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Facilities Council

Development of SRF facilities at UKRI/CI

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Lancaster
University



UNIVERSITY OF
LIVERPOOL



Agenda

1. Overview
2. Development of a new high power SRF test facility at UKRI
3. Development of a new low power SRF test facility at UKRI/CI
4. Summary



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1. Overview

Overview

- **2 Facilities currently in operation for RF testing:**
 - **ESS & PIP-II cavities:**
 - ❑ 700 MHz, 650 MHz
 - ❑ $T \leq 2$ K
 - ❑ $P \leq 500$ W
 - **Choke cavity & Split cavities:**
 - ❑ 7.8 GHz, 6 GHz
 - ❑ $T \geq 4$ K
 - ❑ $P < 1.5$ W
- **Currently no facility for 1.3 GHz cavity testing**



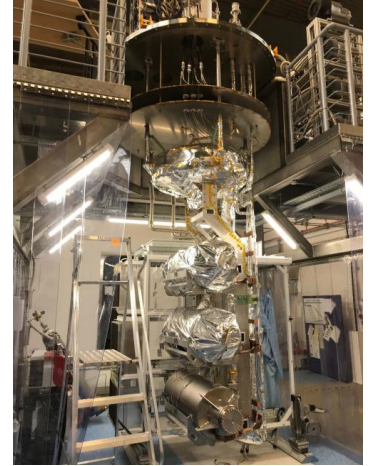


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2. Development of a new high power SRF test facility at UKRI

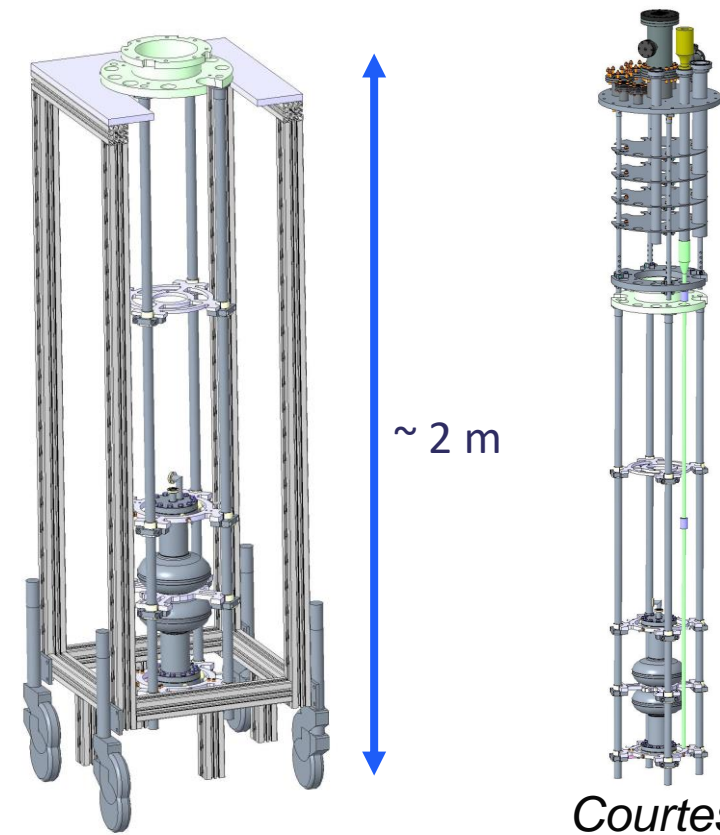
Requirements

- We want the capability for high power testing of 1.3 GHz cavities (not officially required for the IFAST project)
- Ability to test 1 to 9 cell 1.3 GHz cavities
- Development of a new insert for use in the existing ESS/PIP-II Bunker
- LHe testing at 2 K and 4.2 K

