.00
HgP.WALLS	0.42	0.44	0.41	0.31	0.30
Be WIND.	0.86	0.85	0.86	0.90	0.85
TOTAL	3353.58	3532.00	3405.31	3272.13	3271.89

MUCH LESS POWER IN SC#1-19:0.825 kW-->0.184 kW (-0.641 kW)
MUCH LESS POWER IN SH#1-4:2029.6 kW-->1617.22 kW (-412.38 kW)
MUCH LESS POWER IN RS#1-5:213.17 kW-->148.9 kW (-64.8 kW)
MUCH MORE POWER IN BP#1-3:385.71 kW-->704.51 kW (+318.8 kW)
TOTAL POWER IS TRG STATION:3353.58 kW--> 3271.89 kW(-81.69 kW)

PEAK TDP(mW/g)	VS0SH0	VS1SH0	VS2SH0	VS2SH1	VS2SH2
SC#1	0.060	0.040	0.036	0.018	0.018
SC#2	0.005	0.010	0.012	0.006	0.016
SC#3	0.010	0.016	0.008	0.007	0.004
SC#4	0.024	0.011	0.007	0.006	0.002
SC#5	0.022	0.009	0.017	0.008	0.002
SC#6	0.009	0.008	0.012	0.003	0.001
SC#7	0.004	0.002	0.004	0.001	0.001
SC#8	0.070	**0.120**	0.043	0.020	0.025
SC#9	0.038	0.039	0.054	0.022	0.046
SC#10	0.070	0.055	0.041	0.041	0.014
SC#11	0.038	0.060	0.040	0.070	0.060

SC#1 PEAK:0.060 WITHOUT VESSELS-->0.040 mW/g STST VESSELS-->0.018mW/g FOR VS2SH2
SC#8 PEAK:0.070 WITHOUT VESSELS-->0.120 mW/g STST VESSELS-->0.043mW/g WITH W VESSELS

SC DEPOSITED POWER WITH INCREASING W FRACTION IN (W/He)SHIELDING FOR W SHIELDING VESSELS.

POWER DEPOSITED IN THE SC COILS

NiSn/NiTi	60/40	80/20	88/12
SC#1	0.128	0.060	0.047
SC#2	0.009	0.003	0.001
SC#3	0.008	0.005	0.0003
SC#4	0.010	0.003	0.0002
SC#5	0.004	0.003	0.006
SC#6	0.001	0.003	0.002
SC#1-6	0.160	0.074	0.056
SC#7-9	0.045	0.031	0.032
SC#10-12	0.043	0.030	0.026
SC#13-15	0.020	0.014	0.020
SC#16-19	0.048	0.035	0.031
SC#1-19	0.316	0.184	0.165

SC1:0.128 kW -->0.047 kW SC1-6:0.160 kW-->0.056 kW SC#1-19:0.316 kW-->0.165 kW.

SMALL GAIN WITH INCREASING W IN SHIELDING

W VESSELS DUE TO ENGINEERING LIMITATIONS PROVED NOT POSSIBLE.
W PELLETS CAN BE USED FOR THE SHIELDING CONFIGURATION.
60% W+40% He WAS ADOPTED AS NEW SHIELDING.

DIFFERENT CASES EXPLORED WITH MODIFIED POOL.

C1 = NO Hg IN THE POOL C2 = Hg IN THE POOL C3 = NO SH#1

TWO DIFFERENT INJECTION POINTS P11, P12 (LONGEST TRAJECTORIES IN POOL)

