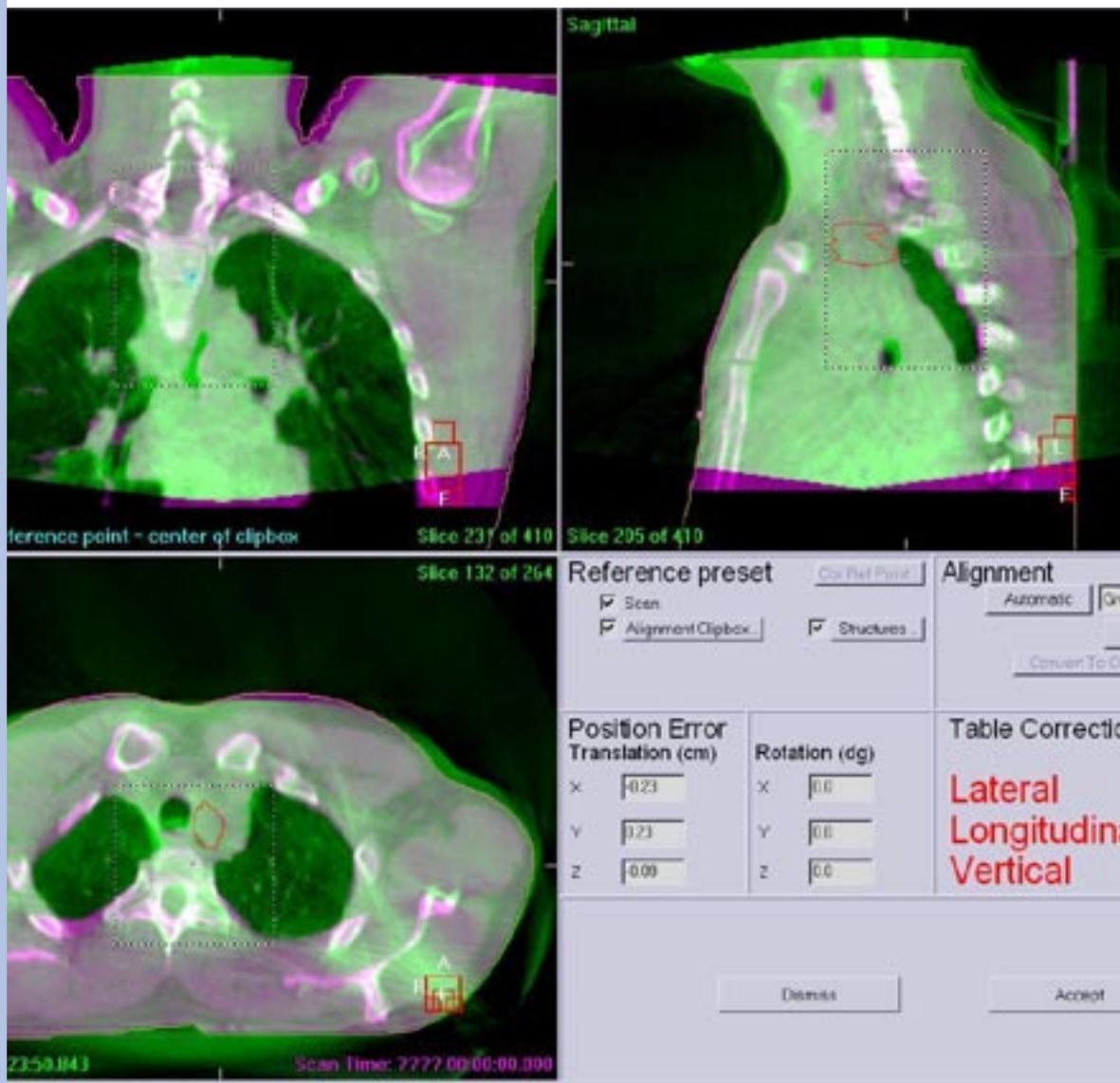


## Case Study



## Re-treatment of a recurrent esophageal cancer using Elekta Synergy® image guidance

**Institution:** Swedish Cancer Institute, Seattle, WA, USA  
**Patient:** Male, 41-years  
**Diagnosis:** Recurrent esophageal cancer  
**Plan:** Four-field oblique 3D conformal, mixed beam energies of 10 and 18MV photons  
**Image guidance:** Elekta VolumeView™ off-line protocol  
**Treatment:** 35Gy, delivered in 14 fractions



## Re-treatment of a recurrent esophageal cancer using Elekta Synergy® image guidance

Radiation Oncologist: **Vivek Mehta MD**  
Physicists: **Tony Wong, Jin-song Ye**  
Lead Radiation Therapist: **Vance Ewald**

### Patient diagnosis and history

A 41-year-old man presented with a locally advanced esophageal cancer. He was treated with neoadjuvant chemoradiotherapy, surgery, and then additional adjuvant chemotherapy.

