# A User's View

July 2019

**Beam data commissioning with the Beamscan water phantom: A user experience**

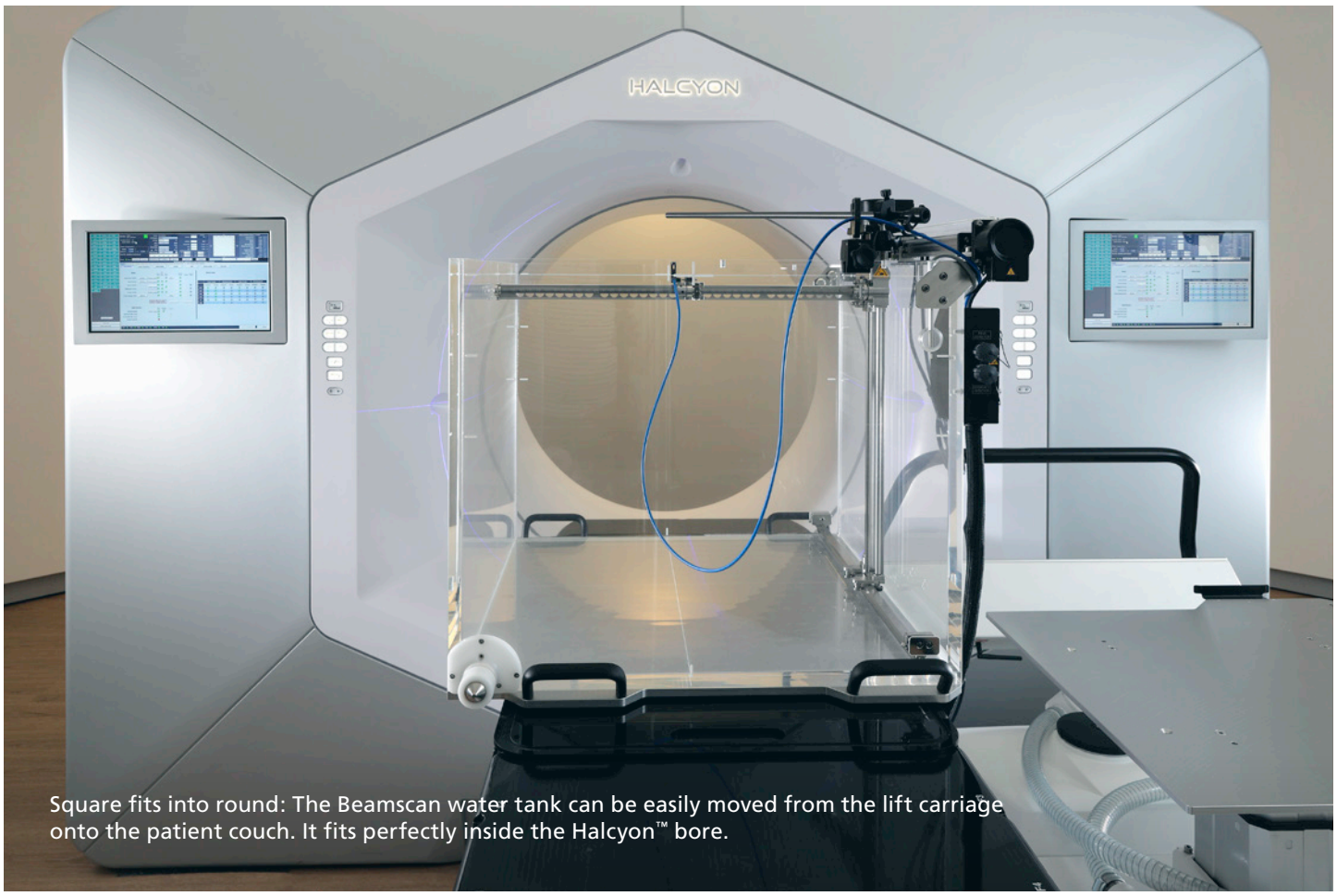
by Marcello Sabatino,
Medical Physicist at the
Radiologische Allianz Hamburg

