

Přílohy

Tabulky výsledků experimentu FNOL

V této sekci Přílohy jsou prezentovány Tabulky 3 až 7 počtů detekovaných impulzů a stanovených hodnot četnosti v oblastech zájmu.

TUK 0	ROI	Velikost (-)	N (-)	\bar{N} (-)	t (s)
EXP	L1 AP	4200	6,32E+05	6,32E+05	150
EXP	L2 AP	4200	4,92E+05	4,92E+05	150
EXP	BG AP	3600	2,97E+05	2,97E+05	150
EXP	L2 LAT	4200	6,05E+05	6,05E+05	150
EXP	L1 LAT	4200	4,60E+05	4,60E+05	150
EXP	BG LAT	4200	3,12E+05	3,12E+05	150
SIM	L1 AP	4200	4,25E+05	3,98E+05	150
SIM	L2 AP	4200	3,71E+05	3,44E+05	150
SIM	BG AP	3600	2,09E+05	1,87E+05	150
SIM	L2 LAT	4200	4,11E+05	3,75E+05	150
SIM	L1 LAT	4200	3,50E+05	3,24E+05	150
SIM	BG LAT	4200	2,01E+05	1,82E+05	150
SIM	L1 AP	4200	3,94E+05		150
SIM	L2 AP	4200	3,45E+05		150
SIM	BG AP	3600	1,84E+05		150
SIM	L2 LAT	4200	3,66E+05		150
SIM	L1 LAT	4200	3,21E+05		150
SIM	BG LAT	4200	1,82E+05		150
SIM	L1 AP	4200	3,85E+05		150
SIM	L2 AP	4200	3,31E+05		150
SIM	BG AP	3600	1,76E+05		150
SIM	L2 LAT	4200	3,63E+05		150
SIM	L1 LAT	4200	3,21E+05		150
SIM	BG LAT	4200	1,77E+05		150
SIM	L1 AP	4200	3,70E+05		150
SIM	L2 AP	4200	3,19E+05		150
SIM	BG AP	3600	1,72E+05		150
SIM	L2 LAT	4200	3,52E+05		150
SIM	L1 LAT	4200	2,94E+05		150
SIM	BG LAT	4200	1,61E+05		150
SIM	L1 AP	4200	4,14E+05		150
SIM	L2 AP	4200	3,55E+05		150
SIM	BG AP	3600	1,93E+05		150
SIM	L2 LAT	4200	3,85E+05		150
SIM	L1 LAT	4200	3,34E+05		150
SIM	BG LAT	4200	1,90E+05		150

Tabulka 3: Výsledné počty detekovaných impulzů v ROI, velikosti ROI, výpočet hodnoty četnosti impulzů v ROI, TUK 0

TUK 1	ROI	Velikost (-)	N (-)	\bar{N} (-)	t (s)
EXP	L1 AP	4200	6,39E+05	6,39E+05	150
EXP	L2 AP	4200	4,84E+05	4,84E+05	150
EXP	BG AP	3600	3,15E+05	3,15E+05	150
EXP	L1 LAT	4200	5,78E+05	5,78E+05	150
EXP	L2 LAT	4200	4,39E+05	4,39E+05	150
EXP	BG LAT	4200	3,00E+05	3,00E+05	150
SIM	L1 AP	4200	3,86E+05	3,81E+05	150
SIM	L2 AP	4200	3,23E+05	3,23E+05	150
SIM	BG AP	3600	1,96E+05	1,86E+05	150
SIM	L2 LAT	4200	3,66E+05	3,62E+05	150
SIM	L1 LAT	4200	3,03E+05	3,05E+05	150
SIM	BG LAT	4200	1,84E+05	1,77E+05	150
SIM	L1 AP	4200	3,67E+05		150
SIM	L2 AP	4200	3,18E+05		150
SIM	BG AP	3600	1,83E+05		150
SIM	L2 LAT	4200	3,51E+05		150
SIM	L1 LAT	4200	3,03E+05		150
SIM	BG LAT	4200	1,80E+05		150
SIM	L1 AP	4200	4,24E+05		150
SIM	L2 AP	4200	3,59E+05		150
SIM	BG AP	3600	1,96E+05		150
SIM	L2 LAT	4200	3,97E+05		150
SIM	L1 LAT	4200	3,37E+05		150
SIM	BG LAT	4200	1,90E+05		150
SIM	L1 AP	4200	3,59E+05		150
SIM	L2 AP	4200	3,05E+05		150
SIM	BG AP	3600	1,76E+05		150
SIM	L2 LAT	4200	3,51E+05		150
SIM	L1 LAT	4200	2,93E+05		150
SIM	BG LAT	4200	1,68E+05		150
SIM	L1 AP	4200	3,69E+05		150
SIM	L2 AP	4200	3,11E+05		150
SIM	BG AP	3600	1,78E+05		150
SIM	L2 LAT	4200	3,43E+05		150
SIM	L1 LAT	4200	2,91E+05		150
SIM	BG LAT	4200	1,64E+05		150

Tabulka 4: Výsledné počty detekovaných impulzů v ROI, velikosti ROI, výpočet hodnoty četnosti impulzů v ROI, TUK 1

TUK 2	ROI	Velikost (-)	N (-)	\bar{N} (-)	t (s)
EXP	L1 AP	4200	6,03E+05	6,03E+05	150
EXP	L2 AP	4200	4,75E+05	4,75E+05	150
EXP	BG AP	3600	2,90E+05	2,90E+05	150
EXP	L1 LAT	4200	6,45E+05	6,45E+05	150
EXP	L2 LAT	4200	4,85E+05	4,85E+05	150
EXP	BG LAT	4200	3,32E+05	3,32E+05	150
SIM	L1 AP	4200	4,65E+05	4,07E+05	150
SIM	L2 AP	4200	3,77E+05	3,42E+05	150
SIM	BG AP	3600	2,31E+05	1,99E+05	150
SIM	L2 LAT	4200	4,19E+05	3,83E+05	150
SIM	L1 LAT	4200	3,59E+05	3,15E+05	150
SIM	BG LAT	4200	2,14E+05	1,95E+05	150
SIM	L1 AP	4200	3,75E+05		150
SIM	L2 AP	4200	3,22E+05		150
SIM	BG AP	3600	1,75E+05		150
SIM	L2 LAT	4200	3,54E+05		150
SIM	L1 LAT	4200	2,91E+05		150
SIM	BG LAT	4200	1,81E+05		150
SIM	L1 AP	4200	4,27E+05		150
SIM	L2 AP	4200	3,69E+05		150
SIM	BG AP	3600	2,16E+05		150
SIM	L2 LAT	4200	4,16E+05		150
SIM	L1 LAT	4200	3,30E+05		150
SIM	BG LAT	4200	2,05E+05		150
SIM	L1 AP	4200	3,66E+05		150
SIM	L2 AP	4200	3,06E+05		150
SIM	BG AP	3600	1,71E+05		150
SIM	L2 LAT	4200	3,49E+05		150
SIM	L1 LAT	4200	2,84E+05		150
SIM	BG LAT	4200	1,77E+05		150
SIM	L1 AP	4200	4,01E+05		150
SIM	L2 AP	4200	3,35E+05		150
SIM	BG AP	3600	2,00E+05		150
SIM	L2 LAT	4200	3,77E+05		150
SIM	L1 LAT	4200	3,11E+05		150
SIM	BG LAT	4200	1,95E+05		150

Tabulka 5: Výsledné počty detekovaných impulzů v ROI, velikosti ROI, výpočet hodnoty četnosti impulzů v ROI, TUK 2

TUK 3	ROI	Velikost (-)	N (-)	\bar{N} (-)	t (s)
EXP	L1 AP	4200	5,88E+05	5,88E+05	150
EXP	L2 AP	4200	4,53E+05	4,53E+05	150
EXP	BG AP	3600	2,91E+05	2,91E+05	150
EXP	L1 LAT	4200	5,95E+05	5,95E+05	150
EXP	L2 LAT	4200	4,66E+05	4,66E+05	150
EXP	BG LAT	4200	3,10E+05	3,10E+05	150
SIM	L1 AP	4200	4,05E+05	3,99E+05	150
SIM	L2 AP	4200	3,45E+05	3,32E+05	150
SIM	BG AP	3600	2,11E+05	1,95E+05	150
SIM	L2 LAT	4200	3,87E+05	3,78E+05	150
SIM	L1 LAT	4200	3,19E+05	3,01E+05	150
SIM	BG LAT	4200	1,98E+05	1,82E+05	150
SIM	L1 AP	4200	4,38E+05		150
SIM	L2 AP	4200	3,63E+05		150
SIM	BG AP	3600	2,09E+05		150
SIM	L2 LAT	4200	4,06E+05		150
SIM	L1 LAT	4200	3,35E+05		150
SIM	BG LAT	4200	1,98E+05		150
SIM	L1 AP	4200	3,97E+05		150
SIM	L2 AP	4200	3,29E+05		150
SIM	BG AP	3600	1,91E+05		150
SIM	L2 LAT	4200	3,80E+05		150
SIM	L1 LAT	4200	2,91E+05		150
SIM	BG LAT	4200	1,63E+05		150
SIM	L1 AP	4200	3,38E+05		150
SIM	L2 AP	4200	2,80E+05		150
SIM	BG AP	3600	1,66E+05		150
SIM	L2 LAT	4200	3,27E+05		150
SIM	L1 LAT	4200	2,56E+05		150
SIM	BG LAT	4200	1,59E+05		150
SIM	L1 AP	4200	4,17E+05		150
SIM	L2 AP	4200	3,42E+05		150
SIM	BG AP	3600	2,00E+05		150
SIM	L2 LAT	4200	3,90E+05		150
SIM	L1 LAT	4200	3,07E+05		150
SIM	BG LAT	4200	1,94E+05		150

Tabulka 6: Výsledné počty detekovaných impulzů v ROI, velikosti ROI, výpočet hodnoty četnosti impulzů v ROI, TUK 3

TUK 4	ROI	Velikost (-)	N (-)	\bar{N} (-)	t (s)
EXP	L1 AP	4200	6,26E+05	6,26E+05	150
EXP	L2 AP	4200	4,94E+05	4,94E+05	150
EXP	BG AP	3600	3,08E+05	3,08E+05	150
EXP	L1 LAT	4200	6,02E+05	6,02E+05	150
EXP	L2 LAT	4200	4,43E+05	4,43E+05	150
EXP	BG LAT	4200	3,13E+05	3,13E+05	150
SIM	L1 AP	4200	4,29E+05	3,75E+05	150
SIM	L2 AP	4200	3,53E+05	3,09E+05	150
SIM	BG AP	3600	2,27E+05	1,83E+05	150
SIM	L2 LAT	4200	4,10E+05	3,58E+05	150
SIM	L1 LAT	4200	3,31E+05	2,90E+05	150
SIM	BG LAT	4200	2,17E+05	1,81E+05	150
SIM	L1 AP	4200	3,54E+05		150
SIM	L2 AP	4200	2,96E+05		150
SIM	BG AP	3600	1,72E+05		150
SIM	L2 LAT	4200	3,46E+05		150
SIM	L1 LAT	4200	2,77E+05		150
SIM	BG LAT	4200	1,81E+05		150
SIM	L1 AP	4200	3,61E+05		150
SIM	L2 AP	4200	3,00E+05		150
SIM	BG AP	3600	1,62E+05		150
SIM	L2 LAT	4200	3,43E+05		150
SIM	L1 LAT	4200	2,91E+05		150
SIM	BG LAT	4200	1,72E+05		150
SIM	L1 AP	4200	3,85E+05		150
SIM	L2 AP	4200	3,14E+05		150
SIM	BG AP	3600	1,84E+05		150
SIM	L2 LAT	4200	3,70E+05		150
SIM	L1 LAT	4200	2,93E+05		150
SIM	BG LAT	4200	1,82E+05		150
SIM	L1 AP	4200	3,44E+05		150
SIM	L2 AP	4200	2,83E+05		150
SIM	BG AP	3600	1,71E+05		150
SIM	L2 LAT	4200	3,20E+05		150
SIM	L1 LAT	4200	2,58E+05		150
SIM	BG LAT	4200	1,56E+05		150

Tabulka 7: Výsledné počty detekovaných impulzů v ROI, velikosti ROI, výpočet hodnoty četnosti impulzů v ROI, TUK 4

Tabulky výsledků experimentu FNM

V této sekci Přílohy je prezentována obdobná Tabulka 8 počtů detekovaných impulzů a stanovených hodnot četnosti v oblastech zájmu pro experiment provedený ve FNM.

