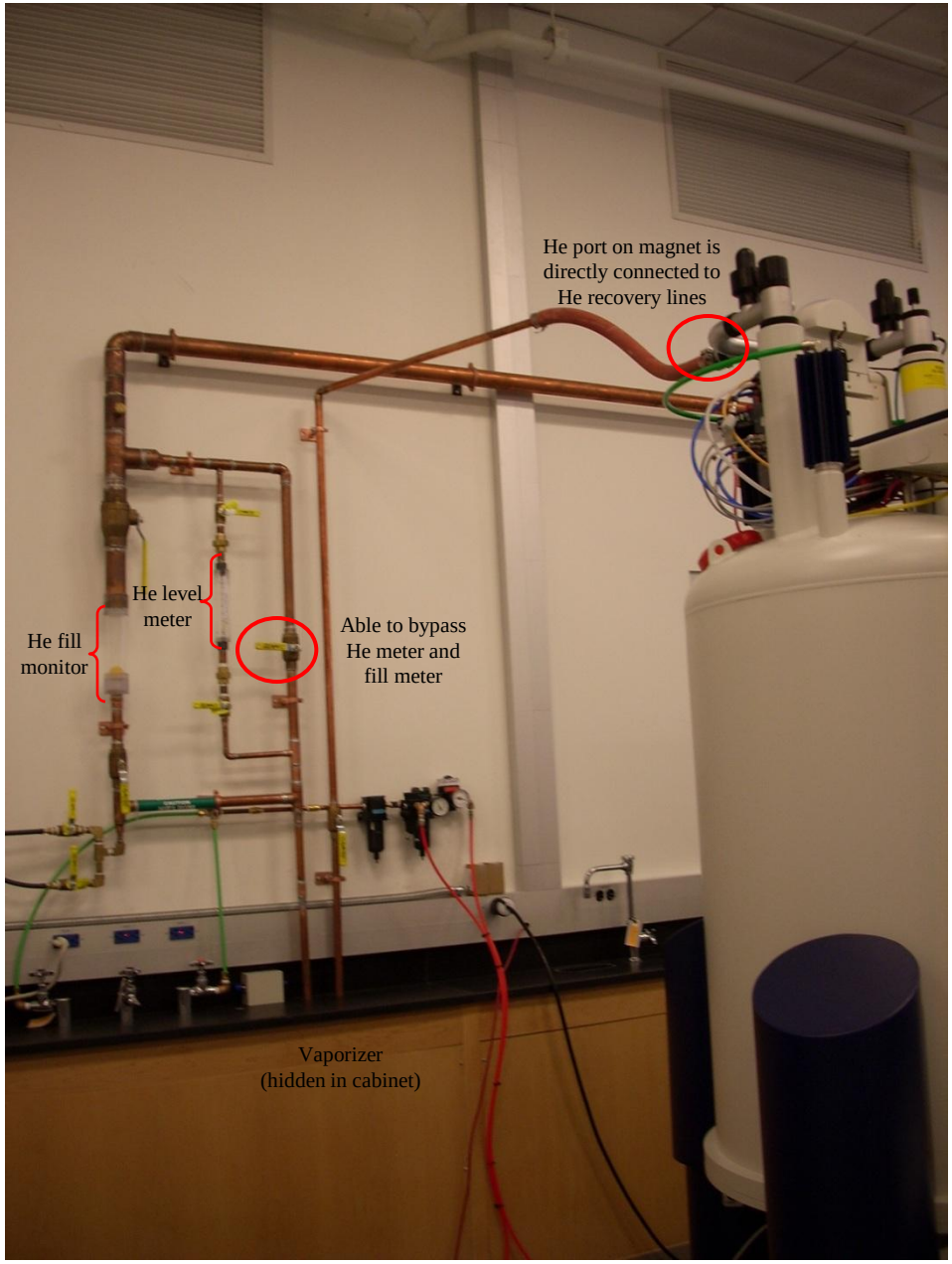
Helium Recovery at Iowa State University

