IDS120j WITH GAPS

SC#4 AZIMUTHAL DPD DISTRIBUTION ANALYSIS
SC#3, SC#4, SC#7 DP AND SC TOTAL DP WITH VARYING GAPS SIZE
(ALL GAPS, SYMMETRIC WAY)
FOR 15.8 g/cc W BEADS IN SHIELDING

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IDS120j GEOMETRY: WITH GAPS

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 # SIMULATIONS USING LOWEST GRADE W BEADS IN SHIELDING (OF 15.8 g/cc)
 # SC#4 AZIMUTHAL DPD DISTRIBUTION STUDIES WITH SYMMETRICALLY VARYING GAPS SIZE.
 # SC#3, SC#4, SC#7 DP AND SC TOTAL DP WITH VARYING GAPS SIZE.

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>SIMULATIONS CODE: mars1510 / MCNP

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

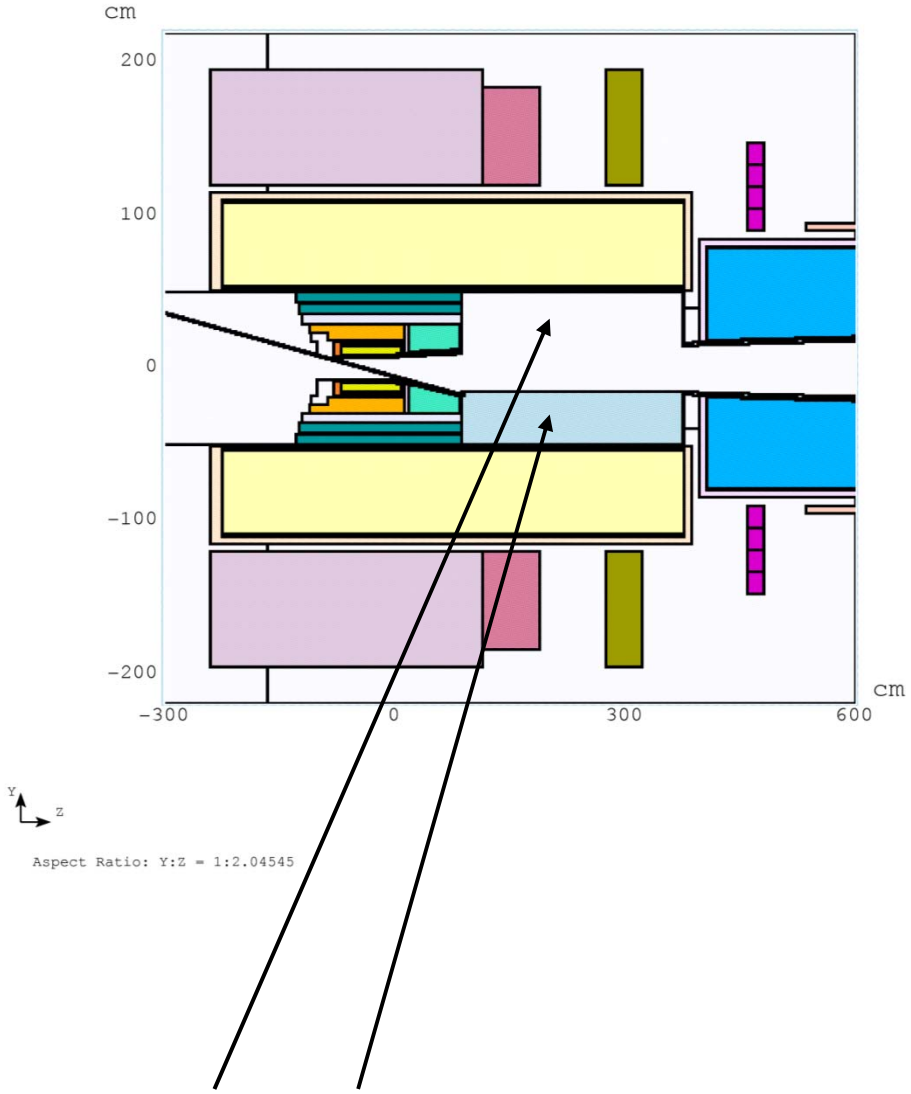
>SHIELDING: 60% W + 40% He (WITH STST VESSELS)

