IMRT AND VMAT: CURRENT AND FUTURE BEST PRACTICES

(OR: DON’T FORGET ABOUT IMRT AND HOW TO SETUP STATIC FIELDS)

Anthony Magliari MS, CMD
I am employed by Varian Medical Systems on the Medical Affairs team

My job currently includes testing new products and providing feedback

I’ve spent over a year planning with Varian’s newest delivery platform: Halcyon (510k pending, not for sale)

I used Eclipse to create the Halcyon plans used in this presentation (it is currently the only commercially available Treatment Planning System for Halcyon)

- I will focus on treatment planning concepts not specific product features where possible (however, screenshots will be utilized where required)
- The views expressed in this presentation are mine, and mine alone. They do not represent those of Varian Medical Systems
- All Halcyon case examples shown here can be viewed/downloaded from: http://medicalaffairs.varian.com
I’ve been working with Treatment Planning Systems since 2002 and have been a clinical dosimetrist since 2011.

I married a dosimetrist and my sister is a dosimetrist.

Last year, at the 2016 AAMD annual meeting, I spoke about Knowledge Based Planning and the role for the dosimetrist as a model creator.

In the clinic I often annoyed therapists by creating IMRT plans when they would’ve preferred to treat the patient with VMAT.

I’m a big fan of Plan Challenge / Plans Studies (www.proknowsystems.com) and love using them as benchmark cases to study differences in delivery systems and treatment planning systems (even algorithms / version differences).

For the record: I’ve never “won” any fully public plan study or plan challenge.

I’m not going to include silly pictures in this presentation, subject matter should be enough to keep people interested.

And, I like questions.
OUTLINE

• Background overview of delivery system specifications for the plans I will show
  – “IMRT comeback”?
• When to use IMRT or VMAT based on target shape and/or OAR relative shape/position
  – Examples of cases where IMRT can potentially provide greater OAR sparing
    • IMRT beam arrangements selected in transverse view based on target shape and OAR
      – Brain (sequential boost GBM)
      – Breast/chestwall (on traditional delivery systems)
      – Head and Neck (simultaneous integrated boost)
  – Example cases where VMAT can provide greater homogeneity or more uniform dose fall-off
    • Head and Neck (slight increase in target homogeneity potential)
    • SBRT Prostate and Spine (SRS/SBRT quick dose falloff in all directions primary goal)
  – Review IMRT vs VMAT depends on target shape and planning goals – pick the right technique
• The importance of utilizing unique collimator rotations for each field/arc (esp. with larger leaf sizes)
  – Examples selecting collimator rotations from Beams Eye View for IMRT and VMAT plans
• General optimization tips/best practice
  – Target/OAR relative weight/priority and associated cost function – do they “make sense”?
    • IMRT specific: Relative smoothing factor priorities for fluence based optimization
    • VMAT specific: Min/max MU settings
  – Non OAR / Normal Tissue Optimization strategies based on number of fields / arc (non)coplanar
    – “Thorough optimization”
• Plan Challenge / Plan Study Retrospective: applying these principles against prior benchmarks
• Considering the present and future
  – IMRT: where it is best for the patient/plan
  – VMAT: hypofractionated breast with Simultaneous Integrated Boost meeting all RTOG 1005 arm2 dose constraints

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
DELIVERY SYSTEM SPECIFICATIONS FOR THESE CASES

- 6X FFF beam at 800 MU/min (all plans require beam modulation)
- 28x28 max field size (greater size requires a multi-isocenter plan)
- Traditional “wind up” gantry, treats from -180 to +180 as per standard (not helical)
- No couch rotation (coplanar delivery only)
- Dual layer “stacked and staggered” MLC
  - Each leaf can reach across the entire 28cm field
    - No more split field delivery / carriage shifts
    - Full field modulation
  - 1cm physical leaf width at isocenter
    - Stacked and staggered hardware design allows for a 5mm effective leaf width
      - Initial software release uses 1cm effective leaf width
      - Stacked and staggered design results in “per leaf jaw tracking” effect
    - Drastically reduced leaf leakage (0.01%)
      - No jaws needed
Stacked and staggered MLC example
DELIVERY SYSTEM SPECIFICATIONS (CONTINUED)

