



DR QA

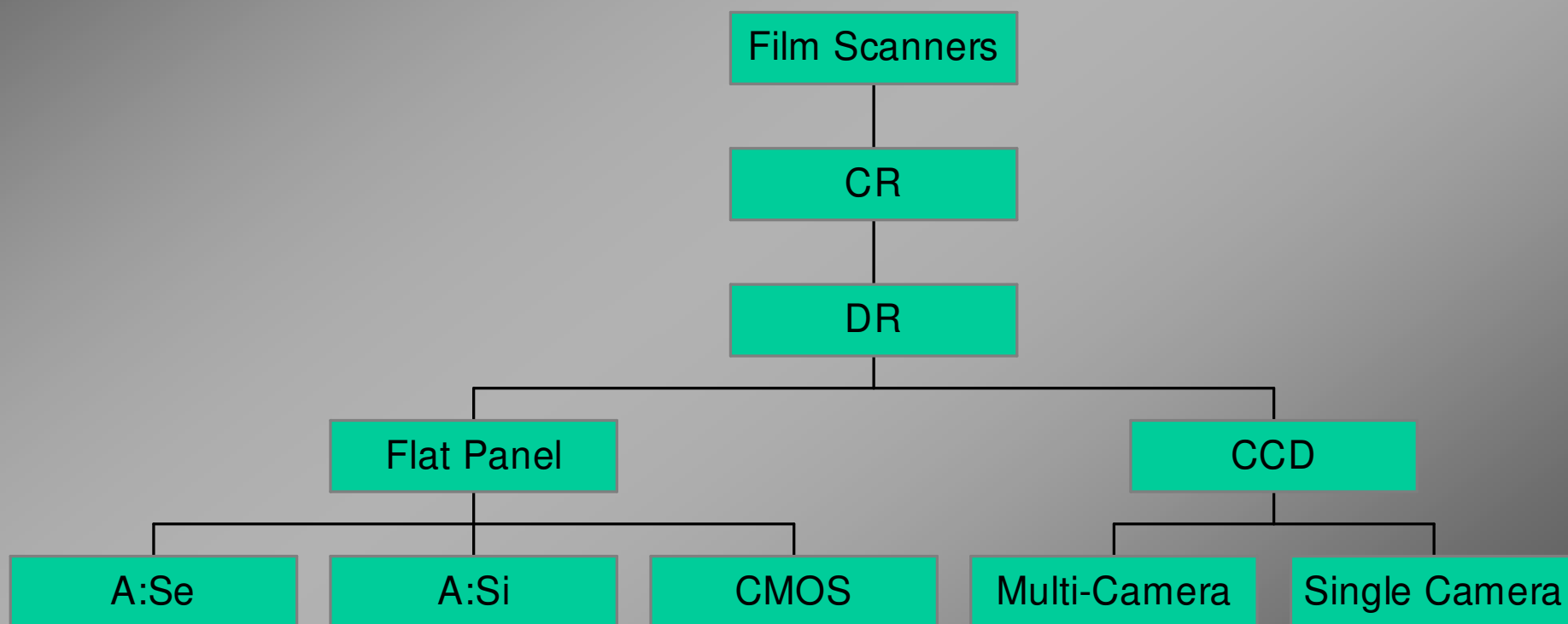
AAPM 46th Annual Meeting
Pittsburgh

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Imaging Dynamics



Overview – Family Tree

Digital "Family Tree"



QA Topics

- **Initial Acceptance Testing**
- **Regular Performance Monitoring**
 - Variable system parameters
 - Automated QA
- **Dose Monitoring**
 - Individual image parameters
 - Exposure trends
- **Technologist success / failure**

Acceptance: Low Contrast

The screenshot displays the DelCano software interface. The main window shows a low-contrast image of a circular target with a grid pattern. The interface includes several control panels:

- LUT:** A dropdown menu for selecting a Look Up Table.
- Level:** A slider and a numeric input field (set to 423) for adjusting the image level.
- Window:** A slider and a numeric input field (set to 369) for adjusting the window size.
- Image Number:** A dropdown menu (set to 1) and a button labeled "1 images".
- Info:** A button for viewing image information.
- New W/L:** A button for creating a new window/level.
- Sticky W/L:** A checkbox for locking the window/level.
- UnLock Zoom:** A button for unlocking the zoom.

