



MICE: Controls & Monitoring

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Outline

- Progress since CM40
- DL Efforts
- Chris's work
- What We Learned from Mock Data Run (MDR1)
- Preparing for MDR2 and 8th March Run
- Odds and Ends



Since CM40

● Trackers

- DL implemented interlocks
- Weiner PL508 power supplies
- ITC508 (temperatures) and MKS937 (vacuum)
- integrated/simplified C&M for shifter operations under development: INITIALIZE/START/PAUSE/STOP/CALIBRATE
- updated VME interface to use CAEN
- built requisite J.Leaver code into standard EPICS code base
- Chris – configuration files for ALH and archiver
- Chris also working on EMR controls – completed WTI power controller
- BeamLine IOC and BeamLine SM
- Running IOCs on miceiocpc1
- RunControl



DL Efforts

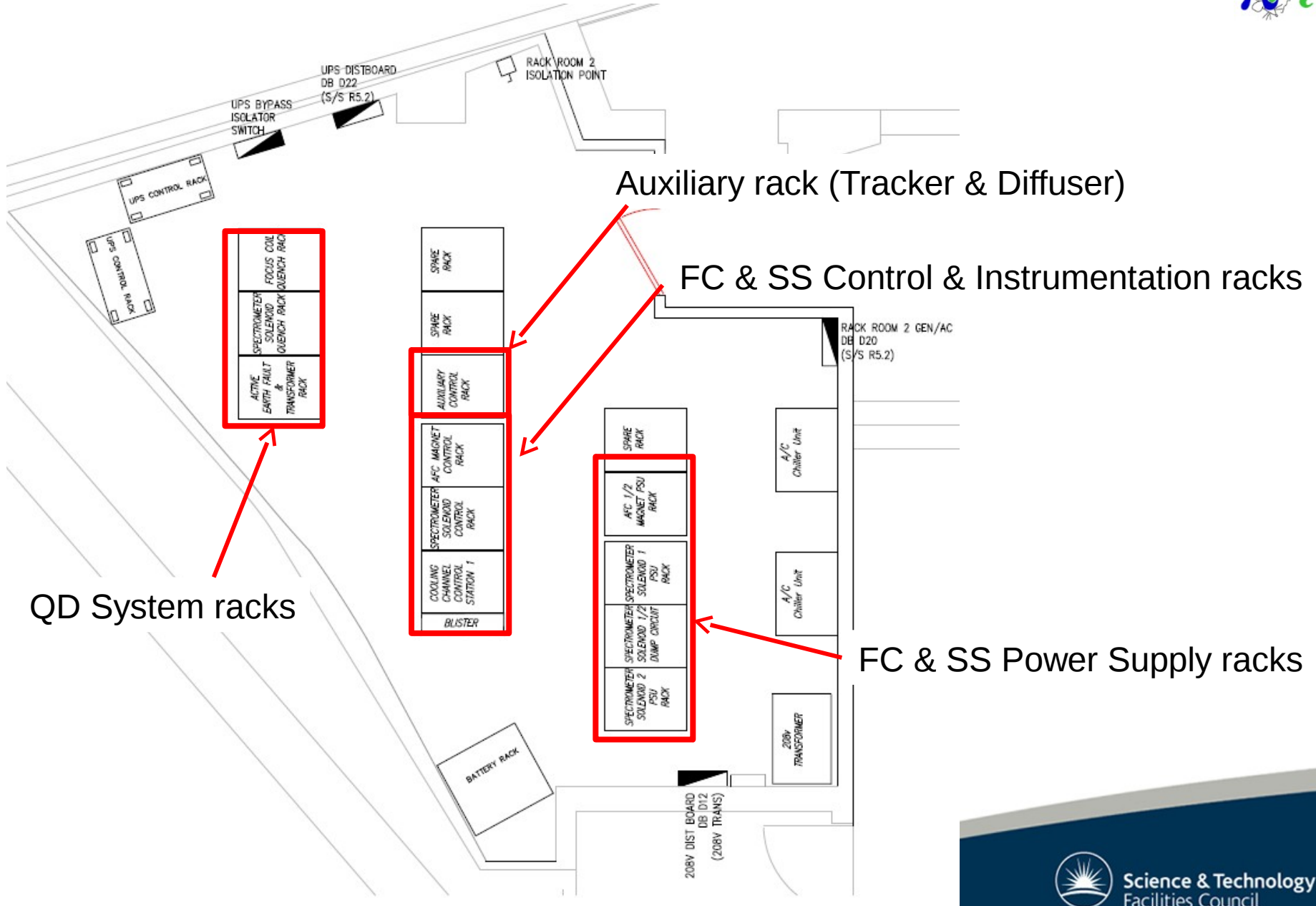
- **RR2 is populated with all of the control racks:**
 - 2 SS power supply racks + 1 energy absorber rack – NEW
 - 1 FC power supply rack – also for beyond Step IV
 - 1 FC instrumentation rack – also for beyond Step IV
 - 1 SS instrumentation rack – NEW
 - 1 additional instrumentation rack w/blister – NEW
 - Tracker/Diffuser control rack
- **Racks populated and now being cabled**
- **Power cables run from RR2 to south mezzanine**

