

VETERINARY CARE

WHITE PAPERS:

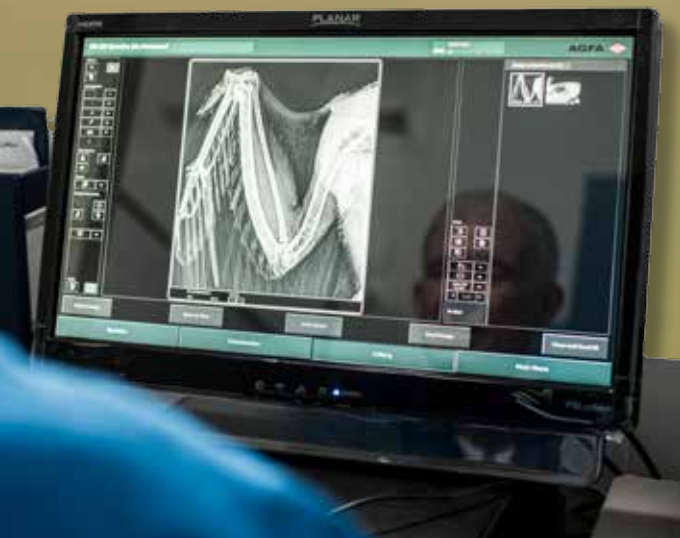
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SPECIAL REPORT

The wide world of animal care

Top athlete, family pet, wildlife: patient. Whether it runs, swims, flies or crawls, as a veterinarian, you know every animal deserves the best care. And increasingly, digital medical imaging is seen to play a crucial role.

In this Special Report for Vets, we'll take a look at how digital imaging is helping vets around the world meet the very specific challenges they face. For creatures both great and small, animal clinics are using this technology to speed up care, reduce radiation and anesthesia dose, and get the clear, detailed images they need to diagnose and make treatment decisions.

We'll take you on a behind-the-scenes tour of two very specialized practices. The renowned Desbrosse equine clinic in France attracts horse owners internationally, by offering first-class, A-to-Z care for the valuable athletes. Its top-quality equipment includes Agfa HealthCare fixed and mobile direct radiography (DR) and computed radiography (CR) solutions. MUSICA image processing gives a clear view, even through the thick and dense muscle mass of the impressive sport horses.

Then fly with us to the Dubai Falcon Hospital (United Arab Emirates), where staff make sure hunting falcons are kept in optimum physical condition. The birds require both special handling and regular workups. Recently, the clinic added a mobile care service and upgraded its Agfa HealthCare CR systems to DR. The solutions bring out 'the detail in every feather', and support the vets to keep the birds fit, trim and ready to fly.

At the Nest Te Kōhanga in the Wellington Zoo (New Zealand), staff handle lots of birds, as well. But here, the feathered patients are primarily wildlife: the care they receive is part of the zoo's conservation efforts. Then there are the zoo's wide-ranging inhabitants, from a 3-inch reptile to a 200 kg lion. Imaging is vital for everything from wellness checks, to diagnosing illness, trauma or injury. The clinic's DR Retrofit with MUSICA image processing provides both the image quality and the speed needed for this fast-paced environment.

And at the Woodland Hills Pet Clinic, in California (USA), the owners take a rather unique approach to caring for beloved family pets. Combining Eastern and Western medicines, the clinic relies on imaging to help achieve the right diagnosis. The CR system not only helps them to get great images with few repeats, but also speeds up workflow, so the clinic can help even more patients!

In addition to these real-life stories, we explore the ins and outs of digital imaging, with a White Paper that puts the technology and benefits in the spotlight. How does it work, what's the difference between DR and CR, how do the different technologies provide advantages such as image quality, ease of use, reduced radiation dose, time savings and more. We've got your questions about digital radiology for veterinary care covered!

So, sit back and enjoy this trip around the world, as we explore some of the different faces of veterinary care...

Christine Uytterhoeven
Global product manager

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The right solution for horses and customers

Agfa HealthCare offers equine veterinary practices **leading-edge imaging solutions** that meet the specific needs of the environment in which they work

INTERVIEW WITH DR. LAURENT BROGNIEZ, VETERINARIAN & **DR. ROLAND PERRIN**, VETERINARIAN
Desbrosse equine veterinary clinic, Saint-Lambert-des-Bois, France



Dr. Roland Perrin

Dr. Laurent Brogniez

“The XERO Viewer enables us to consult images that can be accessed from anywhere in the world, using only a simple internet connection.”

— Dr. Laurent Brogniez
Veterinarian



Sport horses are top athletes with a unique anatomy that is characterized by its complexity and volume of muscle mass. An injury can quickly compromise a horse's career. In order to provide excellence and efficiency to its customers, equine veterinary clinic Desbrosse decided early on to adopt state-of-the-art radiography equipment, and chose Agfa HealthCare solutions. Today, with two mobile kits comprising the Equine DX-D 45 direct radiography (DR) detector, MUSICA next-generation image processing software, a DX-S computed radiography (CR) system and the Enterprise Imaging for Radiology platform including XERO Viewer for remote access to images, the clinic is meeting the challenges of its working environment, improving its diagnostic performance and workflow, and achieving its financial targets.

Initially a general veterinary hospital in Versailles, the Desbrosse clinic was started by Henri Desbrosse. His son Francis Desbrosse carried on the family business, focusing his efforts on horses; he also developed an innovative approach to orthopedic exams for lameness. When he retired nine years ago, veterinarians Roland Perrin and Laurent Brogniez took over the activities in the clinic, which had moved in 1991 to Saint-Lambert-des-Bois, a small village in the department of Yveline, in the Paris region.

Today the clinic specializes in caring for mainly high-level sport horses (jumping, dressage, polo, etc.).

Open 365 days a year, the clinic provides an A-to-Z service for its customers: diagnostics, surgery, emergency, etc. Annually, it carries out orthopedic consultations for nearly 1200 horses, along with 300 surgical procedures and around a thousand standard or urgent procedures. In addition to Dr. Brogniez and Dr. Perrin, the team includes four on-staff veterinarians, two veterinary assistants, and three administrative staff. The clinic's reputation has spread beyond the borders of France, to an international clientele. And while some horses cross the ocean to come to the clinic for treatment, Dr. Brogniez and Dr. Perrin are also frequently called abroad for their equine patients.





EXCELLENCE IS PART OF THE CLINIC'S DNA

The clinic deliberately keeps its size down, focusing on doing everything to satisfy customers and retain their trust. As a result, the clinic has built a reputation for its continuous efforts to provide excellence in all domains. "We use top quality equipment, especially for imaging," highlights Dr. Brogniez. "In order to make sure we got the best, we looked at what was being used in human medicine."

The clinic quickly chose Agfa HealthCare, becoming the first veterinary customer in France to implement the DX-S, in 2008. "We tested it in real conditions with very high-level quality criteria, and we were very satisfied," continues Dr. Brogniez. "At the time, it was already a revolution for imaging, in terms of both diagnostic quality and profitability," adds Dr. Perrin.

For its mobile imaging, the clinic was pleased to stay with Agfa HealthCare, and at the beginning of 2016 implemented two portable DR solutions (with the latest Equine DX-D 45 detectors, MUSICA image processing software and MUSICA workstation); a third portable DR will be added by the end of the year. "Agfa HealthCare did an excellent job of developing its mobile detectors, even though it took a bit longer than some other vendors to bring them to market. But with their exceptional ease of use, the solutions offer a higher quality," comments Dr. Brogniez.



Mobile veterinary DR

- Complete mobile digital radiography solution comprising a MUSICA workstation, MUSICA image processing software and the wireless DX-D 45 detector
- All integrated into a portable, robust and compact kit

DX-D 45 detector

- Detector adapted for use with both fixed and mobile X-ray systems (Automatic Exposure Detection (AED))
- Enhanced workflow and reduced exam time
- Speed of image acquisition: the next image can be made immediately without changing a cassette
- Spare battery

“We are always on the move for our work, and the mobile kit is compact, robust and quite light, which is very important considering the feminization of the profession. Whether 20 km from the clinic, or on the other side of the planet, we have the same quality of performance.” In 2015, the clinic completed its installation with the first Enterprise Imaging for Radiology platform implemented in a veterinary clinic in France.

