

Rapid Changes Ahead Rapid Changes Ahead



Establishing the SNS Sample Environment Program

- Propose instrument/SE interface scheme
- Consider some commercial products
 - Compare capabilities
 - Highlight strengths and weaknesses
- Discuss rapid/automated sample changers
- What SE systems are best for the SNS?

Instrument Systems Group

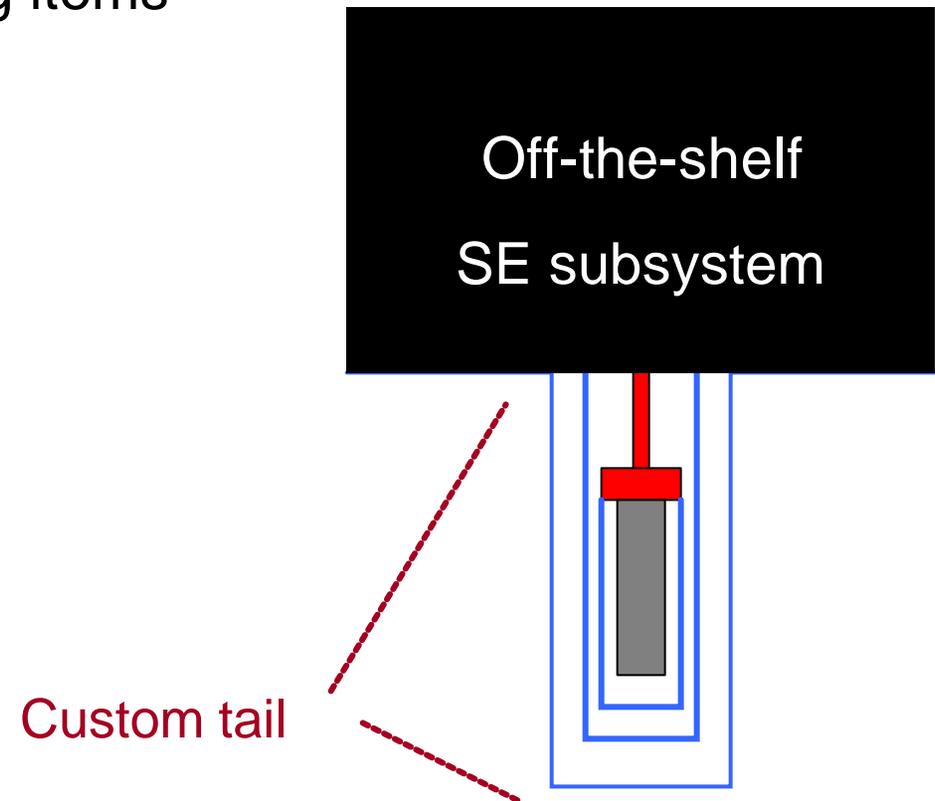
Weekly Seminar

Lou Santodonato, April 18, 2001

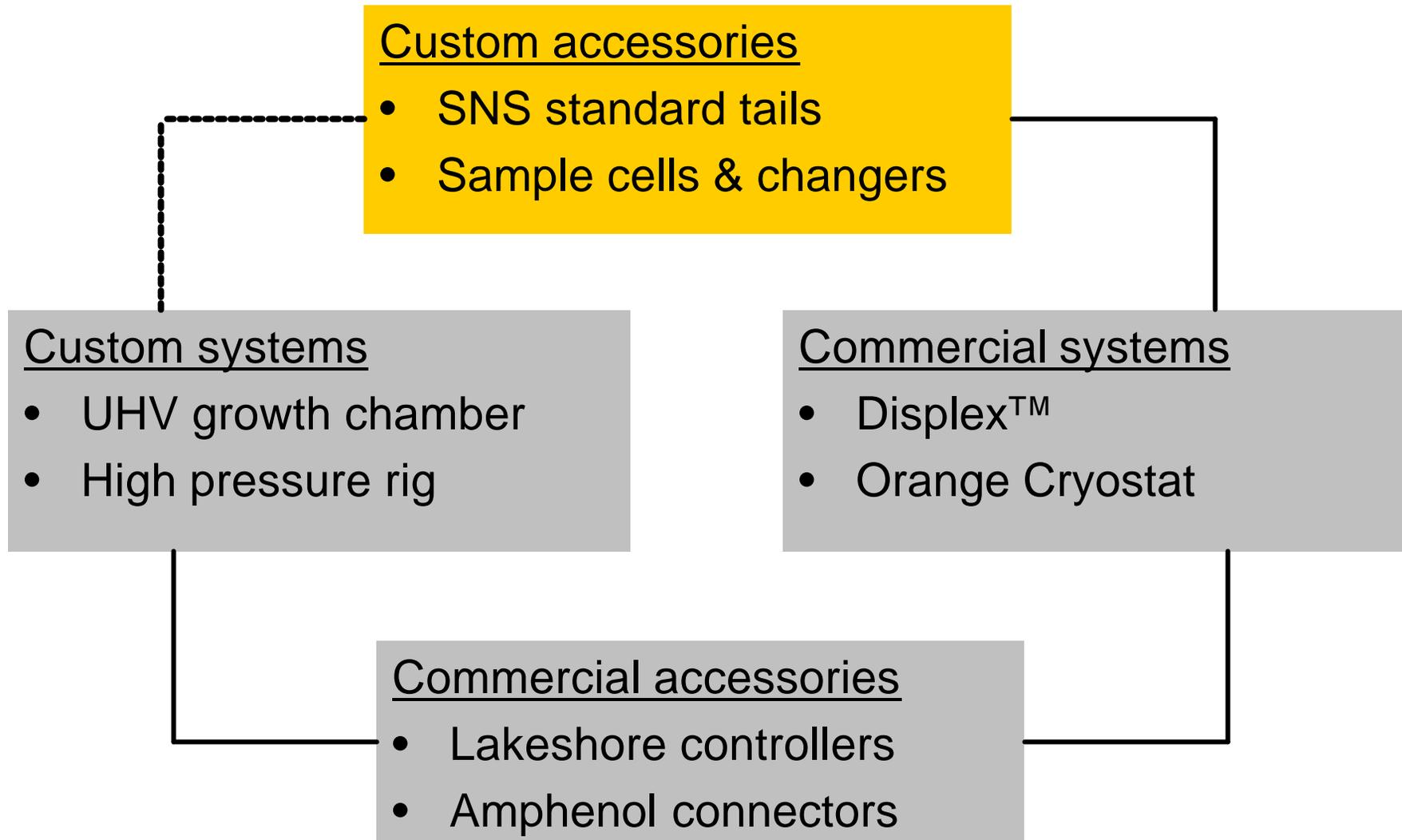
Neutron Scattering Customized SE



- Major components are catalog items
- Customization needed
 - Tail section
 - Thermometry
 - Multi-environment options
- Standard accessory inventory
- Standard mounting schemes