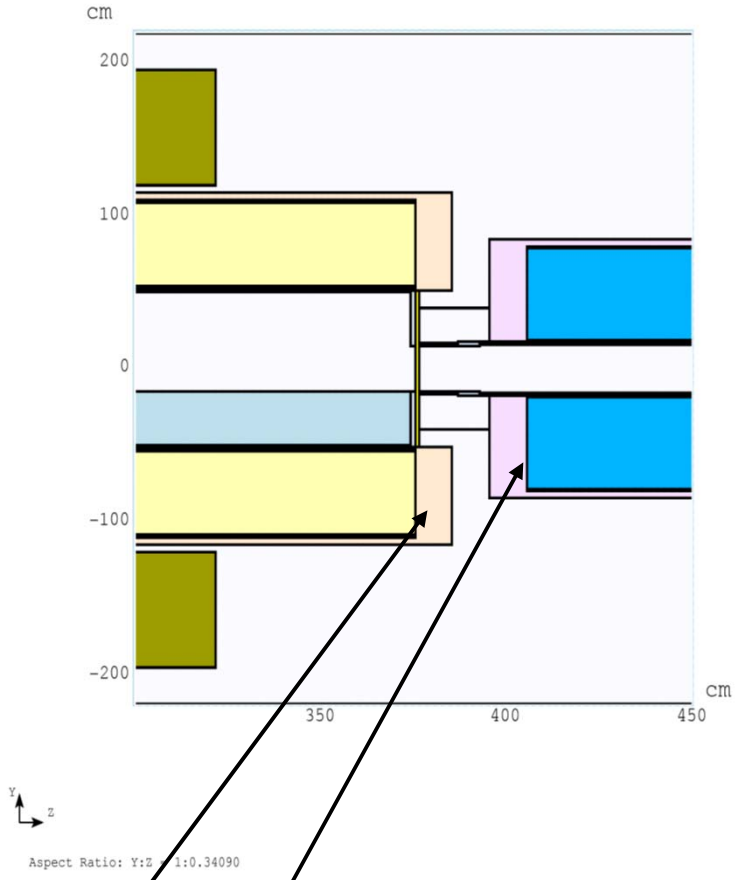
>PROTON BEAM POWER: 4 MW

>PROTON ENERGY: E = 8 GeV

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

IDS120j: GAP 1 DETAIL PLOTS FOR 10 cm SYMMETRIC INCREASE OF GAPS SIZE (YZ CROSS SECTIONS).