“With MUSICA, we can explore the fine details of the structure, with the thoroughness required.”

– Dr. Roland Perrin
Veterinarian



MUSICA DECIPHERS IMAGES FOR A CONFIDENT DIAGNOSIS

For Dr. Brogniez and Dr. Perrin, any discussion of the advantages of these solutions starts with image quality. “The large size of a horse makes radiology difficult. Furthermore, sport horses have a high volume of thick and dense muscle mass, which covers the fine structures,” explains Dr. Brogniez. “There are also imaging challenges with the hoof sheath, especially for visualizing the navicular bone. And finally, we have to control movement and positioning. MUSICA, with its high level of definition and excellent contrast for both bone structures and soft tissues responds ideally to these challenges.” Parameters are customized and set by Agfa HealthCare technicians. “This is fundamental, because every radiologist has their own preferences for greyscale! The other systems we tested were impossible to customize, which confirmed our decision to work with Agfa HealthCare.” For Dr. Perrin, MUSICA offers ‘extraordinary’ quality. “We compared it to other systems without this software and MUSICA is an enormous advantage, enabling us to get excellent information from every image.”

With images available in only a few seconds, the speed of image acquisition is another major benefit. “We see about 16 horses every day. It used to take us 1.5 hours to do a radiology assessment for one horse; now it takes only 45 minutes,” continues Dr. Brogniez.

The financial benefit of this speed is felt strongly, as imaging offers the clinic the greatest returns. “In a musculoskeletal assessment, this is what has the highest cost. For example, within a treatment bill of, say, 500 euro, imaging counts for nearly 400 euro,” Dr. Perrin explains. But it also has a big

impact on customer satisfaction: “Contrary to what you might think, horses are quite patient! But the enhanced speed from the Agfa HealthCare solution is a real benefit for the grooms and handlers who accompany the horses. They have work waiting for them at the stables, and don’t have any time to waste,” explains Dr. Perrin.

MUSICA Large Animals image processing software

- Adapted to veterinary needs
- Consistently high image quality and high level of contrast
- Automatically applies the appropriate image enhancement parameters independent of the exam type, without intervention by the veterinarian
- Excellent image quality provides the potential for dose reduction

Enterprise Imaging for Radiology platform

- Images stored in a single archive: radiography, ultrasound and MRI
- Intuitive interface for smooth workflow
- Management of the care continuum
- Scalable to needs

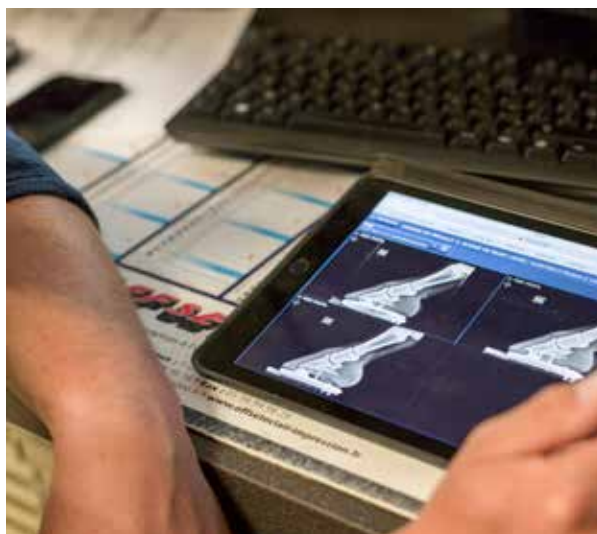
XERO VIEWER: ALL IMAGES, “ANYWHERE, ANYTIME”

With the Enterprise Imaging for Radiology platform, the clinic can archive its images securely. The connectivity enables all of the DICOM modalities of the clinic – radiography, ultrasound and MRI – to be integrated, and all the information to be included in the animal’s patient file. “With the XERO Viewer, the database is accessible from outside the clinic using a simple internet connection, on a smartphone or tablet, for example. The images can be accessed from anywhere in the world,” comments Dr. Perrin. “We showed it to one of the best equine radiologists in the U.S., who was completely blown away by the technology!”

Like radiologists, the veterinarians are taking measures to protect themselves from the imaging radiation. “In human imaging, staff can protect themselves better; but we are more exposed because we are positioned next to the horse. Therefore, our goal is to avoid repeating images,” Dr. Brogniez highlights. “The Agfa HealthCare detectors can work with lower doses of radiation, which reduces risk. And the system stability and image quality mean fewer unnecessary images, which lets us further reduce the risks of staff exposure.”

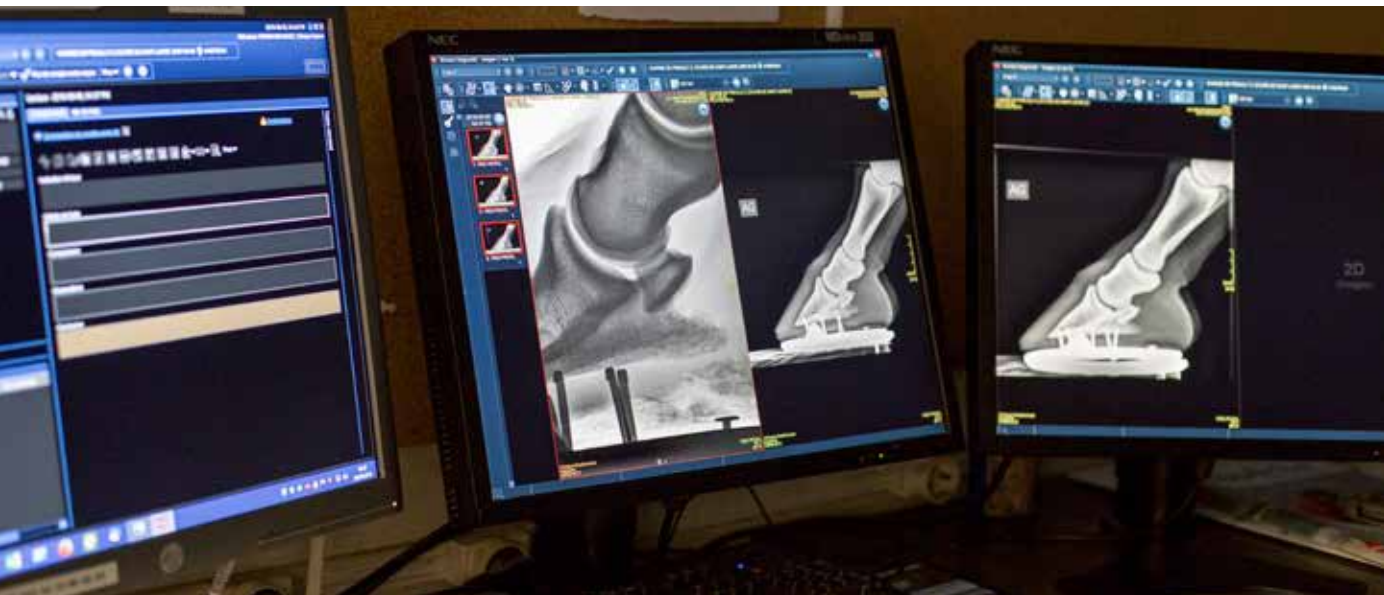
XERO Viewer

- Remote access to imaging information
- Uses a simple internet connection
- Visualization of images on tablets or smartphones



AGFA HEALTHCARE: A COMPETITIVE ADVANTAGE!

Lastly, the veterinarians at the Desbrosse clinic highlight the excellent support services they receive from Agfa HealthCare – a key criterion for this clinic that must be able to rely on the availability of its imaging equipment at every moment. “Agfa HealthCare’s support team offers us responsive service and high quality maintenance. They can even provide the service remotely in certain cases, accessing the detectors,” adds Dr Brogniez, before concluding: “All the benefits we have received from our Agfa HealthCare imaging solutions definitely offer us a competitive advantage!” ■



When East meets West, diagnosis is key

Digital imaging helps support a unique blend of treatments at fast-growing vet clinic

INTERVIEW WITH DR. APRIL LINSON, VETERINARIAN, CO-OWNER
Woodland Hills Pet Clinic, California, USA



“With the CR 10-X, we get more patients through, and we don’t hesitate to say ‘We need X-rays, it will just be a few minutes.’”

