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Fluidised Tungsten Powder Studies at RAL

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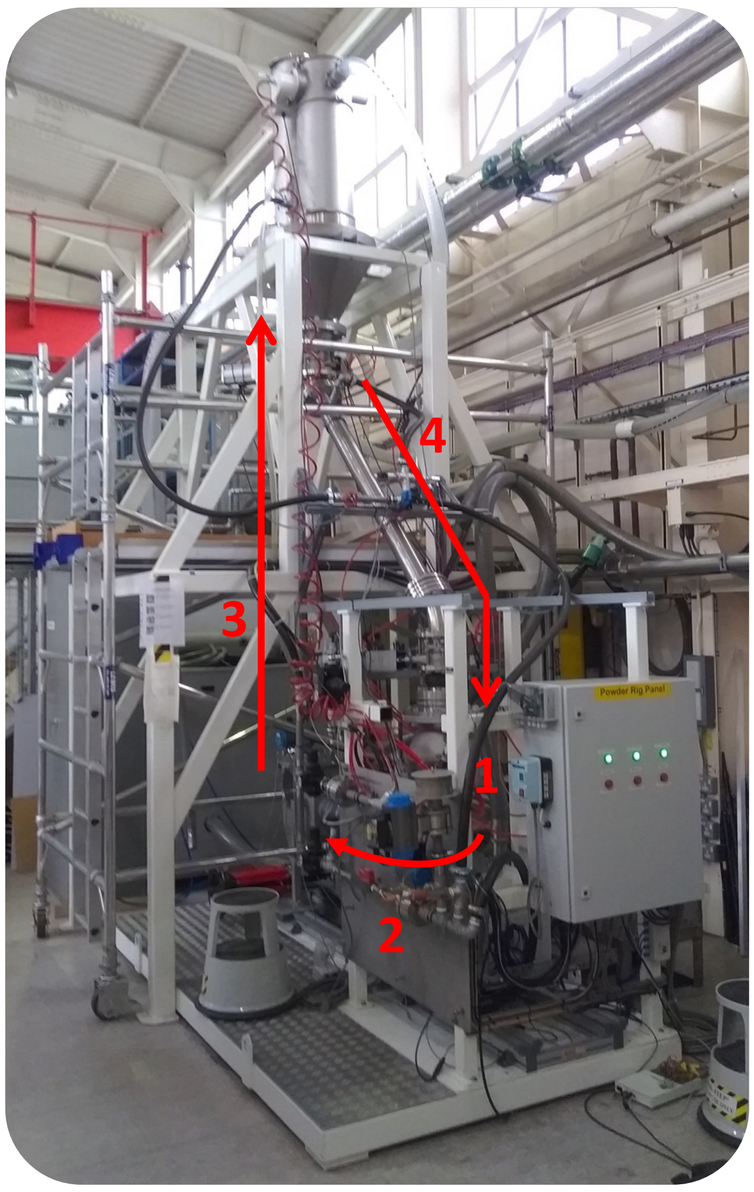
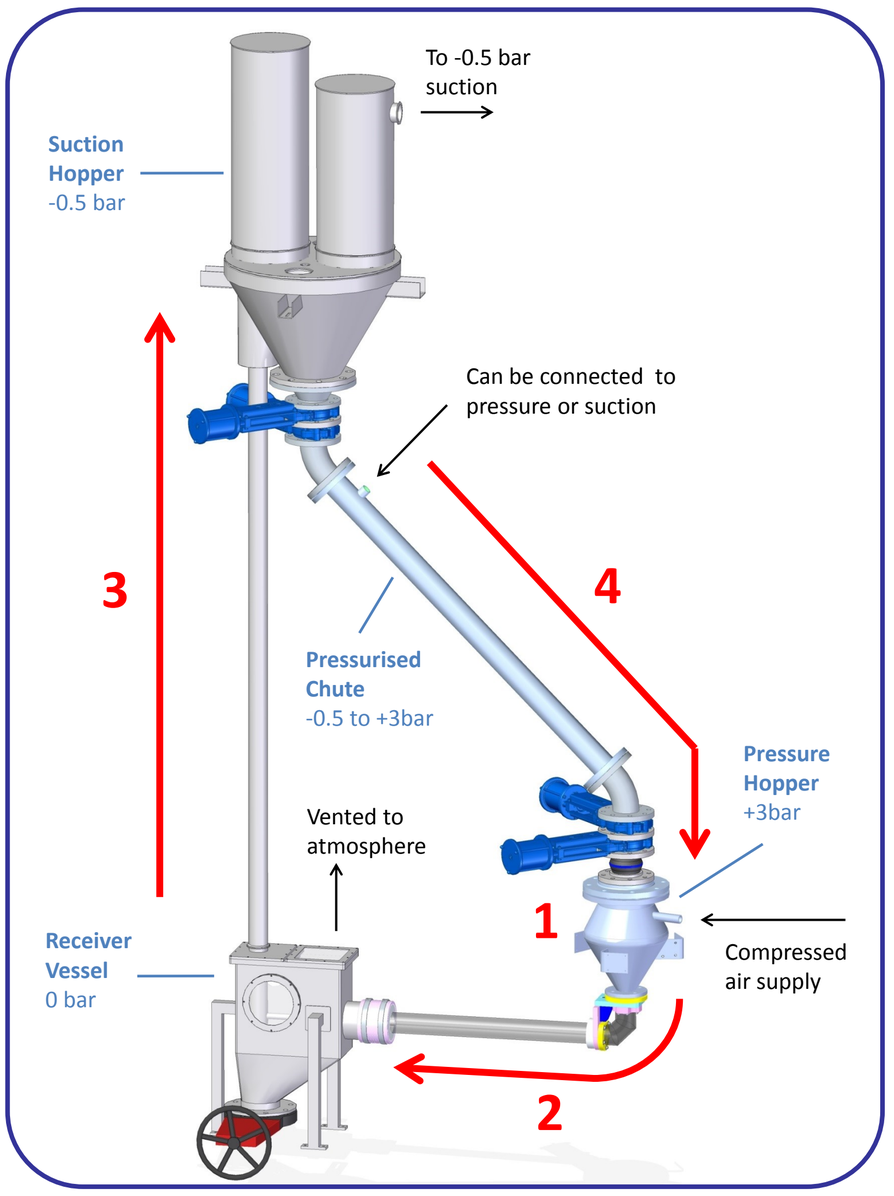
Background

