

# Clinical Experiences with a Patient Skin Dose Monitoring and Tracking Program

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University of Virginia Health System



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## Disclosures:

- Member, Bayer Healthcare Global Advisory Board
- Software shown is in controlled commercial release



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## Dose Level Comparisons...

CT Dose- Often, race to the bottom:

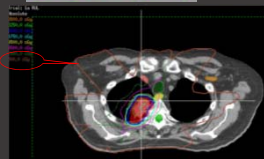
CTDIvol	CTDIvolHead	CTDIvolBody	DIABE
5.6 mSv	-	5.9 mSv	8.2 mSv

Interventional Dose- on the Rise:

Fluoro time	Fluoro	Fluoro Head
19.6 min	963.8 mAs	5941.8 mAs

Rad Therapy Dose- checked by physicist!

IR Doses can be at the Therapeutic Level- Tracking of these doses is not only wise but necessary for protection of the patient and the users!



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### Brief Outline

- What do you need to track Interventional Doses?
- What tools are available?
- Peak Skin Dose (PSD) estimation discussion
- Examples of the fluoroscope setup in software
- UVA Health System Experience: Radimetrics
- Simple validation experiment
- Case 1

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Before we ask what tools are needed to track interventional dose perhaps we should ask....

### What is the Goal of "Tracking" Interventional Dose?

- Calculation of Peak Skin Dose?
- Tracking or estimating patient Stochastic Risk?
- Meeting Regulatory requirements? TJC?
- Track operator metrics?
- Most or All of the above??

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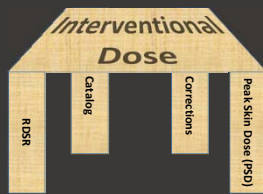
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### What do you need to track Interventional Doses?

Radiation Dose Index Monitoring System (RDIM) or Patient Radiation Dose Monitoring and Tracking Program (PRDMT)

- 4 legged "Table"
- Each "leg" represents a necessary support function
- System or "tracking" is incomplete and unstable without one of the legs



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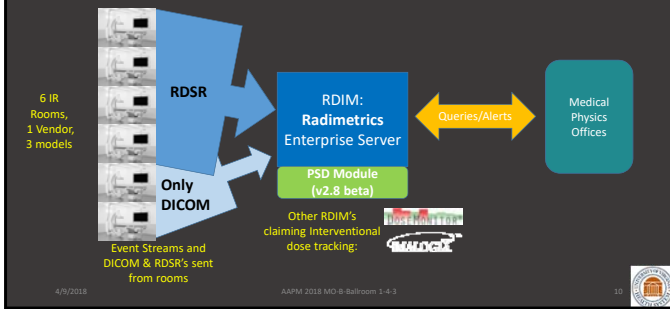
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### Tracking Interventional Doses at UVA: IR Structure/Layout



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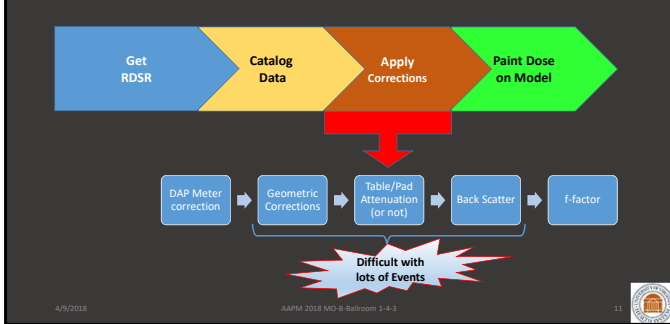
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### How do we Estimate and Show PSD?