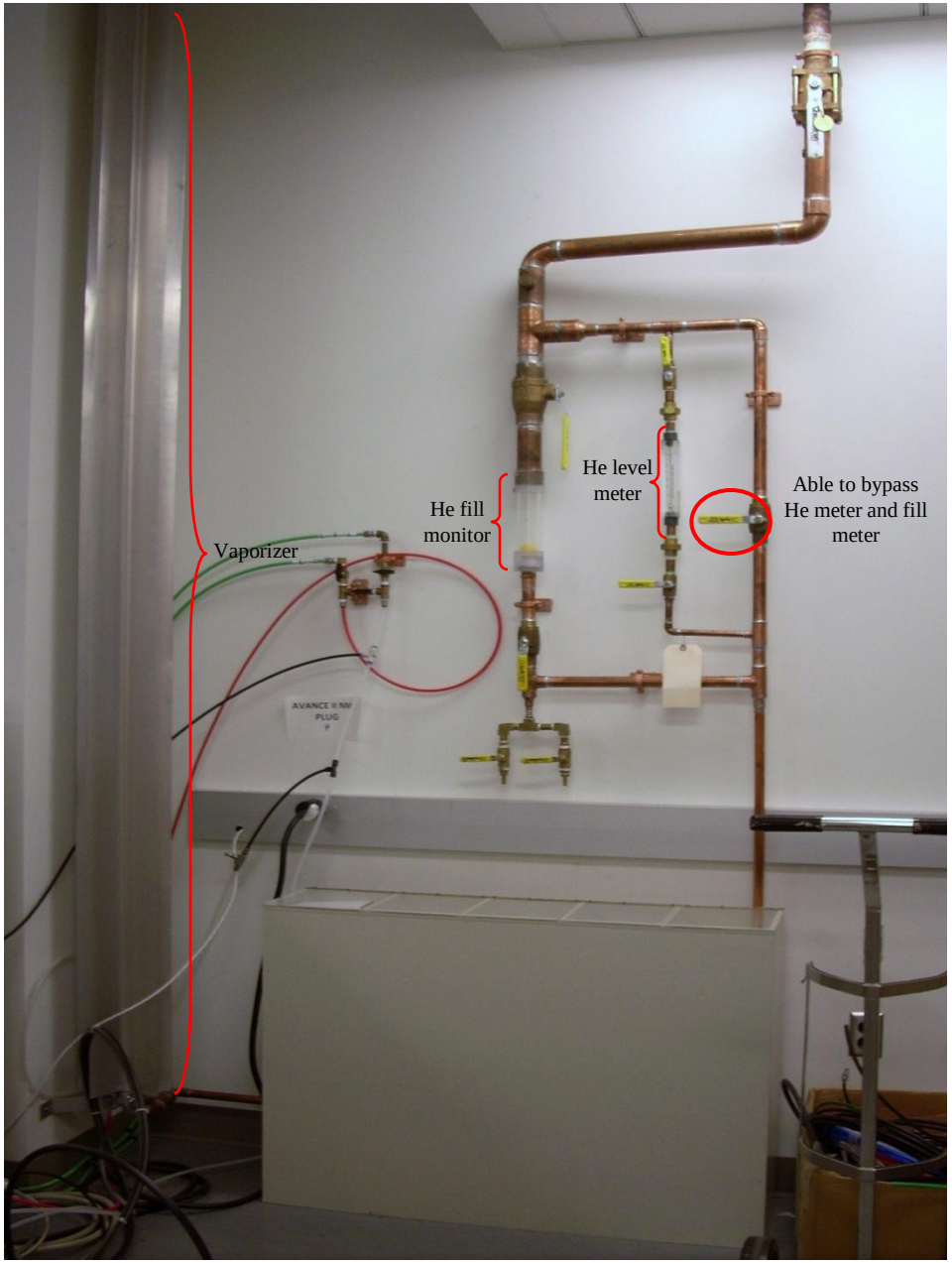
Special Thanks to
Sarah Cady and Marc McGinn

