Science & Technology Facilities Council

RF Station Deployment Plan for MICE Hall

Alan Grant

RF Schedule

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Assumptions

- **Step IV data taking up to 1st June 16.**
  - **Needs to be confirmed – might be beneficial to run a little longer if beam time in June 16.**

- **Installation of RF components starts June 16**
  - **Racks for system #1 used for commissioning system #2 amplifiers, but will be delivered before June 16.**
  - **Will aim to install some equipment and service earlier if access to the hall can be agreed.**

- **Electrically commission 4616 and TH116 Aux and PSU racks using dummy loads for systems #1 for off line testing**
  - **10 days for each amplifier. Highlight any potential issues before going to off line cavity testing.**
  - **This means fully commissioned racks for system #1 not available until 20th Sept.**

- **Cavity #1 moved directly on to cooling channel into downstream position after off line testing is complete, then pumped down.**
  - **Cavity #1 operated with RF system #2 racks in on line position.**
  - **RF system #2 online racks 4616 and TH116 commissioned into dummy loads**
  - **Fully commissioned system #2 racks not available until 22nd Feb 17.**
  - **Delivery of system #2 racks may be delayed as effort and key staff are directed to running and commissioning system #1. Delivery / Installation and commissioning is being re-assessed but could be as much as 3mths delay for system # 2.**

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Assumptions

- Cavity #2 off line and on line testing carried out with system #1 racks.
  - Cavity #2 installed in upstream position
- Installation of South side PRY complete 2nd Jan 17
  - Decommissioning and installation of all floor plates and sliding platforms before south PRY can be installed
- Temporary coax support on North side PRY
  - Fit coax support uprights to south plates in final position
  - Leaves access to North Side of cooling channel for online RF high power tests
- High power tests for cavity #1 and #2 online are run in parallel.
  - Testing to be carried out on late shifts to maintain access to hall for installation work during day shifts
  - Staff available and can run both systems in parallel
- PRY North Side Plates installed after RF high power tests complete May 17
- Final installation of RF distribution system end May 17

