

IMRT/IGRT Patient Treatment: A Community Hospital Experience

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WAKE FOREST

UNIVERSITY

SCHOOL *of* MEDICINE

**I have no research support or
financial interest to disclose.**

- 1. Review a typical IMRT/IGRT implementation process.**
 - 2. Have an understanding of IMRT/IGRT program development at High Point Regional Hospital.**
 - 3. Understand the elements of our IGRT system quality assurance program.**
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- **400 Bed Community Hospital**

 - **Radiation Oncology Department**
 - **External Beam Therapy**
 - 340 New External Beam Patients each Year
 - Average Daily census: 35 patients
 - PET-CT Simulator
 - MLC based IMRT & 3D conformal
 - Two accelerators: One with KV Imaging capability

 - **Brachytherapy program includes:**
 - HDR – Prostate, Partial Breast, Lung, GYN
 - LDR – Prostate seed implants
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IGRT Committee

- **Membership: medical director, physicist, dosimetrist, therapist, and administrative director**

 - **Exhaustive literature review**
 - **Body sites that benefit from IGRT**
 - **Process: implantable markers, 2D imaging, CBCT**
 - **Immobilization**
 - **Margin reduction, dose escalation**
 - **Quality assurance of equipment and treatment**
 - **Inter vs Intra fraction motion and repeat imaging**
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Results of Literature Review

