SNS Operation and Upgrade Plans

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Outline

- **Bottlenecks for Beam Power**
  - **New RFQ**
  - **Beam Energy**
  - **Target**
- **Near Future Plan**
- **Upgrade Plans**
  - **Proton Power Upgrade (PPU)**
  - **Second Target Station (STS)**
- **Summary**

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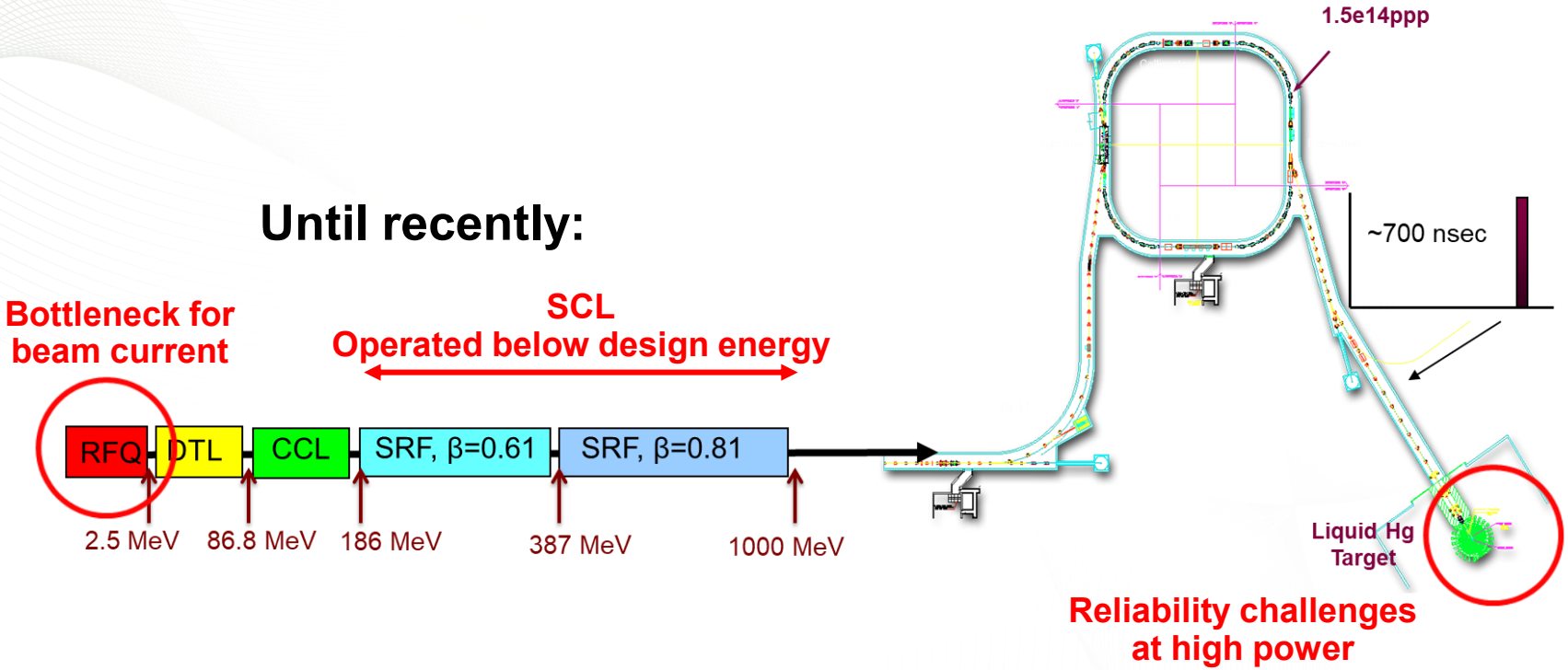
Bottlenecks for Beam Power at SNS



- ❑ Problems with Front End and SCL final energy are solved.
- ❑ The target development is an ongoing activity.

