MAX-PLANCK-INSTITUT
FÜR PLASMAPHYSIK

The FP8 enhancement project “Pellet launching system (PLS)”: Status and Plans

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ASDEX Upgrade

9th Project Planning Meeting EUROfusion Work Package JT-60SA
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EUROfusion

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Current status

Test and commissioning facility at IPP:
- Lab ready since October 2021
- Service contract under negotiation

Fuelling pellet source (PELIN):
- Manufactured
- Modifications underway to correct issues identified during testing
- Delivery target > September 2022

Pacing pellet sources (PELIN):
- Most hardware procured and delivered. Assembly will start after successful operation of FPS
- Delivery target December 2022

Centrifuge and ex-vessel guiding system:
- Detailed design in progress
- Delivery expected for January 2024

Diagnostics:
- Call for tender launched – now part of ex-vessel guiding system

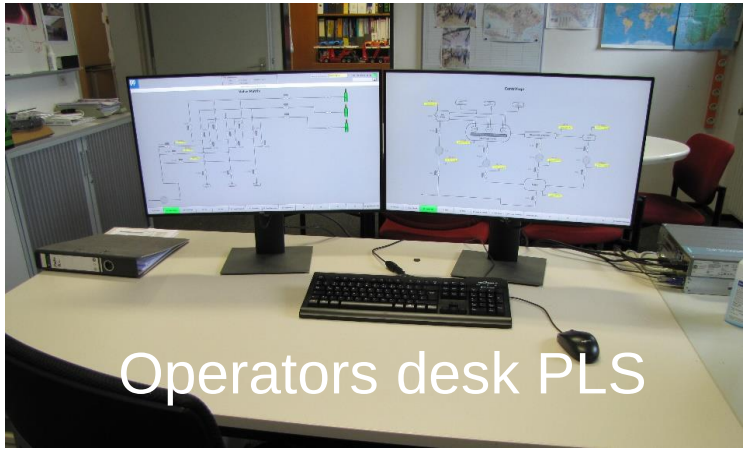
Test and commissioning facility at IPP

Test and commissioning facility at IPP:

Valve matrix – Lab testbed

Control room

Master PLC



Operators desk PLS

Pellet source manufacturing

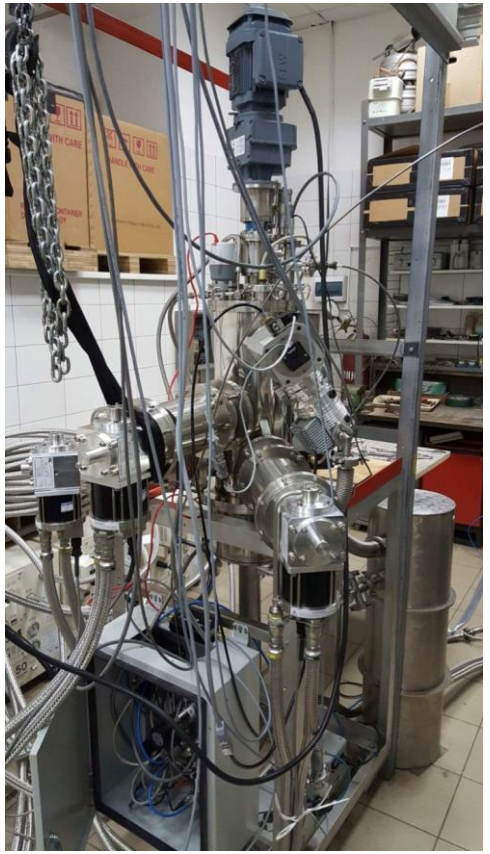
Fuelling source manufactured

Sufficient ice extrusion for 20 Hz repetition rate

Stable operation with arbitrary cutting of pellets not yet achieved

Revised chute approach:
Simplify geometry and minimize length
➔ Capture process managed by stop cylinder design
Need “kinetic” delivery data from PELIN