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RF System #1

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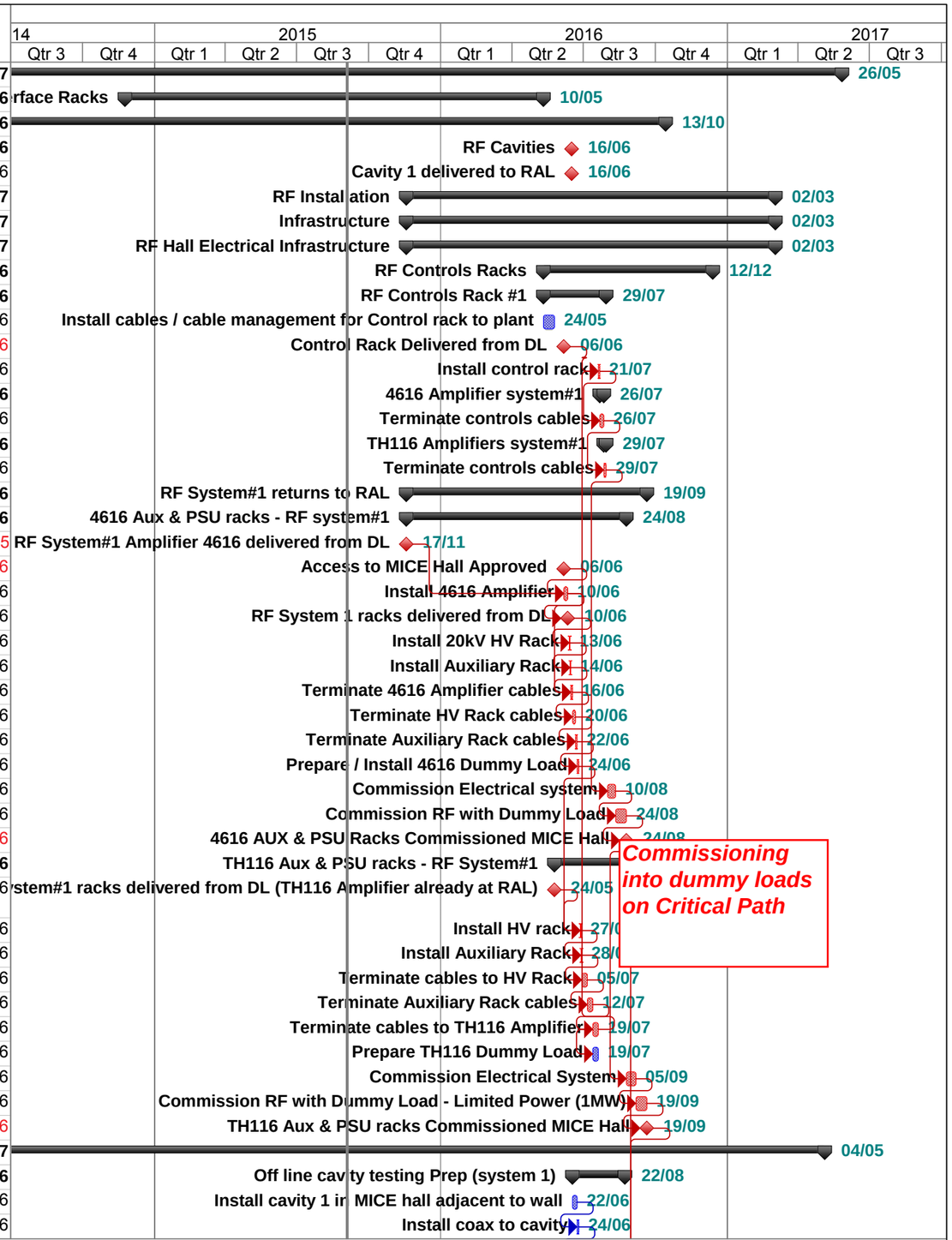
ID	Task Name	Duration	Start	Finish
1	**MICE RF Work Package**	**2198 days**	**01/09/08**	**26/05/17**
18	**RF Control Interface Racks**	**375 days**	**24/11/14**	**10/05/16**
38	**RF Amplifiers Testing**	**2048 days**	**01/09/08**	**13/10/16**
306	**RF Cavities**	**0 days**	**16/06/16**	**16/06/16**
307	Cavity 1 delivered to RAL	0 days	16/06/16	16/06/16
309	**RF Installation**	**319 days**	**17/11/15**	**02/03/17**
310	**Infrastructure**	**319 days**	**17/11/15**	**02/03/17**
311	**RF Hall Electrical Infrastructure**	**319 days**	**17/11/15**	**02/03/17**
312	**RF Controls Racks**	**154 days**	**11/05/16**	**12/12/16**
313	**RF Controls Rack #1**	**58 days**	**11/05/16**	**29/07/16**
314	Install cables / cable management for Control rack to plant	10 days	11/05/16	24/05/16
315	Control Rack Delivered from DL	0 days	06/06/16	06/06/16
316	Install control rack	2 days	20/07/16	21/07/16
317	**4616 Amplifier system#1**	**3 days**	**22/07/16**	**26/07/16**
318	Terminate controls cables	3 days	22/07/16	26/07/16
319	**TH116 Amplifiers system#1**	**3 days**	**27/07/16**	**29/07/16**
320	Terminate controls cables	3 days	27/07/16	29/07/16
329	**RF System#1 returns to RAL**	**212 days**	**17/11/15**	**19/09/16**
330	**4616 Aux & PSU racks - RF system#1**	**194 days**	**17/11/15**	**24/08/16**
331	RF System#1 Amplifier 4616 delivered from DL	0 days	17/11/15	17/11/15
332	Access to MICE Hall Approved	0 days	06/06/16	06/06/16
