Dicom processing in flair

Vasilis.Vlachoudis@cern.ch

Dicom importing to FLUKA

Flair has been enhaced to perform through a user friendly interface:

- Dicom file conversion to enhanced FLUKA voxel format

  - The conversion is done using the python pydicom library

  - The user has to provide:

    - Dicom set identified by the *Series UID*
    - List of predefined materials and compounds
    - Hounsfield ranges to material conversion
    - Hounsfield ranges to density and dE/dx correction scaling

  - The enhanced FLUKA voxel format contains in a single voxel file all the information: Voxel data, material assignments, material and compound definitions and correction factors

- Dicom file conversion to FLUKA USRBIN format

  - Gives the possibility to import the output of the TP systems in flair, where the user can visualize and compare with FLUKA predictions through the standard fluka/flair tools.
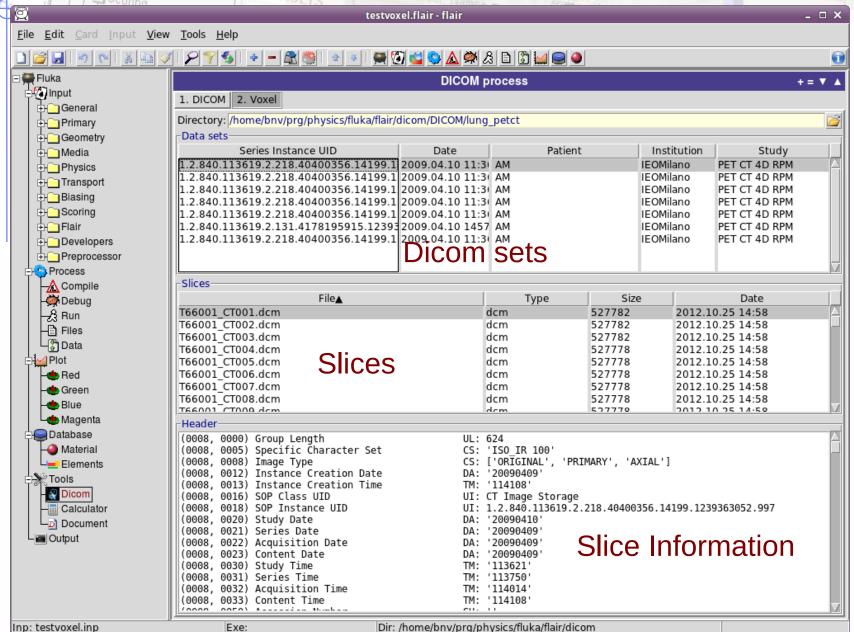
Dicom selection

Voxel Generation

DICOM process

1. DICOM | 2. Voxel

UID: 1.2.840.113619.2.218.40400356.14199.1239363052.739
Patient Name: AM
Institution: IEOMilano
slices: 64
Voxel size [dx x dy x dz]: 0.976562 x 0.976562 x 2.5 mm^3
Rescale: 1 * val + -1024
Unique Units [Regions]: 3719

Date/Time: 2009.04.10 11:36
Study: PET CT 4D RPM
voxels [Nx x Ny x Nz]: 512 x 512 x 64
Dimensions [Dx x Dy x Dz]: 500 x 500 x 160 mm^3
Unit range [Min..Max]: -3024 .. 3071
materials: 43

Materials: material.inp
Unit to Material : body.mat

Dicom information

Materials file

< Unit	Material	Cr[min]	Cr[max]	Cr*[dedx_min]	Cr*[dedx_max]
-1021	AIR	0.6825432	1.3174568	1.0	1.0
-1016	HU<-1015	0.720281108	1.27971895	1.0	1.0
-1011	HU<-1010	0.835391418	1.16460858	1.0	1.0
-1001	HU<-1000	0.733656625	1.16949124	1.0	1.0
-996	HU<-995	0.909584201	1.05424948	1.0	1.0
-989	HU<-988	0.909502356	1.09049764	1.0	1.0
-975	HU<-974	0.85108832	1.14891168	1.0	1.0
-963	HU<-962	0.902912681	1.09708732	1.0	1.0
-951	HU<-950	0.919883508	1.08011649	1.0	1.0
-926	HU<-925	0.862306423	1.13769358	1.0	1.0
-901	HU<-900	0.893000468	1.10699951	1.0	1.0
-831	HU<-830	0.783902333	1.21609767	1.0	1.0
-701	HU<-700	0.75158871	1.24841129	1.0	1.0
-501	HU<-500	0.765689411	1.23431059	1.0	1.0
-121	HU<-120	0.734835247	1.26516475	1.0	1.0
-84	HU<-83	0.980501545	1.01835909	1.0	1.0
-54	HU<-53	0.98600717	1.01305997	1.0	1.0
-24	HU<-23	0.986384099	1.01270032	1.0	1.0
6	HU<7	0.98674495	1.01236373	1.0	1.0
14	HU<18	0.995655766	1.00173225	1.0	1.0
79	HU<80	0.972407965	1.03421835	1.0	1.0
100	HU<120	0.980146255	1.00104493	1.0	1.0
119	HU<120	0.962511989	0.973311932245	1.0	1.0
199	HU<200	0.973911929092	1.02131168	1.0	1.0

Hounsfield unit Conversion to Material and Density correction

Create VOXEL file: test.vxl — VOXEL

Create USRBIN file: dicom.bnn — USRBIN

Inp: testvoxel.inp   Exe: Dir: /home/bnv/prg/physics/fluka/flair/dicom

FLUKA simulation

Voxel 2D projection
Overlayed with a
300MeV p+ beam
Simulation from FLUKA

Flair has the possibility
to make also 3D plots
of voxels