- 4RPM gantry rotation speed (4x traditional speed)
- 2RPM gantry speed with “beam on” (2x traditional speed)
- 5cm/second MLC leaf speed (2x traditional speed)
- 2.5RPM collimator rotation speed (faster or the same depending on comparison)
- 800MU/min dose rate often maintained during IMRT sliding window delivery (~2x norm)

= 9 field IMRT on this system has similar treatment time to 2 arc VMAT on current systems!
**Treatment speed example:** 2012 AAMD / ROR Plan Challenge (https://www.youtube.com/watch?v=QKpc2OGtFuo)

Advanced Stage Lung 63Gy / 35fx

**IMRT 8F** (2:27) treatment field delivery time

**VMAT 5PA** (2:01) treatment arc delivery time

(both cases score >100% of cases submitted in 2012 AAMD/ROR Lung Plan Challenge)
IMRT – COULD IT COME BACK IN STYLE?

• Many institutions implement VMAT in their clinic and “forget about IMRT”
• IMRT is always faster to optimize
  – Iterate through plan versions quicker
  – Thoroughly optimized plans don’t take much longer
• Carefully selected static gantry angles can provide better dosimetric result than VMAT
  – Depends on target shape, OARs and planning goals
• IMRT is often ideal for controlling low dose with beam angle selection
  – Thorax targets (protecting heart and healthy lung)
    • Esophagus
    • Lung
    • Breast/chestwall
  – Manually avoiding treating through metal implants
  – Manually avoiding exit dose through pacemaker/ICD
• But IMRT is slower to deliver (especially with split fields/carriage shifts)
  – maybe not in the future… ”IMRT comeback”?
IMRT BEAM ANGLE SELECTION EXAMPLE 1: BRAIN GBM RTOG 0825 60GY (46GY/23FX+14GY/7FX SEQUENTIAL)
IMRT BEAM ANGLE SELECTION EXAMPLE1: BRAIN GBM RTOG 0825 60GY(46GY/23FX+14GY/7FX SEQUENTIAL)
IMRT BEAM ANGLE SELECTION EXAMPLE 1: BRAIN GBM RTOG 0825 60GY(46GY/23FX+14GY/7FX SEQUENTIAL)
IMRT BEAM ANGLE SELECTION EXAMPLE 1: BRAIN GBM RTOG 0825 60GY(46GY/23FX+14GY/7FX SEQUENTIAL)
IMRT BEAM ANGLE SELECTION EXAMPLE 1: BRAIN GBM RTOG 0825 60GY (46GY/23FX+14GY/7FX SEQUENTIAL)
IMRT BEAM ANGLE SELECTION EXAMPLE 1: BRAIN GBM RTOG 0825 60GY (46GY/23FX+14GY/7FX SEQUENTIAL)
IMRT BEAM ANGLE SELECTION EXAMPLE 1:
BRAIN GBM RTOG 0825 60GY(46GY/23FX+14GY/7FX SEQUENTIAL)

Boost target is round, use VMAT
IMRT BEAM ANGLE SELECTION EXAMPLE 2: BREAST/CHESTWALL (ON TRADITIONAL DELIVERY SYSTEMS)
When starting the beam arrangement be sure not to overlap too many fields over contralateral breast.
IMRT BEAM ANGLE SELECTION EXAMPLE 2: BREAST/CHESTWALL (ON TRADITIONAL DELIVERY SYSTEMS)

“crossup beams” en face effect with less exit dose through ipsilateral lung

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
IMRT BEAM ANGLE SELECTION EXAMPLE 2: BREAST/CHESTWALL (ON TRADITIONAL DELIVERY SYSTEMS)

nearly lateral and opposing directly between first medial beams
IMRT BEAM ANGLE SELECTION EXAMPLE 2: BREAST/CHESTWALL (ON TRADITIONAL DELIVERY SYSTEMS)