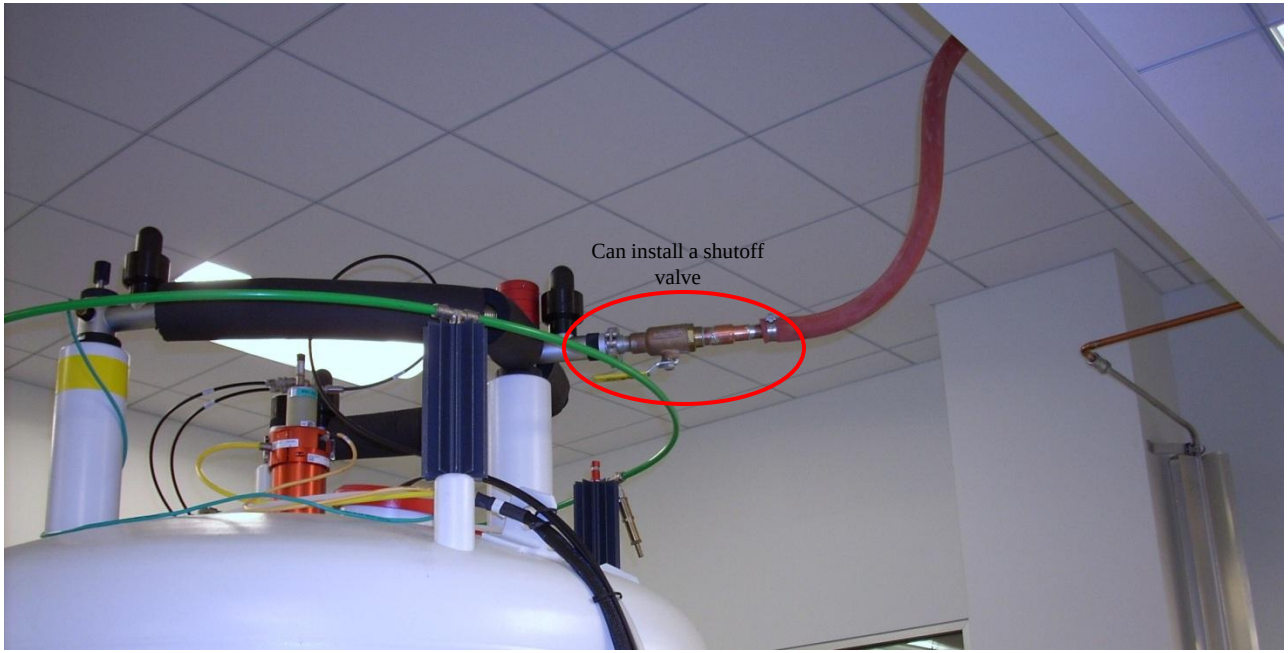
by

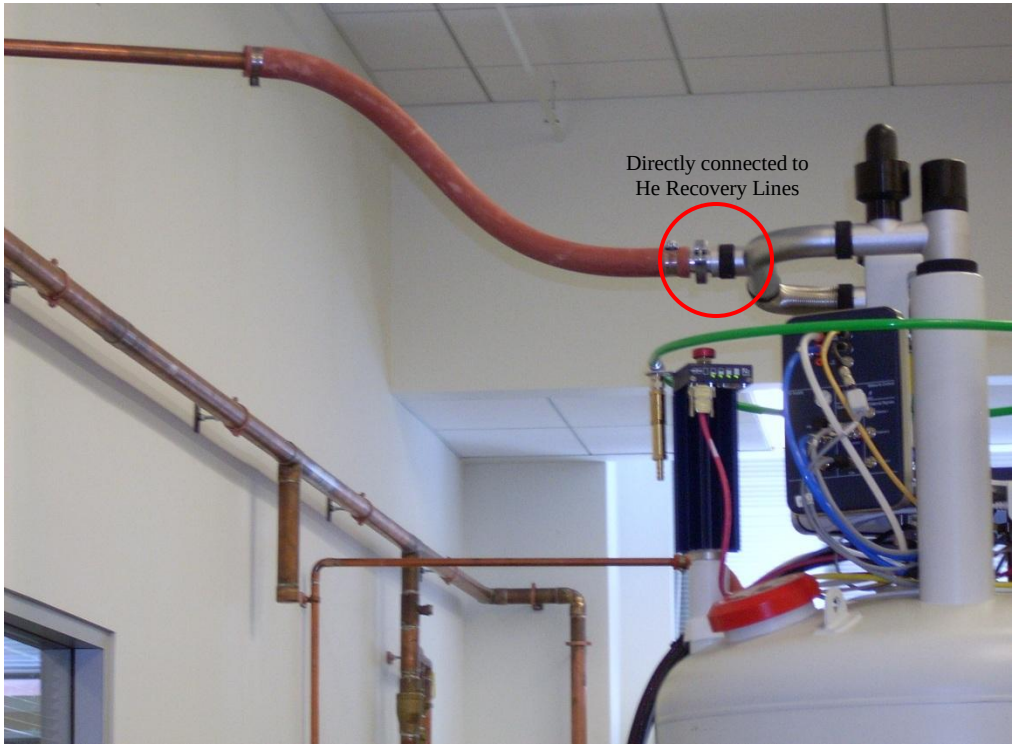
Jennifer Rapp, Ph.D., Spectroscopist
Dean Olson, Ph.D., Director
U. of Illinois NMR Lab
http://scs.illinois.edu/nmr/

