PHILIPS

Dose Management

Digital radiography and fluoroscopy solutions

Proven lower dose rate[1, 2]

with CombiDiagnost R90 and ProxiDiagnost N90

For **pediatric examinations**, Philips **Grid-Controlled Fluoroscopy (GCF) enables a dose rate[1] reduction up to 68%[2]** compared to Pulse-Controlled Fluoroscopy (PCF), depending on patient type and clinical application.

1) Dose rate determined according to IEC 60601-2-54, 203.5.2.4.5.102, System set up: detector format 43 x 43 cm (17 x 17"), patient type children, 0.1 mm Cu + 1 mm Al filter, reduced dose and pulsed slow fluoroscopy mode with 2 pulses/s, Phantom: 5 cm (2 in) PMMA
2) Relative difference of two reference air kerma rates between system with GCF and system with PCF

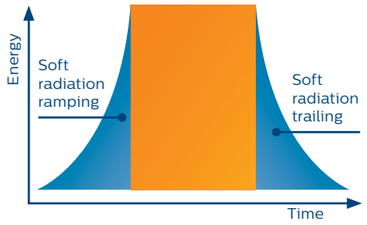
How does Philips GCF reduce the dose rate?

Keeping the dose low in pediatric fluoroscopy examinations
Children are more sensitive to radiation than adults, so it is even more critical that pediatric fluoroscopy follows the ALARA principle (As Low As Reasonably Achievable) to keep the X-ray dose low.

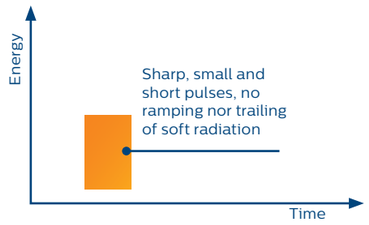
Pulsed fluoroscopy is an established technology, delivering good image quality at a lower dose than continuous fluoroscopy. In pulsed fluoroscopy, the X-rays are created in pulses instead of being continuous, and each pulse results in one image frame of a sequence. Different technologies are available to create these pulses and they differ in terms of cost and performance.

Pulse-Controlled Fluoroscopy (PCF)
With traditional PCF, the high-voltage generator creates the X-ray pulses. However, long power cables from generator to X-ray tube behave like big capacitors, strongly affecting the form of the electric signal they transport. Therefore pulses are not precisely rectangular, but rounded, having rising edges (ramping) and falling tails (trailing). This results in unusable extra dose for the patient (low-energy X-rays, often called soft radiation). This radiation should be avoided because it contributes to patient dose but does not have enough energy to reach the detector, and therefore it does not contribute to the imaging process.

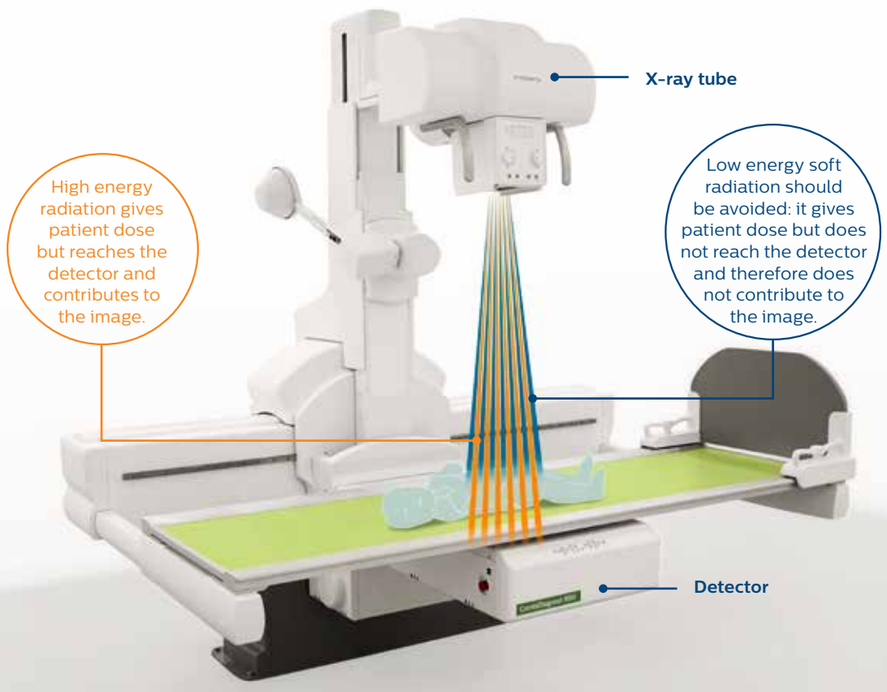
Philips Grid-Controlled Fluoroscopy (GCF)
Philips GCF creates the pulses right inside the X-ray tube. This technology is able to produce sharp pulses without the rising edges and falling tails seen in PCF. It removes the unwanted soft radiation. In addition, GCF is more precise and powerful and is able to create smaller, shorter pulses with lower current but higher voltage. These optimized voltage control curves are tailored specifically to the needs of pediatric fluoroscopy, and the resulting dose rate is substantially lower.