opposing directly between first medial beams and beyond for a concave beam arrangement
IMRT BEAM ANGLE SELECTION EXAMPLE3: HEAD&NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD&NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD & NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD & NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD&NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE: HEAD&NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD & NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD & NECK (2017 QADS/PROKNOW PLAN STUDY)
IMRT BEAM ANGLE SELECTION EXAMPLE 3: HEAD & NECK (2017 QADS/PROKNOW PLAN STUDY)
### IMRT Beam Angle Selection Example 3: Head & Neck (2017 QADS/PROKNOW Plan Study)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Result</th>
<th>Min Req</th>
<th>Ideal</th>
<th>Points</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (%o of the PTV70 covered by 70 (Gy))</td>
<td>95.00</td>
<td>90</td>
<td>✓</td>
<td>95</td>
<td>14.99</td>
</tr>
<tr>
<td>Volume (%o of the PTV70 covered by 73.5 (Gy))</td>
<td>0.00</td>
<td>0</td>
<td>✓</td>
<td>0</td>
<td>7.00</td>
</tr>
<tr>
<td>Dose (Gy) covering 0.03 (cc) of the PTV70</td>
<td>72.93</td>
<td>50</td>
<td>✓</td>
<td>71.3</td>
<td>3.52</td>
</tr>
<tr>
<td>Volume (%o of the CTV70 covered by 70 (Gy))</td>
<td>99.45</td>
<td>95</td>
<td>✓</td>
<td>99</td>
<td>7.00</td>
</tr>
<tr>
<td>Volume (%o of the PTV63-PTV70 covered by 63 (Gy))</td>
<td>95.52</td>
<td>90</td>
<td>✓</td>
<td>95</td>
<td>15.00</td>
</tr>
<tr>
<td>Volume (%o of the PTV63-PTV70 covered by 66.15 (Gy))</td>
<td>31.18</td>
<td>90</td>
<td>✓</td>
<td>20</td>
<td>5.04</td>
</tr>
<tr>
<td>Volume (%o of the CTV63-CTV70 covered by 63 (Gy))</td>
<td>99.39</td>
<td>95</td>
<td>✓</td>
<td>99</td>
<td>7.00</td>
</tr>
<tr>
<td>Volume (%o of the PTV56-PTV63 covered by 56 (Gy))</td>
<td>95.43</td>
<td>90</td>
<td>✓</td>
<td>95</td>
<td>15.00</td>
</tr>
<tr>
<td>Volume (%o of the PTV56-PTV63 covered by 58.8 (Gy))</td>
<td>25.40</td>
<td>90</td>
<td>✓</td>
<td>30</td>
<td>7.00</td>
</tr>
<tr>
<td>Volume (%o of the CTV56-CTV63 covered by 56 (Gy))</td>
<td>98.11</td>
<td>95</td>
<td>✓</td>
<td>99</td>
<td>7.00</td>
</tr>
<tr>
<td>Conformation Number (53.2 (Gy), PTV56)</td>
<td>0.80</td>
<td>0.5</td>
<td>✓</td>
<td>1</td>
<td>9.93</td>
</tr>
<tr>
<td>Dose (Gy) covering 0.03 (cc) of the SPINAL_CORD</td>
<td>47.16</td>
<td>48</td>
<td>✓</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Dose (Gy) covering 0.03 (cc) of the BRAINSTEM</td>
<td>50.62</td>
<td>52</td>
<td>✓</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Dose (Gy) covering 0.03 (cc) of the RT COCHLEA</td>
<td>25.38</td>
<td>45</td>
<td>✓</td>
<td>35</td>
<td>5.00</td>
</tr>
<tr>
<td>Dose (Gy) covering 0.03 (cc) of the LT COCHLEA</td>
<td>29.82</td>
<td>45</td>
<td>✓</td>
<td>35</td>
<td>5.00</td>
</tr>
<tr>
<td>Volume (%o of the LIPS covered by 30 (Gy))</td>
<td>17.08</td>
<td>40</td>
<td>✓</td>
<td>20</td>
<td>5.00</td>
</tr>
<tr>
<td>Mean dose (Gy) to the RT_PAROTID</td>
<td>23.87</td>
<td>30</td>
<td>✓</td>
<td>24</td>
<td>7.00</td>
</tr>
<tr>
<td>Volume (%o of the MANDIBLE covered by 70 (Gy))</td>
<td>9.23</td>
<td>35</td>
<td>✓</td>
<td>10</td>
<td>5.00</td>
</tr>
<tr>
<td>Mean dose (Gy) to the LARYNX</td>
<td>39.20</td>
<td>30</td>
<td>✓</td>
<td>46</td>
<td>7.00</td>
</tr>
<tr>
<td>Volume (%o of the POST NECK covered by 35 (Gy))</td>
<td>9.27</td>
<td>30</td>
<td>✓</td>
<td>10</td>
<td>5.00</td>
</tr>
<tr>
<td>Structure(s) containing the global max dose point (7 values)</td>
<td>Elsewhere</td>
<td>✓</td>
<td>✓</td>
<td>CTV70</td>
<td>5.00</td>
</tr>
<tr>
<td>Estimated beam-on time, all beams (minutes)</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative meterset over all treatment beams</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td>21 (of 21)</td>
<td>17 (of 21)</td>
<td>144.49</td>
<td>150.00</td>
<td></td>
</tr>
</tbody>
</table>

