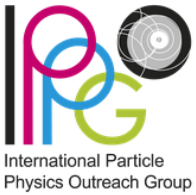


Çfarë është matRad?

Albana Topi, PhD (a.topi@gsi.de)
GSI Helmholtz Center for Heavy Ion Research (gsi.de)
on behalf of IPPOG and IMC

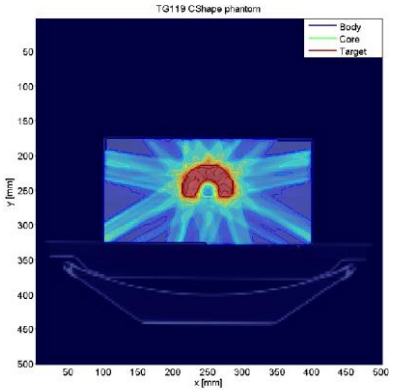
Slides by:
Aris Mamaras
Viridiana Badillo
Enrique Sánchez
Yiota Foka

matRad

matlab + radiation = matRad

- Open source software toolkit for radiation treatment planning of intensity modulated photon, proton and carbon ion therapy
- Implemented for educational and research purposes

Pse bazohet në Matlab?



- User friendly and easy data visualization functionalities
- Convenient debugging
- Allows for rapid prototype developments
- Well known tool in the medical physics community
- Simple syntax compared to higher abstract programming languages like C++
- Standalone (matRad.exe) can be used without license
- An open source independent development environment (IDE) is given by octave

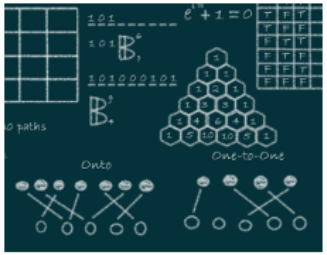
matRad – community

more than 22 institutions use matRad

Si ndodh proçesimi i të dhënave?

INPUT

STORAGE OF VARIABLES TROUGH DATA STRUCTURES



PROCESSING

$$\min f(d(w)), w \in \mathbb{R}^n$$

$$f = \sum_i p_i f_i$$

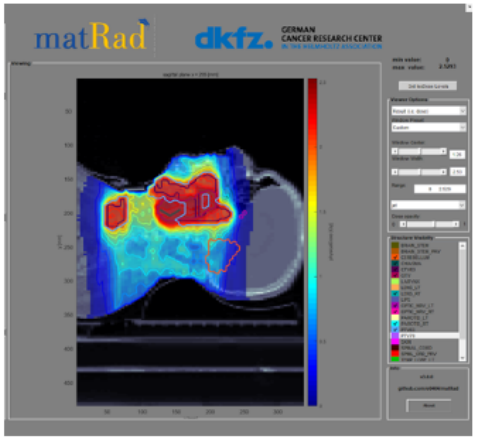
$$s.t. \quad d = Dw$$

$$c_l \leq c(w) \leq c_u$$

$$w_l \leq w \leq w_u$$

$$f(w)\colon \mathbb{R}^n \rightarrow \mathbb{R} \quad , c(w)\colon \mathbb{R}^n \rightarrow \mathbb{R}^m$$

