# IDS120hm GEOMETRY WITH MODIFIED Hg POOL VESSEL

# SIMULATIONS FOR 60% W + 40% He SHIELDING WITHOUT/WITH Hg IN THE POOL AND REMOVING SH1 (P11/P12 'POINTS')

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**IDS120hm: (m IS FOR) modified Hg pool vessel IN IDS120h.**

**# WITHOUT AND WITH Hg IN THE POOL SIMULATIONS.**

**# REMOVING SH1.**

**# P11/P12 INITIAL PROTON BEAM POSITION SIMULATIONS.**

**>mars1510/MCNP**

**>$10^{-11}$ MeV NEUTRON ENERGY CUTOFF**

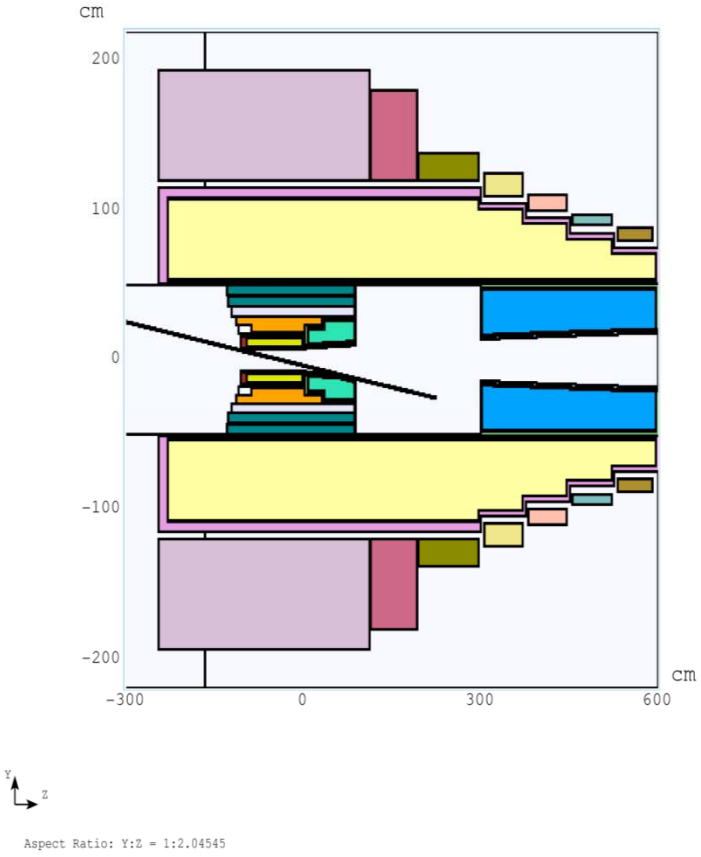
**>SHIELDING: 60% W + 40%H e ( WITH W VESSELS)**

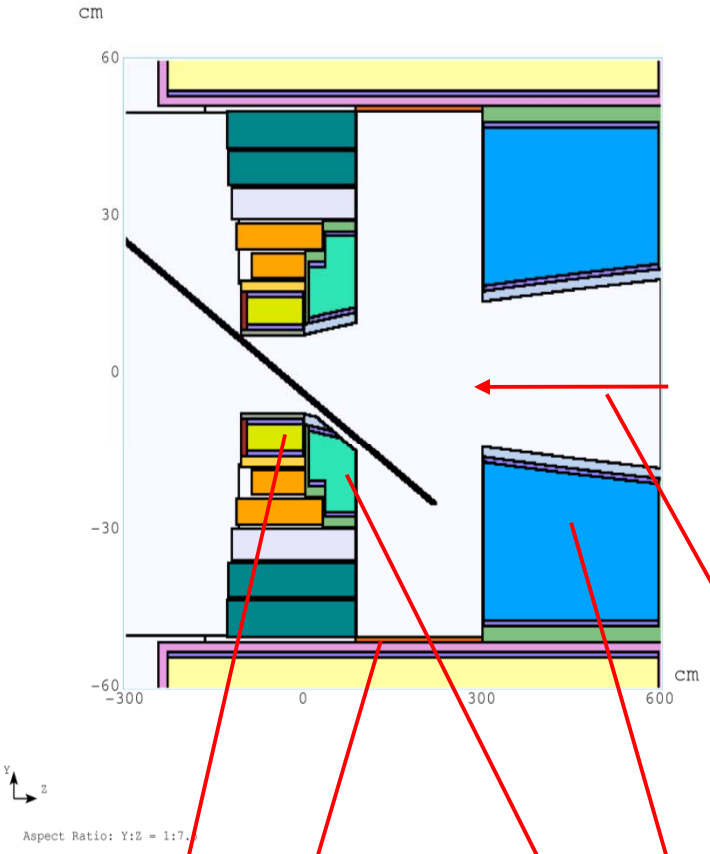
**>4 MW proton beam, Np = 100,000 events.**

