Digital Radiography
Special Supplement

IMAGING Management
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Includes:

- Comprehensive ECRI Institute Product Comparison Chart on the latest DR technology
- The role of DR in streamlining the radiology department
- Case study on the Swiss Paraplegic Centre
- Find out about Safire technology

Swiss Paraplegic Center:

IN SEARCH OF THE MALLEABLE MACHINE

Robotics and auto-stitching software enable the Swiss Paraplegic Center in Nottwil to effectively serve a difficult patient population with digital radiography.

By Judith Gunn Bronson, MS

Paraplegic and quadriplegic patients come from all over Europe for care at The Swiss Paraplegic Center, Nottwil.

The Swiss Paraplegic Center in Nottwil, which opened in October 1990, is a National Center of Competence that provides comprehensive care to paraplegic and quadriplegic patients who come not only from Switzerland, but from all over Europe (and, indeed, the world). The more than 1,000 center employees use the latest in medicine, social services, vocational training, education, and technology to restore patients to the highest possible level of independent function and participation. Patients can be managed from the time of onset of spinal damage through vocational training and finding a new place to live or a new job. In 2005, almost 300 patients began their treatment with a stay in the intensive care unit that averaged 7.4 days and more than 15,000 days of artificial ventilation were delivered.

An institute within the center is devoted to research aimed at making care even better in the future. In contrast to years past, when accidents were the principal cause of spinal-cord injury, almost half of today's patients at the center have an illness such as vascular disease or cancer as the cause of their impairment. As a result, the patients tend to be older (and thus to have more comorbidities) than patients seen in earlier years.

On average, almost 800 patients are receiving some type of treatment at the center on any given day. Much of this treatment is in the form of care for the decubitus ulcers, genitourinary infections and incontinence, respiratory complications, and neuropathic pain that are so prevalent after spinal-cord injuries. Patients, however, also can practice in on-site homelike environments to maximize their ability to cope when they leave the facility. Some learn to walk on up-to-date training equipment such as the Lokomat or participate in equine therapy, sports activities, or psychotherapy to help them adjust to their new circumstances. The individuals who will care for the patients once they leave the center also receive training.

Not all education at the center is for patients and their families. A program has been established to prepare new prostheticists to serve patients with spinal-cord injuries. Employees can also attend foreign-language classes, and health care professionals from all over the world attend conferences and seminars. Help is provided to patients in finding the necessary financial aid for their specialized care.

The condition of the patients and the support equipment they so often require create unique challenges for the radiology department, even with its technologically sophisticated equipment. Well over 5,000 MRI examinations are performed annually, and the center has the first Siemens Sensation 40 multidetector-array CT scanner to be installed in Europe. A new acquisition is the Swissray ddRCombi Trauma system, which the center helped the company develop. It replaced a computed radiography (CR) system and is used mostly for inpatients, although some outpatients and referrals also are imaged.

According to Markus F. Berger, MD, senior consultant in radiology, the complexity of the center's cases means that 15 to 20

patients are examined per day. This is not as many as would be seen in a typical radiography practice, so the features of the ddRCombi Trauma system are especially helpful. Most of the time required for a study is consumed by the difficulties of moving the paraplegic or quadriplegic patient from the wheelchair or bed to the table. Nevertheless, "The room time has decreased," Berger reports. "Once the procedure begins, we can have an image on the screen in 5 seconds."

The center has found the image quality to be better with the new system than with the CR system it replaced. "We confirmed the higher resolution with line-pair trials; the resolution can be as high as 3.5 line pairs per mm. Also, with windowing, leveling, zoom, and such, even bad images can often be fixed, which is helpful for these difficult patients and reduces our retake rate," Berger says.

Some other features of the ddRCombi Trauma system proved helpful. "With film-screen radiography, it was difficult to get the exposures of whole-spine images to match because of the differences in the tissues in the different areas, such as the pelvis and the thorax," Berger notes. "The AutoStitching function makes superb whole-spine images easy to obtain. We also measured the radiation dose, which is a serious concern in this population because they require so many imaging studies, and we found it was half that of our previous CR system."

The Swissray ddRCombi Trauma system has enabled the center to reduce room time.

Markus F. Berger, MD

The center converted to an all-electronic information-management environment eight years ago, and Berger described the integration of the ddRCombi Trauma into the network as exceptionally smooth. The center also has found the system to be highly robust. Its Panel Protection program, combining the ability to halt system movement if an obstacle is detected with shock-absorbing features, helps protect it from damage during these difficult cases. Swissray guarantees 99% uptime.

"In the last few years, our system was upgraded regularly," Berger says. "We now have equipment that is extraordinarily robust, almost never fails, and delivers image quality second to none. Anyone in the market for direct digital radiography should have Swissray on their short list of possible vendors."

Judith Gunn Bronson, MS, is a contributing writer for Imaging Economics.

HEALTHCARE PRODUCT COMPARISON CHART

ECRI Institute
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DIGITAL RADIOGRAPHIC SYSTEMS

PRODUCT COMPARISON CHART

ECRI Institute, a non-profit organisation, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for nearly 40 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research.

ECRI's focus is medical device technology, healthcare risk and quality management, and health technology assessment. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organisations, ministries of health, government and planning agencies, voluntary sector organisations and accrediting agencies worldwide. Its databases (over 30), publications, information services and technical assistance services set the standard for the healthcare community.

More than 5,000 healthcare organisations worldwide rely on ECRI Institute's expertise in patient safety improvement, risk and quality management, healthcare processes, devices, procedures and drug technology. ECRI Institute is one of only a handful of organisations designated as both a Collaborating Centre of the World Health Organisation and an evidence-based practice centre by the US Agency for healthcare research and quality.

