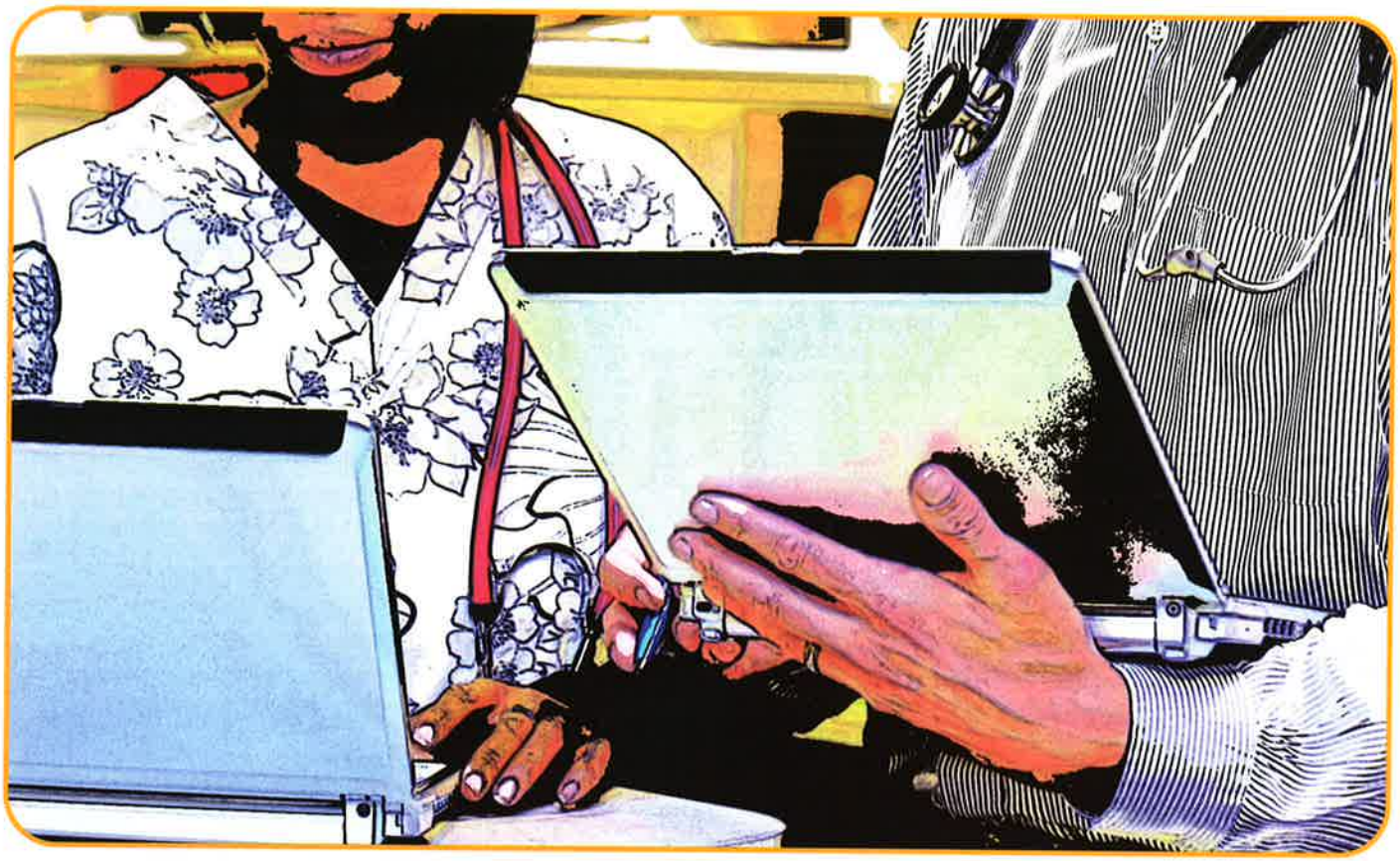


No Paper. No Film. No Problem.

Integrated Varian technologies improve operational efficiency of both clinics and professional practices

By John W. Swanson, PhD, DABR, DABMP

Linked by the ARIA® oncology information management system, integrated Varian technologies are improving operational efficiency for clinics like the Mark H. Zangmeister Center and professional practices like Global Physics Solutions (GPS), a U.S. medical and health physics practice group.