- Additional RR2 UPS
- Grounding/Earthing in hall
- Cable management
- Vacuum/Cryo-coolers
- Power leads/link boxes
- ODH
- Quench Detection/Protection
- For more information, see Steve Griffeth's talk



25mm x 3mm Busbar

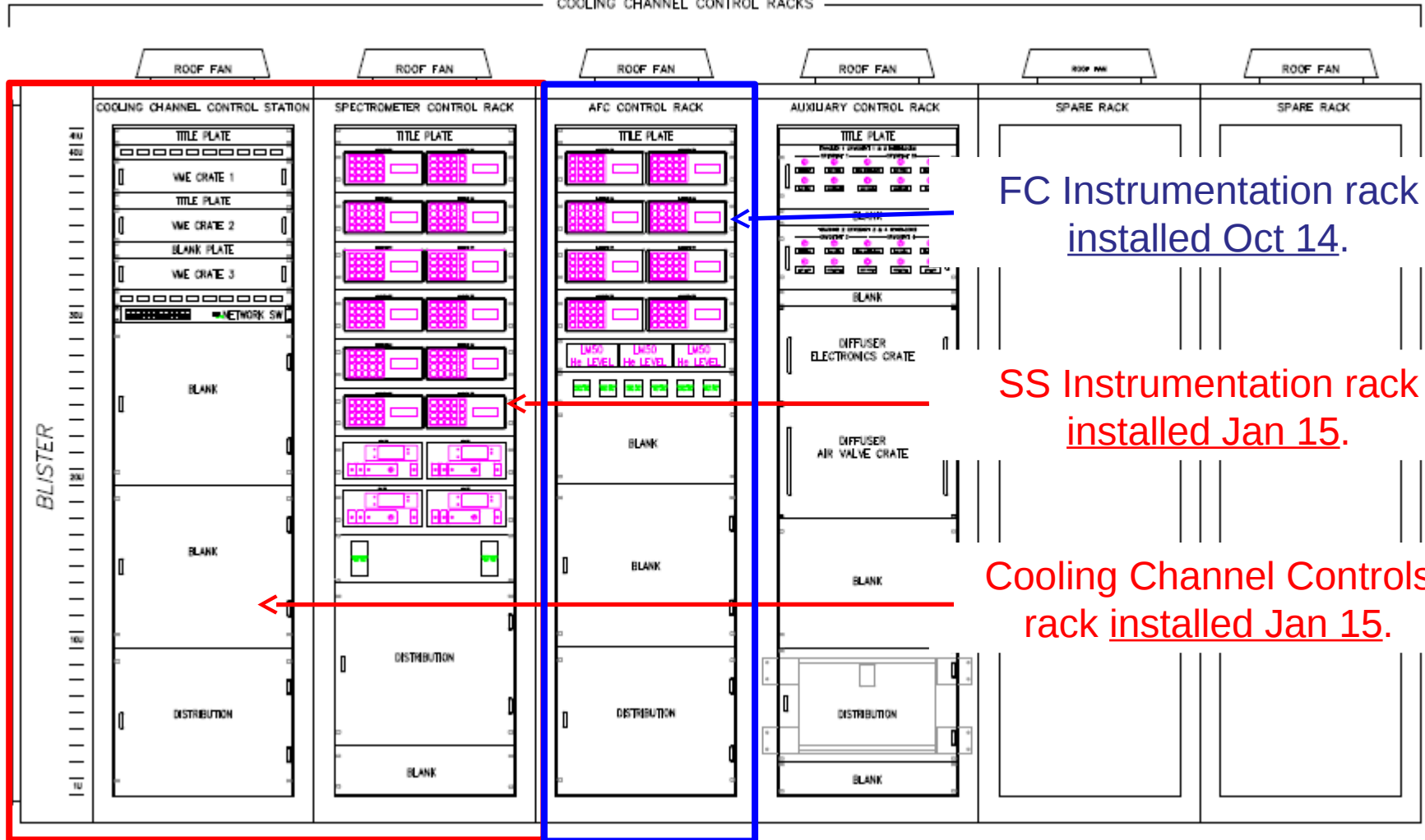
