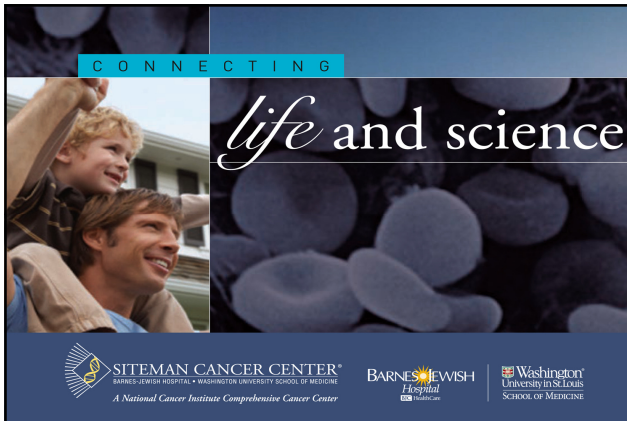





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**In-Room MR-guidance  
The ViewRay System**  
*Sasa Mutic, Ph.D.*

**SITEMAN CANCER CENTER\***  
BARNES JEWISH HOSPITAL • WASHINGTON UNIVERSITY SCHOOL OF MEDICINE  
A National Cancer Institute Comprehensive Cancer Center

**BARNES JEWISH Hospital**  
barnesjewish.org

**Washington University in St. Louis**  
SCHOOL OF MEDICINE

**NCCN** National Comprehensive Cancer Network®

**NCL** National Cancer Leadership

www.siteman.wustl.edu 800-405-3604

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**DISCLOSURE**

**Disclosure**

- I have stock ownership in ViewRay, Inc.
- I have advisory and consulting roles in ViewRay, Inc.

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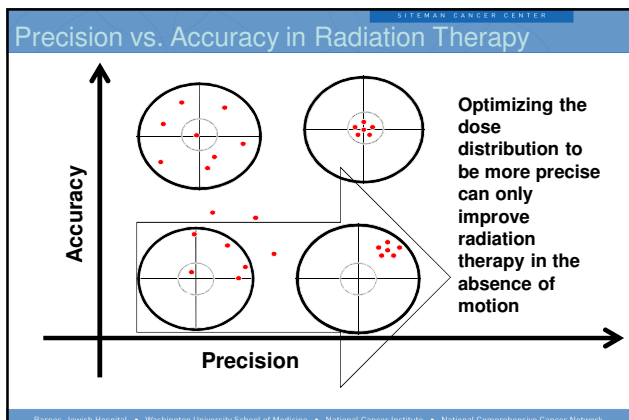
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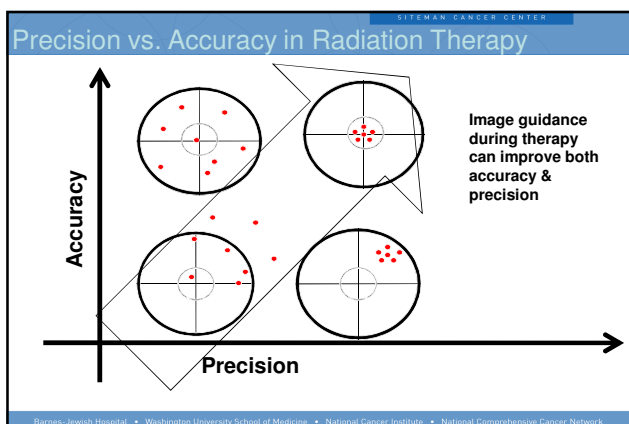
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**ViewRay Concept**

- Split coil 0.35T MR scanner combined with three Co-60 heads
- Parallel imaging (4 fps-single plane, 2 fps-3 orthogonal planes) and delivery (Conventional and IMRT)
- Integrated system – Treatment planning, treatment management, delivery
- On couch planning – auto-segmentation, optimization, calculation
- MR-guided gated delivery
- Fits in standard size treatment room