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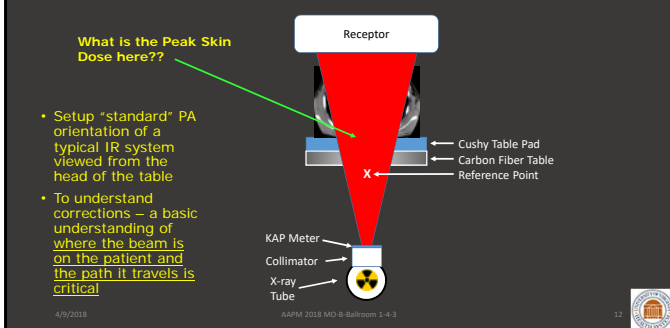
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### Necessary Corrections



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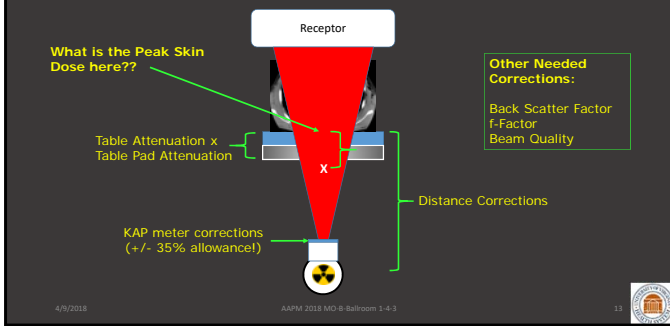
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### Necessary Corrections




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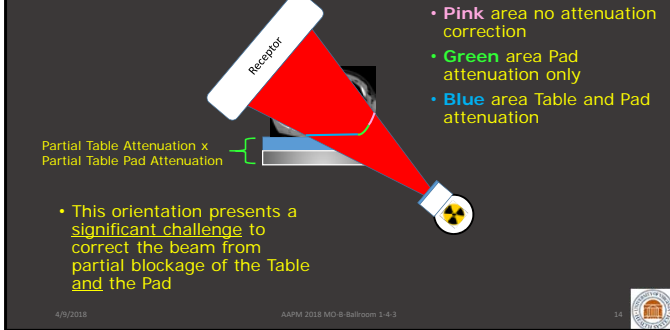
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### Necessary Corrections




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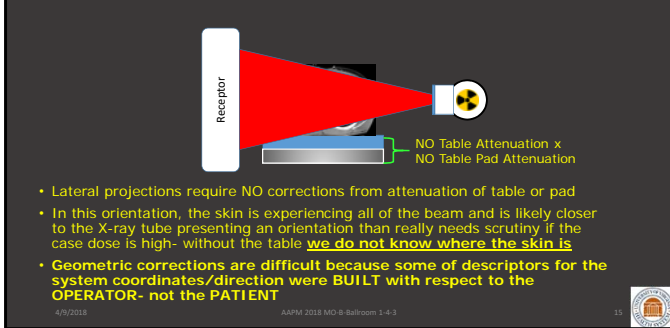
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### Necessary Corrections




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### Equipment Setup: Geometry

- Determination of "lateral" table offset in the "Z" direction-difference between center of image and Z-axis or Lateral travel reported in the RDSR

• Compute the offset between center of the image and the value reported in the RDSR for the image

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### Equipment Setup: Geometry

- Determination of table offset in the "X" direction-difference between center of image and X-axis or Longitudinal travel reported in the RDSR

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### Equipment Setup: Geometry

- Determination of table offset in the "Y" direction-difference between center of image and Y-axis or "Height" reported in the RDSR

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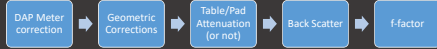
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## Calculating Skin Dose in Radimetrics

- Once skin model selected- skin dose is calculated for all points falling inside of the beam pyramid on that model
- r is the position of the skin relative to source
- RP = Reference Point

$$Dose_r = CF \times Dose_{RP} \times \frac{|rRP|^2}{|r|^2}$$



Jones et al. Journal of Applied Clinical Medical Physics, Vol. 12, no. 4, Fall 2011  
 Johnson, Borrego, et al. "Skin Dose Mapping for Fluoroscopically Guided Interventions", Med Phys. 38 (10), 2011




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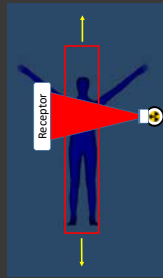
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## Corrections

- One of the most challenging aspects is – we simply do not know WHERE the patient is on the table.
- Placement of the patient higher, lower or off center will affect where the dose is assumed to be on the patient
- Until vendors add patient localization on their fluoroscopes, localization of skin dose needs to be confirmed by other means.