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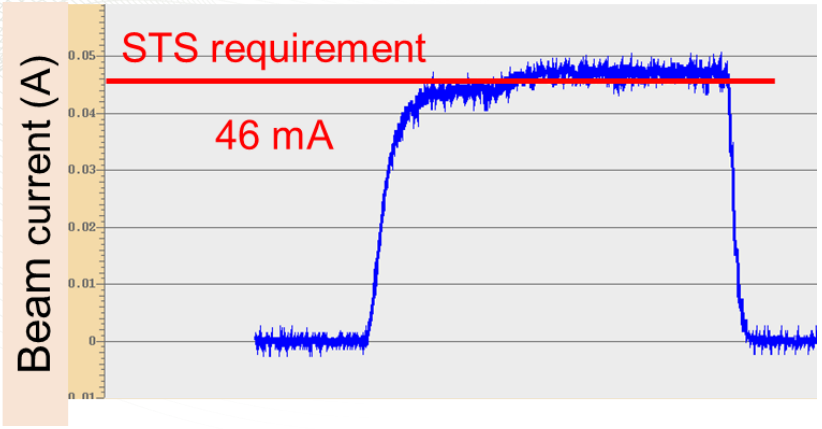
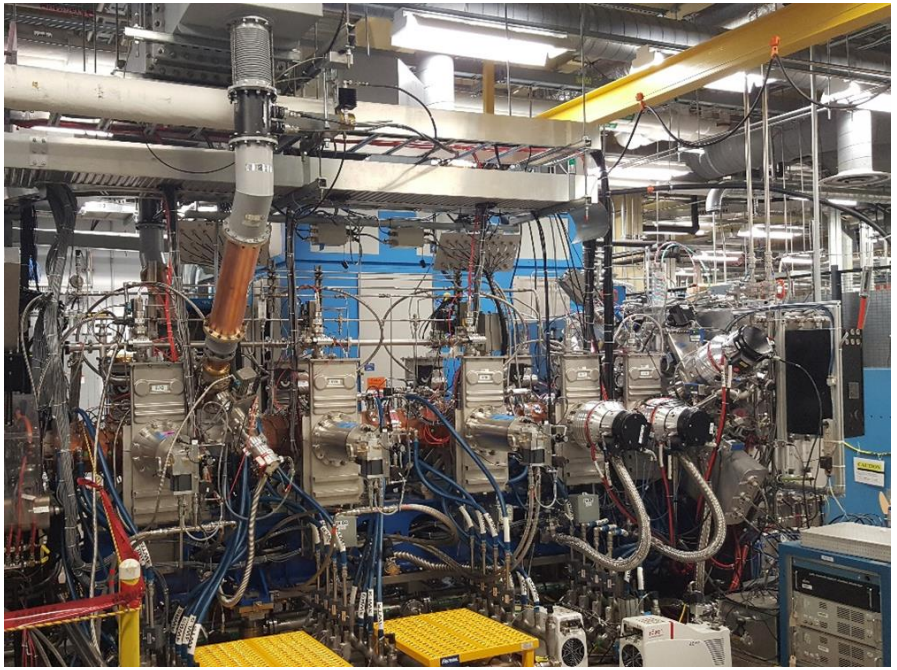
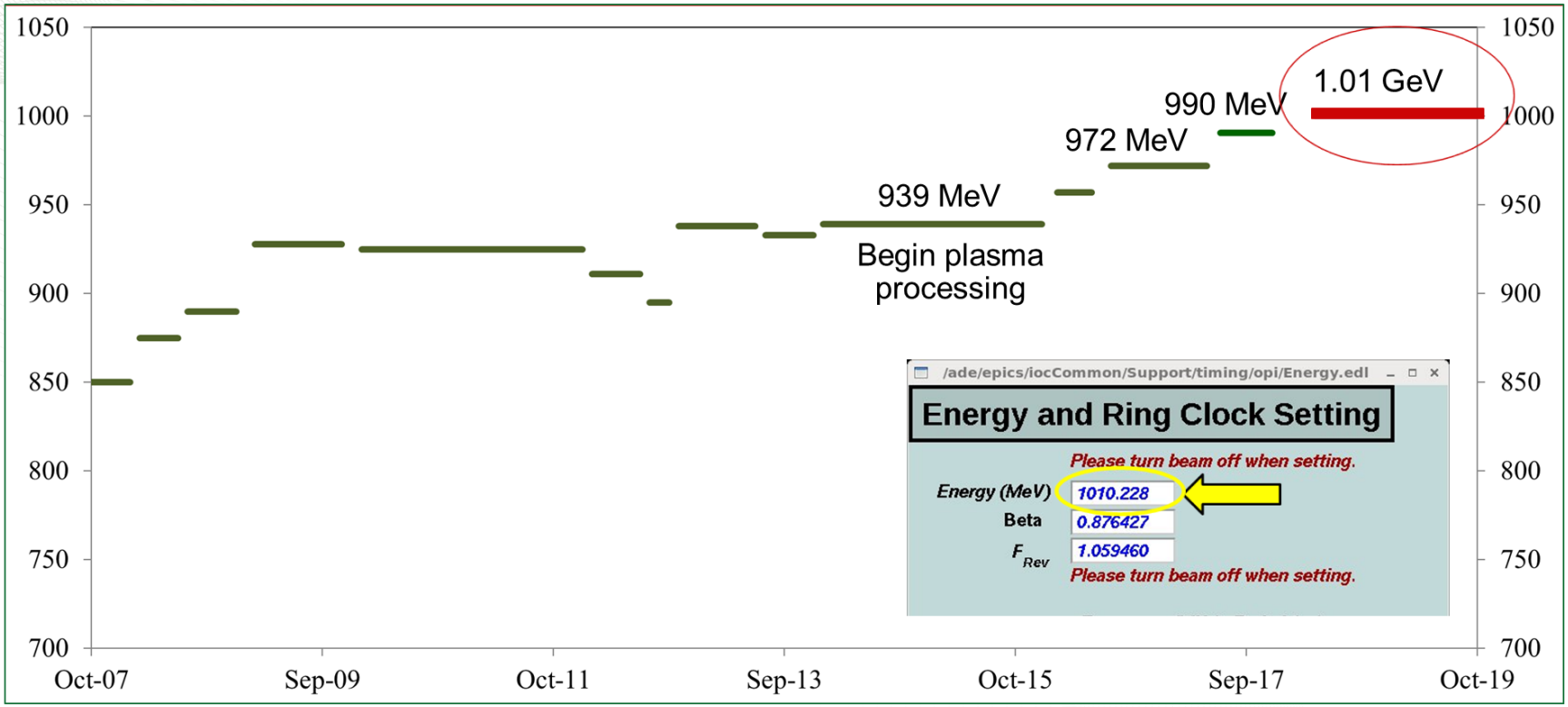
New RFQ Installed in Spring 2018