– **Dr. April Linson**
Veterinarian, co-owner Woodland Hills Pet Clinic, California, USA



At Woodland Hills Pet Clinic, modern and traditional treatments, from the east and the west, come together in what co-owner and vet Dr. April Linson describes as still a fairly unique blend: “A small percentage of practices now offer some ‘traditional’ or herbal medicine or acupuncture. But I don’t believe they are as integrated as we strive to make them at our clinic.” But turning to these alternative treatments doesn’t mean rejecting modern technology. On the contrary: Dr. Linson sees technologies such as digital imaging as crucial for diagnosis.

GIVING MORE PATIENTS BETTER CARE

“Technology helps us to be better vets: the more information we have, the better diagnosis we can make. And that is critical whether you are choosing to follow a treatment based on western or eastern medicine,” she insists. “It is even critical to helping us to determine if a western or eastern treatment is most appropriate. Digital imaging can be especially useful for musculoskeletal cases, but it goes far beyond, as well.”

An experienced vet who formerly had her own practice in Ohio, Dr. Linson and business partner Kim Moore opened the Woodland Hills clinic in 2007. “We purchased an existing vet clinic site, which came with an old X-ray machine with hand-tank processing. Unfortunately, the economic downturn affected our ability to make technology investments, but when we moved to our new location in January 2013, upgrading to digital imaging was high on our list.”



CR 10-X

- Affordable CR solution that makes no compromises on image quality
- Intelligent MUSICA image processing
- Convenient and fast workflow



The clinic chose the CR 10-X computed radiography (CR) solution. “I was already looking at Agfa HealthCare solutions, and I had a contact I trusted at their distributor, ClieTrax. I asked around, as well. The CR 10-X was the right price point; the image processing software requires little manipulation and you get a great image with few repeats.”

But Dr. Linson had two main concerns when selecting a digital imaging solution. “I had worked with another brand of digital imaging system in the past, and we were always having problems: we needed to repeat shots, the manipulation wasn’t good. Agfa HealthCare promised that wouldn’t happen with their solution, and they were right!”

Her other concern was ensuring that the solution would allow the clinic to continue growing. “Since we’ve moved, our business has already grown 38% so far this year! With the CR 10-X, we can get more patients through, while also taking more images. That means that, in addition to allowing us to improve the care we offer, the CR 10-X has proved to be an investment that both supports and enhances our growth.” ■

“In eastern or western medicine, you need the right diagnosis in order to find the right treatment. Imaging helps reach that diagnosis.”

– Dr. April Linson

Did you know ...

Dr. Linson describes the difficult case of diagnosing and treating a puppy suffering from serious digestive problems from a very early age. “We treated the puppy for parasites, but he still had the problems. Digital X-rays were very important to help us rule out a number of potential causes. Based on that information, the owners agreed to ‘alternative’ treatments when the dog was 15 months old. We used herbal medicine and acupuncture for three weeks, and the dog was cured – completely. He’s no longer even on a special diet.”

A quick study

How **DR speed** supports better Zoo care

INTERVIEW WITH DR. BAUKJE LENTING, SENIOR VETERINARIAN
Wellington Zoo, The Nest Te Kōhanga, New Zealand



“With the DR Retrofit we can get really good, clear and quick images that help us to achieve our care goals.”

– **Dr. Baukje Lenting**
Senior Veterinarian, Wellington Zoo

Wellington Zoo's world-renowned The Nest Te Kōhanga animal hospital in New Zealand enhances care for Zoo residents and local wildlife alike, while improving clinical workflows, with Agfa HealthCare's DX-D 30C Retrofit.

At The Nest Te Kōhanga at Wellington Zoo in New Zealand, speed is always of the essence. "With our wildlife patients, the aim is to quickly figure out the illness or injury and get them back into the wild when they have recovered. For wildlife and our Zoo residents, we need to keep the time spent under anesthesia as short as possible. In both cases, fast imaging is crucial," explains Dr. Baukje Lenting, Senior Veterinarian. In this state-of-the-art facility, the portable direct radiography DX-D 30C Retrofit with cesium iodide detector is 'a quick study': easy to use and offering very fast, high-quality images.

PASSION FOR ANIMALS AND CONSERVATION

The Nest Te Kōhanga opened in 2009, and is staffed by permanent veterinarians, two full time and one part time veterinary nurses, a practice manager, and four rotating veterinary residents, as part of the Massey University Masterate Programme. This amazing facility offers seven rehabilitation rooms, a custom-built salt water pool and state-of-the-art equipment, including digital radiology, a dental machine, ultrasound and endoscopy. In the main treatment room, staff make X-rays, change bandages and perform health checks, while surgery takes place in the sterile operating room. The rooms for 'in-patients' can be adapted, from adding incubators for critically ill small animals, to creating enclosures for larger patients or even setting up aviaries that can be expanded as the patient heals, prior to release back in the wild. The saltwater pool helps maintain water proofing and fitness for sea birds.

This is definitely not your usual animal hospital! Very centrally located in the Zoo, it is an integral part of the visitors' experience and the Zoo's conservation efforts. "It's very interactive; most of the rooms are on display, and we can talk to visitors while we work, explaining what we are doing, and sharing with them our passion for conservation and the animals," comments Dr. Lenting.

Imaging in a Zoo creates its own unique challenges, she describes. "The variation in patient size is huge: from a 3-inch reptile to a 200 kg lion. What's more, for some species there are no examples of what a 'normal' image should look like, so we have to extrapolate from a similar type of animal."





For the safety of the animals and staff, as well as to ensure perfect positioning, most of the animals are anesthetized for imaging. Minimizing the time spent under anesthesia is therefore a priority for the entire hospital team.

A CRUCIAL VIEW

Before building The Nest Te Kōhanga, the Zoo did not have its own imaging system. The X-rays were taken at the Zoo using computed radiography (CR) cassettes which were then physically driven to the local Pacific Radiology imaging center where they were processed. Then the Zoo vets could access the images on-line. “Pacific Radiology were very generous with their time and resources, but the process took a lot of time for us to get our images,” comments Dr. Lenting. Whenever possible, the Zoo staff would wake up the animal while waiting for the images, but if positioning was crucial, the patient might have to be kept under anesthetic until the vets confirmed that the images were good.

Imaging is vital for the animals’ care in multiple areas: “We use it for wellness checks, and for diagnosing illness, trauma or injury,” explains Dr. Lenting. “Even for diagnosing animals who have ingested dangerous or toxic materials. We see plenty of fish hooks in wild sea birds, for example. Then, there are the local Kākā, a type of parrot, who are intensely curious. They can ingest bits of metal, especially lead. If we suspect lead poisoning, the direct radiography (DR) offers enough detail and resolution for us to see any particles that might remain in the gastro-alimentary tract, so we know how to treat the bird, in combination with blood tests to assess the birds’ blood lead levels.”



“We commonly see chest and shoulder injuries in our wild bird patients. With the DR we can image those areas very accurately, allowing us to detect things we wouldn’t otherwise be able to.”

– Dr. Baukje Lenting



POSITIONING IS KEY FOR GOOD DIAGNOSIS

A DR system was an obvious addition to the new facilities; however, finding the right one wasn't so easy. Dr. Lenting explains, "We tried out a number of different systems, and then Cass Medical, the local Agfa HealthCare partner, got us the DX-D 30C Retrofit, and it was just right: the quality, the speed, the portability, ..."

The DR makes positioning the animal easy, as the vets can immediately check the images and adapt the positioning as necessary, for better images, faster, with less time under anesthesia. Assuring the best positioning also supports faster, more informed diagnoses.

The DR is very user-friendly, even for the veterinary residents, who are quickly up and running with the system. And the speed and ease-of-use have supported the hospital in enhancing its workflow efficiency: "We're a busy clinic, with ever-increasing numbers of wildlife patients, which is marvelous!" smiles Dr. Lenting. "To be able to do several imaging procedures back-to-

back, efficiently and quickly, really helps with the workflow in the clinic and how many patients we can look at in a day. When we are busy we might do imaging for three to five patients in a day, as well as other care tasks, so speed is important for our workflow."