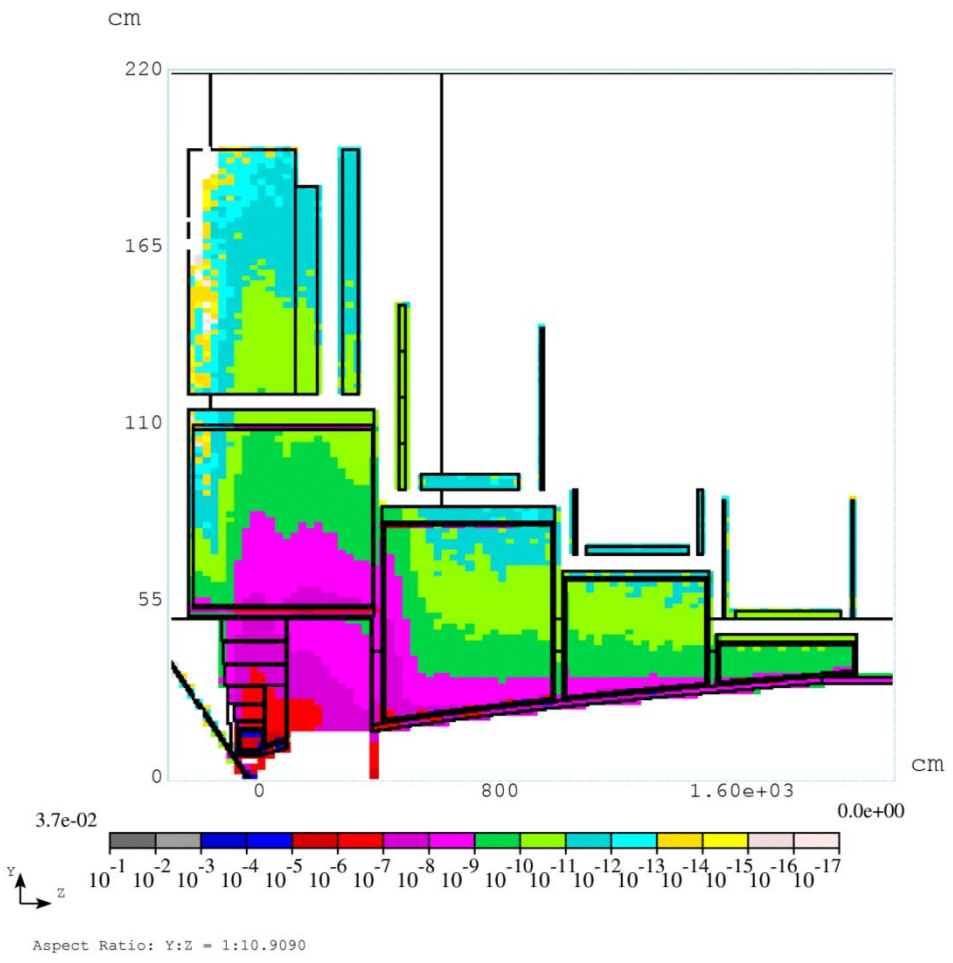


POOL IS EXTENDED ALL THE WAY TO THE END OF THE LENGTH OF SH#4 REGION. UPPER HALF IS VACUUM.

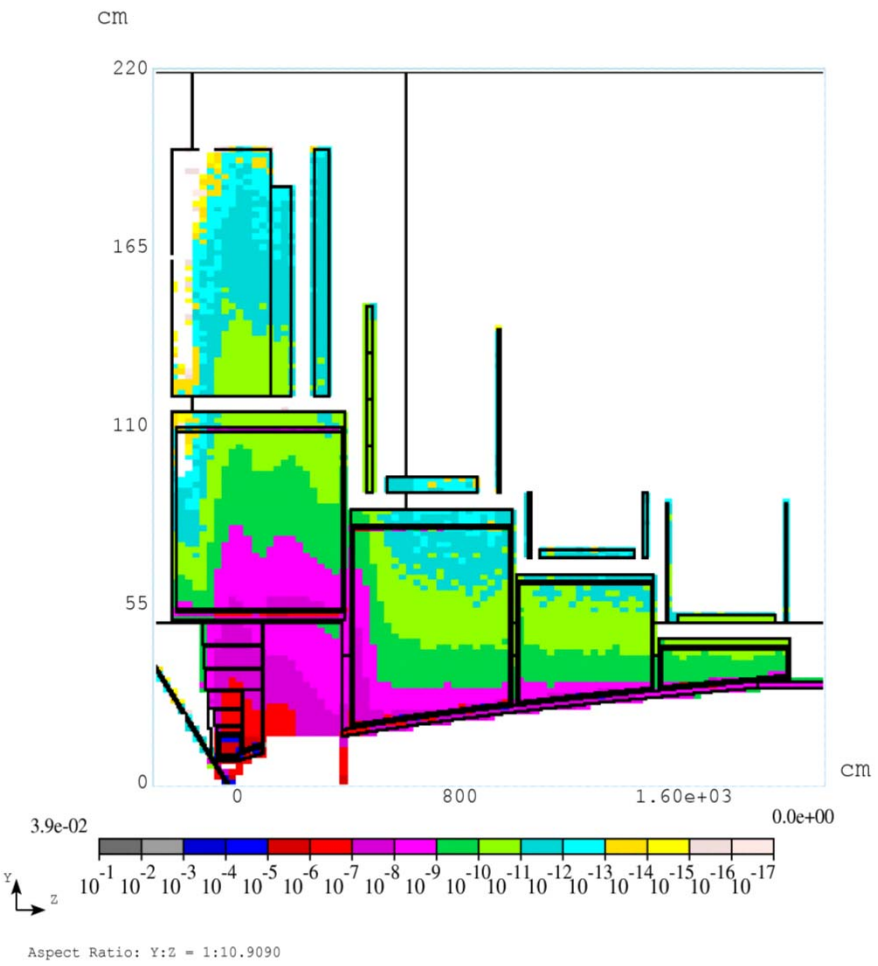
10 cm STST THICK FLANGES ARE USED FOR THE DOWNSTREAM SIDE OF THE UPSTREAM VESSEL SHVS#4, AND THE UPSTREAM SIDE OF THE DOWNSTREAM VESSEL SHVS#2 IN GAP 1.