- **New RFQ was tested at the SNS Beam Test Facility**
- **Installed during 5 months outage (Inner Reflector Plug replacement)**
- **Commissioned at the end of April**
- **Transmission about 94 %**
- **SNS Front End is ready for Second Target Station Upgrade**

Final Beam Energy is 1.01 MW



- **In total 32 cavities have been plasma processed**
- **Two carts have doubled the rate of in situ plasma processing in last 2 outages**
- **Average gradient increase of 20%**
- **No decrease in gradient observed for plasma processed cavities**

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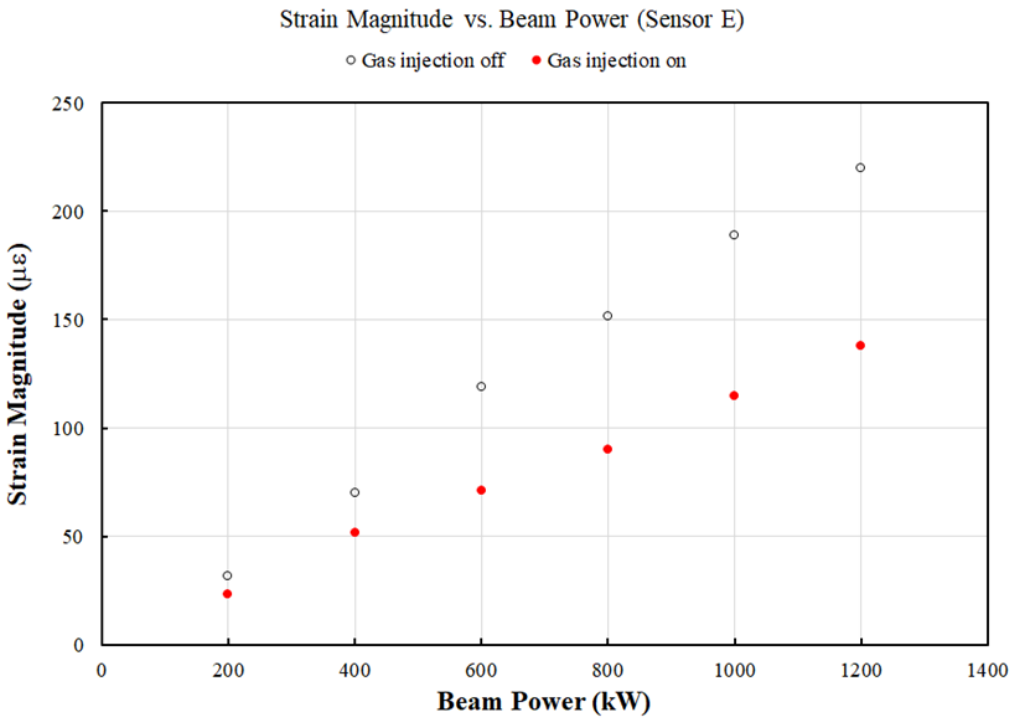
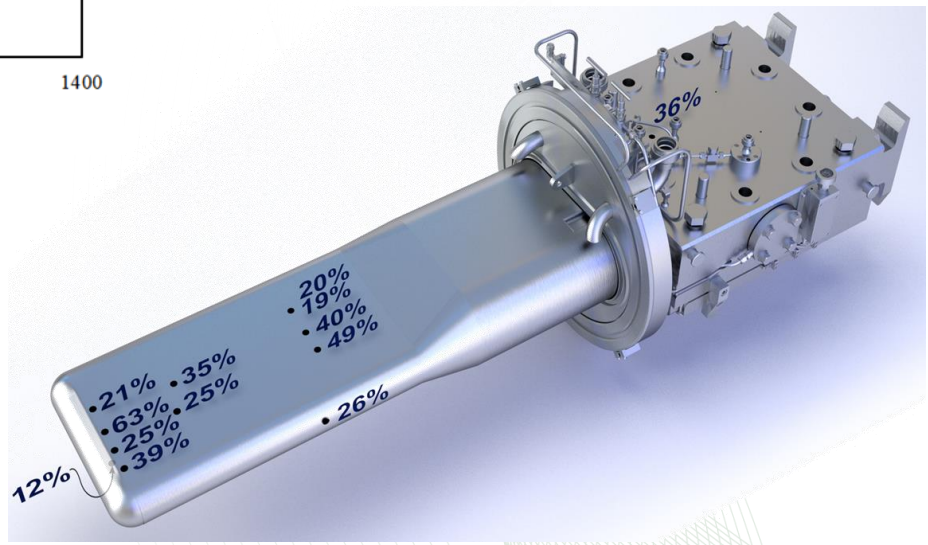
Target with Gas Injection