Sample Environment Inventory



Instrument/SE Interface



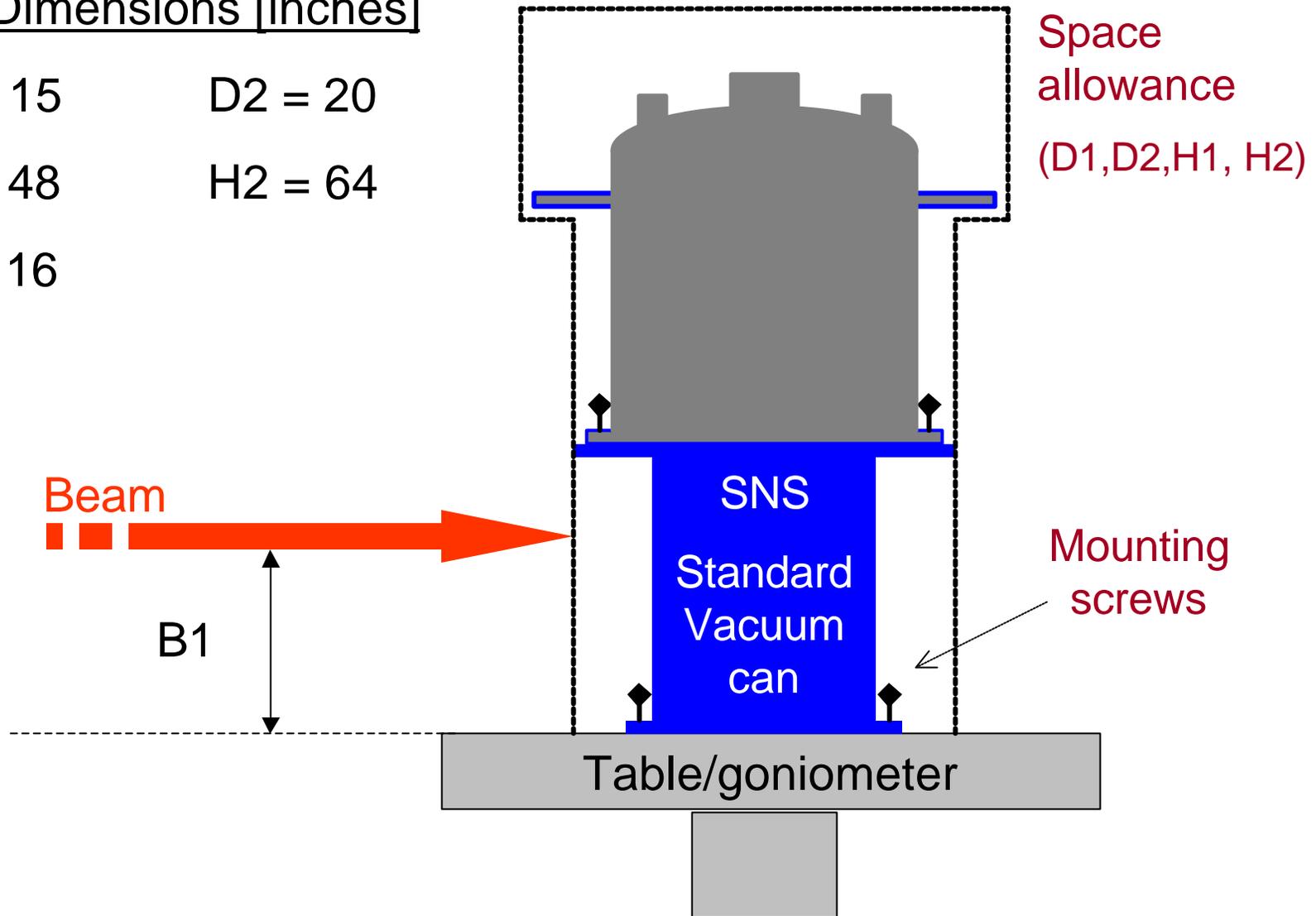
- General use SE inventory will accommodate 3 interface schemes
 - Table / bottom flange
 - Large tank / side flange
 - Small tank / tail flange

Instrument/SE Interface: Table Mount



Key Dimensions [inches]

D1 = 15 D2 = 20
H1 = 48 H2 = 64
B1 = 16



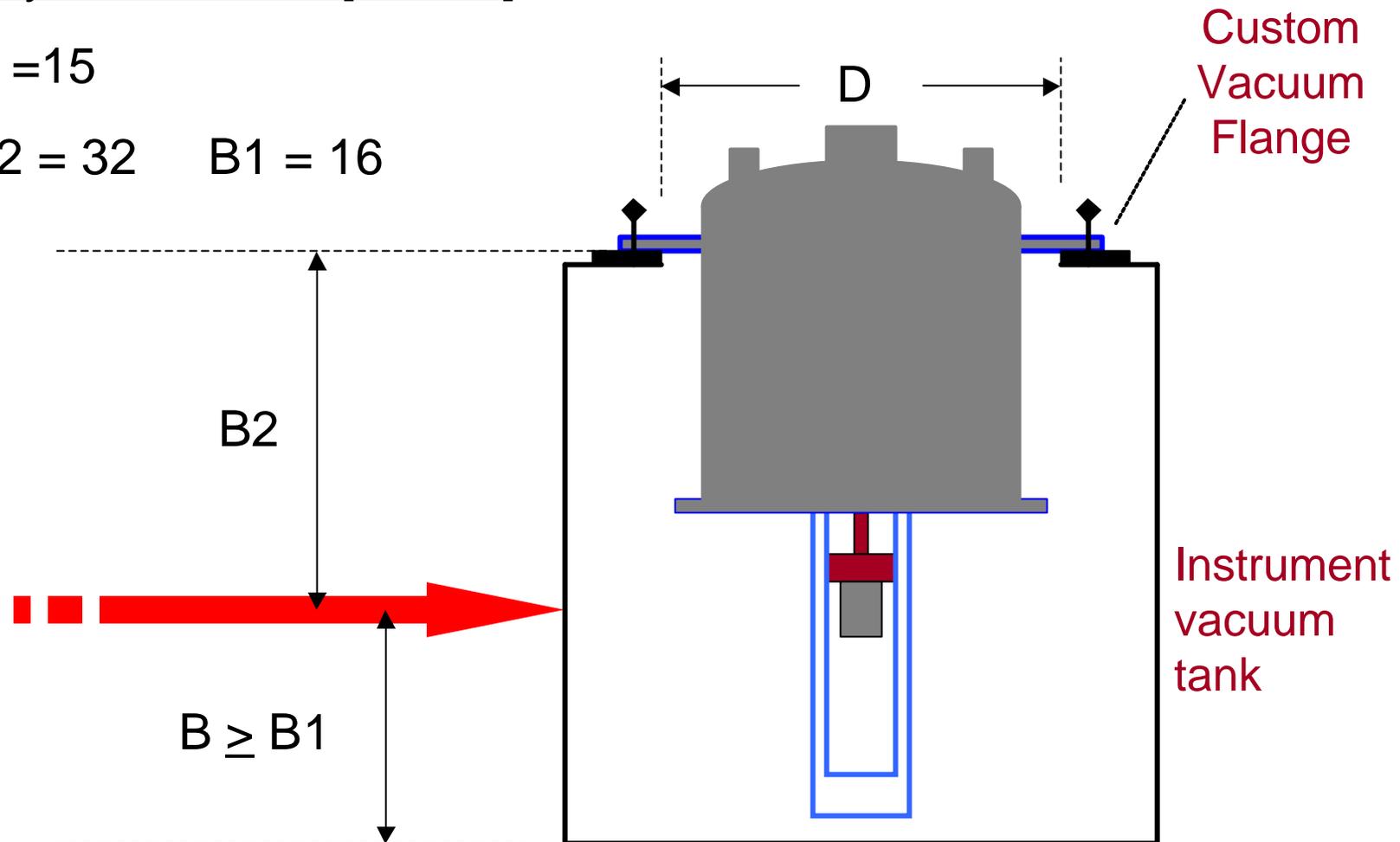
Instrument/SE Interface: Large Tank Style



