

## **IAEA Regional Training Course: "Transition from 2D to 3D Conformal Radiotherapy: Medical Physics Aspects"**

**IAEA Project RLA/6/061: "Training and Updating Knowledge in Medical Physics (ARCAL CVII)"**

**Dates:** 07 to 11 May, 2011

**Host:** Instituto Privado de Radioterapia – Fundación Marie Curie, Córdoba, ARGENTINA

**Foreign teaching staff:** **Rodolfo Alfonso**  
**Jake Van Dyk**

**Course Director:** Daniel Venencia

**Local teaching staff:** Monica Brunetto  
Pablo Castro Peña  
Caroline Descamps  
Diego Fernandez  
Edgardo Garrigó  
Leopoldo Mazzucco  
Yakov Pipman  
Graciela Velez  
Daniel Venencia  
Silvia Zunino

**Local collaborators:** Manuel Castrillon  
Fabian Muñoz  
Cristina Pfaff  
Nicolas Picatto  
Carola Sanchez  
Edward Sanchez

**Participation:** The training course participants from IAEA Member States in the region of Latin America

## **Saturday 7-5-2011**

- 13:00 – 14:00 Registration
- 14:00 – 14:10 Welcome and introduction
- 14:10 – 14:30 The past, present and future of radiation therapy (RT) in the treatment of cancer, **Silvia Zunino**
- 14:30 – 15:00 Steps in RT process. **Yakov Pipman**
  - Differences between 2-D RT, 3-D CRT & IMRT
- 15:00 – 15:30 Image modalities in RT. **Jake Van Dyk**
- 15:30 – 16:00 Coffee break
- 16:00 – 16:45 Target volume and organ at risk (OAR) delineation. ICRU 50, 62, 71 and 83. **Jake Van Dyk**
- 16:45 – 17:15 Geometric uncertainties and set-up margins. **Rodolfo Alfonso**
- 17:15 – 17:45 Patient position and immobilization in RT. **Caroline Descamps**
- 17:45 – 18:15 Patient position verification. **Graciela Velez**

## **Sunday 8-5-2011**

- 8:30 – 8:50 Image acquisition for RT treatment planning. **Monica Brunetto**
  - Definition of CT number
  - CT number to relative electron density conversion (should be discussed before practical session on this topic)
- 8:50 – 9:20 Complexity levels in RT. **Jake Van Dyk**
- 9:20 – 9:50 Virtual simulation. **Yakov Pipman – Edgardo Garrigó**
- 9:50 – 10:10 Image fusion. **Leopoldo Mazzuco**
- 10:10 – 10:30 Coffee break

- 10:30 – 11:10 Target volume visualisation and delineation – practical examples. **Pablo Castro Peña**
  - Breast
  - Prostate
- 11:10 – 11:50 Target volume visualisation and delineation – practical examples. **Diego Fernandez**
  - Head and Neck
  - Lung
- 11:50 – 12:30 Organs motions and internal margins. **Rodolfo Alfonso**
- 12:30 – 13:30 Dose volume tolerance for OAR (from Emami to QUANTEC). **Pablo Castro Peña – Diego Fernández**
- 13:30 – 15:00 LUNCH
- 15:00 – 19:00 PRACTICAL Sessions 1, 2 and 3.
  - Practical session will be done by groups (7 groups)

### **Session #1: QC tests of a CT-scanner and the CT-simulation process**

*QC tests of CT-scanner (based on updated TECDOC 1151, draft version):*

- Coincidence of external laser with CT internal alignment lights
- Alignment of lasers with the center of imaging plane
- Indication of x axis
- Table indexing and position
- Helicoidally reconstructed slice location accuracy
- In plane spatial integrity
- Patient orientation
- CT number constancy and uniformity (water)
- CT number accuracy (lung, bone, muscle, adipose)

### **Session #2: QC tests of the CT-simulation process**

*QC of CT-simulation process. Use of a CIRS thorax phantom to realize all the steps of a typical CT-simulation process.*

- Phantom positioning with external localization marks
- CT-simulation scan (topogram and complete exam)
- Transfer data to TPS workstation

- Image orientation verification
- External and internal (lung and spinal cord) contour outline
- Organs volumes evaluation
- Isocenter align with localization marks
- Reference field and DRR realization

### Session #3: Electronic density versus HU curve

*Measurement and creation of electronic density versus HU curve in the TPS:*

- Acquisition of a CIRS thorax phantom with various electronic inserts
- Image analyze and curve measurement
- Conversion table creation in TPS

