

TARGET VOLUME DELINEATION

CERVICAL CANCERS



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OBJECTIVES

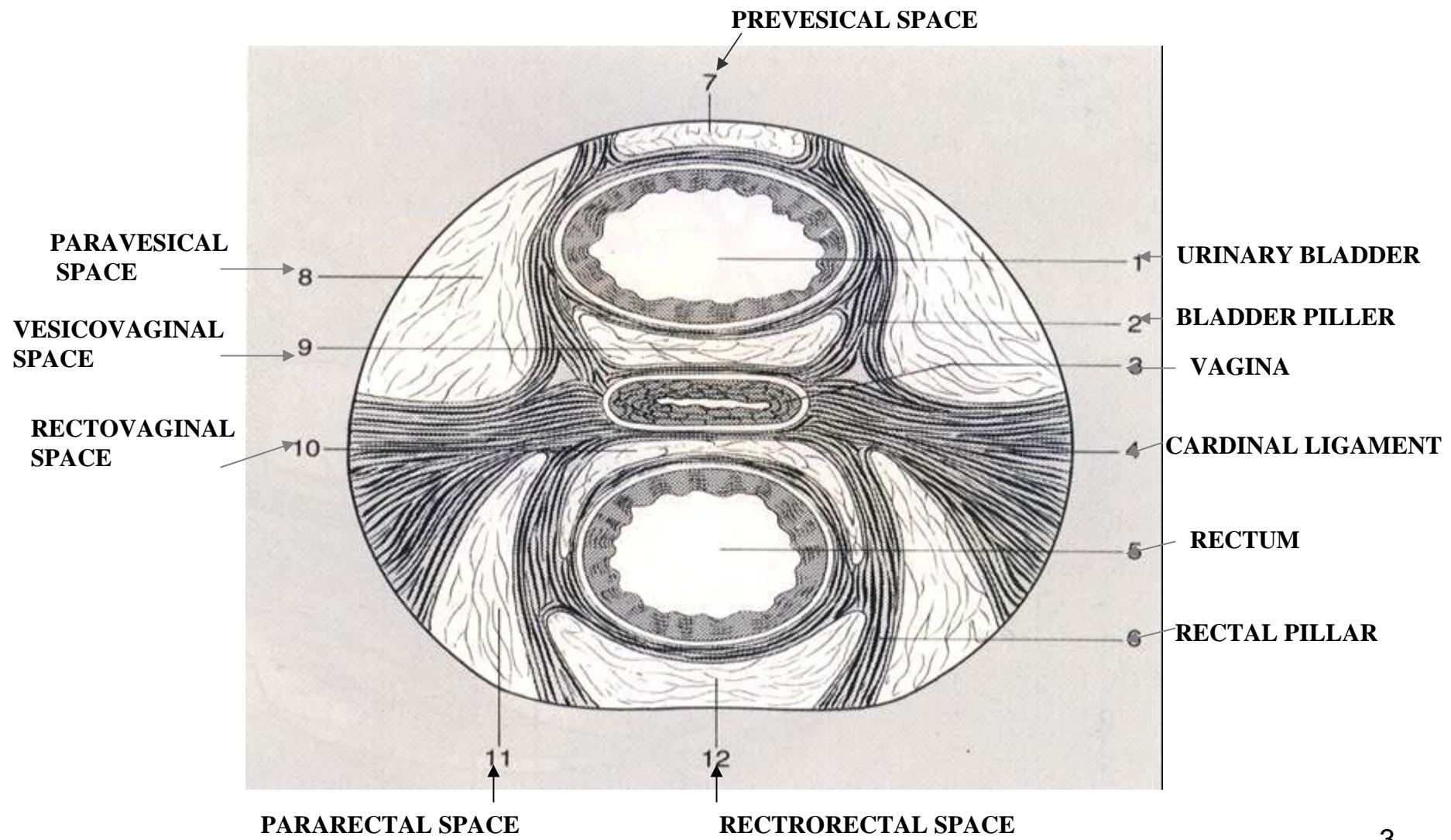
NATURAL HISTORY AND PATTERN OF SPREAD

- Local
- Nodal

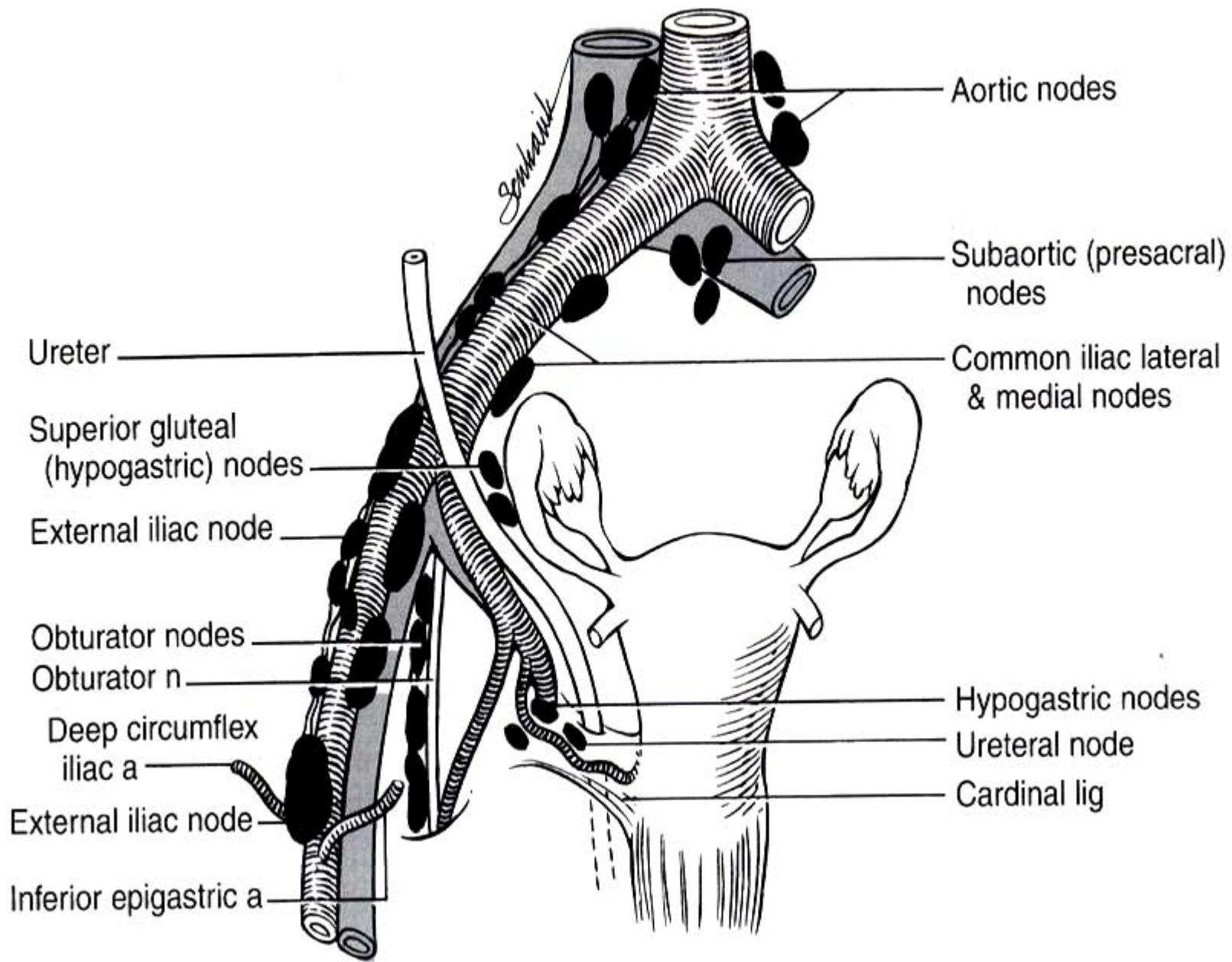
RADIOLOGICAL ANATOMY: AXIAL / SAGITTAL / CORONAL

- Cx, Parametrial tissue, uterus, pelvic organs
- Common, external, internal iliac, presacral vessels and nodes
- Anatomic location of pelvic nodes

Anatomy of the Pelvis



Lymphatic Drainage



TARGET VOLUME DELINEATION IN CERVICAL CANCERS

Introduction & Background

- Conventional to Newer Radiation Techniques have evolved
- Conventional Portals : Less Chances of geographical miss
- Newer RT techniques : Treat / Spare what is marked
- Target Volume delineation : Very Critical
- All the Pelvic Tumors
 - : Internal organ motion
 - : Variation in Position (Bladder and Rectum)
 - : Tumor Regression
 - : Post operative pelvic adhesions (small bowel)

TARGET VOLUME DELINEATION IN CERVICAL CANCERS

- **Imaging Modalities** : CT, MRI, CT- PET, etc...
- **Primary Volumes** : GTV, CTV,
- **Pelvic Nodal Volumes** : CTV_ Vessels, CTV_ Pelvic Nodes
- **TPS Systems** : Networking, Contouring,
Co-registration, Fusion etc..
- **Reproducibility of Target Volumes during entire course of RT**

