Pelvis Planning – A Dosimetrists Story

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ROSWELL PARK
COMPREHENSIVE CANCER CENTER

Welcome

- 19th Annual ROC Niagara Conference
- 2019 Pelvic Radiation Symposium
- 19 Presenters and Topics

Disclosure

- I have no disclosures relative to the presented materials
- The following presentation is a reflection of studies, protocols, and opinions
- No honorarium has been received in regards to the subsequent material
- Eclipse v15

Meet The Speaker

- Lee Culp, M.S CMD RT(T)
- Dosimetrist at Roswell Park Comprehensive Cancer Center
- Previously at THE Ohio State University
- Masters in Dosimetry from University of Wisconsin – La Crosse
- Business and Communication BS from University of Buffalo

My Pride and Joy

Luna

Stella

Radiotherapy at Roswell

- Treat all sites, including Brachy and Gamma
- 4 vaults & Brachy suite
- 1 CT
- 17 Radiation Therapists
- 8 Medical Dosimetrists
- 11 Radiation Physicists

Roswell Park

- Founded in 1898
- First institution in the world to focus exclusively on cancer research
- Mission includes patient care, cancer prevention, and education
- Ranked 14th in the nation for top cancer hospitals in the US News

What is This Talk About?

- Dosimetrists Guide to Pelvis Irradiation
- We'll discuss sites, preferred treatment/dosages, tips & tricks

Will This be Relevent to Therapists?

YES!

Gynecologic Cancers

- Ovaries
- Uterus
- Cervix
- Vagina
- Vulva

Gynecologic Cancers

- 4th most common malignant tumors diagnosed in women in the US
- 20% of all cancers
- 1 million cases diagnosed per year, worldwide

Gynecologic Cancers

- Radiation Therapy is commonly used as definitive treatment in early stages
- For locally advanced stages Radiation in conjunction with surgery and/or chemotherapy
- Palliative patients also receive Radiation

Cervical Cancer

Radiotherapeutic approaches

Extended field RT – with evidence of paraortic involvement

-Includes inguinal nodes with lower vaginal involvement

Brachytherapy in conjunction with pelvic RT

-Preoperatively, and intracavitary

VMAT – if Simultaneous Integrated Boost (SIB), or lymph involvement

-Center specific

Cervical Cancer

- Radiation used for nearly all stages
- Cure rates: 80%
- Radiation for early stages, alone
- If tumor exceeds 4cm surgery then RT

Uterine Cancer

- Receive Surgery upfront (total abdominal hysterectomy and bilateral salpingo-oophorectomy)
- RT is delivered postop
- -Either pelvic RT or brachytherapy
- RT may help risk of locoregional recurrence, along with chemo after surgery as well

Ovarian Cancer

- No longer used alone following surgery
- Used conjunctively with chemo and surgery
- Standard practice is adjuvant chemo
- RT is important in palliative treatments

Vulvar Cancer

- Upfront surgery
- Followed by adjuvant RT or chemo
- Adjuvant RT significantly reduced the risk of recurrence in the inguinal nodes
  - -Treatment of choice after surgery

Vulvar Cancer

RT Techniques

- Pelvic-inguinal irradiation (unresectable)
  - Followed by a boost with a midline block
- High dose to control primary tumor
- Limited use of Brachy in these cases

Vaginal Cancer

- RT is treatment of choice
- -Excellent outcomes
- Locally advanced receive RT and Brachy
- Low number of Vaginal cases diagnosed yearly

External Beam RT

- Used to irradiate multiple targets within pelvis
  - -Uterus/cervix
  - -Upper vagina
  - -Paracervical/parametrial tissues
  - -Pelvic lymph nodes

External Beam RT

- AP/PA fields
- Four-field (AP/PA plus laterals)
  - -Allows for more normal tissue sparring
    - -Small Bowel
    - -Posterior Rectum
- VMAT

External Beam RT

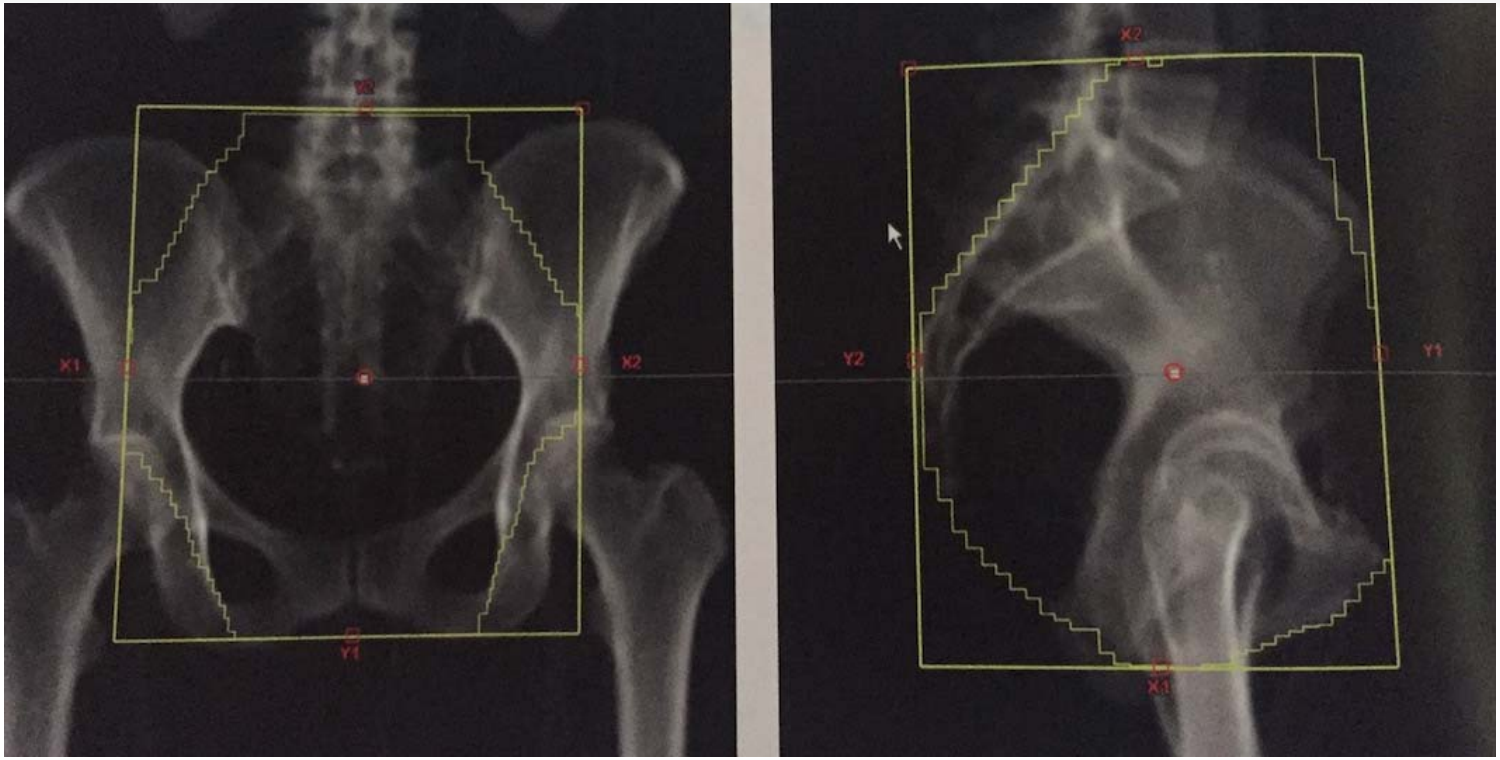
- Superior Border: L4-L5 to include common iliac lymph nodes
- Inferior Border: Inferior obturator foramen
- Lateral Borders: 1-1.5cm beyond pelvic brim