RR2 Layout - rack allocation



FC & SS Instrumentation & Control Racks



COOLING CHANNEL CONTROL RACKS

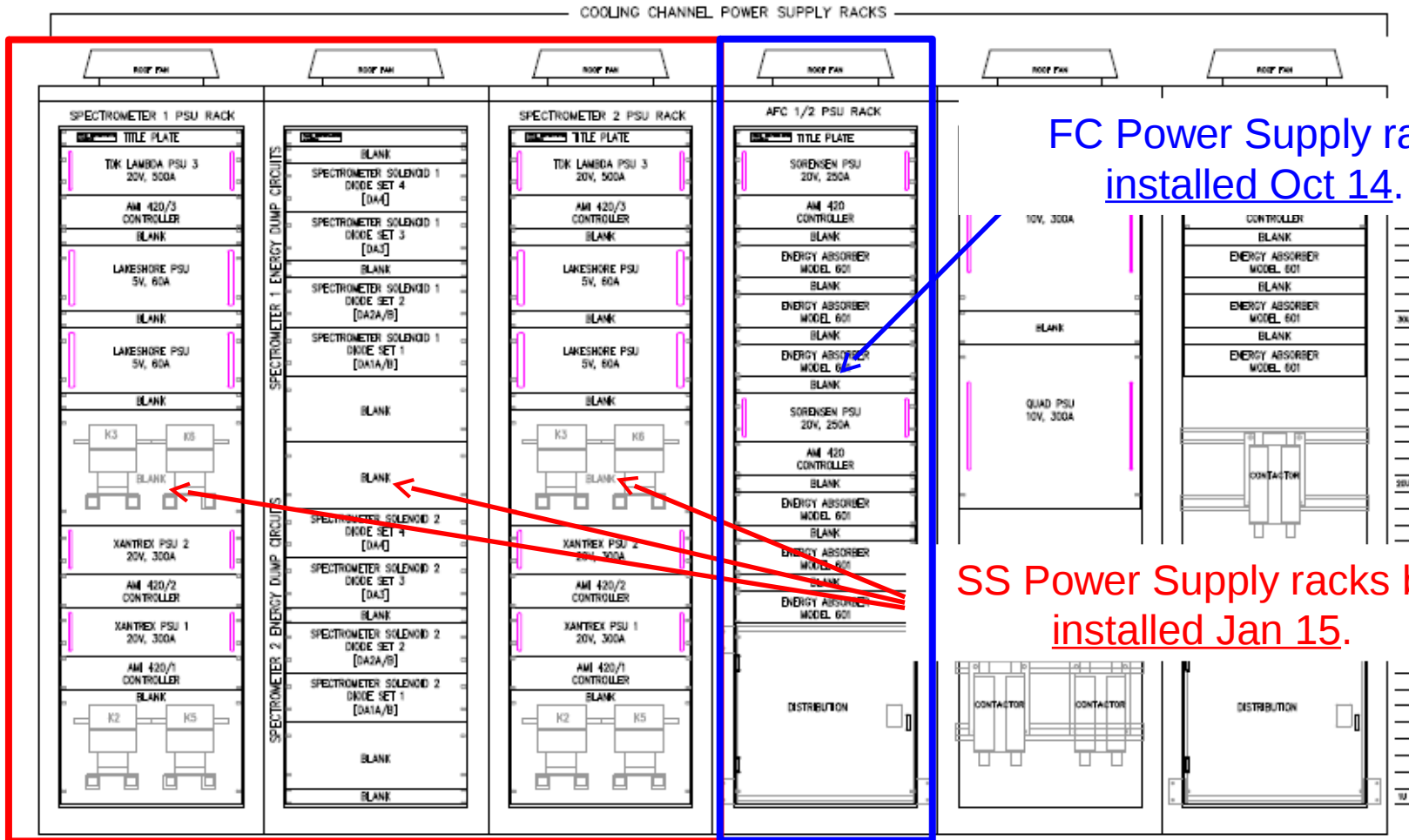


FC Instrumentation rack installed Oct 14.

SS Instrumentation rack installed Jan 15.

