

ANKARA ONKOLOJİ HASTANESİ



SAĞLIK BAKANLIĞI

ANKARA ONKOLOJİ EĞİTİM VE ARAŞTIRMA HASTANESİ

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ANKARA ONKOLOJİ EĞİTİM VE ARAŞTIRMA HASTANESİ



HASTA ZİYARET
SAATLERİ
13.00 - 19.00

IGRT'de Radyolojik Anatomi ve Referans Noktaların Belirlenmesi

Musa KOÇAK
Radyoterapi Teknikeri

ANKARA ONKOLOJİ
EĞİTİM VE ARAŞTIRMA HASTANESİ
RADYASYON ONKOLOJİSİ KLİNİĞİ

GÖRÜNTÜ KILAVUZLUĞUNDA RADYOTERAPİ (IGRT)



IGRT nedir?

IGRT GÜVEN demektir...

Radyolojik görüntülerin kullanımıyla ;
Hedef volüme yüksek doz verilirken,
Normal dokuların en düşük doz almasının sağlandığı
En güvenilir radyoterapi tekniğidir.



Hiçbir şey SABİT

değildir...

- Hasta pozisyonu değişebilir
- Hasta hareket edebilir
- Organ hareketleri olabilir, örneğin ;

Tedavi sırasında ışınlanan hedef hacim yer değiştirebilir (interplay effect, intrafraction motion effect) -Solunumla yer değiştiren akciğerler, abdomen vb.

Tedavi süresi boyunca bir günden diğerine, Organların boyutları veya şekilleri değişebilir.(interfraction motion effect,)- Prostat; rektum ve mesane hacimlerinin değişmesi ile yer değiştirir.

- Tümör boyutunda değişiklikler olabilir.



IGRT

Hastaya çekilen CT den oluşturulan DRR görüntüleri ile tedavi öncesi ve süresince elde edilen görüntülerin eşleştirilmesiyle yapılan tedavi tekniğidir. IGRT 3 şekilde uygulanmaktadır;
Online; tedavi öncesi yapılması,
Offline; tedaviden sonra bir sonraki tedavi için yapılması,
Real time; tedavi sırasında yapılmasıdır.



IGRT UYGULAMALARI ;

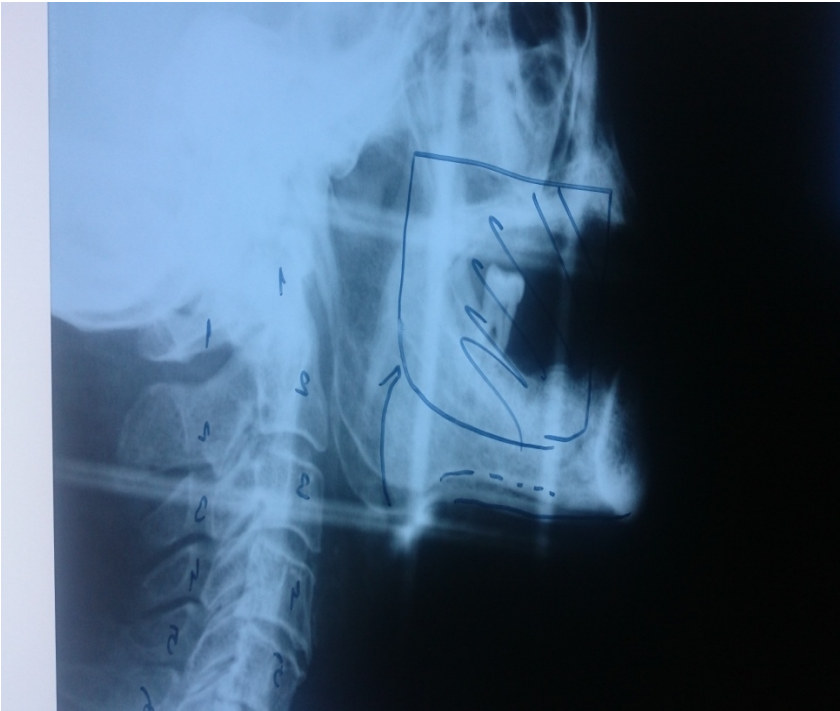
- İki boyutlu IGRT uygulamaları
Mv-Mv (elekt-a-rapidarc)
Kv- Mv
Kv-Kv (rapidarc,cyberknife)
- Üç boyutlu
CBCT (rapidarc)
MVCT (tomotherapy)



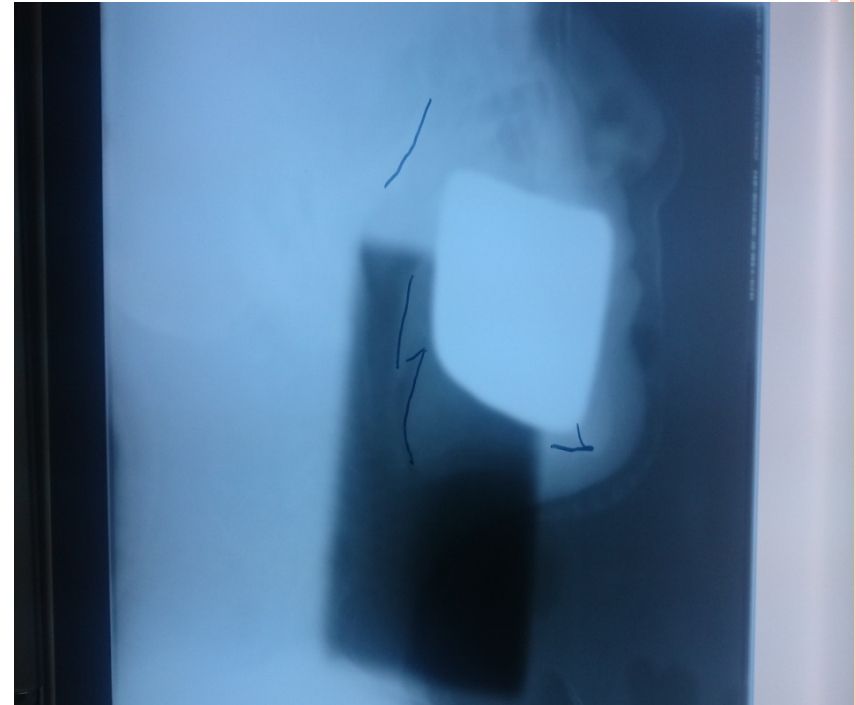
PORTAL İMAJ

Cobalt 60 ve Düşük enerjili linaklarda yapılan uygulama
Port filmlerin simülasyon filmleri ile karşılaştırılması
Konvansiyonel Uygulama

FILM SIMULASYON



PORTAL İMAJ



MV-MV

Megavoltaj enerji ile görüntü elde edim

DRR görüntüleri ile eşleştirme

iViewGT - Lina3 - Database d:\view\dicomdb

Patient Treatment Field Image Tools Administration Service Help

TUTUNCU, MERCAN 23456303792 3 S%100 DR 1 90 06/05/2013 09:25:32 DICOM FFDR Reference 222w x 222h mm

TUTUNCU, MERCAN 23456303792 3 S%100 DR 1 90 06/05/2013 09:25:32 DICOM FFDR Active 222w x 222h mm

50.0% 0.0%

50% 75%

Patient

TURP, MUZEYYEN 26206524782 O
TUTUNCU, MERCAN 23456303792 O
TUTUNEKEN PRONE, RIFKI 31793417836 O
TUZCU, PINAR OZTURK 10985983632 O
TUZUN, DERSIS 65548283988 O
UCAK, MERVE 15055086640 O
UCAR, EMIR 28399777822 O
UCAROL, TUNCER 21679069976 O

Treatment

3 S%100 DR AYSEN-DREBRU-H

Field

1 90
2 270
3 0

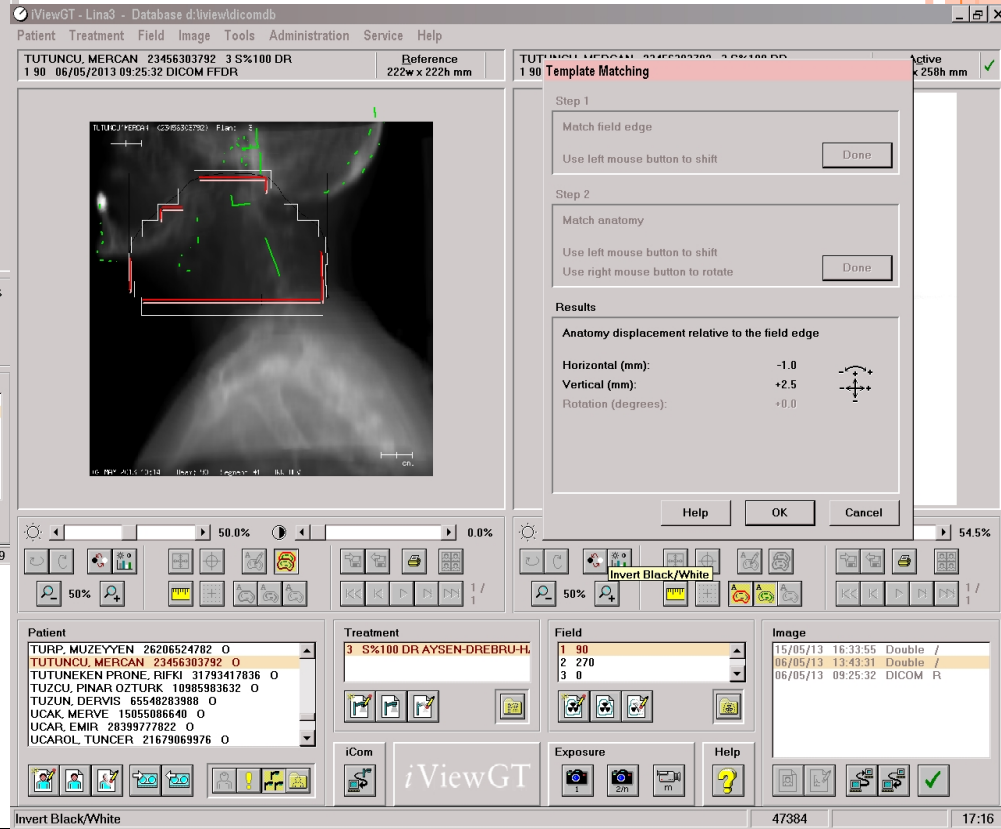
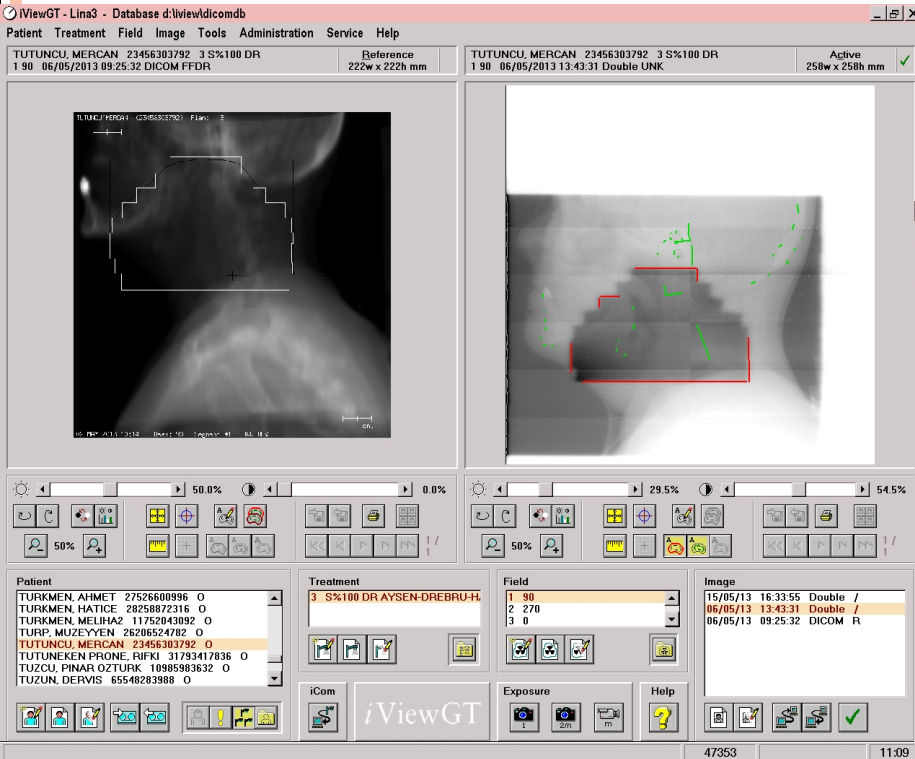
Image

