

# Streamlined workflow for review and analysis of oncology patients

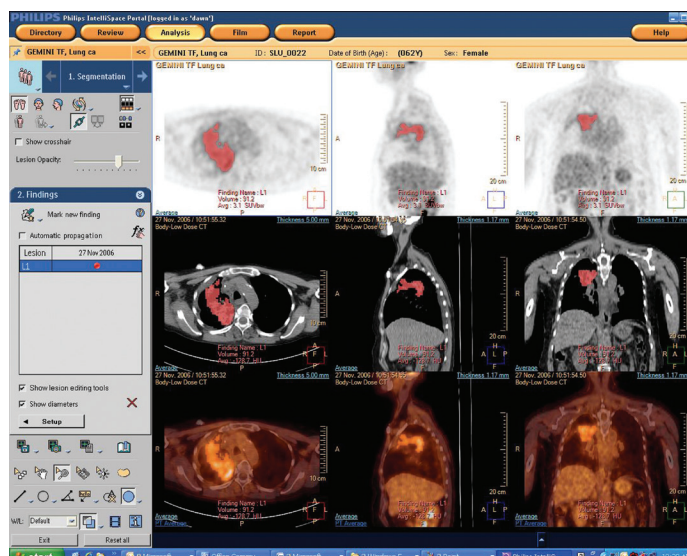
## Philips IntelliSpace Portal – Multi-modality Tumor Tracking application (MMTT)

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Cancer is one of the leading causes of death in the world and costs more in productivity and lost life than any other illness, according to a new report published by the American Cancer Society.<sup>1</sup> With the increase in the aging population and changes in lifestyle behavior, the incidence of cancer is on the rise globally (economically developed and developing countries). Imaging modalities (X-ray, CT, MR, PET, US) play a significant role in detection, diagnosis, staging and monitoring of cancer and also in image-guided treatments like RF ablation. Diagnostic oncology (tumor detection, diagnosis, and monitoring) related scanning account for a majority of all CT procedure volume. Introduction of new drugs and therapies also require continuous and frequent monitoring of the patient to analyze their influence and effect.

Post-processing of oncology (CT, PET/CT, and MR) image datasets can pose a major challenge for radiology and oncology staff. It often requires the maneuvering and analysis of a significant amount of data due to multiple follow-up studies. The user has to:

- Load multiple patient examinations for side-by-side comparisons to the baseline scan and nadir scan (smallest criteria recorded since the treatment started) in case of new progression. These datasets often include exams from multiple imaging modalities.
- Scroll through the numerous images of large datasets to identify and locate the tumors and lymph nodes for follow-up analysis.
- Measure the size of the tumors and lymph nodes including long axis and short axis diameters, as well as other quantitative parameters such as HU values.
- Calculate tumor burden measurements based on RECIST and WHO criteria and assess response to treatment.



The IntelliSpace Portal Tumor tracking application supports datasets from different imaging modalities including CT, MR, and PET/CT. The above image is of a 62-year-old female, history of lung cancer. Large lesion segmented in right upper lobe. Lesion statistics obtained for PET (SUV) and CT (HU).

