PARTNER

Queen's Hospital, part of Barking, Havering & Redbridge University Hospitals NHS Trust (BHRUT)

CHALLENGE

Independent QA for Online Adaptive Radiotherapy—Without Slowing Care

SOLUTION

Safe, Real-Time oART with AdaptCHECK™



Online adaptive radiotherapy (oART) is transforming how cancer patients are treated, allowing plans to be re-optimized in real time based on that patient's anatomy that day. This clinical benefit also creates a challenge: **independent QA must be completed accurately and reliably within minutes, while the patient is on the treatment couch.**

Queen's Hospital is a high throughput acute care center delivering approximately 1,400 new treatments each year to patients across Northeast London. As adaptive treatments became more routine, the physics team needed a QA approach that was not only accurate, but fast enough to fit into their workflows without causing patient discomfort.

THE CHALLENGE

With the expansion of AI-enabled oART on Ethos (Varian Medical Systems Inc. – a Siemens Healthineers company), the team faced a critical question: how to perform fast, independent plan verification without compromising patient safety or workflow efficiency.

In online adaptive radiotherapy, efficiency is not simply a matter of convenience. QA calculations must be completed within minutes, without compromising the efficacy of the adapted plan. Any delay during this process can reduce the ability for QA to be completed before treatment begins, which could reduce patient safety — while also increasing patient discomfort, pressure on staff and, on a larger scale, a barrier to widescale adoption of cutting edge oART.

"In online adaptive radiotherapy, efficiency and accuracy are critical because QA must be completed while the patient is on the couch. Any delay directly impacts the patient experience," notes Ghirmay Kidane, Deputy Head of Radiotherapy Physics, Queen's Hospital.

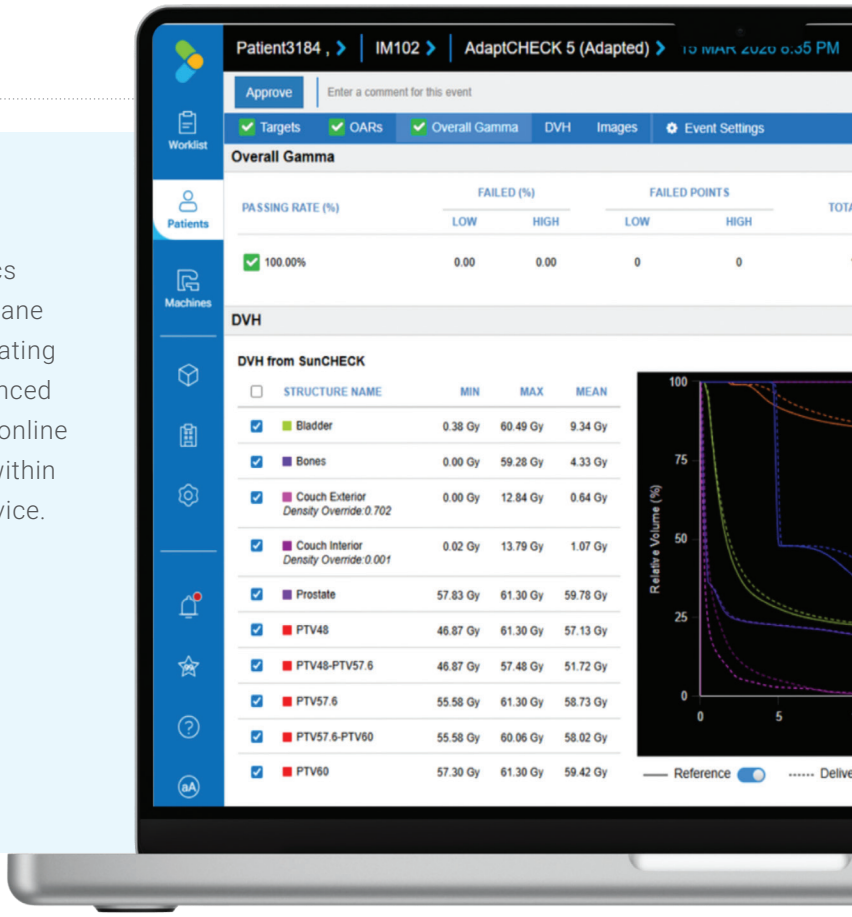
THE SOLUTION

To address this challenge, Queen's Hospital evaluated AdaptCHECK, a solution purpose built for independent QA in online adaptive radiotherapy. Designed to deliver accurate dose verification within the tight time constraints of real-time adaptation, AdaptCHECK enables physics teams to complete QA with the patient on the couch.