15/05/13 16:33:55 Double /
06/05/13 13:43:31 Double /
06/05/13 09:25:32 DICOM R

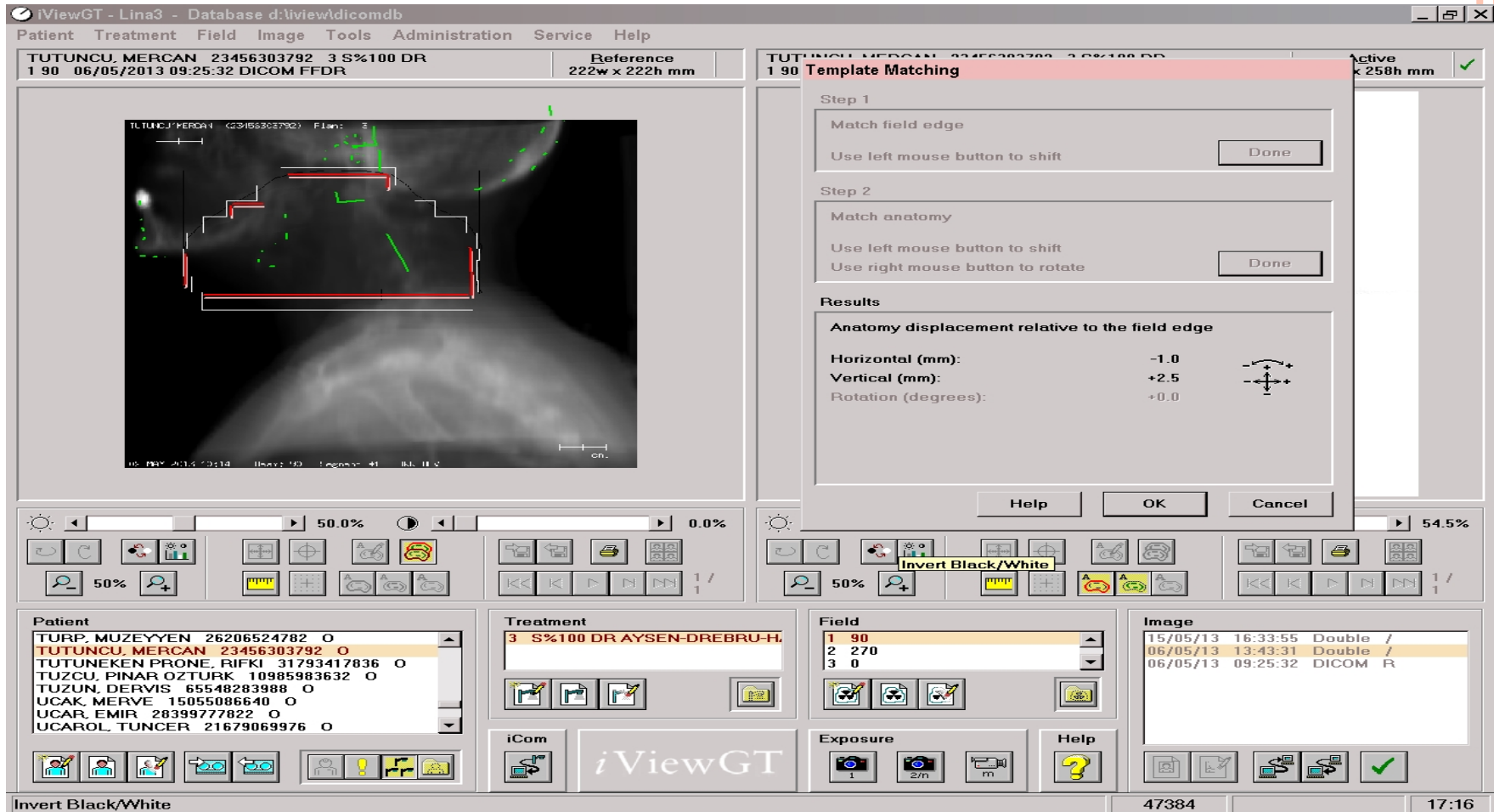
iCom iViewGT Exposure 1 2m m Help

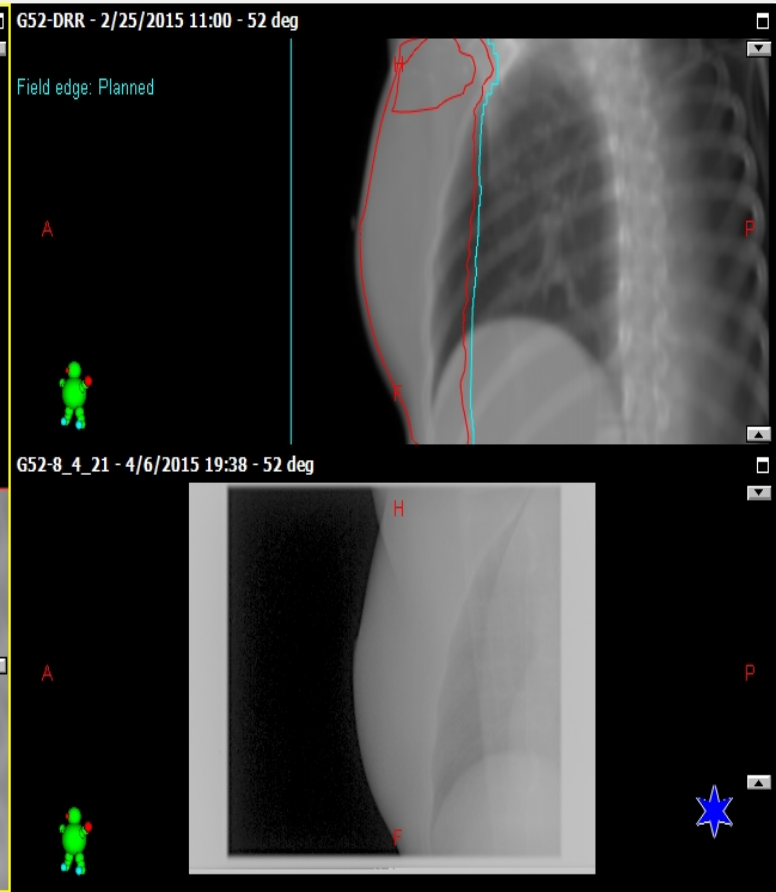
47384 17:14

- Düşük görüntü kalitesi
- 2 boyutlu eşleştirme
- Oblik alanlarda ve yumuşak dokuda eşleştirme zorluğu



Kemik yapılar da eşleştirme imkanı ve işaretleyicilere ihtiyaç sunulması dezavantaj
Alınan epid portal görüntüler üzerinden önce alan sınırları daha sonra anatomik yapıların konturları çizilerek eşleştirme yapılır.





Summary: Images (3 New) / Couch Corrections (Representation: Isocentric Varian, Scale: IEC61217) / Couch (Type: 4DoF)

	LR - PA	G52-8_4_21
Status	*	*
Vrt [cm]		
Lng [cm]		
Lat [cm]		
Rtn [deg]		

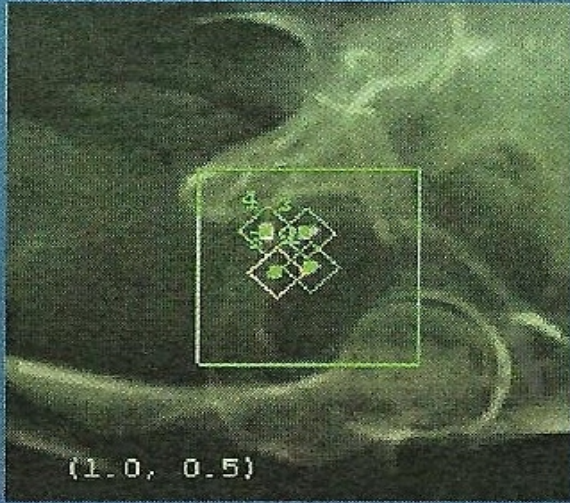


KV - KV

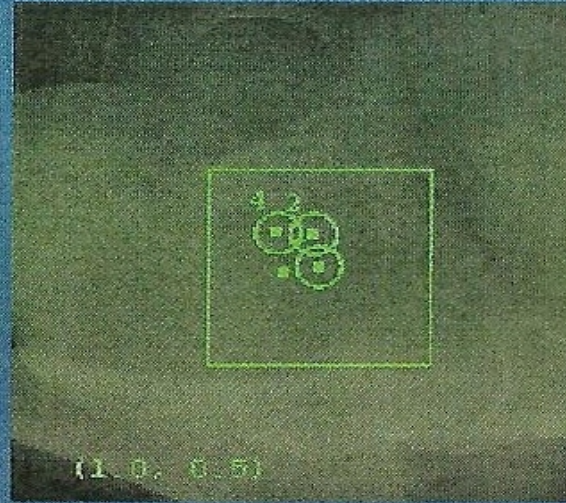
- kV X-ışını tüpü
- İki robotik kol
- Yüksek enerji kalitesi
- Düşük görüntü dozu
- Kemik yapılar üzerinden eşleştirme ve işaretleyiciler kullanılması



•CyberKnife® cihazında da ilk KV-KV görüntülerini aldıktan sonra planlamadan gönderilen DRR görüntüleriyle eşleştirme işlemi yapılarak fiducial konumlaması sağlanmaya çalışır.



