# Near fields to far fields transformation from HFSS extracted fields

* Create a \*.pts file with the sampling points coordinates on a bounding surface (especially the radiation boundary one)

e.g. the first 7 sampling points on a box

-0.0089483333333333342 -0.0089672727272727265 0.08691299999999999

-0.0089483333333333342 -0.0069239610389610386 0.08691299999999999

-0.0089483333333333342 -0.0048806493506493498 0.08691299999999999

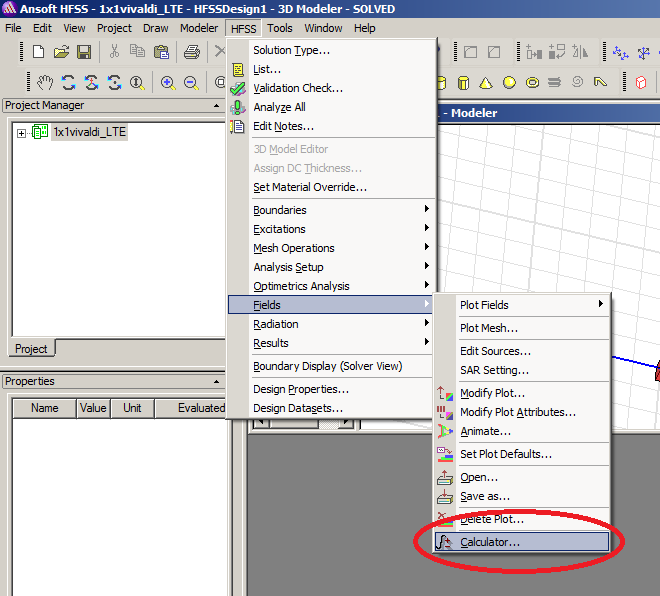
-0.0089483333333333342 -0.002837337662337661 0.08691299999999999

-0.0089483333333333342 -0.00079402597402597301 0.08691299999999999

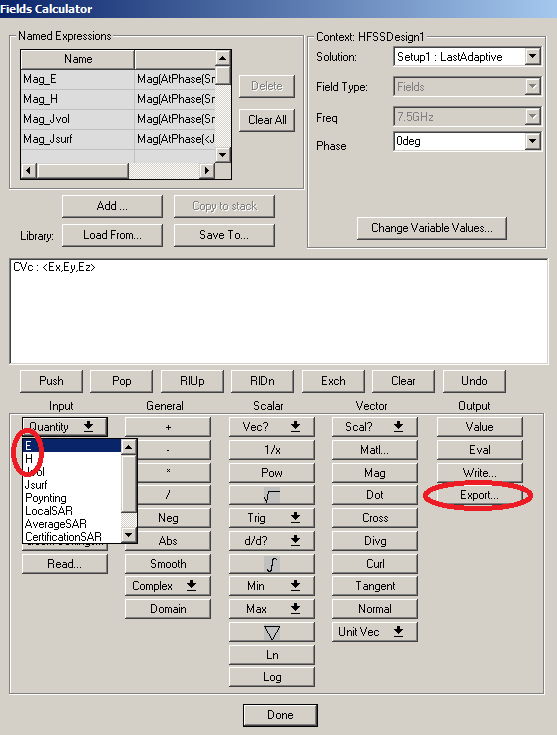
-0.0089483333333333342 0.0012492857142857149 0.08691299999999999

-0.0089483333333333342 0.0032925974025974046 0.08691299999999999

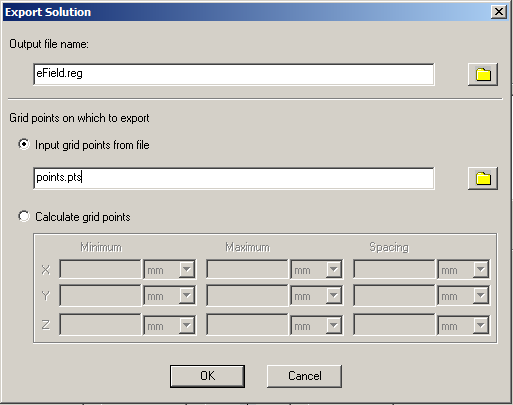
* Extract the fields from the HFFS solutions with the “fields calculator”



* Then select either the electric field E or the magnetic field H as quantities to export



* Once selected the quantity to export, press the button export: a window will appear and we will need to specify the sampling points coordinates file (\*.pts) and the output file of the fields to dump (\*.reg)



* Now we can apply the near to far transformations from the so-sampled fields on the surface.