With oversight of physics operations, Ghirmay Kidane plays a key role in evaluating and implementing advanced technologies, including online adaptive radiotherapy, within a large NHS clinical service.

Ghirmay Kidane
Deputy Head of Radiotherapy Physics,
Queen's Hospital, Barking, Havering &
Redbridge University Hospitals NHS Trust



EVALUATING INDEPENDENT QA FOR oART

The Queen's Hospital physics team identified independent, calculation-based QA as a critical component of their adaptive workflow and began assessing solutions that could meet both clinical and operational demands.

Prior to evaluating AdaptCHECK, the department relied on several established QA tools. DoseCHECK™ was used for routine verification of Eclipse-based plans delivered on Edge and Halcyon (Varian Medical Systems Inc. – a Siemens Healthineers company), while Mobius3D and Mobius Adapt supported QA for Ethos reference and online adaptive plans.

oART WORKFLOWS AT SCALE

However, as adaptive treatments became more routine, the team recognized the need for a solution specifically designed for online adaptive radiotherapy—one that could:

- Deliver fast results
- Integrate seamlessly with Ethos
- Align with existing QA practices across the department.

AdaptCHECK was introduced to address these exact requirements. Built for online adaptive radiotherapy, AdaptCHECK provides independent plan verification for both scheduled and fully re-optimized adaptive plans, without the need for measurement-based QA during treatment.

TESTING AdaptCHECK

Queen's Hospital participated as an early beta test site for AdaptCHECK, allowing the physics team to evaluate the system in realistic clinical conditions and provide direct feedback during its development.

The evaluation focused on retrospective analysis of ten clinical patients representing disease sites commonly treated with adaptive radiotherapy at Queen's Hospital, including prostate, bladder, and esophageal cancers. Treatments were delivered using seven and nine field IMRT plans, reflecting the department's preference for time-effective adaptive delivery.

Each case was assessed at multiple points across the treatment course, including

- reference plan,
- early fractions,
- midcourse fractions, and
- final fractions.

All plans were independently verified using AdaptCHECK and directly compared against the department's existing clinical system.

THE RESULTS

From a dosimetric perspective, the results demonstrated strong agreement. **Gamma passing rates using 2% / 2 mm criteria consistently exceeded 98%, placing AdaptCHECK well within accepted clinical tolerance and comparable to the established adaptive QA solution.** Mean PTV dose differences were approximately 1%, with AdaptCHECK showing particularly tight clustering across treatment fractions.

This consistency gave the physics team confidence that AdaptCHECK provides accurate and reliable independent verification throughout the adaptive treatment course.

In addition to accuracy, calculation speed emerged as a meaningful advantage. By allowing users to bypass unnecessary scheduled plan checks when clinically appropriate, **AdaptCHECK reduced total calculation time by up to 19 seconds for certain IMRT configurations.** While this may appear modest in isolation, within the context of online adaptive radiotherapy, where every second is spent with the patient immobilized on the couch, these time savings contribute to a smoother experience for both patients and staff.

KEY EVALUATION RESULTS

- **>98% gamma passing rates** using 2% / 2 mm criteria
- **~1% mean PTV dose difference**
- **Up to 19 seconds faster** calculation time for certain IMRT configurations

"AdaptCHECK demonstrated accurate dose verification with around a 1% dose difference, high gamma pass rates, faster calculation times, and seamless workflow integration—making it clinically ready and well within tolerance for real-time routine use."

Ghirmay Kidane,
Deputy Head of Radiotherapy Physics,
Queen's Hospital

Equally important is AdaptCHECK's unique ability to connect into the whole department SunCHECK® Platform, rather than another separate system in isolation. This enables centralization of all patient QA data and increases flexibility by enabling access to results from one system and from anywhere in the organization.

Based on the evaluation results and hands-on clinical experience, Queen's Hospital concluded that AdaptCHECK meets the essential requirements for independent QA in online adaptive radiotherapy. The system demonstrated accurate dose verification, fast and predictable calculation times, and seamless workflow integration, all within the constraints of real-world clinical practice. As a result, AdaptCHECK was deemed clinically ready for routine, real-time use in online adaptive radiotherapy at a high-volume NHS center.



Ethos, Edge, Eclipse, Halcyon and Mobius3D/Mobius Adapt are products of Varian Medical Systems, Inc., a Siemens Healthineers Company. Sun Nuclear Corporation is not affiliated with or sponsored by Varian Medical Systems, Inc.