IDS120j: AZIMUTHALLY AVEARAGE DPD MARS PLOTS, FOR 20 cm GAPS, FOR 15.8 g/cc (LEFT AND 18.2 g/cc (RIGHT) W BEADS.

15.8 g/cc W BEADS

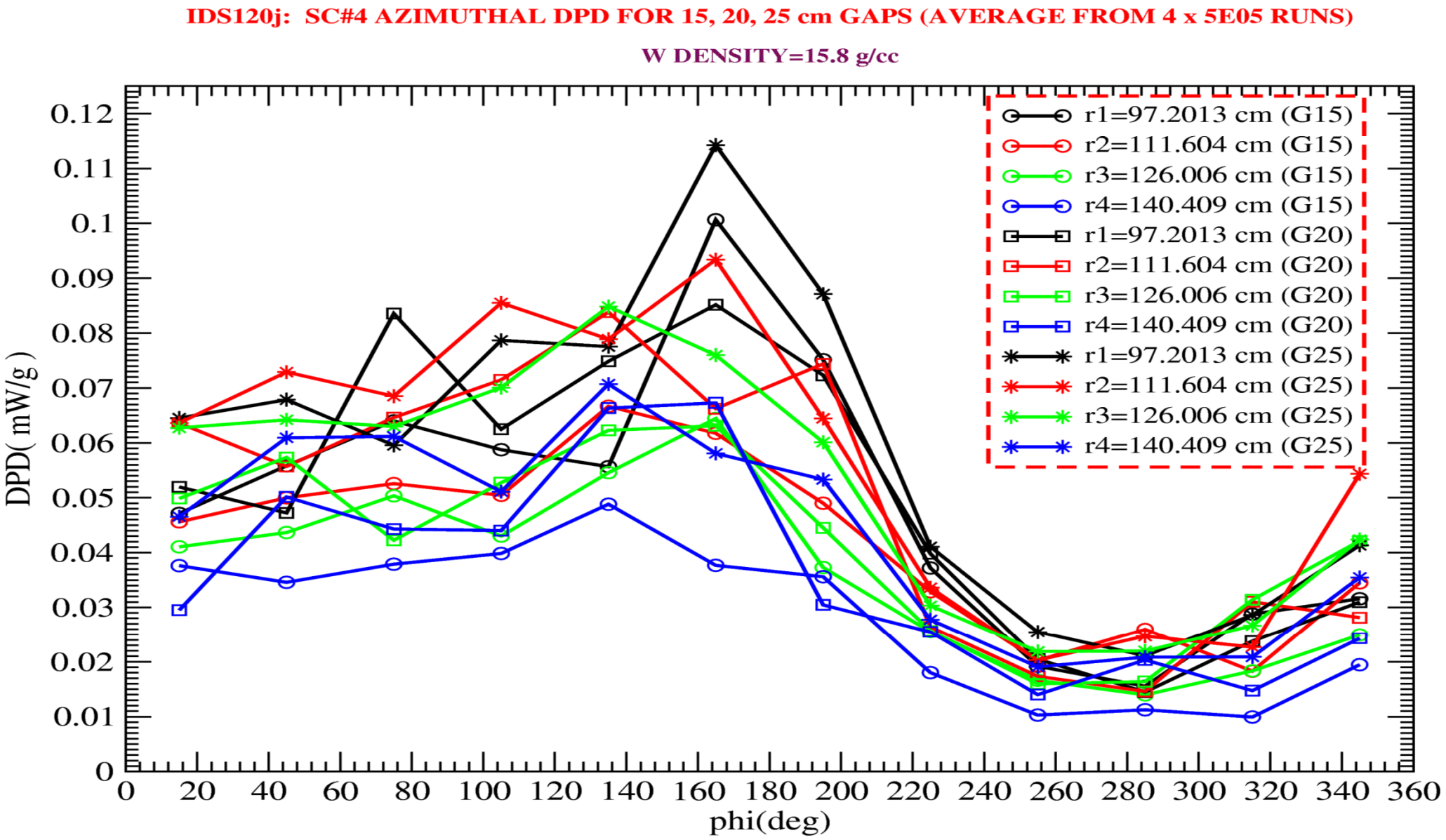


18.2 g/cc W BEADS



FIRST LOOK: ONE CAN NOTICE HOW MUCH DEEPER IS THE RADIAL SPREADING OF RADIATION DP IN, FOR EXAMPLE, SC#1, SC#2 AND SC#3 