TUK 0	ROI	Velikost (-)	N (-)	t (s)	R (cps)
EXP	L2 P1	3600	6,53E+05	300	2175
EXP	L3 P1	2500	4,83E+05	300	1611
EXP	BG P1	4900	6,59E+05	300	
EXP	L1 P2	4900	8,39E+05	300	2796
EXP	L3 P2	2500	4,64E+05	300	1545
EXP	BG P2	4900	6,60E+05	300	
TUK 1					
EXP	L1 P1	2500	7,47E+05	300	2489
EXP	L2 P1	1600	5,48E+05	300	1827
EXP	BG P1	4900	7,24E+05	300	
EXP	L1 P2	2500	9,20E+05	300	3068
EXP	L2 P2	1600	4,88E+05	300	1628
EXP	BG P2	4900	7,29E+05	300	
TUK 2					
EXP	L1 P1	2500	7,42E+05	300	2473
EXP	L2 P1	1600	5,48E+05	300	1826
EXP	BG P1	4900	6,85E+05	300	
EXP	L1 P2	2500	9,11E+05	300	3035
EXP	L2 P2	1600	4,66E+05	300	1552
EXP	BG P2	4900	7,04E+05	300	
TUK 3					
EXP	L1 P1	2500	7,35E+05	300	2449
EXP	L2 P1	1600	5,46E+05	300	1818
EXP	BG P1	4900	7,01E+05	300	
EXP	L1 P2	2500	8,95E+05	300	2984
EXP	L2 P2	1600	4,65E+05	300	1549
EXP	BG P2	4900	6,81E+05	300	

Tabulka 8: Výsledné počty detekovaných impulzů v ROI, velikosti ROI, výpočet hodnoty četnosti impulzů v ROI

MC simulace FNOL

V této části Přílohy je vložen kód Monte Carlo simulace experimentu ve FNOL.

- Digitizer_I131.mac

```
/gate/digitizer/Singles/insert adderCompton
/gate/digitizer/Singles/insert adder
/gate/digitizer/Singles/insert readout
/gate/digitizer/Singles/readout/setPolicy TakeEnergyWinner
/gate/digitizer/Singles/readout/setDepth 1

% Energy window
/gate/digitizer/Singles/insert thresholder
/gate/digitizer/Singles/thresholder/setThreshold 328. keV
/gate/digitizer/Singles/insert upholder
/gate/digitizer/Singles/upholder/setUphold 400. keV
```

- HEGP.mac

```
/gate/SPECThead/daughters/name collimHEGP
/gate/SPECThead/daughters/insert box
/gate/collimHEGP/geometry/setXLength 540 mm
/gate/collimHEGP/geometry/setYLength 66 mm
/gate/collimHEGP/geometry/setZLength 400. mm
/gate/collimHEGP/placement/setTranslation 0. -37.75 0. mm
/gate/collimHEGP/setMaterial Lead
/gate/collimHEGP/vis/setColor grey
/gate/collimHEGP/vis/forceWireframe

/gate/collimHEGP/daughters/name hole1
/gate/collimHEGP/daughters/insert hexagone
/gate/hole1/geometry/setHeight 66 mm
/gate/hole1/geometry/setRadius 2 mm
/gate/hole1/placement/setRotationAxis 1 0 0
/gate/hole1/placement/setRotationAngle 90 deg
/gate/hole1/setMaterial Vacuum
/gate/hole1/vis/setColor blue

# Repeat the hole in an array
/gate/hole1/repeaters/insert cubicArray
/gate/hole1/cubicArray/setRepeatNumberX 53
/gate/hole1/cubicArray/setRepeatNumberY 1
/gate/hole1/cubicArray/setRepeatNumberZ 69
```

```
/gate/hole1/cubicArray/setRepeatVector 10.05 0. 5.8 mm
```

```
/gate/hole1/repeaters/insert linear
```

```
/gate/hole1/linear/setRepeatNumber 2
```

```
/gate/hole1/linear/setRepeatVector 5.02 0. 2.9 mm
```

- Jaszczak_2hollowSpheres

```
/gate/phantom/daughters/name JaszczakWall
```

```
/gate/phantom/daughters/insert cylinder
```

```
/gate/JaszczakWall/geometry/setRmin 10.45 cm
```

```
/gate/JaszczakWall/geometry/setRmax 11 cm
```

```
/gate/JaszczakWall/geometry/setHeight 19.6 cm
```

```
/gate/JaszczakWall/setMaterial PMMA
```

```
/gate/JaszczakWall/vis/setColor grey
```

```
/gate/JaszczakWall/vis/forceWireframe
```

```
/gate/phantom/daughters/name JaszczakFilling
```

```
/gate/phantom/daughters/insert cylinder
```

```
/gate/JaszczakFilling/geometry/setRmin 0 cm
```

```
/gate/JaszczakFilling/geometry/setRmax 10.45 cm
```

```
/gate/JaszczakFilling/geometry/setHeight 19.6 cm
```

```
/gate/JaszczakFilling/setMaterial Water
```

```
/gate/JaszczakFilling/vis/setColor blue
```

```
/gate/JaszczakFilling/vis/forceWireframe
```

```
/gate/JaszczakFilling/daughters/name cyl_1
```

```
/gate/JaszczakFilling/daughters/insert cylinder
```

```
/gate/cyl_1/geometry/setRmin 0 cm
```

```
/gate/cyl_1/geometry/setRmax 1.25 cm
```

```
/gate/cyl_1/geometry/setHeight 3.8 cm
```

```
/gate/cyl_1/setMaterial Water
```

```
/gate/cyl_1/vis/setColor red
```

```
/gate/cyl_1/vis/forceSolid
```

```
/gate/cyl_1/placement/setTranslation 0 6.8 -7.4 cm
```

```
/gate/JaszczakFilling/daughters/name cyl_2
```

```
/gate/JaszczakFilling/daughters/insert cylinder
```

```
/gate/cyl_2/geometry/setRmin 0 cm
```

```
/gate/cyl_2/geometry/setRmax 1.25 cm
/gate/cyl_2/geometry/setHeight 3.8 cm
/gate/cyl_2/setMaterial Water
/gate/cyl_2/vis/setColor green
/gate/cyl_2/vis/forceSolid
/gate/cyl_2/placement/setTranslation 6.3 2.5 -7.4 cm
```

- main.mac

```
# V I S U A L I S A T I O N
/vis/disable
#/control/execute vis.mac

# M A T E R I A L
/gate/geometry/setMaterialDatabase GateMaterials.db

# G A M M A   C A M E R A   G E O M E T R Y
/control/execute SPECT2Heads90.mac

# P H A N T O M
/control/execute phantom.mac

# A C T O R S
/gate/actor/addActor SimulationStatisticActor MyActor
/gate/actor/MyActor/save SimStatB0.txt

# P H Y S I C S
/gate/physics/addPhysicsList emstandard
/gate/physics/processList Enabled
/gate/physics/processList Initialized

# C U T S
#/gate/physics/Gamma/SetCutInRegion phantom 5.4 cm
/gate/physics/Gamma/SetCutInRegion collimHEGP 0.22 cm
/gate/physics/Gamma/SetCutInRegion BackCompartment 100 cm
/gate/physics/Electron/SetCutInRegion world 100.0 m

# I N I T I A L I Z A T I O N
/gate/run/initialize # must be before source def.
```

```

# D I G I T I Z E R
/control/execute Digitizer_I131.mac

# S O U R C E
/control/execute sourceJasz2holSph.mac

# P R O J E C T I O N S
/gate/output/projection/enable
/gate/output/projection/setFileName ProjB0
/gate/output/projection/projectionPlane ZX
/gate/output/projection/pixelSizeY 2.21 mm
/gate/output/projection/pixelSizeX 2.21 mm
/gate/output/projection/pixelNumberY 256
/gate/output/projection/pixelNumberX 256

/gate/random/setEngineSeed auto

/gate/application/setTimeSlice 150 s
/gate/application/setTimeStart 0. s
/gate/application/setTimeStop 150 s

/gate/application/startDAQ

```

- phantom.mac

```

/gate/world/daughters/name phantom
/gate/world/daughters/insert cylinder

/gate/phantom/geometry/setRmin 11 cm
/gate/phantom/geometry/setRmax 11.001 cm # pro tuk 0 cm
/gate/phantom/geometry/setHeight 19.6 cm

/gate/phantom/setMaterial Adipose
/gate/phantom/vis/setColor red
/gate/phantom/vis/forceWireframe

/gate/phantom/placement/setTranslation 9 14 0 cm

/gate/phantom/placement/setRotationAxis 0 0 1
/gate/phantom/placement/setRotationAngle 0 deg