# The Halcyon™ System: A Challenge for Commissioning and QA Equipment

The Halcyon™ is a new linear accelerator for image-guided volumetric intensity modulated radiation therapy, which differs from other accelerators due to its special design with a ring-mounted gantry. It was first put into operation in Germany at the Radiologische Allianz Hamburg, a group of radiation therapy centers, in 2018 and has been in use there ever since. Similar to computed tomography, the accelerator head rotates around the patient behind a ring-shaped cover. This new design for delivering radiation therapy presents medical physicists with special challenges for beam commissioning and QA measurements, because the measuring equipment must be placed inside the ring gantry.

Compared to linear accelerators of conventional design, it is not possible to retract the treatment table and move a water phantom directly into the radiation field with the Halcyon™ system. Instead, the water tank has to be transferred from the lift/tank carriage onto the treatment table and then moved into the ring gantry, presenting a challenge to manufacturers of water scanning systems.

With the PTW water phantom Beamscan, the Halcyon™ accelerator could be commissioned smoothly and in a very short time despite these setup challenges. By introducing modifications to their Beamscan system, PTW now offer a solution for Halcyon™ that makes water scanning both very simple and intuitive.




Square fits into round: The Beamscan water tank can be easily moved from the lift carriage onto the patient couch. It fits perfectly inside the Halcyon™ bore.

# Why we chose Beamscan: User report of the Radiologische Allianz Hamburg

Our experience: Beamscan is set up and ready to scan in approx. 20 minutes.

The decision to purchase a Halcyon™ treatment system raised the question of which water phantom is best suited for measurements on this new accelerator type, both in terms of technology as well as handling (hardware and software). It was also important to us that the commissioning and QA tasks with the phantom proceed quickly: By keeping linac downtime to a minimum you maximize clinical use and availability for patient treatments.

We had only set aside one week to commission the Halcyon™ accelerator, which is very short considering that we had little experience with this system. However, we were actually able to perform all measurements within these few days – a relatively short period of time compared to the commissioning requirements of other linear accelerator types. A significant factor in reducing commissioning time is that golden beam data is provided by the accelerator manufacturer, and only requires verification. The personal support of employees of PTW-Freiburg directly on site was also extremely helpful. They arrived specifically for the commissioning of our Halcyon™ system to test the modifications made to the Beamscan on a clinical site.

The installation and setup of the water tank within the gantry proceeded quickly and smoothly. With some practice, it takes approx. 10 minutes until the water tank is aligned on the patient couch and moved into the gantry. A further 10 minutes are required to position the field and reference detectors. The water phantom is completely set up and ready for measurements within approx. 20 minutes.

**“Everything that runs automatically, that you no longer need to do yourself, makes everyday clinical work easier for us.”**

The Trulevel function of the Beamscan, which automatically levels the correctly aligned water tank, contributes to the quick setup. Using a three-point measurement and mathematical coordinate transformation, the three movement axes of the tank are aligned exactly perpendicular and parallel to the water surface without manual intervention. As a result, leveling is completed in two minutes. Compared to manual leveling, this is not only significantly faster, but also reduces error sources and ensures accurate and reproducible results.

We were also impressed by the quality of the measured data and the scanning speed. With the Beamscan water phantom, we can measure in continuous mode as well as step-by-step, adding to the time-saving features.

We also particularly like the practical modifications made to Beamscan by PTW specifically for the new Halcyon™ accelerator design.

# Why Beamscan convinced us in clinical routine

When first receiving the Beamscan we were pleased to note the water phantom can be set up and operated wirelessly – both for control and data transfer. In the case of an accelerator that is difficult to access due to its ring structure, and where cables might interfere with the machine movement, a wire-free system is an advantage.