333	Install 4616 Amplifier	5 days	06/06/16	10/06/16
334	RF System 1 racks delivered from DL	0 days	10/06/16	10/06/16
335	Install 20kV HV Rack	1 day	13/06/16	13/06/16
336	Install Auxiliary Rack	1 day	14/06/16	14/06/16
337	Terminate 4616 Amplifier cables	2 days	15/06/16	16/06/16
338	Terminate HV Rack cables	2 days	17/06/16	20/06/16
339	Terminate Auxiliary Rack cables	2 days	21/06/16	22/06/16
340	Prepare / Install 4616 Dummy Load	2 days	23/06/16	24/06/16
341	Commission Electrical system	8 days	01/08/16	10/08/16
342	Commission RF with Dummy Load	10 days	11/08/16	24/08/16
343	4616 AUX & PSU Racks Commissioned MICE Hall	0 days	24/08/16	24/08/16
344	**TH116 Aux & PSU racks - RF System#1**	**84 days**	**24/05/16**	**19/09/16**
345	RF System#1 racks delivered from DL (TH116 Amplifier already at RAL)	0 days	24/05/16	24/05/16
346	Install HV rack	1 day	27/06/16	27/06/16
347	Install Auxiliary Rack	1 day	28/06/16	28/06/16
348	Terminate cables to HV Rack	5 days	29/06/16	05/07/16
349	Terminate Auxiliary Rack cables	5 days	06/07/16	12/07/16
350	Terminate cables to TH116 Amplifier	5 days	13/07/16	19/07/16
351	Prepare TH116 Dummy Load	5 days	13/07/16	19/07/16
352	Commission Electrical System	8 days	25/08/16	05/09/16
353	Commission RF with Dummy Load - Limited Power (1MW)	10 days	06/09/16	19/09/16
354	TH116 Aux & PSU racks Commissioned MICE Hall	0 days	19/09/16	19/09/16
412	**Cavities**	**744 days**	**04/06/14**	**04/05/17**
419	**Off line cavity testing Prep (system 1)**	**47 days**	**17/06/16**	**22/08/16**
420	Install cavity 1 in MICE hall adjacent to wall	4 days	17/06/16	22/06/16
421	Install coax to cavity	2 days	23/06/16	24/06/16

