

***Application of a new dosimetry  
formalism to IMRT head and neck  
radiotherapy.***

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- Alfonso et al formalism
- Suitable pcsr field
- Measurements
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# Formalism



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# Alfonso et al Formalism

$$D_{w,Q} = M_Q \cdot N_{D,W,Q_0} \cdot k_{Q,Q_0}$$

*Standard reference  
10 cm x 10 cm field*



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# Alfonso et al Formalism

$$D_{w,Q} = M_Q \cdot N_{D,W,Q_0} \cdot k_{Q,Q_0}$$

*Standard reference  
10 cm x 10 cm field*



*Clinical plan (clin)*



# Alfonso et al Formalism

$$D_{w,Q} = M_Q \cdot N_{D,W,Q_0} \cdot k_{Q,Q_0}$$

$$D_{w,Q}^{f_{pcsr}} = M_{Q_{pcsr}}^{f_{pcsr}} \cdot N_{D,W,Q_0} \cdot k_{Q,Q_0} \cdot k_{Q_{pcsr},Q}^{f_{pcsr},f_{ref}}$$

$$k_{Q_{pcsr},Q}^{f_{pcsr},f_{ref}} = \frac{D_{w,Q_{pcsr}}^{f_{pcsr}} / M_{Q_{msr}}^{f_{pcsr}}}{D_{w,Q}^{f_{ref}} / M_Q^{f_{ref}}}$$

$$D_{w,Q_{clin}}^{f_{clin}} = D_{w,Q_{pcsr}}^{f_{pcsr}} \cdot \Omega_{Q_{clin},Q_{pcsr}}^{f_{clin},f_{pcsr}}$$

*Standard reference  
10 cm x 10 cm field*

*Plan class specific  
reference field (pcsr) ?*

*Clinical plan (clin)*



# *pcsr fields*



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# Suitable pcsr field

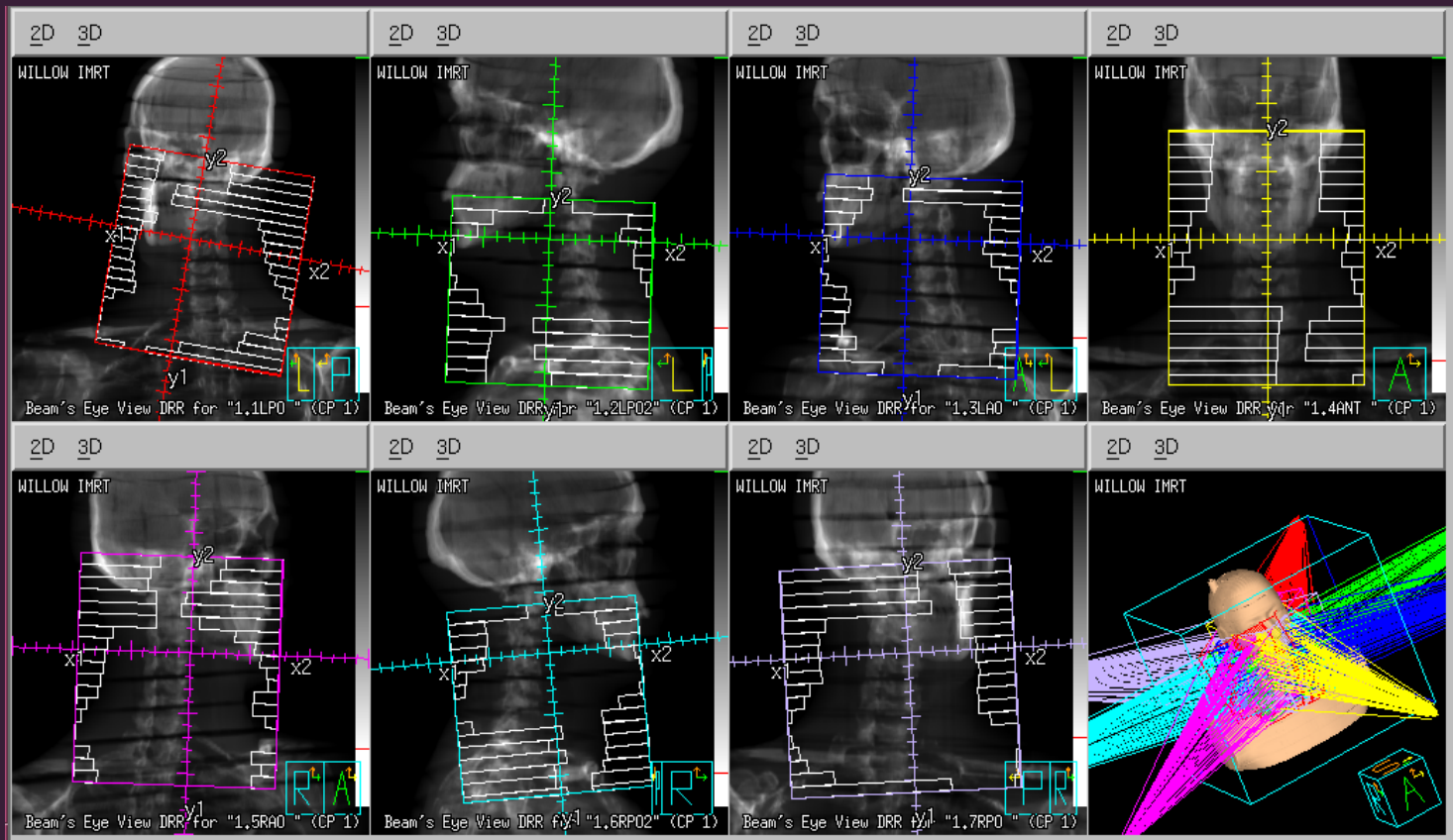
- o close as possible to clinical plan
- o Homogeneous field over the detector (uniform within 1%)

