Modelling

04 Ekim 2011 Salı
22:06

Acronym: Modelling

Geant Modelling of interactions within a detector

04 Ekim 2011 Salı
22:07

Burcin

08 Eylül 2010 Çarşamba
11:08

Test with Redlen 10x10x5 mm pixellated detector.
HV bias is -300 V.
Data collected for 1000 seconds.
File name is burcin_test3_Co57_300V_080910.mpa

Geant4 Simulation Notes - O.A. and B.D.

20 Eylül 2010 Pazartesi
20:18

Evolution of Geant4 simulation package for SU:

13/09/10

1. UMich simulation package taken as a reference. UMich package is very modular and lots of options such as detector size and material, source type and position can be change in settings.ini file. Collimator and/or source holder can also be enable/disable. Please refer to settings.ini file for more information.

2. Physics list files (ExPhysicsList.cc and ExPhysicsList.hh) are modified to match novice example #2.

3. For low energy electromagnetic processes Livermore model is added. G4LECS package is obsolete as of Geant4 V.9.3. This new model can track particles up to 250 eV. For details please see https://twiki.cern.ch/twiki/bin/view/Geant4/LoweProcesses.

4. Pixel definitions are made very crudely.

14/09/10

1. TlBr is added as a detector. (Might be useful in the future!)

2. Simulation output is written in to a file named imaging_output.txt. Data can also be saved in binary mode (which is need to be modified).

14-17/09/10

1. Most of the work is done to add collimator and source holder geometry.

2. Source position automatically changes with existence of collimator and/or source holder. As stated earlier all these parameters can be changed in settings.ini file.

21/09/10

1. Cs 137 source holder is added to the simulation package.

Settings.ini file explanation

30 Eylül 2010 Perşembe
12:50

HANDBOOK FOR SETTINGS.INI FILE
B.D. 24/09/10

This file explains all the parameters given in the settings.ini file to setup the simulation. All these parameters are also explained in the settings.ini file.

numberOfEvent	Sets number of event need to run for each simulation.
detType	Sets which material to use in the simulations. Options are 0 for CZT, 1 for HgI2 and 2 for TlBr.
detSizeX, detSizeY, detSizeZ	Detector dimensions in x,y and z.
detIntvX, detIntvY,detIntvZ	This is required if we setup an array of detectors. Interval in x, y direction means center to center distance of the neighboring detectors. However, interval in z direction means the gap between the neighboring detectors.
detMatrixX, detMatrixY, detMatrixZ	These variables sets the detector matrix information.
pixelSize	Sets the pixel pitch for our detector.
enableTextGeometry	This option is not used. But, I kept it just in case. Options are 0 (off) and 1 (on).
sourceType	Options are 0: User defined source using source position and direction. 1: Point source, photon emitting direction is toward the detector array. 2: Parallel source from a given direction, not requiring photon pass through. 3: Uniform background in energy (0->backgroundEnergyLimit) and direction. 4: Uniform background plus a point source. 5: Point source, photon emitting angle is 4PI. 6: Point source, photon emitting direction is toward the lead collimator for testing. 7: Your own defined source code.
sourceEnergy	Energy of the incoming photon.
distanceToTheDetector	Collimator and/or source holder's distance to the detector. If distance is equals to zero means collimator and/or source holder is right next to the Al box cover.
AlBoxCoverDistance	Al box distance to the detector measured from the box. Keep at 1 cm.
enableCollimator	Enable/disable collimator in the simulation setup. 0: There is no collimator. 1: Collimator is present.
enableSourceHolder	Set up the source holder. 0: There is no source holder.

