



CCLRC
Rutherford Appleton Laboratory

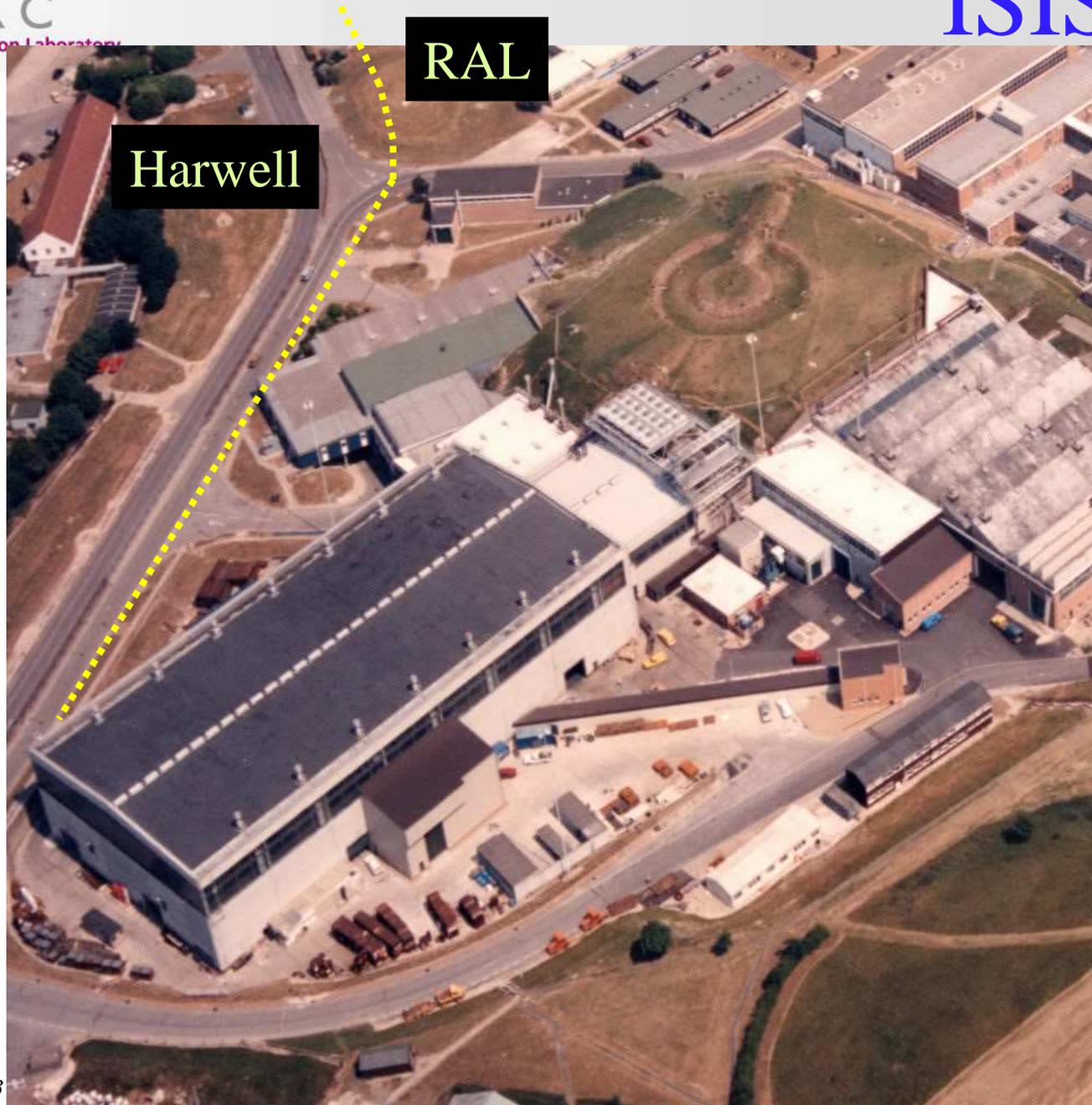


Plans for MICE at RAL

Paul Drumm

WG3 vFact03

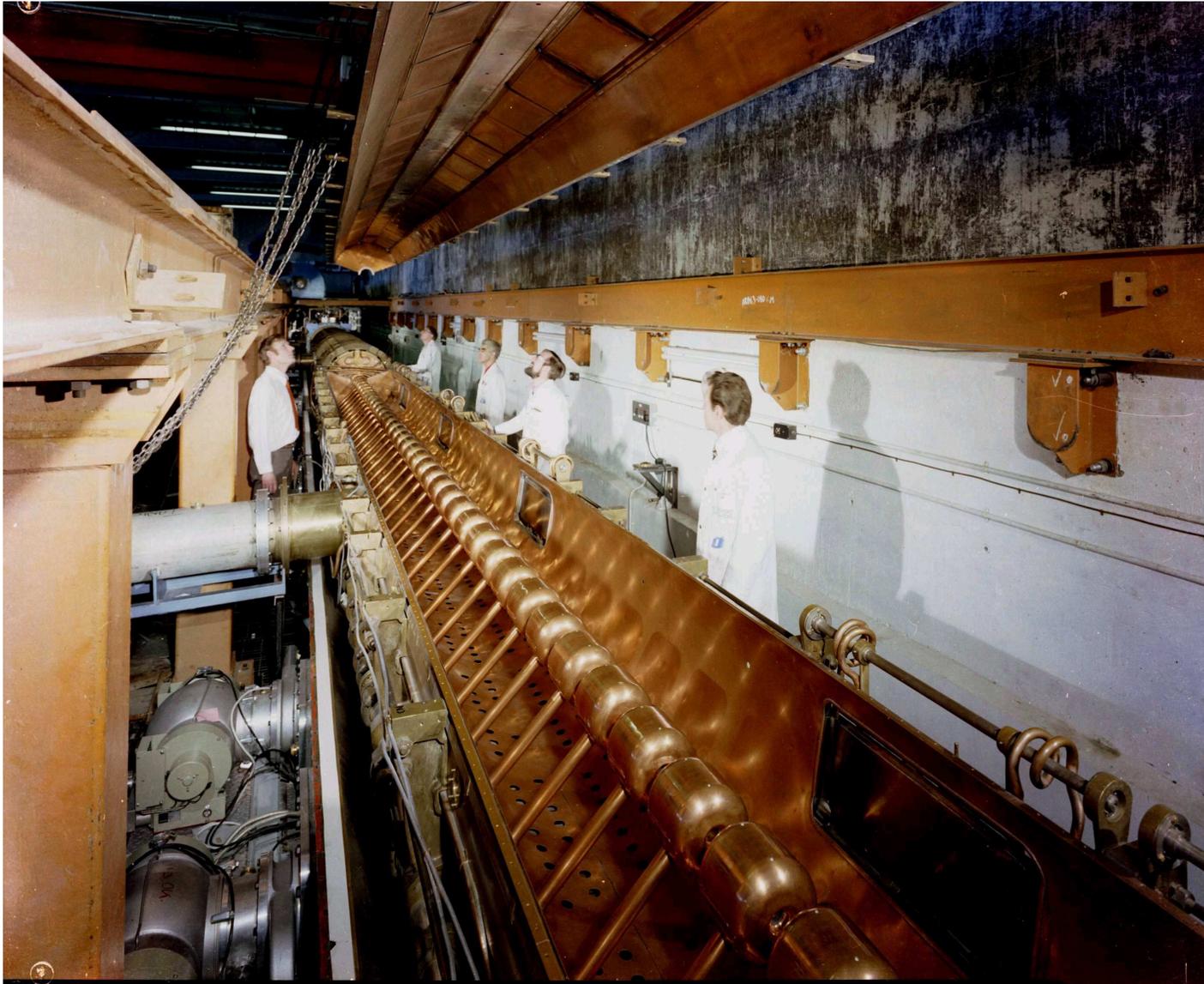
- MICE Status - Yagmur Torun's Talk
 - Scientific approval given
 - Collaboration (incl. host lab) seeking funds
- Demands on Host Laboratory:
 - Muon Beam
 - Experiment Area
 - existing test beam facility
 - Infrastructure....substantial