	Inverse planned pcsr	Simple pcsr
Number of fields	7	7
Number of sub fields	66	21
Gantry angle (°)	150, 100, 55, 0, 315, 260 and 210	
Collimator angles (°)	Varies from 350 to 5	5





# Clinical pcsr field

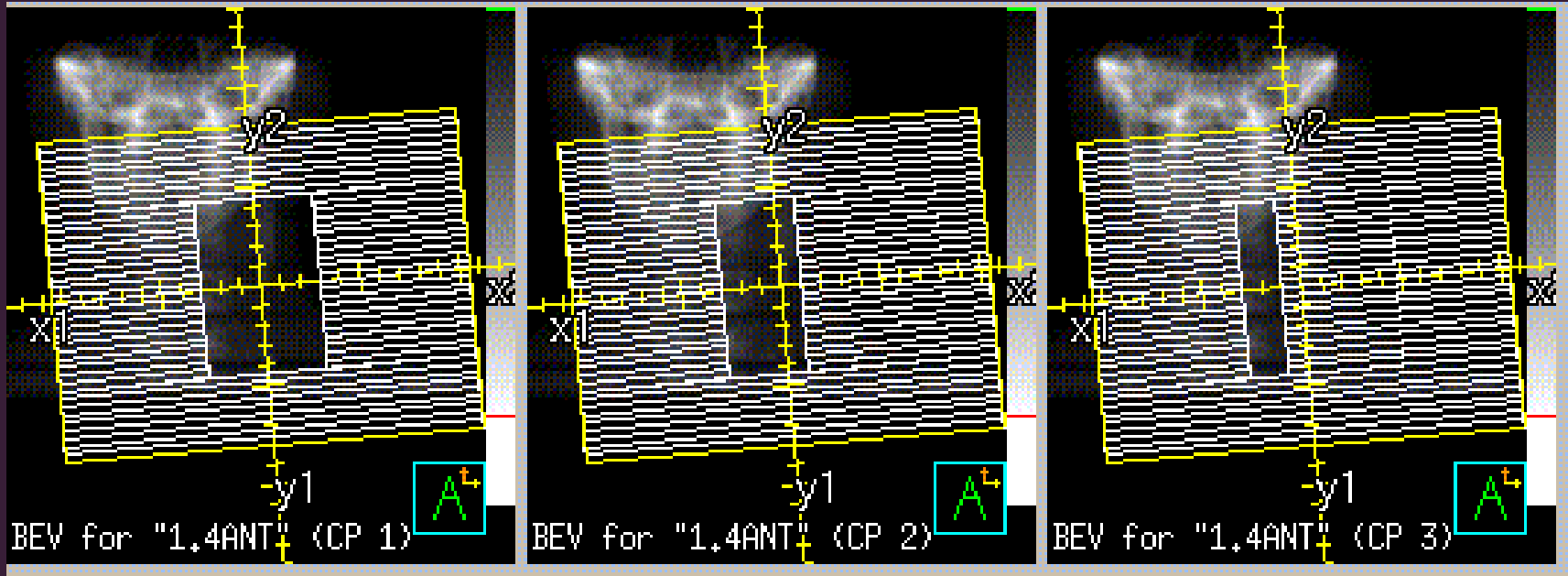


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# Simple pcsr field



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# Measurements



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$$k \frac{f_{pcsr}, f_{ref}}{Q_{pcsr} Q} = \frac{D_{w,Q}^{f_{pcsr}} / M_{Q_{pcsr}}^{f_{pcsr}}}{D_{w,Q}^{f_{ref}} / M_Q^{f_{ref}}}$$

$D_w$  measured using NPL commercial Alanine service



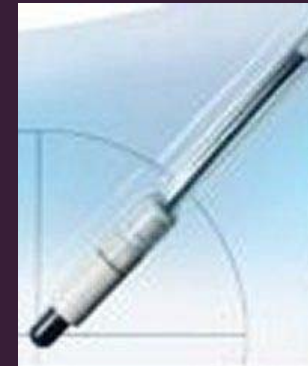
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$$\Omega_{Q_{clin}, Q_{pcsr}}^{f_{clin}, f_{pcsr}} = \frac{M_{Q_{clin}}^{f_{clin}}}{M_{Q_{pcsr}}^{f_{pcsr}}} \left[ \frac{D_{w, Q_{clin}}^{f_{clin}} / M_{Q_{clin}}^{f_{clin}}}{D_{w, Q_{pcsr}}^{f_{pcsr}} / M_{Q_{pcsr}}^{f_{pcsr}}} \right]$$

$D_w$  measured using NPL commercial Alanine service



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# Results



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## Comparison of dose measured by alanine and dose calculated by Pinnacle.