- Major Reality Check
- Prostate and H & N IMRT patients may benefit most

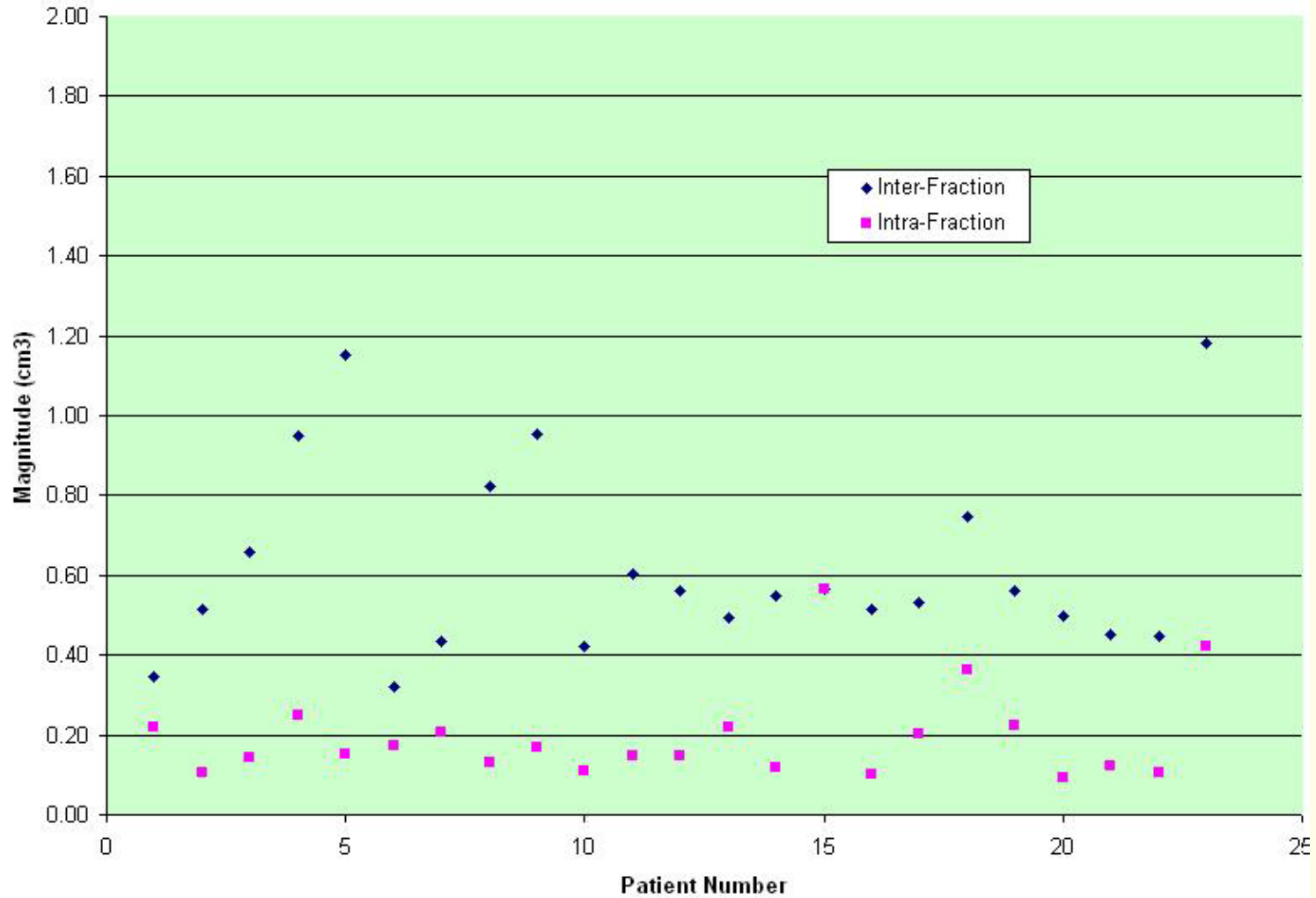
IGRT Billing Requirements

- Level of physician supervision
 - Documentation of daily correction
 - No portal images
 - Who implants markers? Who pays for markers?
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- **Prostate IMRT/IGRT**
 - **2D (AP & LAT) Marker Position Match Preferred**
 - Superior to bony anatomical matching
 - Superior to CBCT because soft tissue delineation is relatively poor
 - **Urologist places gold seeds in office**
 - **Daily patient shift/correction is documented on patient specific Excel spreadsheet**
-

Prostate Mean Vector Correction Analysis



H & N IMRT/IGRT

- Immobilization
 - Minimize rotational setup error – custom head holder
 - Use S-frame immobilization to fix head, neck, and shoulders
 - Imaging (CBCT) Frequency
 - O.A. Zeidan et al – review of several different imaging protocols
 - CBCT every other day
 - Use running mean of CBCT shift on non-imaging treatment days
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H & N IMRT/IGRT

- What about changes as treatment progresses?

Physician reviews anatomical changes/surface contours relative to Tx Plan CT weekly

- $\leq 0.5\text{cm}$ – No Action
 - $0.5\text{cm} > 1.5\text{cm}$ – Dosimetric review at discretion of MD
 - $\geq 1.5\text{cm}$ – re-mask, re-scan, & dosimetric review of current IMRT plan
 - Move forward with current plan or re-plan and implement within 3-5 fractions (no break)
-

H & N IMRT/IGRT

- **What do we align data set to?**
 - Physician discretion
 - Standard initial alignment to C-6 and/or clivus
 - Contour C-6 on Tx plan CT

**NOW WE ARE READY TO START
H&N IGRT USING CBCT!**

OBI - Varian Medical Systems

3D / 3D Match

Transversal - CT_1 - CBCT - 2/24/2009 13:50

Sagittal - CT_1 - CBCT - 2/24/2009 13:50

Frontal - CT_1 - CBCT - 2/24/2009 13:50

Head First Supine
Z: 1.35 cm

X: 0.00 cm

Y: -18.10 cm

Couch Position (VAR_STD Scale) and Shift

	TARGET	ACTUAL	SHIFT		TARGET	ACTUAL	SHIFT	
Couch Vrt	114.1	114.1	0.0	<input checked="" type="checkbox"/> Include	Couch Lat	97.5	97.5	0.0 <input checked="" type="checkbox"/> Include
Couch Lng	151.3	151.3	0.0	<input checked="" type="checkbox"/> Include	Couch Rtn	179.9	179.9	0.0 <input type="checkbox"/> Include

All units in cm and degrees

Perform the anatomy match

CT saved

1. Acquire

Tuesday, February 24, 2009

1:52 PM

Can we use IGRT on “This Patient”?

IGRT can be a benefit to many patients but.....

