Prehľad radiačnej záťaže CT vyšetrení.

FNsP F.D.R. v BB
Ing. Pavol Laurenčík
Bc. Marián Banský

Úvod:

- Žiadne vedomosti o meraní dávky CT vyšetrení
- Otázka do akej mieri ovplyvňuje CT vyšetrenie celkovú dávku rádioterapie
- Aká je veľká radiačná záťaž CT oproti prírodnému žiareniu

Priemerné hodnoty prír. žiarenia:

- (1) Priemerný ročný dávkový ekvivalent na Zemi je 3mSv
- (2) 2,2 mSv/rok -hodnota priemerného radiačného pozadia pre UK -podla autora B. Walla -táto hodnota môže kolísat od 1,5 do 7,5 mSv/rok.

V Českej republike sa pre priemerné ročné ožiarenie z prírodných zdrojov udáva hodnota 3,5 mSv.

(1) Klinická radiobiologie –Pavel Kuna, Leoš Navrátil a kol. 2005

(2) Rentgen Bulletin, 2001 Praha

(3)Report of the United Nations Scientific Committee on the Effects of Atomic Radiation -2000

Table 1
Average radiation dose from natural sources

Source	*Worldwide average annual effective dose (mSv)*	*Typical range (mSv)*
External exposure		
Cosmic rays	0.4	0.3-1.0 [a]
Terrestrial gamma rays	0.5	0.3-0.6 [b]
Internal exposure		
Inhalation (mainly radon)	1.2	0.2-10 [c]
Ingestion	0.3	0.2-0.8 [d]
Total	2.4	1-10

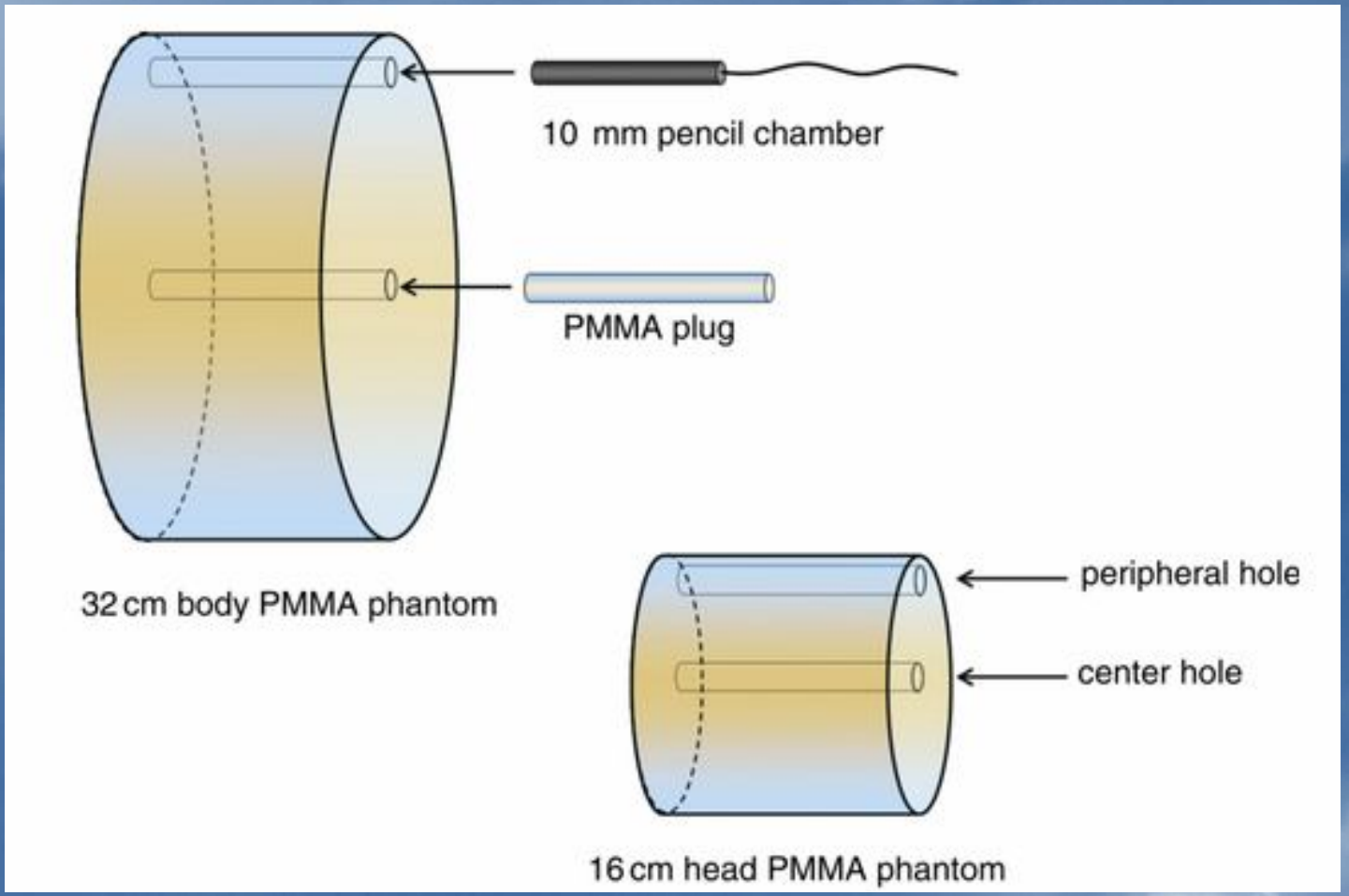
a Range from sea level to high ground elevation.
b Depending on radionuclide composition of soil and building materials.
c Depending on indoor accumulation of radon gas.
d Depending on radionuclide composition of foods and drinking water.

Stredné efektívne dávky pri vybraných vyšetreniach:

Vyšetřovací metoda	Typické efektivní dávky (mSv)	Ekvivalentní počet snímků při rtg vyšetření plic	Přibližná doba, za kterou by člověk obdržel ekvivalentní dávku ozáření z přírodních zdrojů [2)]
CT hlavy	2.3	115	1 rok
CT hrudníku	8	400	3.6 roku
CT břicha nabo pánve	10	500	4.5 roku

2) Prirovnané k hodnote 2,2 mSv/rok
Rentgen Bulletin, 2001 Praha

Teória merania dávky CT:



What is $CTDI_{vol}$?

