IDS120j WITHOUT GAPS AND WITH MAXIMUM SIZE GAPS (aka ''NIGHTMARE'' SCENARIO)

SC#4, SC#7 AZIMUTHAL DPD DISTRIBUTION ANALYSIS.

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IDS120j GEOMETRY: WITHOUT GAPS/WITH MAX SIZE GAPS

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 # DP SIMULATIONS.

 # SC#4, SC#7 AZIMUTHAL DPD DISTRIBUTION STUDIES.

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>SIMULATIONS CODE: mars1510 / MCNP

>NEUTRON ENERGY CUTOFF: 10^{-11} MeV

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

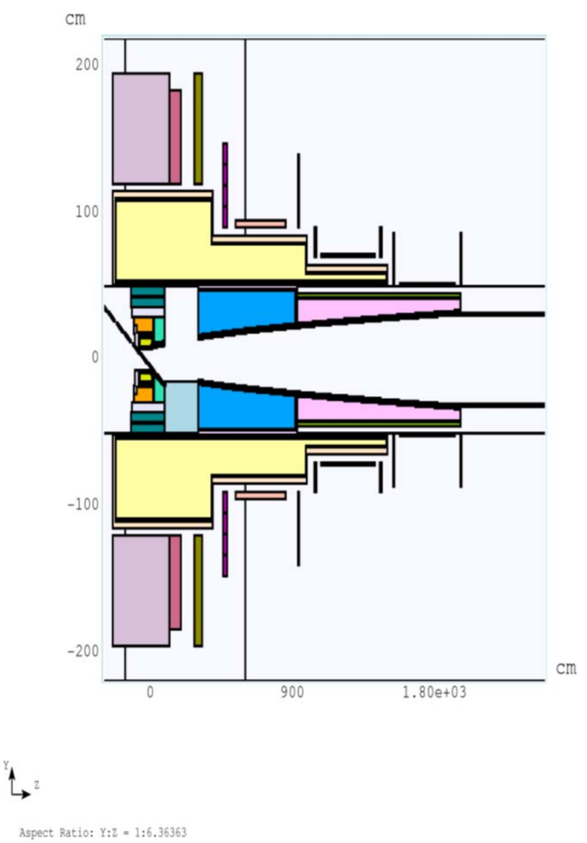
>PROTON BEAM POWER: 4 MW

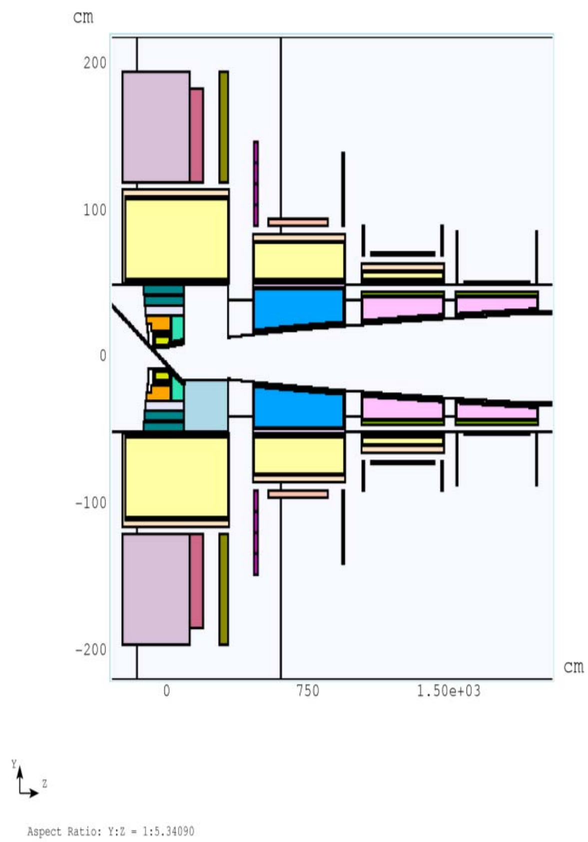
>PROTON ENERGY: E = 8 GeV

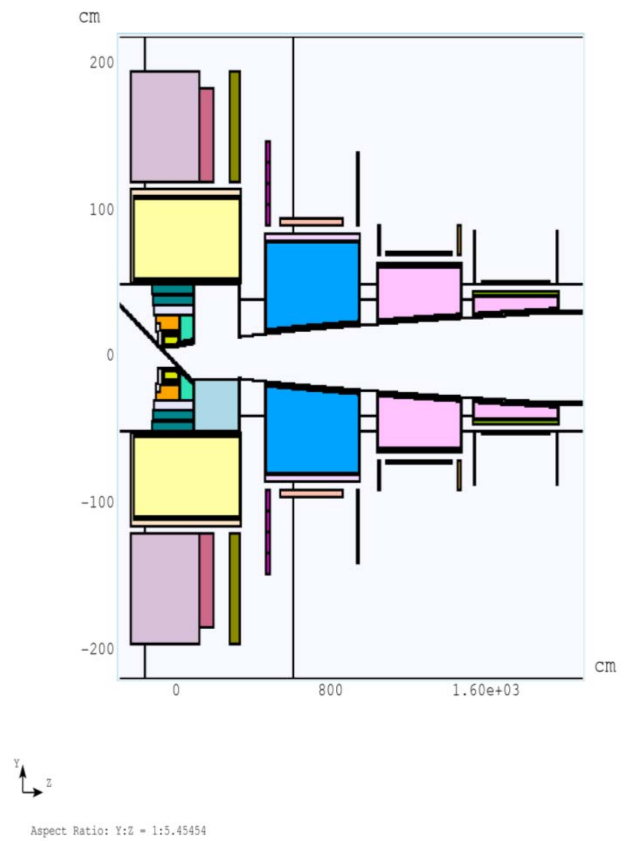
>PROTON BEAM PROFILE: GAUSSIAN, $\sigma_x = \sigma_y = 0.12$ cm

IDS120j WITHOUT (LEFT) AND WITH GAPS (TWO SHIELDING CONFIGURATIONS RIGHT)

YZ CROSS SECTION PLOTS.