In recent years, GPS helped the Zangmeister Center, a new 110,000-square-foot comprehensive cancer center in Columbus, Ohio, become operational in record time. In this article, John W. Swanson, PhD, DABR, DABMP, senior vice president of GPS, discusses how his organization assists clinicians at the Zangmeister Center with the optimization of their radiation oncology and imaging department programs. The Zangmeister Center has streamlined and augmented clinical and technical operations and performance through the implementation of a filmless and paperless environment.

From a patient's perspective, the value of receiving care in a paperless, filmless environment is clear. It means that all of the information about the patient exists in one place, and care providers have the information they need, precisely when they need it. There's no waiting for days or for another department to send records that might go astray. When a patient shows up for daily treatments, the details about the prior day's treatment —including images generated at the treatment machine—are right there for the doctor to review. No one has to search for files. More importantly, in a comprehensive cancer center with medical and radiation oncologists accessing the same electronic medical record, patient care is better coordinated and managed from start to finish.

What might be less apparent, but equally important, is that from a clinical administrator's perspective, operating in a wholly electronic environment provides ways of increasing efficiency in departmental operations.

Louis Rivello, MD, Matthew Daniels, PhD, and Steve Gasiecki, MS, prepare for an SRS procedure at the Zangmeister Center.

Managing workload with remote dosimetry and physics

A professional practice group, GPS provides treatment centers with supplemental physics and dosimetry services, both onsite and from remote locations. When a clinical practice grows, its need for physicists and dosimetrists may increase in relatively small increments. GPS helps clinics manage growing workloads by remotely supporting the clinic's physicists and dosimetrists, at least until the volume of work justifies the addition of another full-time person. For clinics that are operating electronically, GPS can use remote access to redeploy excess capacity to other facilities. Varian's integrated technology helps make all this possible.

This was the situation faced by the Mark H. Zangmeister Center in Columbus, Ohio. Thanks to remote connectivity capabilities, GPS physicists and dosimetrists are able to log in to a secure website and use Citrix software to access Zangmeister's ARIA oncology information system and Eclipse™ treatment planning workstations—from either Macintosh or PC computers anywhere in the world. Since security and patient privacy are paramount, all of the data accessed through Citrix is encrypted and two separate logins are used to ensure that only authorized staff members have access.

Working this way not only promotes efficiency for both Zangmeister and GPS, it also enables greater flexibility for the radiation oncology consultants. For instance, if a patient's treatment plan must be completed for the following day, a dosimetrist can work from home rather than having to stay late at the clinic.

Communicating through a computer-messaging client

GPS's remote dosimetrists communicate with physicians, physicists, and other clinical staff using a computer-messaging client instead of an intercom, phone system, or e-mail. This mode of communication has several advantages. Since the majority of clinical work is computer-based, it is less intrusive to receive an instant message rather than a phone call or page. Unlike a ringing telephone, which demands an immediate response, instant messages allow the recipient to respond when appropriate, and the messages can be answered more quickly and with less effort than is the case with e-mail. In addition, a full communications log is automatically generated.

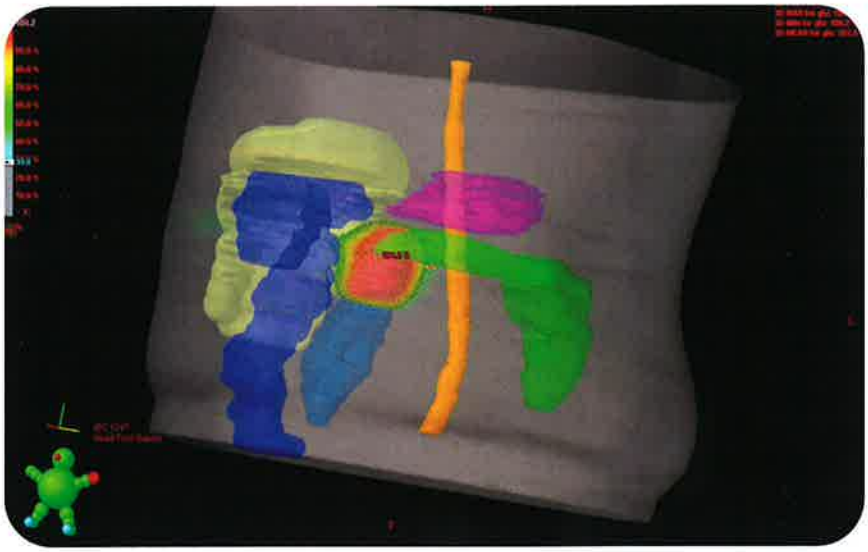
GPS recently implemented remote access across all of its Varian sites. Senior physicists have remote access to the Eclipse and ARIA systems at each site they manage. The software also allows the organization to define which dosimetrists have access to which client sites, allowing them to work from home several days a week in some cases.