```

```
/control/execute Jaszczak_2hollowSpheres.mac
```

- sourceJasz2holSph.mac

```
/gate/source/addSource Jasz_fill gps  
/gate/source/Jasz_fill/gps/particle gamma  
/gate/source/Jasz_fill/gps/ene/mono 364.489 keV  
/gate/source/Jasz_fill/setForcedUnstableFlag True  
/gate/source/Jasz_fill/setForcedHalfLife 693210 s  
/gate/source/Jasz_fill/setActivity 15472222 becquerel
```

```
/gate/source/Jasz_fill/gps/pos/type Volume  
/gate/source/Jasz_fill/gps/pos/shape Cylinder  
/gate/source/Jasz_fill/gps/pos/radius 10.46 cm  
/gate/source/Jasz_fill/gps/pos/halfz 9.3 cm  
/gate/source/Jasz_fill/attachTo JaszczakFilling
```

```
/gate/source/addSource Jasz_Cyl1 gps  
/gate/source/Jasz_Cyl1/gps/particle gamma  
/gate/source/Jasz_Cyl1/gps/ene/mono 364.489 keV  
/gate/source/Jasz_Cyl1/setForcedUnstableFlag True  
/gate/source/Jasz_Cyl1/setForcedHalfLife 693210 s  
/gate/source/Jasz_Cyl1/setActivity 763889 becquerel
```

```
/gate/source/Jasz_Cyl1/gps/pos/type Volume  
/gate/source/Jasz_Cyl1/gps/pos/shape Cylinder  
/gate/source/Jasz_Cyl1/gps/pos/radius 1.25 cm  
/gate/source/Jasz_Cyl1/gps/pos/halfz 1.9 cm  
/gate/source/Jasz_Cyl1/attachTo cyl_1
```

```
/gate/source/addSource Jasz_Cyl2 gps  
/gate/source/Jasz_Cyl2/gps/particle gamma  
/gate/source/Jasz_Cyl2/gps/ene/mono 364.489 keV  
/gate/source/Jasz_Cyl2/setForcedUnstableFlag True  
/gate/source/Jasz_Cyl2/setForcedHalfLife 693210 s  
/gate/source/Jasz_Cyl2/setActivity 763889 becquerel
```

```
/gate/source/Jasz_Cyl2/gps/pos/type Volume  
/gate/source/Jasz_Cyl2/gps/pos/shape Cylinder  
/gate/source/Jasz_Cyl2/gps/pos/radius 1.25 cm  
/gate/source/Jasz_Cyl2/gps/pos/halfz 1.9 cm
```

```

/gate/source/Jasz_Cyl2/attachTo cyl_2

/gate/source/Jasz_fill/gps/ang/type iso
/gate/source/Jasz_fill/gps/ang/mintheta 60. deg
/gate/source/Jasz_fill/gps/ang/maxtheta 120. deg
/gate/source/Jasz_fill/gps/ang/minphi 150. deg
/gate/source/Jasz_fill/gps/ang/maxphi 300. deg

/gate/source/Jasz_Cyl1/gps/ang/type iso
/gate/source/Jasz_Cyl1/gps/ang/mintheta 60. deg
/gate/source/Jasz_Cyl1/gps/ang/maxtheta 120. deg
/gate/source/Jasz_Cyl1/gps/ang/minphi 150. deg
/gate/source/Jasz_Cyl1/gps/ang/maxphi 300. deg

/gate/source/Jasz_Cyl2/gps/ang/type iso
/gate/source/Jasz_Cyl2/gps/ang/mintheta 60. deg
/gate/source/Jasz_Cyl2/gps/ang/maxtheta 120. deg
/gate/source/Jasz_Cyl2/gps/ang/minphi 150. deg
/gate/source/Jasz_Cyl2/gps/ang/maxphi 300. deg

/gate/source/Jasz_fill/visualize 1000 yellow 3
/gate/source/Jasz_Cyl1/visualize 200 red 3
/gate/source/Jasz_Cyl2/visualize 200 green 3

```

- SPECT2Heads90

```

# G E O M E T R Y

/gate/world/geometry/setXLength 100 cm
/gate/world/geometry/setYLength 100 cm
/gate/world/geometry/setZLength 100 cm

# Scanner Head
/gate/world/daughters/name SPECThead
/gate/world/daughters/insert box
/gate/SPECThead/geometry/setXLength 54. cm
/gate/SPECThead/geometry/setYLength 16. cm
/gate/SPECThead/geometry/setZLength 40. cm
/gate/SPECThead/placement/setTranslation 0 35 0 cm
/gate/SPECThead/setMaterial Air
/gate/SPECThead/repeaters/insert ring

```

```
/gate/SPECThead/ring/setRepeatNumber 2
#/gate/SPECThead/ring/setPoint1 0 0 1 cm
#/gate/SPECThead/ring/setPoint2 1 0 0 cm
/gate/SPECThead/ring/setFirstAngle 0 deg
/gate/SPECThead/ring/setAngularSpan -90 deg
```

```
# Collimator
/control/execute HEGP.mac
```

```
# Crystal
/gate/SPECThead/daughters/name krystal
/gate/SPECThead/daughters/insert box
/gate/krystal/geometry/setXLength 54 cm
/gate/krystal/geometry/setYLength 9.5 mm #3,8 palce
/gate/krystal/geometry/setZLength 40. cm
/gate/krystal/placement/setTranslation 0 0 0 cm
/gate/krystal/setMaterial NaITl
/gate/krystal/vis/setColor yellow
/gate/krystal/vis/forceSolid
```

```
/gate/systems/SPECThead/crystal/attach krystal
/gate/krystal/attachCrystalSD
```

```
# BACK-COMPARTMENT
```

```
/gate/SPECThead/daughters/name BackCompartment
/gate/SPECThead/daughters/insert box
/gate/BackCompartment/geometry/setXLength 54. cm
/gate/BackCompartment/geometry/setYLength 75.25 mm
/gate/BackCompartment/geometry/setZLength 40. cm
/gate/BackCompartment/placement/setTranslation 0. 42.375 0. mm
/gate/BackCompartment/setMaterial Air
/gate/BackCompartment/vis/setColor grey
```

- vis.mac

```
/vis/open OGL
/vis/viewer/set/viewpointThetaPhi 0 0
/vis/viewer/panTo 0.15 0.15
/vis/drawVolume
```

MC simulace FNM

V této části Přílohy je vložen kód Monte Carlo simulace experimentu ve FNM.

- AttenuationRange.dat

```
3
0 100 Air
100 980 Adipose
980 1777 Air
```

- CTphant

```
/gate/world/daughters/name tuk0
/gate/world/daughters/insert ImageNestedParametrisedVolume
/gate/tuk0/geometry/setImage tuk0.mhd

/gate/tuk0/geometry/setRangeToMaterialFile AttenuationRange.dat

/gate/tuk0/placement/setTranslation 0. 0. 0. mm
/gate/tuk0/placement/setRotationAxis 1 0 0
/gate/tuk0/placement/setRotationAngle 0 deg
```

- Digitizer.mac

```
/gate/digitizer/Singles/insert adderCompton
/gate/digitizer/Singles/insert adder
/gate/digitizer/Singles/insert readout
/gate/digitizer/Singles/readout/setPolicy TakeEnergyWinner
/gate/digitizer/Singles/readout/setDepth 1

#Energy window
/gate/digitizer/Singles/insert thresholder
/gate/digitizer/Singles/thresholder/setThreshold 336.9 keV
/gate/digitizer/Singles/insert upholder
/gate/digitizer/Singles/upholder/setUphold 391.6 keV
```

- HEGP.mac


```
/gate/SPECThead/daughters/name collimHEGP
/gate/SPECThead/daughters/insert box
/gate/collimHEGP/geometry/setXLength 533 mm
/gate/collimHEGP/geometry/setYLength 59.7 mm
/gate/collimHEGP/geometry/setZLength 387. mm
/gate/collimHEGP/placement/setTranslation 0. -34.6 0. mm
/gate/collimHEGP/setMaterial Lead
/gate/collimHEGP/vis/setColor white
/gate/collimHEGP/vis/forceSolid
```

```
/gate/collimHEGP/daughters/name hole1
/gate/collimHEGP/daughters/insert hexagone
/gate/hole1/geometry/setHeight 59.7 mm
/gate/hole1/geometry/setRadius 2 mm
/gate/hole1/placement/setRotationAxis 1 0 0
/gate/hole1/placement/setRotationAngle 90 deg
/gate/hole1/setMaterial Vacuum
```

Repeat the hole in an array

```
/gate/hole1/repeaters/insert cubicArray
/gate/hole1/cubicArray/setRepeatNumberX 51
/gate/hole1/cubicArray/setRepeatNumberY 1
/gate/hole1/cubicArray/setRepeatNumberZ 64
/gate/hole1/cubicArray/setRepeatVector 10.39 0. 6. mm
```

```
/gate/hole1/repeaters/insert linear
/gate/hole1/linear/setRepeatNumber 2
/gate/hole1/linear/setRepeatVector 5.2 0. 3. mm
```

- main.mac

```
# V I S U A L I S A T I O N
```

```
/vis/disable
```

```
#/control/execute vis.mac
```

```
# M A T E R I A L
```

```
/gate/geometry/setMaterialDatabase GateMaterials.db
```

```
# G A M M A C A M E R A G E O M E T R Y
```

```
/control/execute SPECT2Heads90.mac
```

```

# P H A N T O M
/control/execute phantom.mac

# A C T O R S
/gate/actor/addActor SimulationStatisticActor MyActor
/gate/actor/MyActor/save SimStatT0.txt

# P H Y S I C S
/gate/physics/addPhysicsList emstandard
/gate/physics/processList Enabled
/gate/physics/processList Initialized

# C U T S
/gate/physics/Gamma/SetCutInRegion nema 5.4 cm
/gate/physics/Gamma/SetCutInRegion collimHEGP 0.22 cm
/gate/physics/Gamma/SetCutInRegion BackCompartment 100 cm
/gate/physics/Electron/SetCutInRegion world 100.0 m

# I N I T I A L I Z A T I O N
/gate/run/initialize # must be before source def.

# D I G I T I Z E R
/control/execute Digitizer_I131.mac

# S O U R C E
/control/execute source.mac

# P R O J E C T I O N S
/gate/output/projection/enable
/gate/output/projection/setFileName ProjT0
/gate/output/projection/projectionPlane ZX
/gate/output/projection/pixelSizeY 4.42 mm
/gate/output/projection/pixelSizeX 4.42 mm
/gate/output/projection/pixelNumberY 128
/gate/output/projection/pixelNumberX 128

/gate/random/setEngineSeed auto

/gate/application/setTimeSlice 300. s

```

```
/gate/application/setTimeStart 0. s
/gate/application/setTimeStop 300. s
```

```
/gate/application/startDAQ
```

