

# Development of “FUJIFILM DR D-EVO plus C24i/s”

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## Abstract

We have newly developed the small and light CsI DR cassette, “FDR D-EVO plus C24i/s”, which features better image quality with low dose exposure, improved durability and prolonged battery life. The details of the FDR D-EVO plus C24i/s are described in this paper.

## 1. Introduction

In recent years, the introduction of cassette-type digital radiography (DR) systems has been more and more promoted. In particular, in the domains of orthopedics and otolaryngology where various physical positioning is required in capturing images, DR systems using a smaller cassette instead of the conventional 14-inch  $\times$  17-inch cassette models are useful. Moreover, there is a need for cassettes being compatible with the trays dedicated to small-size incubators. In those cases, a streamlined workflow can be realized by using a small-cassette DR system (Fig. 1).

To meet these circumstances, we developed a small, 24-cm  $\times$  30-cm cesium iodide (CsI) DR cassette. In this paper, we introduce the new cassette named “FDR D-EVO plus C24i/s”. Its small size offers increased flexibility in use, which is

suited to the diverse positioning requirements for imaging in the field of orthopedics. In addition, as it can be mounted onto the trays dedicated to incubators without alteration, it can be introduced as an imaging solution for diagnosis for newborn babies.

## 2. Features

The FDR D-EVO plus C24i/s, which is a small and light DR cassette, has achieved a higher resolution and a lower level of X-ray exposure by enhancing the DR functions and capabilities of the conventional D-EVO series DR cassettes that employ Fujifilm’s original technology, Irradiation Side Sampling (ISS) system. The following are the features of the FDR D-EVO plus C24i/s (Fig. 2).



Fig. 1 The 24cm  $\times$  30cm DR cassette: FDR D-EVO plus C24 i/s, well suited for small patients and anatomy.

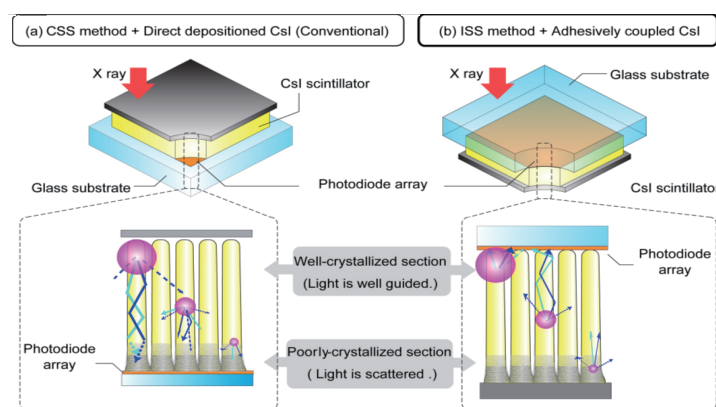


Fig. 2 Unlike Conventional Side Sampling (CSS) methods (a), FUJIFILM Irradiated Side Sampling (b) avoids the poorly-crystallized section of the CsI scintillator.

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## 2.1 Reduction of the exposure dose

Images are obtained by reading out X-ray signals with which the CsI scintillator is irradiated using an analog electrical circuit and outputting the data via analog/digital conversion. The FDR D-EVO plus C24i/s employs a newly developed high-sensitivity, low-noise analog electrical circuit and achieves high-performance digital image processing. By using those technologies in combination with our original ISS system (Fig. 2), we succeeded in obtaining high DQE with reduced X-rays and in lessening the graininess of images as a consequence of the low-level noise. RQA5-standard DQE (for FDR D-EVO plus C24i/s and FDR D-EVO plus C35i/s) with each exposure dose and MTF are shown respectively in Fig. 3 and Fig. 4.

