IQWorks – progress to date and how you can get involved

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NHS
Lothian

Progress since Nottingham

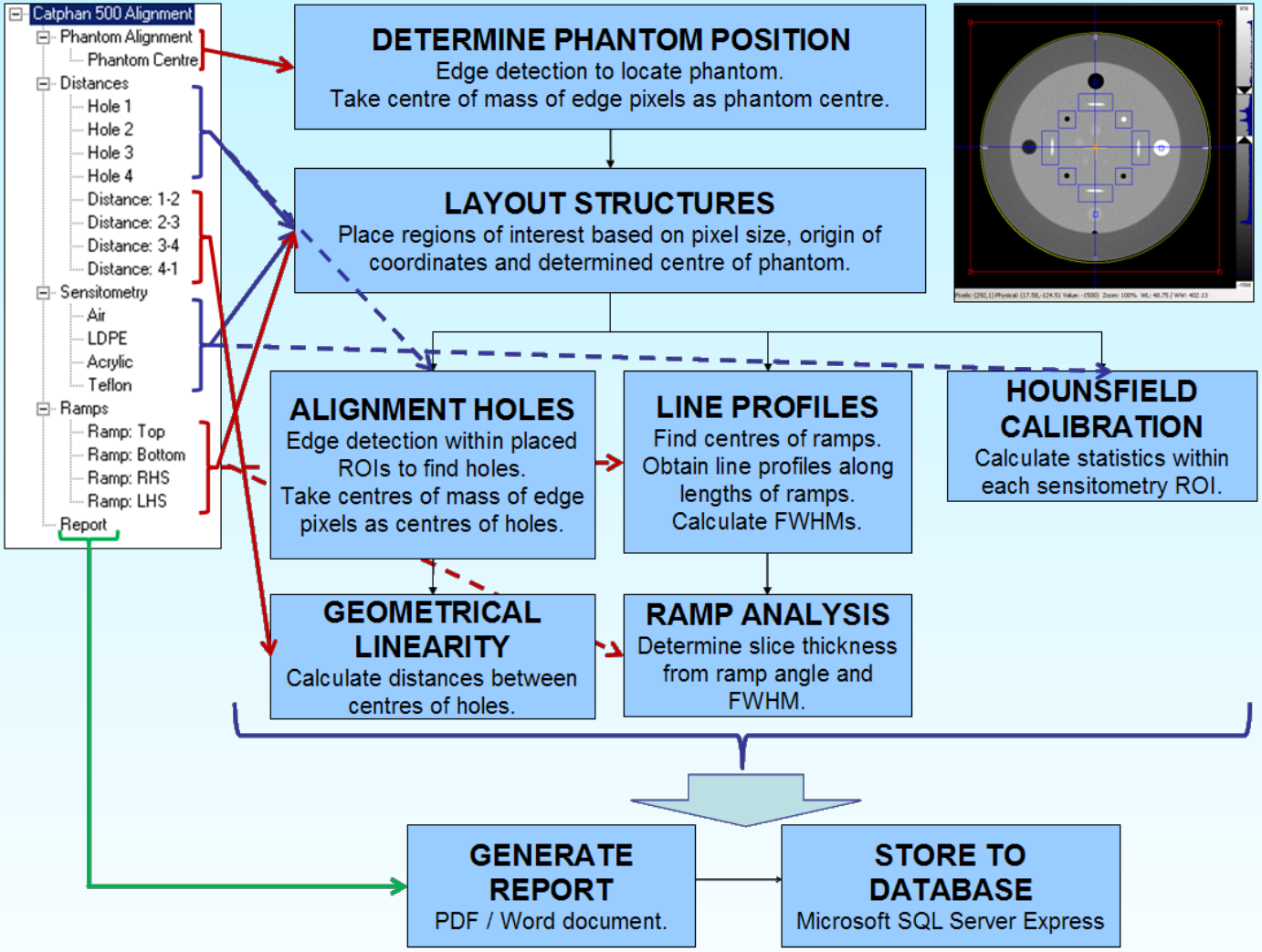
- Open source DICOM module
- Consolidation
- Evolution of algorithms
  - Particularly edge MTF and NPS
- Display QA module
- Bug fixing
  - And bug creating!

