

ESS reliability and availability approach

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The European Spallation Source

European Spallation Source



Main headlines

- World's leading neutron source
- A user facility providing outstanding scientific performance
- High brightness
- High reliability
- Environmentally friendly

Technical scope

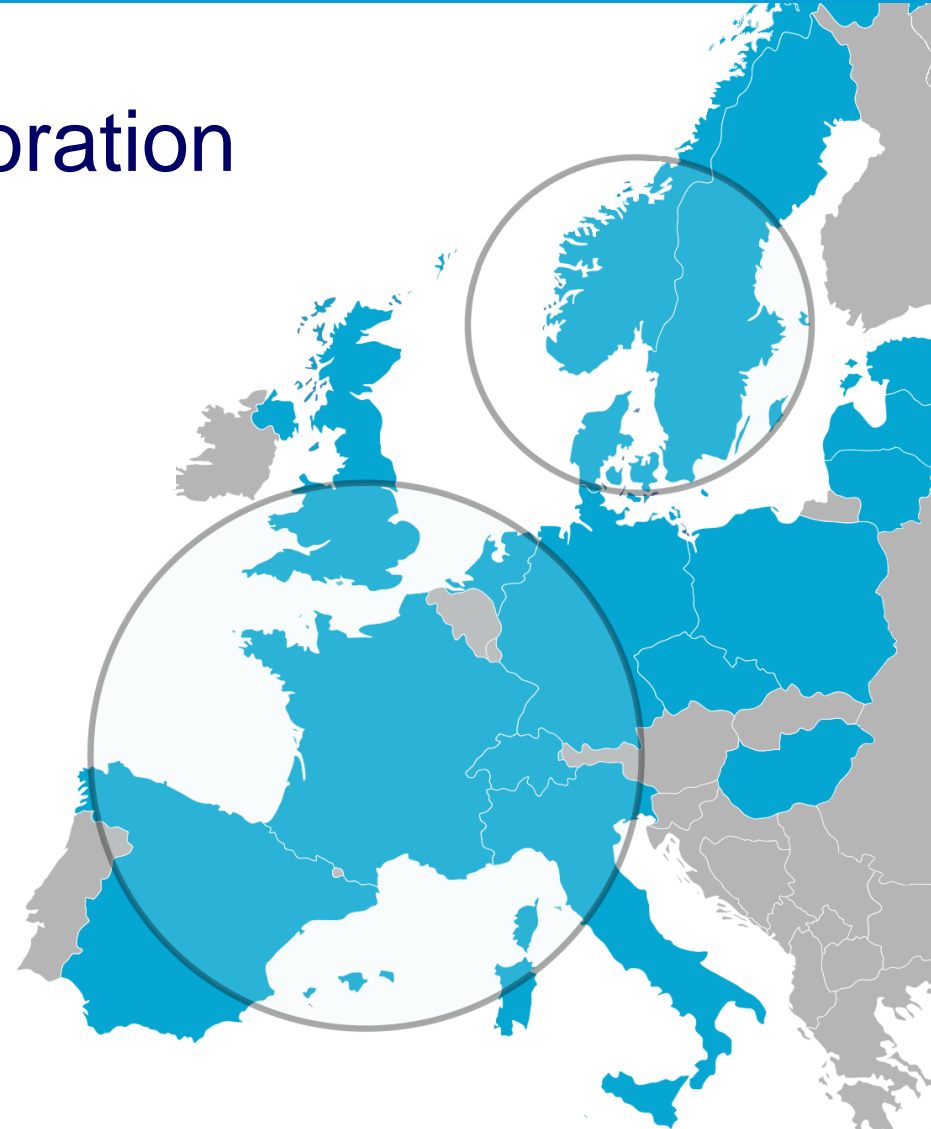
- Accelerator: protons, 5 MW, long pulse, 2.86 ms, 14 Hz
- Target: Tungsten rotating wheel, helium cooled, new moderator.
- 22 instruments
- Construction budget 1.8 B€
- Operation budget 140 M€/year
- Receiving 2000-3000 users per year