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
IMRT BEAM ANGLE SELECTION EXAMPLE3: HEAD&NECK (2017 QADS/PROKNOW PLAN STUDY)
### WHAT ABOUT VMAT?

#### HEAD&NECK (2017 QADS/PROKNOW PLAN STUDY)

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Country</th>
<th>TPS</th>
<th>Modality</th>
<th>Score</th>
<th>Dose QA Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonathan Stenbeck</td>
<td>Greenville Health System</td>
<td>United States</td>
<td>Eclipse</td>
<td>VMAT</td>
<td>146.9</td>
<td>ArcCHECK</td>
</tr>
<tr>
<td>Richard Shores</td>
<td>Greenville Health System</td>
<td>United States</td>
<td>Eclipse</td>
<td>VMAT</td>
<td>146.0</td>
<td></td>
</tr>
<tr>
<td>Rik Westendorp</td>
<td>Behandellocatie Deventer</td>
<td>The Netherlands</td>
<td>RayStation</td>
<td>Tomotherapy</td>
<td>145.8</td>
<td></td>
</tr>
<tr>
<td>Joakim Nilsson</td>
<td>SkÅVnes Universitetssjukhus</td>
<td>Sweden</td>
<td>Eclipse</td>
<td>VMAT</td>
<td>145.7</td>
<td>Delta4</td>
</tr>
<tr>
<td>ROLLAND Julien</td>
<td>Institut Paoli Calmettes - CHICAS</td>
<td>France</td>
<td>RayStation</td>
<td>VMAT</td>
<td>145.7</td>
<td>ArcCHECK</td>
</tr>
<tr>
<td>Anthony Magliari</td>
<td>Varian Medical Systems</td>
<td>United States</td>
<td>Eclipse</td>
<td>IMRT (Dynamic)</td>
<td>145.4</td>
<td>Octavius729</td>
</tr>
<tr>
<td>Mark Arends</td>
<td>RIF</td>
<td>The Netherlands</td>
<td>RayStation</td>
<td>VMAT</td>
<td>145.2</td>
<td>EBT3 film</td>
</tr>
<tr>
<td>Vanessa Magliari</td>
<td>St Anthony's Medical Center</td>
<td>United States</td>
<td>Eclipse</td>
<td>IMRT (Dynamic)</td>
<td>145.1</td>
<td></td>
</tr>
<tr>
<td>Kensuke Tani</td>
<td>EuroMediTech Co., LTD</td>
<td>Japan</td>
<td>RayStation</td>
<td>VMAT</td>
<td>145.0</td>
<td></td>
</tr>
<tr>
<td>Thomas Costantino</td>
<td>21st Century Oncology</td>
<td>United States</td>
<td>Eclipse</td>
<td>IMRT (Dynamic)</td>
<td>144.9</td>
<td></td>
</tr>
<tr>
<td>Simon Heinze</td>
<td>Kantonsspital St.Gallen</td>
<td>Switzerland</td>
<td>Hi-Art</td>
<td>Tomotherapy</td>
<td>144.8</td>
<td>ArcCHECK</td>
</tr>
<tr>
<td>Friedemann Herberth</td>
<td>Kantonsspital St.Gallen</td>
<td>Switzerland</td>
<td>Eclipse</td>
<td>VMAT</td>
<td>144.6</td>
<td>ArcCHECK</td>
</tr>
</tbody>
</table>

Top 5% scorers out of 238 submissions:

Due to the scoring metric design, at the high end, target homogeneity was key factor, prioritized over OAR sparing.