## Definitions

### Response Evaluation Criteria in Solid Tumors (RECIST)

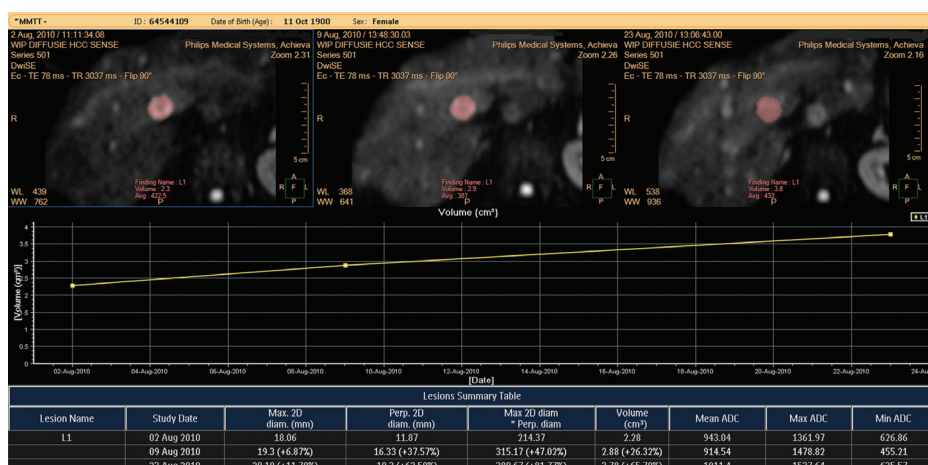
A published guideline used to assess the change in size (maximum diameter in 2D plane) of solid tumors and lymph nodes in response to therapy. The response is categorized into:

- Complete Response (CR): disappearance of all target lesions
- Partial Response (PR): 30% decrease in sum of diameters of all target lesions
- Stable Disease (SD): No change in the size of the lesions
- Progressive Disease (PD): 20% or absolute 5 mm increase in sum of diameters of target lesions

The user identifies the target lesions on the baseline examination. Target lesions should be selected on the basis of their size (lesions with the longest diameter) and their suitability for accurate repeated measurements (either by imaging techniques or clinically).

### World Health Organization (WHO)

The WHO criteria defined shrinkage of a tumor as the decrease in the product of the largest perpendicular diameters in the largest “slice” of the tumor on a scan.



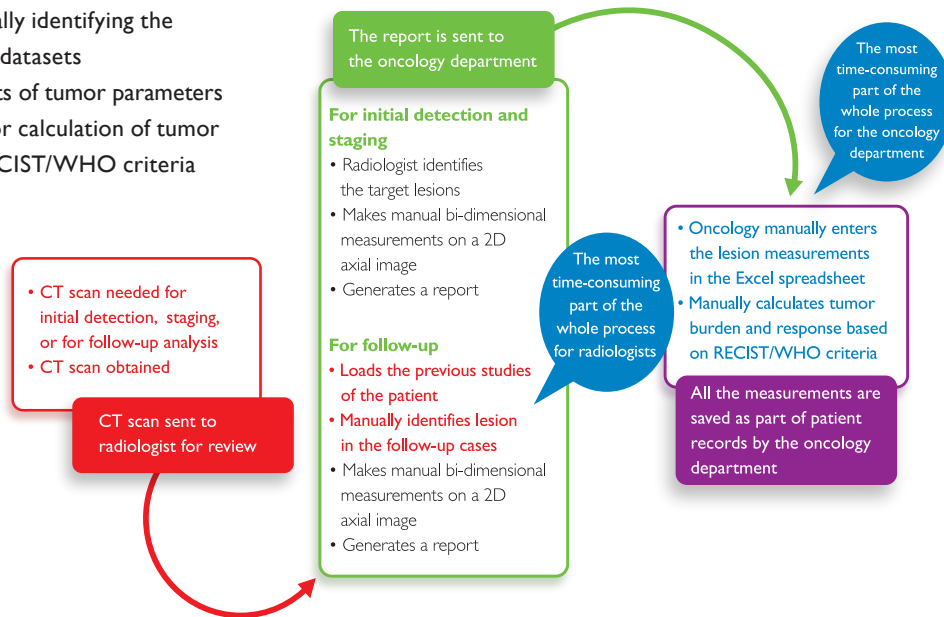
The MMTT application can also be used to analyze MR data. In this case, a diffusion dataset is used to assess the size and activity of a lesion. The Apparent Diffusion Coefficient (ADC) values don't change over the time period, whereas the size of the lesion appears to increase over the time frame.

