

MULTI-VENDOR COMPUTED TOMOGRAPHY SYSTEMS MAINTENANCE PHASE II

Course Length: 2 weeks
CEU's Awarded: 8

Introduction

Multi-Vendor Computed Tomography Systems Maintenance is a skills development course designed as a continuation of the Principles of Servicing Computed Tomography Systems course (Phase I). Through attending this course, the service professional will become self-confident in working on the gantry, patient transport, detector assembly, DAS, SRU, X-ray control systems, and operator workstation sub-systems. Special attention will be given to x-ray tube changes. Hands-on lab time is emphasized, and makes up approximately 80% of the overall course content.

Prerequisites

To attend this course, the service professional must have a good knowledge of CT physics and procedures gained through attendance at the RSTI Principles of Servicing Computed Tomography Systems (Phase I) course or equivalent experience.

Objectives

Following attendance of this course, participants will be able to:

- Change the X-ray tube, realign and recalibrate the X-ray generator
- Calibrate, replace and align the hardware associated with the gantry and patient transport
- Troubleshoot gantry, patient transport and X-ray systems
- Troubleshoot the digital acquisition system and detector array
- Troubleshoot the scan reconstruction unit
- Troubleshoot the operator workstation

Course Outline

All lab functions will be repeated on each system available

DAY 1

System Operation and Power Distribution

- I. Systems operational parameters
 - A. Major system component identification
 - B. System controls
 1. Safety
 2. Interlocks
 - C. Patient registration/scheduling
 - D. Exam/technique settings
- II. System architectures
 - A. System block diagrams
- III. Power distribution
 - A. Power distribution diagrams
 1. Main AC power
 2. Sub-system AC power
 3. DC power supplies

System Operation and Power Distribution Lab Activities

- I. Scheduling an exam

- A. Patient registration
- B. Selecting technique parameters
 1. Scout view
 2. Axial views
 3. Helical views
- II. Power distribution
 - A. Verify AC power supplies
 1. Main power distribution
 2. Gantry AC power
 3. Table AC power
 4. Console Power
 - B. Verify DC power supplies
 1. Control system DC power supplies
 2. Gantry DC power supplies
 - A. Stationary
 - B. Rotating
 3. Table DC power supplies
 4. X-ray system DC power supplies
 - A. X-ray generator
 - B. X-ray tube rotor control
 - C. Collimator
 5. Detector/DAS area DC power supplies

DAY 2

System Operation and Power Distribution Lab Activities continued

- I. Scheduling an exam
 - A. Patient registration
 - B. Selecting technique parameters
 1. Scout view
 2. Axial views
 3. Helical views
- II. Power distribution continued
 - A. Verify AC power supplies
 1. Main power distribution
 2. Gantry AC power
 3. Table AC power
 4. Console Power
 - B. Verify DC power supplies
 1. Control system DC power supplies
 2. Gantry DC power supplies
 - A. Stationary
 - B. Rotating
 3. Table DC power supplies
 4. X-ray system DC power supplies
 - A. X-ray generator
 - B. X-ray tube rotor control
 - C. Collimator
 5. Detector/DAS area DC power supplies

DAY 3

Motor/Motion Controls and Position Indication

- I. Motor verification and replacement
 - A. Gantry rotation
 1. Axial speed control
 2. Axial motor driver
 3. Harmonization/Encoding
 - B. Patient transport/table movement and indexing
 1. Tabletop horizontal control
 - A. Speed control
 - B. Motor drivers
 - C. Harmonization/Encoding
 2. Table vertical travel
 - A. Speed control
 - B. Motor drive
 - C. Position indication
- II. Laser and light knife position indicators
 1. Operation
 2. Alignment

Motor/Motion Control and Positioning Lab Activities

- I. Gantry rotation
 - A. Axial driver verification
 1. Axial motor driver waveforms
 2. Rotational speed tests
 - B. Drive assembly mechanical adjustments
 - C. Encoder verification
- II. Patient transport
 - A. Vertical motor driver waveforms
 - B. Vertical position indication
 - C. Horizontal motor driver waveforms
 - D. Encoder verification
- III. Laser/Light knife adjustments

DAY 4

X-ray system

- I. X-ray generation
 - A. High voltage control
 - B. Filament controls
 1. Filament drive
 2. Position (Z control)
 3. Z position detection
 - C. Rotor controller
 - D. Collimator controls
 1. Pre-patient
 2. Post-patient
 - E. Filter control
 - II. X-ray tube change
 - A. Tube selection
 - B. De-install/install issues
 - C. Required calibrations and alignments
- X-ray System Lab Activities
- I. X-ray tube change
 - A. De-install procedures
 - B. Installation procedures
 - II. High voltage control waveforms
 - A. Intermediate voltage verification
 - B. kV demanded
 - C. kV actual
 - D. VCO frequency
 - E. IGBT/SCR gate drive
 - III. kV calibration
 - IV. Filament drive waveforms
 - A. Filament drive demanded
 - B. Filament drive actual
 - C. mA demanded
 - D. mA actual
 - V. mA calibration
 - VI. Z position alignment

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SYSTEMS MAINTENANCE

PHASE II CONT.