„ volume computed tomography dose index „

„ CT dávkovo objemový index “

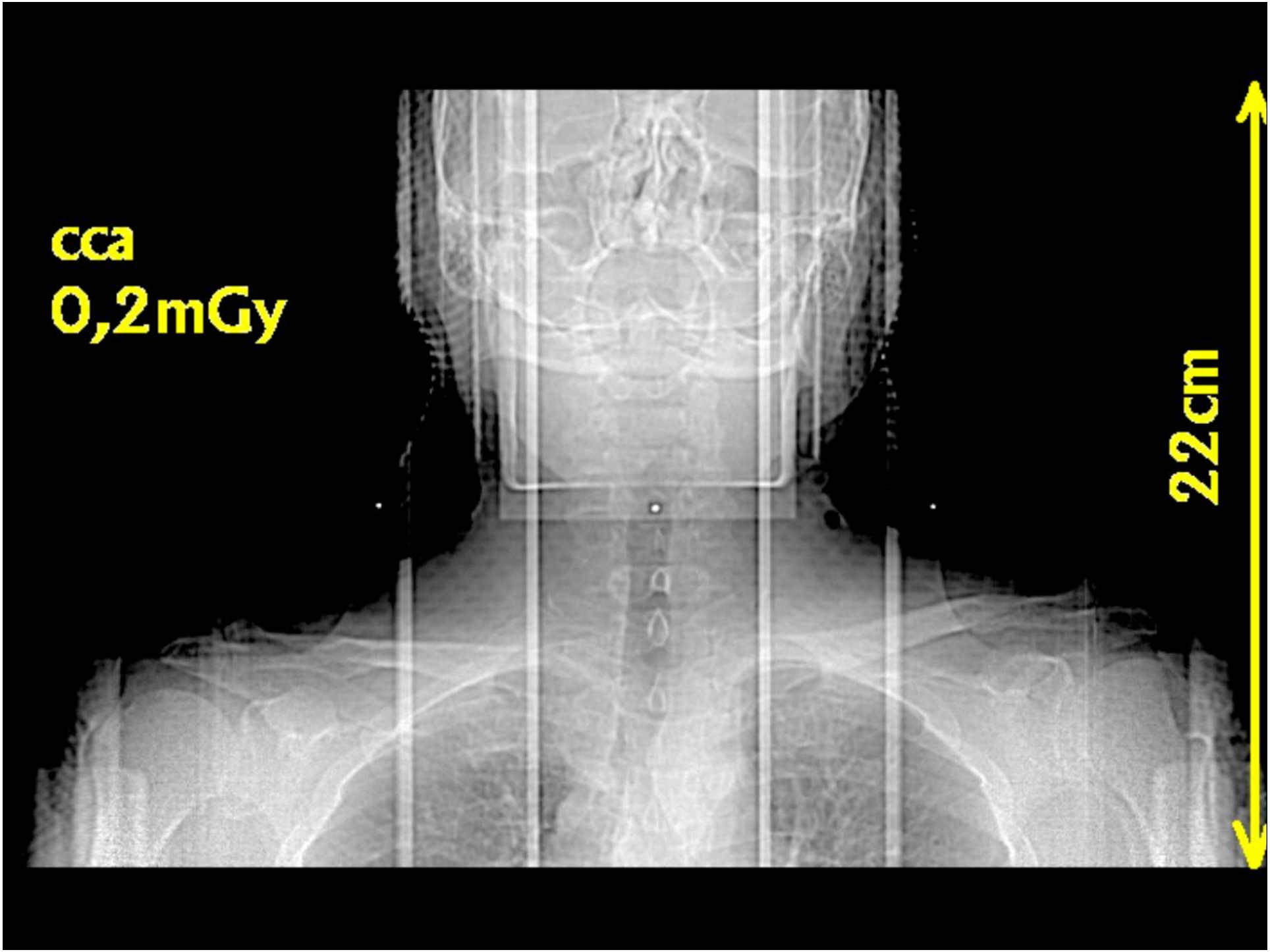
is a quantity that can be measured on either a large (32 cm) or small (16 cm) plastic cylinder (the type of plastic is PMMA). Dose measurements are made at the center and at the periphery, and these values are combined using a weighted average to produce a single estimate of radiation dose to that plastic cylinder. The $CTDI_{vol}$ measured in the large phantom is used as a reference for adult CT in the torso and also as a reference for pediatric body CT. The $CTDI_{vol}$ measured in the small phantom is used as a reference for head CT, and also as a reference for pediatric body CT. The $CTDI_{vol}$ value is reported in the units of mGy. Once the $CTDI_{vol}$ values are measured on a particular CT scanner by the manufacturer, they are stored in a table and can be computed from the technique factors used to scan the patient.