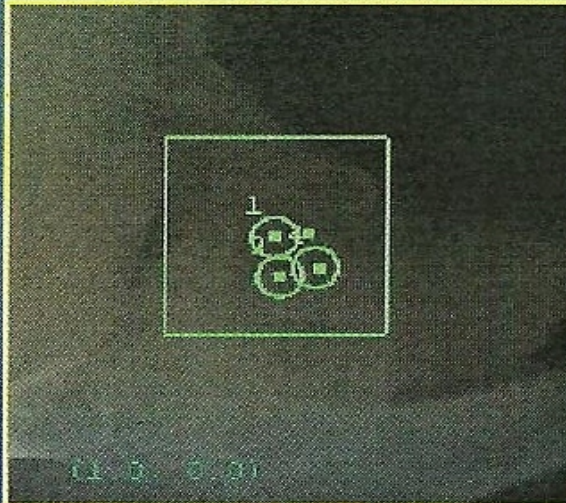
Synthetic Image B



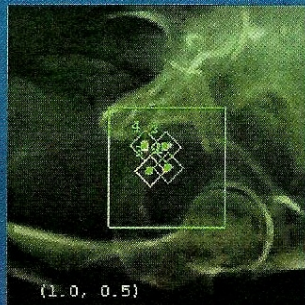
Camera Image B



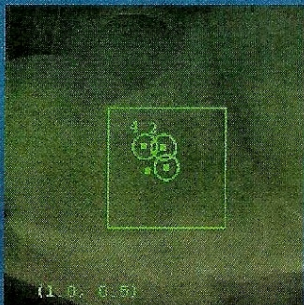
Overlay of Images B



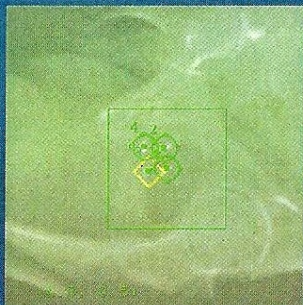
Synthetic Image A



Camera Image A



Overlay of Images A



Couch Corrections

RGT: 0.2 mm

SUP: 0.3 mm

ANT: 0.1 mm

LFT: 0.8 deg

H-UP: 0.5 deg

CCW: 0.2 deg

Correlation Error

Tracking Mode

Fiducial

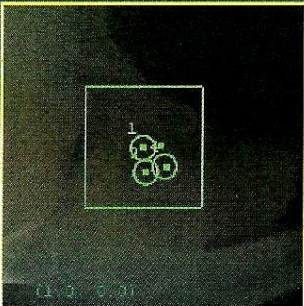
Imaging Parameters

Treatment Monitoring

Synthetic Image B



Camera Image B



Overlay of Images B



RGT (mm) LFT (mm) POS (mm) ANT (mm) SUP (mm) INF (mm)

Reset

Align

AutoCouch

Add
Subtract

XRS A

kV: 125 mA: 150

EX: 150

XRS B

kV: 125 mA: 150

EX: 150

X-ray Parameters

WINDOW 65535
LEVEL 65535
65535
57626

Apply W/L To All

Invert

View Mode

Offset

Zoom

Auto

Display Fiducial Markers

Enable Offset

Fiducial Tracking

Fiducial 1

Fiducial 2

Fiducial 3

Fiducial 4

Display ROI

Fiducial 1

Patient Size

Medium

Synchrony
Modeling

Automatic Modeling

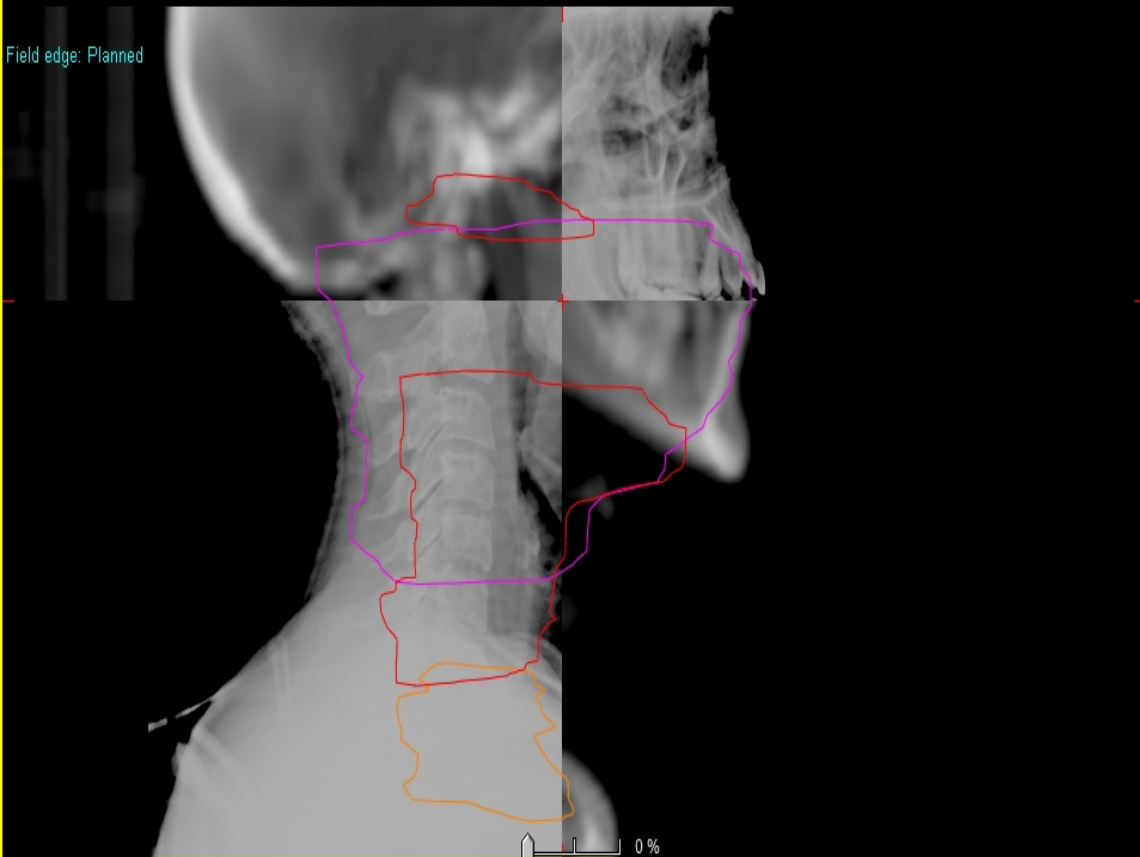
Reset Model

- Fiducial konumlamasından emin olana kadar hizalama tekrarlanır. Fiduciallar cihaza doğru tanımlatıldıktan sonra tedaviye başlanır.

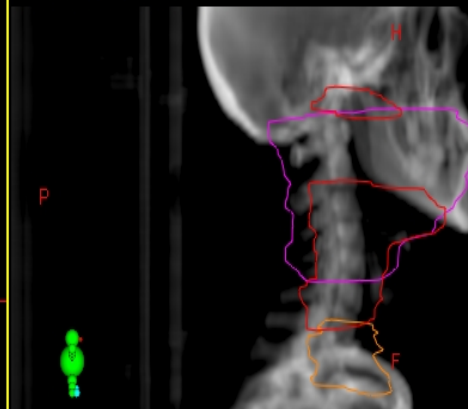


LR-DRR - LR1 - 4/1/2015 15:55 - 270 deg

Field edge: Planned



LR-DRR - 3/19/2015 10:32 - 270 deg



LR1 - 4/1/2015 15:55 - 270 deg



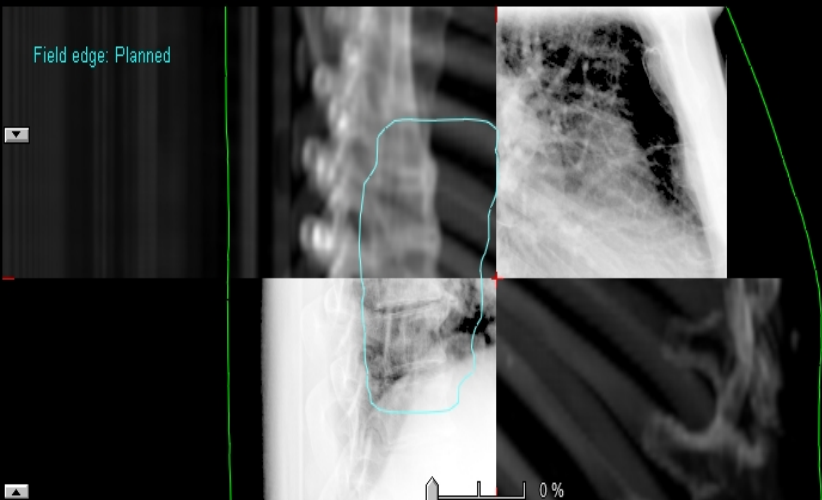
Fri 3/20/2015 13:50	Mon 3/23/2015	Tue 3/24/2015 13:59	Wed 3/25/2015 16:40	Thu 3/26/2015 16:04	Fri 3/27/2015 14:45	Mon 3/30/2015 16:07	Tue 3/31/2015 15:04	Wed 4/1/2015 15:55	Thu 4/2/2015 16:00	Fri 4/3/2015 15:07	Mon 4/6/2015 16:23	Tue 4/7/2015 17:04	Wed 4/8/2015 15:56	Thu 4/9/2015 16:01	Fri 4/10/2015 13:53	Mc 4/13/2015 16:00