ISIS Linac

~600 keV C-W
H-Injector

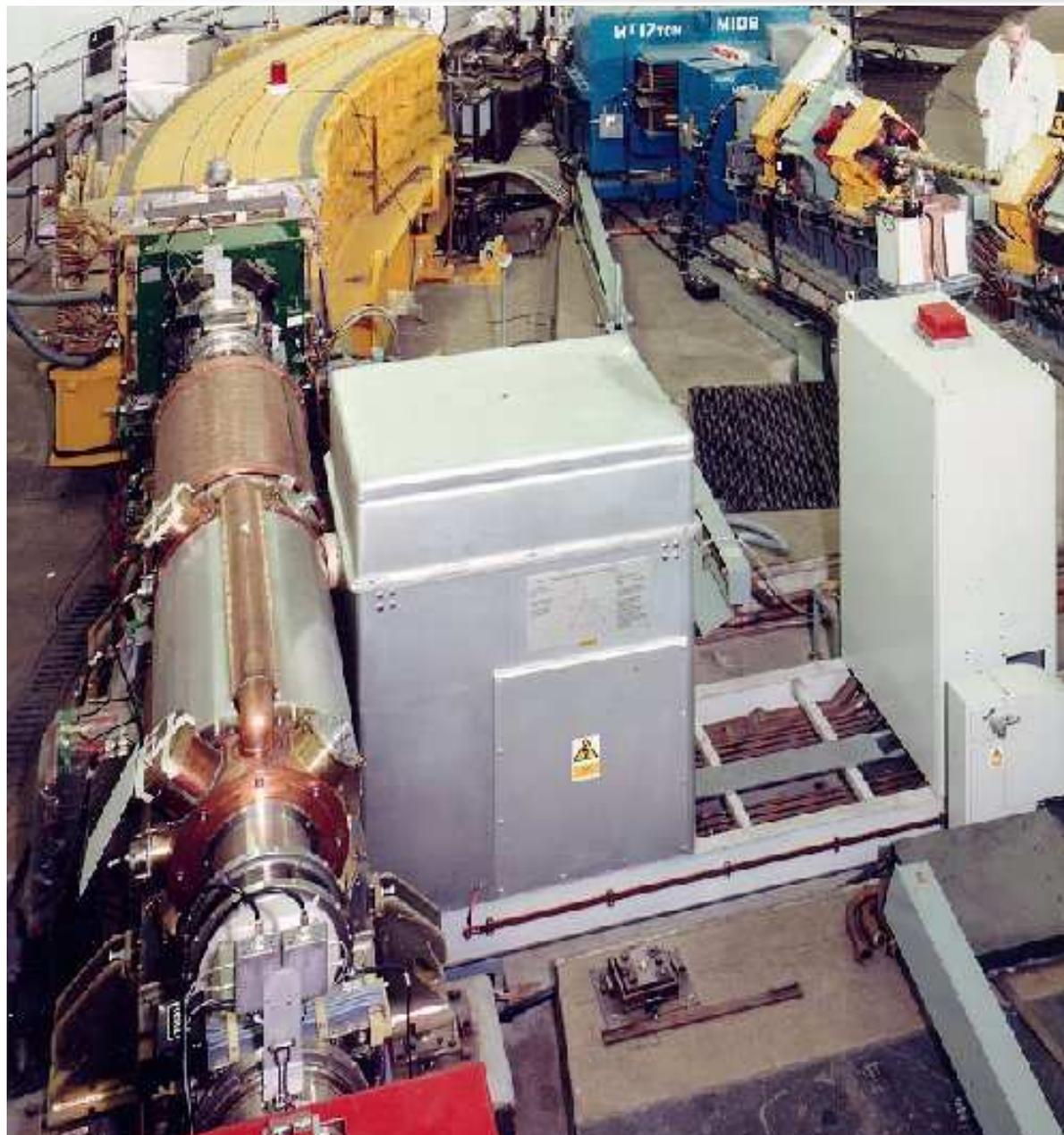
70 MeV DTL Linac



paul drumm, mutac jan 2003



ISIS Ring



50 Hz Rapid Cycling Synchrotron

Charge-Exchange (foil) injection

Fill ~ 10 ms

Accelerate ~ 10 ms

200 μA , 800 MeV Beam (160 kW)

1.5 MHz, dual harmonic

- two bunches

$\sim 1.5 \times 10^{13}$ protons total

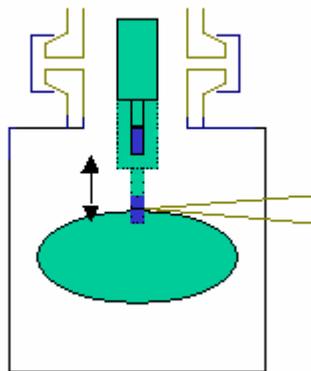


Existing Facility

- Insertion (dipping) Target in synchrotron
- Beam line Based on ex NIMROD magnets (1950s) – multi – GeV beams (!)
- Beam (p/ π) Used for Detector Testing
- Low rate
- Low use
- Upgrade for MICE

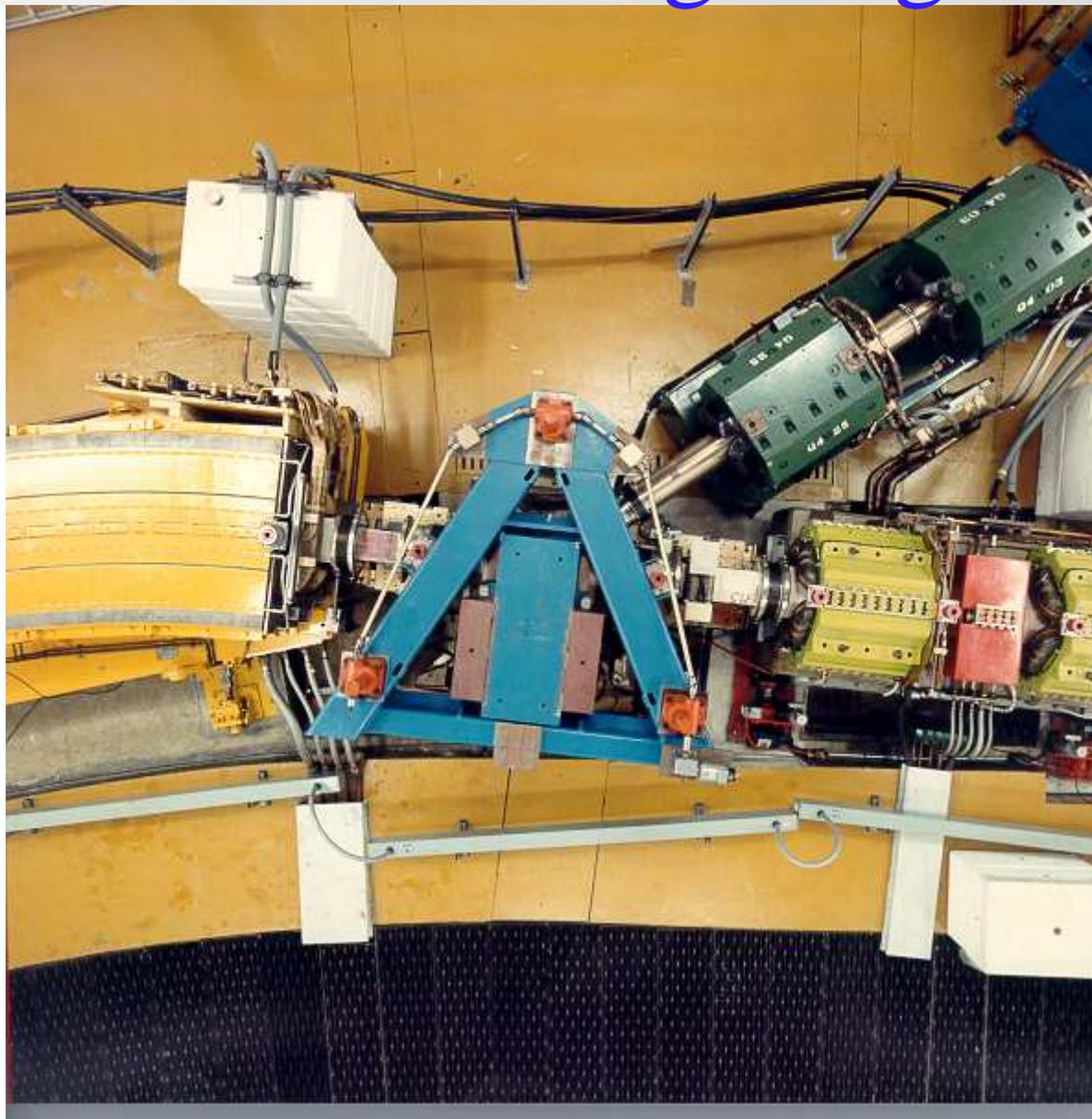
Existing Target

Internal Target catches edge of beam



Replacement Target System Needed

- Reliability
- Reproducibility



paul drumm, mutac jan 2003



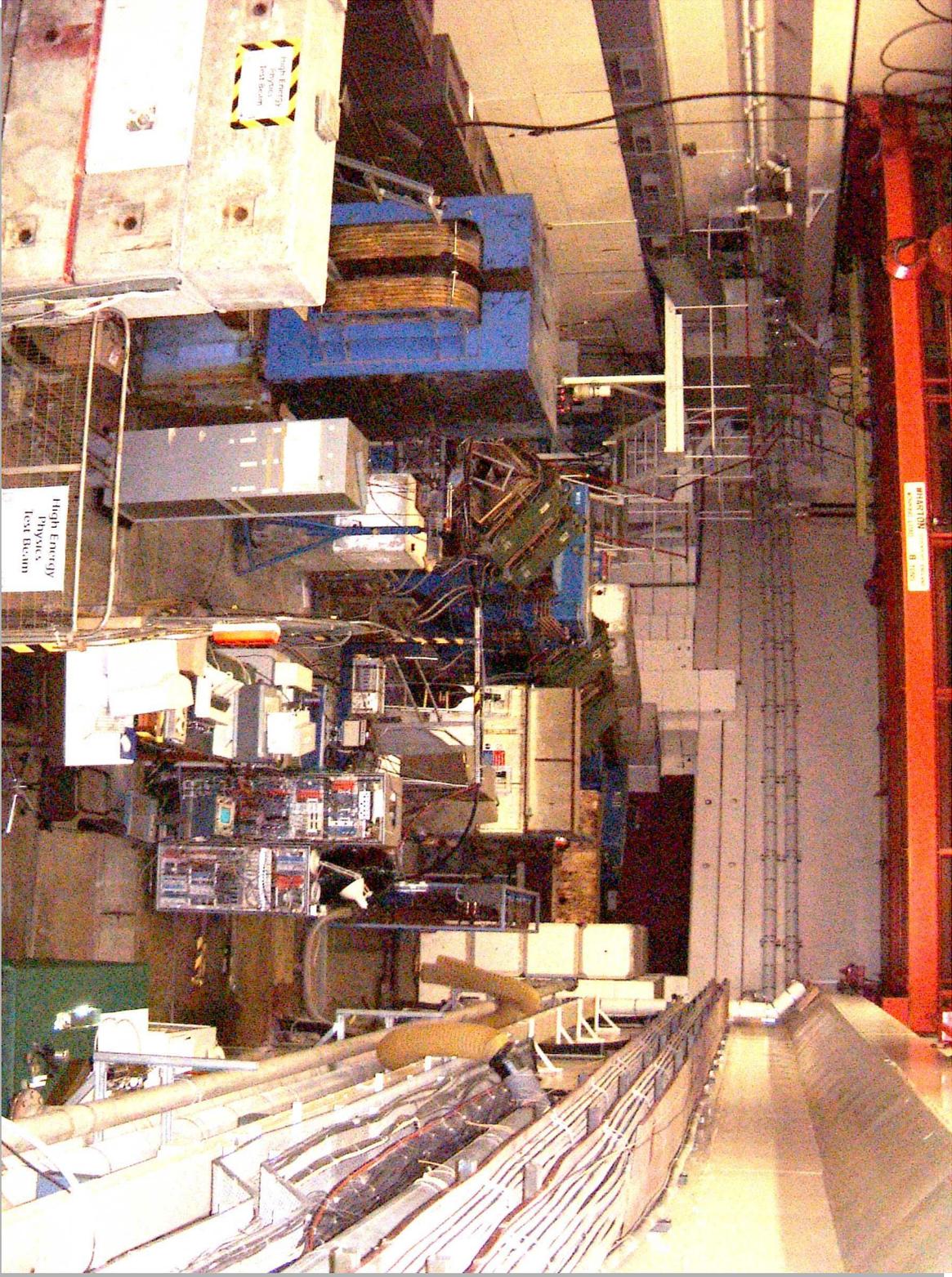


paul drumm, mutac jan 2003



CCLRC
Rutherford Appleton Laboratory

Mice Hall



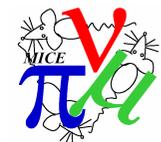
Hall:

$L = 47 \text{ m}$ $W = 12 \text{ m}$ $H = 8 \text{ m}$

$S = 564 \text{ m}^2$ $V = 4512 \text{ m}^3$

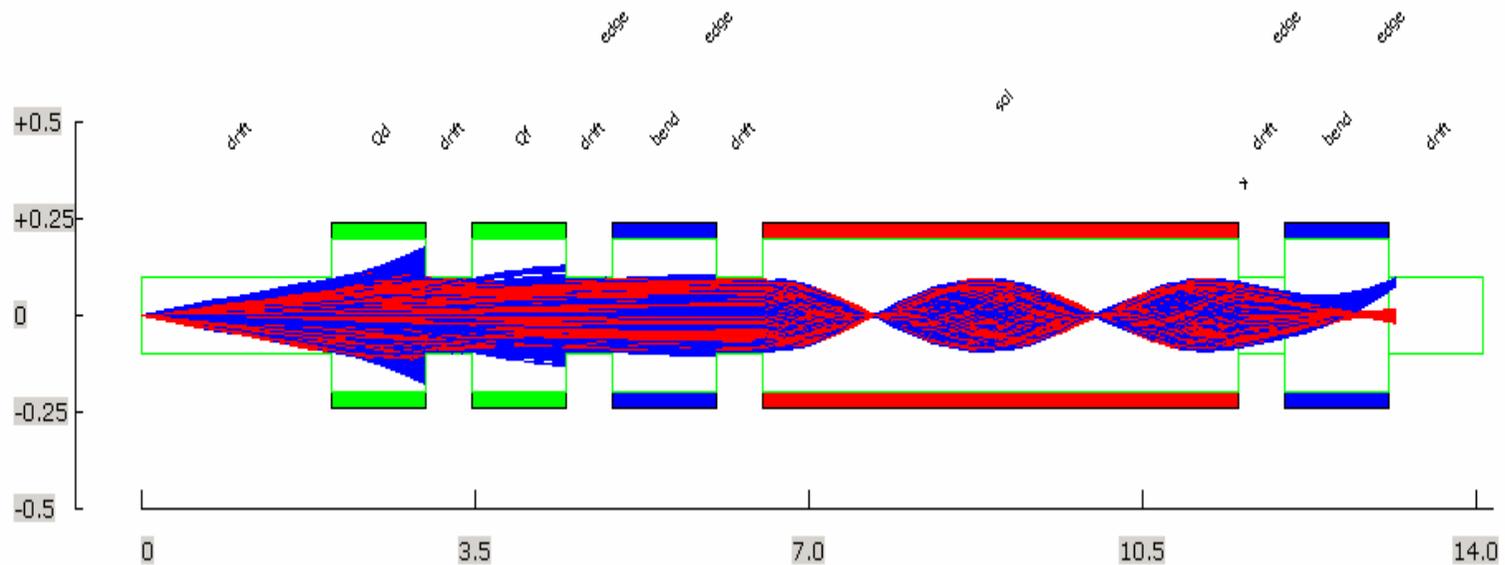
Two overhead cranes (8 tonnes each)



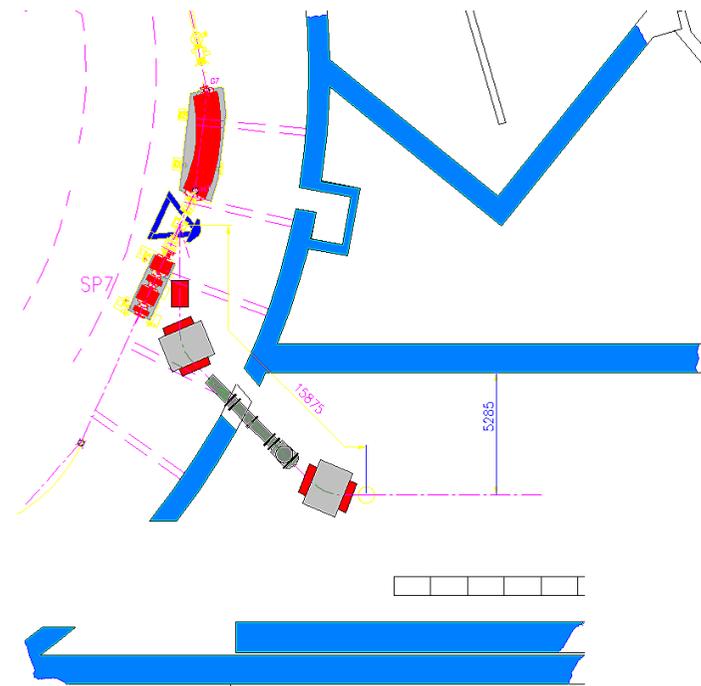


- Reuse existing beam elements
- PSI SC magnet from μ E4 beam line (5m, 5T)
 - Production Target & Capture - quads
 - π momentum selection (dipole)
 - Decay (Solenoid)
 - μ momentum selection / π rejection (dipole)

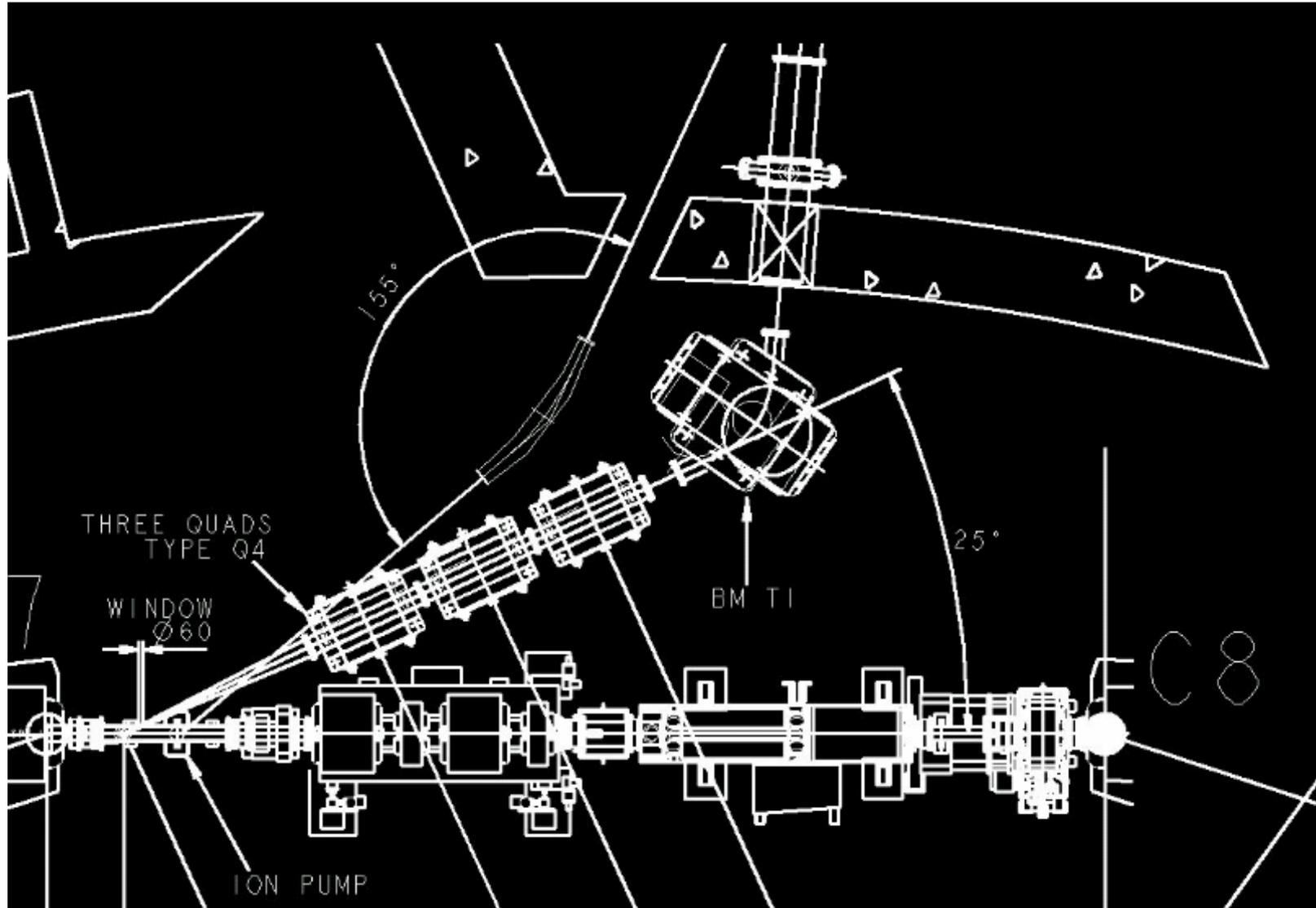
(quad doublet Example)



- $P_{\mu} < 400 \text{ MeV}/c$
- Rejection of protons and pions $< 10\%$
- few muons per μs
- Two solutions possible:
 - PSI solenoid
 - cryogenics available
 - release by PSI
 - quadrupoles
- Preferred solution - Solenoid



