

TOPAX NDT Solutions LLP

4th ICEPIM & OMIC Gas 2018

Transition from Conventional RT to Digital –CR

29th Jan. 2018



Krishna Bhuta ASNT Level III

www.topaxndtsolutions.com

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Digital Radiography

- Film Digitisation
- Computed Radiography (CR)
- Direct Radiography – (DR) Flat Panel

Starting of The New Era.....



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**Array 2905 Film Digitizer with
Industrex Soft Ware**

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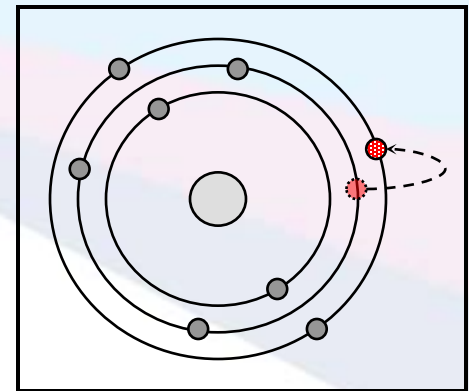
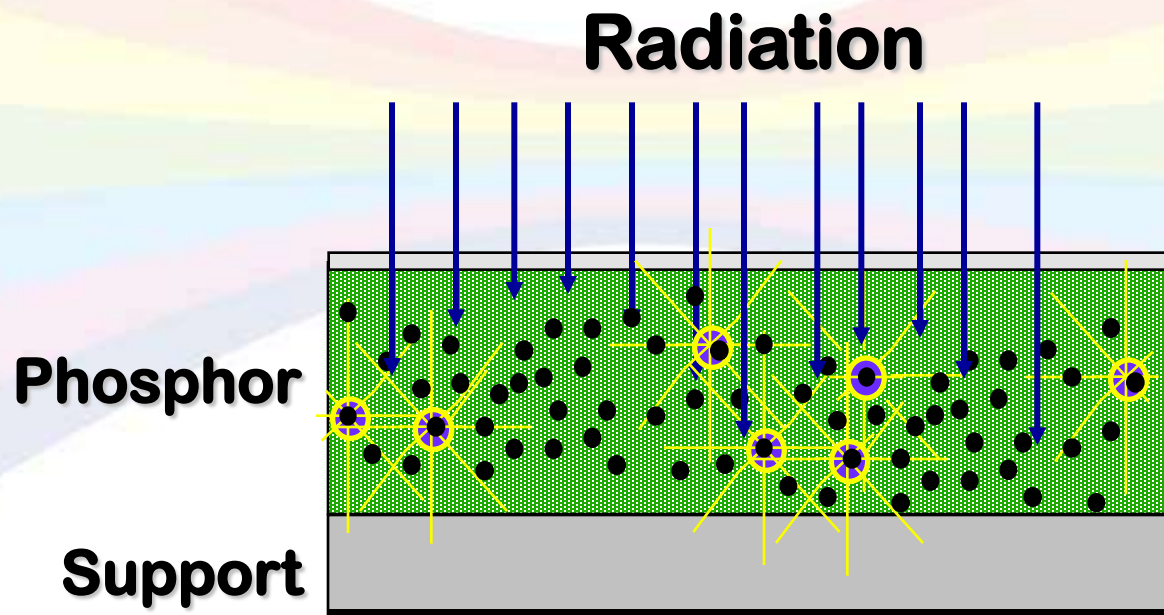
Computed Radiography System

- LASER Scanner
- Imaging Plate
- High Mp Monitor
- High Quality User Friendly DICONDE Software
- Training
- After Sales Service

How Does CR Work?

How do phosphor plates work?