VMAT has slight advantage in homogeneity potential.

---

IMRT and VMAT: current and future best practices  
Anthony Magliari, MS CMD
VMAT OBVIOUS CHOICE FOR SMALL ROUND TARGETS
SBRT PROSTATE (2016 AAMD/RSS PROKNOW PLAN STUDY)

VMAT score: 141.1

IMRT score: 140.2

IMRT is king when it comes to providing uniform, rapid dose fall off

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
IMRT AND VMAT: WHEN TO CHOOSE WHICH

• IMRT
  – Larger target
  – Target with obvious straight line edges and beams to mimic those edges
  – Maximum possible OAR sparing is required and beams bisect that/those OAR(s)
  – Less time is available for optimization and plan iterations
  – Patient treatment time less of a concern... perhaps no longer valid in the future

• VMAT
  – Small target
  – Round target without any obvious straight line edges
  – Uniform or very rapid dose fall off is highly desirable
  – More time is available for optimization and plan iterations
  – Maximum possible target homogeneity is required
  – Shorter treatment time needed... perhaps no longer valid in the future
  – Low confidence in ability to choose good static gantry positions

• However
  – Either technique can create very high quality plans in almost all cases
  – These are just tips to help you create the best possible plans based on your goals
IMRT BEAM SELECTION BEST PRACTICE SUGGESTIONS

GENERAL CASES:
• Don’t use equally spaced beams (this is just lazy) a better result is likely with VMAT
• Space the beams every 20-40 degrees, on average, sometimes >40 degrees can be good
• Avoid using directly opposing beams
  – Consider opposing beams by ~10 degrees to make straight line divergence on one side for extreme gradient (PTV/rectum, PTV/spinal cord, PTV/parotid, etc)
• Beams should follow or mimic your target shape and bisect abutting highest value OARs
• Don’t be afraid to go back and adjust beams or add a new beam where needed
  – If you see strange “dose spill” from one side or corner of your target before trying to fix it with a dose control structure in the optimizer – check your beams!

BREAST CASES (on traditional delivery systems):
• Start as far over towards the contralateral breast as you can (50-60 degrees)
• Space your first 3 beams close together (20 degrees or less)
• Consider nearly AP (often 5-10 degrees offset towards contralateral side) and nearly lateral
  – Use either a single 45-50 degree beam or 2 “crossup beams” at +/- 10 degrees
• Place your last 3-4 beams opposing between your first 3 beams and beyond for concaveity
  – Consider fixing the jaws on these beams to avoid treating through lung
• Always make sure the resulting beam arrangement is concave
• Consider manually splitting fields and mixing energies between the sides
• Be prepared to manually extend fluence into air on tangent oriented beams for flash
Plan with all beams/arcs utilizing unique and well spaced collimator positions
  • This especially important when utilizing wider MLC leaves
  • The more unique collimator rotation positions in a plan the better
    – Consider increasing the number of arcs used for more unique collimator positions
      » If the machine can deliver VMAT at 2x speed, consider 2x arcs
        • With the new delivery system I often use:
          • 4 arcs on standard fraction (usually 315, 0, 45, 90)
          • 6 arcs on large fractions (usually 300, 330, 0, 30, 60, 90)
    – Select collimator rotations from a Beams Eye View for IMRT
      » Look for concavity in target shape
      » Follow general shape of target
      » Consider at least one beam with collimator at 90
        • I often make the most AP or PA field 90 degree collimator
IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
COLLIMATOR ROTATION EXAMPLE: BEV FOR IMRT

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
OPTIMIZATION TIP: TARGET/OAR RELATIVE PRIORITY

— General optimization priority / weighting example
  • Targets 100-170
    — Often start with:
      » Max dose “lower objective” priority 110
      » Min dose “upper objective” priority 140
  • OARs 40-100
    — Often start with:
      » Very low priority OARs multiple “lower objectives” priority 40
      » Normal priority OARs multiple “lower objectives” priority 50
      » Higher priority OARs multiple “lower objectives” priority 60
      » Very high priority OARs multiple “lower objectives” priority 70-75
      » Max dose serial OAR single “lower objective” priority 100
        • And/or consider using “upper gEUD” with $a=40$
        • DMPO (Pinnacle/RaySearch) uses 0-100 but same concept
  — Always watch the real-time cost function graph to make sure structure order makes sense
OPTIMIZATION TIP: TARGET/OAR EXAMPLE