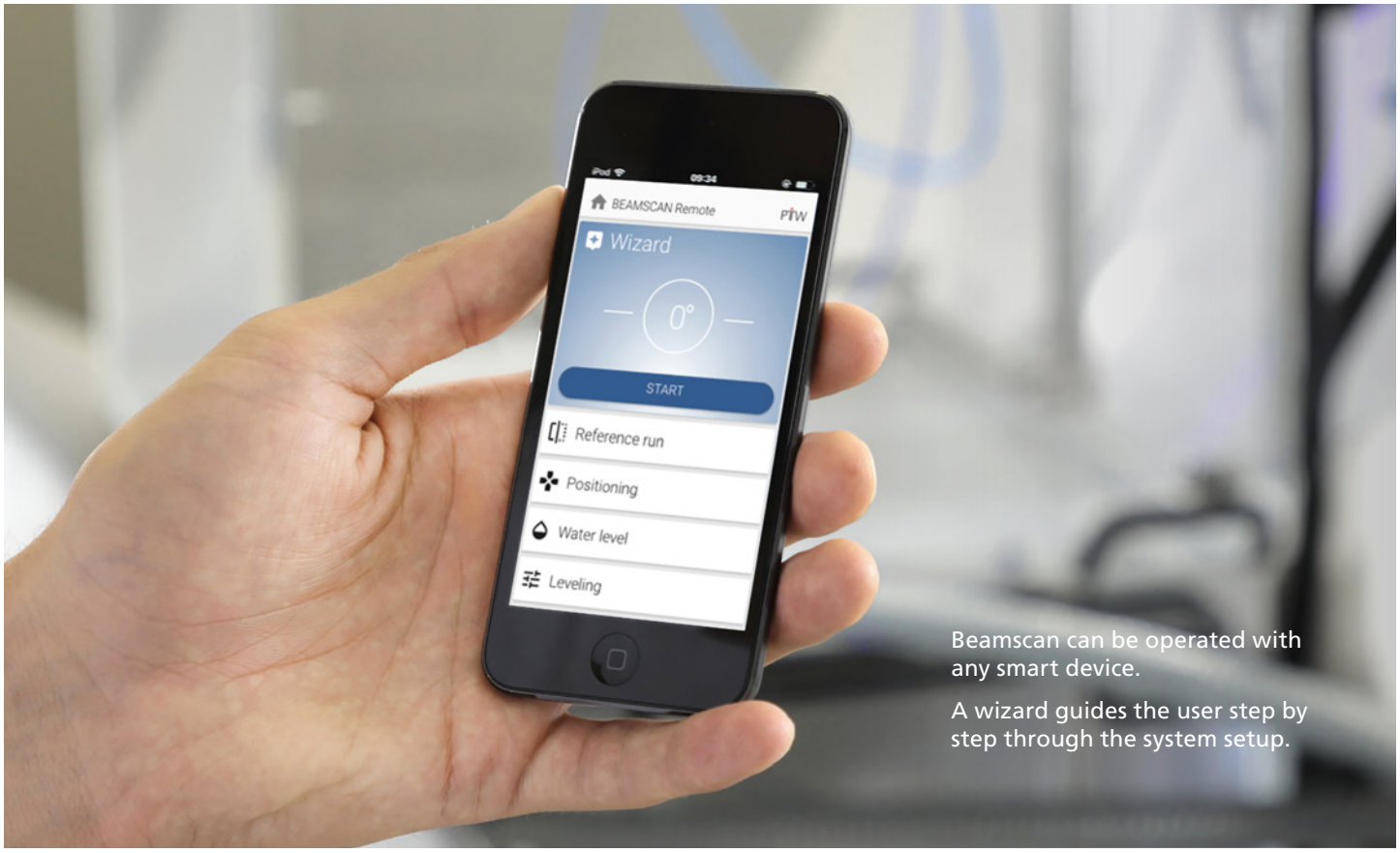
## Fact Sheet

- Commissioning time: < 1 week; Beamscan setup in Halcyon™: approximately 20 minutes
- Time savings and reduction of error sources thanks to automated system
- Ease of use thanks to user-friendly design and an intuitive, self-explanatory setup wizard

**Personal**

Marcello Sabatino, Medical Physicist, Radiologische Allianz Hamburg

- Since 2010 Medical physicist at the Radiologische Allianz Hamburg
- 2011: Acquisition of medical physics expert qualification and appointment as radiation protection officer for the areas of radiation therapy and X-ray diagnostics
- 2016: Master of Science degree in postgraduate distance study “Medical Physics” at Kaiserslautern University of Applied Science




Beamscan can be operated with any smart device.

