IDS120j WITHOUT RESISTIVE MAGNETS: NEW Hg MODULE

mars1510 (DESKTOP) vs. mars1512 (PRINCETON CLUSTER) [UPDATED]

Nicholas Souchlas, (PBL) (10/6/2013)

IDS120j GEOMETRY, NO RESISTIVE MAGNETS: WITH 20 cm GAPS BETWEEN CRYOSTATS

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 # MODIFIED Hg MODULE SIMULATES VAN GRAVE'S DESIGN.

A SYSTEMATIC COMPARISON BETWEEN mars1510 (DESKTOP) AND mars1512 (CLUSTER).

TARGET STATION POWER DISTRIBUTION AND SC#1 + SC#2 SEGMENTATION STUDIES FROM 1E5 / 5E5 / 4x5E5 / 5E6 / 2E7 EVENTS SIMULATIONS USING mars1510 (DESKTOP) AND mars1512 (PRINCETON CLUSTER). Ding Xiaoping SET UP THE 5E6 EVENT SIMULATIONS IN THE CLUSTER, (100 SUBDIRECTORIES, 5E4 EVENTS EACH).

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>SIMULATIONS CODE: mars1510 / mars1512 (USING MCNP CROSS SECTION LIBRARIES)

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

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

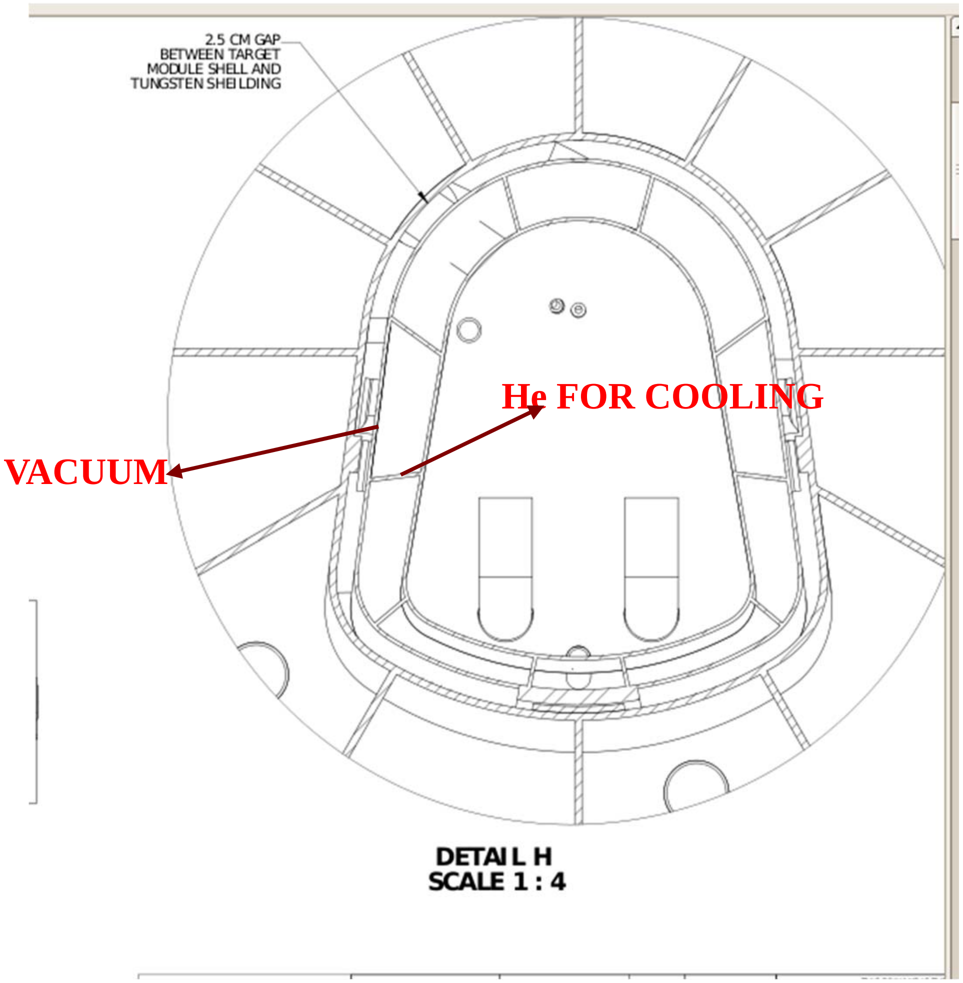
>PROTON BEAM POWER: 4 MW

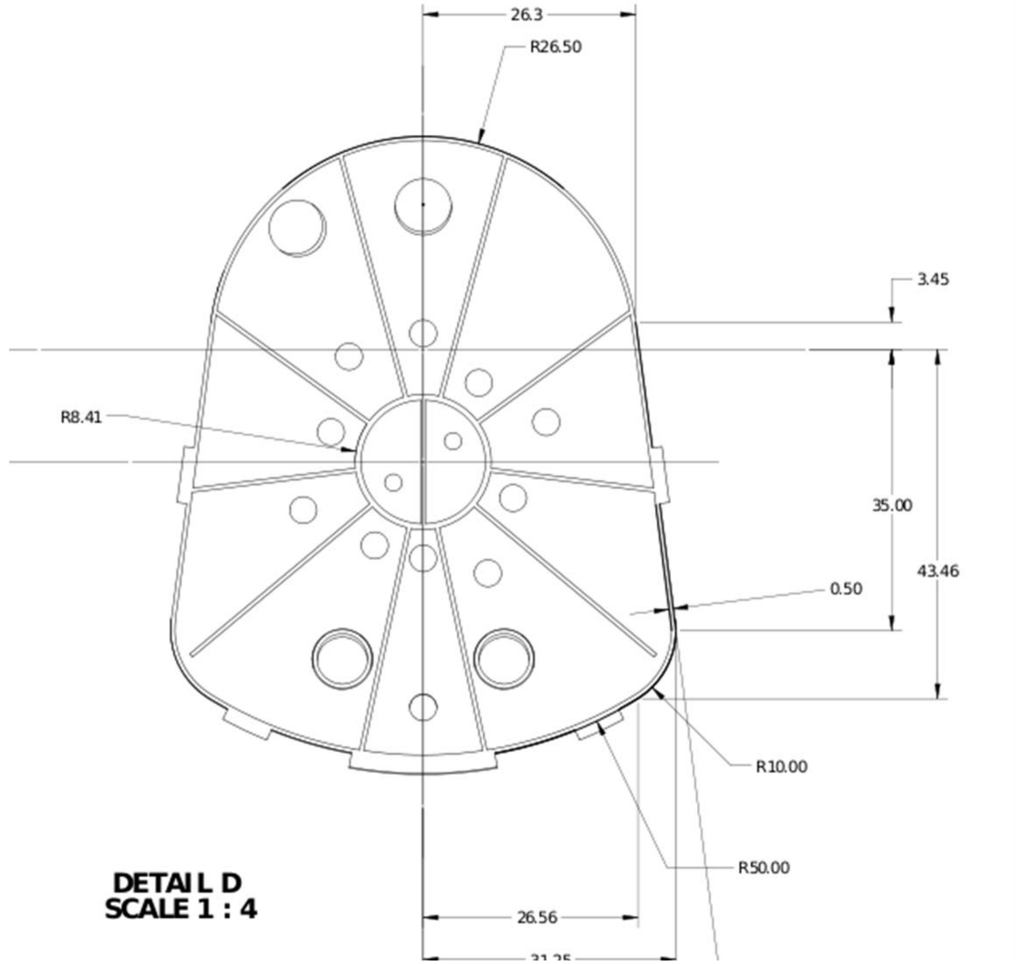
>PROTON ENERGY: E = 8 GeV

>PROTON BEAM PROFILE: GAUSSIAN, $\sigma_x = \sigma_y = 0.12$ cm (P12)

>EVENTS IN SIMULATIONS : N_p = 100,000 / 500,000 / 4 x 500,000 / 5,000,000
20,000,000

IDS120j: yz CROSS SECTIONS WITH DETAILS OF Hg POOL MODULE FROM VAN GRAVE'S PRESENTATION (8 / 9 / 2012).

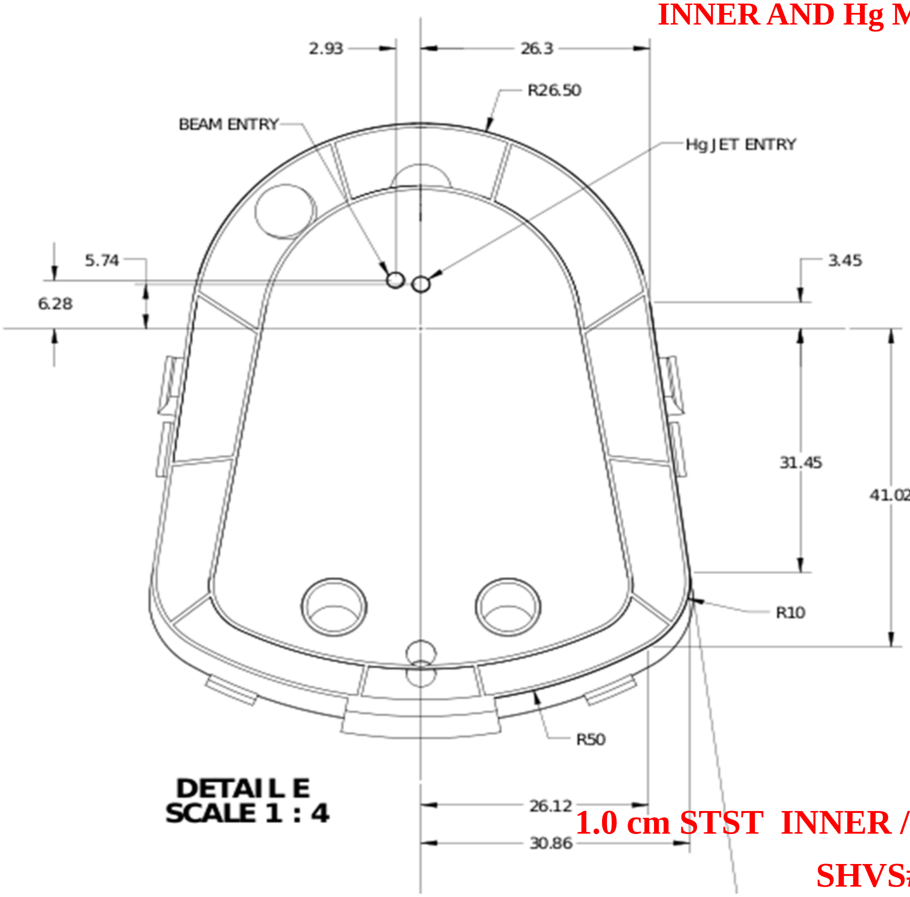




THE DESIGN REQUIRES A 2.5 cm ! GAP BETWEEN SH#1 INNER VESSEL AND Hg POOL MODULE OUTER VESSEL. AN EVEN LARGER SPACE APPEARS TO BE BETWEEN INNER AND OUTER VESSEL OF THE Hg POOL MODULE FOR THE FLOW OF He GAS FOR COOLING THE POOL.

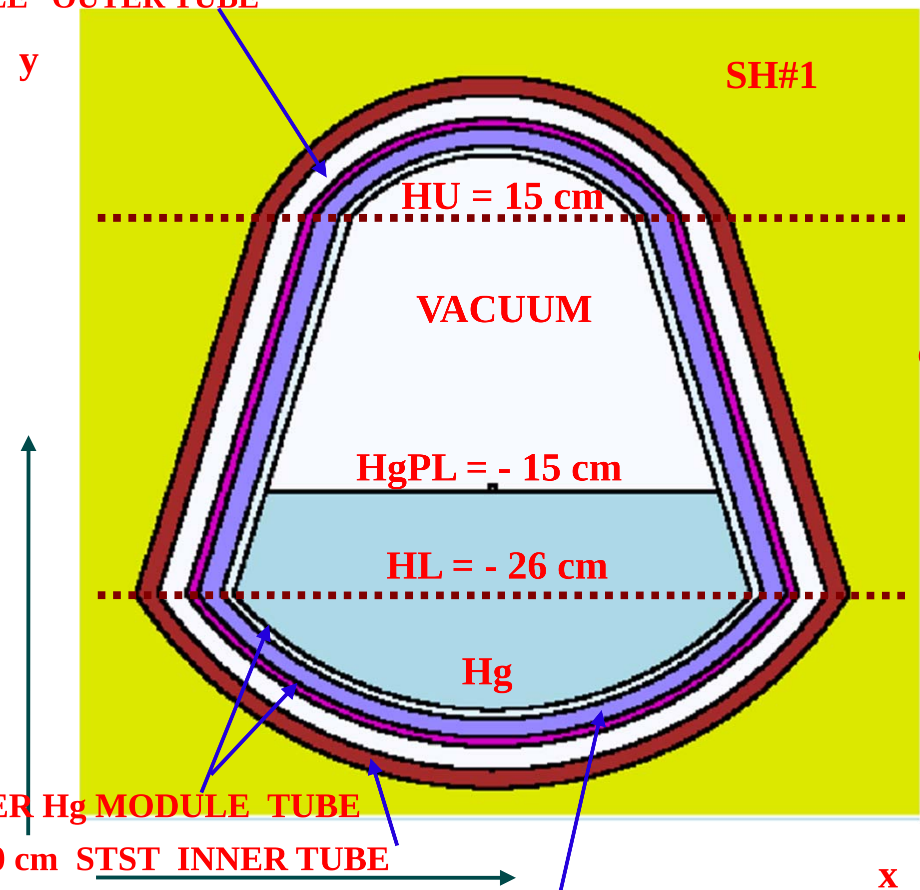
THE RADIUS OF THE UPPER HALF SEMICIRCULAR SECTION OF INNER Hg POOL VESSEL WILL BE 26.5 cm, MUCH LARGER THAN THE BEAM PIPE APERTURE AT THE END OF CRYO#1 (~ 17.7 cm).

IDS120j: yx CROSS SECTION WITH DETAILS OF Hg POOL MODULE FROM VAN's PLOTS (LEFT) AND ADAPTED DESIGN FOR MARS SIMULATIONS (RIGHT) [AT z = 100 m].