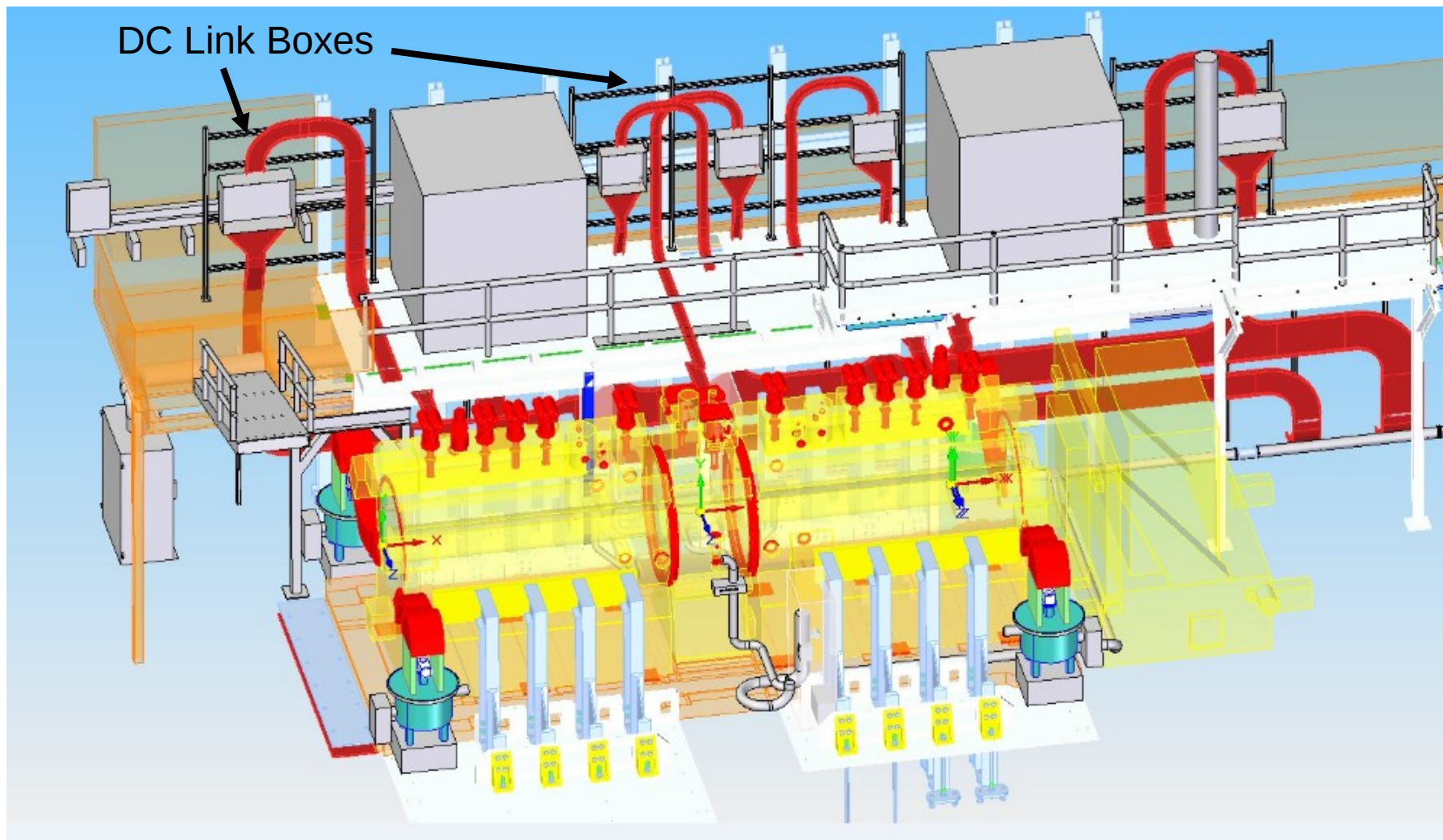
Cooling Channel Controls rack installed Jan 15.

FC & SS Power Converter Racks



- All racks have been fully electrically tested at DL.
- This includes thermal loading of all systems and cooling modifications.
- Xantrex PSUs to be changed to Lambda PSUs

Cable management for DC cables and link boxes for SS & FC



Drawing indicates the position of the DC link Boxes and DC cable management.