External Beam RT

- Anterior Border: lateral the pubic symphysis for external iliac nodes coverage
- Posterior Border: S2-S3 interspace

- Customized blocking (MLCs) to decrease dose to surrounding normal tissues

External Beam RT



External Beam RT

Positioning

- Most centers: Supine
- Some centers: Prone with a Bellyboard
  - -to help reduce the volume of small bowel irradiated
  - -Usually only three fields used
- Some centers prefer to treat with a full bladder to displace small bowel

***Consistent bladder and rectal filling throughout treatment is key**

External Beam RT

- Moderate-high energy photon beams (10+ MV)
- Lower energies can be used in thin patients (6 MV)
- Wedges added to lateral fields to decrease "hot spots"

External Beam RT

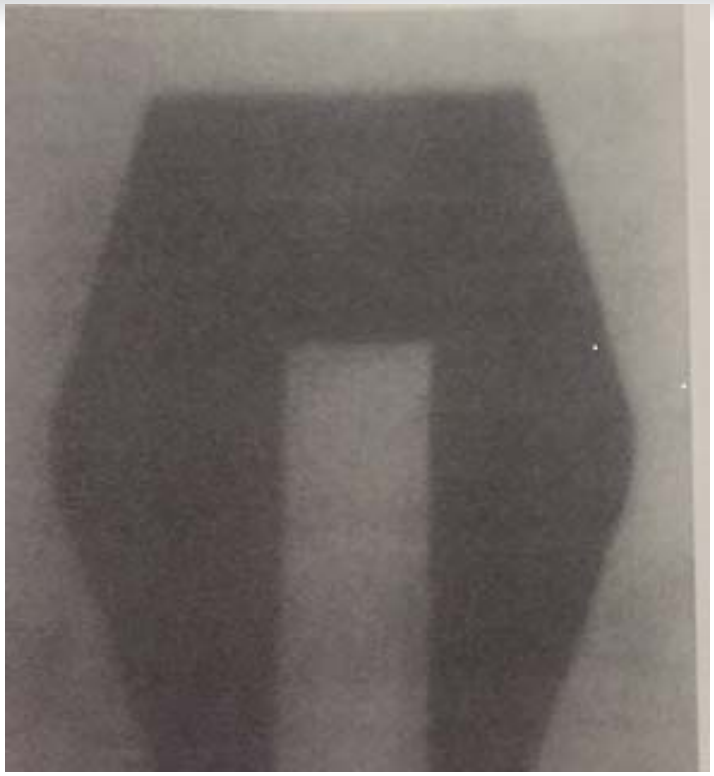
- Doses range from 3960 – 5040cGy
- 180 – 200cGy per fraction

- Higher doses used in patients undergoing external beam alone
- Lower doses for external beam + Brachy

External Beam RT

- Midline block used sometimes
  - Allows higher total dose utilizing Brachy
    - Cervical patients
    - Typically 1000 – 1200cGy
      - 5 – 6 fractions

External Beam RT



External Beam RT

- IMRT has seen in increase in GYN cancers
- Effective in reducing pelvic bone marrow irradiation
  - This is especially useful with patients receiving concurrent chemo

External Beam RT

- IMRT
  - Utilized to deliver higher doses
  - Conventional techniques made it hard to deliver doses above 6000cGy
  - Can use SIB with IMRT

External Beam RT

- SIB
  - Utilized with involved para-aortic nodes
  - Para-aortic receives conventional Fractions
    - 180cGy/day 4500cGy total dose
  - Involved Nodes receive *Higher* than conventional fraction
    - 240cGy/day 6000cGy total dose

External Beam RT

Targets based on ICRU 50 Guidelines

- GTV – Gross tumor volume
- CTV – Clinical target volume
- CTV_{Nodes} – Common, external and internal iliac nodes and pre-sacral space
- CTV_{Vagina} – vaginal cuff + paravaginal/parametrial tissues
- PTV – CTV + 1-2cm
  - For Patient setup uncertainty and organ motion

External Beam RT

Normal Tissues:

- Small Bowel
- Bladder
- Rectum
- Sigmoid Colon
- Pelvic Bones/Femoral Heads

External Beam RT

VMAT plans

-Typically 4500cGy

-180cGy daily

VMAT + Brachy plans

-Higher doses at 5040cGy

External Beam RT

Frog Leg?

Lower Vaginal, Pelvic-inguinal Irradiation
Supine
Minimize skin folds
-Reducing Hot spots

External Beam RT

Constraints

- Small bowel max < 4500cGy
- Kidneys <33% to receive less than 1000cGy
- Spinal Cord max <4500cGy
- Rectum <50% to receive less than 5000cGy
- Bladder <50% to receive less than 5500cGy

Prostate Cancer

- Most common malignant tumors diagnosed in men in the US
- 190,000 new cases yearly
- 27,000 men die annually
- PSA tests improve outcomes

Prostate Cancer

RT Techniques

- External photon beam
  -CT/MRI - IMRT
- Low Dose rate Brachy
- High Dose rate Brachy

Prostate Cancer

Radical Prostatectomy

- Substantial risk or impotence
- Urinary incontinence
- Sexual dysfunction

Prostate Cancer

External Beam Radiation Therapy

- Prostate always be treated
- Include?
  - Seminal Vesicles
  - Pelvic Lymph Nodes
    - Associated with high risk nodal disease and worse clinical outcome

Prostate Cancer

External Beam Radiation Therapy

- Normal Structures/OAR
  - Rectum
  - Bladder
  - Femoral Heads
  - Penile Bulb
  - Small/Large Bowels