The ESS project

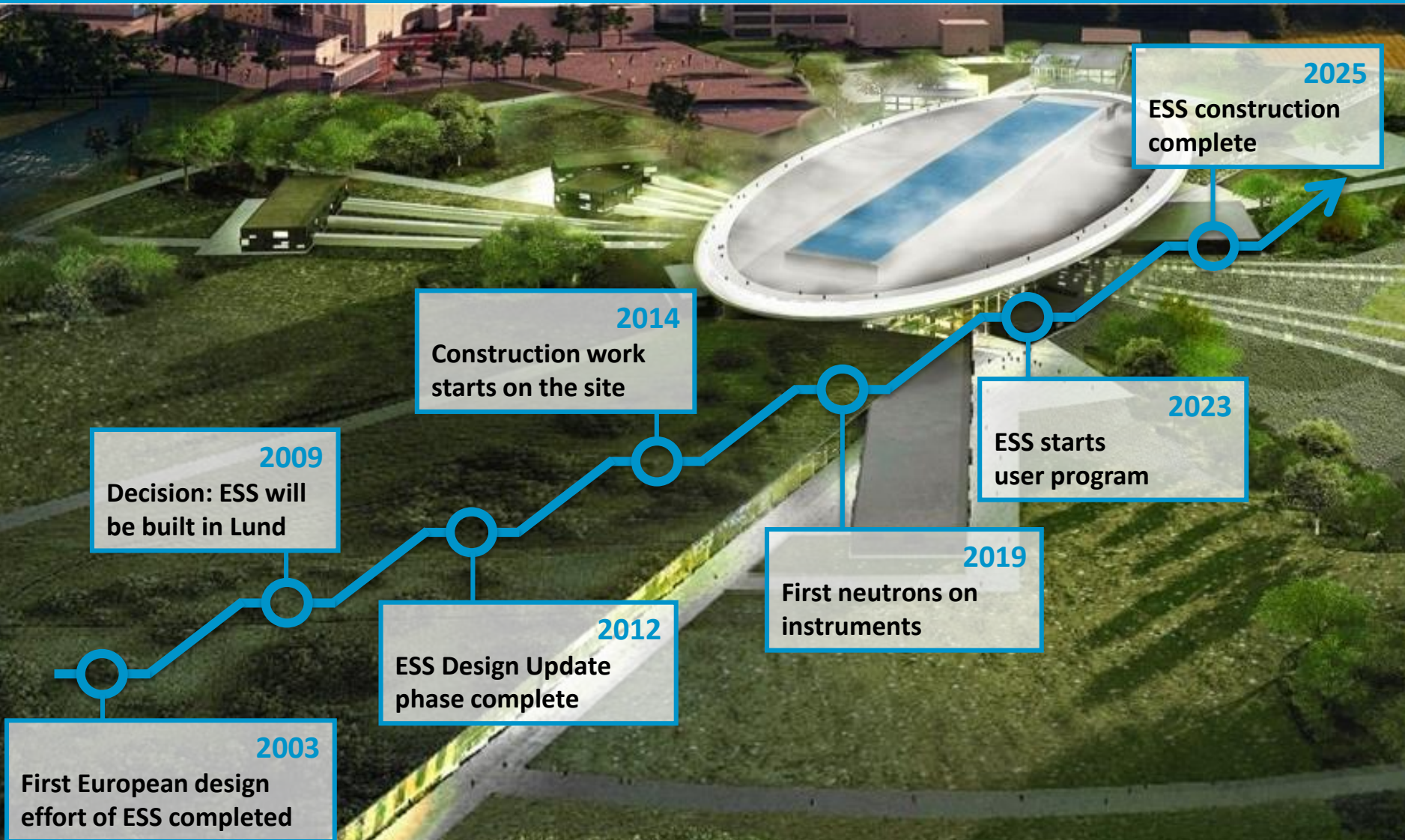
International collaboration

Sweden and Denmark:
47.5% Construction
15% Operations
100% Cash

Partner Countries:
52.5% Construction
85% Operations
~70%/30% In-Kind/Cash



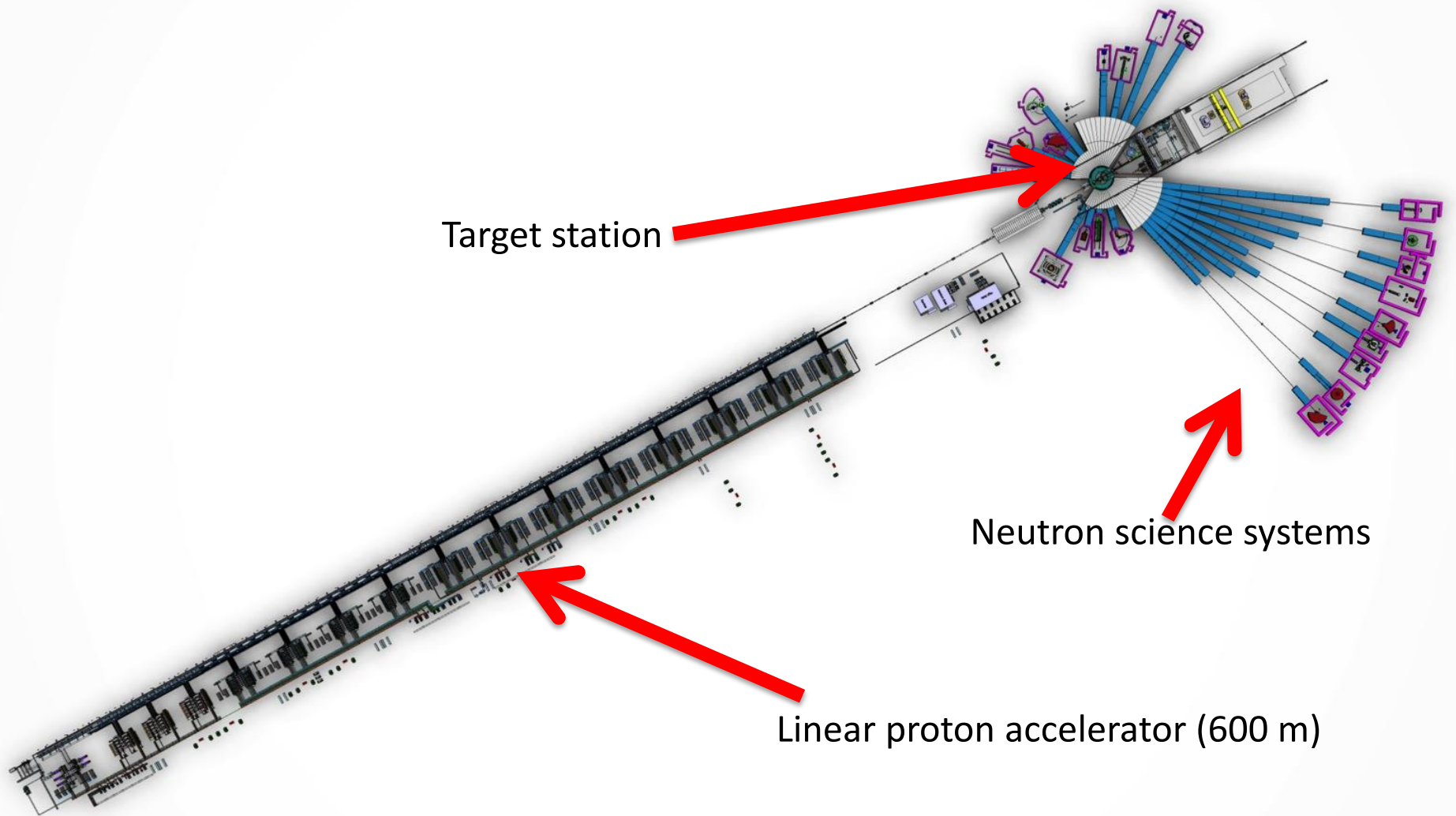
Main milestones of the project



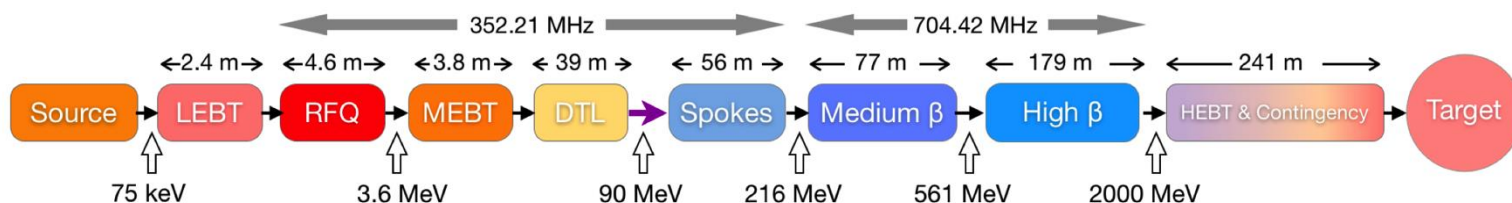
Construction



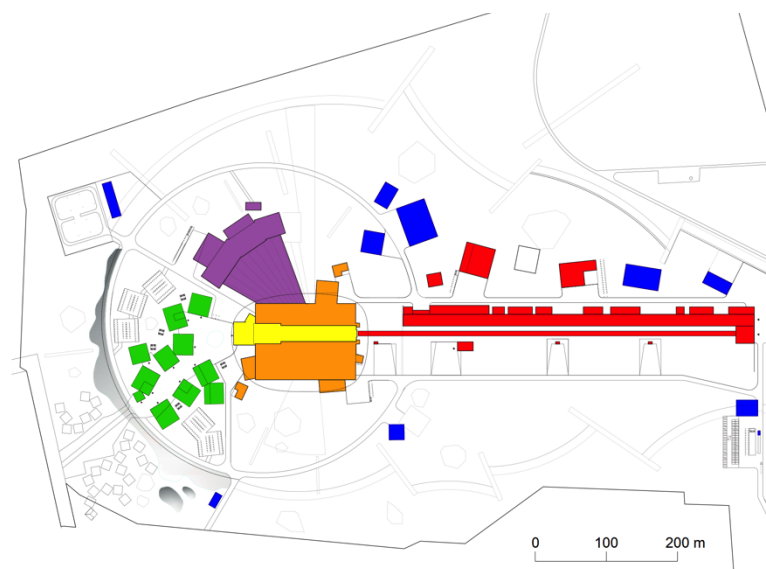
ESS production of neutrons for science



ESS Linac Parameters



Particle species	p
Average power	5 MW
Energy	2.0 GeV
Current	62.5 mA
Peak power	125 MW
Pulse length	2.86 ms
Rep rate	14 Hz
Max cavity surface field	45 MV/m
Operating time	5200 h/year



Reliability and Availability at ESS

- **ESS goal:** science produced by the users
 - High brightness neutron beam
 - High reliability and availability of the beam
- **Reliability and availability analyses goals:**
 - Translate users needs into technical requirements
 - Analyze the design to see if the requirements can be achieved
 - Propose changes if necessary
 - Give a global overview of the future operation of the machine in the design phase

ESS RAMI goals: science production

- ESS users' and stakeholder's needs
 - High brightness neutron beam
 - High availability and reliability of the neutron beam
- RAMI goals
 - Available beam for users: 4000h/year
 - At least 90% of the users should receive a neutron beam that will allow them to execute the full scope of the their experiments in their first attempt.

