20to2T5m WITH RESISTIVE MAGNETS: C TARGET
SC#3, BeWind#1 TDPD AZIMUTHAL DISTRIBUTION

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20to2T5m WITH RESISTIVE MAGNETS: WITH 10 cm GAPS BETWEEN CRYOSTATS

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 # SC#3 AND BeWind#1 AZIMUTHAL TDPD SIMULATIONS, WITH ADDITIONAL SHIELDING AFTER THE RS [ICEM = 1 MODE SIMULATIONS].

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➡ **SIMULATION CODE: mars15(2014)[USING MCNPDATA x-SECTION LIBRARIES FOR NEUTRON INTERACTIONS WITH KE < 14 MeV]**

➡ **NEUTRON ENERGY CUTOFF: 10^{-12} GeV**

➡ **SHEILDING: 60% W + 40% He [WITH STST VESSELS]**

➡ **B_z (r = 0, z) : 20 T [z = 0.0 cm] ---→ 2.0 T [z ~ 500.0 cm]**

➡ **C ROD RADIUS / ANGLE: 0.80 cm / 65 mrads (~ 3.72 degrees) [-40.0 < z < 40.0 cm]**
C density ~ 1.8 g/cc { C DUMP: NO DUMP }

➡ **PROTON BEAM POWER: 4.0 MW**

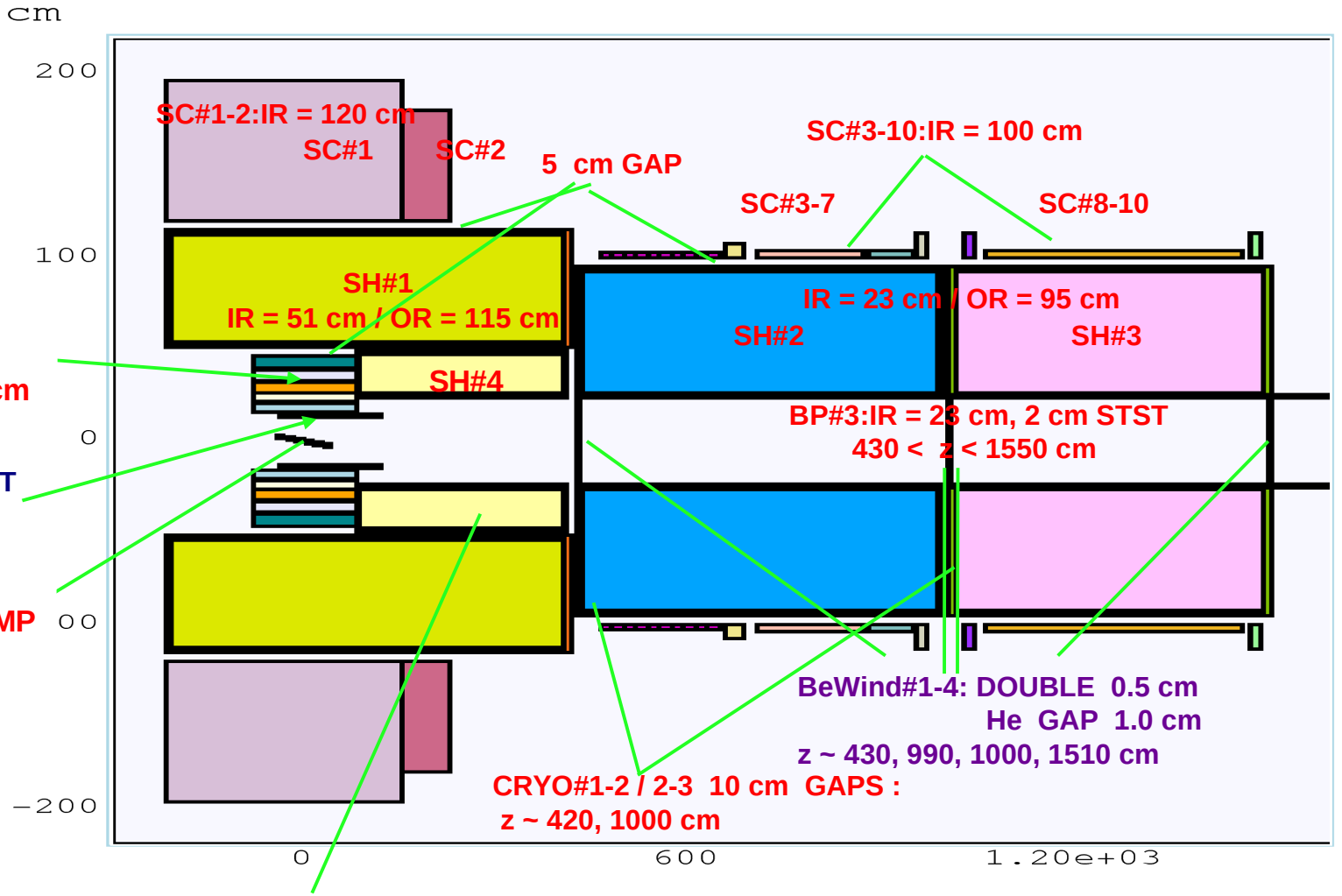
➡ **PROTON ENERGY: E = 6.75 GeV**

➡ **PROTON BEAM PROFILE : GAUSSIAN, σ_x = 0.3268 σ_y = 0.3272 cm**
[5 micron emmitance, sigma star =0.18 at z = 0.0 cm]

➡ **PROTON BEAM LAUNCH : (xo, yo, zo) = (-2.274236, 5.93971, -100.0) cm**
(dcxo, dcyo, dczo) = (0.03922601, -0.0503227, -0.9979624)

➡ **EVENTS IN SIMULATIONS : N_p = 5E6 ==> 100 (SUBDIRECT) x 5E4 (STEP: 10^-3)**

20to2T5m: yz CROSS SECTION (x = 0.0 cm) WITH GEOMETRY DIMENSIONS / PARAMETERS.
ADDITONAL SHIELDING HAS BEEN INSERTED AFTER THE RS TO PROTECT SC#3.