	1: Source holder is Am-241, Co-57 or Cd-109. 2: Source holder is Cs-137.
sourceHolderIsCo57	This is needed if source holder is for Co, because there is extra lead piece inside the source holder and it needs to be added. Options are 0: Source holder is not Co-57, i.e it is Am-241 or Cd-109. 1: Source holder is Co-57.
enableAlBoxCover	Enable/disable aluminum box cover. Options are 0: No box cover. 1: Box cover is present.
sourcePosX, sourcePosY, sourcePosZ	Source position should be shift according to the collimator/source holder position. Read su_czt.cc for details. After changes in su_czt.cc keep these positions to zero.
sourceDirX, sourceDirY, sourceDirZ	Defaults values are 0, 1 and 0 for x,y and z, respectively.
SBRatio	Source to background ratio, effective only when source type is 4. I haven't tested this one, as of 24/09/10.
backgroundEnergyLimit	Background energy range from 0 to backgroundEnergyLimit. Effective only when source type is 3 or 4. I haven't tested this one, as of 24/09/10.
energyResolution	Energy resolution is defined as FWHM energyResolution*100% at 662keV. For example, to define 0.5% FWHM at 662keV, energyResolution should be 0.005.
depthResolution	To define depth resolution in mm.
outputImagingDataInText	Save output as number of interaction (i.e. single, double pixel event etc.), energy, pixel x, pixel y, x, y, and z position, interaction type. Options are 0 (off) and 1 (on).
outputImagingDataInBinary	Save output as number of interaction (i.e. single, double pixel event etc.), energy, pixel x, pixel y, x, y, and z position, interaction type. Options are 0 (off) and 1 (on). For some reason binary file is bigger than the text file ????

outputElectronCloud	Save electron cloud information into a file. Format is number of cloud points, x's, y's, z's, energy's (binary mode)
outputInitParametersInText	Initial energy, initial position, initial direction of the source particle. Data written in text mode. Options are 0 (off) and 1 (on). I don't think this is really important.
outputInitParametersInBinary	Initial energy, initial position, initial direction of the source particle. Data written in text mode. Options are 0 (off) and 1 (on). I don't think this is really important.
displayTrackDetails	To print track details. Options are 0 (off) and 1 (on).
collimatorTestThickness	Simple lead collimator for testing. Thickness of the lead.

collimatorTestDiameter	Simple lead collimator for testing. Diameter of the lead.
collimatorTestHoleDiameter	Simple lead collimator for testing. Diameter of hole in lead.