For more information, visit *www.ecri.org*

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	ECRI[1]
MODEL	**Nontilting**
WHERE MARKETED	
FDA CLEARANCE	Yes
CE MARK (MDD)	Yes
SYSTEM	
Film	Yes
Digital	Optional
Type	
Tomography	Optional barless
BUCKY SYSTEM	
Type	Motorized
Size, cm (in)	43 x 43 (17 x 17)
AEC	3-field
Grid ratios	10:1 or higher
Lines/mm (in)	2.5 (100)
Cassette sizes, cm (in)	All standard
Longitudinal travel, cm (in)	50 (20)
DIGITAL SYSTEM	
Spatial resolution	>3 lp/mm
Matrix, pixels	<150 microns
Gray levels	4,096
DICOM 3.0 compliant	Yes
RADIOGRAPHIC CAPABILITIES	
Bucky	Yes
Cross table	Yes
Horizontal	Yes
Off table	Yes
Upgradable for digital	Yes
X-RAY GENERATORS	
Preferred units	80 kW
X-RAY TUBES	
Preferred units	
TUBE SUSPENSION	
Model, suspension	
Model, collimator	
ACCESSORIES	
Compression bands	Yes
Handgrips	Optional
Head clamps	Optional
Footrest	Optional
Others	
POWER REQUIREMENTS	Standard
PURCHASE INFORMATION	
List price, std configuration	
Warranty	
Year first sold	
OTHER SPECIFICATIONS	
Last Updated	

Footnotes to the Product Comparison Chart

1 These recommendations are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.
2 Due to continuous product improvments all data are subject to change without further notice
3 Dx-Si is Configurable to Customer Requirements (e.g. Wallstand or Radiographic table only or both)

Publication of all submitted data is not possible: for further information please contact ECRI or editorial@imagingmanagement.org.

	Carestream HEALTH			AGFA HealthCare
Kodak DirectView DR 3000 System (3 in 1 DR Solution) [2]	**Kodak DirectView DR 7500WM System (Multipurpose Wall Stand)** [2]	**Kodak DirectView DR 7500DM System (Multipurpose Dual Detector)** [2]	**Kodak DirectView DR 9500 System (Multipurpose Ceiling Mounted Single Detector)** [2]	**DX-Si** [3]
Worldwide	Worldwide	Worldwide	Worldwide	Western Europe and Canada
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
No Yes CsI (Tl) flat panel No	No Yes CsI (Tl) flat panel No	No Yes CsI (Tl) flat panel No	No Yes CsI (Tl) flat panel No	Integrated Digital CR system Available as Option
Motorized, 3 axis of motion 43 x 43 (17 x 17) Yes, 3 chambers 8:1, 12:1, choice out of 3 different grids 80 Lines/cm (203 Lines/inch) Cassetteless 0 (0)	Motorized, 5 axis of motion, 6th axis optional (floor rail) 43 x 43 (17 x 17) Yes, 5 chambers 10:1, 12:1, choice out of 3 different grids 40 Lines/cm (102 Lines/inch) Cassetteless 478 (188)	Motorized, 5 axis of motion, 6th axis optional (floor rail) 43 x 43 (17 x 17) Yes, 5 chambers 10:1, 12:1, choice out of 3 different grids 40 Lines/cm (102 Lines/inch) Cassetteless 478 (188)	Motorized, 6 axis of motion 43 x 43 (17 x 17) Yes, 5 chambers 8:1, 12:1, choice out of 4 different grids 80 Lines/cm (203 Lines/inch) Cassetteless 550 (217)	Cassette Based Yes, Three Field 12 / 13 h/D 40 / 70 Lines/cm 15 x 30, 18 x 24, 24 x 30, 35 x 43 Left 33cm, Right 28cm
3.5 lp/mm Matrix 3000 x 3000, Pixel 143µm 16,384 capture; 4,096 gray levels output Yes	3.5 lp/mm Matrix 3000 x 3000, Pixel 143µm 16,384 capture; 4,096 gray levels output Yes	3.5 lp/mm Matrix 3000 x 3000, Pixel 143µm 16,384 capture; 4,096 gray levels output Yes	3.5 lp/mm Matrix 3000 x 3000, Pixel 143µm 16,384 capture; 4,096 gray levels output Yes	Scanning Resolution 50 micron (20pixel / mm) N/A 16 bits Linear / Pixel. Data Acquisition, 12 bits / Pixel. Output to Processor Yes
Yes Yes Yes Yes Digital System	Yes Yes Yes Yes Digital System	Yes Yes Yes Yes Digital System	Yes Yes Yes Yes Digital System	Yes Yes Yes Yes TBD
64 or 80 kW high frequency with digital feedback control circuitry	80 kW high frequency with digital feedback control circuitry	80 kW high frequency with digital feedback control circuitry	65 or 80 kW high frequency with digital feedback control circuitry	Siemens Gen IT 50 / 80kW
300,000 or 400,000 HU	400,000 HU	400,000 HU	400,000 HU	Siemens SV 150 / 40 / 80C
Motorized floor-mounted C-arm Automatic	Overhead mounted, fully motorized, manual or auto movements Automatic	Overhead mounted, fully motorized, manual or auto movements Automatic	Motorized or manual ceiling-mounted 3D-U-arm with auto movements Automatic	Siemens 3D Top Ceiling Suspension Siemens Multileaf Collimator AL 01/ML 02
Depends on type of table Depends on type of table Depends on type of table Depends on type of table Kodak DirectView EVP software, DICOM Worklist Management Software, IHE Scheduled Workflow Software, Capture Link Software, Dose Area Product Meter	Depends on type of table Depends on type of table Depends on type of table Depends on type of table Kodak DirectView EVP software, DICOM Worklist Management Software, IHE Scheduled Workflow Software, Capture Link Software, Dose Area Product Meter, Floor Rail for lateral Wall Stand motion	Optional Yes N/A N/A Kodak DirectView EVP software, DICOM Worklist Management Software, IHE Scheduled Workflow Software, Capture Link Software, Dose Area Product Meter, Floor Rail for lateral Wall Stand motion	Depends on type of table Depends on type of table Depends on type of table Depends on type of table Kodak DirectView EVP software, DICOM Worklist Management Software, IHE Scheduled Workflow Software, Capture Link Software, Dose Area Product Meter	Yes Yes No No 4m Bridge Extension, Ceiling Rail Extension, Telescope Extension, Grid 13 / 70 150cm
380-480 VAC; 50/60 Hz	380-480 VAC; 50/60 Hz	380-480 VAC; 50/60 Hz	380-480 VAC; 50/60 Hz	
$331,500	$420,000	$620,000	$595,000	Approx. €225,000
1 year 2006	1 year 2005	1 year 2005	1 year 2007	1 year 2006
The floor-mounted DR 3000 System offers a compact footprint and is fully motorized. In this single-detector system, the arm maintains constant alignment between the X-ray tube and the Bucky for rapid patient positioning. It is capable of handling upright, table, and angle projections. The arm offers two-speed motorized movement and two presets provide Auto-positioning for upright or table projections. The DR 3000 uses the same flat-panel digital image capture technology and image processing software provided with all KODAK DIRECTVIEW DR Systems.	Designed for multi use. Base system comes fully motorized with bidirectional tube and/or detector tracking, bidirectional tube/detector centering, optional 16 user configurable auto-positioning linkable to RIS procedure codes for automated workflow. Wallstand base configuration with 5 axis of motion, motorized, 6th axis (floor rail) optional. Kodak DirectView EVP software, DICOM Worklist Management, Capture Link Software for CR/DR integration, IHE Scheduled Workflow Software; HIS/RIS Connectivity, Dose Area Product Meter.	Base system comes fully motorized with bidirectional tube and/or detector tracking, bidirectional tube/detector centering, optional 16 user configurable auto-positioning linkable to RIS procedure codes for automated workflow. Wallstand base configuration with 5 axis of motion, motorized, 6th axis (floor rail) optional. Kodak DirectView EVP software, DICOM Worklist Management, Capture Link Software for CR/DR integration, IHE Scheduled Workflow Software; HIS/RIS Connectivity, Dose Area Product Meter.	The DR 9500 incorporates a ceiling mounted U-arm (tube and detector) that offers unprecedented flexibility. The DR 9500 easily moves around the patient, making it ideal for all horizontal, upright and angled projections. The Bucky and the tube are always aligned, enabling faster positioning, enhanced comfort, and added convenience for patients - particularly those with limited mobility. Its three operator interfaces are strategically located to minimize technologist relocation. Patient data from the hospital's HIS/RIS is transferred (via DICOM worklist) to the system's operator console, as well as to the two operator interfaces on the U-arm. It can quickly and efficiently perform exams traditionally performed with a dual detector system.	
April 2007	April 2007	April 2007	April 2007	