Agfa HealthCare's 'gold-standard' MUSICA image processing provides the detail the Zoo needs for the smaller and larger patients. "With the DR, we get sufficient detail and good resolution of bone structure and internal organs, even, for example, for silvereyes, a small bird weighing only 10 grams. And then of course we go up to that 200 kg lion, for which we can image most body parts."

"We treat a lot of birds, because New Zealand has many wild bird species. We commonly see chest and shoulder injuries in our wild bird patients, but with their strong flight musculature we can't feel these easily by hand. With the DR we can image those areas very accurately, allowing us to detect things we wouldn't otherwise be able to."



IMAGES WHERE THEY ARE NEEDED!

One key factor in selecting a DR solution was portability. “We wanted to have the flexibility to carry out imaging in animals’ habitats if necessary. By taking images directly in the habitat, we could keep anesthesia times short for a sick animal or very large animal like a giraffe. We could also easily image, for example, a giraffe’s hooves – lameness can be a problem area for these animals – in the hold in the habitat.”

The hospital can also send digital images to outside specialists, such as orthopedic surgeons, for a second opinion.

Dr. Lenting concludes, “In our fast-paced environment, speed is crucial, as I imagine it would be for other clinics, as well. What’s more, having up-to-date technologies is important for us: part of our strategy is to ‘Punch above our weight’, to be a leader in our domain. And finally, the goals of The Nest Te Kōhanga are to provide Zoo and wildlife patients with an excellent level of care, make sure the welfare of all our animals is meeting our high standards, and also to contribute directly to conservation both locally and internationally. With the DR Retrofit we can get really good, clear and quick images that help us to achieve those goals.” ■

“The DR makes positioning the animal easy, as the vets can immediately check the images and adapt the position as necessary, for better images, faster, with less time under anesthesia.”

– Dr. Baukje Lenting





Since The Nest Te Kōhanga opened, there has been a huge increase in the number of wild animals treated: from 155 in 2010 up to 478 in 2015. Dr. Lenting attributes this to increased awareness of the work of the hospital in caring for wildlife and in conservation.

Agfa HealthCare and Cass Medical's contribution

When The Nest Te Kōhanga opened, the Zoo tried several third-party DR solutions, but was not satisfied. Agfa HealthCare and its local partner Cass Medical worked closely with the Wellington Zoo to find a DR solution that met the needs of The Nest Te Kōhanga for a portable solution offering fast, high-quality images for a very diverse range of animal sizes.

DR Retrofit

- All the workflow and image quality benefits of direct radiography
- Very fast images and very fast workflow
- Cesium iodide detectors offer excellent image quality
- MUSICA image processing provides clear details and excellent resolution, for both very small and very large animals
- Easy to use and to learn
- Portable

Digital radiography in the spotlight

DIRK DE LANGHE

Solutions Development Manager – Agfa HealthCare

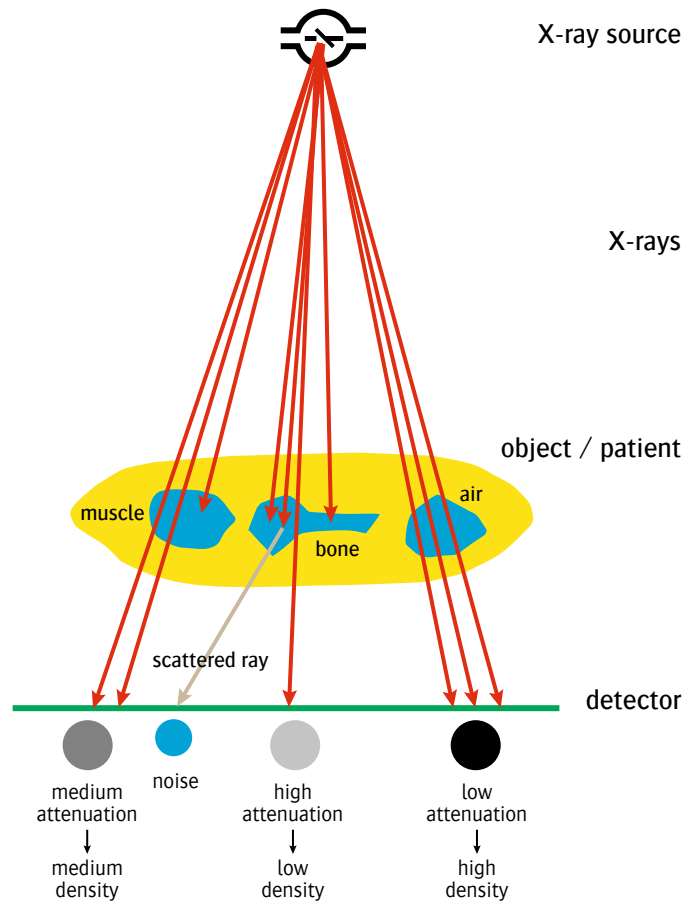
More than a century ago, in 1895, Wilhelm Conrad Röntgen discovered X-rays. Thanks to this ground-breaking discovery, he is considered as the father of diagnostic radiology. Veterinarians, too, use X-rays to diagnose their patients. Traditionally, this was done with conventional film-screen systems; today, more and more veterinarians are implementing digital medical imaging systems. Clearly, computed radiography (CR) and direct radiography (DR) offer considerable benefits for animal healthcare, including time savings and optimal image quality, even with a lower radiation dose.



BASIC PRINCIPLE

X-ray generators are used to make radiographic exposures. As the X-rays pass through the patient, the way in which they are absorbed varies depending on the density of the body tissues (bone, fat, water, air, etc.). With a conventional exposure, the unabsorbed X-rays are captured in a special cassette with a fluorescent screen, and the remaining radiation is converted to visible light. This light hits the film, reacts with the silver bromide and causes the silver ions to precipitate. After the development, fixation, drying and rinsing of the film, a conventional X-ray image is obtained.

Conventional radiography delivers solid results, but the technology is labor-intensive and time-consuming. In addition, so-called 'wet' development uses chemicals that must be handled and disposed of in an environmentally-sound way.



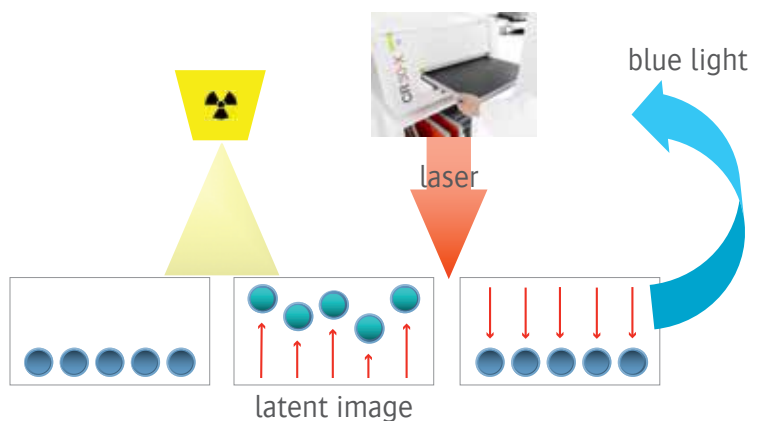
FROM ANALOG TO DIGITAL

Digital imaging systems that, like conventional systems, use a standard X-ray generator, offer a solution to the disadvantages.

Computed radiography (CR) is an indirect digital imaging technology that was introduced in the 1980s within the human healthcare domain. In the veterinary world, equine veterinarians, who must often work in the field, were the first to make use of this technology. Around the year 2000, veterinarians began using the technology – which had become more compact and affordable – on a larger scale.

With CR, the X-rays are captured using a 'capture' phosphor plate – rather than a fluorescent screen in combination with conventional film. When the plate is exposed to X-rays, some of the radiation energy is absorbed, causing the excited electrons to

Computed Radiography



create a temporary image on the imaging plate. This latent image is then scanned with a reader using laser light, capturing the visible light that is released when the excited electrons return to their ground state under the influence of the laser beam. The energy that is captured is converted into electric signals. The result is an extremely accurate image that appears on the computer monitor some 30 to 60 seconds after the exposure.