COMSOL modelling of Electric field lines and weighting potentials

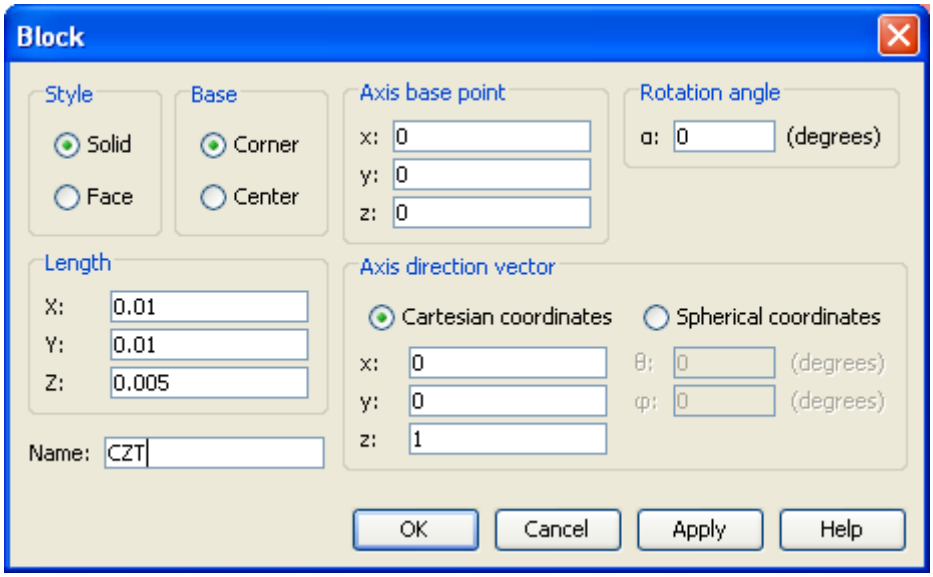
04 Ekim 2011 Salı
22:08

Ozge Comsol Studies

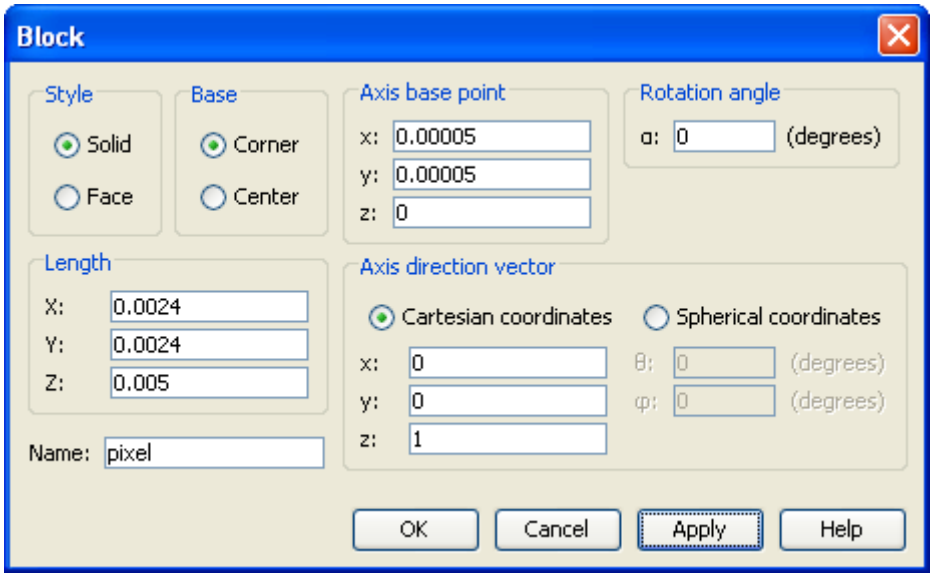
23 Eylül 2010 Perşembe
15:47

File->New-> Space Dimension 3D
-> Comsol Multiphysics -> Electromagnetic -> Electrostatics then OK.

Draw-> Block (for creating the CZT detector Volume)

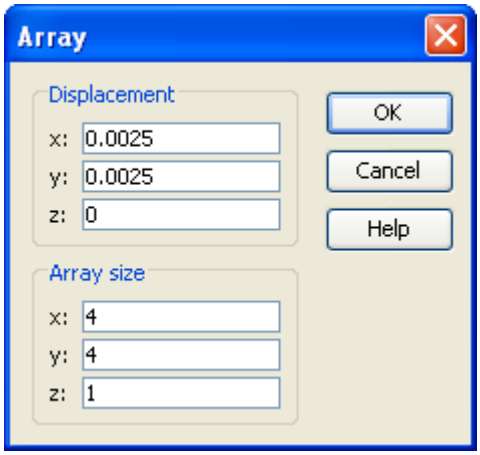


For creating pixel inside the mother volume.