RS#1-5: IR = 16 cm
OR = 46 cm
-80.34 < z < 160.44 cm

BP#1:IR = 13 cm
0.5 cm DOUBLE STST
0.5 cm He GAP
-39 < z < 121 cm

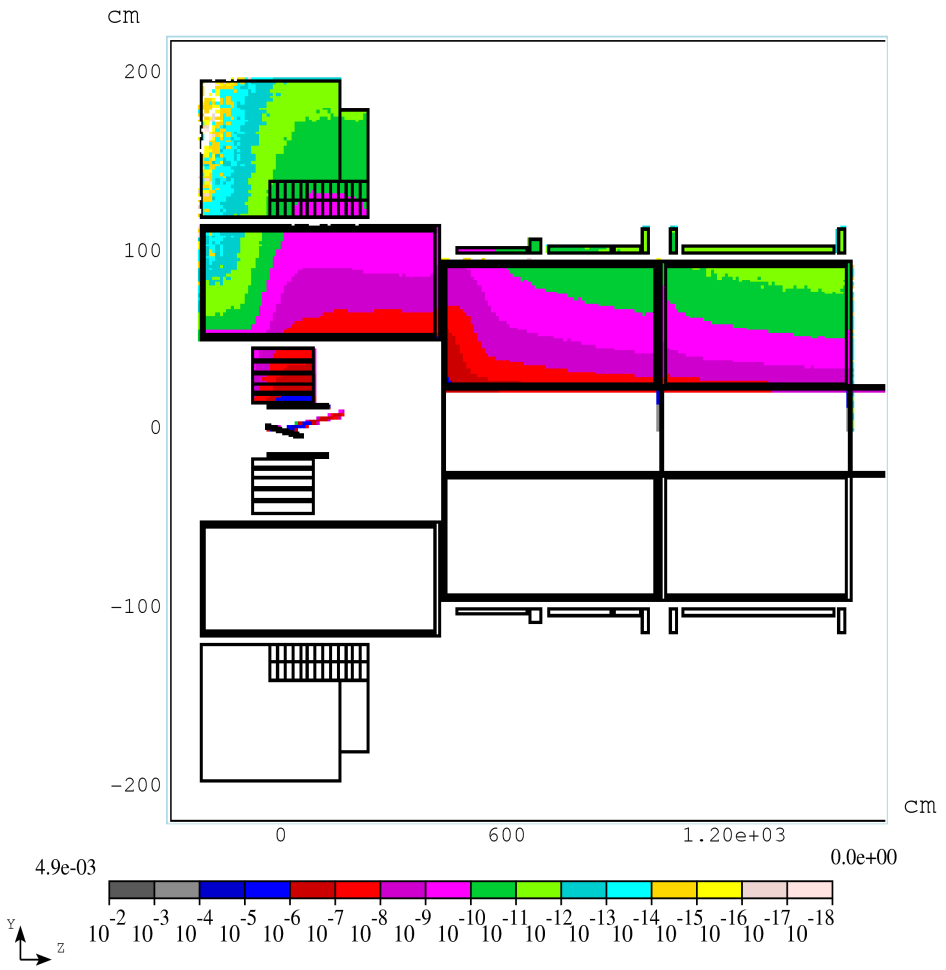
C TARGET / NO DUMP
-40.0 < z < 40.0 cm
R = 0.80 cm

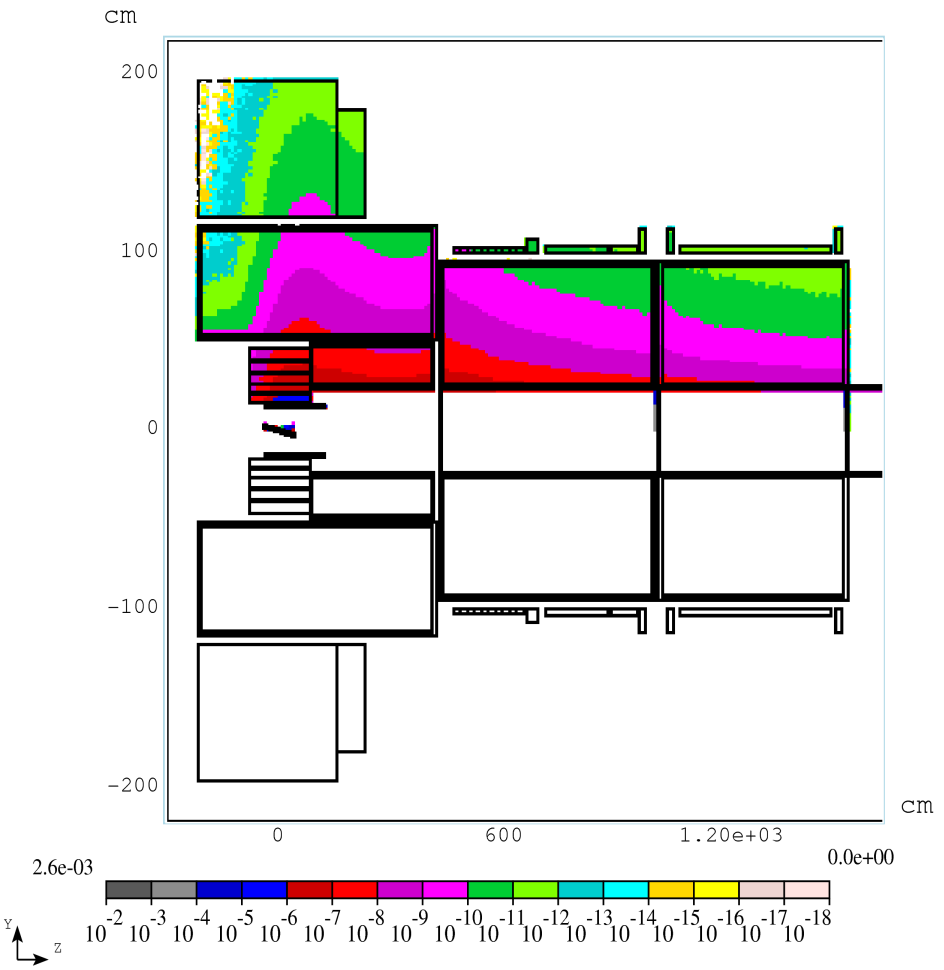
SH#4: ADDITIONAL SHIELDING AFTER
RS INSERTED TO PROTECT SC#3
23.0 < r < 50.5 cm , 82.0 < z < 420.0 cm
2 cm THICK TUBES, 5 cm THICK FLANGES

