Absorber-Focus Coil Safety Working Group

Introduction and Design Concepts

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CENTER FOR BEAM PHYSICS

RAL Safety Meeting
October 30, 2003

Outline

- Introduction
- Design concepts

Introduction

- This meeting is to give RAL safety folks a progress report on where we are in developing the concept for the MICE absorber system
  - we solicit your feedback on our plans
- We are working toward an "internal" review of our conceptual design
  - to be held in December, 2003
- Absorber-Focusing Coil Safety Working Group set up by Paul Drumm to finalize concept, get it reviewed, and get approval to proceed to a full engineering design
  - after the engineering design, there will be an external review, organized by RAL, to give final approval to fabricate the system
  - formal permission to operate will come from the RAL safety group after verifying that implementation was done correctly and that operations plans are in place

    ⇒ *RAL Safety Group is final arbiter of what is acceptable*

Introduction

- Working Group members:

Giles Barr (Oxford)
Elwyn Baynham (RAL)
Ed Black (IIT)
Tom Bradshaw (RAL)
Mary Anne Cummings (NIU)
Mike Green (LBNL/Oxford)
Shigeru Ishimoto (KEK)
Iouri Ivaniouchenkov (RAL)
Wing Lau (Oxford)

Mike Zisman (LBNL), convener

- Members chosen based on expertise and activities for MICE
  - absorber effort centered at KEK and near Fermilab
  - magnet work centered at LBNL and Oxford/RAL
  - infrastructure work centered at RAL
- AFCSWG met biweekly since mid-March, mostly via phone conferences

Introduction

- Today's agenda:

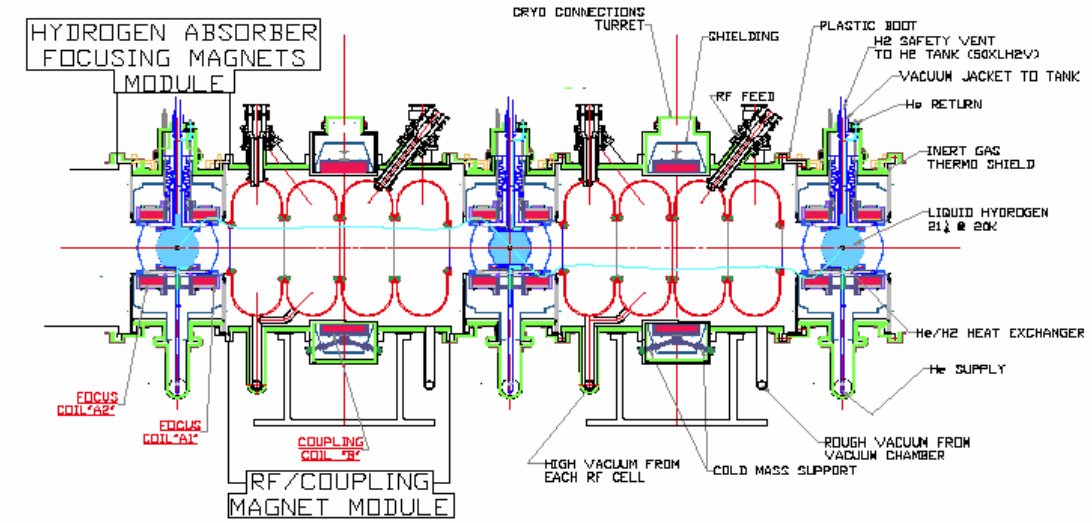
Update on present design concept	~~Cummings~~ Zisman	10 min
Hydrogen system approach	Ivaniouchenkov	10 min
Technical issues being addressed	Baynham	10 min
Plans for December internal review	Zisman	10 min

- We would like to exchange views with you, so our goal is to keep the talks brief and informal to allow time for discussion

- Alan Bross has also joined us to provide comments on any potential safety issues that might pertain to the MICE detectors