CT Imaging : GOLD STD FOR RT PLANNING

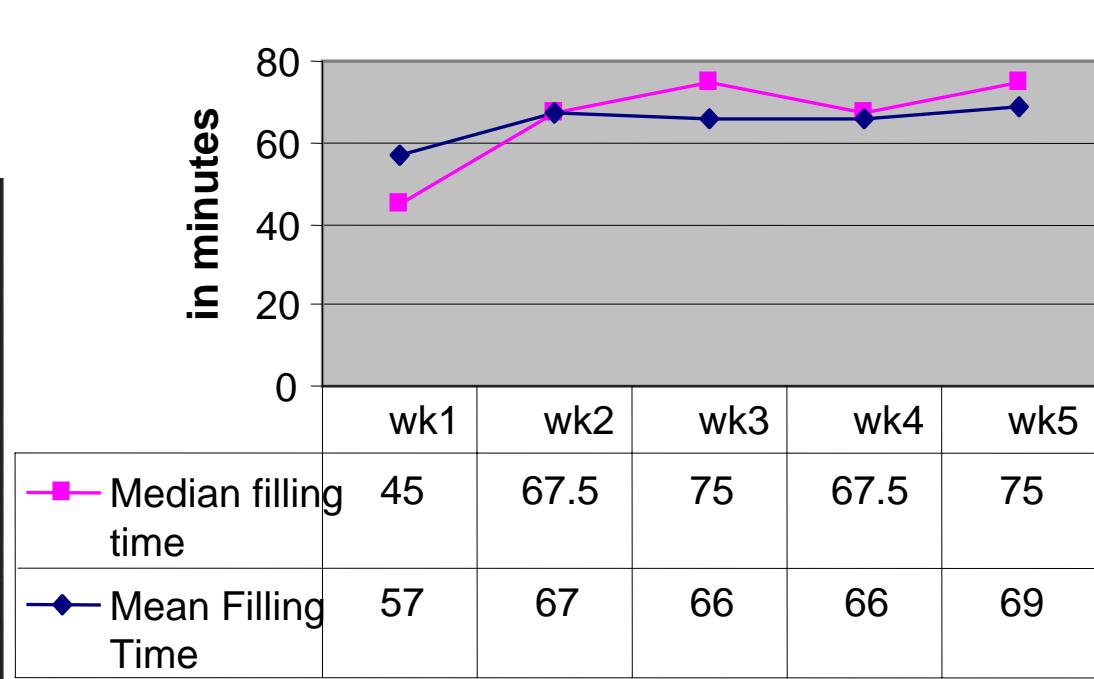
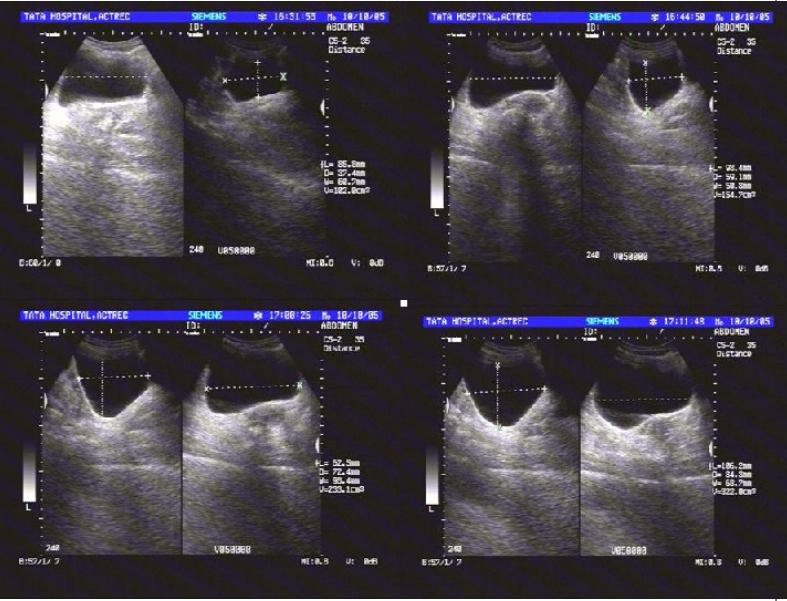
Radiological Anatomy : CT / MR Knowledge mandatory

CT – SIMULATION PROTOCOL

- **EUA / Clinical Examination / Diagnostic Imaging**
- **Bladder: To be emptied 1 hour prior followed by 1 lt. of water**
- **Oral Contrast (water) : 750-1000 ml , 30-45 minutes prior**
- **Rectal Contrast-Dilute: 20-30 cc just prior to Scans (not mandatory)**
- **IV Contrast : Max. 100 ml IV push (*to delineate vessels*)**
- **Scans done after 4-5 minutes**
- **5mm serial axial / spiral scans from L3 to 3 cm below introitus**
- **CT Data transferred to Contouring work station**

Bladder filling Protocol

- Empty the bladder followed by 750-1000 ml of water over 15 minutes
- Imaging / RT treatment done after 45 minutes of bladder emptying
- N = 45 pts with serial USG for bladder filling



Illustrating the linearity of bladder filling time
(mean and median values) with the passage of time in weeks.