	ECRI[1]	Swissray	Swissray	Swissray
MODEL	**Nontilting**	**ddRCompact Chest**	**ddRCompact**	**ddRCompact Plus**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
SYSTEM		C-Arm single detector	C-Arm single detector multi functional, mobile table	C-Arm single detector multi functional, off detector imaging capable, mobile table
Film	Yes	No	No	No
Digital	Optional	Yes	Yes	Yes
Type		Direct Digital Radiography	Direct Digital Radiography	Direct Digital Radiography
Tomography	Optional barless	No	No	No
BUCKY SYSTEM				
Type	Motorized	HD Silicon Solid State	HD Silicon Solid State	HD Silicon Solid State
Size, cm (in)	43 x 43 (17 x 17)	44 x 44 (17.32 x 17.32)	44 x 44 (17.32 x 17.32)	44 x 44 (17.32 x 17.32)
AEC	3-field	3-field chamber	3-field chamber	3-field chamber
Grid ratios	10:1 or higher	15:1	15:1	15:1
Lines/mm (in)	2.5 (100)	80 L/cm	80 L/cm	80 L/cm
Cassette sizes, cm (in)	All standard	Cassette-free	Cassette-free	Cassette-free
Longitudinal travel, cm (in)	50 (20)	Fixed (multiaxis)	Fixed (multiaxis)	Fixed (multiaxis)
DIGITAL SYSTEM				
Spatial resolution	>3 lp/mm	3.3 lp/mm	3.3 lp/mm	3.3 lp/mm
Matrix, pixels	<150 microns	4096 x 4096 pixels	4096 x 4096 pixels	4096 x 4096 pixels
Gray levels	4,096	16384 (14 bit)	16384 (14 bit)	16384 (14 bit)
DICOM 3.0 compliant	Yes	Yes	Yes	Yes
RADIOGRAPHIC CAPABILITIES				
Bucky	Yes	No	Yes	Yes
Cross table	Yes	Yes	Yes	Yes
Horizontal	Yes	Yes	Yes	Yes
Off table	Yes	Yes	Yes	Yes
Upgradable for digital	Yes	N/A (digital system)	N/A (digital system)	N/A (digital system)
X-RAY GENERATORS				
Preferred units	80 kW	50 kW at 100 kHz	80 kW at 100 kHz	80 kW at 100 kHz
X-RAY TUBES				
Preferred units		Optilix 150/30/50 HC-100L	Optitop 150/40/80 HC-100L	Optitop 150/40/80 HC-100L
TUBE SUSPENSION				
Model, suspension		Integrated in C-Arm	Integrated in C-Arm	Integrated in C-Arm
Model, collimator		Automatic	Automatic	Automatic
ACCESSORIES				
Compression bands	Yes	Optional	Optional	Optional
Handgrips	Optional	Optional	Optional	Optional
Head clamps	Optional	Optional	Optional	Optional
Footrest	Optional	N/A	N/A	N/A
Others		OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package	OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package	OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package
POWER REQUIREMENTS	Standard	208 / 230 VAC 50 Hz - 60 Hz	208 / 230 VAC 50 Hz - 60 Hz	208 / 230 VAC 50 Hz - 60 Hz
PURCHASE INFORMATION				
List price, std configuration		€183,500	€196,000	€211,500
Warranty		1 year	1 year	1 year
Year first sold		2007	2007	2007
OTHER SPECIFICATIONS		Complete APS - Automated Positioning System, Fully automated, remote controlled	Complete APS - Automated Positioning System, Fully automated, remote controlled	Complete APS - Automated Positioning System, Fully automated, remote controlled
Last Updated		April 2007	April 2007	April 2007