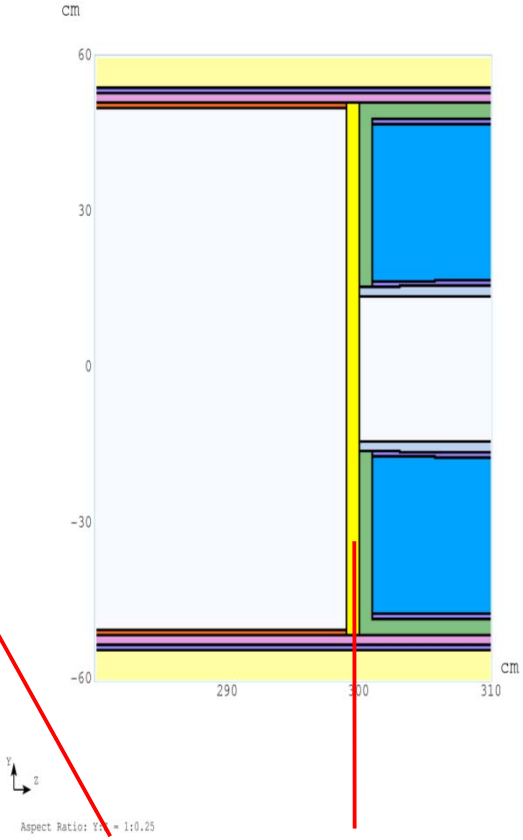
**>PROTON ENERGY E = 8 GeV.**

**>GAUSSIAN PROFILE: $\sigma_x = \sigma_y = 0.12$ cm.**

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




SH1-->SH1A

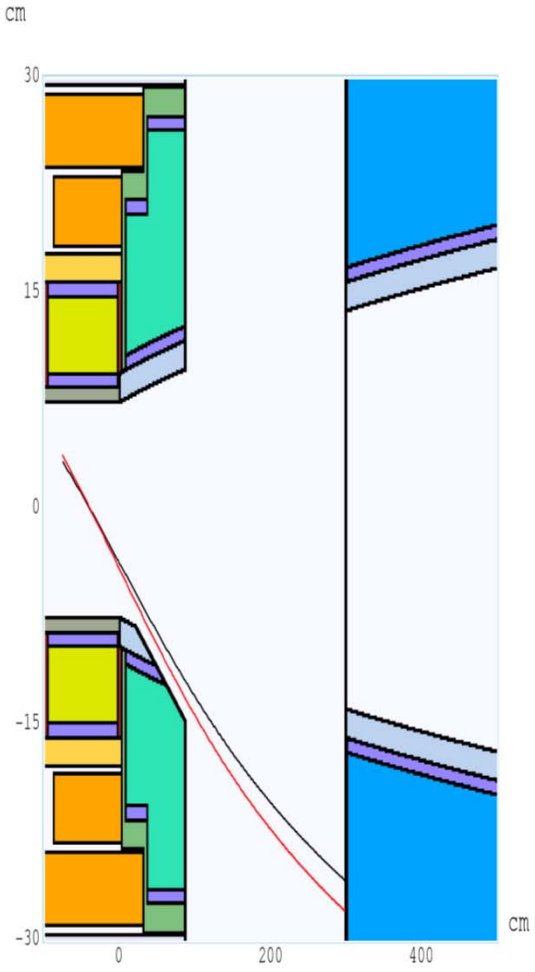
SH2-->SH1B + SH2

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

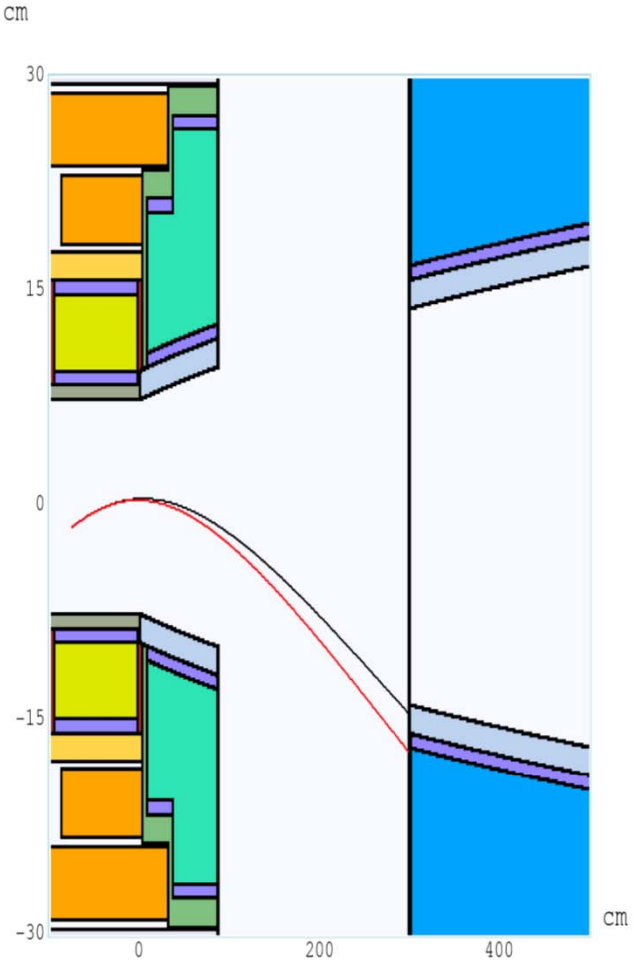
