

How to Identify and Resolve Potential Clinical Errors before They Impact Patients Treatment: Lessons Learned

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How to Resolve Potential Clinical Errors
 Troubleshooting issues with linear accelerator
 Measurement and Calibration Discrepancy: Advanced Warning Guidance

Major Accidents in Radiation Therapy

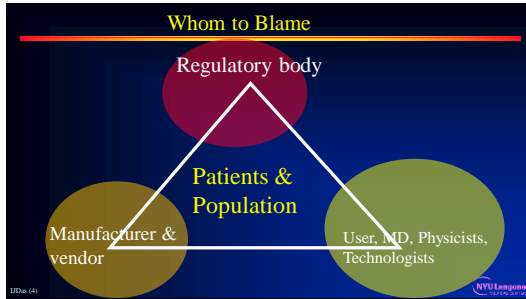
- ❖ Therac 25: killing 8 patients
 - ⌘ Software glitch
- ❖ Tampa: overdosing 72 patients
 - ⌘ Human error, not double checking
- ❖ Philadelphia VA: 45 patients, under dose
 - ⌘ Human error
- ❖ New York: killing 3 patients
 - ⌘ Malfunction, design fault and human error
- ❖ Missouri: Over dosing 70 patients
 - ⌘ Training and education

WVU Langone

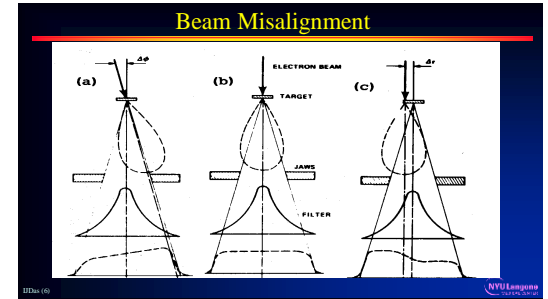
Scott Jensen marks Mr. Jerome Parker's 14th treatment. Parker's copy treatment had gone well, but multiple computer glitches occurred while the medical physicist read the machine physical read. The instructions for the multibeam collimator were lost and the collimator knives were fully open for three doses of radiation.

IMRT Factor

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- ### Common Trigger Level
- ❖ 2% no problem
 - ❖ 3% check parameters
 - ❖ 5% do not treat (non wedge)
 - ❖ 7% do not treat (wedged beam)
 - ❖ Check set up & parameters
 - Depth, Energy, Field Size, SSD
 - Setup, Electrometer Setting, Cable etc.
 - If not satisfied
 - Measure in a different phantom
 - Resolve issues
- NYU Langone



Scenario

- ❖ Variability in reading with electrometer
- ❖ 3% -7% dose diff with SSD
- ❖ 5% change in dose (temp and press due to storm)
- ❖ Electrons sensitivity with phantom
- ❖ Treatment Planning
 - ⊠ Arm in fields
 - ⊠ Exit beam (view it)
 - ⊠ Color wash (hot spot location, RVR)
 - ⊠ Sarcoma of leg, position dose to other leg

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Common Mistake

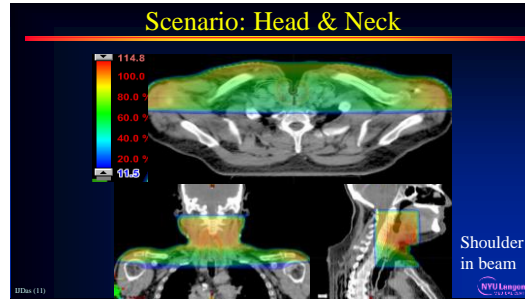
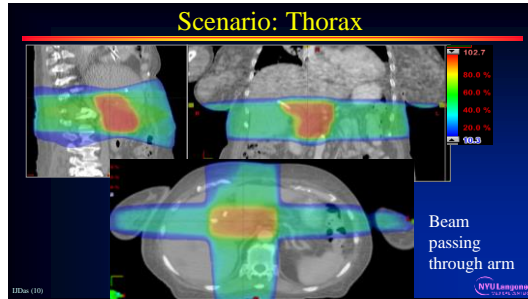
- ❖ Bolus issues in photon and electron
 - ⊠ Not accounted or linked
- ❖ Improper contouring
 - ⊠ SBRT table/ devices (Not-accounted)
- ❖ Grid size selection
 - ⊠ Small structure
 - ⊠ Slice thickness
- ❖ Algorithm
 - ⊠ PBS for lung
 - ⊠ On/Off selection for inhomogeneity