Swissray ddRFormula	Swissray ddRFormula Plus	Swissray ddRCombi Plus FP	Swissray ddRCombi Trauma	SIEMENS AXIOM Aristos Family
Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
C-Arm single detector multi functional, mobile table	C-Arm single detector multi functional, off detector imaging capable, mobile table	Over head tube suspension, single detector multi functional, off detector imaging capable, mobile table	Over head tube suspension, single fixed or mobile elevating detector multi functional, off detector imaging capable, fixed elevating table with 4 way float top	Wall stand/ table detector/ multi-functional, ceiling mounted detector with cantilevered table
No	No	No	No	Yes
Yes	Yes	Yes	Yes	Yes
Direct Digital Radiography	Direct Digital Radiography	Direct Digital Radiography	Direct Digital Radiography	For radiography
No	No	No	No	Yes, selected systems
Si TFT Flat Panel	Si TFT Flat Panel	Si TFT Flat Panel	Si TFT Flat Panel	Flat Detector
43 x 43 (17 x 17)	43 x 43 (17 x 17)	43 x 43 (17 x 17)	43 x 43 (17 x 17)	43 x 43 (17 x 17)
5-field chamber	5-field chamber	5-field chamber	5-field chamber	3-field Active Iontomat
15:1	15:1	15:1	15:1	15:01
80 L/cm	80 L/cm	80 L/cm	80 L/cm	8 (206)
Cassette-free	Cassette-free	Cassette-free	Cassette-free	N/A
Fixed (multiaxis)	Fixed (multiaxis)	Fixed (multiaxis)	Fixed (multiaxis)	61 (24) to 346 cm (136) depending on system
3.5 lp/mm	3.5 lp/mm	3.5 lp/mm	3.5 lp/mm	3.5 lp/mm
3000 x 3000 pixels	3000 x 3000 pixels	3000 x 3000 pixels	3000 x 3000 pixels	3000 x 3000, 143 µm
16384 (14 bit)	16384 (14 bit)	16384 (14 bit)	16384 (14 bit)	14-bit
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes, wall position/table
Yes	Yes	Yes	Yes	Yes and optional trolley required for wall stand system
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
N/A (digital system)	N/A (digital system)	N/A (digital system)	N/A (digital system)	N/A
80 kW at 100 kHz	80 kW at 100 kHz	80 kW at 100 kHz	80 kW at 100 kHz	High frequency, 50 or 80 kW (polydoros LX)
Optitop 150/40/80 HC-100L	Optitop 150/40/80 HC-100L	Optitop 150/40/80 HC-100L	Optitop 150/40/80 HC-100L	Siemens Optilix; 0.6, 1 mm focal spot, 600 kHU; Siemens Optitop; 0.6, 1 mm focal spot, 783 HU
Integrated in C-Arm	Integrated in C-Arm	3D Ceiling Suspension	3D Ceiling Suspension	Ceiling-mounted and floor mounted available
Automatic	Automatic	Automatic	Automatic	Automatic multileaf with filter selection
Optional	Optional	Optional	Optional	Yes
Optional	Optional	Optional	Optional	Yes
Optional	Optional	Optional	Optional	Optional (not for wall stand)
N/A	N/A	N/A	N/A	N/A
OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package	OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package	OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package	OrthoVision, Bone Mineral Density Package, ALLinONE Stand, Pediatric Imaging Package	Barcode reader; footswitch for table height adjustment, Orthostepper
208 / 230 VAC 50 Hz - 60 Hz	208 / 230 VAC 50 Hz - 60 Hz	208 / 230 VAC 50 Hz - 60 Hz	208 / 230 VAC 50 Hz - 60 Hz	400-480 VAC ±10%; 50/60 Hz ±6%; 3-phase
€365,500	€404,000	€404,000	€457,500	$475,000 to 765,000 depending on system and options
1 year	1 year	1 year	1 year	1 year
2006	2006	2005	2005	1999 and 2002
1. Complete APS - Automated Positioning System, Fully automated, remote controlled 2. The Si Flat Planel FP-5000 detector is protected by a patent pending 3P – Panel Protection Program including infrared sensors and shock absorbers to achieve industry leading reliability.	1. Complete APS - Automated Positioning System, Fully automated, remote controlled 2. The Si Flat Planel FP-5000 detector is protected by a patent pending 3P – Panel Protection Program including infrared sensors and shock absorbers to achieve industry leading reliability.	1. Complete APS - Automated Positioning System, Fully automated, remote controlled 2. The Si Flat Planel FP-5000 detector is protected by a patent pending 3P – Panel Protection Program including infrared sensors and shock absorbers to achieve industry leading reliability.	1. Complete APS - Automated Positioning System, Fully automated, remote controlled 2. The Si Flat Planel FP-5000 detector is protected by a patent pending 3P – Panel Protection Program including infrared sensors and shock absorbers to achieve industry leading reliability.	Scoliosis imaging; 2005 (Fx Plus) and 2006 (Vx Plus); decentered collimation; 17" x 17" detector; footswitch for locking tabletop movement; table shuttle; patient support for chest exams; additional patient display.
April 2007	April 2007	April 2007	April 2007	April 2007

	ECRI[1]	you can Canon	you can Canon	you can Canon
MODEL	**Nontilting**	**Canon DR System CXDI-31**	**Canon DR System CXDI-40EC**	**Canon DR System CXDI-40EG**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
SYSTEM				
Film	Yes	No	No	No
Digital	Optional	Yes	Yes	Yes
Type		GOS and a-Si	CsI and a-Si	GOS and a-Si
Tomography	Optional barless	Not specified	Possible and limited to 3 seconds acquisition time	Possible and limited to 3 seconds acquisition time
BUCKY SYSTEM				
Type	Motorized	Filmless	Filmless	Filmless
Size, cm (in)	43 x 43 (17 x 17)	N/A	N/A	N/A
AEC	3-field	N/A	Optional	Optional
Grid ratios	10:1 or higher	4:1, 8:1, 10:1	8:1, 10:1, 12:1	8:1, 10:1, 12:1
Lines/mm (in)	2.5 (100)	60/cm	40/cm	40/cm
Cassette sizes, cm (in)	All standard	Filmless	Filmless	Filmless
Longitudinal travel, cm (in)	50 (20)	N/A	N/A	N/A
DIGITAL SYSTEM				
Spatial resolution	>3 lp/mm	5 lp/mm	3.1 lp/mm	3.1 lp/mm
Matrix, pixels	<150 microns	2256 x 2878	2688 x 2688	2688 x 2688
Gray levels	4,096	4,096	4,096	4,096
DICOM 3.0 compliant	Yes	Yes	Yes	Yes
RADIOGRAPHIC CAPABILITIES				
Bucky	Yes	Filmless	Yes	Yes
Cross table	Yes	Yes	Optional	Optional
Horizontal	Yes	Not specified	Not specified	Not specified
Off table	Yes	Yes	Not specified	Not specified
Upgradable for digital	Yes	N/A	N/A	N/A
X-RAY GENERATORS				
Preferred units	80 kW	Any	Any	Any
X-RAY TUBES				
Preferred units		Any	Any	Any
TUBE SUSPENSION				
Model, suspension		Any	Any	Any
Model, collimator		Any	Any	Any
ACCESSORIES				
Compression bands	Yes	None specified	None specified	None specified
Handgrips	Optional	None specified	None specified	None specified
Head clamps	Optional	None specified	None specified	None specified
Footrest	Optional	None specified	None specified	None specified
Others		None specified	None specified	None specified
POWER REQUIREMENTS	Standard	100, 120, 230, 240 VAC; 50/60 Hz	100, 120, 230, 240 VAC; 50/60 Hz	100, 120, 230, 240 VAC; 50/60 Hz
PURCHASE INFORMATION				
List price, std configuration		$120,000	$180,000	$160,000
Warranty		1 year	1 year	1 year
Year first sold		2002	2003	2002
OTHER SPECIFICATIONS		None specified.	None specified.	None specified.
Last Updated		April 2006	April 2006	April 2006