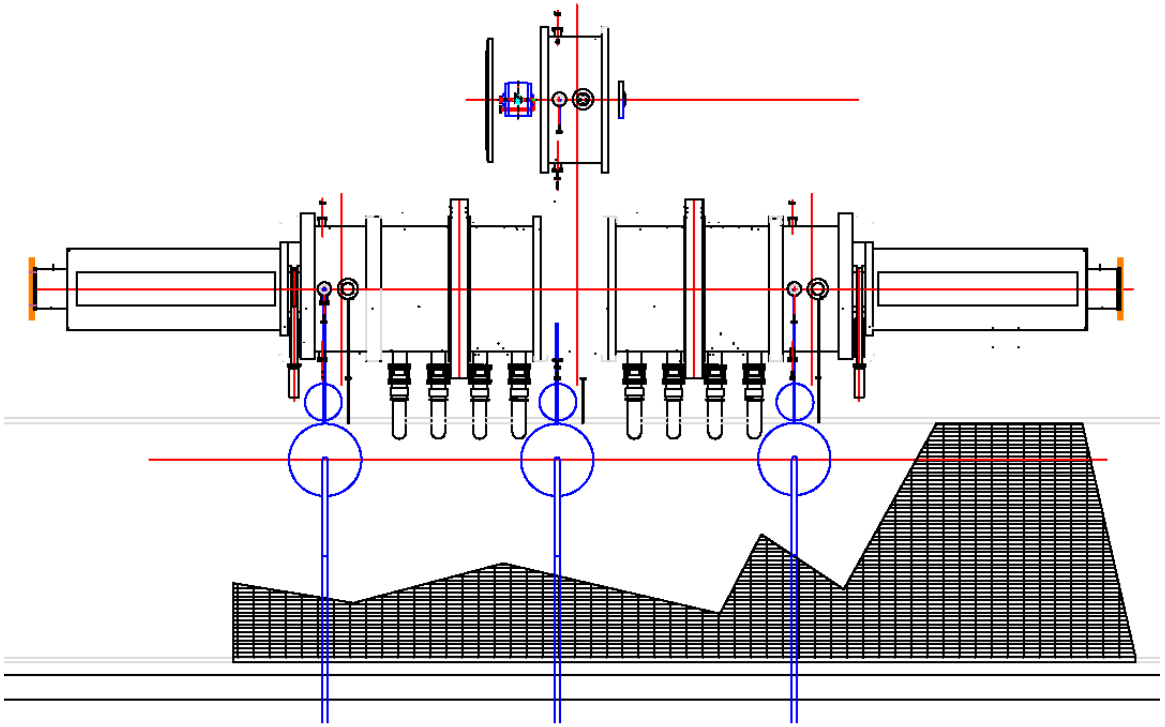
Design Concepts

- **MICE**: "cool" muons (reduce beam emittance) by repeated traversals of low-*Z* absorber and reacceleration in high-gradient RF cavities
  - for optimal performance we use LH_2 absorbers
    - large *dE/ds* gives good cooling and low *Z* gives minimal heating
  - not lost upon us that LH_2 has its practical disadvantages too
- Need closely spaced components for efficient cooling channel implementation



Design Concepts

- Installation and removal of components is non-trivial



— puts premium on reliable, pre-certified components

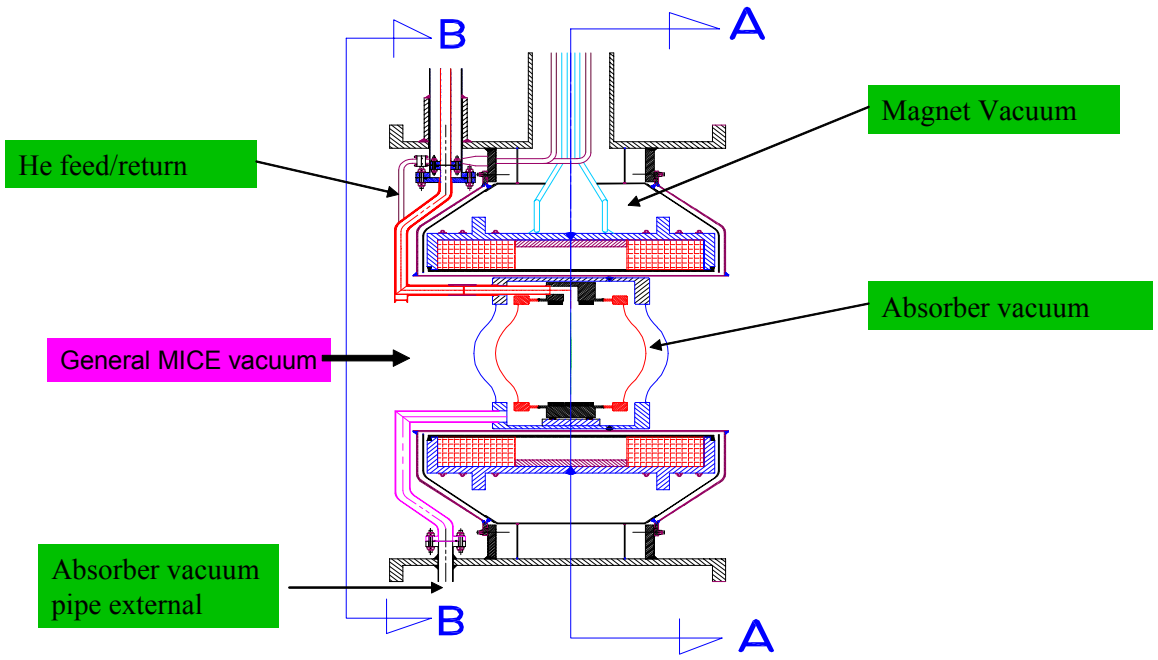
  - we assume pre-tested spare absorbers, with all repairs done on the bench