- NEMA.mac

```
# The following phantom is Gate representation of the
# NEMA 2-2001 IQ Phantom. The dimensions of this phantom
# are taken directly from "NEMA NU 2, Chapter 7, 2001".
```

```
# P H A N T O M G E O M E T R Y
```

```
/gate/world/daughters/name nema
/gate/world/daughters/insert box
/gate/nema/placement/setTranslation 0.0 10.0 0.0 cm
/gate/nema/geometry/setXLength 30. cm
/gate/nema/geometry/setYLength 23. cm
/gate/nema/geometry/setZLength 22. cm
/gate/nema/setMaterial Air
/gate/nema/vis/forceWireframe
/gate/nema/vis/setColor gray
```

```
# Upper Half of Phantom
```

```
# Center Section of Upper Outer Shell
```

```
/gate/nema/daughters/name outershell1
/gate/nema/daughters/insert cylinder
/gate/outershell1/placement/setTranslation 0.0 -3.5 0.0 cm
/gate/outershell1/geometry/setRmax 15. cm
/gate/outershell1/geometry/setHeight 21.4 cm
/gate/outershell1/geometry/setPhiStart 0. deg
/gate/outershell1/geometry/setDeltaPhi 180. deg
/gate/outershell1/setMaterial Plastic
/gate/outershell1/vis/forceWireframe
/gate/outershell1/vis/setColor red
```

```
# Water in Phantom
```

```
/gate/outershell1/daughters/name upperinterior
/gate/outershell1/daughters/insert cylinder
/gate/upperinterior/placement/setTranslation 0.0 0.0 0.0 cm
/gate/upperinterior/geometry/setRmax 14.7 cm
```

```

/gate/upperinterior/geometry/setRmin 0.0 cm
/gate/upperinterior/geometry/setHeight 21.4 cm
/gate/upperinterior/geometry/setPhiStart 0. deg
/gate/upperinterior/geometry/setDeltaPhi 180. deg
/gate/upperinterior/setMaterial Water
/gate/upperinterior/vis/forceWireframe
/gate/upperinterior/vis/setColor blue

# Plastic Shell Surrounding Center Cylinder
/gate/upperinterior/daughters/name centercyl
/gate/upperinterior/daughters/insert cylinder
/gate/centercyl/placement/setTranslation 0.0 3.5 0.0 cm
/gate/centercyl/geometry/setRmax 2.5 cm
/gate/centercyl/geometry/setHeight 21.4 cm
/gate/centercyl/setMaterial Plastic
/gate/centercyl/vis/forceWireframe
/gate/centercyl/vis/setColor red

# Hollow Space in Central Cylinder
/gate/centercyl/daughters/name centercylin
/gate/centercyl/daughters/insert cylinder
/gate/centercylin/placement/setTranslation 0.0 0.0 0.0 cm
/gate/centercylin/geometry/setRmax 2.1 cm
/gate/centercylin/geometry/setRmin 0.0 cm
/gate/centercylin/geometry/setHeight 21.4 cm
/gate/centercylin/setMaterial Air
#/gate/centercylin/vis/forceWireframe
/gate/centercylin/vis/setColor gray

# 10 mm Sphere Exterior
/gate/upperinterior/daughters/name sphere10
/gate/upperinterior/daughters/insert sphere
/gate/sphere10/placement/setTranslation -2.86 8.45367 3.7 cm
/gate/sphere10/geometry/setRmax 0.6 cm
/gate/sphere10/setMaterial Plastic
/gate/sphere10/vis/forceWireframe
/gate/sphere10/vis/setColor red

# 10 mm Sphere
/gate/sphere10/daughters/name sphere10in

```

```

/gate/sphere10/daughters/insert sphere
/gate/sphere10in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/sphere10in/geometry/setRmax 0.5 cm
/gate/sphere10in/geometry/setRmin 0.0 cm
/gate/sphere10in/setMaterial Air
#/gate/sphere10in/vis/forceWireframe
/gate/sphere10in/vis/setColor gray

# 10 mm Fill Capillary Exterior
/gate/upperinterior/daughters/name fill10
/gate/upperinterior/daughters/insert cylinder
/gate/fill10/placement/setTranslation -2.86 8.45367 7.5 cm
/gate/fill10/geometry/setRmax 0.35 cm
/gate/fill10/geometry/setHeight 6.4 cm
/gate/fill10/setMaterial Plastic
/gate/fill10/vis/forceWireframe
/gate/fill10/vis/setColor red

# 10 mm Fill Capillary
/gate/fill10/daughters/name fill10in
/gate/fill10/daughters/insert cylinder
/gate/fill10in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/fill10in/geometry/setRmax 0.25 cm
/gate/fill10in/geometry/setRmin 0. cm
/gate/fill10in/geometry/setHeight 6.4 cm
/gate/fill10in/setMaterial Air
#/gate/fill10in/vis/forceWireframe
/gate/fill10in/vis/setColor gray

# 13 mm Sphere Exterior
/gate/upperinterior/daughters/name sphere13
/gate/upperinterior/daughters/insert sphere
/gate/sphere13/placement/setTranslation +2.86 8.45367 3.7 cm
/gate/sphere13/geometry/setRmax 0.75 cm
/gate/sphere13/setMaterial Plastic
/gate/sphere13/vis/forceWireframe
/gate/sphere13/vis/setColor red

# 13 mm Sphere
/gate/sphere13/daughters/name sphere13in

```

```

/gate/sphere13/daughters/insert sphere
/gate/sphere13in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/sphere13in/geometry/setRmax 0.65 cm
/gate/sphere13in/geometry/setRmin 0.0 cm
/gate/sphere13in/setMaterial Air
#/gate/sphere13in/vis/forceWireframe
/gate/sphere13in/vis/setColor gray

# 13 mm Fill Capillary Exterior
/gate/upperinterior/daughters/name fill13
/gate/upperinterior/daughters/insert cylinder
/gate/fill13/placement/setTranslation +2.86 8.45367 7.5875 cm
/gate/fill13/geometry/setRmax 0.35 cm
/gate/fill13/geometry/setHeight 6.225 cm
/gate/fill13/setMaterial Plastic
/gate/fill13/vis/forceWireframe
/gate/fill13/vis/setColor red

# 13 mm Fill Capillary
/gate/fill13/daughters/name fill13in
/gate/fill13/daughters/insert cylinder
/gate/fill13in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/fill13in/geometry/setRmax 0.25 cm
/gate/fill13in/geometry/setRmin 0. cm
/gate/fill13in/geometry/setHeight 6.225 cm
/gate/fill13in/setMaterial Air
#/gate/fill13in/vis/forceWireframe
/gate/fill13in/vis/setColor gray

# 17 mm Sphere Exterior
/gate/upperinterior/daughters/name sphere17
/gate/upperinterior/daughters/insert sphere
/gate/sphere17/placement/setTranslation +5.72 3.5 3.7 cm
/gate/sphere17/geometry/setRmax 0.9 cm
/gate/sphere17/setMaterial Plastic
/gate/sphere17/vis/forceWireframe
/gate/sphere17/vis/setColor red

# 17 mm Sphere
/gate/sphere17/daughters/name sphere17in

```

```
/gate/sphere17/daughters/insert sphere
/gate/sphere17in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/sphere17in/geometry/setRmax 0.85 cm
/gate/sphere17in/geometry/setRmin 0.0 cm
/gate/sphere17in/setMaterial Air
#/gate/sphere17in/vis/forceWireframe
/gate/sphere17in/vis/setColor gray
```

```
# 17 mm Fill Capillary Exterior
/gate/upperinterior/daughters/name fill17
/gate/upperinterior/daughters/insert cylinder
/gate/fill17/placement/setTranslation +5.72 3.5 7.675 cm
/gate/fill17/geometry/setRmax 0.3 cm
/gate/fill17/geometry/setHeight 6.05 cm
/gate/fill17/setMaterial Plastic
/gate/fill17/vis/forceWireframe
/gate/fill17/vis/setColor red
```

```
# 17 mm Fill Capillary
/gate/fill17/daughters/name fill17in
/gate/fill17/daughters/insert cylinder
/gate/fill17in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/fill17in/geometry/setRmax 0.25 cm
/gate/fill17in/geometry/setRmin 0. cm
/gate/fill17in/geometry/setHeight 6.05 cm
/gate/fill17in/setMaterial Air
#/gate/fill17in/vis/forceWireframe
/gate/fill17in/vis/setColor gray
```

```
# 37 mm Sphere Exterior
/gate/upperinterior/daughters/name sphere37
/gate/upperinterior/daughters/insert sphere
/gate/sphere37/placement/setTranslation -5.72 3.5 3.7 cm
/gate/sphere37/geometry/setRmax 1.95 cm
/gate/sphere37/setMaterial Plastic
/gate/sphere37/vis/forceWireframe
/gate/sphere37/vis/setColor red
```

```
# 37 mm Sphere
/gate/sphere37/daughters/name sphere37in
```

```

/gate/sphere37/daughters/insert sphere
/gate/sphere37in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/sphere37in/geometry/setRmax 1.85 cm
/gate/sphere37in/geometry/setRmin 0.0 cm
/gate/sphere37in/setMaterial Air
#/gate/sphere37in/vis/forceWireframe
/gate/sphere37in/vis/setColor gray

# 37 mm Fill Capillary Exterior
/gate/upperinterior/daughters/name fill37
/gate/upperinterior/daughters/insert cylinder
/gate/fill37/placement/setTranslation -5.72 3.5 8.175 cm
/gate/fill37/geometry/setRmax 0.35 cm
/gate/fill37/geometry/setHeight 5.05 cm
/gate/fill37/setMaterial Plastic
/gate/fill37/vis/forceWireframe
/gate/fill37/vis/setColor red

# 37 mm Fill Capillary
/gate/fill37/daughters/name fill37in
/gate/fill37/daughters/insert cylinder
/gate/fill37in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/fill37in/geometry/setRmax 0.25 cm
/gate/fill37in/geometry/setRmin 0. cm
/gate/fill37in/geometry/setHeight 5.05 cm
/gate/fill37in/setMaterial Air
#/gate/fill37in/vis/forceWireframe
/gate/fill37in/vis/setColor gray

# Exterior Shell of Upper Half of Phantom
# Top Side
/gate/nema/daughters/name topshell1
/gate/nema/daughters/insert cylinder
/gate/topshell1/placement/setTranslation 0.0 -3.5 10.85 cm
/gate/topshell1/geometry/setRmax 15. cm
/gate/topshell1/geometry/setRmin 0. cm
/gate/topshell1/geometry/setHeight 0.3 cm
/gate/topshell1/geometry/setPhiStart 0. deg
/gate/topshell1/geometry/setDeltaPhi 180. deg
/gate/topshell1/setMaterial Plastic

```



```

/gate/topshell1/vis/forceWireframe
/gate/topshell1/vis/setColor yellow

/gate/nema/daughters/name bottomshell1
/gate/nema/daughters/insert cylinder
/gate/bottomshell1/placement/setTranslation 0.0 -3.5 -10.85 cm
/gate/bottomshell1/geometry/setRmax 15. cm
/gate/bottomshell1/geometry/setRmin 0. cm
/gate/bottomshell1/geometry/setHeight 0.3 cm
/gate/bottomshell1/geometry/setPhiStart 0. deg
/gate/bottomshell1/geometry/setDeltaPhi 180. deg
/gate/bottomshell1/setMaterial Plastic
#/gate/bottomshell1/vis/forceWireframe
/gate/bottomshell1/vis/setColor yellow

# Lower Half Of Phantom
# Lower Left Corner Center Section Cylinder
/gate/nema/daughters/name outershell2
/gate/nema/daughters/insert cylinder
/gate/outershell2/placement/setTranslation 7.0 -3.5 0.0 cm
/gate/outershell2/geometry/setRmax 8. cm
/gate/outershell2/geometry/setHeight 21.4 cm
/gate/outershell2/geometry/setPhiStart 270. deg
/gate/outershell2/geometry/setDeltaPhi 90. deg
/gate/outershell2/setMaterial Plastic
/gate/outershell2/vis/forceWireframe
/gate/outershell2/vis/setColor red

/gate/outershell2/daughters/name LLinterior
/gate/outershell2/daughters/insert cylinder
/gate/LLinterior/placement/setTranslation 0.0 0.0 0.0 cm
/gate/LLinterior/geometry/setRmax 7.7 cm
/gate/LLinterior/geometry/setRmin 0. cm
/gate/LLinterior/geometry/setHeight 21.4 cm
/gate/LLinterior/geometry/setPhiStart 270. deg
/gate/LLinterior/geometry/setDeltaPhi 90. deg
/gate/LLinterior/setMaterial Water
/gate/LLinterior/vis/forceWireframe
/gate/LLinterior/vis/setColor blue