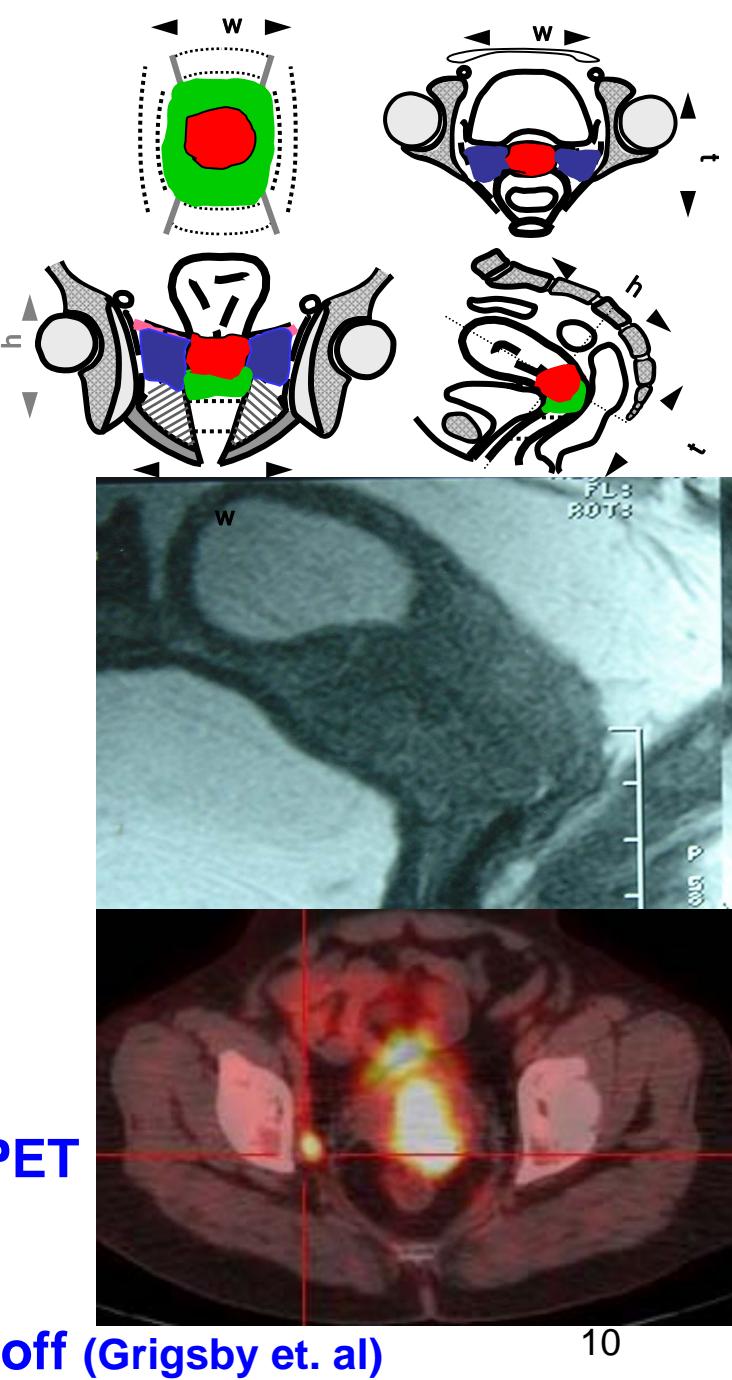
TARGET DELINEATION

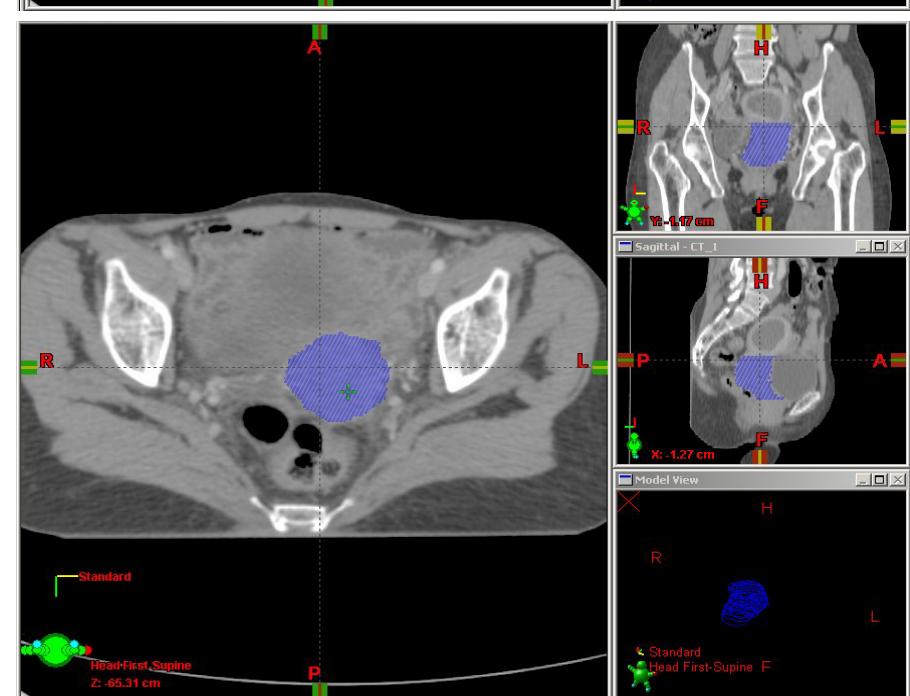
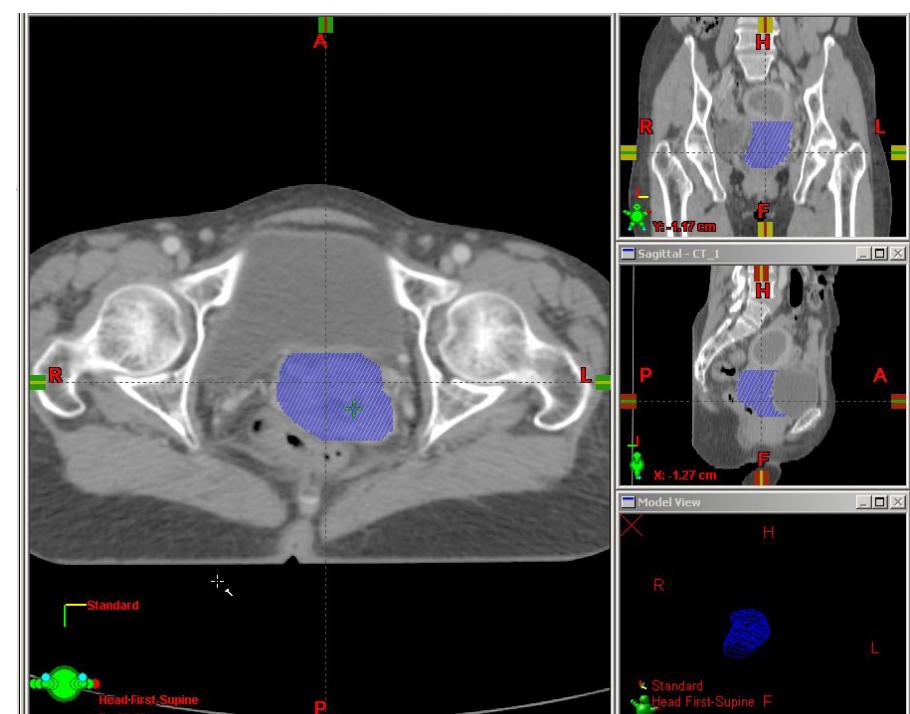
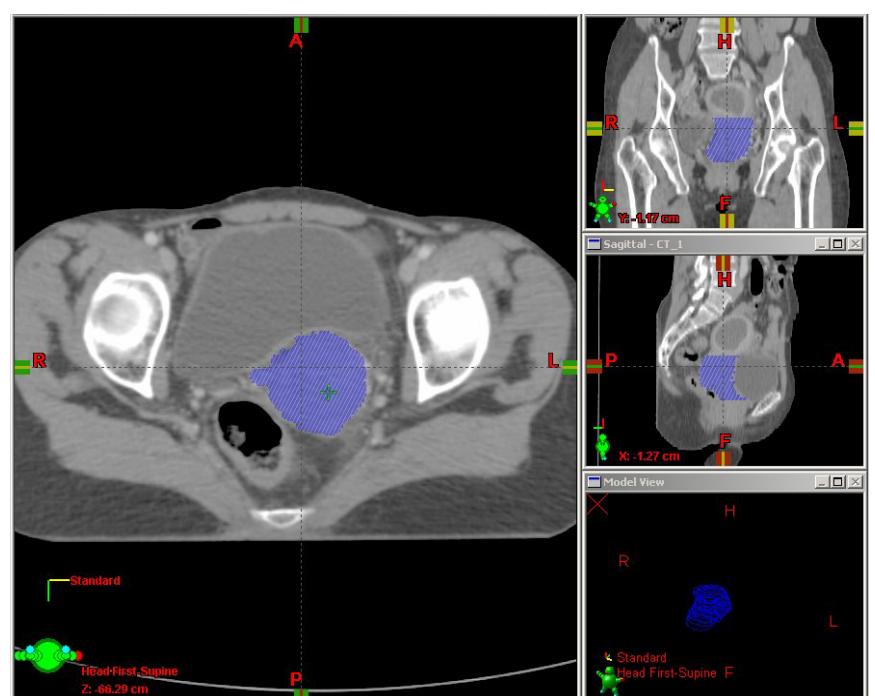
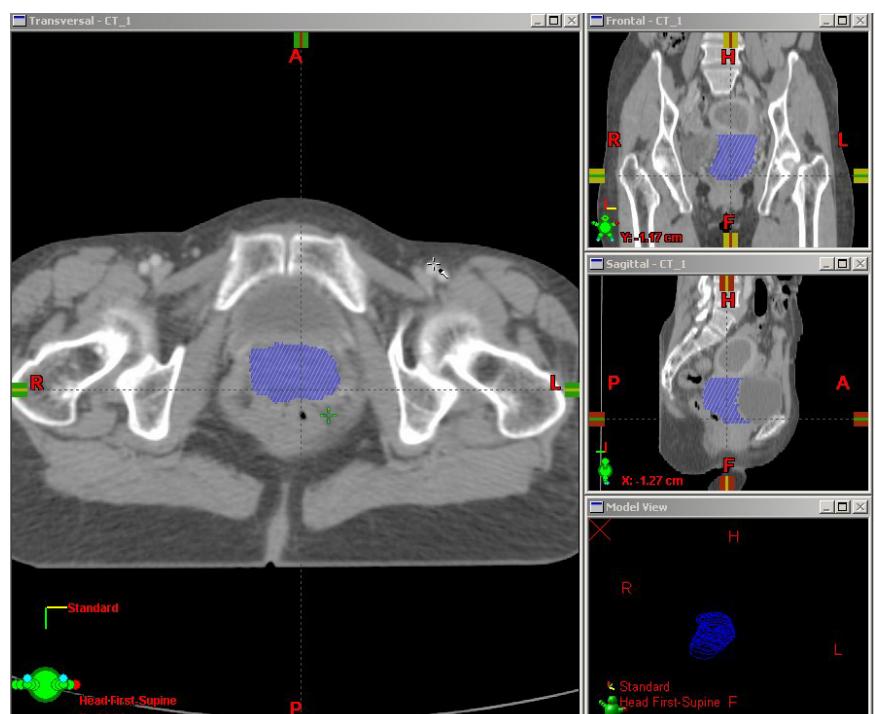
No definite consensus guidelines

- **GTV_{cervix}** : Gross tumor + Cx + Gross Visible Para Disease
- **CTV_{cervix}** : GTV + Uterus + Margins (Internal Organ Motion)
- **CTV_{nodes}** : CTV Vessels + 7 mm margin
- **CTV_{pelvis}** : CTV_{cervix} + CTV_{nodes}
 - Sup: L5-S1 vertebrae
 - Inf: Lower border of Obturator/lower extent of disease
