### THE MEDAUSTRON ION THERAPY CENTER EXPERIENCES FROM 6 YEARS OF CLINICAL OPERATION

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### WHO we are:

 Ion therapy centre for cancer treatment and research

 One of only 12 centers worldwide treating with Carbon ions

Patients from all over the world

220 employees



### RADIOTHERAPY IN GENERAL

- The aim is to **prevent further proliferation** of the tumor cells
- This requires a **high radiation dose** in the tumor cells
- Organs at risk tolerate only a low radiation dose





### THE PRINCIPLE OF PARTICLE THERAPY



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### FACILITY OVERVIEW



- Synchrotron based
- Injector operated at 7 MeV
- 77.6 m circumference Synchrotron
  - Extraction via betatron core









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### MEDICAL PRODUCT

>MedAustron is a medical device manufacturer

- We follow the stipulations defined by the European Medical Device Regulation
- We have a Quality Management System according to ISO 13485 established
- > Wherever possible: Follow industrial standards



### DETOUR: MEDICAL PRODUCT DEVELOPMENT



Graphical illustration taken from product development process



### INDICATIONS TREATED AT MEDAUSTRON



Values July 2022 • values rounded



### DEVELOPMENT OF MEDAUSTRON





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### CHALLENGES

- Integration of new rooms into ongoing operation
- Maintain **quality** standards (medical device)
- 8 modalities currently
- Communication and organization
- Documentation
- Keep uptime high
- Constant development

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### TREATMENT STATISTICS



patients – -treatment duration



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# MEDICAL PRODUCT - INCIDENT HANDLING

- All incidents are recorded
  - O Downtime
  - O Circumstances
  - Machine Set-up
- Review of incidents
  - Grouping of incidents
  - Priorisation of incidents
  - O Define measures
- Error codes are used to group them
  Total downtime per error
  Frequency of occurence

#### **One timer:**

- High downtime/incident
- Single occurrence
- Mostly hardware issues
- E.g.: Shim-cident

### **Systematic errors:**

- minor downtime/incident
- Frequent occurence → high total downtime!
- Software issues, design flaws



### EXPECT THE UNEXPECTED

### An insight into selected issues at MedAustron



### SHIM-CIDENT (before patient treatment)

### Shims:

- Correct magnetic field inhomogenities
- Adjust magnetic field length

#### What happend?

- Change in beam orbit
- Beam losses
- Intensity reduction











- Immediate (temporary) shim repair
- Find long term solution (redesign)

- Re-commissioning
- Re-acceptance of beams
- Pulsing test annually



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# DIPOLE CHAMBER LEAK

- Carbon beam hitting weld of chamber
- Weld is leaking





- Increase of vacuum pressure on extraction side of Source
- Unstable working conditions
- Occurence: 2 times





- New chamber design  $\rightarrow$  weld outside
- Thicker out wall
- Pulsed operation of the ion source is being considered







# DIPOLE CHAMBER DEPOSIT

#### **Reduced p+ current**

- Beam profiles after spectrometer different compared to the reference
- There are no intercepting beam line elements between ion source and beam diagnostic tank









# DIPOLE CHAMBER DEPOSIT

- Large metallic flakes were found inside the chamber
- Changes in the magnetic field moved these flakes and affected the beam
- Chamber has been magnetized





#### **Measures:**

- Preventive
  - maintenance adapted
- Observing
  - **QA-measurement**





### **SUMMARY**

MedAustron is a synchrotron based center for ion therapy for cancer treatment and research

• Presently 45 patients/day

• Provider of proton and carbon beam

• Medical product: Importance of incident handling and documentation



# **QUESTIONS ?**