```

```

# Lower Right Corner Center Section Cylinder
/gate/nema/daughters/name outershell3
/gate/nema/daughters/insert cylinder
/gate/outershell3/placement/setTranslation -7.0 -3.5 0.0 cm
/gate/outershell3/geometry/setRmax 8. cm
/gate/outershell3/geometry/setHeight 21.4 cm
/gate/outershell3/geometry/setPhiStart 180. deg
/gate/outershell3/geometry/setDeltaPhi 90. deg
/gate/outershell3/setMaterial Plastic
/gate/outershell3/vis/forceWireframe
/gate/outershell3/vis/setColor red

/gate/outershell3/daughters/name LRinterior
/gate/outershell3/daughters/insert cylinder
/gate/LRinterior/placement/setTranslation 0.0 0.0 0.0 cm
/gate/LRinterior/geometry/setRmax 7.7 cm
/gate/LRinterior/geometry/setRmin 0. cm
/gate/LRinterior/geometry/setHeight 21.4 cm
/gate/LRinterior/geometry/setPhiStart 180. deg
/gate/LRinterior/geometry/setDeltaPhi 90. deg
/gate/LRinterior/setMaterial Water
/gate/LRinterior/vis/forceWireframe
/gate/LRinterior/vis/setColor blue

# Bottom Box
/gate/nema/daughters/name outershell4
/gate/nema/daughters/insert box
/gate/outershell4/placement/setTranslation 0.0 -7.5 0.0 cm
/gate/outershell4/geometry/setXLength 14. cm
/gate/outershell4/geometry/setYLength 8. cm
/gate/outershell4/geometry/setZLength 21.4 cm
/gate/outershell4/setMaterial Plastic
/gate/outershell4/vis/forceWireframe
/gate/outershell4/vis/setColor red

# Interior Box
/gate/outershell4/daughters/name IBox
/gate/outershell4/daughters/insert box
/gate/IBox/placement/setTranslation 0.0 0.15 0.0 cm
/gate/IBox/geometry/setXLength 14. cm

```

```

/gate/IBox/geometry/setYLength 7.7 cm
/gate/IBox/geometry/setZLength 21.4 cm
/gate/IBox/setMaterial Water
/gate/IBox/vis/forceWireframe
/gate/IBox/vis/setColor blue

# 22 mm Sphere Exterior
/gate/IBox/daughters/name sphere22
/gate/IBox/daughters/insert sphere
/gate/sphere22/placement/setTranslation +2.86 2.39633 3.7 cm
/gate/sphere22/geometry/setRmax 1.2 cm
/gate/sphere22/setMaterial Plastic
/gate/sphere22/vis/forceWireframe
/gate/sphere22/vis/setColor red

# 22 mm Sphere Interior
/gate/sphere22/daughters/name sphere22in
/gate/sphere22/daughters/insert sphere
/gate/sphere22in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/sphere22in/geometry/setRmax 1.1 cm
/gate/sphere22in/geometry/setRmin 0.0 cm
/gate/sphere22in/setMaterial Air
#/gate/sphere22in/vis/forceWireframe
/gate/sphere22in/vis/setColor gray

# 22 mm Fill Capillary Exterior
/gate/IBox/daughters/name fill22
/gate/IBox/daughters/insert cylinder
/gate/fill22/placement/setTranslation +2.86 2.39633 7.8 cm
/gate/fill22/geometry/setRmax 0.35 cm
/gate/fill22/geometry/setHeight 5.8 cm
/gate/fill22/setMaterial Plastic
/gate/fill22/vis/forceWireframe
/gate/fill22/vis/setColor red

# 22 mm Fill Capillary
/gate/fill22/daughters/name fill22in
/gate/fill22/daughters/insert cylinder
/gate/fill22in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/fill22in/geometry/setRmax 0.25 cm

```

```

/gate/fill22in/geometry/setRmin 0. cm
/gate/fill22in/geometry/setHeight 5.8 cm
/gate/fill22in/setMaterial Air
#/gate/fill22in/vis/forceWireframe
/gate/fill22in/vis/setColor gray

# 28 mm Sphere Exterior
/gate/IBox/daughters/name sphere28
/gate/IBox/daughters/insert sphere
/gate/sphere28/placement/setTranslation -2.86 2.39633 3.7 cm
/gate/sphere28/geometry/setRmax 1.5 cm
/gate/sphere28/setMaterial Plastic
/gate/sphere28/vis/forceWireframe
/gate/sphere28/vis/setColor red

# 28 mm Sphere
/gate/sphere28/daughters/name sphere28in
/gate/sphere28/daughters/insert sphere
/gate/sphere28in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/sphere28in/geometry/setRmax 1.4 cm
/gate/sphere28in/geometry/setRmin 0.0 cm
/gate/sphere28in/setMaterial Air
#/gate/sphere28in/vis/forceWireframe
/gate/sphere28in/vis/setColor gray

# 28 mm Fill Capillary Exterior
/gate/IBox/daughters/name fill28
/gate/IBox/daughters/insert cylinder
/gate/fill28/placement/setTranslation -2.86 2.39633 7.95 cm
/gate/fill28/geometry/setRmax 0.35 cm
/gate/fill28/geometry/setHeight 5.5 cm
/gate/fill28/setMaterial Plastic
/gate/fill28/vis/forceWireframe
/gate/fill28/vis/setColor red

# 28 mm Fill Capillary
/gate/fill28/daughters/name fill28in
/gate/fill28/daughters/insert cylinder
/gate/fill28in/placement/setTranslation 0.0 0.0 0.0 cm
/gate/fill28in/geometry/setRmax 0.25 cm

```

```

/gate/kill28in/geometry/setRmin 0. cm
/gate/kill28in/geometry/setHeight 5.5 cm
/gate/kill28in/setMaterial Air
#/gate/kill28in/vis/forceWireframe
/gate/kill28in/vis/setColor gray

/gate/nema/daughters/name topshell2
/gate/nema/daughters/insert cylinder
/gate/topshell2/placement/setTranslation 7.0 -3.5 10.85 cm
/gate/topshell2/geometry/setRmax 8. cm
/gate/topshell2/geometry/setRmin 0. cm
/gate/topshell2/geometry/setHeight 0.3 cm
/gate/topshell2/geometry/setPhiStart 270. deg
/gate/topshell2/geometry/setDeltaPhi 90. deg
/gate/topshell2/setMaterial Plastic
#/gate/topshell2/vis/forceWireframe
/gate/topshell2/vis/setColor yellow

/gate/nema/daughters/name topshell3
/gate/nema/daughters/insert cylinder
/gate/topshell3/placement/setTranslation -7.0 -3.5 10.85 cm
/gate/topshell3/geometry/setRmax 8. cm
/gate/topshell3/geometry/setRmin 0. cm
/gate/topshell3/geometry/setHeight 0.3 cm
/gate/topshell3/geometry/setPhiStart 180. deg
/gate/topshell3/geometry/setDeltaPhi 90. deg
/gate/topshell3/setMaterial Plastic
#/gate/topshell3/vis/forceWireframe
/gate/topshell3/vis/setColor yellow

/gate/nema/daughters/name topshell4
/gate/nema/daughters/insert box
/gate/topshell4/placement/setTranslation 0.0 -7.5 10.85 cm
/gate/topshell4/geometry/setXLength 14. cm
/gate/topshell4/geometry/setYLength 8. cm
/gate/topshell4/geometry/setZLength 0.3 cm
/gate/topshell4/setMaterial Plastic
/gate/topshell4/vis/forceWireframe
/gate/topshell4/vis/setColor yellow

```

```
/gate/nema/daughters/name bottomshell2
/gate/nema/daughters/insert cylinder
/gate/bottomshell2/placement/setTranslation 7.0 -3.5 -10.85 cm
/gate/bottomshell2/geometry/setRmax 8. cm
/gate/bottomshell2/geometry/setRmin 0. cm
/gate/bottomshell2/geometry/setHeight 0.3 cm
/gate/bottomshell2/geometry/setPhiStart 270. deg
/gate/bottomshell2/geometry/setDeltaPhi 90. deg
/gate/bottomshell2/setMaterial Plastic
#/gate/bottomshell2/vis/forceWireframe
/gate/bottomshell2/vis/setColor yellow
```

```
/gate/nema/daughters/name bottomshell3
/gate/nema/daughters/insert cylinder
/gate/bottomshell3/placement/setTranslation -7.0 -3.5 -10.85 cm
/gate/bottomshell3/geometry/setRmax 8. cm
/gate/bottomshell3/geometry/setRmin 0. cm
/gate/bottomshell3/geometry/setHeight 0.3 cm
/gate/bottomshell3/geometry/setPhiStart 180. deg
/gate/bottomshell3/geometry/setDeltaPhi 90. deg
/gate/bottomshell3/setMaterial Plastic
#/gate/bottomshell3/vis/forceWireframe
/gate/bottomshell3/vis/setColor yellow
```

```
/gate/nema/daughters/name bottomshell4
/gate/nema/daughters/insert box
/gate/bottomshell4/placement/setTranslation 0.0 -7.5 -10.85 cm
/gate/bottomshell4/geometry/setXLength 14. cm
/gate/bottomshell4/geometry/setYLength 8. cm
/gate/bottomshell4/geometry/setZLength 0.3 cm
/gate/bottomshell4/setMaterial Plastic
#/gate/bottomshell4/vis/forceWireframe
/gate/bottomshell4/vis/setColor yellow
```

```
#      A t t a c h   P h a n t o m
/gate/nema/attachPhantomSD
/gate/upperinterior/attachPhantomSD
/gate/centercyl/attachPhantomSD
/gate/centercylin/attachPhantomSD
/gate/sphere10/attachPhantomSD
```