2.5 cm VACUUM GAP BETWEEN SHVS#1 INNER AND Hg MODULE OUTER TUBE

$\varphi = 90^O$



$\varphi = 0^O$

1.0 cm STST INNER / OUTER Hg MODULE TUBE

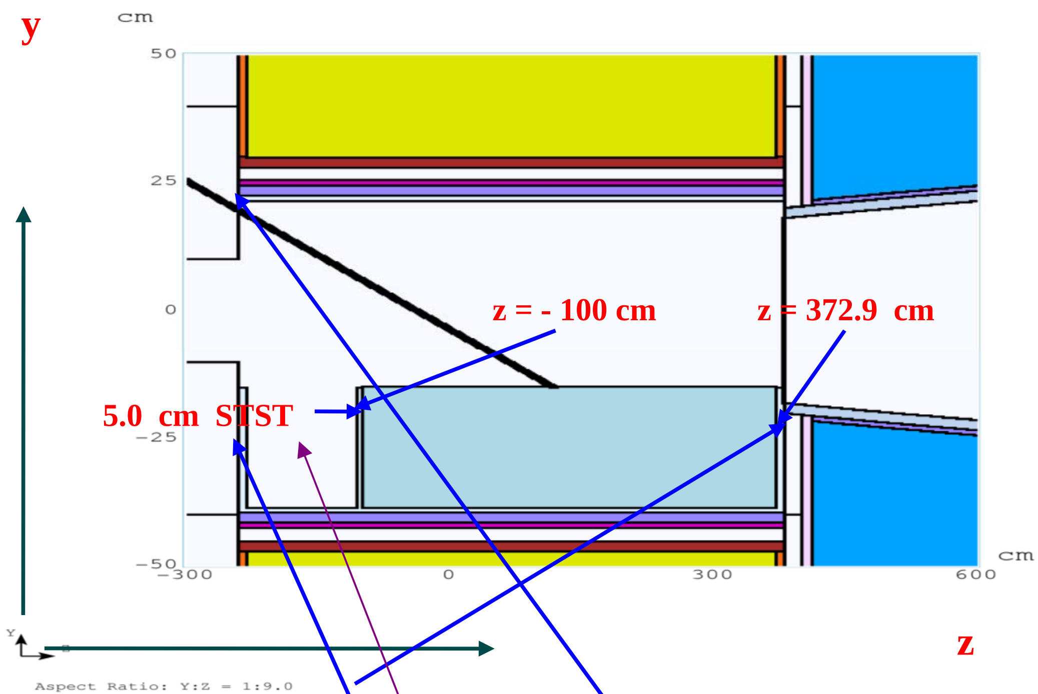
SHVS#1: 2.0 cm STST INNER TUBE

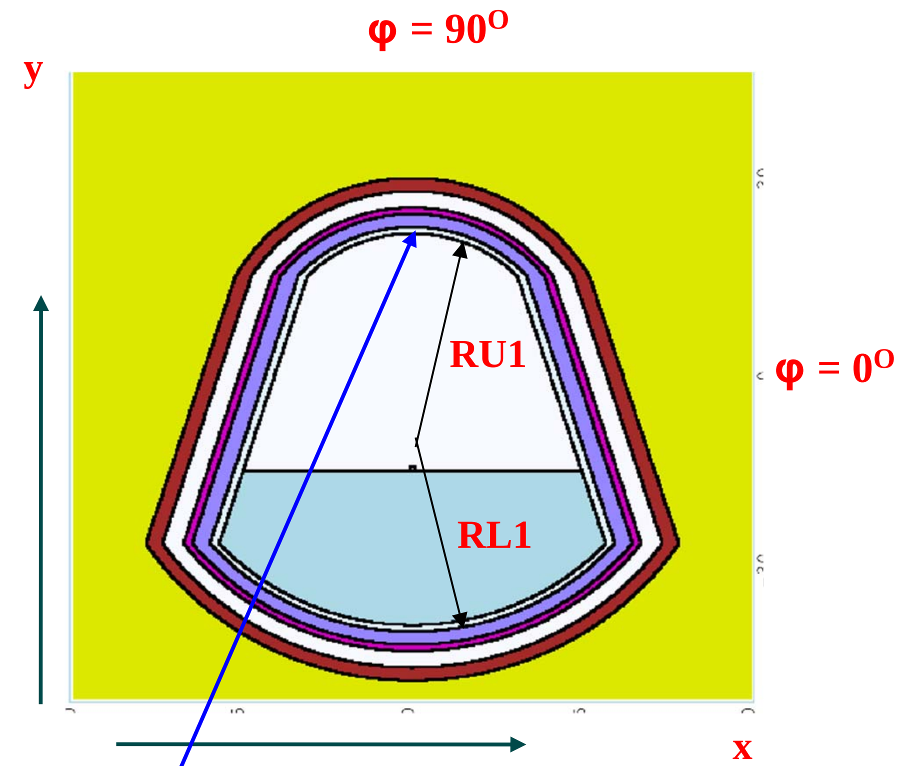
x

2.0 cm He GAP BETWEEN INNER AND OUTER MODULE TUBES FOR COOLING.

EVERYTHING HAS BEEN PARAMETRIZED FOR FUTURE CONVINIENCE. THE HEIGHTS OF THE END POINTS OF THE STRAIGHT SECTIONS ARE HL = - 26 cm AND HU = 15 cm. THE FREE Hg POOL SURFACE IS AT y = - 15 cm. THE RADIUS OF THE LOWER HALF OF THE INNER VESSEL OF THE Hg MODULE IS NOW SMALLER THAN BEFORE : FROM ~ 45 cm ----> ~ 39 cm. THE REST OF THE SPACE BETWEEN SHVS#1 INNER AND OUTER TUBE (AT R ~ 115 cm) IS FILLED WITH SHIELDING.

IDS120j: yz (LEFT) AND yx AT z = 10 cm (RIGHT) CROSS SECTION WITH DETAILS OF THE NEW Hg MODULE AND THE LOWER HALF OF THE UPSTREAM REGION.



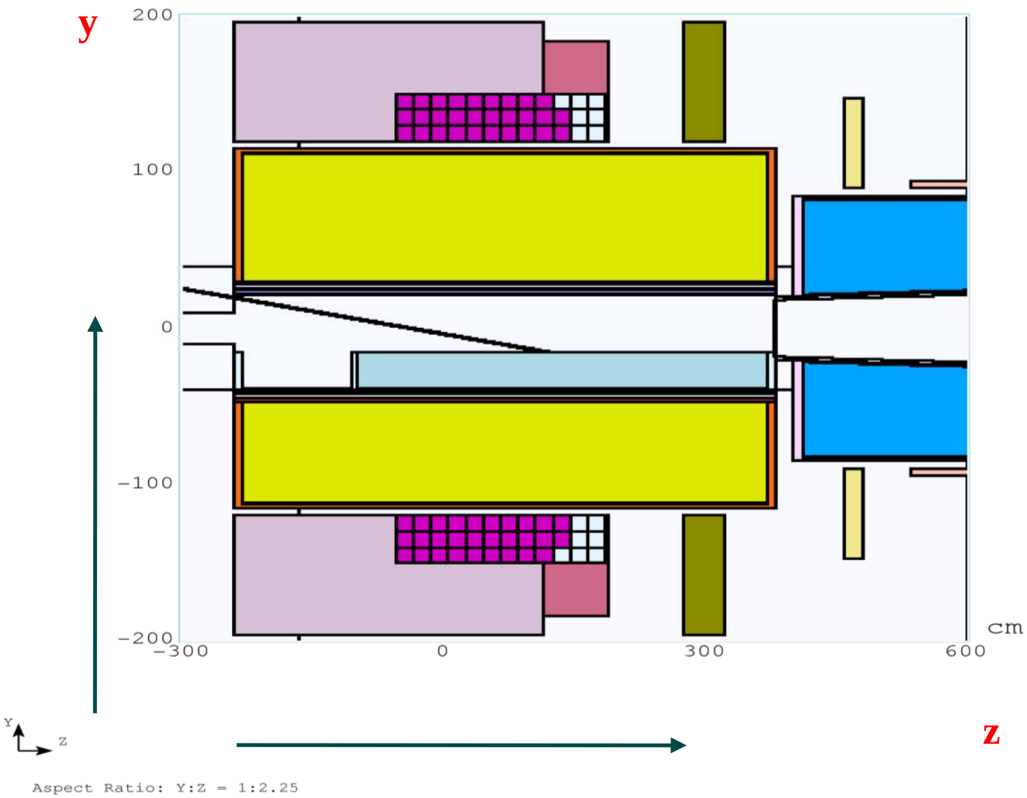


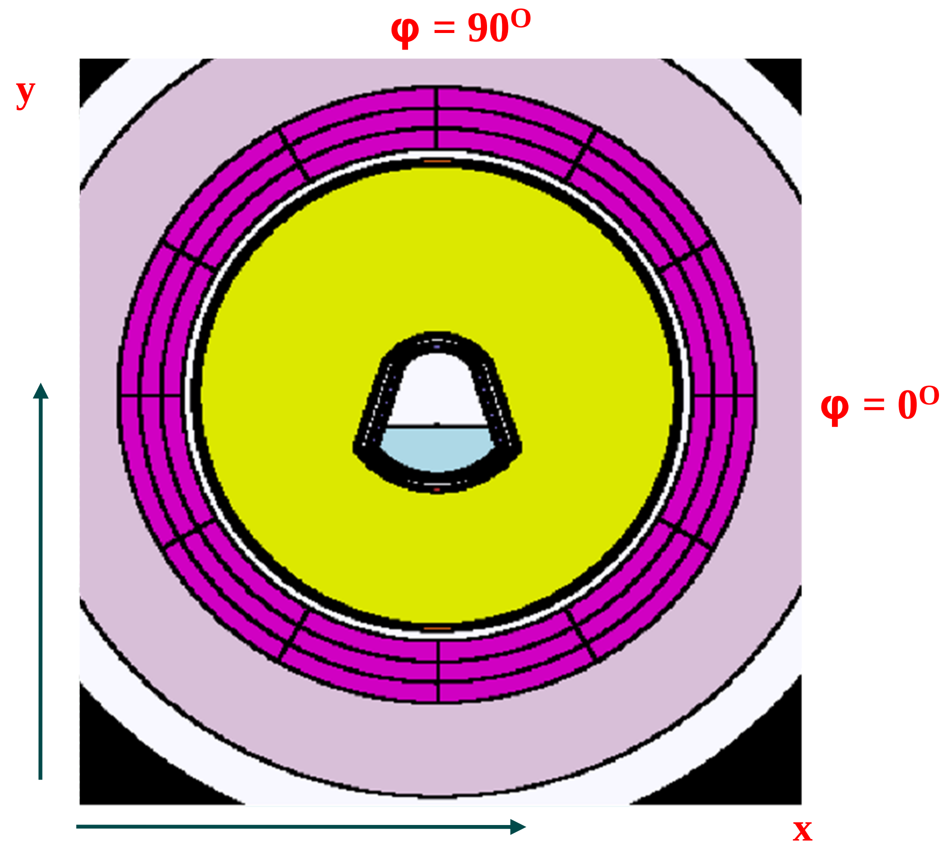
10 cm THICK STST FOR THE UPSTREAM AND DOWNSTREAM FLANGE OF Hg MODULE

THE RADIUS OF THE TOP SEMICIRCULAR SECTION OF THE Hg INNER TUBE IS SUCH THAT WILL NOT INTERFERE WITH THE Hg JET AND THE BEAM PROTONS AT THE BEGINNING OF CRYO#1 (z ~ - 240 cm) [RU1 = 28.0 cm AND RL1 = 45.0 cm]

 # ACCORDING TO VAN'S DESIGN THE VOLUME FROM THE BEGINNING OF CRYO#1 (z ~ - 240 cm)TO THE BEGINNING OF THE Hg POOL (z ~ - 100 cm) AND FROM y ~ -15 cm TO THE BOTTOM OF THE Hg MODULE INNER VESSEL (R ~ 39 cm) WILL BE EMPTY TO ACCOMODATE THE PIPES AND OTHER COMPONENTS OF THE Hg POOL MODULE.
 # SOME IMPROVEMENT IN SHIELDING IS ACHIEVED BY UNIFYING SH#1 AND SH#4. THERE WILL BE SIGNIFICANT INCREASE IN THE SHIELDING MASS (> 200 tons) TO BE CONTAINED IN THE NEW VESSEL (SHVS#1) ==> GREATER ASSYMETRY IN THE WEIGHT DISTRIBUTION. He COOLING OF SUCH A LARGE VOLUME (> 22 m^3) OF SHIELDING CAN BE CHALENGING.

IDS120j: yz (LEFT) AND yx CROSS SECTION WITH DETAILS OF THE SC#1+2 SEGMENTATION.





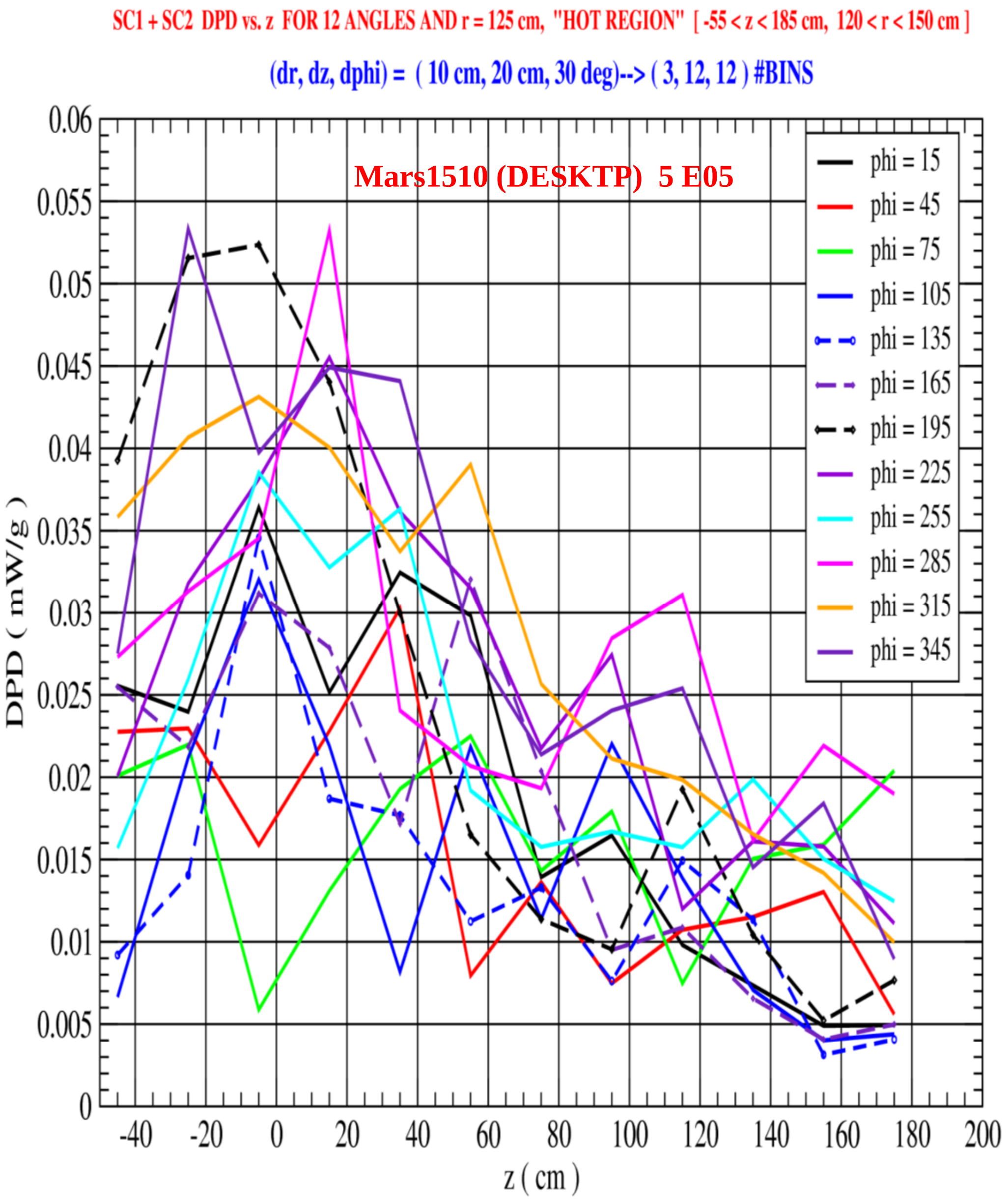
$120.0 < r < 150.0$ cm dr = 10.0 cm N_r = 3 bins