 - Post: Presacral region upto S3 (Nodes + Uterosac. liggs)
 - Ant: Post. Bladder Wall / Ext. Iliac vess. with margins
- **PTV** : CTV + Margins
(Depending on Immobilization Accuracy)

GTV_CERVIX

- Gross disease on imaging
- Entire Cervix
- Parametrial Disease : Clinical and Imaging
- Other modalities done like MRI Pelvis, CT – PET
- PET – CT : 40% of the max SUV value as cut-off (Grigsby et. al)

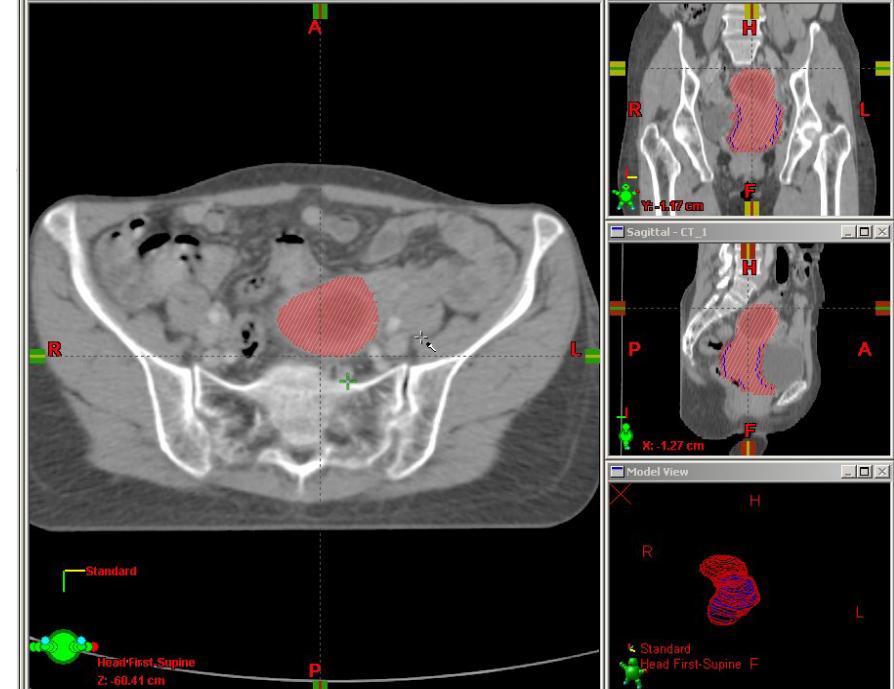
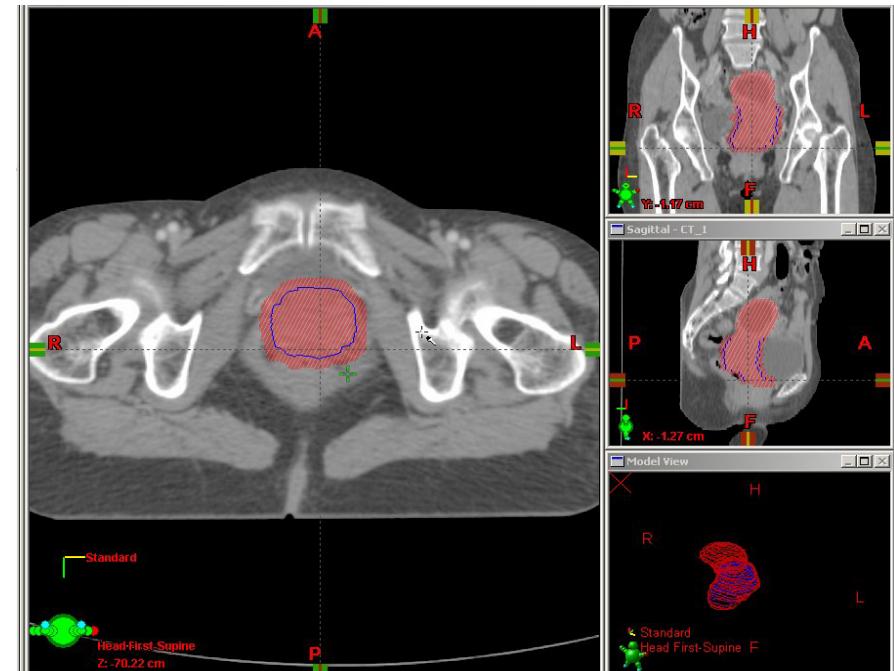
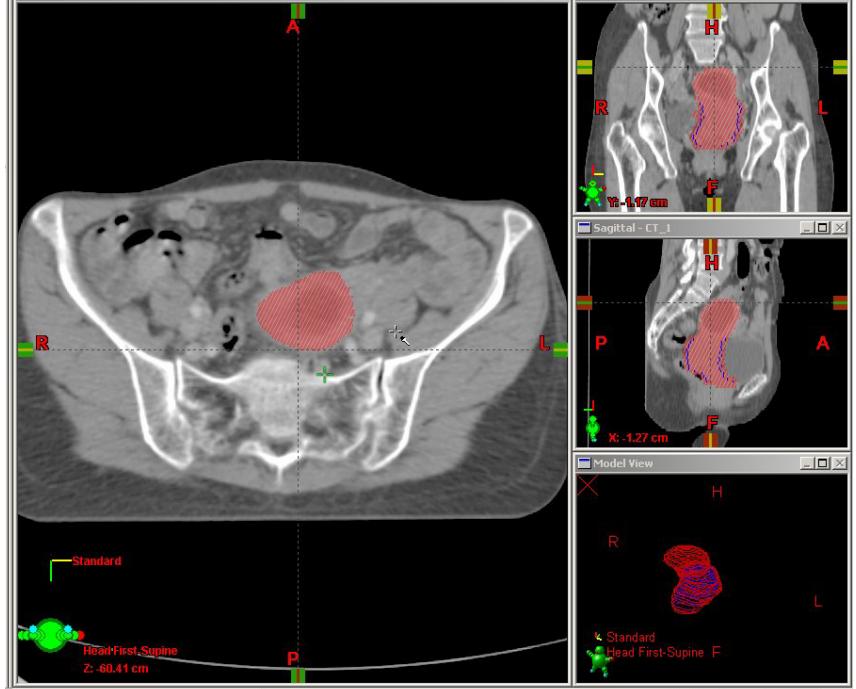