T 181X33 SIB Session Timeline Course Timeline

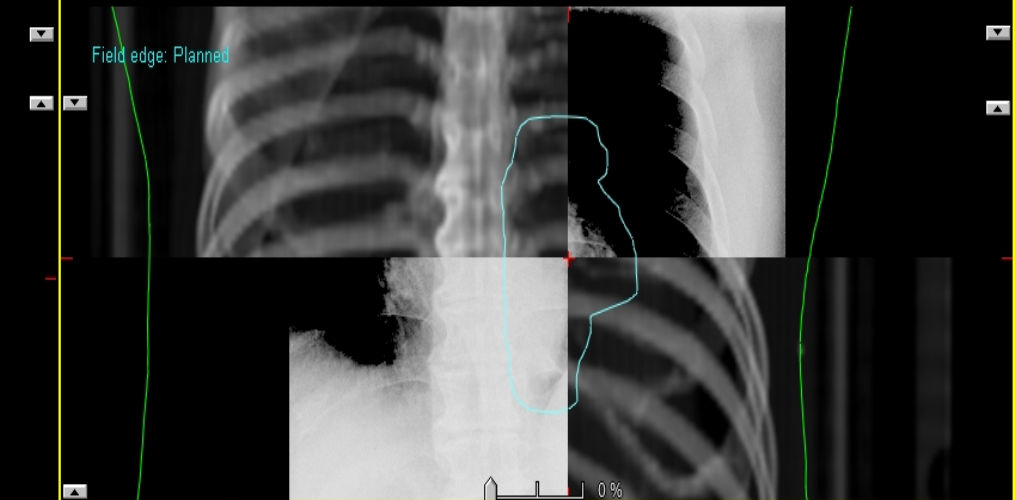


Session Wed 4/1/2015, Image 1 of 4

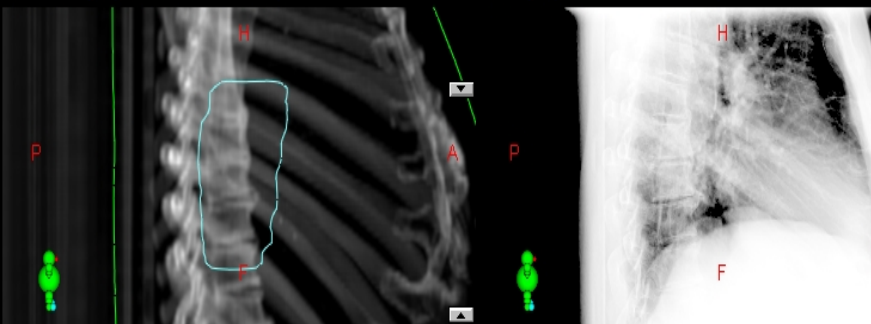
LR-DRR - LR - 5/11/2015 14:54 - 270 deg



AP-DRR - AP - 5/11/2015 14:55 - 0 deg

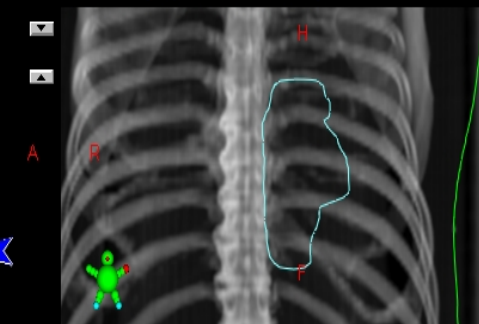


LR-DRR - 5/11/2015 11:45 - 270 deg

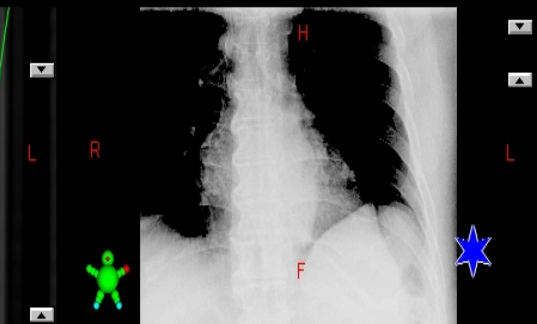


LR - 5/11/2015 14:54 - 270 deg

AP-DRR - 5/11/2015 11:45 - 0 deg



AP - 5/11/2015 14:55 - 0 deg



Summary: Images (2 New/2 App) / Couch Corrections (Representation: Isocentric Varian, Scale: IEC61217) / Couch (Type: 4DoF)

	LR - AP
Status	*
Vrt [cm]	
Lng [cm]	
Lat [cm]	
Rtn [deg]	



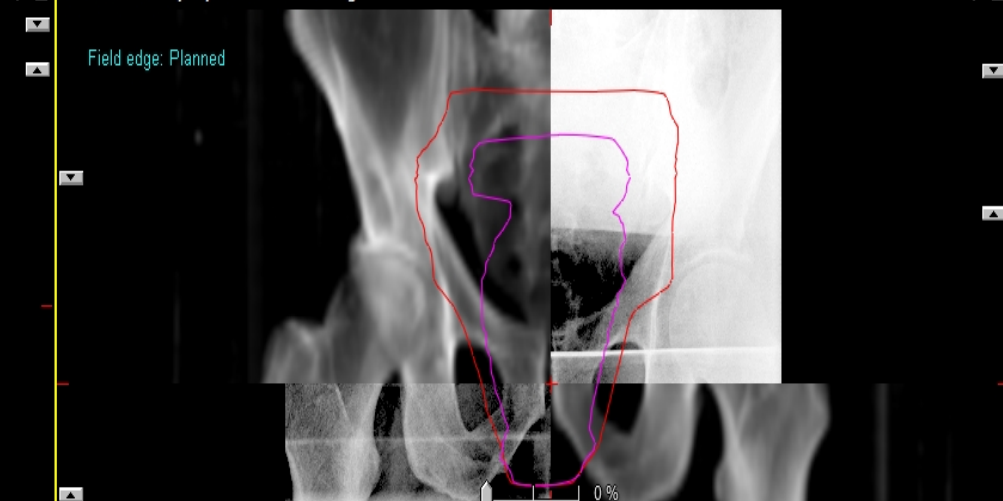
File Edit View Insert Measure Matching Review Tools



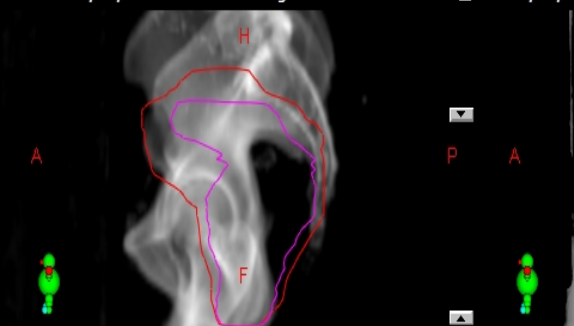
LR-DRR - LR - 2/18/2015 10:28 - 270 deg



AP-DRR - AP - 2/18/2015 10:29 - 0 deg



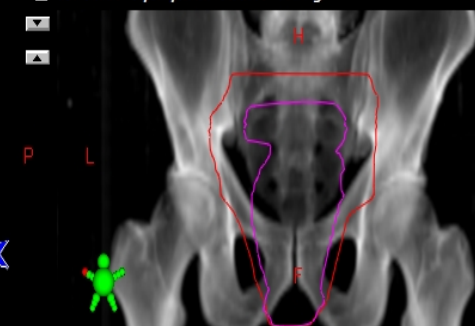
LR-DRR - 2/10/2015 09:40 - 270 deg



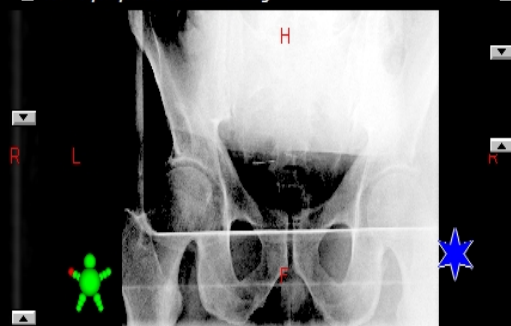
LR - 2/18/2015 10:28 - 270 deg



AP-DRR - 2/10/2015 09:40 - 0 deg



AP - 2/18/2015 10:29 - 0 deg



Summary: Images (3 New) / Couch Corrections (Representation: Isocentric Varian, Scale: IEC61217) / Couch (Type: 4DoF)

	LR - AP	CBCT_1
Status	*	*
Vrt [cm]		
Lng [cm]		
Lat [cm]		
Rtn [deg]		