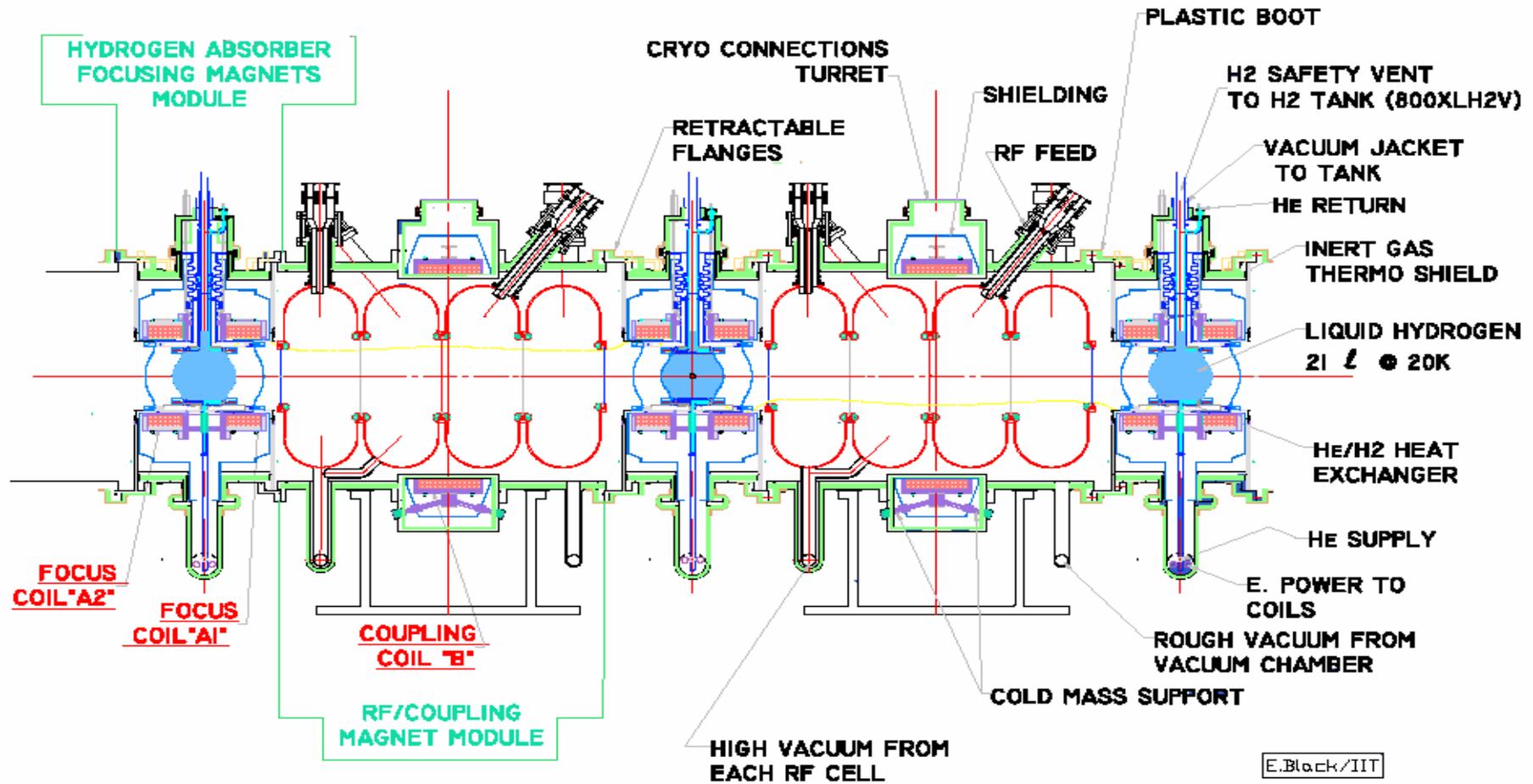
Front End Options



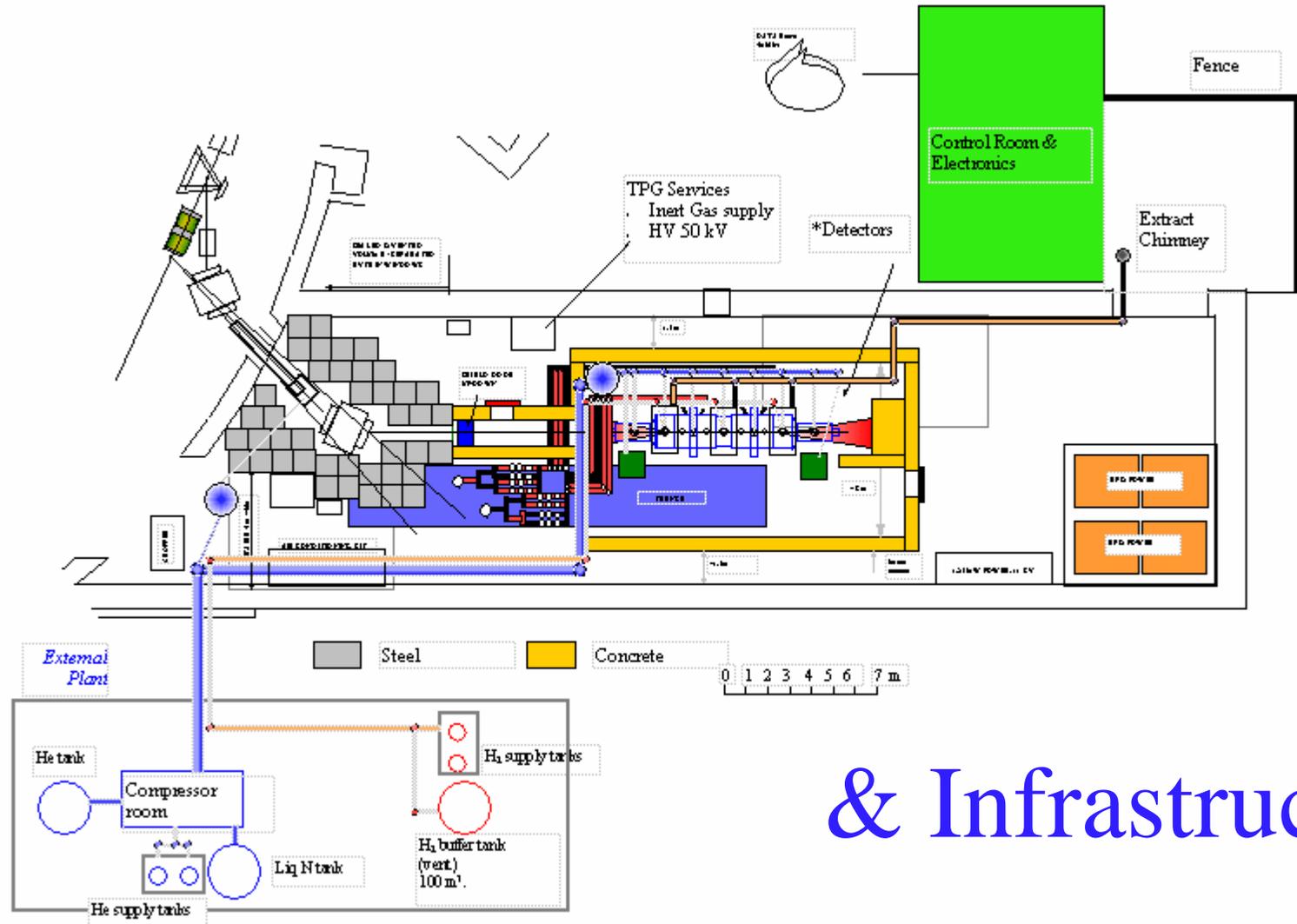
paul drumm, mutac jan 2003



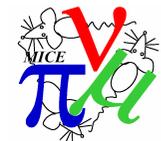
MICE Experiment



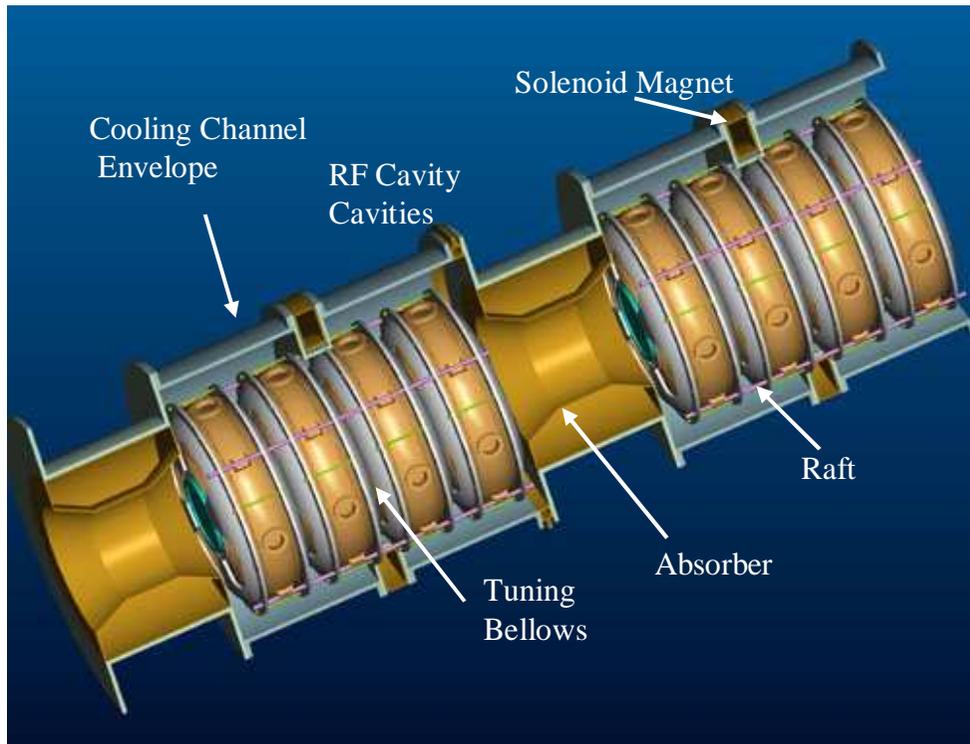
MICE Layout...



