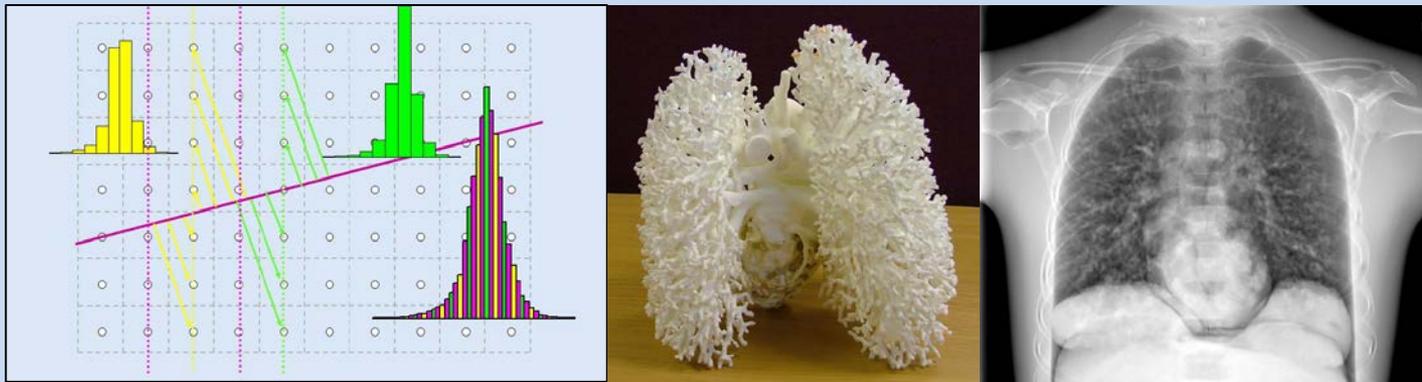


Module MPE07

Innovative techniques
in X-ray imaging:
Quantitative measurements
Optimisation studies



This is what you get...



- High level training from international experts
- Review of scientific literature

Quantitative Measurements

- Understanding of Quantitative measurements (MTF, NPS, DQE)
- Ability to calculate MTF, NPS and DQE
- Ability to apply knowledge to quality control, fault finding and system procurement

Optimisation studies

- Understand the range of optimisation methodologies
 - Phantoms (physical & anthropomorphic), study types
- How to undertake observer studies
- Understanding of the clinical task
- You produce your own optimisation study proposal



Take home messages



- Quantitative measurements can provide a deeper understanding about imaging systems
- We need to be able to relate quantitative measurements to the effect on clinical exam
- The clinical task must be considered during optimisation
- The risk of mis-diagnosis may be higher than that associated with radiation dose
- Working at MPE level is not only about good science but also requires soft-skills e.g. leadership, negotiation



Teaching methods



60 Hours Online

20 Hours Face to Face,
Guildford, UK

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Text

Conditioning of the data for MTF

Simply using the raw data of the edge spread function (ESF) to calculate the MTF may produce satisfactory results. However, there may be issues with noise [see quiz below] and potentially discontinuities in the resultant line spread function (LSF). Data conditioning can improve the resultant MTF's accuracy if undertaken correctly.

To reduce the noise in the resultant edge spread function (ESF), the edge is imaged at relatively high dose, typically up to five times the detector dose for clinical examinations. Of course it is essential that the dose level used is still within the range used for measurement of the signal transfer properties. Nevertheless, further processing of the ESF is generally undertaken to reduce the noise. The smoothing process must be used carefully to ensure that information is not lost while minimising noise. There are a number of smoothing regimes that are used on the ESF:

Savitzky-Golay: The Savitzky-Golay method uses a moving fit over the ESF to smooth the data (Savitzky and Golay 1964), this can reduce the noise while having a minimal effect on the signal of interest. Samci *et al* (1998) used a fourth order polynomial moving fit over a

Why is smoothing of the edge spread function necessary?

Noise will be amplified in the differentiation stage

To simulate a perfect system

To remove high frequency information

Quizzes

Webcasts

Secondary Quantum Noise

- Related to number of secondary quanta detected
 - Poisson noise
- NPS frequencies proportional to sinc^2 (+aliasing)

Discussion

Post Question

Alistair Mackenzie

Regarding what do the quantitative measurements really mean. Can you discuss this article, in particular consider what do we know now?

Show Comments: #1 Add Comment

We now have IEC standards for measuring DQE so we can compare the merits of the detectors on the market. In addition to this, we have evidence to show that clinical image quality is correlated with image quality metrics such as DQE however this only examines detector aspects of image quality. Other measures are also important such as CNR, effective DQE.

Demonstration Videos

Tele-conference

Seminars

Discussion

Practicals

Case studies

Meet experts

Previous participants

“The knowledge was presented in an **easily accessible fashion**, particularly the on-line course was very well structured and contained a lot of useful material. ”

“It was great pleasure, AND most important a lot of knowledge that can be used for optimizing procedures in DR & **benefit our patients**”

“I feel **more confident with the quantitative measurements** now. Just in time for a big DR project getting underway here”

“I sincerely believe that attending this course has been for me a great opportunity to do **better my job**”

“Thanks a lot for this course which was a highly informative workshop and thank you all for the European collaboration during studies ”

“It was a great pleasure for me to attend this **"powerful" Module.**”

“This has been a superb course. A lot of work went into distilling large amounts of information down into serious knowledge. The **exam was good** to demonstrate how much work I still need to do!”

“Thanks to all presenters for making such a useful resource and sharing their knowledge. I really **enjoyed the social aspects** of the course too.”

“The study materials and especially the videos covered such a lot of **aspect never met in any of courses** I've attended before. The course was very complete.”

“The practical aspects in particular had given me the **confidence to introduce new working practices.**”