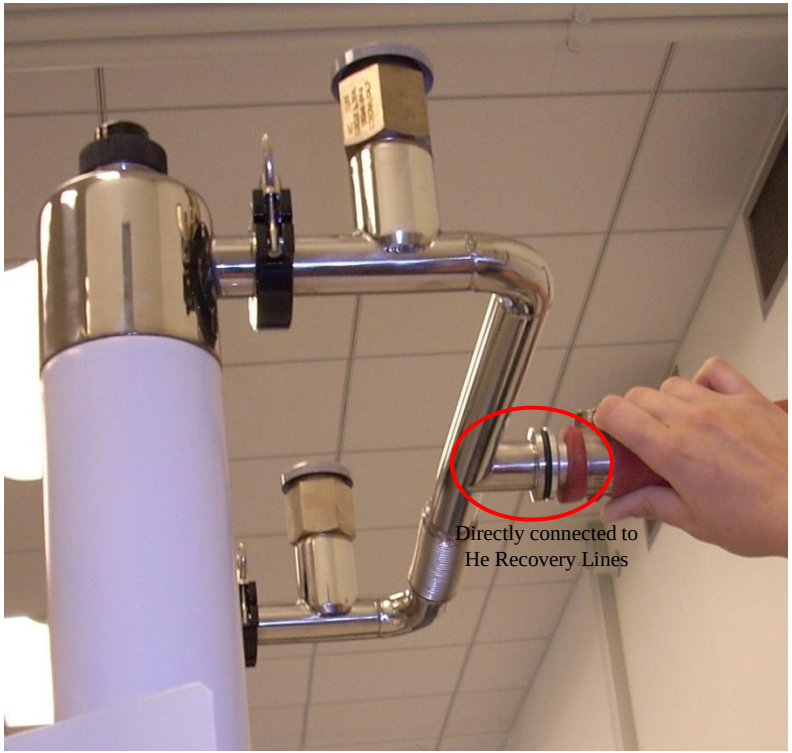
Helium Recovery Set-Up at Magnet






Can install a shutoff
valve


Directly connected to
He Recovery Lines


Directly connected to