DC Link Boxes & Magnet Cables for SS



SS Magnet
termination block



SS – DC link box

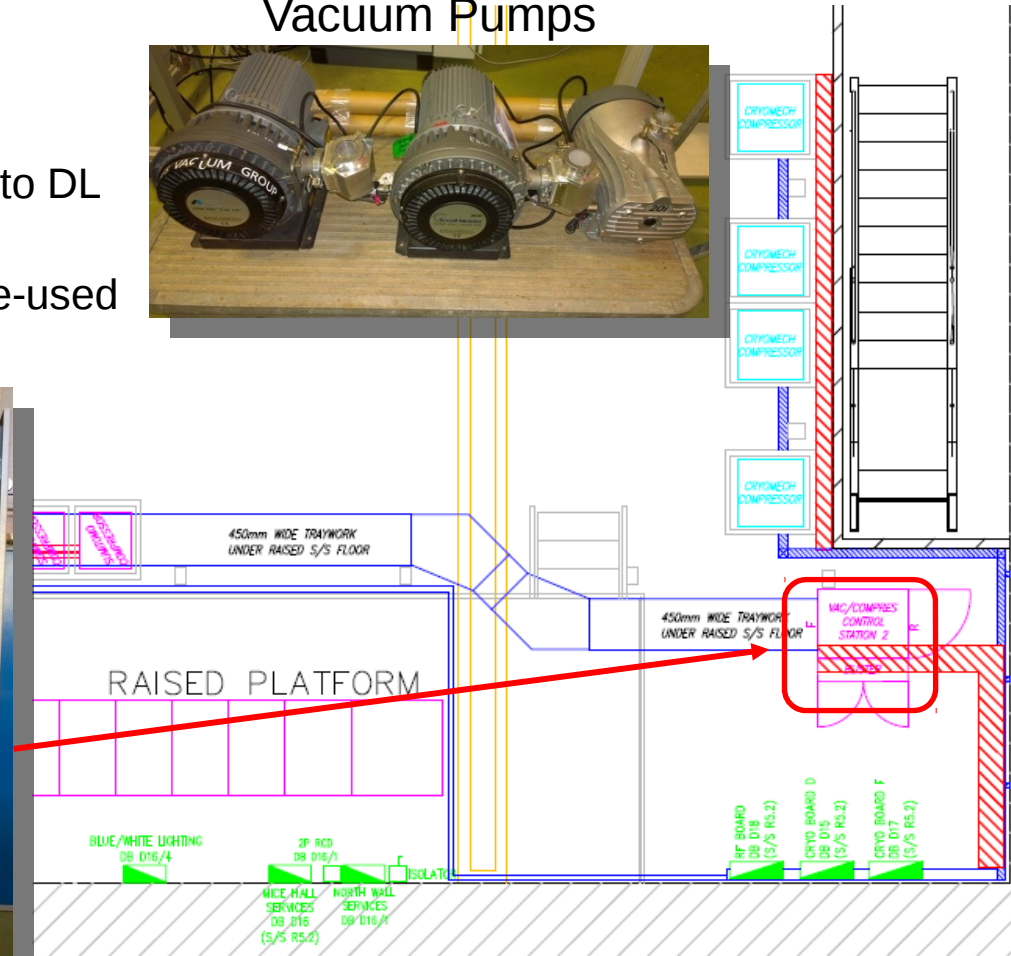
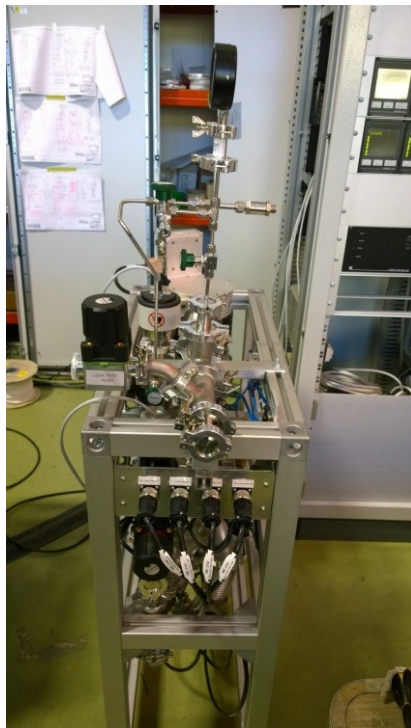
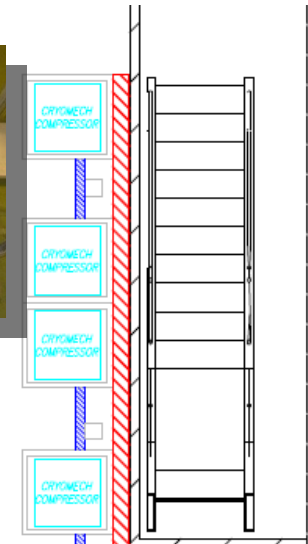
DC magnet cables and Cable
management for FC & SS

Compressor and Vacuum Rack



- Vacuum / compressor rack will be installed in March 2015.
- Rack is fully assembled and electrically checked.
- Vacuum equipment has been delivered to DL for system commissioning.
- Cables from rack to equipment will be re-used in MICE Hall.