Key Dimensions [inches]

$D = 15$

$B_2 = 32$ $B_1 = 16$



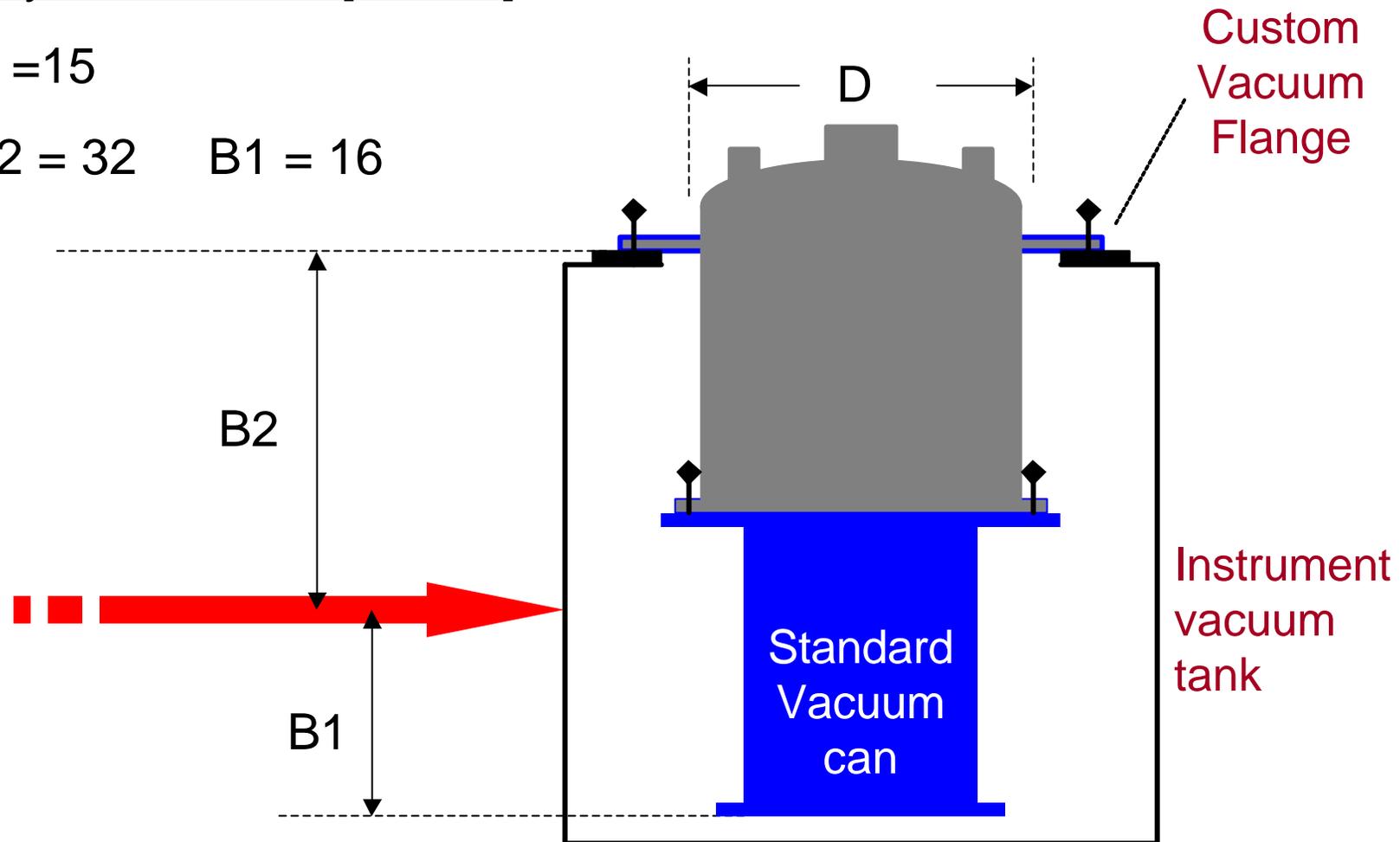
Instrument/SE Interface: Large Tank Style



Key Dimensions [inches]