The right-hand side of the interface contains the **IDC Image Operations** panel, which includes buttons for **Invert**, **Crop**, **Mirror**, **Flop**, **Despckle**, **MONO1/2**, **Pre-Process**, **Post-Process**, **NPS**, **Enhance**, **Equalize**, **MTF**, **ACE**, **Segment**, **Slice...**, **Anat Histogram**, **Histogram**, **Add**, **Subtract**, **Average**, **Copy**, **PlotLUT**, **Find Defects**, **MacBeth**, **Shutter**, and **X-Params**.

Below the operations panel is the **Events** log, which shows the following text:

```
kv=0 mA=0  
mAs=0 ms=0  
Finished handling image in 157ms  
triggered 10125 ms ago.  
ready for next image
```

At the bottom right, there is a **Percent (%)** vs **Energy** graph showing a green shaded area under a curve. The x-axis ranges from 0 to 100, and the y-axis ranges from 0 to 100. The curve starts at 0, rises to a peak of approximately 100% at 50 energy, and then falls back to 0.

The Windows taskbar at the bottom shows the Start button, several icons, and the following information: **x: 2314 y: 1951 = 565 w: 4000 h: 4000** and **4:37 PM**.

Acceptance: High Contrast

The screenshot displays the DelCano software interface. The main window shows a high-contrast image of a component with a scale. The scale markings are: 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0. The software interface includes a menu bar (File, Edit, Image), a toolbar, and a main control panel. The control panel has sections for LUT (Level: 3295, Window: 2893), Image Number (1), and various processing options (Invert, Crop, Mirror, Flip, etc.). A histogram is visible in the bottom right corner, showing a distribution of pixel values. The status bar at the bottom indicates the image dimensions: x: 2453 y: 2004 = 3564 w: 4128 h: 4128. The system tray shows the time as 4:29 PM.

Acceptance: Distortion

The software interface includes the following components:

- Grid:** A grid of numbers from 12 to 40, with a vertical scale on the left numbered 0 to 25.
- LUT Panel:** Includes buttons for Edit, Weights, and Burn In. A Level slider is set to 930, and a Window slider is set to 1618. Buttons for Lock W/L and UnLock Zoom are present.
- Image Information:** Image Number 1, 1 images.
- Operations Panel:** Includes buttons for Invert, Crop, Mirror, Flip, Despeckle, MONO1 / 2, Pre-Process, Post-Process, NPS, Enhance, Equalize, MTF, ACE, Segment, Slice..., Anat. Histogram, Histogram, Add (1000), Subtract, Average, Copy, PlotLUT, Find Defects, MacBeth, Shutter, and X-Params.
- ROI Panel:** ROI: (935, 573) (1, 2) (.11 mm, .22 mm) mean=1805 std_Dev=2. Includes buttons for 1700 Calibration, Continuous Dig., << Previous, Reject, Next >>, and RES ET.
- Events Panel:** kv=0 mA=0 mAs=0 ms=0 Finished handling image in 125ms triggered 11844 ms ago. ready for next image.

Acceptance: Distortion



The software interface is divided into several sections:

- Top Grid:** A horizontal grid of numbers from 14 to 40, used for alignment or measurement.
- Left Scale:** A vertical scale from 0 to 24, with a green box highlighting the area between 10 and 20.
- Central Panel:** A blue vertical bar.
- Right Panel:** A control panel with the following sections:
 - LUT:** Includes buttons for Edit, Weights, and Burn In. Level is set to 2048. Window is set to 4095. Includes Lock W/L and UnLock Zoom buttons.
 - Image Number:** Set to 1, with 1 images.
 - Buttons:** Info, New W/L, and Sticky W/L.
 - IDC Image Operations:** Includes Invert, Crop, Mirror, Flip, Despeckle, MONO1 / 2, Pre-Process, Post-Process, NPS, Enhance, Equalize, MTF, ACE, Segment, Slice..., Anat. Histogram, and Histogram.
 - Math Operations:** Add (1000), Subtract (Img# 1 from Img# 2), Average (Img# 1 to Img# 2), Copy, PlotLUT, Find Defects, MacBeth, Shutter, X-Params.
 - Calibration:** 1700 Calibration, Continuous Dig., << Previous, Reject, Next >>.
 - ROI Data:** ROI: (2035, 1411) (245, 1909) (26.46 mm, 206.17 mm) mean=1283.142 std_Dev=316.6. Includes R, ES, ET labels.
 - Events:** kv=0 mA=0, mAs=0 ms=0, Finished handling image in 125ms, triggered 11844 ms ago, ready for next image.