Vacuum Pumps



Vacuum Rack

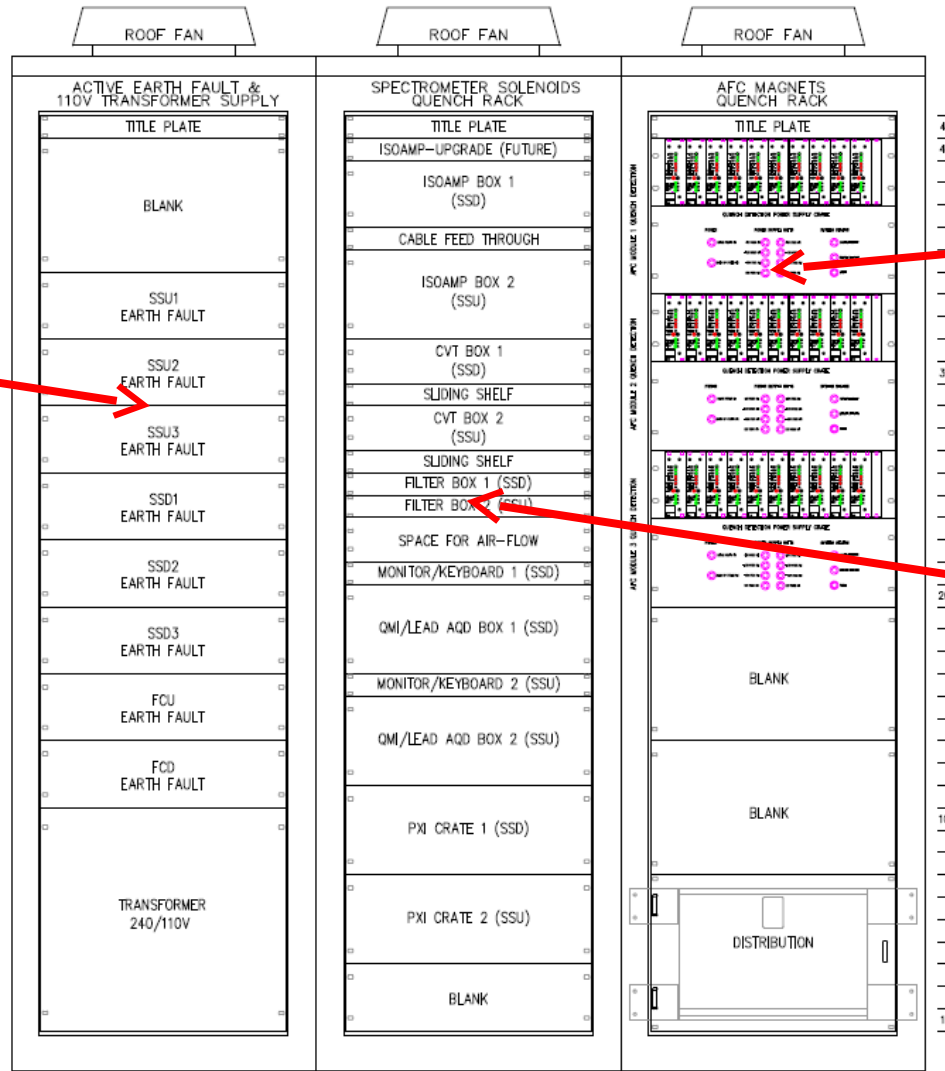
Vacuum Equipment

Quench Detection System Racks



Spare rack – used to house earth/ground fault protection and 230/110V transformer

A 19 inch rack has been assembled and shipped to US for populating with SS equipment



2 QD systems installed in rack for FC 1 & 2

2 QD systems installed in rack for SS up & down stream



DL Efforts



Power supplies



Instrumentation



Chris's Work

- Parsing script developed:
 - Reads .csv supplied by system expert
 - Produces fully formed (mostly) alarm handler & archiver configurations
- Working experience needed to finalize alarm limits and exception tolerances
- Completed systems:
 - Beamline (sans DS)
 - Focus Coil
 - CKOV
 - Many hall environment monitors

			Owner	Support	Required Time (hours)	Pr	
Controls and Monitoring	Environment	Temperature	IOC	Hanlet			
			GUI(s)	Hanlet		1	
		Humidity	ALH	Hanlet		1	
			Archiver	Hanlet		1	
		Barometry	IOC	Hanlet		40	
			Documentation	Hanlet		0	
		WaterLeak	IOC	Hanlet		40	
			GUI(s)	Hanlet		3	
			Archiver	Hanlet		1	
			Documentation	Nebrasky		0	
	Beamline	Beamline Magnets	IOC	DL		5	
			GUI(s)	Hanlet		1	
			ALH	Hanlet		1	
			Archiver	Hanlet		1	
			StateMachine	Hanlet		40	
			Documentation	Nebrasky		20	
		Proton Absorber	IOC	Hanlet		40	
			GUI(s)	Hanlet		3	
			ALH	Hanlet		1	
		Beam Stop	Archiver	Hanlet		5	
			TestSuite	Hanlet		5	
			Documentation	Nebrasky		10	
			IOC	Hanlet		30	
			GUI(s)	Hanlet		0	
			ALH	Hanlet		1	
		Diffuser	Archiver	Hanlet		1	
			Documentation	Nebrasky		5	
			IOC	Hanlet		40	
GUI(s)	Hanlet			4			
ALH	Hanlet			1			
Archiver	Hanlet			1			
MICE Channel	CKOV	TestSuite	Blackmore		10		
		Documentation	Blackmore		1		
		IOC	Hanlet		10		
		GUI(s)	Hanlet		2		
MICE Channel	FC	ALH	Hanlet		1		
		Archiver	Hanlet		1		
		StateMachine	Hanlet		80		
		TestSuite	Watson		80		
		Documentation	Watson		20		
		IOC	DL				
		GUI(s)	Hanlet		10		



Chris's Work

EMR IOC

- Early work
 - IOC reads WTI plugs
 - Just monitoring controls to be added
- Slow work, educating myself on how networks and devices communicate

	1	TI	P	TP	RI	RTI	V
A	4 A	4 A	273 W	333 W	37	37	235 V
B	5 A	5 A	233 W	263 W	54	54	234 V
C	0 A	0 A	0 W	0 W	0	0	0 V
D	0 A	0 A	0 W	0 W	0	0	0 V
T		8 A		133 W		91	

-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		
-0 A	-1 W	-1	1		



MDR1 - Goals

• Goals for MDR1 15-01-21

- 1) Integrate BeamLine IOC into BeamLine StateMachine
- 2) Integrate BeamLine StateMachine into RunControl
- 3) Integrate Detectors into Detector StateMachine
- 4) Integrate Detectors StateMachine into RunControl
- 5) Deprecated goal: only BeamLine – drop 3 and 4
 - EMR C&M not ready
 - tracker C&M not far enough along



MDR1 - BeamLine IOC

- BeamLine is:

- Target
- NC magnets
- Decay Solenoid
- Proton Absorber
- Beam Stop
- Diffuser

- BeamLine IOC does not include Target or DS
- Combines remaining elements
- Checks readiness of each device
- Checks when each device has read=set values
- Provides menu driven control for PA & DF



MDR1 - BeamLine IOC

Menu driven control of proton absorber and diffuser

Proton Absorber Control (on miceiocptest...)