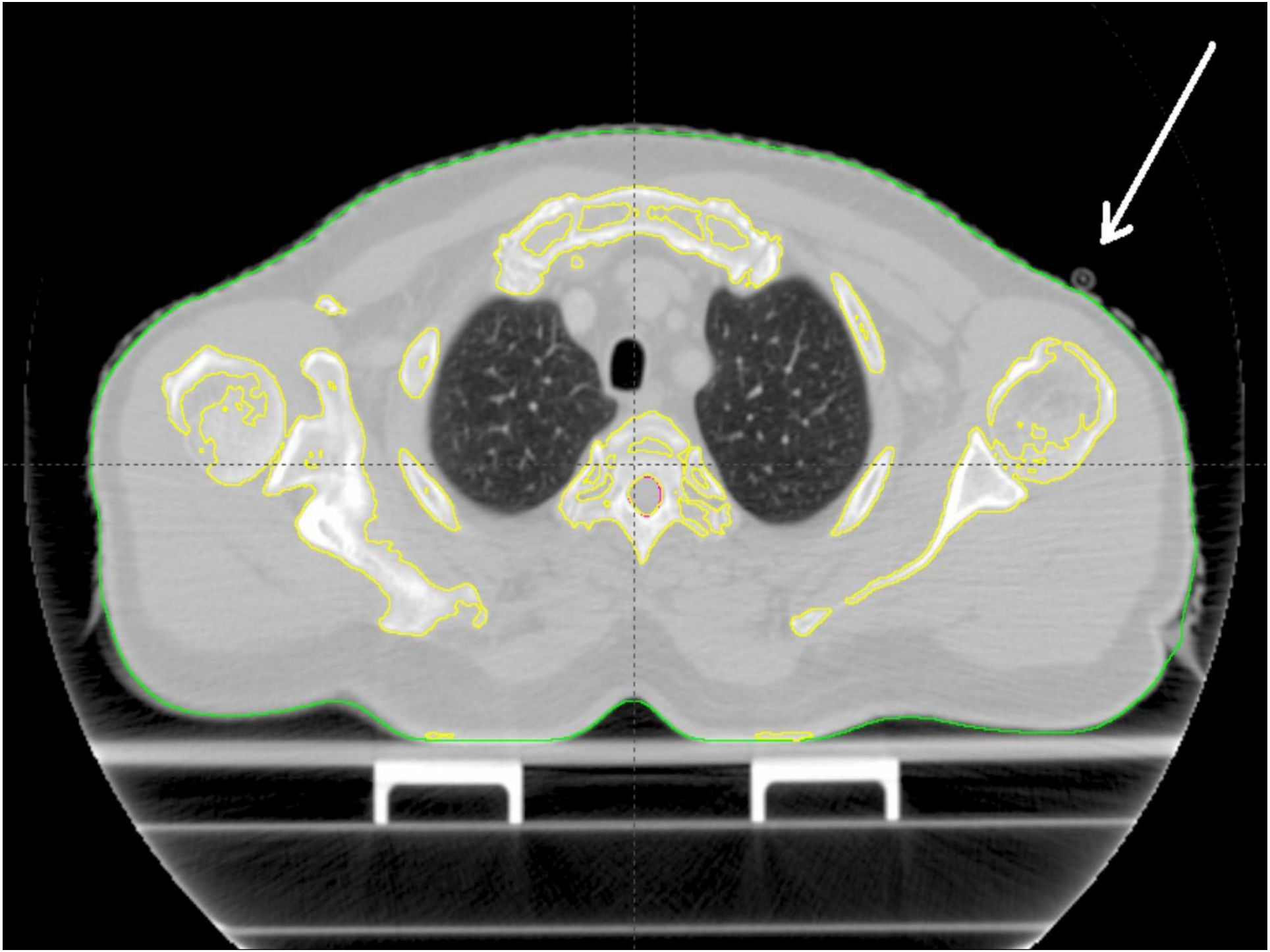
What is DLP?

„ dose length product „-„dávkovo dĺžkový produkt“

CT scans are performed over a length of the patient - sometimes they can be performed over a relatively short range in the patient, but more commonly they can extend greater distances, such as from the upper abdomen to the lower pelvis. The length of the scan is determined in centimeters, and the DLP is determined by multiplying the $CTDI_{vol}$ value by the scan length, resulting in the units of mGy-cm.

Ukážka pacientského CT s dávkovým „Reportom“


cca
0,2mGy
22cm



Patient Name: [redacted] A

Exam no: 8766

Accession Number: 388

12 Feb 2013

Patient ID: [redacted]