TO INVESTIGATE DIFFERENCES IN THE DP DISTRIBUTION

POWER DEPOSITED IN THE SC COILS

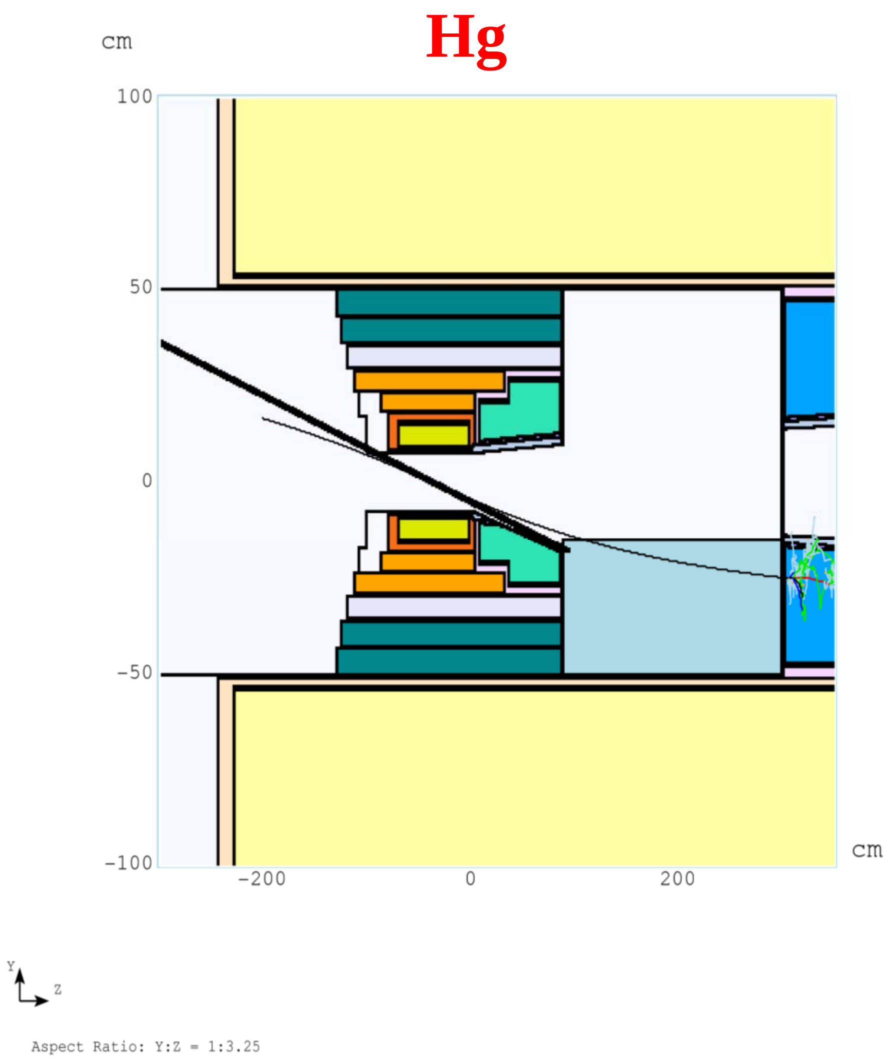
NiSn/NiTi	C1(P11)	C1(P12)	C2(P11)	C2(P12)	C3(P11)	C3(P12)
SC#1	0.237	0.181	0.209	0.160	0.225	0.274
SC#2	0.033	0.037	0.042	0.044	0.034	0.046
SC#3	0.014	0.020	0.042	0.044	0.038	0.053
SC#4	0.026	0.032	0.028	0.026	0.025	0.028
SC#5	0.013	0.023	0.004	0.007	0.005	0.005
SC#6	0.003	0.002	0.001	0.001	0.007	0.007
SC#1-6	0.326	0.295	0.326	0.282	0.334	0.413
SC#7-9	0.054	0.051	0.060	0.050	0.047	0.049
SC#10-12	0.060	0.052	0.070	0.050	0.057	0.053
SC#13-15	0.045	0.037	0.026	0.044	0.041	0.045
SC#16-19	0.075	0.067	0.063	0.070	0.055	0.056
SC#1-19	0.560	0.502	0.545	0.496	0.534	0.617