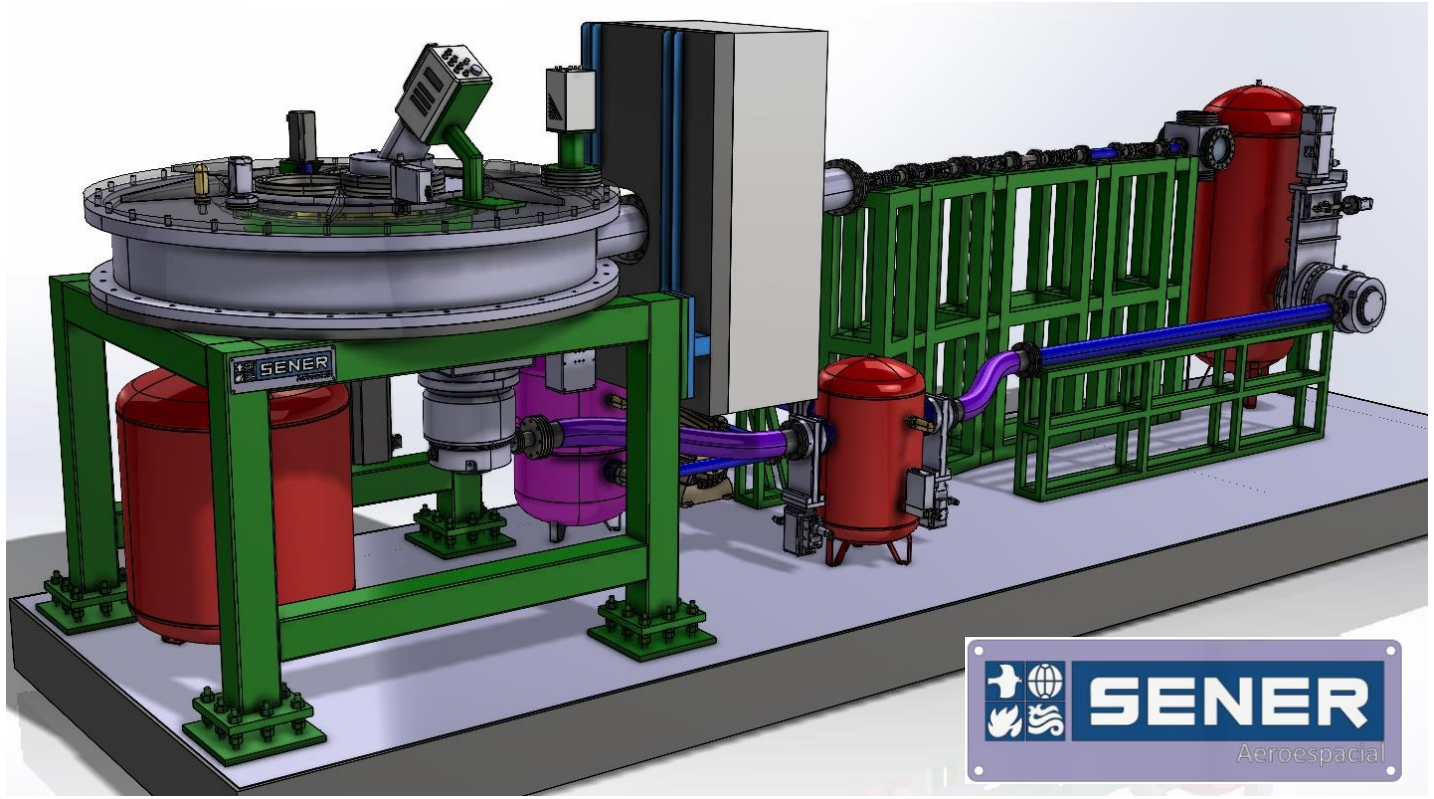
PELIN is a Russian company
What if….?
➔ Considerations by B. Ploeckl



Launcher design in progress

Pellet launching system itself and diagnosing units

2 pellet sources from PELIN – 3rd slot for stop cylinder observation unit



Start up configuration:
Fuelling pellet source (up to 20 Hz)
ELM pacing pellet source (up to 50 Hz)
Simultaneous control of fuelling & pacing
Tailored single pellet train to minimize cross-talk

Diagnostics at centrifuge exit:
Adjust acceleration

Diagnostics close to torus entrance valve:
Pellet speed and integrity

Timeline

Preparation of infrastructure at IPP: 5.10.2021

Fuelling source testing: *1.9.* – 15.11.2022

Pacing source testing: 1.12. 2022 – 15. 2. 2023

Manufacturing of centrifuge: 1.5.2022 – 17.1.2024

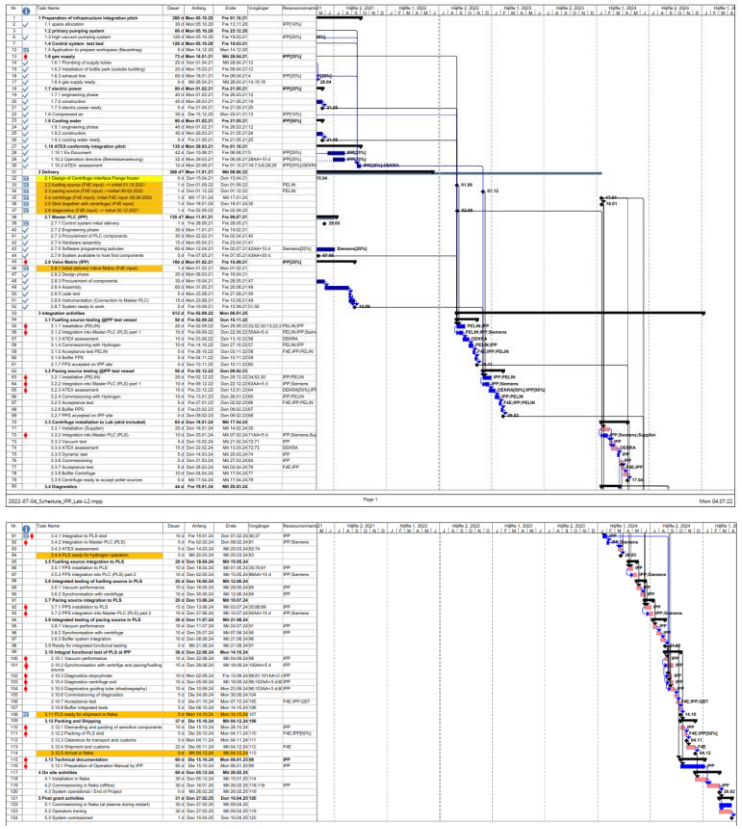
Installation of centrifuge in testbed: - 20.3.2024