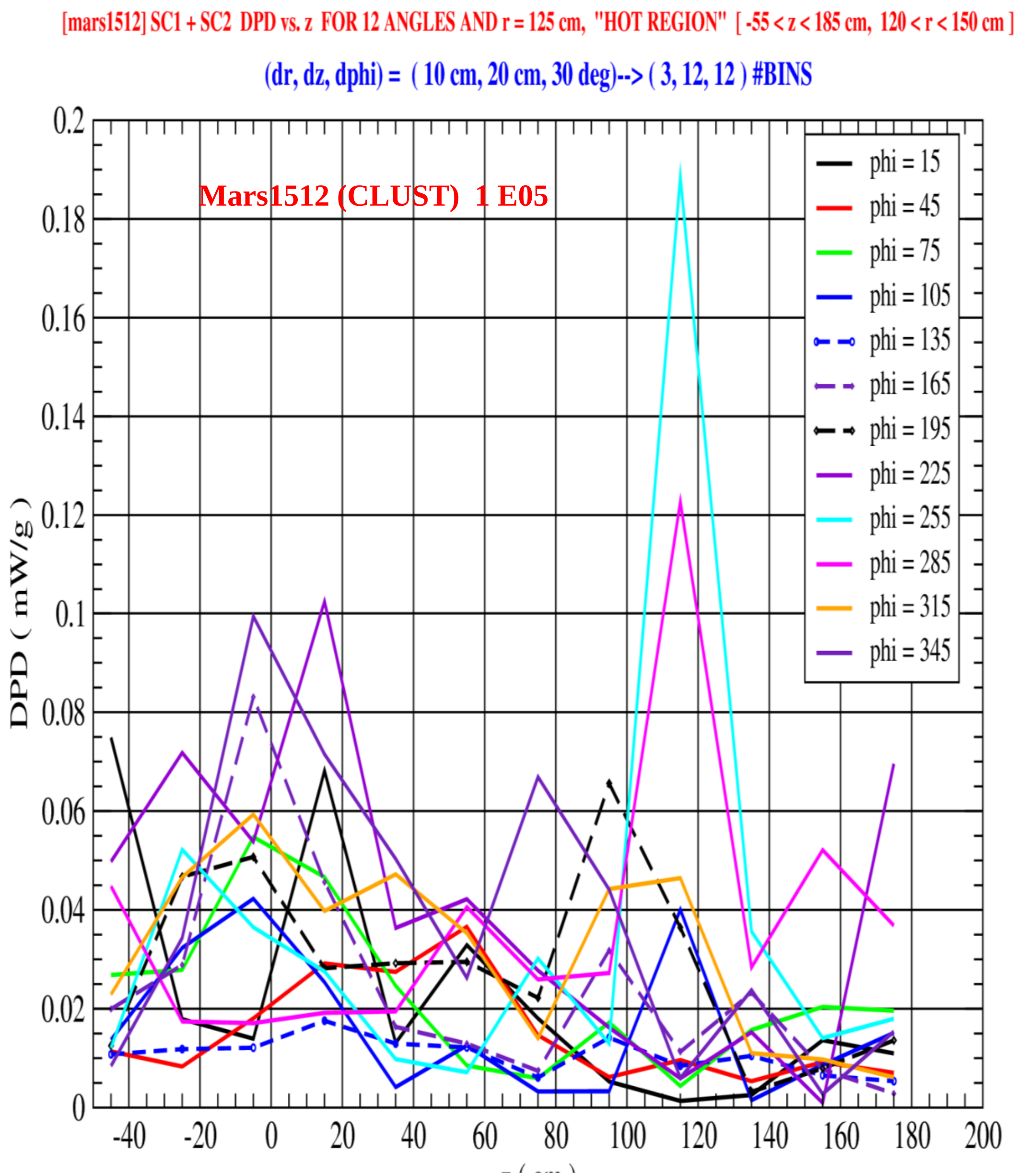
$-55.0 < z < 185.0$ cm dz = 20.0 cm N_z = 12 bins

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

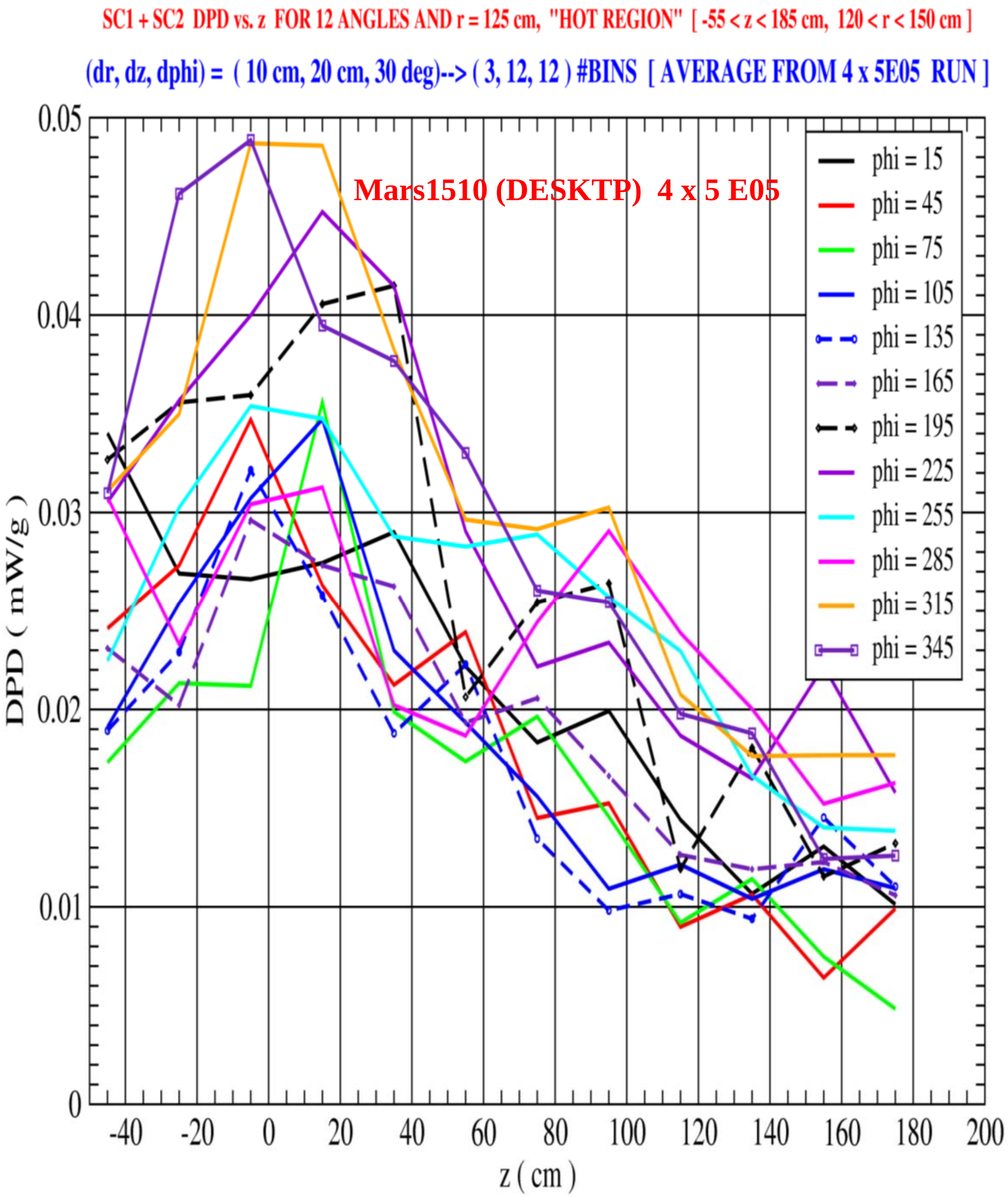
N_{tot} = 432 "pieces"

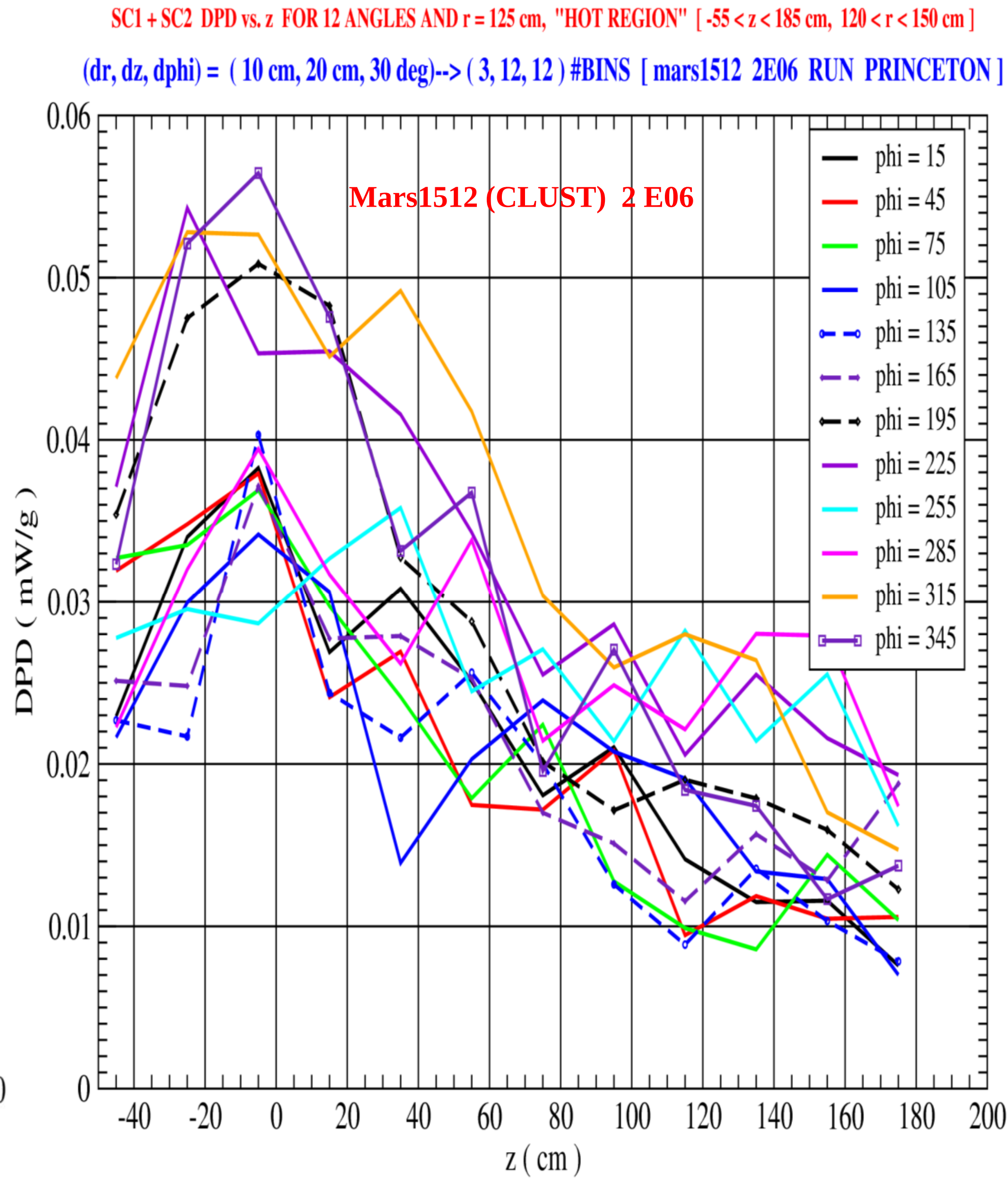
ONLY THE AREA WITH HIGHEST AVERAGE AZIMUTHAL DPD (DETERMINED FROM MARS PLOTS) WAS STUDIED.