LightSpeed16

Exam Description: LOKALIZACIA

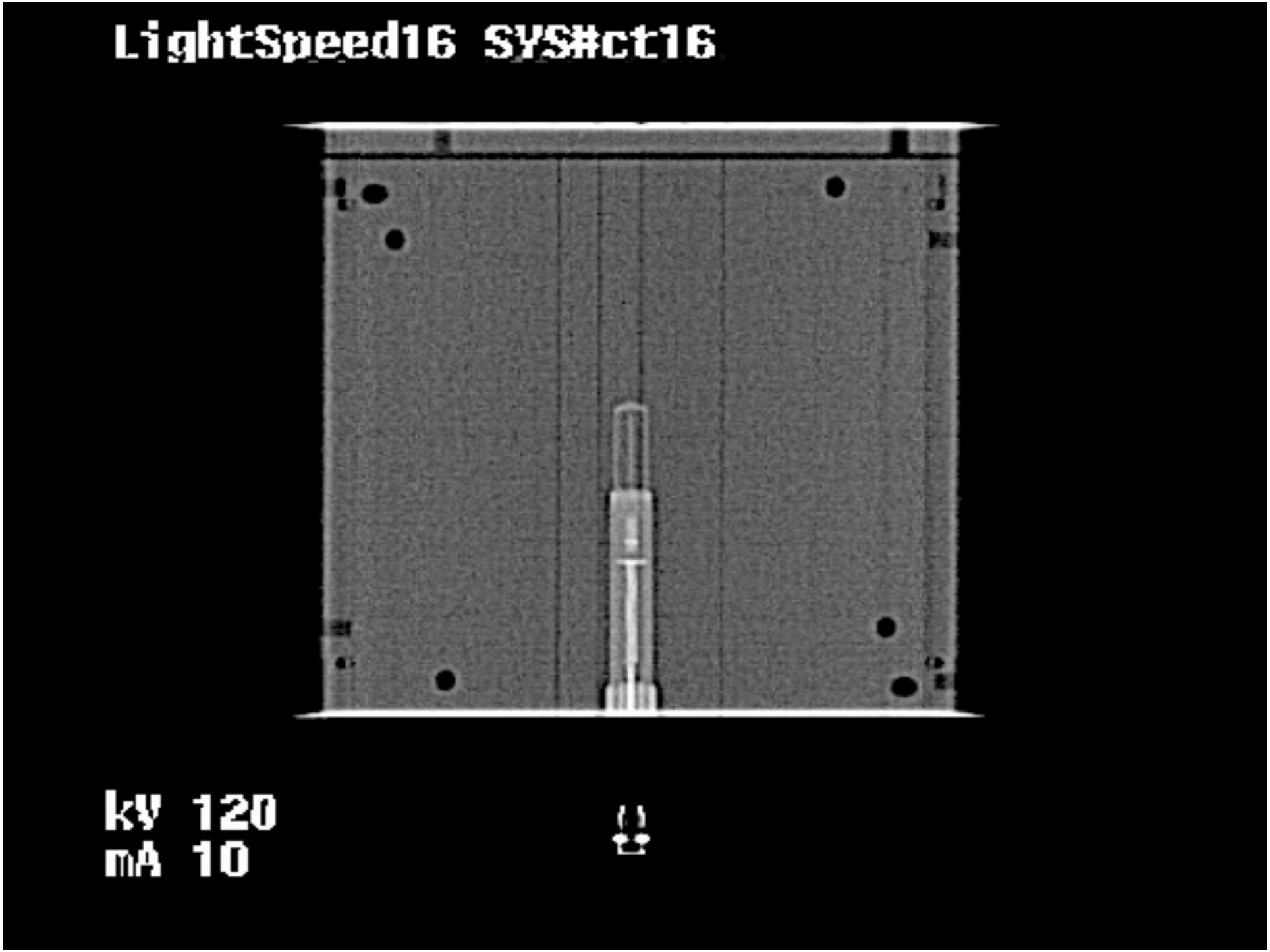
Dose Report

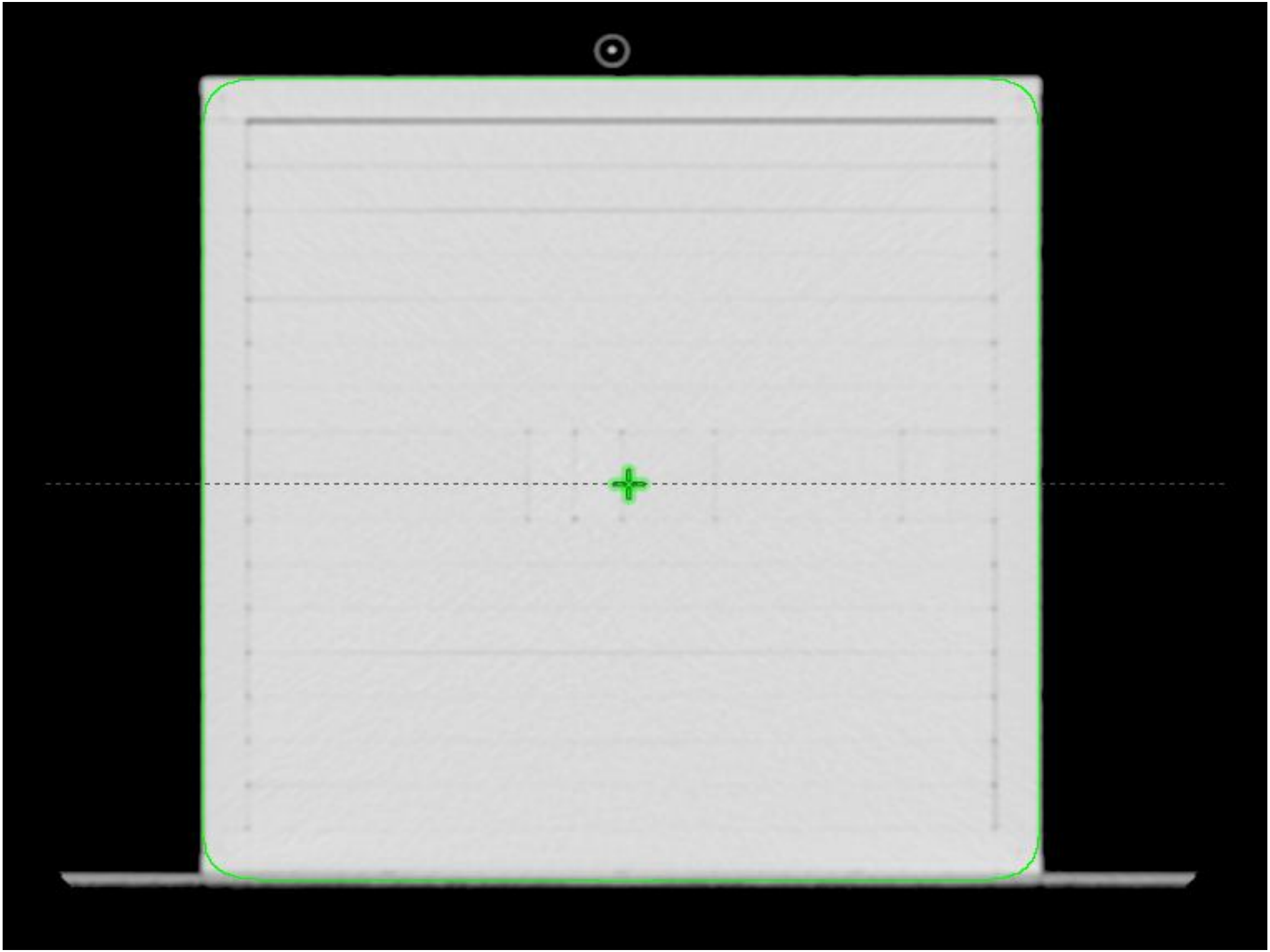
Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S120.000-I100.000	12.42	309.86	Body 32
			Total Exam DLP:	309.86	