Prostate Cancer

External Beam Radiation Therapy

- Traditionally four field technique
- Inverse-planned IMRT
  - Improved normal tissue DVH
  - Receive higher doses with IMRT

Prostate Cancer

External Beam Radiation Therapy

- Fractionation:
  - 7020 – 8000 cGy
  - Fossa 6800 cGy
    - 180 – 200 cGy/day

Tips & Tricks - Planning

- 6X or 10X (if possible)
  - 10X can cool off the plan
- Full Bladder/Empty Rectum
  - Should be similar for each treatment

Tips & Tricks - Planning

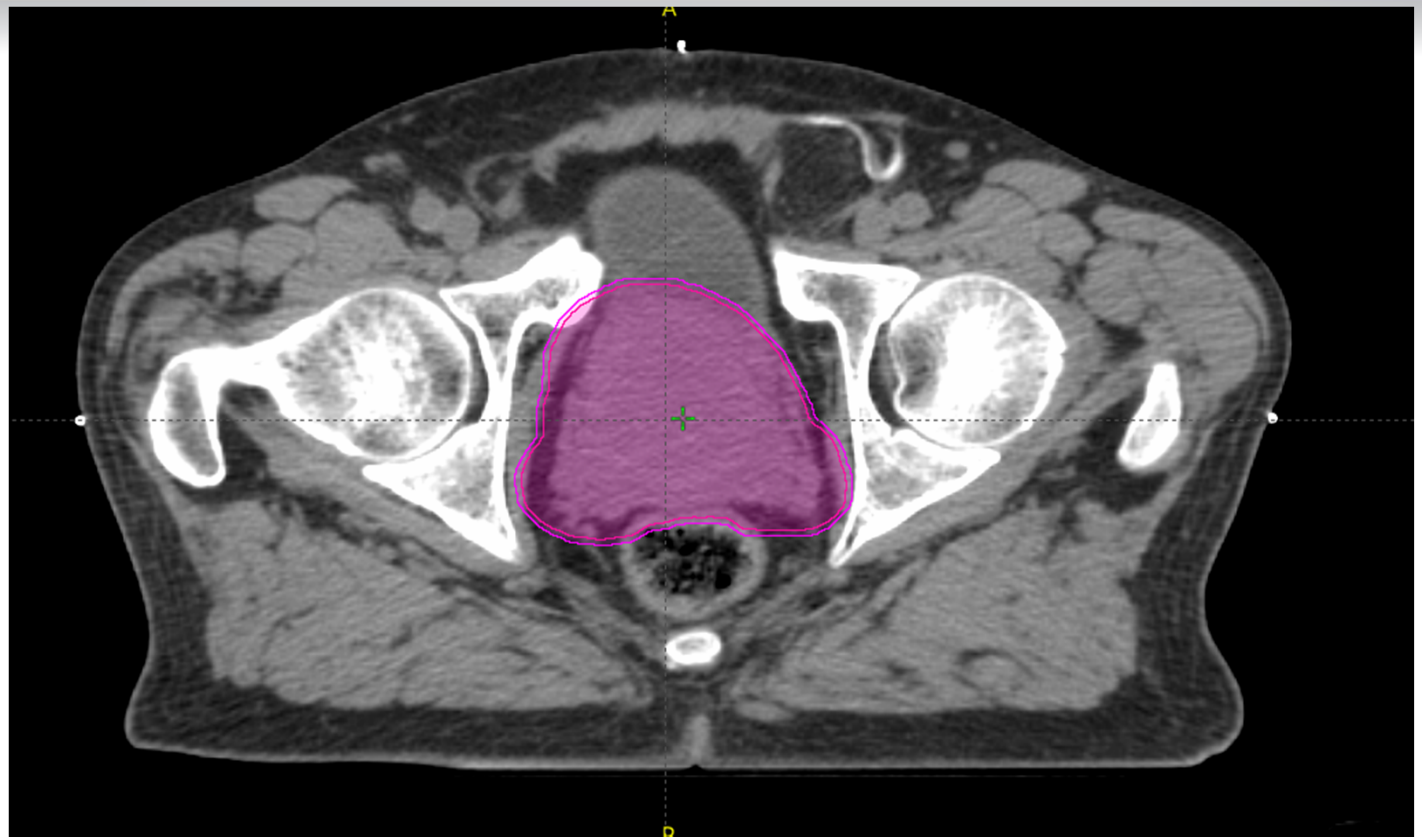
Isocenter: Central to PTV

- Beam is most intense at the center
  - Minimize travel of x jaws which is 15 cm
- ANT/POST where rectum/prostate meet
  - Can help decrease rectal dose