Strain measurements showed 10%–60% reduction in strain during first phase of gas injection



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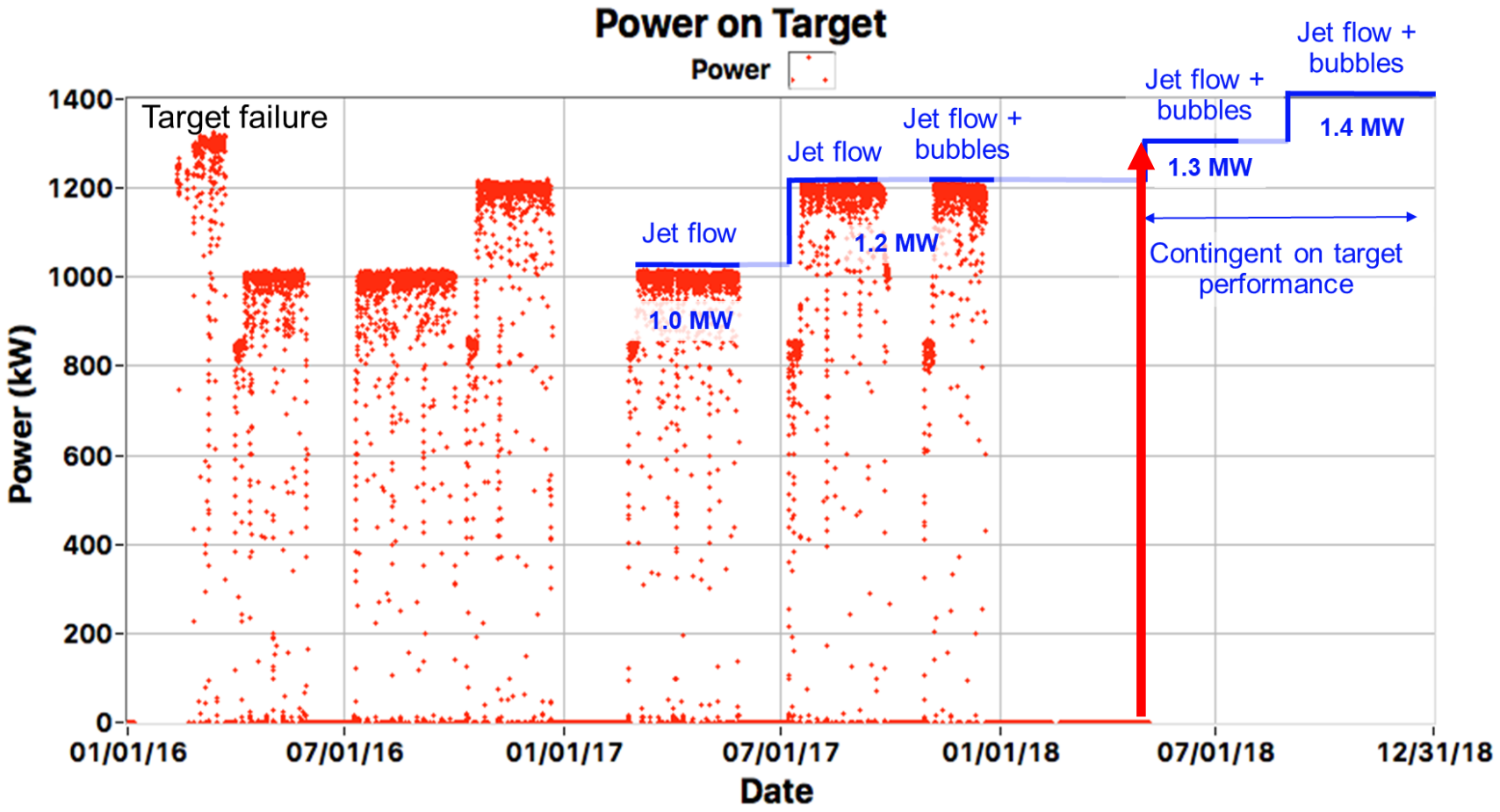
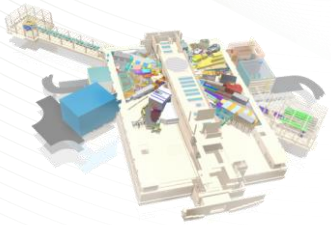
Beam Power History and Near Future Plans