After each exposure, the images on the phosphor plates should be erased. Some systems do this in conjunction with image reading, after which the plate can be immediately re-exposed to X-rays. The phosphor plates can be re-used thousands of times, but are eventually subject to wear and tear.

Phosphor plates come in two types: 'standard' phosphor plates and plates with needle crystals. The standard CR plates with coated phosphor provide outstanding image quality; plates with needle phosphors (cesium bromide), however, offer even sharper images at a lower dose.

Imaging plates also come in various sizes. In addition to larger sizes, Agfa HealthCare also offers smaller plates for intra-oral applications, suitable both for small pets and for horses.



▲ CR systems include one or more phosphor plates (available in different sizes), a laser scanner, a computer with a high-quality monitor and, optionally, a printer.

HIGH-QUALITY IMAGES IN SECONDS

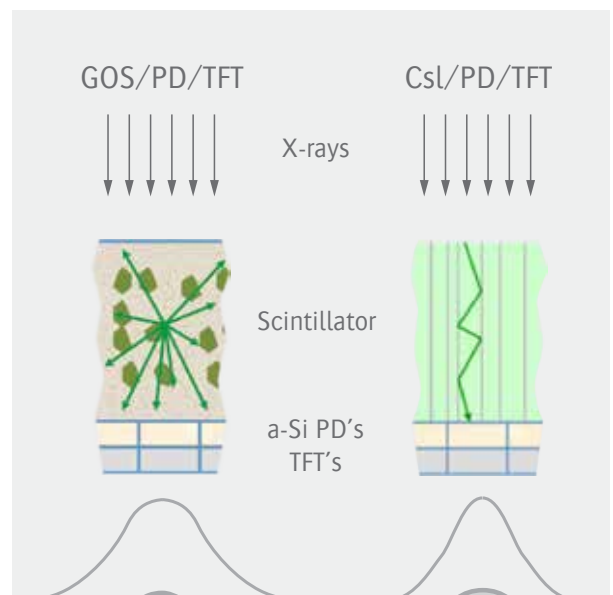
Next to CR, direct radiography (DR) is also gaining ground. DR systems use a detector plate (flat panel detector) to capture the X-rays. A scintillator converts the X-rays into visible light that is then converted into a digital signal using photodiodes and 'Thin Film Transistors' (TFT). Just a few seconds after the exposure, the image already appears on the computer screen. There is no need for a reader or scanner to process the image.

The type of scintillator determines to a large degree the quality and cost of the detector. Scintillators with powder phosphor (Gadolinium Oxysulphide – GOS) are relatively cost-efficient to produce and offer good image quality. Scintillators equipped with cutting-edge needle phosphor (Cesium Iodide – CsI) are also available. As with CR, needle phosphor will – at a similar dose – produce a sharper image; this is because the light scattering in the scintillator is limited.

Compared to CR, the major benefit of DR is even faster images. In addition, retakes (if necessary) can be performed immediately; there is no need to replace the cassette.

The inverse side is that the DR technology is more expensive, and therefore requires a higher investment compared to CR. In addition, the detector plate is more sensitive to damage:

a kick from a horse, for example, could require the complete replacement of the detector system. Considering the cost, many veterinary practices prefer CR.



EASE OF USE

In general, CR and DR digital imaging systems are easy to operate. The veterinarian selects an exam type on the computer and the correct parameters are transmitted to the X-ray generator. As soon as the images are taken, they are sent to the workstation, where they can be optimized for interpretation. With the more advanced systems available, the entire workflow is automated.

When a hardcopy is needed, the image can be printed on paper or transparent film, similar to conventional X-ray film. Paper images from an office printer can be useful in client communication, while prints from high-quality film printers produce diagnostic-quality films.

Both CR and DR are particularly suitable for mobile applications. A small footprint CR system, used together with a laptop computer, is easily transportable in a car. The smaller DR detectors on the market today are very practical to use.

The top-of-the-line for house calls – e.g. for equine healthcare – are the wireless auto-trigger flat panel detectors.



EXCELLENT IMAGE QUALITY

Digital radiography puts an end to the disadvantages of conventional silver film. In addition to the usage drawbacks noted earlier (labor-intensive, time-consuming, chemicals...), film has a limited dynamic range for radiation, which means that it cannot tolerate a wide radiation dose range without risking saturation or underexposure. In some studies, this limited range means certain areas may be overexposed, while others will be underexposed – on the same film.

Conversely, digital systems have a higher dynamic range (more shades of grey) and a completely linear nature. Therefore, even underexposed or overexposed images can be visualized with all details. Lesions that would not be visible on conventional film are perceptible with digital systems.

Because of the linear nature of the detector and the possibility for image processing, details of both soft tissue and bone can be viewable on the same image. Retakes, which require additional radiation exposure for both operator and patient (and possibly additional sedation for the latter) can be avoided. The exam is completed more quickly, at a lower cost.

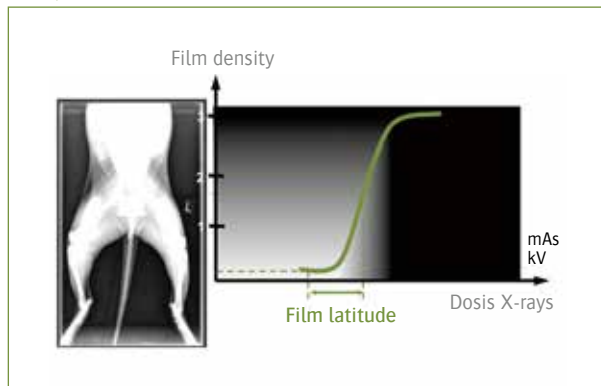
The software also makes it possible to make measurements, such as heart dimensions, hip angle in a dog or hoof angle in a horse, etc. The manipulated image can be stored with the original image.

Proper image processing is an important component. Nearly all suppliers have built image processing software into their CR and DR systems, but the methodology and quality of this software determine to a large extent the quality of the diagnostic image. The best image processing software will automatically visualize all details – low and high contrasts in small and large objects, independent of animal species, pathology or animal size. The advantage for the veterinarian is that he can focus on the patient and is not distracted by having to search for the correct settings for an optimal image processing. One example is Agfa HealthCare's MUSICA image processing, which today is considered the gold-standard in both human and veterinary radiology. The MUSICA software analyzes each image and automatically applies the appropriate image enhancement parameters, independent of the exam type.

LOWER RADIATION DOSE

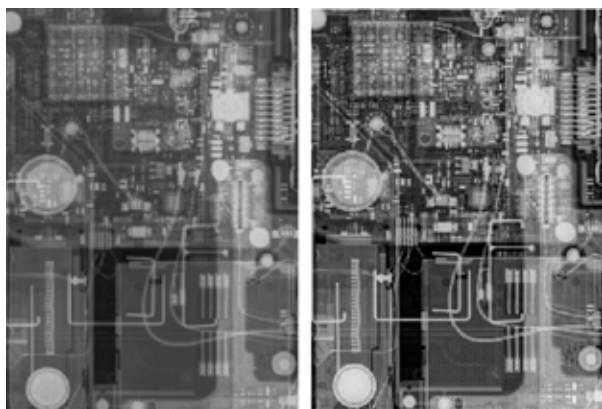
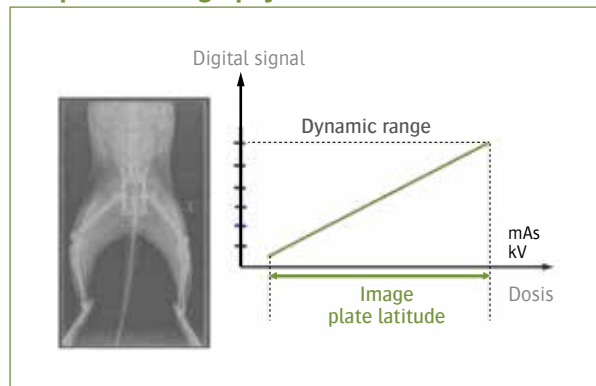
As the harmful effects of ionizing radiation have become apparent, diagnostic imaging is increasingly carried out according to the ALARA (as low as reasonably achievable) principle for radiation dose. In a nutshell, this means that rather than aiming to obtain the nicest image, the objective is the most efficient image. This is an image that visualizes the details needed to make a diagnosis, while applying the lowest radiation dose.

