

Digital Radiography

MAI Group

2009

Fred Morro: Fujifilm NDT Systems

Director: Digital Radiography Products: NDT

Fujifilm: 20 Years

NDT RTR System Sales: 10 years

QA MGR: Investment Castings (L3): 2 Years

Director: NDT Operations Navy Nuclear Reactors
10 years

Digital Radiography:

Gaining in use as a true film Replacement
Has Achieved many Image Quality Requirements.

There are several reasons for the increased
Interest in Digital RT imagery:

- Cost
 - Availability
 - Improved Performance
-

MAI Group

Has a very interesting Task

Your Part:

Evaluate Particular NDT RT images Taken with Various Filmless Technologies and make Comparisons to proposed Digital Reference Images in a Round Robin procedure.

MAI Group

Our Discussion:

Primarily will cover CR and DR.

CR: Computed Radiography

DR: Direct Radiography

We will explore these technologies and attempt to Clarify and Explain any differences, perceived or actual.

First: Some Background

Radiographic Film:

Has been and still is an excellent product

It is supported by the Medical Industry

As Medical converts to Digital Technology
Analog Film is slowly being phased out
Medically, leaving NDT Films in a limited
Declining marketplace:

Why?

Radiographic Film:

- Environmental Issues
 - Water
 - Waste
- Cost of Petro-Chemicals
- Cost of Silver
- The Overall Cost when considering Lower Volume

To that: ***Add:***

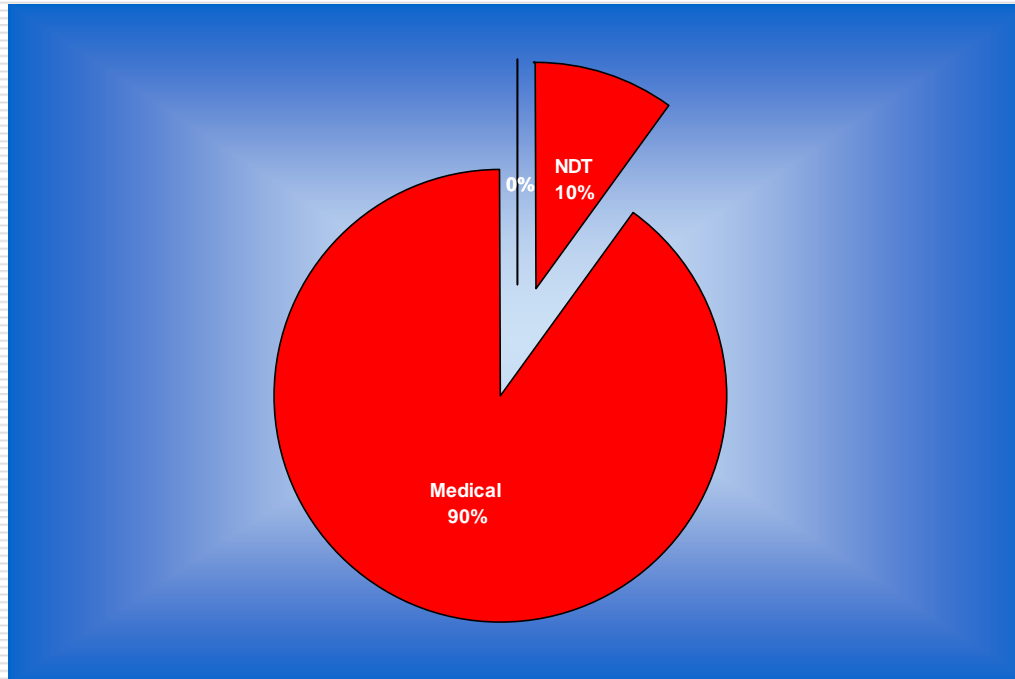
Radiographic Film:

Advances: CR and DR Spatial Resolution And Performance in general have improved to the point that they now can be used in many NDT Arenas.

We now have the Imaging Capabilities.

Now we need all the Supporting Documents and Standards

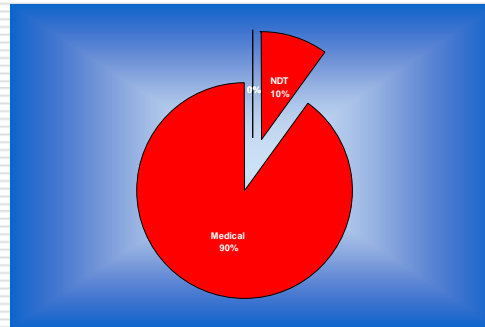
Radiographic Film:



Medical Imaging

Is the Market Driver for New Technologies

Radiographic Film:



SHRINKING DEMAND

Medical Imaging

Is the Market Driver for New Technologies

Supporting Documents & Standards

- Company Procedures
 - Training Procedures
 - Customer Requirements
 - Military Codes
 - ASME Codes
 - ASTM Standards
 - Written
 - Visual
-

ASTM Standards

Written:

- All CR Documents are in place and approved
 - Many CR Documents are being Updated

 - Many DR Documents are in place and approved
 - The balance are in process
-

ASTM Standards

Visual:

ASTM Reference Radiographic Images do Exist for Aluminum.

