EUROPEAN
SPALLATION
SOURCE

ESS safety strategy on commissioning and operation

Commissioning Workshop 10-12 October 2022

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Outline

1 Safety integrated in engineering phases

2 Safety strategy on commissioning and operation

3 Example of review of safety before commissioning with proton beam

4 Possible topics to discuss

5 Summary

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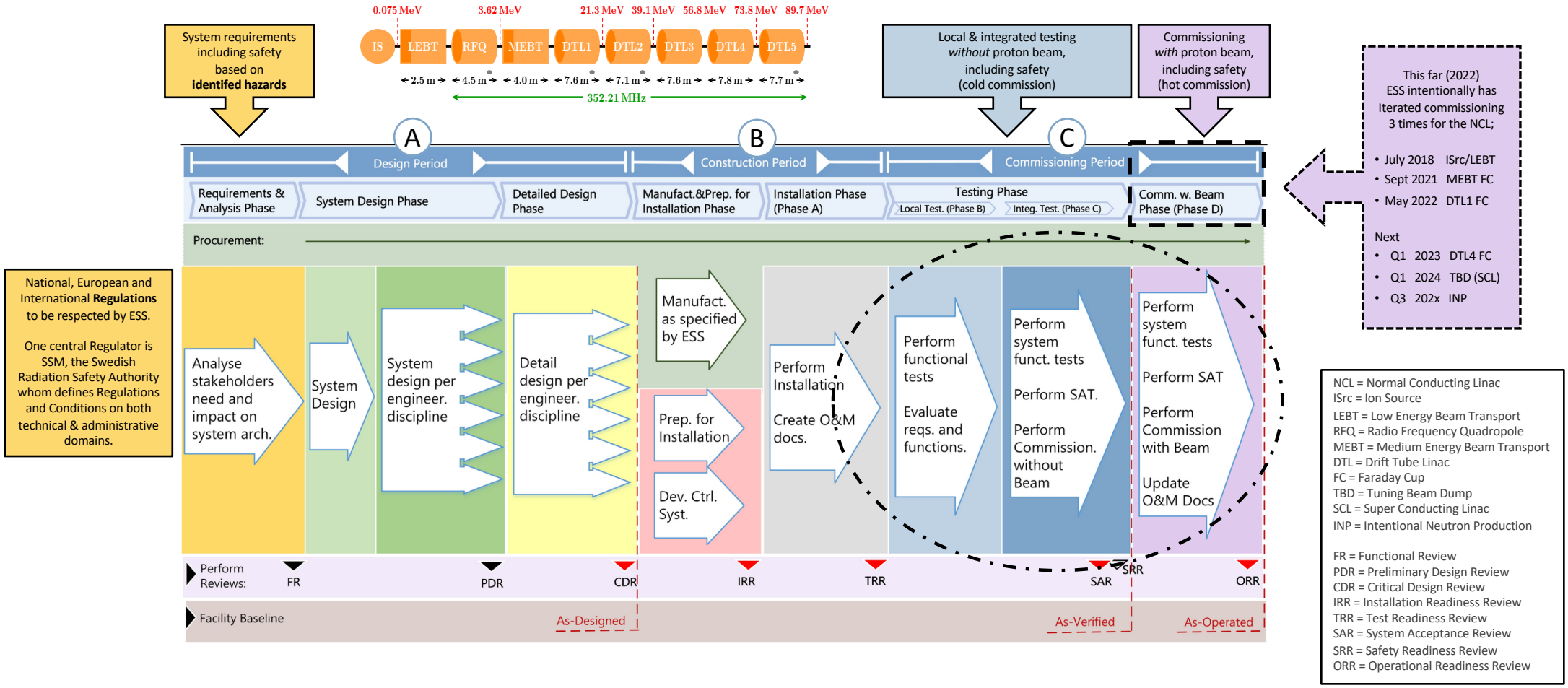
Safety integrated in engineering phases

Part of the
Normal Conducting Linac

Safety integrated in engineering phases



National, European and International **Regulations** to be respected by ESS.

One central Regulator is SSM, the Swedish Radiation Safety Authority whom defines Regulations and Conditions on both technical & administrative domains.