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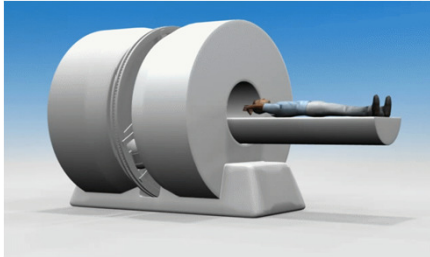
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## ViewRay Concept

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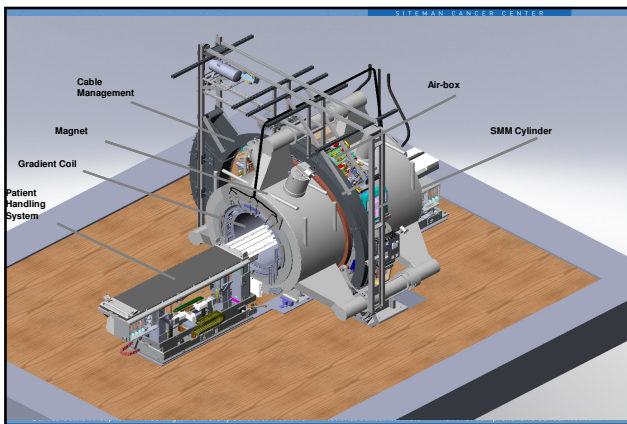
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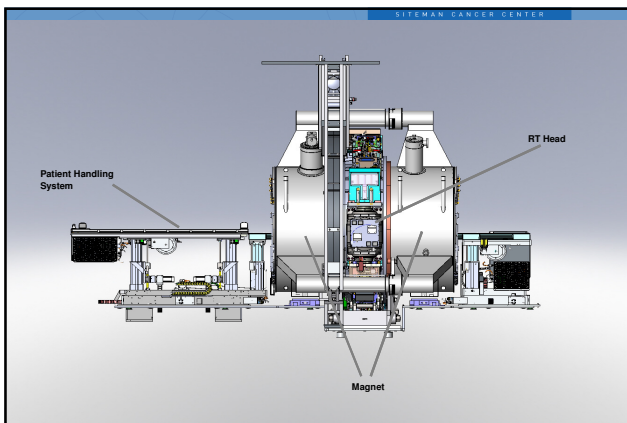
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ViewRay Concept

| Feature                   | Reasoning/benefit                                |
|---------------------------|--------------------------------------------------|
| Co-60                     | Compatibility with MR                            |
| Split magnet              | Radiotransparent architecture & rigging          |
| Three Heads               | Dose rate – 680 cGy/min                          |
| Fully divergent MLC       | Reduction of geometric penumbra                  |
| 0.35T MR                  | Minimization of MR effects on dose distribution  |
| Dedicated planning system | Accounting for MR effects, other unique features |

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# Dosimetric concerns

- 1) Dose distribution in the presence of MR fields
- 2) Co-60 vs. linac based IMRT
- 3) Measurement techniques
- 4) QA constraints

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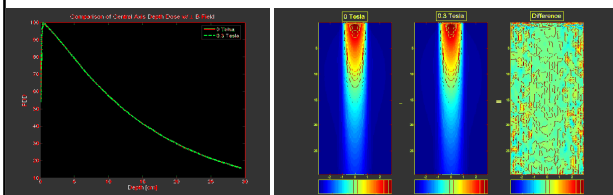
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# Co60 + low-field MRI at 0.3 Tesla in tissue (1g/cc)



MC shows essentially no distortion in tissue or water  
MFP for large angle collisions of secondary electrons much shorter than radius of gyration

