## AbstractID: 11000 Title: Analytic Expression and Functional Fitting for the COMS Eye <br> Plaque Dosimetry Data

Purpose: We developed an analytic expression and functional fitting scheme for the COMS eye plaque dosimetry data generated from Monte Carlo calculations which incorporated the heterogeneity effects of the COMS plaque assembly (gold alloy backing and silastic insert). Method and Materials: For each plaque size and a specific radionuclide and seed model, I-125 (model 6711) or Pd-103 (model 200), the 2D dosimetry data in a central plane, $\mathrm{D}(\mathrm{x}=0, \mathrm{y}, \mathrm{z})$, generated from Thomson's Monte Carlo calculations ${ }^{1}$ were expressed as a product of three functions, $\mathrm{F}_{0}(\mathrm{z})$, $F_{1}(y, z)$ and $F_{2}(y, z) . F_{0}(z)$ was a fitting rational function of $z$ for the central axis depth doses, $D(x=0, y=0, z)$. The off-axis ratio, $O A R(x=0, y, z)=$ $\mathrm{D}(\mathrm{x}=0, \mathrm{y}, \mathrm{z}) / \mathrm{D}(\mathrm{x}=0, \mathrm{y}=0, \mathrm{z})$, was expressed as the product of $\mathrm{F}_{1}(\mathrm{y}, \mathrm{z})$ and $\mathrm{F}_{2}(\mathrm{y}, \mathrm{z}) . \mathrm{F}_{1}(\mathrm{y}, \mathrm{z})$ described the dose profile in the primary field. $\mathrm{F}_{2}(\mathrm{y}, \mathrm{z})$ was a sigmoid function, describing the collimating effect of the plaque. Using TableCurve2D v5.01.05, we obtained the fitting parameters for the functions, $F_{0}(z), F_{1}(y, z)$ and $F_{2}(y, z)$. Results: We obtained the following equations for $F_{0}, F_{1}$ and $F_{2}$. $F_{0}(z)=\left(a_{1}+a_{3} Z+a_{5} z^{2}\right) /\left(1+a_{2} z+a_{4} z^{2}\right)$, where $a_{1}$ through $\mathrm{a}_{5}$ were fitting parameters. $\mathrm{F}_{1}(\mathrm{y}, \mathrm{z})=\exp (-\mathrm{h}|\mathrm{y}| \mathrm{P}) . \mathrm{F}_{2}(\mathrm{y}, \mathrm{z})=1+\mathrm{b} /\{1+\exp [-(|\mathrm{y}|-\mathrm{c}) / \mathrm{d}]\}$. For each plaque size and radionuclide, the parameters, $\mathrm{h}, \mathrm{p}, \mathrm{b}, \mathrm{c}$, and d, were further fitted to various functions of z with up to 4 parameters each. Along the central axis, all the fitted dose values were within $\pm 2 \%$ of the Monte Carlo generated doses. For the majority ( $>95 \%$ ) of the off-axis points in the eye, the fitted dose values were within $\pm 2 \%$ of the Monte Carlo generated doses. Conclusion: An analytic expression and functional fitting scheme for the COMS eye plaque dosimetry data in a central plane was developed to facilitate the routine treatment planning calculations for eye plaque cases, with the heterogeneity effects of the plaque assembly taken into account. ${ }^{1}$ Thomson, Taylor and Rogers, MP 2008; 35, 5530.