FOR 15.5 g/cc OVER 18.2 g/cc W BEADS. A SIGNIFICANT INCREASE IN THE DP IS EXPECTED THEREFORE FOR THESE FIRST 3-4 SC COILS WHEN USING LOWEST GRADE W BEADS.

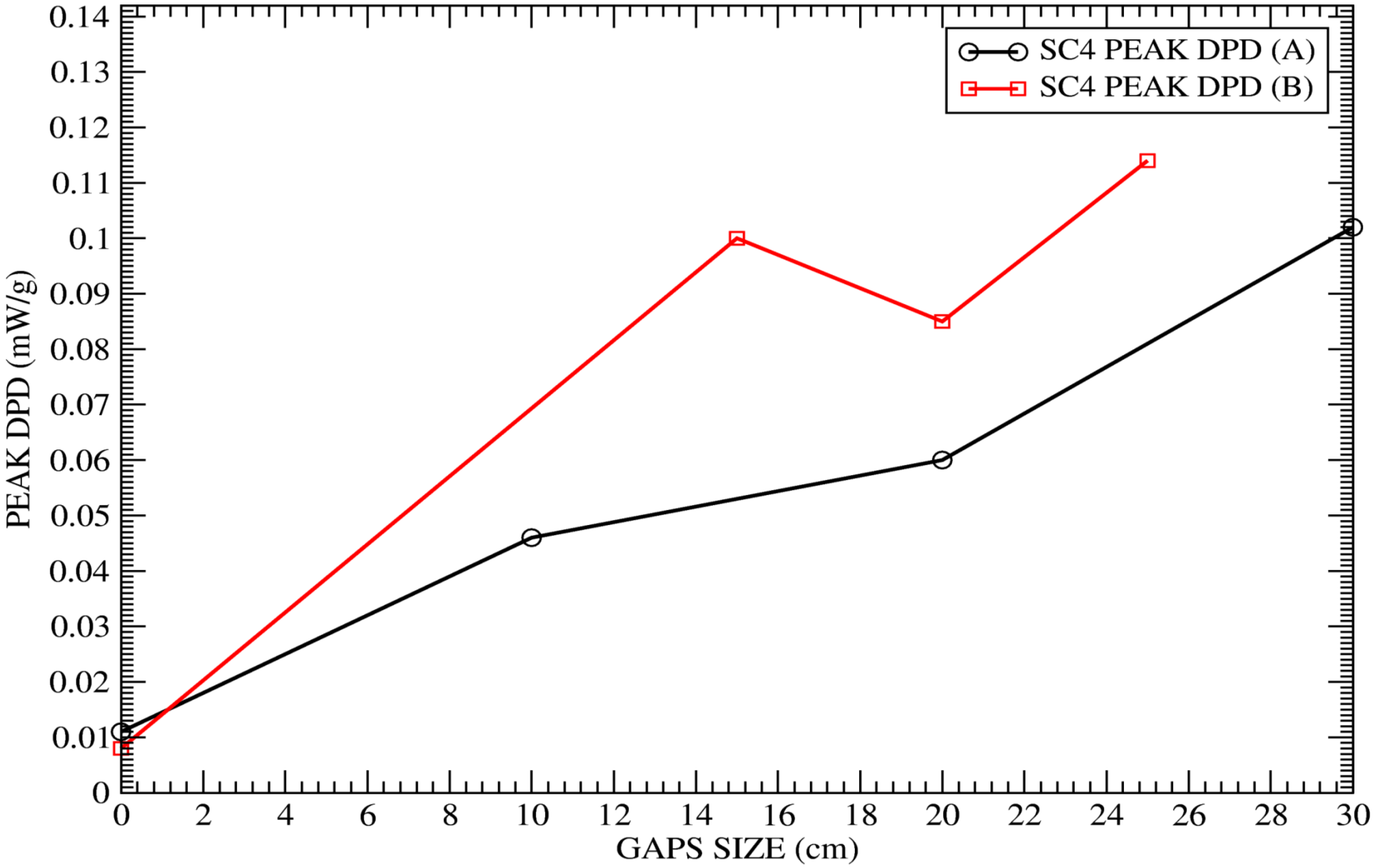
IDS120j: SC#4 DPD AZIMUTHAL DISTRIBUTIONS FOR 15, 20, 25 cm GAPS (FORM 4 x 5E05 EVENTS, 15.8 g/cc W BEADS DENSITY)