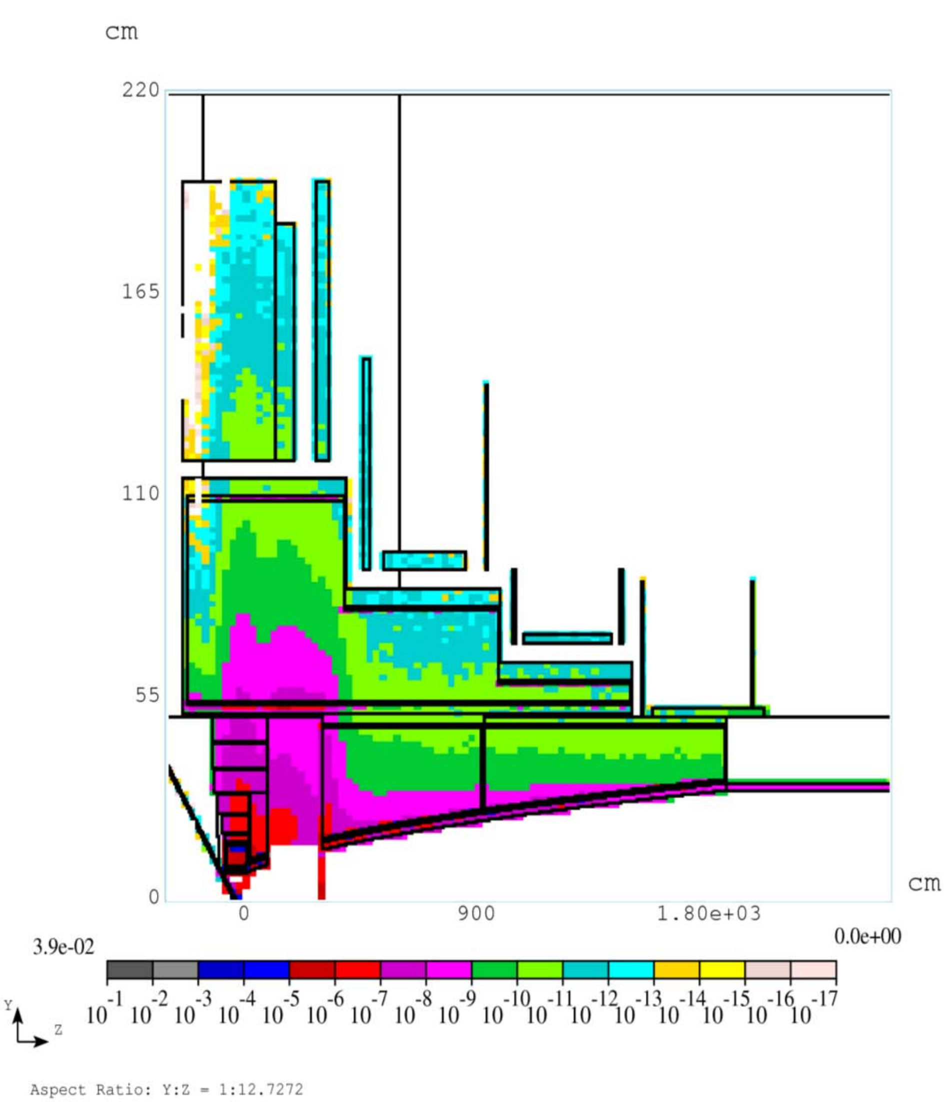
RIGHT PLOT SHIELDING CONFIGURATION:

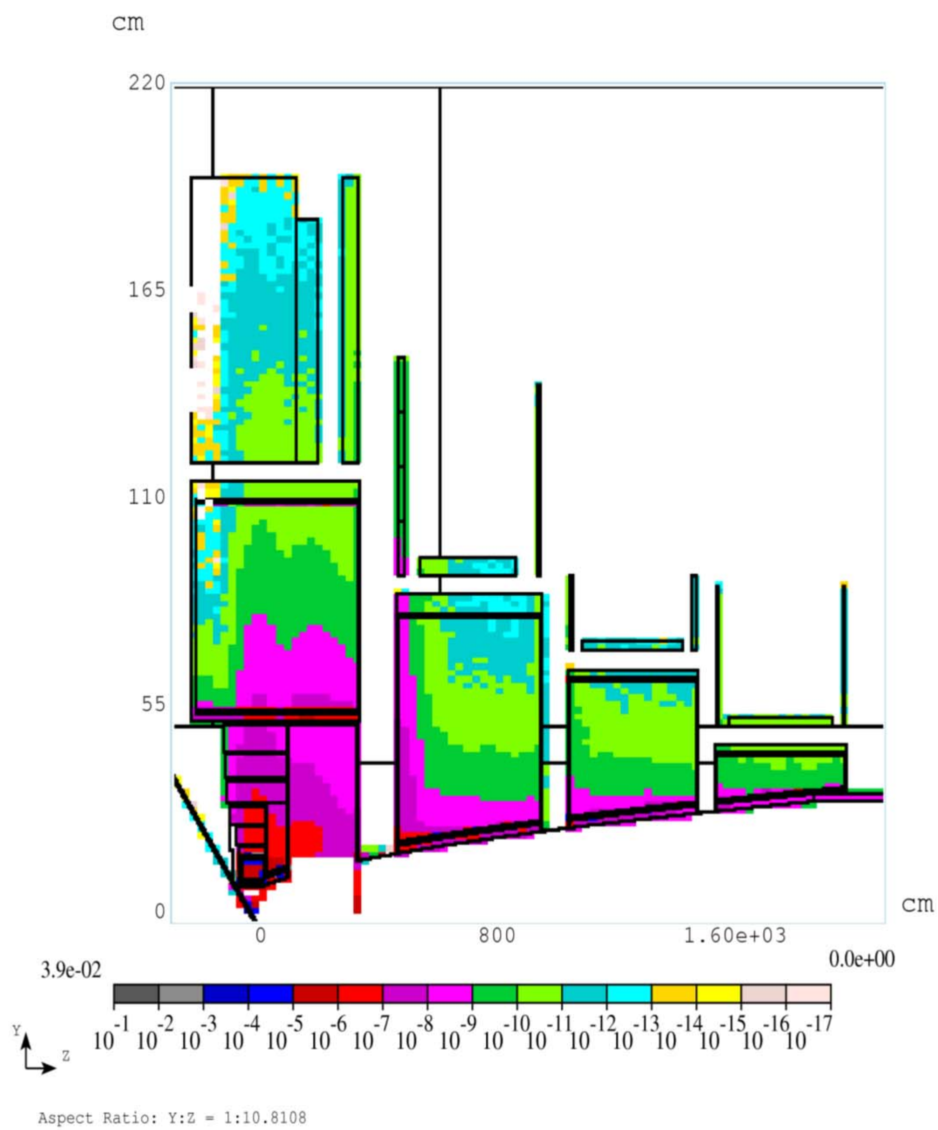
SH#2 REGION (BLUE): #LENGTH ~ 5 m, #AVERAGE RADIAL THIKNESS ~ 0.6 m #WEIGHT ~ 32 TONNS

SH#3 REGION (PINK) : #LENGTH ~ 4 m, #AVERAGE RADIAL THIKNESS ~ 0.4 m #WEIGHT ~ 14 TONNS

SH#4 REGION (YELLOW): #LENGTH ~ 5.4 m, #AVERAGE RADIAL THIKNESS ~ 0.55 m #WEIGHT ~ 52 TONNS (FOR 18.2 g/cc W DENSITY)

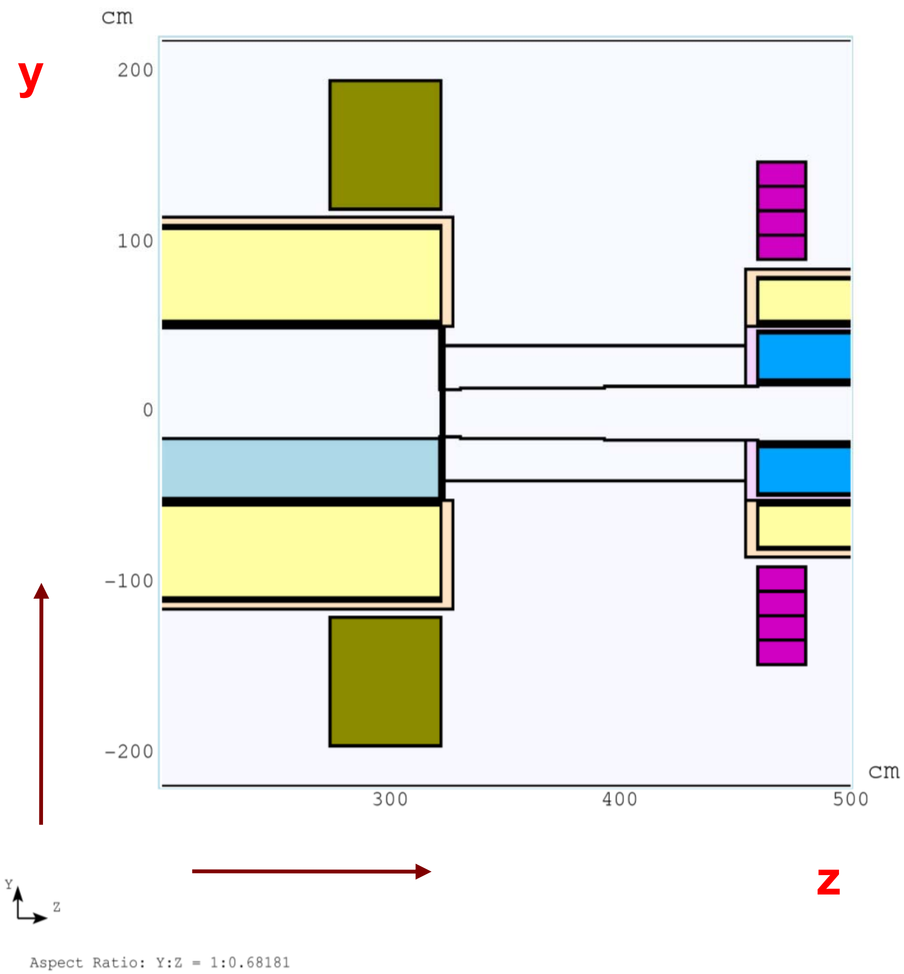
IDS120j: DP DISTRIBUTION WITHOUT GAPS (LEFT) AND WITH MAXIMUM GAPS SIZE (RIGHT)