He Recovery Lines

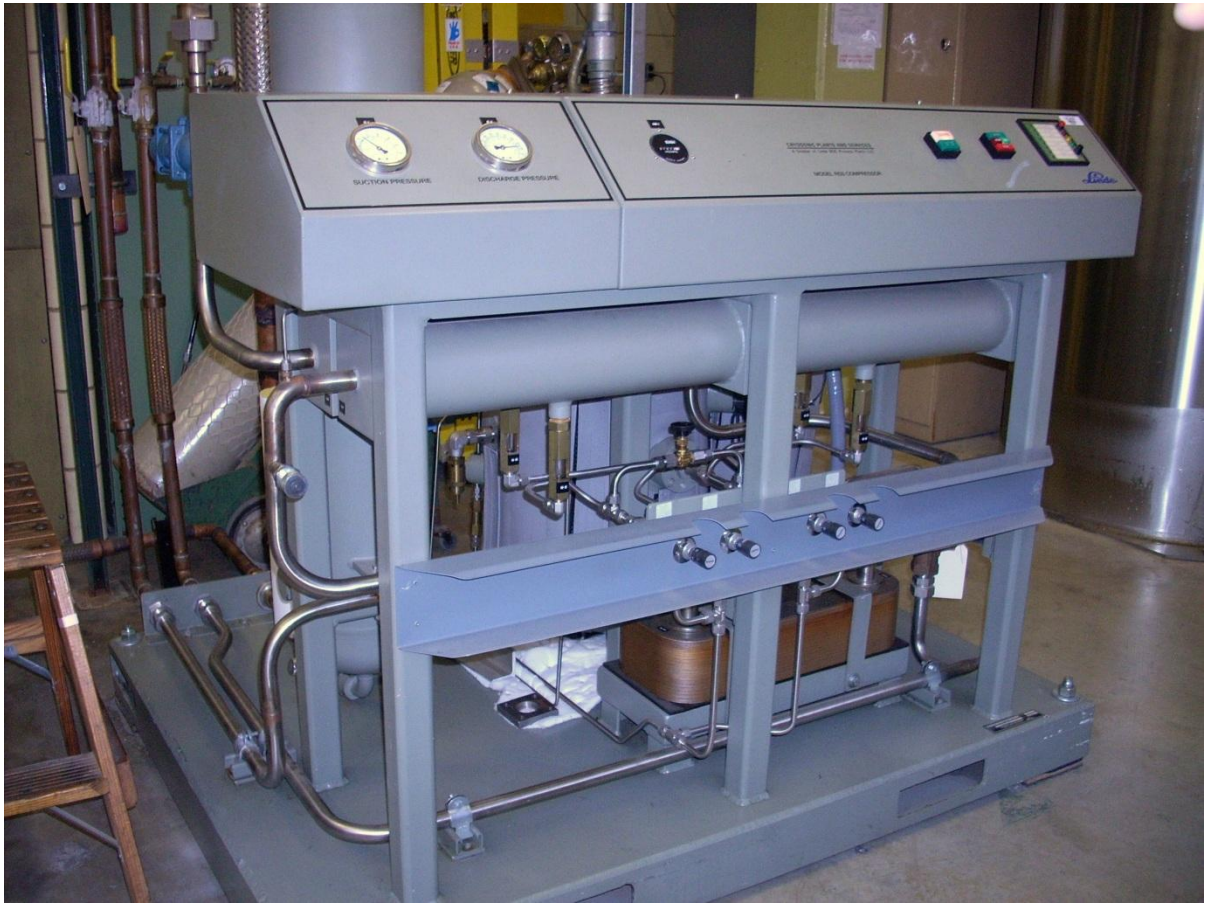
Basement – Helium Gas Bag

Helium Gas Collection Bag

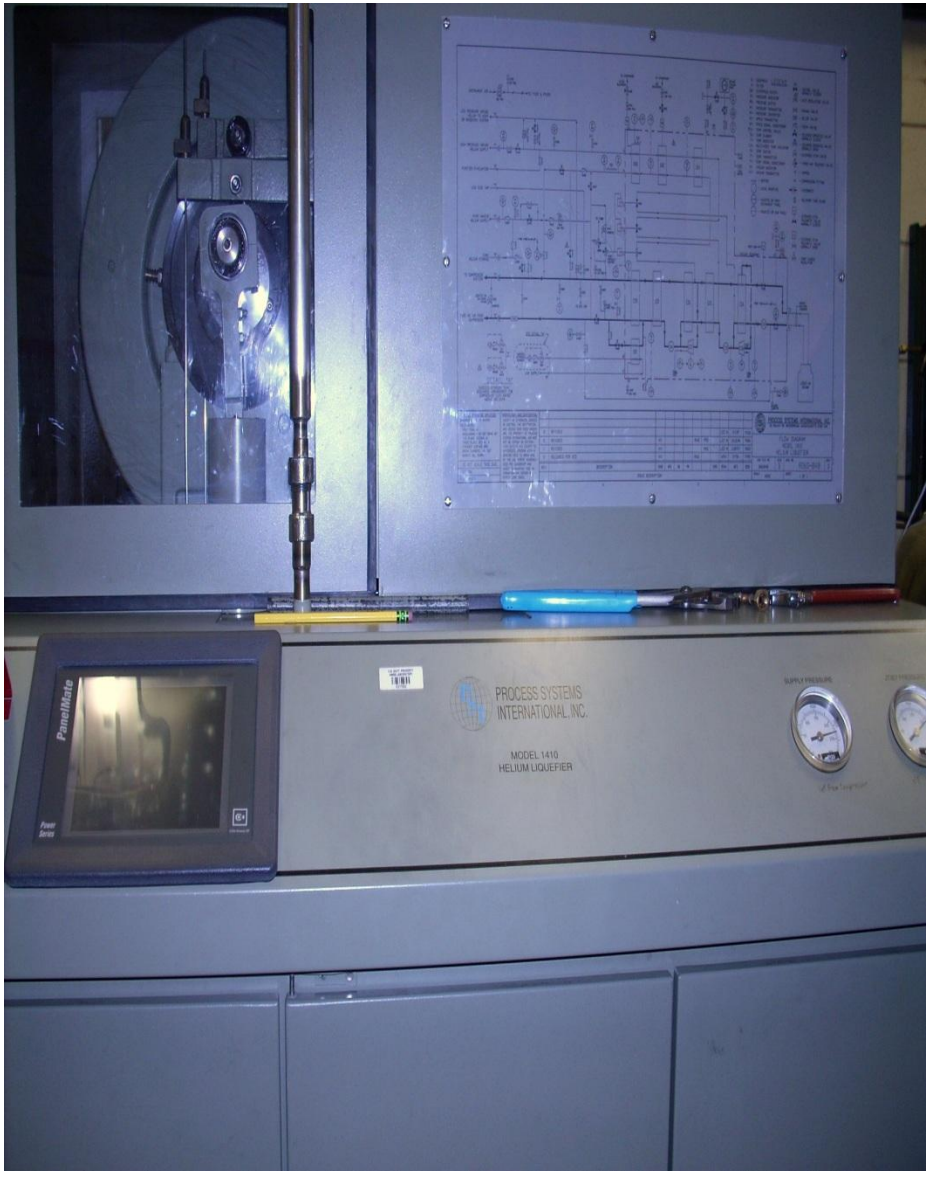