Monitoring

- **Noise characteristics**
- **Physical properties**
 - Temperature
 - Output level
- **Computer system**

Monitoring: Analysis Tools

The screenshot displays the DelCano software interface. The main window shows a 3D model of a detector component with a red rectangular region of interest (ROI) and a green cross-section line. A 'Plot ROI Cross-section' window is open, showing a graph of the cross-section data. The graph has 'Y Axis' on the vertical axis (0 to 400) and 'X Axis' on the horizontal axis (0 to 150). The data shows a sharp increase in the Y-axis value starting around X=75.

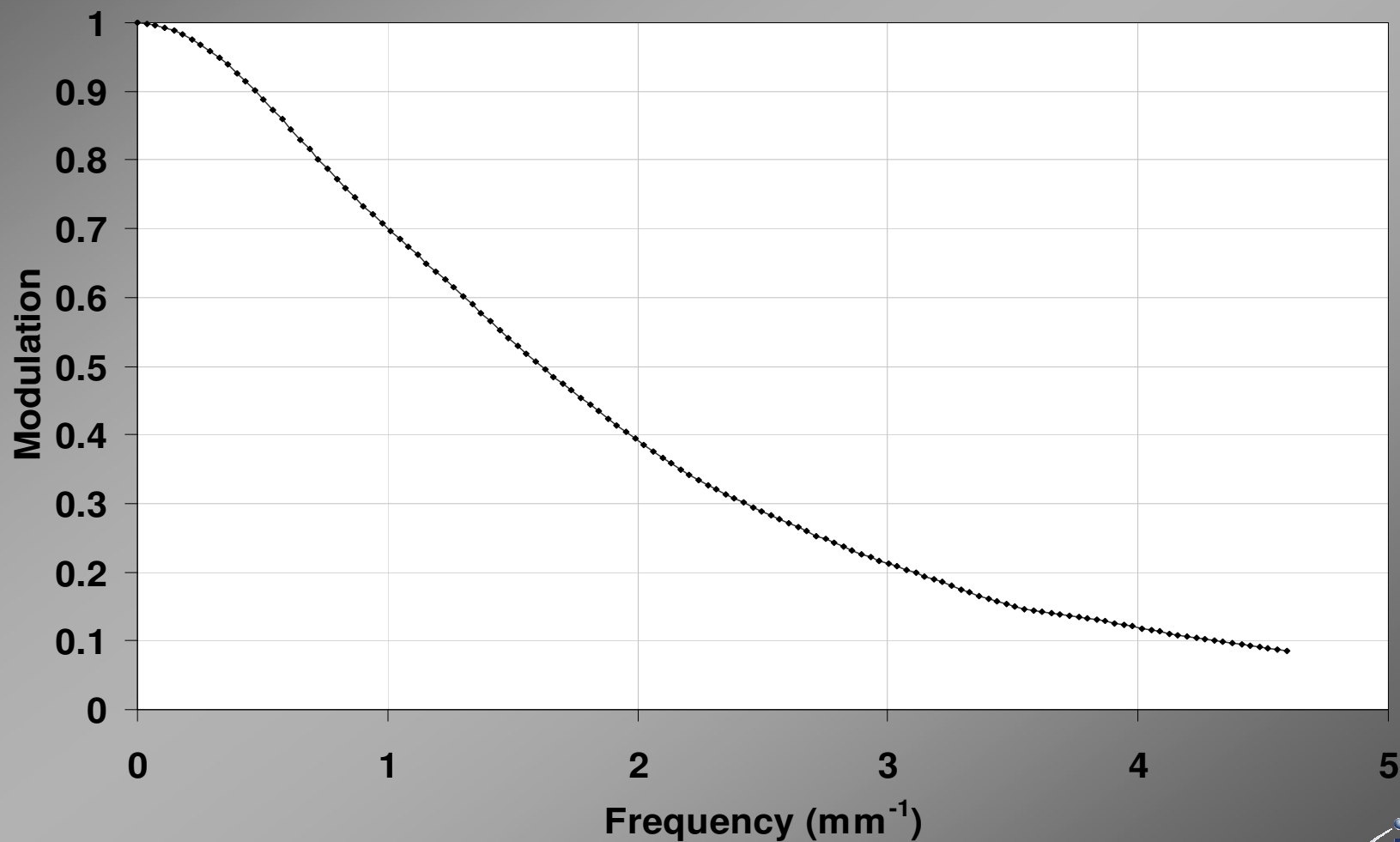
The right-hand side of the interface contains several control panels:

- LUT:** A dropdown menu for Look Up Tables, with 'Edit' and 'Weights' buttons below it.
- Level:** A numeric input field set to 2048.
- Window:** A numeric input field set to 4095, with 'Lock W/L' and 'Image Number' (1) controls below it.
- IDC Image Operations:** A panel with buttons for 'Invert', 'Crop', 'Mirror', 'Flip', 'Barrel...', '+90', '-90', 'Despeckle', 'Undo', 'Filter', 'Anatomy', and 'Projection'.
- Pre-Process / Post-Process:** Buttons for 'Pre-Process', 'Post-Process', 'NPS', 'Sharpen', 'Equalize', 'MTF', 'ACE +', 'Segment +', and 'Slice...'.
- Subtract / Average:** Controls for subtracting or averaging two images (Img# 1 and 2).
- Copy / PlotLUT / Cooling:** Buttons for 'Copy', 'PlotLUT', and 'Cooling'.
- MacBeth / Test Process / X-Params:** Buttons for 'MacBeth', 'Test Process', and 'X-Params'.
- 1700 Calibration / Continuous Dig.:** Buttons for '1700 Calibration' and 'Continuous Dig.'.
- Navigation:** '<< Previous', 'Reject', and 'Next >>' buttons.
- ROI Statistics:** Text showing 'ROI: (988, 844) (163, 21) (17.6 mm, 2.27 mm) mean=2064 std_dev=1485'.
- Events:** A text area displaying 'The camera is initializing' and 'Camera Ready'.
- IDC COM Control:** A 'Revert' button and a graph showing a green shaded area and a blue line.

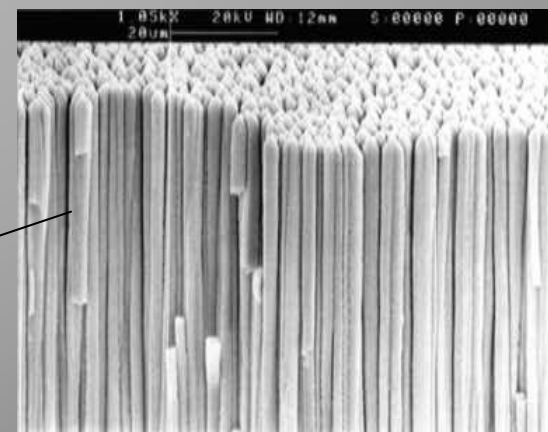
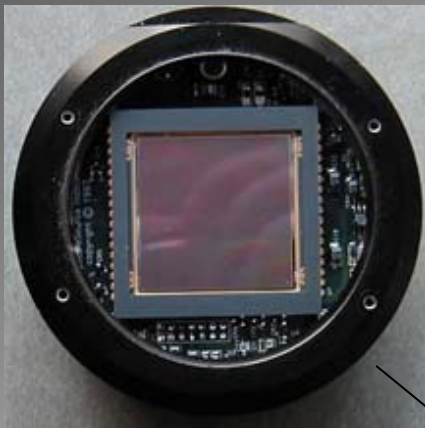
The bottom status bar shows: x: 1365 y: 854 = 145 w: 2064 h: 2064 Temp: -10.1C

Monitoring: MTF

Presampled MTF: horizontal direction



Monitoring: Components



Monitoring: Dark & Flatfields

Xplorer Calibration [X]

Flat field and Dark field Correction

Apply Flatfield and Darkfield Correction Configure...