4616 Installation & test into dummy load

TH116 Installation & test into dummy load

Commissioning into dummy loads on Critical Path



Project: MICE HALL INSTALLATION S
Date: 04/09/15

Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only

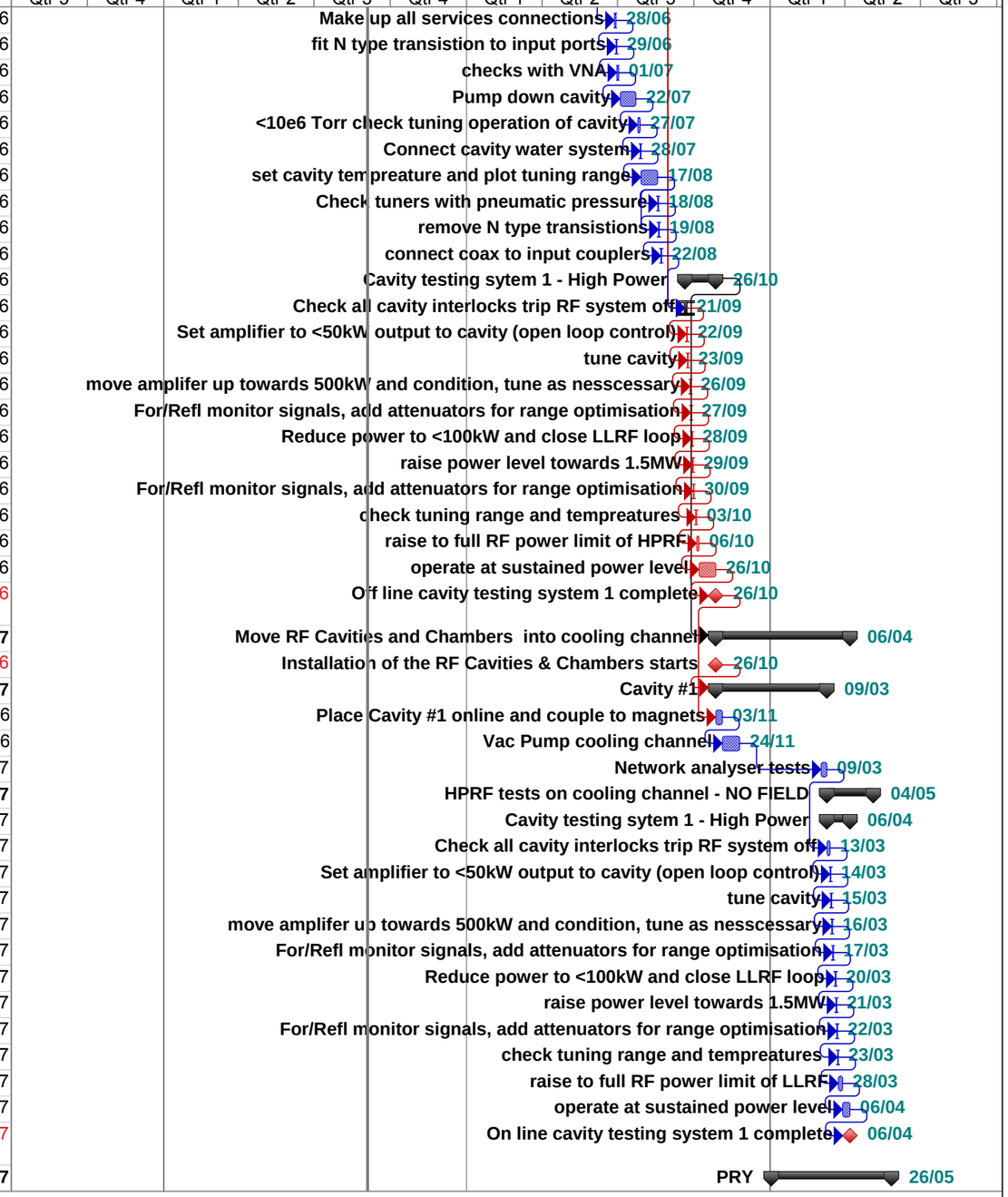
ID	Task Name	Duration	Start	Finish
422	Make up all services connections	2 days	27/06/16	28/06/16
423	fit N type transistion to input ports	1 day	29/06/16	29/06/16
424	checks with VNA	2 days	30/06/16	01/07/16
425	Pump down cavity	3 wks	04/07/16	22/07/16
426	<10e6 Torr check tuning operation of cavity	3 days	25/07/16	27/07/16
427	Connect cavity water system	1 day	28/07/16	28/07/16
428	set cavity tempreature and plot tuning range	14 days	29/07/16	17/08/16
429	Check tuners with pneumatic pressure	1 day	18/08/16	18/08/16
430	remove N type transistions	1 day	19/08/16	19/08/16
431	connect coax to input couplers	1 day	22/08/16	22/08/16
432	**Cavity testing sytem 1 - High Power**	27 days	20/09/16	26/10/16
433	Check all cavity interlocks trip RF system off	2 days	20/09/16	21/09/16
434	Set amplifier to <50kW output to cavity (open loop control)	1 day	22/09/16	22/09/16
435	tune cavity	1 day	23/09/16	23/09/16
436	move amplifer up towards 500kW and condition, tune as nesso	1 day	26/09/16	26/09/16
437	For/Refl monitor signals, add attenuators for range optimisatio	1 day	27/09/16	27/09/16
438	Reduce power to <100kW and close LLRF loop	1 day	28/09/16	28/09/16
439	raise power level towards 1.5MW	1 day	29/09/16	29/09/16
440	For/Refl monitor signals, add attenuators for range optimisation	1 day	30/09/16	30/09/16
441	check tuning range and tempreatures	1 day	03/10/16	03/10/16
