

## Studi distribusi dosis 3D pasien selama penyinaran berbasis MLC log file = Study of 3D dose distribution of patient treatment based on MLC log file

Andrian Dede Handika, author

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### Abstrak

Banyak peneliti telah menyelidiki log file linac untuk Quality Assurance (QA) teknik Intensity-Modulated Radiation Therapy (IMRT) dan Volumetric Modulated Arc Therapy (VMAT). Dibandingkan antara QA konvensional berdasarkan pengukuran, QA menggunakan log file menawarkan berbagai keuntungan termasuk spasial dan resolusi temporal yang lebih tinggi. Ini berarti QA menggunakan log file tidak memerlukan detektor dan fantom dalam pengukurannya, dan dapat diperoleh secara otomatis serta memberikan informasi untuk pengiriman fraksional setiap pasien. Tujuan dari penelitian ini adalah untuk mengembangkan dan merekonstruksi distribusi dosis 3D untuk QA khusus pasien IMRT berdasarkan log file linac menggunakan metode Modified Clarkson Integration (MCI). Log file dari linac Varian Unique diekstraksi dan dihitung untuk memperoleh distribusi dosis 3D menggunakan MATLAB versi 2016a. Kemudian, distribusi dosis dari log file dibandingkan dengan DICOM RT Dose dari Treatment Planning System (TPS) Eclipse. Kalkulasi dosis menggunakan metode MCI untuk lapangan sederhana dengan berbagai variasi (teknik, luas lapangan, dan kedalaman) memiliki dikrepansi kurang dari  $\pm 2\%$  pada isocenter. Di sisi lain, kalkulasi evaluasi gamma indeks dengan berbagai kriteria Dose Difference (DD) dan Distance to Agreement (DTA) 3%/3 mm, passing rate di atas 95%, sedangkan kriteria untuk 2%/2 mm dan 1%/1 mm di atas 90%. Kalkulasi evaluasi gamma indeks 2D untuk pasien IMRT dengan kriteria 4%/4 mm dan 3%/3 mm, passing rate masing-masing di atas 90% dan 85%. Evaluasi 3D gamma indeks lebih baik daripada 2D untuk kriteria 4%/4 mm dan 3%/3 mm. Hasil ini menunjukkan bahwa metode MCI dan log file dapat digunakan untuk kalkulasi dosis dan alternatif patient-specific QA IMRT.

.....Many researchers have investigated the linac log file for Intensity-Modulated Radiation Therapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT) Quality Assurance (QA). In comparison between the conventional QA based on measurements, QA using log files offers various advantages including spatial sampling and higher temporal resolution. It does not mean it does not require tools and phantoms in its measurements, but the QA based log file can be automatically generated and provide information for patient fractional delivery. The aim of this study was to develop and reconstruct 3D dose distribution for IMRT patient-specific QA based on linac log file using Modified Clarkson Integration (MCI) method. Linac log file from Varian Unique was extracted and calculated to 3D dose distribution using MATLAB version 2016a. Then, dose distribution from the log file was compared with DICOM RT Dose from Eclipse Treatment Planning System (TPS). Dose calculations using the MCI method for simple open fields of various variations (techniques, field size, and the depth) had discrepancy less than  $\pm 2\%$  at isocenter. On the other hand, the calculation of gamma index evaluation with various criteria Dose Difference (DD) and Distance to Agreement (DTA) of 3%/3 mm, the passing rate is above 95%, while the criteria for 2%/2 mm and 1%/1 mm above 90%. Calculation of gamma index evaluation 2D for IMRT patient with various criteria of 4%/4 mm and 3%/3 mm, the passing rate is above 90% and 85%, respectively. Evaluation Gamma Index 3D is better than 2D for criteria 4%/4 mm and 3%/3 mm. This result showed that MCI method and the log file can

be used for dose calculation and alternative IMRT patient-specific QA.