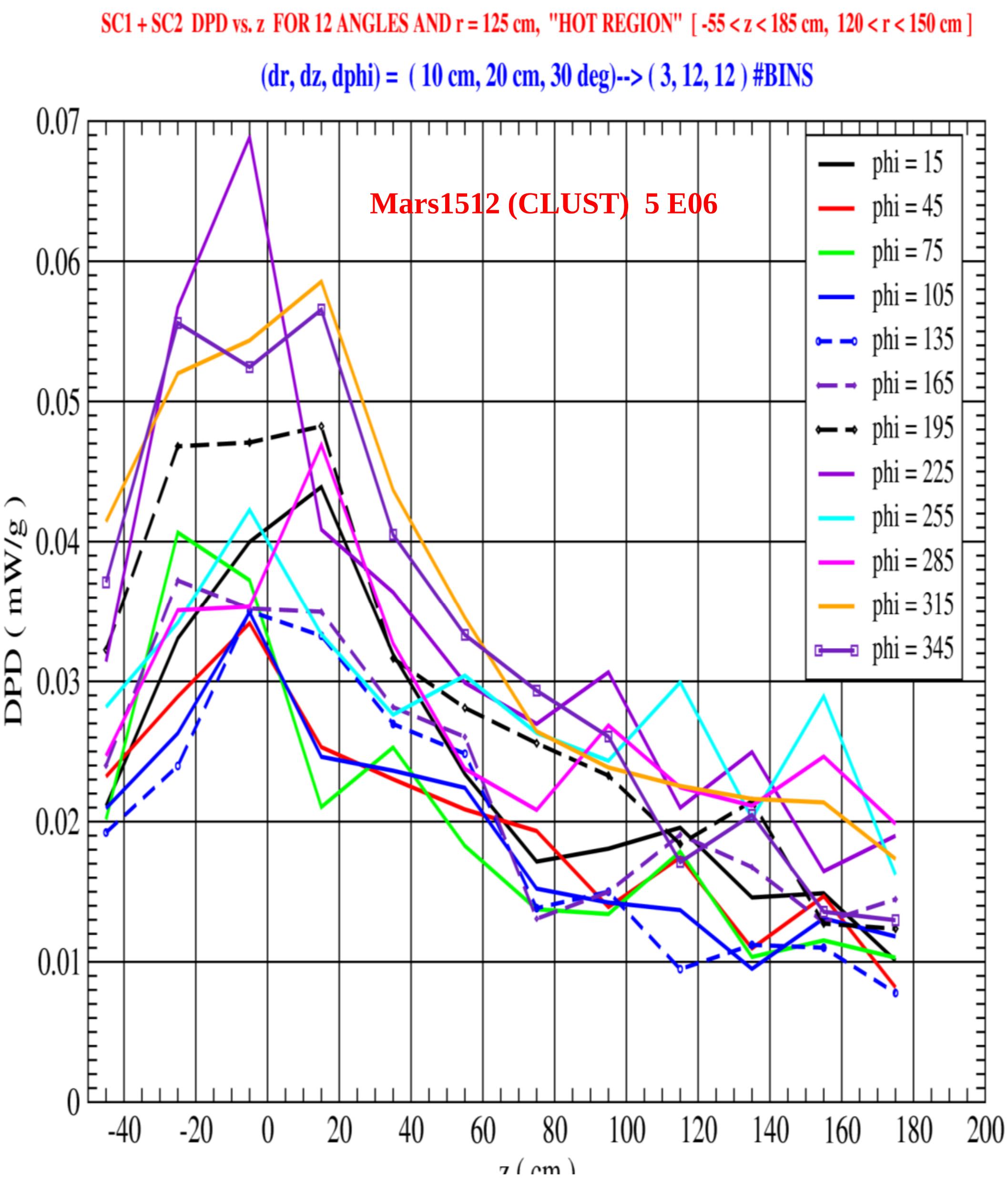


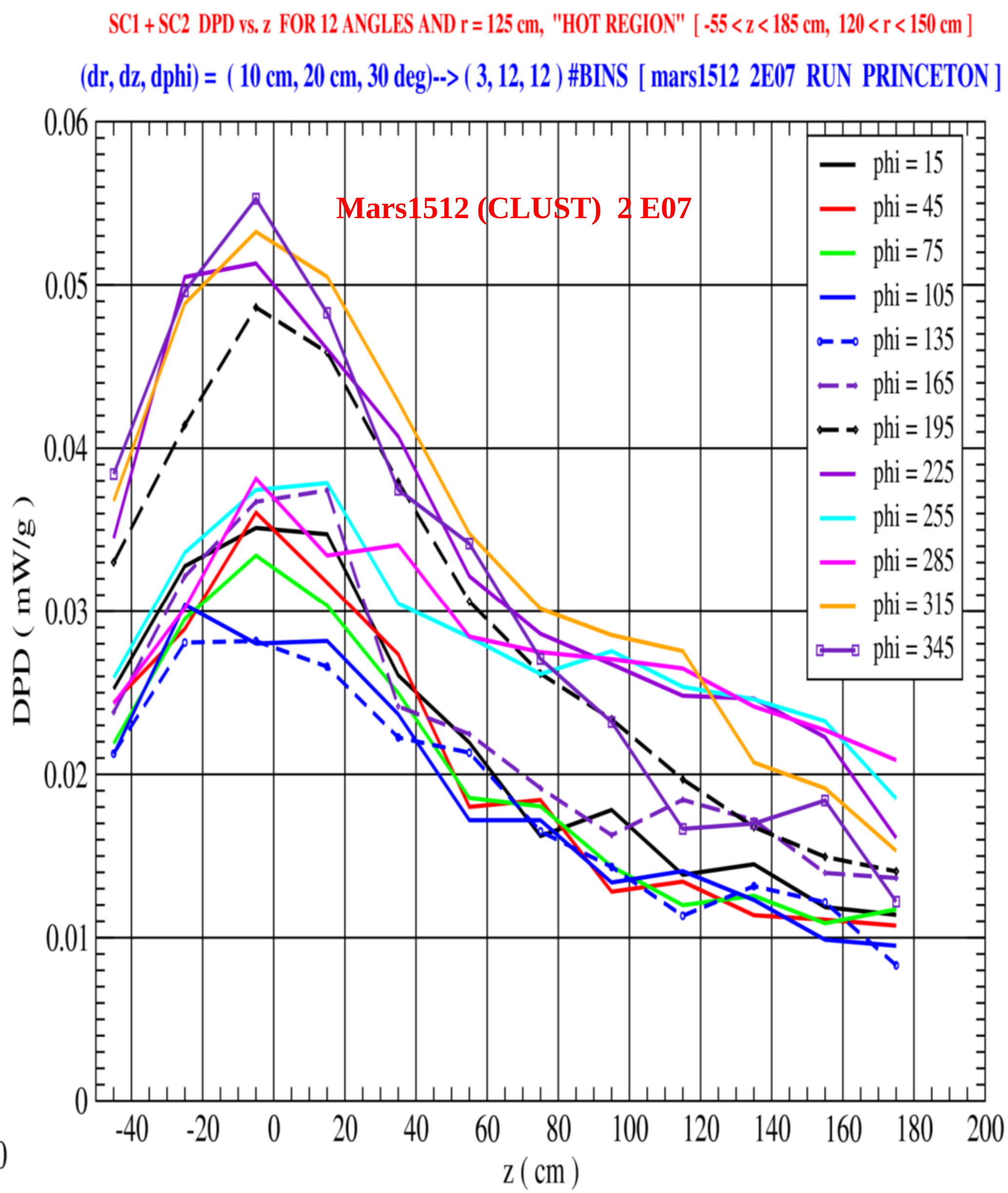
PEAK TDPD mars1510 ~ 0.055 mW / g IN SC#1 mars1512 ~ 0.19 mW / g IN SC#2.
BOTH CODES SHOW MOST OF THE DP TO BE BETWEEN ~ - 40 < z < 40 cm AND IN THE LOWER HALF OF SC#1+2, TOWARDS THE + x DIRECTION. NEW MARS CODE GIVES TDPD ~ 0.1 mW / g IN THE SAME REGION mars1510 GIVES PEAK TDPD. BUT THE PEAK TDPD ACCORDING TO mars1512 IS FURTHER DOWNSTREAM. mars1512 ISOLATED PEAK SPIKES INDICATE STATISTICALLY POOR DATA AND WE HAVE UNRELIABLE CONCLUSIONS FOR THE PEAK TDPD.



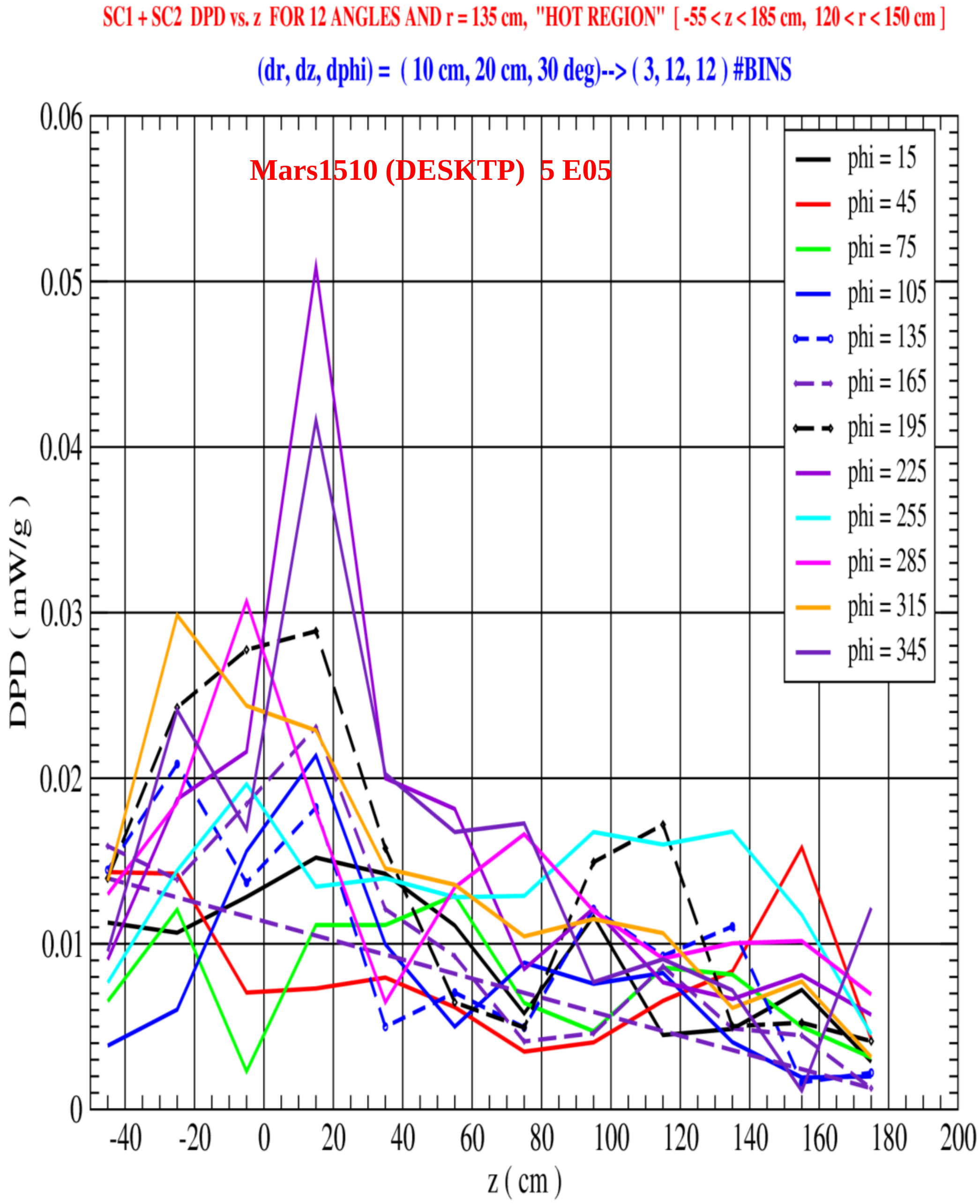


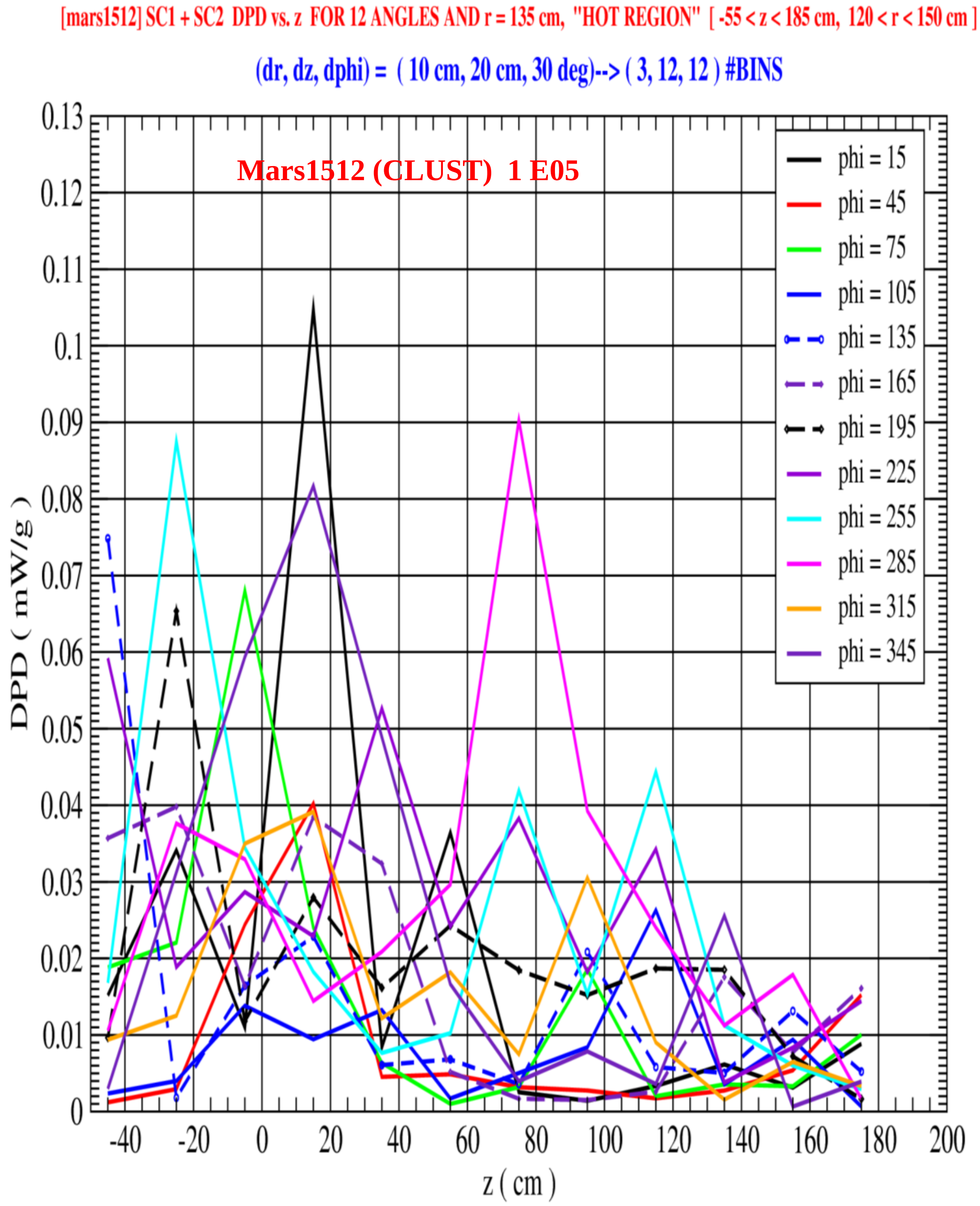
PEAK TDPD mars1510 ~ 0.049 mW / g IN SC#1 mars1512 ~ 0.056 mW / g IN SC#1.
BOTH CODES SHOW MOST OF THE DP TO BE BETWEEN ~ - 40 < z < 40 cm AND IN THE LOWER HALF OF SC#1+2, TOWARDS THE + x DIRECTION. FROM THE SHAPE OF THE LINES FOR THE ANGLES phi = 315 deg. AND phi = 345 deg. NEAR THE PEAK REGION FOR BOTH mars1510 AND mars1512 IT LOOKS LIKE WE HAVE REACH A VERY GOOD ESTIMATION OF THE PEAK TDPD WITH 2E6 SIMULATIONS. THE ESTIMATED PEAK TDPD FROM BOTH mars VERSIONS ARE ALSO IN VERY GOOD AGRREMENT.