- **Different body sites need different criterion**
 - **Soft tissue alignment can be difficult – do you implant markers?**
 - **How much inter-fraction motion is expected?**
 - **How much intra-fraction motion...gating?**
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A quality assurance program for the on-board imager[®]

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Program Elements

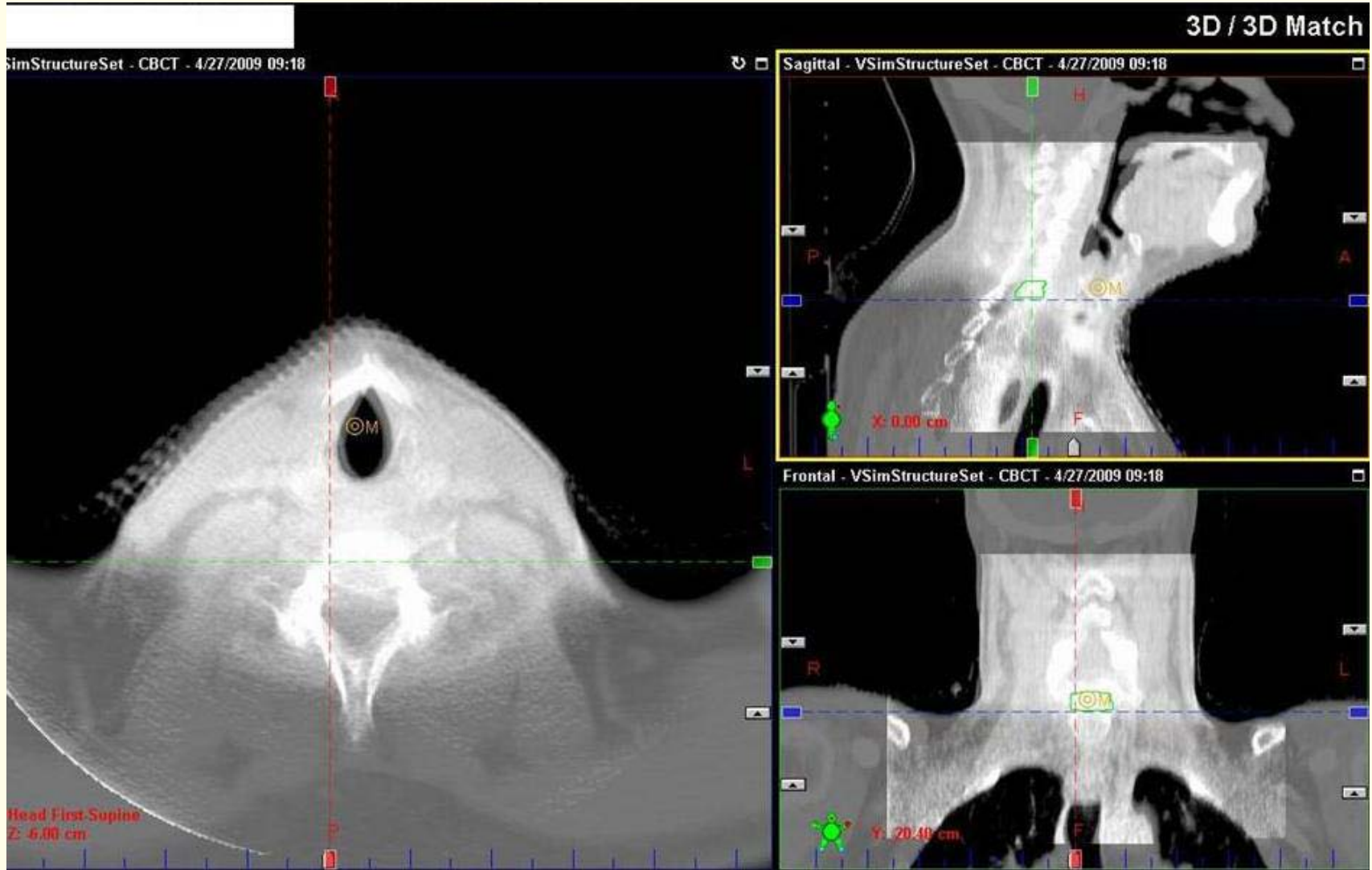
- **Safety and Functionality QA**
 - **Geometrical Accuracy QA**
 - **Image Quality QA**
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- **Daily QA Tests**
 - **Verify the functionality of all safety systems**
 - **Door Interlock**
 - **Warning Lights**
 - **Collision Interlocks**
 - **Imaging Isocenter Accuracy**
 - **Couch shift/positioning Accuracy**
 - **Adds about 15mins to daily accelerator QA**
-

