

FUJI COMPUTED RADIOGRAPHY

FUJI IMAGING PLATE



New easy-to-recycle box for a clean environment.

FUJI IMAGING PLATE

A Revolutionary Medium for the CR System
Heralds a New Era in Radiographic Diagnosis
—Laser Reading of Recorded X-Ray Images—

The Fuji Imaging Plate (IP) is an entirely new X-ray image recording medium that replaces today's conventional film/screen systems. The Imaging Plate is the world's first photostimulable phosphor put to practical use as a recording medium.

The IP accurately detects X-ray information and stores it as energy within the phosphor particles. It offers high sensitivity, high sharpness, low noise radiographs for diagnosis by utilizing a high-emission photostimulable phosphor, BaFX (X = halogen), in a high-density dispersion image recording layer.

Further, because the photostimulated luminescence is remarkably linear to the X-ray exposure over a very wide range, any single Imaging Plate accommodates a broad sensitivity spectrum from high sensitivity (low dosage) to low sensitivity (high dosage), making it possible to tailor exposures to suit particular diagnostic needs.

Using a Fuji Imaging Plate, a Computed Radiography System image processor allows contrast modification, spatial frequency processing, and other image processing operations to yield quality radiographs of high diagnostic value. This opens up a whole new range of diagnostic possibilities.



CR SYSTEM: An Overview

Until now, radiographs have been produced by using a combination of intensifying screens and X-ray film. To offer an alternative to this conventional method, Fujifilm has developed a new X-ray diagnostic system called Computed Radiography (CR).

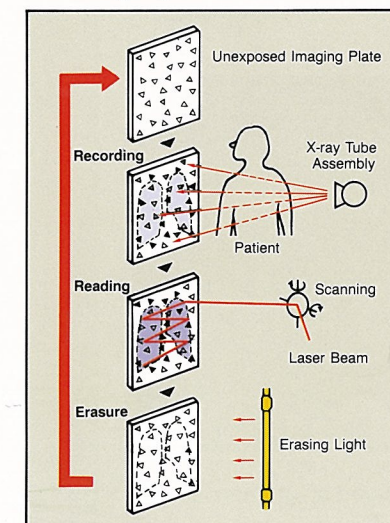
Employing an energy storage type (photo-stimulable) phosphor, the CR System offers the following advantages:

- 1) Increased diagnostic information is provided with diminished background noise. Also, with wider latitude for technical variations, the system reduces radiographic repeats.
- 2) X-ray dosage can be reduced.
- 3) Selective image enhancement, by means of computer processing, offers new diagnostic possibilities.
- 4) CR is a digitized imaging system, thus image and patient data can be stored on optical disks. Spatial data transmission also opens the way to future interfacing with Picture Archiving and Communication Systems (PACS).

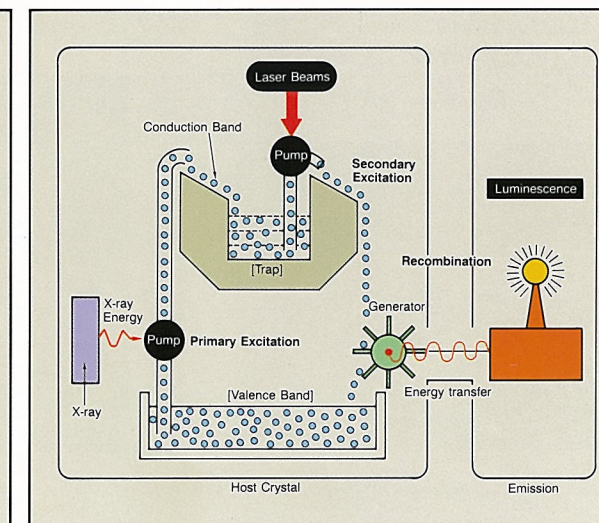
Imaging Plate: Mechanics

The Imaging Plate (IP) is composed of a highly packed dispersion of X-ray energy storage type (photo-stimulable) phosphor on a polyester support. The IP can be used repeatedly in the X-ray exposure, X-ray image reading, and image erasing cycle.