~ 15 - 20 cm GAPS APPEAR TO BE THE CRITICAL GAPS SIZE FOR THE SC#4 DPD PEAK VALUES TO REACH OR EXCEED THE "ITER LIMIT" FOR 15.8 g/cc W BEADS. PEAKS NOW ARE CLOSER TO THE IR.

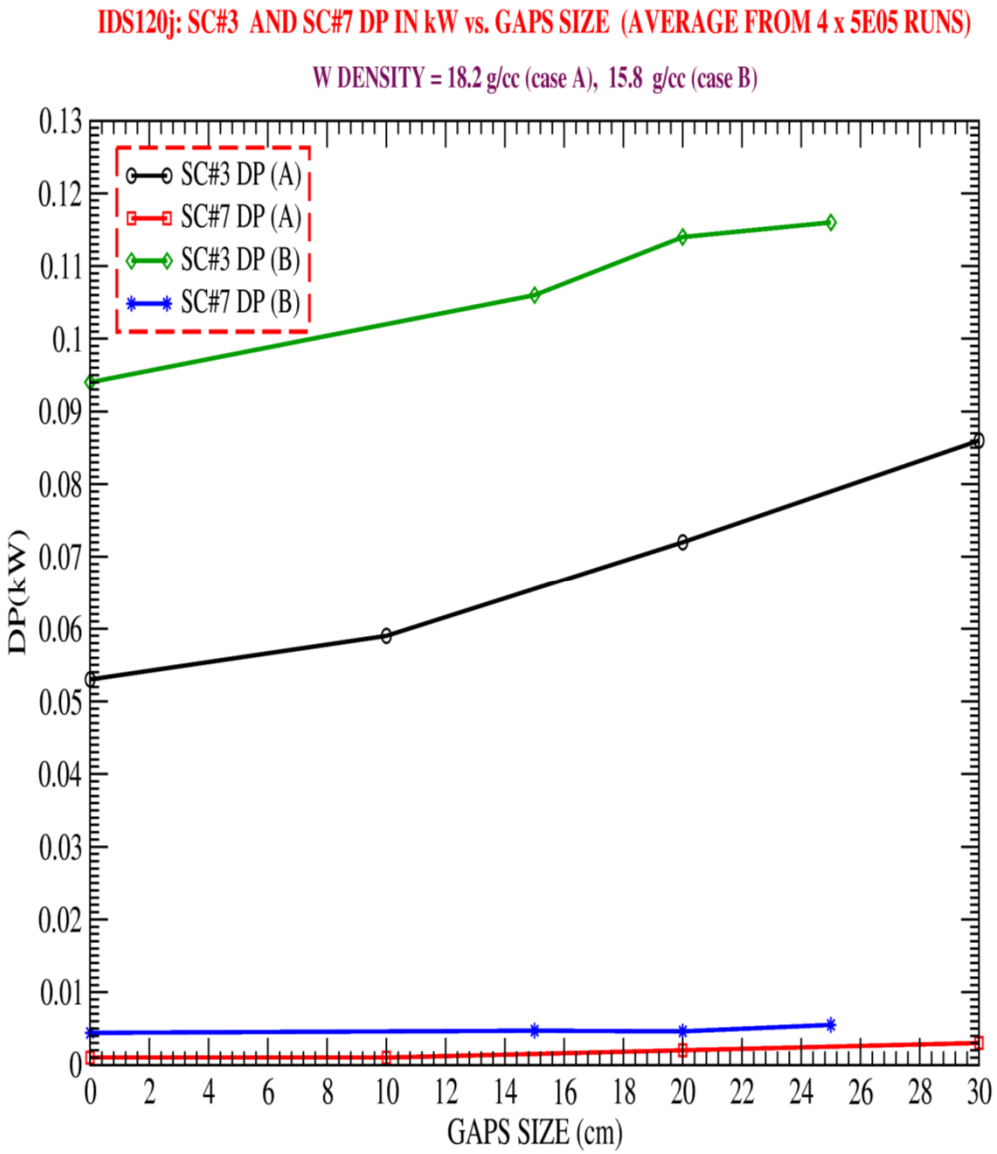
IDS120j: SC#4 PEAK DP IN mW/g vs. GAPS SIZE (AVERAGE FROM 4 x 5E05 RUNS)