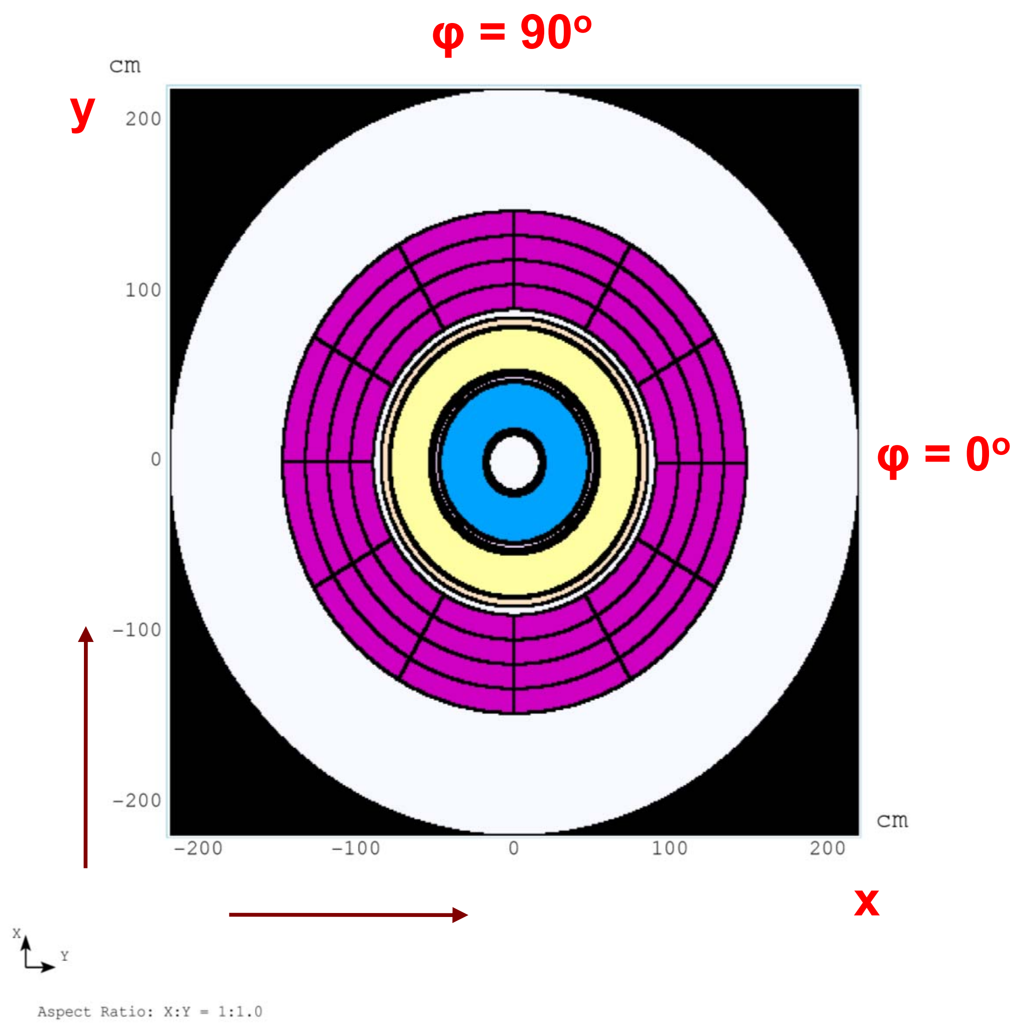




FIRST LOOK: GAPS AFFECT MOSTLY SC#3, SC#4 AND SC#7, SC#4 WITH MOST SERIOUS PROBLEM. GAP BETWEEN CRYO #1 AND #2 HAS THE MOST SIGNIFICANT EFFECT NOT ONLY IN THE NEIGHBORING SCs BUT ALSO IN THE SCs FURTHER DOWNSTREAM.

IDS120j: GAP BETWEEN CRYO 1-2 AND SC#4 SEGMENTATION DETAILS.