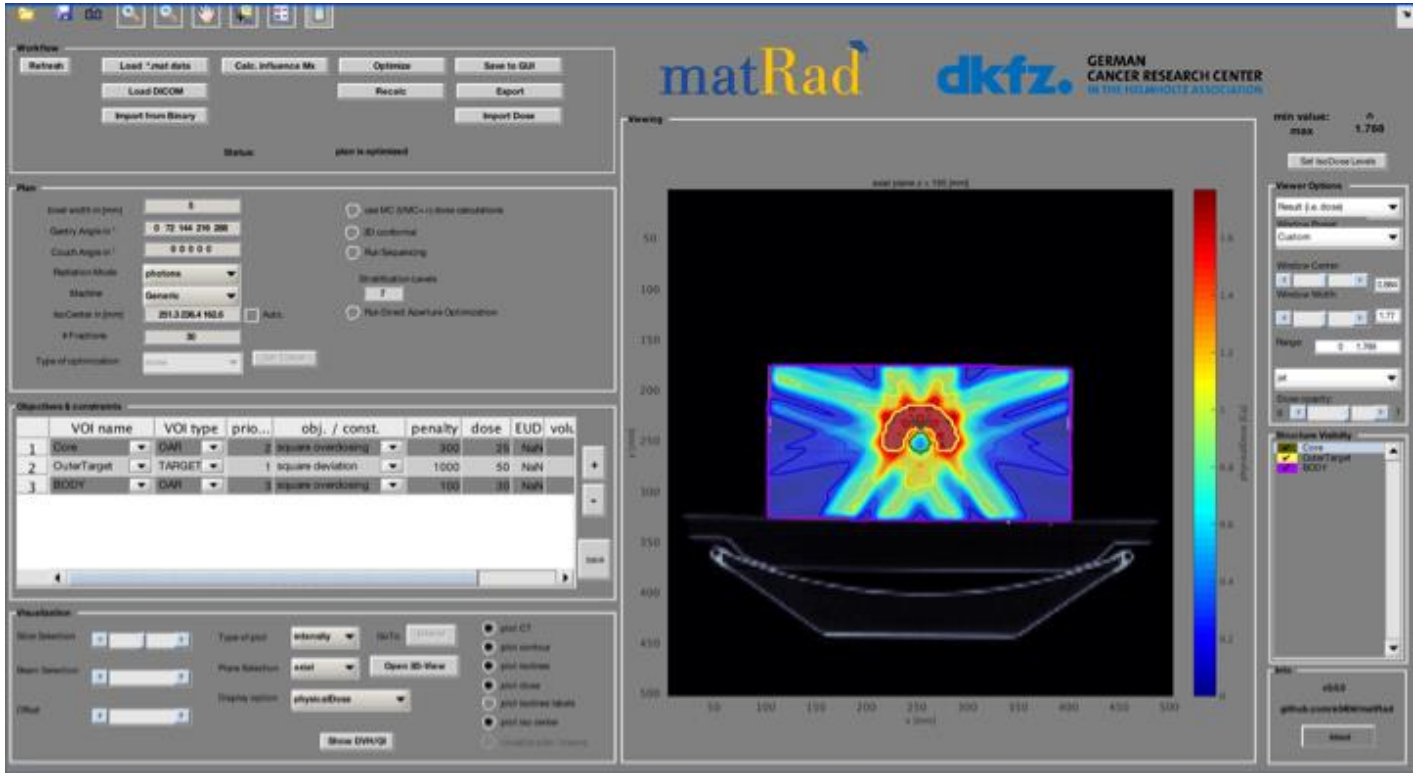
RESULTS STORAGE AND VISUAL PROCESSING



PROCEDURE

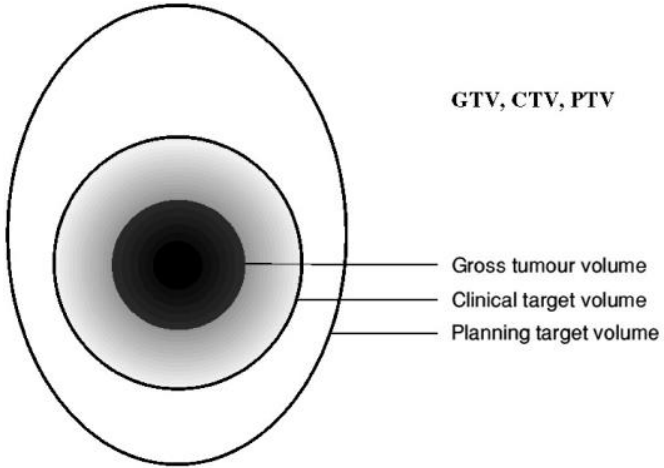
Interfaqja grafike e matRad

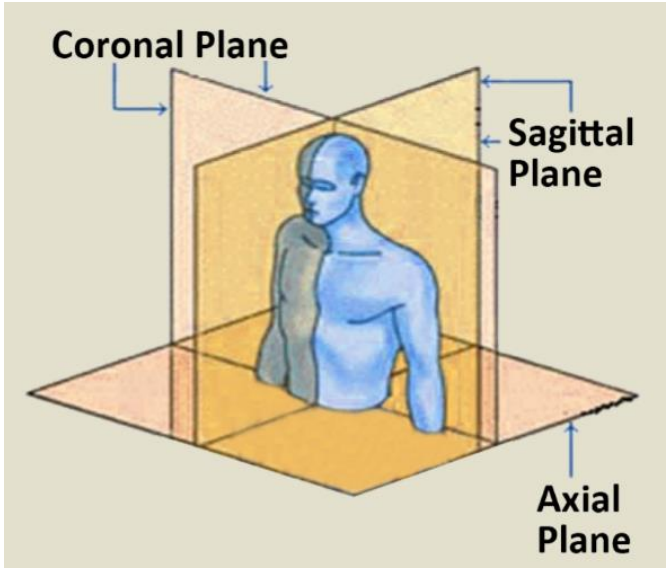
Mund të përdoret me
Matlab ose me matRad GUI