CTV_CERVIX

- **GTV_Cervix**
- **Margins for internal organ motion: Max : 5 mm**
- **Uterus**
- **Upper 2-3 cm of vagina**

(Buchali et al; Radiother Oncol 52: 29-34; 1999)



CTV_PELVIC NODES

PHYSICS CONTRIBUTION

MAPPING PELVIC LYMPH NODES: GUIDELINES FOR DELINEATION IN INTENSITY-MODULATED RADIOTHERAPY

ALEXANDRA TAYLOR, F.R.C.R.,* ANDREA G. ROCKALL, F.R.C.R.,† RODNEY H. REZNEK, F.R.C.R.,†
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Purpose: To establish guidelines for delineating the clinical target volume for pelvic nodal irradiation by mapping the location of lymph nodes in relation to the pelvic anatomy.

Methods and Materials: Twenty patients with gynecologic malignancies underwent magnetic resonance imaging with administration of iron oxide particles. All visible lymph nodes were outlined. Five clinical target volumes were generated for each patient using modified margins of 3, 5, 7, 10, and 15 mm around the iliac vessels. The nodal contours were then overlaid and individual nodes analyzed for coverage. The volume of normal tissue within each clinical target volume and planning target volume was also measured to aid selection of the margin that could provide maximal nodal, but minimal normal tissue, coverage.

Results: In total, 1216 nodal contours were evaluated. The nodal coverage was 56%, 76%, 88%, 94%, and 99% using vessel margins of 3, 5, 7, 10, and 15 mm, respectively. The mean volume of bowel within the planning target volume was 146.9 cm^3 with a 7-mm margin, 190 cm^3 with a 10-mm margin, and 266 cm^3 with a 15-mm margin. Minor modification to the 7-mm margin ensured 99% coverage of the pelvic nodes.

Conclusion: Blood vessels with a modified 7-mm margin offer a good surrogate target for pelvic lymph nodes. By making appropriate adjustments, coverage of specific nodal groups may be increased and the volume of normal tissue irradiated decreased. On the basis of these findings, recommended guidelines for outlining pelvic nodes have been produced. © 2005 Elsevier Inc.

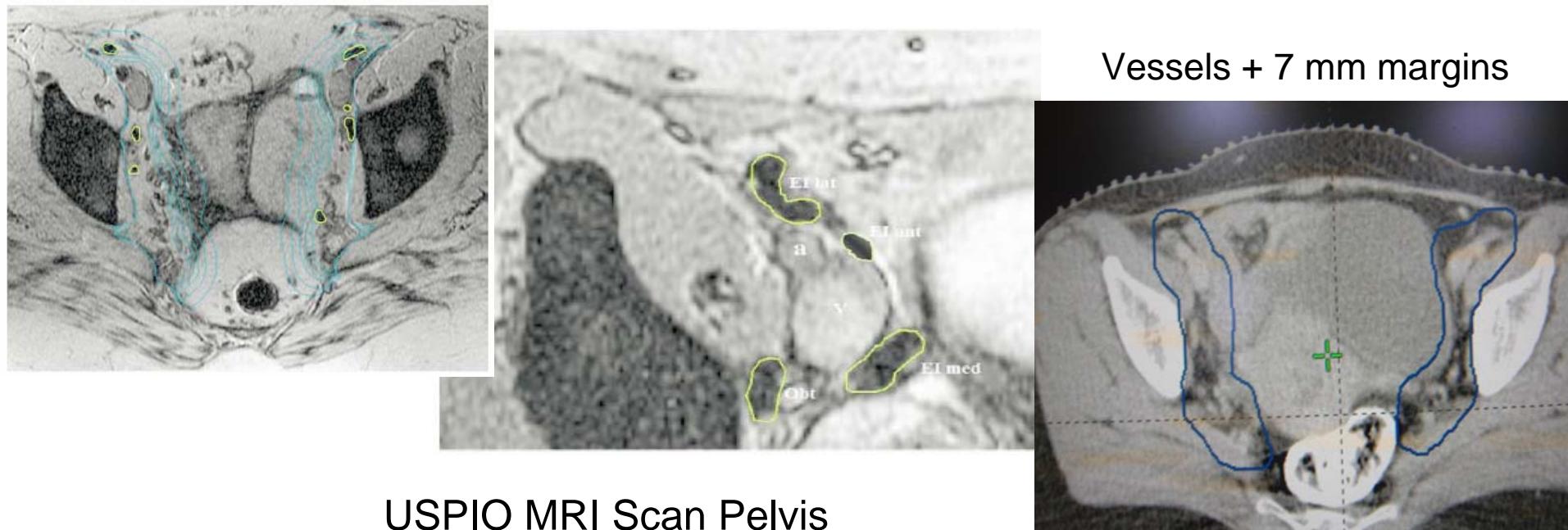
doi:10.1016/j.ijrobp.2005.05.062

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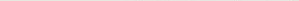
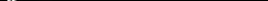
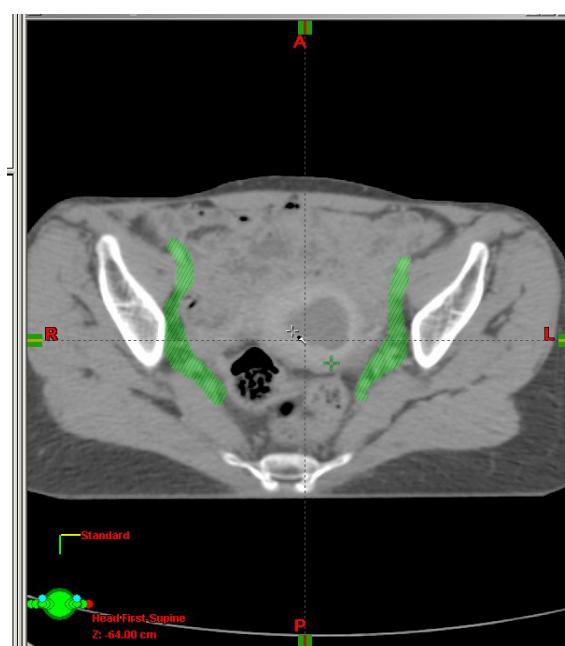
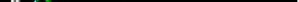
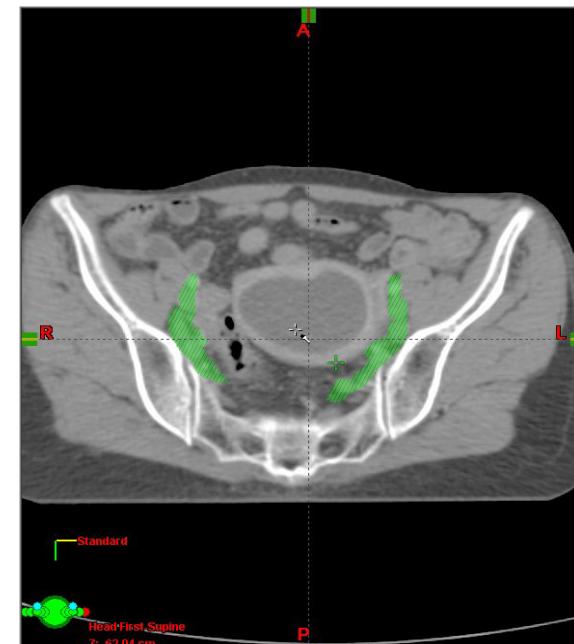
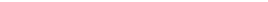
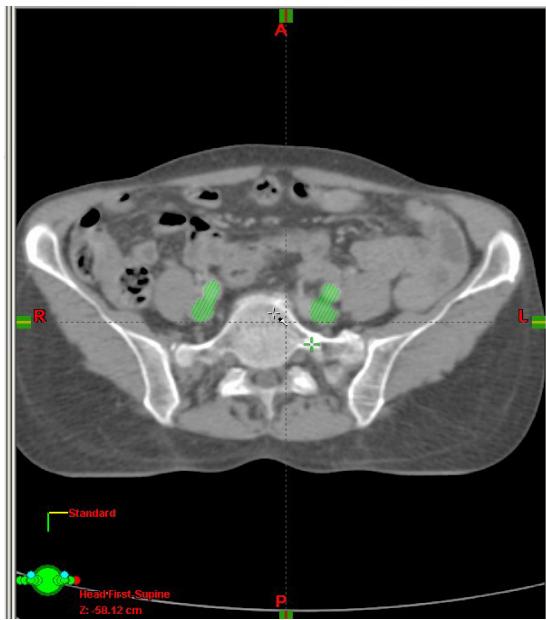
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Blood vessels with a modified 7-mm margin offer a good surrogate target for pelvic lymph nodes.