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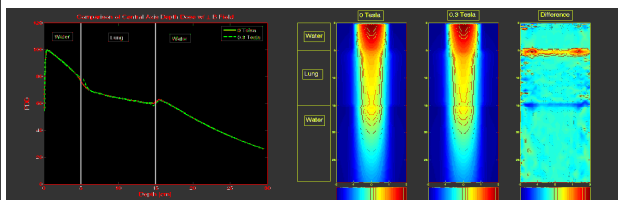
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# Co60 + low-field MRI at 0.3 Tesla in lung (0.2 g/cc)



MC shows very small distortion in lung density material

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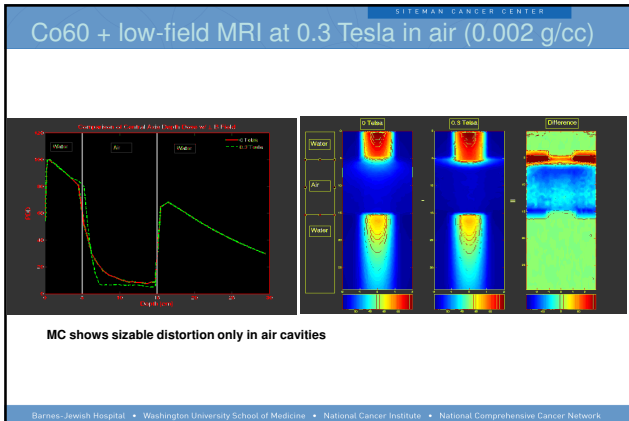
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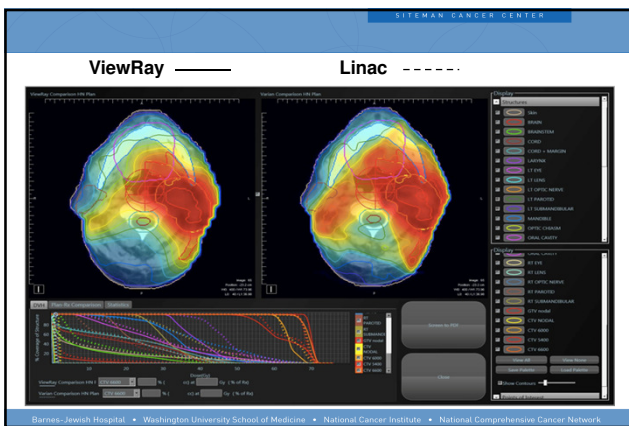
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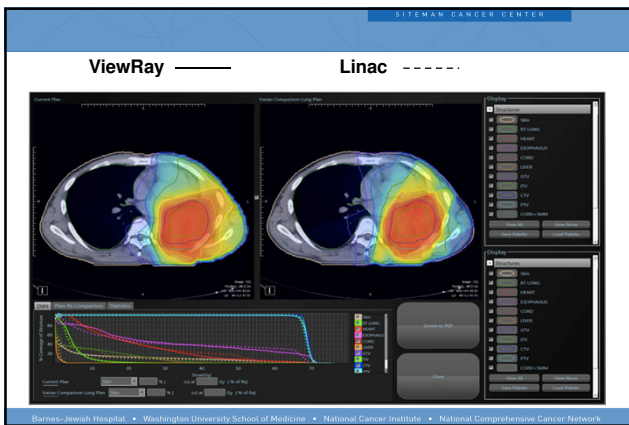
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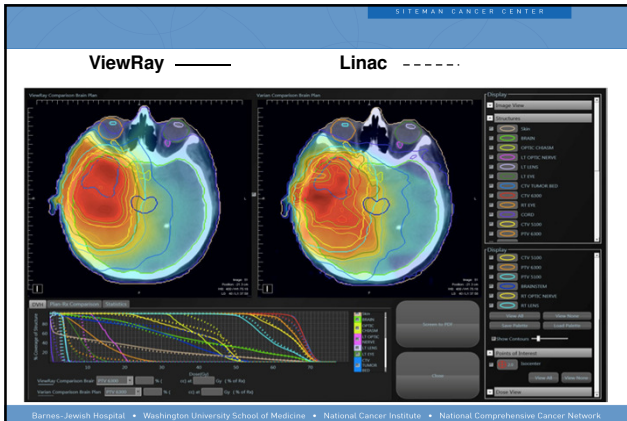
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### Clinical work

