MRI Phase 2: Advanced MRI Service

RADIOLOGICAL SERVICE TRAINING INSTITUTE

Introduction

The MRI Advanced course is a skills development course designed to build on fundamentals acquired during the MRI Principles service training course. The course will teach service engineers the concepts of MRI system calibration, performance monitoring and verification, and diagnostics. This course will also teach engineers MRI image artifact recognition, analysis, and corrective action.
We will cover system software management methods, including cloning, ghosting, backup, and restore.

Prerequisites

To attend this course, the service professional must have completed MRI Phase 1 (MRI Principles), or relevant experience.

Objectives

At the conclusion of this course participants will be able to:

- Understand concepts of system calibrations:
  - Magnetic (B0) field calibration
  - Gradient field calibration
  - RF (B1) field calibration
  - Eddy current compensation
- Review logs:
  - System log
  - MMU log
  - QA logs
- Understand diagnostic concepts:
  - Phantom imaging
  - System log
  - Image artifact evaluation
  - Image artifact corrective action
- Follow circuit operations of system detail block diagrams
- Perform system troubleshooting, and corrective action methods

Course Outline

Day 1

- Advanced MRI principles:
  - Theory & Physics
  - Main subsystems
    - Magnetic field (B0)
    - RF field (B1) transmit-receive chain
    - Gradient field chain
    - Control & Computation
    - Colling systems
  - Process of image creation
  - Coils
  - Safety

Day 2

- Monitoring system performance
  - Magnet monitoring
- Cold head swap methods
- Magnetic field (B0) shimming calibration
  - Tools required
  - Shimming process
- Gradient field (BΔ) calibration
  - Tools required
  - Gradient calibration process
- RF field (B1) calibration
  - Tools required
  - RF calibration process
- Lab activities:
  - Magnet monitoring
  - Gradient field (BΔ) calibration
  - RF field (B1) calibration

Day 3

- Eddy current compensation (ECC)
  - Tools required
  - ECC Calibration process
- System performance monitoring
  - Daily QA
    - SNR
    - Uniformity
    - Ghosting
    - Resolution
    - Slice thickness
    - Geometric distortion
  - Field maps
  - Noise scans
- Advanced clinical applications

- Lab activities:
  - Eddy current compensation (ECC)
  - Perform system monitoring
    - Daily QA
    - Perform field maps
    - Perform noise scans

Day 4

- Troubleshooting and diagnostics
  - System log
  - MMU log

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Hands-On Training Course
Course Length: 1 Weeks
CEU's Awarded: 4 CEU's
State of Ohio Registration No. 93-09-1377T

- Magnetic field (B0) stability checks
- Gradient field (BΔ) stability checks
- RF Field (B1) stability checks

- Artifact evaluation
  - Clinical image evaluation
  - Phantom image evaluation
  - Types of artifacts
  - Causes and corrective action
- Image creation troubleshooting
  - Proton excitation
  - Receive signal collection & filtration
  - Data processing
  - Image construction & display
- Workstation and software management
  - OS load
  - Application load
  - Cloning
  - Ghosting
  - Backup
  - Restore

- Lab activities:
  - Review logs
  - Artifact evaluation
  - Workstation maintenance

Day 5

- Advanced system diagrams
  - Communication busses
  - System block diagrams
- Advanced Planned Maintenance
  - QA & System logs
  - Magnet monitoring
  - System performance
    - Head coils
    - Body coils
    - Receive coils

- Lab activities:
  - Review advanced system diagrams
  - Perform advanced system maintenance