What can it do?

Methodology

- The Generic Phantom
  - All phantoms composed of atomic components
  - e.g. Impulse object, slice thickness ramp
- Develop analysis methods for each component
- User constructs ‘analysis tree’ for any phantom
- Perform analysis on multiple images
- Report and store results

What can it do?

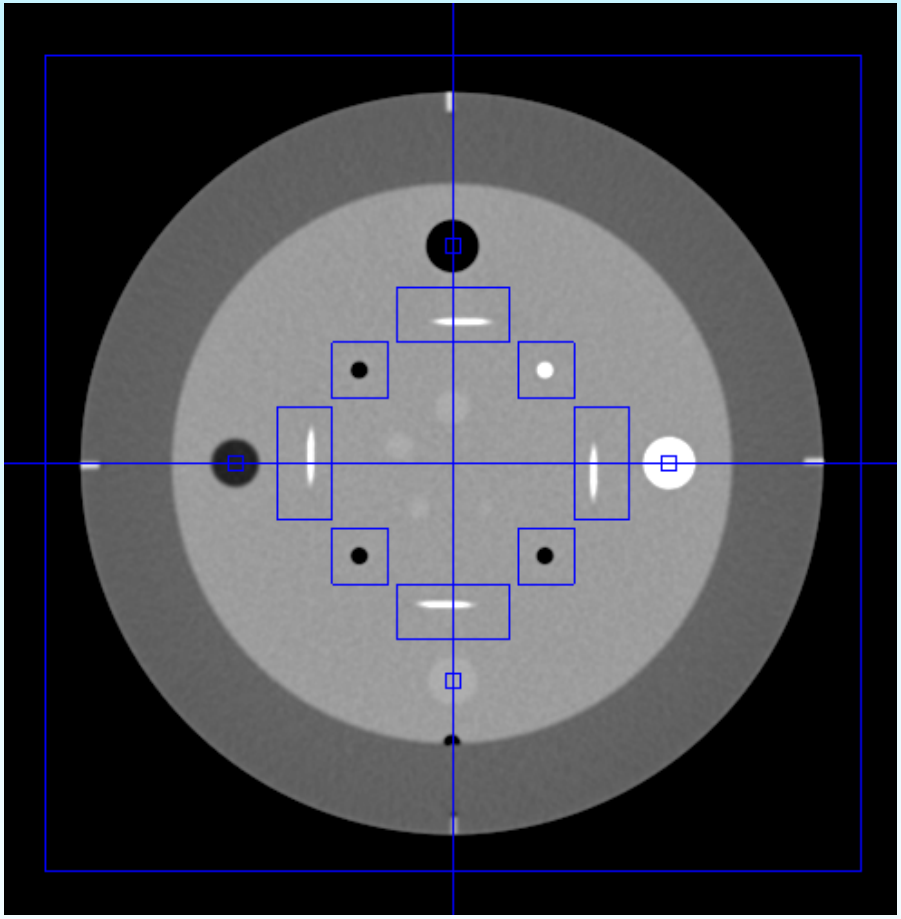


Features

- Comprehensive set of ‘atomic’ analysis modules
- Suitable for almost all phantoms and modalities
- Flexible user-customisation of analysis tree
- Flexible reporting framework
- Testing of result values -> limits framework
- Storage to database or Excel file
- DICOM Browser