FlatField paths:

- + C:\IDC\confimages\FlatField.idr
-
- ?

DarkField paths:

- + C:\IDC\confimages\Darkfield_125.idr
-
- ?

Automatically update Darkfield correction

Xplorer Device Settings

Width: Integration Time (ms):

Height: Pixel Spacing (mm):

Use Falling-Edge Trigger Serial Number:

Images

Show initial preview Trigger (Simulate X-Ray)

Geometric Correction

Apply Geometric Correction Configure...

X Map: ...

Y Map: ...

Rotate Left 90 degrees Rotate Right 90 degrees

Don't Rotate Rotate 180 degrees

Cropping ROI Offsets

Left: Top: Reset

Right: Bottom:

Artifacts

Despeckle

Charge Trap Removal Configure...

X-Ray Generator

Communicate with Generator Configure...

OK Cancel Apply

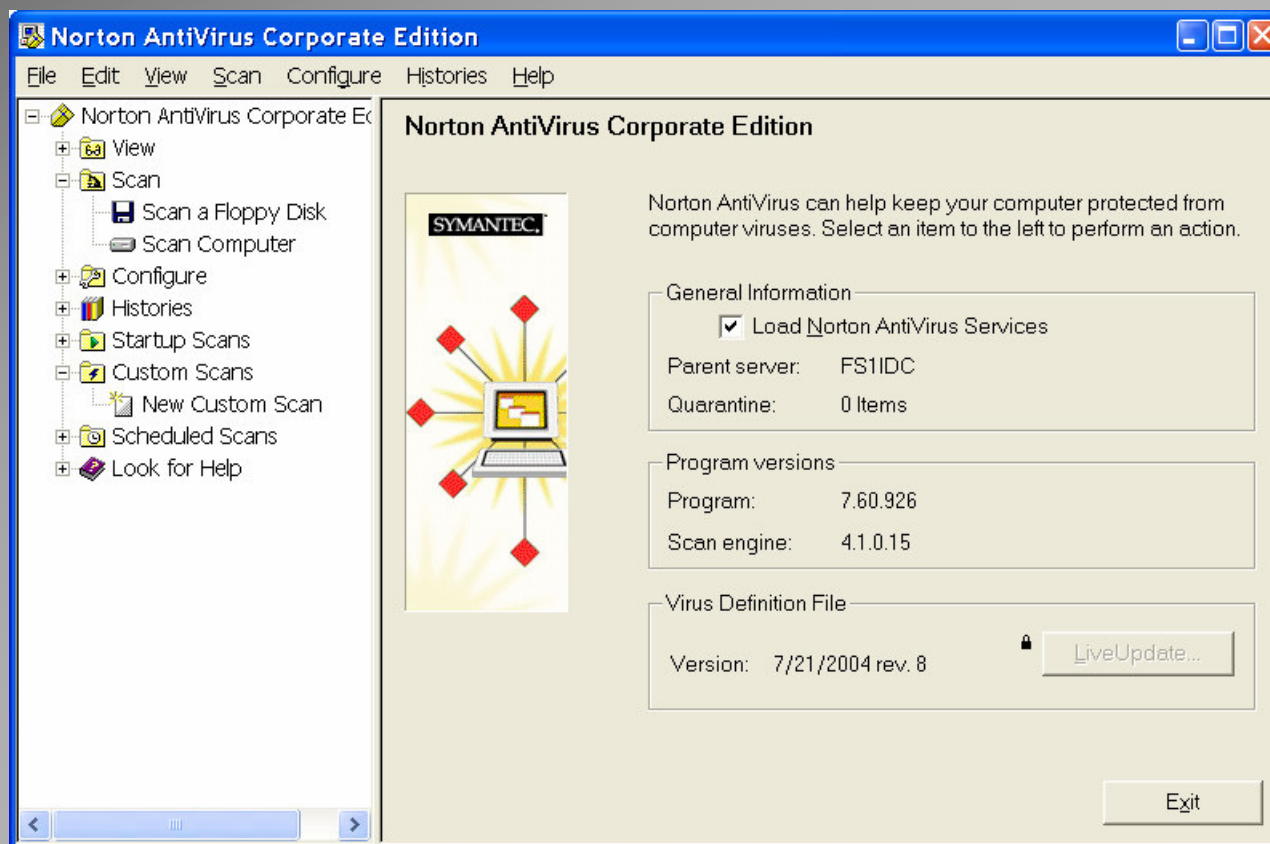
Monitoring: Noise



The software interface includes the following components:

- LUT:** A dropdown menu with an "Edit" button below it.
- Weights:** A button.
- Burn In:** A button.
- Level:** A numeric input field set to "8204" with a vertical slider below it.
- Window:** A numeric input field set to "2686" with a vertical slider below it.
- Lock W/L:** A button.
- Image Number:** A numeric input field set to "1".
- Info:** A button.
- New W/L:** A button.
- Sticky W/L:** A checkbox.
- UnLock Zoom:** A button.
- Trigger:** A dropdown menu.
- Display:** A dropdown menu.
- IDC Image Operations:** A group of buttons including "Invert", "Crop", "Mirror", "Flip", "Despeckle", "MONO1 / 2", "Pre-Process", "Post-Process", "NPS", "Enhance", "Equalize", "MTF", "ACE", "Segment", "Slice...", "Anat. Histogram", and "Histogram".
- Add:** A numeric input field set to "1000".
- Subtract:** Buttons for "Img# 1" and "from Img# 2".
- Average:** Buttons for "Img# 1" and "to Img# 2".
- Copy:** A button.
- PlotLUT:** A button.
- Find Defects:** A button.