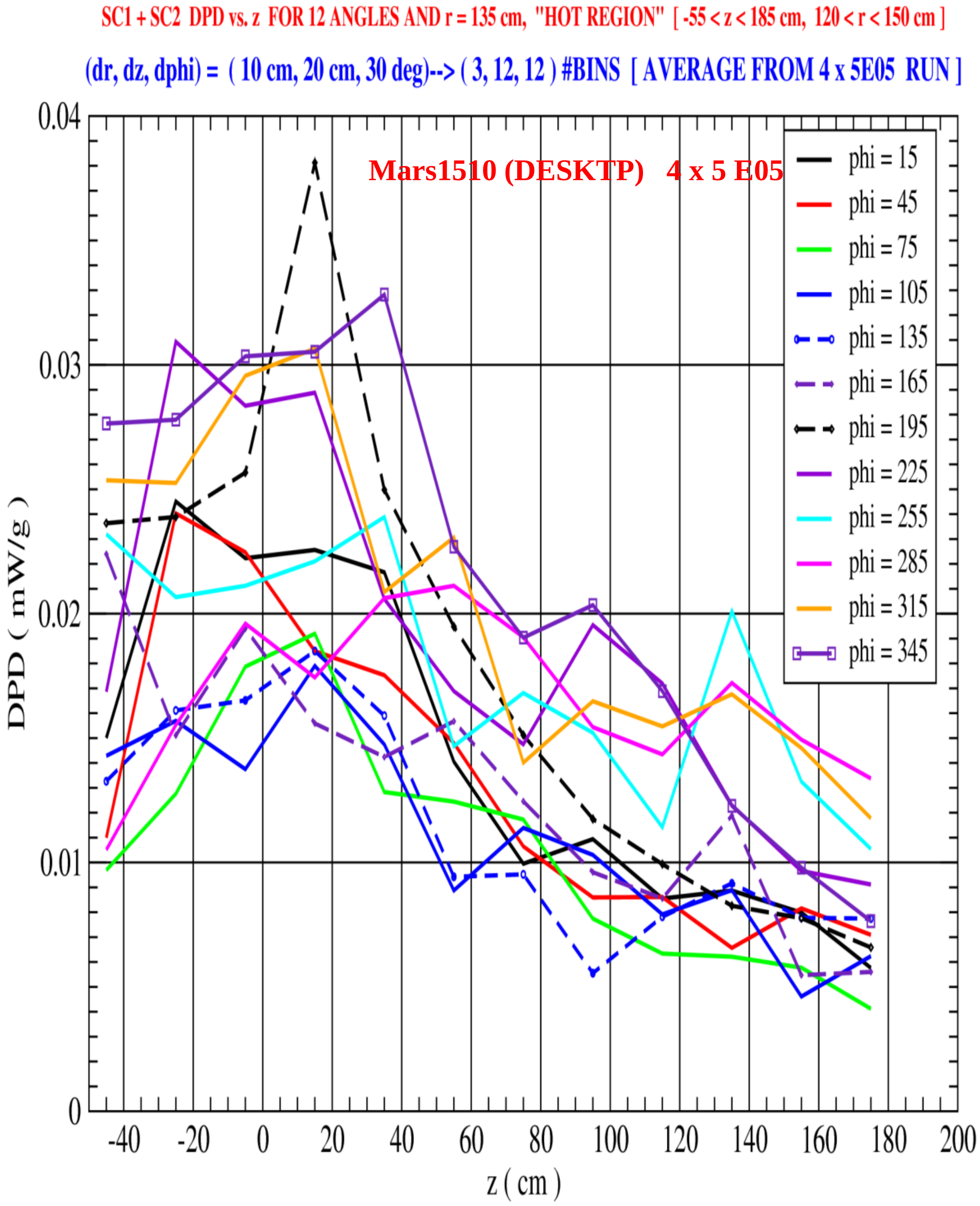


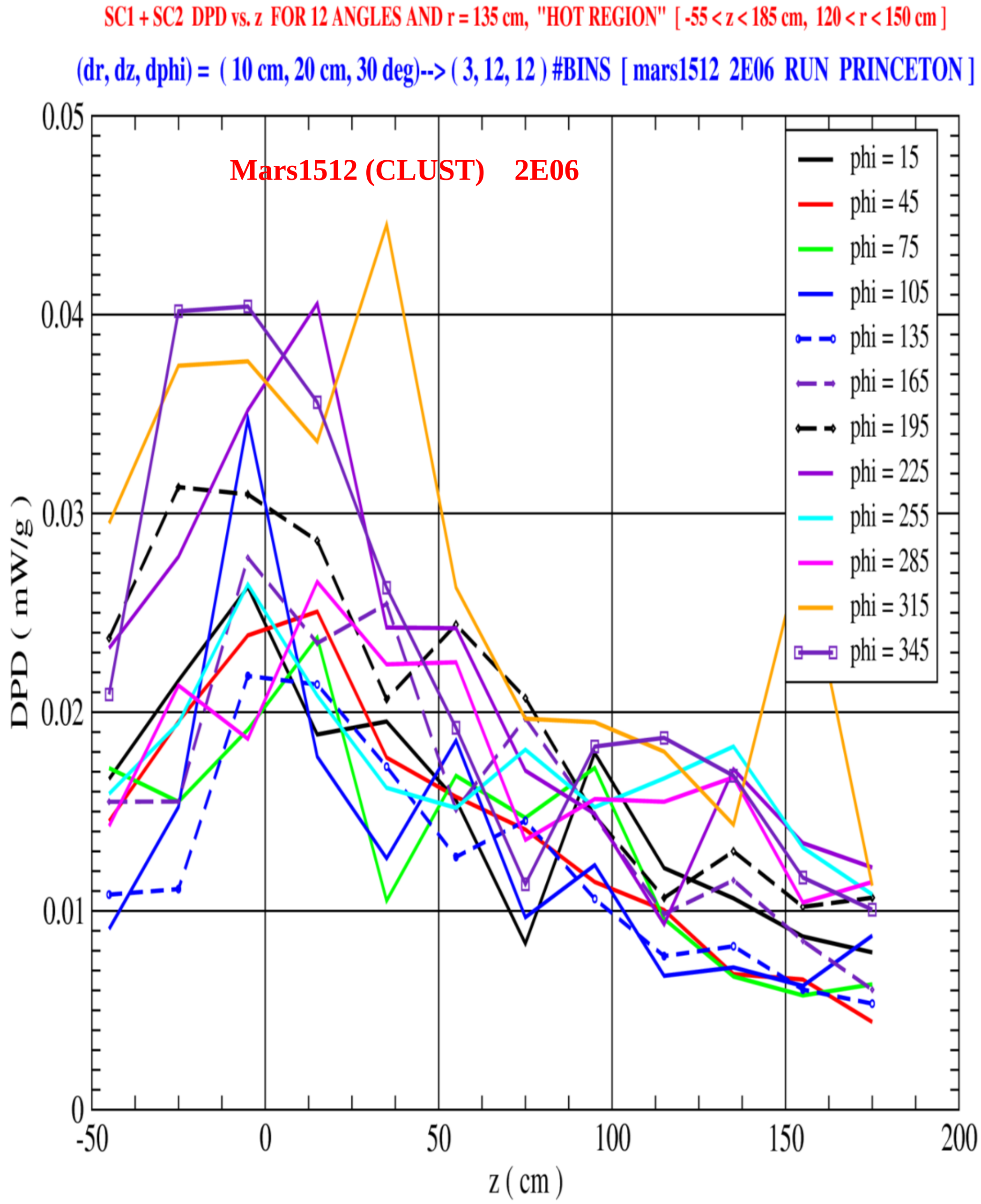
PEAK TDPD mars1512 [5E06] ~ 0.069 mW / g IN SC#1 mars1512 [2E07] ~ 0.055 mW / g IN SC#1 .
MOST OF THE DP APPEARS TO BE BETWEEN ~ - 40 < z < 40 cm AND IN THE LOWER HALF OF SC#1+2, TOWARDS THE + x DIRECTION. THE SHAPE OF mars1512 [2E06] PEAK LINE FOR phi = 225 deg. NEAR THE PEAK REGION INDICATES WE CAN NOT TRUST THAT ESTIMATION OF THE PEAK TDPD FROM mars1512. THE mars1512 [2E07] HAS A BETTER SHAPE FOR THE phi = 225 deg. LINE. IN BOTH CASES FROM THE LINES FOR ANGLES phi = 315 deg. AND phi = 345 deg. NEAR THE PEAK REGION IT LOOKS LIKE WE HAVE REACH A GOOD ESTIMATION OF THE PEAK TDPD. THIS IS ALSO TRUE
FOR THE 2E06 Mars1512 SIMULATION.



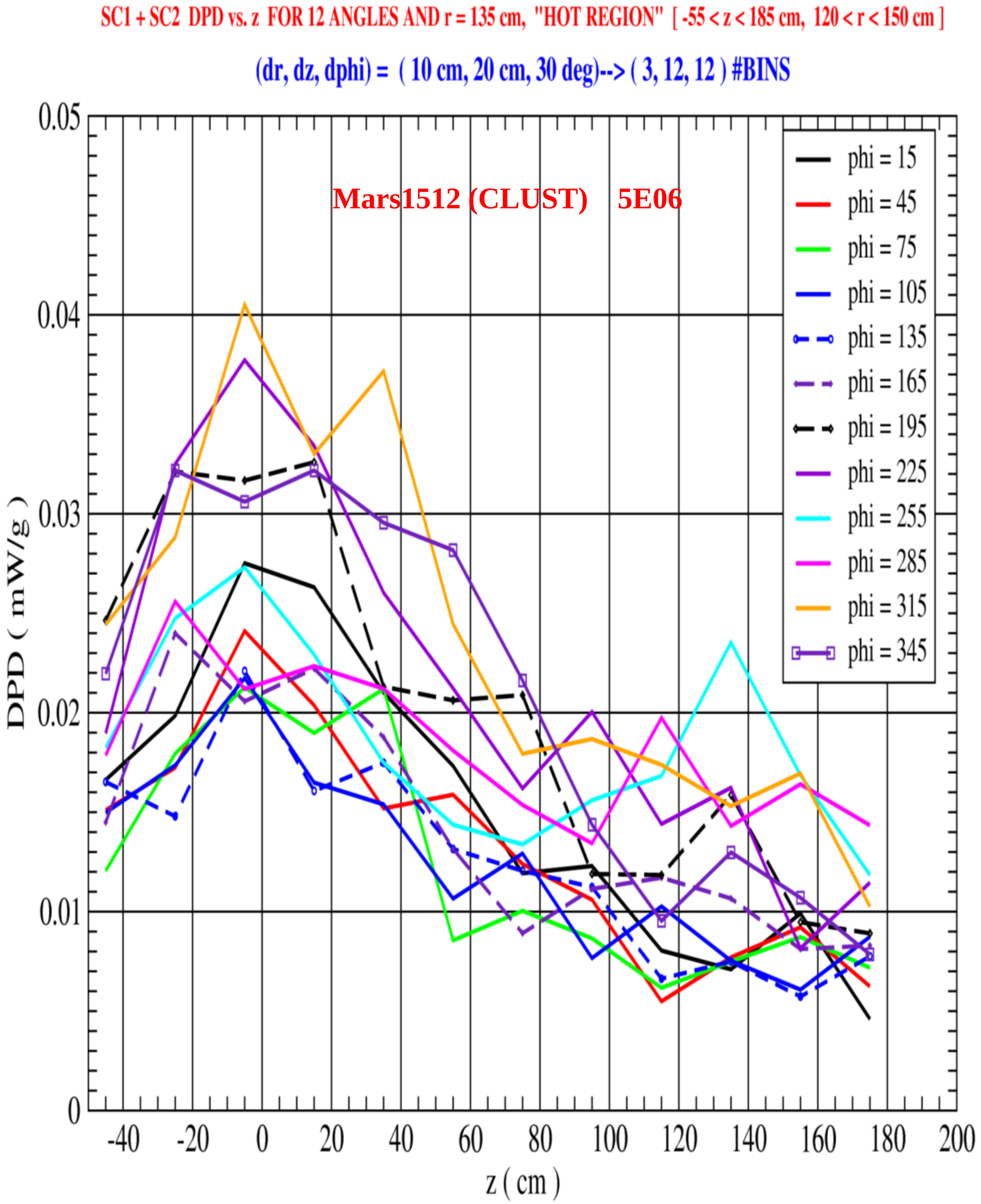


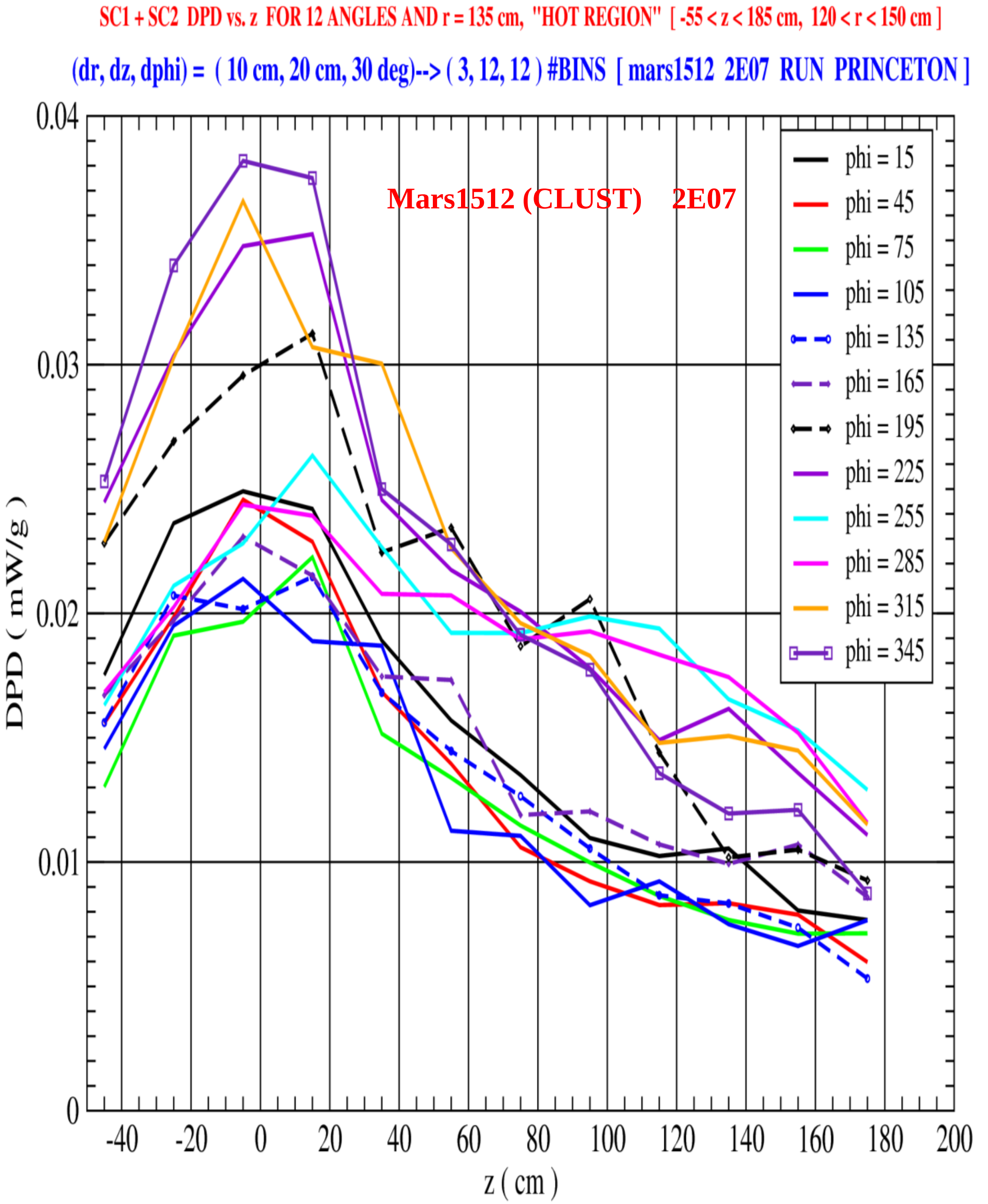
PEAK TDPD mars1510 ~ 0.051 mW / g mars1512 ~ 0.107 mW / g . mars1512 PREDICTS TDPD OVER ITER LIMIT EVEN AT THIS RADIUS. A 1E5 mars1510 SIMULATION ACTUALLY GIVES SAME PEAK TDPD (~ 0.19 mW / g) AS A 1E5 mars1512 SIMULATION, ALTHOUGH AT A DIFFERENT LOCATION. ALTHOUGH THERE WAS AN IMPROVEMENT IN THE PHYSICS MODELING AND HANDLING THE STATISTICS THE RESULTS ARE NOT CLOSER TO THE mars1510 (5E5). THE PEAKS ARE ISOLATED SPIKES AND INDICATE MORE EVENTS NEEDED FOR STATISTICAL CONVERGENCE FOR BOTH mars1510 AND mars1512.