MODIFIED Hg POOL EXTENDS FROM 86 cm TO ~ 300 cm ALONG THE z-AXIS AND UP ~ 50 cm RADIALLY

1 cm THICK STST WALLS USED FOR THE Hg POOL VESSEL

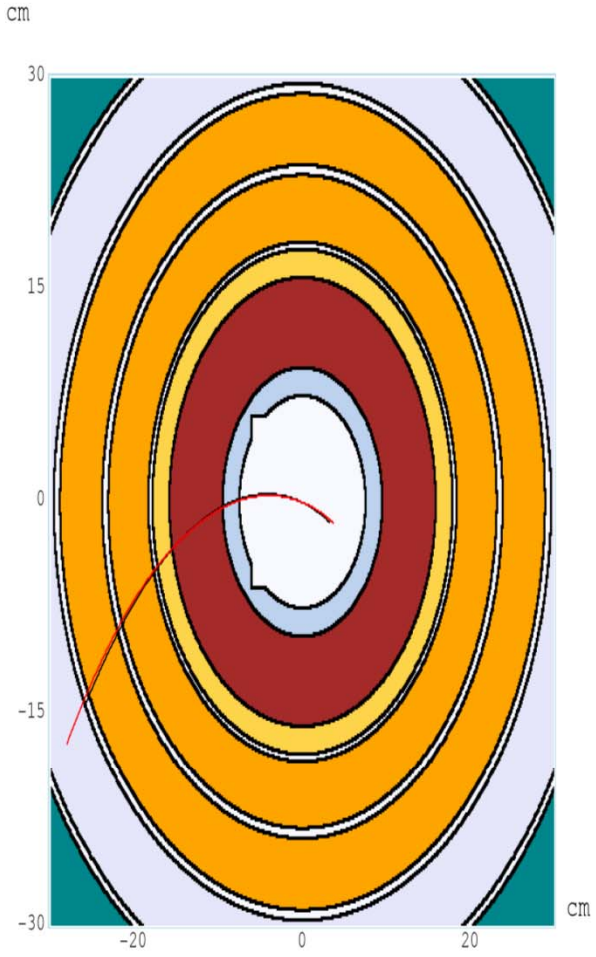
**P11 AND P12 INITIAL PROTONS BEAM POSITION POINTS WILL BE USED FOR THE SIMULATIONS.**
**PROJECTION OF P11 (BLACK) AND P12 (RED) PROTONS TRAJECTORY PLOTS.**