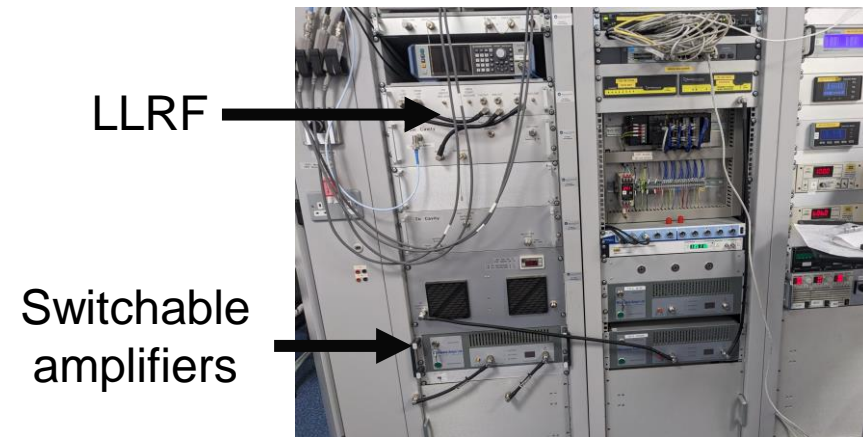


Progress

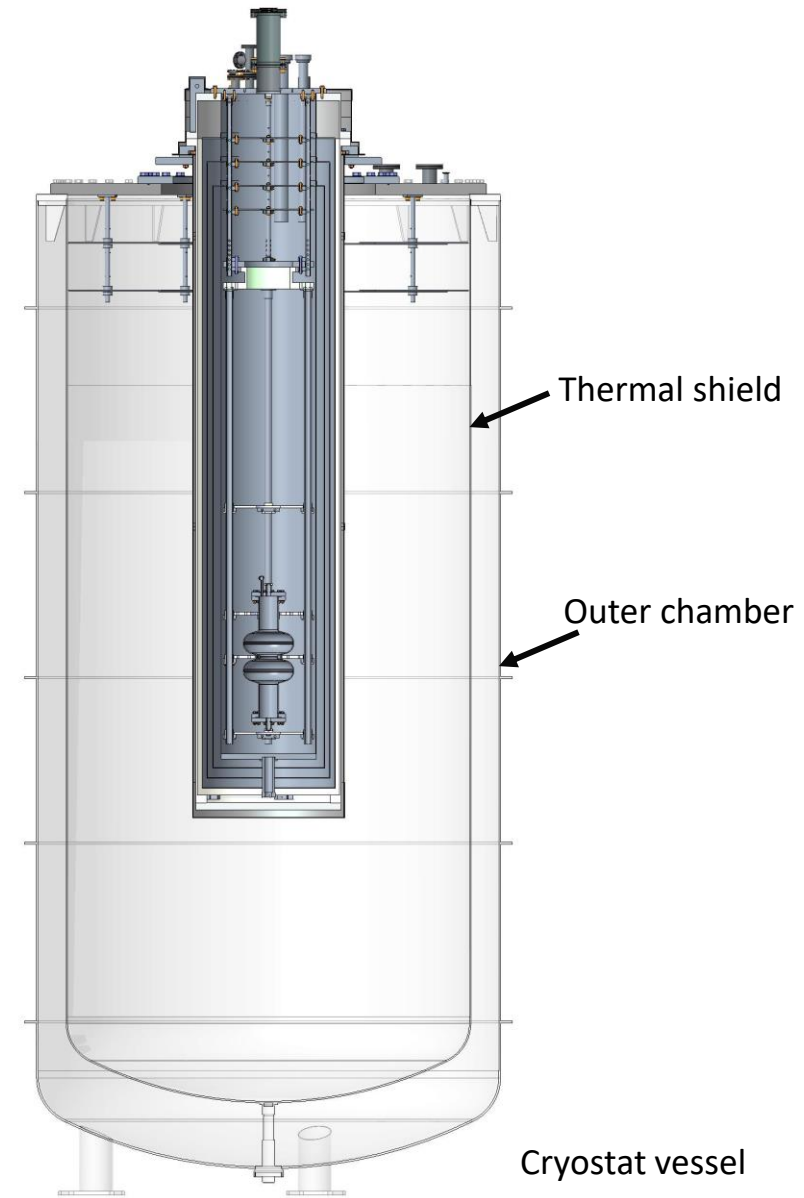
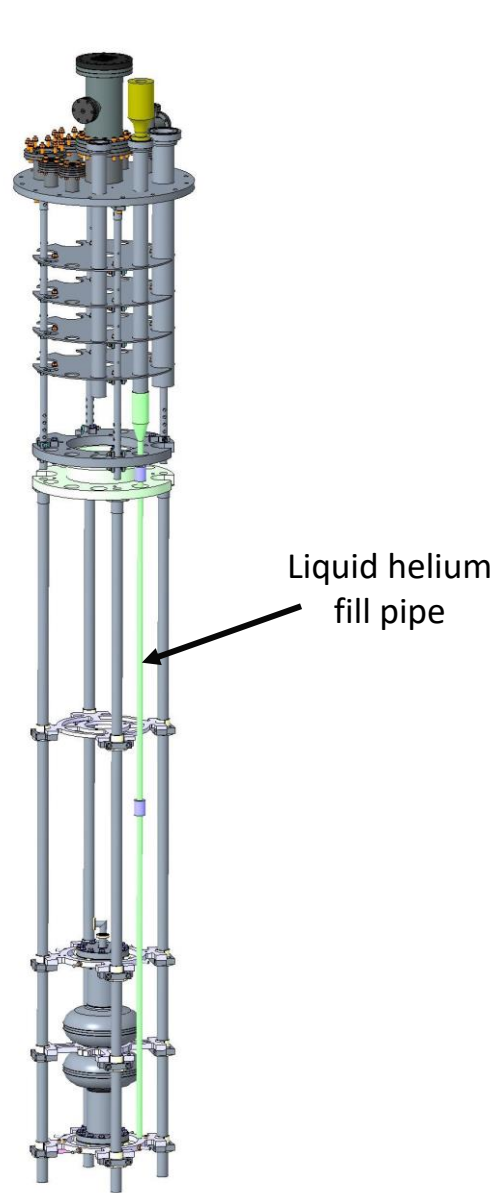
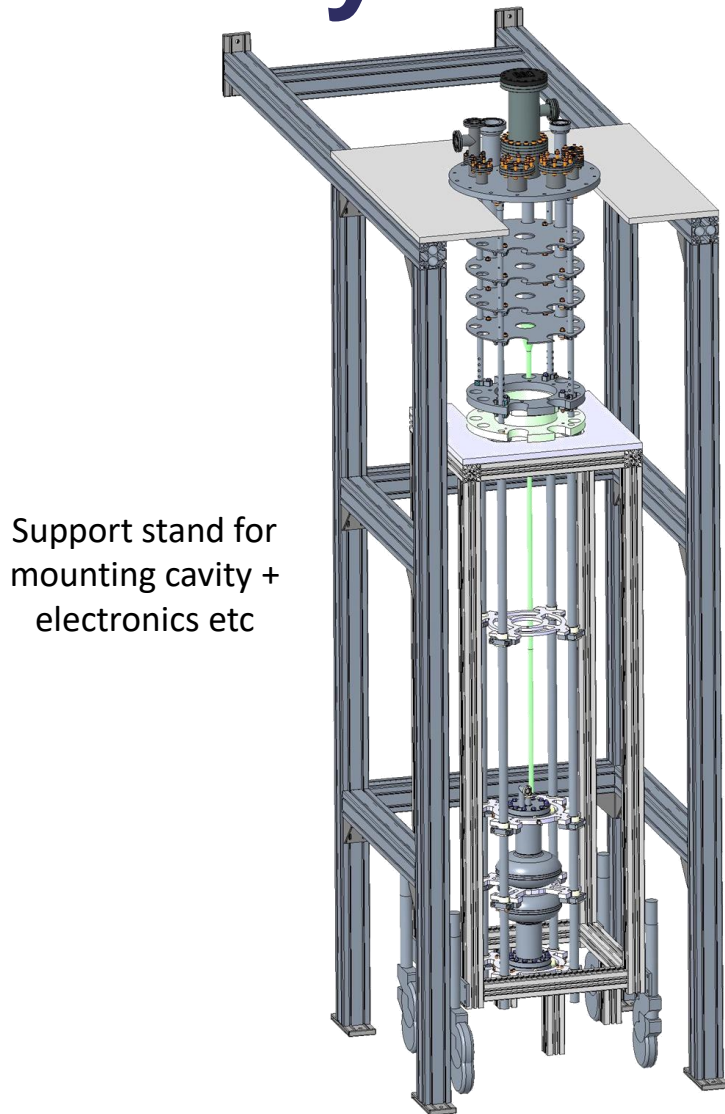
- **Designs completed & in manufacturing stage**
- **RF System:**
 - ❑ A single system for 650 MHz, 700 MHz and 1.3 GHz
 - ❑ $P \leq 200 \text{ W}$
- **Aim to commission in June/July with 2-cell bulk Nb 1.3 GHz cavity previously tested at Fermilab**