& Infrastructure



RF System



8×201 MHz
Cavities

1 MW per cavity

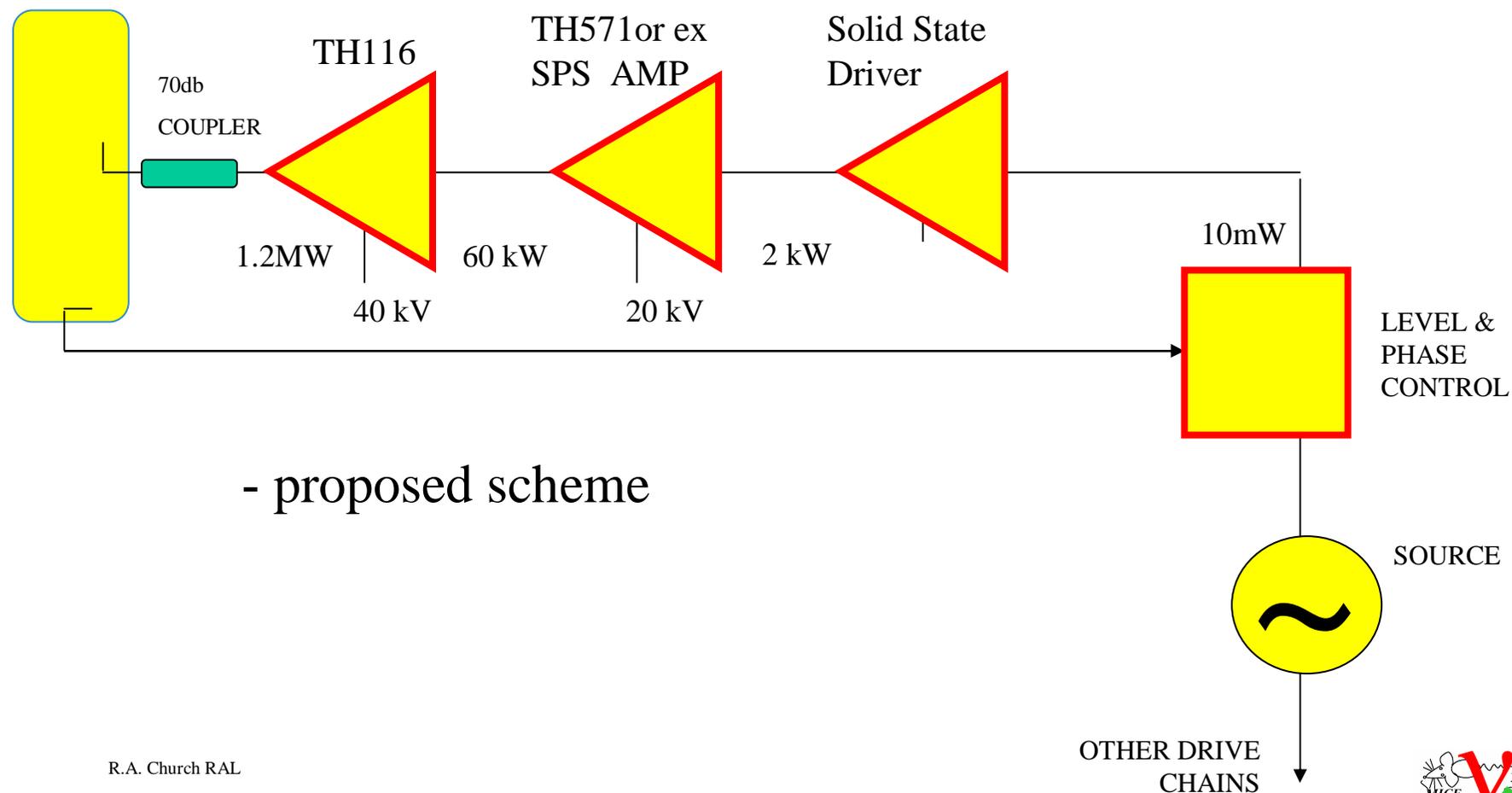
Low Duty Factor

1-2 ms

1-10 Hz

average power
 ~ 1 kW/Hz

RF Drive - One Chain drives 1 Cavity

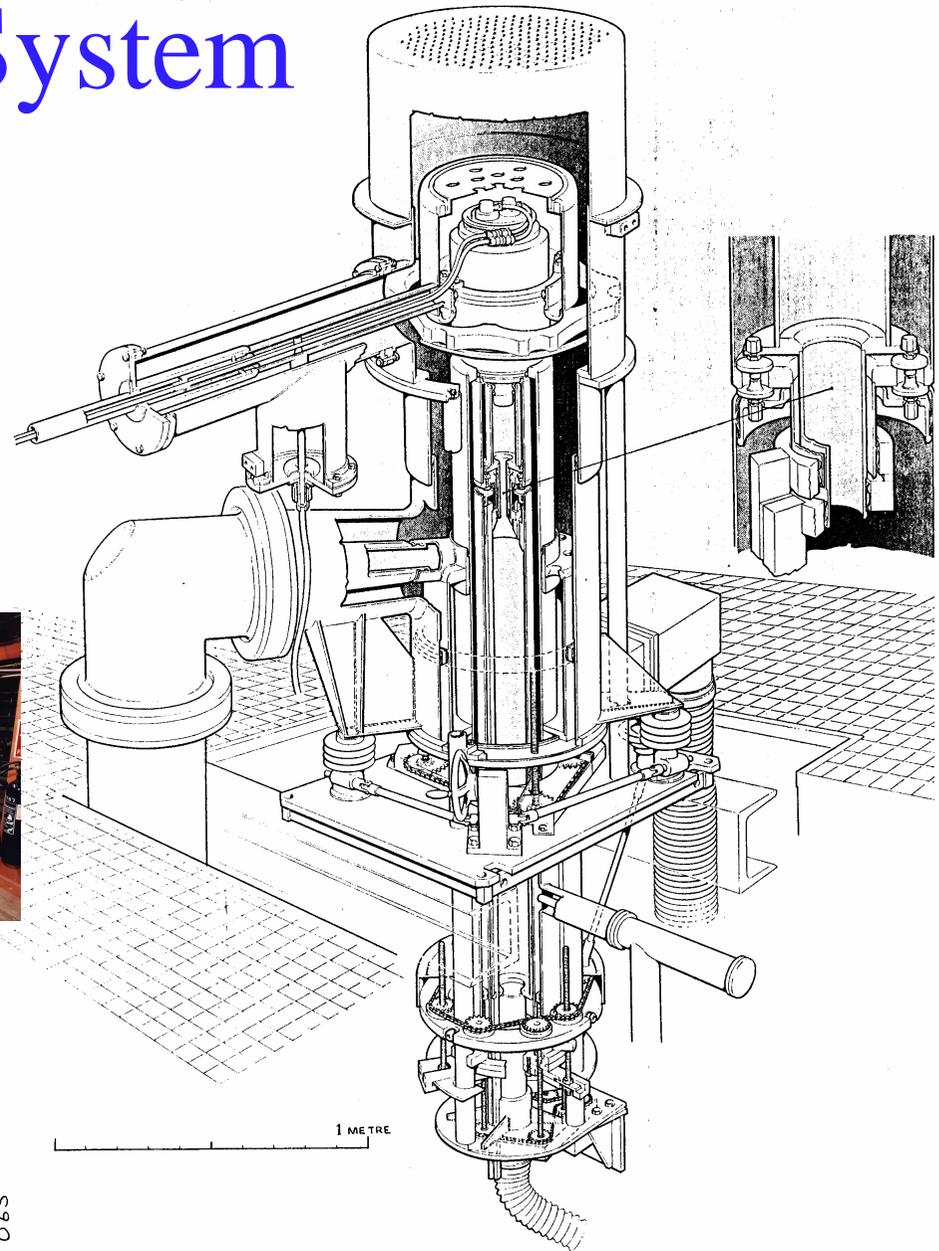


R.A. Church RAL

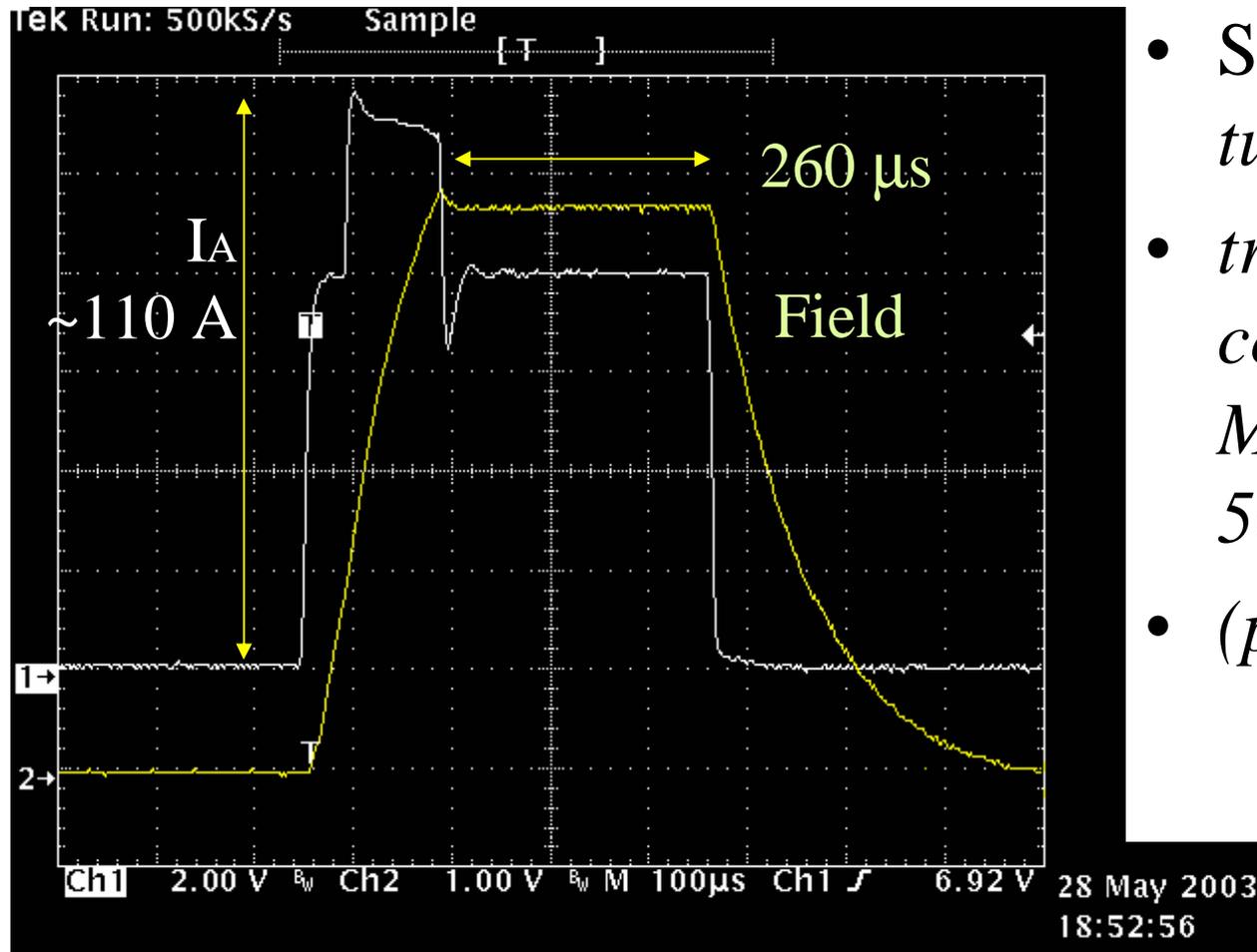
paul drumm, mutac jan 2003



RF System

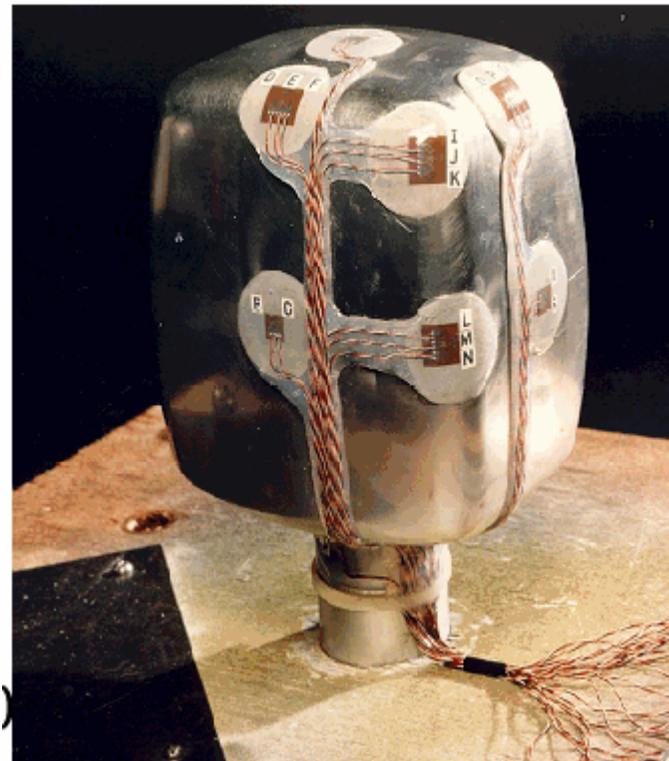
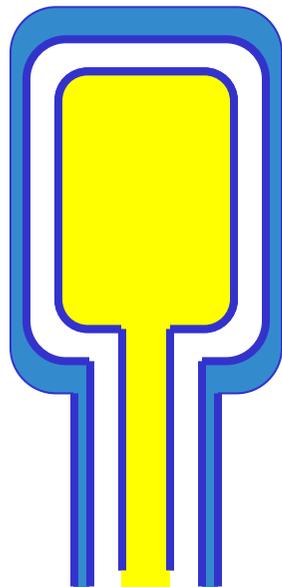