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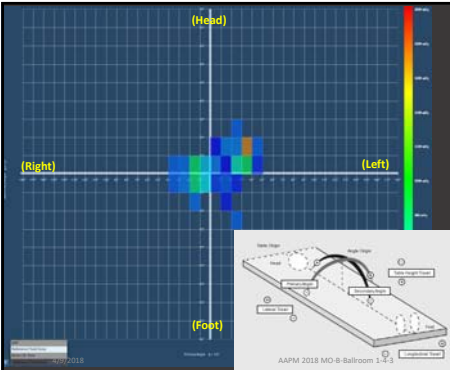
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## Example Angulation Map

- Shows C-arm angle vs. dose
- Primary angles (LAO-RPO)
- Secondary angles (cranial-caudal)
- Displays dose in coarse increments from an "unwrapped cylinder"



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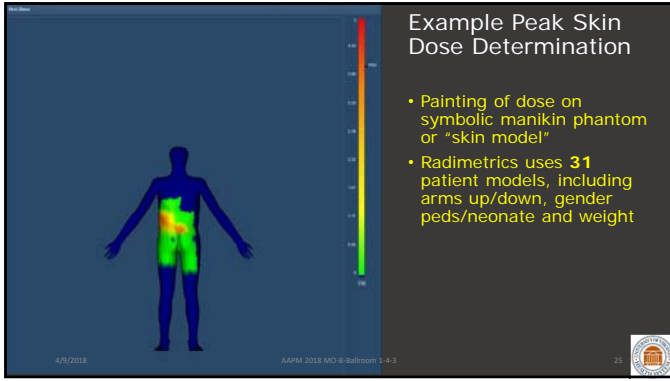
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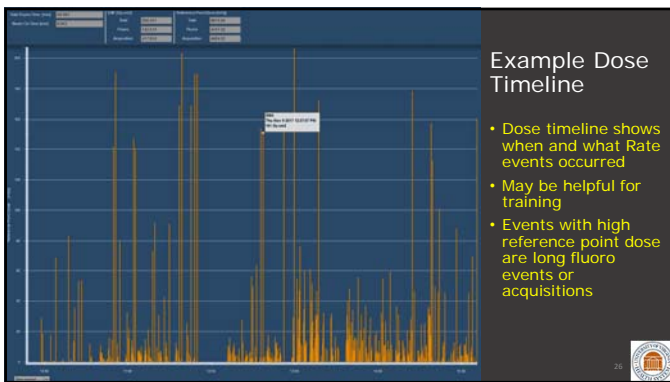
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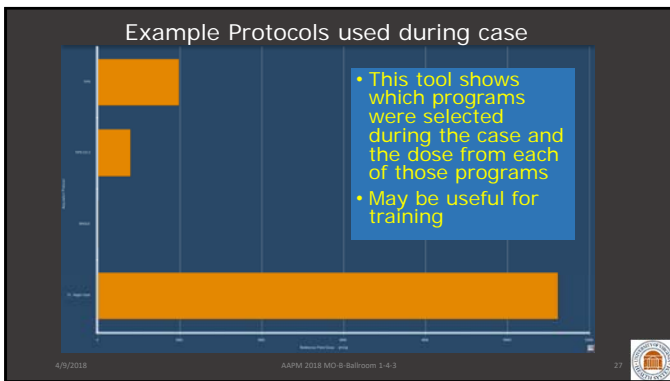
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**Conclusions:**

- Doses from FGI's are much higher than CT's doses that many institutions are currently tracking
- There are tools to track interventional dose both in and outside of the lab
- Peak Skin Dose is the metric we typically watch
- Corrections to arrive at accurate PSD are difficult and may not fully be ready commercially
- Patient location on the table is a significant hurdle
- Alerts for elevated or Substantial Radiation Dose Levels or SRDL's need responding to
- Tracking these doses is the right thing to do for our patients
- Registries using tracked data may provide useful insight into better or "Best Practices"

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**THANK YOU!**



Questions?

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