## Monday 9-5-2011

- 8:30 – 9:10 Dosimetric data acquisition. Beam data modelling. **Rodolfo Alfonso**
- 9:10 – 9:30 Dose calculation algorithm. **Rodolfo Alfonso**
- 9:30 – 10:00 Heterogeneity correction for photon beam RT. **Jake Van Dyk**
- 10:00 – 10:30 Forward versus inverse planning. **Yakov Pipman**
- 10:30 – 11:00 Coffee break
- 11:00 – 13:00 Treatment planning commissioning. IAEA TecDoc 1583. **Edgardo Garrigó**
  - Practical Session 4
- 13:00 – 14:00 LUNCH
- 14:00 – 14:20 General concepts of 3-D CRT. **Leopoldo Mazzuco**
  - $D_{min}$ ,  $D_{mean}$ ,  $D_{max}$ ,  $D_{xx\%}$ ,  $V_{yyGy}$
  - DRR
  - DVH
  - BEV
  - EUD
  - Automatic margins generation
  - Documentation, recording, reporting

- 14:20 – 14:40 Beam shaping. QC of MLC and Mould room (*based on updated TECDOC 1151, draft version*). **Monica Brunetto**
- 14:40 – 15:10 Guidelines for transition from 2D to 3D. IAEA TECDOC 1588. **Jake Van Dyk**
- 15:10 – 15:30 Treatment plan evaluation in 3-D CRT. **Graciela Velez**
- 15:30 – 15:50 Data transfer from TPS to treatment machine. **Caroline Descamps**
- 15:50 – 16:10 Coffee break
- 16:10 – 18:00 Treatment planning strategies for conformal 3D RT in lung and head and neck. **Graciela Velez**
  - Practical Session 5 – CHAPTER 1. Discussion.

#### **Session #4: Use of TecDoc 1583 for TPS dose commissioning**

*Treatment planning of test cases of IAEA TecDoc 1583 using phantom images,*

1. Use the CIRS phantom images
2. Reproduce Tests cases 1, 3 and 5 in the TPS
3. Calculate doses at points of interest
4. Compare with previously measured doses at the same points

#### **Session #5: 3D Treatment planning process for breast and lung cancer.**

*Virtual simulation and 3D Treatment planning 3D procedure,*

- 1 Using a pre scanned patient data review images and contours,
- 2 Create planning target volume (PTV),
- 3 For each one of the treatment localization
  - Create reference isocenter
  - Reference images for localization
  - Treatment plan with conformal beams
  - Calculate dose
  - Analyze dose distribution
  - Influence of heterogeneity correction
  - Influence of dose calculation grid size
  - Calculate dose volume histogram (DVH)
  - Based on fiducial markers, prepare patient setup indications for RTTs

## Tuesday 10-5-2011

- 8:00 – 10:00 Treatment planning strategies for conformal 3D RT in breast and prostate. **Daniel Venencia**
  - Practical Session 5 – CHAPTER 2. Discussion.
- 10:00 – 10:30 Coffee break
- 10:30 – 11:00 Physics aspects of IMRT. **Daniel Venencia**
- 11:00 – 11:30 Commissioning of IMRT treatments. AAPM TG-119 test cases. **Rodolfo Alfonso**
- 11:30 – 12:00 Clinical aspects of IMRT, **Silvia Zunino**
- 12:00 – 12:40 Treatment plan evaluation in IMRT. **Yakov Pipman**
- 12:40 – 13:00 Radiobiological considerations of IMRT treatment. New concepts. **Edgardo Garrigó**
- 13:00 – 14:00 LUNCH
- 14:00 – 16:00 Practical Session 6. Discussion.
- 16:00 – 16:30 Coffee break
- 16:30 – 17:15 Image guidance radiotherapy (IGRT). **Jake Van Dyk**
- 17:15 – 18:00 QA of IMRT treatment plans. **Edgardo Garrigó - Leopoldo Mazzuco**

### **Session #6: Treatment planning dose comparison between 2D, 3D and IMRT for prostate cancer.**

*Dose comparison between 2D, 3D and IMRT dose distribution for prostate cancer,*

- 1 Use 2D, 3D and IMRT treatment plan of a prostate cancer
- 2 Verify all plan have the same median dose to the CTV.
- 3 Compare doses in the target volume for all treatment modalities
- 4 For rectum, bladder and femoral head compare DVH
- 5 Calculate EUD for all treatment modalities

## **Wednesday 11-5-2011**

- 8:30 – 9:00 Why do we need QA of Radiotherapy? **Jake Van Dyk**
- 9:00 – 9:45 In vivo Dosimetry. **Rodolfo Alfonso**
- 9:45 – 10:15 Stereotactic radiotherapy and radiosurgery. **Daniel Venencia**
- 10:15 – 10:45 Coffee break
- 10:45 – 11:15 Equipments needs. Staff and training. **Graciela Velez**
- 11:30 – 12:30 EVALUATION. Discussion.