R.F. POWER AMPLIFIER.

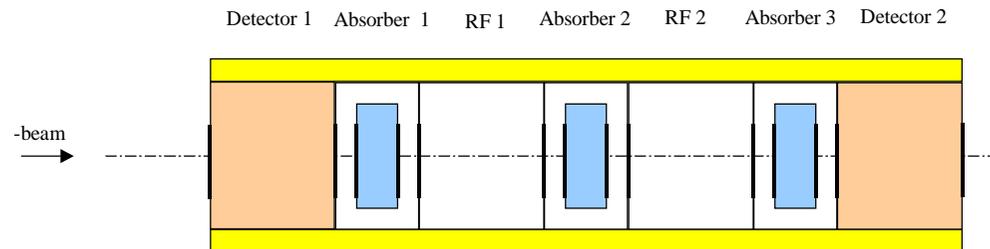
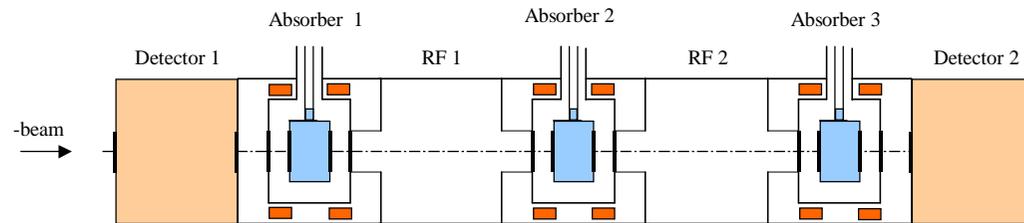
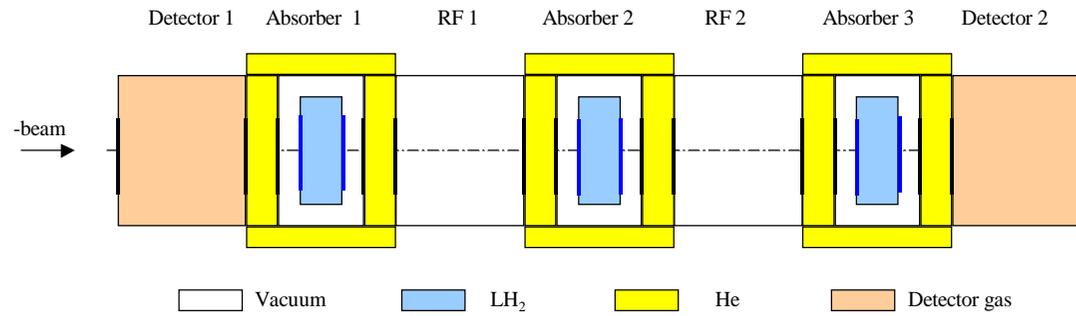


- Stock of ~ 12 *retired tubes*
- *trial tube operated comfortably at 1.25 MW (~300 μ s pulse at 50/32 Hz)*
- (*peaks at ~1.6 MW*)

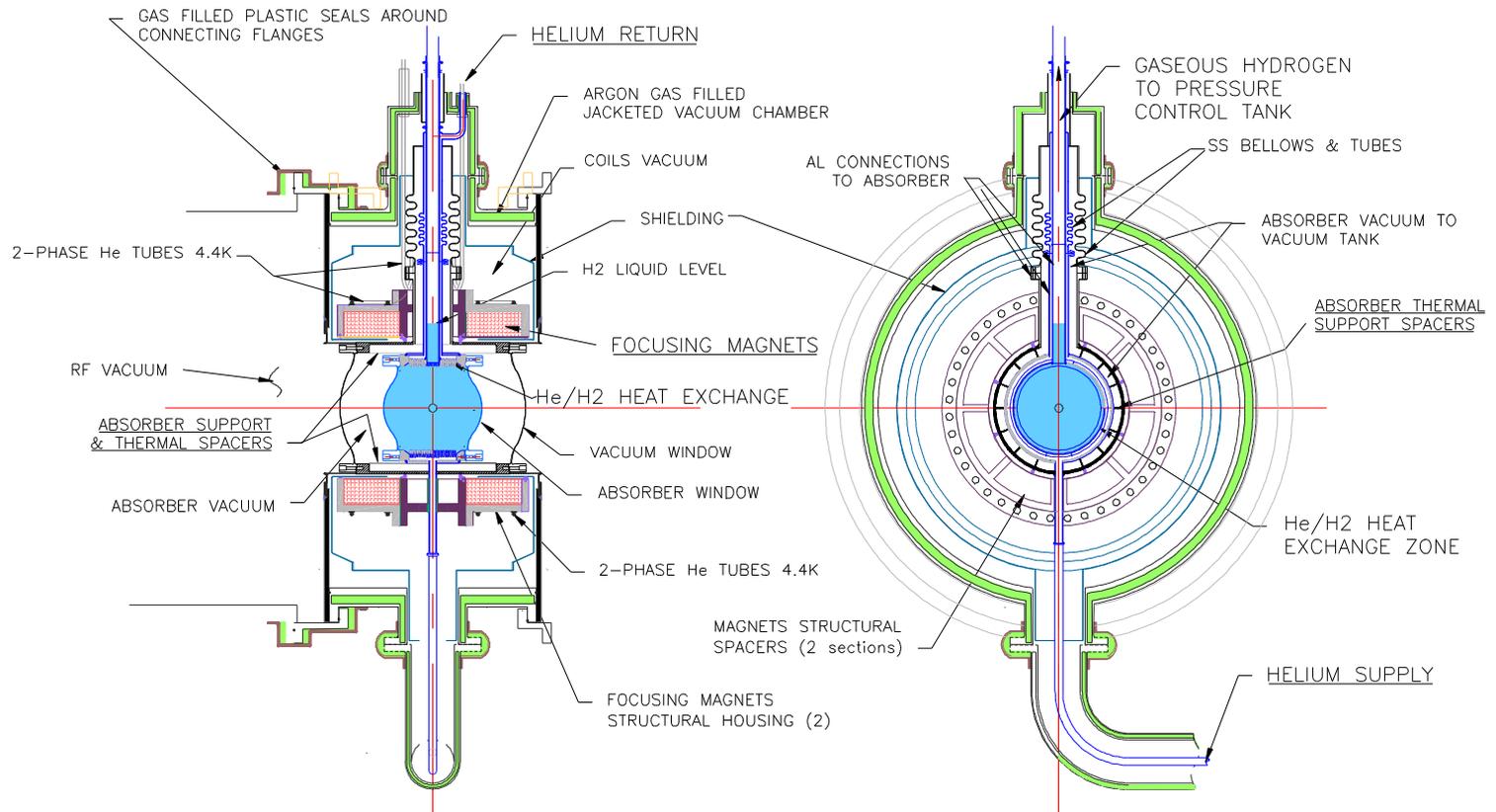
- Liquid Hydrogen – Major safety issue
 - ISIS Liquid Hydrogen Moderator