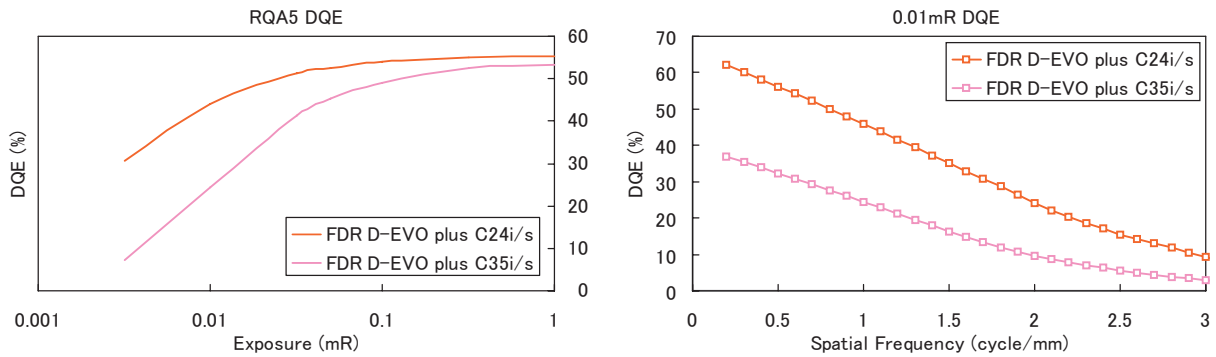


Fig. 3 Comparison of Detective Quantum Efficiency (DQE) between FDR D-EVO plus C24 i/s and FDR D-EVO plus C35i/s.

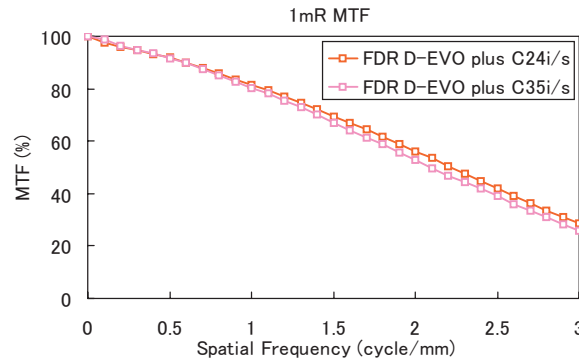


Fig. 4 Comparison of Modular Transfer Function (MTF) between FDR D-EVO plus C24i/s and FDR D-EVO plus C35i/s.

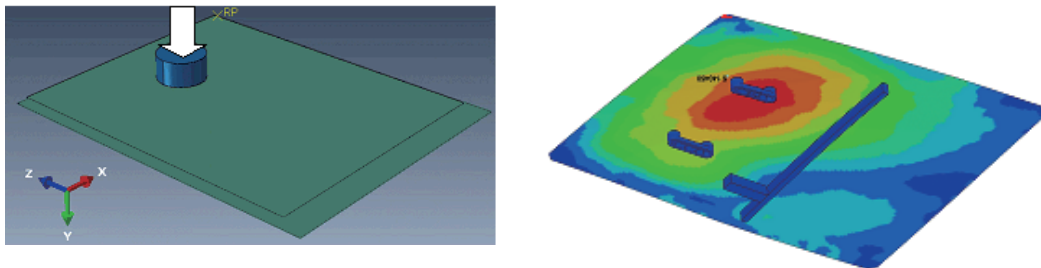


Fig. 5 Spot load dispersion design of FDR D-EVO plus C24i/s.

## 2.2 Improvement of robustness

We have developed four models of DR cassettes. Based on expertise accumulated via those activities, we newly developed a solid simulation technology and created a high-strength DR cassette by effectively deploying reinforcements inside. It sustains a 310-kg load against the full imaging surface (double that of our other products) and a 160-kg load on any  $\phi$  40-mm spot of the imaging surface (1.5 times the load of our other products) in spite of its light weight of 1.9 kg including the battery. The spot load dispersion design model is shown in Fig. 5. This robustness has enabled the provision of safe and comfortable imaging environments to radiologists in any situation including in the field of orthopedics where the weight of patients is applied to the equipment.