Device Name: "TCW181-CM"
 Software version: "v1.01"
 Release date: "August 2012"
 IP Address: 172.16.246.156
 SubNet Address: 255.255.255.0
 Gateway Address: 172.16.246.165
 MAC Address: 00 04 A3 AA 11 3
 DHCP Config: 0

ON OFF
 1 1 0
 2 2 0
 3 3 0
 4 4 0
 0 0

AllOn
 AllOff

Set value for proton absorber: **146mm**

5.7 bar Supply air pressure
 1.0 bar Relief IN air pressure
 1.0 bar Relief OUT air pressure

Exit

p Absorber Switch	Limit Switches	p Absorber Plates
29mm Up value	0 Closed	29 mm
49mm Up value	0 Closed	49 mm
53mm Up value	0 Closed	53 mm
15mm Up value	0 Closed	15 mm
29mm Down value	1 Open	p Absorber 146 mm
49mm Down value	1 Open	
53mm Down value	1 Open	
15mm Down value	1 Open	

Bit mask : 0xF

/home/epics/epicsDEV/Config/opi/ed/diffuser.edl (on miceiocptest.micenet.rLac.uk)

IRIS 1 IRIS 2 IRIS 3 IRIS 4

0.207 X0 0.000 X0 0.938 X0 0.000 X0

OPEN CLOSE OPEN CLOSE OPEN CLOSE OPEN CLOSE

Line Pressure
 Remote
 Power

Diffuser
 In 3 1 Out

AirOff

IRIS MASK
 0x 5

Total RadLen
 1.1 X0

Set Diffuser
1.944 X0
 Setting

Exit

Busy: IRIS 2 opening

This feature allows RC to set these devices; i.e. read value from CDB and then set device



MDR1 - BeamLine State Machine

- **It WORKS!**
- **First attempt to test BL SM.**
- **Needs tuning, but need time with equipment in operation**
- **Needs alarm and archiver parameters tuned by BL expert**



MDR1 - Run Control

- It WORKS with BeamLine!
- First attempt to test with BL SM.
- Needs tuning, but need time with equipment in operation
- New IOCs (NUC) work
- Will not work when errors are present

The screenshot displays two main windows: 'MICE Run Status' and 'MICE Run Control'.

MICE Run Status:

- Run number: 5994
- Run type: Physics Data
- Trigger Type: TOF1
- Spill Gate Width: 0.00 ms
- DATE Status: Run Complete
- gdcHostName: [input field]

Three histograms are shown: Event Size, Particle Triggers, and Acc/Req Triggers. Below them is a table of trigger counts:

	Spill:	Integrated
Particle Triggers	0	0
Requested Triggers	0	0
GVa1 Triggers	0	0
ToF0 Triggers	0	0
ToF1 Triggers	0	0
LMC-12	0	0
LMC-34	0	0
LMC-1234	0	0

MICE Run Control:

- Buttons: Begin Run, MICE Step (Step IV), Run Type (Physics Data), Trigger Type (TOF1), Beam Optics (6-200+M0), Cooling Chan (CoolChan), Comment (End MockDataRun 21-0)
- Warnings: 'BadThing' (red), 'Whoa' (cyan), 'BeamLine not ready' (black box with 'Please Note' and 'Hit display when complete' buttons)
- Status: 'Ready to Start DATE from DAQ PC' (yellow box)
- DATE Status: Run Complete
- RC Status: Writing End Run Info to CDB
- Buttons: Start Processes, Writing to: Test CDB (yellow circle), EXIT (yellow), Debug On (grey)
- Inputs: Enter Tag Name (max 20 characters), LDC Host Name, GDC Host Name (gdcHostName)
- Buttons: Run DFC (grey)

A terminal window at the bottom shows the command prompt: epics@miceiocptest: ~/epicsDEV/iocTops/DAQMon/DAQMo...