CTV VESSELS



Pelvic Nodal Volume Delineation Guidelines

Table 1 — Summary of the guidelines for delineating nodal regions

Lymph node group	Recommended margins*
Common iliac	7 mm margin around vessels. Extend posterior and lateral borders to psoas and vertebral body
External iliac	7 mm margin around vessels. Extend anterior border by a further 10 mm anterolaterally along the iliopsoas muscle to include the lateral external iliac nodes
Internal iliac	7 mm margin around vessels. Extend lateral borders to pelvic side wall
Obturator	Join external and internal iliac regions with a 17 mm wide strip along the pelvic side wall
Pre-sacral	Subaortic: 10 mm strip over anterior sacrum Mesorectal: cover entire mesorectal space

*Also include any visible nodes.

SAJARA BEGUM,, ANSARI [A]
Axial7 Volume 2/Volume 1
I: 581.2
DFOV 50.0 cm

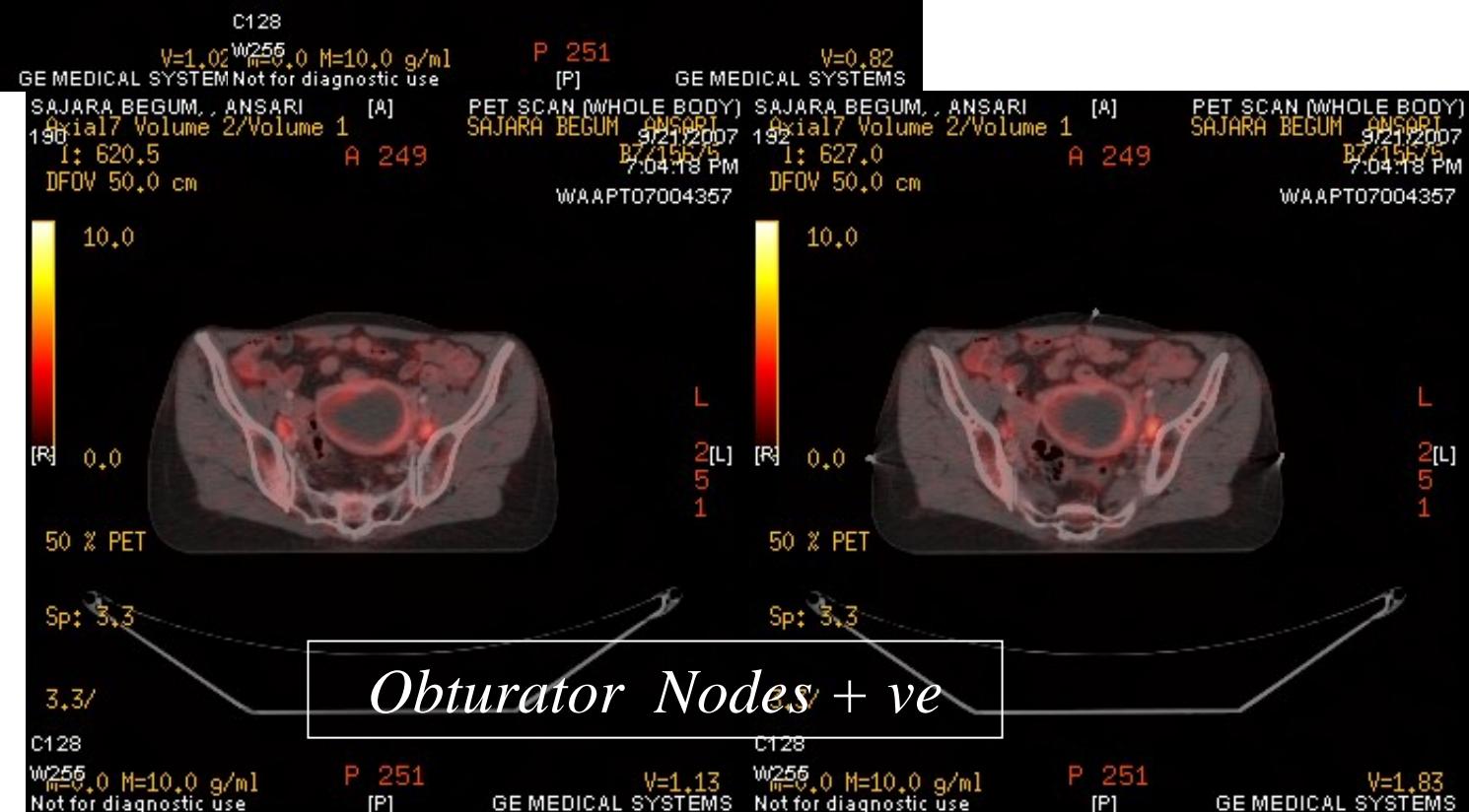
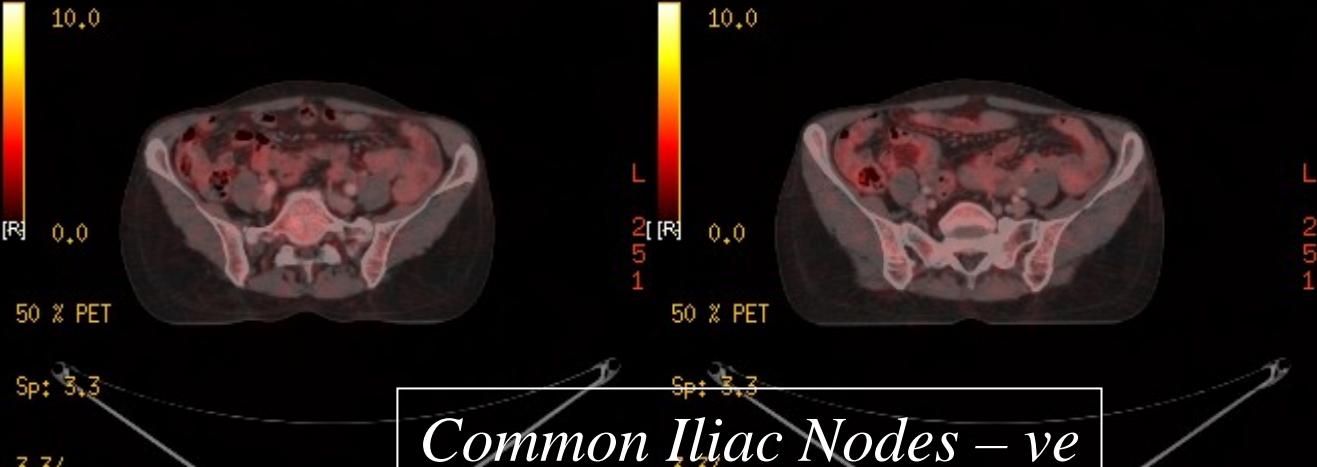
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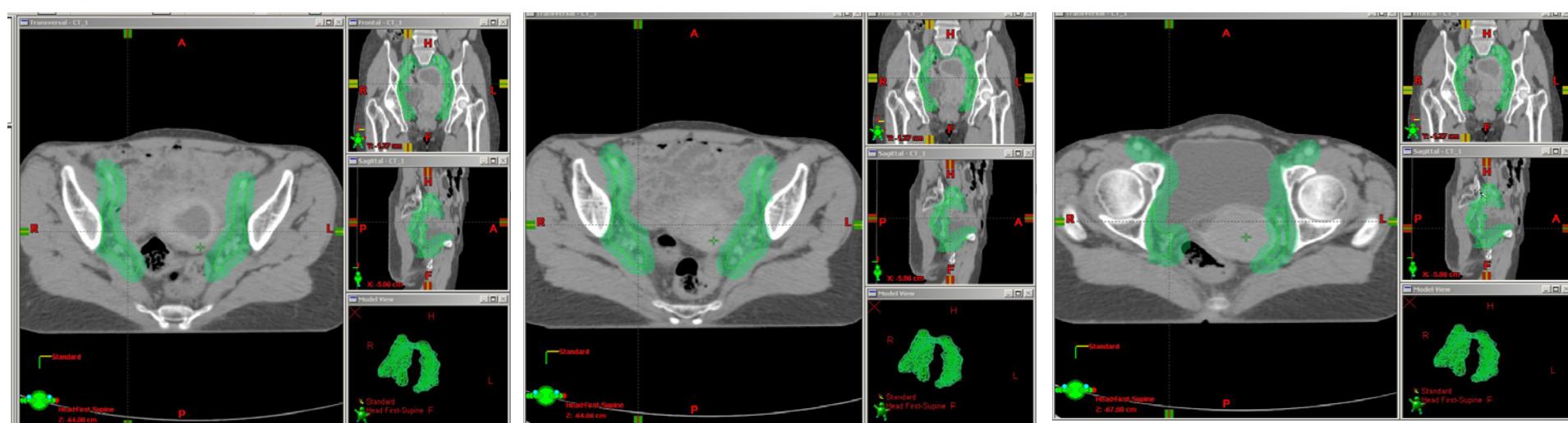
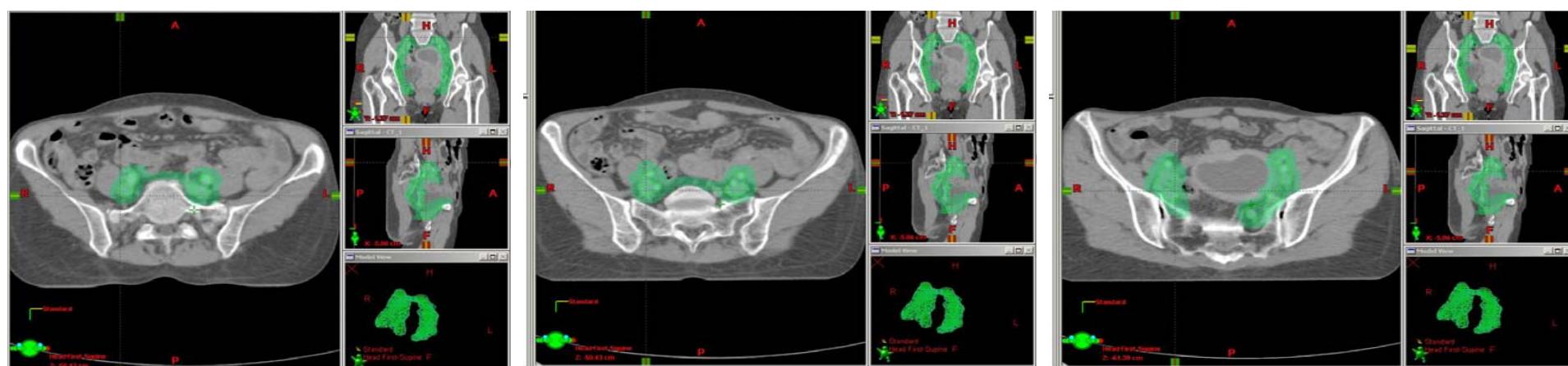
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SAJARA BEGUM,, ANSARI [A] 9/21/2007
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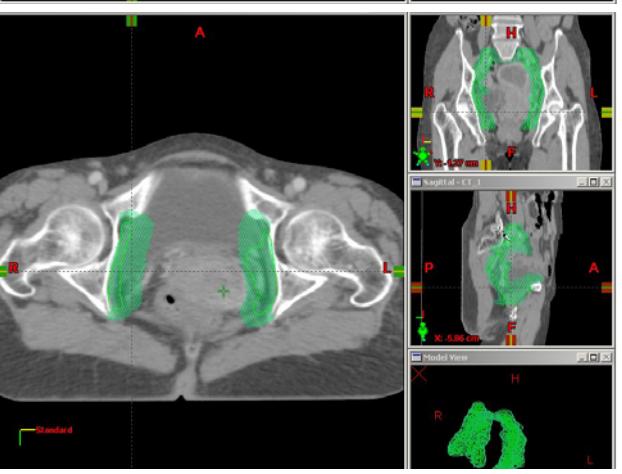
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B7/15/07 I: 591.0
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CTV NODES