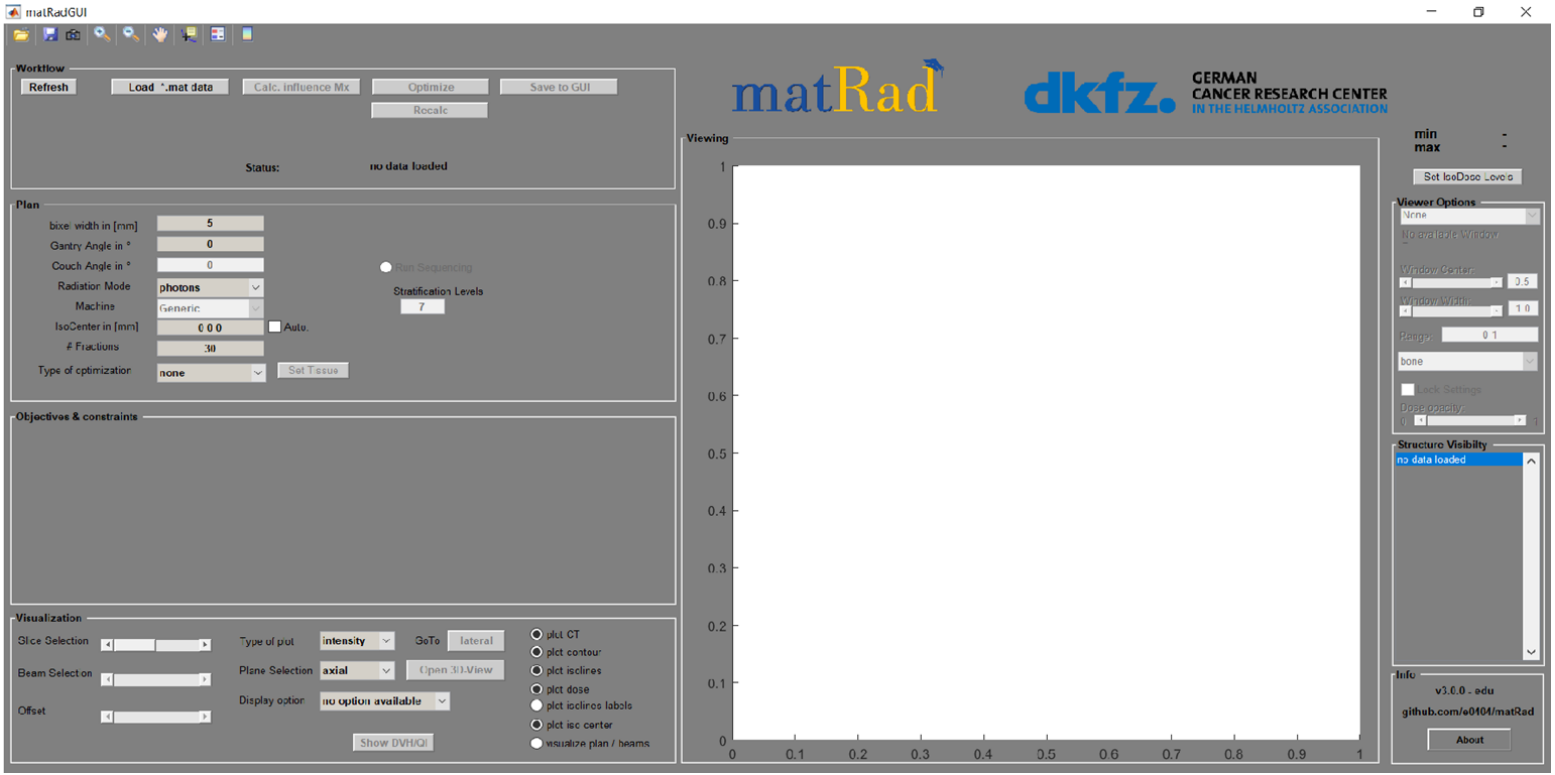
Paketa e matRad për PTMC

- Paketa e instalimit të programit vjen bashkë me 3 raste studimi:
  - TG 119 ose fantoma C
  - Liver
  - Head & Neck (H&N)