Courtesy of C. Hill



Facility overview



Courtesy of C. Hill

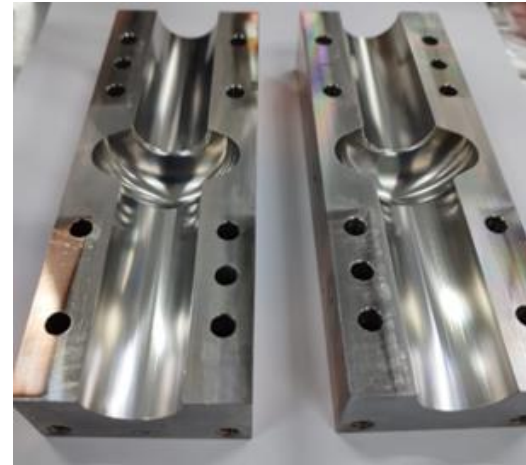


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3. Development of a new low power SRF test facility at UKRI/CI

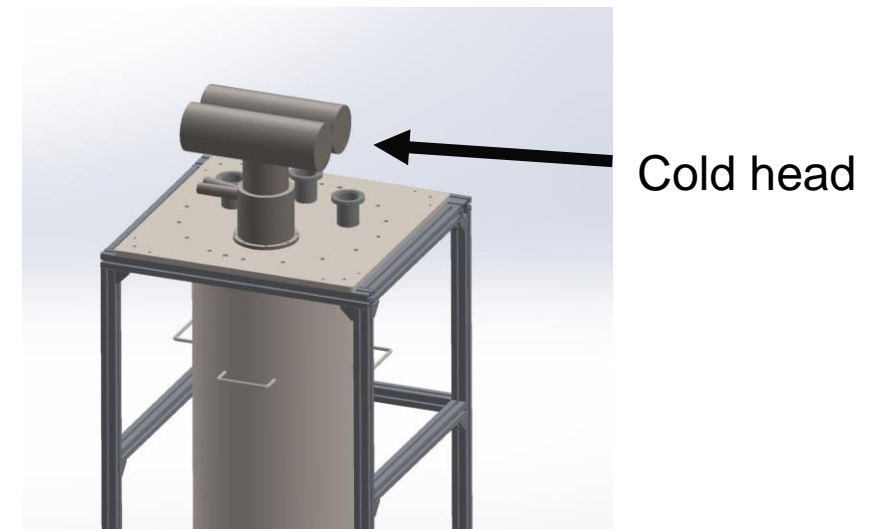
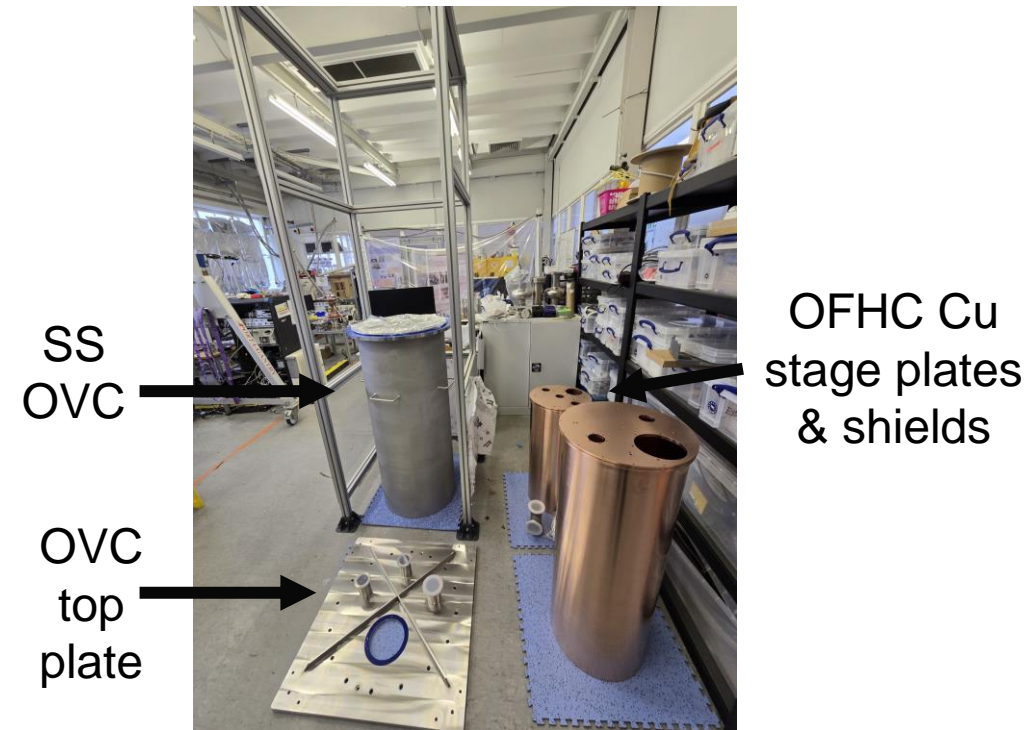
Requirements