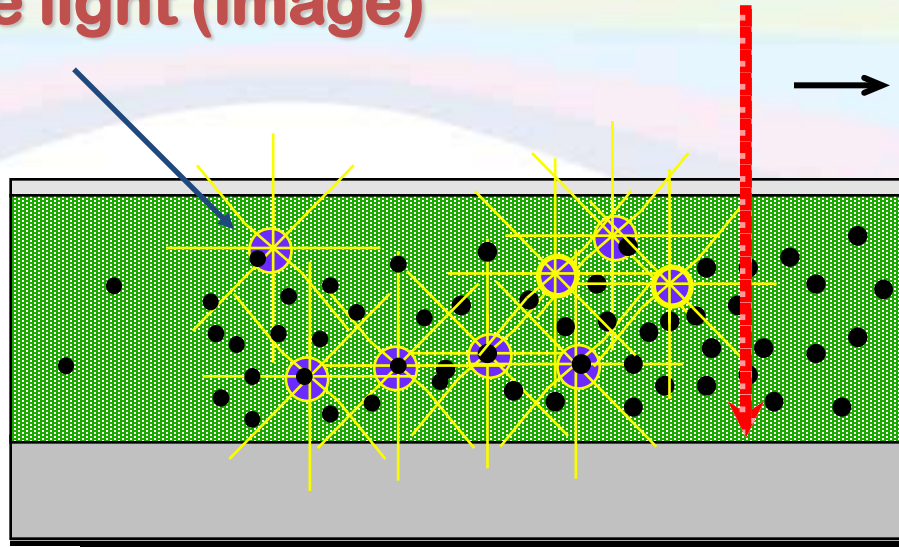
Radiation reaching the plate causes electrons in the phosphor to move to, and remain at, higher energy levels. These millions of electrons at various energy levels make up the latent image.



How is the latent image released?

A red laser scans the plate and the laser energy causes the electrons to return to their original state, emitting blue light in the process. The amount of blue light emitted is related to the radiation dose that specific area received during exposure.

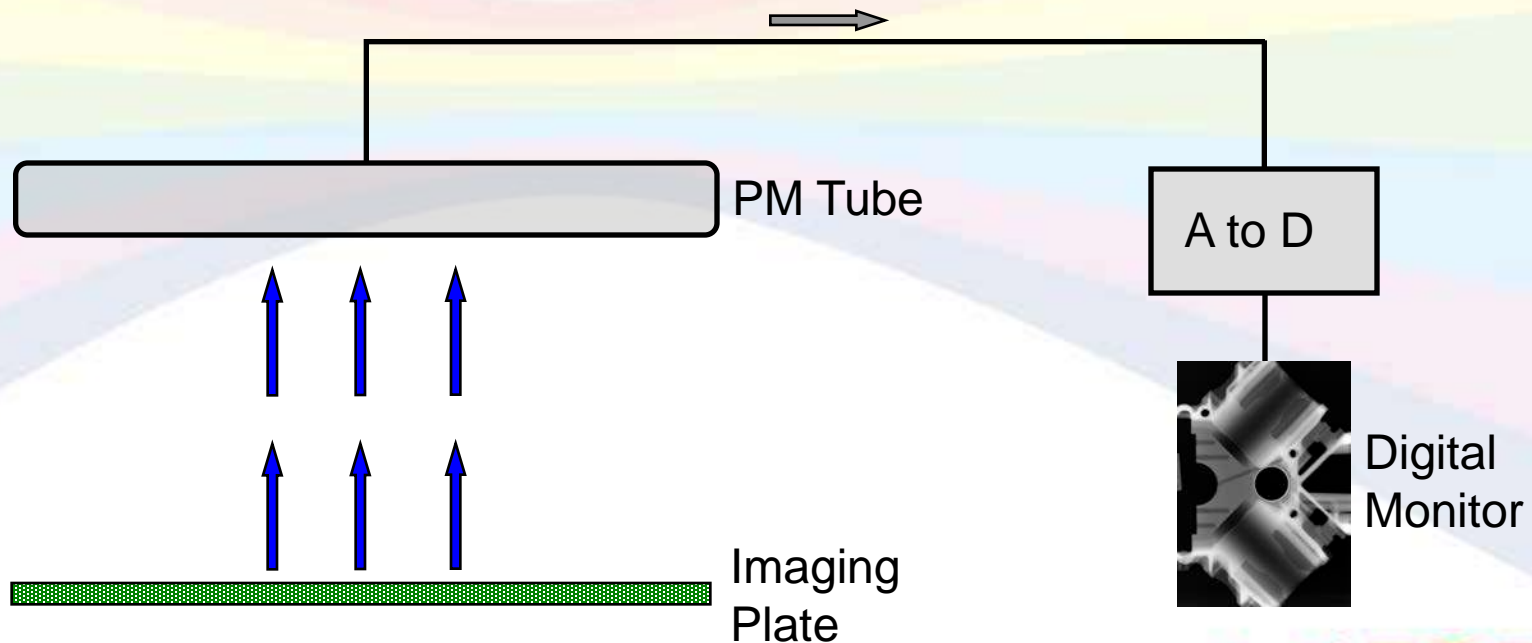
Stimulating red laser
Stimulated emission of blue light (image)



What happens to the emitted blue light?