Make sure the cost function graph structure order and relative cost look right

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
IMRT optimal fluence smoothing:

*X and Y smoothing priority values are relative to all other priorities* – don’t let these values drift too far from your others or your MU will increase too much and plan be become over modulated (DMPO: similar to control points per field)

VMAT MU Objective:

Lots of misconceptions, actually most useful to use “Minimum MU” slightly more than current plan to force additional modulation in certain plans to increase plan quality.
OPTIMIZATION: NORMAL TISSUE

• Consider:
  • compromised beam geometry (beams/arcs on only one side of patient)
  • Uniform dose fall off -or- OAR sparing (tradeoff)

Example NTO setting: starting point for compromised geometry plan (breast/chestwall)

Every TPS has a tool or multiple tools (Monaco) for implementing normal tissue sparing
Coincidentally, falloff value used seems to have some correlation to number of fields

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
**OPTIMIZATION: THOROUGHNESS**

IMRT: Increase max iterations and max time, turn off auto mode, wait until cost line is flat

-- DMPO (Pinnacle/RaySearch) you can increase the "stopping tolerance" to E07-E08 or even 0

VMAT: Pause the VMAT optimizer at each MR substep (MR1: 5 times, MR2&3: twice, MR4: once)

10 pauses total, letting the cost line get flat before unpausing (automated method in the works)
APPLYING BEST PRACTICES: RETROSPECTIVE AAMD PLAN CHALLENGE / PLAN STUDY RESULTS

Histogram of 2011 (Prostate Fossa)
N: 126  Min: 58.18  Max: 142.47  Median: 119.69  Mean: 117.10  Std Dev: 16.42

Histogram of 2012 (Abdomen)

Histogram of 2013 (Anus)
N: 157  Min: 47.61  Max: 146.79  Median: 124.14  Mean: 121.72  Std Dev: 16.92

Histogram of 2014 (Breast)
N: 81  Min: 85.45  Max: 149.45  Median: 134.59  Mean: 131.40  Std Dev: 13.50

Histogram of 2015 (Hippocampal Sparing)
N: 223  Min: 38.73  Max: 146.12  Median: 127.08  Mean: 125.00  Std Dev: 17.72

Histogram of 2016 (SBRT Prostate)
N: 420  Min: 78.94  Max: 147.17  Median: 141.00  Mean: 138.18  Std Dev: 8.29

IMRT and VMAT: current and future best practices
Anthony Magliari, MS CMD
FUTURE LOOK

– Don’t forget about IMRT
  • Practice making plans IMRT plans and setting up static fields today
    – Keep your beam angle selection skills sharp, could be often useful again
    – It is the current best solution for multifield breast IMRT
    – Often a great choice for large irregular target shapes
      » Head and Neck
      » Lower dose (often irregular) nodal targets
      » When maximum OAR sparing is valued over uniform dose fall-off
– VMAT isn’t going away either
  • In the future VMAT could become a popular solution for breast treatment utilizing protocols like RTOG 1005 arm2: hypofractionated breast with simultaneous integrated boost
    – Possible to meet all dose constraints due to drastically reduced leakage MLC with “per leaf jaw tracking” effect
FUTURE LOOK: VMAT BREAST

IMRT and VMAT: current and future best practices

Anthony Magliari, MS CMD
FUTURE LOOK: VMAT BREAST ARC’S EYE VIEW
QUESTIONS?

• Special thanks to:
  The beam angle selection kings at Siteman Cancer Center (Barnes-Jewish / Washington University)
  • Kenny Baker
  • Andrew Lindsey
  • rest of Physics / Dosimetry team
  Kevin Moore (UCSD)
  • “concave beams for breast”
  OG Radiation Oncology Resources (ROR) crew
  Ben Nelms & ProKnow Systems team
  Greg Robinson & Sun Nuclear Corporation
  AAMD
  My colleagues at Varian
  Vanessa Magliari, CMD