Our purpose here is to start the process of Developing Reference Radiographic Images for Other materials.

Steel and Titanium

You are a key element for these Developments

Imaging Technology

CR and DR



Imaging Technology



CR

Employs Imaging Phosphors Which are used in Cassettes, Exposed like Film, and "Processed" or read in a READ UNIT, sub sequentially erased And reused.



Images are exported to a Work Station for Interpretation and disposition

Imaging Technology

CR and DR

DR employs a flat panel
Which houses a conversion
Package, converting to an
X-Ray Image

Images are exported to a
Work Station for
Interpretation and
disposition



KEY ELEMENTS

"CR" Has Always Consisted of Four Major Elements



1

Imaging Plates
"IP's"



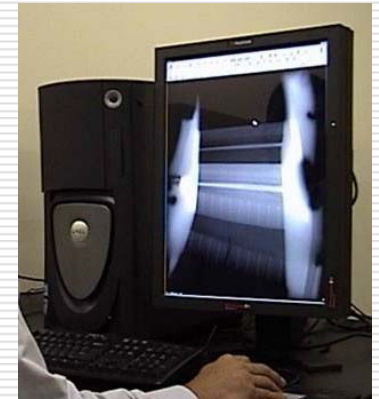
2

Reader Unit
"RU"

```
01001001110010010010011110001
10100101010101010101010000001
10101010001100110011001100110
110011000001101111000011100000
10101010101010101010101010101
01101000101010010101001010010
10111010001010101010101010001
11010101000101001010010101000
00101001001001011000111101010
11100101001010101010000111100
00111000100010101010101010101
1111000101010101010100001010000
10101010101010101010000011110
00101010010001010011001010001
10110010100101010101001010001
```

3

Software



4

Workstation

KEY ELEMENTS

"DR" Has Always Consisted of Three Major Elements



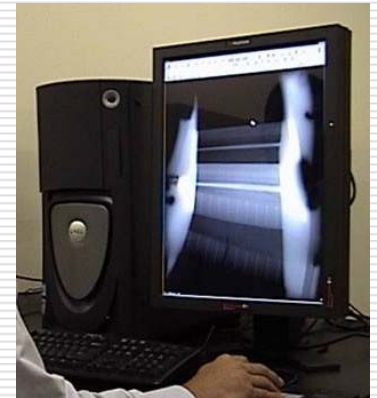
1

DR Panel

```
01001001110010010010011110001
10100101010101010101010000001
10101010001100110011001100110
11001100000110111100011100000
10101010101010101010101010101
01101000101010010101001010010
10111010001010101010101010001
11010101000101001010010101000
00101001001001011000111101010
11100101001010101010000111100
00111000100010101010101010101
1111000101010101010100010100001
10101010101010101010000011110
00101010010001010011001010001
10110010100101010101001010001
.....
```

2

Software



3

Workstation

KEY ELEMENTS

As there are Several differences with regards to CR and DR Imaging technology,

The best way to address these differences is Via a comparative matrix.

NOTE: There is no One Solution as there is no one optimum Film Speed

KEY ELEMENTS

Feature	CR	DR	Film
Resolution	Variable 50 – 100 m	Fixed 100 m	Fixed Speed
Steps	2 Step	1 Step	2 Step
Flexibility	Yes	No	Yes
Lead /Screens	Yes	No	Yes
Special Shapes	Yes	No	Yes

KEY ELEMENTS

Feature	CR	DR	Film
Longer Than 17"	Yes	No	Yes
Variable Contrast	Yes	Yes	No
Variable Gray Scale	Yes	Yes	Maybe
Software Features	Yes	Yes	No
Support Multiple Cells	Yes	No	Yes

KEY ELEMENTS

Feature	CR	DR	Film
Special Focal Spot	No	At Times	No
Custom System	No	At Times	No
Artifact suppression	No	Yes	No
Burn In 1-10	2	7	0
Pixel Issues	No	Yes	No

KEY ELEMENTS

Feature	CR	DR	Film
Tethered	No	Yes	No
Benign	Yes	No	Yes
Portable	Yes	No	Yes
Real Time	No	Yes	NO
Delicate 1-10	4	10	4

KEY ELEMENTS

Feature	CR	DR	Film
SNR	Good v	Good v	Very Good v
Acceptance	Yes	Yes	Yes
Available	Yes	Yes	Yes
High Energy	Yes	Yes*	Yes
Cycles	Many	Many	1

Digital Radiography:

Both Imaging Technologies:

- Do have a place as Film Substitutes
 - Can save the user a great deal of expense
 - Are Diconde Compliant
 - Can Generate Film Quality Images
 - Have Management's Interest
 - Are cost effective

 - Will be **VALIDATED** before **IMPLEMENTED**
-

Digital Radiography:

Our Mission:

- Conduct Round Robin Tests
 - Seek Feedback from you
 - Provide Reference images
 - Support Your Activities
-