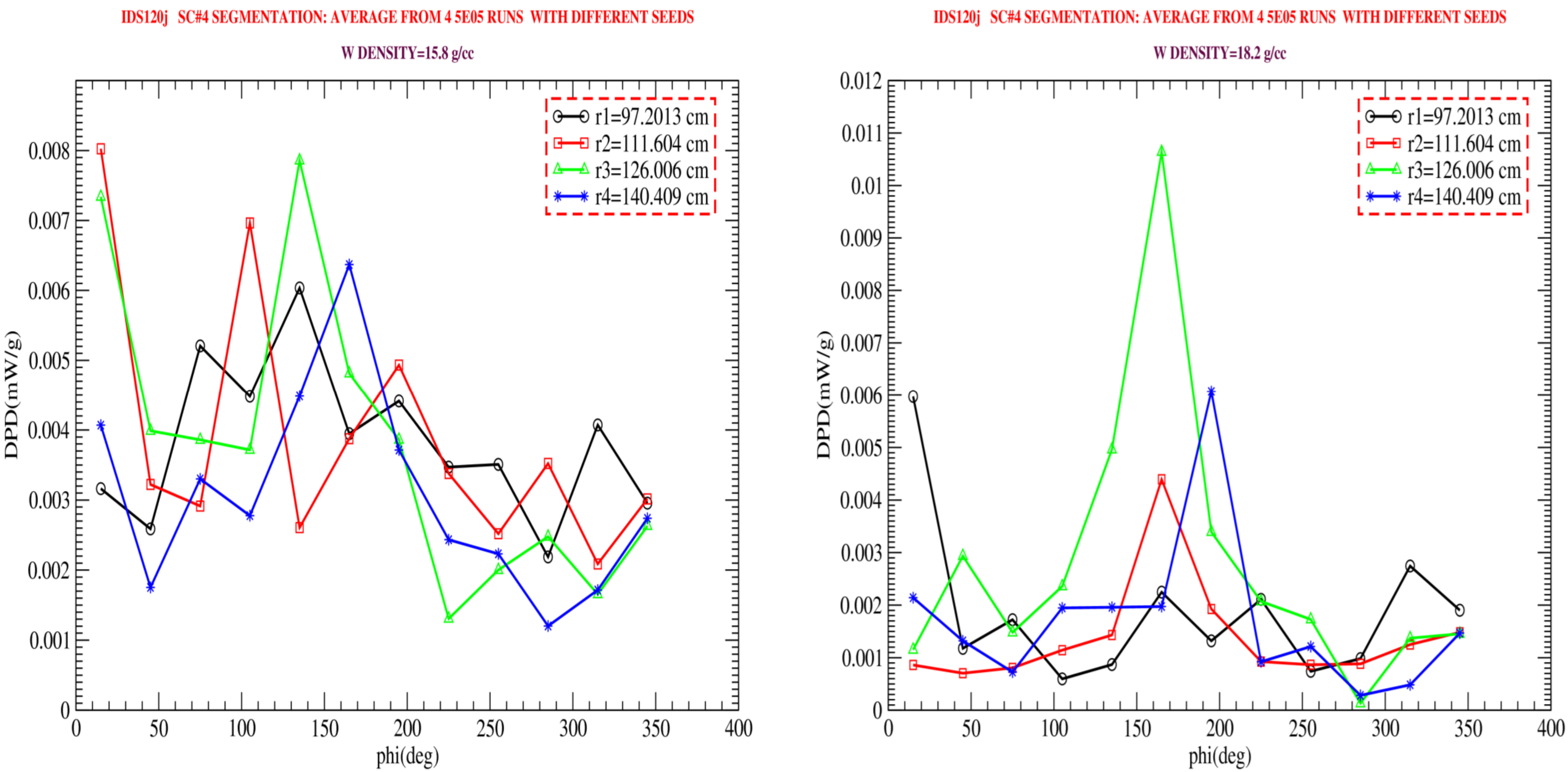
90 < r < 147.61 cm **dr = 14.40 cm** **N_r = 4 bins**

459.0 < z < 480.31 cm **dz = 21.31 cm** **N_z = 1 bin**

0.0 < φ < 360.0 deg. **dφ = 30 deg.** **N_φ = 12 bins**

N_{tot} = 48 "pieces"

SC#4 DPD AZIMUTHAL DISTRIBUTION WITHOUT GAPS: 15.8 g/cc (LEFT) AND 18.2 g/cc (RIGHT) W DENSITY (AVERAGE FROM 4 5E05 EVENT SIMULATIONS).

