



Exploitation of Pulse Tubes at ISIS

Beth Evans

Introduction

- Pulse Tube: Background and History
- Advantages: Pulse Tubes v GM coolers
- ISIS Test and Development Programme

Pulse Tube - Background

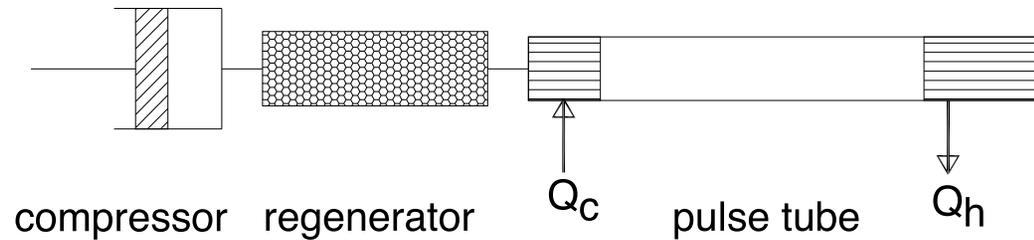


Cryomech pulse tube

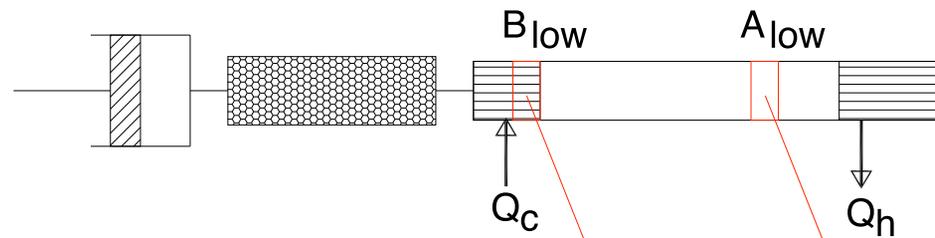


Southampton University
pulse tube

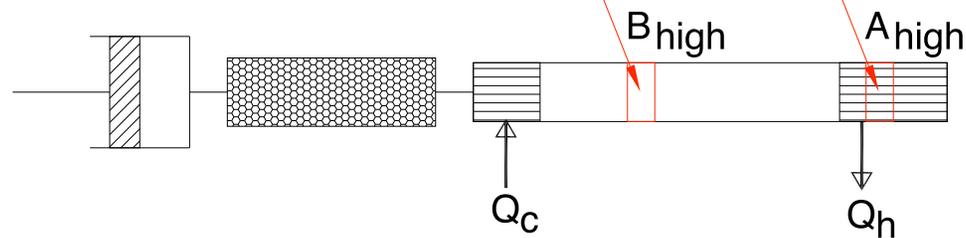
How does the Pulse Tube work?