Film/Screen



Thanks to CR and DR it is possible today to limit dose. Even when an image is 'underexposed', with CR or DR the large range of radiation intensity results in an image with sufficient detail.

Computed Radiography



◀ Powder phosphor - GOS (left) vs needle phosphor - CsI (right)

Using needle phosphor and optimized image processing software, such as MUSICA, makes it possible to move another step in limiting radiation dose. Needle phosphor enables a more efficient conversion of X-ray beams in the signal, with only a small impact by light scatter during detection, for an even more accurate image at a lower dose. In combination with better noise suppression from the image processing software, optimal images can be obtained with a lower radiation dose.

TIME SAVINGS

In addition to the generally better image quality, CR and DR also offer significant time savings. As film development is no longer necessary, images are available considerably more quickly. CR produces images in 30 to 60 seconds, while DR takes just a few seconds.

The subsequent workflow steps have also become much easier. Images can be stored electronically and sent to another veterinarian for a second opinion. And after the exam, they are easier to retrieve. Physical storage space and a darkroom are no longer necessary.

There is no longer a need to wait till the image is developed to start any necessary treatment; the waiting time for the animal's owner for the imaging results is reduced, as well.

Veterinarian Ingrid Putcuypys from animal healthcare practice 'Kat en Hond' in Deinze, Belgium, uses a CR system. She summarizes the major advantages she has experienced as follows: "The system is very easy to operate. I only need to select an exam on my workstation and after the exposure the image is automatically optimized with the MUSICA image processing software. All in all, this takes no longer than one minute, and often I am amazed by the image quality." ■



The top-of-the-line for house calls – e.g. for equine healthcare – are the wireless auto-trigger flat panel detectors.

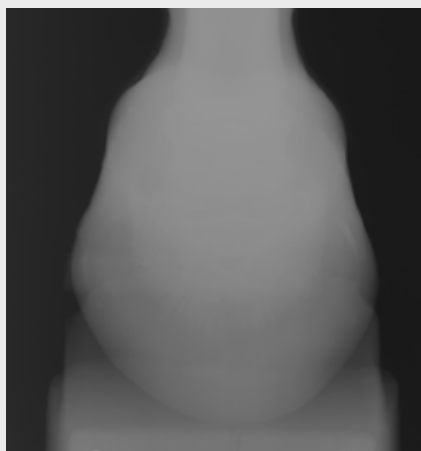
▲ The complete DR mobile solution meets the specific needs of veterinarians in the field.

Image processing can make or break digital X-ray images

DIRK DE LANGHE

Solutions Development Manager – Agfa HealthCare

In recent years, new technologies in medical imaging, in particular computed radiography (CR) and direct radiography (DR), have become both more compact and more affordable, making them increasingly appealing alternatives to conventional film and development. In this article, we consider the important role of image processing software for these digital radiography solutions. In effect, when you are preparing to make the change to digital radiography, it is important to consider not only the quality of the detector itself, but also the image processing software that is delivered with the solution. Here's why, and what to consider.



◀ Image processing is a transformation of an invisible radiation image ('RAW' image) into a readable image (processed image)



Raw image

Processed image

IMAGE PROCESSING: AN ABSOLUTE NECESSITY

Classic film/cassette/screen systems intrinsically offer a very simple sort of image processing, which results, for example, in images in which soft tissue and bone are often not visible at the same time. But with computers, we have many more possibilities; in principle, all information from a raw image can potentially be provided in a balanced and easy to interpret way.

Digital detectors capture almost all of the information from X-ray images. However, the radiation range is so large that raw, unprocessed images are unclear. Without image processing, they become more or less impossible to interpret for the human eye, and consequently cannot be used for diagnosis.

To enhance the visibility of the details, CR and DR systems always include image processing. This function is usually integrated within the workstation used for making the images. However, the possibilities and the quality of the software can vary a lot, so be alert.

The systems currently available on the market can be broadly classified into three groups:

- basic image processing systems;
- conventional systems with multi-resolution image enhancement;
- sophisticated, automated systems with multi-resolution image enhancement.

BASIC IMAGE PROCESSING SYSTEMS

The most basic systems for image enhancement offer a limited set of elementary functions. With such a system, you can perform a number of general processing tasks, such as adapting the grey tones for the anatomical part you wish to examine; using a filter to make the image sharper; adjusting the contrast by equalizing the histogram; optimizing the image noise; etc.

This type of software first emerged from 1985-1990; it is still supplied today in combination with CR and DR systems by a number of, mostly local, veterinarian suppliers.

But to get a good result with these elementary software systems, you will usually need to do quite a lot of manual post-processing for each individual image. Not only is this time-consuming, but it isn't always easy to visualize all the relevant information that is potentially available in the image in an optimal way. In other words, the image quality may not always be satisfactory.

CONVENTIONAL SYSTEMS FOR IMAGE PROCESSING

When CR systems were introduced for human healthcare in the beginning of the 1990s, they stimulated the need for a more powerful and convenient image processing. This led to the development of a new generation of software based on multi-resolution technology. Essentially, these software systems split the image into different frequency components, each of which is processed separately. The image is then recomposed, resulting in an image with enhanced contrast and more visible information.

When you select an exam type on the workstation, an image processing algorithm is applied automatically, based on an extensive range of values that have been predefined for that specific exam type. So it is important to configure the correct

image processing for each exam, including factors such as the body part, exposure dose, patient position, patient weight, possible use of contrast media, etc.

This is rather labor-intensive, but when done properly, the images are easy to interpret, and require you to do only limited manual post-processing. In practice, the configuration is not always carried out perfectly, so more post-processing is required.

An example of this type of technology is Agfa HealthCare's first-generation MUSICA image processing software, which was released in 1993. The acronym MUSICA stands for *MULTI Scale Image Contrast Amplification*.

ADVANCED, AUTOMATED IMAGE PROCESSING

While conventional first-generation multi-scale technology is still the industry standard today, second-generation multi-resolution image enhancement software has been available since 2007. This software analyzes the incoming raw image and then independently applies a very extensive set of parameters for image optimization. All the parameters needed to generate an optimal image are automatically derived or calculated based on the raw image.

With this software, the image is first split into its different frequency components (the multi-resolution decomposition). Next, a number of adjustments are automatically made: details with too-high contrast are attenuated; details with subtle contrast are enhanced; edges are sharpened when relevant; noise in lower contrast areas is minimized. The image is then recomposed (the multi-resolution reconstruction). All of this takes only a fraction of a second, and is completed automatically.

After the image acquisition, you receive a turnkey image on the screen, which visualizes all clinical information from the raw image in a balanced way. This almost always allows you to make a diagnosis at a glance.