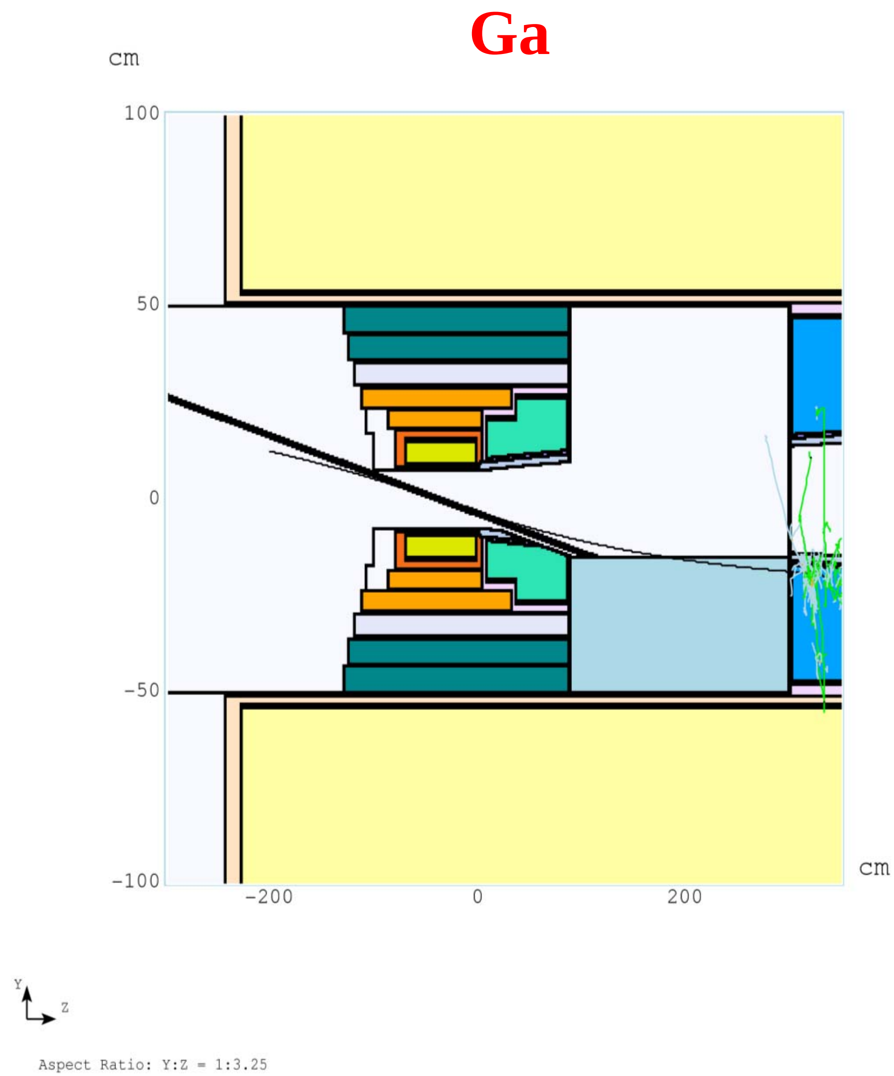
SC1:0.160 kW - 0.274 kW SC1-6:0.282 kW- 0.413 kW SC#1-19: >0.5 kW

SMALL FLUCTUATIONS BETWEEN P11 AND P12 POINTS.

NO SIGNIFICANT ISSUES IN TERMS OF DP IN SC's.

CENTER OF BEAM PROTONS TRAJECTORY FOR Hg AND Ga TARGETS WITH JET AND POOL PRESENT(BUT NOT INTERACTING). POOL SURFACE IS AT y = - 15.0 cm





Hg vs. Ga TARGET: IT APPEARS PROTONS INTERACT WITH Ga JET IN A LONGER REGION THAN IN THE Hg TO COMPANSATE FOR THE SMALLER SIZE Ga ATOMS.

IS IT POSSIBLE TO ROTATE Ga JET TO ALLOW PROTONS ENTER SOONER THE POOL AND THEREFORE TRAVEL LONGER DISTANCE IN Ga POOL?

SUMMARY FOR TOTAL POWER DEPOSITED IN DIFFERENT COMPONENTS IN TARGET STATION.