- Low power testing ($P \leq 2.5 \text{ W}$)
- Cryocooler operation at 4.2 K
- 1 - 2 tests per week
- **Able to test different single cell cavities:**
 - **1.3 GHz**
 - **6 GHz (split & closed)**
 - **+ other frequencies (3 GHz...)**

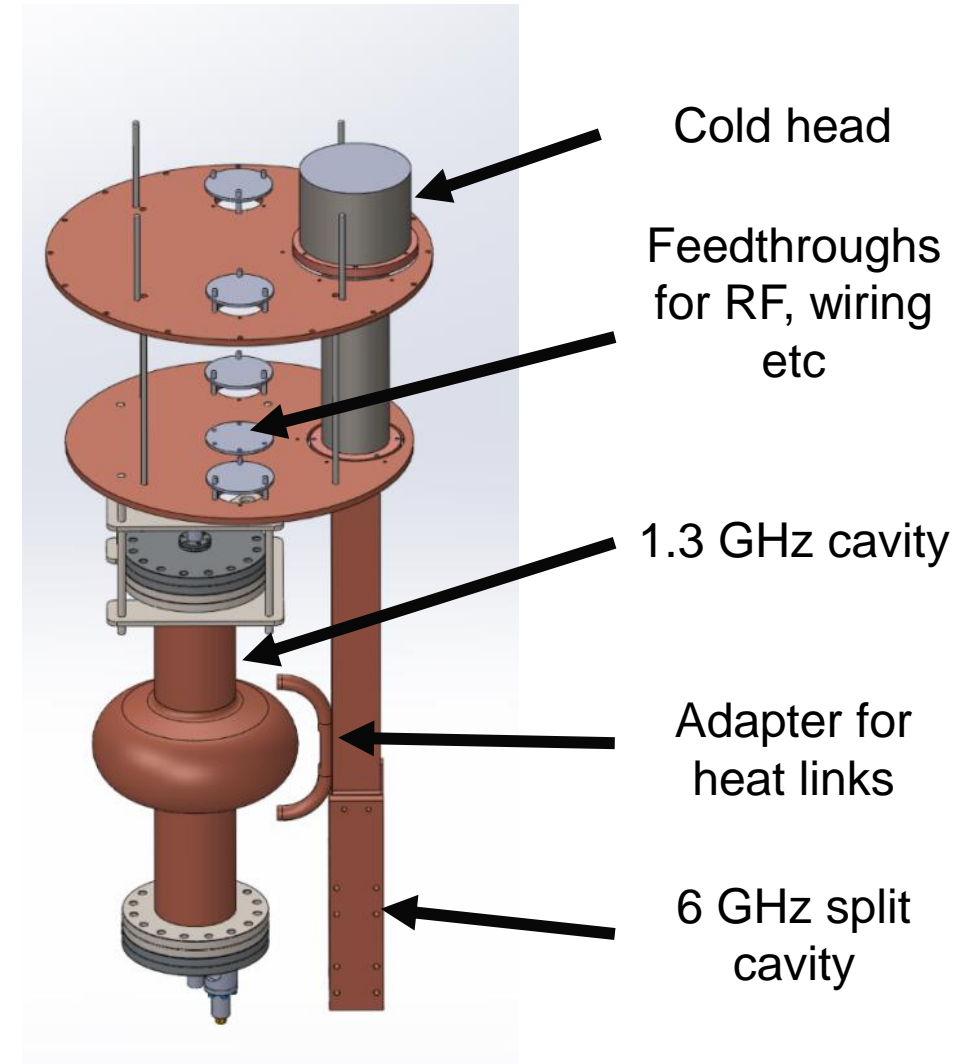
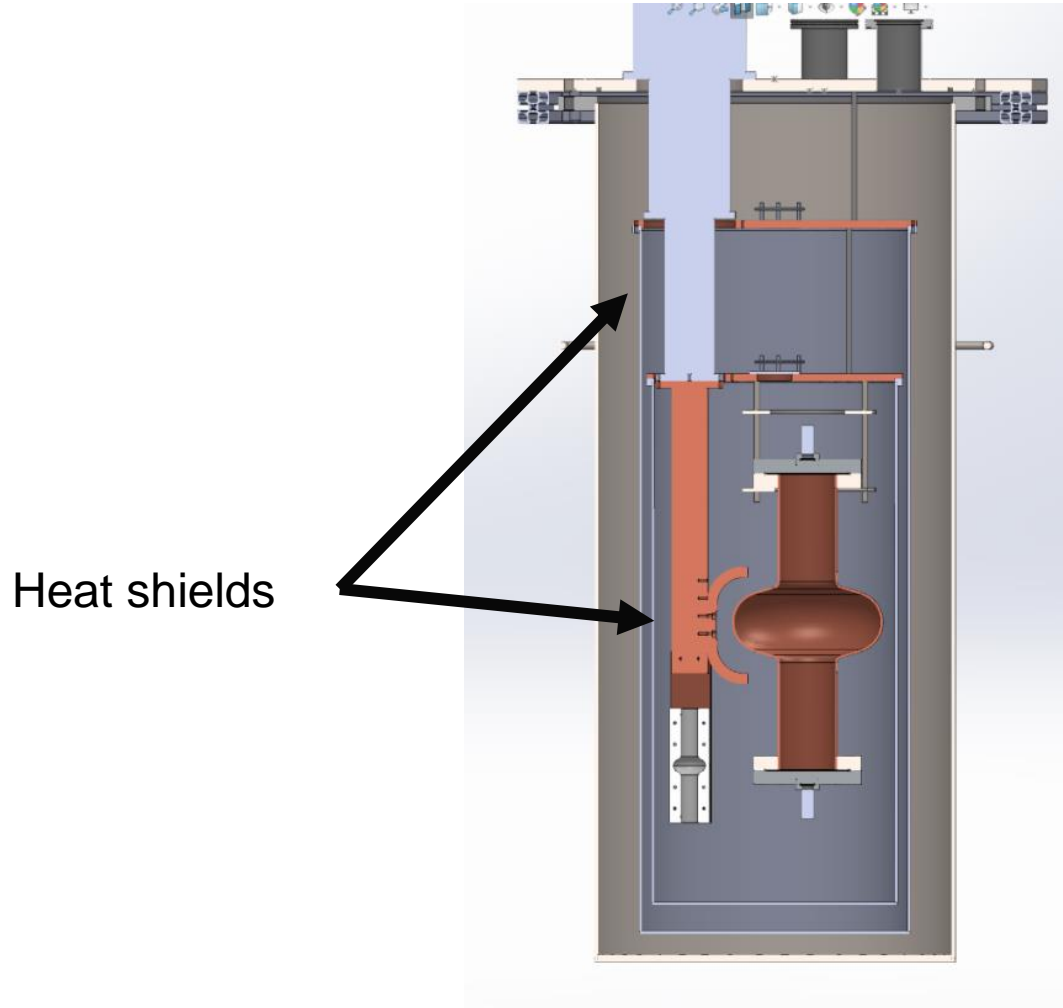