20to2T5m: yz CROSS SECTION (x = 0.0 cm) WITH AZIMUTHALLY AVERAGE TDPD DISTRIBUTION BEFORE (LEFT) AND AFTER INTRODUCING SHIELDING AFTER THE RS REGION (RIGHT)

{ LEFT PLOT HAS R= 0.72 cm C TRGT AND DUMP WITH 40 < z < 160 cm FOR DUMP }

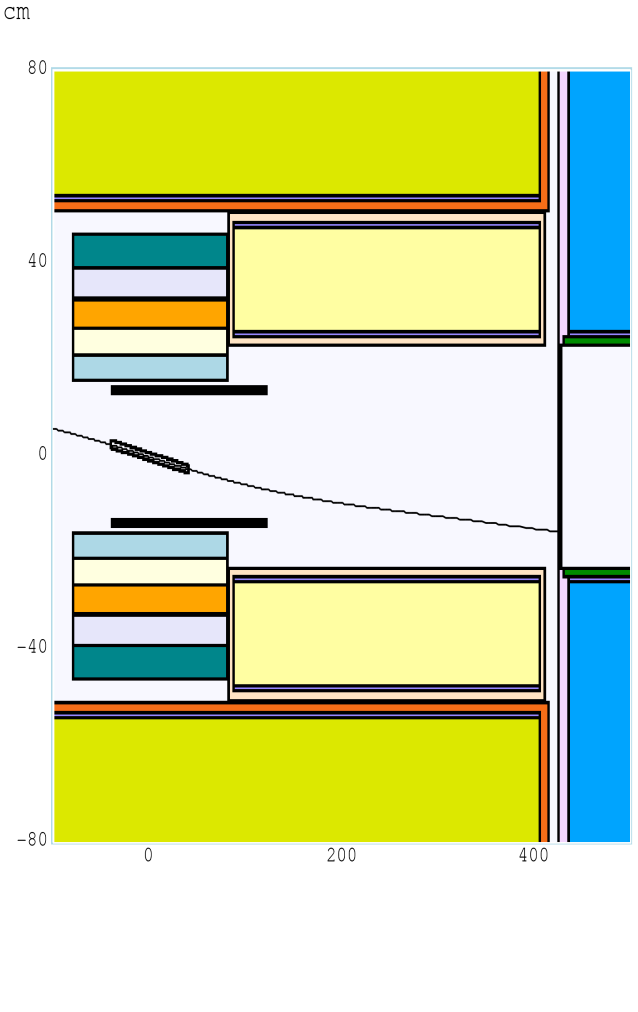
COLOR SCALES ARE THE SAME FOR BOTH PLOTS



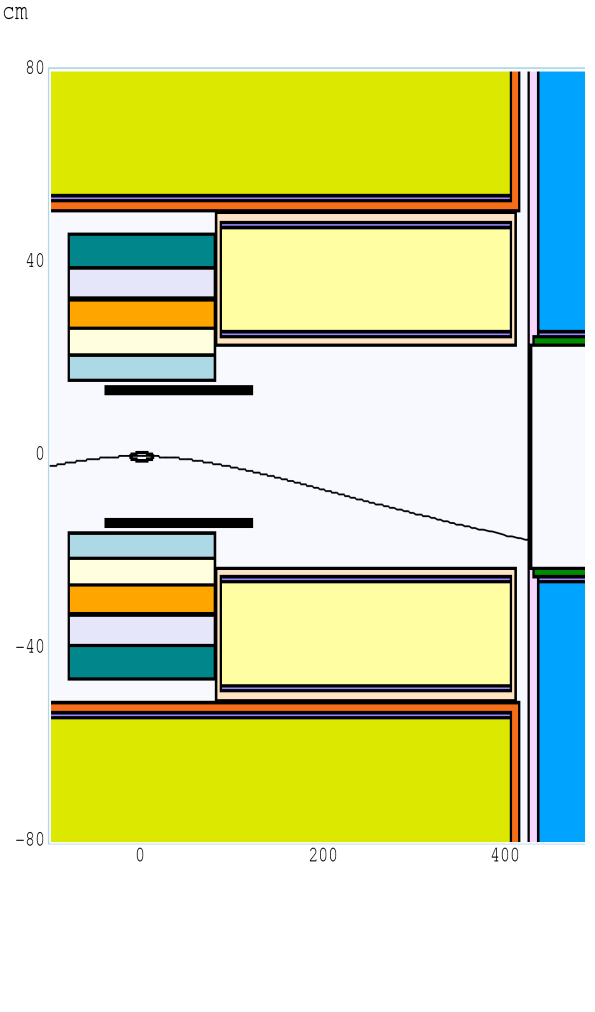


20to2T5m: yz AT x = 0.0 cm (RIGHT) , xz AT y = 0.0 cm (MIDDLE), xy AT z = 426.0 cm (LEFT) CROSS SECTION WITH THE PROTON BEAM CENTROID TRAJECTORY PROJECTION WITHOUT C TARGET AND BeWind#1. TRAJECTORY DATA SHOW THAT THE PROTONS WILL CRASH ON THE BP#3 WALL AT z ~ 426.0 cm (THE PEAK TDPD OF SC#3 IS AT ~ 225 degrees AS ONE MAY EXPECT FROM THE xy PLOT)