	Canon DR System CXDI-50G	Canon DR System CXDI-50C	Definium 8000	Definium 6000	RadSpeed Safire
	Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	No	No	Also possible	Also possible	Yes
	Yes	Yes	Yes	Yes	Optional
	GOS and a-Si	CsI and a-Si	CsI	CsI	Shimadzu Safire
	Possible and limited to 3 seconds acquisition time	Possible and limited to 3 seconds acquisition time	Yes (VomlumeRAD multislice tomography)	No	Optional barless
	Filmless	Filmless	DIGITAL DETECTOR Filmless	DIGITAL DETECTOR Filmless	Motorized
	N/A	N/A	41 x 41 (16 x 16)	41 x 41 (16 x 16)	35 x 43 (14 x 17)
	N/A	N/A	Yes	Yes	3-field
	4:1, 6:1, 8:1, 10:1	4:1, 6:1, 8:1, 10:1	12:1	13:1	10:1 or higher
	40/cm	40/cm	Not specified	Not specified	2.5 (100)
	Filmless	Filmless	Filmless	Filmless	All standard
	N/A	N/A	±63 (±25)	N/A	40 (15)
	3.1 lp/mm	3.1 lp/mm	2.5 lp/mm, DQE 77%	2.5 lp/mm, DQE 65%	3.3 lp/mm
	2208 x 2688	2208 x 2688	2022 x 2022, 200 µm	2022 x 2022, 200 µm	<150 microns
	4,096	4,096	14-bit	14-bit	16384 (14 bit on DICOM) 4096 (on LI)
	Yes	Yes	Yes	Yes	Yes
	Filmless	Filmless	DIGITAL DETECTOR	DIGITAL DETECTOR	Yes
	Yes	Yes	Yes (depending on configuration)	Yes	Yes
	Not specified	Not specified	Yes	Yes	Yes
	Yes	Yes	Yes with CR or film cassette	Yes with CR or film cassette	Yes
	N/A	N/A	N/A	N/A	Yes
	Any	Any	Jedi (65, 80 kW)	65, 80 kW	80 kW, Type: UD150B-40
	Any	Any	Maxiray 100	Maxiray 100	0,6/1,2mm Type: 0.6/1.2P324DK-85SF
	Any	Any	Overhead Tube Suspension	Overhead Tube Suspension	CH-200, ceiling suspension
	Any	Any	Automatic multileaf with filter selection	Automatic multileaf with filter selection	R-30H, auto size-sensing collimator
	None specified	None specified	Yes	Optional	Yes
	None specified	None specified	Yes	Optional	Optional
	None specified	None specified	Optional	No	Optional
	None specified	None specified	No	No	Optional
	None specified	None specified	None specified	Lateral cassette holder	
	100, 120, 230, 240 VAC; 50/60 Hz	100, 120, 230, 240 VAC; 50/60 Hz	380-480 VAC ±10%; 50/60 Hz ±6%; 3-phase	380-480 VAC ±10%; 50/60 Hz ±6%; 3-phase	Standard
	$112,000	$130,000			
	1 year	1 year	1 year	1 year	
	2003	2006	2005	2006	
	None specified.	None specified.	Autopositioning, autoimage paste, volume RAD, and dual energy options.	Autoprotocol, dual energy options.	
	April 2006	April 2006	February 2006	May 2007	

	ECRI[1]	PHILIPS	PHILIPS	PHILIPS
MODEL	**Nontilting**	**Essenta DR**	**DigitalDiagnost**	**DigitalDiagnost VM**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
SYSTEM				
Film	Yes	Yes	Yes	Yes
Digital	Optional	Yes	Yes	Yes
Type		CsI scintillator with a-Si	CsI scintillator with a-Si	CsI scintillator with a-Si
Tomography	Optional barless	No	Optional, no mechanical coupling	No
BUCKY SYSTEM				
Type	Motorized	Digital detector	Digital detector	Digital detector
Size, cm (in)	43 x 43 (17 x 17)	43 x 43 (17 x 17)	43 x 43 (17 x 17)	43 x 43 (17 x 17)
AEC	3-field	3-field chamber	5-field chamber	5-field chamber
Grid ratios	10:1 or higher	12:1, 8:1	12:1, 8:1	12:1, 8:1
Lines/mm (in)	2.5 (100)	3.6 (90)	3.6 (90)	3.6 (90)
Cassette sizes, cm (in)	All standard	N/A	N/A	N/A
Longitudinal travel, cm (in)	50 (20)	N/A	46 (18.1)	Up to 374 (147.2)
DIGITAL SYSTEM				
Spatial resolution	>3 lp/mm	Up to 3.5 lp/mm	Up to 3.5 lp/mm	Up to 3.5 lp/mm
Matrix, pixels	<150 microns	3000 x 3000	3000 x 3000	3000 x 3000
Gray levels	4,096	16,368 (14-bit)	16,368 (14-bit)	16,368 (14-bit)
DICOM 3.0 compliant	Yes	Yes	Yes	Yes
RADIOGRAPHIC CAPABILITIES				
Bucky	Yes	Yes	Yes	Yes
Cross table	Yes	Yes	Yes	Yes
Horizontal	Yes	Yes	Yes	Yes
Off table	Yes	Yes	Yes	Yes
Upgradable for digital	Yes	Yes	N/A	N/A
X-RAY GENERATORS				
Preferred units	80 kW	Optimus, microprocessor-controlled high-frequency generator, 50 kW; optional 65, 80 kW	Optimus, microprocessor-controlled high-frequency generator, 50 kW; optional 65, 80 kW	Optimus, microprocessor-controlled high-frequency generator, 50 kW; optional 65, 80 kW
X-RAY TUBES				
Preferred units		RO 1750, 150 kV with nominal focal spots 0.6/1.2 mm; optional high-speed tube SRO 33/100, 150 kV with nominal focal spots 0.6/1.2 mm; tubes with focal spot 0.6/1.0 mm or 0.3/1.0 mm	RO 1750, 150 kV with nominal focal spots 0.6/1.2 mm; optional high-speed tube SRO 33/100, 150 kV with nominal focal spots 0.6/1.2 mm; tubes with focal spot 0.6/1.0 mm or 0.3/1.0 mm	RO 1750, 150 KV with nominal focal spots 0.6/1.2 mm; optional high-speed tube SRO 33/100, 150 kV with nominal focal spots 0.6/1.2 mm; tubes with focal spot 0.6/1.0 mm or 0.3/1.0 mm
TUBE SUSPENSION				
Model, suspension		N/A	CS 2, CS 4 overhead	CS 2, CS 4 overhead
Model, collimator		Manual	Automatic	Automatic
ACCESSORIES				
Compression bands	Yes	Optional	Optional	No
Handgrips	Optional	Yes	Yes	No
Head clamps	Optional	Optional	Optional	No
Footrest	Optional	No	No	No
Others		None specified	Optional lateral cassette holder	None specified
POWER REQUIREMENTS	Standard	380-400, 415-480, 190-360 VAC; 50/60 Hz	380-400, 415-480, 190-360 VAC; 50/60 Hz	380-400, 415-480, 190-360 VAC; 50/60 Hz
PURCHASE INFORMATION				
List price, std configuration		$190,000-220,000	$440,000-500,000	$350,000-380,000
Warranty		1 year	1 year	1 year
Year first sold		2007	1999	2004
OTHER SPECIFICATIONS		Eleva Workspot, Variofocus (each size between small and large focal spot is selectable via APR), UNIQUE image processing, Move-to-position functionality, patient safety concept, Philips xLNA lung nodule assessment (option), Quality Control Kit (option), DICOM 3.0, Direct access to previous exams (Option), Touch or non-touch screen LCD monitor, Reject analysis (Option), Extended security – mShield firewall (Option)	Barcode reader, digital wall stand, fully integrated CR reader, automatic image stitching, fully integrated second tube, variofocus (each size between small and large focal spot is selectable via APR).	Barcode reader, fully integrated CR reader, automatic image stitching, variofocus (each size between small and large focal spot is selectable via APR).
Last Updated		May 2007	May 2007	May 2007

