

An experimental approach to Automatic Exposure Control testing

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Abstract

An Experimental Approach to AEC Testing

A New Zealand Qualified Health Physicist (QHP) is required, under the Radiation Protection Act of 1965 and the Radiation Protection Regulations 1982, to perform auditing compliance tests on x-ray equipment at regular intervals to ensure that this equipment conforms to the Code of Safe Practice with the use of x-rays. The protocol for these tests must be approved by the National Radiation Laboratory (NRL).

One of these test protocols sets out the requirements for the functionality testing of the x-ray machine Automatic Exposure Control (AEC). The current NRL protocol for AEC testing is based on the radiographic film environment (NRL C5 1994). This protocol was tested to determine its applicability to the digital computed radiography (CR) imaging systems which are replacing screen-film systems. To begin this process a comparison of the different exposure indexes for each image medium was required. This proved to be achievable using a system of exposure dose comparison. The AEC test process for both image modalities follows identical requirements but differ slightly in the test methods used to achieve these. The most significant finding throughout this stage was not the differences between protocols but was the requirement to achieve consistent exposure index values over the clinical kVp range for each image medium. This requirement, applicable to any x-ray image medium, became the focus of this thesis.

The thesis has explored through experimentation, the effect of optimisation of AEC kVp compensation for the variable kVp response of an image medium, on image consistency. At Christchurch Hospital where this investigation took place the work has shown that the performance of AEC devices can be optimised to improve image consistency, indicated by a more consistent exposure index over the clinical kVp range. The optimisation process also achieves a more consistent dose response to the image plate. A dose variation of 8.3% from the average was achieved compared to 26% in the unoptimised version. No clinically significant changes to image quality were apparent in test images. Under these conditions it was found that AEC functionality could be assessed solely by the measurement of AEC dose to the image plate (IP). Use of this test method provides quantifiable time management benefits for the Medical Physicist and for the radiology departments in which they work.

Disclaimer

To the best of my knowledge and belief this thesis contains no material which has been accepted for the award of any other degree or diploma in any university and contains no material previously published or written by another person except where due reference is made in the text of the thesis.

I give consent to this thesis being made available for photocopying and loan, if accepted for the award of the degree.

Signed:

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