Today we have 1.3 MW

SNS Upgrade Plans

24 instrument positions
19 instruments built



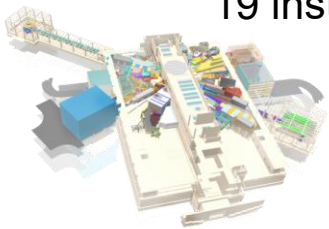
FTS

1.4 MW

Accelerator

Now

24 instrument positions
19 instruments built



FTS

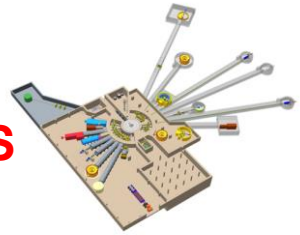
2 MW

0.8 MW

Accelerator

22 instrument slots,
8 initial instruments

STS



After STS Upgrade

After PPU Upgrade

FTS – First Target Station
STS – Second Target Station
PPU – Proton Power Upgrade

- **Proton Power Upgrade project doubles accelerator power capability**
  - **Increases FTS capability + capacity and provides accelerator basis for STS**
- **Second Target Station provides new instrument hall with world class cold neutron brightness**

PPU Parameters: ΔPower = Δenergy*ΔCurrent

	SNS 1.4 MW	PPU FTS 60 Hz operation	PPU full upgrade capability
Proton beam power capability (MW)	1.4	2.0	2.8
Beam energy (GeV)	1.0	1.3	1.3
RFQ output peak beam current (mA)	33	46	46
Average linac chopping fraction (%)	22	41	18
Average macropulse beam current (mA)	25	27	38
Energy per pulse (kJ)	23	33	47
Pulse repetition rate (Hz)	60	60	60
Macro-pulse length (ms)	1	1	1
FTS decoupled moderator brightness/pulse (AU)	1	1.43	2.04
FTS coupled moderator brightness/pulse (AU)	1	1.51	2.16

+30%

+50%

No change

- **PPU delivers 2.8 MW capable accelerator**
- **Prior to STS, accelerator will run at 2 MW to FTS**

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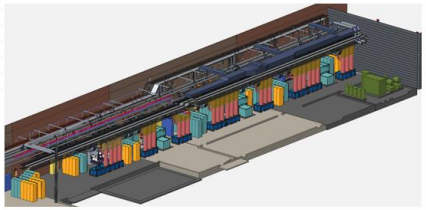
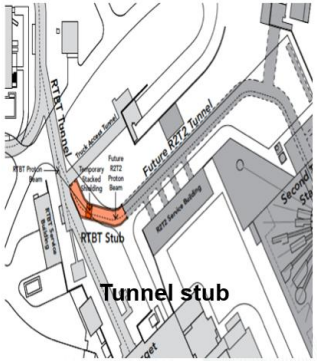
PPU Technical Scope

Conventional Facilities

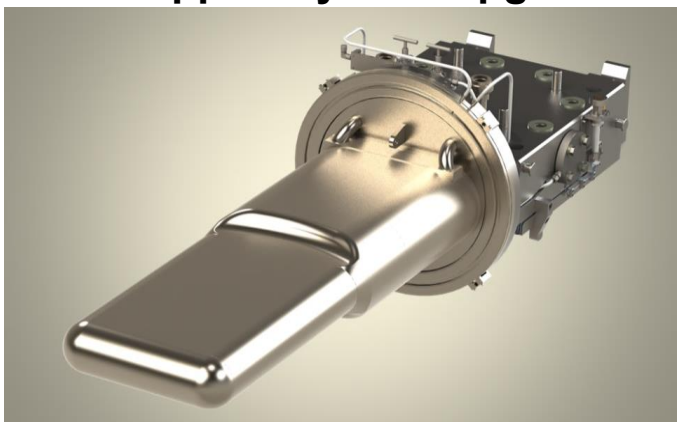
Klystron gallery





Target systems:

- **2 MW target vessel**
- **Support system upgrades**



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PPU Guiding Principles

- Minimize SNS operational impact
- Target: Leverage ongoing operations target improvements
- Optimize built-in facility upgrade provisions and build on operational lessons
- Accelerator
  - Use existing technology where possible
  - Utilize partnerships, sub-contract
  - No equipment rework for STS following PPU