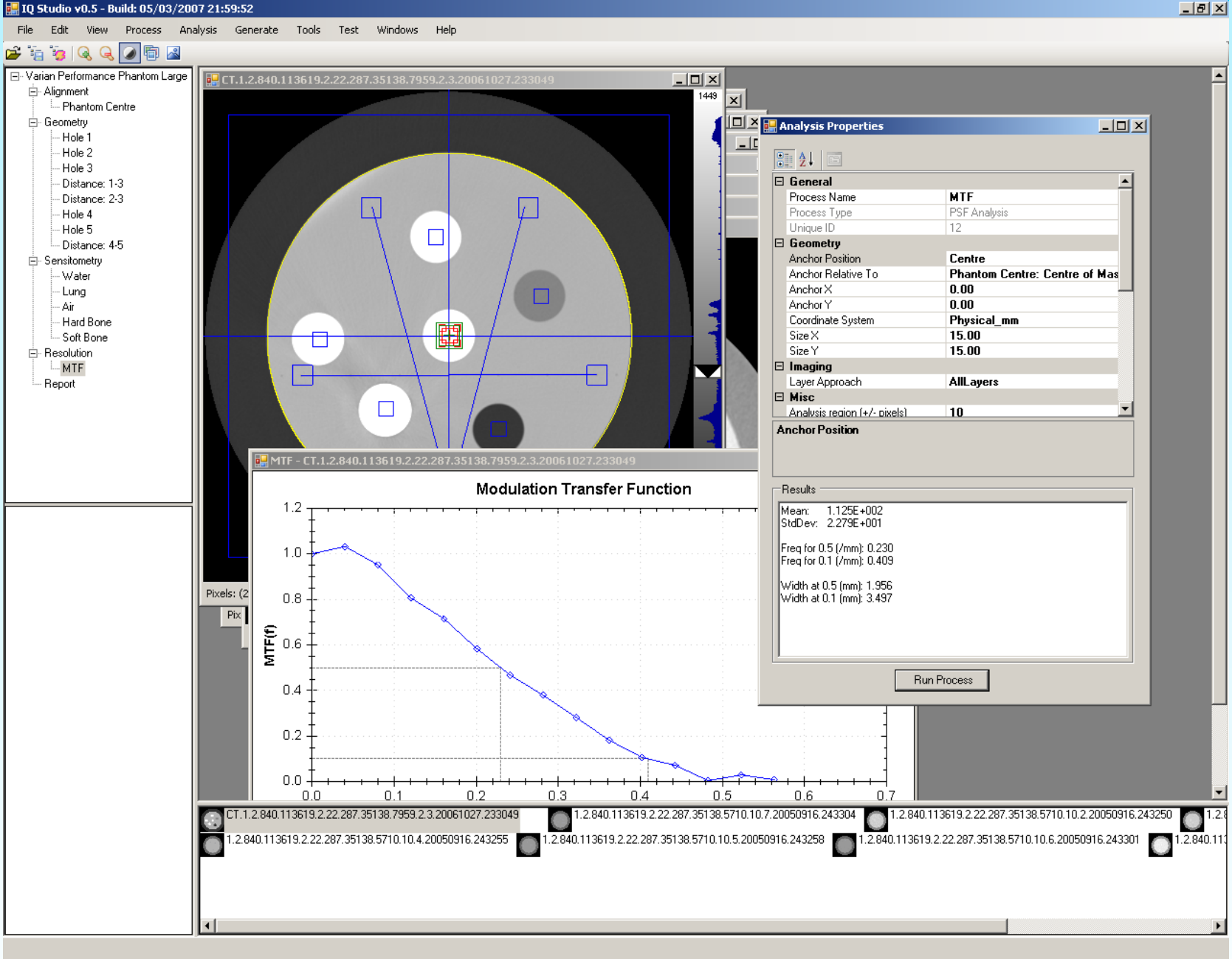
Catphan Alignment Slice

- Catphan 500 Alignment
  - Phantom Alignment
    - Phantom Centre
  - Distances
    - Hole 1
    - Hole 2
    - Hole 3
    - Hole 4
    - Distance: 1-2
    - Distance: 2-3
    - Distance: 3-4
    - Distance: 4-1
  - Sensitometry
    - Air
    - LDPE
    - Acrylic
    - Teflon
  - Ramps
    - Ramp: Top
    - Ramp: Bottom
    - Ramp: RHS
    - Ramp: LHS
  - Report