Remote access also allows multiple users to connect to the same computer at the same time. This enables GPS physicists to troubleshoot problems remotely and to train the on-site physicists without having to travel. The remote access software is fully HIPAA compliant and provides the organization with a history of who is accessing each computer. Recently, a GPS physicist at the Zangmeister Center was able to use the remote access capabilities to provide a physicist at a new site with remote training on implementing IGRT protocols for Varian's Trilogy® system.

Remote approval of patient positioning—in real time

Using remote electronic connections, GPS has enabled physicians at the Zangmeister Center to view the online kV-kV or cone-beam CT (CBCT) image matching from their offices in real time. These remote connections are initiated at the treatment console in order to ensure that only computers in the physician's offices are allowed to view the On-Board Imager® workstation remotely. For additional security, the information sent over this connection is encrypted.

After therapists complete the kV-kV or CBCT matching, they use the computer-messaging client to inform the physician that the patient plan is ready for review. Physicians can then adjust the shift just before the patient is treated instead of reviewing the plan at the end of the day. By performing this function from their offices, physicians save valuable time. The entire process adds only about 30 seconds to the treatment. If a physician is unavailable to review a shift in real time within 60 seconds and the shift is less than one centimeter, therapists can



An image from the SBRT treatment plan for cancer of the right adrenal gland, generated using Eclipse treatment planning software.

apply the shift without physician approval. This ensures that patient positioning is not compromised by the extra procedural step. If the shift is greater than one centimeter, a physicist is contacted to review the shift before treatment.

Chart quality assurance

Although it can be daunting at first to move from paper to an electronic chart, it is well worth the effort. This is especially true in the area of chart quality assurance. GPS uses Varian's Chart QA, which makes the frustrating "weekly chart hunt" a thing of the past. Chart QA allows physicists to check everything that used to be checked on a paper chart as well as additional items such as gantry, couch, and jaw positions. Chart QA also color codes the information, highlighting any treatment that was not delivered as planned and indicating if there were any overrides and which staff members performed them.

The Documents tab in Chart QA ensures that all the necessary information, such as IMRT QA documents or secondary MU checks, is available for each patient. This is especially valuable for physicists who are checking the charts of patients for whom they did not perform the initial chart checks. Physicists can also annotate the electronic chart to provide a permanent record of information that the physicist considers necessary.

At the Zangmeister Center, physicists check charts on a routine basis every day. "By filtering, we can quickly and efficiently check the charts of each patient receiving 5, 10, 15, etc., treatments," says medical physicist Matthew Daniels, PhD. "This allows all of our physicists to perform weekly chart checks on patients as they have time, instead of spending a large amount of time one day a week. After completing these checks, we click the Chart QA button and the weekly chart-check charges are automatically billed. Our billing specialists no longer have to worry about adjusting dates for weekly chart checks."

"Varian's CBCT technology performed flawlessly, and after several breath holds, the physician was able to match a breath-hold CBCT to the planning breath-hold CT scan."

Matthew Daniels, PhD, Zangmeister Center

SBRT in a freestanding center

GPS has also helped start a stereotactic body radiation therapy (SBRT) program at the Zangmeister Center. One early case involved treatment of a right adrenal gland. Because of its location in the abdomen, the adrenal gland moves during respiration, and is surrounded by critical structures such as the kidney, liver, and small bowel. The radiation oncologist chose to treat it with IMRT utilizing a breath-hold technique. Three planning CT scans were acquired with breath hold in order to ensure that the planning target volume (PTV) encompassed the residual motion and included any variations in the patient's breath-hold pattern over time.