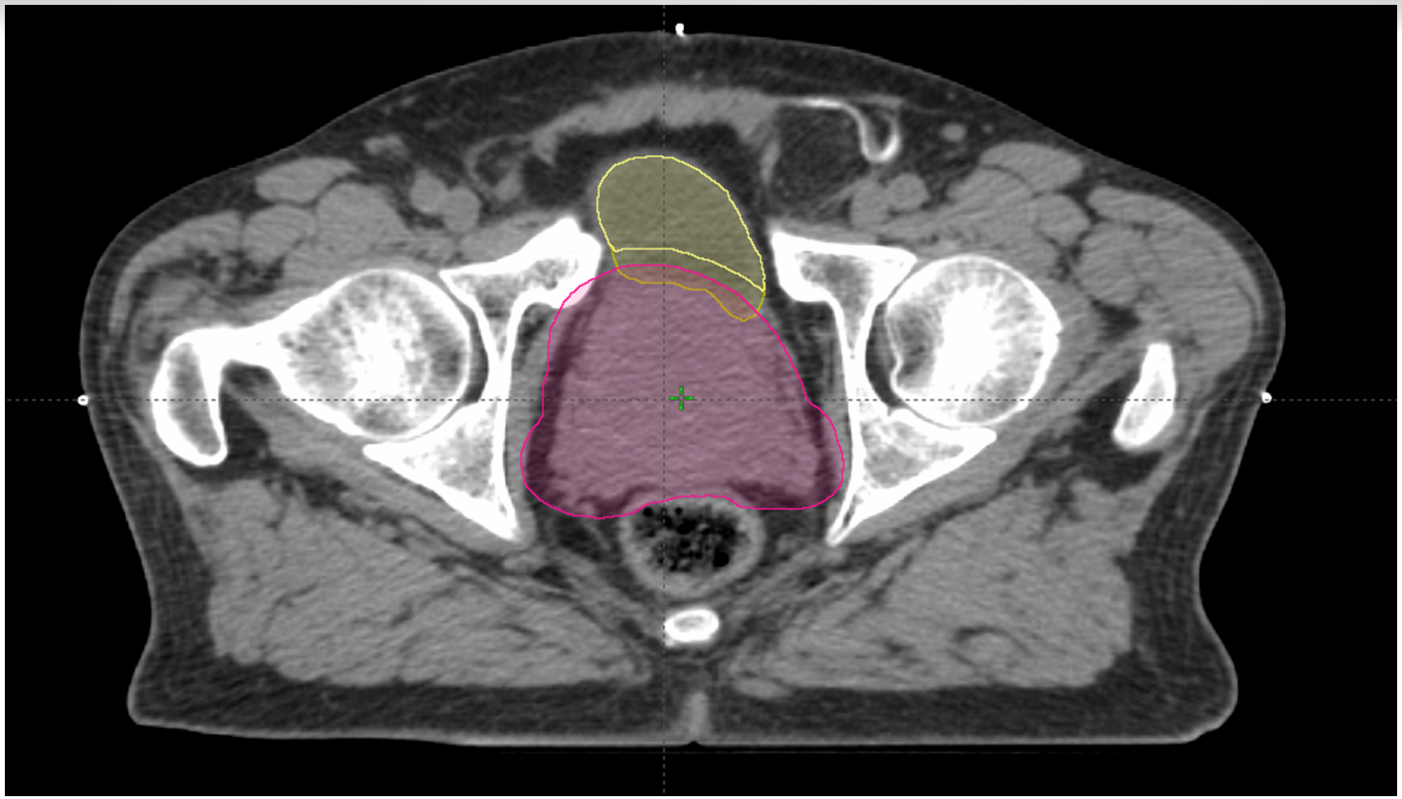
Tips & Tricks - Planning

- Collimator angles should be the slope of the rectum
- Playback arc rotation prior to Optimization
  - -Ensures jaws not too tight on PTV
    - -Will cause plan to be hot