442	raise to full RF power limit of HPRF	3 days	04/10/16	06/10/16
443	operate at sustained power level	14 days	07/10/16	26/10/16
444	Off line cavity testing system 1 complete	0 days	26/10/16	26/10/16
471	**Move RF Cavities and Chambers into cooling channel**	**105 days**	**26/10/16**	**06/04/17**
472	Installation of the RF Cavities & Chambers starts	0 days	26/10/16	26/10/16
473	**Cavity #1**	**85 days**	**27/10/16**	**09/03/17**
474	Place Cavity #1 online and couple to magnets	6 days	27/10/16	03/11/16
475	Vac Pump cooling channel	3 wks	04/11/16	24/11/16
476	Network analyser tests	1 wk	03/03/17	09/03/17
482	**HPRF tests on cooling channel - NO FIELD**	**40 days**	**10/03/17**	**04/05/17**
483	**Cavity testing sytem 1 - High Power**	20 days	10/03/17	06/04/17
	Check all cavity interlocks trip RF system off	2 days	10/03/17	13/03/17
	Set amplifier to <50kW output to cavity (open loop control)	1 day	14/03/17	14/03/17
	tune cavity	1 day	15/03/17	15/03/17
	move amplifer up towards 500kW and condition, tune as nesscessary	1 day	16/03/17	16/03/17
	For/Refl monitor signals, add attenuators for range optimisation	1 day	17/03/17	17/03/17
	Reduce power to <100kW and close LLRF loop	1 day	20/03/17	20/03/17
	raise power level towards 1.5MW	1 day	21/03/17	21/03/17
	For/Refl monitor signals, add attenuators for range optimisation	1 day	22/03/17	22/03/17
	check tuning range and tempreatures	1 day	23/03/17	23/03/17
	raise to full RF power limit of LLRF	3 days	24/03/17	28/03/17
	operate at sustained power level	7 days	29/03/17	06/04/17
	On line cavity testing system 1 complete	0 days	06/04/17	06/04/17
		102 days	**02/01/17**	**26/05/17**