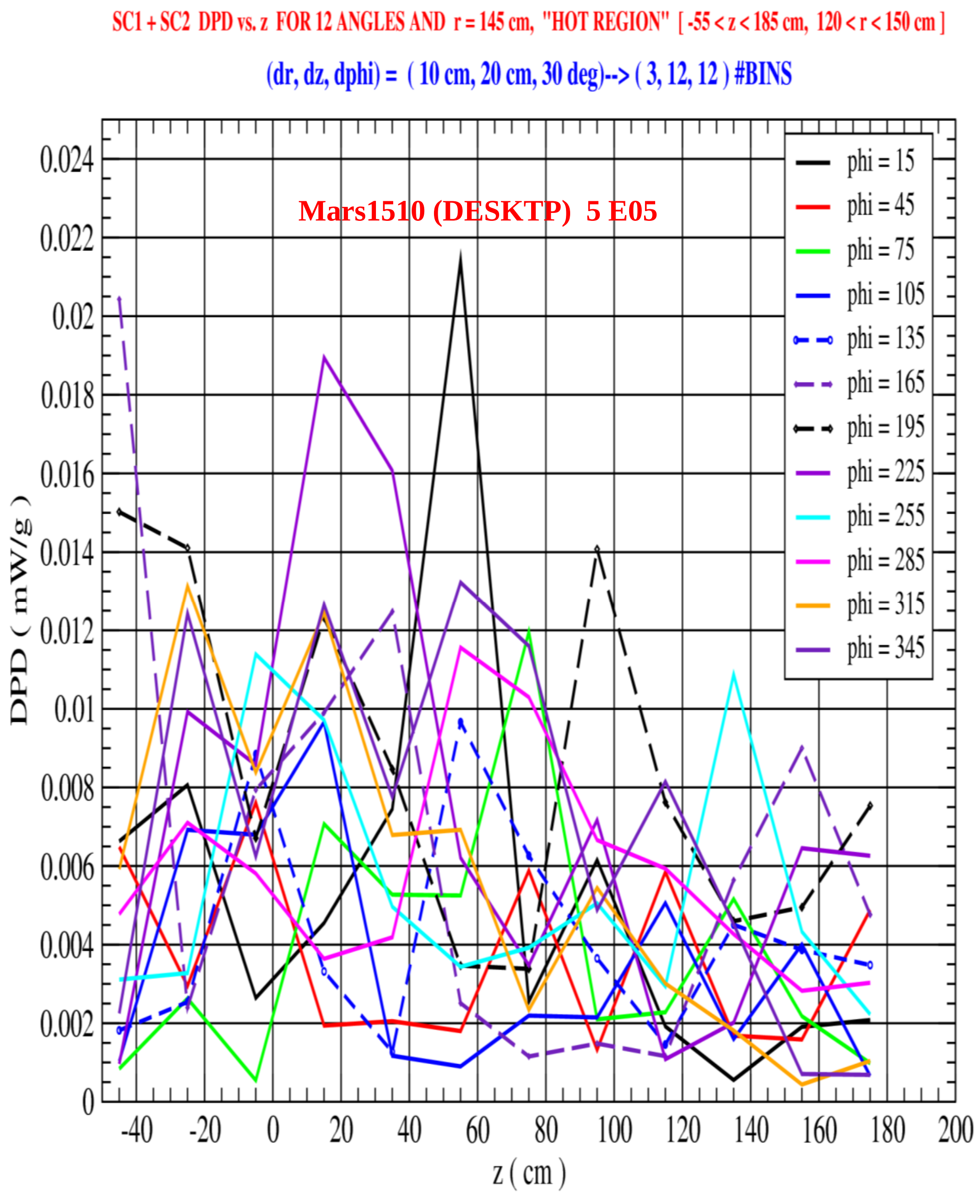


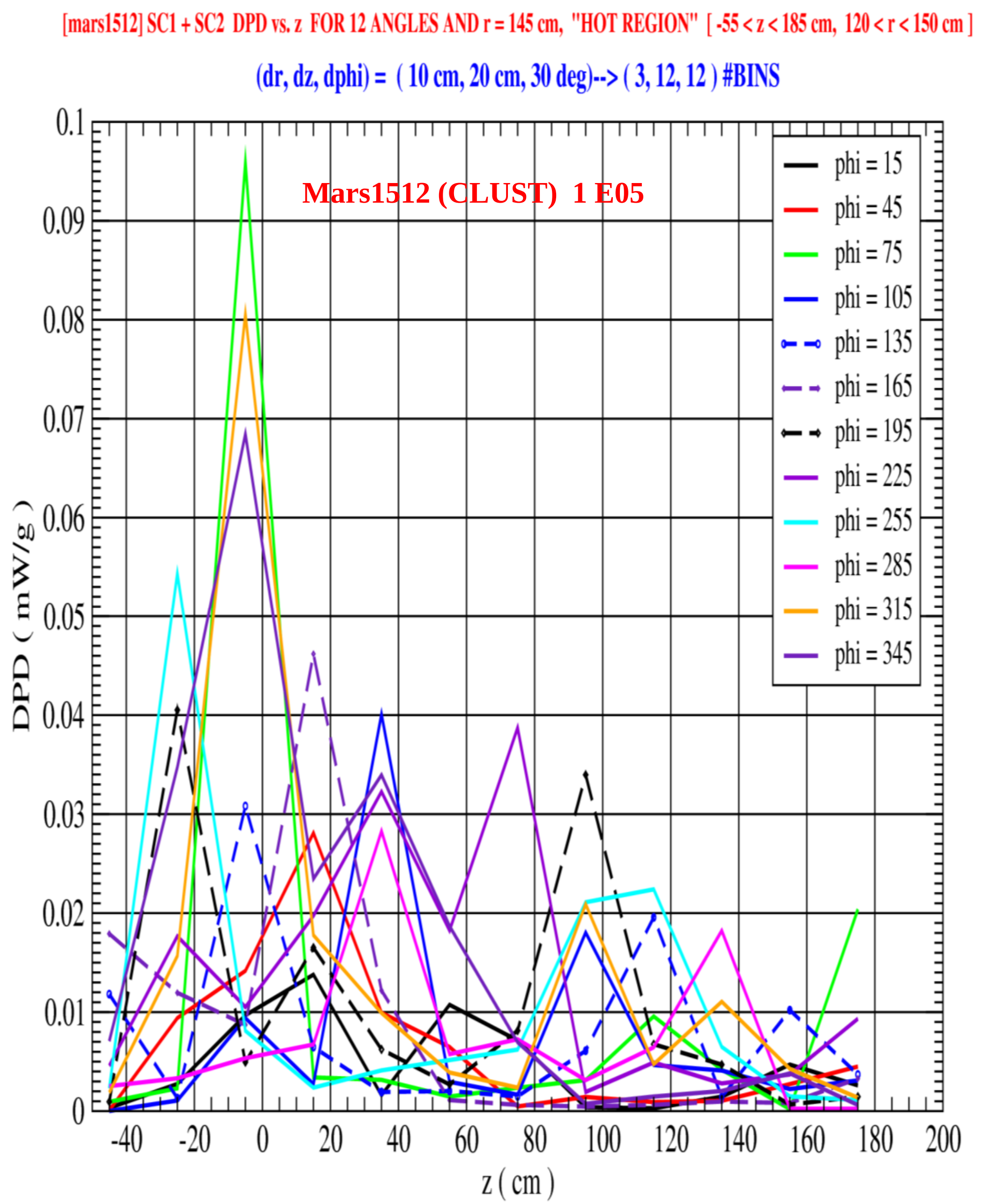
PEAK TDPD mars1510 ~ 0.038 mW / g mars1512 ~ 0.044 mW / g . BOTH CODES PREDICT PEAK DENSITIES ~ 0.04 mW / g FOR THIS RADIUS ALTHOUGH AT DIFFERENT ANGLES. THE SHAPE OF THE CORRESPONDING LINES INDICATES THERE IS STILL STATISTICAL UNCERTAINTY NEAR THE PEAK REGION AND THE ESTIMATION CAN NOT BE TRUSTED.



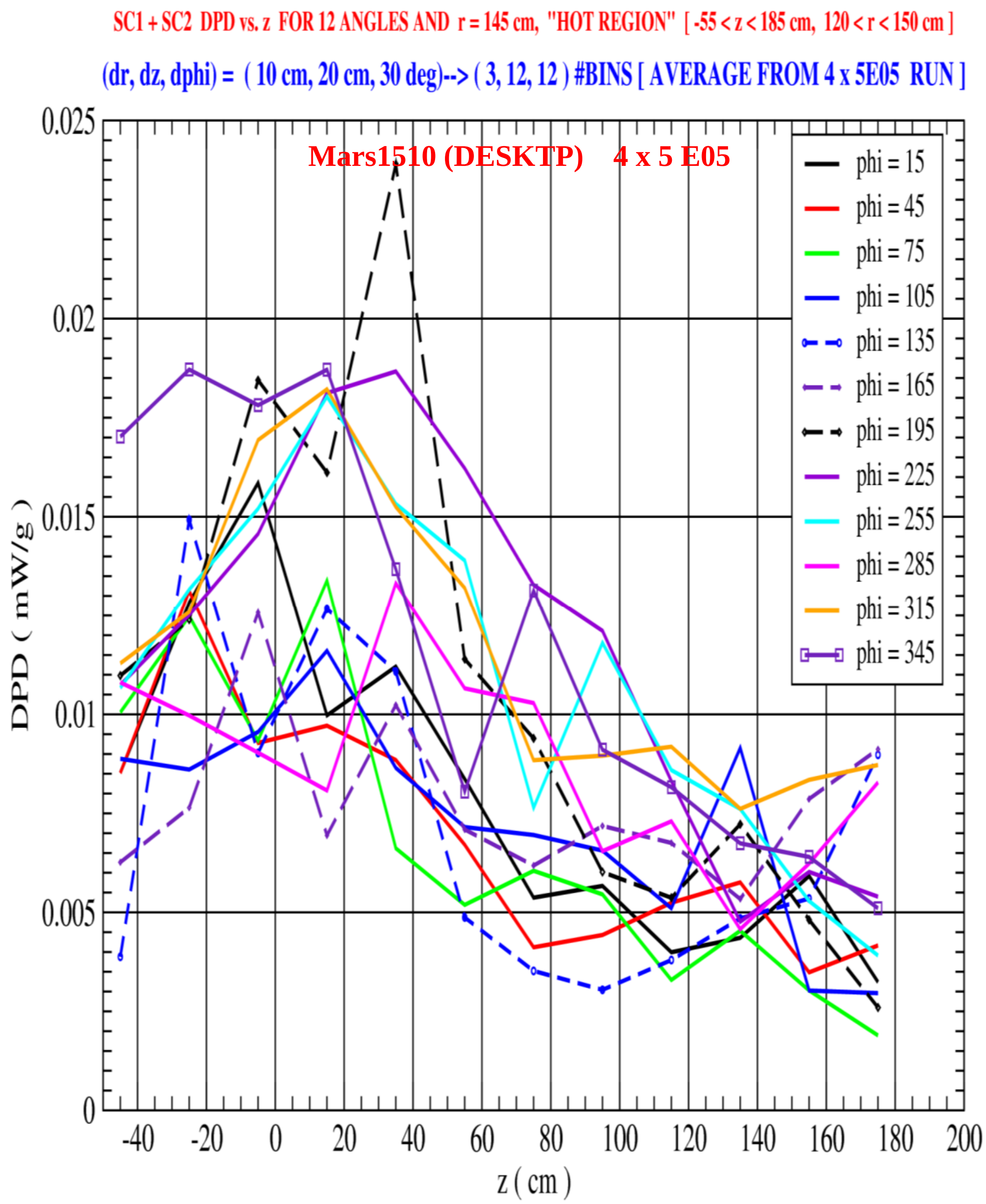


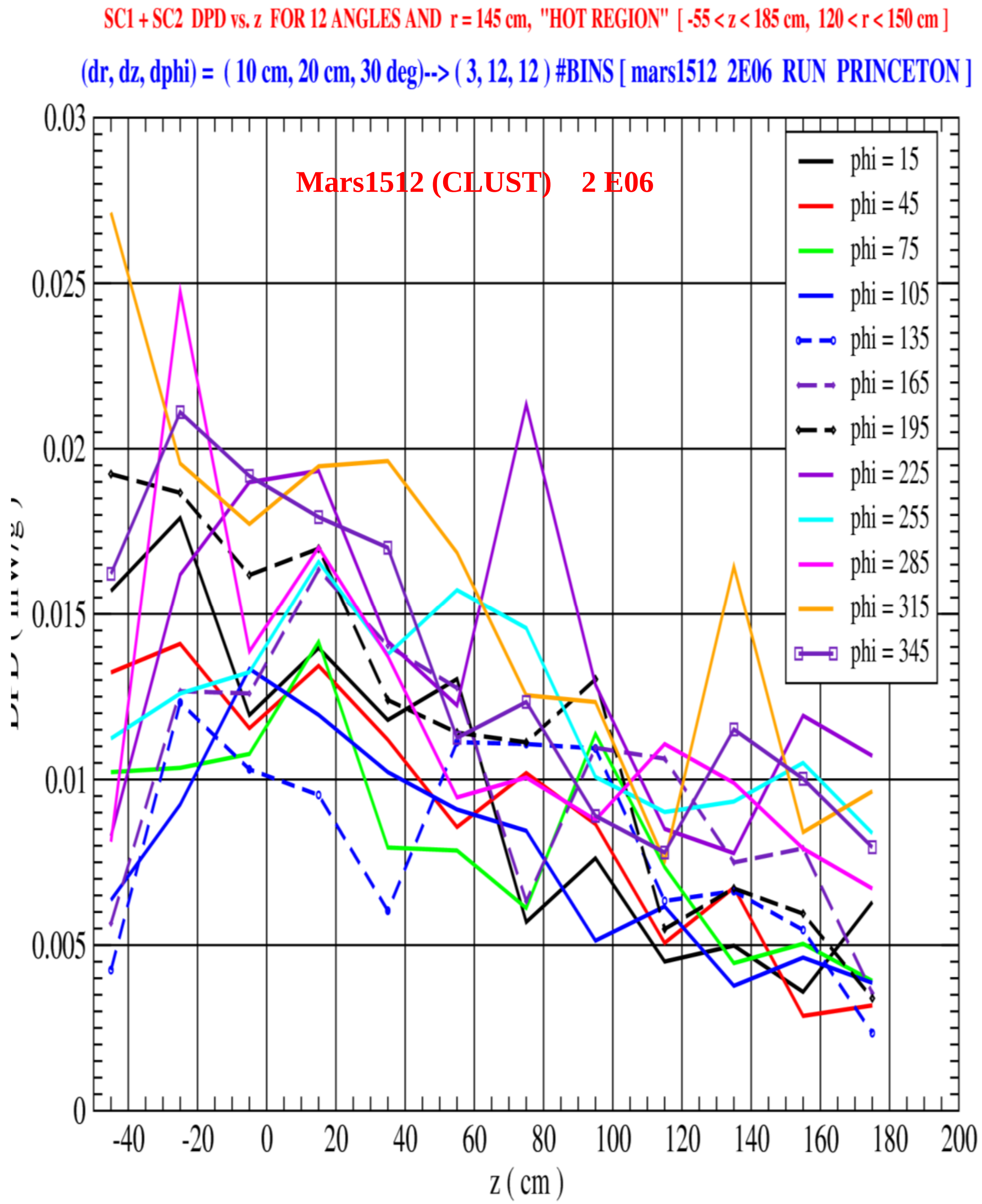
PEAK TDPD mars1512 [5E06] ~ 0.04 mW / g mars1512 [2E07] ~ 0.038 mW / g . BOTH SIMULATIONS PREDICT PEAK DENSITIES ~ 0.04 mW / g FOR THIS RADIUS ALTHOUGH AT DIFFERENT ANGLES. THE SHAPE OF THE CORRESPONDING LINES INDICATES THERE IS STILL STATISTICAL UNCERTAINTY NEAR THE PEAK REGION. AT THE END, UNLESS THERE IS SOMETHING UNATURAL IN THE SIMULATIONS, ONE SHOULD NOT EXPECT A TDPD PEAK HIGHER THAN THAT AT 125 cm RADIUS AND THEREFORE ONE SHOULD NOT PAY ATTENTION TO THESE PLOTS.