- **Monthly QA Tests**
 - **Magnification Accuracy**
 - **Imaging Arm Positioning Integrity**
 - **Imaging Isocenter accuracy versus Gantry Angle**
-

- **Quarterly/Annual QA Tests**
 - **CBCT Image Quality**
 - **HU reproducibility**
 - **Low Contrast Resolution**
 - **HU Uniformity**
 - **In-slice spatial linearity**
 - **Slice thickness accuracy**
-

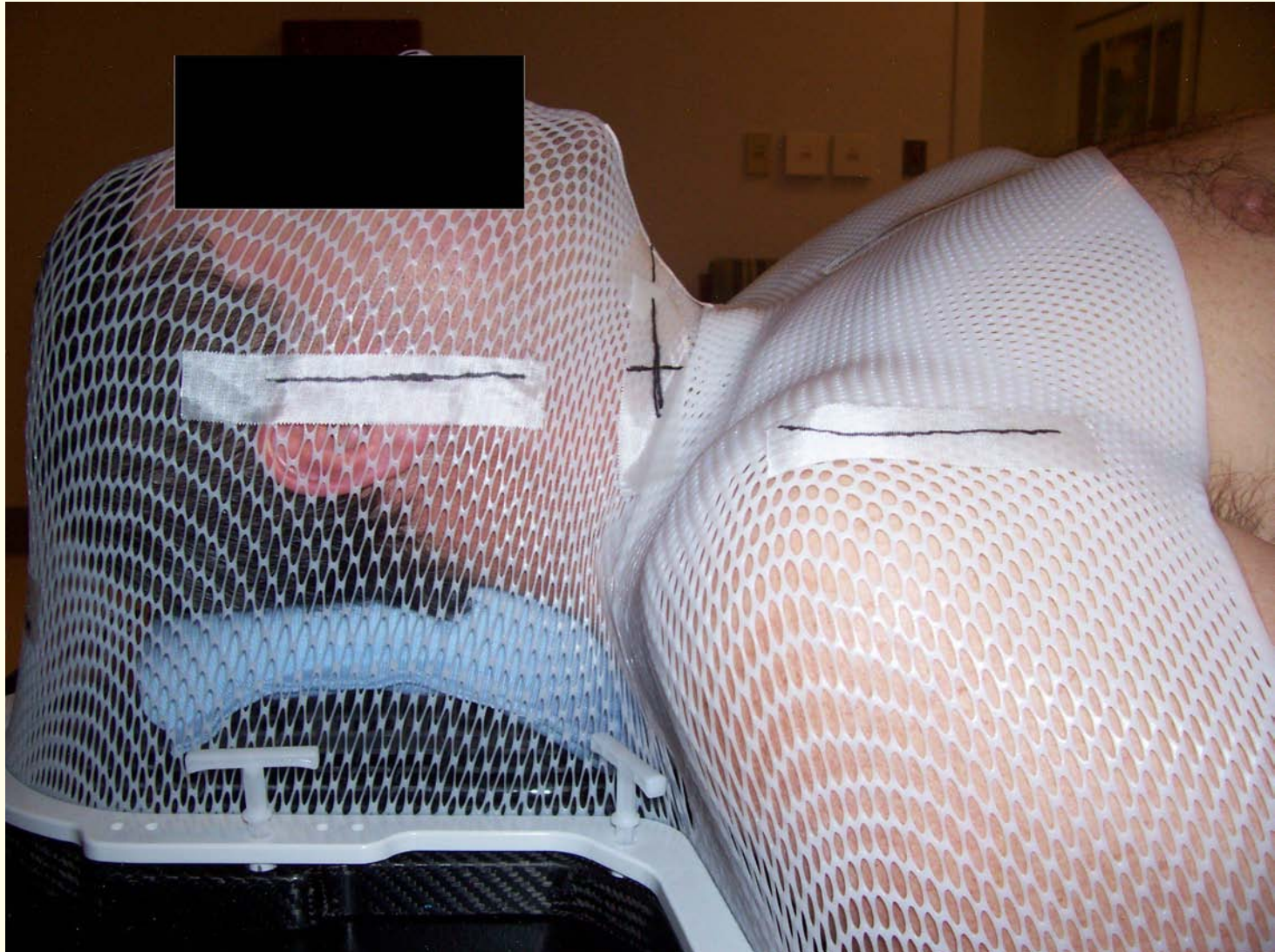
Thank You for Your Attention!