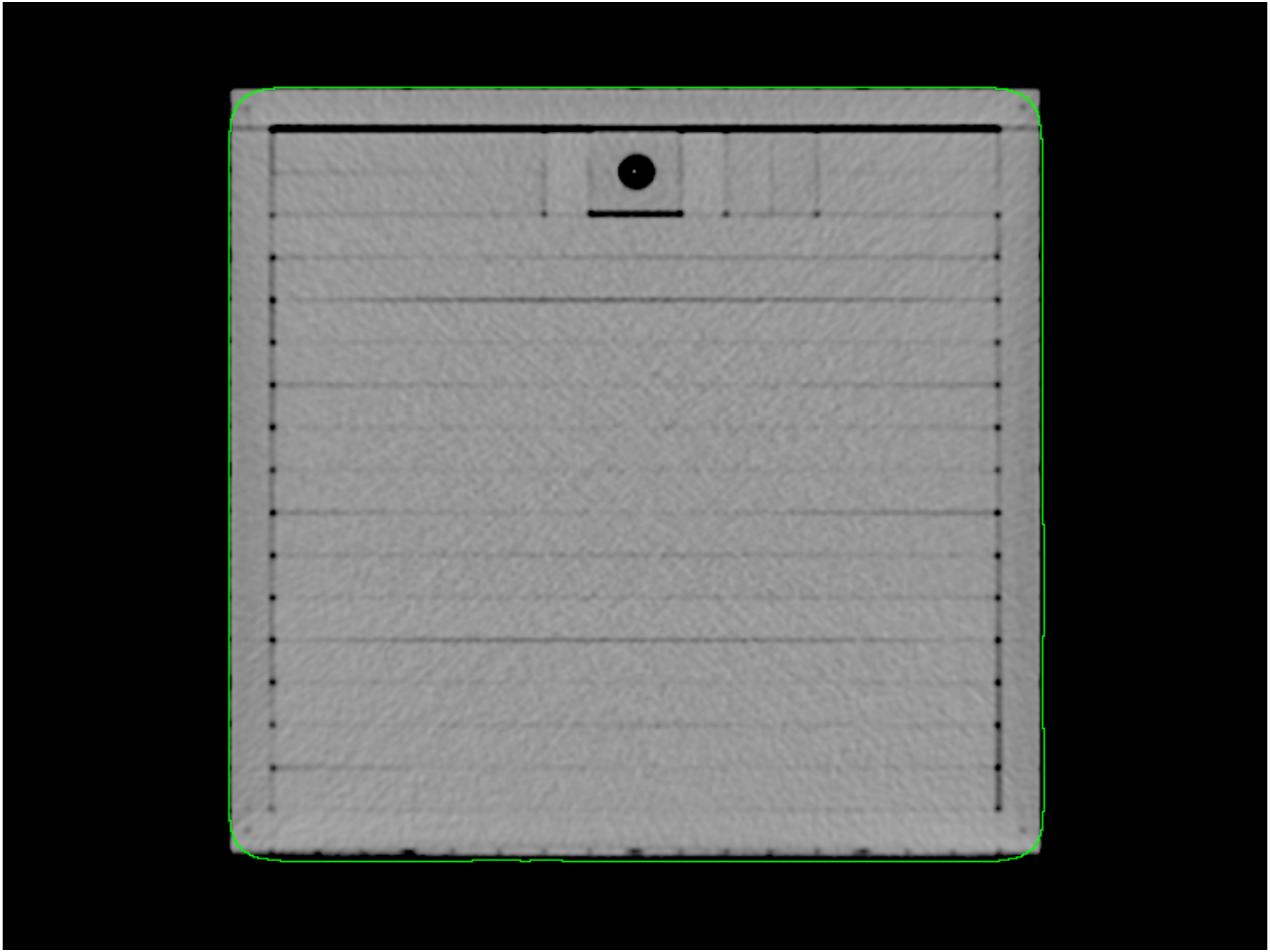
1/1

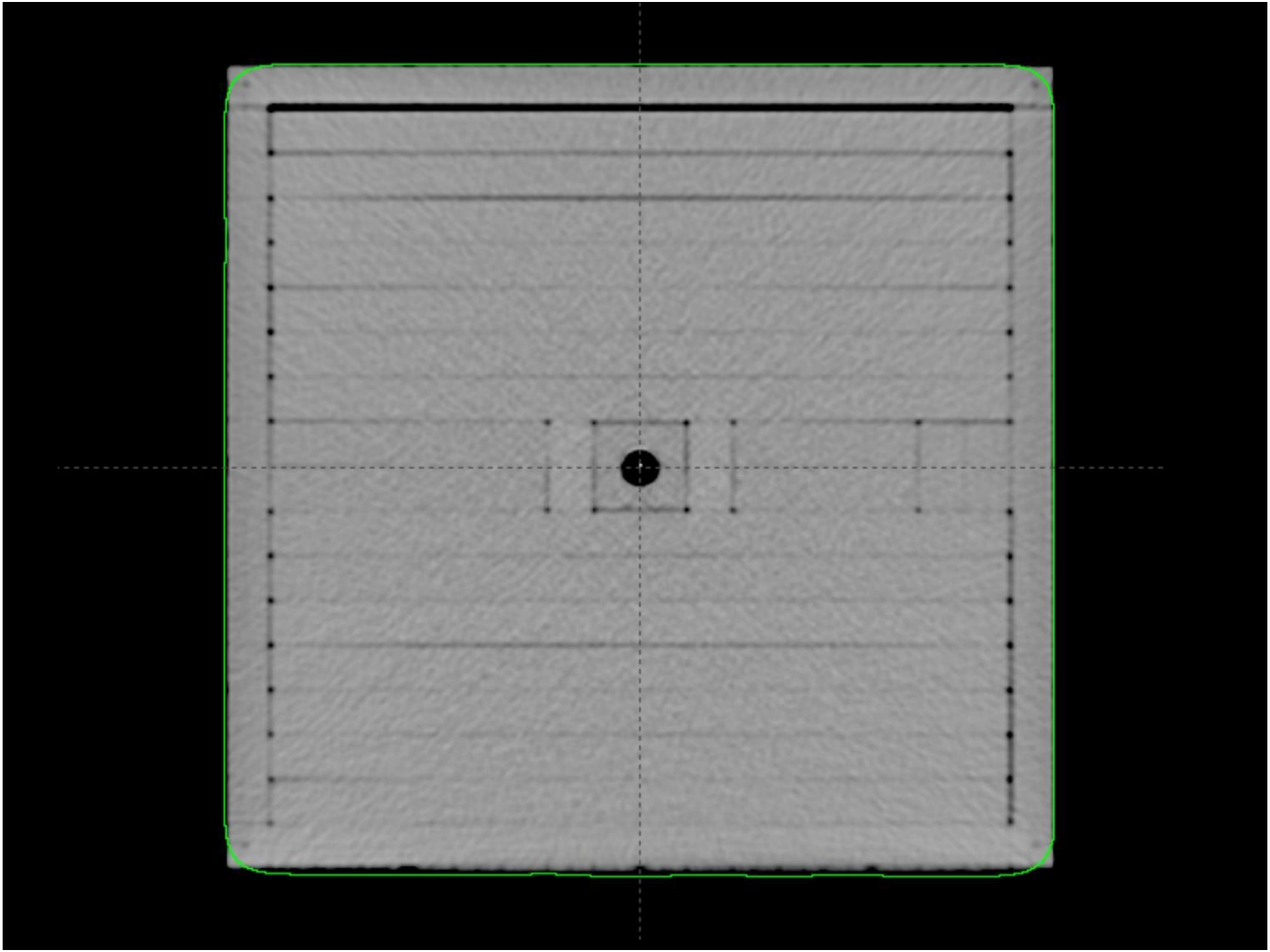
Namerané 17,1 mGy

Ukážka merania vo fantóme s „Reportom“


LightSpeed16 SYS#ct16
kV 120
mA 10







Patient Name: TEST KOCKA
Exam no: 8767
Accession Number:
12 Feb 2013
Patient ID: 12/02/2013
LightSpeed16
Exam Description:

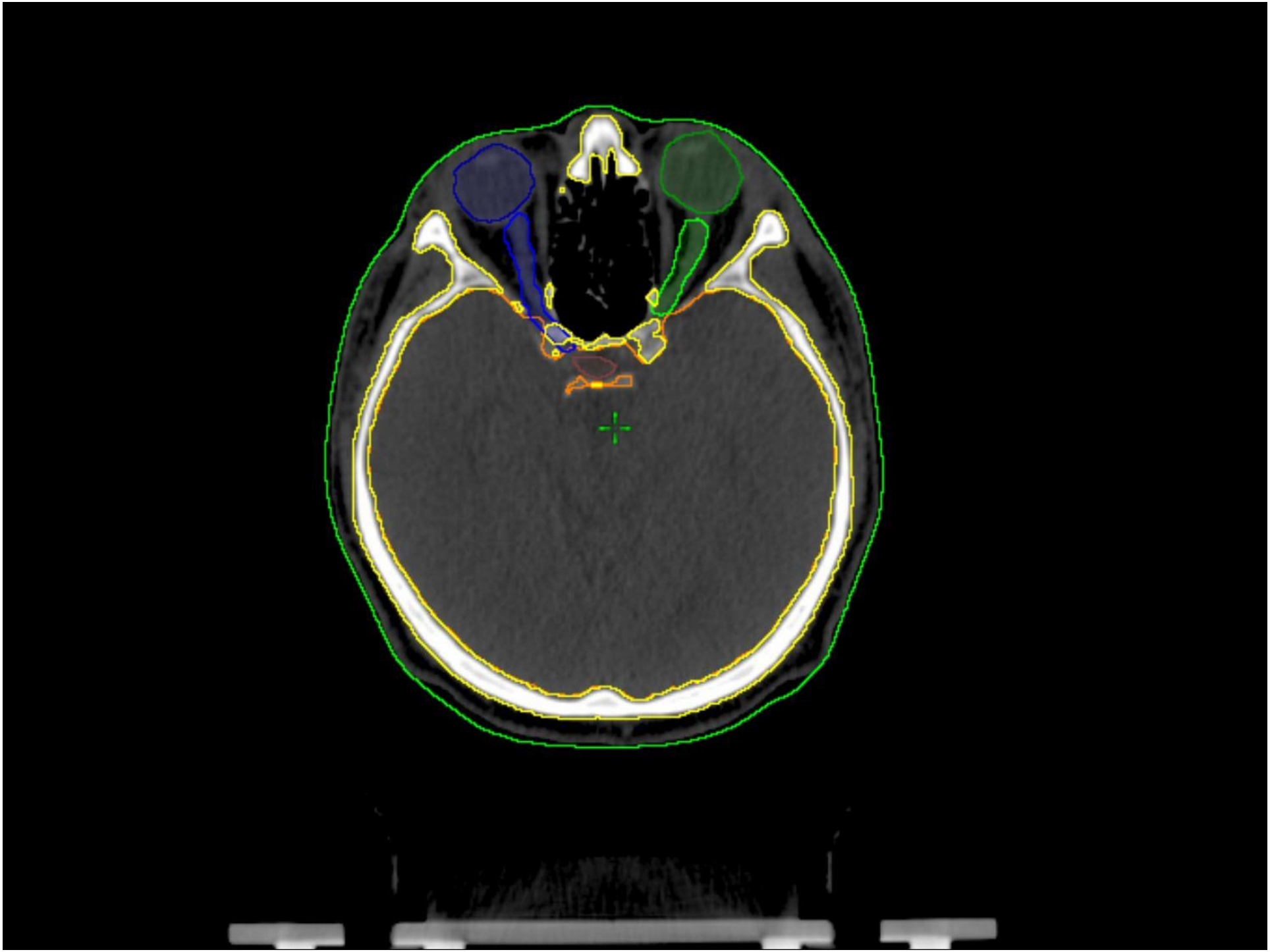
Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S50.000-I50.000	6.03	80.60	Body 32
3	Helical	S50.000-I50.000	6.03	80.60	Body 32
4	Helical	S50.000-I50.000	6.03	80.60	Body 32

Namerané:

10,5 mGy
10,2 mGy
8,7 mGy

Ukážky rôznych vyšetrovaných objemov a k nim prislúchajúce „Reporty“



Patient Name: [redacted] PAVOL

Exam no: 8296

Accession Number: 1414

26 Nov 2012

Patient ID: [redacted]

LightSpeed16

Exam Description: LOK

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S110.000-I90.000	10.11	232.10	Body 32
			Total Exam DLP:	232.10	