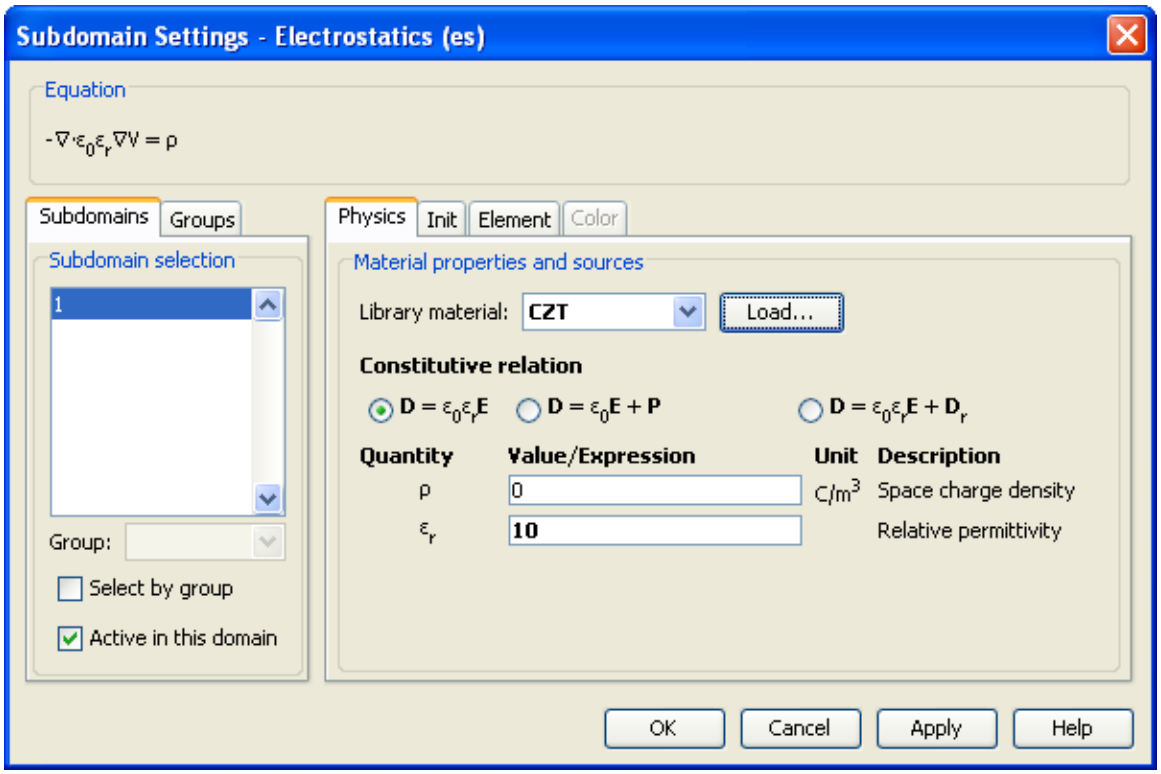


Then OK.

By using array command, it can be created more volumes in one time.



Physics -> Subdomain Settings -> (Select Subdomain) Load User defined Materials -> CZT



Then OK.

Physics -> Boundary Settings pixel one is selected V=1 others are ground.

Mesh -> Initialize Mesh
Solve -> Solve Problem

With COMSOL 4.1 3D CZT Detector simulated.

File name is CdZnTe_280211_3D_WP.mph for weighing potential
File name is CdZnTe_280211_2D_SE.mph for different steering electrode potentials

First,

• Select “3D” Select Space Dimension Menu then push "NEXT" cursor
• AC / DC > Electrostatics (es) then push "NEXT" cursor
• Select study type -> Stationary
• Checkered flag to Finish

--CREATE GEOMETRY
In the geometry first cathodes were created as an array. CZT was created as a rectangle and extruded 5 mm. Then cathodes extruded from the CZT block 0.1 mm in the reverse direction. Anodes were extruded as cathodes 0.1 mm.