YZ PROJECTION




XZ PROJECTION




XY PROJECTION

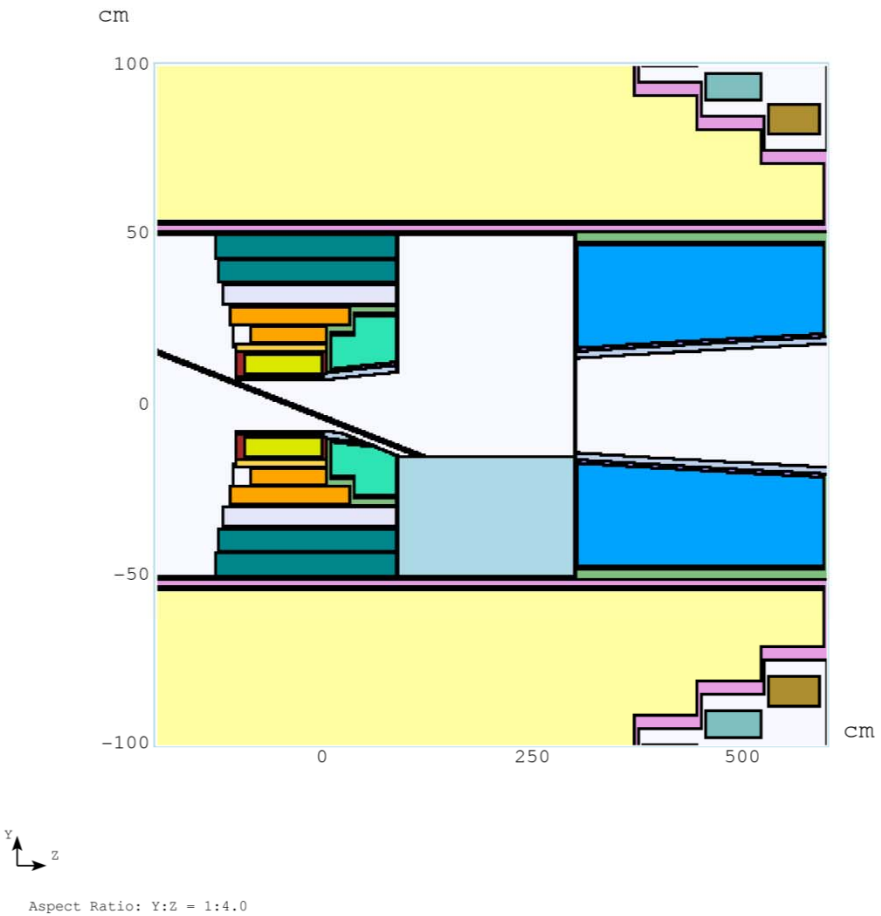
Aspect Ratio: Y:Z = 1:10.0

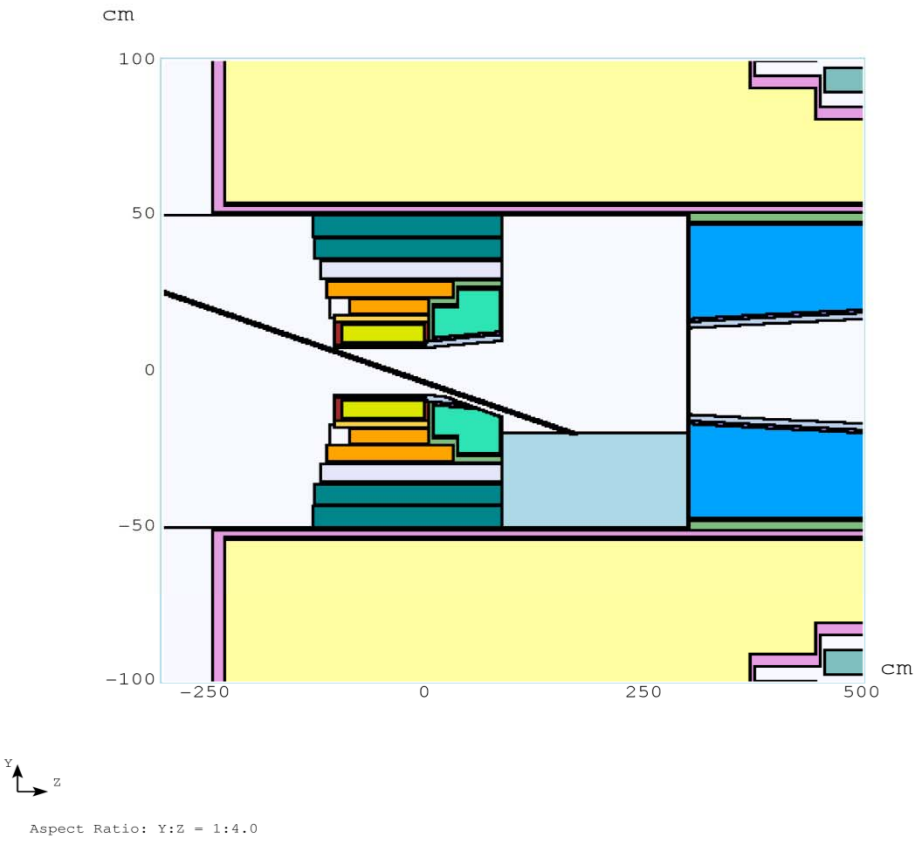
Ratio: X:Z = 1:10.0

Aspect Ratio: X:Y = 1:1.0

**P12 PROTONS ENTER THE Hg POOL SOONER AND THEREFORE HAVE A LONGER TRAJECTORY.**

# IDS120hm WITH Hg IN THE POOL UP TO y = - 15 cm (LEFT) AND UP TO y = - 20 cm (RIGHT)

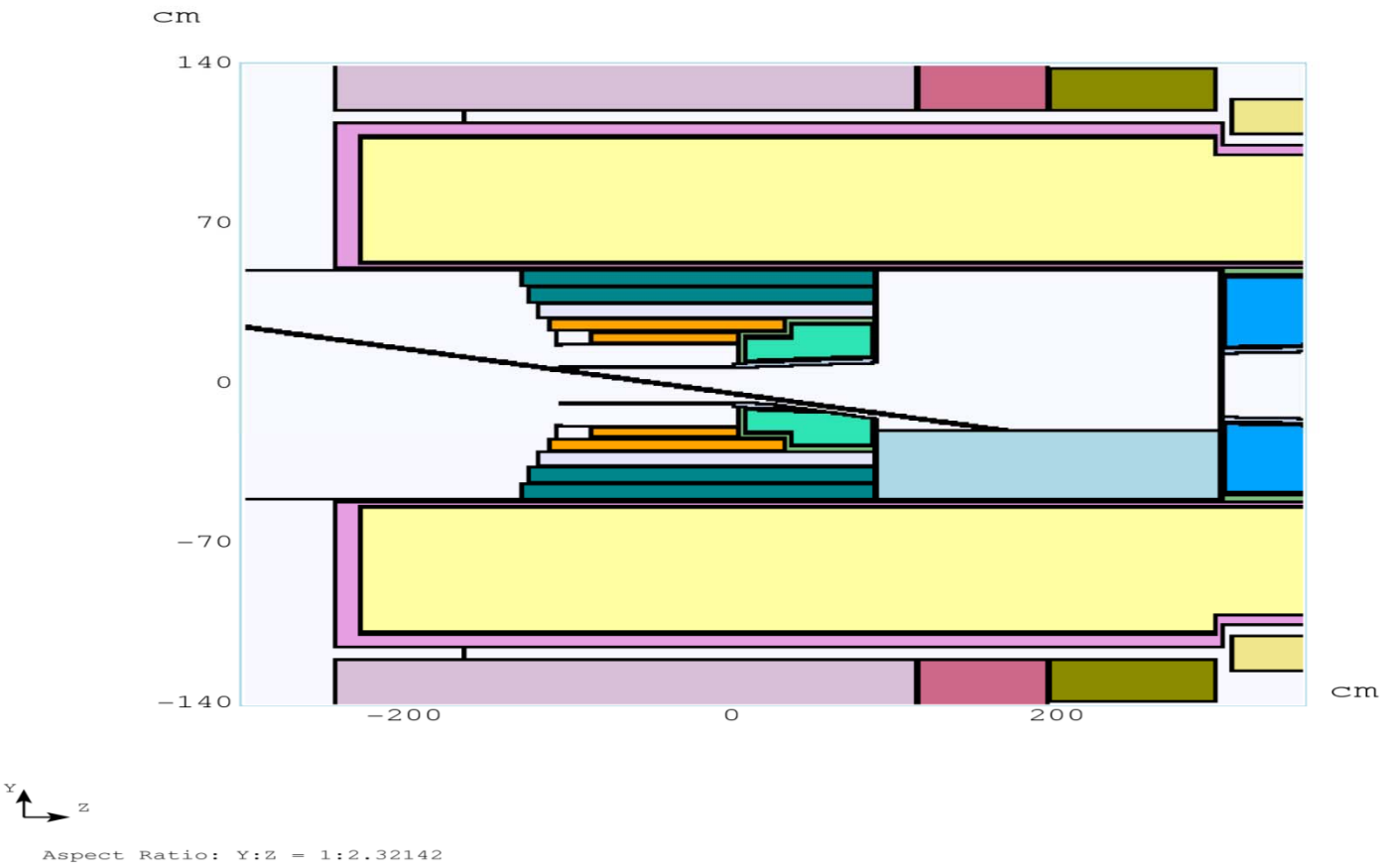