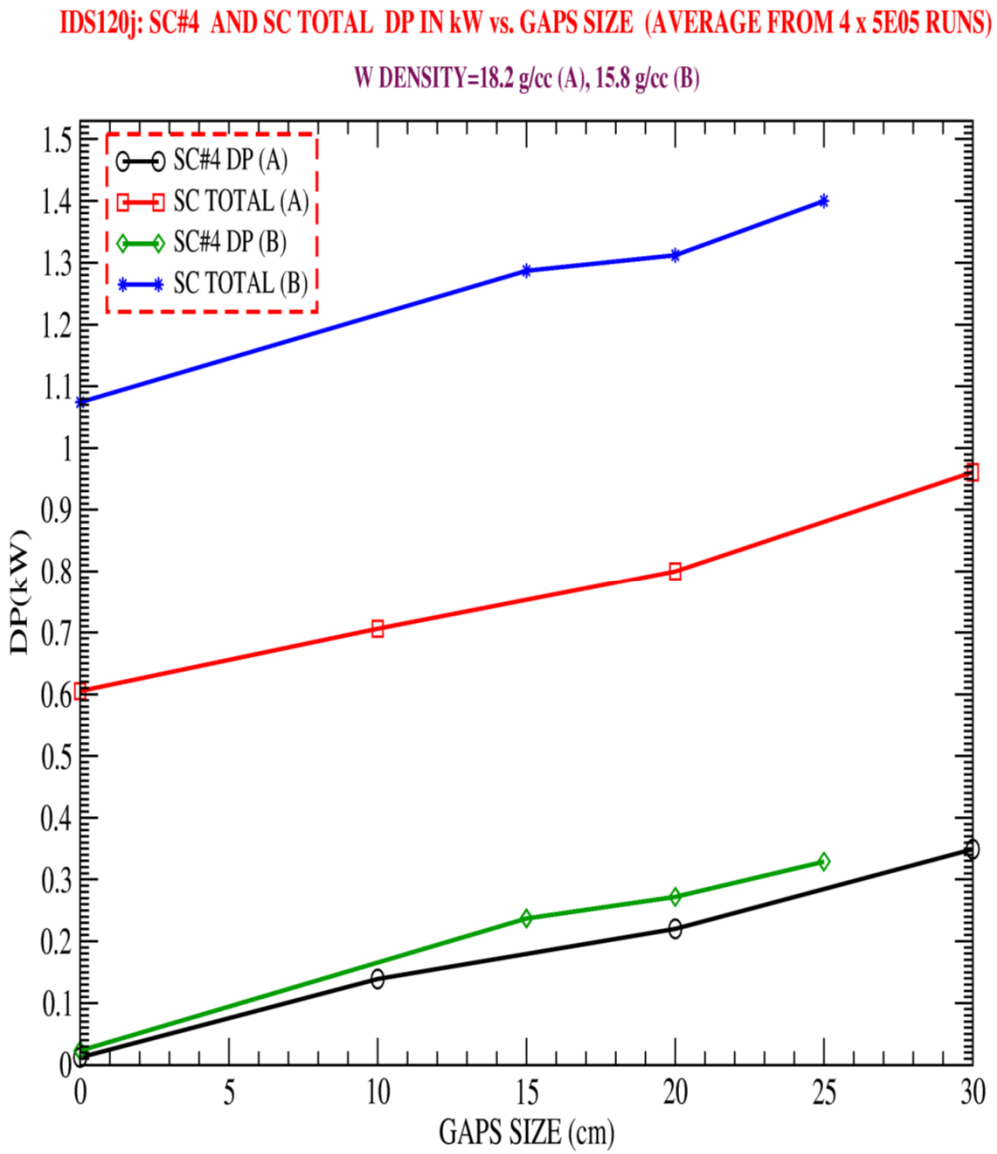
W DENSITY=18.2 g/cc (A), 15.8 g/cc (B)