MAKING DIGITAL RADIOGRAPHY MORE EFFICIENT

Results of a Study of Workflow and Dose Reduction

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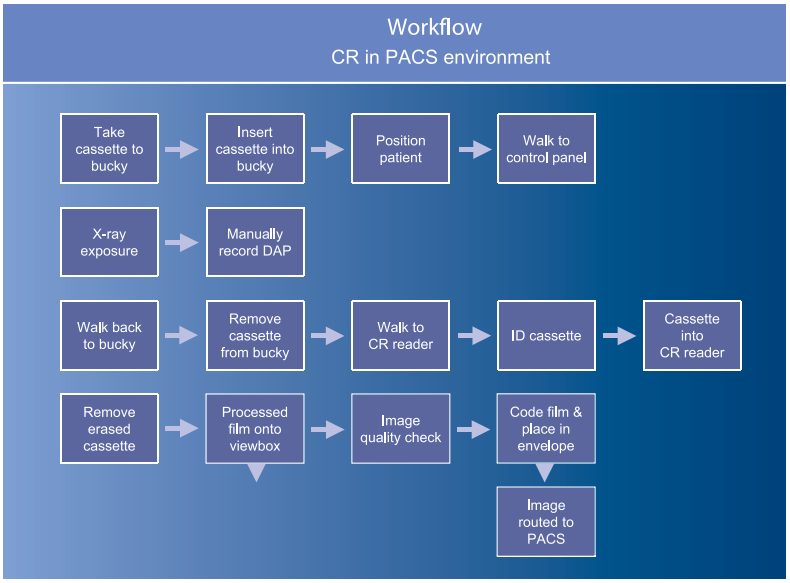
There is much research and study taking place across Europe to anticipate the advent of the digital hospital. Since imaging is at the heart of medical healthcare services, it makes sense that studies need to take place now, in anticipation of the needs of a fully-electronic imaging department, to ensure that the patient receives the best possible services. One of the ways we can do this is to make our facility as efficient as possible, examining the steps necessary in the workflow to improve throughput. In this article, I will present the results of a study that took place with the support of Kodak/Carestream Health, in cooperation with the Centre for Biomedical Engineering (CBME) and the Technical University of Frankfurt. This study examined not only the comparison of the latest CR and DR systems to check which is the best future contender, it also examined what happens to the quality of the image when the dose is reduced. Can we cope equally well with a lower dose?

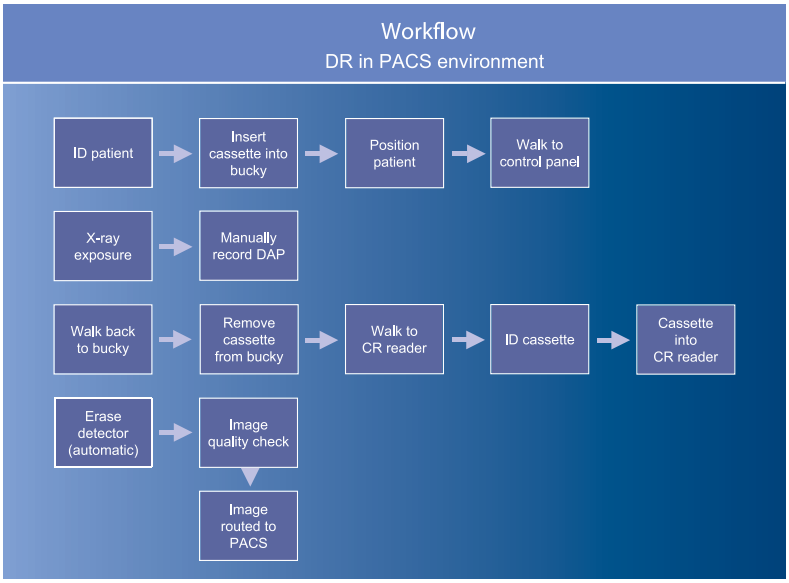
Progress in Digital Radiography

Digital detectors have come a long way since the initial Digital Subtraction Angiography (DSA) systems in the 1970's, which were rapidly followed by CR in the eighties, DR in the nineties and later on, flat panel technology. Today, digital radiography offers many advantages and possibilities, including the reconstruction and reformatting of images, easier image processing, a wide range of acquisition, rapid storage and retrieval, better distribution and more controlled viewing and analysis, amongst others. What this adds up to finally, is improved image management.