D = 15

B2 = 32 B1 = 16



Instrument/SE Interface: Small Tank Style

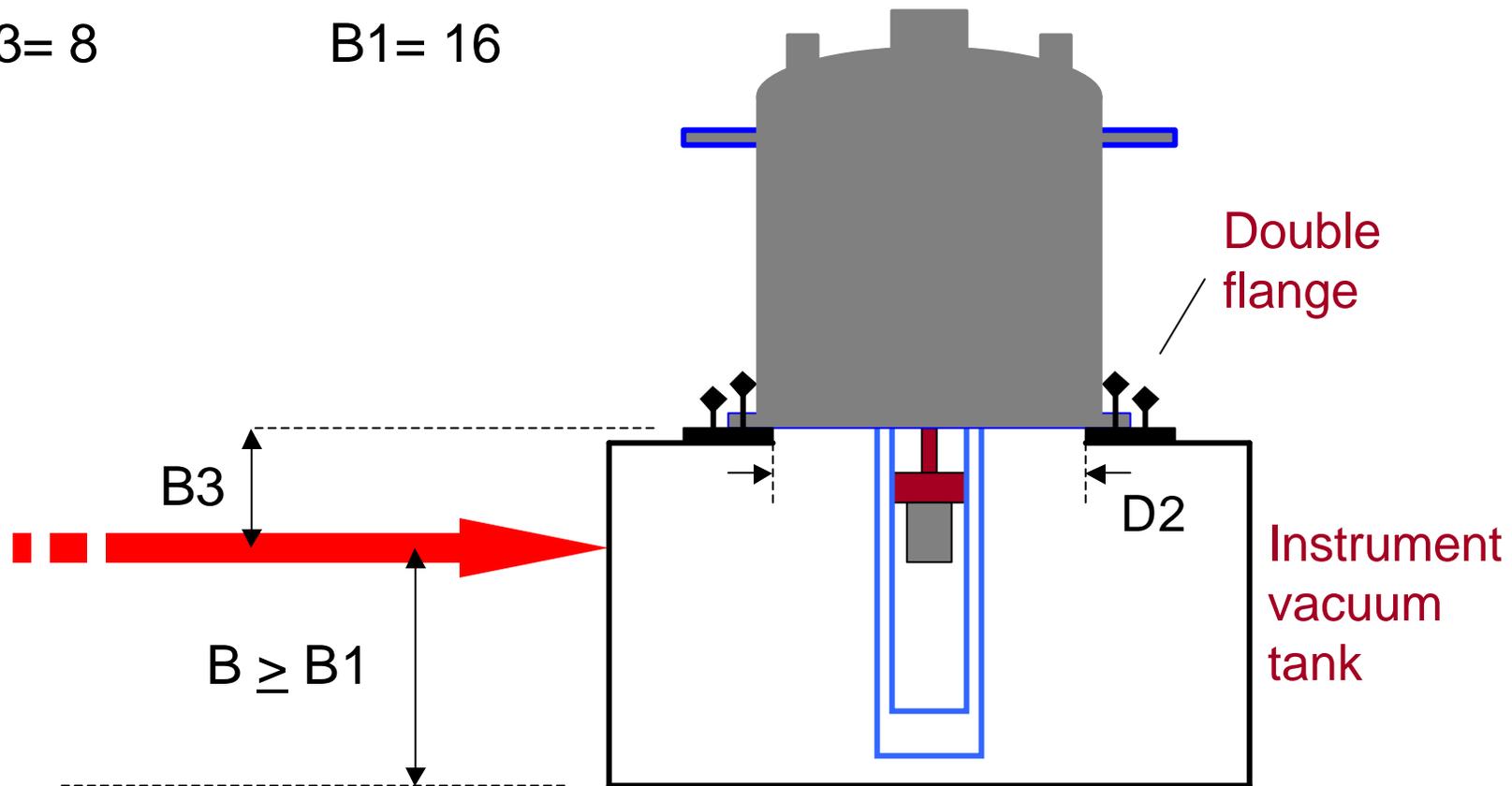


Key Dimensions [inches]

D2 = 11

B3 = 8

B1 = 16



Instrument/SE Interface: Small Tank Style

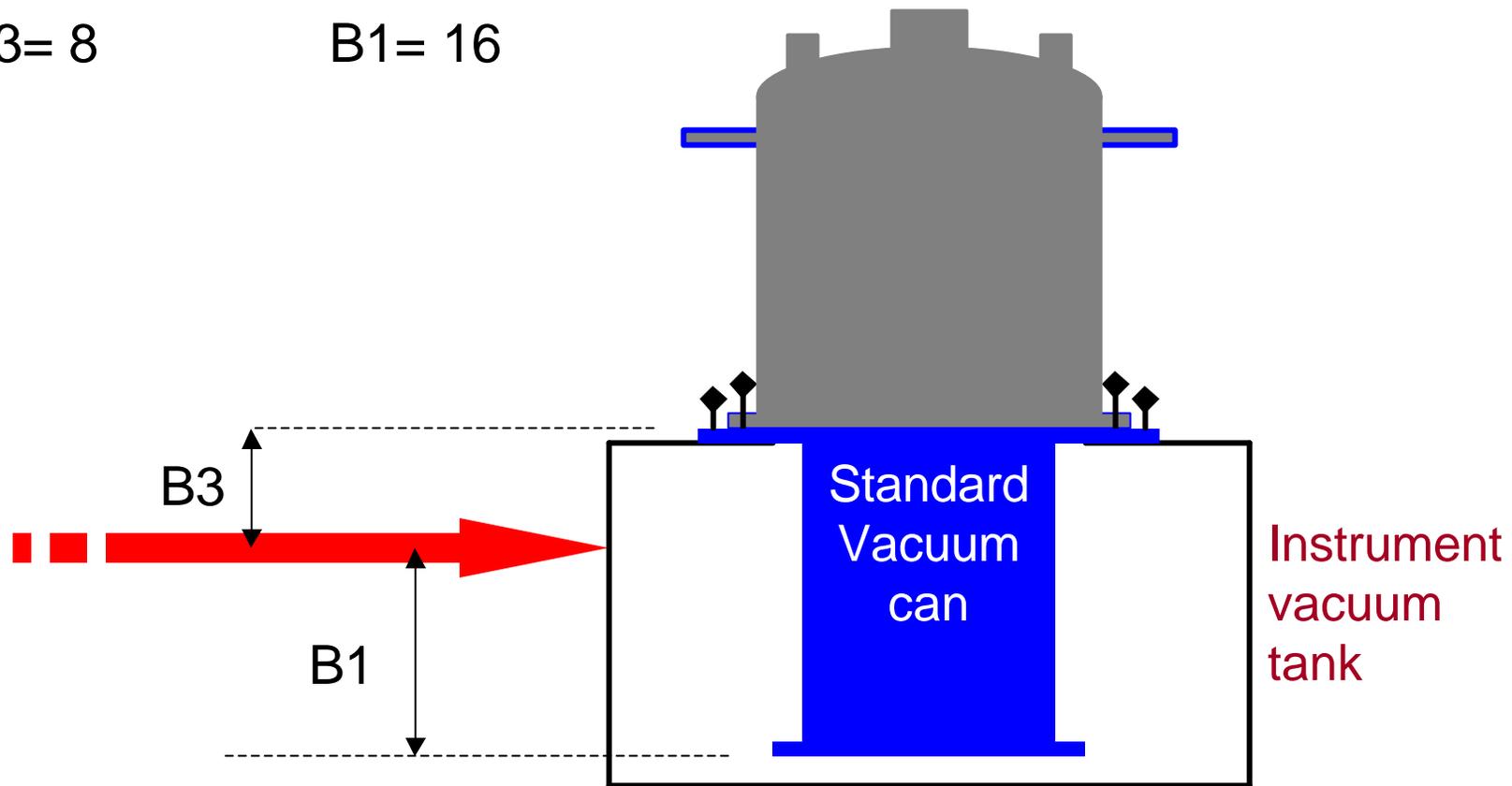


Key Dimensions [inches]