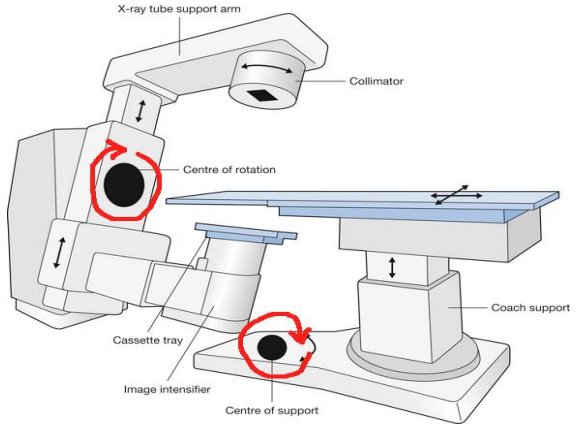


Nisja e programit

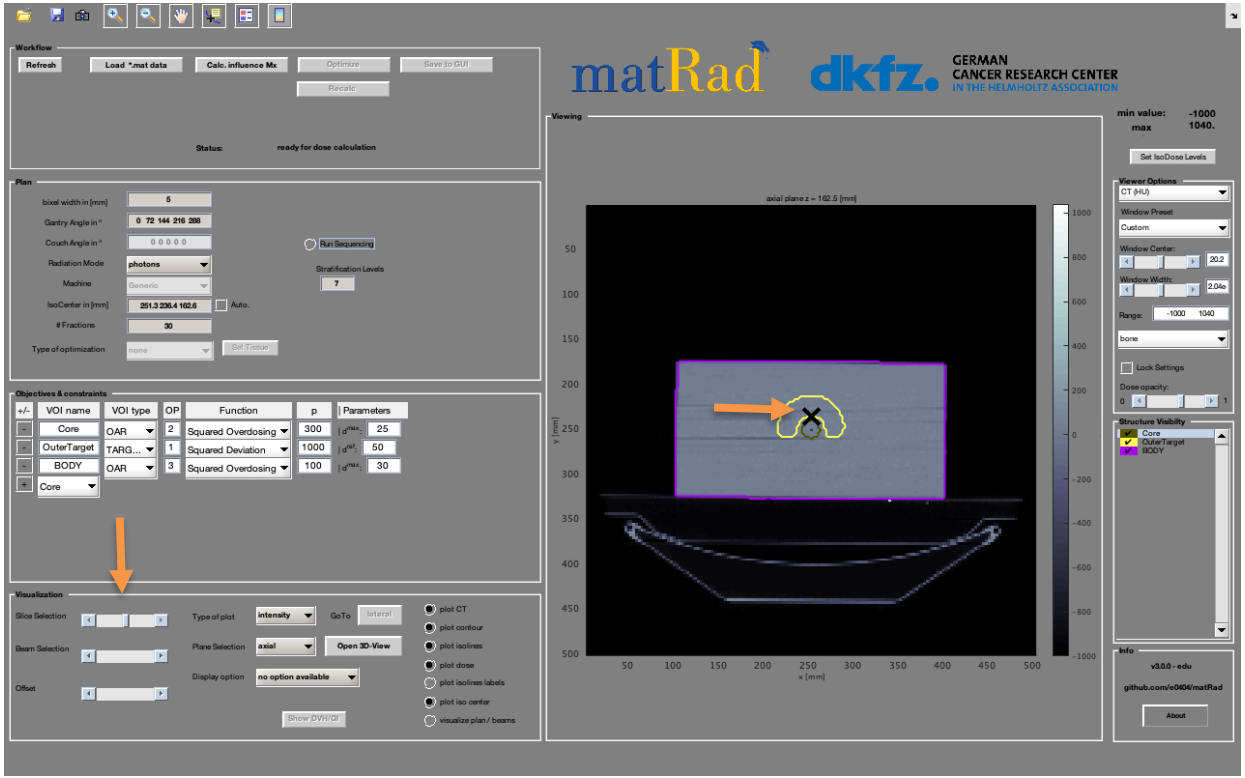


Paneli: Plan

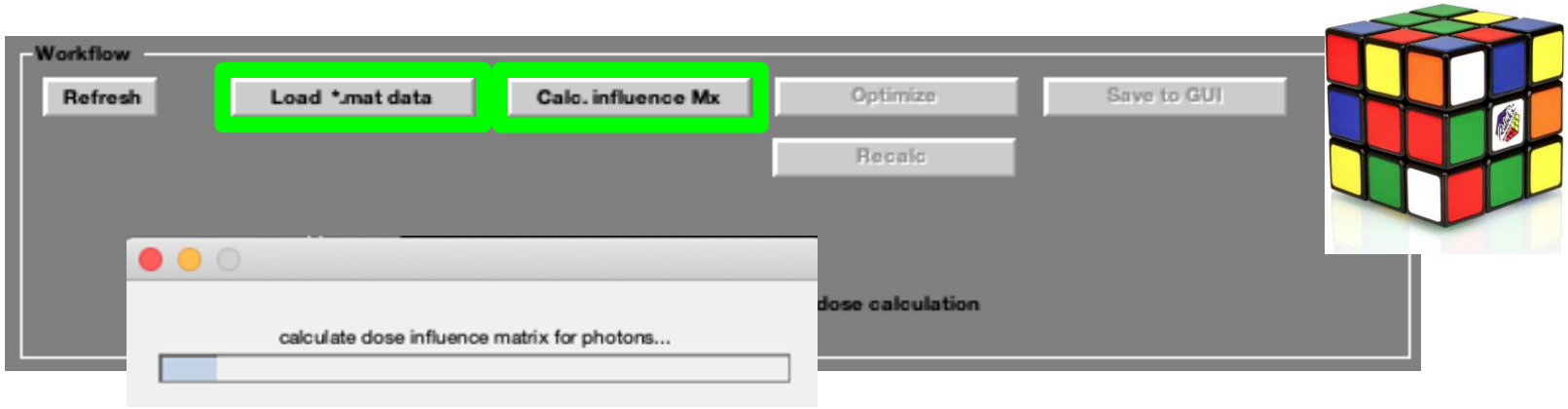
- **Bixel width**: square size.
- **Gantry and couch angles:** *Vendos vlerat e kendeve për Gantry dhe për couch (krevatin e pazientit). Nëse përdoren 5 kënde për Grantry, atëhere do të kemi* 5 kënde edhe për krevatin. Këto kënde kanë vlera nga 0º deri 359º.
- **Radiation mode**: çfarë grimce do të përdoret.
- **Isocenter**: Gjithmon verifiko që “automatic isocenter” është aktive. Është qëndra ku kalon tufa e rrezatimit.
- **Fractions:** Numri i fraksioneve = numri “slices” apo fetave që do të përdoren për të vizualizuar 3D graphics.
- **Run sequencing**: përdoret për të kolimuar tufën (për rastin tonë nuk është aktive)