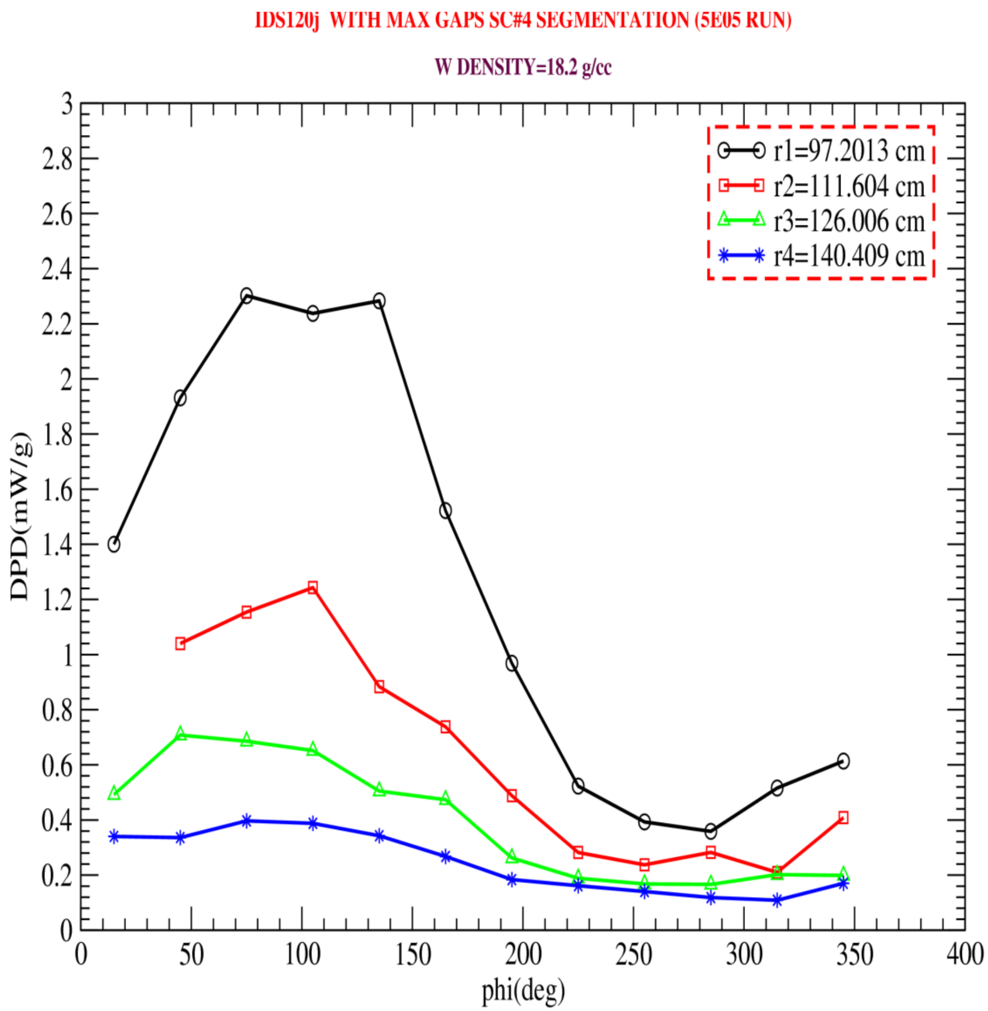


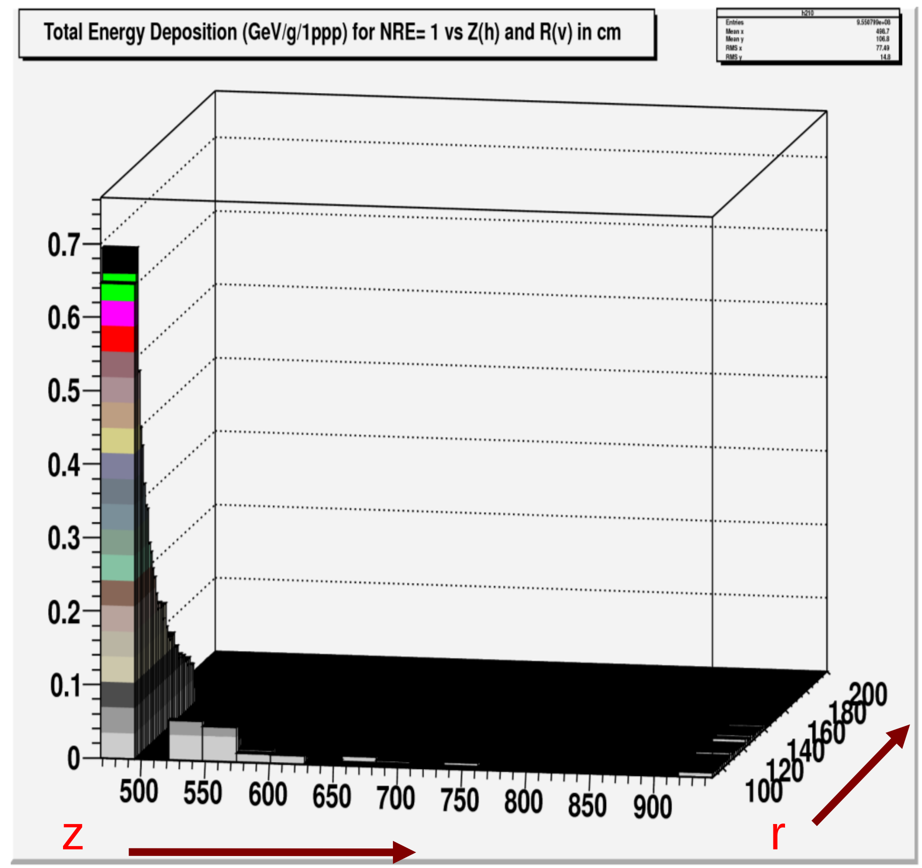
DPD $\lesssim$ 0.008 mW/g (sum 0.023 kW) DPD $\lesssim$ 0.011 mW/g (sum 0.012 kW)

PEAKS APPEAR TO BE IN THE UPPER HALF OF SC#4, TOWARD – x AXIS

SC#4 DPD AZIMUTHAL DISTRIBUTION WITH GAPS: 18.2 g/cc W DENSITY (LEFT) FROM 5E05 EVENTS.

AZIMUTHALLY AVERAGE DPD PLOT BY USING ROOT SOFTWARE (RIGHT).