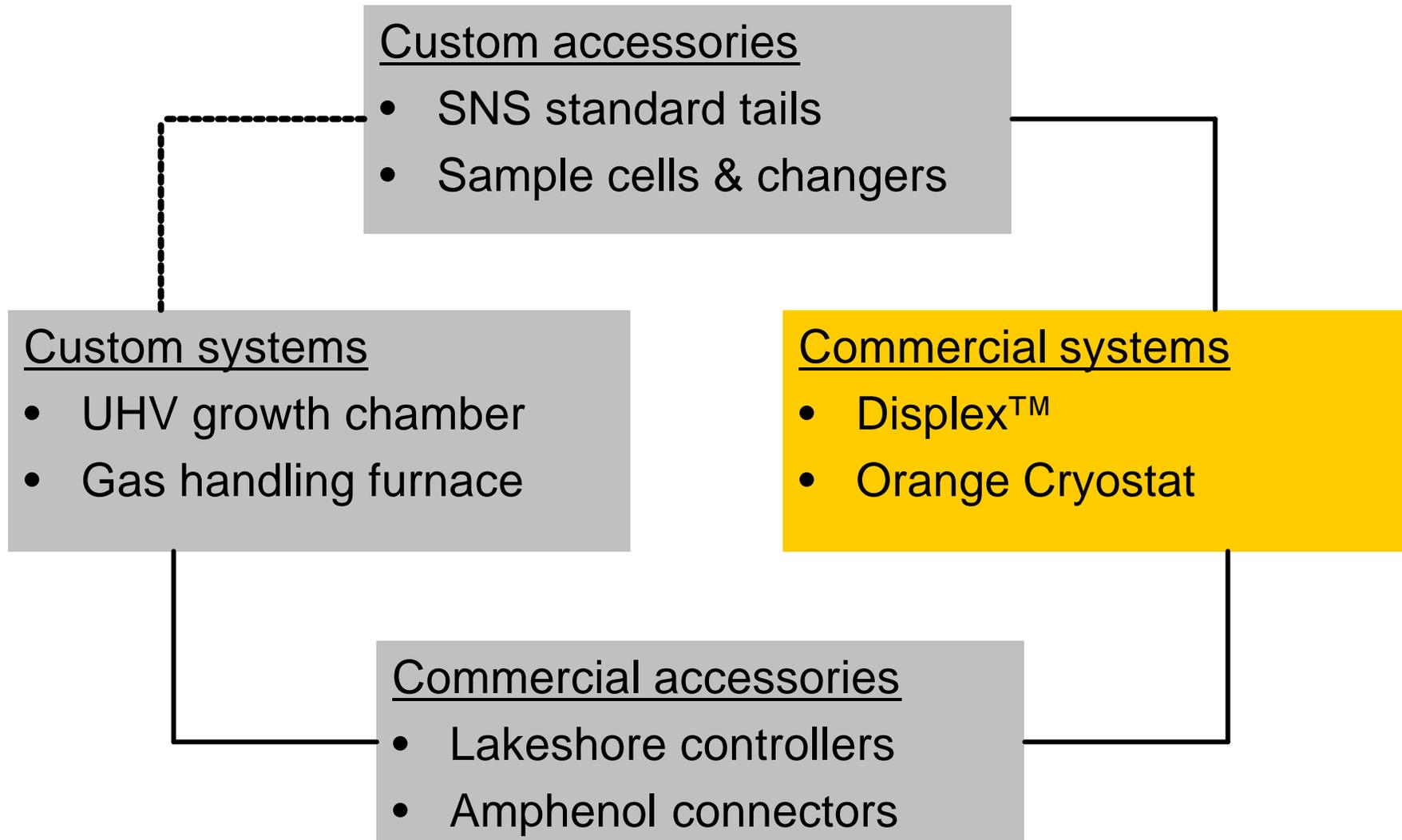
D2 = 11

B3 = 8

B1 = 16



Sample Environment Inventory



Orange Cryostat

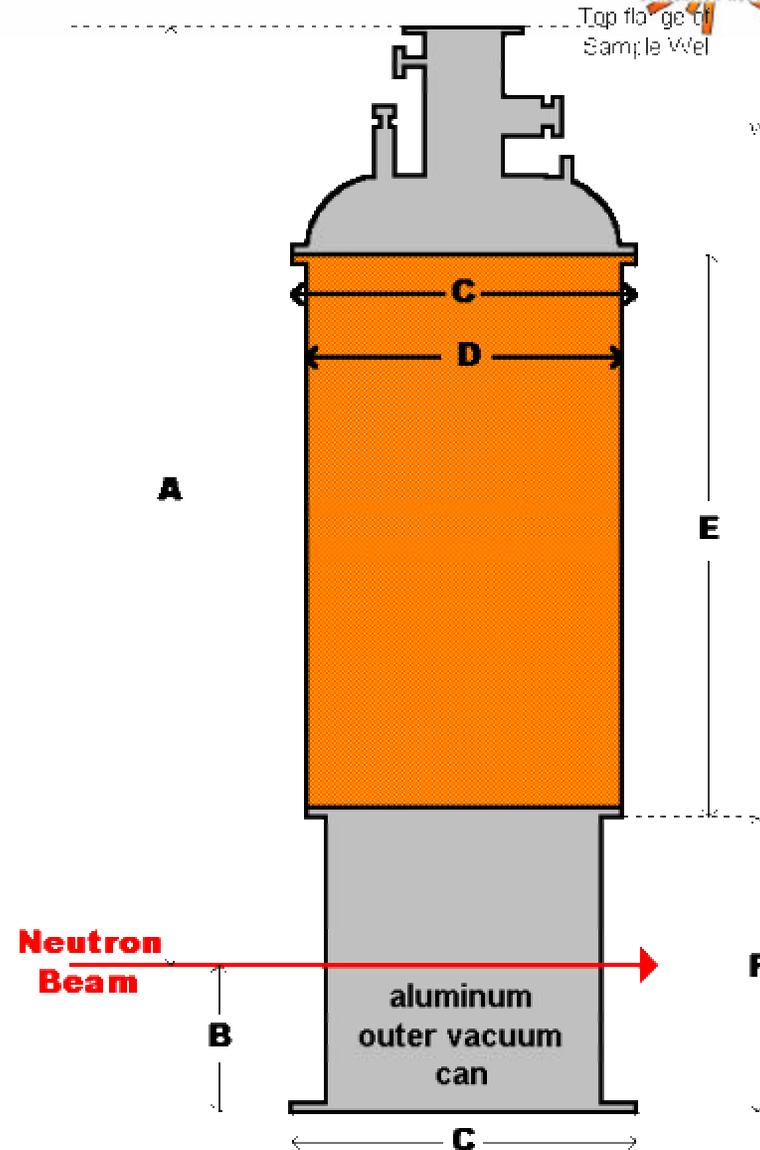
- 1.4 to 300 K
- Well known in neutron community
- Operation can be difficult
- Top loading scheme
 - Custom sample probes
 - Rapid sample change