Analysis Modules

- General ROI
- Edge detection – find centre of phantom
- Edge analysis -> Angles, LSF, MTF
- Distance measurements
- Bar pattern analysis -> MTF
- Uniformity analysis -> Profiles, indices
- Contrast
- Contrast to Noise Ratio (CNR)
- Noise Analysis (SNR, NPS)
- Detective Quantum Efficiency (DQE)


IQ Studio v0.5 - Build: 05/03/2007 21:59:52
File
Edit
View
Process
Analysis
Generate
Tools
Test
Windows
Help
Varian Performance Phantom Large
Alignment
Phantom Centre
Geometry
Hole 1
Hole 2
Hole 3
Distance: 1-3
Distance: 2-3
Hole 4
Hole 5
Distance: 4-5
Sensitometry
Water
Lung
Air
Hard Bone
Soft Bone
Resolution
MTF
Report
CT.1.2.840.113619.2.22.287.35138.7959.2.3.20061027.233049
Analysis Properties
General
Process Name
MTF
Process Type
PSF Analysis
Unique ID
12
Geometry
Anchor Position
Centre
Anchor Relative To
Phantom Centre: Centre of Mas
Anchor X
0.00
Anchor Y
0.00
Coordinate System
Physical_mm
Size X
15.00
Size Y
15.00
Imaging
Layer Approach
AllLayers
Misc
Analysis region (+/- pixels)
10
Anchor Position
MTF - CT.1.2.840.113619.2.22.287.35138.7959.2.3.20061027.233049
Modulation Transfer Function
MTF(f)
Results
Mean: 1.125E+002
StdDev: 2.279E+001
Freq for 0.5 (/mm): 0.230
Freq for 0.1 (/mm): 0.409
Width at 0.5 (mm): 1.956
Width at 0.1 (mm): 3.497
Run Process
Pixels: (2
Pix
1.2.840.113619.2.22.287.35138.5710.10.7.20050916.243304
1.2.840.113619.2.22.287.35138.5710.10.2.20050916.243250
1.2.840.113619.2.22.287.35138.5710.10.4.20050916.243255
1.2.840.113619.2.22.287.35138.5710.10.5.20050916.243258
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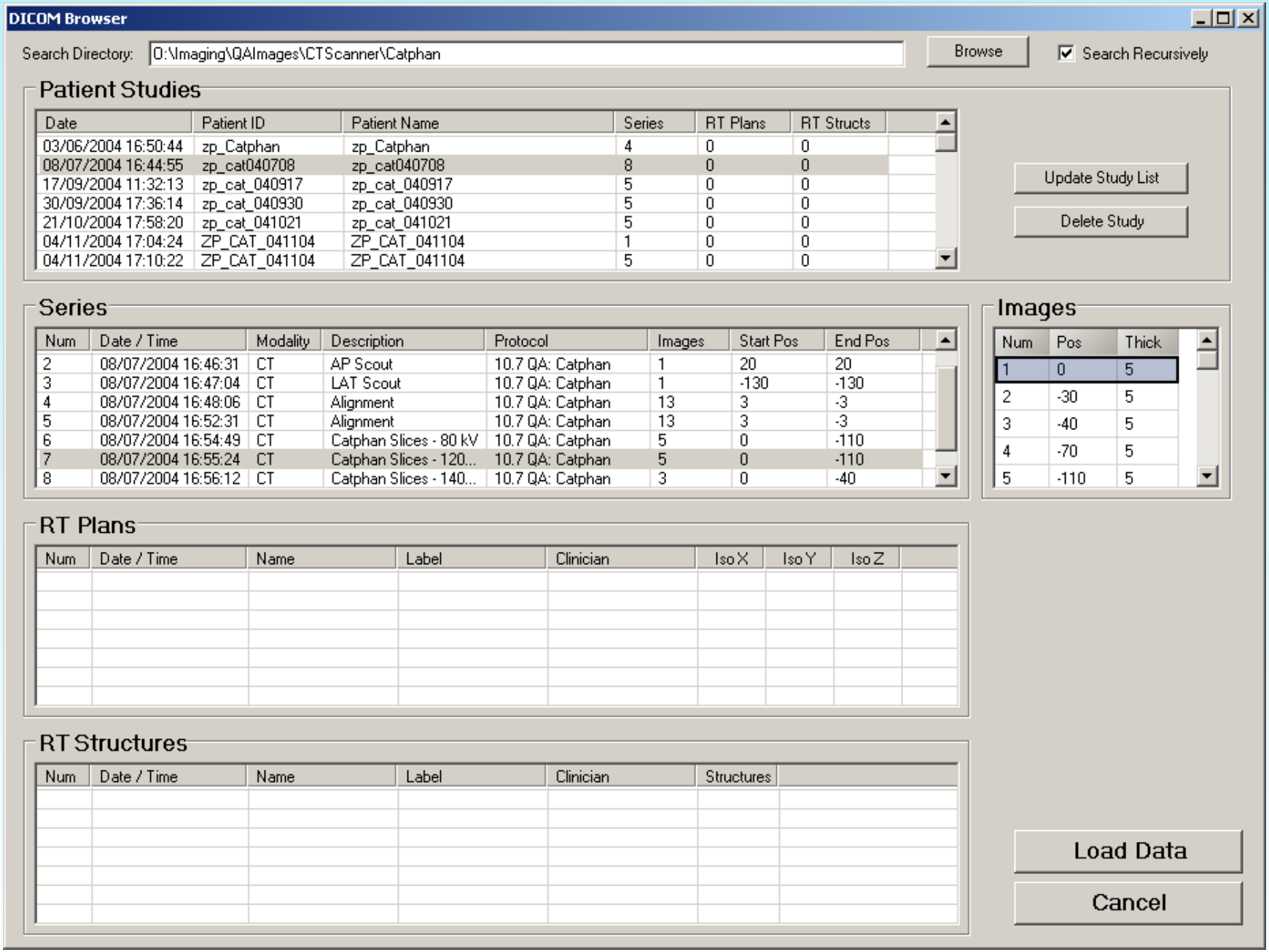
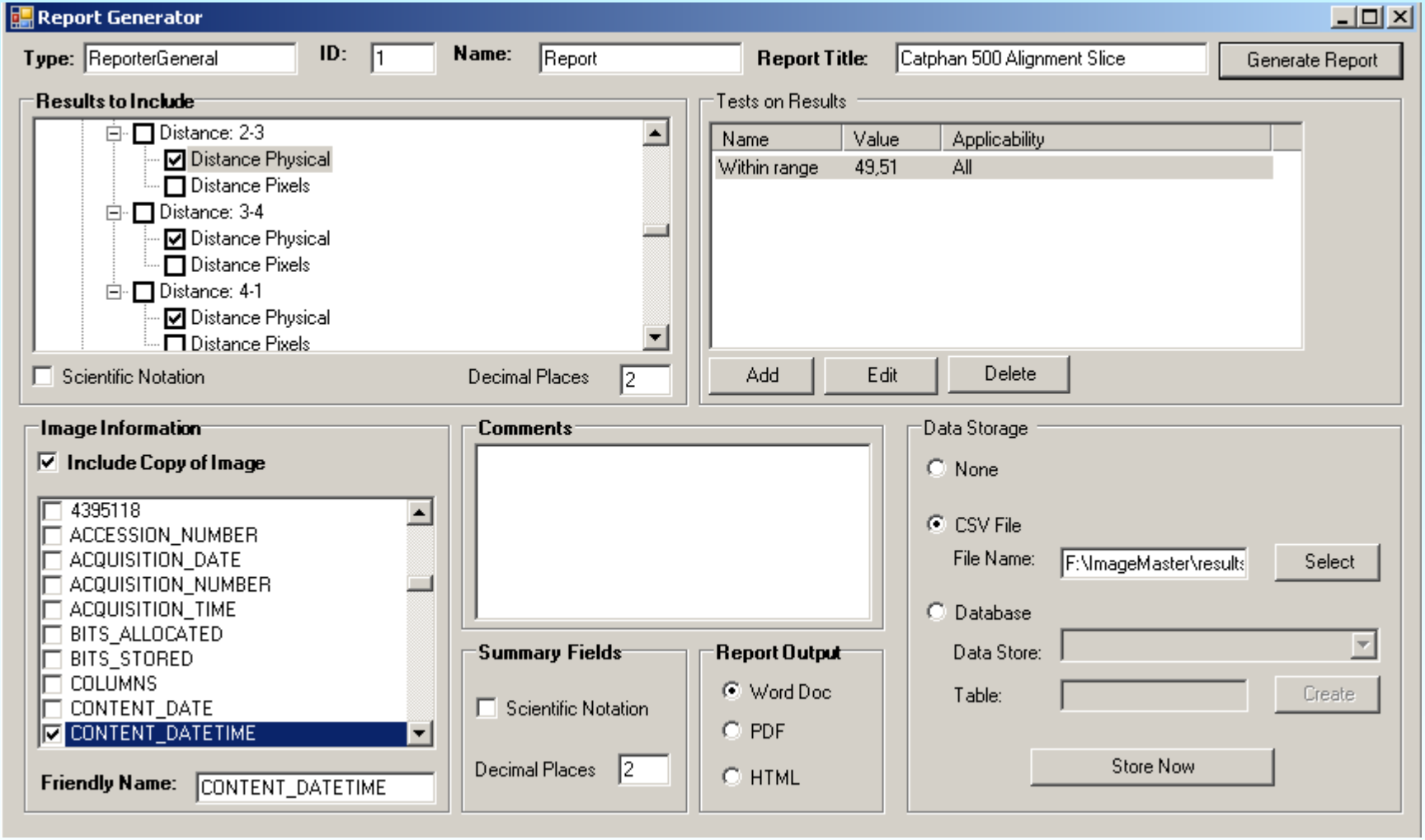
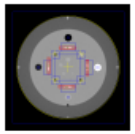

