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# Grid-less imaging with SkyFlow: **Time savings and workflow improvements**

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A study involving experienced radiographers found that bedside chest imaging, using SkyFlow technology in a gridless workflow, resulted in up to 50 seconds- with an average of 34 seconds- time savings per examination compared to workflow with a grid. SkyFlow provides grid-like image contrast enhancement for non-grid images. The technology is fully automatic, patient adaptive, and works without special attention.

## Introduction

Bedside chest radiography is frequently performed in the ICU, since many patients' health makes it difficult for them to withstand upright chest radiography. While these exams provide important diagnostic data, image quality is frequently compromised due to scattered radiation.

To improve on that, an anti-scatter grid can be attached to the detector. Placed between the patient's body and the detector, the grid absorbs most scattered radiation while allowing x-rays that contribute to the diagnostic image to pass through. Although a grid can enhance image quality, it also complicates workflow. A clip-on grid adds bulk and weight to the detector, and can be difficult for technologists to maneuver and uncomfortable for patients. In addition, aligning the grid to the x-ray beam is a time-consuming and error-prone procedure. If the grid is misaligned, it can result in grid cut-off artifacts and the absorption of primary radiation, which negatively impacts image quality. Therefore, the practical difficulties with grids frequently outweigh the benefits.

SkyFlow intelligent technology, introduced in 2013, automatically corrects for the contrast loss due to scattered radiation for bedside or trolley chest exams, creating grid-like contrast enhancement without the use of a grid.<sup>1</sup>

At St. Lucas Andreas Hospital (Amsterdam, the Netherlands), technologists also noted that eliminating grid use provides more time to focus on the patient, and offers numerous workflow advantages that translate into substantial time savings.<sup>2</sup> To assess and quantify the time saved with SkyFlow gridless workflow, rather than imaging with a grid, Philips researchers conducted a summative usability test.

## Test methodology

The test was conducted in a simulated environment at Philips Diagnostic X-ray facilities in Hamburg, Germany, to ensure precise measurements that would not be attainable at hospitals, given the many variables in patient population and practices. To simulate an ICU environment, a test dummy was placed in a hospital bed with a bed sheet, blanket and pillow.

Twelve radiographers with a minimum of five years of experience took part in the testing. All the radiographers were experienced with bedside chest X-ray exams in intensive care units and the Philips MobileDiagnost wDR portable system.

The test simulated the workflow of a typical ICU bedside chest exam. The radiographers were presented with a scenario of a patient in the ICU after a heart attack. The patient is off ventilation, and requires a bedside AP chest exam. Each tester performed two workflow iterations: with and without a grid. The testers performed each test twice. The first set of tests was executed without measurement, to avoid learning bias. The second, measured set of tests was counterbalanced by randomizing the test order. The test with the grid included bringing the mobile X-ray system into the room, attaching and aligning the grid, performing the exam, detaching the grid, cleaning the grid, cleaning the detector, putting the detector back into the detector home, and moving the mobile X-ray system back to the start location.

The test without the grid and using SkyFlow included bringing the mobile X-ray system into the room, performing the exam, cleaning the detector, putting the detector back into the detector home, and moving the mobile X-ray system back to the start location.

Observers ensured all required actions were completed and measured task completion time. The test area was clearly marked with indicators showing where the X-ray system was to be positioned at the beginning and end of the exam, so observers had a clear indication of when to start and stop the time measurement.

All exams were performed on a MobileDiagnost wDR 2 system with SkyFlow license and a large 35 cm x 43 cm (14" x 17") SkyPlate detector. For the exams that included a grid, a clip-on grid was used.

## Results

On average, compared to workflow with a grid, the gridless workflow with SkyFlow was faster by 33.58 seconds per examination, with a 95% confidence interval [25.60 sec., 41.45 sec.]. The result was significant (paired two-sample t-test,  $p < 0.001$ ).

## Conclusion

The usability test showed that compared to the workflow with a grid, the gridless workflow with SkyFlow is typically faster by nearly 34 seconds. Time-savings resulted because in a gridless workflow with SkyFlow, technologists did not have to attach or detach a clip-on grid to the detector or clean the grid. In addition, while the patient has to be positioned properly regardless of if a grid is used, using a grid requires careful, time-consuming alignment of the grid to the x-ray beam to avoid grid cutoff artifacts. Given the many bedside chest x-rays performed in a typical ICU, eliminating grid use and using SkyFlow can positively impact workflow while providing images with grid-like contrast.



Usability Study Time Savings





Bedside chest image acquired with a grid



Bedside chest image acquired with SkyFlow

### Technologists report that SkyFlow aids positioning, cleaning, and patient comfort

In addition to the quantitative time savings, the technologists who completed the study commented on other advantages of gridless chest x-rays with SkyFlow. These include:

- Lighter weight makes bedside positioning easier
- Easy to handle
- Less complex cleaning requirement
- Peace of mind:
  - No concerns about positioning and aligning the x-ray source relative to the detector to avoid grid cut off
  - No concerns about incorrectly placing the detector in the clip-on grid
  - No concerns about a decrease in image quality due to poor grid cleaning
- Patient comfort because the device is thinner without a grid, and there is no grid handle pushing against the patient's back

### How SkyFlow works

For use in both bedside and trolley chest exams, SkyFlow technology identifies scatter signal and automatically subtracts it from the image, resulting in grid-like image contrast.

To deliver the correct contrast automatically for each individual patient type -- from pediatric to bariatric -- SkyFlow first estimates the scatter based on pre-calculated scatter patterns that originate from physical simulations and are available in a database. Using a database results in a short computation time.

Next, SkyFlow calculates from this image the scatter signal that a grid would remove at optimal alignment. That signal is subtracted from the original detector image, resulting in a scatter-corrected image with grid-like image contrast.

1. Mentrup D, Neitzel U, Jockel S, Maack HI, Menser B. Grid-like contrast enhancement for bedside chest radiographs acquired without anti-scatter grid. Philips Healthcare.
2. Save time and enjoy great image quality: A customer story from St. Lucas Andreas Hospital, Amsterdam, Philips Healthcare, 2014