**POOL WITH Hg AT y = - 15 cm HAS SURFACE AT SAME LEVEL AS BEAM PIPE AT z = 300 cm**
**** NOT GOOD ****
**P11: TRAJECTRORY LENGTH ~ 174 cm ~ 12 IL**
**P12: TRAJECTRORY LENGTH ~ 192 cm ~ 14 IL**
**(1 IL~ 15 cm )**
**NECESSARY DEPTH < - 26 cm (P11), - 28 cm (P12)**
**x WALL = +/- 15 cm (P11), +/- 28 (P12)**

**POOL WITH Hg AT y = - 20 cm HAS SURFACE LEVEL 5 cm BELLOW BEAM PIPE AT z = 300 cm**
**P11: TRAJECTRORY LENGTH ~ 104 cm ~ 7 IL**
**P12: TRAJECTRORY LENGTH ~ 131 cm ~ 9 IL**
**(1 IL~ 15 cm )**
**** IS THIS ADEQUATE ?? ****
**WILL BE USED FOR SIMULATIONS WITH Hg IN THE POOL.**

# IDS120hm WITHOUT SH1, Hg SURFACE IN POOL AT y = - 20 cm (WORK STILL IN PROGRESS)




**TABLES NOTATION:** C1 = IDS120hm WITHOUT Hg IN THE POOL VESSEL
C2 = IDS120hm WITH Hg IN THE POOL VESSEL, SURFACE AT y = - 20 cm
C3 = IDS120hm WITHOUT SH#1, Hg POOL SURFACE AT y = - 20 cm
FOR EACH CASE BOTH P11 / P12 INITIAL PROTON BEAM POSITIONS EXAMINED