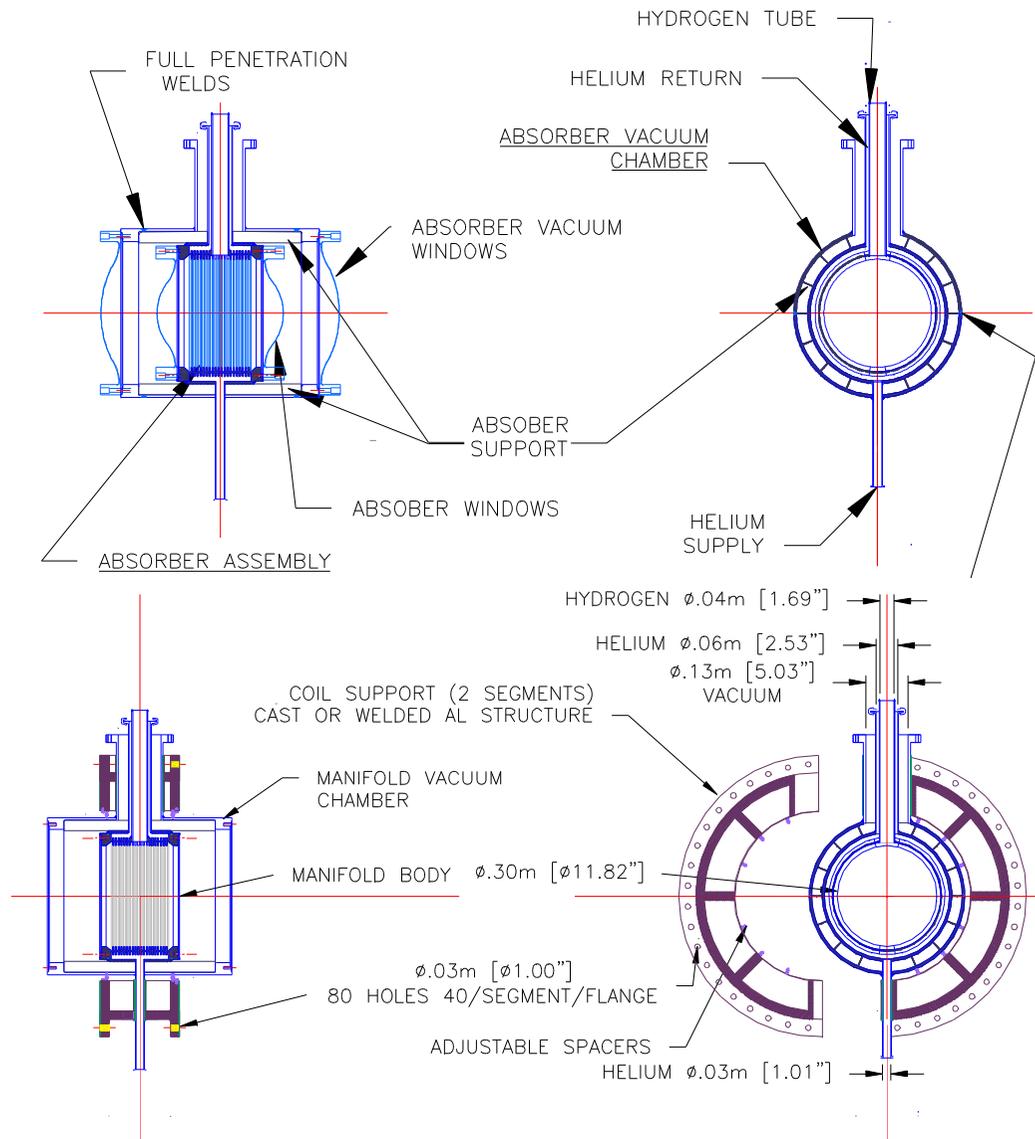
Absorber ..



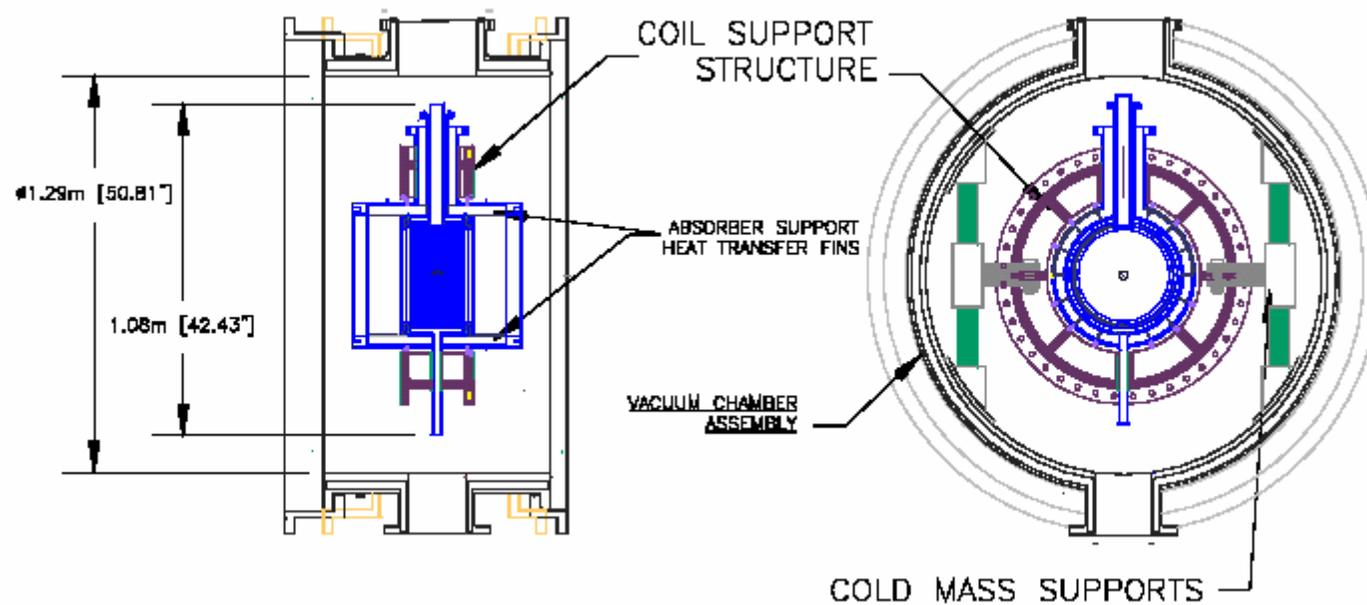
Absorber Evolution ...



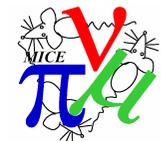
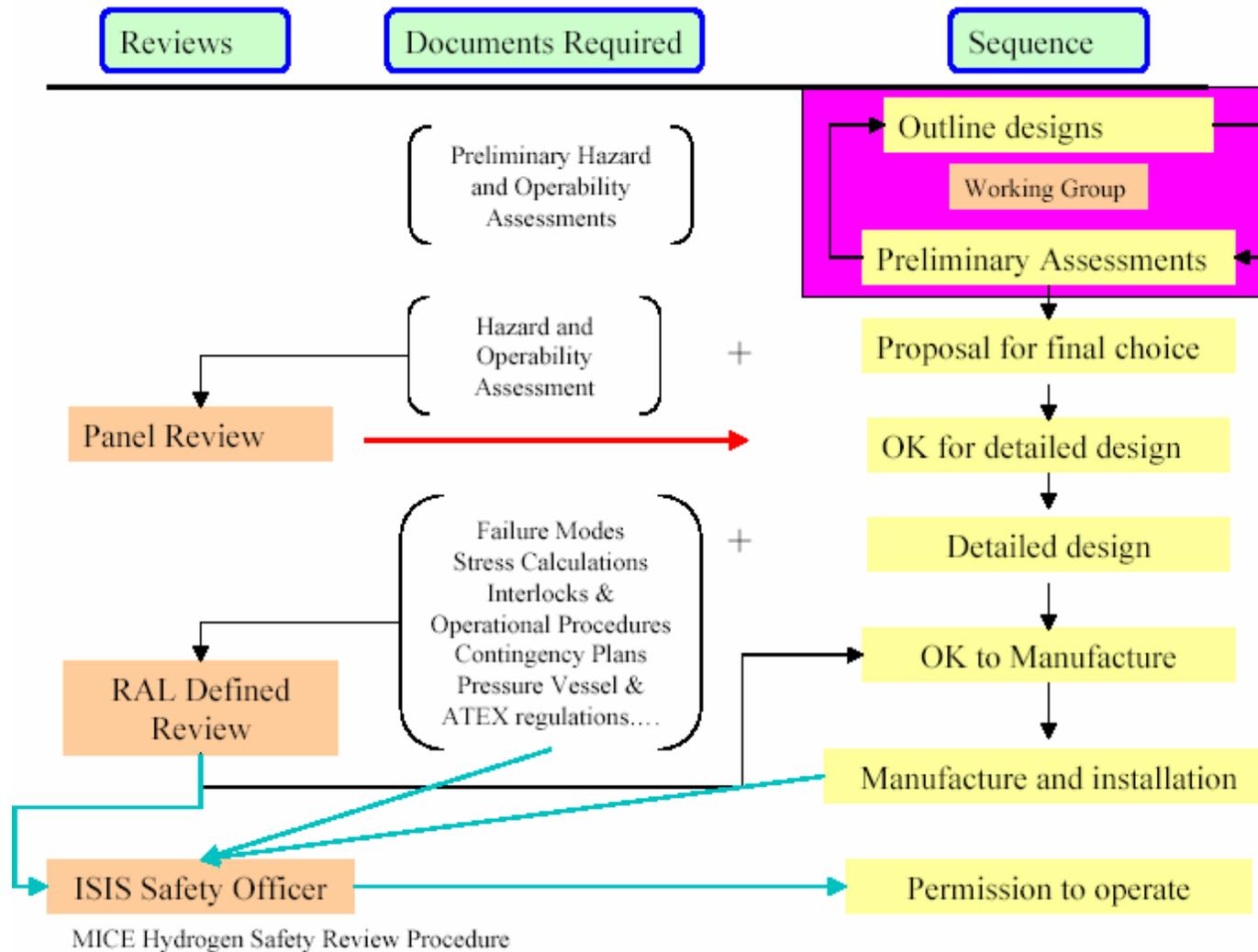
Absorber Integration



Absorber Integration ..