- Fluidised tungsten powder can withstand extremely high beam power without the cavitation issues associated with liquid targets
- Possible applications include multi-MW neutron, neutrino and muon sources
- A test rig for fluidised tungsten powder was built at Rutherford Appleton Laboratory





Powder Cycle

1. Pressurised powder hopper
2. Ejection of dense phase powder (proton beam would intercept here)
3. Suction lift of lean phase powder
4. Gravity chute refills powder hopper

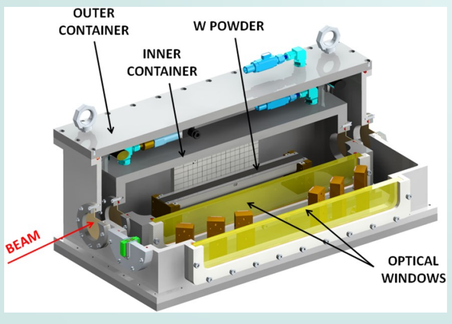
Features

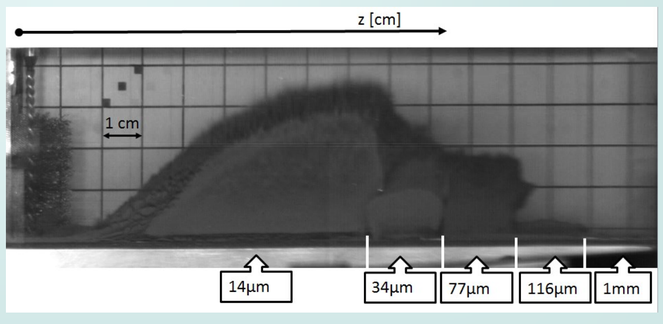
- Demonstrates all processes required for a future target facility
- Chute can be pressurised, to refill pot without disrupting powder ejection, allowing continuous circulation
- Control system allows automatic operation and data logging

RAL fluidised tungsten powder rig, showing key components of the cycle

In Beam Testing

- Two experiments were carried out on the HiRadMat facility at CERN
- A trough of stationary tungsten powder was hit with a high energy proton pulse, causing the powder to erupt
- Splash velocity at 29 J/g = 0.44 m/s for tungsten powder, 30 m/s for liquid mercury

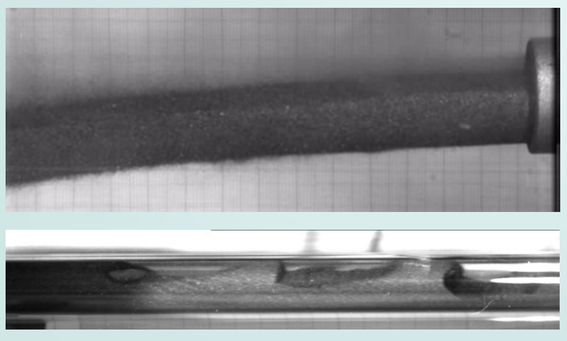


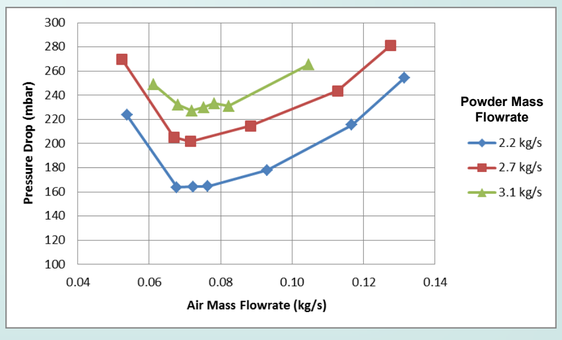


Experiment layout (L), photo of powder eruption for various particle sizes (R)

Cycle Development

- Erosion mitigation measures, including double slide valve design and avoiding bends in the lean phase section
- Powder ejected in free jet and contained target modes
- Flowrates and pressure drops optimised for dense and lean phase tungsten powder flow





Powder jet and contained target configurations (L), suction lift pressure drop (R)

References

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High Power Targets

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