Design Concepts

- LH_2 safety is our dominant concern
  - design to separate LH_2 and O_2
  - design to avoid possible ignition sources near hydrogen
  - prefer passive protection where possible
    - window thickness based on safety factor of 4 for absorber window and 2.5 for vacuum window (at MAWP)
    - separate vacuum volumes provided for absorbers, magnets, and cavities
    - hydrogen vents into external buffer tank
- There are other safety issues
  - instrumentation should be intrinsically safe
  - magnet quenches should not give rise to safety concerns
  - detector-related ignition sources must also be avoided

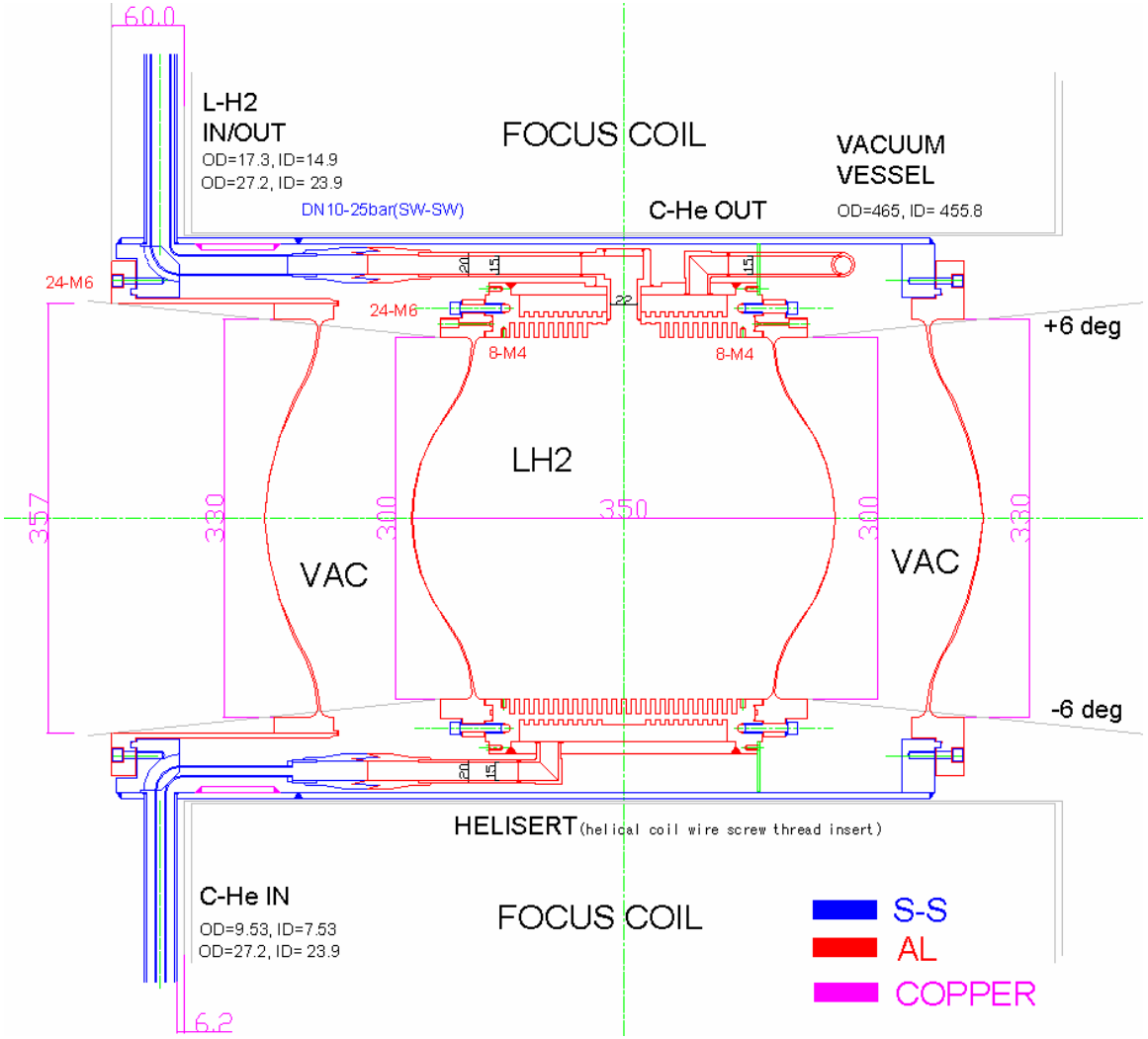
Design Concepts

- We are looking at three possible implementations of the system (variations on a theme)
  - basic design concept



