Koreksi lateral response artifacts (LRA) flatbed scanner pada film gafchromic dosimetri radioterapi teknik IMRT dan VMAT = Correcting lateral response artifacts (LRA of flatbed scanner towards gafchromic dosimetry film by conducting radiotherapy technics IMRT and VMAT

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Abstrak

[ABSTRAK
Film gafchromic EBT2 dan EBT3 cocok digunakan untuk jaminan kualitas (QA) pada treatment planning systems (TPS) dan linear accelerator (LINAC) serta verifikasi radioterapi teknik IMRT dan VMAT. Namun generasi selanjutnya dari film gafchromic EBT yaitu EBT2 dan EBT3 ketika dilakukan scanning (pemindaian) menggunakan scanner flatbed masih terdapat artefak geometris yang dahulunya juga ditemukan pada film EBT sehingga memerlukan penanggulangan dan koreksi yang sesuai. Pada penelitian ini menggunakan scanner flatbed Epson expression 10000XL, Epson perfection V700 dan Mikrotek 1000XL plus yang dapat menangkap warna dengan rinci dan presisi. Perangkat lunak yang digunakan dalam koreksi ini adalah FilmQA Pro 2015. Hasil yang diperoleh yaitu Koefisien A dan B diterapkan untuk variasi posisi lateral terhadap nilai tanggapan di lokasi yang bersamaan, sehingga pengkoreksian tanggapan artifak lateral dapat dilakukan. Pada dosis maksimum nilai koreksinya <0,5% dan pada kasus <0.2%. Pada pengukuran ulang untuk setiap film, standar deviasi yang diperoleh untuk setiap film sekitar 0.19%. Pengujian dosimetri channel tunggal (merah) sebelum dan sesudah koreksi pada kasus IMRT didapatkan hampir 91% dari piksel memenuhi 3% / 3mm kriteria gamma keseluruhan dengan ambang batas dosis > 10%. Untuk pengujian kasus VMAT, film di scan dengan posisi di pusat scanner dan posisi ektrim tepi scanner, maka pengukuran di channel warna merah 4% lebih tinggi dibandingkan channel warna hijau dan biru. Rata-rata konsistensi pengukuran dosis selama daerah terkena dosis > 100 cGy adalah sekitar 21,8 cGy dan di daerah yang paling dekat dengan tepi scan window sekitar 10 mm dengan perbedaan dosis 35 cGy. Setelah dilakukan koreksi, rata-rata konsistensi dosis pada tiga channel di sekitar daerah terpapar sekitar 5,1 cGy. Perbedaan dosis antar channel sekitar 9 cGy. Hasil ini menunjukkan koreksi respon artefak lateral memang perlu dilakukan. Respon yang diukur tergantung pada posisi film pada pemindai dan dosis yang diberikan. Pengukuran pada channel warna merah menunjukkan sensitivitas yang lebih besar pada dosis rendah, sedangkan respon pada channel hijau atau biru memberikan perpanjangan jangkauan dinamis dari film ke dosis tinggi. Metode triple-channel dosimetri telah terbukti memiliki keuntungan signifikan atas single channel dosimetry dengan akurasi dosimetri yang baik.
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ABSTRACT
The film of gafchromic EBT2 and EBT3 are appropriate for quality assurance (QA) to the radiotherapy technics verification of IMRT and VMAT. In the next generations of EBT which are EBT2 and EBT3, are still attained the geometrical artifacts once scanning by flatbed scanner which is used to be found on EBT film in order to need an overcome ways and an appropriate correction. This research used a flatbed scanner EPSON expression 10000XL, EPSON perfection V700 and Microtech 1000XL plus and FilmQA Pro 2015 as a software for correcting it. The result shows that coefficient A and B were applied for lateral correction

artifacts responses can be made. On the maximum dose, it has correction value as much as <0,5% and in case was <0.2%. The deviation standard was approximately 0,19% on re-measure for each film. Prior to the dosimetry measurement of single channel (red) and subsequent to the correction IMRT has got almost 91% of pixel which met with gamma criteria, 3% / 3mm, with dose threshold 10% TH. In the measurement of VMAT‟s case, film scanned on the center of scanner and the extreme position of the scanner edge. Thus, measurement in the red channel was 4% higher than green and blue channel. The average of dose measurement consistency during area exposed to doses > 100 cGy is approximately 21,8 cGy and the closest area with the edge of scan window is around 10 mm at difference doses 35 cGy. After correction, the average of doses consistency was 5,1 cGy on the three channel where exposed. The distinction of doses was approximately 9 cGy among channels. This result stated that the correction of artifacts lateral response is needed to carry on. The method of triple-channel dosimetry has the significant advantage on single-channel dosimetry with a good consistency. Through escalation dose and variation of lateral position, the distinct response would be increased on single-channel which is red channel. The measurement on red channel reveals the highest sensitivity on the slight dose. Whereas, a green or blue channel response provides a dynamic range extension of film to a high dose. Thus, the method of dosimetry triple-channel has the significant contribution of single-channel evidently with a good dosimetric accuracy., The film of gafchromic EBT2 and EBT3 are appropriate for quality assurance (QA) to the radiotherapy technics verification of IMRT and VMAT. In the next generations of EBT which are EBT2 and EBT3, are still attained the geometrical artifacts once scanning by flatbed scanner which is used to be found on EBT film in order to need an overcome ways and an appropriate correction. This research used a flatbed scanner EPSON expression 10000XL, EPSON perfection V700 and Microtech 1000XL plus and FilmQA Pro 2015 as a software for correcting it. The result shows that coefficient A and B were applied for lateral correction artifacts responses can be made. On the maximum dose, it has correction value as much as <0,5% and in case was <0.2%. The deviation standard was approximately 0,19% on re-measure for each film. Prior to the dosimetry measurement of single channel (red) and subsequent to the correction IMRT has got almost 91% of pixel which met with gamma criteria, 3% / 3mm, with dose threshold 10% TH. In the measurement of VMAT‟s case, film scanned on the center of scanner and the extreme position of the scanner edge. Thus, measurement in the red channel was 4% higher than green and blue channel. The average of dose measurement consistency during area exposed to doses > 100 cGy is approximately 21,8 cGy and the closest area with the edge of scan window is around 10 mm at difference doses 35 cGy. After correction, the average of doses consistency was 5,1 cGy on the three channel where exposed. The distinction of doses was approximately 9 cGy among channels. This result stated that the correction of artifacts lateral response is needed to carry on. The method of triple-channel dosimetry has the significant advantage on single-channel dosimetry with a good consistency. Through escalation dose and variation of lateral position, the distinct response would be increased on single-channel which is red channel. The measurement on red channel reveals the highest sensitivity on the slight dose. Whereas, a green or blue channel response provides a dynamic range extension of film to a high dose. Thus, the method of dosimetry triple-channel has the significant contribution of single-channel evidently with a good dosimetric accuracy.]