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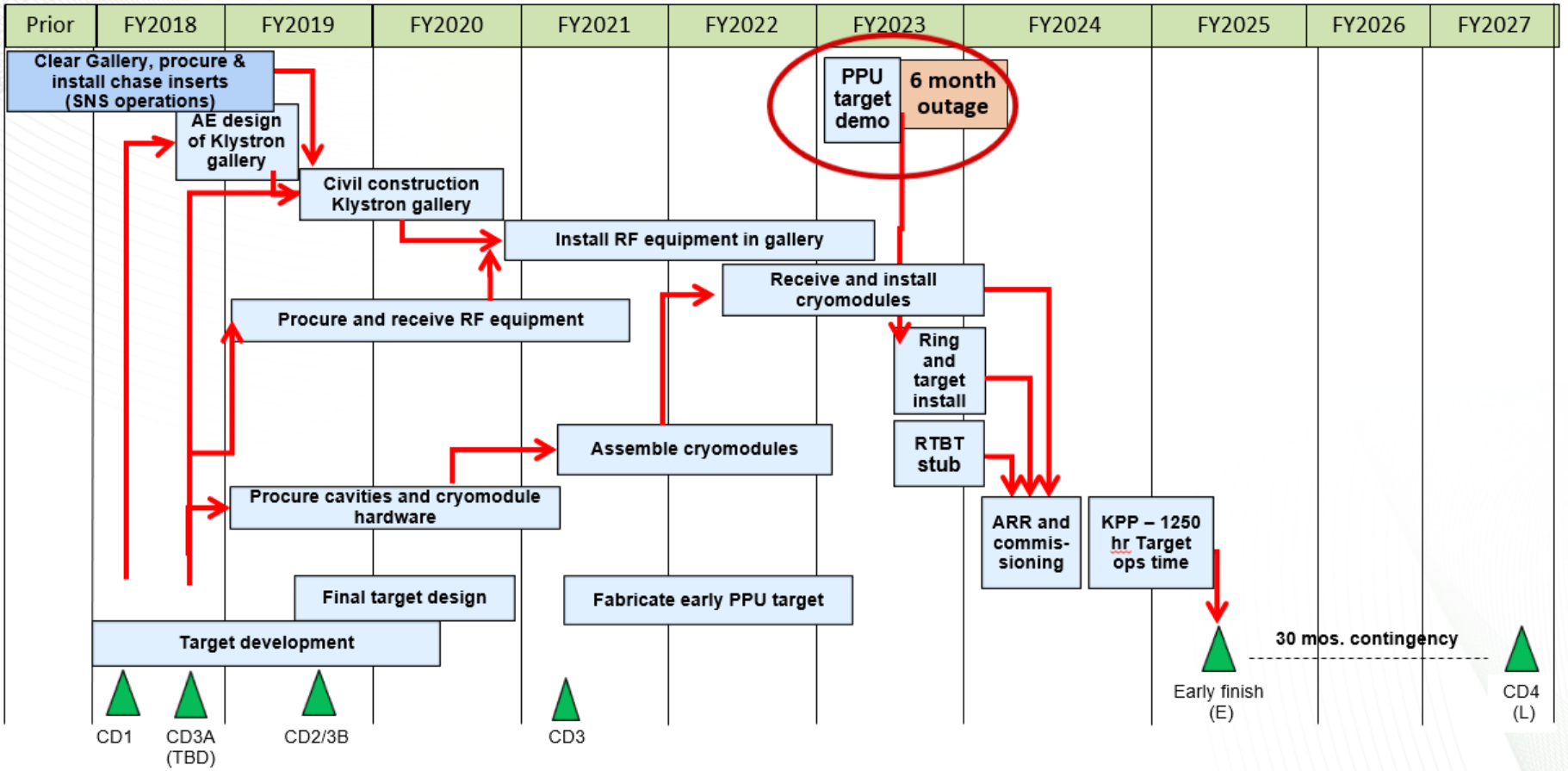
PPU Notional Schedule (John Galambos)



