# Medical Physics Seminar
# Monday, October 19, 2015
# 1345 HSLC - 4:00 P.M.


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### The Role of Physics in CT Protocol Optimization over the Range of CT Scanner Types: Recommendations and Misconceptions

The understanding of how scan and reconstructions parameters affect image quality, patient dose, and total scan time is essential to the proper optimization of CT scanner protocols. This understanding is greatly complicated by the differences in user interfaces and in the effects of varying scan and reconstruction parameter with scanners from different manufacturers and even with different scanners from the same manufacturer. Certain scan parameters affect patient dose and image quality (kV, mA, rotation time, effective mAs, pitch, noise index (NI), standard deviation (SD), target effective (TE) mAs), while a subset of these affect the total scan time – which is important for breath hold and contrast considerations. There is a logical method of approaching the modifications of these parameters to achieve the necessary diagnostic image quality at the lowest dose, within total scan time limitations. This method must take into account the model and manufacture of CT scanner, but unfortunately has often not been followed in the development of published CT protocols.

Some examples of common confusions and misconceptions involving protocol optimization:

The automatic exposure control (AEC) systems from various manufacturers have dramatically different interfaces and perform their functions very differently. Even with the use of AEC, optimal CT scans are not usually obtained with a single protocol for all size patients. In AEC mode the dose can be reduced by raising the NI or lowering the TE mAs. However raising the kV can either raise or lower the dose depending on the AEC system used. Imaging infants to large adults can utilize a range of kV from 80 to 140 kV, with large patients requiring a higher NI and higher TE mAs when using AEC.

The effects of pitch and the ways to adjust pitch to optimize image quality and patient dose have appeared to be particularly confusing. Raising the pitch above a value of 1.0 is usually not an optimal way to lower dose due to detrimental effects on image artifacts and slice thickness. Instead, the use of a pitch less than 1.0, with shorter rotation times and lower mA is preferred. Pitch values less than 1.0 do not unnecessarily over-irradiate the patient since the added radiation is effectively utilized in the image reconstruction in reducing image noise. Raising the pitch above 1.0 should only be a final step used to reduce the total scan time when it is clinically too long.

**1345 HEALTH SCIENCES LEARNING CENTER 4:00—5:00 P.M.**