DICOM Browser
Search Directory:
O:\Imaging\QAImages\CTScanner\Catphan
Browse
Search Recursively
Patient Studies
Date
Patient ID
Patient Name
Series
RT Plans
RT Structs
03/06/2004 16:50:44 zp_Catphan zp_Catphan 4 0 0
08/07/2004 16:44:55 zp_cat040708 zp_cat040708 8 0 0
17/09/2004 11:32:13 zp_cat_040917 zp_cat_040917 5 0 0
30/09/2004 17:36:14 zp_cat_040930 zp_cat_040930 5 0 0
21/10/2004 17:58:20 zp_cat_041021 zp_cat_041021 5 0 0
04/11/2004 17:04:24 ZP_CAT_041104 ZP_CAT_041104 1 0 0
04/11/2004 17:10:22 ZP_CAT_041104 ZP_CAT_041104 5 0 0
Update Study List
Delete Study
Series
Num
Date / Time
Modality
Description
Protocol
Images
Start Pos
End Pos
2 08/07/2004 16:46:31 CT AP Scout 10.7 QA: Catphan 1 20 20
3 08/07/2004 16:47:04 CT LAT Scout 10.7 QA: Catphan 1 -130 -130
4 08/07/2004 16:48:06 CT Alignment 10.7 QA: Catphan 13 3 -3
5 08/07/2004 16:52:31 CT Alignment 10.7 QA: Catphan 13 3 -3
6 08/07/2004 16:54:49 CT Catphan Slices - 80 kV 10.7 QA: Catphan 5 0 -110
7 08/07/2004 16:55:24 CT Catphan Slices - 120... 10.7 QA: Catphan 5 0 -110
8 08/07/2004 16:56:12 CT Catphan Slices - 140... 10.7 QA: Catphan 3 0 -40
Images
Num
Pos
Thick
1 0 5
2 -30 5
3 -40 5
4 -70 5
5 -110 5
RT Plans
Num
Date / Time
Name
Label
Clinician
Iso X
Iso Y
Iso Z
RT Structures
Num
Date / Time
Name
Label
Clinician
Structures
Load Data
Cancel