The patient did well for nearly five years when he presented with an enlarged left supraclavicular lymph node. He underwent a left-modified radical neck dissection. Four of 25 lymph nodes were involved with malignancy that was consistent with recurrent esophageal cancer. The largest deposit measured 5cm. There was also evidence of extracapsular extension. A complete staging evaluation revealed no evidence of disease elsewhere. He subsequently received radiotherapy to the left neck and supraclavicular fossa. He also received adjuvant chemotherapy.

Within a few months, the patient developed bone metastasis and received additional palliative radiation therapy and chemotherapy.

The patient then was noted to have a new 8 x 10mm nodule located along the anterior margin of the thoracic esophagus that was metabolically active on PET-CT. The patient underwent an esophageal endoscopic ultrasound and FNA. Pathology revealed malignant cells consistent with adenocarcinoma. This lesion appeared to originate between the superior edge of the initial radiation therapy fields and the inferior edge of the more recent supraclavicular radiation therapy fields. On the CT PET there was evidence of a hypermetabolic lesion in the liver and in the L2 vertebral body. The patient was treated with chemotherapy. Unfortunately, the disease progressed and the patient became symptomatic with hoarseness. Despite his disease, the patient had been functional throughout this time and the hoarseness/loss of voice had a dramatic impact on his quality of life.

The patient subsequently underwent radiation treatment to this isolated focus of disease in close proximity to the two previously treated fields utilizing Elekta Synergy® image guided system with VolumeView™ imaging software.

### Previous radiation therapy

Approximately five years prior to this treatment course, the initial esophageal fields received 45Gy in 25 fractions, using 6MV photons, and a three-dimensional technique. The left supraclavicular/low neck fields received 45Gy in 25 fractions, using 6MV photons and an AP-PA technique approximately three months prior to this treatment course.

## Treatment

The radiation therapy dose was 35Gy, delivered in 14 fractions with 2.5Gy per fraction. The treatment technique used was four-field oblique 3D conformal, with mixed beam energies of 10 and 18MV photons (see figure 1).

Positional accuracy was evaluated using an off-line VolumeView™ imaging protocol on Elekta Synergy® as it was considered that the margin we had used to account for set-up uncertainty, would be sufficient for this protocol. This was in addition to our conventional ‘anterior-posterior’ and ‘lateral’ MV portal images for treatment set-up. The conventional EPID images were also reviewed off-line and used to compare with VolumeView™ images to gain an understanding of the advantages of using 3D volume imaging.

The patient was imaged daily for the first three fractions, then weekly thereafter. The positional accuracy was noted to be within our action level of 3mm. The radiation therapy was well tolerated and completed as planned. The additional time for treatment to obtain the VolumeView™ images was acceptable.

### Treatment time ≈ 10 minutes:

- 3 mins. – patient set-up
  - 2 mins. – acquisition
  - >2 mins. – off-line set-up correction (if required)
  - 3 mins. – treatment delivery
  - 1 min. – registration
- Off-line correction protocol, using grey scale registration*