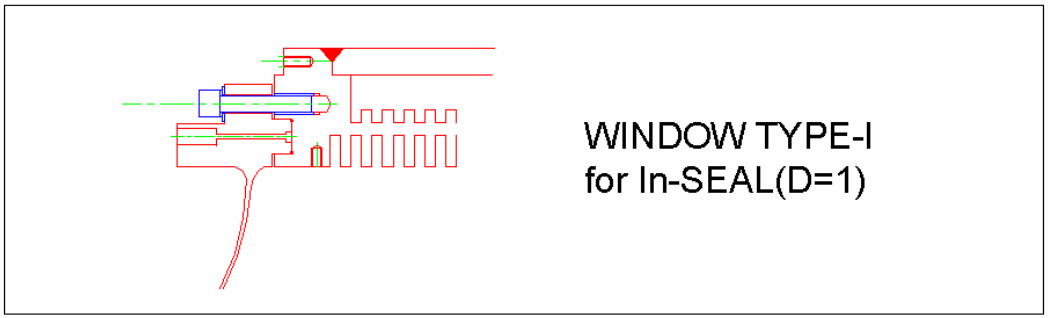
Design Concepts

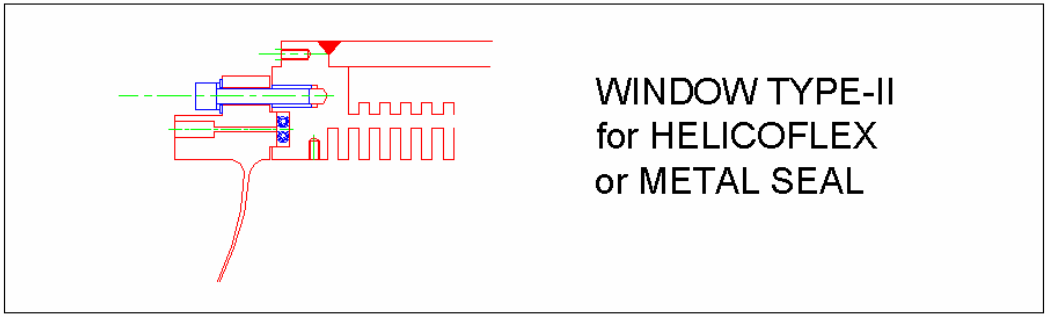
- **Bolted design concept**

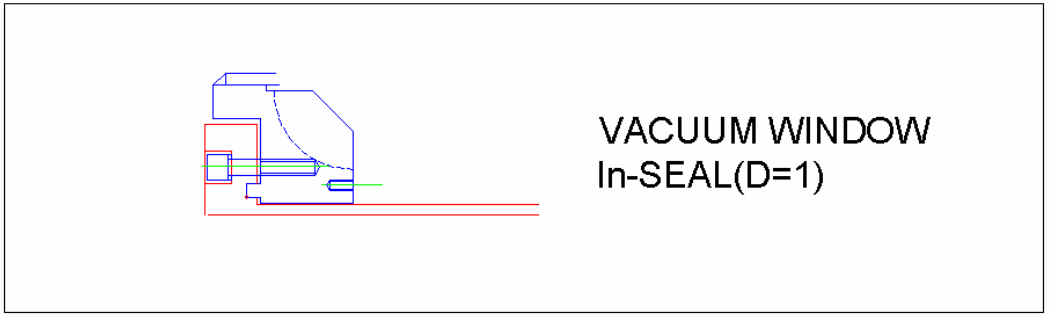


Design Concepts

- Seal concepts

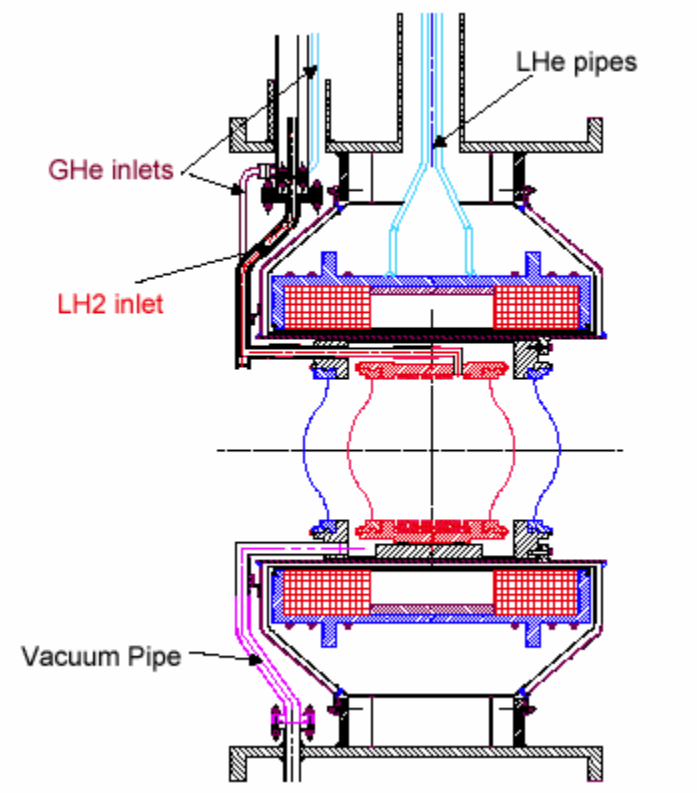