Plan	Dose measured using alanine (cGy)	Dose calculated using Pinnacle (cGy)	Difference (%)
Inverse planned pcsr	199.1	198.2	0.5
Simple pcsr	203.6	198.1	2.7
Clinical plan 1	197.9	198.6	0.3
Clinical plan 2	201.4	198.6	1.4



$$k \begin{matrix} f_{pcsr}, f_{ref} \\ Q_{pcsr}, Q \end{matrix}$$

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## Detector

	Inverse planned pcsr field	Simple pcsr field
NE2571	1.005	1.001
IBA cc13	1.021	1.021

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$$\Omega \begin{matrix} f_{clin}, f_{pcsr} \\ Q_{clin}, Q_{pcsr} \end{matrix}$$

Detector	Clinical plan 1		Clinical plan 2	
	Inverse planned pcsr field	Simple pcsr field	Inverse planned pcsr field	Simple pcsr field
NE2571	0.993	0.996	0.999	0.997
IBA cc13	1.033	1.032	1.033	1.034



# Summary

## □ Alfonso et al formalism

-can be used for head and neck IMRT

## □ Suitable pcsr field

-Inverse planned pcsr

-Simple pcsr

## □ Measurement

-factors for Farmer and cc 13



## Future work

- Investigate simple pcsr field that can be used for other clinical sites.
- Investigate more anatomical phantoms.
- Factors for other commonly used chambers.



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