A wizard guides the user step by step through the system setup.

The water phantom is operated via a supplied iPod, which is connected via WiFi. Since the control takes place via a web server installed in the Beamscan, the water phantom can also be operated with any other smart device, such as tablets or your own smartphone, via the web browser. This wireless operation is very convenient, because you do not have to stand directly next the water phantom.

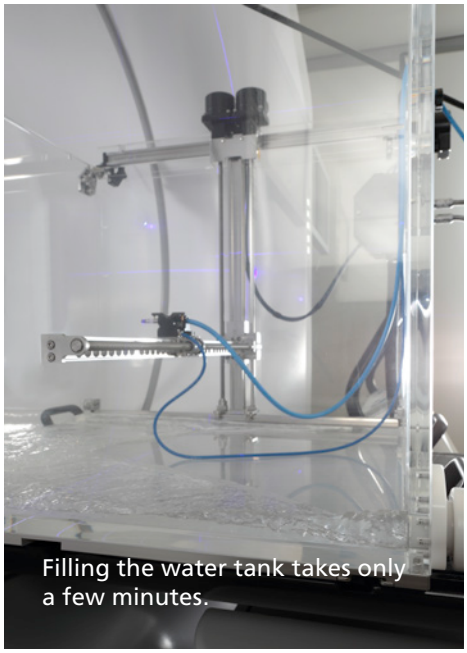
The Beamscan lift/tank carriage can be maneuvered effortlessly and has brakes that can be reached and locked with your foot regardless of the position of the wheels. Despite its weight, the water tank can easily be moved onto the patient couch by one person alone. For this purpose, the lift/tank carriage is first driven backwards as close as possible to the patient couch, the water tank is lifted a few millimeters above the couch surface using the lifting ram on the carriage and then unlocked. Since the carrier plate of the tank has been coated with a sliding film, especially for this application, it can be pushed onto the patient couch with little effort and then rotated by 180°.

When the water hose is plugged in, the tank is aligned with the crosshairs, and the required source-to-surface distance (SSD) is adjusted using the lateral lasers. The exact positioning of the reference detector in the accelerator takes some getting used to due to the ring gantry of the Halcyon™ system, but with a little practice this becomes easier. Thanks to the Trufix holder system (auto-EPOM detector positioning), the field detector can be mounted quickly and easily on the water tank: It does not have to be screwed on, but snaps into the holder by a clicking action.


The tank is aligned using the crosshairs, and the SSD is adjusted using the lateral lasers.


The Auto Setup Wizard has an excellent visual design and can be used intuitively. It guides you step by step through the setup, so that you can keep track of the process at all times. You can also easily review or repeat steps that have already been completed. Another plus: The Beamscan Wizard is simple and intuitive, limiting steps to essential functions, which we found to be very positive. The water tank can be filled in a few minutes. The water hose itself is sufficiently long and has valve couplings on both ends so that it can be removed during measurement. To ensure that the water drains completely after the measurement, the bottom of the tank is inclined. The water tank and hose can be separated and reconnected with just two hand grips.

Since the commissioning of the Halcyon™ system in 2018, we have been constantly using the Beamscan in the Radiologische Allianz Hamburg for ongoing quality control work.


Filling the water tank takes only a few minutes.