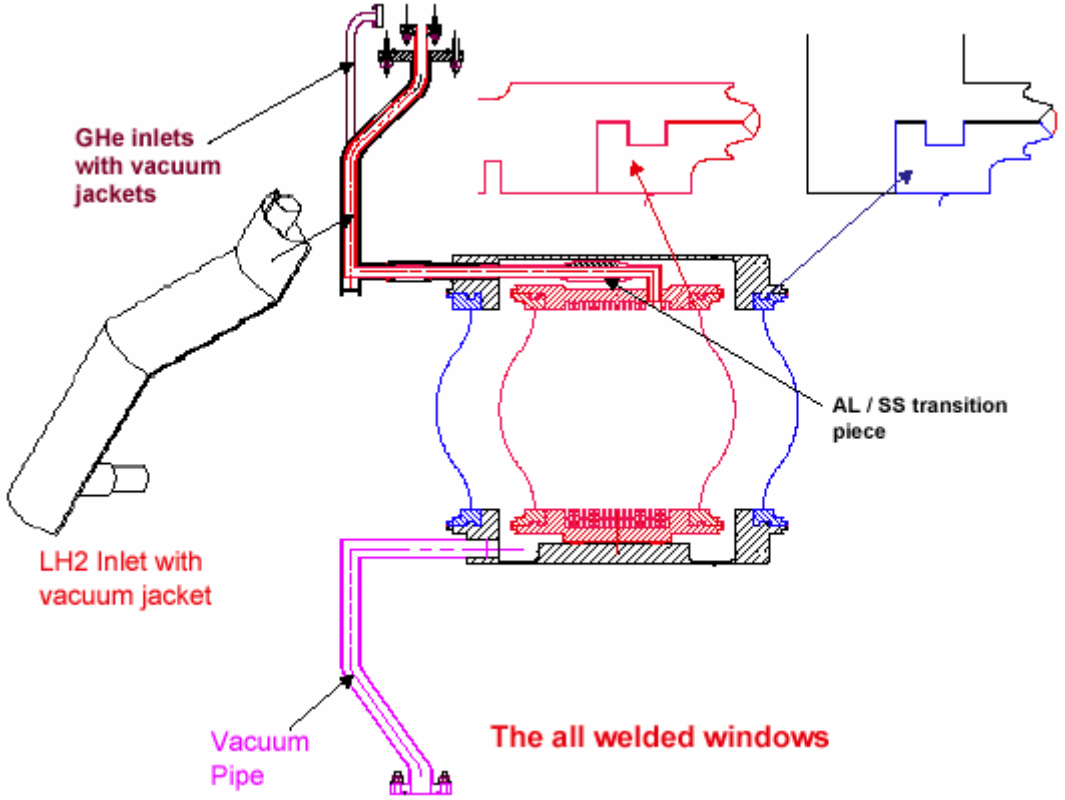
Design Concepts

- **Welded design concept**



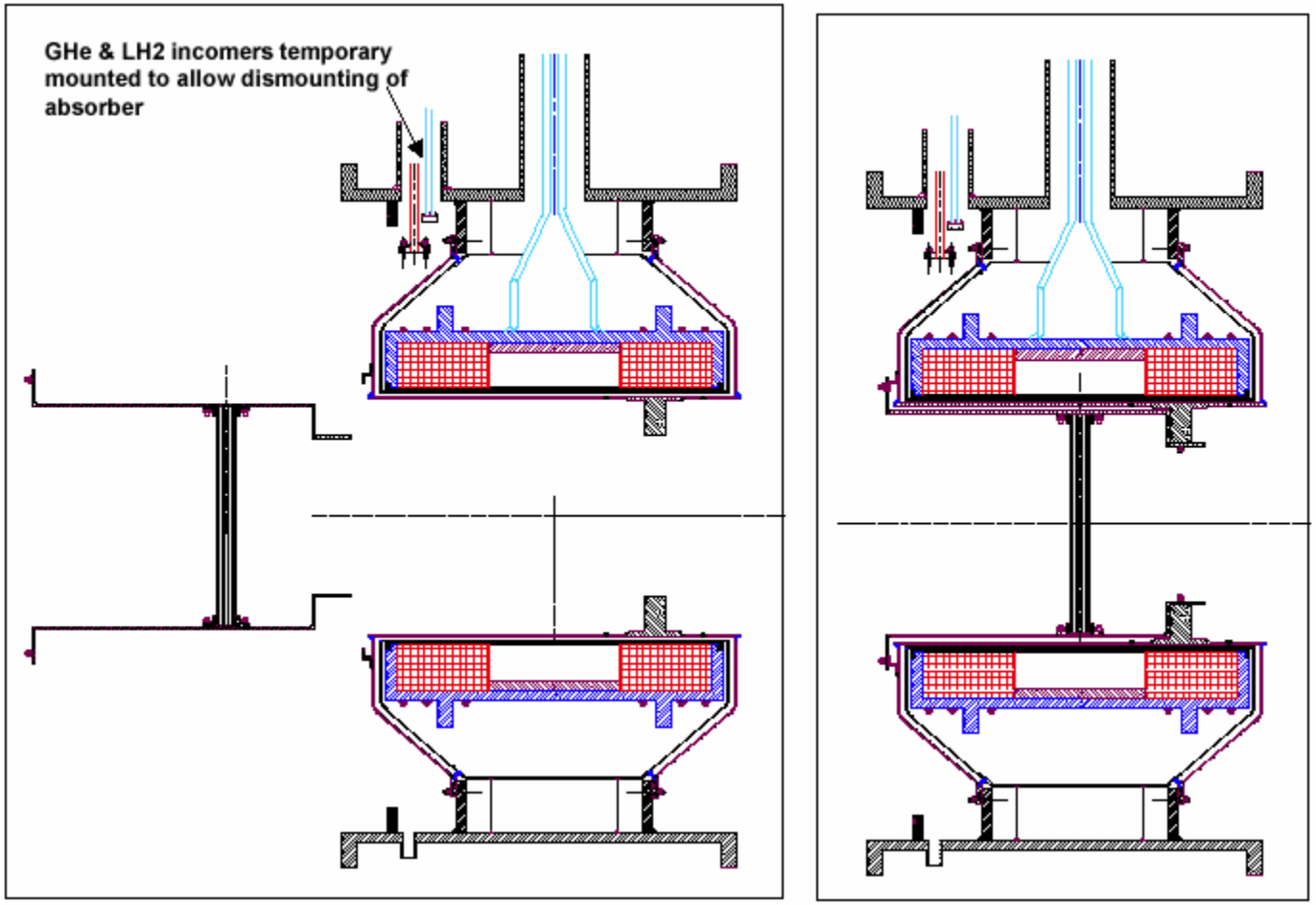
Design Concepts

- **Welded design details**



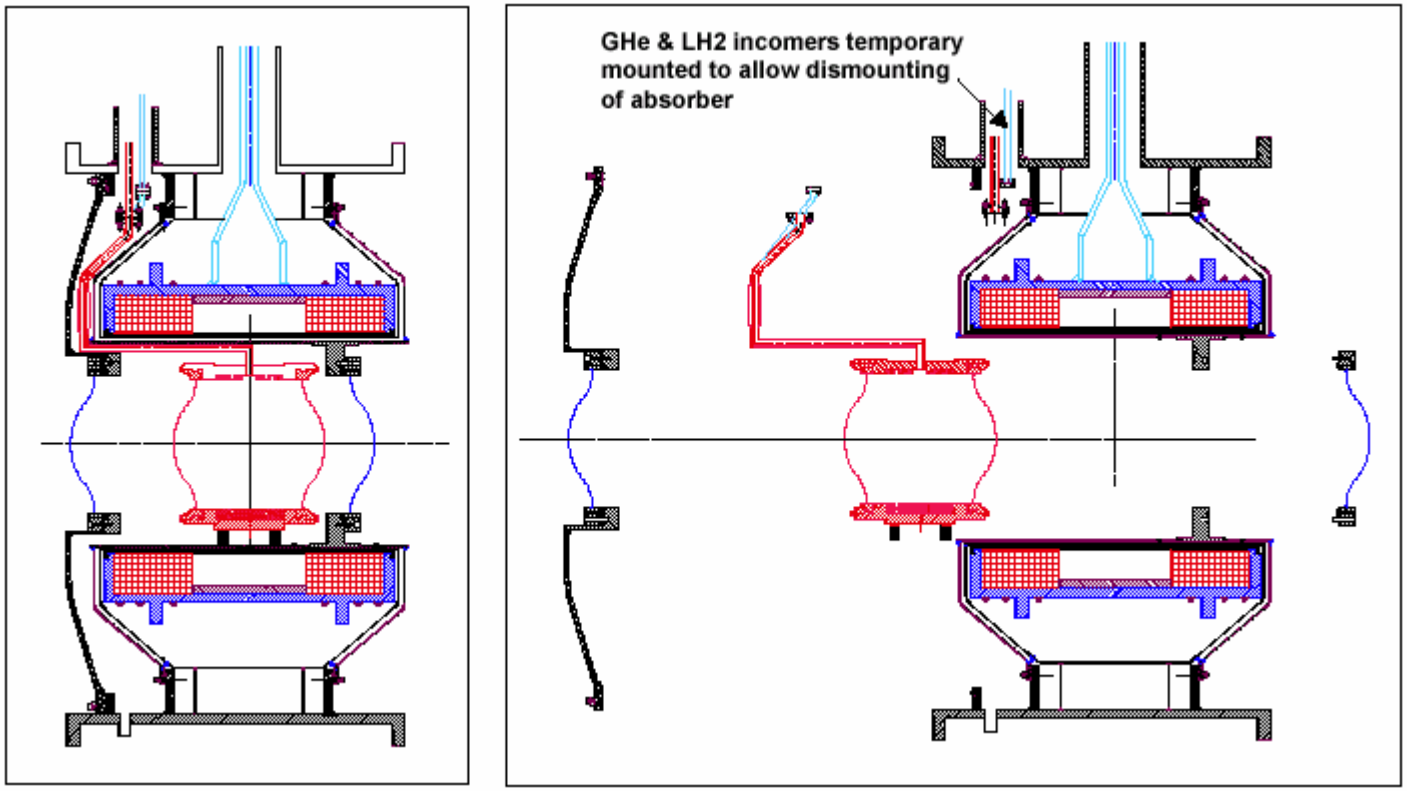
Design Concepts

- Solid absorber concept



Design Concepts

- Alternative concept for vacuum volume implementation



Design Concepts

- We continue working toward choosing a specific implementation
  - most difficult question is "to weld or not to weld"
- We will define an R&D program to validate our design choice
  - anticipate having a baseline option and a fallback option for this critical aspect
  - plan is to vigorously pursue R&D on both options
- At present, the view is that either option (bolted or welded) can be made to work acceptably