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- VII. Rotor control waveforms
- VIII. Collimator control waveforms
- IX. Collimator alignment
- X. Filter position control verification
- XI. Beam on window adjustment
- XII. Plane of rotation adjustment
- XIII. ISO center adjustment

DAY 5

X-ray System Lab Activities continued

- I. X-ray tube change
 - A. De-install procedures
 - B. Installation procedures
- II. High voltage control waveforms
 - A. Intermediate voltage verification
 - B. kV demanded
 - C. kV actual
 - D. VCO frequency
 - E. IGBT/SCR gate drive
- III. kV calibration
- IV. Filament drive waveforms
 - A. Filament drive demanded
 - B. Filament drive actual
 - C. mA demanded
 - D. mA actual
 - V. mA calibration
 - VI. Z position alignment
- VII. Rotor control waveforms
- VIII. Collimator control waveforms
- IX. Collimator alignment
- X. Filter position control verification
- XI. Beam on window adjustment
- XII. Plane of rotation adjustment
- XIII. ISO center adjustments

DAY 6

Detector and DAS

- I. Detector architectures
 - A. Maintenance issues
 - B. Detector replacement
- II. DAS architectures
 - A. Pre-amp/Channel boards
 - B. DAS control
 - C. Data convolution
- III. Data transmission
 - A. Fiber optics
 - B. Slip ring data transfers
 - 1. Optical transmission
 - 2. Brushes
 - 3. RF transmitters

X-ray System Lab Activities continued

- I. X-ray tube change
 - A. De-install procedures
 - B. Installation procedures
- II. High voltage control waveforms
 - A. Intermediate voltage verification
 - B. kV demanded
 - C. kV actual
 - D. VCO frequency
 - E. IGBT/SCR gate drive
- III. kV calibration
- IV. Filament drive waveforms
 - A. Filament drive demanded

- B. Filament drive actual
- C. mA demanded
- D. mA actual
- V. mA calibration

- VI. Z position alignment
- VII. Rotor control waveforms
- VIII. Collimator control waveforms
- IX. Collimator alignment
- X. Filter position control verification
- XI. Beam on window adjustment
- XII. Plane of rotation adjustment
- XIII. ISO center adjustment

Detector/DAS Labs

- I. Pre-amp/Channel board verification
 - A. Detector output mapping
 - B. Pre-amp measurements
- II. Detector/DAS replacement
 - A. Removal procedures
 - B. Installation and alignment
- III. Data transfer verification
 - A. DAS data output
 - B. Data transfer through slip ring verification
 - C. Data to image processing verification

DAY 7

Detector/DAS Labs Continued

- I. Pre-amp/Channel board verification
 - A. Detector output mapping
 - B. Pre-amp measurements
- II. Detector/DAS replacement
 - A. Removal procedures
 - B. Installation and alignment
- III. Data transfer verification
 - A. DAS data output
 - B. Data transfer through slip ring verification
 - C. Data to image processing verification

DAY 8

Image processing and handling

- I. Front end processing
- II. Temporary preprocessed data storage
- III. Image reconstruction
- IV. Processed image handling
 - A. Image generation for display
 - B. Image storage
 - 1. System disk
 - 2. MOD
 - 3. CD/DVD ROM
 - 4. Print services
 - 5. DICOM

Image processing and Handling Labs

- I. Image reconstruction system testing
 - A. Image processor
 - B. Image generator
- II. Image reconstruction testing
 - A. Real time reconstruction
 - B. Retro-reconstruction
- III. Manage image files
 - A. Image disks
 - 1. Replacement
 - 2. Managing storage space

- B. MOD
- C. DICOM setup
- D. Printer setup

DAY 9

System control and Image Quality

- I. System host computer
 - A. Field replaceable units
 - B. System hard drive
 - II. System to Gantry control
 - A. Stationary controls
 - B. Rotating controls
 - III. System to X-ray system control
 - A. X-ray generation
 - B. Collimation
 - IV. System to image processing/handling
 - V. Image quality control tests
- ##### System control and Image Quality Labs
- I. System control communications verification
 - II. System state back-up and restore
 - III. QC phantom image evaluation
 - A. Resolution
 - B. Contrast
 - C. CT number tracking
 - D. Image noise
 - IV. System troubleshooting
 - A. Electronic
 - B. Software assisted

DAY 10

- I. Course review
- II. Final exam
- III. Course evaluation