- MacBeth:** A button.
- Shutter:** A button.
- X-Params:** A button.
- 1700 Calibration:** A button.
- Continuous Dig.:** A button.
- Navigation:** Buttons for "<< Previous", "Reject", and "Next >>".
- ROI Data:** A text box containing: "ROI: (1519, 1496)", "(1002, 1003)", "(108.22 mm, 108.32 nm)", "mean=7756.753", and "std_Dev=49.59".
- Events:** A scrollable text box containing: "kv=0 mA", "mAs=0 ms=0", "Finished handling image in 125ms", "triggered 16406 ms ago.", and "ready for next image".

Monitoring: Computer



“System” includes the computer...

Monitoring: Computer

The screenshot shows a Windows desktop environment. The taskbar at the top contains several icons: 'idc', a red 'X' over a globe, a server rack, a document, a group of people, a printer, a calendar, and a 'M2' logo. The desktop background is dark with various icons for applications and folders, including 'My Computer', 'iTunes', 'Adobe Photoshop...', 'My Network Places', 'astro photos', 'Astro Photos', 'Recycle Bin', 'China Pictures', 'Autostar Suite', 'Internet Explorer', 'docs', 'Magellan 2', 'Microsoft Outlook', 'Robins images', 'scrabble', 'Quick Install', 'Unused Desktop...', and 'Shortcut to DelCano...'. A dialog box titled 'IDC Magellan 2 - Disk Space Monitor' is open in the center. It displays disk usage information for the C: drive and allows for setting warning thresholds.

IDC Magellan 2 - Disk Space Monitor

Drive:

Disk size:	30,005,788,672 bytes
Total free:	11,262,812,160 bytes
Disk used :	18,742,976,512 bytes

Show Caution (yellow) below: MB

Show Urgent (red) below: MB

Show Panic Message below: MB

Additional message text (e.g. I.T. Contact Information):

Please contact your local support staff for information on how to off-load some images to make room on your hard-drive.