Reporting Framework



Catphan 500 Alignment Slice



CONTENT_DATETIME:	29/09/2006 12:15:43
DEVICE_SERIAL_NUMBER:	0000287.0035138
EXPOSURE_TIME:	1500
INSTITUTION_NAME:	EDINBURGH CANCER CENTRE
KVP:	120
MANUFACTURER:	GE MEDICAL SYSTEMS
MANUFACTURERS_MODEL_NA	HiSpeed
ME:	
PATIENT_ID:	zp_cat_060929
PATIENTS_NAME:	zp_cat_060929
SLICE_LOCATION:	+0.00
SLICE_THICKNESS:	5.0
X_RAY_TUBE_CURRENT:	200
Z_POS:	0

Phantom Alignment

	COM - X (mm)	COM - Y (mm)
Phantom Centre	-0.51	-0.26

Distances

	Distance Physical
Distance: 1-2	50.17
Distance: 2-3	50.09
Distance: 3-4	50.03
Distance: 4-1	50.11
Average	**50.10**
Std Dev	**0.05 (0.1%)**

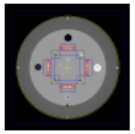
Sensitometry

	Mean Value	Standard Deviation
Air	-989.05	3.59
LDPE	954.32	3.50
Acrylic	116.80	2.82
Teflon	-100.18	3.08
Average	**-4.53**	**3.25**
Std Dev	**691.47 (15271.8%)**	**0.31 (9.7%)**

Ramps

	FWHM
Ramp: Top	4.86
Ramp: Bottom	4.89
Ramp: RHS	4.92
Ramp: LHS	4.90
Average	**4.89**
Std Dev	**0.02 (0.5%)**

Catphan 500 Alignment Slice



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INSTITUTION_NAME:	EDINBURGH CANCER CENTRE
KVP:	120
MANUFACTURER:	GE MEDICAL SYSTEMS
MANUFACTURERS_MODEL_NA	HiSpeed
ME:	
PATIENT_ID:	zp_cat_060925
PATIENTS_NAME:	zp_cat_060925
SLICE_LOCATION:	+0.00
SLICE_THICKNESS:	5.0
X_RAY_TUBE_CURRENT:	200
Z_POS:	0

Phantom Alignment

	COM - X (mm)	COM - Y (mm)
Phantom Centre	-0.58	0.79

Distances

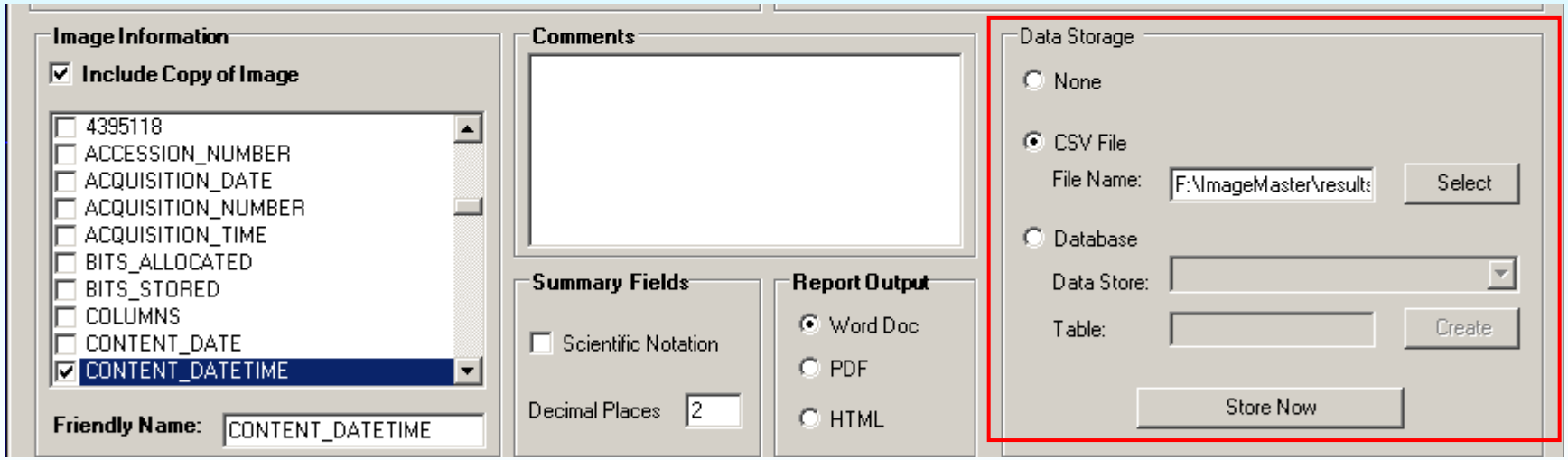
	Distance Physical
Distance: 1-2	50.07
Distance: 2-3	50.29
Distance: 3-4	50.13
Distance: 4-1	50.11
Average	**50.15**
Std Dev	**0.08 (0.2%)**