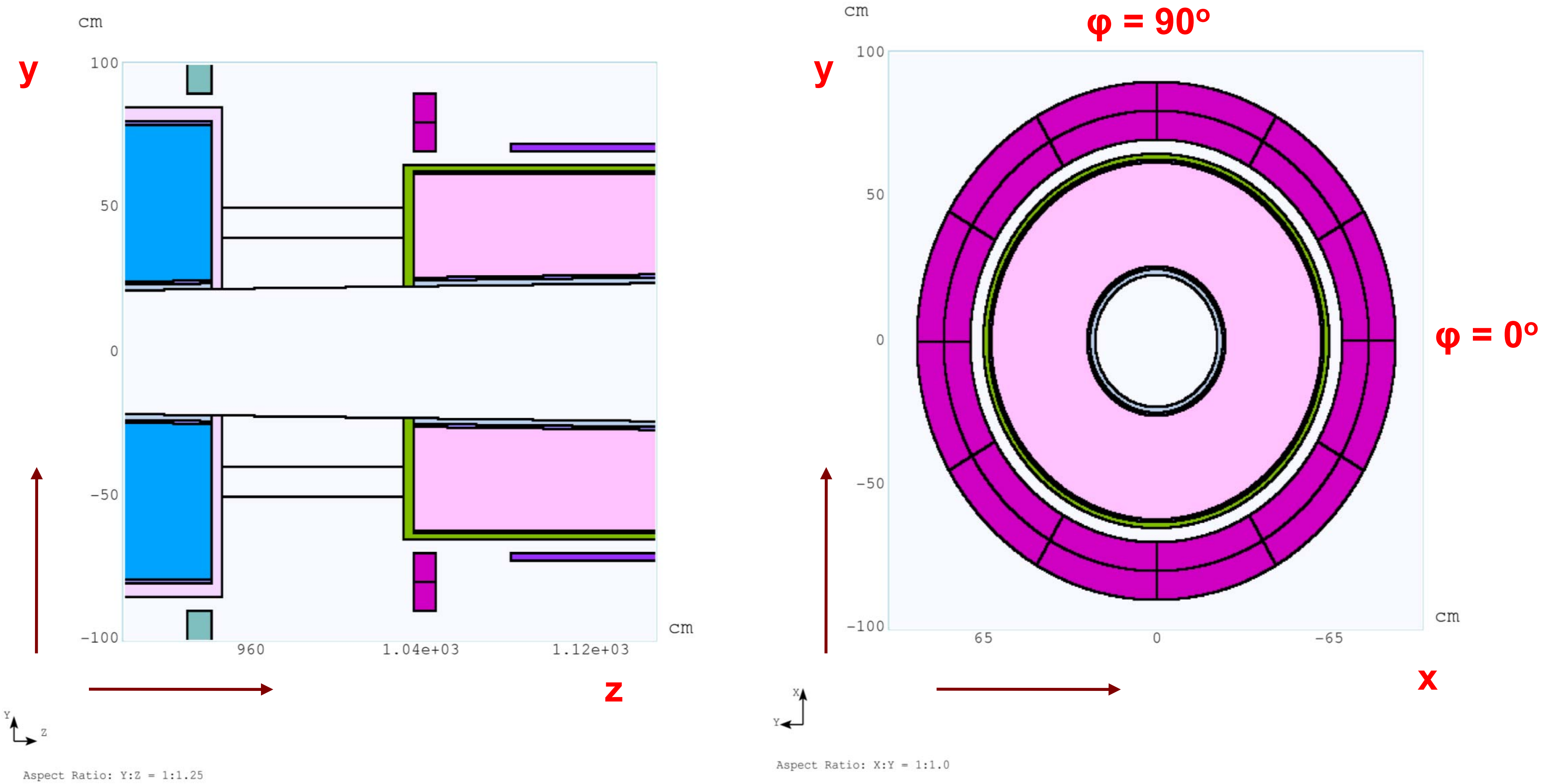


SC#4: DPD ≲ 2.4 mW/g (sum = 3.64 kW vs. 3.73 kW without segm.) DPD ≲ 0.7 mW/g

PEAKS APPEAR TO BE ALSONG THE + y AND – x DIRECTION.

FROM RIGHT PLOT: DOES THAT MEAN THE STUDY II GEOMETRY SC#1 PEAK IS IN REALITY > 19 mW/g ?!!

CRYO #2 AND #3 GAP AND SC#7 AZIMUTHAL SEGMENTATION DETAILS.