MDR1 - Problems

- ToF & KL use CAEN SY527 – pci card did not run w/SL6.4; built deprecated PC (SL5.7) to operate – thanks Ed
- Ignored GVa1 & CKOV HV C&M since awaiting new SY4527 card
- **Note: have no spare for aging and unsupported system**
- Diffuser: new hardware problem – IRIS 1 does not open
 - this brings to light failure of RC when HW problem exists
 - fixed by closing/opening IRIS
- Run Control GUI needs updating
 - fix to selections of: beam configurations, BL ready button, step selection
- Integration with DAQ – missing parameters from DATE
- Need TargetMon to work again
- Write to CDB did not work; normally awaits trigger, so don't know root cause



MDR1 - Problems

- Most significant lesson is the rigidity of operational requirements of subsystems for RC
- this **MUST** be true for data taking
- develop “TEST” runs to allow for operation with missing subsystems
- TEST will give options to turn off READY requirements of individual devices



Preparing for MDR2

- **Goals for MDR2 – sometime late February?**
 - 1) **Integrate BeamLine IOC into BeamLine StateMachine**
 - **Fix problems from MDR1**
 - 2) **Integrate BeamLine StateMachine into RunControl**
 - **Complete tests from MDR1**
 - 3) **Integrate Detectors into Detector StateMachine**
 - **EMR C&M in progress – see C.Heidt's talk**
 - **tracker C&M in progress – w/E.Overton**
 - 4) **Integrate Detectors StateMachine into RunControl**

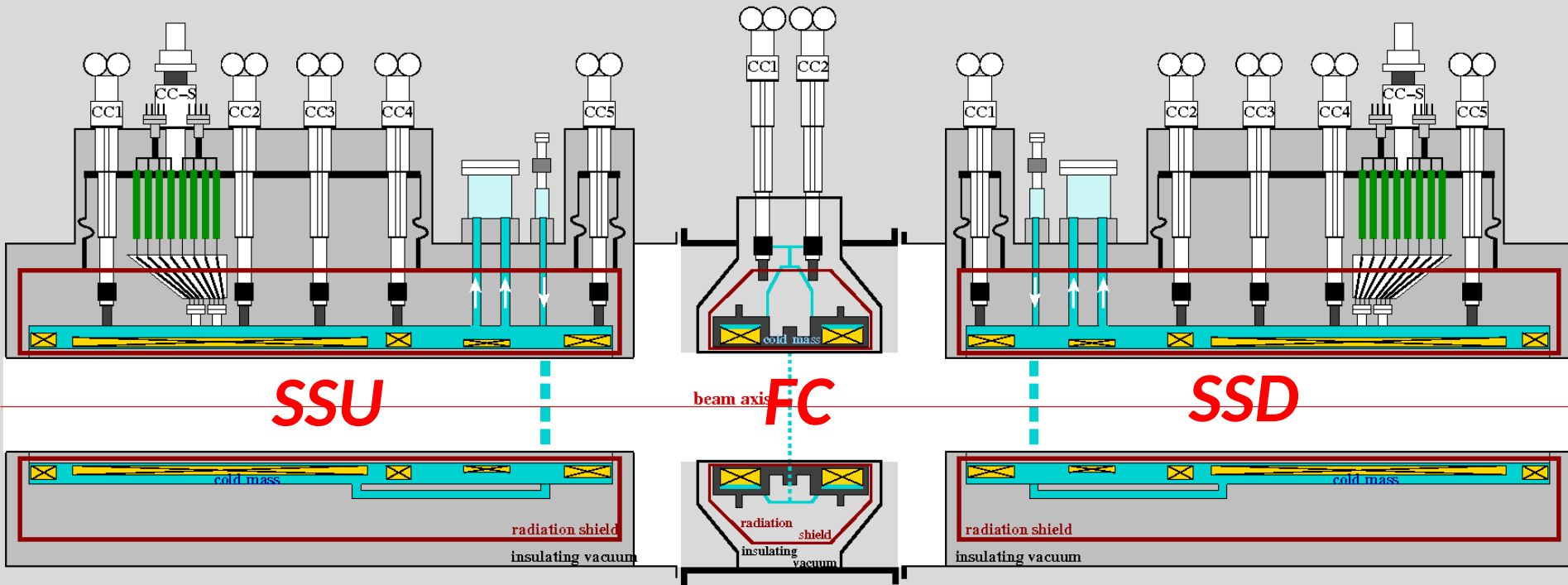


Odds and Ends

- **Post MDR2 – 8th March running**
- **W/BeamLine and Detectors integrated, next need MICE channel elements:**
 - **SSs**
 - **FC**
 - **LH2**
 - **PRY movement monitoring**
 - **B-Field monitoring**
 - **Good news: SS and FC SMs advanced**
- **Goal is to have MLCR “look & feel” complete before MICE channel is integrated – March weekend running**



Step IV Operations



- Vacuum
- Compressors
- Cryogenics
- Pressure
- Power Supply

- Vacuum
- Compressors
- Cryogenics
- Pressure
- Power Supply

- Vacuum
- Compressors
- Cryogenics
- Pressure
- Power Supply



Summary

- **Much progress since CM40:**
 - BeamLine IOC and SM
 - RunControl w/BeamLine integration
 - Tracker C&M: Weiner PSs, integration, ...
 - Updated ALH and Archiver configuration files
 - Progress on EMR C&M
- **DL efforts + Chris's work**
- **MDR1 exhibited many successes**
- **MDR1 taught us many lessons**
 - RunControl too strict; will use TEST mode when hardware fails
- **Preparing for MDR2 and beyond**
- **MICE channel integration well advanced, but next to come online in April**