# Near fields to far fields transformation from LTE solutions and solutions-to- near- fields operator

**\_callSolvers.bat :** batch file that calls the necessary processes for radiation model system matrices. The execution of this code must (should) be combined with a matlab one that calls the ParDiSo (MEX compiled PARallel Direct SOlver)

@echo off

REM Frequency of analysis

set freq=7.5e9

REM Searches automatically the \*.hfss file (must be unique!!!) in the directory to obtain the name

REM of the project

for /F "tokens=\*" %%\* in ('dir /b \*.hfss') do call :Sub %%~n\*

goto :eof

:Sub

echo Name of Project : %\*.hfss

echo Chosen Frequency : %freq% Hz

echo.

REM Copies the HFSS model files (mesh, materials, boundary conditions) into the current directory

cd %\*.hfssresults

cd \*.results

cd \*.cmesh

copy current.\* ..\..\..\\*

cd ..\..\..\

echo.

echo.

echo Please check if model files have been copied then

echo press a button to call the Mesh Reader ...

echo

pause

echo.

REM calling the MeshReader to create the LTE model from the HFSS model files

call ..\\_femSolvers\ANST\_MeshReader.exe %\*

echo.

echo.

echo Press a button to call the Wave Solver ...

echo

pause

echo.

set path=%path%;..\..\\_femSolvers\

cd lte\_fileset

REM Modify the \*.mpara file to set the polynomials order (the last number in the SOLID definition)

REM remember that HFSS polynomial order begins with 0 while LTE's one with 1 (3D tent basis)

call notepad %\*.mpara

REM Modify the \*.seinfo file to obtain infos on the phases of excitation of the ports - these

REM informations are dump only if the EM\_WaveSolver is called with the +singleEnded option

call notepad %\*.seinfo

REM Calls the EM\_WaveSolver in order to build the FEM matrix A and the right-hand sides b related to

REM the feeding ports - the solutions-to-fields operator will be dumped using the options

REM +fieldValues +fieldFunctional - the +directMatlab option relies on the mex compiled ParDiSo

call EM\_WaveSolver.exe %\* %freq% +directMatlab +fieldValues +fieldFunctional

REM call EM\_WaveSolver.exe %\* %freq% +singleEnded +directMatlab +fieldValues +fieldFunctional

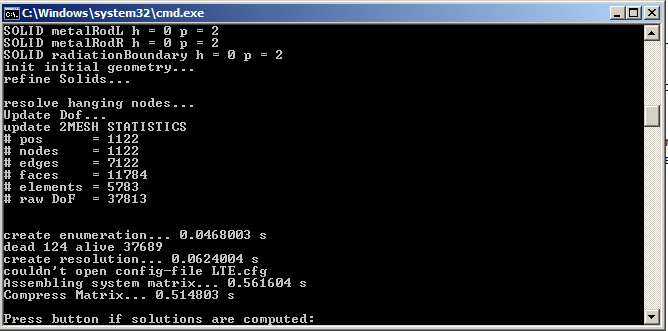
echo

echo.

Pause

The EM\_WaveSolver will stop at a certain level in order to compute the solutions x(i) = A\b(i) with the ParDiSo and a *FieldEvaluationPoints.fmat* file of the near fields sampling points coordinates must be provided, properly formatted with the matlab function writeMatFull(mP, 'lte\_fileset\FieldEvaluationPoints.fmat') in order to proceed with the construction of the solutions-to-near-fields operator.

**Note:** Once the solutions files and the FieldEvaluationPoints.fmat are dumped, an arbitrary character has to be inserted after the command line Press button if solutions are computed: then, pressing enter, the process will proceed.



The solutions-to-fields operator is made of 3 parts: fieldFunctional\*num2UnNum\*comp2Ext where *fieldFunctional* is the vertical concatenation of *mFH* (functional that provides the magnetic field on the sampling points ([Hx(1); Hy(1); Hz(1); Hx(2); … ; Hz(N)] for N sampling points) and *mFE* (idem but for Ex, Ey and Ez).

We only need to supply the N2F operator expanded in a truncated Fourier series to obtain the full radiation model.