Recovery Compressor

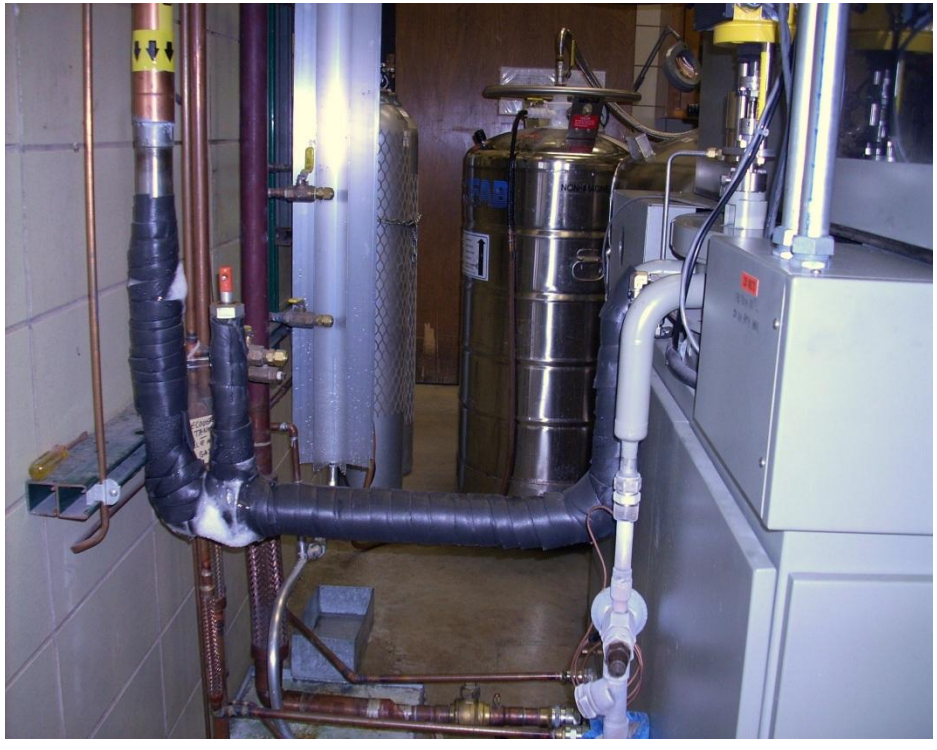
Holding Tanks – Clean and Dirty He Gas

RSS Compressor for Liquefier



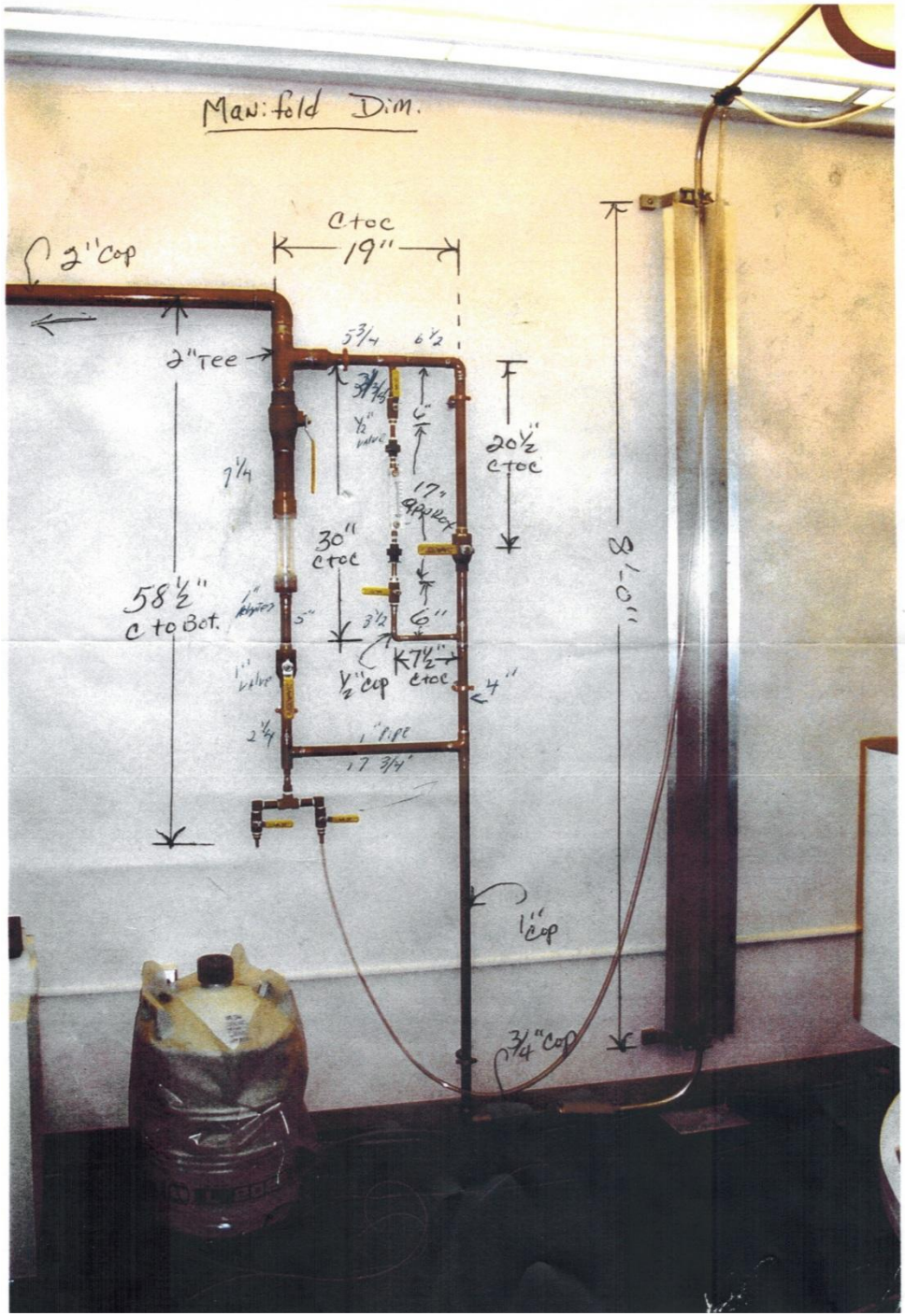