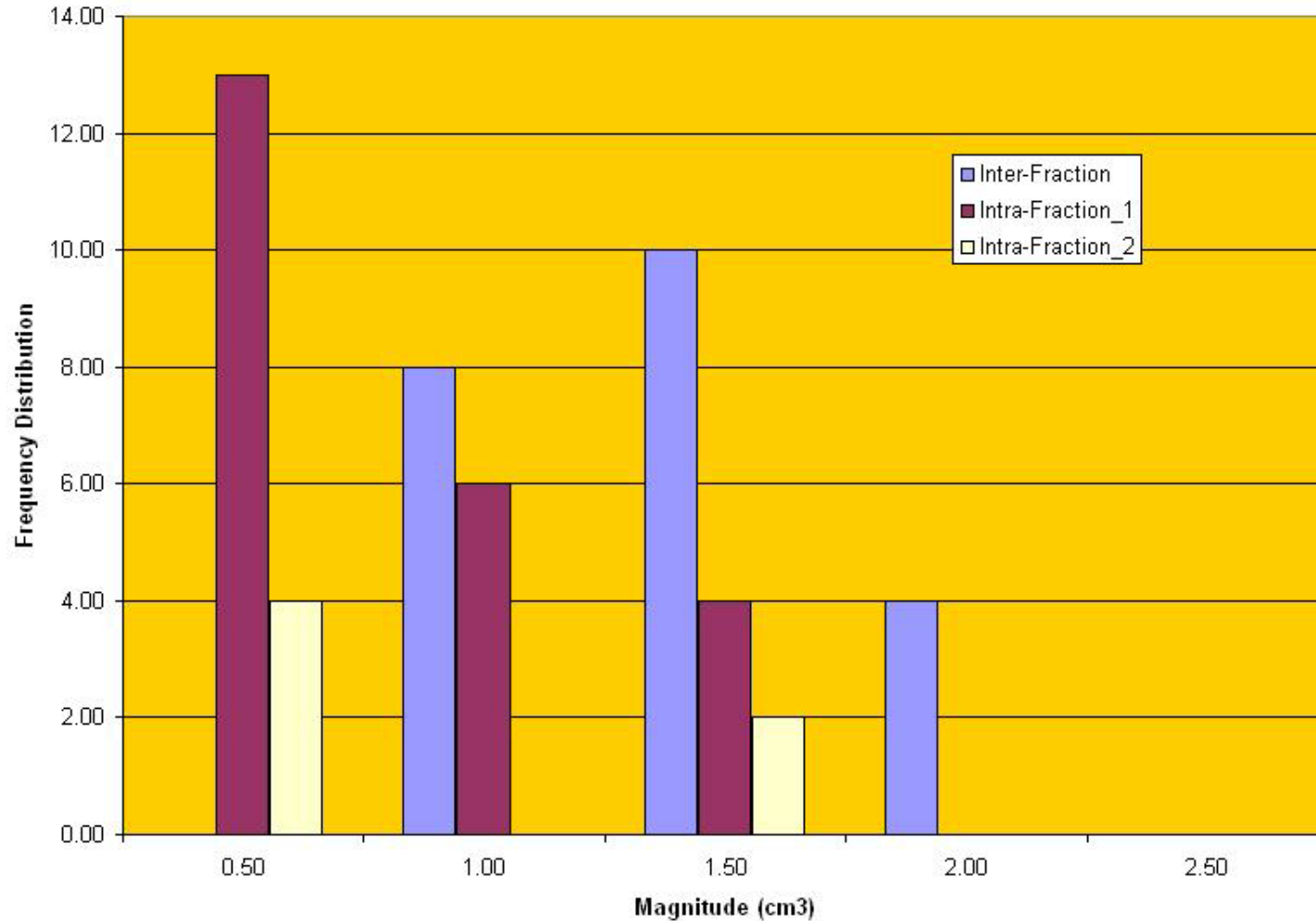
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Maximum Vector Correction



- Prostate IMRT/IGRT
 - How to interpret a patient shift: a vector?
 - What requires re-imaging?

3D Vector Magnitude

$$V = \sqrt{SI^2 + AP^2 + RL^2} = \text{Actual size of target shift!}$$