Dose reduction
Results

	Phase I		Phase II		Phase III	
	S/F	DR	S/F	DR	S/F	DR
Dose reduction: 0%	2.0	1.8	2.1	2.1	1.9	2.0
Dose reduction: 25%				1.9		1.8
Dose reduction: 50%				2.0		1.8
Dose reduction: 62.5%				2.8		2.5
Dose reduction: 75%				3.6		4.0
Dose reduction: 87.5%				4.6		4.3





CR Vs. DR – Summary

Computed Radiography (CR), uses photo-stimulable phosphor plates to obtain digital images, and can be implemented by updating the cassettes you use in your current x-ray system. Digital Radiography (DR) requires the use of newer x-ray systems with an integrated digital detector. Presently, the latter option is more expensive though it enhances workflow due to the added advantage that it is no longer necessary to handle the cassettes. Thus, while the most common solution is to use CR with mobile systems, there are already mobile x-ray units with an integrated flat panel digital detector on the market using a phosphor plate.

Although digital imaging systems have the potential for dose reduction, the most common outcome is that this dose reduction is not realised, since over-exposure goes undetected, unlike with film where the image turns dark or black. In digital imaging, by contrast, the image becomes clearer when it is over-exposed. Also, there is a tendency to take more images than necessary. Exams levels per patient seem to increase with the use of digital systems. Further, it is very easy to delete images, and technologists tend to repeat exposure if the image is not satisfactory. Thus digital imaging is likely to increase not only the number of exposures but also patient dose.

What's on the Market?

Digital radiography's current array of technologies, which are being examined by the different manufacturers, include CR, Photoconductor Drum, Direct DR, Indirect DR and Charged Coupled Device (CCD) DR. Manufacturers are competing to provide the most efficient system. As well as Fuji, AGFA and Kodak/Carestream Health, Hologic, Toshiba, Canon, GE, Philips, Siemens, Imix, Swissray, Imaging Dynamics, and Delft Diagnostic Imaging are involved in the development of a variety of different technologies using storage phosphor plates, flat-panel detectors and CCD in different combinations.

The main technology driving CCD-based digital radiography (DR) systems is the CCD cameras themselves. Currently, there are several CCD-based digital x-ray systems available with the primary technological difference between the CCD-based systems being the number of CCD cameras that each system uses. Among those companies opting for the multiple CCD configuration are Swissray, which uses four CCD cameras and Wuestec Medical Inc., which uses two CCD cameras in its current system. Companies that use a single CCD configuration include Nucletron B.V., Imix, Trex Medical and Imaging Dynamics.

Workflow Comparisons

As with any new technology, digital detectors have their disadvantages. Aside from the cost of digital detectors, one must also account for the cost of converting previous records to digital, the inconvenience of learning to use the concept and the fact that this system can produce more images than are actually required. Also, it is the consensus that for digital detectors, higher doses result in a better image quality.

However, we set out to clarify what exactly was the outcome when comparing workflow across three different systems: in conventional film screen systems in daylight processing, CR in a PACS environment and DR in a PACS environment, of which the latter involved the least number of steps in routine workflow.

Creating the Winning Formula: Dose Reduction and Digital Radiography

As noted above, there is a certain consensus that without a higher dose, digital radiography does not perform to its best. Part of our trials involved shattering this myth to clarify whether DR systems are the best future investment option for medical healthcare facilities. This study on the dose reduction rate up to the limit of diagnostic utilisation compared Philips Horizontal Diagnost H, a screen-film system using Kodak/Carestream Health's skeletal insight SC 200/SC 400 and Kodak/Carestream Health's DirectView DR 7100

The three-phase trial was designed to evaluate image quality advantages in digital equipment versus analogue equipment. In phase one, the objective was to do exactly this, using a contrast-detail phantom trial. In phase two we then aimed to evaluate the minimum required dose to obtain acceptable images for diagnostic purposes which was performed on extremities from cadavers and finally we repeated this on 85 patients.

Resolution and Evaluation

A total of eight radiologic technicians worked on the project, examining key areas such as resolution, contrast, articulation and soft tissue areas, to assess whether with DR one could reduce the dose and still achieve an acceptable image. Through the examples we used, we could still ensure a quality image with a relatively low dose per study and no loss of detail. In our research laboratory we then used post-processing steps to fine-tune the images and provide the best detail. With this key step involved, we were able to implement a 50% dose reduction without overall loss of quality.

Conclusion

As this study proved, it is paramount to analyse workflow as otherwise, potential benefits to the workflow may be unrecognised. It is also important to include the patient's needs in the study protocol. It is highly possible to implement DR and using fine tuning to incorporate a significant dose reduction. We are gaining expertise all the time.

CHANGING THE WORLD OF X-RAY IMAGING

Outstanding advantages of the World's First Direct-conversion FPD, SHIMADZU *safire*, for Dual-application (Fluoroscopy&Radiography)

safire: *S*himadzu *A*dvanced *F*lat *I*maging *RE*ceptor

Introduction

Doctor Roentgen, winner of the first Nobel Prize, discovered X-rays in 1895. In 1896, the following year, the son of Shimadzu Corporation's founder Genzo Shimadzu Jr. became the first person in Japan to succeed in capturing X-ray images. Based on X-ray technology accumulated over more than a century since the corporation was founded, Shimadzu continues to pursue the R&D for the most advanced technology in this field, providing high added value and reliability diagnostic imaging systems and solutions to advanced medical facilities. Our challenge to develop the world's first Direct-conversion flat panel detector(FPD) for both still images and moving images which nobody could provide still now is also the one that was made from such pioneer spirits and rich clinical and X-ray field experiences of ours.

If we look at the history of X-rays, we can see that the evolution of X-ray technology can be divided into two general areas: still images and fluoroscopic (moving) images. The development of still-image technology, of course, is tied to the history of film-screen systems. Even in this digital age, film imaging is used widely for radiography because of its high image quality. The history of fluoroscopy began with fluorescent screens. This was followed by the historical development of the I.I. ("image intensifier"), and now this technology is used widely in fluoroscopic tables and cardiac/angio systems in combination with CCD cameras and digital image processing systems.