Liquefier


PROCESS SYSTEMS
INTERNATIONAL, INC.
MODEL 1410
HELIUM LIQUEFIER
PanelMate

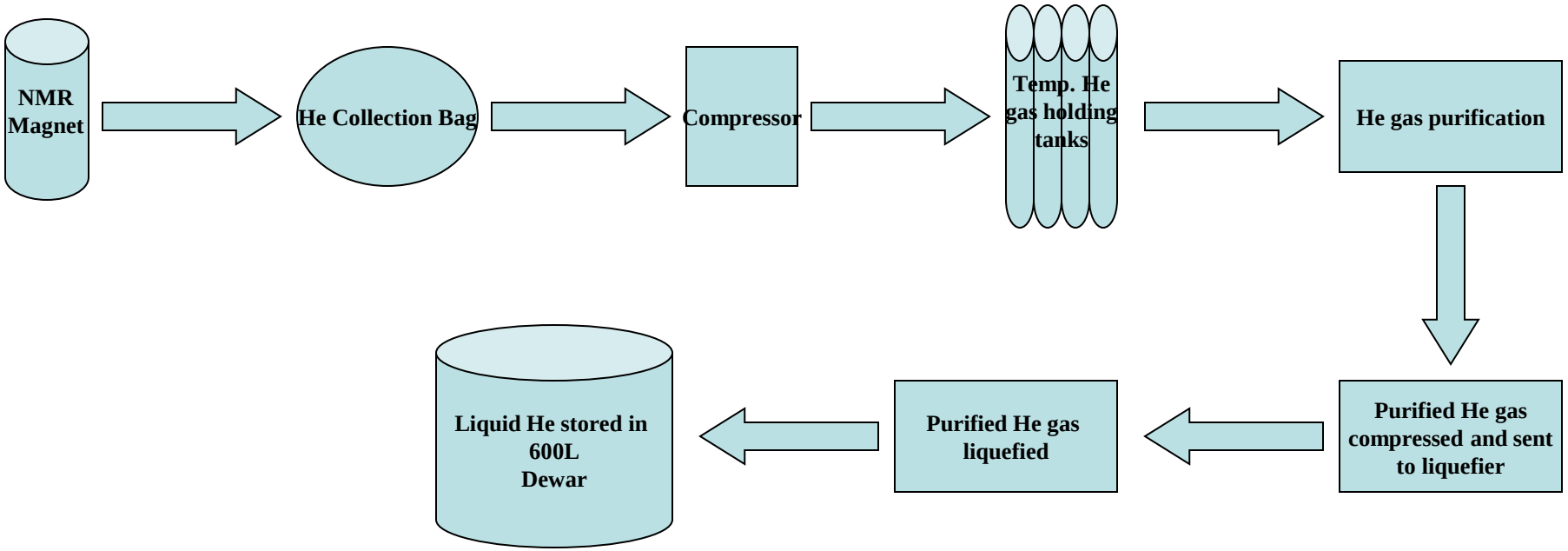


Final Holding Tank (600L)

