**Simulation Data for Gen3 System at MDA**

A number of simulation calculations were made using the geometry of the Gen3 system now at MDA. The results are in the file ‘simulations’ which has put on the sugarsync cloud as a shared file for the people on the conference call of last week. These are intended as starting points for discussion so feedback is necessary if more calculations are desired. The basic premise is to provide simulated data for a number of dipoles and for 1 and 5 standard stage positions. The coordinates of the sensors is given in file 1 below with the first 7 being at the central stage position and the following are for the stage being moved to positions shown in file 10 with the dipole positions shown in file 9 (Note the value of the z axis is negative for the dipoles to give a consistent coordinate system; same result if stage z had been used instead with positive values).

All of the sim files show the fields (or flux) as a single row of values for the 7 sensors followed by a similar row for each stage position. The file name indicates number of dipoles and stage positions. These files can be directly input into the analysis code MSA code by clicking the Simulated Data? Button and then the LOAD DATA button to load the file in. The code looks for files ending in .sim. Note also that the stage coordinates must be input to the code when this is done as the .sim files do not contain this information. The stage coordinates used here are shown in file 10. Inputting these .sim files into MSA should give back exactly the dipole coordinates and strengths shown in these files. The exceptions are for a noise input where a random noise of 10pT was introduced (this is only an approximation of real noise as it is not synchronous across sensors but introduced randomly into each sensor output). This noise shows a small deviation in fit. The other exception is for flux calculation where there appears to be a small difference between the dipole parameters being input and those coming back from the MSA fit. It is not clear at this point if this is an error in the simulated flux data or the MSA flux calculation which has not been thoroughly checked out since its original coding by Trace Tessier. Some work is needed here. The flux is calculated for the 7 channel circular sensors by dividing the face up into circles and triangles into 256 segments, calculating the field in each segment and multiplying by the area of that segment and then adding all of the segments together. It is calculated in picoWebers (pT-m-m).

A few examples of contour plots for these fields and flux calculations are shown using the code DiaDem or the MSA code to indicate that multiple dipoles give contour lines that can be used to give guesses as to initial values for solving the inverse problem in MSA. All sims were done assuming 0 degree rotation angle for the dewar with respect to the stage as the actual dewar angle at MDA was not known.

The folder simulations contains the following files

1) Field&flux\_vs\_coords.xls: has all of the x, y, and z cords for five stage positions of a seven channel array with zero degree rotation about the dewar axis, Also has B and W for a five stage position and one dipole case.

2) dip\_1\_stpos\_1 .txt .sim: Values of B for a single dipole of 1.0E+05 pJ/T strength at 4 cm from the central sensor of the Gen3 system for one stage position. (see stage position and dipole position screen shots for coordinates and strengths0

3) dip\_1\_stpos\_5 .txt .sim: As above for 5 stage positions.

4) dip\_2\_stpos\_5 .txt .sim: two dipoles

5) dip\_3\_stpos\_5 .txt .sim: 3 dipoles

6) dip\_5\_stpos\_5 .txt .sim: 5 dipoles

7) dip\_3\_stpos\_5\_noise .txt .sim: 3 dipoles with 10pT random noise

8) pcdipole\_ctl\_panel.jpg: Screen shot of PcDipole control panel showing parameters used to simulate Gen3 system. The code was set to calculate the 7 channel system. Note that the rotation angle of the dewar was set to 0 degrees and not the actual dewar angle of the MDA Gen3 system which was unknown. If the sim data above are fed into the MSA code using the simulation input, the code will need to be adjusted for this angle. (This is actually one way to determine the correct angle of the dewar orientation with respect to the stage.)

9) pcdipole\_dipolesl.jpg: Screen shot of the dipole parameters used in the sim calculations.

10) pcdipole\_stages.jpg: Screen shot of the stage parameters

11) MSA\_input\_panel.jpg: Screen shot of MSA code used to fit above sim data. Note that the stage positions have to be fed in by hand based on the screen shot of the stage parameters.

12) DiaDem\_5dip\_ctrs.jpg: Contour fields for the 5 dipole sim case from above using the code DiaDem

13) MSA\_5dip\_ctrs.jpg: As in 12 but from the MSA code.

14) dip\_5\_stpos\_5\_flux .txt .sim: As in 6 above but a flux calculation

15) dip\_1\_stpos\_5\_flux .txt .sim: As in 3 but flux

16) DiaDem\_5dip\_flux\_ctrs.jpg: As in 12 but flux