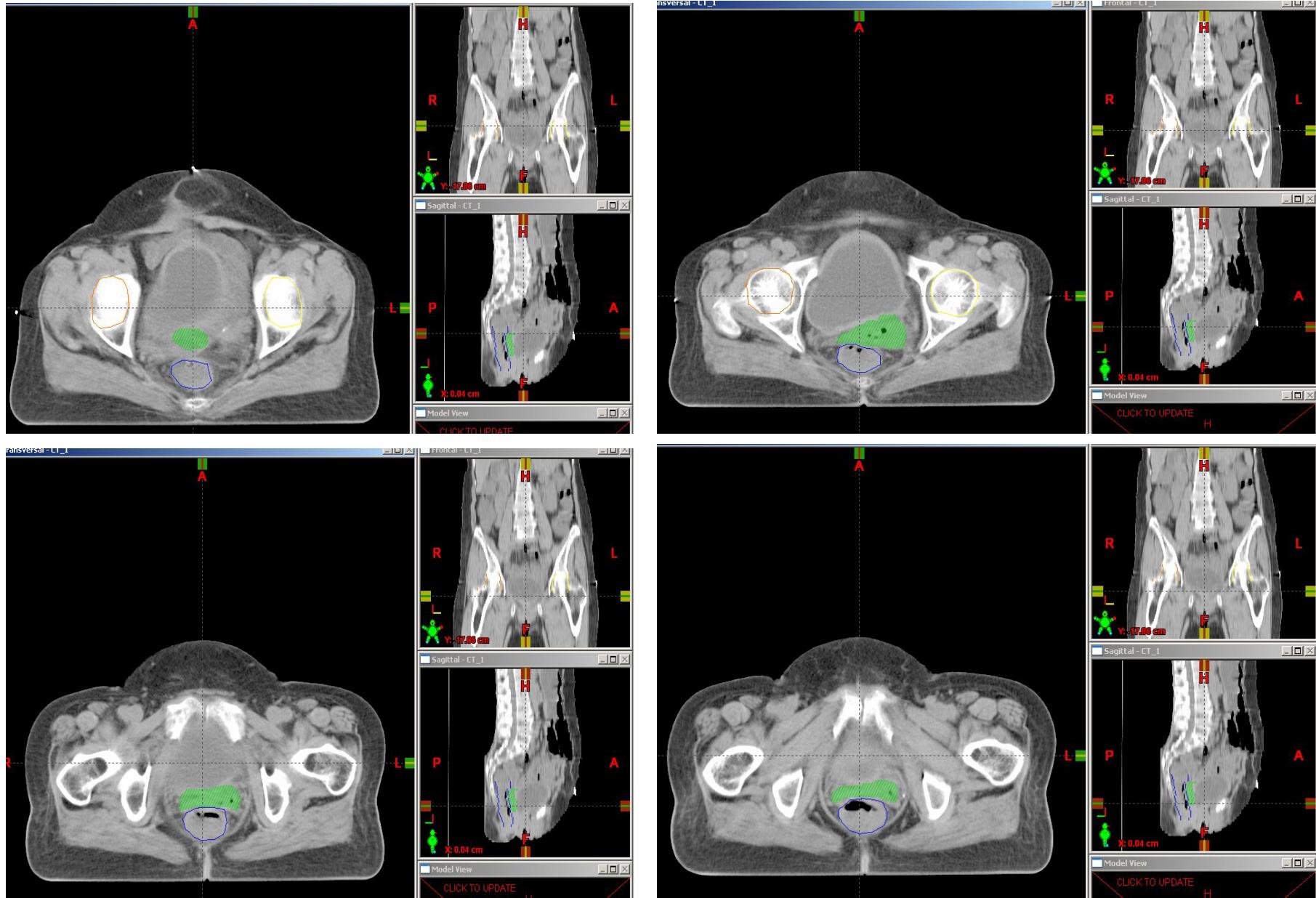


Post – operative Cervix / Endometrium

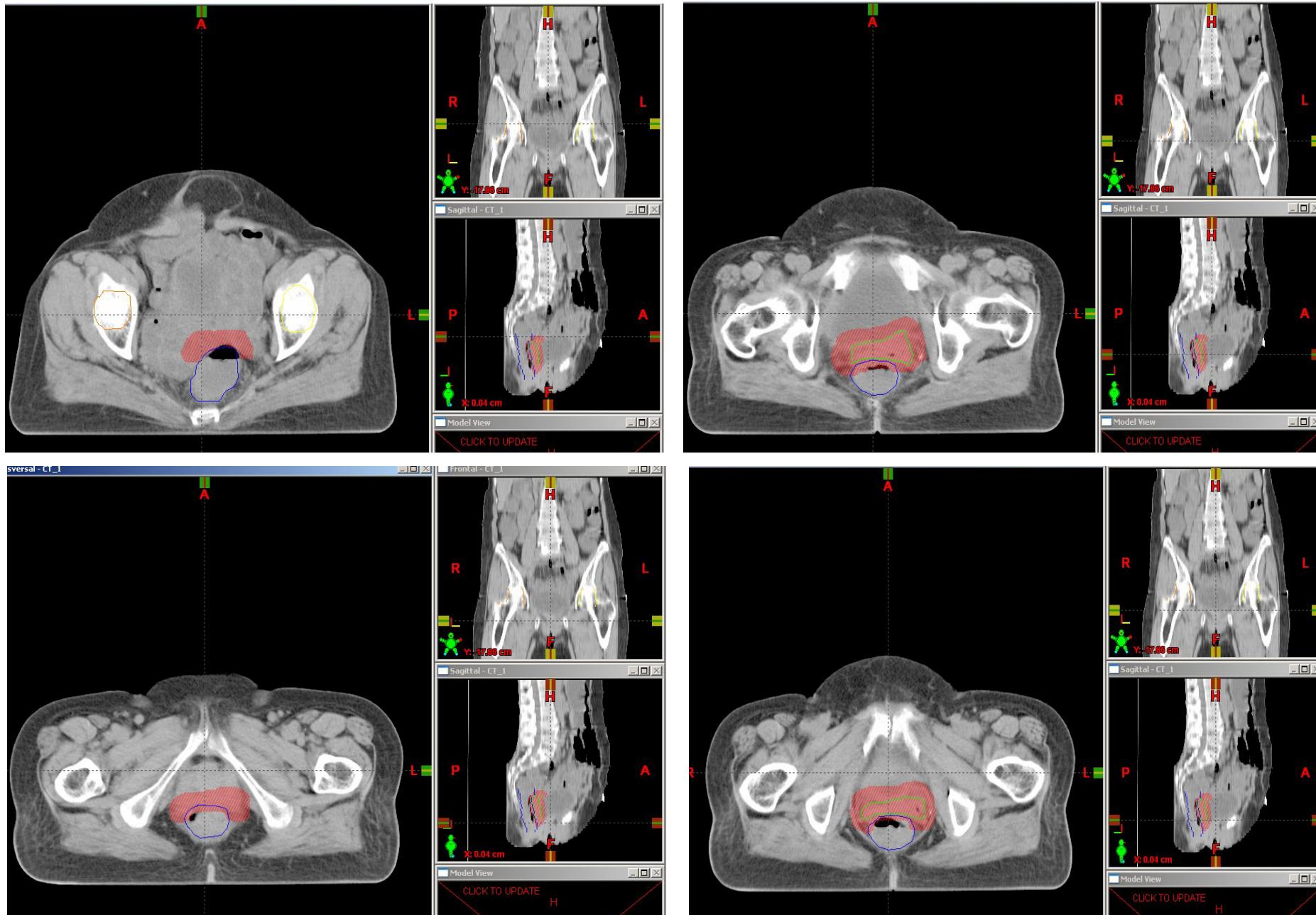
Target Volume Delineation

- **CTV_Vault** : Vault and immediate para-vaginal tissues
 - **CTV_Vagina** : CTV_Vault + Margins (SI: 2-3 cm; AP / LAT: 1.5 cm)
 - **Pelvic Nodes** : Pelvic vessels with margins (modified 7 mm)
 - : Lymphocele regions
 - **OAR** : SBR, Rectum, Bladder
- Small Bowel Adhesions and fixed to pelvic cavity**

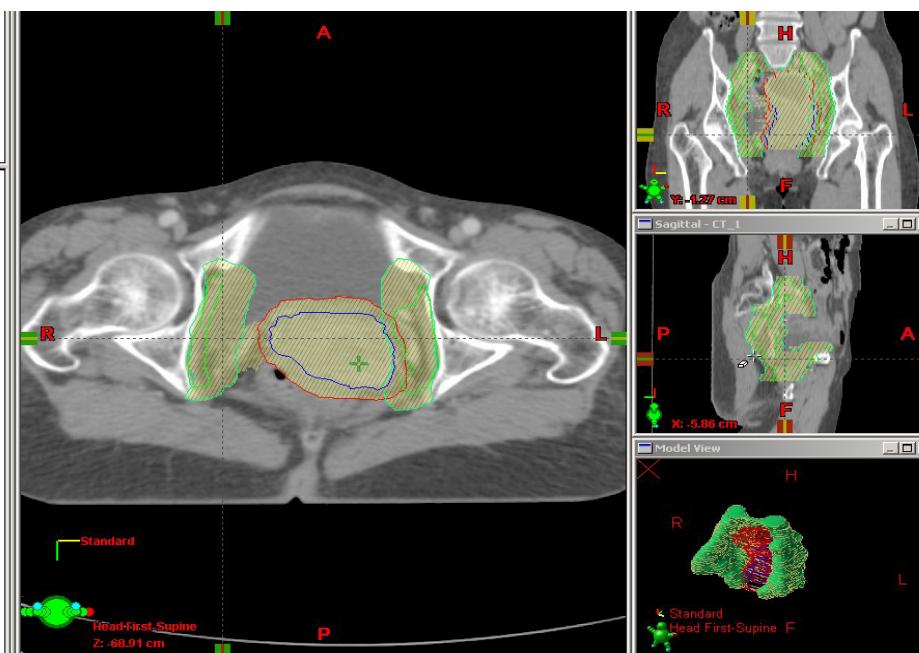
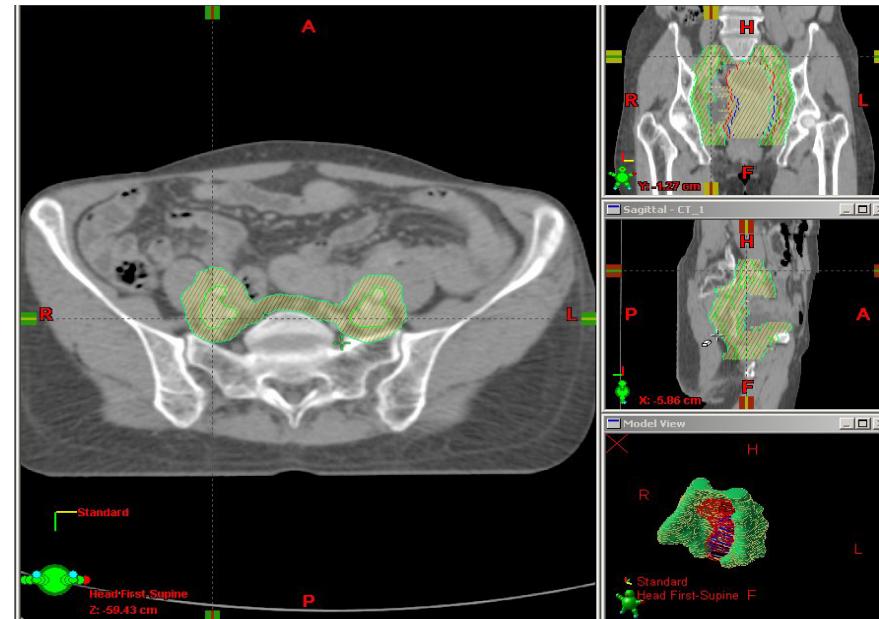
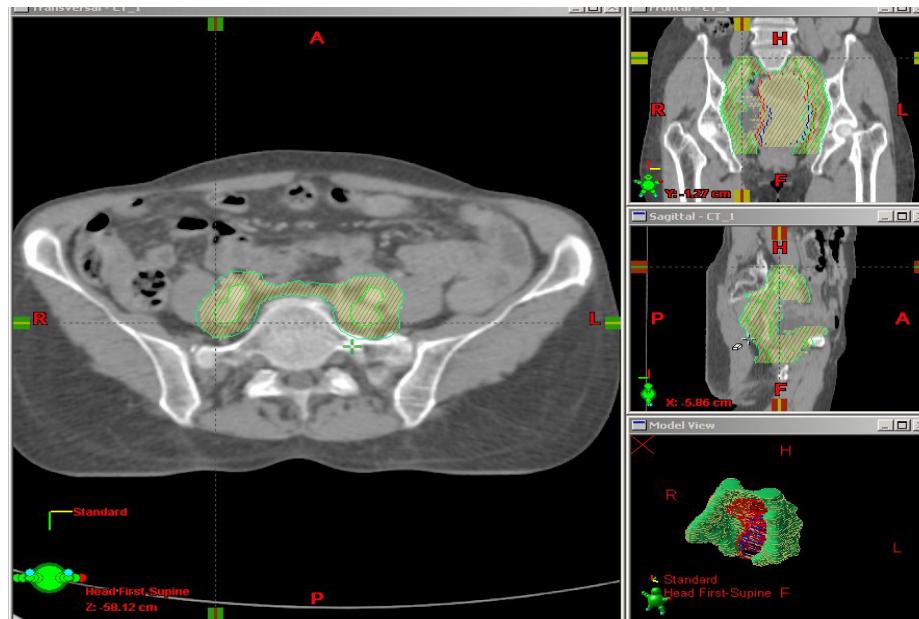
CTV VAULT