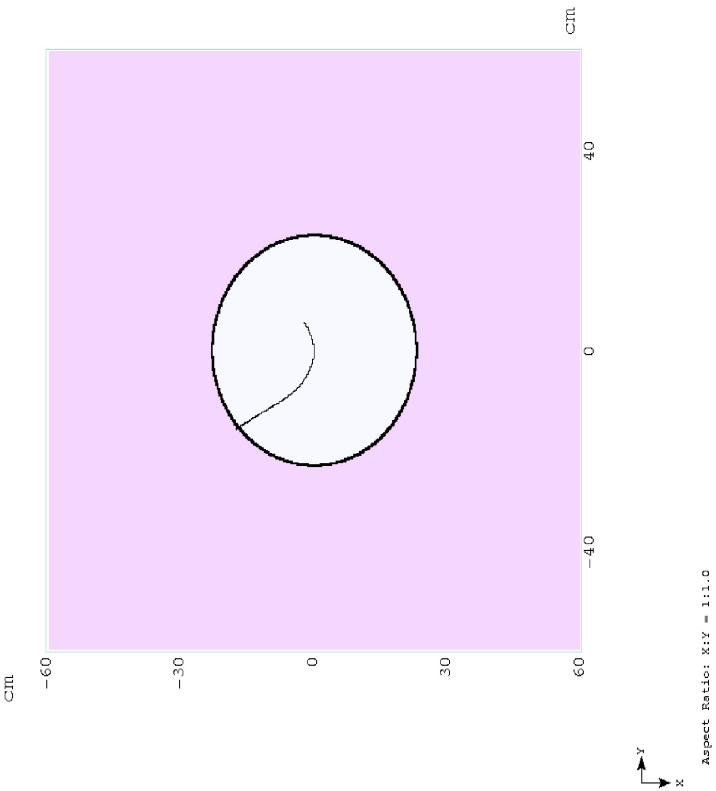
yz AT x = 0.0 cm



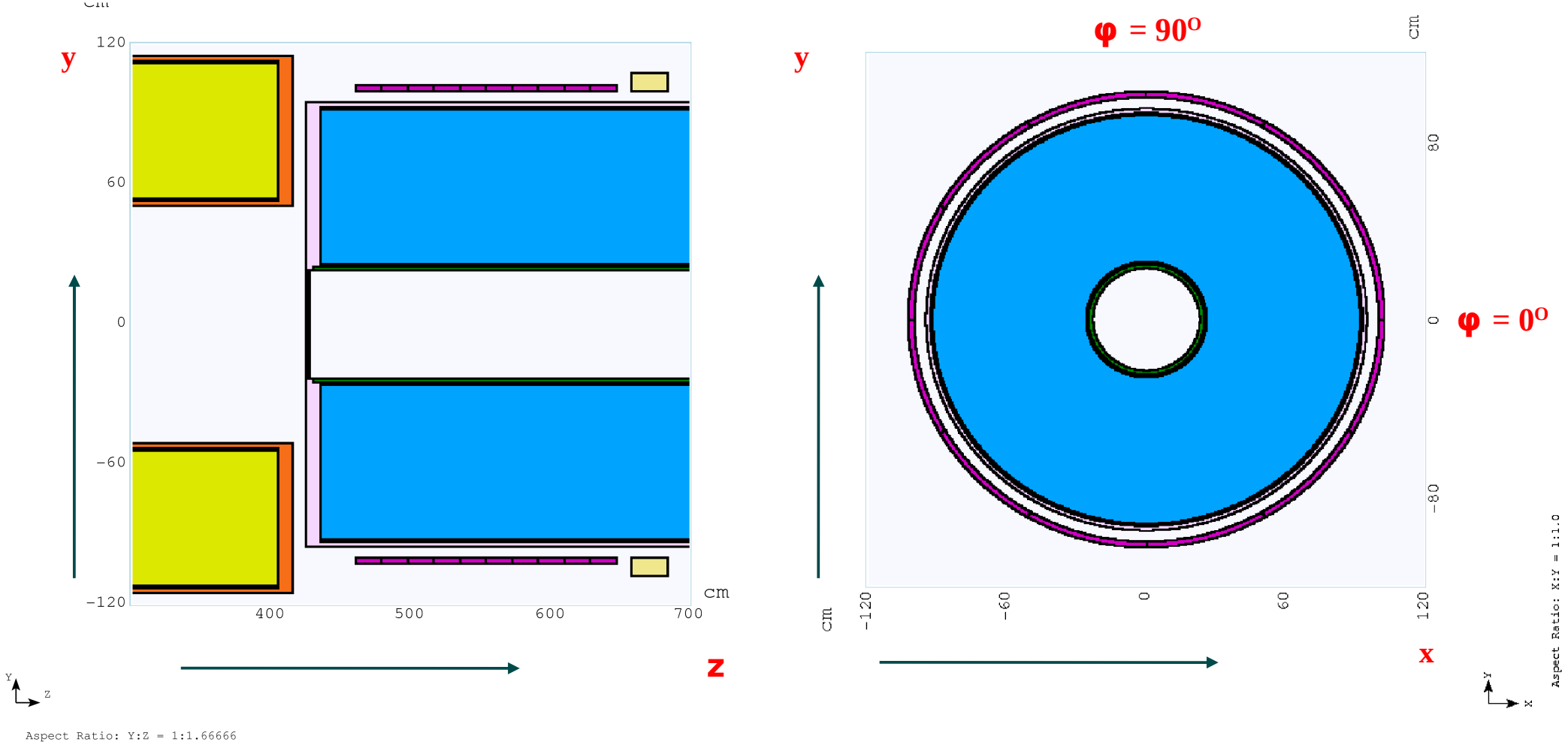
xz AT y = 0.0 cm



xy AT z = 426.0 cm



SC#3 SEGMENTATION DETAILS : yz AT x = 0.0 cm [LEFT] AND xy AT z = 540.0 cm [RIGHT] CROSS SECTION.



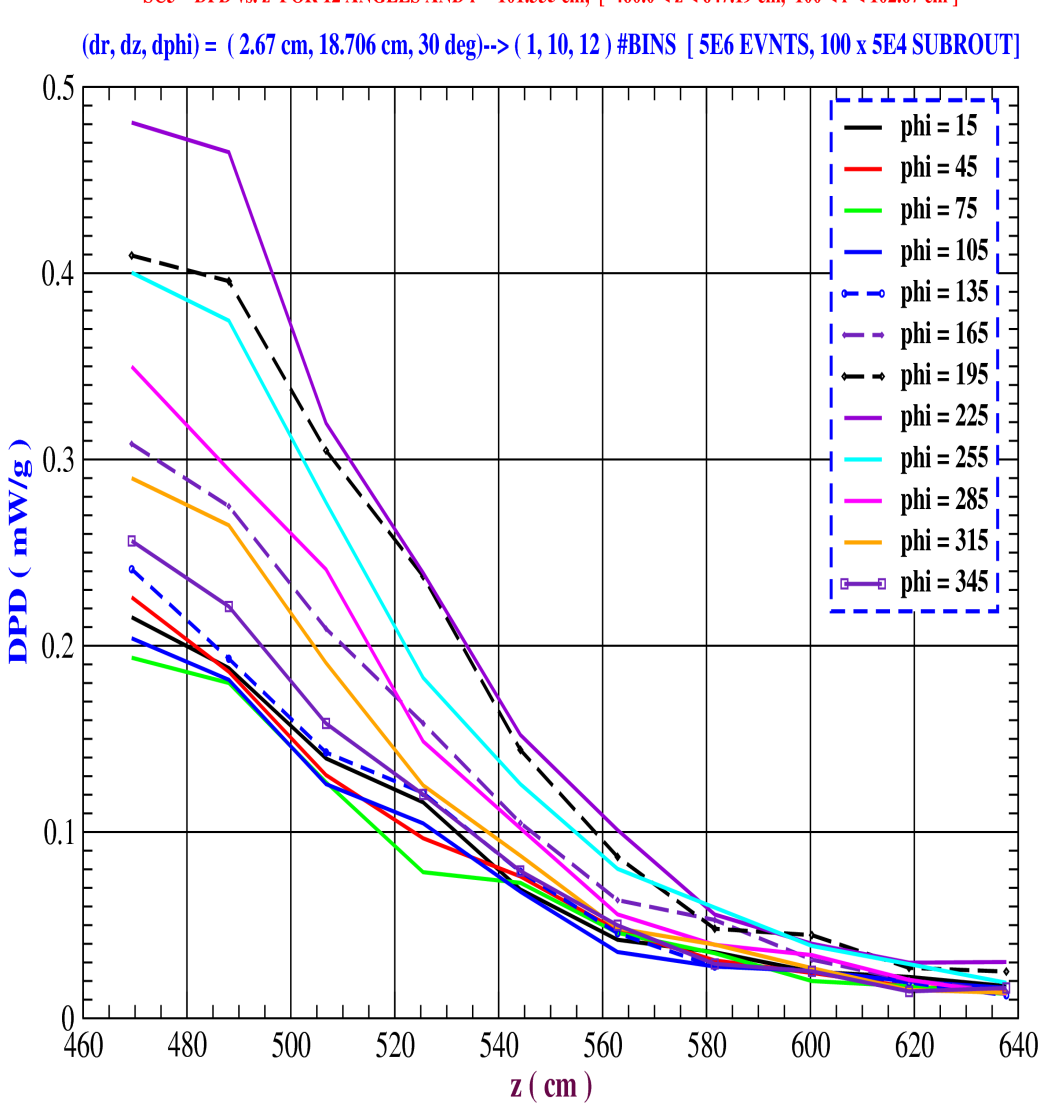
$100.0 < r < 102.67$ cm $dr = 2.67$ cm $N_r = 1$ bins