/gate/sphere10in/attachPhantomSD
/gate/fill10/attachPhantomSD
/gate/fill10in/attachPhantomSD
/gate/sphere13/attachPhantomSD
/gate/sphere13in/attachPhantomSD
/gate/fill13/attachPhantomSD
/gate/fill13in/attachPhantomSD
/gate/sphere17/attachPhantomSD
/gate/sphere17in/attachPhantomSD
/gate/fill17/attachPhantomSD
/gate/fill17in/attachPhantomSD
/gate/sphere37/attachPhantomSD
/gate/sphere37in/attachPhantomSD
/gate/fill37/attachPhantomSD
/gate/fill37in/attachPhantomSD
/gate/sphere22/attachPhantomSD
/gate/sphere22in/attachPhantomSD
/gate/fill22/attachPhantomSD
/gate/fill22in/attachPhantomSD
/gate/sphere28/attachPhantomSD
/gate/sphere28in/attachPhantomSD
/gate/fill28/attachPhantomSD
/gate/fill28in/attachPhantomSD
/gate/IBox/attachPhantomSD
/gate/LLinterior/attachPhantomSD
/gate/LRinterior/attachPhantomSD
/gate/outershell2/attachPhantomSD
/gate/outershell3/attachPhantomSD
/gate/outershell4/attachPhantomSD
/gate/topshell1/attachPhantomSD
/gate/topshell2/attachPhantomSD
/gate/topshell3/attachPhantomSD
/gate/topshell4/attachPhantomSD
/gate/bottomshell1/attachPhantomSD
/gate/bottomshell2/attachPhantomSD
/gate/bottomshell3/attachPhantomSD
/gate/bottomshell4/attachPhantomSD

/gate/world/daughters/name cold_area
/gate/world/daughters/insert cylinder

```
/gate/cold_area/vis/forceWireframe
/gate/cold_area/vis/setColor green
/gate/cold_area/geometry/setRmax 14.7 cm
/gate/cold_area/geometry/setHeight 22 cm
/gate/cold_area/placement/setTranslation 0 8.2 0 cm
/gate/cold_area/setMaterial Air
```

```
/gate/world/daughters/name cold_area1
/gate/world/daughters/insert cylinder
/gate/cold_area1/vis/forceWireframe
/gate/cold_area1/vis/setColor green
/gate/cold_area1/geometry/setRmax 4.40 cm
/gate/cold_area1/geometry/setHeight 22 cm
/gate/cold_area1/placement/setTranslation -9.3 -3.7 0 cm
/gate/cold_area1/setMaterial Air
```

```
/gate/world/daughters/name cold_area2
/gate/world/daughters/insert cylinder
/gate/cold_area2/vis/forceWireframe
/gate/cold_area2/vis/setColor green
/gate/cold_area2/geometry/setRmax 4.40 cm
/gate/cold_area2/geometry/setHeight 22 cm
/gate/cold_area2/placement/setTranslation -10.5 -3.3 0 cm
/gate/cold_area2/setMaterial Air
```

```
/gate/world/daughters/name cold_area3
/gate/world/daughters/insert cylinder
/gate/cold_area3/vis/forceWireframe
/gate/cold_area3/vis/setColor green
/gate/cold_area3/geometry/setRmax 4.40 cm
/gate/cold_area3/geometry/setHeight 22 cm
/gate/cold_area3/placement/setTranslation -12.6 -2.4 0 cm
/gate/cold_area3/setMaterial Air
```

```
/gate/world/daughters/name cold_area4
/gate/world/daughters/insert cylinder
/gate/cold_area4/vis/forceWireframe
/gate/cold_area4/vis/setColor green
/gate/cold_area4/geometry/setRmax 4.40 cm
```



```
/gate/cold_area4/geometry/setHeight 22 cm  
/gate/cold_area4/placement/setTranslation -15.6 -0.5 0 cm  
/gate/cold_area4/setMaterial Air
```

```
/gate/world/daughters/name cold_area5  
/gate/world/daughters/insert cylinder  
/gate/cold_area5/vis/forceWireframe  
/gate/cold_area5/vis/setColor green  
/gate/cold_area5/geometry/setRmax 4.40 cm  
/gate/cold_area5/geometry/setHeight 22 cm  
/gate/cold_area5/placement/setTranslation -17.2 2.0 0 cm  
/gate/cold_area5/setMaterial Air
```

```
/gate/world/daughters/name cold_area6  
/gate/world/daughters/insert cylinder  
/gate/cold_area6/vis/forceWireframe  
/gate/cold_area6/vis/setColor green  
/gate/cold_area6/geometry/setRmax 4.40 cm  
/gate/cold_area6/geometry/setHeight 22 cm  
/gate/cold_area6/placement/setTranslation -18.3 4.7 0 cm  
/gate/cold_area6/setMaterial Air
```

```
/gate/world/daughters/name cold_area7  
/gate/world/daughters/insert cylinder  
/gate/cold_area7/vis/forceWireframe  
/gate/cold_area7/vis/setColor green  
/gate/cold_area7/geometry/setRmax 4.40 cm  
/gate/cold_area7/geometry/setHeight 22 cm  
/gate/cold_area7/placement/setTranslation -18.4 10.4 0 cm  
/gate/cold_area7/setMaterial Air
```

```
/gate/world/daughters/name cold_area8  
/gate/world/daughters/insert cylinder  
/gate/cold_area8/vis/forceWireframe  
/gate/cold_area8/vis/setColor green  
/gate/cold_area8/geometry/setRmax 4.40 cm  
/gate/cold_area8/geometry/setHeight 22 cm  
/gate/cold_area8/placement/setTranslation -18.2 11.7 0 cm  
/gate/cold_area8/setMaterial Air
```

```
/gate/world/daughters/name cold_area9
/gate/world/daughters/insert cylinder
/gate/cold_area9/vis/forceWireframe
/gate/cold_area9/vis/setColor green
/gate/cold_area9/geometry/setRmax 4.40 cm
/gate/cold_area9/geometry/setHeight 22 cm
/gate/cold_area9/placement/setTranslation -17.5 14.2 0 cm
/gate/cold_area9/setMaterial Air
```

```
/gate/world/daughters/name cold_area10
/gate/world/daughters/insert cylinder
/gate/cold_area10/vis/forceWireframe
/gate/cold_area10/vis/setColor green
/gate/cold_area10/geometry/setRmax 4.40 cm
/gate/cold_area10/geometry/setHeight 22 cm
/gate/cold_area10/placement/setTranslation -16.5 17.0 0 cm
/gate/cold_area10/setMaterial Air
```

```
/gate/world/daughters/name cold_area11
/gate/world/daughters/insert cylinder
/gate/cold_area11/vis/forceWireframe
/gate/cold_area11/vis/setColor green
/gate/cold_area11/geometry/setRmax 4.40 cm
/gate/cold_area11/geometry/setHeight 22 cm
/gate/cold_area11/placement/setTranslation -14.6 19.4 0 cm
/gate/cold_area11/setMaterial Air
```

```
/gate/world/daughters/name cold_area12
/gate/world/daughters/insert cylinder
/gate/cold_area12/vis/forceWireframe
/gate/cold_area12/vis/setColor green
/gate/cold_area12/geometry/setRmax 4.40 cm
/gate/cold_area12/geometry/setHeight 22 cm
/gate/cold_area12/placement/setTranslation -12.7 21.4 0 cm
/gate/cold_area12/setMaterial Air
```

```
/gate/world/daughters/name cold_area13
/gate/world/daughters/insert cylinder
/gate/cold_area13/vis/forceWireframe
```

```
/gate/cold_area13/vis/setColor green
/gate/cold_area13/geometry/setRmax 4.40 cm
/gate/cold_area13/geometry/setHeight 22 cm
/gate/cold_area13/placement/setTranslation -10.7 23.1 0 cm
/gate/cold_area13/setMaterial Air
```

```
/gate/world/daughters/name cold_area14
/gate/world/daughters/insert cylinder
/gate/cold_area14/vis/forceWireframe
/gate/cold_area14/vis/setColor green
/gate/cold_area14/geometry/setRmax 4.40 cm
/gate/cold_area14/geometry/setHeight 22 cm
/gate/cold_area14/placement/setTranslation -8.4 24.3 0 cm
/gate/cold_area14/setMaterial Air
```

```
/gate/world/daughters/name cold_area15
/gate/world/daughters/insert cylinder
/gate/cold_area15/vis/forceWireframe
/gate/cold_area15/vis/setColor green
/gate/cold_area15/geometry/setRmax 4.40 cm
/gate/cold_area15/geometry/setHeight 22 cm
/gate/cold_area15/placement/setTranslation -5.9 25.4 0 cm
/gate/cold_area15/setMaterial Air
```

```
/gate/world/daughters/name cold_area16
/gate/world/daughters/insert cylinder
/gate/cold_area16/vis/forceWireframe
/gate/cold_area16/vis/setColor green
/gate/cold_area16/geometry/setRmax 4.40 cm
/gate/cold_area16/geometry/setHeight 22 cm
/gate/cold_area16/placement/setTranslation -2.5 27 0 cm
/gate/cold_area16/setMaterial Air
```

```
#COLD LESIONS 2/2
```

```
/gate/world/daughters/name cold_area1s
/gate/world/daughters/insert cylinder
/gate/cold_area1s/vis/forceWireframe
/gate/cold_area1s/vis/setColor green
/gate/cold_area1s/geometry/setRmax 4.40 cm
/gate/cold_area1s/geometry/setHeight 22 cm
```

```
/gate/cold_area1s/placement/setTranslation 9.3 -3.7 0 cm
/gate/cold_area1s/setMaterial Air

/gate/world/daughters/name cold_area2s
/gate/world/daughters/insert cylinder
/gate/cold_area2s/vis/forceWireframe
/gate/cold_area2s/vis/setColor green
/gate/cold_area2s/geometry/setRmax 4.40 cm
/gate/cold_area2s/geometry/setHeight 22 cm
/gate/cold_area2s/placement/setTranslation 10.5 -3.3 0 cm
/gate/cold_area2s/setMaterial Air

/gate/world/daughters/name cold_area3s
/gate/world/daughters/insert cylinder
/gate/cold_area3s/vis/forceWireframe
/gate/cold_area3s/vis/setColor green
/gate/cold_area3s/geometry/setRmax 4.40 cm
/gate/cold_area3s/geometry/setHeight 22 cm
/gate/cold_area3s/placement/setTranslation 12.6 -2.4 0 cm
/gate/cold_area3s/setMaterial Air

/gate/world/daughters/name cold_area4s
/gate/world/daughters/insert cylinder
/gate/cold_area4s/vis/forceWireframe
/gate/cold_area4s/vis/setColor green
/gate/cold_area4s/geometry/setRmax 4.40 cm
/gate/cold_area4s/geometry/setHeight 22 cm
/gate/cold_area4s/placement/setTranslation 15.6 -0.5 0 cm
/gate/cold_area4s/setMaterial Air

/gate/world/daughters/name cold_area5s
/gate/world/daughters/insert cylinder
/gate/cold_area5s/vis/forceWireframe
/gate/cold_area5s/vis/setColor green
/gate/cold_area5s/geometry/setRmax 4.40 cm
/gate/cold_area5s/geometry/setHeight 22 cm
/gate/cold_area5s/placement/setTranslation 17.2 2.0 0 cm
/gate/cold_area5s/setMaterial Air

/gate/world/daughters/name cold_area6s
```

```
/gate/world/daughters/insert cylinder
/gate/cold_area6s/vis/forceWireframe
/gate/cold_area6s/vis/setColor green
/gate/cold_area6s/geometry/setRmax 4.40 cm
/gate/cold_area6s/geometry/setHeight 22 cm
/gate/cold_area6s/placement/setTranslation 18.3 4.7 0 cm
/gate/cold_area6s/setMaterial Air
```

```
/gate/world/daughters/name cold_area7s
/gate/world/daughters/insert cylinder
/gate/cold_area7s/vis/forceWireframe
/gate/cold_area7s/vis/setColor green
/gate/cold_area7s/geometry/setRmax 4.40 cm
/gate/cold_area7s/geometry/setHeight 22 cm
/gate/cold_area7s/placement/setTranslation 18.4 10.4 0 cm
/gate/cold_area7s/setMaterial Air
```

```
/gate/world/daughters/name cold_area8s
/gate/world/daughters/insert cylinder
/gate/cold_area8s/vis/forceWireframe
/gate/cold_area8s/vis/setColor green
/gate/cold_area8s/geometry/setRmax 4.40 cm
/gate/cold_area8s/geometry/setHeight 22 cm
/gate/cold_area8s/placement/setTranslation 18.2 11.7 0 cm
/gate/cold_area8s/setMaterial Air
```

```
/gate/world/daughters/name cold_area9s
/gate/world/daughters/insert cylinder
/gate/cold_area9s/vis/forceWireframe
/gate/cold_area9s/vis/setColor green
/gate/cold_area9s/geometry/setRmax 4.40 cm
/gate/cold_area9s/geometry/setHeight 22 cm
/gate/cold_area9s/placement/setTranslation 17.5 14.2 0 cm
/gate/cold_area9s/setMaterial Air
```

```
/gate/world/daughters/name cold_area10s
/gate/world/daughters/insert cylinder
/gate/cold_area10s/vis/forceWireframe
/gate/cold_area10s/vis/setColor green
/gate/cold_area10s/geometry/setRmax 4.40 cm
```

```
/gate/cold_area10s/geometry/setHeight 22 cm
/gate/cold_area10s/placement/setTranslation 16.5 17.0 0 cm
/gate/cold_area10s/setMaterial Air
```

```
/gate/world/daughters/name cold_area11s
/gate/world/daughters/insert cylinder
/gate/cold_area11s/vis/forceWireframe
/gate/cold_area11s/vis/setColor green
/gate/cold_area11s/geometry/setRmax 4.40 cm
/gate/cold_area11s/geometry/setHeight 22 cm
/gate/cold_area11s/placement/setTranslation 14.6 19.4 0 cm
/gate/cold_area11s/setMaterial Air
```

```
/gate/world/daughters/name cold_area12s
/gate/world/daughters/insert cylinder
/gate/cold_area12s/vis/forceWireframe
/gate/cold_area12s/vis/setColor green
/gate/cold_area12s/geometry/setRmax 4.40 cm
/gate/cold_area12s/geometry/setHeight 22 cm
/gate/cold_area12s/placement/setTranslation 12.7 21.4 0 cm
/gate/cold_area12s/setMaterial Air
```

```
/gate/world/daughters/name cold_area13s
/gate/world/daughters/insert cylinder
/gate/cold_area13s/vis/forceWireframe
/gate/cold_area13s/vis/setColor green
/gate/cold_area13s/geometry/setRmax 4.40 cm
/gate/cold_area13s/geometry/setHeight 22 cm
/gate/cold_area13s/placement/setTranslation 10.7 23.1 0 cm
/gate/cold_area13s/setMaterial Air
```

```
/gate/world/daughters/name cold_area14s
/gate/world/daughters/insert cylinder
/gate/cold_area14s/vis/forceWireframe
/gate/cold_area14s/vis/setColor green
/gate/cold_area14s/geometry/setRmax 4.40 cm
/gate/cold_area14s/geometry/setHeight 22 cm
/gate/cold_area14s/placement/setTranslation 8.4 24.3 0 cm
/gate/cold_area14s/setMaterial Air
```

```
/gate/world/daughters/name cold_area15s
/gate/world/daughters/insert cylinder
/gate/cold_area15s/vis/forceWireframe
/gate/cold_area15s/vis/setColor green
/gate/cold_area15s/geometry/setRmax 4.40 cm
/gate/cold_area15s/geometry/setHeight 22 cm
/gate/cold_area15s/placement/setTranslation 5.9 25.4 0 cm
/gate/cold_area15s/setMaterial Air
```

```
/gate/world/daughters/name cold_area16s
/gate/world/daughters/insert cylinder
/gate/cold_area16s/vis/forceWireframe
/gate/cold_area16s/vis/setColor green
/gate/cold_area16s/geometry/setRmax 4.40 cm
/gate/cold_area16s/geometry/setHeight 22 cm
/gate/cold_area16s/placement/setTranslation 2.5 27 0 cm
/gate/cold_area16s/setMaterial Air
```