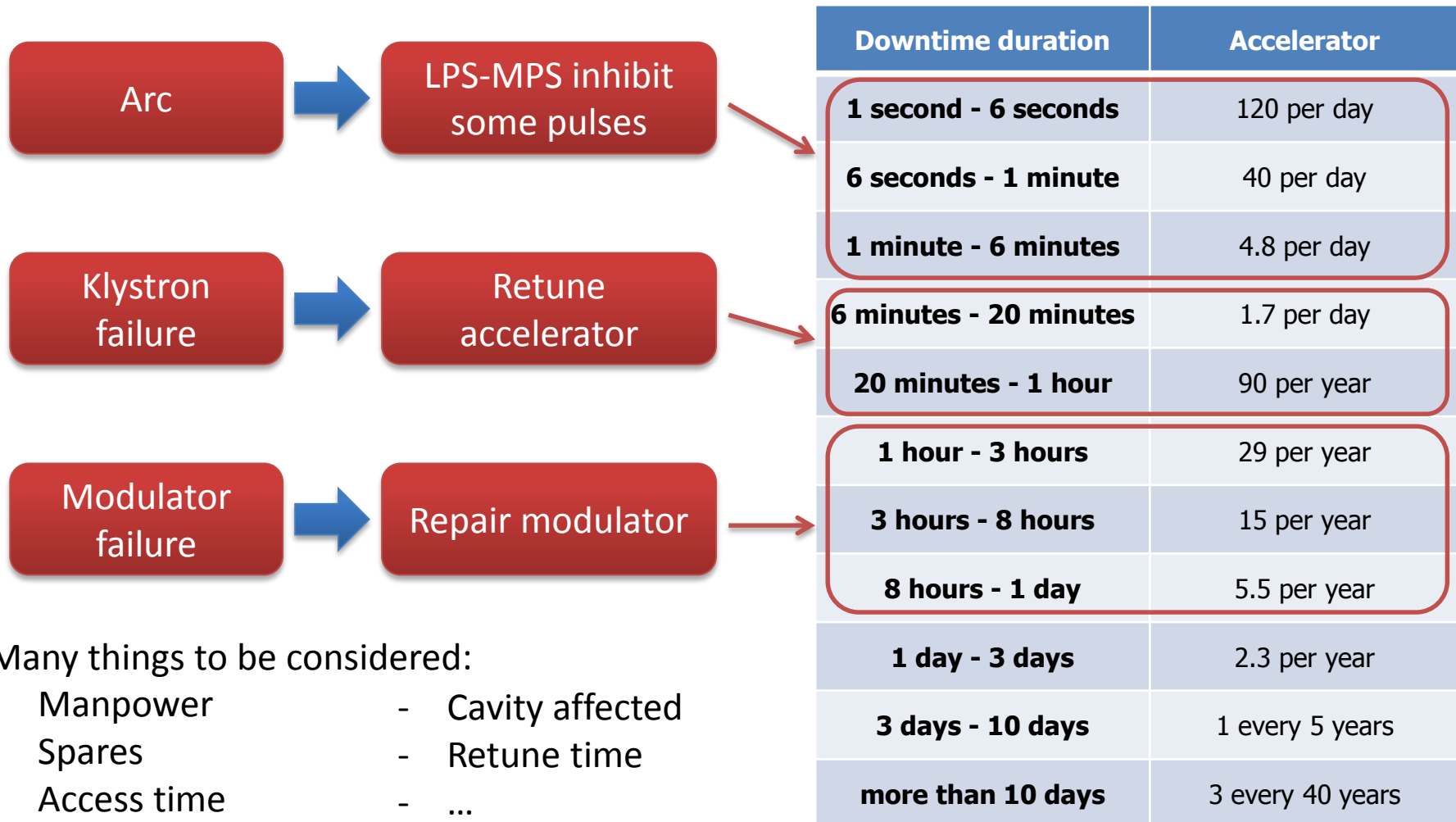
ESS RAMI requirements (preliminary)

- Maximum tolerable number of events with certain duration

Downtime duration	Maximum number of events
1 second - 6 seconds	120 trips per day
6 seconds - 1 minute	40 tips per day
1 minute - 6 minutes	5 trips per day
6 minutes - 20 minutes	350 trips per year
20 minutes - 1 hour	99 trips per year
1 hour - 3 hours	33 trips per year
3 hours - 8 hours	17 trips per year
8 hours - 1 day	6.7 trips per year
1 day - 3 days	2.4 trips per year
3 days - 14 days	0.65 trips per year
14 days - 3 months	1 every 5 years
3 months - 10 months	1 in 100 years
more than 10 months	1 in 500 years

- All of them can occur and the users' and stakeholder's requirements would be fulfilled.

Requirements at AD: Failure examples



Many things to be considered:

- Manpower
- Spares
- Access time
- Cavity affected
- Retune time
- ...