This far (2022) ESS intentionally has Iterated commissioning 3 times for the NCL;

- July 2018 ISrc/LEBT
- Sept 2021 MEBT FC
- May 2022 DTL1 FC

Next

- Q1 2023 DTL4 FC
- Q1 2024 TBD (SCL)
- Q3 202x INP

NCL = Normal Conducting Linac
ISrc = Ion Source
LEBT = Low Energy Beam Transport
RFQ = Radio Frequency Quadropole
MEBT = Medium Energy Beam Transport
DTL = Drift Tube Linac
FC = Faraday Cup
TBD = Tuning Beam Dump
SCL = Super Conducting Linac
INP = Intentional Neutron Production

FR = Functional Review
PDR = Preliminary Design Review
CDR = Critical Design Review
IRR = Installation Readiness Review
TRR = Test Readiness Review
SAR = System Acceptance Review
SRR = Safety Readiness Review
ORR = Operational Readiness Review

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Safety strategy on commissioning and operation

Proton beam stop after DTL1 (21,3 MeV)

Safety strategy on commissioning and operation

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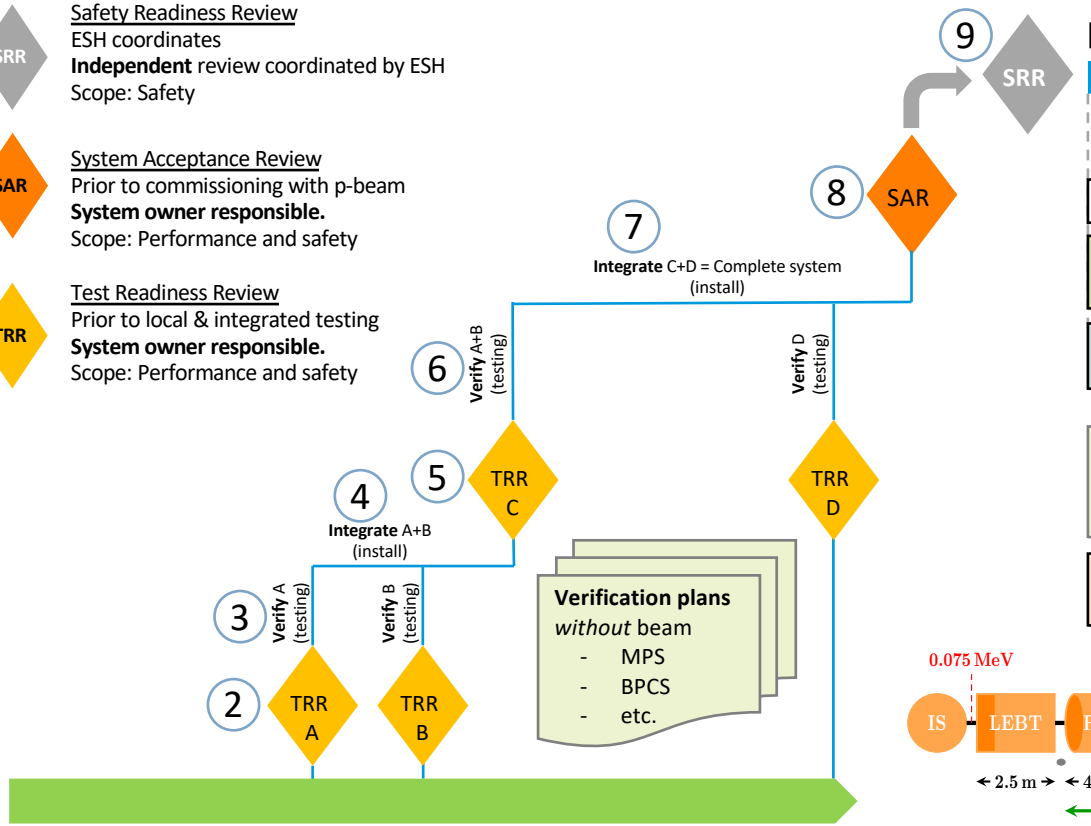
SRR — Safety Readiness Review
ESH coordinates
Independent review coordinated by ESH
Scope: Safety

SAR — System Acceptance Review
Prior to commissioning with p-beam
System owner responsible.
Scope: Performance and safety

TRR — Test Readiness Review
Prior to local & integrated testing
System owner responsible.
Scope: Performance and safety



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proton beam commissioning | **continuous operation**

Verify C+D = Complete system **Commissioning**

Operate Complete system **Operations**

OLC – Operational Limits and Conditions

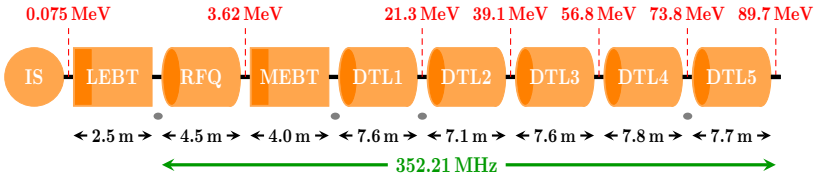
System Permit and **Beam Authorisation**

Permit **Operations**

Commissioning plan

Verification plans *with* beam
- MPS
- BPCS
- etc.