Trick Structures – _pPTV

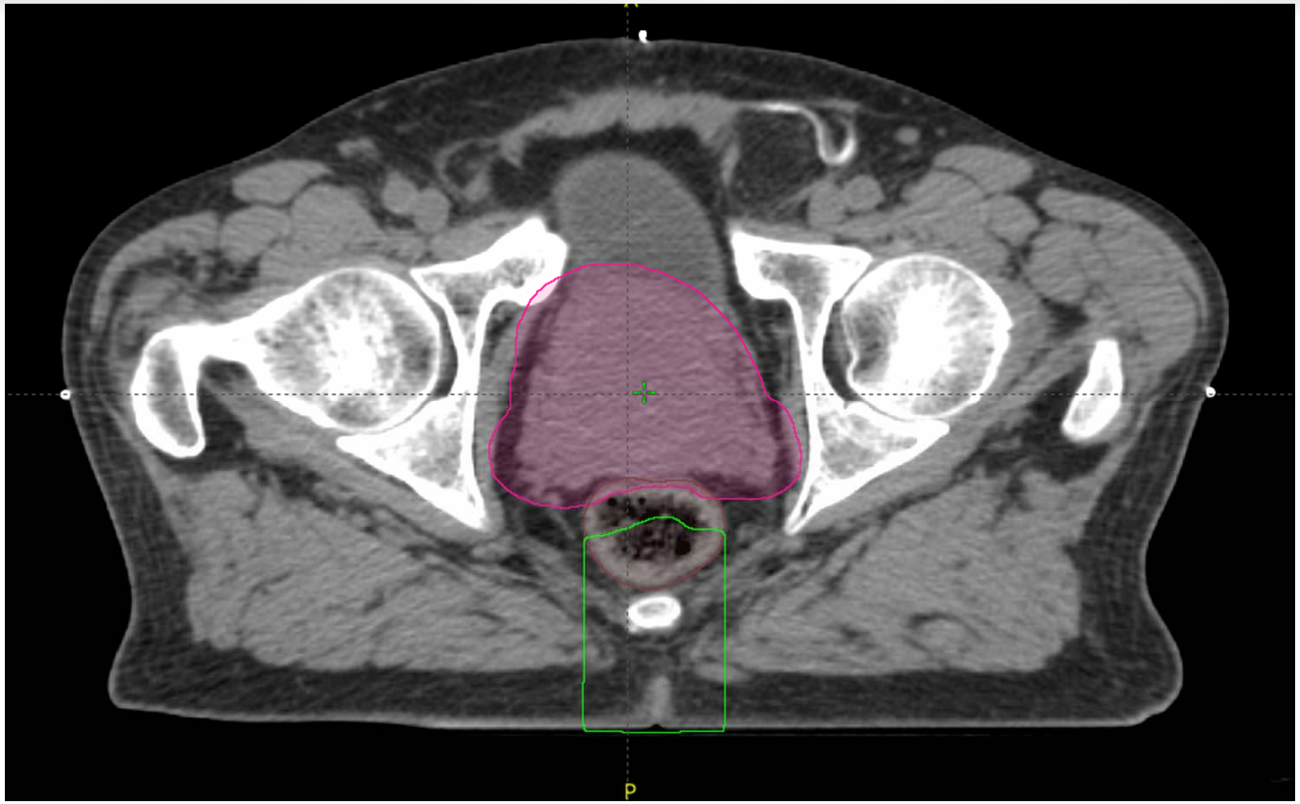


Trick Structures – _Bladder OUT

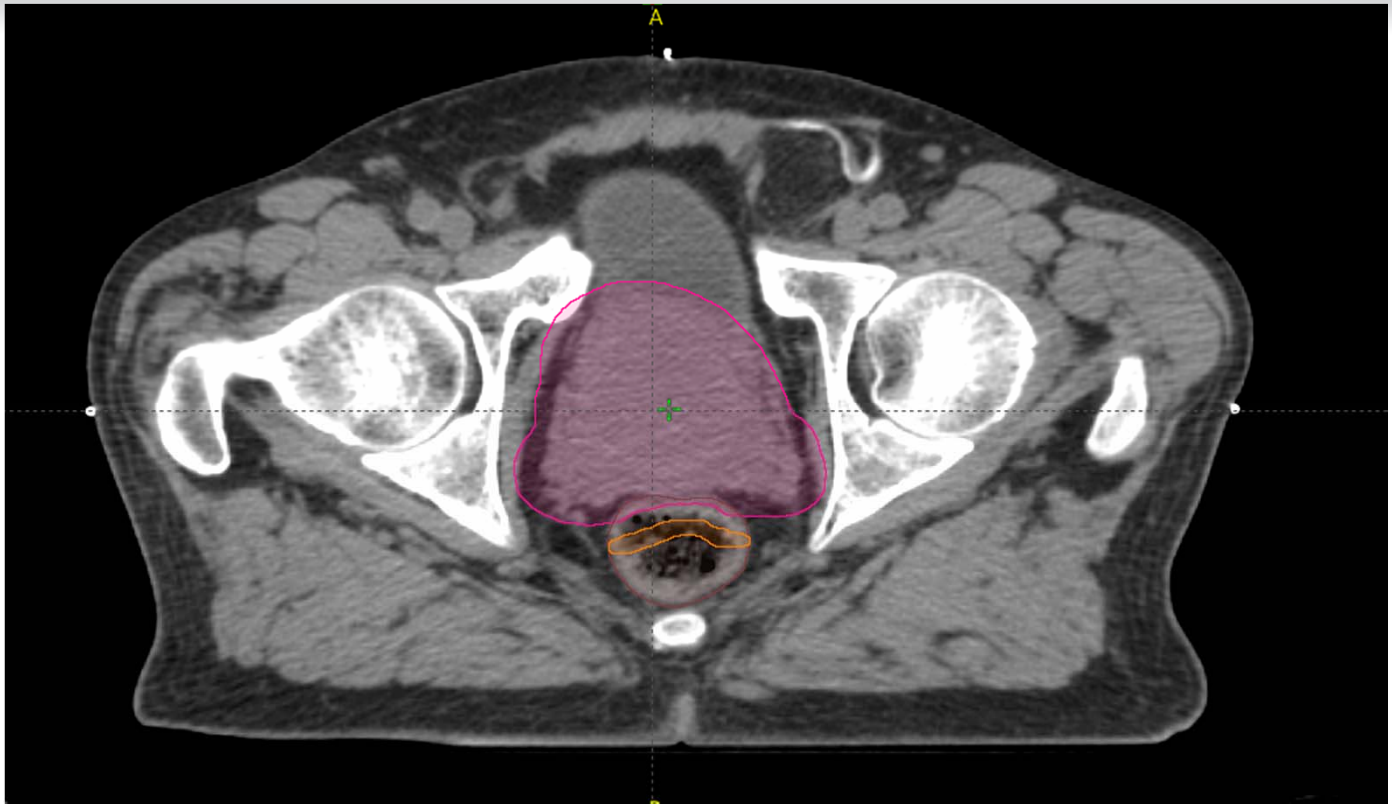


Trick Structures – _Rectum OUT

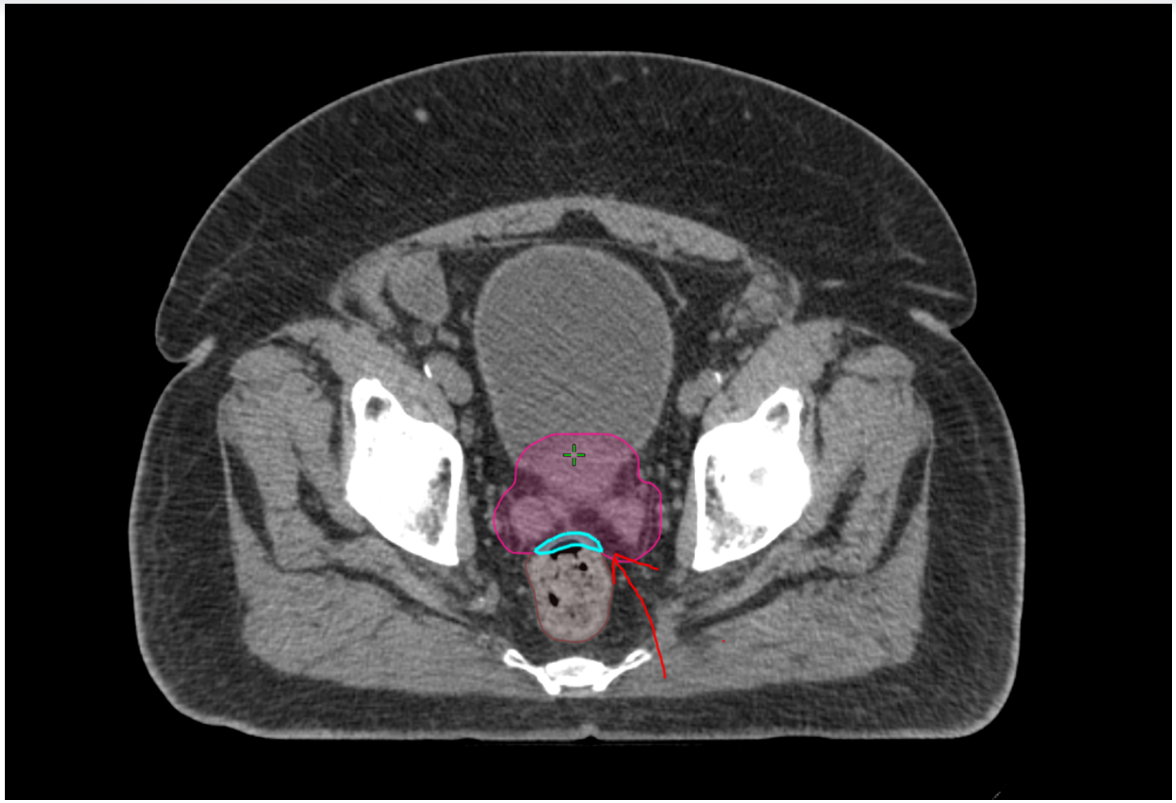
Trick Structures – _POST Avoid