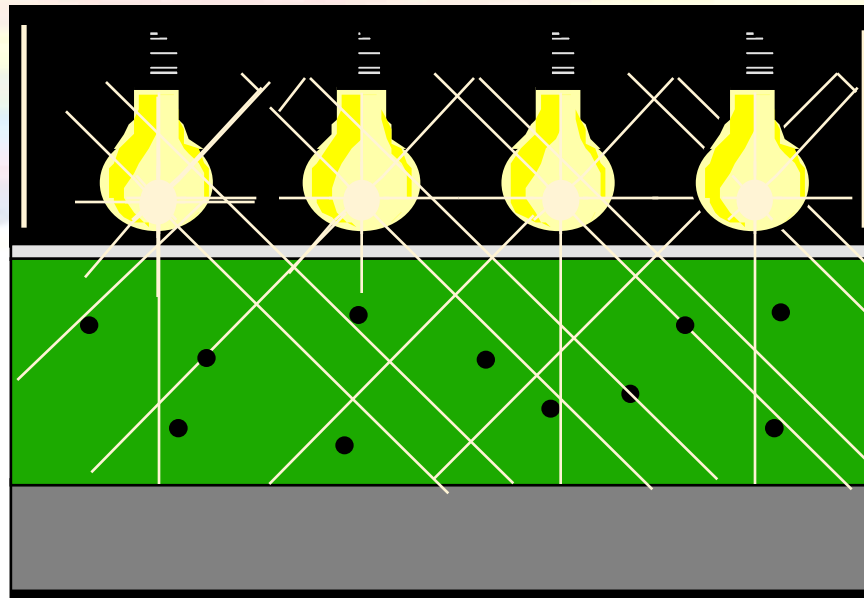
The light from each area illuminated by the laser is collected by a photomultiplier tube and converted into a digital pixel value, corresponding to the amount of light emitted by the phosphor.

These pixels are then assembled to make the digital image.