- phantom.mac

```
/control/execute NEMA.mac
/control/execute CTphant.mac
```

- source.mac

```
/gate/source/addSource Jasz_fill gps
/gate/source/Jasz_fill/gps/particle gamma
/gate/source/Jasz_fill/gps/ene/mono 364.489 keV
/gate/source/Jasz_fill/setForcedUnstableFlag True
/gate/source/Jasz_fill/setForcedHalfLife 693210 s
/gate/source/Jasz_fill/setActivity 175000000 becquerel
```

```
/gate/source/Jasz_fill/gps/pos/type Volume
/gate/source/Jasz_fill/gps/pos/shape Cylinder
/gate/source/Jasz_fill/gps/pos/radius 14.7 cm
/gate/source/Jasz_fill/gps/pos/halfz 10.7 cm
/gate/source/Jasz_fill/attachTo cold_area
```

```
/gate/source/Jasz_fill/gps/Forbid cold_area  
/gate/source/Jasz_fill/gps/Forbid cold_area1  
/gate/source/Jasz_fill/gps/Forbid cold_area2  
/gate/source/Jasz_fill/gps/Forbid cold_area3  
/gate/source/Jasz_fill/gps/Forbid cold_area4  
/gate/source/Jasz_fill/gps/Forbid cold_area5  
/gate/source/Jasz_fill/gps/Forbid cold_area6  
/gate/source/Jasz_fill/gps/Forbid cold_area7  
/gate/source/Jasz_fill/gps/Forbid cold_area8  
/gate/source/Jasz_fill/gps/Forbid cold_area9  
/gate/source/Jasz_fill/gps/Forbid cold_area10  
/gate/source/Jasz_fill/gps/Forbid cold_area11  
/gate/source/Jasz_fill/gps/Forbid cold_area12  
/gate/source/Jasz_fill/gps/Forbid cold_area13  
/gate/source/Jasz_fill/gps/Forbid cold_area14  
/gate/source/Jasz_fill/gps/Forbid cold_area15  
/gate/source/Jasz_fill/gps/Forbid cold_area16  
/gate/source/Jasz_fill/gps/Forbid cold_area1s  
/gate/source/Jasz_fill/gps/Forbid cold_area2s  
/gate/source/Jasz_fill/gps/Forbid cold_area3s  
/gate/source/Jasz_fill/gps/Forbid cold_area4s  
/gate/source/Jasz_fill/gps/Forbid cold_area5s  
/gate/source/Jasz_fill/gps/Forbid cold_area6s  
/gate/source/Jasz_fill/gps/Forbid cold_area7s  
/gate/source/Jasz_fill/gps/Forbid cold_area8s  
/gate/source/Jasz_fill/gps/Forbid cold_area9s  
/gate/source/Jasz_fill/gps/Forbid cold_area10s  
/gate/source/Jasz_fill/gps/Forbid cold_area11s  
/gate/source/Jasz_fill/gps/Forbid cold_area12s  
/gate/source/Jasz_fill/gps/Forbid cold_area13s  
/gate/source/Jasz_fill/gps/Forbid cold_area14s  
/gate/source/Jasz_fill/gps/Forbid cold_area15s  
/gate/source/Jasz_fill/gps/Forbid cold_area16s
```

```
/gate/source/addSource Jasz_Sph1 gps  
/gate/source/Jasz_Sph1/gps/particle gamma  
/gate/source/Jasz_Sph1/gps/ene/mono 364.489 keV  
/gate/source/Jasz_Sph1/setForcedUnstableFlag True  
/gate/source/Jasz_Sph1/setForcedHalfLife 693210 s
```



```
/gate/source/Jasz_Sph1/setActivity 7850000 becquerel

/gate/source/Jasz_Sph1/gps/pos/type Volume
/gate/source/Jasz_Sph1/gps/pos/shape Sphere
/gate/source/Jasz_Sph1/gps/pos/radius 1.85 cm
/gate/source/Jasz_Sph1/attachTo sphere28in

/gate/source/addSource Jasz_Sph2 gps
/gate/source/Jasz_Sph2/gps/particle gamma
/gate/source/Jasz_Sph2/gps/ene/mono 364.489 keV
/gate/source/Jasz_Sph2/setForcedUnstableFlag True
/gate/source/Jasz_Sph2/setForcedHalfLife 693210 s
/gate/source/Jasz_Sph2/setActivity 3370000 becquerel

/gate/source/Jasz_Sph2/gps/pos/type Volume
/gate/source/Jasz_Sph2/gps/pos/shape Sphere
/gate/source/Jasz_Sph2/gps/pos/radius 1.4 cm
/gate/source/Jasz_Sph2/attachTo sphere17in

/gate/source/addSource Jasz_Sph3 gps
/gate/source/Jasz_Sph3/gps/particle gamma
/gate/source/Jasz_Sph3/gps/ene/mono 364.489 keV
/gate/source/Jasz_Sph3/setForcedUnstableFlag True
/gate/source/Jasz_Sph3/setForcedHalfLife 693210 s
/gate/source/Jasz_Sph3/setActivity 2180000 becquerel

/gate/source/Jasz_Sph3/gps/pos/type Volume
/gate/source/Jasz_Sph3/gps/pos/shape Sphere
/gate/source/Jasz_Sph3/gps/pos/radius 1.1 cm
/gate/source/Jasz_Sph3/attachTo sphere13in

/gate/source/Jasz_fill/visualize 1000 yellow 3
/gate/source/Jasz_Sph1/visualize 200 red 3
/gate/source/Jasz_Sph2/visualize 200 magenta 3
/gate/source/Jasz_Sph3/visualize 200 cyan 3
/gate/source/number1/visualize 200 green 3
/gate/source/number2/visualize 200 green 3
/gate/source/number3/visualize 200 green 3
/gate/source/number4/visualize 200 green 3
/gate/source/number5/visualize 200 green 3
```

```
/gate/source/number6/visualize 200 green 3
/gate/source/number7/visualize 200 green 3
/gate/source/number8/visualize 200 green 3
/gate/source/number9/visualize 200 green 3
/gate/source/number10/visualize 200 green 3
/gate/source/number11/visualize 200 green 3
/gate/source/number12/visualize 200 green 3
/gate/source/number13/visualize 200 green 3
/gate/source/number14/visualize 200 green 3
/gate/source/number15/visualize 200 green 3
/gate/source/number16/visualize 200 green 3
/gate/source/number1s/visualize 200 green 3
/gate/source/number2s/visualize 200 green 3
/gate/source/number3s/visualize 200 green 3
/gate/source/number4s/visualize 200 green 3
/gate/source/number5s/visualize 200 green 3
/gate/source/number6s/visualize 200 green 3
/gate/source/number7s/visualize 200 green 3
/gate/source/number8s/visualize 200 green 3
/gate/source/number9s/visualize 200 green 3
/gate/source/number10s/visualize 200 green 3
/gate/source/number11s/visualize 200 green 3
/gate/source/number12s/visualize 200 green 3
/gate/source/number13s/visualize 200 green 3
/gate/source/number14s/visualize 200 green 3
/gate/source/number15s/visualize 200 green 3
/gate/source/number16s/visualize 200 green 3
```

