Operation of S-DALINAC for more than 30 Years by Students


Work supported by DFG through GRK 2128
Outline

• Introduction
  • S-DALINAC
  • Control Room

• Operations Team
  • Organisational Structure
  • Tasks

• Examples
  • Improvements, Upgrades
  • Knowledge Transfer
  • Keep Aging Accelerators Running

• Summary
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• Summary
S-DALINAC
Superconducting-Darmstadt-Linear-Accelerator

General parameters:

Modus: cw-operation
Operating frequency: 3 GHz
Max. energy: 130 MeV
Max. current: 20 µA (60 µA)

• Built in the 1980s
• First beam in 1987
• 1991 first recirculated beam
S-DALINAC
Superconducting-Darmstadt-Linear-Accelerator

**Purpose**
- Deliver beam for experiments + education in nuclear physics
- Accelerator science + education in accelerator physics
- Not a user-facility, but a machine of a university (→ third party funding projects)

- Installation, upgrades and improvements over the years (thesis work)
Control Room

Panorama view:
Door to measurement room, floorplan with names of all elements, operational section, monitoring and safety section
Control Room

Operation or monitoring of all parameters

Magnet or RF settings
Control Room

Personnel and machine safety interlock, monitoring cryo plant

View of screens, main alarm system (cryo plant, infrastructure)
Operators Interface

Start center

RF main overview
Digital Oscilloscope

SRF cavity controlled

SRF cavity not controlled
Diagnostic Screens

Beam loss monitor system  

Target controlling
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Organisational Structure

Head of Operations (Dr., permanent)

Head of Control System Group (Dr., permanent)

Control System Group (students, non-permanent)

Other Scientific Members (students, non-permanent)

Technical Group (permanent)

Student Assistants (night, weekend) (non-permanent)
Organisational Structure

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In charge of operation

Number of People:
1 Head of Operations
1 Head of Control System Group
5 Control System Group Members
3 Other Scientific Members
1 Technical Group
5 Student Assistants
10-15 Student Assistants
Organisational Structure

- Head of Operations (Dr., permanent)
- Head of Control System Group (Dr., permanent)
- Head of Technical Group (permanent)
- Control System Group (students, non-permanent)
- Other Scientific Members (students, non-permanent)
- Student Assistants (night, weekend) (non-permanent)

Education in accelerator physics

In charge of operation

03.10.2018 | Michaela Arnold | TU Darmstadt | AG Pietralla | Operation for more than 30 Years by Students
An Educational Accelerator...

Tasks done mainly by students:

- Operation of cryo plant
- Beam tuning and SRF cavity operation
- Maintenance of beam line and diagnosis
- Work on vacuum system
- Maintenance of SRF cavities/cryostats (including work in clean room)

- Simulations
- Construction of elements (with help of technical staff)
Tasks done mainly by students:

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- Construction of elements (with help of technical staff)
... leads to Fleeting Knowledge

- Exchange of students at least after PhD thesis finished
- Exchange of student assistants typically every 1-3 years

→ Training of new students and student assistants
  - Observation of experienced members
  - Wiki with how-to’s, background information, check lists,…
  - Learning by doing
  - Regular courses for student assistants
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Improvements, Upgrades (Examples)

New recirculation beam line including energy-recovery linac (ERL) mode (PhD thesis)
- „Hot topic“ in accelerator physics
- Many open questions

High-energy scraper-system (PhD thesis)
- Improvement of energy resolution for experiments
- Stabilization of beam energy
Knowledge Transfer (Examples)

Leak in LN$_2$ shielding of cryostat (March 2017)
• Complete disassembly and re-assembly of cryostat module
• Done by students with the help of technical staff
Knowledge Transfer (Examples)
Knowledge Transfer (Examples)

- Balancing
- Electrically Lifting
- Tibetan Step Lifting
- Lifting with Stand

Knowledge Transfer
- Examples

- Operation for more than 30 Years by Students
Keep Aging Accelerators Running
(Examples)

• Regular maintenance of main machines (cryo plant, cooling water and compressed air production,...)

• Exchange of aged elements to prevent damages: e.g. o-ring gaskets

• Regular check of all elements (beam diagnostics, valves, pumps,...)

• Most important spare parts have to be in stock

• Be creative in fixing broken parts! (spare parts could be difficult to find)
Keep Aging Accelerators Running
(Examples)

Refurbishment of cryo plant due to loss of cooling power

2 K pumping station
(Leybold 4x 2g/s warm, 2004)

2 K refrigerator providing ~120 W
(SULZER TCF 100/2K L/R, 1982)

Compressor
(Kaeser ESD 351, 2003)

Picture: www.resale.de
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Take Home Message

Introduction
S-DALINAC and control room
Take Home Message

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S-DALINAC and control room

Organisational structure, educational accelerator

Very good hands-on training!
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Examples
Thank you for your attention!

Picture: Jan-Christoph Hartung