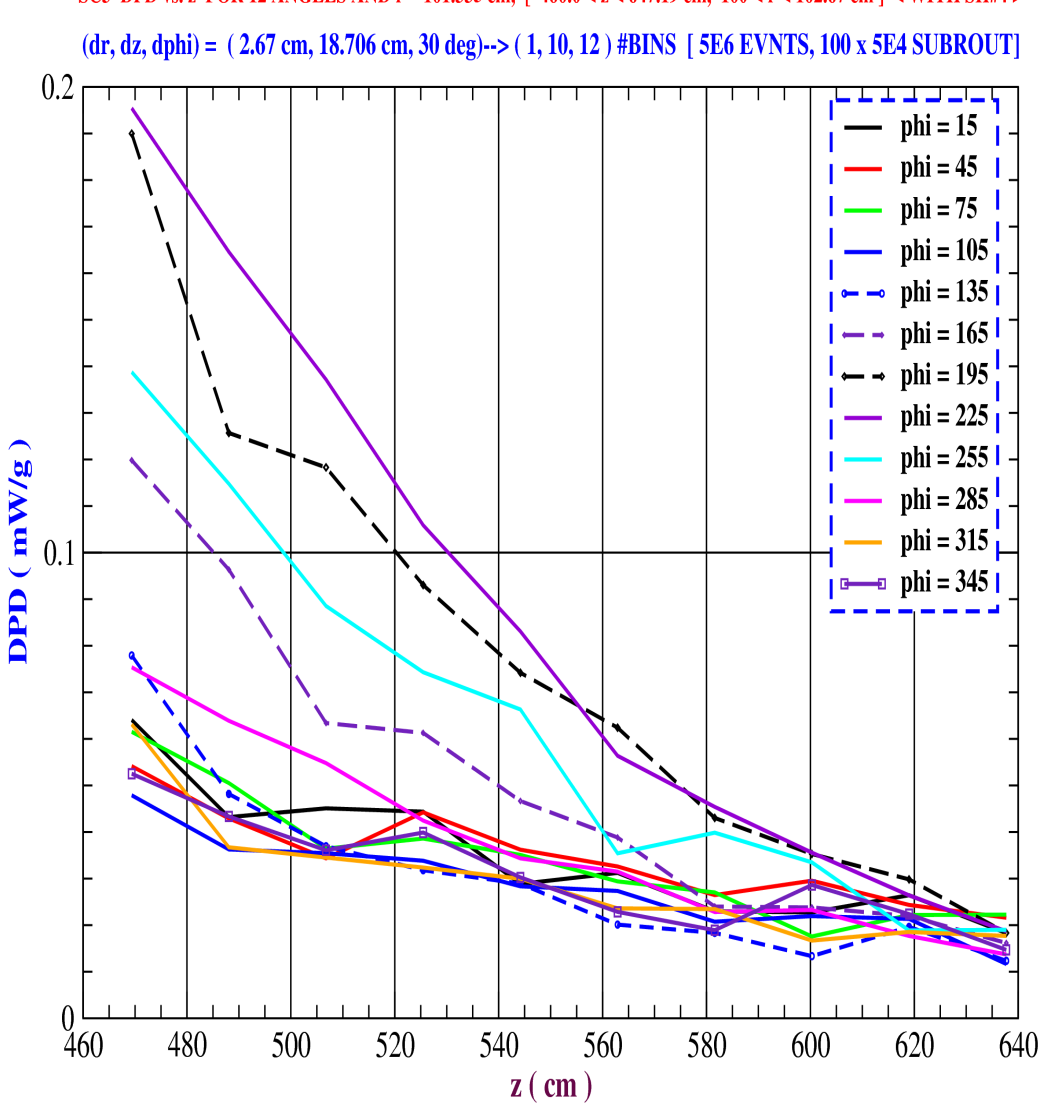
$460.0 < z < 647.19$ cm $dz = 18.706$ cm $N_z = 10$ bins

$0.0 < \varphi < 360.0$ deg. $d\varphi = 30$ deg. $N_\varphi = 12$ bins

$N_{tot} = 120$ "pieces"

SC#3 : TDPD AZIMUTHAL DISTRIBUTION FOR 12 ANGLES.
BEFORE (LEFT) AND AFTER ADDITIONAL SHIELDING AFTER RS (RIGHT)





PEAK: 0.48 mW/g AT (r, z, phi) = (101.335 469.353 225) **PEAK:** 0.20 mW/g AT (r, z, phi) = (101.335 469.353 225)

TDP: 0.253 kW (''PIECES'') vs. 0.252 kW (NO SEGMNT) **TDP:** 0.098 kW (''PIECES'') vs. ? (NO SEGMNT)

WITH THE ADDITIONAL SHIELDING THE PEAK TDPD DECREASES BY MORE THAN 50%
AND FOR 1 MW IS MUCH SMALLER THAN 0.1 mW / g

mars15 (2014) : ***~ 3.5 - 4 hrs FOR 5E4 EVENTS, ~ 4 - 8 hrs FOR 5E6 = 100 SUBDIRECTORY x 5E4 SIMULATIONS***
(SINCE SOMETIMES SOME SUBDIRECTORY JOBS WILL START AFTER SOME WAITING TIME) **[BOTH:MCNP, ICEM =1]**
{DING XIAOPING SET UP 3 NEW GNUMake FILES FOR mars1514 MULTIDIRECTORY JOB}
mars1514 + new Princeton cluster much faster than mars1512 + Old Princeton cluster