TEDAVI/T1 180X25

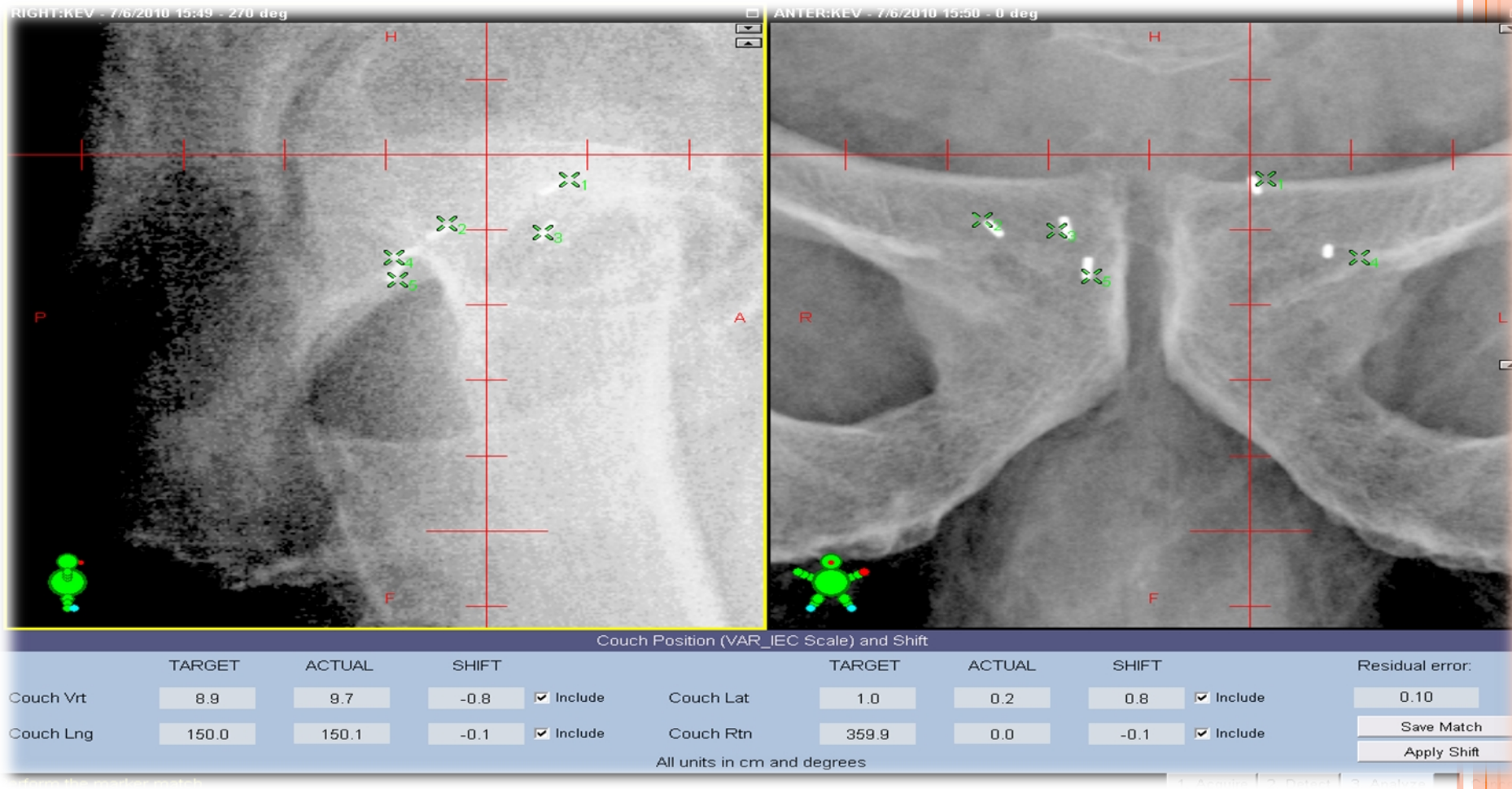
Session Timeline

Course Timeline



Session Wed 2/18/2015, Image 1,2 of 3

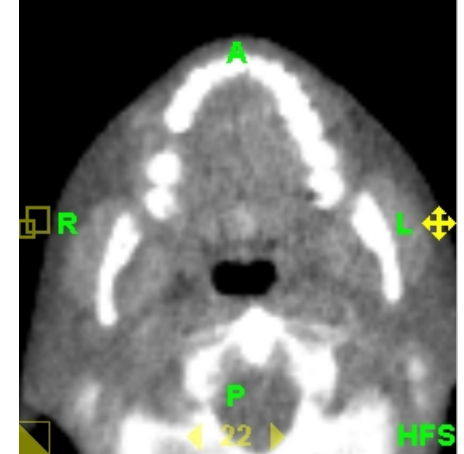
İŞARETÇİLER (MARKER) KULLANARAK EŞLEŞTİRME



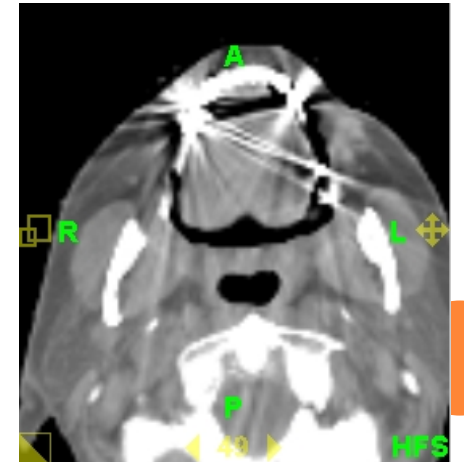
MVCT

- Kalite ve Çözünürlük yeterli
- 1-3 dk MVCT çekim süresi
- 1-3 cGy düşük sayılabilecek doz
- Metal artefakt KVCT'ye göre az
- Gerektiğinde CT amaçlı kullanım (Metal implant, kilolu hasta)

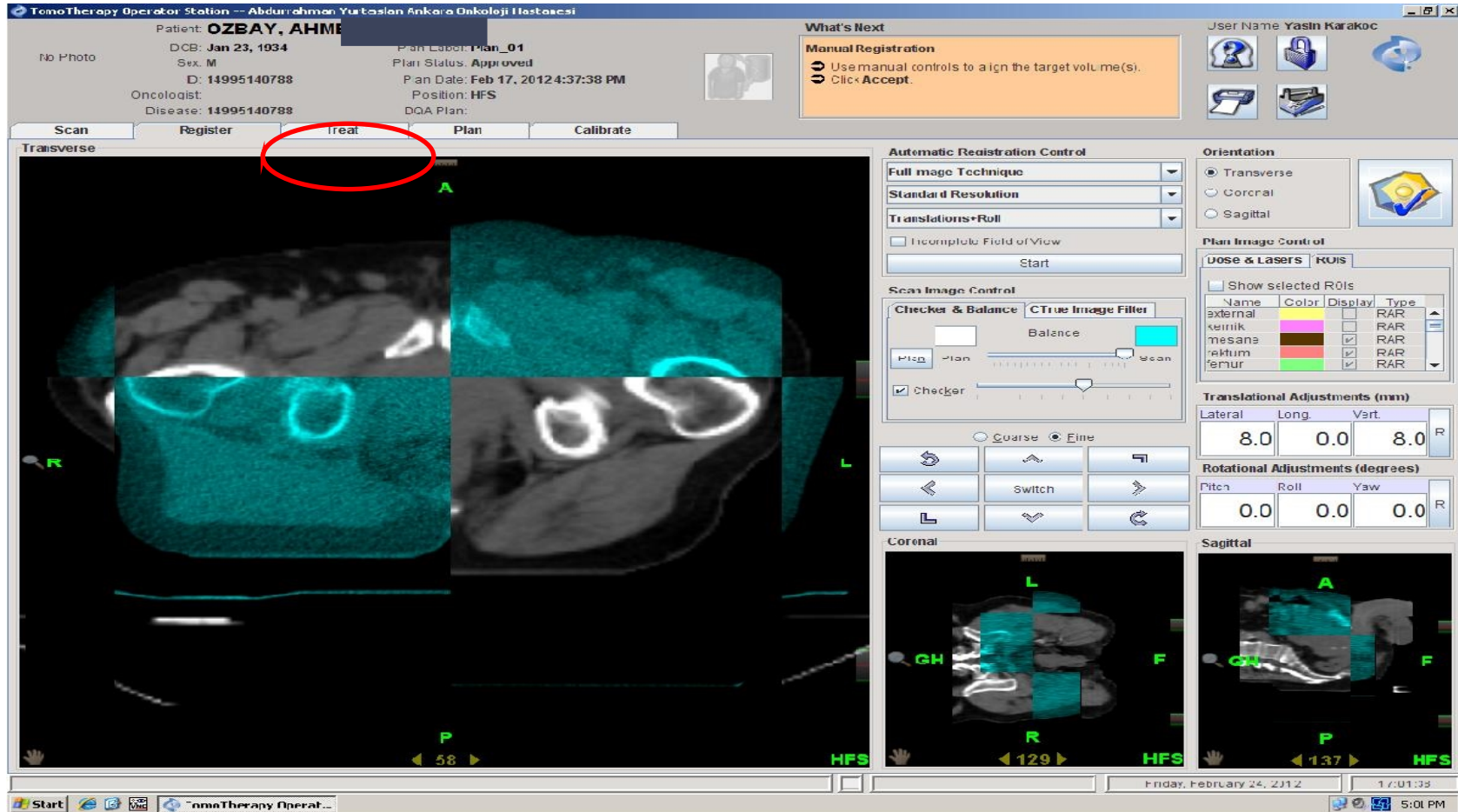
MVCT



KVCT



- Alınan MVCT ve kVCT görüntülerinin eşleştirilmesi



Patient: **ILKBAHAR, BEYTULLAH**DOB: **Mar 7, 1939**Sex: **M**ID: **30748698948**

Oncologist:

Disease: **30748698948**Plan Label: **Plan_01SIB**Plan Status: **Approved**Plan Date: **Mar 20, 2013 1:31:20 PM**Position: **HFS**

DQA Plan:

No Photo

What's Next

Manual Registration

- Use manual controls to align the target volume(s).
- Click **Accept**.

User Name: **Yasin Karakoc**

Scan

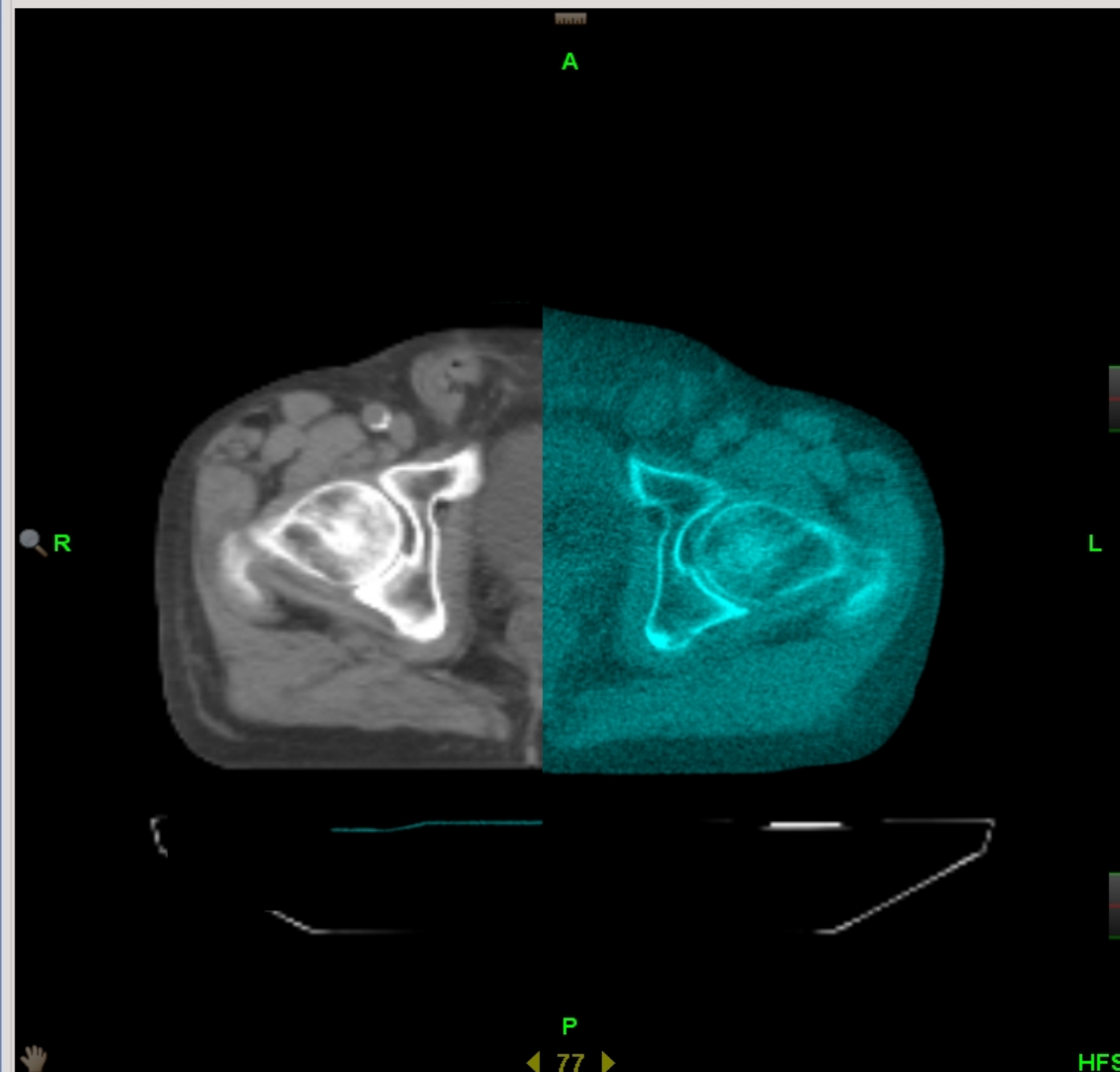
Register

Treat

Plan

Calibrate

Transverse



Automatic Registration Control

Full Image Technique

Standard Resolution

Translations+Roll

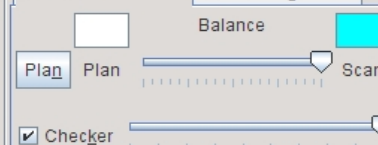
☐ Incomplete Field of View

Start

Scan Image Control

Checker & Balance

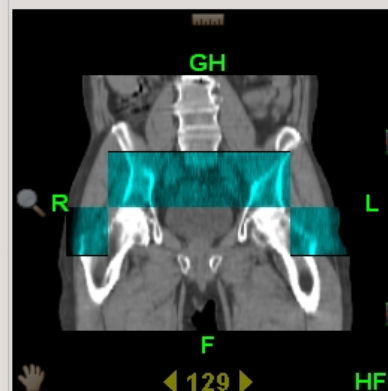
CTrue Image Filter

☐ Coarse ☒ Fine

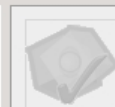
Export Screen



Coronal



Orientation

☒ Transverse☐ Coronal☐ Sagittal

Plan Image Control

Dose & Lasers ROIs

☐ Show selected ROIs

Name	Color	Display	Type
EKS	Yellow	☐	RAR
FEMUR_R	Blue	☒	RAR
FEMUR_L	Purple	☒	RAR
REKTUM	Teal	☒	RAR
MESANE	Cyan	☒	RAR

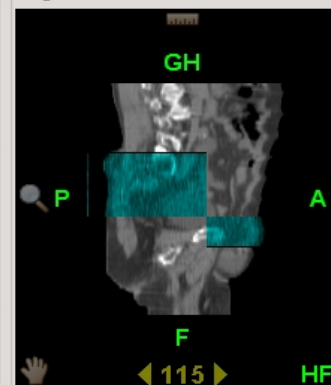
Translational Adjustments (mm)

Lateral	Long.	Vert.
3.0	11.2	9.0

Rotational Adjustments (degrees)

Pitch	Roll	Yaw
0.0	0.1	0.0

Sagittal



Automatic registration has completed

Tuesday, April 30, 2013

10:06:16

Patient:

DOB: Nov 29, 1950

Sex: F

ID: 12169562114

Oncologist:

Disease: 12169562114

Plan Label: Plan_01

Plan Status: Approved

Plan Date: Jan 2, 2012 10:38:41 AM

Position: HFS

DQA Plan:



What's Next

Manual Registration

- Use manual controls to align the target volume(s).
- Click **Accept**.