### The Multi-modality Tumor Tracking application (MMTT)

of Philips IntelliSpace Portal provides the tools to help simplify the review and analysis of multi-modality oncology datasets for tumor detection and monitoring. The application has semi-automatic segmentation tools to facilitate 2D and 3D segmentation of tumors and lymph nodes. For instance, it allows the user to make quick bi-dimensional measurements using 2D measurements tools as shown in Figure 2. The application also enables graphical tracking of the size of the tumor across the different time points (Figure 3). After the measurements are completed, it automatically performs the RECIST and WHO calculations.

# Current workflow for evaluation of oncology cases

- Time spent in manually identifying the tumors in follow-up datasets
- Manual measurements of tumor parameters
- Manual data entry for calculation of tumor burden based on RECIST/WHO criteria



## MMTT application

The Multi-modality Tumor Tracking application supports loading and comparison of patient datasets from different imaging modalities such as CT, MR, PET/CT, and SPECT/CT. The application has dedicated tools for segmentation and measurements of tumors for the different imaging modalities.

### Easy follow-up assessment

Oncology scans require frequent comparison with previous datasets, to identify tumors and make measurements. The application simplifies assessment of follow-up datasets by:

- Allowing loading of up to eight previous and current datasets of the patient
- Allowing simultaneous side-by-side comparisons of four previous and current datasets of the patient
- Allowing loading of saved results from all previous datasets of the patients, if the user has saved results (segmented tumors and measurements) from analysis of previous datasets
- Automatic registration of the current and previous datasets (CT to CT)
  - Reduces the need to scroll through the datasets in order to locate the target tumors, and this improves workflow

### Segmentation tools

The MMTT application offers semi-automatic segmentation tools for 3D volumetric segmentation of tumors and lymph nodes. It also offers simplified 2D measurement tools for quick bi-dimensional measurement of tumors and lymph nodes in cases where 3D volumetric segmentation is not needed.

- Semi-automatic segmentation of tumors and lymph nodes to measure long axis and short axis diameter, volume, Hounsfield Unit (HU) values, and SUV values
  - Semi-automated measurements are more reproducible than manual measurements made by radiologists

## Assessing response treatment

Response to treatment is evaluated by making calculations defined by standard criteria, (e.g., RECIST and WHO) using measured tumor parameters. Manual calculation of these parameters and criteria could be a time-consuming and tedious task.

## The MMTT application allows

- Automatic calculation of tumor burden based on RECIST/WHO criteria
- Measurements from all loaded time points and results are displayed in a table
- Visual tracking of tumor parameters on a graph
- Display of histogram of the HU and SUV values of segmented tumors and lymph nodes for all the time points loaded into the application
- Measurement of ADC values of the tumor over different time points, using diffusion weighted MRI

## Saving and reporting of results

The MMTT application allows

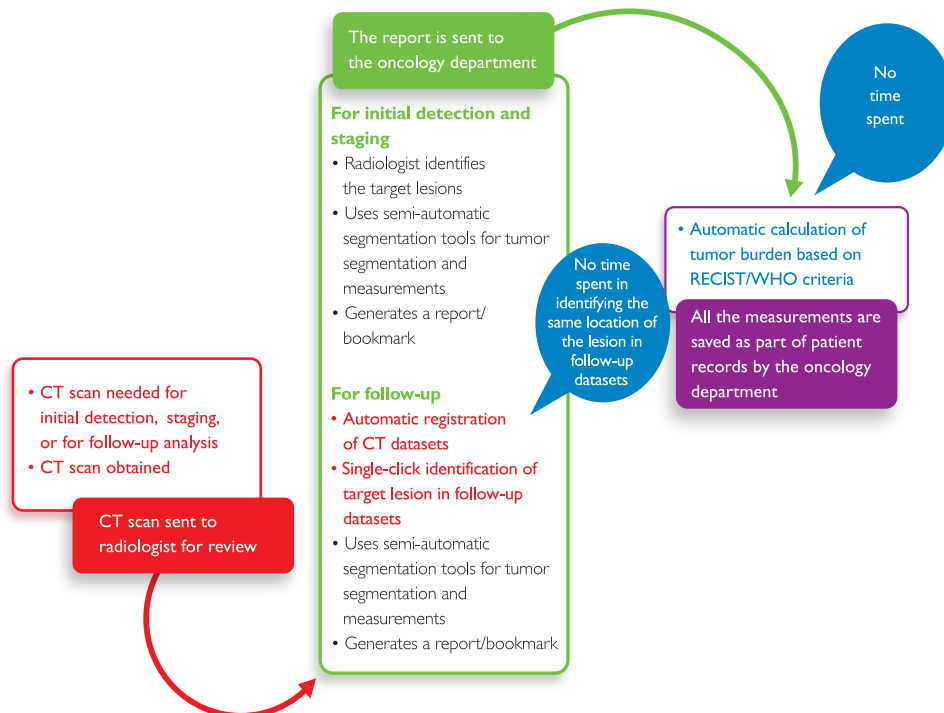
- Ability to save bookmarks to allow for easy review of results by the referring physician or radiologist
- Ability to save results: segmented lesions, registration of the datasets, measurements table, graphical tracking of information from the application for future reference and analysis