Monitoring: System



IDC Magellan 2 - TECCM

TEC Controller Settings

TEC Set-point (degrees C):

TEC On

Reset TECC

Port Settings

Port Configuration:

TEC Controller Status

Name	Value
TEC	ON
SETPOINT	263.0
TECTEMP	263.4
PSV	11.8
TECV	5.9
TECI	2.2
PWBTEMP	43.6
AMBIENT	27.2
CHAN1	991
CHAN2	0
ERRFLAG	128
OPFLAG	40
Serial	1

Ok

Monitoring: Automation

Performed Studies:

All

	Locked	Patient Name	Patient ID	Date & Time	Physician Name	View
+ [lock icon]		demo, demo	911	25/Jun/2004 05:44 PM		

Send

Print

Export

Delete

Move Image

Edit Patient

Lock Study

Reports

Configure

Close

Monitoring: Automation

The screenshot displays the IDC Magellan 2 - Study/Image Manager application. The main window is titled "IDC Magellan 2 - Study/Image Manager" and contains a "Performed Studies:" section with a dropdown menu currently set to "All". To the right of this section are "Send" and "Print" buttons, along with a refresh icon.

Overlaid on this is the "Xporter" window, which is titled "Export Setup". It features a table with the following data:

Last Name	First name	Patient ID	Date & Time	Physician	Anatomy	View	Status	Comments
demo	demo	911	25-Jun-2004 17:44	,	Abdomen	Antero-poste	Accepted	
demo	demo	911	25-Jun-2004 17:44	,	Abdomen	Antero-poste	Accepted	

Below the table, the "Image Export Options:" section includes checkboxes for "Unprocessed Images" (unchecked) and "Processed Images" (checked). To the right of these options are "Export to FTP", "Export to Disk", and "Cancel" buttons.

At the bottom of the Xporter window, there are "Configure" and "Close" buttons, and a horizontal scrollbar.