- SPECT2Heads90.mac

```
/gate/world/geometry/setXLength 100 cm
/gate/world/geometry/setYLength 100 cm
/gate/world/geometry/setZLength 100 cm

# Scanner Head
/gate/world/daughters/name SPECThead
/gate/world/daughters/insert box
/gate/SPECThead/geometry/setXLength 53.3 cm
/gate/SPECThead/geometry/setYLength 16. cm
/gate/SPECThead/geometry/setZLength 38.7 cm
```

```
/gate/SPECThead/placement/setTranslation 0 35 0 cm
/gate/SPECThead/setMaterial Air
/gate/SPECThead/repeaters/insert ring
/gate/SPECThead/ring/setRepeatNumber 2
#/gate/SPECThead/ring/setPoint1 0 0 1 cm
#/gate/SPECThead/ring/setPoint2 1 0 0 cm
/gate/SPECThead/ring/setFirstAngle 45 deg
/gate/SPECThead/ring/setAngularSpan -90 deg
```

```
# Collimator
```

```
/control/execute HEGP.mac
```

```
# Crystal
```

```
/gate/SPECThead/daughters/name krystal
/gate/SPECThead/daughters/insert box
/gate/krystal/geometry/setXLength 53.3 cm
/gate/krystal/geometry/setYLength 9.5 mm
/gate/krystal/geometry/setZLength 38.7 cm
/gate/krystal/placement/setTranslation 0. 0. 0. cm
/gate/krystal/setMaterial NaITl
/gate/krystal/vis/setColor yellow
/gate/krystal/vis/forceSolid
```

```
/gate/systems/SPECThead/crystal/attach krystal
```

```
/gate/krystal/attachCrystalSD
```

```
# BACK-COMPARTMENT
```

```
/gate/SPECThead/daughters/name BackCompartment
/gate/SPECThead/daughters/insert box
/gate/BackCompartment/geometry/setXLength 53.3 cm
/gate/BackCompartment/geometry/setYLength 75.25 mm
/gate/BackCompartment/geometry/setZLength 38.7 cm
/gate/BackCompartment/placement/setTranslation 0. 42.375 0. mm
/gate/BackCompartment/setMaterial Air
/gate/BackCompartment/vis/setColor grey
```

- vis.mac

```
/vis/open OGL
```

```
/vis/viewer/set/viewpointThetaPhi 0 0
/vis/viewer/panTo 0.15 0.15
/vis/drawVolume
```

MATLAB skript pro hledání ROI FNOL

Následující MATLAB skript byl použit pro automatizované vyhledávání ROI na snímcích.

```
% Load PNG file and convert it to grayscale
colorImage = imread('fnoltuk0LATPNG.png');
grayImage = rgb2gray(colorImage);
grayImageCopy=grayImage;

% Define full ROI location and sum
xF_start=1;
xF_end=size(grayImageCopy, 2);
yF_start=1;
yF_end=size(grayImageCopy, 1);

brightest_roiFull_location = [xF_start, yF_start];
roiFull_sum = sum(sum(grayImageCopy(yF_start:yF_end, xF_start:xF_end)));

% Output the location and sum of the background ROI
disp('Total counts in picture:');
disp(['Location (X, Y): ' num2str(brightest_roiFull_location)]);
disp(['Sum of Intensities: ' num2str(roiFull_sum)]);

% Define the size of the ROI 1 (in pixels)
roi1_width = 60;
roi1_height = 70;

% Initialize variables to store ROI location and sum
brightest_roi1_location = [0, 0];
max_brightest_roi1_sum = 0;

% Iterate through the grayscale image
for x = 1:size(grayImageCopy, 2)
    for y = 1:size(grayImageCopy, 1)
```

```

% Define rectangular ROI region centered at (x, y)
x1_start = max(1, x - roi1_width / 2);
x1_end = min(size(grayImageCopy, 2), x + roi1_width / 2);
y1_start = max(1, y - roi1_height / 2);
y1_end = min(size(grayImageCopy, 1), y + roi1_height / 2);

% Calculate the sum of pixel intensities within the ROI
roi1_sum = sum(sum(grayImageCopy(y1_start:y1_end, x1_start:x1_end)));

% Check if the sum in the current ROI is higher than the current brightest
if roi1_sum > max_brightest_roi1_sum
    % Update the brightest ROI
    max_brightest_roi1_sum = roi1_sum;
    brightest_roi1_location = [x, y];
end
end
end

% To find the second etc brightest ROI:
% Subtract the pixel values of the brightest ROI and set them to 0 (black)
x1_start = max(1, brightest_roi1_location(1) - roi1_width / 2);
x1_end = min(size(grayImageCopy, 2), brightest_roi1_location(1) + roi1_width / 2);
y1_start = max(1, brightest_roi1_location(2) - roi1_height / 2);
y1_end = min(size(grayImageCopy, 1), brightest_roi1_location(2) + roi1_height / 2);

grayImageCopy(y1_start:y1_end, x1_start:x1_end) = 0;

% Output the location and sum of the brightest ROI
disp('Brightest ROI 1:');
disp(['Location (X, Y): ' num2str(brightest_roi1_location)]);
disp(['Sum of Intensities: ' num2str(max_brightest_roi1_sum)]);

% Define the size of the ROI 2 (in pixels)
roi2_width = 60;
roi2_height = 70;

% Initialize variables to store ROI location and sum
brightest_roi2_location = [0, 0];
max_brightest_roi2_sum = 0;

```

```

% Iterate through the grayscale image
for a = 1:size(grayImageCopy, 2)
    for b = 1:size(grayImageCopy, 1)
        % Define rectangular ROI region centered at (a, b)
        x2_start = max(1, a - roi2_width / 2);
        x2_end = min(size(grayImageCopy, 2), a + roi2_width / 2);
        y2_start = max(1, b - roi2_height / 2);
        y2_end = min(size(grayImageCopy, 1), b + roi2_height / 2);

        % Calculate the sum of pixel intensities within the ROI
        roi2_sum = sum(sum(grayImageCopy(y2_start:y2_end, x2_start:x2_end)));

        % Check if the sum in the current ROI is higher than the current brightest
        if roi2_sum > max_brightest_roi2_sum
            % Update the brightest ROI
            max_brightest_roi2_sum = roi2_sum;
            brightest_roi2_location = [a, b];
        end
    end
end

% Prepared for finding another ROI etc
% Subtract the pixel values of the second brightest ROI and set them to 0 (black)
x2_start = max(1, brightest_roi2_location(1) - roi2_width / 2);
x2_end = min(size(grayImageCopy, 2), brightest_roi2_location(1) + roi2_width / 2);
y2_start = max(1, brightest_roi2_location(2) - roi2_height / 2);
y2_end = min(size(grayImageCopy, 1), brightest_roi2_location(2) + roi2_height / 2);

grayImageCopy(y2_start:y2_end, x2_start:x2_end) = 0;

% Define the size of the background (in pixels)
roiBG_width = 60;
roiBG_height = 60;

% Output the location and sum of the second brightest ROI
disp('Brightest ROI 2:');
disp(['Location (X, Y): ' num2str(brightest_roi2_location)]);
disp(['Sum of Intensities: ' num2str(max_brightest_roi2_sum)]);

```

```

% Define background ROI location and sum
xBG_start=250;
xBG_end=310;
yBG_start=190;
yBG_end=250;

brightest_roiBG_location = [xBG_start, yBG_start];
roiBG_sum = sum(sum(grayImageCopy(yBG_start:yBG_end, xBG_start:xBG_end)));

% Output the location and sum of the background ROI
disp('Background ROI:');
disp(['Location (X, Y): ' num2str(brightest_roiBG_location)]);
disp(['Sum of Intensities: ' num2str(roiBG_sum)]);

% Define the size of the full image (in pixels)
roiFull_width = size(grayImageCopy, 2);
roiFull_height = size(grayImageCopy, 1);

% Display the original grayscale image
figure;
imshow(grayImage, []);

% Show two brightest ROIs with a green and red border on the original image
% and background
hold on;
rectangle('Position', [x1_start, y1_start, roi1_width, roi1_height],
'EdgeColor', 'g', 'LineWidth', 2);
hold off;
hold on;
rectangle('Position', [x2_start, y2_start, roi2_width, roi2_height],
'EdgeColor', 'r', 'LineWidth', 2);
hold off;
hold on;
rectangle('Position', [xBG_start, yBG_start, roiBG_width, roiBG_height],
'EdgeColor', 'b', 'LineWidth', 2);
hold off;
rectangle('Position', [xF_start, yF_start, roiFull_width, roiFull_height],
'EdgeColor', 'm', 'LineWidth', 2);
hold off;

```

MATLAB skript pro stanovení koeficientů prokladu FNOL

Následující MATLAB skript byl použit pro zpracování dat do grafické podoby.

```
exp1 = L1APexp;
exp2 = L1LATexp;
exp3 = L2APexp;
exp4 = L2LATexp;

xe1 = exp1(:,1);
ye1 = exp1(:,2);
xe2 = exp2(:,1);
ye2 = exp2(:,2);
xe3 = exp3(:,1);
ye3 = exp3(:,2);
xe4 = exp4(:,1);
ye4 = exp4(:,2);

fe1=fit(xe1,ye1,'poly1')
fe2=fit(xe2,ye2,'poly1')
fe3=fit(xe3,ye3,'poly1')
fe4=fit(xe4,ye4,'poly1')

plot(fe1,"-r",xe1,ye1, "+r");hold on; plot(fe2,"-b",xe2,ye2, "+b");hold on;
plot(fe3,"-g",xe3,ye3, "+g");hold on; plot(fe4,"-m",xe4,ye4, "+m");

grid on
grid minor
xlabel("HU (cm)")
ylabel("A/R (Bq/cps)")

legend("Experiment L1AP", "Fit: A/R = 1.404e-05 * HU + 0.001257",
"Experiment L1LAT", "Fit: A/R = 2.311e-06 * HU + 0.001777",
"Experiment L2AP", "Fit: A/R = 9.35e-06 * HU + 0.001645",
"Experiment L2LAT", "Fit: A/R = -2.283e-06 * HU + 0.001379")

hold off
xl = get(gca,'YTickLabel');
```



```
new_xl = strrep(xl(:),'.',' '); set(gca,'YTickLabel',new_xl)
yl = get(gca,'XTickLabel');
new_yl = strrep(yl(:),'.',' '); set(gca,'XTickLabel',new_yl)
```