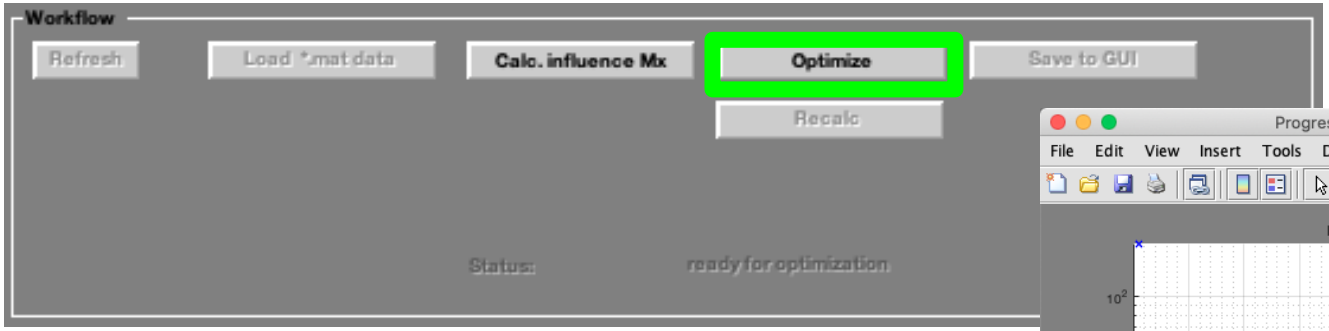
Isocenter

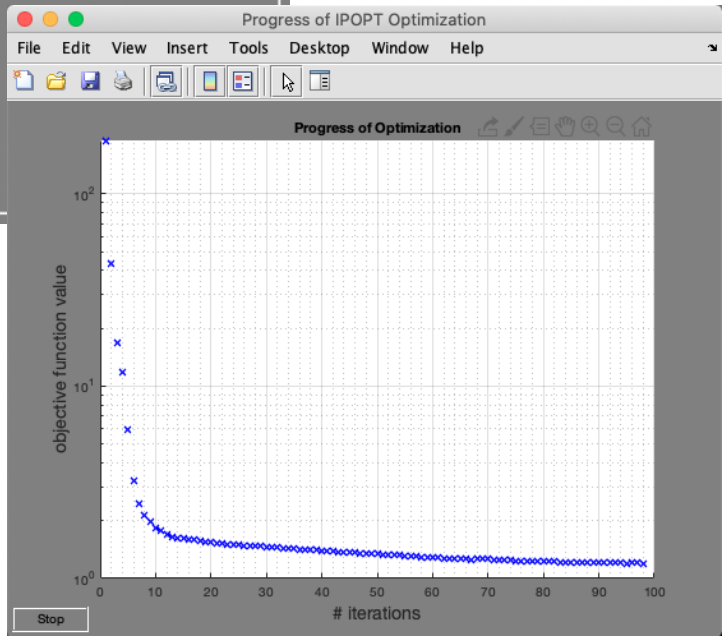

matRad
dkfz.
GERMAN CANCER RESEARCH CENTER
IN THE HELMHOLTZ ASSOCIATION
Workflow
Refresh
Load *.mat data
Calc. influence Mx
Optimize
Save to GUI
Recalc
Status:
ready for dose calculation
Plan
bixel width in [mm]
Gantry Angle in °
Couch Angle in °
Radiation Mode
photons
Machine
Generic
IsoCenter in [mm]
Fractions
Type of optimization
Run Sequencing
Stratification Levels
Auto.
Set Tissue
Objectives & constraints
+/-
VOI name
VOI type
OP
Function
p
Parameters
Core
OAR
Squared Overdosing
OuterTarget
TARG...
Squared Deviation
BODY
Visualization
Slice Selection
Beam Selection
Offset
Type of plot
intensity
GoTo
lateral
Plane Selection
axial
Open 3D-View
Display option
no option available
Show DVH/QI
plot CT
plot contour
plot isolines
plot dose
plot isolines labels
plot iso center
visualize plan / beams
Viewing
axial plane z = 162.5 [mm]
x [mm]
y [mm]
min value:
max
-1000
1040.
Set IsoDose Levels
Viewer Options
CT (HU)
Window Preset
Custom
Window Center:
Window Width:
Range:
bone
Lock Settings
Dose opacity:
Structure Visibility
Core
OuterTarget
BODY
Info
v3.0.0 - edu
github.com/e0404/matRad
About

Paneli: Workflow



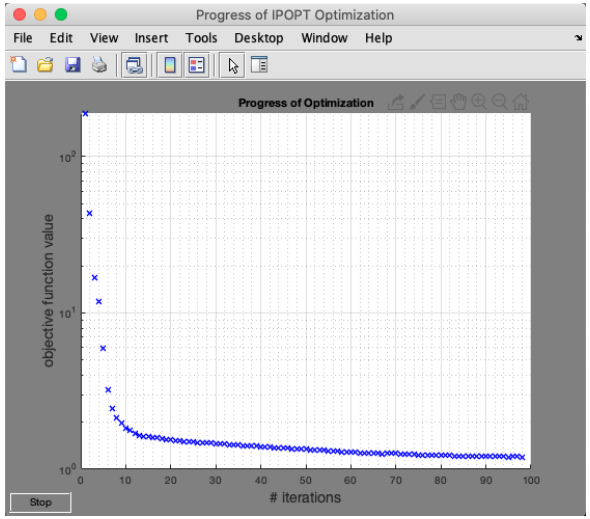
Paneli: Workflow





Here the program will look for the minimum radiation flux per bixel.

Workflow – exponential distribution



- The optimizer optimizes a non-linear constrained optimization problem with an interior-point algorithm. The objective function and constraint functions are built from the specific objectives one can set in the table.

Objectives & constraints

+/-	VOI name	VOI type	OP	Function	p	Parameters
-	Core	OAR	2	Squared Overdosing	300	d^{max}: 25
-	OuterTarget	TAR...	1	Squared Deviation	1000	d^{ref}: 50
-	BODY	OAR	3	Squared Overdosing	100	d^{max}: 30
+	Core					

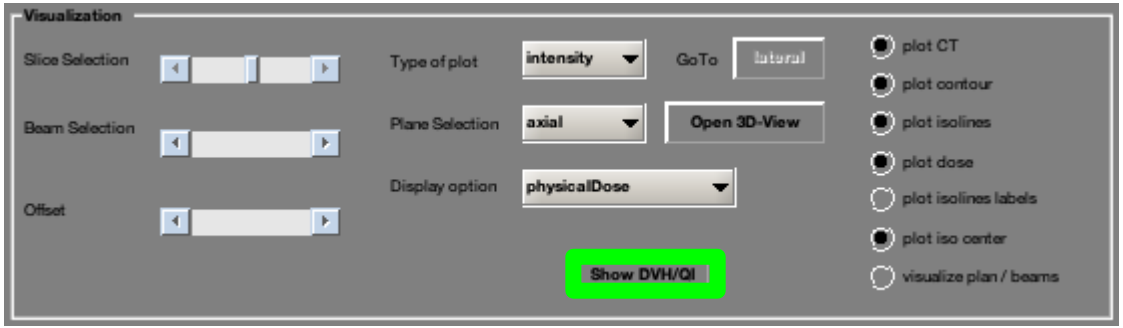
Objectives and constraints include the organs of interest (e.g target), as well as the organs at risk (e.g body, core etc.) that are about to be irradiated and also, we want to avoid obtaining more dose.