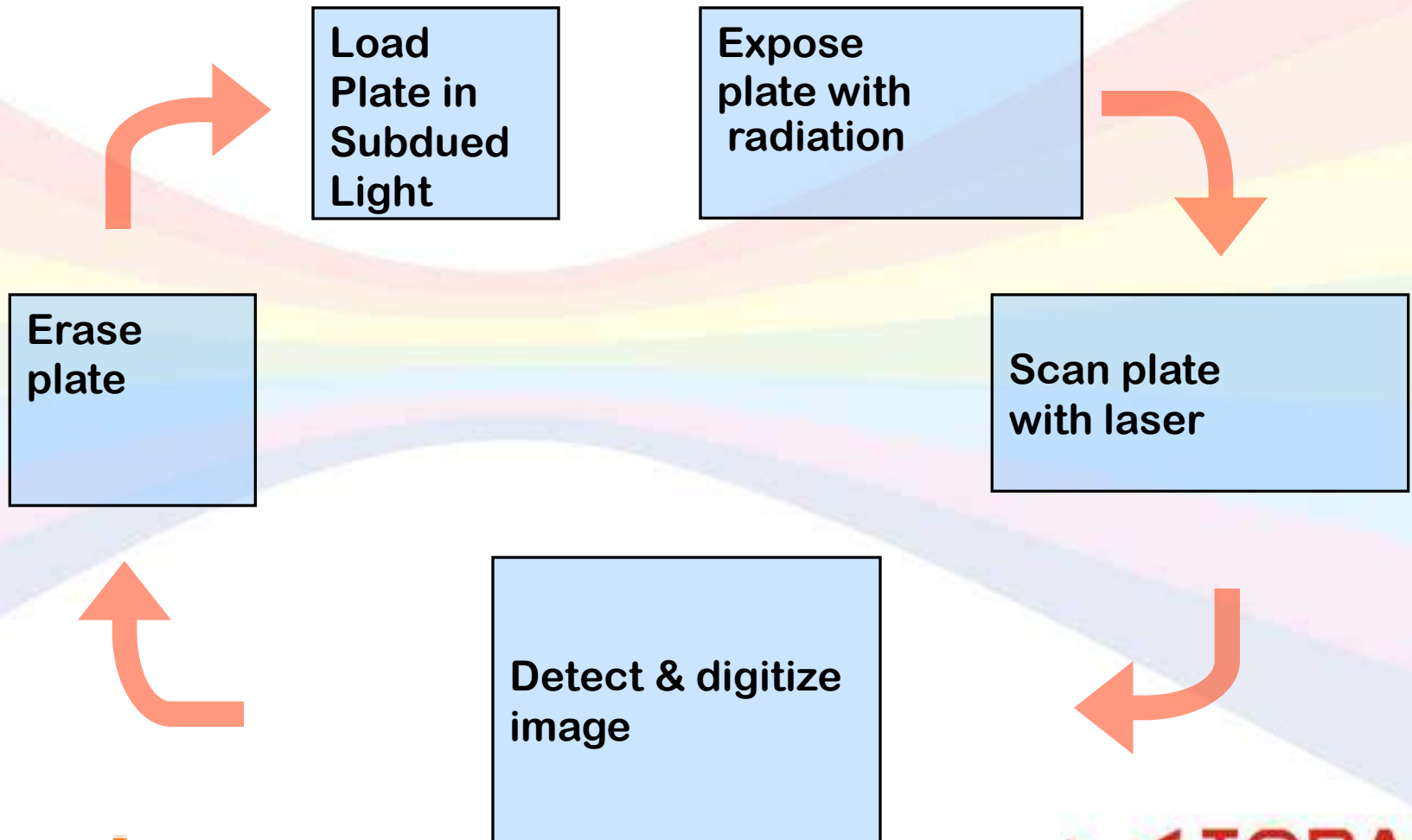


Can the plate be reused now?

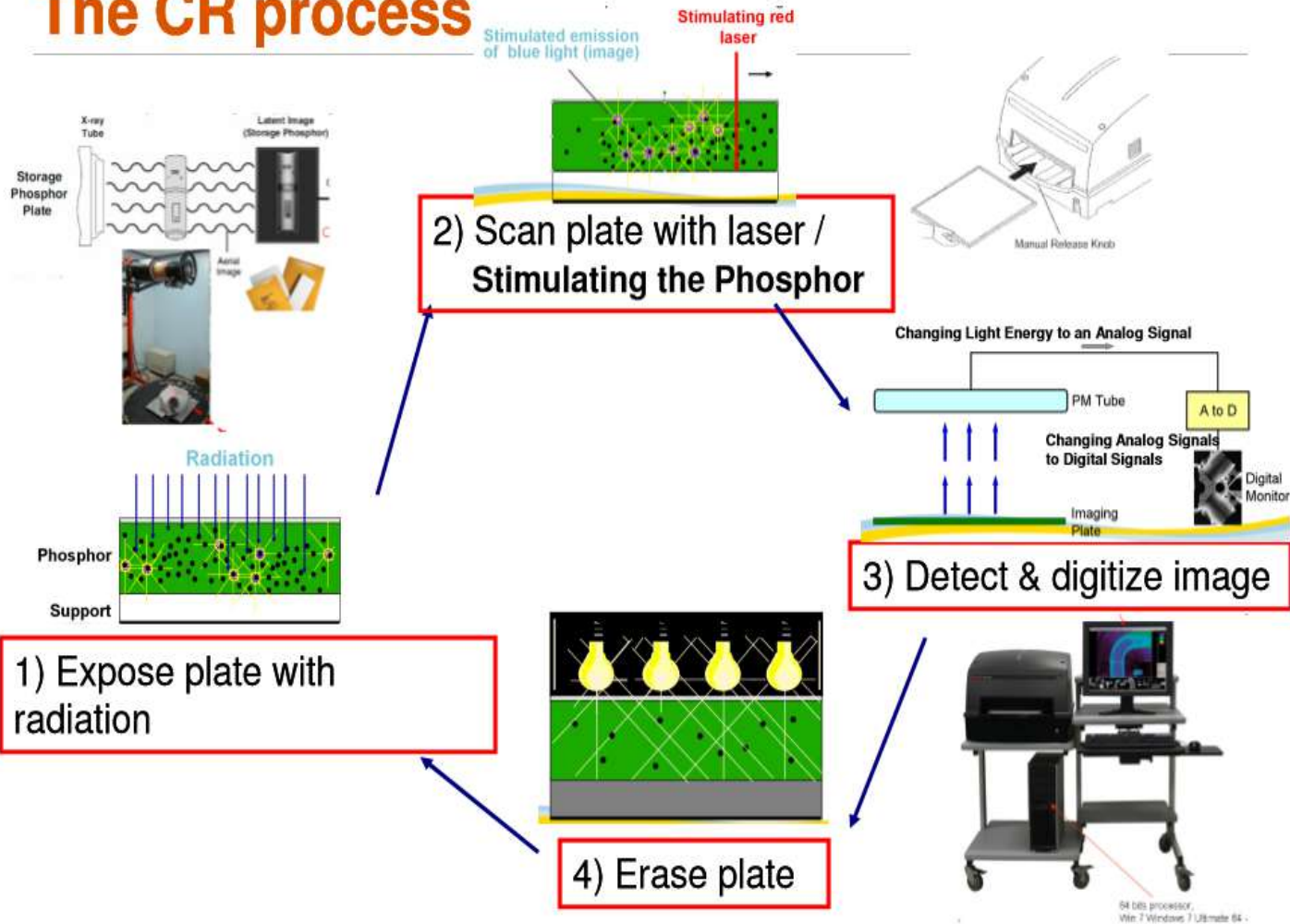
Before reuse the plate is flooded with light to erase any residual image remaining after reading. This is usually carried out automatically within the plate reader, but can also be accomplished by exposing the plate to room light or day light.