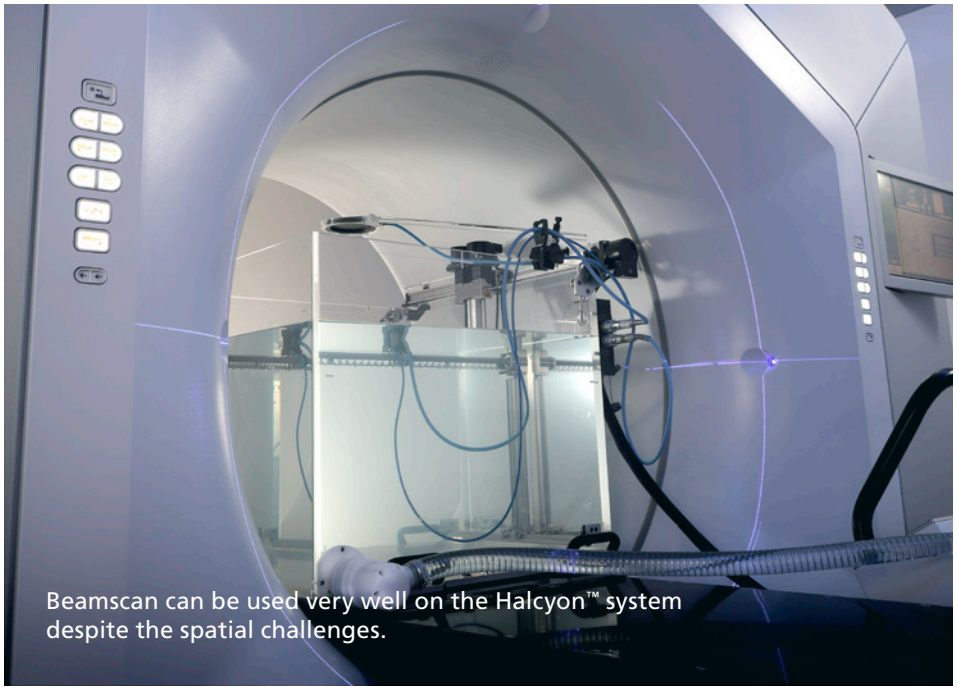

Tip: When attaching the water hose, pull the unlocking sleeve backwards at the same time.

# Tips & Tricks

Initially, we assembled and disassembled the Beamscan in the Halcyon™ linear accelerator with two people. But then we realized that this can also be done easily by one person alone with a bit of practice.

The coupling of the water hose can be placed more easily on the counterpart on the tank by simultaneously pulling the unlocking sleeve backwards. Since the water tank slides very easily, we recommend to plug in the hose coupling before aligning the lasers.

When attaching the detector, it is also important to ensure that the cable has no twist and that the cable length in the water tank is sufficient. The reference detector should be positioned so that no shading of the penumbra can occur. If this is the case, it needs to be realigned.



Beamscan can be used very well on the Halcyon™ system despite the spatial challenges.

**“When I work with another water phantom, I notice that I have already become a bit spoiled by the Beamscan.”**

# Brief and to the point

The Beamscan water phantom has proven its worth in our radiation therapy center thanks to its simple handling and automated procedures. We were particularly impressed by the features that save time and effort in everyday clinical work, especially the rapid assembly and disassembly, wireless operation, automatic tank leveling and continuous scanning.

Despite the spatial challenges, the Beamscan – with its carefully engineered modifications – can be used with ease and efficiency on the Halcyon™ system.

Once you get used to the high comfort of Beamscan, it is difficult to work with other water phantoms again.

### Other Beamscan features

- Automatic correction of the water level in the water tank (e.g., in case of evaporation)
- PlamoEclipse: Fast and automated comparison of the measurement data against the Golden Beam Data provided by the manufacturer
- Thanks to its simple handling, quick assembly and disassembly as well as the built-in precision electrometer, the water phantom can also be used optionally for absolute dosimetry
- ‘Automatic’ TPR measurements using the built-in water sensor
- Wide range of useful measurement and analysis functions, including automated task lists, calculation of field-size-dependent output factors, and calculation of TPR/TMR from depth dose curves

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