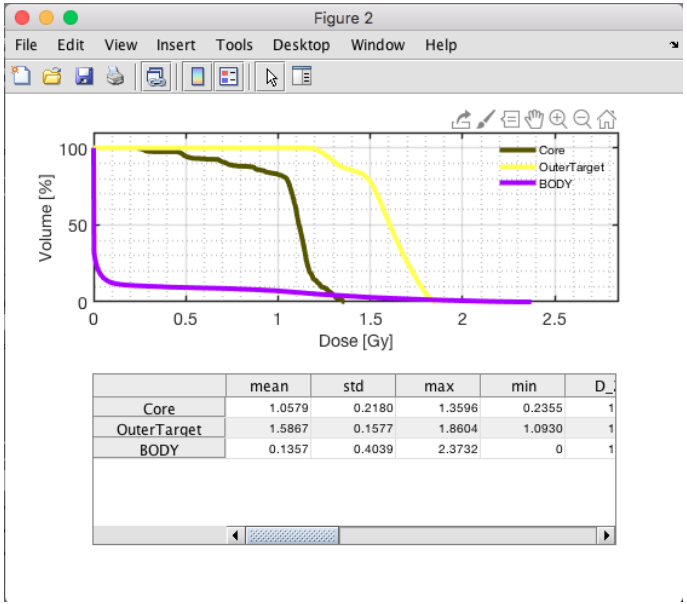
Workflow: Save to GUI

Kjo komand ruan set-up e krijuar dhe kërkon që ti vendosësh një emër.
Ky hap është i rëndësishëm për shfaqjen e DVH.

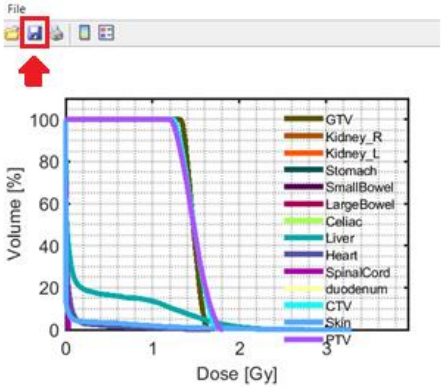
Visualisation

Show DVH/QI: tregon dose-volume histogram që i korrespondojnë planit që krijon.