User Name: 

Scan

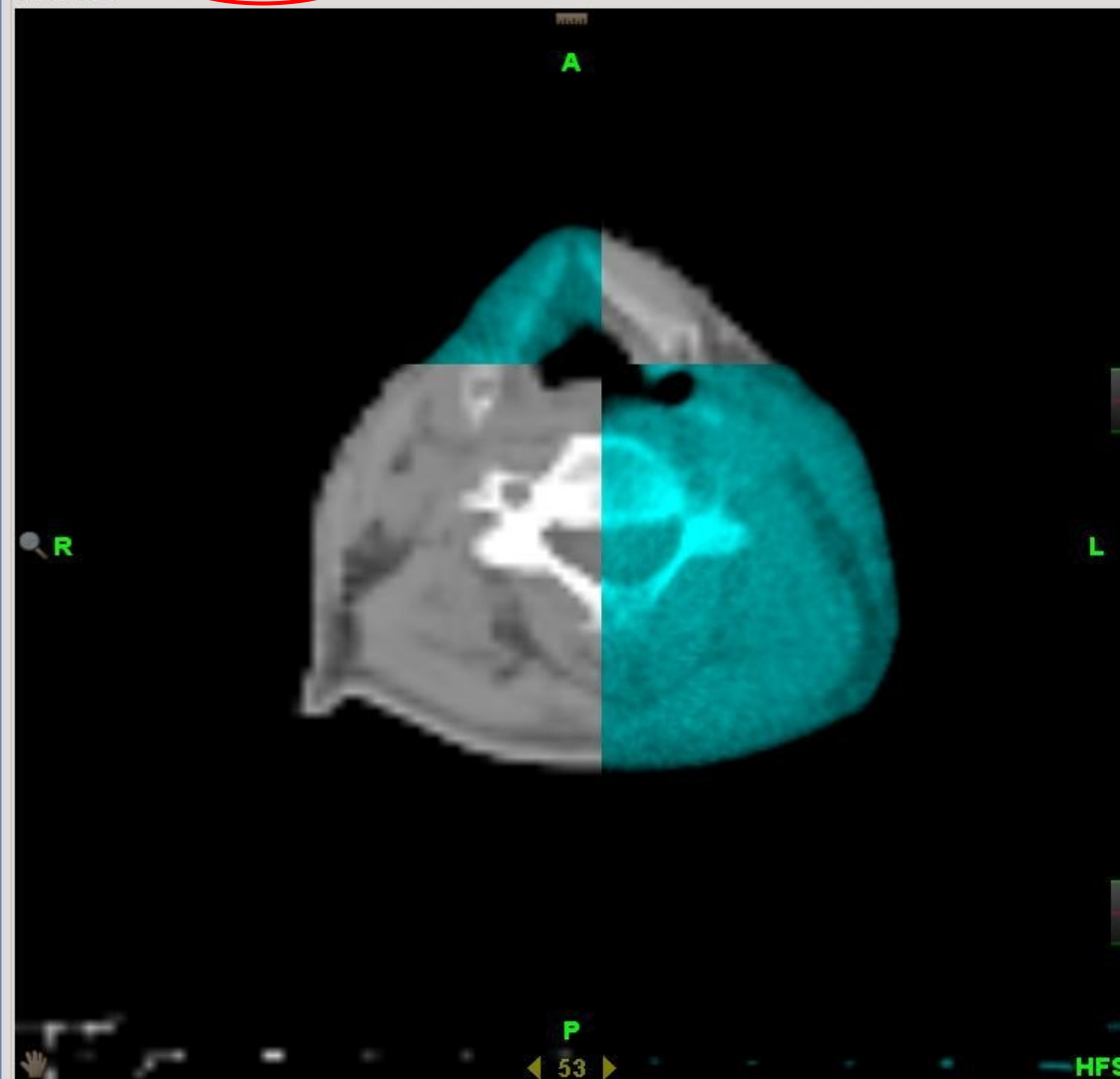
Register

Treat

Plan

Calibrate

Transverse



Automatic Registration Control

Full Image Technique

Standard Resolution

Translations+Roll

☐ Incomplete Field of View

Start

Scan Image Control

Checker & Balance

CTrue Image Filter

Plan

Plan

Balance

Scan

☒ Checker

Plan

Scan

☐ Coarse ☒ Fine

↶

↵

↷

↶

Switch

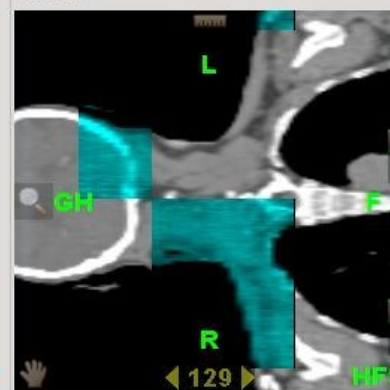
↷

↶

↵

↷

Coronal



Orientation

☒ Transverse☐ Coronal☐ Sagittal

Plan Image Control

Dose & Lasers ROIs

☐ Show selected ROIs

Name	Color	Display	Type
AC_SAG	Cyan	☒	RAR
AC_SOL	Magenta	☒	RAR
AVOID_C...	Black	☒	RAR
BEYIN_S...	Yellow	☒	RAR
COCHLE...	Yellow	☐	RAR

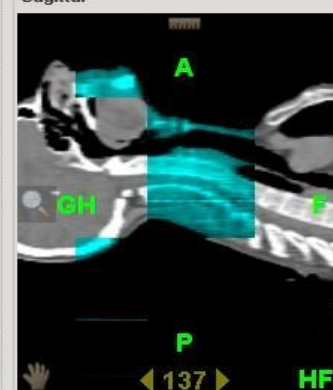
Translational Adjustments (mm)

Lateral	Long.	Vert.
-0.2	-1.1	3.4

Rotational Adjustments (degrees)

Pitch	Roll	Yaw
0.0	1.0	0.0

Sagittal

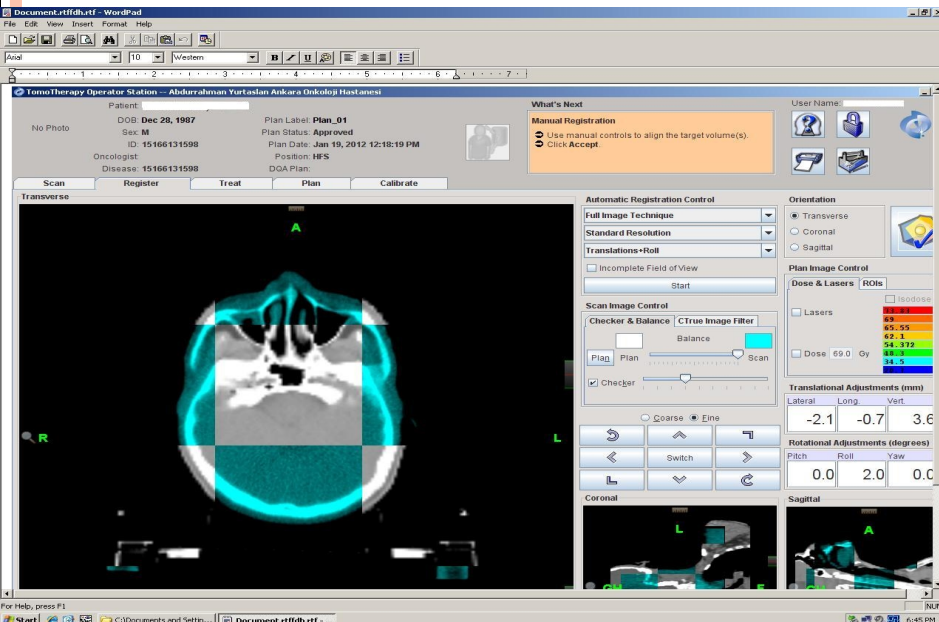


Auto Fusion has completed.

