Computerised image quality measurements

Nicholas Keat
ImPACT
St George's Hospital, London

Why do we need it?

- It is possible to perform QC measurements using tools on scanner console
  - ROI to give mean CT number and SD
  - Distance measurement tools for variety of tests
- As the number of images increases, this becomes impractical

Why do we need it?

- Repeatability and consistency is important, particularly when comparing results
  - Do all scanner tools give the same result?
  - Are the ROIs the same size and in the same position?
  - Results can’t be queried if there is a problem
  - Range of testing limited by tools available

Benefits

- Automation
  - Can run same analysis on many images at once
- Repeatability
  - Results can be queried
  - Data can be explored to assess anomalies
- Output in adaptable format
  - Can output summary information, e.g. MTF50, MTF10 or more full data e.g. entire MTF curve

Disadvantages

- Costs of development software
- Development costs
- Support / bug fixes
- Not commercial standard software
  - Incompatibilities with some images or situations
  - Crashes not uncommon – have to be aware of shortcomings

Evolution of IQ measurements at ImPACT

- IMPARS – old Ramtek Unix system, used reformatted images
- IMPASS – Sparc (Unix) system, used reformatted images, but could read DICOM images
  - Had to manually type results into excel etc manually!
- Current system, programmed in IDL on Windows PCs (www.rsinc.com)

Benefits of DICOM

- Compatibility
  - Previously had to take manufacturers' image format and write a 'conversion' program to a common format that is used by the analysis system
  - IDL is able to read DICOM files natively, so no conversion necessary

Transfer of images

- Used to have to have appropriate tape / MOD etc drive to read each archive format
- DICOM network transfers (Storage SCU) eliminate need for extra hardware
- CD-R is now often the easiest transfer option

How the current system works

- Images from assessment are put in directory on PC
- Images are indexed to get scan details
  - kV, mA, slice, z-pos, patient name, date etc
- Selector program used to browse and pick images for analysis
- List of image files sent to separate analysis routines
- Results output to .csv file (to be read into Excel)

IQ parameters analysed

- CT number and standard deviation
- Image uniformity
- Noise power spectrum
- Spatial resolution
  - Edge and point spread functions
- Axial z-sensitivity
- Helical z-sensitivity

- Plus image browser, low contrast phantom scoring, basic 3d viewer, various R&D tools