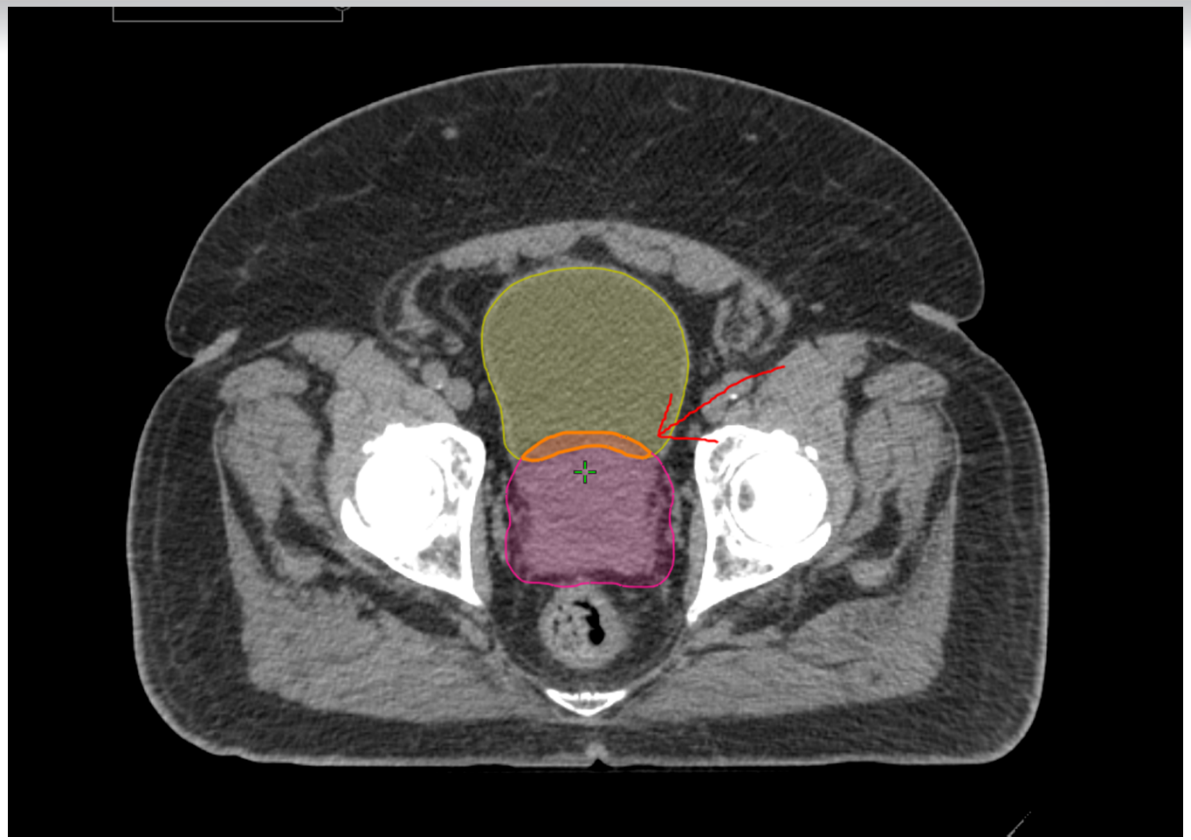
Trick Structures – _Rectum Avoid



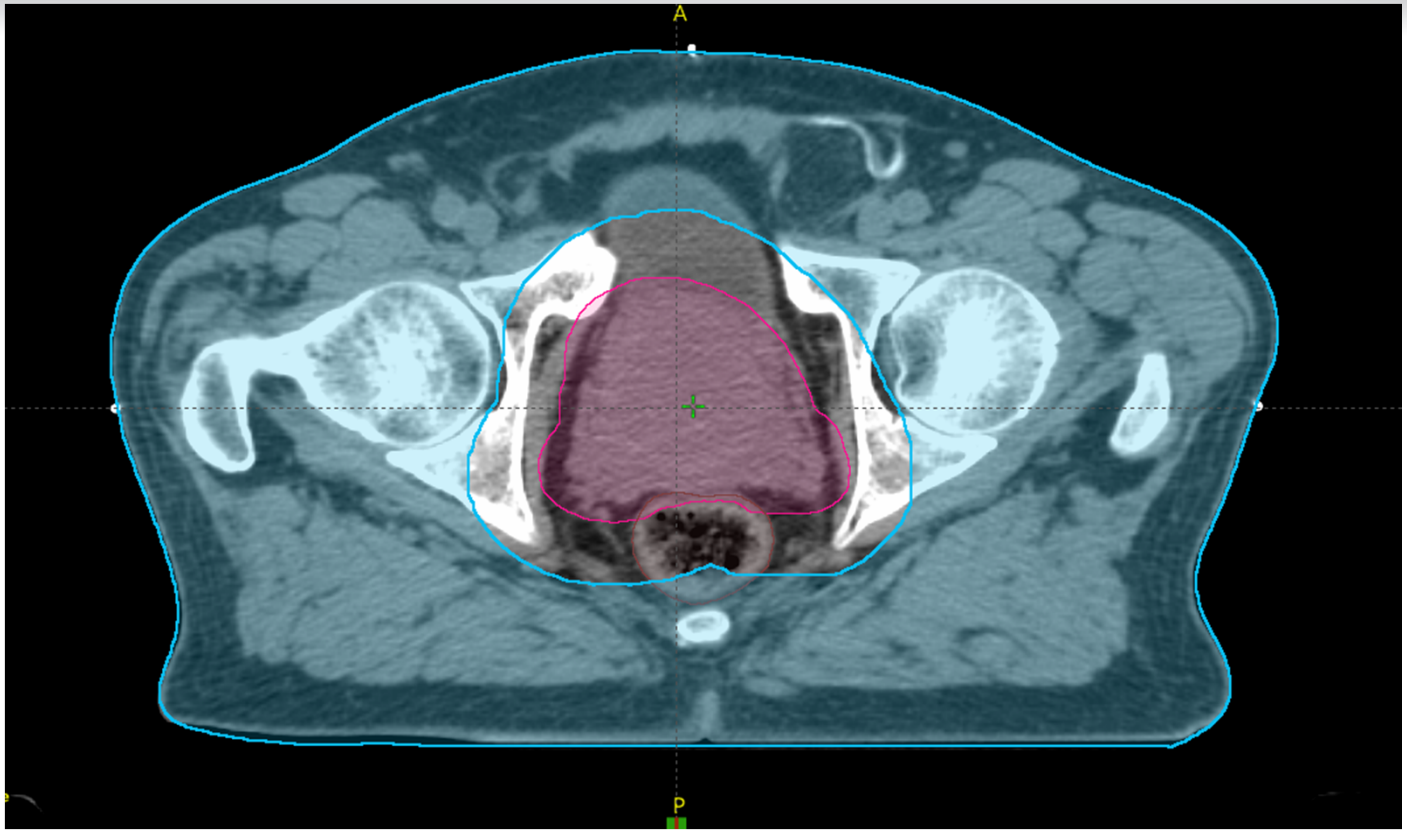
Trick Structures – _Rectum IN



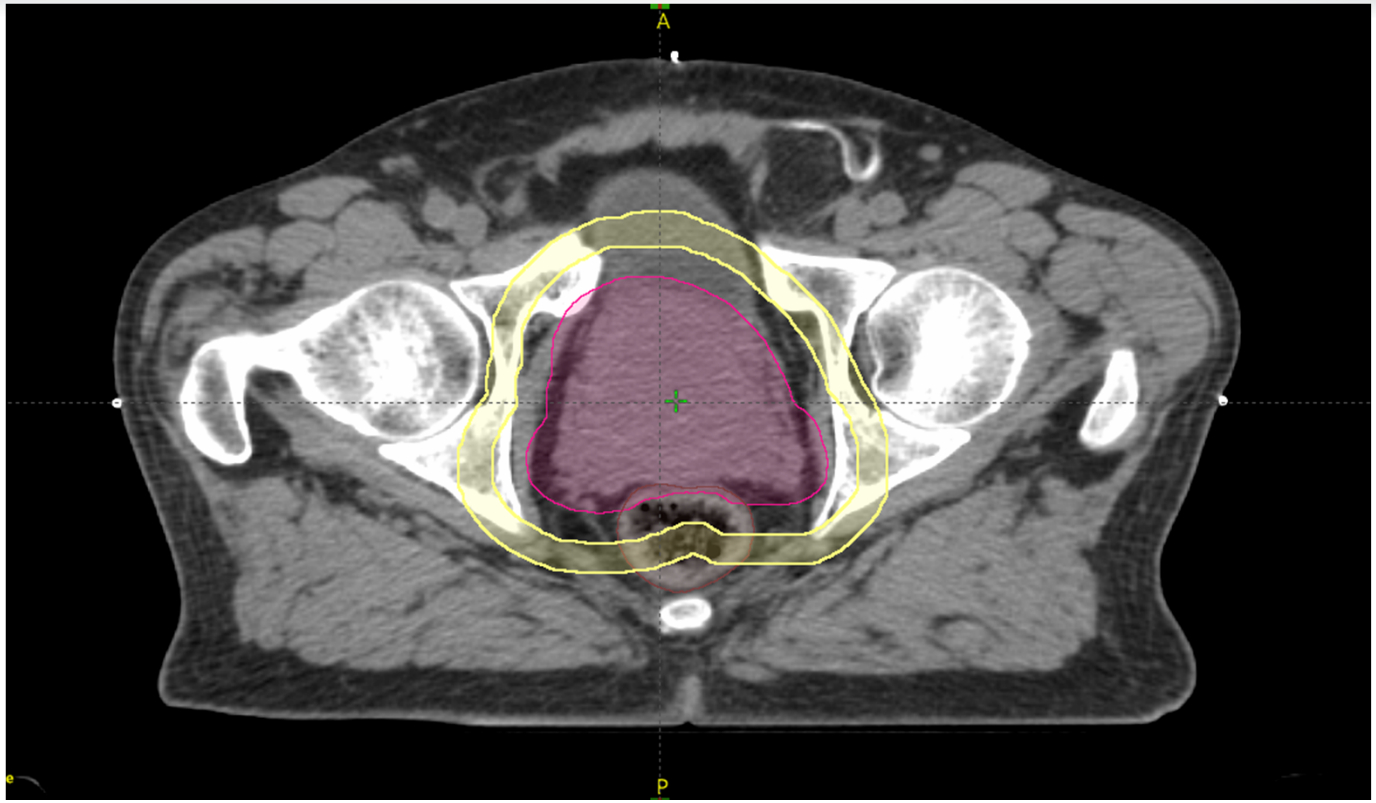
Trick Structures – _Bladder IN