Before
Compression

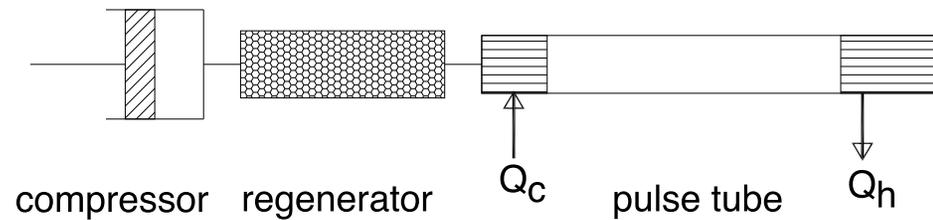


After
Compression

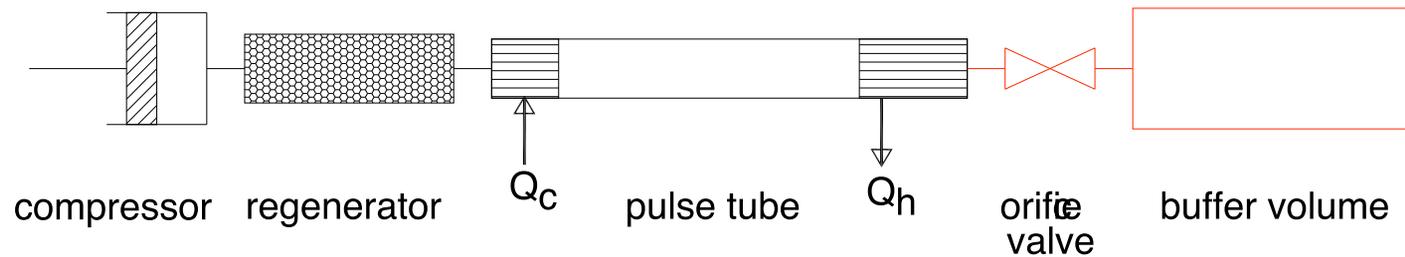


Pulse Tube Types

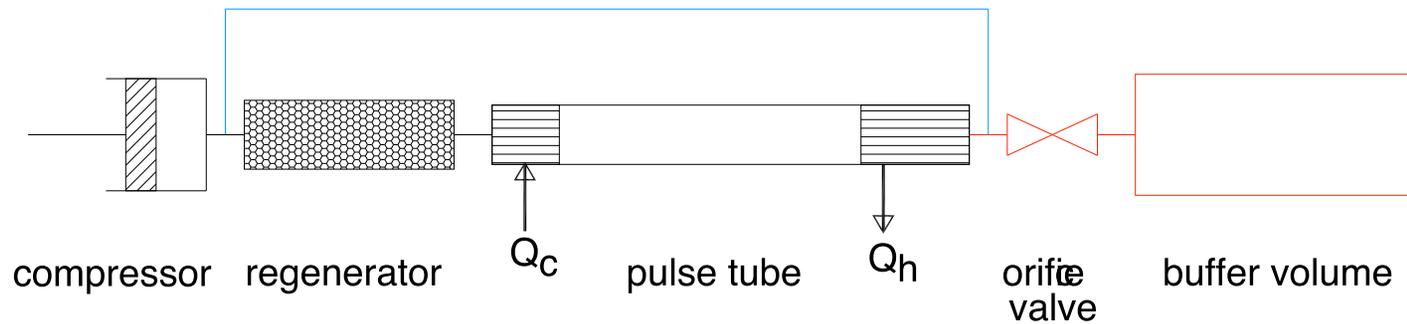
Basic Pulse Tube: 120 K



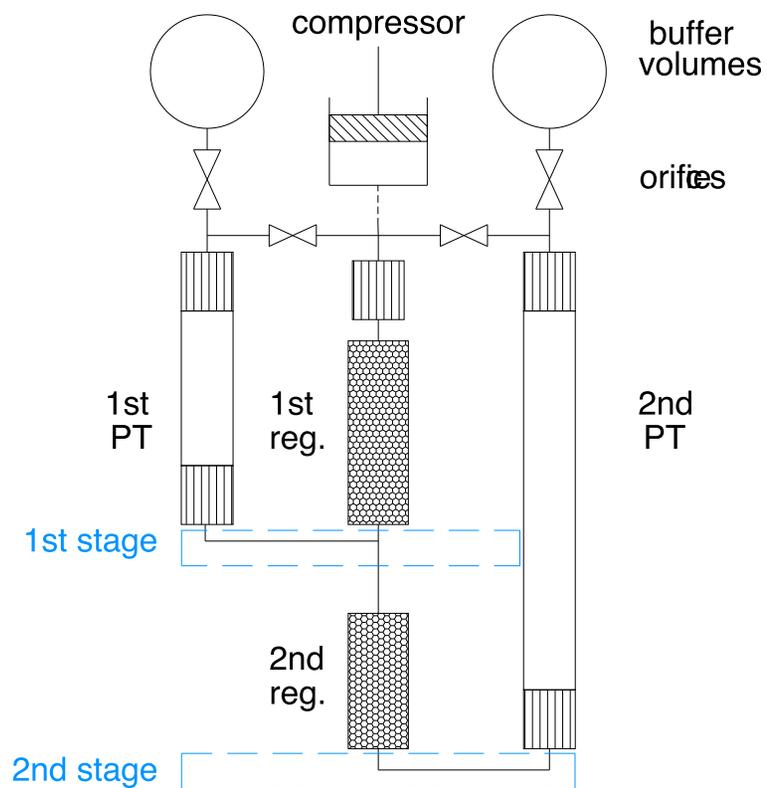
Orifice Pulse Tube: 60 K



Double Inlet Pulse Tube: 40 K



Pulse Tube – Multi-stage



Multi-stage
pulse tube: 3 K



Cryomech pulse tube

Why Pulse Tubes?