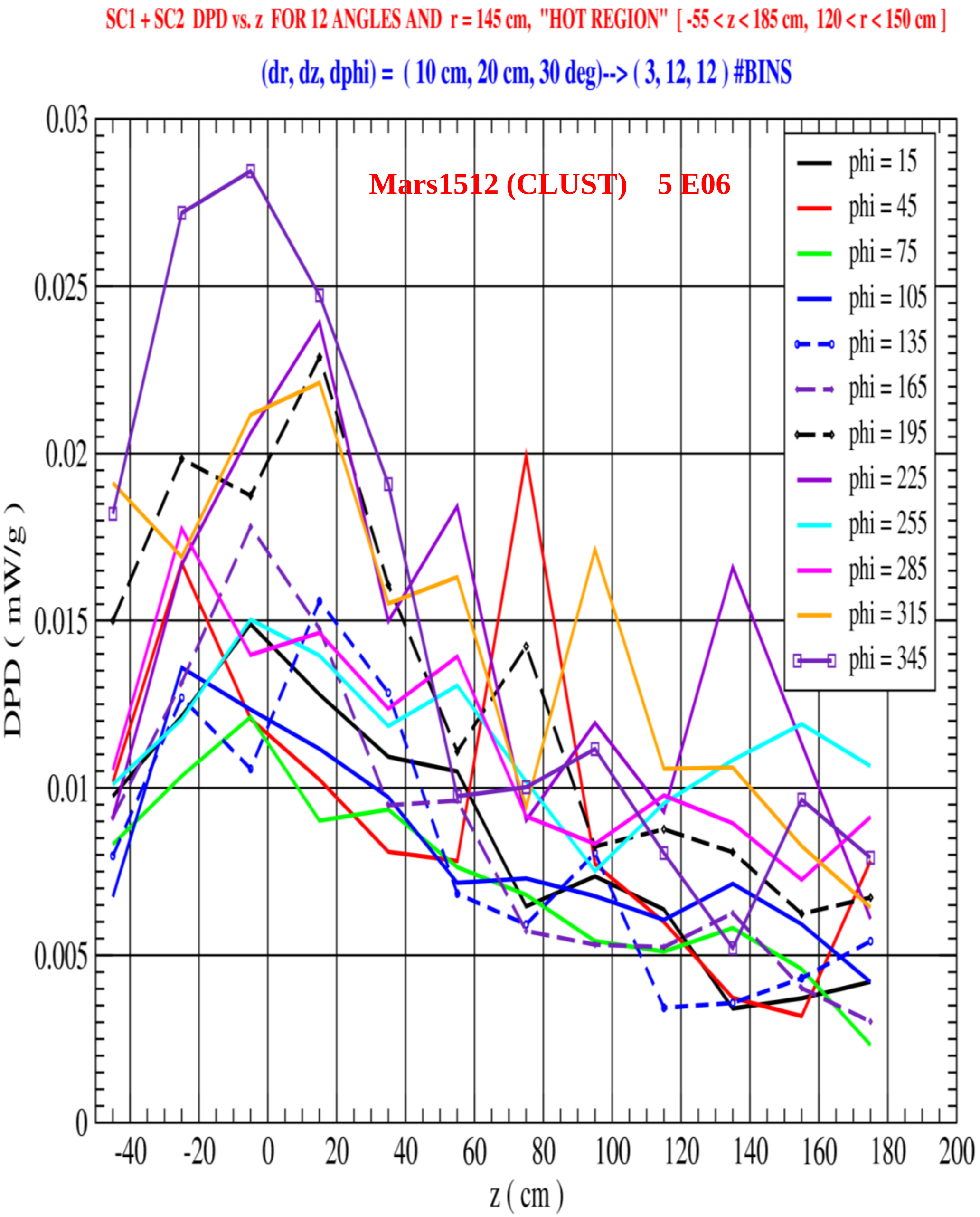


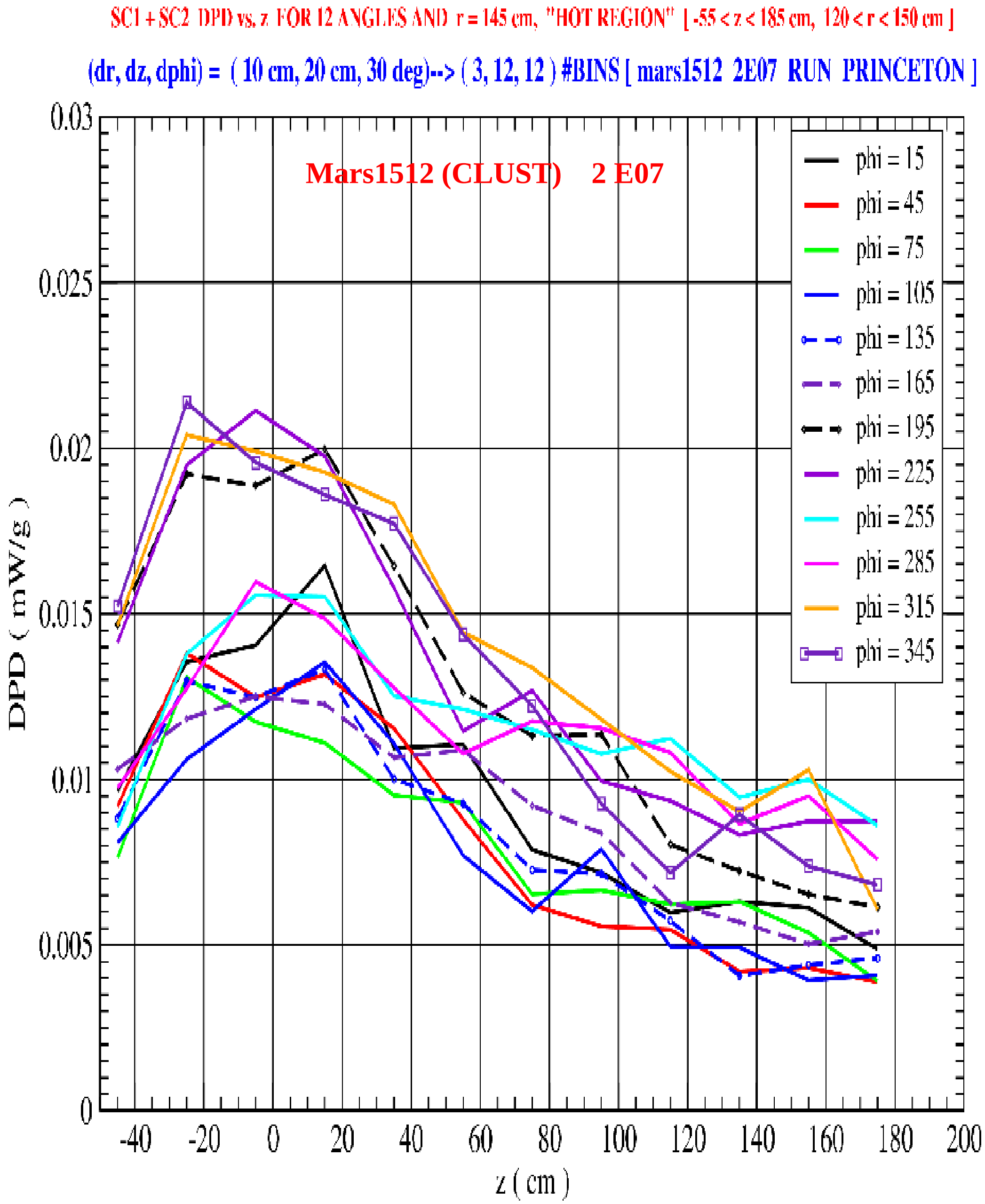
PEAK TDPD mars1510 ~ 0.022 mW / g mars1512 ~ 0.098 mW / g . A LOT OF STATISTICAL NOISE IN BOTH PLOTS .





PEAK TDPD mars1510 ~ 0.024 mW / g mars1512 ~ 0.028 mW / g .





PEAK TDPD mars1512 [5E06] ~ 0.028 mW / g mars1512 [2E07] ~ 0.023 mW / g . LIKE IN THE r = 135 cm PLOTS ONE SHOULD NOT PAY ATTENTION TO THE AZIMUTHAL VARIATION OF THE PEAK TDPD IN ABOVE PLOTS.

GENERAL COMMENTS ON THE PLOTS .

PEAK TDPD IS THE MOST IMPORTANT NUMBER IN THE TARGET STATION SIMULATIONS. IT IS THE NUMBER THAT DETERMINES THE SIZE OF THE COILS AROUND THE TARGET REGION AND DOWNSTRTEAM AS WELL AS THE FEASIBILITY (IN PART) OF COOLING DIFFERENT PARTS OF THE STATION .
WE USE A SEGMENTATION SETUP FOR ESTIMATING THAT NUMBER.

THE "PIECES" SIZE IS RATHER ARBITRARY. WE TRY TO CHOOSE A SIZE THAT WILL GIVE US AS STATISTICALLY RELIABLE RESULTS AS POSSIBLE IN THE PEAK POWER DENSITY REGION.
THERE IS NO RULE OR RECIPE HOW TO CHOOSE THE SIZE.

*LESS ENERGY IS DEPOSITED IN "PIECES" IN CERTAIN DIRECTIONS THAN IN "PIECES" IN OTHER DIRECTIONS.
*THE OUTER REGION "PIECES" IN THE STATION RECIEVE LESS (LESS DENSE) ENERGY THAN THE "PIECES" CLOSER TO THE TARGET.
* LIKE WISE DOWNSTREAM "PIECES" GET LESS (LESS DENSE) ENERGY THAN "PIECES" CLOSER TO THE TARGET.

THE SEGMENTATION WE IMPLEMENT HAS "PIECES" OF THE SAME SIZE IN ALL ANGLES AND ALONG THE AXIAL DIRECTION. THE SIZE INCREASES ONLY IN THE RADIAL DIRECTION. THAT SOMEWHAT WILL TAKE CARE THE STATISTICAL PROBLEM IN THAT DIRECTION.

TO ACHIEVE SMOOTH VARIATION IN THE PLOTS FOR ALL DIRECTIONS (r,z, phi) WE MAY HAVE NOT ONLY TO INCREASE THE NUMBER OF EVENTS TO DEAL WITH THE STATISTICALLY POOREST REGIONS BUT ALSO DECRASE THE SIZE OF THE "PIECES" EVERYWHERE (UNLESS WE IMPLEMENT A MORE COMPLICATED SEGMENTATION SCHEME). A LOT MORE TIME WILL BE DEVOTED IN SIMULATIONS.

IS THIS NECESSARY ? NO.
WE NEED TO MAKE SURE THERE IS SOME SMOOTH VARIATION IN THE PEAK REGION ONLY.
THE LINES FOR THE TWO ANGLES 315 AND 345 DEGREES (mars1510 / mars1512 2E6 PLOTS, PAGE 8) THAT GIVE US THE LARGEST TDPD ARE QUITE CLOSE TO EACH OTHER. THERE IS ALSO A RATHER SMOOTH AXIAL VARIATION FOR BOTH OF THEM IN THE PEAK REGION [$-40 < z < 40$ cm], THEREFORE THE PEAK TDPD ~ 0.05 / 0.06 mW / g
IS A RESULT WE CAN TRUST. THE mars1512 (5E6) 225 DEGREE LINE THOUGH (LEFT PLOT IN PAGE 9) THAT GIVES THE PEAK TDPD ~ 0.069 mW / g IT APPEARS LESS SMOOTH THAN THE LINES FOR THE 315, 345 DEGREE ANGLES THAT GIVE THE NEXT LARGEST TDPD . THEREFORE MORE WEIGHT SHOULD BE PUT IN THE SECOND LARGEST TDPD RATHER THAN THE FIRST ONE. IT IS INPORTANCE TO NOTICE HERE THAT FOR 2E06 EVENTS mars1512 225 DEGREE LINE DOES NOT GIVE HIGHEST PEAK TDPD IT IS ONLY AT HIGHER STATISTICS WE NOTICE SUCH A BEHAVIOUR.

WE ALSO NEED TO PERFOM A SERIES OF SIMULATIONS WITH INCREASING NUMBER OF EVENTS UNTIL THERE IS STABILITY IN THE RESULT OF THE PEAK TDPD (EVEN IF THERE IS A SMOOTH VARIATION OF THE TDPD IN THE PEAK REGION WE STILL HAVE TO ENSURE WE ALSO HAVE REACH A STABLE SOLUTION IN THAT REGION) .

GENERAL COMMENTS ON THE MAKING OF THE PLOTS / PROCESSING+ ANALYSING DATA AND SETTING UP mars1512 .

 # IN THE FIRST STEP FOR THE CREATION OF THE PLOTS THE TDP (FROM MARS.OUT FILE) AND THE TDPD (FROM MTUPLE.NON FILE) DATA FOR ALL "PIECES" ARE COPIED INTO TWO FILES. DATA FOR THE TDP (FROM MARS.OUT FILE) IN THE DIFFERENT STATION PARTS ARE ALSO COPIED IN A FILE.

 # THREE SMALL c++ CODES WILL PROCESS THE DATA. THE TDP IN THE DIFFERENT VOLUMES OF THE STATION IS STORED IN A FILE AND THE DATA WILL BE COMPARED WITH OTHER CASES TO MAKE SURE THERE IS NO PROBLEM IN THE SEGMENTATION SET UP OF THE CODE. THE TDP OF THE UNSEGMENTED PART OF THE COIL (S) OR REGION (IF ANY) WILL BE USED WITH THE TDP FROM ALL PIECES (CALCULATED USING A c++ CODE) AND COMPARED WITH THE TDP FROM THE UNSEGMETNED COIL (S) OR REGION. THE CODE FOR THE TDPD WILL GIVE THE PEAK TDPD AND ALSO ORGANIZE THE DATA IN INCREASING r ORDER (FOR THE SEGMENTATION CASES WITH MORE THAN ONE RADIAL BIN).

 # FOR EACH r (IF MORE THAN ONE RADIAL BIN IS USED) THE DATA WILL BE SAVED IN SEPARATE FILES. ANOTHER SMALL c++ CODE WILL ORGANIZE THE DATA IN INCREASING ANGULAR ORDER FOR EACH r. THE DATA FOR EACH ANGLE WILL BE CO PIED / SAVED IN SEPARATE FILES.

 # USING "GRACE" THE DATA WILL BE PLOTED BY READING THEM FROM EACH FILE SEPARATELY .

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 # FIRST AND MOST IMPORTANT STEP IN SETTING UP MULTIPLE JOBS WITH mars1512 IS SETTING UP THE Makefile. IT HAS SOME STRUCTURE THAT IT IS NOT CLEAR HOW DETERMINES THE EXECUTION OF THE MULTI-DIRECTORY JOB. MARS README FILE DOES NOT PROVIDE ANY DETAILS ON THAT.

 # ONE CAN RUN NEW MARS IN PRINCETON CLUSTER FOR ONE-DIRECTORY JOBS IN THE USUAL WAY. THE JOB WILL BE EXECUTED BY USING qsub -l cput= .... IN BATCH MODE OR ./rmars-mcnp-linux IN INTERACTIVE MODE IN C-SHELL ENVIOREMENT. YOU CAN ALSO CREATE THE EXECUTABLES AND SET UP THE MULTI-DIRECTORY JOB <u>BUT</u> WHEN YOU TRY TO RUN THE JOB WITH ./start-jobs 100 YOU GET THE MESSAGE n1=1 : Command not found n2=1 : Command not found If: Expression Syntax AND THE JOB IS NOT EXECUTED. <u>AFTER ~ 15 - 20 EMAILS EXCHANGED WITH Ding I REALIZED THAT THE COMMAND DOES NOT WORK IN C-SHELL ENVIOREMENT.</u>

 # NEW MARS WILL GIVE YOU THE AVERAGE FOR ALL DATA FILES <u>*EXCEPT MARS.OUT !*</u> ISOLATING THE DATA OF INTEREST AND GETTING THE AVERAGE IS NOT THAT SIMPLE FOR SOMEONE WITHOUT MUCH EXPERIENCE. THE TDP CAN BE CALCULATED THOUGH FROM THE TDPD USING THE VOLUMES AND THE MATERIAL DENSITIES.