- Generation of an application-specific report with key images of all the segmented lesions, measurements table, graph display of the selected parameters, and any other images selected by the user. The user can customize the report, add more images, text, etc., based on their own requirements
- Ability to save the report on PACS or easy sharing with the referring physicians

## Real time communication with oncologists

IntelliSpace Portal offers an integrated medical networking platform enabling radiologists to communicate and collaborate. IntelliSpace Portal has many integrated features such as reporting, bookmarks, and collaboration tools. Together these provide the ability to access, create, and communicate actionable information throughout the institution. These tools allow high-quality collaboration between radiologists and referring physicians at virtually any onsite or remote location. The collaborative tools are Internet-based for real time interaction and communication between radiologists and oncologists. The collaboration tool enables radiologists to discuss a case and share information (e.g., tumor parameters, tumor burden, key images) with oncologists to improve patient care.

# Streamlined workflow with MMTT



“The new MMTT application from Philips has really made our lives easier. We do not have to spend time pulling out the measurements from the radiologists’ reports, entering in an Excel spreadsheet, and calculating the RECIST measurements. This all is done automatically by the application; we can now just add the report or a screenshot to the patient history at our end. This is great!”

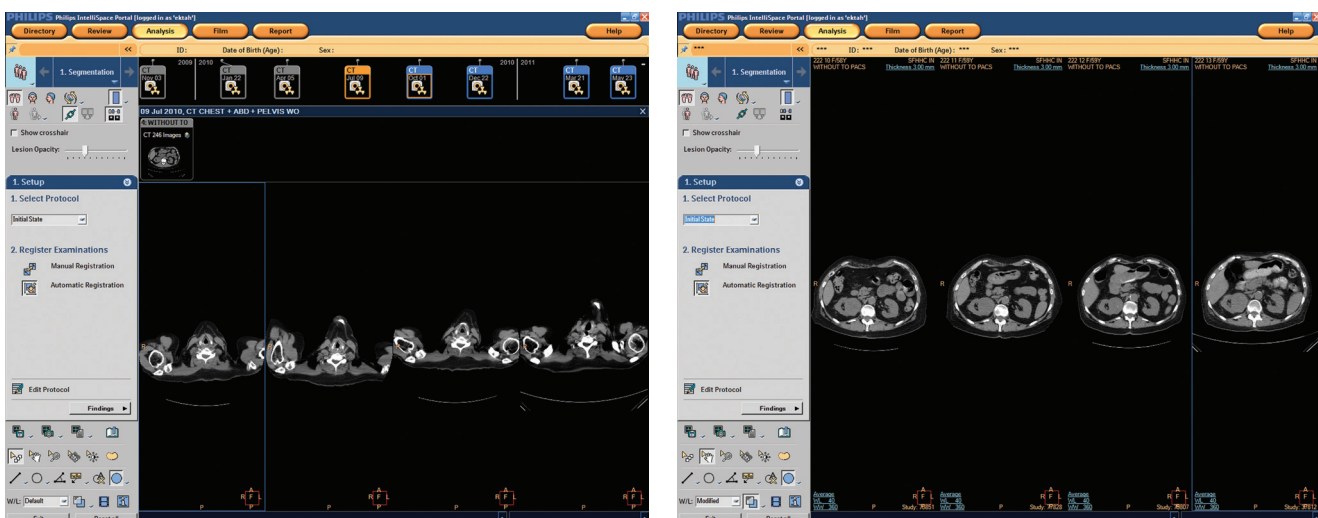
Debra Duvall, RN, BSN  
Clinical Research Coordinator  
St. Francis Cancer Research Foundation