# 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.**

## POWER DEPOSITED IN THE SHIELDING (SH#), SHIELDING VESSELS (SHVS#), AND SH1 W TUBE 2 (SH1T2)

| – | C1(P11) | C1(P12) | C2(P11) | C2(P12) | C3(P11) | C3(P12) |
|---|---|---|---|---|---|---|
| SH#1A | 556.50 | 554.50 | 560.50 | 560.50 | – | – |
| SH#1B | 343.90 | 385.90 | 340.70 | 391.70 | 442.20 | 485.75 |
| SH#2 | 616.50 | 561.00 | 244.20 | 181.45 | 242.00 | 189.45 |
| SH#3 | 24.22 | 22.36 | 24.08 | 22.18 | 24.27 | 22.05 |
| SH#4 | 61.95 | 65.30 | 79.15 | 82.55 | 103.50 | 106.00 |
| SH#1-4 | 1603.07 | 1589.06 | 1248.63 | 1238.38 | 813.97 | 803.25 |

**SH#1A: > 0.5 MW FOR C1, C2**
**SH#1B: P12 - P11 ~ +40.0 kW C1, C2 --> C3 ~ +100.0 kW**
**SH#2 : P12 - P11 > -50.0 kW C1 --> C2, C3 ~ -370.0 kW**
**SH#1-4: P12 - P11 ~ SMALL SO MOSTLY REDISTRIBUTION OF DP IN SH. C1 --> C2 --> C3 ~ -350 kW / -800 kW**

| – | C1(P11) | C1(P12) | C2(P11) | C2(P12) | C3(P11) | C3(P12) |
|---|---|---|---|---|---|---|
| SHVS#1 | 54.60 | 56.20 | 61.80 | 49.74 | – | – |
| SHVS#2 | 101.25 | 106.15 | 93.55 | 92.90 | 235.15 | 238.30 |
| SHVS#3 | 0.88 | 0.78 | 0.83 | 0.77 | 0.82 | 0.80 |
| SHVS#4 | 25.33 | 26.68 | 41.23 | 44.94 | 54.40 | 57.45 |
| SHVS#1-4 | 182.06 | 189.81 | 197.41 | 188.35 | 290.37 | 296.55 |
| SH1T2(W) | 68.95 | 69.15 | 69.85 | 69.30 | – | – |

**SHVS#2: C1 --> C2 --> C3 ~ -10.0 kW / +145.0 kW**
**SHVS#1-4: C1, C2 --> C3 > +100 kW**
**NO SIGINICANT FLUCTUATIONS BETWEEN P11, P12**

## POWER DEPOSITED IN RESISTIVE MAGNETS (RS#) AND BEAM PIPE (BP#).

| Cu | C1(P11) | C1(P12) | C2(P11) | C2(P12) | C3(P11) | C3(P12) |
|---|---|---|---|---|---|---|
| RS#1+2 | 113.20 | 113.60 | 110.85 | 111.40 | 498.80 | 498.80 |
| RS#3 | 48.45 | 49.32 | 46.61 | 49.11 | 155.95 | 135.45 |
| RS#4+5 | 63.35 | 63.45 | 63.65 | 65.25 | 157.70 | 156.80 |
| RS#1-5 | 225.00 | 226.37 | 222.11 | 225.76 | 812.15 | 791.05 |

**RS#1+2: C1, C2 --> C3 > 3.4 TIMES MORE TDP WITHOUT SH1 (+386.0 kW)**
**RS#1-5: ~ 225 kW --> 812 kW (+587 kW)**
**P11, P12 SMALL DIFERENCES FOR C1, C2 AND ~ 20 kW FOR C3**

| BP | C1(P11) | C1(P12) | C2(P11) | C2(P12) | C3(P11) | C3(P12) |
|---|---|---|---|---|---|---|
| BP#1(W) | 439.15 | 436.90 | 439.97 | 434.50 | 361.10 | 360.45 |
| BP#2(ST) | 245.80 | 242.05 | 247.85 | 242.40 | 269.50 | 265.50 |
| BP#3(ST) | 9.16 | 8.87 | 9.46 | 8.66 | 9.07 | 9.40 |
| BP#1-3 | 694.11 | 687.82 | 697.28 | 685.56 | 639.67 | 635.35 |