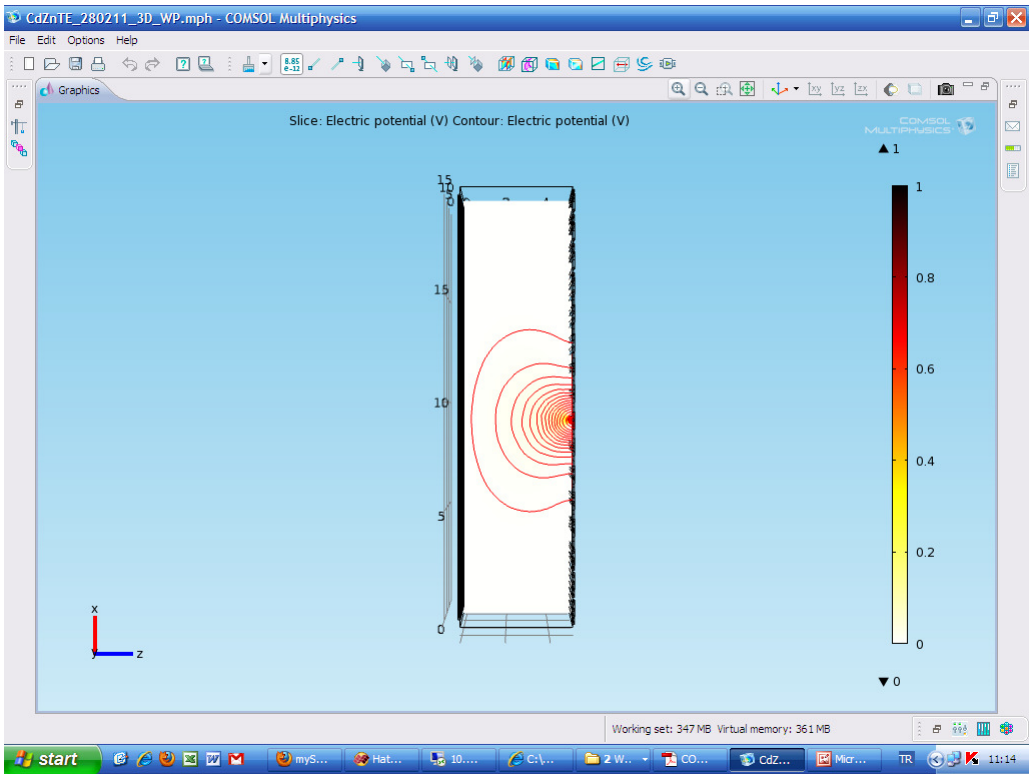
--SELECT MATERIALS
CZT Mateial was created first (In Materials, right click, select material, then define the properties of the material in order to create the material)
Anodes and Cathodes materials were selected as AU.

ELECTROSTATICS
--All cathode surfaces were selected GROUND, only referance anode was selected as 1 V. All other surfaces were zero charge symmetry.

MESH
--Right click, then select build all.