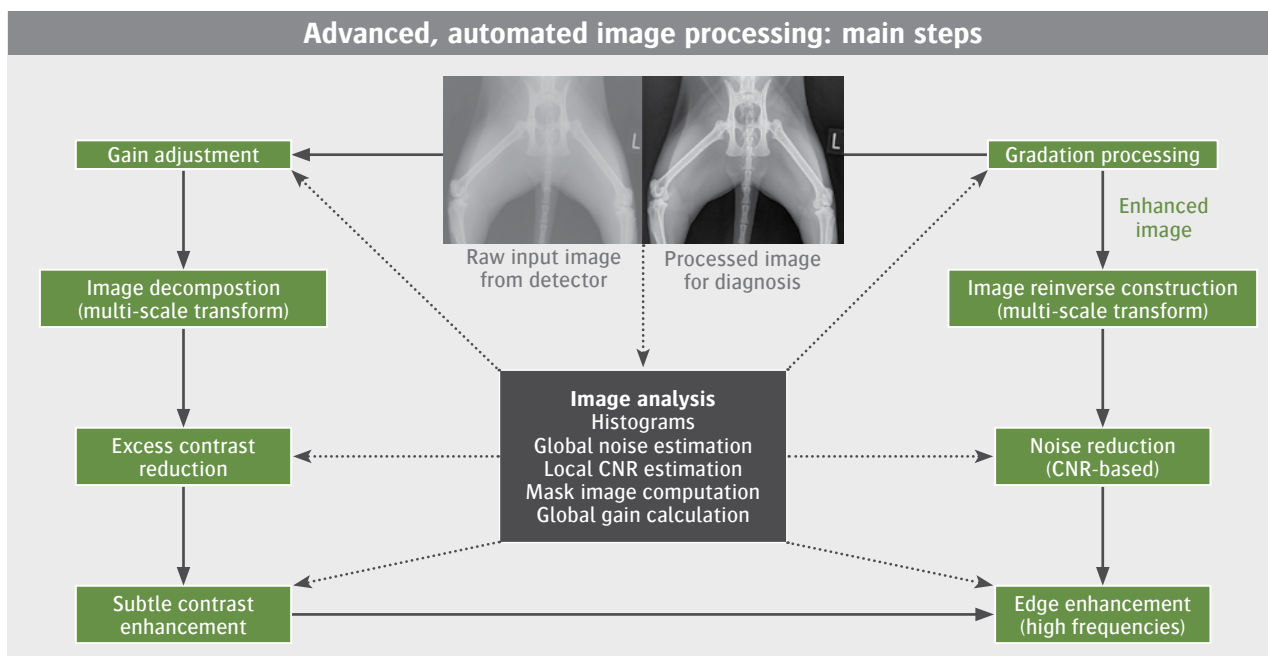
It won't make a difference whether you are exposing a large dog's thorax or a tiny bird's wing: the processing is largely independent of breed, body part and X-ray dose. So as we see, this generation of software for image processing delivers images with a consistently high quality, while making manual post-processing almost redundant. Very little pre-

configuration of the system is necessary, allowing an easier and quicker installation.

Some of the systems even enable the adjustment of contrast, brightness and sharpness, to accommodate each user's preference. Another important advantage is that both soft and bone tissue are visible simultaneously in the same image, which was unthinkable with conventional X-ray images. This can be interesting in cases such as, for example, a tiny fracture that is hardly visible in the bone, but with a clearly visible injury of the surrounding tissue.

Agfa HealthCare's next-generation MUSICA is an example of a state-of-the-art image processing tool. Next to the advantages described above, it offers:

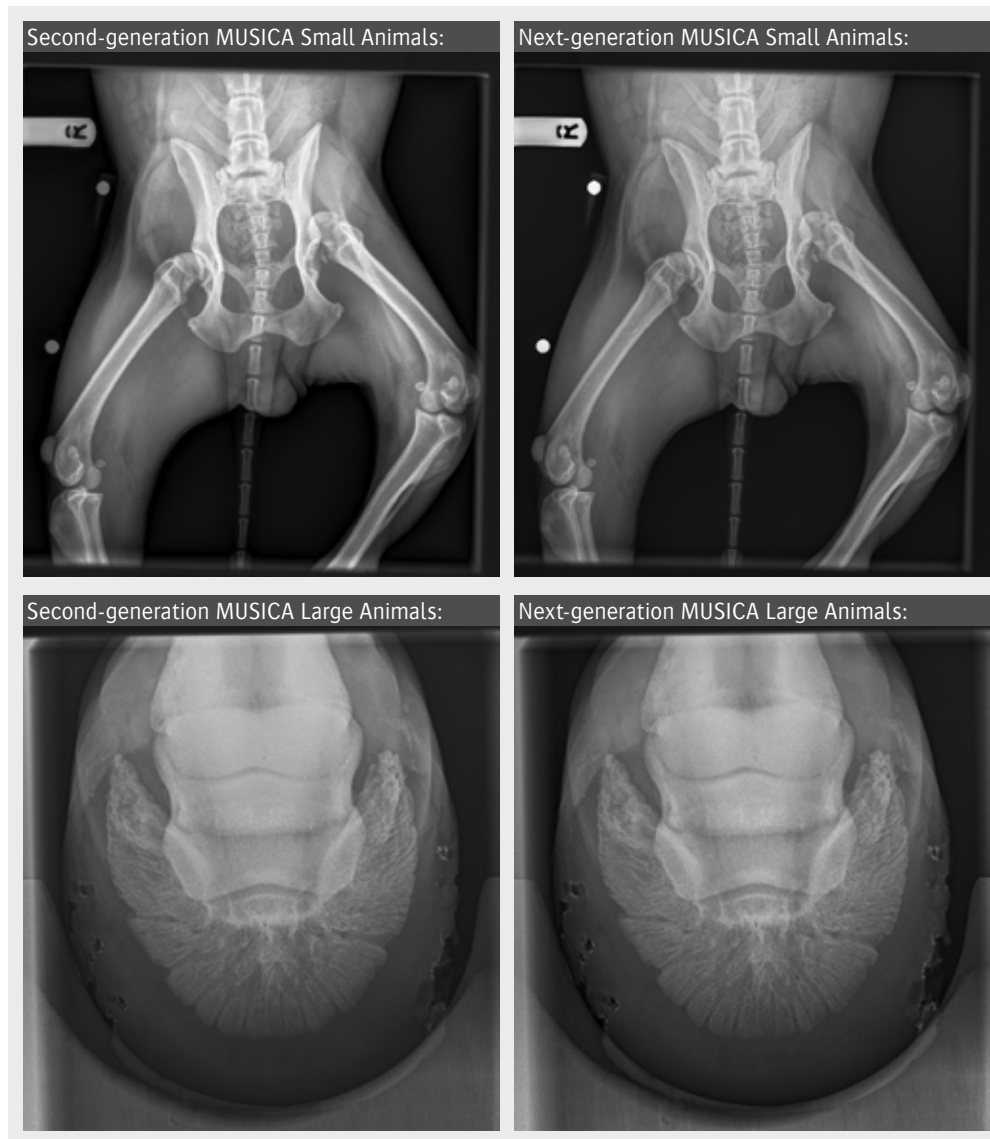
- Soft tissue visibility with natural gradients and subtle details, up to the skin line;
- More, sharp and well-balanced (fine) details in both trabecular and cortical bone, including smoother transitions;
- Enhanced visibility in complex, dense and superimposed bone structures: e.g. sinus cavities, carpals, etc.;
- Less brightness of the cortical bone;
- Good uniformity in wide range exposures such as spine and long/dense bone;
- Well-controlled noise level.



SPECIFIC MODULES FOR VETERINARIANS

Vendors of these sophisticated systems offer both universal versions for veterinary radiology and specialized packages that are optimized for either small or large animals. This allows the

same digital radiography system to deliver excellent images for every sized animal from, for example, a tiny bird up to a large dog, and more.



CONCLUSION

Veterinarians who are considering making the change to digital radiography are well advised to extensively evaluate the quality of the CR or DR detector. But just as important is the quality of the image enhancement software that comes with the solution. The basic systems don't always deliver images that meet your expectations, while the first generation

of the more advanced multi-resolution image processing software still requires quite a bit of manual configuration. If you want your images to appear on screen automatically and with optimal quality, supporting a convenient and accurate diagnosis, a latest-generation advanced image processing system, such as MUSICA, may be the best choice for you. ■

It's all in the details, with falcon care

Dubai Falcon Hospital keeps bird athletes in flying form,
with **DR Retrofit** and **Enterprise Imaging for Radiology**

INTERVIEW WITH SARAH GOUGH, ASSISTANT MANAGER, REGISTERED VETERINARY NURSE
Dubai Falcon Hospital, United Arab Emirates



“The MUSICA image processing is incredible, you get such clear images... It brings out the detail in every image, in every feather.”