Recording/Reading/Erasing Cycle



Mechanics of Photostimulated Luminescence



Properties and Characteristics

1. Sensitivity

In contrast to the conventional X-ray film/screen systems, the Imaging Plate can deliver radiographs of excellent quality over a very broad sensitivity range.

With X-ray film and intensifying screens, speed is defined by the exact combination of the two. CR Systems have no such speed limitations, since each type of Imaging Plate can be used over a wide range of exposures. If a relative speed of 400 is assumed for a combination of standard X-ray film (e.g., Fuji Super HR-G) and standard screen (e.g., Fuji HR-Regular), speed performance of the Imaging Plate is rated at between 20 and 2,000.

The Imaging Plate thus allows exposures ranging from low dosage (high sensitivity) to high dosage (low sensitivity), specifically adapted to the anatomical area in question and the exposure method employed.

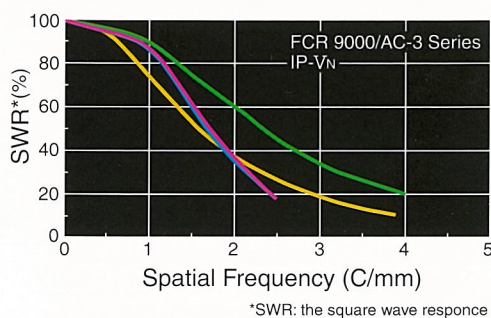
2. Sharpness

The CR System is capable of accentuating IP response at any desired spatial frequency with the aid of image processing. This provides appropriately enhanced diagnostic images for any body region and exposure method. Without image processing, the sharpness is determined by the pixel size and the type of Imaging Plate used.

The following chart illustrates SWR (square wave response) curves for ST-V_N 14 × 17 in./14 × 14 in. (pixel size 200 × 200 μm), 10 × 12 in./24 × 30 cm (pixel size 150 × 150 μm), 8 × 10 in. (pixel size 100 × 100 μm) and for HR-V 18 × 24 cm (pixel size 100 × 100 μm) with FCR 9000/AC-3 Series.

[Imaging Plate Sharpness]

- HR 18 × 24 cm
- ST 8 × 10 in.
- ST 10 × 12 in./24 × 30 cm
- ST 14 × 17 in./14 × 14 in.



*SWR: the square wave response

3. Granularity

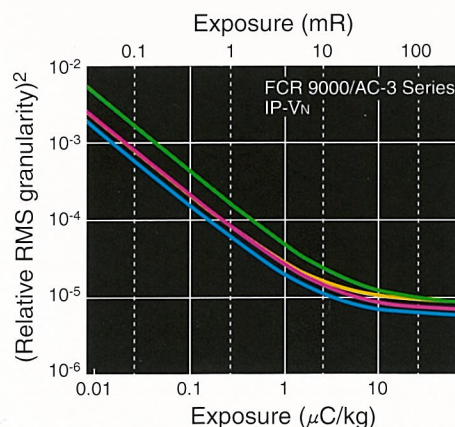
Since the Imaging Plate has a wide exposure latitude, it is necessary to specify acceptable granularity levels for the type of exposure being considered.

In high speed (low dosage) exposures, the granularity is determined chiefly by the quantum mottle of X-ray energy; in low speed (high dosage) exposures, it is determined by the structural mottle of the Imaging Plate. As exposure levels increase, the resultant image carries larger amounts of diagnostic information.

The following chart shows the granularity curves (RMS) as a function of exposure.

[Imaging Plate Granularity]

- HR 18 × 24 cm
- ST 8 × 10 in.
- ST 10 × 12 in./24 × 30 cm
- ST 14 × 17 in./14 × 14 in.