Progress

- **All main components manufactured and delivered**
- **Aim to begin vacuum & cryogenic tests by end of April**
- **RF System to be developed**
 - ❑ A single system for 1 – 8 GHz
 - ❑ New LU postdoc to work on this
- **Fixed & variable couplers being designed**



Facility overview



Courtesy of O. Poynton & J. Rigby



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4. Summary

Comparison of facilities

	Low power facility	High power facility
Cavities	Single cell: 1.3 GHz, 3 GHz, 6 GHz Split: 6 GHz	Single cell 1.3 GHz Up to 9 cell 1.3 GHz
T (K)	> 4	2, 4.2
P (W)	2.5	200
Testing Rate	2/week	1/week*

* Limited to few tests/year – priority to ESS/PIP-II operations

On track for 1.3 GHz cavity testing this year

Month	Low power facility	High power facility
April	Start building & vacuum tests	Procurement & manufacturing
May	Electrical & cryogenic tests Develop LLRF system	
June	Commissioning with 1 cell 1.3 GHz bulk Nb cavity	Start building
July		Commissioning with 2 cell 1.3 GHz bulk Nb cavity
Late-2024	First consecutive low power & high power TF cavity tests	

Acknowledgements

STFC/CI: O. B. Malyshev, J. Rigby, O. Poynton, A. Akintola, T. Sian, R. Valizadeh, L. Smith, J. Conlon, C. Benjamin, S. Pattalwar, G. Miller, A. Blakett-May, A. Vick, C. Hill, M. Pendleton, M. Jones, P. Smith, A. Wheelhouse, D. Mason

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University of Liverpool/CI: S. Simon, J. Bradley



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Questions?



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Thank you



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@STFC_matters



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