The CR process



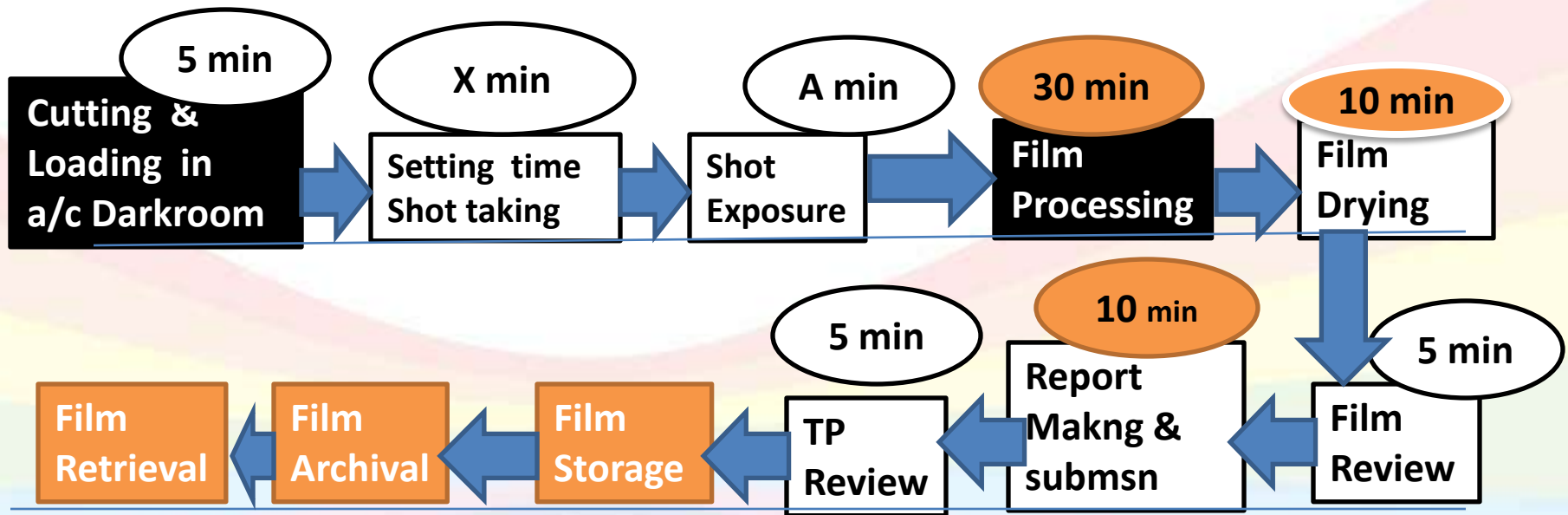
The CR process



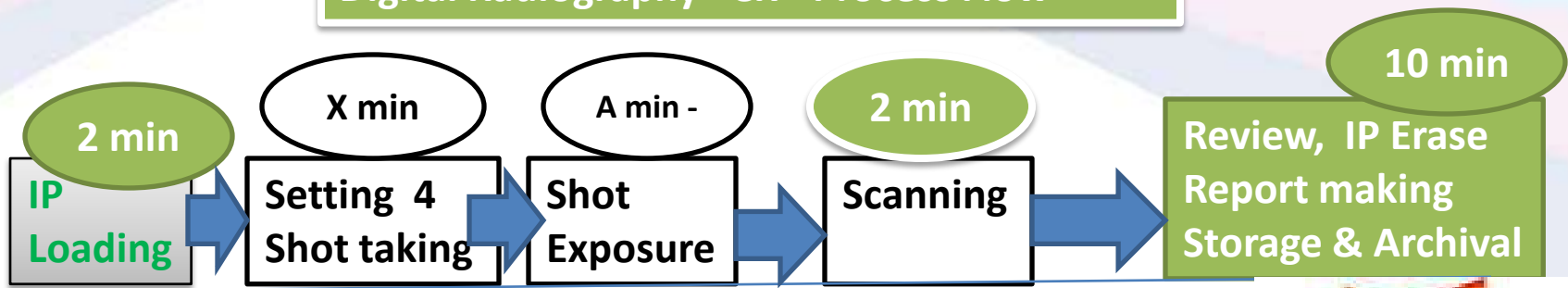
Film Radiography vs. CR

Film Radiography	Computed Radiography
X-ray tube or isotope	Same
Cassette or pouch	Same
Radiographic technique	Same
Film	Reusable phosphor plate
Darkroom	Subdued room light
Film processor & chemicals	Phosphor plate reader
Light-box viewer	High resolution monitor

Conventional Manual Radiography - Process Flow & Time per shot



Digital Radiography –CR - Process Flow



Computer Radiography (CR) Standards

CEN standards:

EN 14784-1 : Industrial CR with storage phosphor imaging plates

Part 1 : Classification of systems

EN 14784-2 : Industrial CR with storage phosphor imaging plates

Part 2 : General principles for examination of metals using X-rays and gamma rays

ASTM standards :

ASTM 2007-00 : **Standard Guide for Computed Radiography**

ASTM 2033-99 : **Standard Practice for Computed Radiography**

ASTM 2445-05 : **Standard Practice for Qualification and Long-Term Stability of CR systems**

ASTM 2446-05 : **Standard Practice for Classification of CR systems**

ASTM 2339-04 : **Digital Imaging and Communication in NDE (DICONDE)**

ASME code :

ASME 2476 : **Radiography using phosphor imaging plates**

ASME Section V & API-1104 : **Welding Quality Image**

Japan , Australia and China Standard are a mixture of EN and ASTM standard

Computer Radiography (CR) Standards

CR ASME Codes

- ASME Article 2, Appendix VIII
 - Allows filmless radiography
 - Replacement of film by CR
- ASME code, section V, Article 2
 - 2T hole must be displayed, or
 - Essential wire display

Table 4 — Minimum SNR_{av} values (CR and DDA) and metal front screens (screens for CR only) for the digital radiography of aluminium and titanium

Radiation source	Minimum SNR _{av} ^a		Type and thickness of metal front screens mm
	Class A	Class B	
X-ray potentials ≤ 150 kV	70	120	≤0,03 (Pb)
X-ray potentials > 150 kV to 250 kV	70	100	≤0,2 (Pb) #
X-ray potentials > 250 kV to 500 kV	70	100	≤0,2 (Pb) #
Yb 169	70	100	≤0,2 (Pb) #
Se 75	70	100	≤0,3 (Pb) #