### 2.3 Long-duration operation with a battery

Following a complete review of the electrical drive and control circuits inside the flat panel sensor and thorough reduction in the size (space) and the power consumption, long operation for about 7.5 hours per battery charge (double that of our other products) has been realized. In addition, continuous imaging of 800 captures is possible. Fig. 6 shows the power consumption reduction effect of the FDR D-EVO plus C24i/s and FDR D-EVO plus C35i/s while they are waiting or reading out images, standardized by letting the maximum power consumption be 1. This effect helps improve the imaging workflow and usability inside hospitals considerably.

Moreover, the FDR D-EVO plus C24i/s has been made compatible with conventional systems by using the same battery as that used in the other FDR D-EVO series cassettes.



Fig. 6 Power Consumption comparison between FDR D-EVO plus C24i/s and FDR D-EVO plus C35i/s.

### 2.4 Features of the D-EVO series that have been retained

The FDR D-EVO plus C24i/s can be used in parallel with the other D-EVO series DR cassettes. Speedy image display (Fig. 7) and auto trimming of irradiation fields, which are the features of the D-EVO series DR cassettes, are retained by the FDR D-EVO plus C24i/s, realizing a streamlined imaging workflow. Also, it has incorporated the SmartSwitch function (X-ray Auto Detection Mode, Fig. 8). This enables more flexible imaging, utilizing the advantage of its small size.

## 3. Conclusion

The FDR D-EVO plus C24i/s has enabled high-flexibility imaging while reducing the required exposure dose. With this, the potential of DR cassettes in various domains, such as orthopedics and otolaryngology, can be increased.

(“FUJIFILM”, “FDR D-EVO” and “SmartSwitch” referred to in this paper are registered trademarks of FUJIFILM Corporation.)

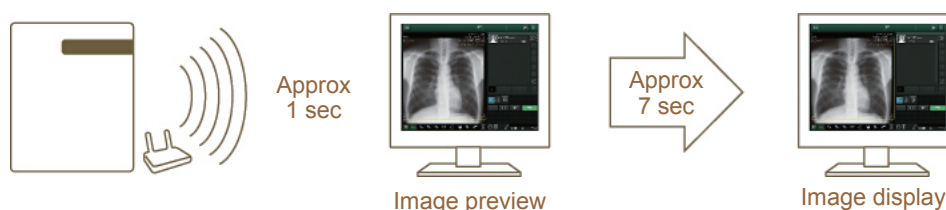


Fig. 7 FDR D-EVO plus C24i/s exposure cycle time.

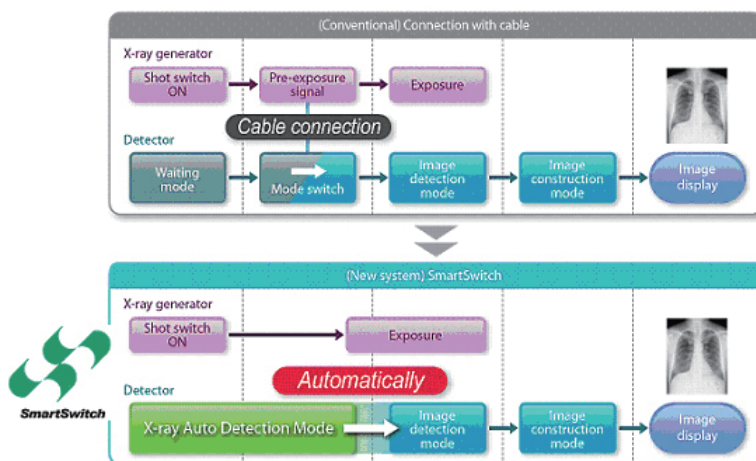


Fig. 8 FUJIFILM SmartSwitch technology enables X-ray auto detection, eliminating the need for electrical interfacing with the X-ray generator.