“Standard” Orange Cryostat



- Key Outer Dimensions [inches]
D = 12.5 E = 22.3
- Orange body fits present scheme
- Specify custom flanges at top and bottom of orange body
- Use SNS custom tail



I.L.L. Cryofurnace

- 1.4 to 570 K
- Extends range with same performance as standard Orange Cryostat
- Not as well known as OC, but references available
- Expect same user-un-friendly operation



Closed-Cycle Refrigerators (CCRs)

- Conventional Gifford-McMahon (GM)
 - mature technology sold in many varieties
 - typical temperature range 10 – 325 K
- Modified GM
 - many new products emerging
 - base temperatures below 2 K
- Pulse Tube
 - new vibration-free technology
 - base temperatures below 3 K
 - less efficient than GM

Displex™ DE-204 System



- 6 – 350 K
- 9-Watt cooling capacity at 20 K
- 30-minute cooldown to 20 K (as-supplied)
- Turn-key operation
- Bottom loading
- Bottom loading



Omniplex™ Top Loading CCR



- 12 – 300 K
- Driven by DE-204 (9 W @ 20 K)
- Initial cool down: 75 minutes
- Sample cool down: 12 minutes
- Cryogen-free top loading
- No experience with system



SuperTran™ Continuous Flow System



- 1.4 – 700 K
- Sample in vapor
- No experience
- Rapid Cool
- Compact & Modular



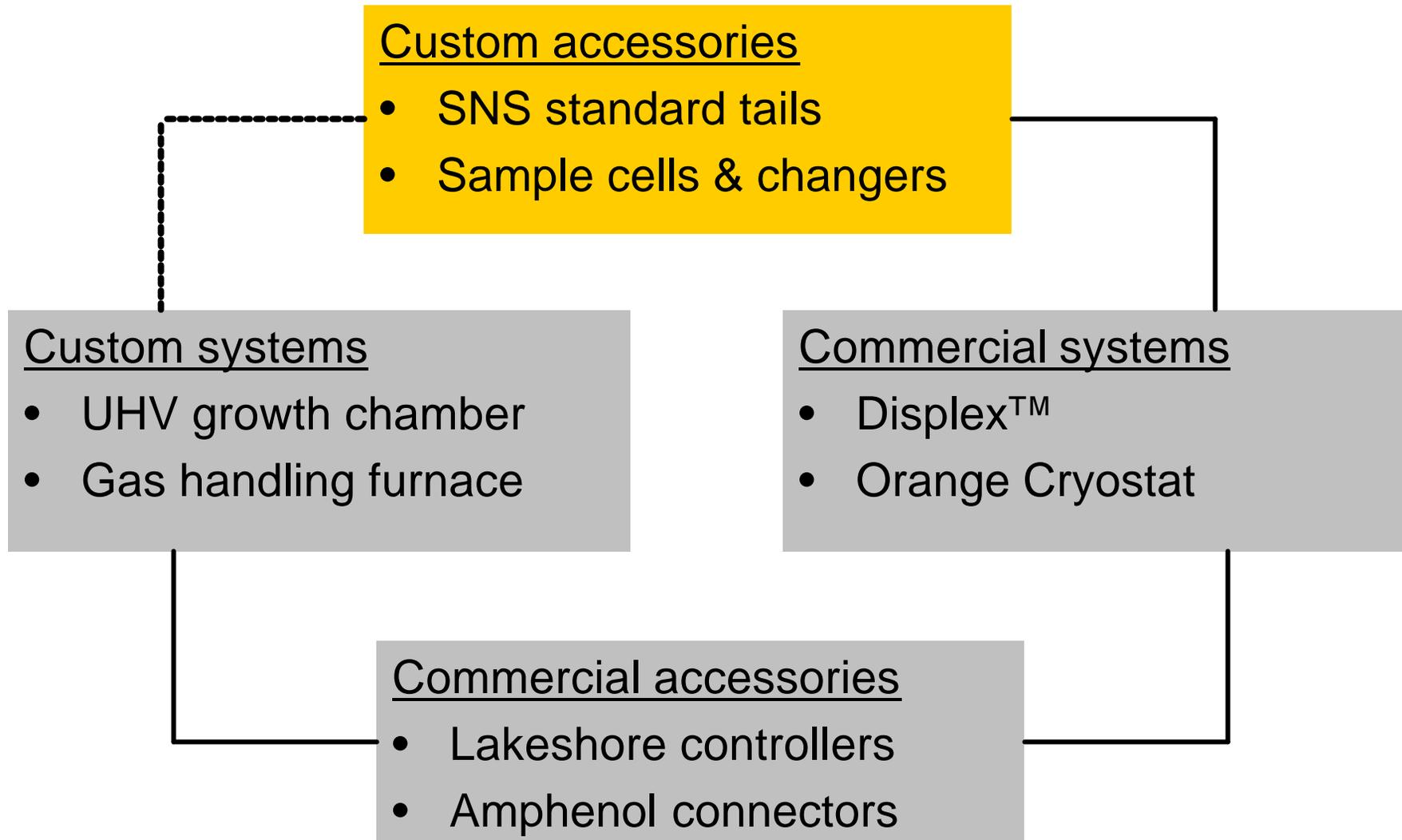
Superconducting Magnet Systems



- NIST CT-Mag “Old Blue”
 - Relatively simple
 - Modular
 - 7 Tesla Max
 - Some liquid helium in beam
- Cryogen-free products emerging