^a Instead of 0,2 mm lead, a 0,1 mm screen with an additional filter of 0,1 mm may be used outside of the cassette

[#] If the SNR_{av} is measured in the HAZ/parent material these values shall be multiplied by 1,4, except if the weld cap and root are flush with the parent material



Health & Safety



Costs



Time



Water Conservation



Data Management



Waste Reduction



Communications



Environment



Advantage of Film Less (IP or CR) Radiography

A	* Works with All types of Radiographic Sources X ray, Se-75, Ir192, CO-60 , Betatron & Linear Accelerator
B	* Any Imaging Plate Size 1x1" 59" or even longer in various types
1	* Only Subdued Light
2	* No Darkroom Accessories require
3	* Immediate result compared to Film Radiography
4	* Multiple usage of Imaging Plate (handling Precaution require)
5	* N # Shots per IP use with CR (with Soft /Hard Cassettes)
6	* Reduction in Exposure Time, Retakes & Shifts working
7	* EHS Compliant - Less Hazardous
8	* Higher Productivity : Multiple Thickness only one shot require
9	* IP Cost per size per each
10	* Report making automatic configured
11	* Data Sharing & Archiving will be very easy
12	* Reduction in Manpower & shifts
13	* HUGE COST REDUCTION

Digitised stand alone actual working

Customer :

Job Details : 12 mm - 40" dia , Thk : 10mm -80 mm , Films : AA400/D7, Rad Sources : Xray, Ir 192 , Co 60 & etc, Sensitivity Reqd : 2%

FILM Usage					Imaging Plate (IP) in lieu of Film.							
#	Item use: 4x5, 12x 10" & 12 x15" & 14x17"	Cost Itemwise	Shots/day	Cost/Day	Cost/Month 25 days	Ip Cost of 10 x40 cm	Number of Images /IP	Cost Itemwise	Shots/day	Cost/day	Cost/Month(25)	Saving / month
1	Film: 10 x 40 cm (assumed size of Radiograph use in your plant)	80	100	8000	200000	20000	186	107.5269	350	37634	940860	-740860
2	Process Charge (Developing Labour)	25		2500	62500			0		0	0	62500
3	Labour Charge while taking Xray	10		1000	25000			10		1000	25000	0
4	Developing Chemical For Processing	2		200	5000			0		0	0	5000
5	Misc: Film Viewing + Source charges + Report making & Submission cost	20		2000	50000			20		2000	50000	0
6	Total	137		13700	342500		>40%	137.5269		40634	1015860	-673360
7	Film Digitisation	80		8000	200000							
8	Total cost	217			542500		>60%					
11	CR Cost HPX1 Plus OR HPX Pro(as given below)											
12	CR Cost											
Film Radiography Requirement		 <p align="center">TOPAX NDT Solutions LLP B 61 , 114, Veena Ind estate, Near City Mall, Opp. Monginis Cake factory, Off Andheri Link Road Andheri (West), Mumbai 400 053 India. Tel: +91 22 26394823 / 65566946 Cell: +9198200 59375:</p> 				Advantage of Film less (IP or CR) Radiography						
1	Dark Room					* Only Subdude Light						
2	Dark Room Accessories					* No Darkroom Accessories require						
3	Processing Chemicals					* Immediate result compared to Film Radiography						
4	Higher Exposure time					* Multiple usage of Imaging Plate (handling Precaution require)						
5	Processing Time					* 600-1000 Shots per IP use on HPX-1 in Kochi Ref, (with Soft						
6	Drying time					* Reduction in Expsoure Time, Retakes & Shifts working						
7	Film Viewing					* EHS Compliant - Less Hazardous						
8	Report making					* Higer Productivity : Multiple Thickness only one shot require						
9	Report Submissoion					* IP Cost of 10 x 40 cm is Rs 18000/- per each						
10	Data Storage /Sharing Challenges					* Report making automatic configured						
11	Archiving Challenges	Prepared by Krishna Bhuta (Level III)				* Data Sharing & Archiving will be very easy		* Reduction in Manpower & shifts		* HUGE COST REDUCTION		

Questions ???