Trick Structures – _Ring50



Trick Structures – _Ring80



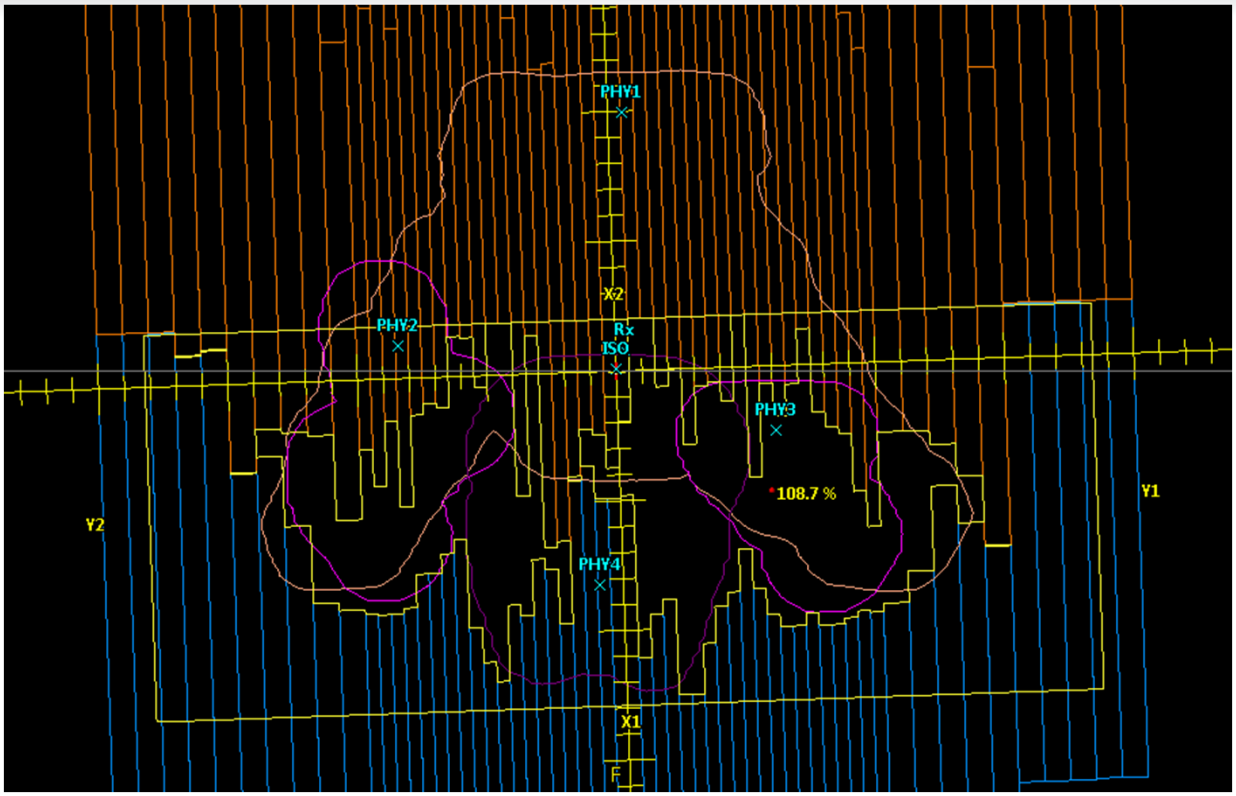
Trick Structures –

- 2 arcs
  - Small, round, simple structure
    - Bladder or prostate
  - 1st arc 5-30* collimator
  - 2nd arc 90* collimator