- Dose – VolumeView™ 1.5cGy
- EPID – 6cGy

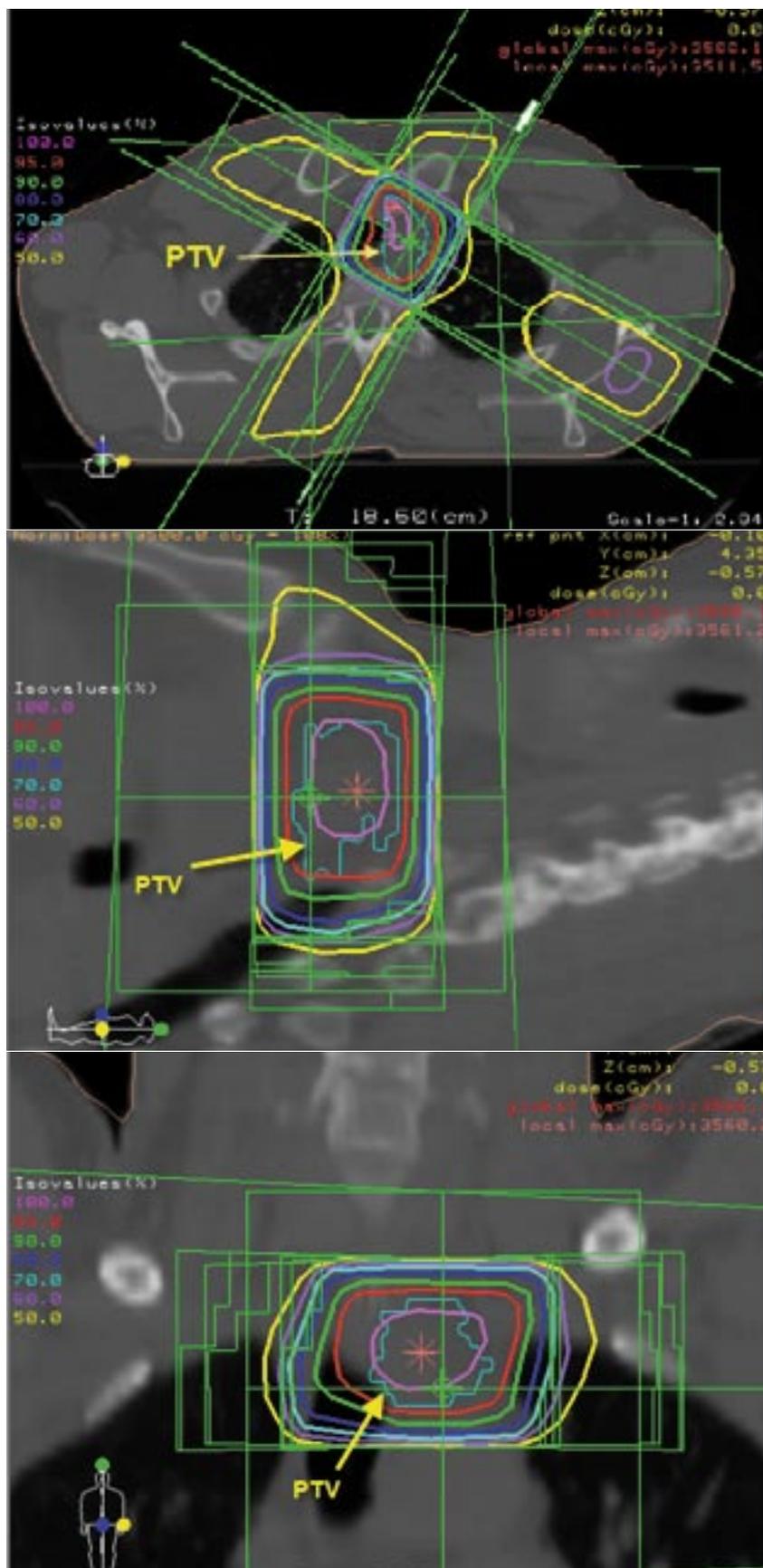


Figure 1: dose distribution of the four-field oblique 3D RT with mixed beam energies of 10 and 18 MV photons shown in (top image) transverse, (center image) sagittal and (bottom image) coronal views.

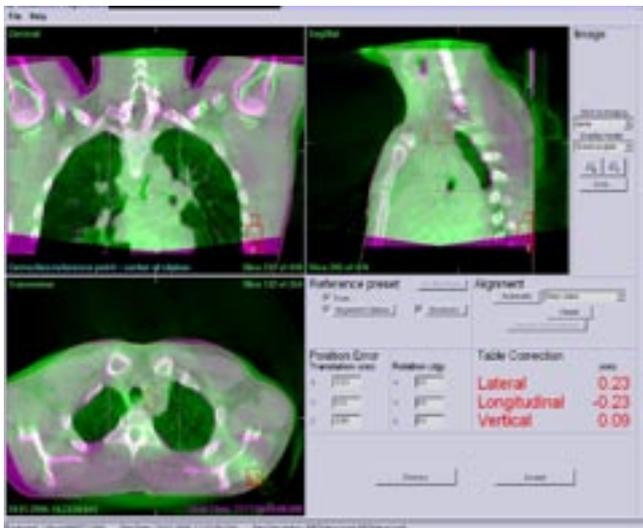


Figure 2: VolumeView™ registration of the target. While the VolumeView™ (in green) shows the patient's arm position in treatment is slightly different from the reference CT (in purple), it does not affect the dose coverage of the PTV.

### Outcome and follow-up

The patient's hoarseness improved at the end of treatment. The patient continued to work and was appreciative of treatment. Unfortunately, the patient developed progressive and symptomatic disease from other sites within three months of completing this course of radiation therapy. At time of last follow-up, his disease was locally controlled within the radiated areas.

### Discussion

The use of VolumeView™ imaging provided verification of the target's position while the patient was in the treatment position. This resulted in greater confidence in treatment delivery and enabled dose reduction to the surrounding normal tissues. During the first two months of implementation of this technology, there have been significant workflow improvements that have reduced the resources and time necessary to employ IGRT. These improvements are based on improved data transfers from TPS to XVI, increased staff expertise and confidence with this new equipment, and confirmation that an off-line correction protocol is capable of providing the accuracy we require.