******* DEPOSITED POWER IN DIFFERENT PARTS OF THE TARGET STATION IN kW (Np / STEP): 5E6 / 10^{-3} *******

A) SC# 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 : 1.655 / 0.364 / 0.098 / 0.016 / 0.022 / 0.005 / 0.004 / 0.006 / 0.010 / 0.002

TOTAL DP SC#1-10: 2.18 { WITH ~ 2.12 kW JUST IN SC#1+2+3 }

B) DP IN RS COILS RS# 1 / 2 / 3 / 4 / 5 : 401.324 / 192.997 / 100.133 / 58.707 / 34.549

TOTAL: 787.709 (USING A 65% Cu + 7% H_2O +288% MgO MIXTURE WITH ~ 7.0 g/cc DENSITY)

C) DP IN SHIELDING SH# 1 / 2 / 3 / 4 : 111.044 / 519.229 / 39.729 / 695.231

TOTAL : 1,365.233 (~ 35 % OF 4 MW)

D) DP IN VESSELS SHVS# 1 / 2 / 3 / 4 : 14.91 / 50.301 / 2.850 / 387.83

TOTAL: 455.895

E) DP IN C TRGT : 112.86 (USING 1.8 g/cc DENSITY FOR BOTH TARGET AND DUMP)

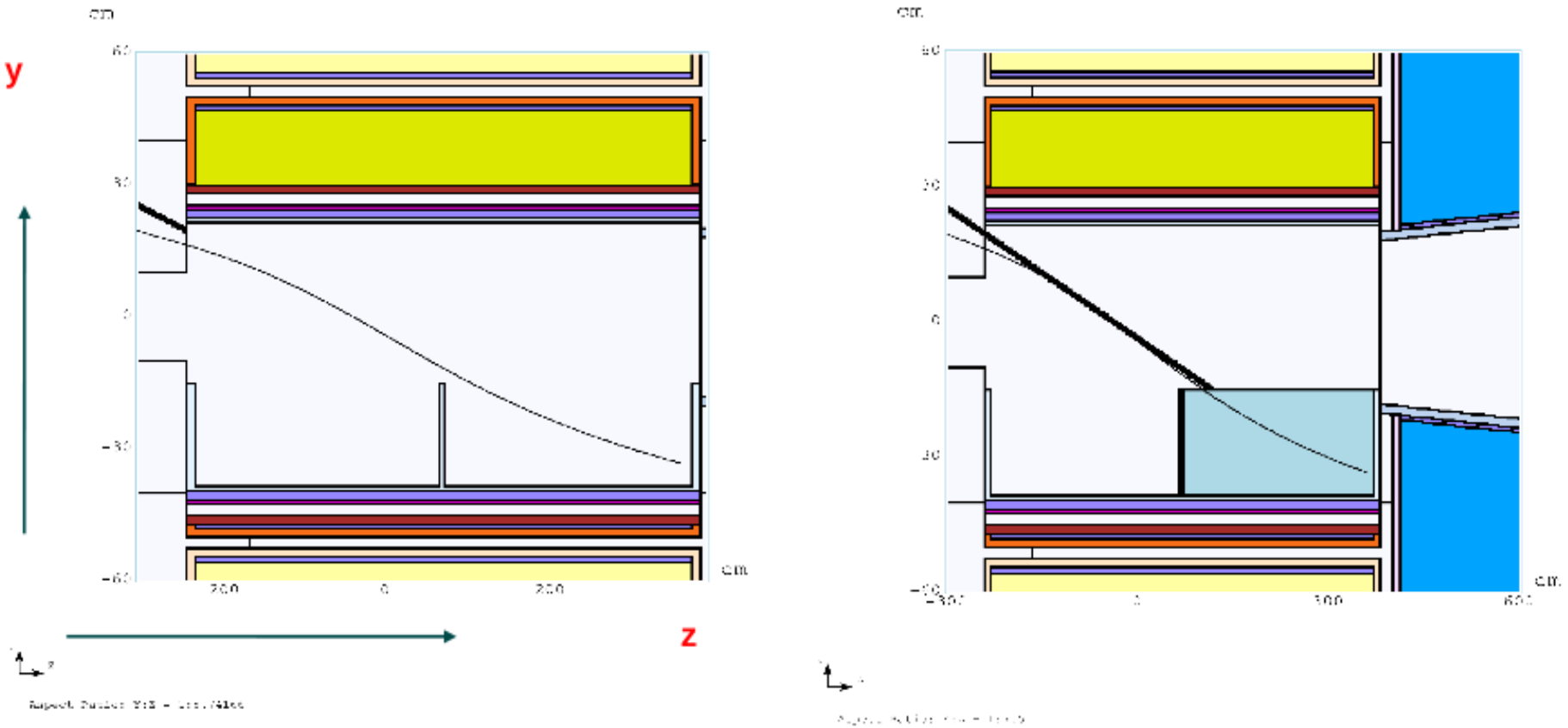
F) DP IN Be WINDOW 1 / 2 / 3 / 4 : 3.017 / 1.523 / 1.410 / 1.184