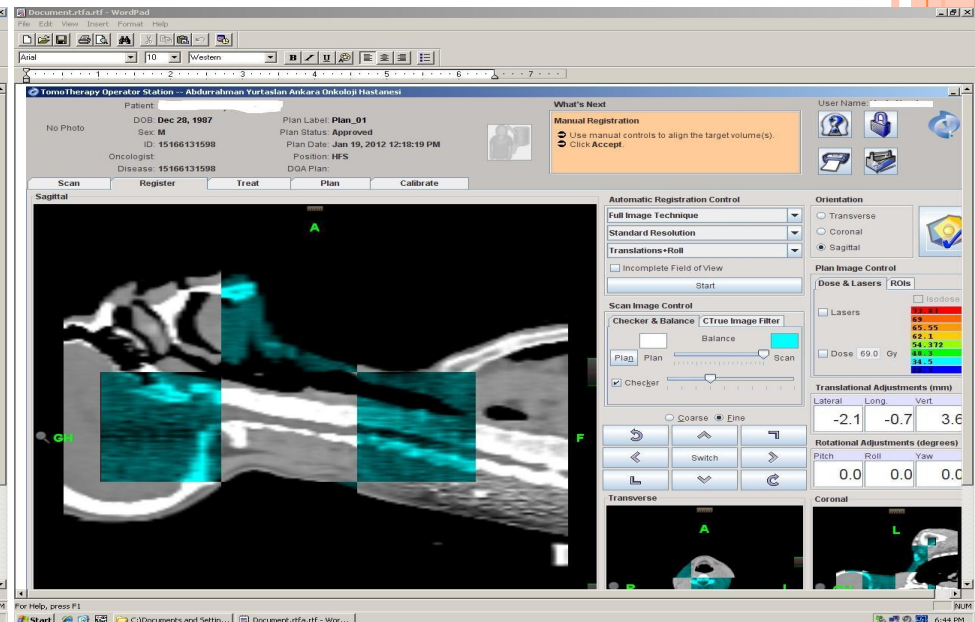
Wednesday, January 11, 2012

14:46:28

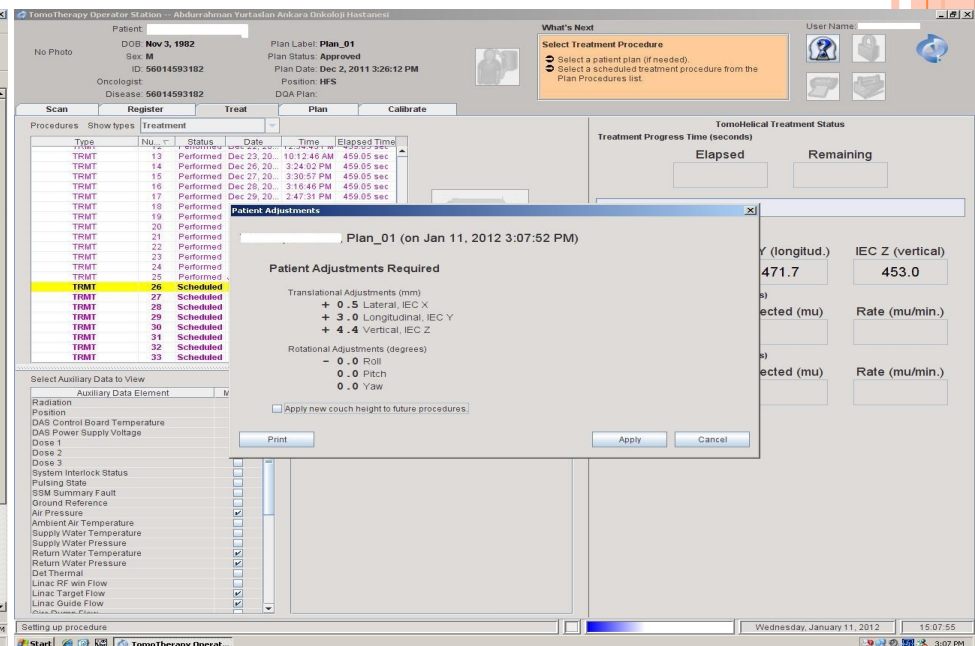
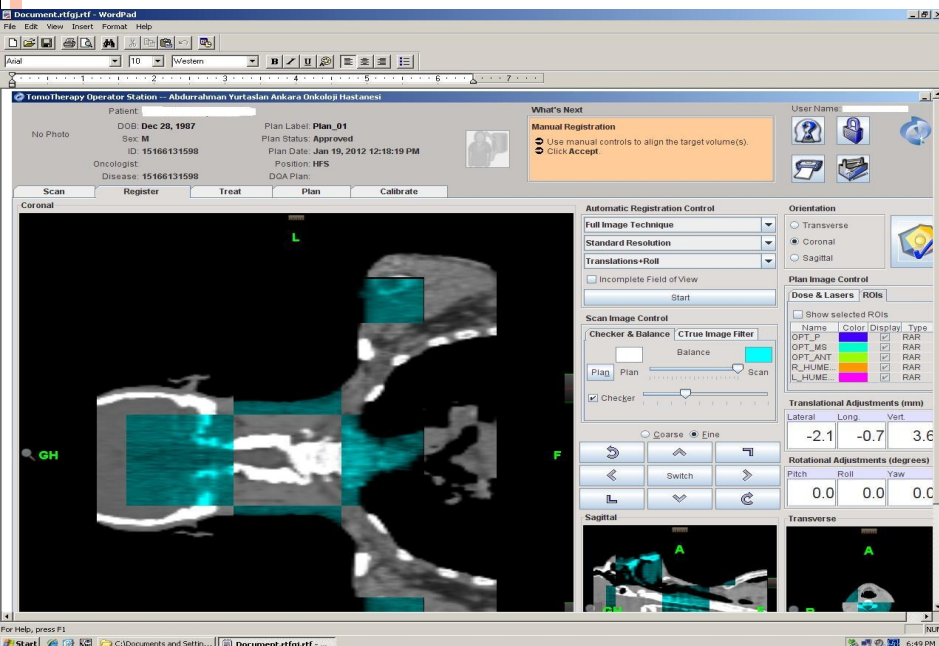
Transverse



Sagittal

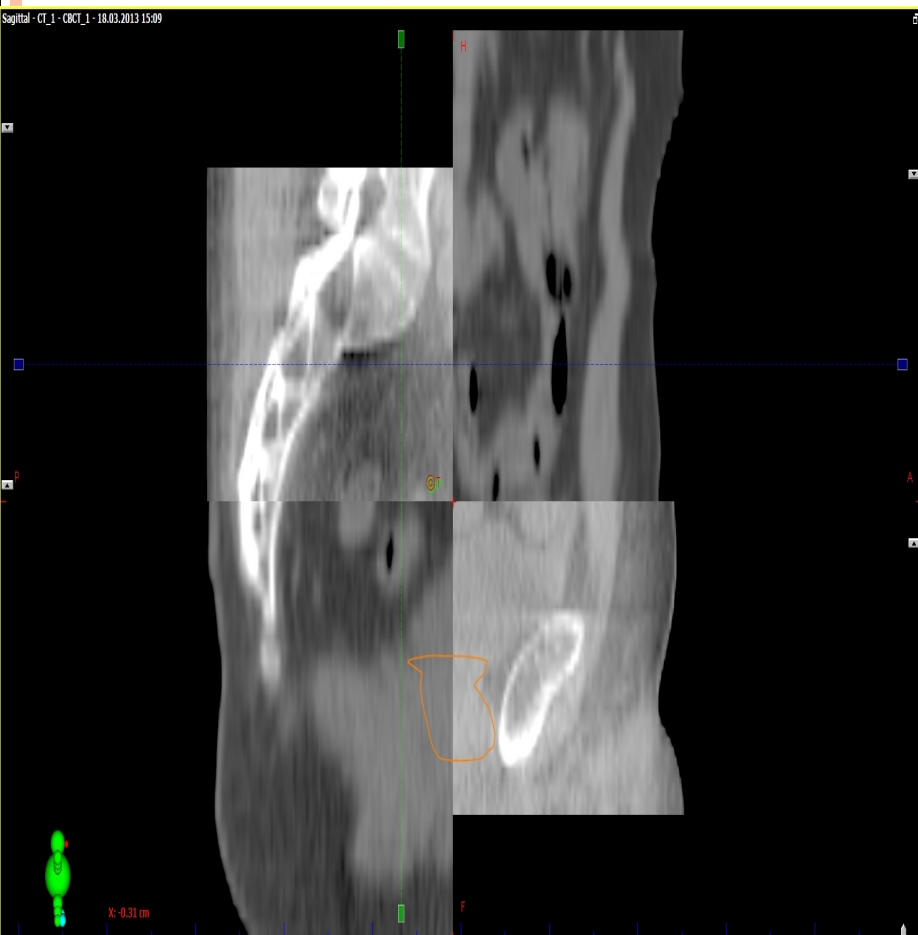


Coronal



CBCT

Sagittal - CT_1 - CBCT_1 - 18.03.2013 15:09



Summary: Images (3 New) / Couch Corrections (IEC61217 scale)

	LR - AP	CBCT_1
Status	*	*
Vrt [cm]		
Lng [cm]		
Lat [cm]		
Rtn [deg]		

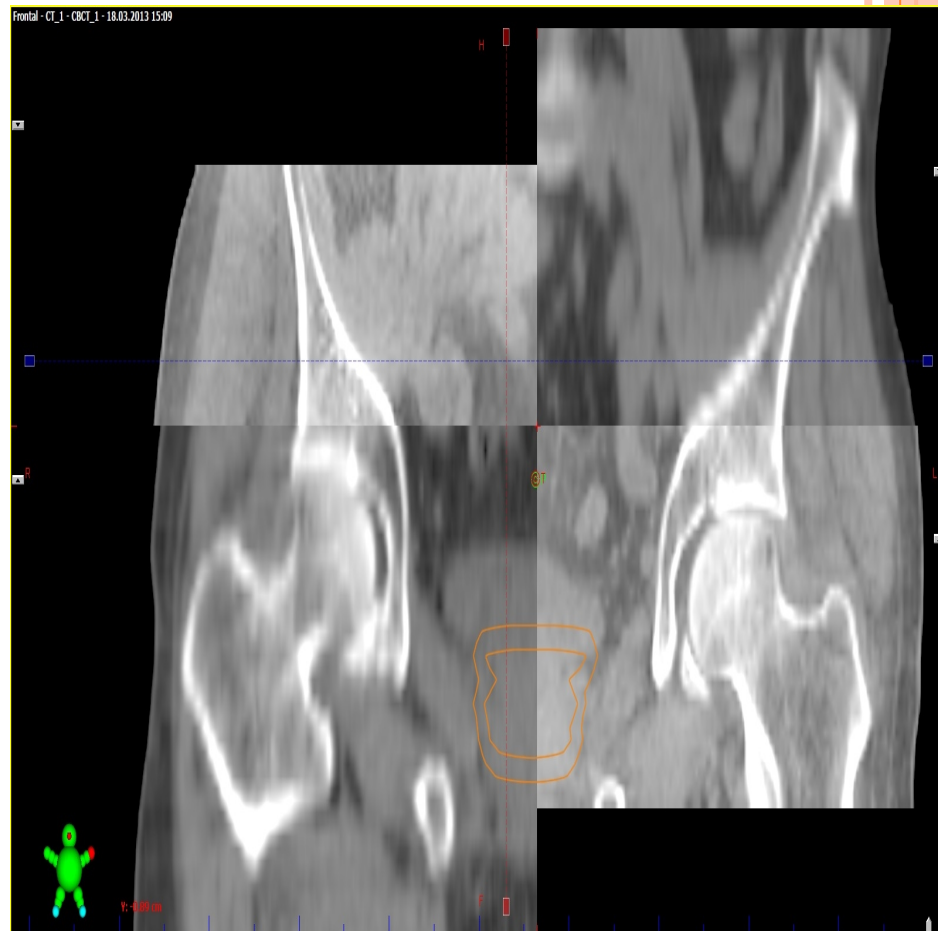


RAI 200x25

Session Timeline Course Timeline

Session Mon 18.03.2013, Image 3 of 3

Frontal - CT_1 - CBCT_1 - 18.03.2013 15:09



Summary: Images (3 New) / Couch Corrections (IEC61217 scale)

