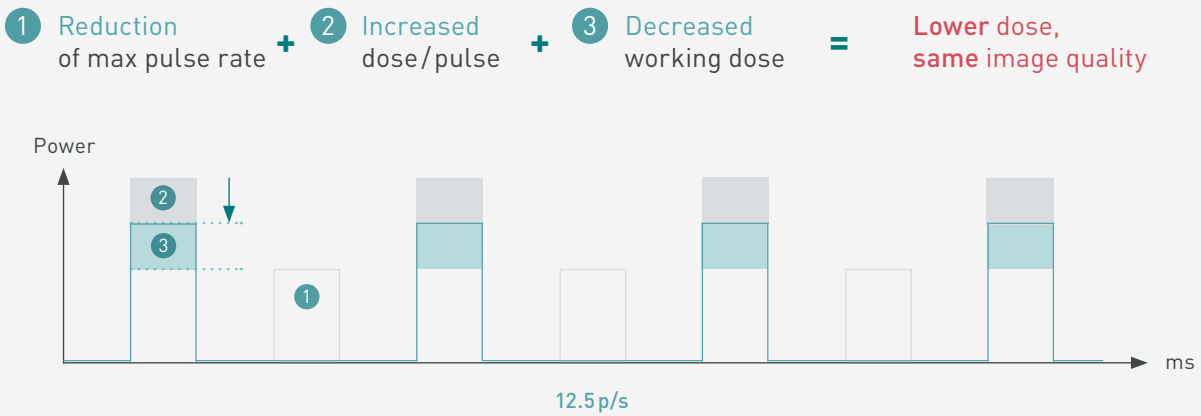
ziehm imaging

Dose management

SmartDose[1] concept for optimized radiation exposure

Effective dose management in mobile C-arms is essential for balancing patient safety with premium image quality, especially in today's surgical environments.

Ziehm Imaging stands out with its SmartDose concept, a comprehensive suite of intelligent features designed to automatically optimize dose levels without sacrificing image quality or workflow efficiency. By integrating advanced hardware and software solutions, SmartDose is adapting to clinical needs in real time. This holistic approach combines elements like optimized pre-filtration of the X-ray beam, adaptive pulsed fluoroscopy, and real-time object detection to deliver premium performance across a wide range of procedures, while adhering to ALARA (As Low As Reasonably Achievable) principles.



SmartDose
Best image quality. Minimized dose.

Figure 1: SmartDose principle: Automatically reduces total dose by lowering maximum pulse rate and optimizing dose per pulse, maintaining image quality.

Key components of SmartDose

SmartDose encompasses multiple features that work in tandem to reduce dose. Combined, these features provide a seamless workflow experience that prioritizes image quality, patient safety and dose efficiency.

LASER POSITIONING DEVICE

Allows for precise patient alignment without unnecessary exposure.

VIRTUAL COLLIMATORS

For exposure-free positioning of slot and iris collimators.

OBJECT DETECTED DOSE CONTROL (ODDC)

Detects patient anatomy in real time and dynamically adjusts exposure parameters and noise reduction filters, while also featuring an automatic pulse rate reduction during static imaging for optimal dose and image quality.

BEAM FILTRATION[2]

BeamFiltration is an advanced anti-scatter grid paired with an optimized beam hardening which selectively removes low-energy X-ray photons, thereby significantly reducing patient dose and improving image quality.

HIGH-SPEED AUTOMATIC DOSE REGULATION (ADR)

High speed X-ray exposure control for optimal exposure parameters, including tube voltage and tube current, ensuring excellent image quality at minimized dose levels.

REMOVABLE ANTI-SCATTER GRID

Enhances image contrast by suppressing scattered radiation. For pediatric or low-dose applications, the grid can be removed to reduce entrance skin dose.

ZAIP (ZIEHM ADAPTIVE IMAGE PROCESSING)

Advanced image processing algorithms and noise reduction filters that enhance contrast between soft tissue, bone, and metal to visualize even finest structures like guidewires.

PREMAG

Digital pre-magnification of the live monitor image when switching to a different magnification mode, allowing the user to preview the field of view of the next image taken without additional exposure.

Additional considerations

In addition to advanced X-ray beam filtration, SmartDose leverages pulsed fluoroscopy to further minimize dose levels. Unlike continuous fluoroscopy, which delivers a constant beam, pulsed operation emits short, high-frequency bursts of X-rays. Ziehm Imaging's monoblock generators produce well-defined pulses with minimal overlap and heat generation, enabling a significant dose reduction compared to continuous modes (Figure 1).

To optimize both image quality and dose efficiency, the system dynamically adjusts pulse rates: higher frequencies (e.g. 25 pps) are used during motion to avoid blur, while lower rates (e.g. 8 pps) are applied when anatomy is at rest. High-speed ADR ensures seamless transitions, while adaptive noise reduction filters are applied in real time to maintain image clarity at reduced dose levels.

Conclusion

Ziehm Imaging's SmartDose represents a paradigm shift in dose management for mobile C-arms. This technology not only upholds ALARA principles but also enhances clinical reliability and image quality. SmartDose empowers healthcare professionals to achieve superior outcomes with minimal health risk to patients, setting a new standard in interventional imaging.

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2. European Society of Radiology (ESR): White paper on radiation protection by the European Society of Radiology. In: Insights Imaging; 2011
3. Ron Villane, Kimberly Haas, Anne-Kathrin Meier, Günther Stelzer: Dose Management at Ziehm Imaging; 2016

[1] The SmartDose concept includes a variety of hard- and software features. Due to regulatory reasons the availability of each feature may vary. Please contact your local Ziehm Imaging sales representative for detailed information.

[2] The technology Beam Filtration reduces dose exposure for Ziehm Imaging flat-detector systems in comparison with conventional filtration techniques. Data on File. Results may vary.