Dimensions of Helium Recovery System at Magnet

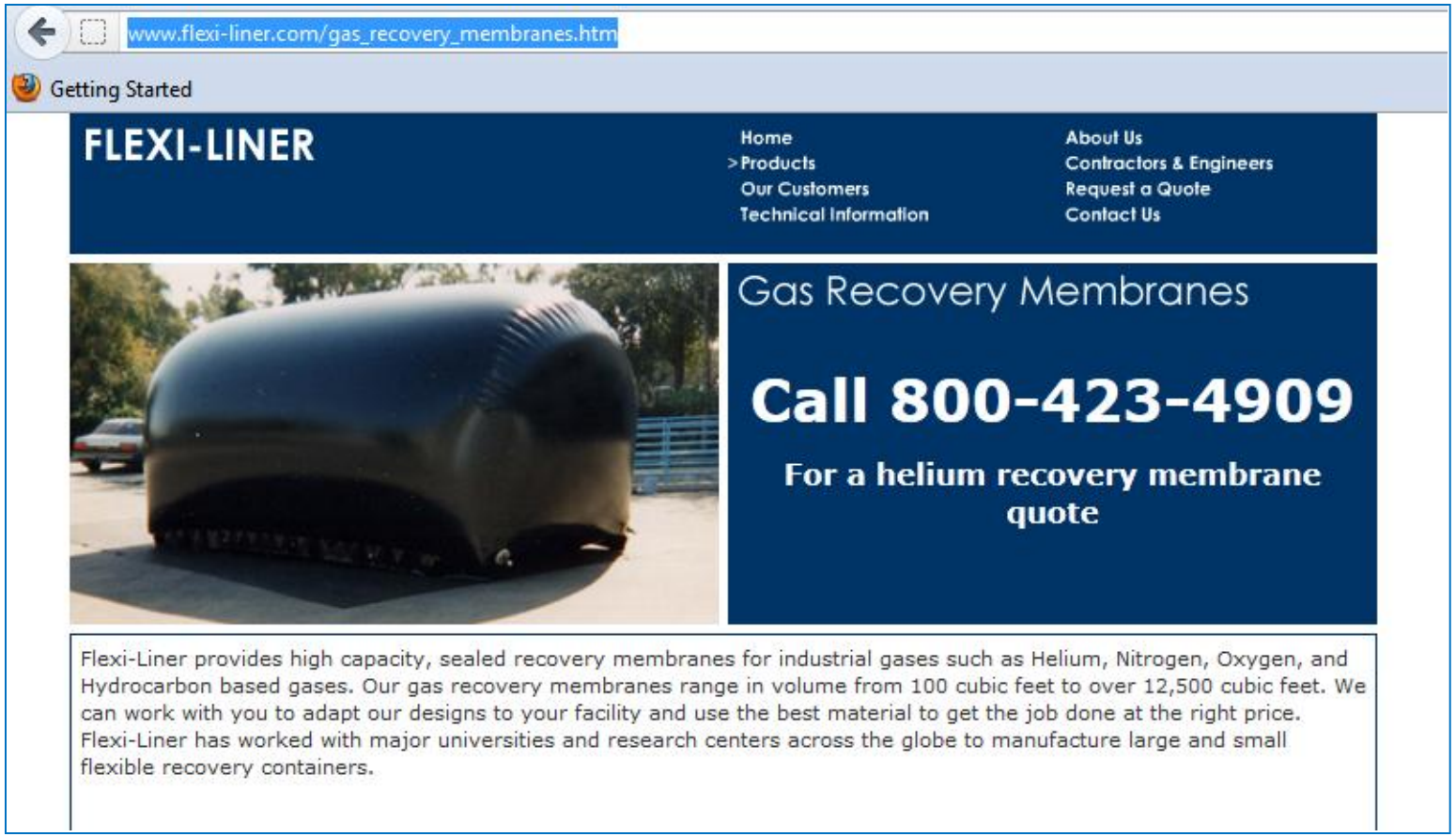


Total Helium Recovery Pathway



Helium Storage Bag

- Serves as a volume buffer between a magnet (especially during a fill) and a liquification system
- http://www.flexi-liner.com/gas_recovery_membranes.htm



Helium Fun Facts

- **A bag of about 12,000 cubic feet is about $12K**
  - **The cost is non-linear. A bag twice as big costs less than twice as much. Shapes are customized.**
- **1 liter of LHe expands to 26.63 SCF**
  - **SCF = standard cubic feet (P = 1 atm and 70 degrees F)**
- **Our new 800 MHz magnet holds about 1000 L, but takes 4500 L to cool down at installation.**
- **When working with non-scientists, it is good to mention that helium is:**
  - **Non-toxic, non-flammable, and non-corrosive**
  - **A lot like nitrogen except lighter**
- **A purification and liquification system could cost $300-500K.**
  - **The facility in our nearby Physics Department is staffed by one full-time employee and runs 24/7 and is down just 2 weeks per year.**

Substitute for Plume Observation During Helium Fills

- A special flow component serves as:
  - A check valve to gently allow the one-way exit of helium gas from the magnet on a continuous basis without affecting NMR data
  - A flow indicator that shows plainly when the helium Dewar of the magnet is full
- Note:
  - On earlier slides, this was labeled as a “helium fill monitor”
  - It is really a “ping pong ball check valve”
  - This is entirely an Iowa State idea!

Ping Pong Ball Check Valve

How It Works

Beginning of LHe Fill

Middle of LHe Fill:
The ball rises somewhat

Ping Pong Ball Check Valve

How It Works

End of LHe Fill:

The ball rises nearly to the top over a short period of about 2 min

What really makes it work:

The inner profile of the cylinder is slightly V-shaped; the higher the ball, the faster the flow!