SC#4 PEAK DPD APPEARS TO BE CLOSE TO THE "ITER" LIMIT EVEN FOR ~ 15 cm GAPS FOR 15.8 g/cc W BEADS, BUT IT ALSO LOOKS LIKE THERE IS MORE STATISTICAL "NOISE" FOR THIS CASE.

IDS120j: **SC#3, SC#7 (LEFT) AND SC#4, SC TOTAL (RIGHT) DP vs. GAPS SIZE (FROM 4 x 5E05 EVENTS, 15.8 g/cc AND 18.2 g/cc W BEADS DENSITY)**





SC#3, SC#7: AS EXPECTED USING LOWER DENSITY W BEADS WILL AFFECT MORE SC NEAR TARGET. SC TOTAL > 1 kW EVEN WITH NO GAPS FOR 15.8 g/cc W BEADS.

COMMENTS ON VAN'S CONCEPT FOR THE TARGET VESSEL.

RESISTIVE COILS AND SHIELDING MATERIAL IN REGION SH#1 WILL BE REPLACED BY A STST CYLINDER WITH OUTER RADIUS ~ 50 cm.

CURVE THE CYLINDER TO ACCOMODATE THE VARIOUS COMPONENTS (BEAM PIPE, Hg JET PIPE, Hg POOL VESSEL, Hg POOL DRAINING PIPES etc.)

FOR 15.8 g/cc W BEADS IN SHIELDING WE HAVE :

& ~ 1.1 kW TOTAL DP IN SC COILS WITH ~ 1 kW IN SC#1 - SC#3 ALONE.

& ~ 900 kW OF DP JUST IN SHIELDING AREA SH#1A. ANOTHER ~ 337 kW IN SH#1B

& ~ 284 kW DP IN RESITIVE COILS.

& ~ 223 kW IN THE 1 cm THICK, ~ 100 cm LONG BP#1 IN TARGET REGION.

OVERALL ~ 1.74 MW OF THE BEAM POWER WILL BE STOPPED BY THE RS, BP#1 AND SH#1.

POSSIBLE OUTCOME OF IMPLEMENTING THAT CONCEPT:

EXCESSIVE ENERGY DEPOSITED IN FIRST 3 - 4 SC COILS, WITH PEAK DPD LIKELY OVER THE "ITER" LIMIT.
PROBLEMS WITH REMOVING HEAT LOAD FROM AREAS IN THE STST CYLINDER CLOSE TO THE TAREGT REGION ? THE COOLING "HOLES" IN THE STST CYLIDER WILL FURTHER WEAKEN ITS SHIELDING EFFECTS.
WITH SMALLER MAGNETIC FIELD NEAR THE TARGET REGION MORE ENERGY WILL BE SPREAD OUT RADIALLY AROUND THAT REGION ?