The amplitude of the patient's breath hold was tracked by Varian's RPM™ respiratory gating software to provide a baseline value. Since the patient was receiving a hypofractionated treatment and the tumor was surrounded by critical structures, image guidance was necessary.

Varian's On-Board Imager device was used to acquire a CBCT image to ensure that the location of the adrenal gland was correct prior to every treatment. However, it was necessary to stop and start the CBCT acquisition several times because the patient was not able to hold his breath for the entire minute that a single CBCT acquisition requires. "Varian's CBCT technology performed flawlessly, and after several breath holds, the physician was able to match a breath-hold CBCT to the planning breath-hold CT scan," says Matthew Daniels, PhD, medical physicist.

"Varian Medical Systems has provided us with much better tools to deliver higher-quality cancer care."

Ming Zeng, MD, PhD, Zangmeister Center

During both the CBCT acquisition and the treatment, the amplitude of the breath hold was tracked using Varian's respiratory gating system and compared to the baseline values acquired during the initial CT scans. "If the amplitude varied significantly from this baseline, we were able to tell the patient to adjust how deeply he was breathing," says Daniels. "Taken all together, these steps allowed us to treat the patient with a hypofractionated technique and a high degree of confidence."

After treatment, a pair of kV-kV images was acquired to monitor the intrafraction motion of the patient. Since a high dose rate (1,000 MU/min) was used, the total treatment time for the patient was around five minutes, even with the breath-hold technique. The intrafraction motion was found to be minimal (<2mm).

According to Ming Zeng, MD, PhD, a radiation oncologist at the Zangmeister Center, "Varian Medical Systems has provided us with much better tools to deliver higher-quality cancer care." And at the Zangmeister Center, as at GPS, quality care and operational efficiency walk hand in hand.

John W. Swanson is a senior vice president at GPS, which provides medical and health physics services to healthcare and commercial clients.

The Efficiency of an Integrated HDR Environment

MedCentral Health System of Mansfield, Ohio, a busy in-hospital practice, recently designed a new cancer center to be operated as a hospital-based freestanding facility on the hospital grounds. In addition to IGRT-enabled Trilogy® and Clinac® iX accelerators, MedCentral uses an Acuity™ simulation and imaging machine, a GE 16-slice PET/CT scanner, and a Varian-equipped high-dose-rate (HDR) brachytherapy system, all tied together with Eclipse™ and ARIA® software.

"An integrated environment like the one provided by Varian's ARIA system helps efficiency not only in the linac paradigm for external beam treatment, but also for a 'one-stop shop' HDR program," says Steve Gasiecki, MS, a GPS professional serving as chief of physics at the MedCentral facility. "Having an Acuity simulator with CBCT and an HDR afterloader in the same room makes for a very efficient treatment experience for the patient as well as the staff."

The Acuity simulator in the multifunctional HDR suite is used in a variety of ways. Since every treatment accessory on the Trilogy and Clinac also fits on the Acuity machine, Acuity is used to troubleshoot any set-up issues for external beam treatments. The MLC projector allows the visualization of MLC-shaped fields on a patient's skin. MedCentral physicians appreciate having a "classic" simulator in the department for simple simulations. In CBCT imaging mode, the Acuity system can be used to image patients who are not good candidates for treatment planning CT simulation.

The Acuity system is also tightly integrated into the HDR treatment process. A typical tandem and ring or vaginal cylinder patient can be positioned on the Acuity table, the applicator(s) inserted, and the patient imaged using CBCT. While the patient rests, not having moved from the Acuity table, the physicist uses BrachyVision™ software to create the treatment plan, which is quickly approved, double checked, and delivered. The entire process takes roughly 1 to 1.5 hours, depending on applicator and plan complexity. Subsequent vaginal cylinder plans are based on the original plan, with verification of the cylinder placement coming from a quick anterior-posterior (AP) image of the inserted cylinder. These additional fractions find the patient in and out of the HDR Acuity suite within 20 to 30 minutes. Tandem and ring plans are replanned for each fraction, as the setup is different from week to week.

"These kinds of processes would take hours if it weren't for the tight integration of all the hardware and software components with the patient's electronic record," says Gasiecki. "We selected these interconnected technologies from Varian precisely because this was how we wanted to operate. It's been exciting to see that vision become a reality."