MedAustron

Accelerator Control System

Design, Installation and Commissioning

Johannes Gutleber
MedAustron Project

• Ion therapy center in Austria
• Designed and developed under guidance of CERN
• Project handed over to Austrian company in 2013

• Wiener Neustadt
• 50 km south of Vienna
• 1’000 km East of CERN
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Evolution of Radiotherapy
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Photon 2 Fields
Evolution of Radiotherapy

Photon 2 Fields

Photon 5 Fields
Evolution of Radiotherapy

Photon 2 Fields

Photon 5 Fields

Proton 3 Fields
Bragg Peak Effect

Penetration Depth (max. 35 cm)

- x-rays
- protons
- carbon ions

Relative Dose (%)

Area of Tumor

Healthy Tissue
Bragg Peak Effect

Penetration Depth (max. 35 cm)

Relative Dose (%)

- x-rays
- protons
- carbon ions

Area of Tumor

Healthy Tissue
Ion Therapy Accelerator

- Ion Sources
- Linear Accelerator
- Irradiation Rooms
- Synchrotron

Dimensions:
- 140 m
- 50 m
Best of Breed Design
Best of Breed Design

WinCC OA
Panels

Qt

C#

WPF
Best of Breed Design

Presentation (Tier 1)
WinCC OA panels with Qt extensions, Labview VIPs integrated with WinCC OA, ProShell C# framework and procedures (WPF)
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**Presentation (Tier 1)**
WinCC OA panels with Qt extensions, Labview VIPs integrated with WinCC OA, **ProShell** C# framework and procedures (WPF)

**Processing (Tier 2)**
100% virtualized (VMWare ESX server, Win 2008R2)
Supervisory control via **SIEMENS/ETM WinCC OA** (Ctrl scripts)
**SV/OPC** for command & monitoring, **HTTP** for FEC configuration
**Oracle** for accelerator configuration (**Repository Management System**), **Publisher/subscriber** (C#, C++, LV), **Virtual Accelerator Allocator**, **Logging service** from all systems via standard protocol
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Equipment (Tier 3)
PXIe (CPU 8135), Win 7, LV 2010, FECOS framework unifies configuration, commanding and monitoring (Cosylab), application components developed in Labview, 1 system VME/Linux/C++
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Frontend (Tier 4)
Thomson LLRF, CERN LLRF, Pantechnik VIs, DSP code, PLCs, …
Installation Timeline 2012

Oct 1, 2012
Building and IT ready

- Development setup at CERN
- Remote deployment via Citrix VDI and RDP
- 1 person on-site permanently
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Installation Timeline 2012

- Interlock system
- SCADA infrastructure
- Vacuum control
- Frontend controllers
- Timing system
- Analogue Signal Acq.
- Ion source control

Oct 1, 2012
Building and IT ready

Dec 10, 2012
Source commissioning start

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Installation Timeline 2012

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Installation Timeline 2013

- Development setup at CERN and in Austria
- Remote development until July 2013
- On-site deployment and development 3 people

February, 2013
On-site development setup
Installation Timeline 2013

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Installation Timeline 2013

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Commissioning Process

- Local Installation
- Local Commissioning
- Remote Commissioning
- Beam Commissioning
- System Validation
- Control System Involvement
Commissioning Process

Identify and place equipment, put under asset control, connect and make operational.
Commissioning Process

- **Local Installation**
- **Local Commissioning**
- **Remote Commissioning**
- **Beam Commissioning**
- **System Validation**

**Control System Involvement**

- **Identify and place equipment**, put under asset control, connect and make operational.
- **Test equipment** and performances
- **Verify safety** and interlock functions
- **Test controls communication** + configuration
Commissioning Process

**Local Installation**
- Identify and place equipment, put under asset control, connect and make operational.

**Local Commissioning**
- Test equipment and performances
- Verify safety and interlock functions
- Test controls communication + configuration

**Remote Commissioning**
- Verify equipment functions, performances and safety functions with control system

**Beam Commissioning**

**System Validation**

**Control System Involvement**
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  - Verify equipment functions, performances and safety functions with control system

- **Beam Commissioning**
  - Generate beam using control system including equipment. Determine settings for baseline configuration and store in repository

- **System Validation**

Control System Involvement
Commissioning Process

Local Installation

Identify and place equipment, put under asset control, connect and make operational.

Local Commissioning

Test equipment and performances
Verify safety and interlock functions
Test controls communication + configuration

Remote Commissioning

Verify equipment functions, performances and safety functions with control system

Beam Commissioning

Generate beam using control system including equipment. Determine settings for baseline configuration and store in repository

System Validation

Perform beam operation with all integrated systems. Measure performance and assess quality.
Phase Advancement
Phase Advancement

SAFETY AND QUALITY GATE
Phase Advancement

Preconditions

Phase C

Postconditions

SAFETY AND QUALITY GATE
Phase Advancement

SAFETY AND QUALITY GATE

Preconditions

Phase C

Postconditions
Lessons Learnt
Lessons Learnt

Systems Engineering
Lessons Learnt

Systems Engineering

Work with Contractor
Lessons Learnt

- Systems Engineering
- Work with Contractor
- Varying Involvement
CERN portfolio enriched with blueprint of medical accelerator
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Transfer from fundamental physics to life-science application
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Transfer from fundamental physics to life-science application

Large-scale knowledge transfer from CERN to member-state