## Case study

(Courtesy: Franciscan Saint Francis Health, Indianapolis, IN)

A patient with prior history of stroke, hypercholesterolemia and hypertension was diagnosed with renal cell carcinoma stage T1bN2M0. The patient had ten follow-up CT scans over a period of two years. The primary tumor in the kidney remained stable over the course of therapy; however, the patient was taken off the therapy due to increase in toxicities. The MMTT application allows loading of results from all the scans of the patient and data from eight scans (Figure 1).

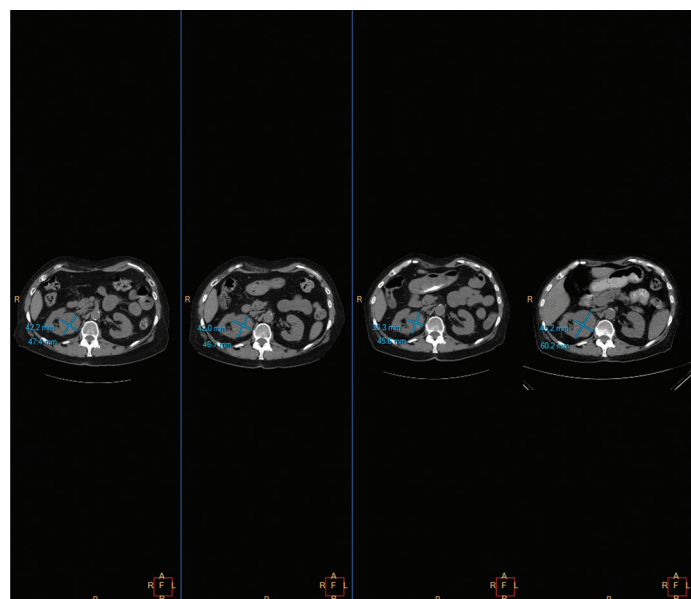
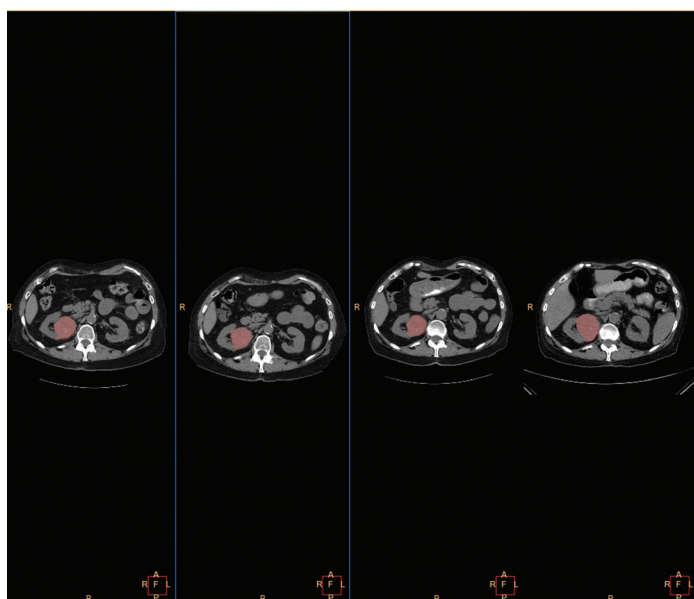
Automatic registration tools align the data automatically for easy identification of target lesions in follow-up datasets (Figure 1). Semi-automatic segmentation tools allow volumetric segmentation of the data. 2D tools allow quick bi-dimensional measurements (Figure 2). Measurements from the lesion can be tracked on the graph or displayed in the table (Figure 3). RECIST tumor burden is calculated automatically (Figure 3).