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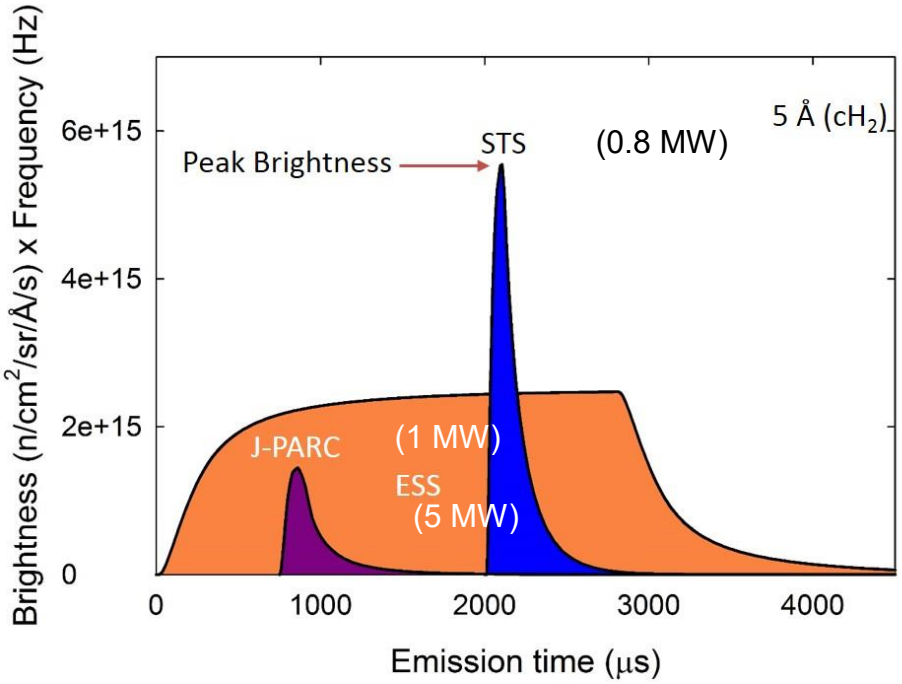
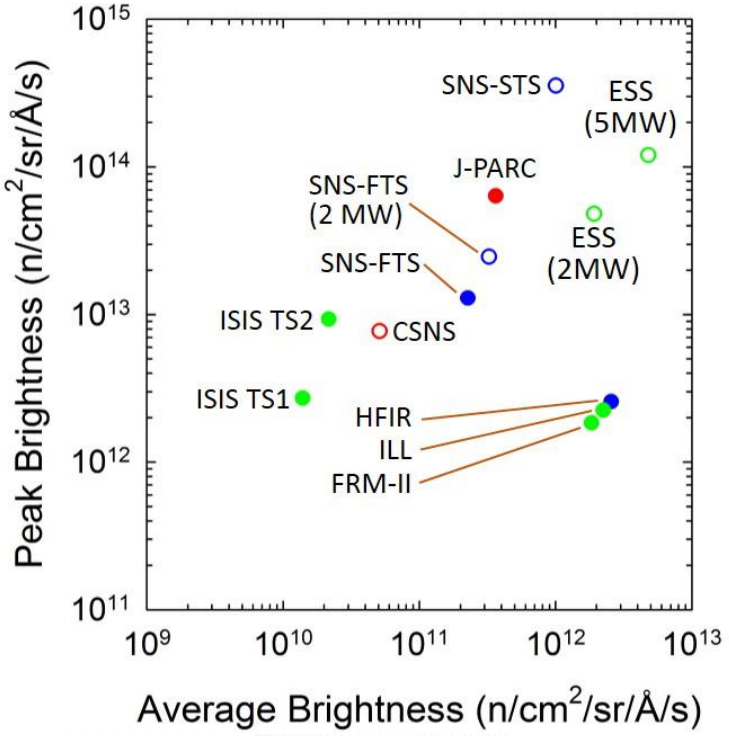
Second Target Station: World Class Cold Neutron Performance

5 Å – long wavelength comparison





- STS will be the highest peak brightness long wavelength neutron source

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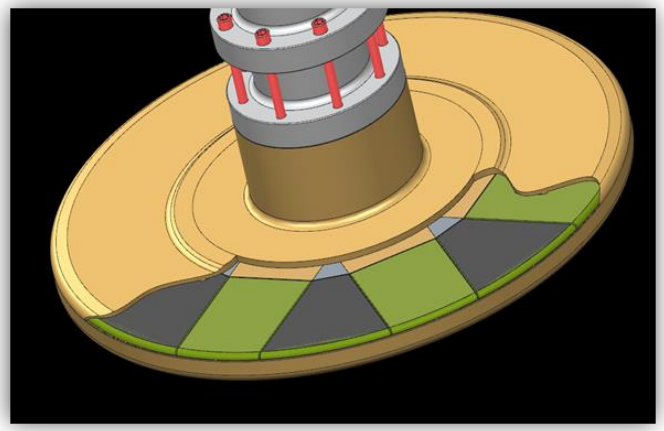
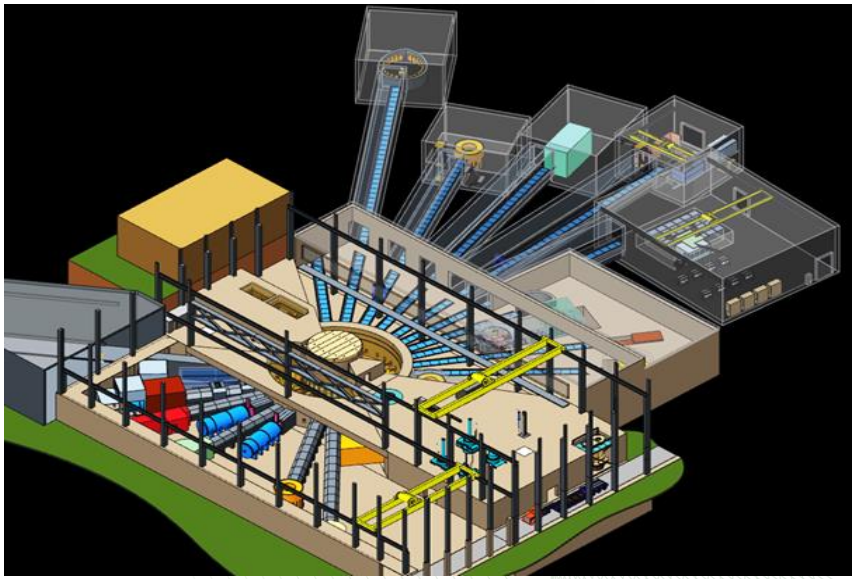
STS project activities