Monitoring: Automation



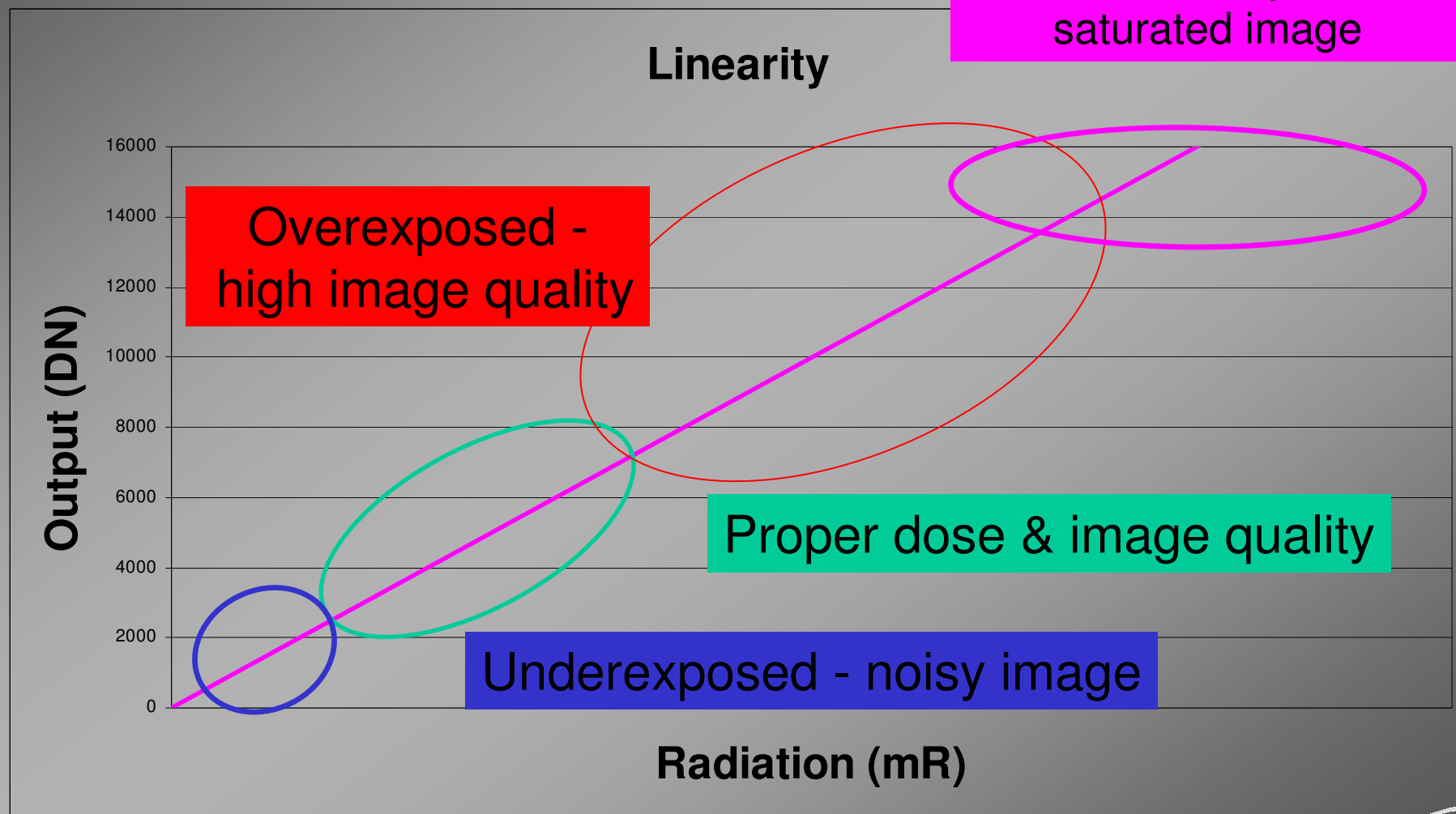
Grid / Phantom Drawer

Monitoring: Automation

- Longwave ultraviolet – 345nm
- Shortwave ultraviolet – 254nm



Exposure Monitoring



Exposure Monitoring: Calibration

- Determine mR/DN using 80kVp, 1mm Cu filtered beam
- Set a desired “speed equivalent” S_0 for each anatomy in database

Exposure Monitoring: Segmentation

- Find region of direct exposure
- Find region outside collimation
- Get median anatomy histogram value
- Calculate system entrance exposure, from DN / mR relationship

$$X_{Med} = I_{Med} \cdot R_{IO}$$

Exposure Monitoring: Calculation

- Calculate estimated film speed equivalent

$$S_a = \frac{200}{X_{Med}}$$

- Compare to target speed equivalent


$$f = \log_2 \left(\frac{S_0}{S_a} \right)$$

- Range should be from -1 to +1

Exposure Monitoring: Display

idc [Icons: Close, Refresh, Print, etc.] [M2]

Study: Test Test Tech: Tech **Current Image** Next Image
DOB: Unknown Ref. Phy.: Chest Anatomy
Sex: Unknown Left Lateral Projection
KV:120 mAs:40 F#+.25



#1 [Thumbnail of chest X-ray]

ICE LUT: Custom
[Navigation icons: Az, R, L, etc.]

Exposure Monitoring: Reporting

The screenshot displays the IDC Magellan 2 - Study/Image Manager application. The main window shows a table of performed studies with columns for 'Locked' and 'Patient Name'. A dialog box titled 'IDC Magellan 2 - Study/Image Reports' is open, allowing users to generate reports. The dialog includes sections for Report selection, Printer Options, Date Range, Image Properties, and Footer information. A vertical toolbar on the right contains various actions like Send, Print, Export, Delete, Move Image, Edit Patient, Lock Study, Reports, Configure, and Close.

IDC Magellan 2 - Study/Image Manager
Performed Studies:

Locked	Patient Name
	demo, demo

IDC Magellan 2 - Study/Image Reports

Report: (Dropdown menu open showing: Rejection Summary Report, Rejections by Technologist, Rejections by Anatomy, Rejections by Projection, Rejection Details)

Printer Option: (Dropdown menu)

Printer: (Dropdown menu)

Copies: (Spinner)

Report Options

Date Range

Start Date: (Dropdown)

End Date: (Dropdown)

Image Properties

Technologist: (Dropdown)

Anatomy: (Dropdown)

Projection: (Dropdown)

Footer

Location:

E-mail Options | Preview | Print | Close

Send | Print | Export | Delete | Move Image | Edit Patient | Lock Study | Reports | Configure | Close



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