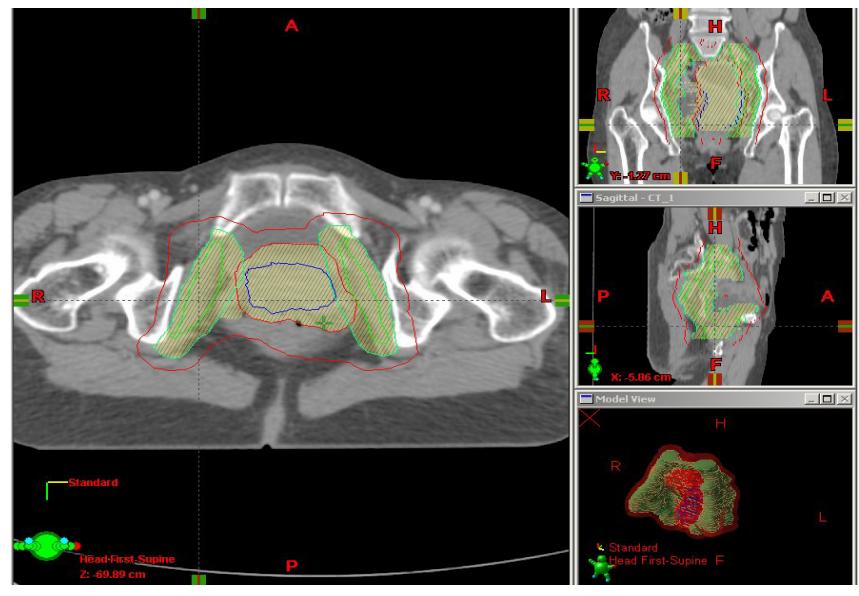
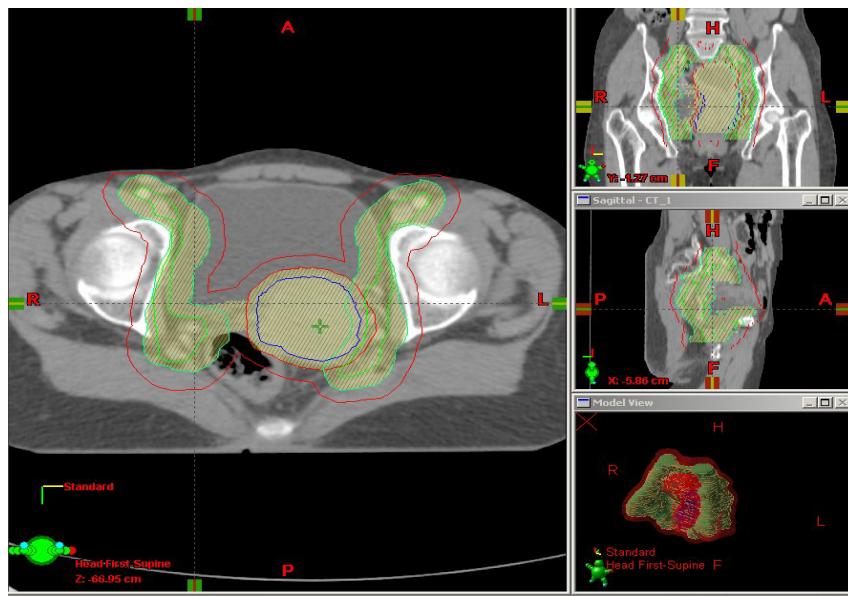
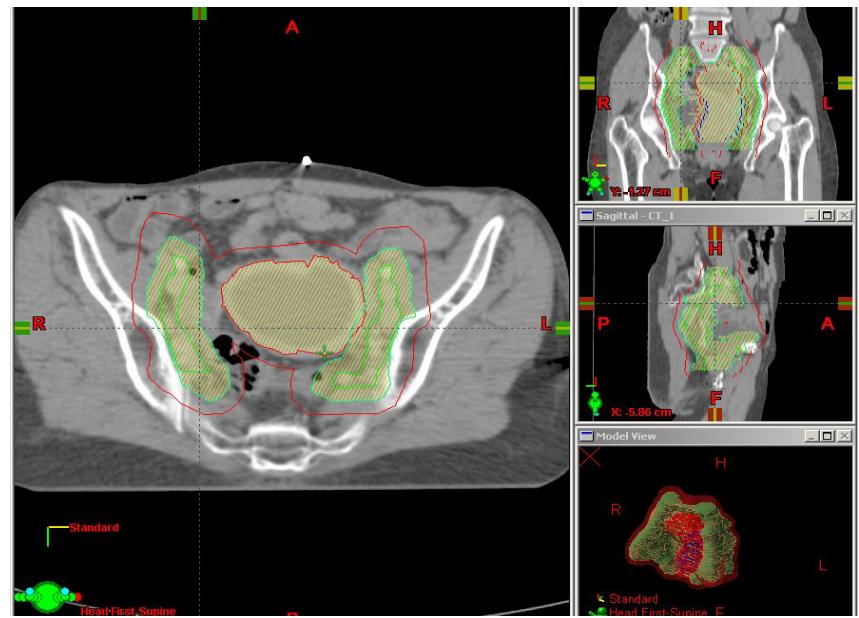
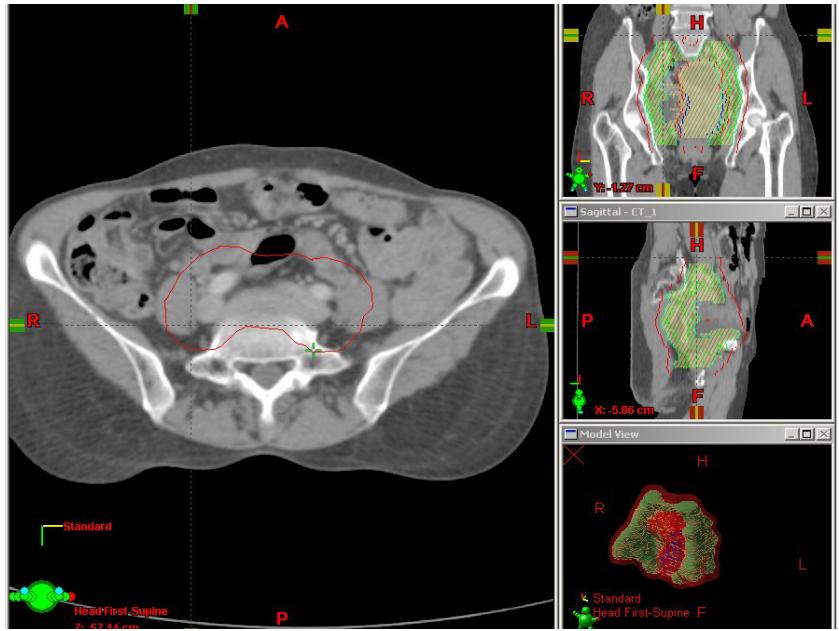
CTV VAGINA

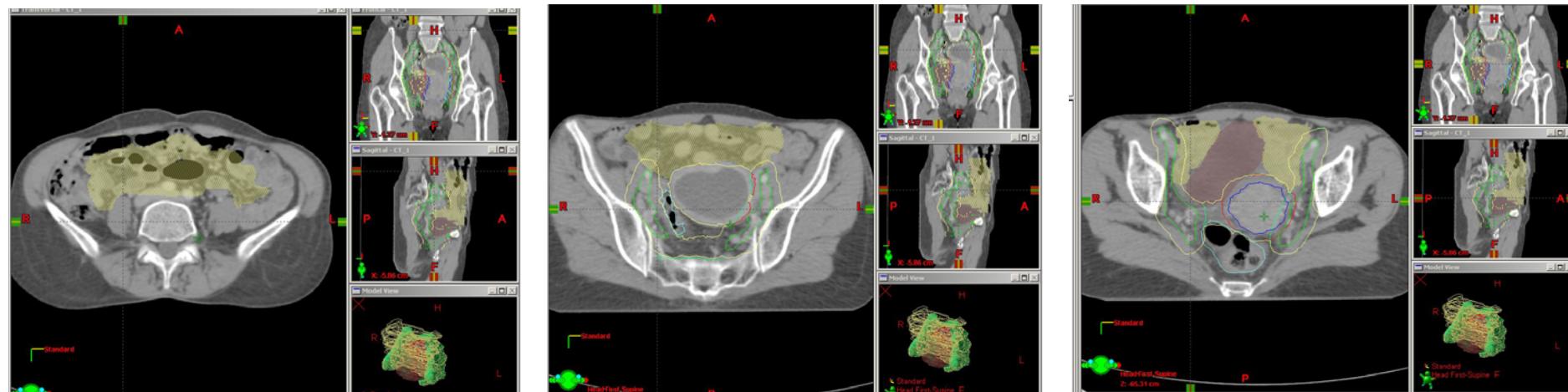


CTV PELVIS

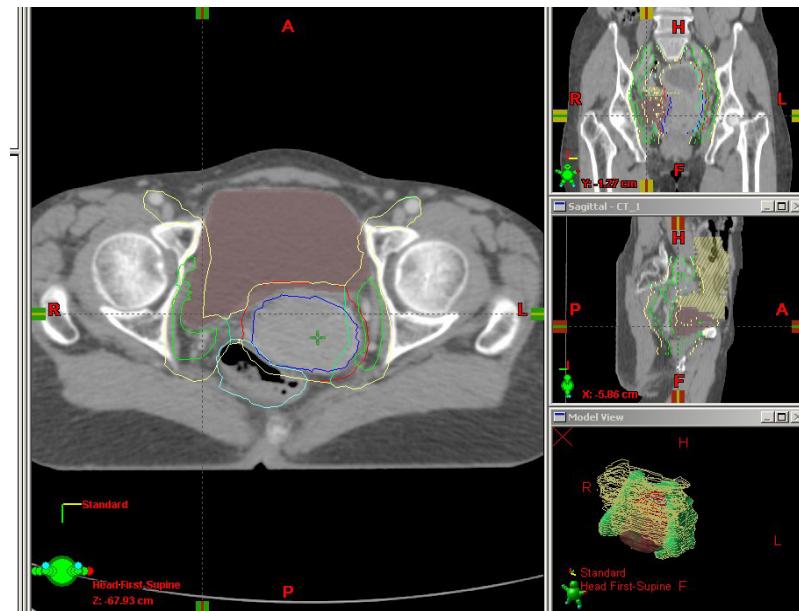
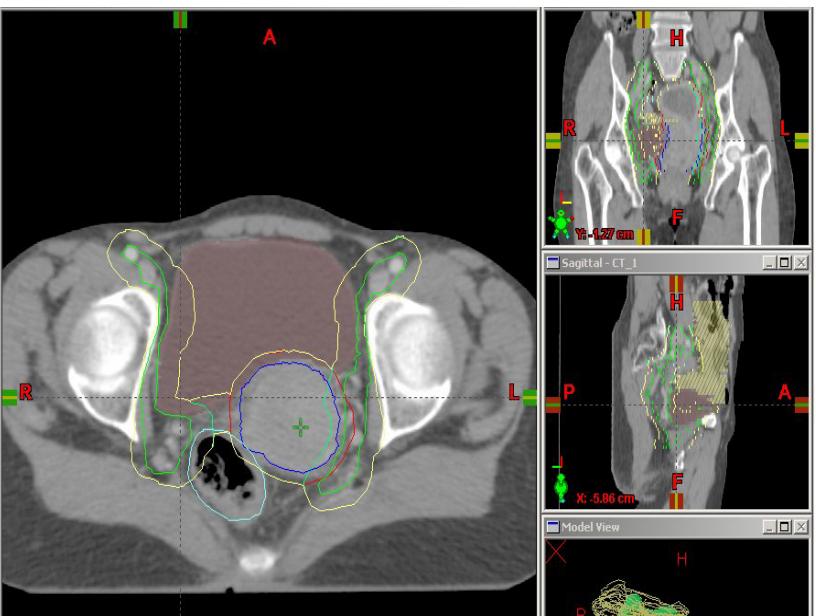


PTV PELVIS





OAR



SUMMARY

- Primary Pelvic tumors : No definite consensus for GTV / CTV
 - Pelvic Nodal Delineation : Guidelines evolving but needs validation
 - Planning Imaging : CT standard as of today
 - Planning Imaging : Newer imaging MRI, MRS, CT – PET etc
 - Reproducibility of Volumes : No standard guidelines
 - Tumor Regression during RT : Active Research Area

Thank You 26