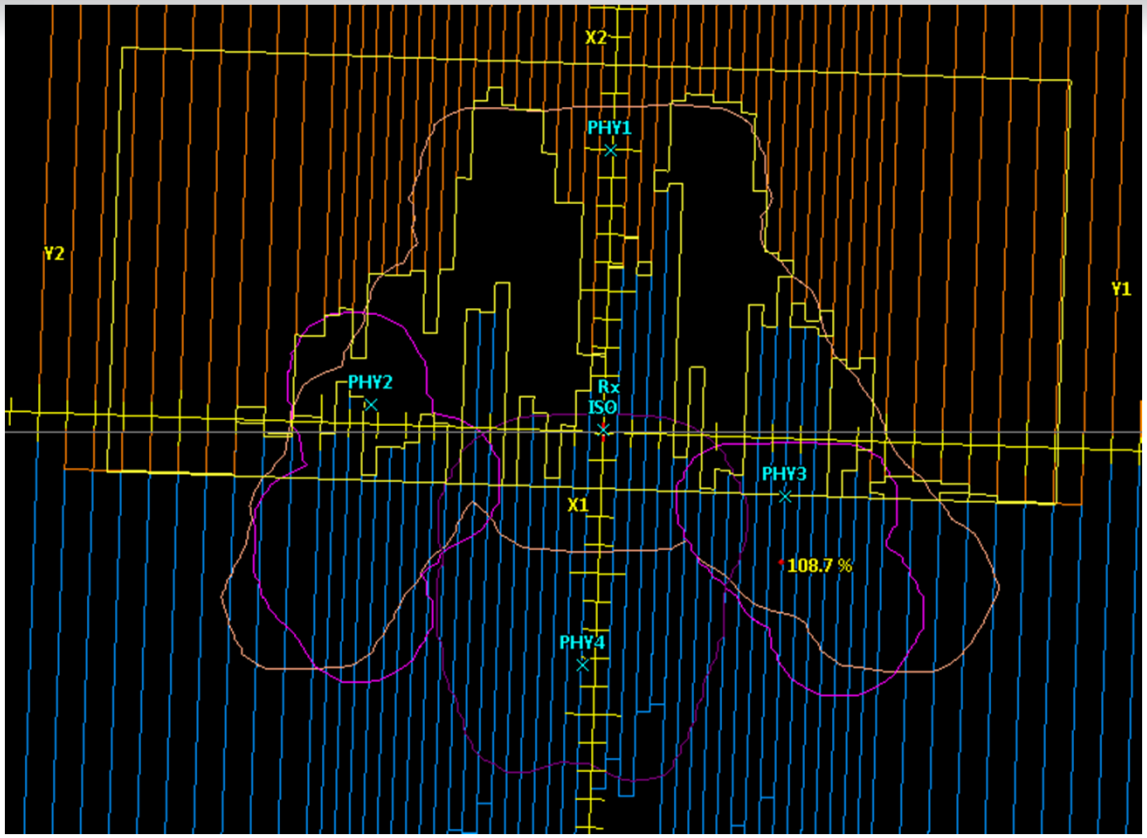
Trick Structures –

- 3 arcs
  - Nodal patients
  - 1st arc 5-30* collimator
  - 2nd arc 88-90* collimator
  - 3rd arc 90-92* collimator

2nd & 3rd arc

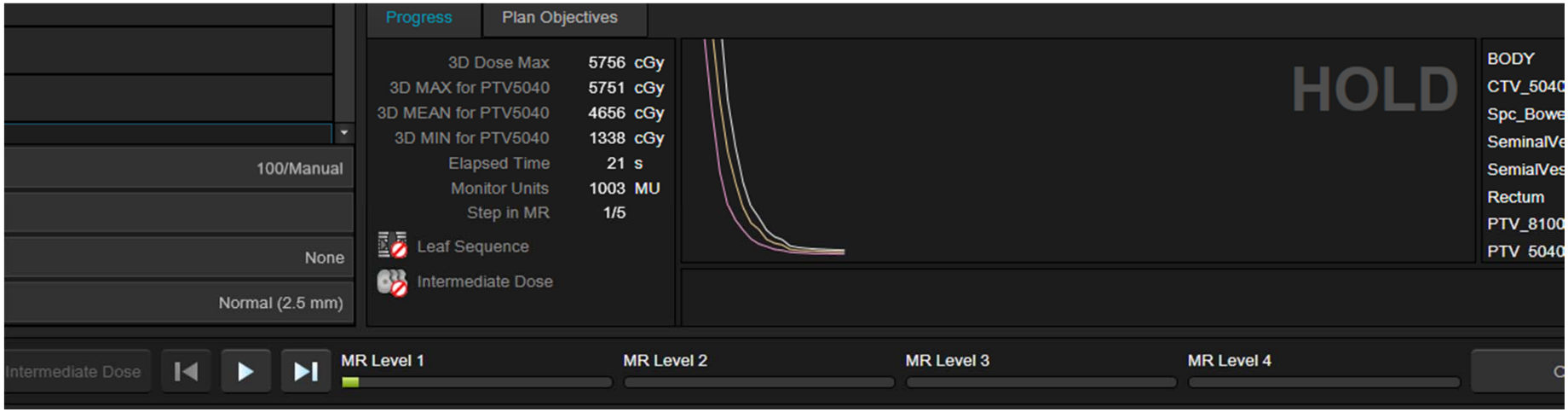


2nd & 3rd arc



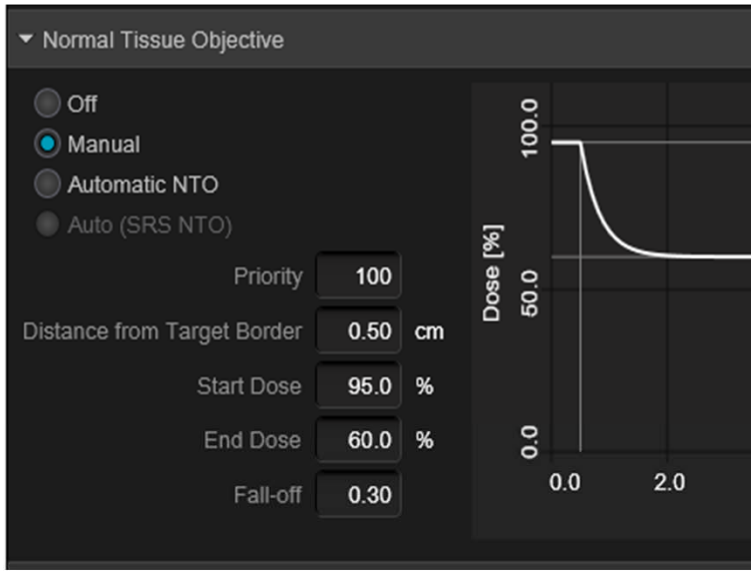
Tips & Tricks - Optimizer

- Make most changes in MR Level 1



Tips & Tricks - Optimizer

- NTO
  - Priority 100-150
  - Distance Target: 0.5cm
  - Start Dose: 95
  - End Dose : 60
  - Fall-off: 0.05-0.3



Questions?

Any Questions?

Thank You

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