Emergency Preparedness Plans and a defined **Safe State**



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MPS = Machine Protection Systems
BPCS = Basic Process Control System

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Example of review of safety before commissioning with proton beam

Safety review May 2022 up to DTL1 FC

Example of review of safety before commissioning with proton beam

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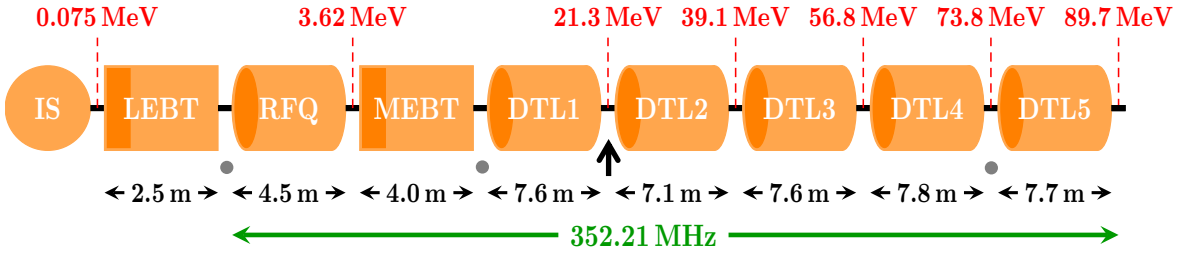
Licence to Operate these NCL phases already received from SSM.



Hazards

- Ionising radiation
- Non-ionising radiation (RF)
- Electrical
- Fire
- Explosives
- Pressurised equipment
- Etc.

Safety measures (Engineered)

- Shielding
- Personnel Safety System (PSS1)
- Radiological & Environmental Monitoring Systems (REMS)
- Machine Protection Systems (MPS)
- Fire alarm
- Fire sprinkler (water)
- ATEX zones for explosive atmospheres
- Safety valves for pressurised equipment
- Etc.

Safety measures (Administrative)

- Organisation
- Roles & Responsibilities
- Training
- MCR activities including meeting structure
- Operation & Safety procedures
- Etc.

In addition

- Overall commissioning plan
- System specific commissioning plan
- Verification *reports* without beam
- Verification *plans* with beam

Roles (some examples)

- Shift leader & Operator
- Beam Commissioning Coordinator
- Study leaders
- Machine section coordinator
- Occupational Health & Safety
- Radiation Protection
- Electrical Operation Leader
- First Responder
- Emergency Response Team

Procedures (some examples)

- Operational Limits and Conditions
- Local rules for safety
- Procedure for work orders
- Rules for interlocks
- Rules for software updates
- Procedure for Beam Parameter Limits
- Beam Switching procedure
- OPI Handbook (Operator Interfaces)
- Emergency procedures
- Establishment of the Safe State

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SSM = Swedish Radiation Safety Authority

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MCR = Main Control room

The Safety Readiness Review (SRR) is a process by which
EQUIPMENT, PERSONNEL and PROCEDURES
associated with commissioning/operation are verified with respect to safety.

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Possible topics to discuss

View of local control room

Possible topics to discuss

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- Safety envelope or safety criteria for accelerator, target and instruments.
- Actions required if operation is deviating from the safety envelope.
- Safe state descriptions. Principles and parameters.
- Criteria for when to apply change control / configuration management for modifications or repairs.

5 Summary

Summary
ESS safety strategy on commissioning and operation

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- Identification of safety requirements in the design process.

- Local & integrated testing (verification of requirements) system by system without proton beam.
  Including safety requirements.

- Stepwise commissioning & testing of different parts of ESS with proton beam (accelerator, target, Instruments).
  Including safety.

- Later on gradual power increase with proton beam together with additional testing.
  Including safety.

- Systematic review approach for each step.
  Including safety.

- Systematically collecting lessons learned from each step and also learning from others via experience exchange.

Thank you