PCF: Un-sharp, high and long pulses, with ramping and trailing, creating extra dose for the patient through soft radiation



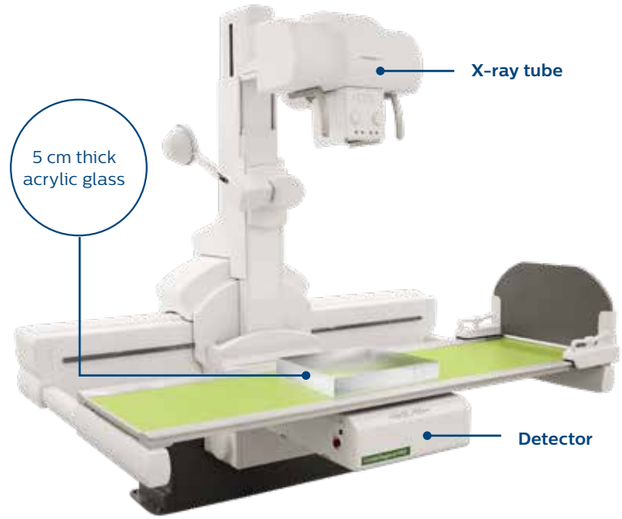
GCF: Sharper, smaller and shorter pulses without ramping or trailing of soft radiation, delivers only dose that contributes to the image



How much does Philips GCF reduce the dose rate?

Measurement setup
Measurements of the dose rate values were carried out in an experimental setup following the definitions of IEC 60601-2-54 (section 203.5.2.4.5.102), with one modification. To mimic the tissue thickness of a pediatric patient, acrylic glass (also called PMMA) with a thickness of 5 cm (2") was used instead of the typical 20 cm (7.9") representing an adult.

The dose rates were determined for a GCF and a PCF system, with otherwise identical technical conditions:
- Patient type: Children
- Pre-filtration: 0.1 mm Copper, 1 mm Aluminum
- Fluoroscopy flavor: reduced dose
- Pulse rate: Slow (2 frames per second)
- Detector format: 43x43 cm (17x17")



Results: Dose rates of GCF versus PCF

Philips system	**CombiDiagnost R90** (remote controlled)	**ProxiDiagnost N90** (nearby controlled)
Source Image Distance (SID)	120 cm (47.3")	103 cm (40.6")
Position of reference point - Above tabletop - From tube focal spot	 30 cm (11.8") 70 cm (27.6")	 1 cm (0.4") 62 cm (24.4")
Air Kerma rate with PCF	0.22 mGy/min	0.24 mGy/min
Air Kerma rate with GCF	0.07 mGy/min	0.07 mGy/min
Air Kerma rate reduction with GCF vs PCF	1 – (0.07 / 0.22) = **68.2%**	1 – (0.07 / 0.24) = **70.8%**

In this setup, simulating a pediatric examination, the dose rate measured with GCF is **68.2% lower** than the rate measured with PCF for the CombiDiagnost R90, and **70.8% lower** than the rate measured with PCF for the ProxiDiagnost N90.

This significant dose rate reduction with GCF is achieved by suppressing the soft radiation of PCF pulses and by creating shorter and smaller pulses.

References

- IEC 60601-2-54 document
- Instructions For Use:
  - CombiDiagnost R90 (4512 987 40385 AA/709 APR 2019)
  - ProxiDiagnost N90 (4512 987 43213 AA/706 MAR 2019)

Related Philips DRF solutions featuring GCF and comprehensive dose management:

CombiDiagnost R90
2-in-1 Digital Radiography and Remote Fluoroscopy

ProxiDiagnost N90
DRF Digital Radiography and Nearby Fluoroscopy

4522 991 51071 * SEP 2019

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