****

 # A NEW c++ CODE WAS CREATED THAT WILL PERFORM THE JOB OF THE SMALL CODES AND PERFOM SOME OF THE JOBS DONE MANUALLY BEFORE. IT CAN ALSO READ THE DATA FROM MTUPLE.NON FROM BOTH MARS VERSIONS (NEW MARS MTUPLE.NON FILE HAS MORE COLUMNS), IT CAN HANDLE ONE OR UP TO THREE RADIAL BIN SEGMENTATIONS. THE CODE IS MORE FLEXIBLE AND IT CAN SAVE TIME WHEN PROCESSING THE DATA.

mars1510: 1E5 ~ 7.72 hrs, [5E5 ~ 38.33 hrs] VS. mars1512: 1E5 ~ 111.06 hrs, [5E5 ~ *555.3 hrs (23.6 d) !!!* (ESTIM)]

A) THE PEAK DPD IN SC#1+2:

mars1510: ~ 0.19 mW / g AT (r, z, phi) = (125 cm, 35 cm, 225 deg) IN SC#1 [1E5 EVENTS]
mars1510: ~ 0.07 mW / g AT (r, z, phi) = (125 cm, 35 cm, 225 deg) IN SC#1 [5E5 EVENTS]
mars1512: ~ 0.19 mW / g AT (r, z, phi) = (125 cm, 115 cm, 255 deg) IN SC#2 [1E5 EVENTS]

***** DEPOSITED POWER IN DIFFERENT PARTS OF THE TARGET STATION IN kW *****

B) SC#1+2: 0.687 (+0.211) = 0.898 0.670 (+0.248)=0.918 0.759(+0.289)=1.048 (..)= DP IN UNSEGMENTED PART

SC#3:	0.048	0.060	0.076	SC#4:	0.130	0.146	0.146
SC#5:	0.012	0.014	0.016	SC#6:	0.004	0.005	0.005
SC#7:	0.006	0.008	0.005	SC#8:	0.010	0.010	0.009
SC#9:	0.003	0.004	0.005	SC#10-12:	0.152	0.108	0.127

TOTAL DP SC#1-12: 1.263 1.273 1.437

C) DP IN SHIELDING

SH#1 :	575.00	574.13	583.00
SH#2 :	95.85	93.84	94.00
SH#3 :	10.37	10.07	9.69
SH#4 :	5.22	4.81	4.69

D) DP IN VESSELS

SHVS#1 :	3.12	3.13	3.04
SHVS#2 :	42.56	36.08	24.30
SHVS#3 :	4.10	6.62	1.26
SHVS#4 :	0.56	0.50	0.50

E)

DP IN Hg JET :	406.60	406.25	382.90
DP IN Hg POOL :	1240.00	1246.12	1254.50

F)

DP IN Be WINDOW :	10.31	10.18	11.88
DP IN BP#2 :	106.60	107.37	116.40
DP IN BP#3 :	19.87	19.26	18.73
DP IN Hg POOL INNER TUBE :	275.50	272.91	263.20
DP IN Hg POOL OUTER TUBE :	165.20	164.26	159.95
DP IN SHVS#1 INNER TUBE :	163.30	163.41	155.80
TOTAL DP :	3,125.51	3,117.58	3,085.29

mars1510: 4 x 5E5 ~ 50 hrs VS. mars1512: *5E6 > 100 hrs ~ 4 - 5 days {100 SUBDIRECTORY, 5E04 EVENTS EACH JOB (DEPENDS ALSO ON QUE / WAITING TIME [WT] }, 4 x 5E6 > ~ 5 - 6 days (SAME AS BEFORE SET UP)*

A) THE PEAK DPD IN SC#1+2:

mars1510: ~ 0.049 mW / g AT (r, z, phi) = (125 cm, -5 cm, 345 deg) IN SC#1 [4 x 5E5 EVENTS]
mars1512: ~ 0.056 mW / g AT (r, z, phi) = (125 cm, -5 cm, 345 deg) IN SC#1 [2E6 EVENTS]
mars1512: ~ 0.069 mW / g AT (r, z, phi) = (125 cm, -5 cm, 225 deg) IN SC#1 [5E6 EVENTS] >>>>>> [Ding]
Mars1512: ~ 0.055 mW / g AT (r, z, phi) = (125 cm, -5 cm, 345 deg) IN SC#1 [4 x 5E6 EVENTS]

***** DEPOSITED POWER IN DIFFERENT PARTS OF THE TARGET STATION IN kW *****

B) SC#1+2: [0.647 (+0.271)=0.918] 0.735 (+ 0.308)= 1.043 0.730 (+0.315)=1.045 0.728(+ 0.310)= 1.038

WHERE NUMBERS IN (..)= DP IN UNSEGMENTED PART OF SC#1+2

SC#3:	[0.066]	0.070	0.064	0.067	SC#4: [0.149]	0.154	0.154	0.153
SC#5:	[0.017]	0.016	0.016	0.016	SC#6: [0.005]	0.005	0.004	0.004
SC#7:	[0.008]	0.009	0.008	0.007	SC#8: [0.010]	0.010	0.010	0.010
SC#9:	[0.004]	0.005	0.005	0.004	SC#10-12: [0.159]	0.148	0.149	0.146

TOTAL DP SC#1-12: [1.336] 1.458 1.455 1.447

C) DP IN SHIELDING

SH#1 :	[573.30]	583.30	584.10	581.27
SH#2 :	[93.70]	92.90	92.95	92.63
SH#3 :	[10.12]	9.60	9.62	9.61
SH#4 :	[4.77]	4.61	4.65	4.62

D) DP IN VESSELS

SHVS#1 :	[3.13]	3.11	3.12	3.08
SHVS#2 :	*[39.82]*	*25.77*	*25.08*	*26.22*
SHVS#3 :	[3.33]	1.44	1.35	1.46
SHVS#4 :	[0.49]	0.45	0.45	0.46

E) *DP IN* *Hg JET : [406.23] 380.99 380.93 380.25*
DP IN Hg POOL : [1248.78] 1250.91 1252.61 1246 48

F)

DP IN	Be WINDOW :	[10.17]	11.86	11.87	11.83
DP IN	BP#2 :	[106.09]	114.11	114.47	113.29
DP IN	BP#3 :	[19.23]	18.74	18.73	18.65
DP IN Hg POOL	INNER TUBE :	[273.53]	263.39	263.82	262.49
DP IN Hg POOL	OUTER TUBE :	[164.73]	160.09	160.20	159.56
DP IN SHVS#1	INNER TUBE :	[163.53]	156.15	156.27	155.48

TOTAL DP :[3,122.37] 3,078.97 3,081.79 3,068.95

COMMENTS AND CONCLUSIONS ON mars1510 vs. mars1512 .

A mars1512 JOB TAKES MORE TIME TO FINISH IN THE CLUSTER DUE TO QUE WAITING (~ SEVERAL DAYS). A 5E6 mars1512 JOB IN THE CLUSTER TAKES ~ TWICE AS MUCH THE TIME OF A 4 x 5E5 mars1510 IN THE DESKTOP (**** mars1512 EXECUTES THE JOB IN 100 SUBDIRECTORIES WITH 5E4 EVENTS EACH (Ding) // ALL 4 5E5 mars1510 JOBS RUNNING AT THE SAME TIME) . FOR CERTAIN SEEDS IT TAKES MORE TIME TO RUN THE SUBDIRECTORY JOB THAN OTHERS. ################ A 4 x 5 E06 AND A 2E06 mars1512 JOBS ARE IS IN PROGRESS AND DUE IN A FEW DAYS TO COMPLETE THE SYSTEMATIC STUDY AND COMPARISON OF TWO MARS VERSIONS ===> STUDY COMPLETE

THERE IS NO INFORMATION IF MARS CAN COLECT THE DATA FROM fort. FILES FROM DIFFERENT SUBDIRECTORIES IN ONE fort. FILE. A ROOT CODE THAT CAN ANALYSE THE DATA IN fort. FILES IN EACH SUBDIRECTORY IS AVAILABLE FOR MY STUDIES BUT IT APPEARS IN ODER TO USE THAT FILE AS AN INPUT IN OTHER SIMULATIONS YOU HAVE TO COPY AND PASTE THEIR DATA INTO ONE FILE

IF SIMULATION DATA ARE READ FROM A DATA FILE THERE IS NO INFORMATION HOW TO BREAK THE JOB IN A NUMBER OF SUBDIRECTORIES USING A SPECIFIC NUMBER OF DATA FOR EACH SUB - JOB. I ASSUME THIS HAS TO BE DONE MANUALLY.

****

BOTH mars VERSIONS SHOW IN GENERAL A FAST CONVERGENCE IN THE ESTIMATION OF THE DEPOSITED POWER IN DIFFERENT VOLUMES OF THE STATION, EVEN FOR VOLUMES THAT ARE FAR FROM THE TARGET REGION. A mars1510 OR mars1512, 5E5 EVENT SIMULATION CAN PROVIDE RELIABLE INFORMATION ON THE DEPOSITED POWER IN DIFFERENT PARTS OF THE TARGET STATION.

TO ACHIEVE STATISTICAL CONVERGENCE AND STABILITY IN THE PEAK TDPD REQUIRES A MUCH LARGER NUMBER OF EVENTS IN BOTH mras1510 AND mars1512 SIMULATIONS. IN BOTH CASES IT APPEARS WE NEED AT LEAST 2E6 EVENTS TO REACH SOME RELIABLE ESTIMATION OF THE PEAK TDPD (IN SC#1+2 AT LEAST).

BOTH CODES HAVE IN GENERAL GOOD AGREEMENT IN THE DP IN DIFFERENT VOLUMES OF THE STATION (LIKE THE DP IN THE SCs) WITH FEW EXCEPTIONS. THE MOST IMPORTANT DIFFERENCES ARE OBSERVED IN THE Hg JET (~ - 25 kW) , SHVS#2 (~ - 15 kW) SH#1 (~ + 11 kW), Hg POOL INNER TUBE (~ - 10 kW) DEPOSITED POWER. BOTH CODES ALSO GIVE PEAK TDPDs THAT ARE VERY CLOSE (mars1510: 0.049 mW / g VS. mars1512: 0.056 mW / g).

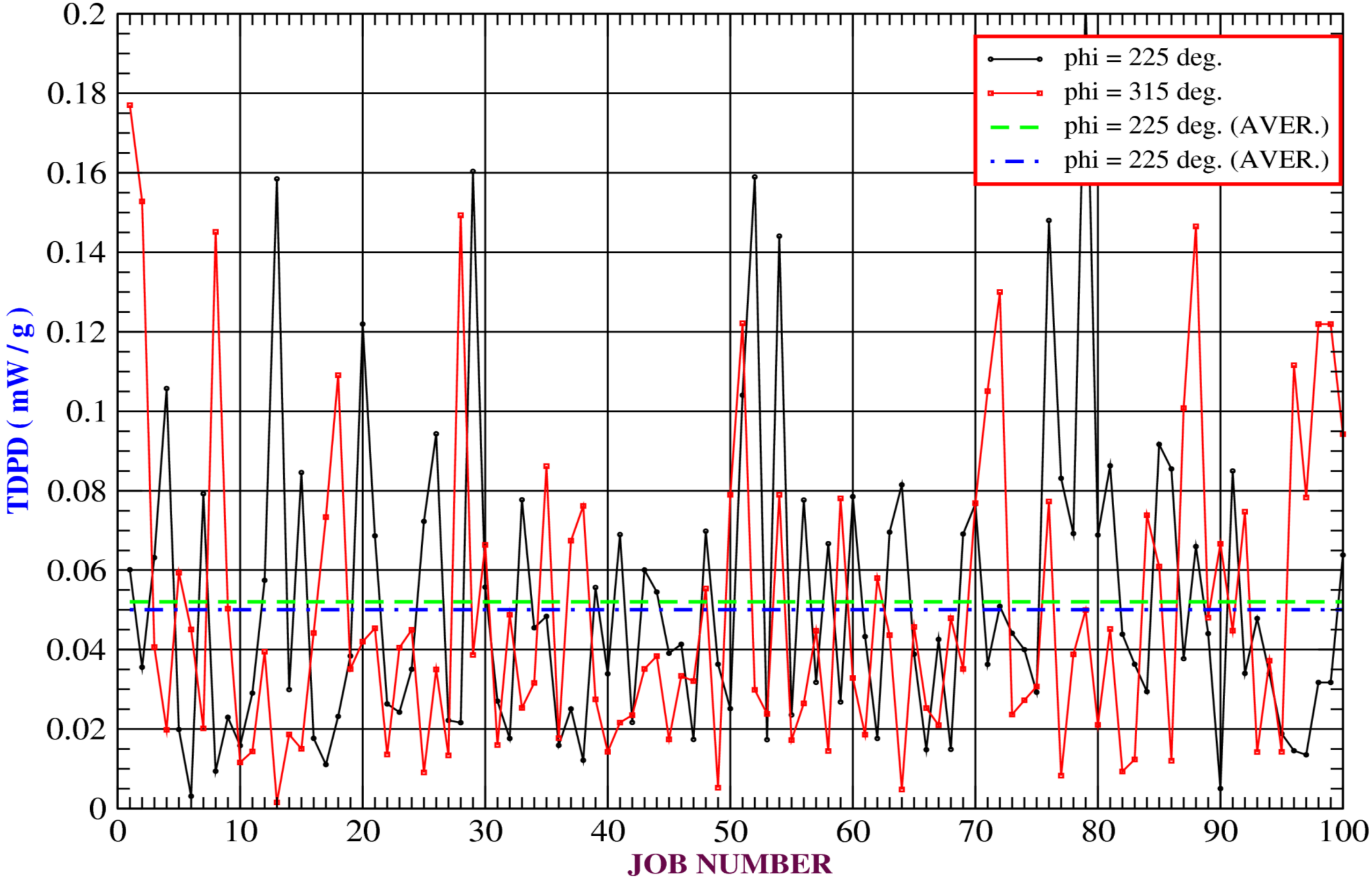
DING SET UP THE 5E06 SIMULATIONS IN PRINCETON CLUSTER AND HELPED ME LEARN AND SOLVE MY PROBLEMS IN SETTING UP AND RUNNING MULTI-DIRECTORY mars1512 JOBS. DURING THE PERIOD OF ONE DAY ONLY AND UNTIL 12 AM WE EXCHANGED OVER 10 EMAILS UNTIL I REALIZED THE PROBLEM WAS THE C-CELL ENVIRONMENT I WAS WORKING WITH.

I AM REALLY GRATEFUL FOR HIS HELP AND PATIENCE.

DING SUGGESTED FOR PLOTTING A PARAMETER FROM MY mars1512 STUDIES AS THE JOB NUMBER FUNCTION. WE AGREED THE PARAMETER TO BE THE TDPD FOR THE PIECES WITH PEAK TDPD.

FOR THE PLOT IN NEXT PAGE I CHOOSE THE TDPD FOR "PIECES" #137 AND # 176 THAT I HAVE THE HIGHEST AND SECOND HIGHEST TDPD FROM THE SECOND mars1512 JOB WITH 5E06 EVENTS.

TDPD variation vs. job number for 225 deg. and 315 deg. for the segmentation "piece"
with average peak TDPD (5 E06 = 100x 5E04 jobs, Ding first job set up).



AVERAGE TDPD mars1512 (5E06 = 100 x 5E04) -- 225 deg ~ 0.0520 mW / g sigma ~ 0.0380 mW / g
AVERAGE TDPD mars1512 (5E06 = 100 x 5E04) -- 315 deg ~ 0.0497 mW / g sigma ~ 0.0383 mW / g
IF INSTEAD OF 100 SUB-JOBS WE HAVE 50 WITH MORE EVENTS EACH IS SIGMA GOING TO BE SMALLER ?