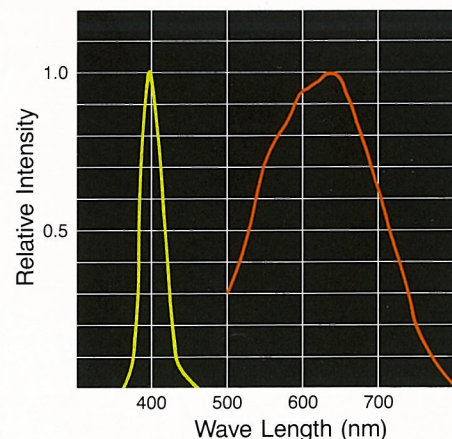
4. Spectral Characteristics

The chart shows the emission and stimulation spectra of the photostimulable phosphor BaFX: Eu²⁺ used in the Imaging Plate.

The emission spectrum peaks in the wavelength region of 400 nm, which is close to the peak spectral sensitivity of the emission detector (photomultiplier). The stimulation spectrum is a close match to the helium-neon laser emission spectrum, wavelength for wavelength. From these data, it can be said that BaFX: Eu²⁺ is an excellent photostimulable phosphor.

[Imaging Plate Emission and Stimulation Spectra]

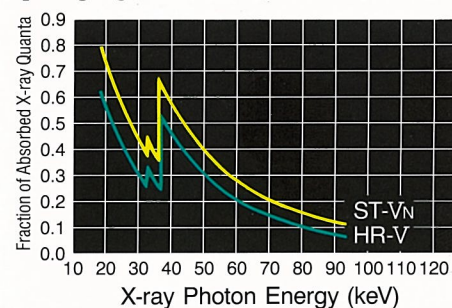
- Emission
- Stimulation



5. X-ray Spectral Absorption

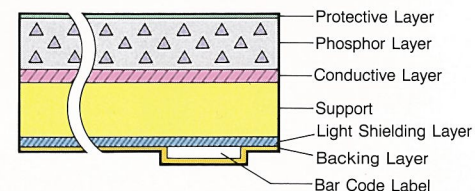
The figure shows the X-ray absorption spectra of the Imaging Plates ST-V_N and HR-V. The sharp upswings near 33 keV and 37 keV show the K-edge characteristics of iodine (I) and barium (Ba), respectively.

[Imaging Plate X-ray Absorption]



6. Structure of ST-V_N and HR-V

Shown below is a diagrammatic cross section of the Fuji Imaging Plates ST-V_N and HR-V.



IP Types and Sizes

Type	Nominal Size		Actual Size	Diagnostic Uses
	inches	cm	mm	
ST-V _N	14 × 17	35 × 43	354 × 430	Used with cassettes and magazines for general radiography. Also used with special magazines for subtraction, angiography and simultaneous multisection tomography.
	14 × 14	35 × 35	354 × 354	
	10 × 12	—	252 × 303	
	—	24 × 30	238 × 298	
	8 × 10	—	201 × 252	
	—	18 × 24	178 × 238	
HR-V	8 × 10	—	201 × 252	Used for mammography* and bone radiography (high sharpness use).
	—	18 × 24	178 × 238	

*Mammography use available for research purpose only in the U.S.A.

CR Films



Fujifilm supplies a range of CR films that provide a hard copy CR image to allow a convenient archival device and a conventional diagnostic media tool. There are three types of film, as described below.

CR Film Type 633A

has a helium-neon laser sensitive emulsion specially developed for use with FCR AC-1/AC-1 PLUS. The spectral sensitivity peaks near 633 nm.

CR Film Type 780

has an infrared laser sensitive emulsion developed for use with the Image Recorder FL-IM2636N, FL-IM2636II and FL-IM3543II used with FCR AC-2, FCR7000, FCR7501, FCR9000 and AC-3 systems. The spectral sensitivity peaks near 780 nm.

CR Film Type 780-H

has an infrared laser sensitive emulsion developed for use with the FL-IM D and FL-IM DM, used with the FCR AC series, FCR7000 series and FCR9000 series systems. The spectral sensitivity peaks near 780 nm.



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