- **Review on the initial instruments and general target/instrument hall choices in April 2017**
  - **Rotating water cooled tungsten target concept chosen**
  - **Instrument hall general layout**
- **Technical parameter changes:**
  - **15 Hz, 2 cold moderators**
- **STS project activities suspended June 2017**
  - **Focus resources on PPU**





Summary

- PPU is launched
- Front End is ready
- All activities are at full speed

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Thanks for your attention!

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Backup slides

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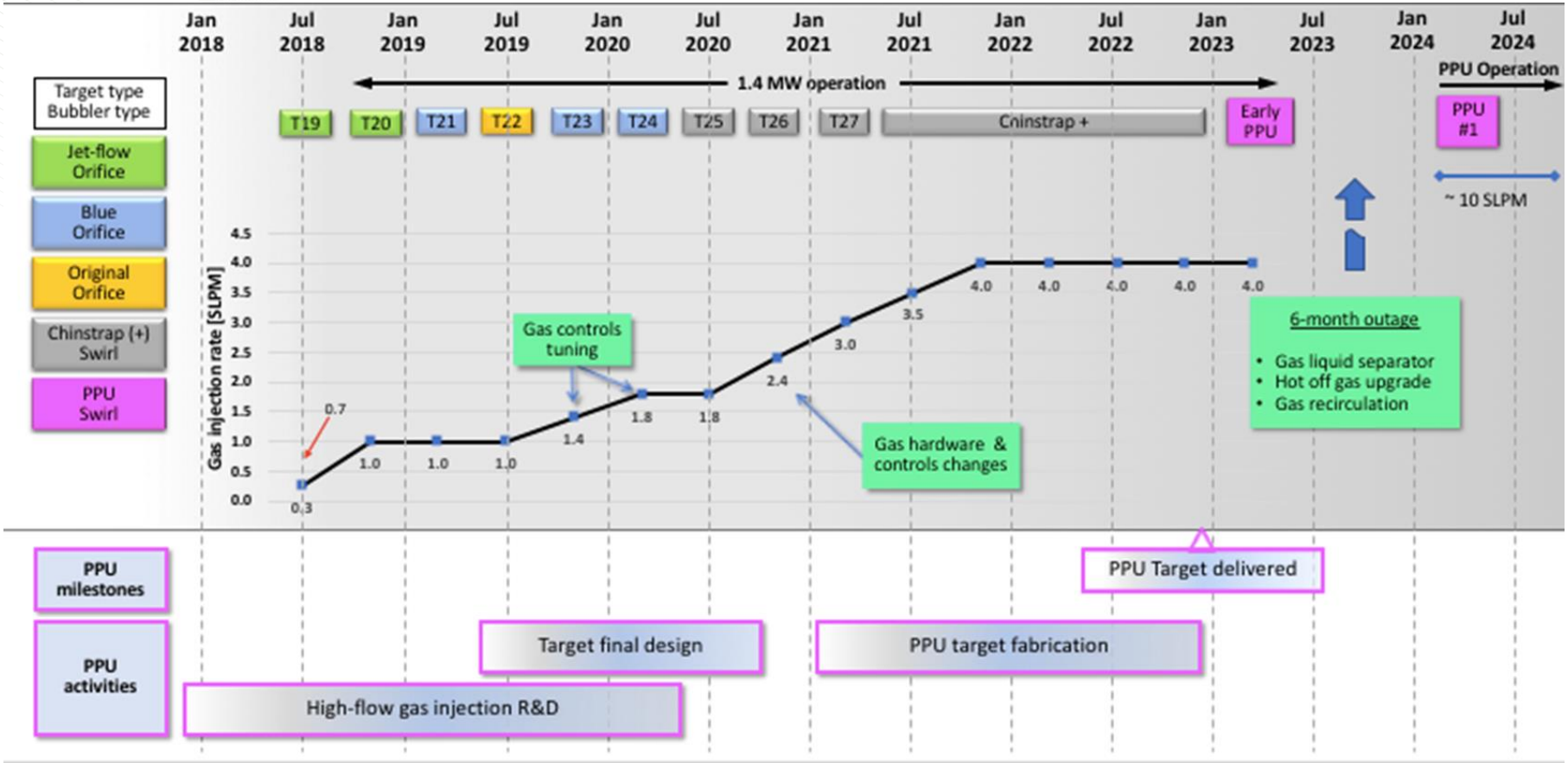
Target gas injection ramp-up: operations and PPU



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