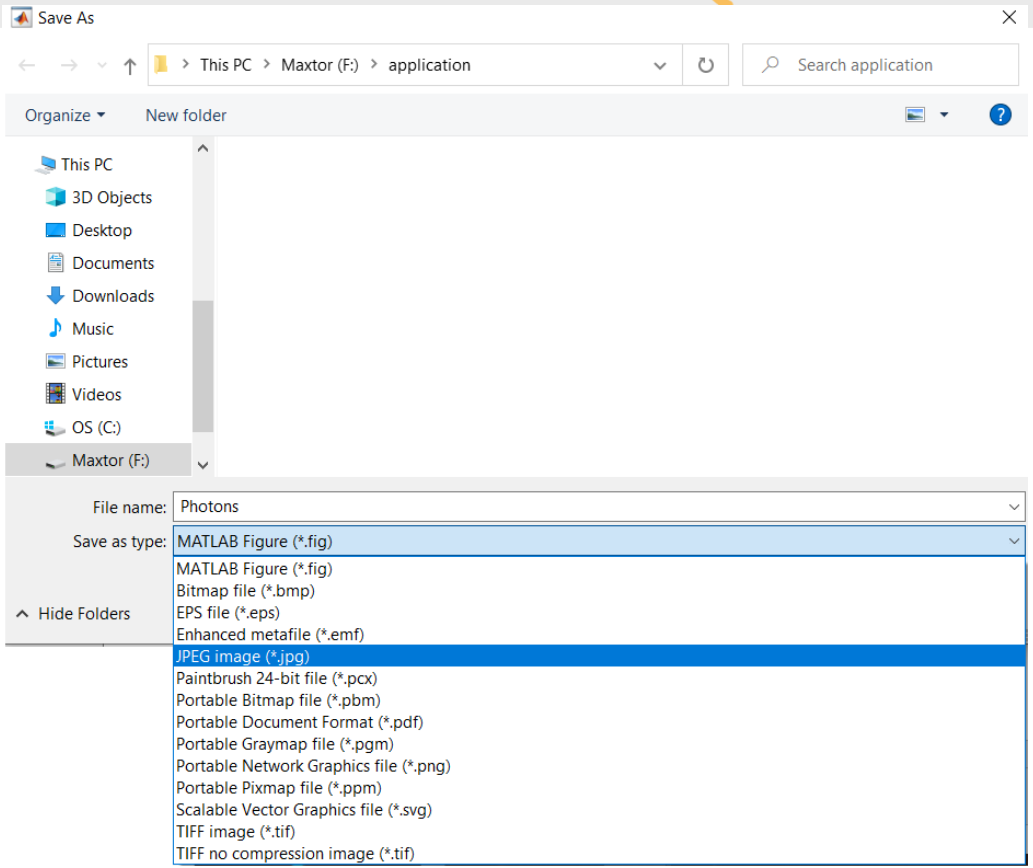




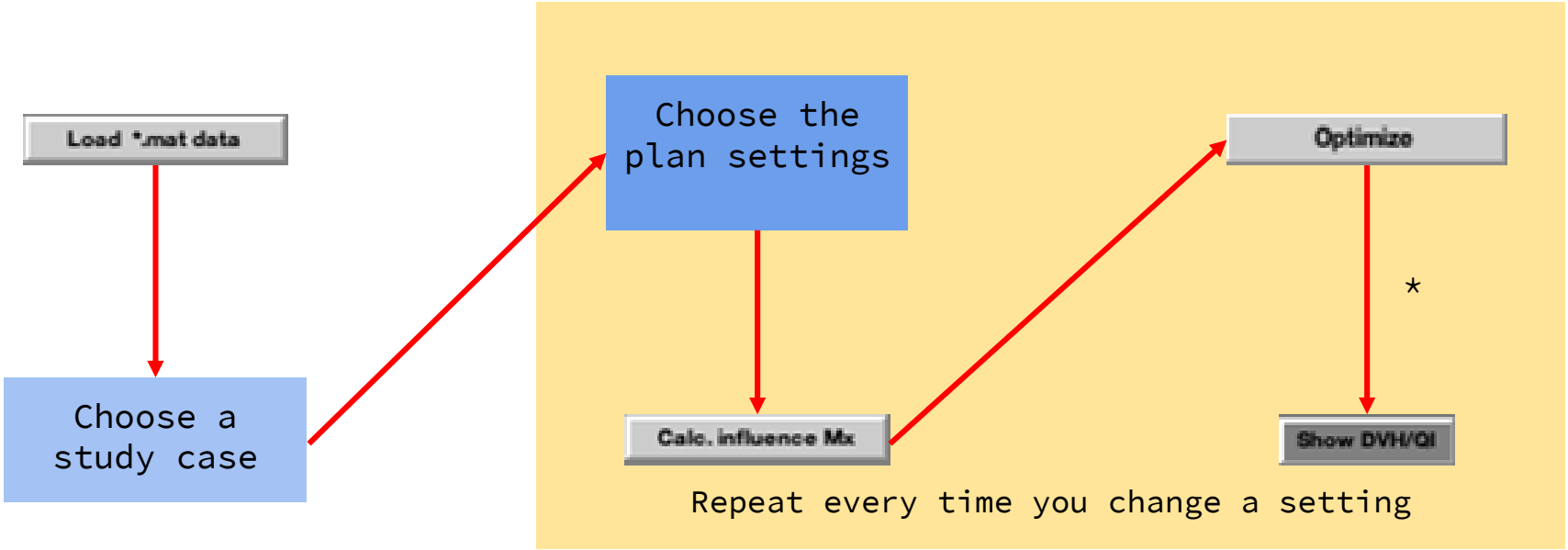
DVH për çdo rast studimi



	max	min	mean
GTV	1.6394	1.3173	1.4714
Kidney_R	0	0	0
Kidney_L	0	0	0
Stomach	0	0	0
SmallBowel	0	0	0
LargeBowel	0	0	0
Celiac	0	0	0
Liver	2.6394	0	0.2547
Heart	1.6706	0	0.0370
SpinalCord	0.0383	0	0.0053
duodenum	0	0	0



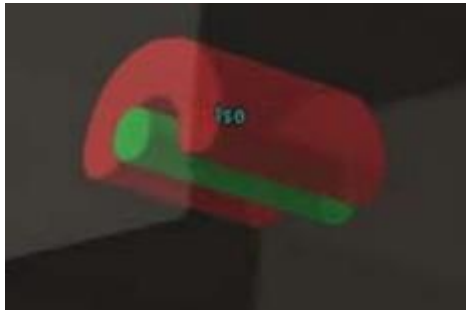
Përmbledhje e proçeseve

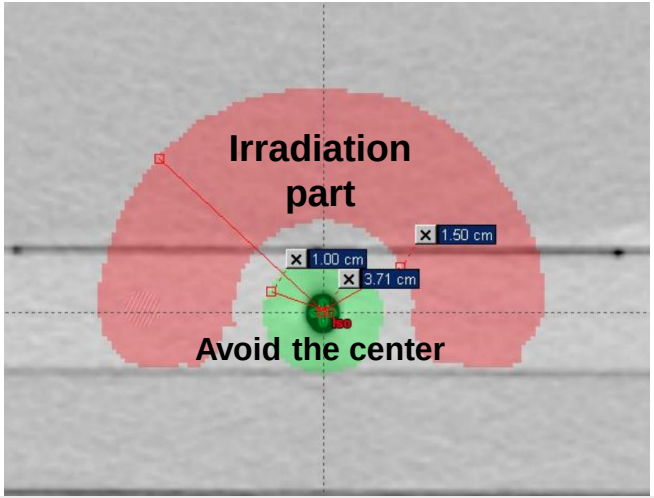


TG119 Fantom case

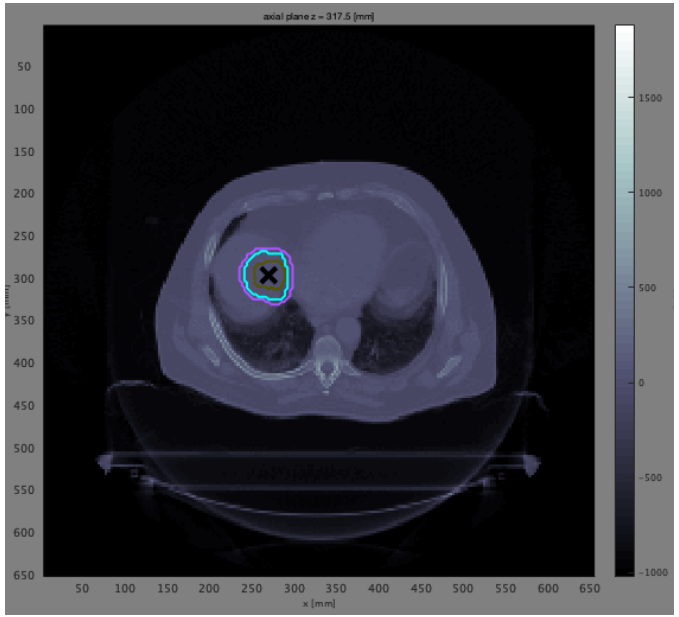
- Fantoma TG119 apo fantoma C përdoret nga profesionistë për të verifikuar të paisjet funksionojnë siç duhet. Kanë formë dhe dimensione standarte.