TOTAL: 7.135

G) DP IN BP# 1 / 3 : 217.063 / 287.32

TOTAL DP IN TARGET STATION :3,235.46

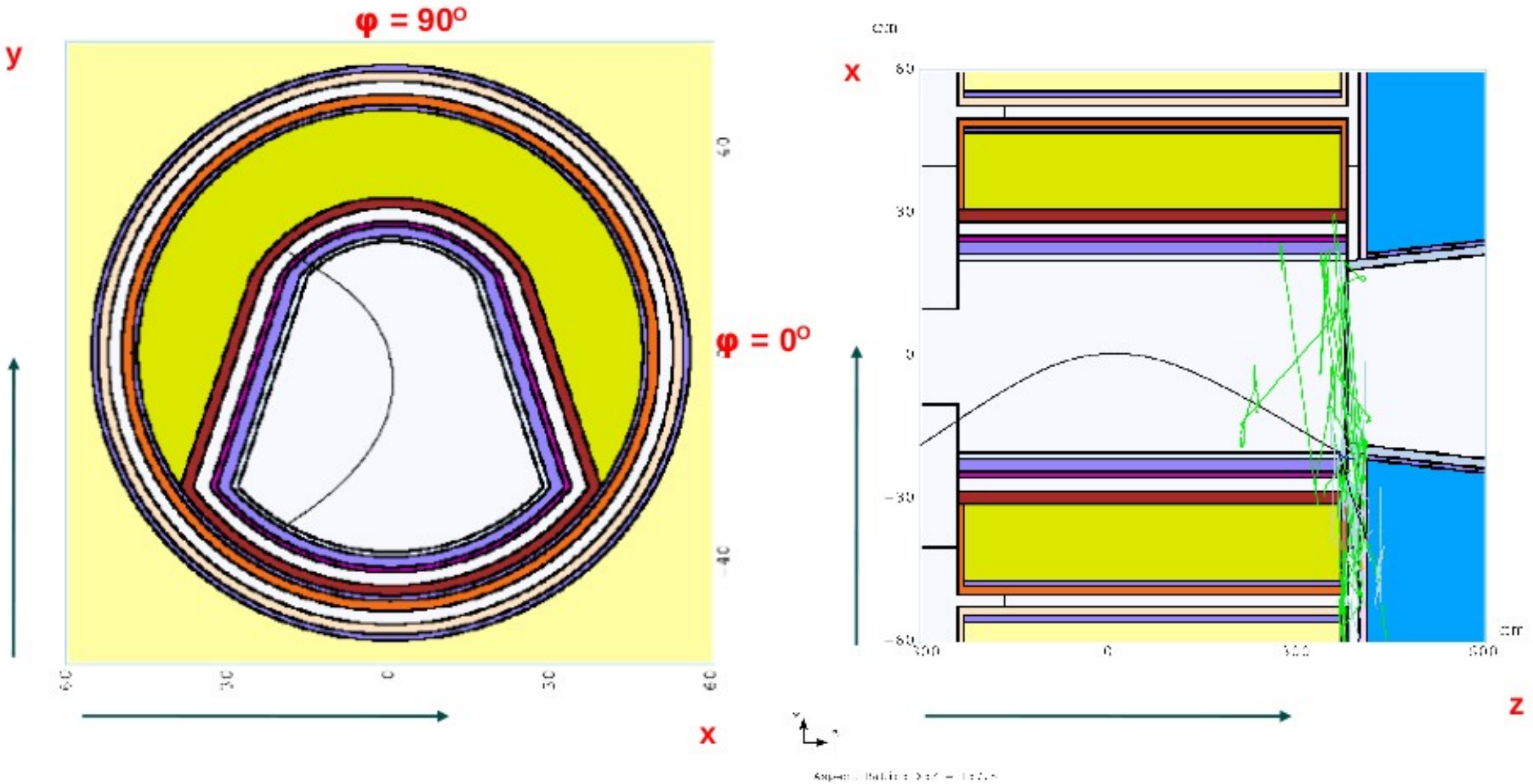
IDS120j: yz CROSS SECTION WITH THE PROTON BEAM CENTROID P12 TRAJECTORY SHOWING (RIGHT) AND WITHOUT SHOWING (LEFT) THE Hg POOL AND Hg JET.



PROTONS ENTER THE Hg POOL AT (x, y, z) ~ (- 1.61, -15.00, 104.66) cm AND WILL BE STOPPED BY THE SIDE (SEMICIRCULAR) WALL AT (x, y, z) ~ (-19.39, -33.26, 358.80) cm (~ 10 cm BEFORE THEY REACH THE RIGHT SIDE FLANGE OF Hg MODULE) COVERING A DISTANDE ~ 255.41 cm ~ 17 IL (1 IL ~ 15 cm).
IS IT POSSIBLE FOR POOL TO BE SORTER AND FILL THE REST OF THE UPSTREAM VOLUME WITH SHIELDING ?

NOTICE : R1, HU (HL ?) DIMENSIONS OF Hg MODUL ARE DETERMINED FROM THE SPACE NEEDED FOR THE PROTON BEAM TRAJECTORY. DIFFERENT INJECTION POINTS WILL PROBABLY REQUIRE DIFFERENT VALUES FOR THESE PARAMETERS.

IDS120j: yx (AT z = 200 cm) (LEFT) AND xz (RIGHT) CROSS SECTION WITH THE PROTON BEAM CENTROID P12 TRAJECTORY.



20to2T5m : yz CROSS SECTION (x = 0.0 cm) WITH B FIELD MAP AND CENTROID TRAJECTORY WITHOUT C TARGET / DUMP PRESENT . THE BEAM WILL REACH THE CRYO#1 UPSTREAM Be WINDOW (AT z ~ 430 cm) NEAR THE BOTTOM AREA. POWER LEAK FLOW { ENERGY FLOW = KE (p, n)+E($e^{\pm}$, $\pi^{\pm}$, π^{0}, $\mu^{\pm}$, $K^{\pm}$, γ) } .

[z = - 200.0 , 1500.0 cm, R = 210.0 cm SURFACE DETECTORS].