TOTALS	Hg	Ga
SC#1-12	0.460	0.518
SH#1-4	1466.52	1631.48
SHVS#1-4	310.78	300.25
RS#1-5	293.30	224.23
BP#1-3	420.21	502.74
Hg/Ga TARG.	400.90	215.15
Hg/GaPOOL	388.05	375.00
POOLWALLS	10.53	10.04
Be WIND.	6.88	6.32
TOTAL	3297.63	3265.73

Ga TARGET RECIEVES ABOUT HALF THE POWER DEPOSITED IN Hg, WHILE Ga POOL ABOUT 13 kW LESS ENERGY THAN THAT IN Hg POOL.
SINCE Ga ATOMS HAVE MUCH SMALLER ATOMIC NUMBER (31) THAN Hg ATOMS (80) A SMALLER NUMBER OF INTERACTIONS WILL OCCUR BETWEEN p AND Ga TARGET. A SMALLER NUMBER OF INTERACTIONS WILL ALSO TAKE PLACE BETWEEN PROTONS AND Ga ATOMS IN THE POOL. IN ADDITION SINCE Ga IS A ”SOFTER” TARGET THE SCATTERING ANGLES ARE SMALLER. MORE PROTONS IS EXPECTED TO END UP IN THE Ga POOL.

THAT WILL SOMEHOW MITIGATE THE EFFECT OF THE INTERACTION LENGTH p-Ga "DISSADVANTAGE" AND AT THE END WE GET ABOUT THE SAME DP IN Hg AND Ga POOLS(ASSUMMING MOST OF THE DP IN THE POOL IS DUE TO PROTONS AND/OR THE DP FROM OTHER RADIATION SOURCES IS ABOUT THE SAME FOR BOTH CASES.

Be WINDOW ABOUT SAME DP FOR BOTH TARGETS.

AZIMUTHALLY AVERAGE DEPOSITED POWER DENSITY PEAKS IN SC#1-12.

PEAK(mW/g)	Hg	Ga
SC#1	0.040	0.040
SC#2	0.026	0.017
SC#3	0.018	0.090
SC#4	0.003	0.003
SC#5	0.012	0.007
SC#6	0.001	0.001
SC#7	0.001	0.001
SC#8	0.002	0.007
SC#9	0.005	0.001
SC#10	0.001	0.004
SC#11	0.008	0.004
SC#12	0.007	0.004

THE PEAK VALUES IN BOTH Hg AND Ga TARGETS ARE VERY SIMILAR AND THE ONLY SIGNIFICANT DIFFERENCE IS OBSERVED IN SC#3.

TEN HIGHEST DEPOSITED POWER DENSITIES FOR SC#1.

Np=4E05 EVENTS

RID	r(cm)	z(cm)	ϕ	DPD(mW/g)
464	127.5	107	315	0.16745
156	122.5	-13	75	0.13275
339	127.5	57	165	0.05905
109	122.5	-33	105	0.0586
223	127.5	7	285	0.05255
172	127.5	-13	195	0.05025
210	122.5	7	255	0.04845
150	127.5	-23	255	0.046835
126	127.5	-33	255	0.045645
200	127.5	-3	315	0.041945

SH#1 APPEARS TO HAVE A SPOT WITH DPD>0.15 mW/g. STATISTICAL FLUCTUATIONS CAN BE SIGNIFICANT FOR A VOLUME AT IR=120 cm WHERE VERY LITTLE ENERGY IS DEPOSITED AND THERE IS MORE UNIFORMITY IN THE AZIMUTHAL DPD DISTRIBUTION.
SIMULATIONS WITH LARGER NUMBER OF EVENTS/LARGER VOLUMES MAYBE NECESSARY.
WORK IN PROGRESS.

SC#1 SUM(PARTIAL) OF DEPOSITED POWER USING PARTIAL SUM FROM 456 “PIECES”
0.222(0.0047) kW
vs. 0.316 kW WITHOUT SEGMENTATION FROM 4E05 EVENTS