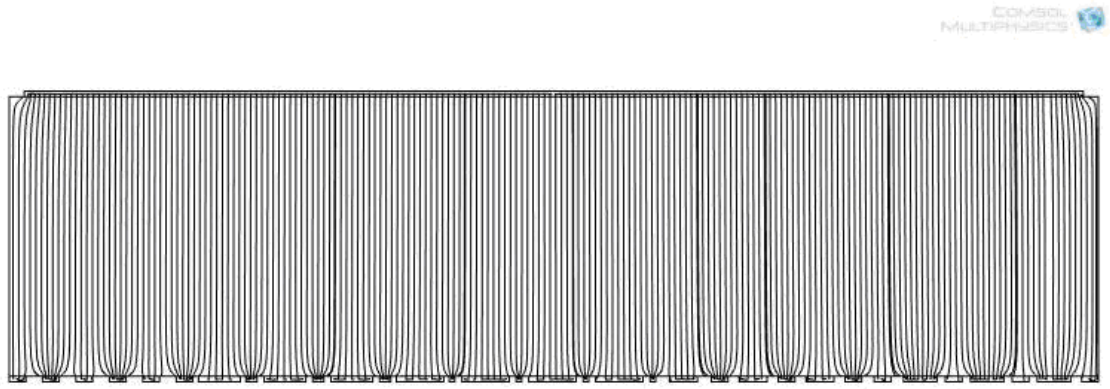
STUDY 1
--Right click, then compute

RESULTS
-- Tables -> 3D Plot Group -> Select Slice 1 and select Contour 1 Plots

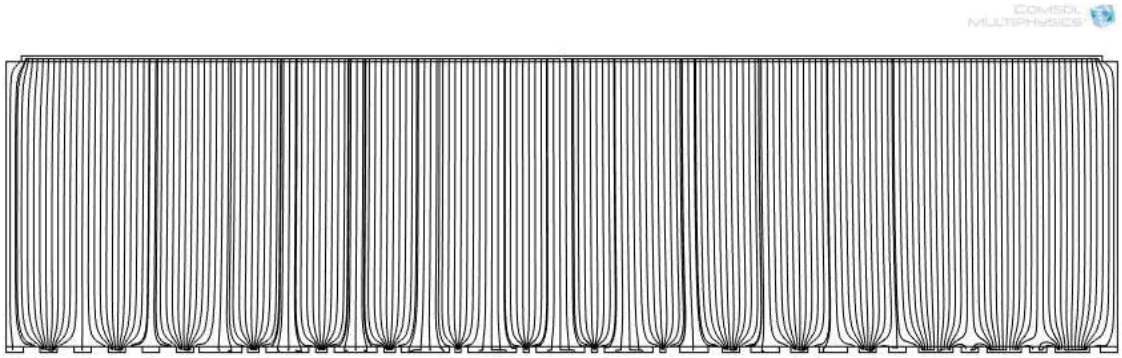


For different steering electrode potentials, steering electrodes were selected -20 and -50 volt,respectively. cathodes were selected -500 volt. Anode surfaces were selected as Ground and other surfaces were selected as zero charge.

While steering electrode -20 Volt, cathode -500 volt



While steering electrode -50 Volt, cathode -500 volt



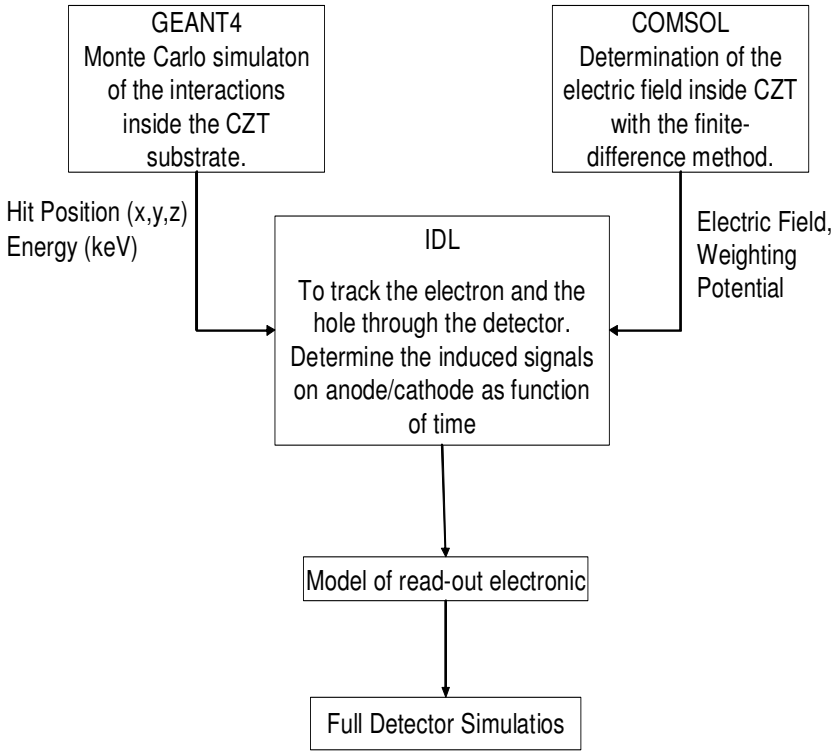
IDL Modeling of charge transport and collection