Integration of fuelling source: - 12.6.2024

Integration of pacing source: - 21.8.2024

Integral functional test: - 14.10.2024

Arrival in Naka: 4.12.2024



Plans 2022/23

Fuelling source testing: *1.9.* – 15. 11.2022
Pacing source testing: 1.12. 2022 – 15. 2. 2023
Manufacturing of centrifuge: 1.5.2022 – 17.1.2024

➔During manufacturing of centrifuge/guiding system/diagnostics
Take care system interfaces fit
Take care system fits into IPP lab (vacuum, electrical, PLC) & for ATEX
Take care system fits into QST environment

Commissioning and characterisation of both extruders
Provide all relevant interface data and pellet kinetic data

Further preparation of on-site commissioning (local and on plasma)

Plans 2022/23

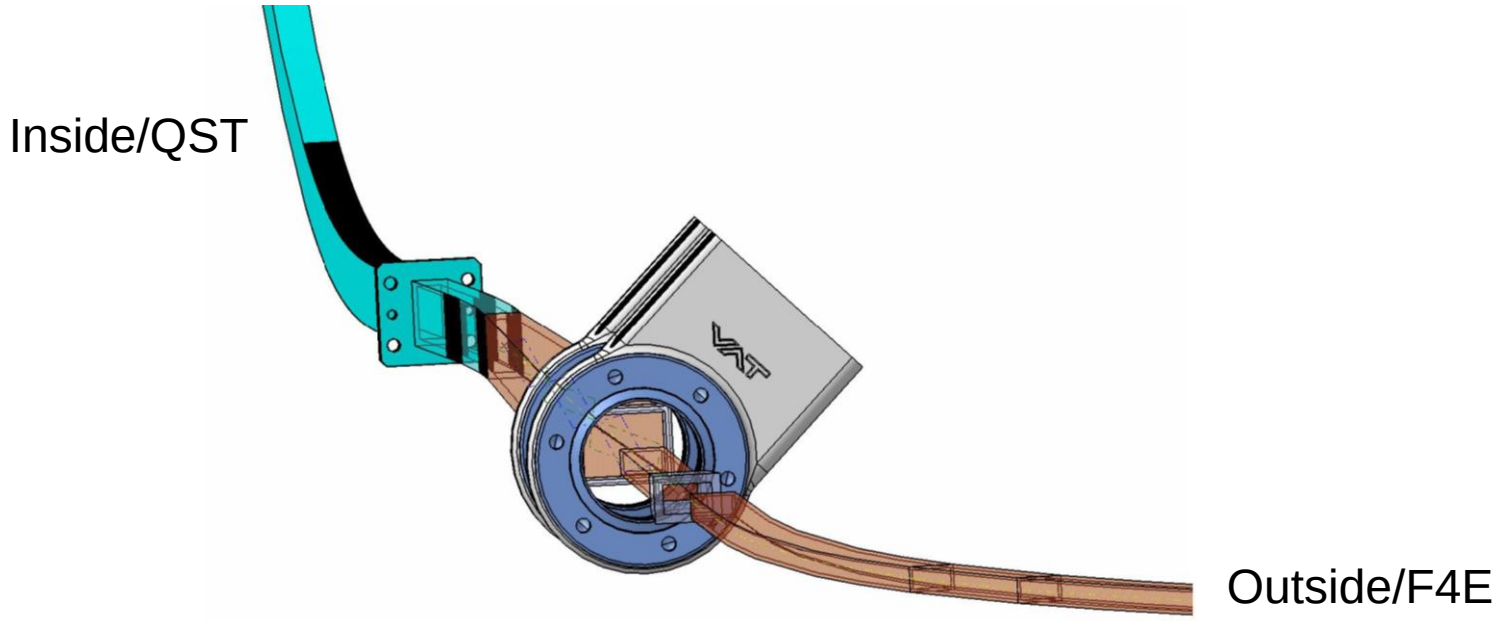
Commissioning and characterisation of both extruders:

Fuelling Pellet Source - Ø = L = 2.4 mm at up to 20 Hz
Full performance with H_2 for > 100 s
Full performance with D_2 for > 100 s
Performance with HD
Performance with admixed gases in H_2
Considered: 0.5 and 1.0 mol% N_2, 1.0 and 2.0 mol% Ne

Pacing Pellet Source - Ø = L = 1.2 mm at up to 50 Hz
Full performance with H_2 for > 100 s
Full performance with D_2 for > 100 s

Interface F4E/QST

Pellet guiding system:
Until double torus gate valves part of F4E share
Gate valves and tubes inside vessel part of QST share
Design guidelines for interface provided
See document “Design- guidelines for the funnel in pellet guiding tube (PGT) after the torus entrance gate valve of JT-60SA”



Interface F4E/QST

Control approach:

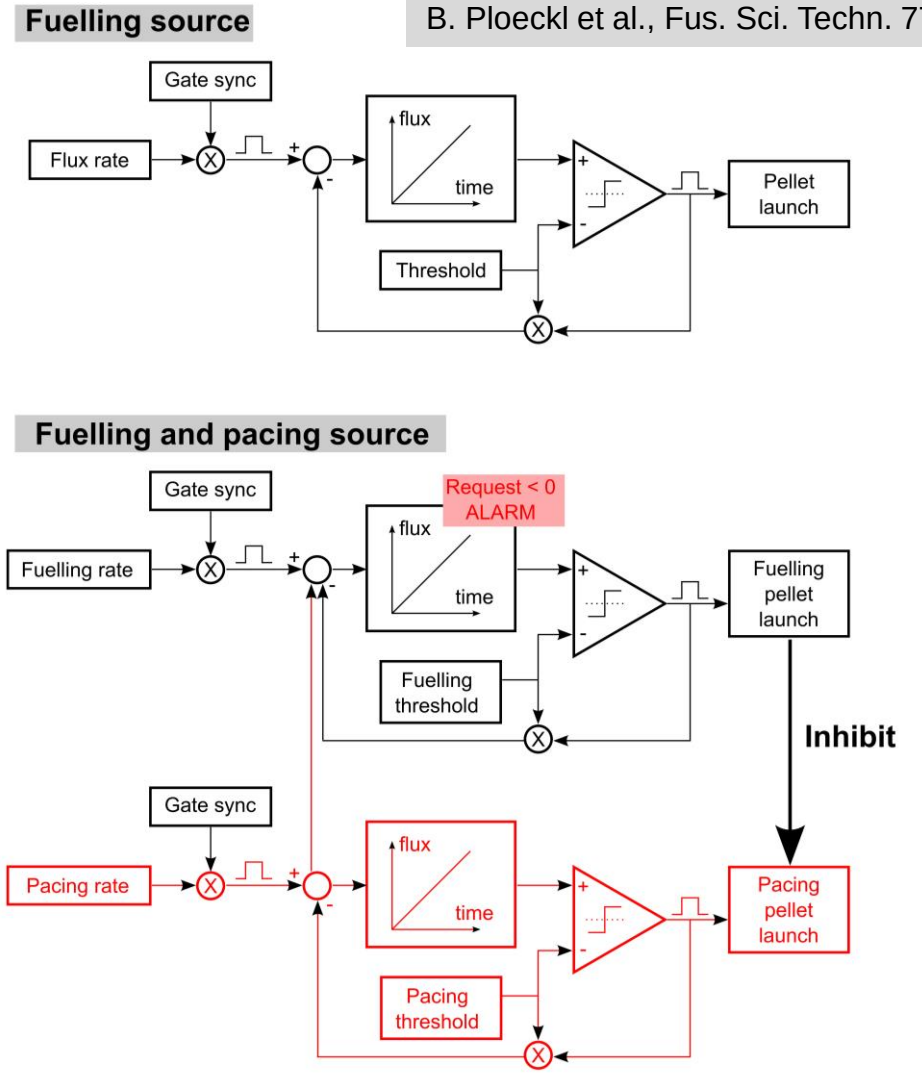
Initial part with feed forward request
- per pellet source
- with combined sources

Final part with feed back request
- per pellet source
- with combined sources

Appling AUG PLC local controller
On request provide profile control tool
➔ Need for “system identification”

DIFFER

B. Ploeckl et al., Fus. Sci. Techn. 77 (2021) 199



SOFT 2022

- B. Ploeckl et al.:
Testbed for the Pellet Launching System for JT-60SA
- C. Piccinni et al.:
Injection of Ar-doped pellets: towards a multifaceted plasma actuator
- P. T. Lang et al.:
Concept for a multi-purpose EU-DEMO pellet launching system