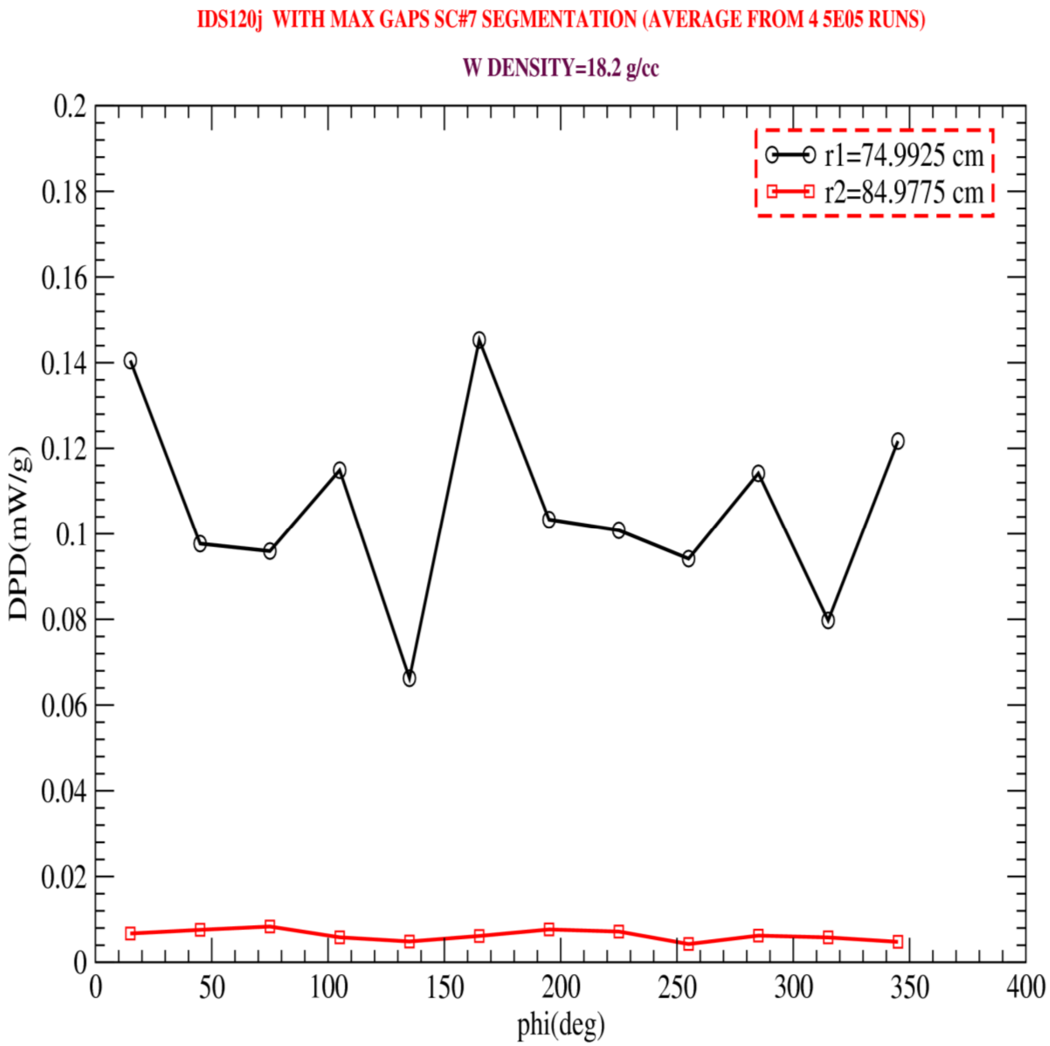
$70 < r < 89.97$ cm **dr = 9.985 cm** **N_r = 2 bins**

$1036.0 < z < 1046.67$ cm **dz = 10.67 cm** **N_z = 1 bin**

$0.0 < \varphi < 360.0$ deg. **dφ = 30 deg.** **N_φ = 12 bins**

N_{tot} = 24 "pieces"

SC#7: DPD AZIMUTHAL DISTRIBUTION WITH GAPS FROM 4 x 5E05 EVENTS (18.2 g/cc W DENSITY).



	NO GAPS		GAPS
SC#1 :	0.383 kW	------------->	0.368 kW
SC#2 :	0.105 kW	------------->	0.120 kW
SC#3 :	0.053 kW	------------->	0.799 kW
SC#4 :	0.012 kW	------------->	3.700 kW
SC#5 :	0.003 kW	------------->	0.080 kW
SC#6 :	0.001 kW	------------->	0.052 kW
SC#7 :	0.003 kW	------------->	0.061 kW
SC#8 :	0.008 kW	------------->	0.006 kW
SC#9 :	0.002 kW	------------->	0.006 kW
SC#11-12 :	0.035 kW	------------->	0.052 kW
SC#1-12 :	0.605 kW	------------->	5.244 kW
RADIAL DP FLOW :	74.15 kW	----->	531.78 kW

SC#4: DPD ≲ 0.15 mW/g (sum = 0.060 kW vs. 0.061 kW without segm.) PEAK APPEAR TO BE ALONG THE + y AND - x DIRECTION AS IN SC#4.
PROBLEM IN SC#4 LOOKS LIKE IS MANEGEABLE.
SC#3 SEGMENTATION ANALYSIS IN PROGRESS.

GAP BETWEEN CRYO #1 AND #2 IS THE MAJOR PROBLEM IN THE GAPS CONFIGURATION. AT THE SAME TIME THAT FIRST GAP SHOULD BE BIGGER THAN THE OTHERS TO SATISFY THE NEEDS FOR Hg POOL VESSEL + BEAM PIPE + Be WINDOW + SHIELDING MATERIAL COOLING, AS WEEL AS OTHER ENGINEERING COMPONENTS THERE. AT LEAST ~ 20 cm WILL BE DEDICATED TO THE UPSTREAM AND DOWNSTREAM STST FLANGES OF THE NEIGHBORING SHIELDING VESSELS AND MORE THAN ~ 20 - 30 cm FOR THE DIFFERENT COMPONENTS, THEREFORE SHIELDING GAP ≳ 50 - 60 cm. A VIABLE SOLUTION (BUT NOT NECESSARILY ENGINEERINGLY FAVORABLE) CAN INCLUDE:

A. INTRODUCTION OF SHIELDING IN THE UPPER HALF OF THE Hg POOL VESSEL,
B. NOT EXTENDING THE POOL ALL THE WAY TO THE END OF THE #1 CRYOSTAT LENGTH,
C. ASSYMETRIC EXTENSION OF THE SHIELDING FROM CRYO #1 TOWARDS CRYO #2,
D. SC IR INCREASE MAYBE EVEN TO 120 cm.