- High reliability - OI NMR superconducting magnet
- ‘Maintenance-free’ –
compressor: 20,000hrs
coldhead: no routine maintenance
- Low level of transmitted vibration
fluid interface & thin film experiments



ISIS Test and Development Programme

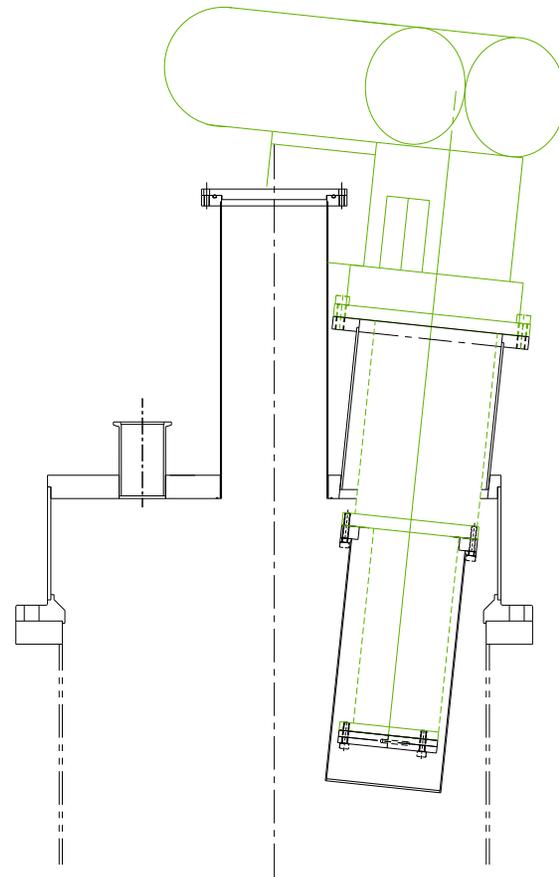
- **Stage 1:** in-house test of Cryomech PT410. Confirmation of technical specifications.
- **Stage 2:** Top-loading 4K 'cryostat' based on PT410.
- **Stage 3:** 1.8 K cryo-free system.

Stage 1

PT410 Technical Specifications:

- Base temperature: 2.8 K
- 1.0 W @ 4.2 K
- 60 mins to 4 K

- PT410 Cost: \$38,000
(coldhead + compressor)



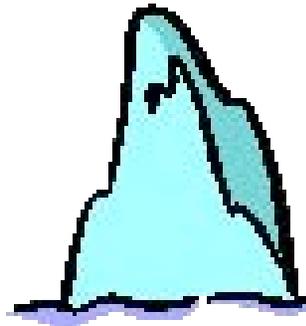
Stage 1

Pulse tube test
Stage 1 Assembly:
Cost: £4800



 Scientific Products Ltd

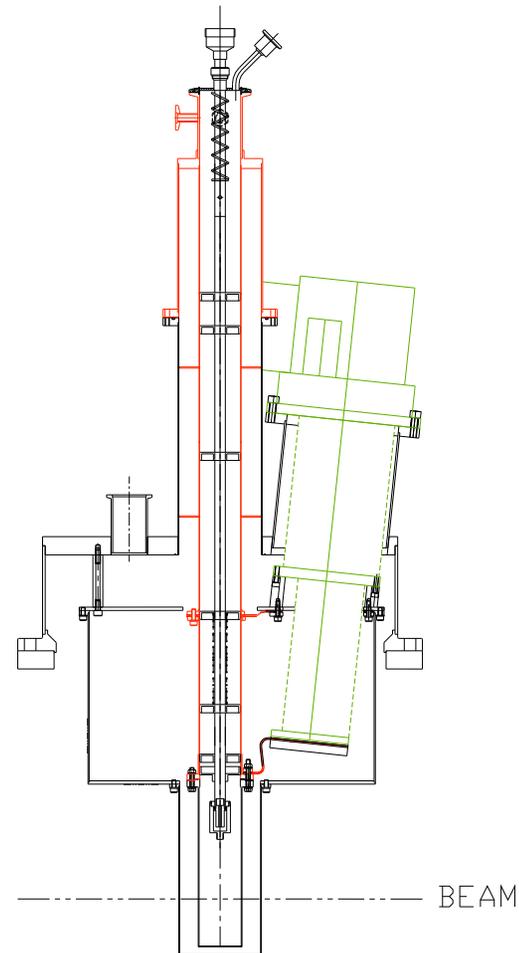
Pulse tube test - Disaster!!