Safety Loop



Magnets & Cryogenics

Principle Issues

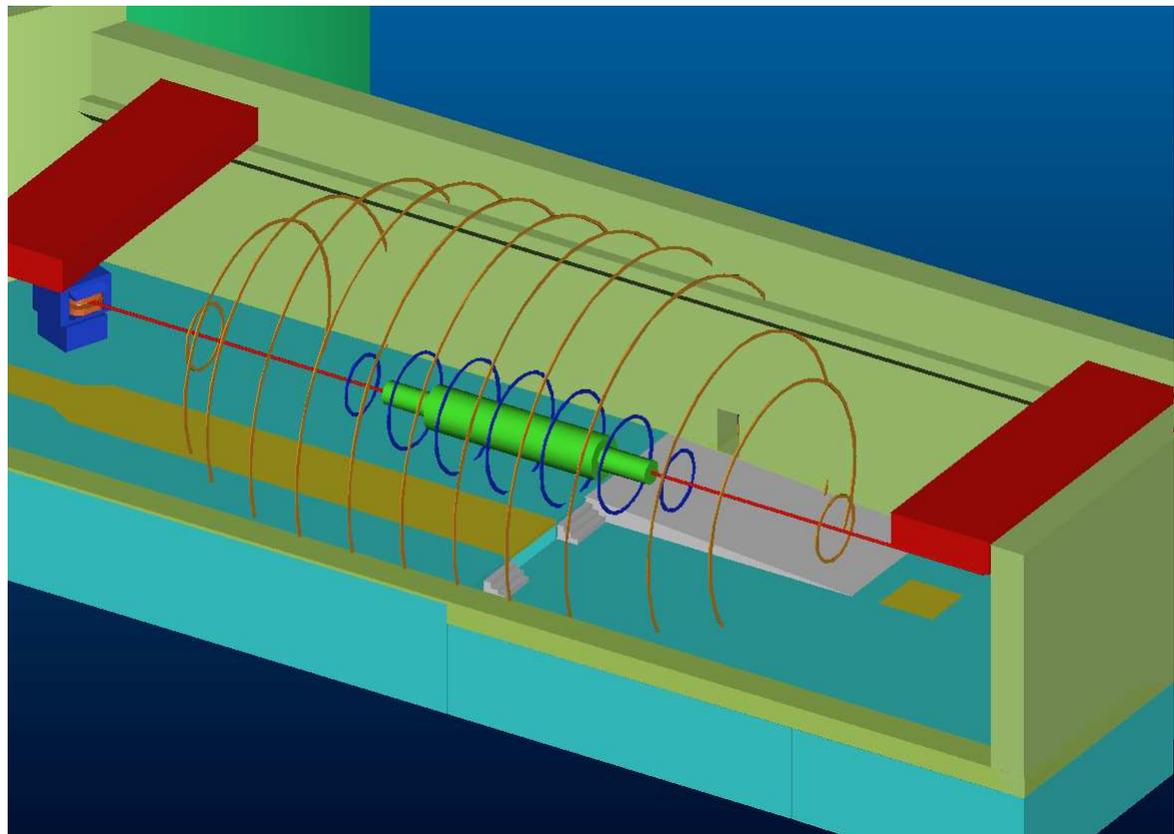
- Fringe Fields
- Cryogenic Requirements - 380W @4K = 500W Unit

Blue contours:

10 mT

Orange:

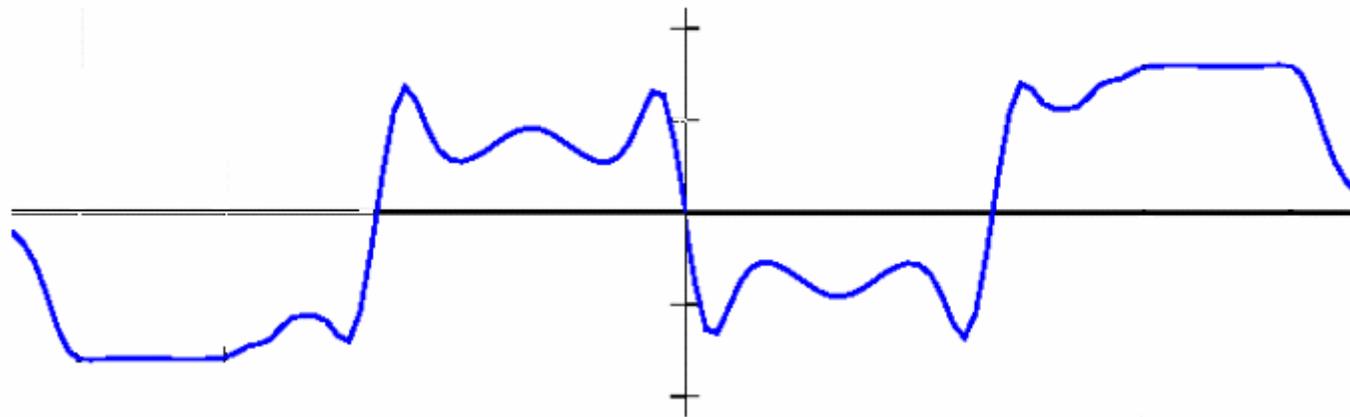
0.5 mT



Other Magnetic Configurations

Fields in same direction

- Still needs to be evaluated
- affect on the linac
- impact on machine instrumentation & operation
- impact on working environment



Detectors

Spectrometer:

Technology Choices:

Issues:

SiFi - Large cyro cooling needed for VLPCs

TPG – HV & flammable gas (next to Lig.H cell)

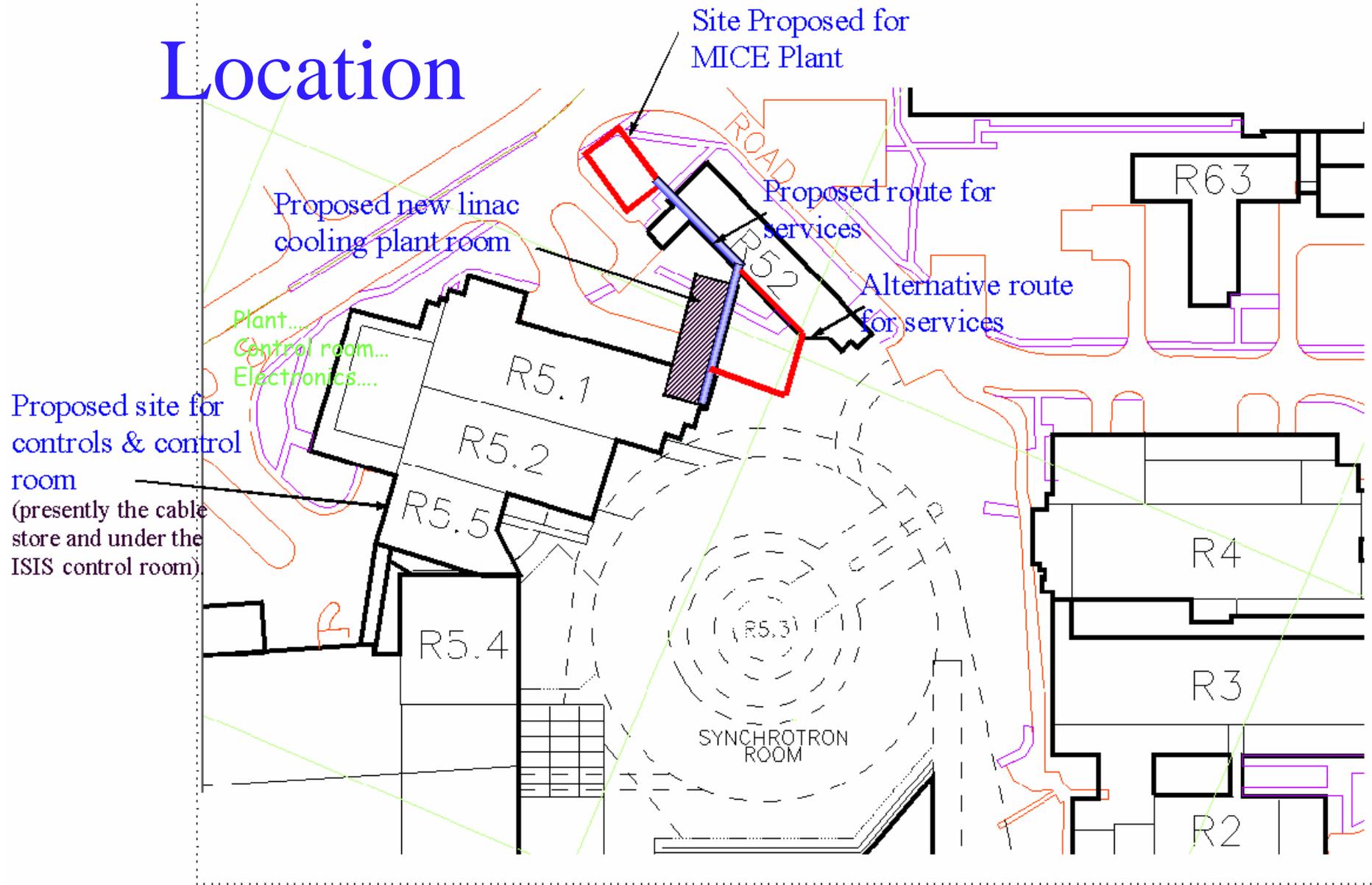
Basic Infrastructure

Plant:	Electrical Power	~ 400 kW
	Cooling Power	~ 500 kW plant
	Cryogenic System	~ 500 W system small system for μ Sol
	Hydrogen Delivery & Handling	- condensation cooling - ventilation system & safety
	Control Room	- local rack space

Installation

- phased build of the experiment
- support & alignment system

Location



- Muon Solenoid
- MICE Solenoids
- SciFi detectors
- Cryogenic Absorbers
- est. ~500W of cooling @4K (incl. margin)
- complicated system
 - design work in progress

Critical Issues: Beam Line

Long Shutdown

Break into ISIS Synchrotron from MICE Hall

Have Shielding available

- Next Spring (2004)

Competes with other ISIS projects

- 300 μ A upgrade*
- Second Target Station*
- RFQ Installation
- delivery of contracted neutron amp.hours

* work in synch. vault

Expected Progress

- Proposal submitted start 2003
- Positive reviews from
 - international review panel
 - UK funding agency panel
- MICE is part of the UK's Science road map
 - funds not yet allocated to MICE-UK
 - budget funding originally foreseen 2004...
 - negotiations taking place for 2003
- Collaborators requesting funds

- Now till ...
 - clear hall in preparation for
- 2004 Shutdown
 - Start breaking into concrete
- Proceed to install infrastructure
 - Electrical Power, cryogenics, cooling power
 - Beam Line Solenoid installation & tests
- Beam line completed in 2005/6 Shutdown
- MICE Installation follows
 - Expect mice staged operation in 2006....

- RF Drivers
 - need clarification - cost issue
- Absorber & Coils Group
 - design & safety case developing
- Absorber Safety Review
- Coil Field Configurations
 - need evaluation/shielding
- Integration