Image Selector

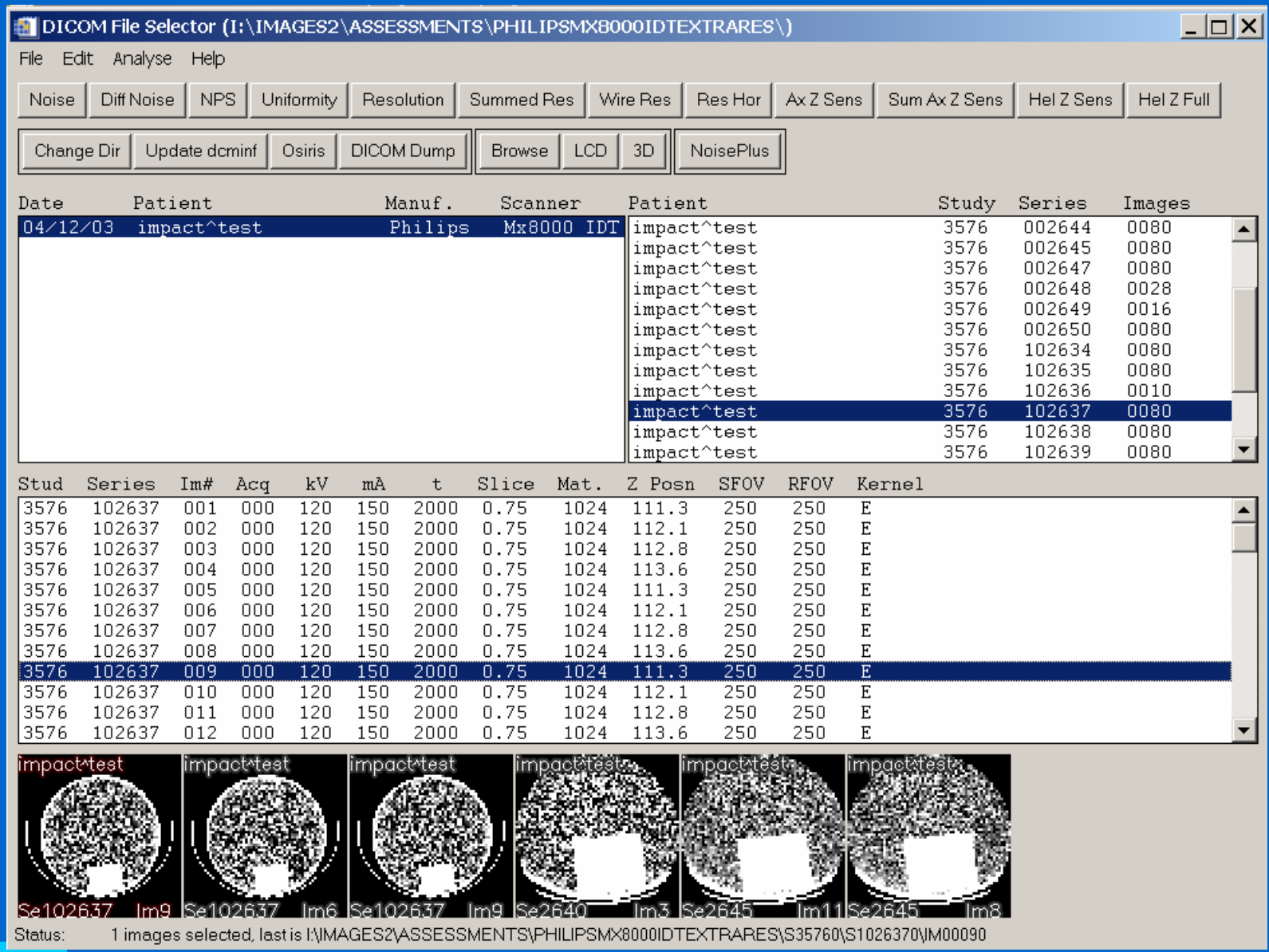
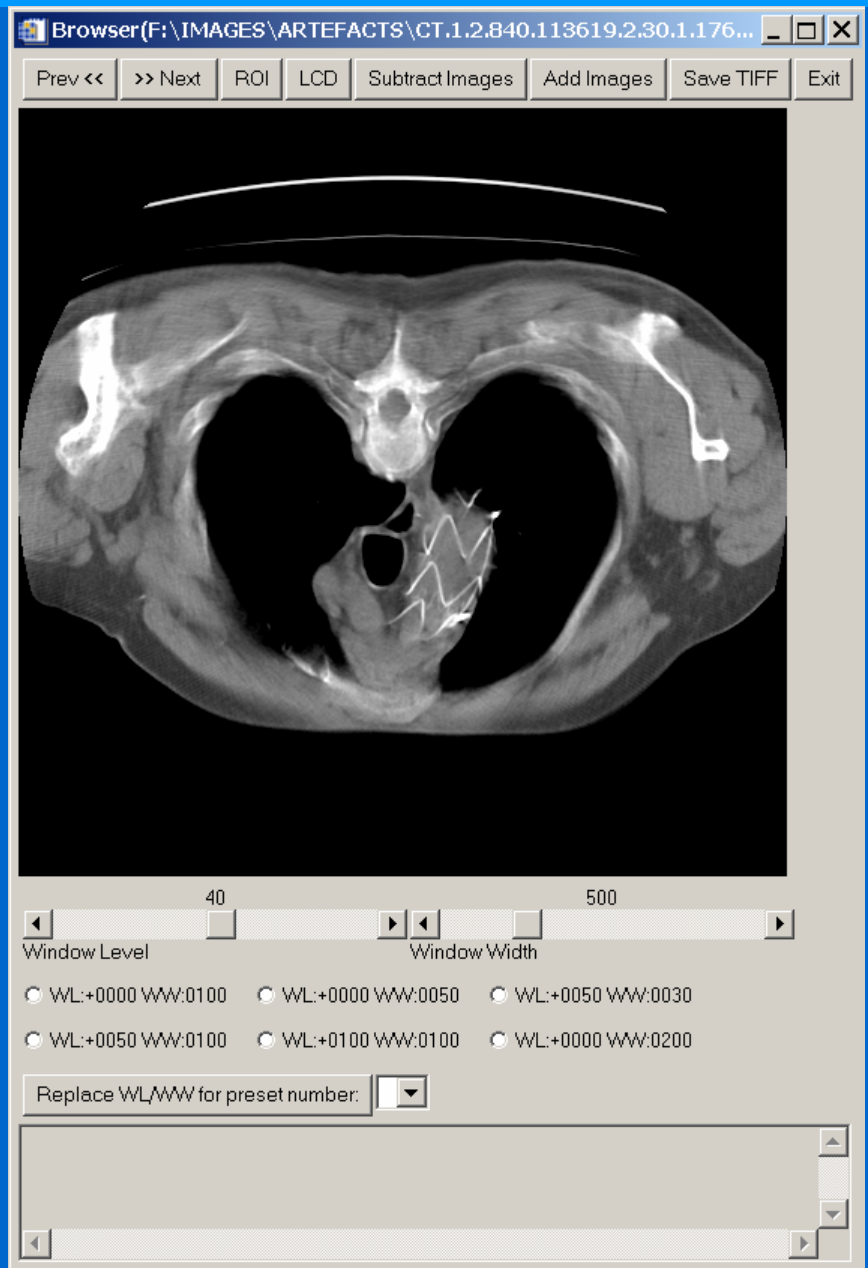
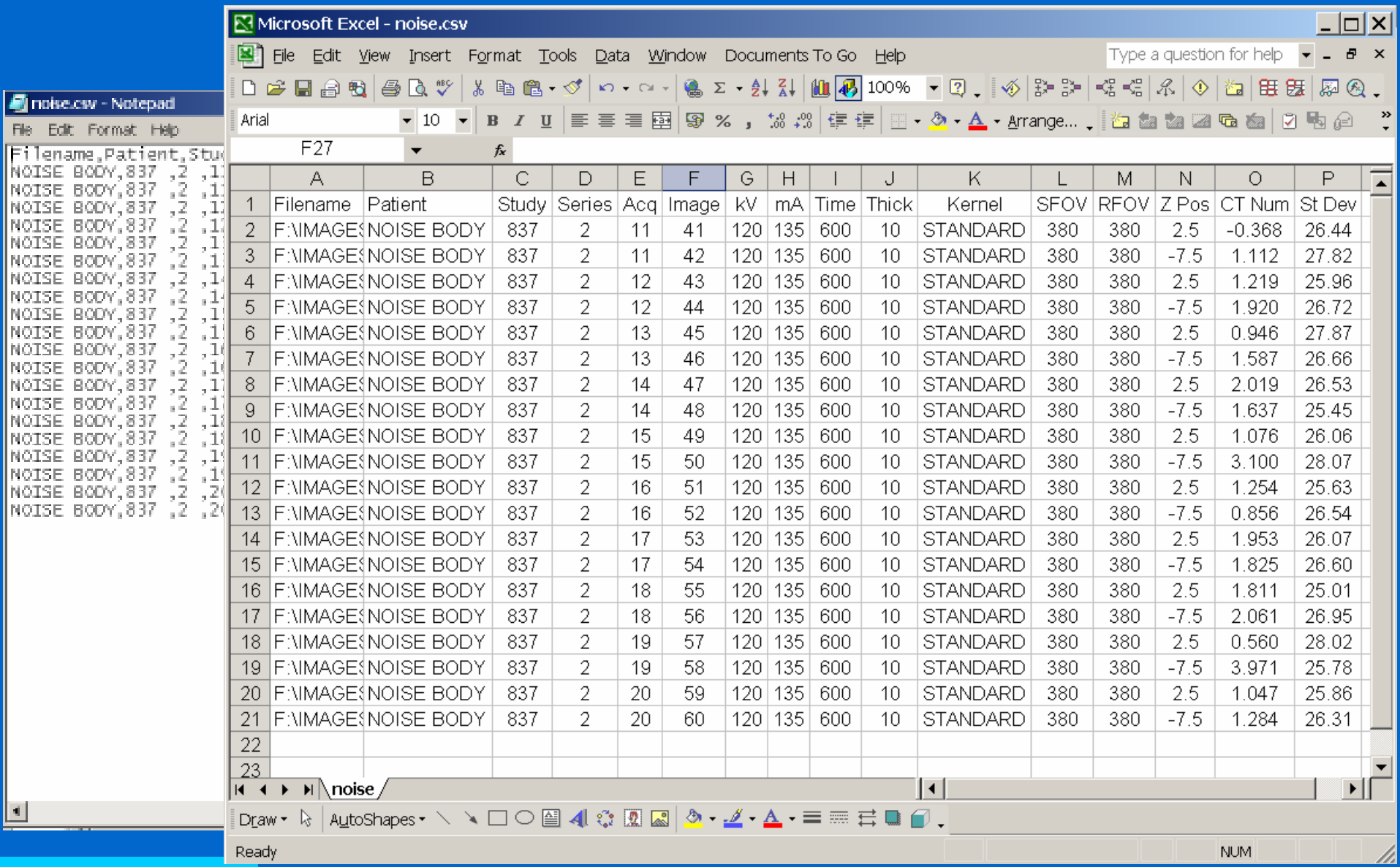


Image viewer



System output



Future development

- More analysis!
  - General ROIs
  - Modular analysis routines (plug in format)
- Better error handling
- Flexible output templates
- Make analysis less CT specific for other modalities
  - The imaging world is not just 512 x 512!
- Better structure and commenting