The way that the history of X-rays is intertwined with that of detectors underlines the significance of developments in detector technology. In Shimadzu, we are well aware that progress in X-ray detector technology can lead to advances in the whole field of X-ray technology. To achieve the higher image quality than film, we spent a long time for researches and repeated clinical evaluations. It was really a big challenge and investment. We finally succeeded in launching the world's first Direct-conversion FPD for Dual-application(Fluoroscopy & Radiography) to the world.

X-ray Conversion Method for Moving-image

Fig. 1 shows the X-ray conversion method for moving- image FPD. With indirect-conversion FPD which is the majority in the current FPDs, X-rays are firstly converted to light by a CsI phosphor, and then this light is converted to electric signals by photodiodes. During this 2-stage conversion process, light is scattered and images are made from those scattered lights, making it impossible to achieve the image quality equal to or better than that obtained with film. This conversion process and phosphor material are almost same as that of I.I./CCD camera. So, the image quality is also expected to be the same as I.I./CCD. On the other hand, "Direct-conversion FPD" converts X-rays directly to electric signals. This method, while requiring an extremely high technical capability, is ideal for obtaining high-quality images.

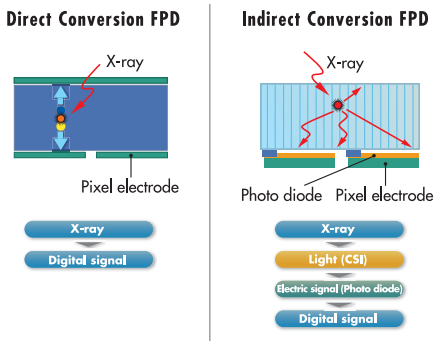


Fig. 1 X-ray Conversion Method for Moving-image FPD

Fig. 2 is a graph showing the modulation transfer function (MTF) for indirect-conversion FPD, direct- conversion FPD, film-screen, and the I.I. and CCD camera combination. The horizontal axis represents the spatial frequency and the vertical axis represents the transmission rate of image information. The closer the MTF is to 1.0, the more faithful the image is to the original. As *Fig. 3* clearly shows, direct-conversion

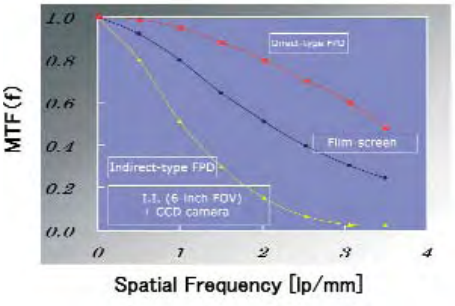


Fig. 2 Comparison of MTF Curve for Different X-ray Detectors

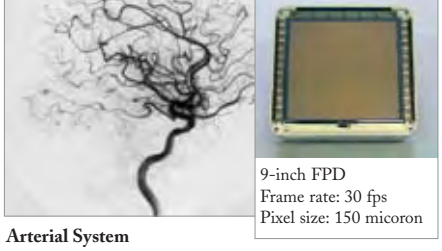
Fig. 3: Coronary Artery

FPD offer a spatial resolution that surpasses that of film-screen. On the other hand, indirect-conversion FPD offer only the same level of image quality as the I.I. and CCD camera combination.

Clinical images obtained by Shimadzu Direct-conversion FPD *safire* systems

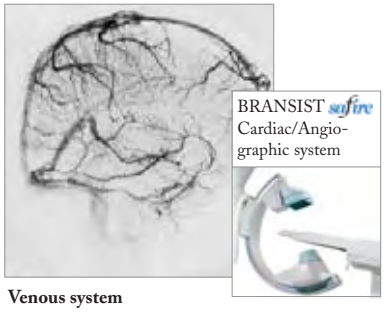
Fig. 3 shows a clinical image of the Right Coronary Artery obtained by our Cardiac/Angiographic system. A stent implant along with its structure is very clearly visualized, which were difficult to be observed with conventional I.I. or indirect FPD systems. *safire* will greatly help your safe and prompt interventional procedures, and it also means radiation exposure and injected contrast medium can be reduced consequently.

Fig. 4 shows a pulsed DSA image of the head. It is possible to clearly visualize the detailed structure of the head's vascular system with the contrast medium flowing from the arterial system to the venous system with time.



9-inch FPD
Frame rate: 30 fps
Pixel size: 150 micoron

Arterial System

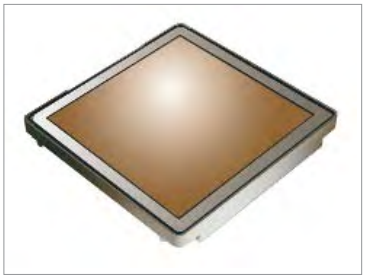


BRANSIST *safire*
Cardiac/Angiographic system

Venous system

Fig. 4

14" x 17" FOV by 17" x 17" FPD



17" x 17" FOV Fluoroscopy & Radiography Pixel size: 150 micron

Universal table system SONIALVISION *safire*

Radiographic System RADSPEED *safire*

Fig. 5

Fig. 5 shows a clinical image obtained by our 17"x17" *safire* which provides the world's largest Field Of View as of today. It can cover even the whole colon, which could not be covered even by I.I. This FPD for both fluoroscopy & radiography is integrated in our universal solution RF table, SONIALVISION *safire* which has various advanced application capabilities such as Tomo-synthesis etc. Also the same FOV size FPD(for radiography) has been integrated in our General Radiographic System, RADSPEED *safire*.

Summary

It is believed that direct-conversion FPD will revolutionize the world of medical imaging diagnosis, and it will be standardized in the next-generation. It will not only achieve the outstanding resolution clinical images, but offer the potential to reduce radiation and contrast injection, also increase safety, efficiency and clinical possibility in your examinations. ❍

We can't decide what's more innovative. The image quality, integration, ease of use, or that it all looks

so darn good together

It's hard to improve on the DX-S. A breakthrough in Digital Radiography, it combines low dose and precision imaging with the flexibility of a cassette-based workflow. But with DX-Si (Pending FDA 510(k) Market Clearance), Agfa HealthCare takes it one step further. A complete in-room digital radiography solution, DX-Si provides seamless integration between all components, including the DX-S, the X-ray system and the HIS, RIS and PACS. All through the intuitive, touch-screen interface of the NX workstation. Making this a complete Digital Radiography solution that performs even better together than it looks.

Learn about our breakthrough solutions.
Visit Agfa HealthCare at www.agfa.com/healthcare

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