– Sarah Gough
Assistant Manager, Registered Veterinary Nurse

The art of falconry has been practiced for thousands of years, and has been recognized by UNESCO for its cultural importance and value. The birds used in falconry are not seen as only hunting companions: they are athletes, and like all athletes, it is important to ensure that they are in optimal physical condition. The Dubai Falcon Hospital was the first hospital facility specialized in falcons in the Middle East, and over time it has become a model for other falcon hospitals in the region. The recent opening of a new radiology suite provided an opportunity for the hospital to further enhance the care and service it offers, by upgrading its Agfa HealthCare computed radiography (CR) imaging solutions to direct radiography (DR), with the DR Retrofit. At the same time, the hospital implemented Enterprise Imaging for Radiology.

In 1983, H.H. Sheikh Hamdan bin Rashid al Maktoum set up the Dubai Falcon Hospital in the United Arab Emirates (UAE) to provide veterinary services for the hunting and breeding falcons of the royal families in the region. At the time, there were no similar facilities for falcons in the Middle East, so the hospital also provided emergency services and free assistance for all falcons. The hospital now includes an international team of veterinarians, qualified veterinary nurses and several experienced falcon technicians. This team represents different countries and backgrounds, and is directed by Mr. Humaid Al Muhairi, general manager of the Falcon Hospital.



FIT AND TRIM, AND READY TO FLY

Sarah Gough, the hospital's veterinary nurse and also assistant manager under medical director Dr. Antonio Di Somma, joined the team in 2009. "After working for about nine years with small animals in the UK, I relocated to Dubai, to work at the Falcon Hospital," she recalls. "The differences in dealing with the raptors compared to small animals like cats and dogs are quite striking. Small animal veterinary practices usually deal with a limited number of birds, whereas here that's what we do every day. From a practical point of view, it's quite a change: for example, giving a falcon oral medicine requires two people, to prevent harm to both the humans and the birds! All diagnostic exams are performed under general anesthesia to reduce the stress to the falcons."

Sarah Gough highlights that these birds are not pets: they are athletes, like hunting dogs or race horses, and it is the responsibility of the hospital to ensure that they are always in top condition. Each falcon normally undergoes two complete check-ups per year, at the start and end of the falcon season, which generally runs October to February in Dubai. "We perform a complete workup for each falcon, comprising a physical

examination, blood tests, parasitology, endoscopy of the thoracic air sacs, and two X-rays (lateral and ventrodorsal views)."

In between these check-ups, the birds may come in for routine health checks, with the occasional muscular injuries or fractures caused by trauma, for example. The birds can also suffer from spinal abnormalities. And as athletes, the condition of the birds' feathers is of key importance: the hospital has an 'imping' room where broken or damaged primary and tail feathers are repaired.

Agfa HealthCare's contribution

Building on a long customer relationship with the Dubai Falcon Hospital, Agfa HealthCare and its regional partner STAR-Trivitron implemented the two DR Retrofit solutions and the Enterprise Imaging for Radiology, migrated 5000+ studies from the old PACS, and carry out preventative maintenance for the hospital.



MOBILE CARE, ON THE SPOT

As part of the ‘natural evolution’ of the hospital, says Sarah, it recently renovated and expanded its radiology department, and also started up a mobile care service. At the same time, the hospital decided to upgrade its existing Agfa HealthCare CR systems to DR, with two Retrofit solutions: a mobile, portable Retrofit that can be used on hunting trips, and another Retrofit in the radiology suite.

“For the mobile hospital, we needed the portability of DR. Our mobile Retrofit is comprised of a laptop and the DR, so it is very practical. For our radiology suite, upgrading to DR was also a natural progression, and the Retrofit made it very easy,” explains Sarah Gough.

The DR Retrofit required little change in the workflow of Sarah Gough and dedicated falcon technician Ahmed Kutty, who take the images. “Switching was easy, although it took a while to adjust to the cassette-less workflow and to remember to click directly on the screen to take the images.”



IMAGING SPEED COUNTS IN ANIMAL SAFETY

On the other hand, the advantages were immediately clear: “We can take pictures faster; if necessary, we can reposition the animal and ‘fire off’ another image right away. While this accelerates our tasks, what is most important is that the faster speed means less time under anesthesia for the falcons, which is safer for them. To give an example, for a full check-up (which involves more than X-rays) including CR images, a falcon would be anesthetized for 30 minutes, and if retakes were needed it would be even longer. However, when using the DR, the birds are anesthetized for only about 15 minutes, and the occasional retakes are immediate.”

The veterinarians are equally happy with the quality of the images. “The image quality is really amazing, there is more clarity. We were already used to the MUSICA image processing, which is incredible: you don’t have to do anything, it does everything for you. You get such clear images: it brings out the detail in every image, even in the feather.”

INTEGRATED IMAGES FOLLOW A BIRD'S ENTIRE HISTORY

When upgrading to DR, the hospital also implemented the Enterprise Imaging for Radiology solution to replace its old picture archiving and communication system (PACS). "The solution does a lot for us now, but also offers us many possibilities for the future," comments Sarah Gough. "Firstly, we need it for storing our images: when we switched over, we migrated over 5000 studies, without any problems.

We keep all images of our falcons for their entire lifetime; our oldest falcon is 24 years old and we have its entire history. We often compare X-rays if any changes are apparent."

But the platform also offers new viewing possibilities for the veterinarians. "Before, they always viewed and diagnosed on the workstation, but now they can use the larger diagnostic screen. We can share images easily, putting multiple images on a USB stick for the falcons' owners, or send them by email, for example."

The hospital also has plans to extend its use of the solution: "One project is to include our other DICOM modalities (the endoscopy images, and future ultrasound images) on the Agfa HealthCare system. This will allow us to integrate all of the images, so they can all be stored in a single accessible place."

In her years at the Dubai Falcon Hospital, Sarah Gough has seen a lot of changes, including more and more falcon hospitals opening their doors in neighboring countries. "But we remain the gold-standard; Dubai Falcon Hospital is the original blueprint which other hospitals follow. We are committed to continuing to fulfill the vision of H.H. Sheikh Hamdan bin Rashid al Maktoum to offer the highest level of falcon care. ■

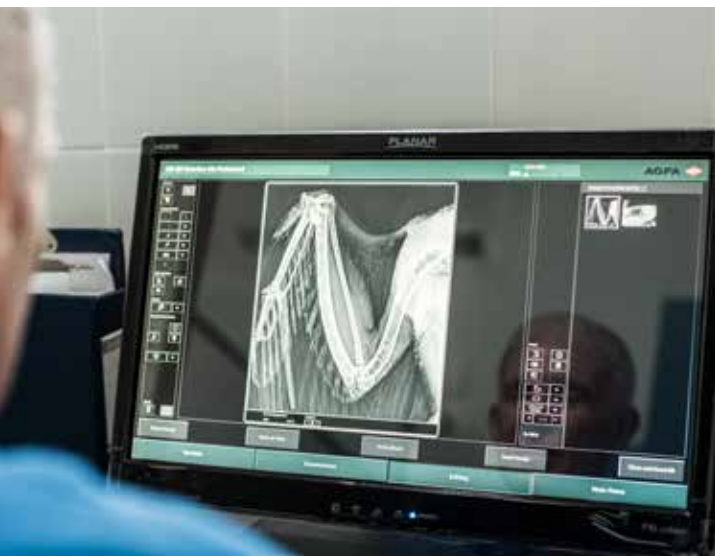


DR Retrofit

- All the workflow and image quality benefits of direct radiography
- Maximizes existing imaging investment
- Easy installation, quickly up and running
- Very fast images, with very high quality
- MUSICA image processing, offering very clear, highly detailed images

"The image quality is much better, there is more clarity. We were already used to the MUSICA image processing, which is incredible: you don't have to do anything, it does everything for you."

– Sarah Gough



Enterprise Imaging for Radiology

- Can store all images – X-ray, endoscopy, ultrasound, ... – in a single repository
- Delivers workflow efficiencies via a highly intuitive user interface
- Reduces complexity through use of a single platform
- Scalable to meet your changing imaging needs

WIRELESS MOBILE VETERINARY MUSICA DR SUITCASE

- Efficient, fast and intuitive workflow
- Laptop NX workstation with positioning guidance
- Wireless image transmission
- Convenient, portable and rugged suitcase
- Superior and consistent image quality with MUSICA DR image processing
- An easy way to go direct digital
- Automatic Exposure Detection



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