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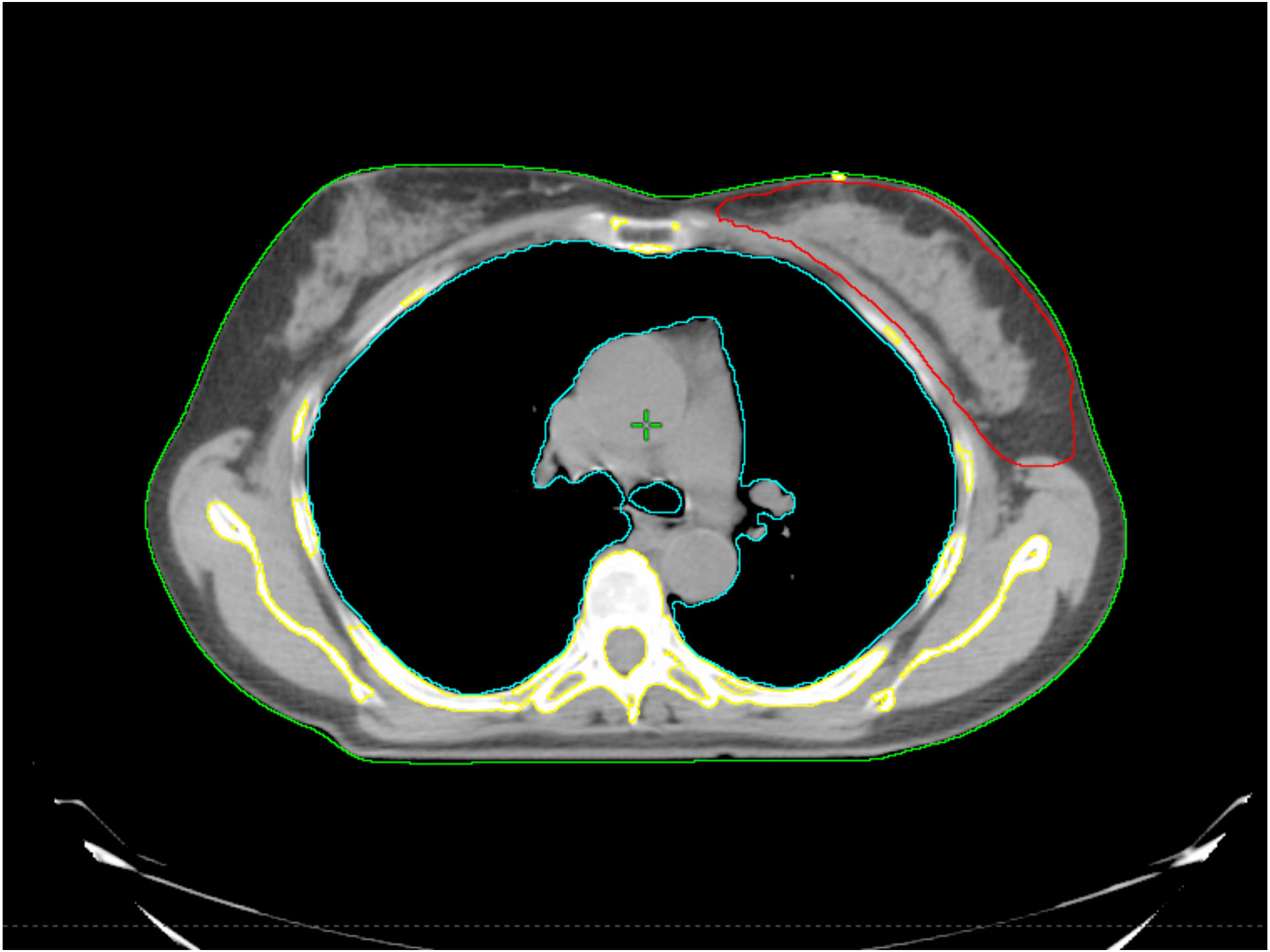


Patient Name: [redacted] ANNA A

Exam no: 8634

Accession Number: 259

28 Jan 2013

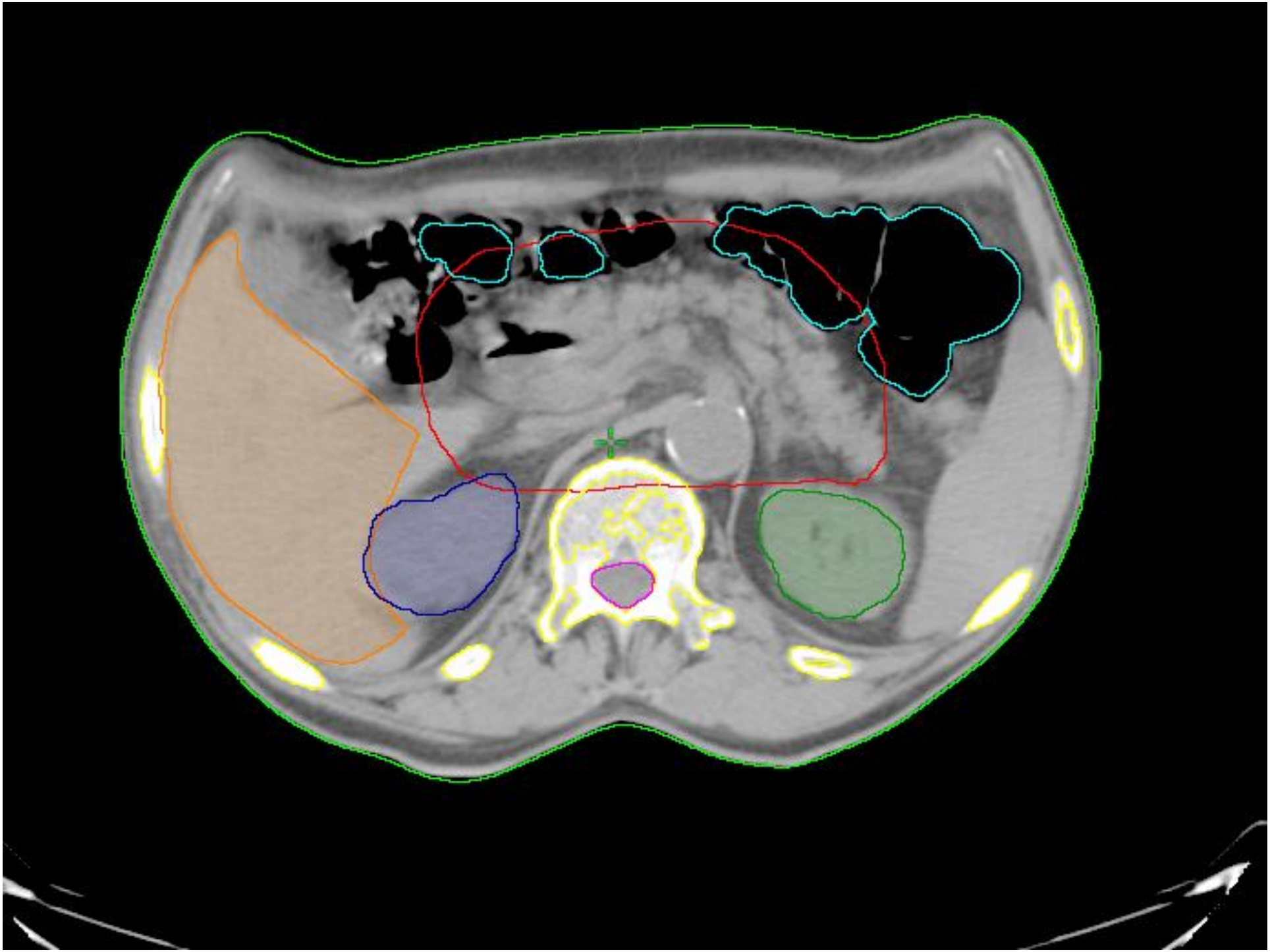
Patient ID: [redacted]