Sample Environment Inventory

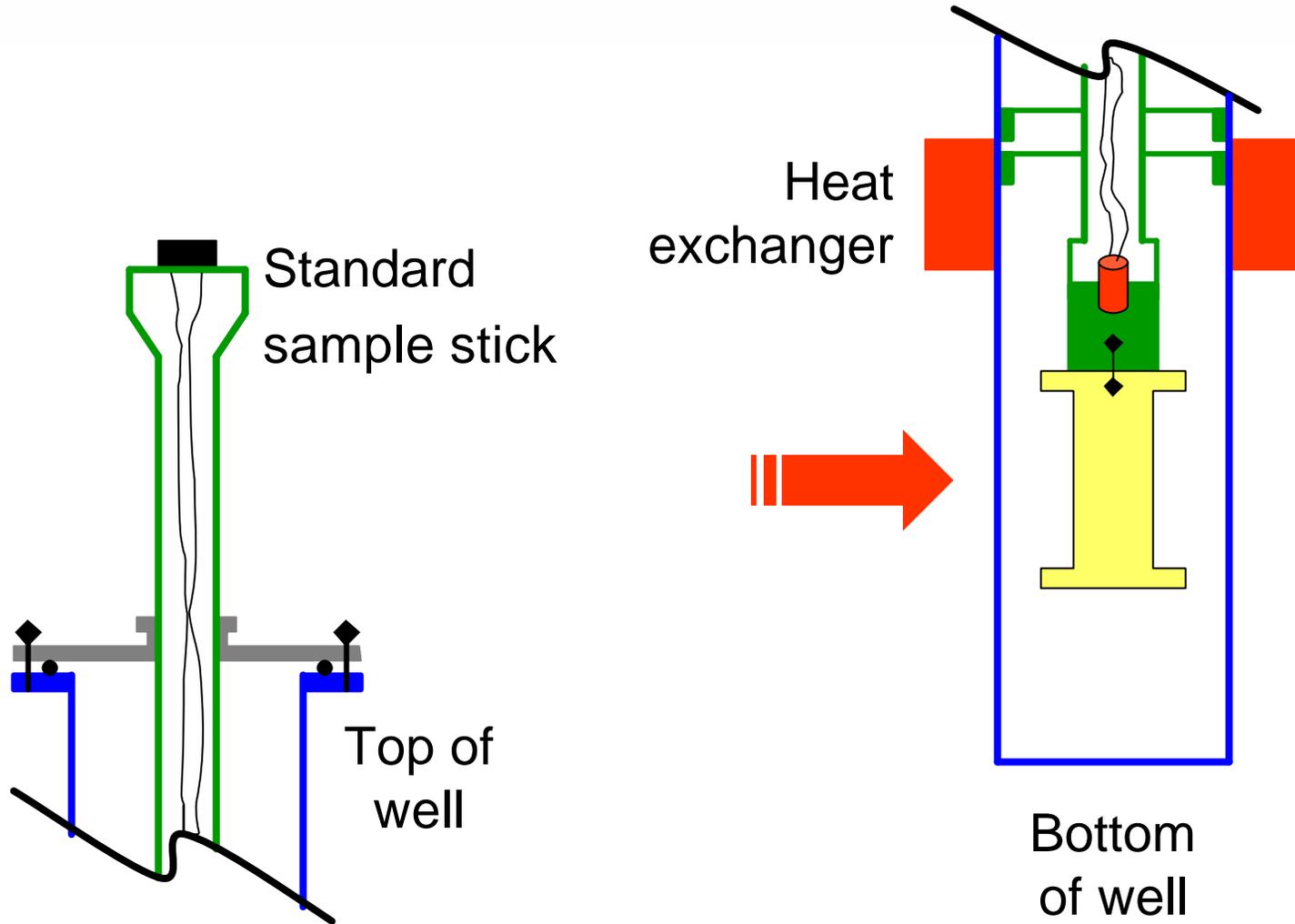


Rapid/Automated Sample Changes

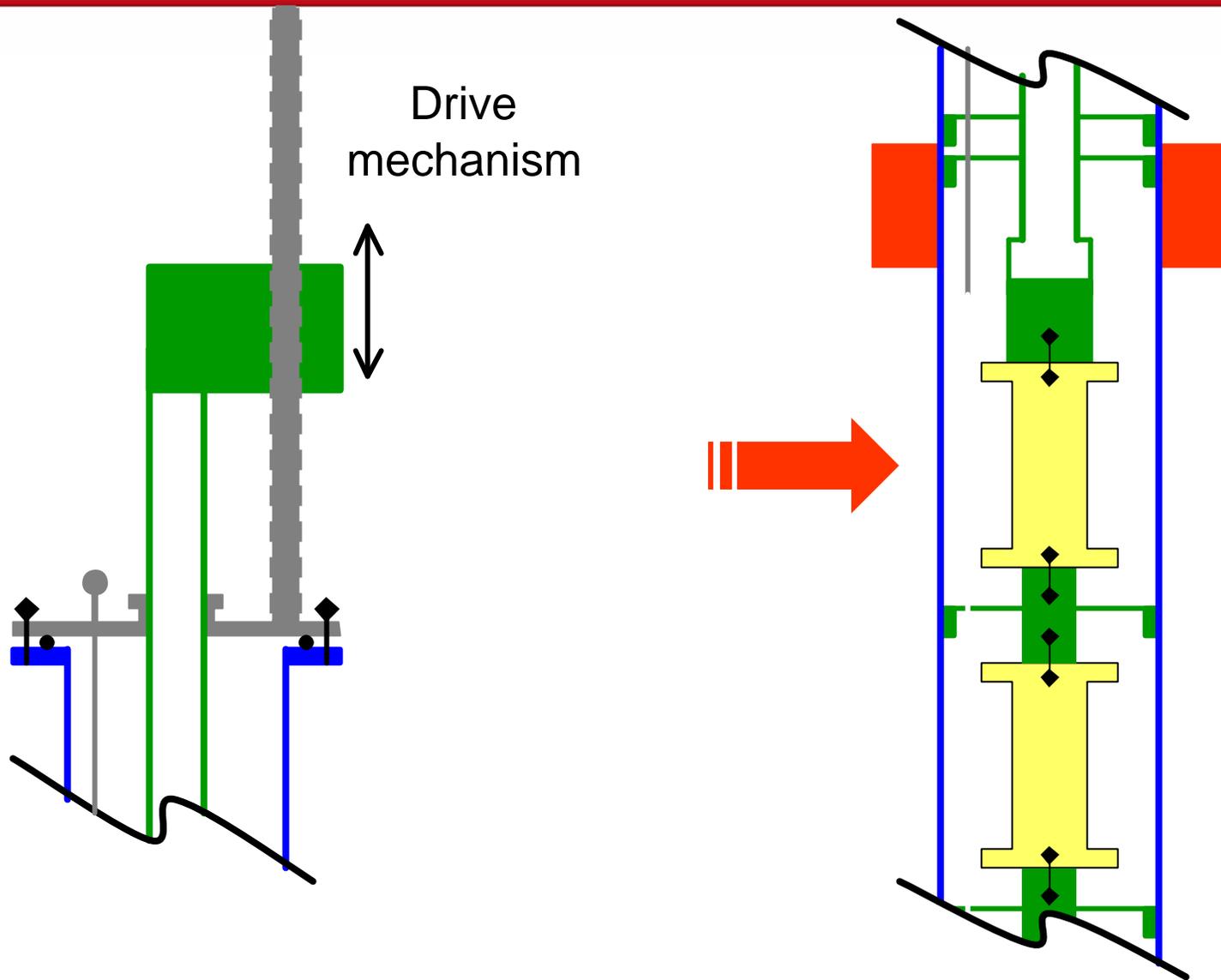


- Existing designs for room temperature region
 - IPNS 10 position RTSC
 - NIST temperature controlled (-10 to 100 C) 10 position
- New designs needed for cryogenic & high temperature
 - Integrate with existing environments