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Block & MLC Verification

Blocking on spine

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Scenario: Brain

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Clinical Investigation

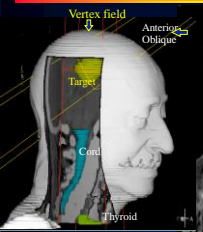
DOSE ESTIMATION TO CRITICAL ORGANS FROM VERTEX FIELD TREATMENT OF BRAIN TUMORS

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 LAWRENCE R. COIA, M.D.,[‡] WALTER J. CURRAN, JR., M.D.,[†] AND BARBARA FOWLE, M.D.*

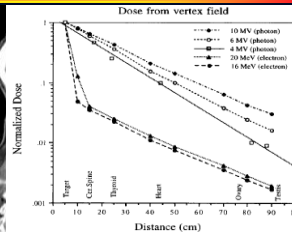
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Vertex Field




Dose from vertex field




Distance (cm)	10 MV (photon)	6 MV (photon)	4 MV (photon)	20 MeV (electron)	16 MeV (electron)
0 (Target)	1.0	1.0	1.0	1.0	1.0
10 (Cca Spine)	0.8	0.7	0.6	0.5	0.4
20 (Thymus)	0.6	0.5	0.4	0.3	0.2
40 (Heart)	0.4	0.3	0.2	0.15	0.1
70 (Ovary)	0.25	0.2	0.15	0.1	0.07
90 (Testis)	0.18	0.14	0.1	0.07	0.05



Display to Watch



Calculation
Grid effect



Observation

While calibrating a 6 MV photon beam, you noticed consistently 3-5% difference in dose;

What you need to check and what is most probable cause?

- A. Field size
- B. Gantry angle
- C. Source to Surface distance (SSD)
- D. Calibration has drifted
- E. Energy

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-Observation

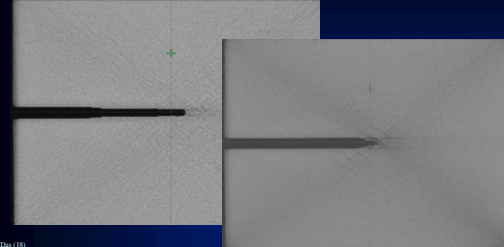
While calibrating a electron beams, you noticed consistently 3-5% difference in dose;

What you need to check and what is most probable cause?

- A. Gantry or collimator angle
- B. Source to surface distance
- C. Drift in electrometer
- D. Calibration has drifted
- E. See next slide (actual event)

HDa (17) NYU Langone

Error Associated with Solid water Phantom



HDa (18)

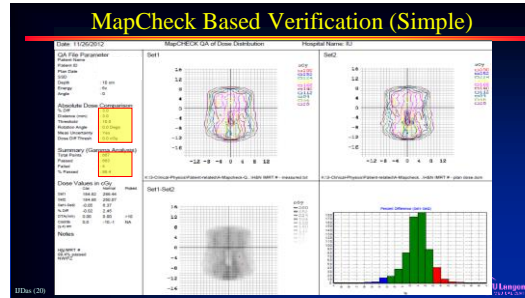
-Observation

While calibrating a photon beams, you noticed that readings are fluctuating by 10%;

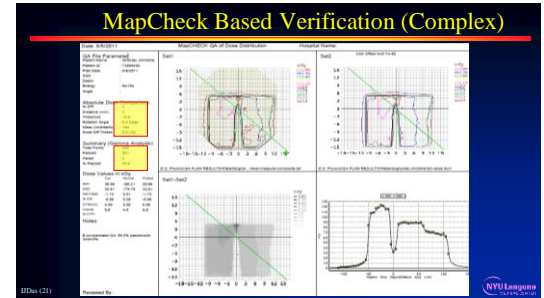
What you need to check and what is most probable cause?

- A. Automatic frequency control (AFC) of the machine
- B. Flatness and symmetry of the machine
- C. Defective Chamber
- D. SSD
- E. Bias on electrometer

IDDas (19)



IDDas (20)



IDDas (21)



Lessons Learnt

- ❖ Write down the parameters during commissioning
- ❖ Compare data with same protocol
 - ⌘ Uniformity & Symmetry
 - Manufacturer definition
 - IAEA
 - European
 - USA
 - National
 - ⌘ Variations between protocols
 - ⌘ Ionization to dose conversion
 - ⌘ PDD to TMR conversion

IBDm (22) 