LightSpeed16

Exam Description: LOKALIZACIA

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S150.000-I150.000	8.45	282.03	Body 32
			Total Exam DLP:	282.03	



Patient Name: [redacted] JAN

A

Exam no: 8880

Accession Number: 501

15 Mar 2013

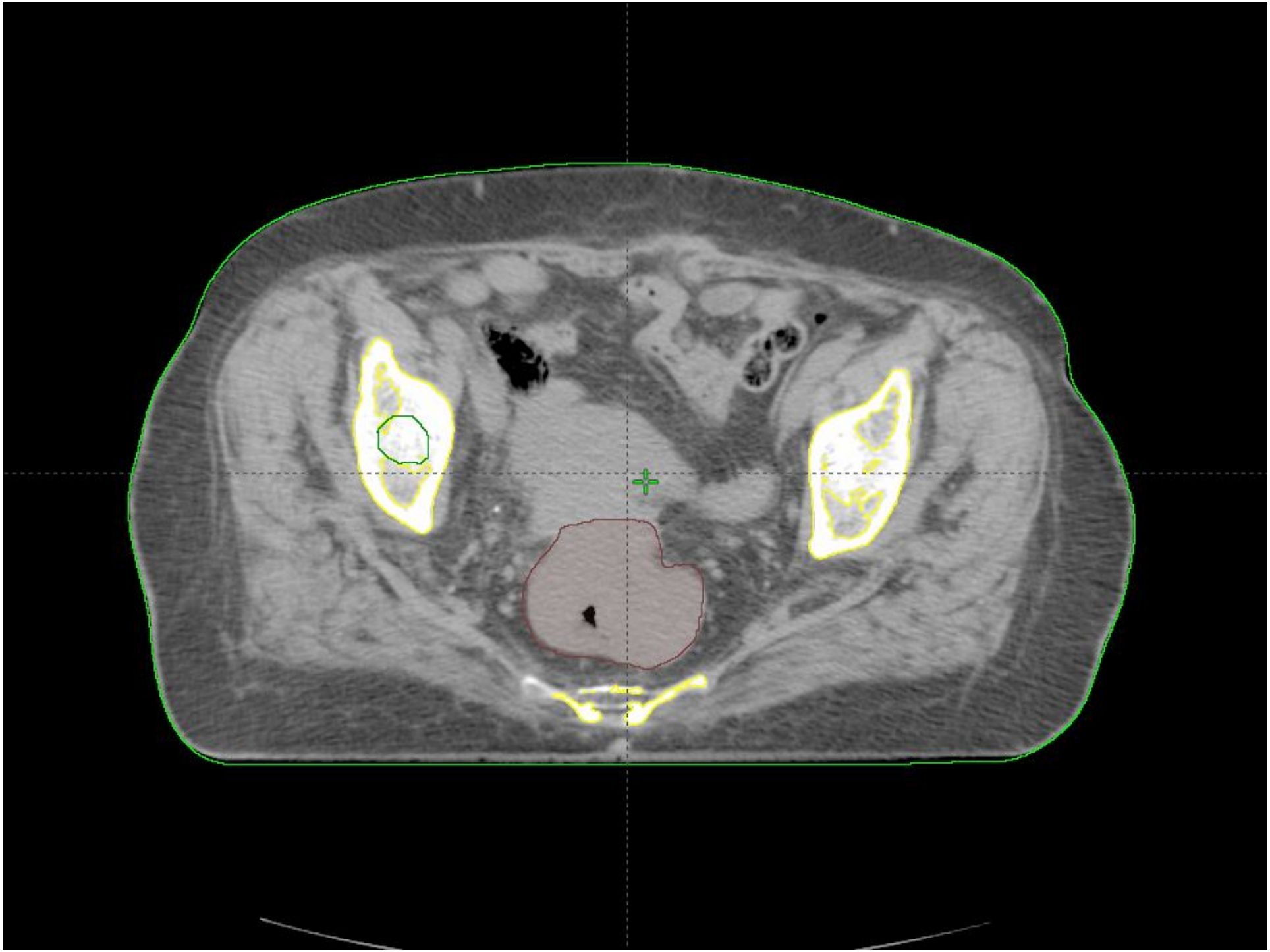
Patient ID: [redacted]

LightSpeed16

Exam Description: LOKALIZACIA

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S150.000-I200.000	11.47	440.10	Body 32
			Total Exam DLP:	440.10	



Patient Name: [redacted] HELENA A

Exam no: 8361

Accession Number: 1481

18 Dec 2012

Patient ID: [redacted]

LightSpeed16

Exam Description: LOKALIZACIA

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S120.000-I110.000	20.66	544.51	Body 32
			Total Exam DLP:	544.51	

1/1

Záver:

- Dávka z CT vyšetrení zanedbateľne zvyšuje dávku v cieľovom ožarovacom objeme.
  ==> 0,010Gy vs. 2Gy ==> 1 : 200 rozdiel a to len pre jednu frakciu !!!
- Pri sérii: 0,010Gy vs. 50Gy ==> 1 : 5000.
- Oproti prírodnému ožiareniu však zohráva významnú hodnotu!
- Merané na CT LG Light Speed 16.

Ďakujem za pozornosť.