04 Ekim 2011 Salı
22:08

Ozge IDL Studies

03 Mayıs 2011 Salı
14:02

Modelling of CZT Detector

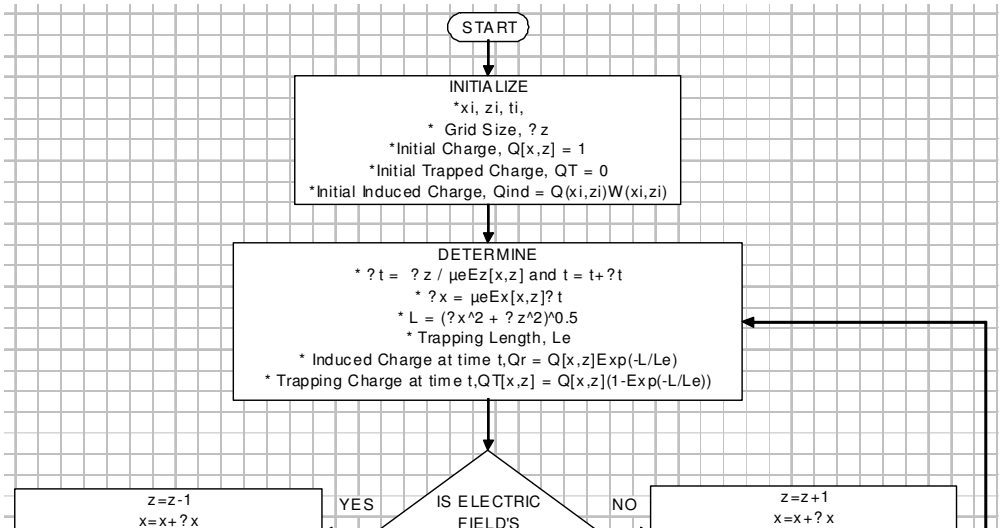


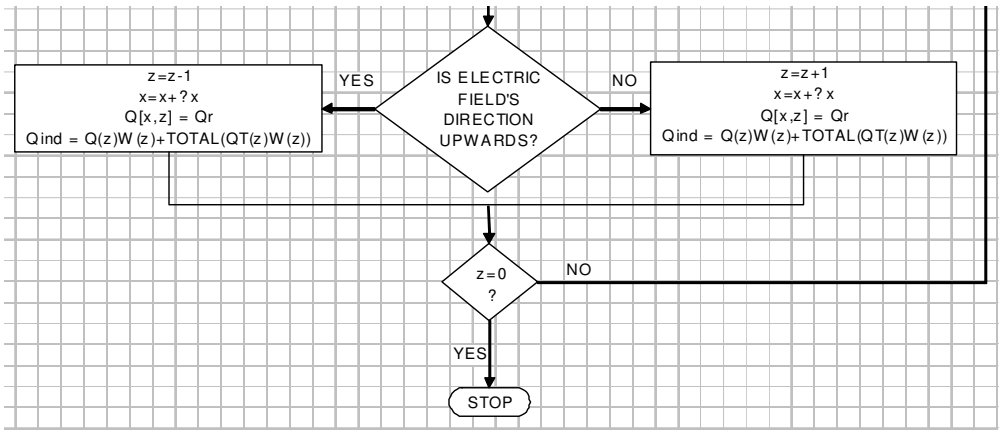
IDL programs:

C:\Documents and Settings\emrahk\Desktop\Modelling

1. read_my_data.pro (Read Electric Field, Weighting Potential field on anode, and Weighting potential field on cathode data txt files created by COMSOL, and refine grid.)
2. electron_motion.pro (Define electron motion inside the detector)
3. hole_motion.pro (Define hole motion inside the detector)

FlowChart of the Program




z=z-1
x=x+?x
Q[x,z] = Qr
Qind = Q(z)W(z)+TOTAL(QT(z)W(z))
YES
IS ELECTRIC FIELD'S DIRECTION UPWARDS?
NO
z=z+1
x=x+?x
Q[x,z] = Qr
Qind = Q(z)W(z)+TOTAL(QT(z)W(z))
z=0 ?
NO
YES
STOP