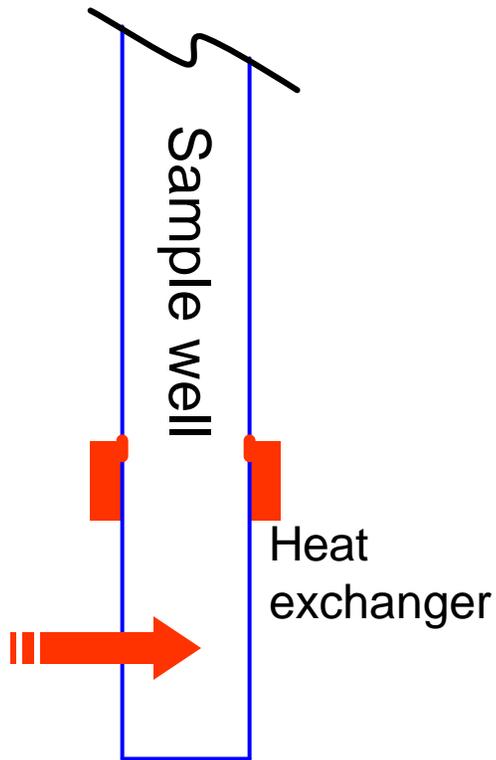
Top Loading Cryostat



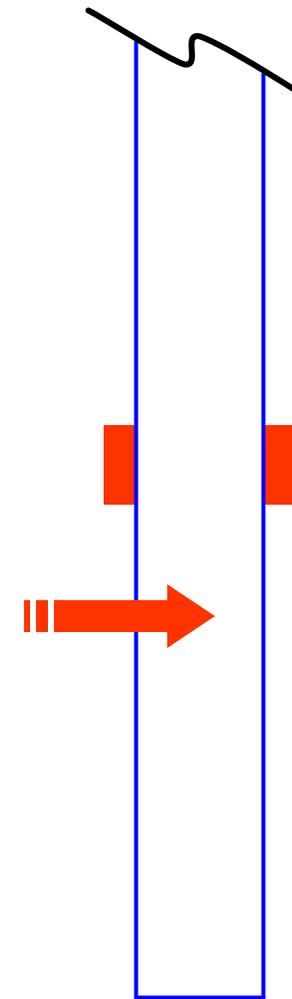
Top Loading Sample Changer



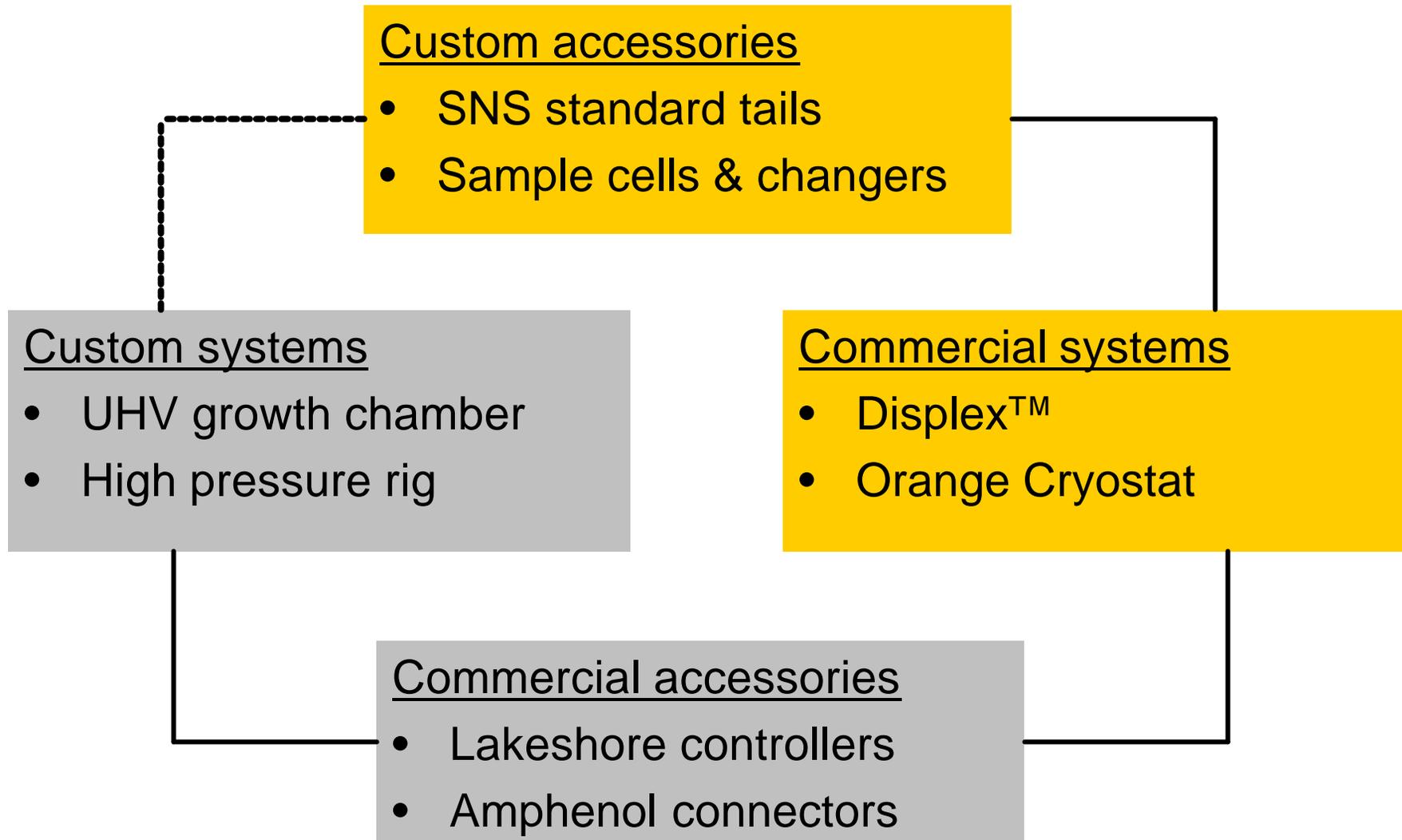
Deep-well top loading system



- Typical sample well offers limited vertical range
- Deeper well accommodates multiple samples
- Modified stick/baffle arrangement needed
- How deep can we go before hurting performance?



Sample Environment Inventory



What Systems are Best for SNS?



- Orange Cryostats (or equivalent) **with proper customization and support instrumentation**
- Orange Cryofurnaces (why bother with standard OC?)
- CCR with lowest base temperature and highest power
 - Top loading versions may be competitive with OC
 - Some bottom loaders may be necessary for low background experiments

Worth Investigating

- Cryogen-free superconducting magnets
- Continuous flow systems