Stage 2

Pulse tube toploader

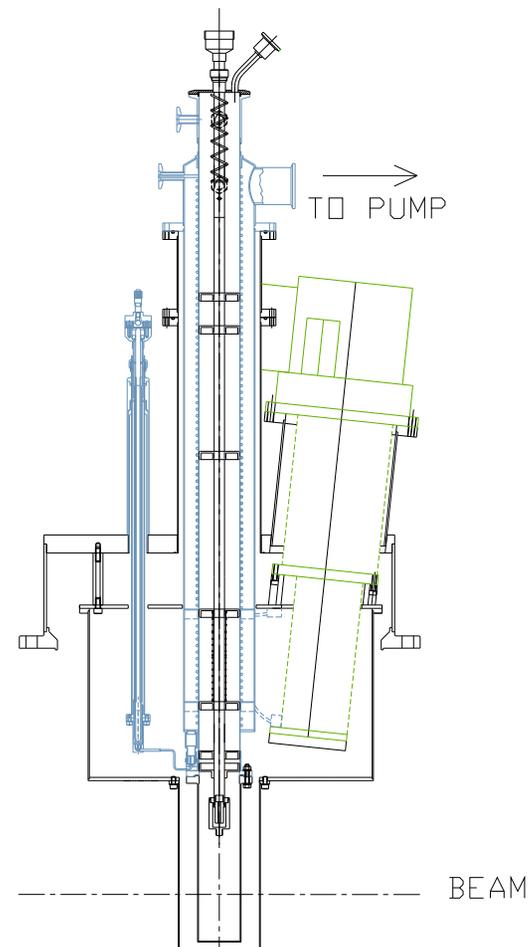
- AS/ISIS CCR design
- 50 mm sample diameter
- Comparison: GM/PT
- Stage 2 assembly cost: £8600



Stage 3

1.8 K cryogen free toploader

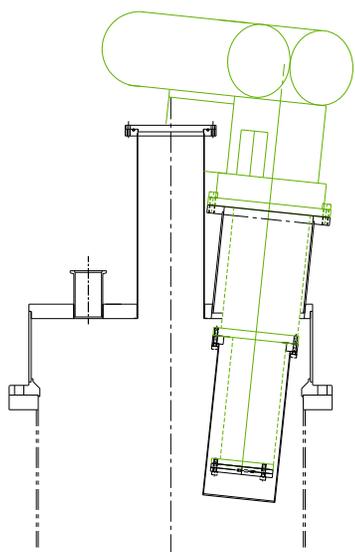
- 1.8 – 700 K
- Hot sample stick
- Dilution inserts
- Stage 3 cost:
£8,000?



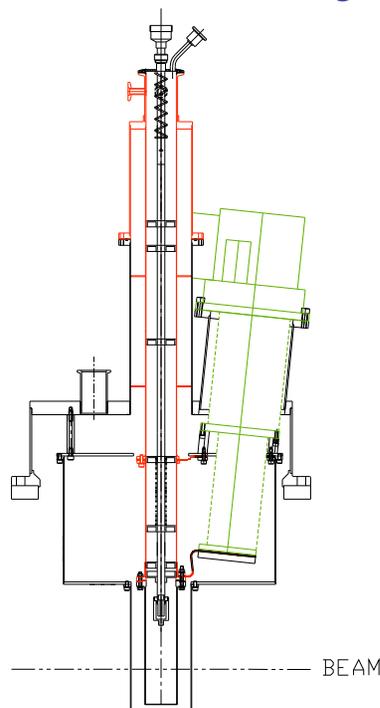
Reliability Issues

- System gas volumes
20 m flexible lines/existing rigid pipework
- Gas purity
99.999% pure helium
line contamination
- Sturdiness
transit problems

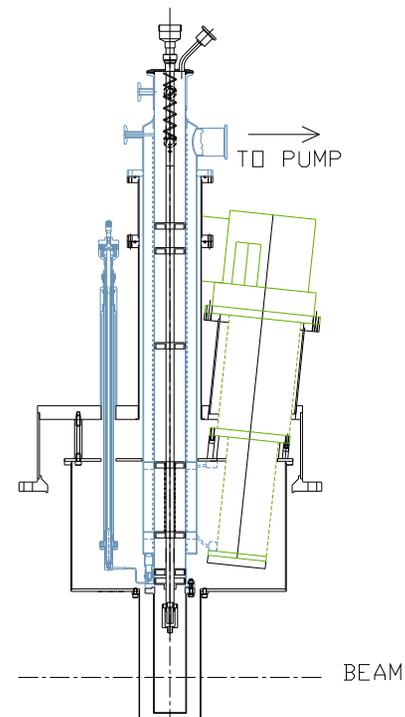
Summary



Stage 1



Stage 2



Stage 3

Reliable cryogen-free running from 1.8-700 K +
dilution insert temperatures??