- Qëllimi i përdorimit është rrezatimi i zonës në formë “C” dhe evitimi i zones qëndrore

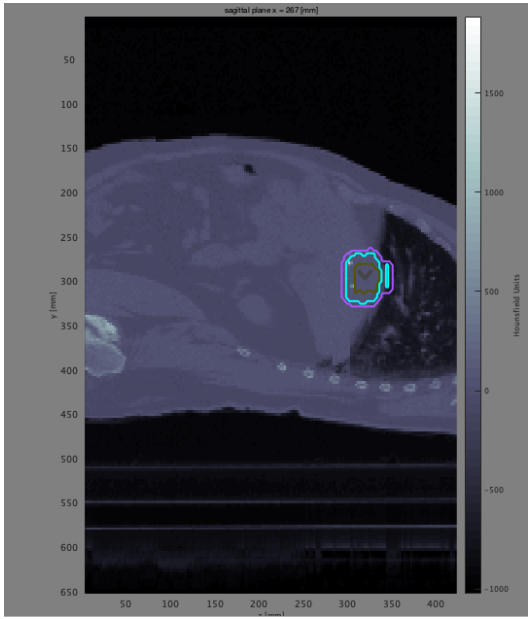




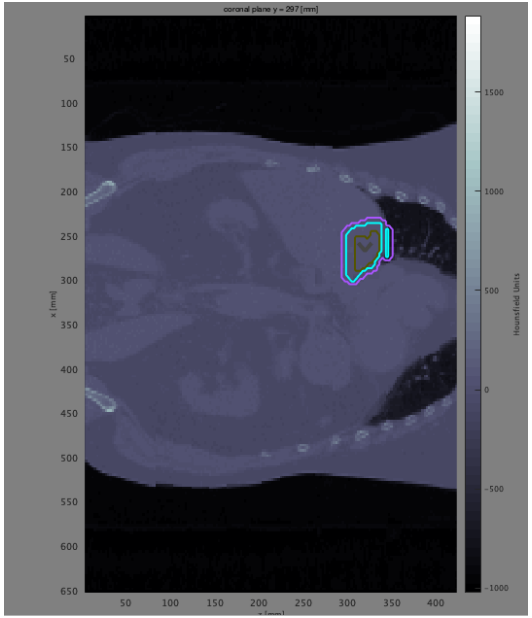
Liver case



Axial view

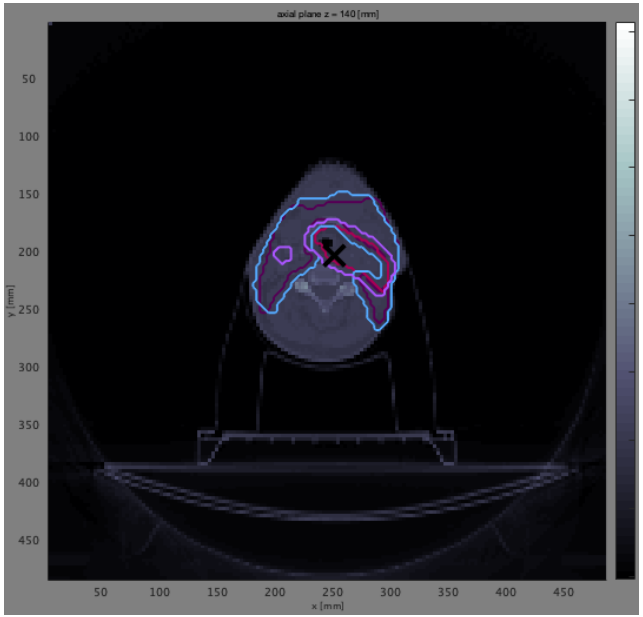


Sagittal view

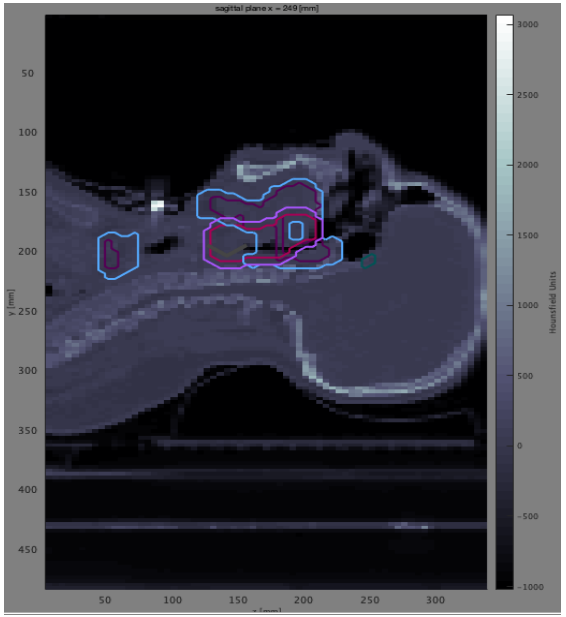


Coronal view

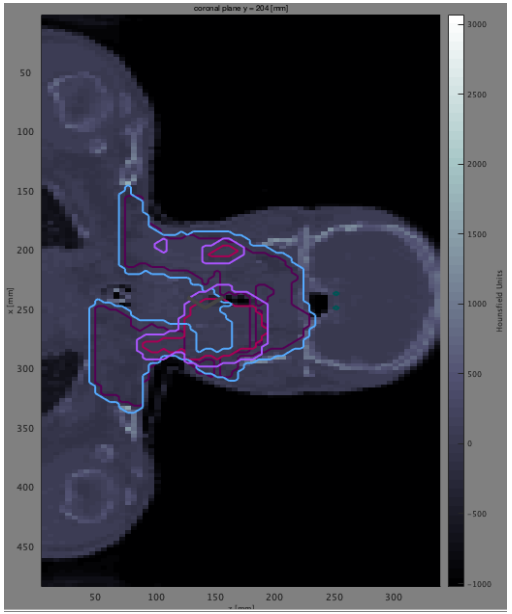
Head & Neck case



Axial view



Sagittal view



Coronal view