**BP#1: C1, C2 --> C3 ~ -80.0 kW**
**BP#2: C1, C2 --> C3 ~ +24.0 kW**
**BP#1-3: C1, C2 --> C3 ~ -54.33 kW**
**P11, P12 IN BP#1-3 DIFFERENCES BETWEEN 5-10 kW.**

## SUMMARY FOR TOTAL POWER DEPOSITED IN DIFFERENT AREAS.

| TOTALS | C1(P11) | C1(P12) | C2(P11) | C2(P12) | C3(P11) | C3(P12) |
|---|---|---|---|---|---|---|
| SC#1-19 | 0.56 | 0.50 | 0.55 | 0.50 | 0.53 | 0.62 |
| SH#1-4 | 1603.07 | 1589.06 | 1248.63 | 1238.38 | 813.97 | 803.25 |
| SHVS#1-4 | 182.06 | 189.81 | 197.41 | 188.35 | 290.37 | 296.55 |
| RS#1-5 | 225.00 | 226.37 | 222.11 | 225.76 | 812.15 | 791.05 |
| BP#1-3 | 694.11 | 687.82 | 697.28 | 685.56 | 639.67 | 635.35 |
| Hg TARG. | 413.50 | 409.00 | 412.25 | 407.90 | 412.45 | 408.60 |
| Hg POOL | – | – | 317.50 | 333.35 | 320.80 | 337.60 |
| HgP.WALLS | 7.00 | 7.67 | 11.83 | 13.00 | 11.93 | 13.19 |
| Be WIND. | 7.78 | 7.89 | 7.63 | 7.40 | 7.69 | 7.41 |
| TOTAL | 3202.03 | 3187.27 | 3185.04 | 3169.50 | 3309.56 | 3293.62 |

**SC#1-19:** ~ 0.5 FOR ALL CASES
**SH#1-4:** ~ 1/2 THE POWER WITHOUT SH1 ( ~ -790.0 kW)
**RS#1-5:** ~ 2.5 TIMES MORE DP WITHOUT SH1 (~ +587.0 kW)
**BP#1-3:** ~ -55.0 kW LESS DP WITHOUT SH1
**BeWind:** ~ 7.4-7.7 kW

## SC#1-11 PEAK VALUES.

| PEAK(mW/g) | C1(P11) | C1(P12) | C2(P11) | C2(P12) | C3(P11) | C3(P12) |
|---|---|---|---|---|---|---|
| SC#1 | 0.025 | 0.018 | 0.028 | 0.027 | 0.020 | 0.035 |
| SC#2 | 0.009 | 0.010 | 0.018 | 0.016 | 0.015 | 0.018 |
| SC#3 | 0.007 | 0.009 | 0.012 | 0.016 | 0.014 | 0.020 |
| SC#4 | 0.011 | 0.014 | 0.013 | 0.012 | 0.014 | 0.016 |
| SC#5 | 0.011 | 0.012 | 0.004 | 0.005 | 0.007 | 0.020 |
| SC#6 | 0.009 | 0.005 | 0.006 | 0.002 | 0.002 | 0.002 |
| SC#7 | 0.005 | 0.003 | 0.005 | 0.014 | 0.007 | 0.001 |
| SC#8 | 0.075 | 0.035 | 0.054 | 0.050 | 0.035 | 0.170 |
| SC#9 | 0.045 | 0.050 | 0.070 | 0.140 | 0.055 | 0.040 |
| SC#10 | 0.060 | 0.070 | 0.006 | 0.070 | 0.060 | 0.040 |
| SC#11 | 0.060 | 0.050 | 0.040 | 0.042 | 0.060 | 0.050 |

**PEAK VALUES WITH EXCEPTION OF TWO CASES MUCH LOWER THAN 0.15 mW/g**

**SC#9 FOR C2(P12) AND SC#8 FOR C3(P12) CASES APPEAR TO HAVE PROBLEM. WE DON'T HAVE THAT PROBLEM FOR P11 POINT. PEAK VALUES SHOW SENSITIVITY ON INJECTION POINT FOR PROTONS BEAM.**