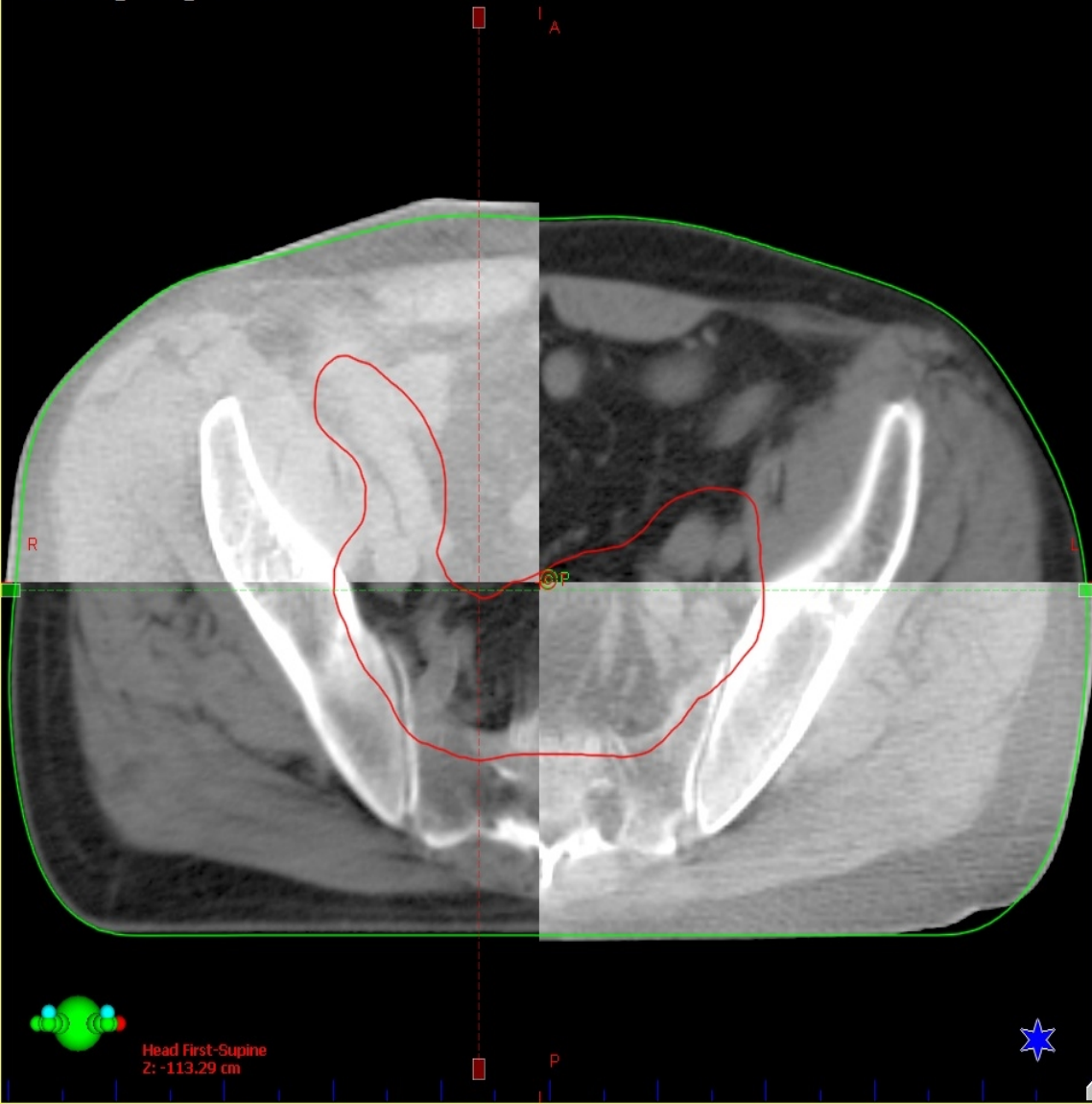
	LR - AP	CBCT_1
Status	*	*
Vrt [cm]		
Lng [cm]		
Lat [cm]		
Rtn [deg]		



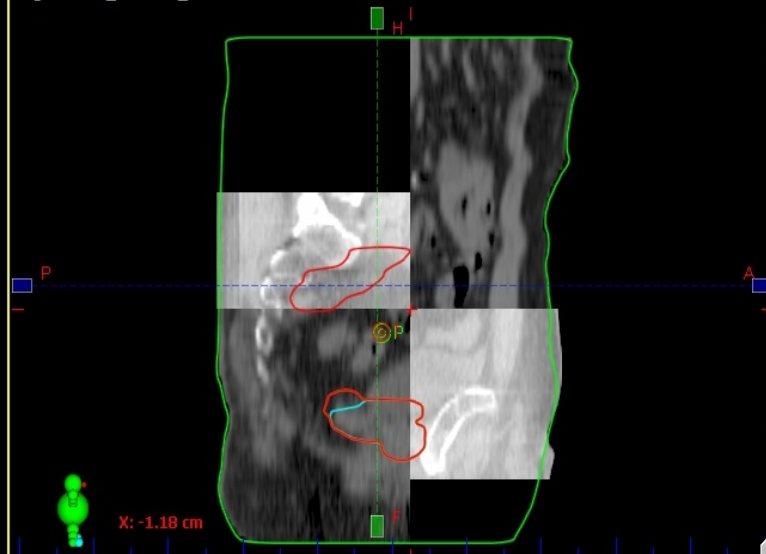
RAI 200x25

Session Timeline Course Timeline

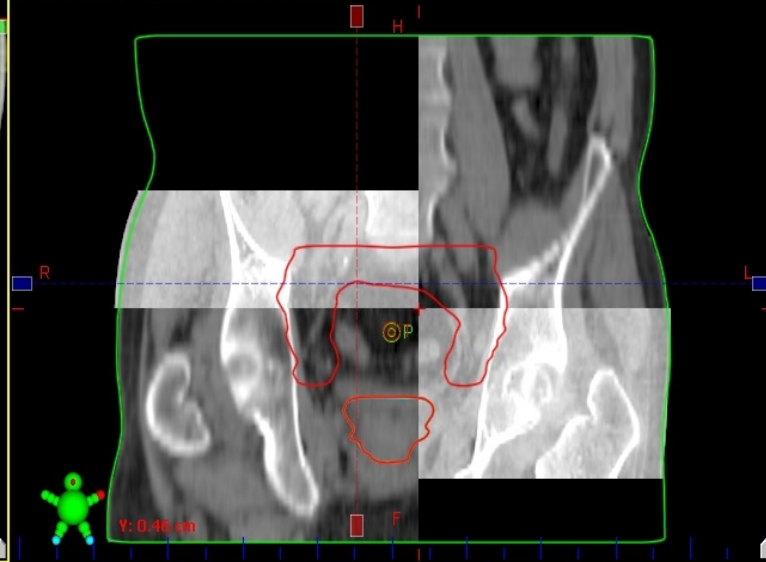
Session Mon 18.03.2013, Image 3 of 3



Head First-Supine
Z: -113.29 cm



X: -1.18 cm



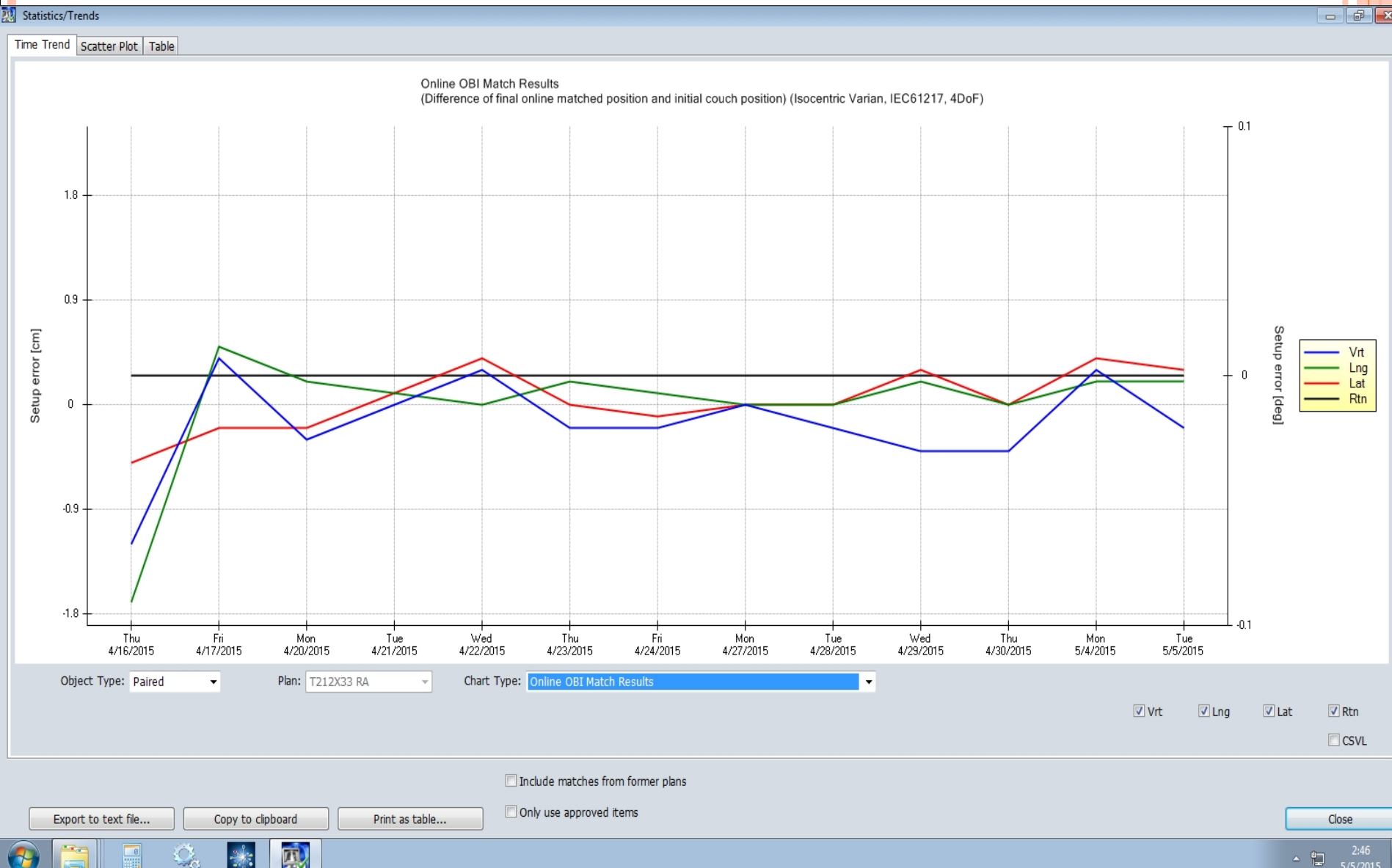
Y: 0.46 cm

Summary: Images (3 New) / Couch Corrections (IEC61217 scale)

	LR - AP	CBCT_1
Status	*	*
Vrt [cm]		
Lng [cm]		
Lat [cm]		
Rtn [deg]		



GÜNLÜK SET-UP HATALARI 3 MM VE ALTINDA



Sonuç olarak ;

IGRT

Yapılan tüm tedavilerde minimum set up hatası ve maksimum güvenilirlik sağlamaktadır.