Sensitometry

	Mean Value	Standard Deviation
Air	-987.47	2.93
LDPE	955.92	2.91
Acrylic	116.94	2.91
Teflon	-96.89	3.42
Average	**-2.87**	**3.04**
Std Dev	**691.36 (24050.9%)**	**0.22 (7.1%)**

Result Data Storage Options

- CSV File
  - Opens easily in Excel
- Microsoft SQL Server Express database
  - Can be queried by Access or Excel
  - Good for central storage of many tables
  - Better for number crunching



Possible Further Development

- No software QA tool works in the way *you* want to do QA
- But – analysis tree implementation means only generic tools are required
- Add circular / ellipsoid ROI
- Extend database storage support
- Tools to access images
  - DB Interface (Conquest)
  - Generalise: hide RT/modality specific parts

What next?

- Establish steering/coordination group
  - Why?
  - Who?
  - How?
  - Meet?
- Tasks for group
  - Agreeing direction for IQWorks
  - Administering developers and upload rights
  - Keeping it all together and keeping it moving
  - Administering website, mailing lists etc
  - Helping to secure endorsements

Project contributions

- Documentation
- Test images
  - Images of phantoms
    - for different modalities (CT, DR, CR, MRI, RT…)
    - and for the SAME modality but different manufacturer / device model (to iron out DICOM compatibility issues)
- Analysis trees
- Experience feedback
- Algorithms
- QA of system

Glitzy launch/training meeting

- Training meeting
  - For end users
  - IPEM DRSIG interested in organising
  - Possibly co-sponsored by ICSIG and BIR Rad Phys Committee
- Developer meeting?
  - Form core team of developers / supporters
  - More informal
  - Hosted at Oxford?
  - If enough interest can be organised by ICSIG
- Paper – PMB or BJR

IPEM, SIG, UG relationships

- IQWorks project not ‘owned’ by any one group
- CTUG, DMWP, UKMPG, DRSIG, ICSIG, RTSIG, BIR Rad Phys com.
  - All have an interest in IQWorks
  - All can contribute ideas, influence direction
- CTUG is sponsoring cost of website
- IPEM DRSIG sponsoring training meeting

IPEM, SIG, UG relationships

- *Hopefully,* various UGs and SIGs will endorse IQWorks
- *Hopefully,* NHS Medical Physics departments will contribute employees' time

Beyond the NHS

- *Hopefully,* IQWorks will be adopted beyond the UK
  - US: Andrew's grand tour
  - Rest of the World
- *Hopefully,* developers from beyond the UK will get involved
  - Local translations
  - More/better algorithms

IQWorks release

- Compiled version only at first
- Need to verify distribution rights for some modules
- Will enable people to have a first look
- Hopefully will get some user response and feedback
- Available end of the week…

IQWorks release – How?

- Binary install available on website

  www.iqworks.org
- Instructions on website on how to install
  - Will not be foolproof at first!
  - But step-by-step instructions and help available
- Intend to establish
  - Wiki
  - Possibly bulletin board
  - Mailing lists
  - Bug and feature request trackers on sf.net

Any questions?

www.iqworks.org

sf.net/projects/iqworks

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