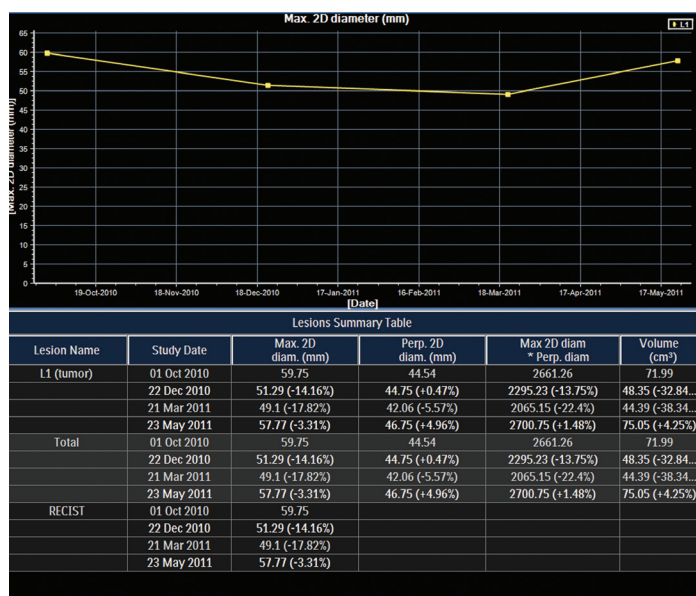
**Figure 1.** The MMTT application allows loading of eight multi-modality datasets of the patient. The loaded datasets can be visualized on a timeline. The application allows simultaneous comparison of four datasets. The loaded CT datasets are automatically registered with each other using Automatic Registration.

“The MMTT application has really helped us simplify and streamline our workflow. It has all the necessary tools for a complete oncologic evaluation of the dataset. This application is a real time-saver for the radiologists.”

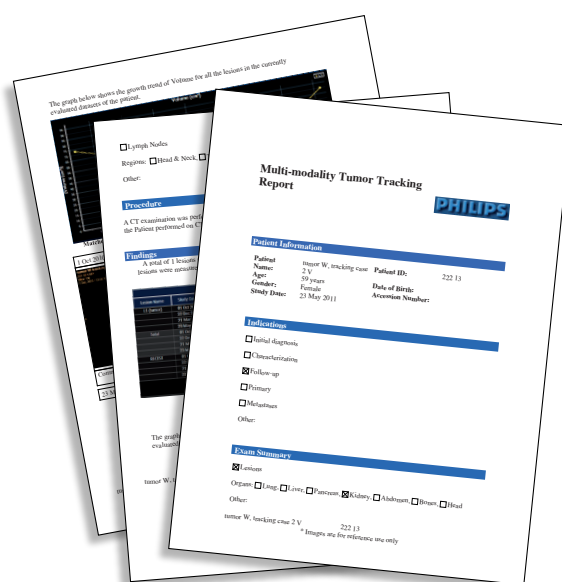
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**Figure 2.** The application allows volumetric 3D segmentation of lesions in the loaded datasets. The application allows simple bi-directional measurements of lesions in the loaded datasets.



**Figure 3.** The application displays all the calculated parameters for the segmented lesions in a table, along with the completely automatic RECIST calculations. The selected measurement of the tumors can also be tracked on a graph.



**Figure 4.** The MMTT application supports sending of all the analysis including the results table, graph, and key images to the report.



**The author would like to acknowledge  
the following for their input:**

Jeffrey Yanof  
Kevin Buchan  
Philippe Coulon  
Sigal Amin-Spector  
Thomas Naypauer

## **References**

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Printed in The Netherlands.  
4522 962 79521 \* NOV 2011