201105295 Feasibility Study of Low-Field Magnetic Resonance Imaging (MRI) for Radiotherapy Target Identification

- Imaging system commissioned for clinical use with dummy sources (now with actual sources as well)
- Uses ViewRay magnet under IRB approved status
- Intermittent imaging based on organ site (CNS/H+N; thorax, abdomen, pelvis)
- Acquired images on 27 patients

TH-E-BRA-7 Initial Experience with the ViewRay System – Quality Assurance Testing of the Imaging Component - Y Hu\*, O Pechenaya Green, P Parikh, J Olsen, S Mutic, Washington University School of Medicine, Saint Louis, MO

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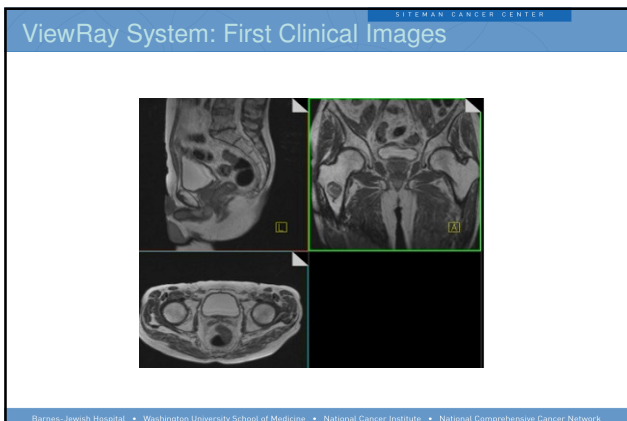
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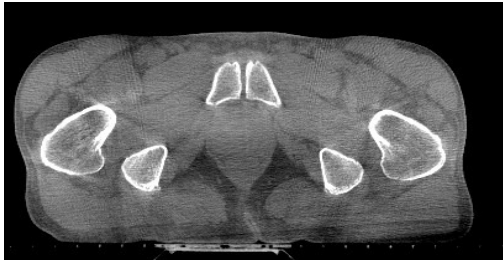
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Patient's CBCT



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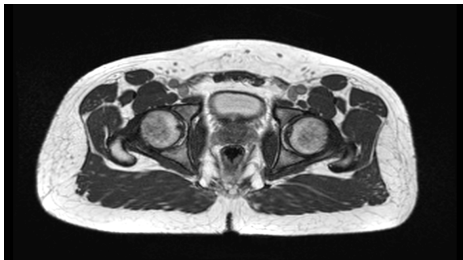
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90s ViewRay MR



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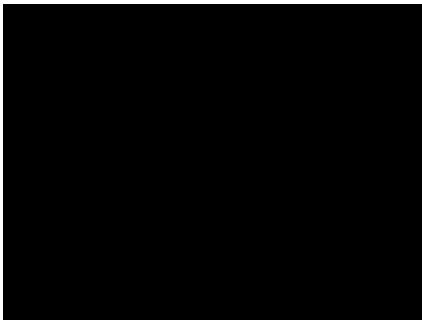
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20 sec pilot scan



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Clinical Images

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Clinical Images

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Clinical Images

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## Gated Delivery - Concept



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## Gated Delivery – Implementation Liver Treatment



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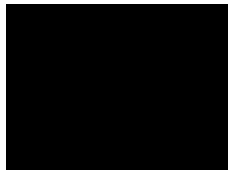
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## Conclusions

- Initial imaging study demonstrates the expected benefits of MR imaging – Presentations at ASTRO
- Commissioning work in progress and dosimetric techniques in development
- Preparations in progress for the first clinical treatment



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Thank you!

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