Off line High Power Tests against North shield wall

North PRY plates not installed at this point

Cavity#1 installed in downstream position. Will be driven using system#2 amplifier and racks

High Power Tests repeated in cooling channel final position with access from north side.



TALLATION S
Date: 04/09/15

Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only

RF System #2

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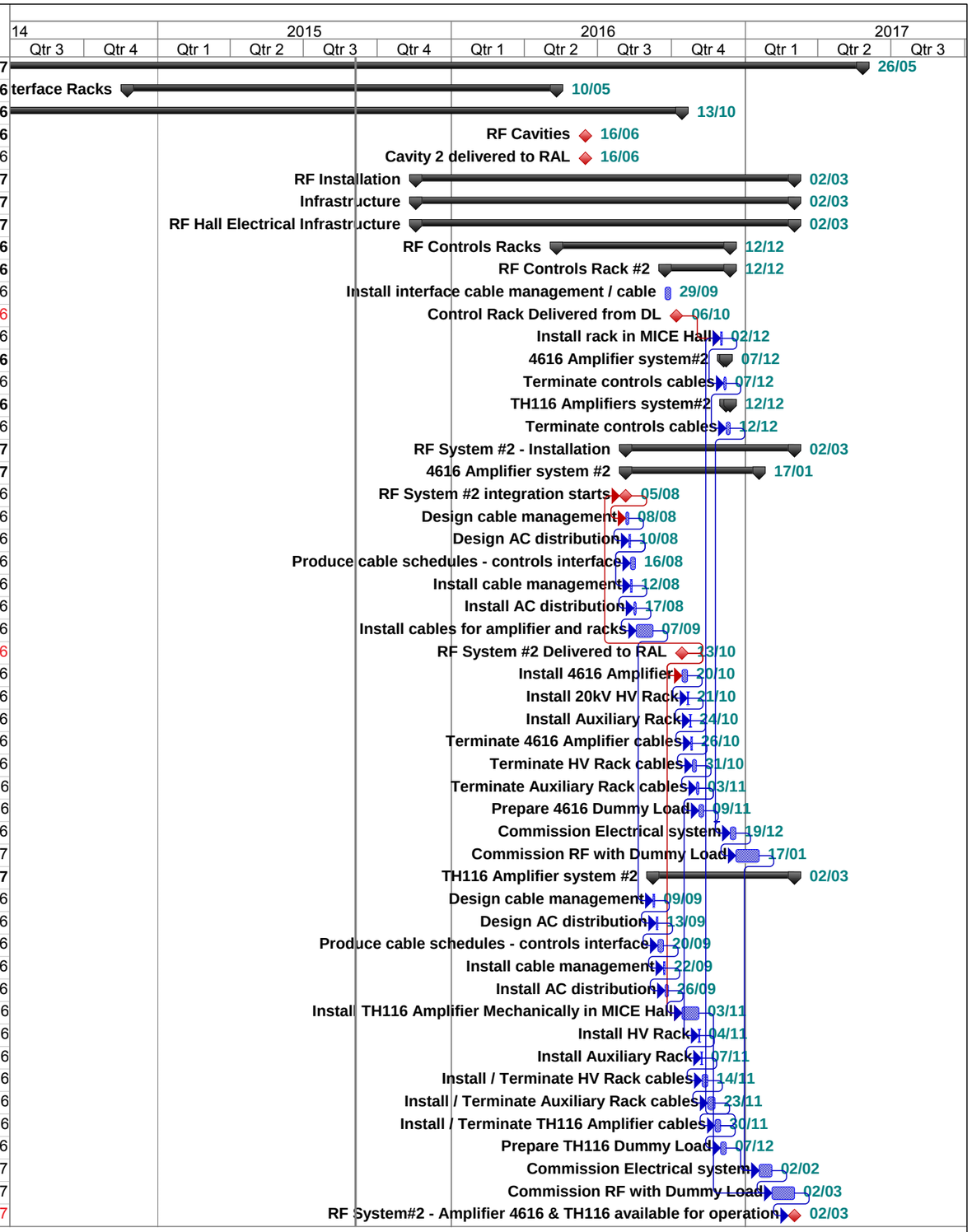
ID	Task Name	Duration	Start	Finish
1	**MICE RF Work Package**	**2198 days**	**01/09/08**	**26/05/17**
18	**RF Control Interface Racks**	**375 days**	**24/11/14**	**10/05/16**
38	**RF Amplifiers Testing**	**2048 days**	**01/09/08**	**13/10/16**
306	**RF Cavities**	**0 days**	**16/06/16**	**16/06/16**
308	Cavity 2 delivered to RAL	0 days	16/06/16	16/06/16
309	**RF Installation**	**319 days**	**17/11/15**	**02/03/17**
310	**Infrastructure**	**319 days**	**17/11/15**	**02/03/17**
311	**RF Hall Electrical Infrastructure**	**319 days**	**17/11/15**	**02/03/17**
312	**RF Controls Racks**	**154 days**	**11/05/16**	**12/12/16**
321	**RF Controls Rack #2**	**57 days**	**23/09/16**	**12/12/16**
322	Install interface cable management / cable	5 days	23/09/16	29/09/16
323	Control Rack Delivered from DL	0 days	06/10/16	06/10/16
324	Install rack in MICE Hall	2 days	01/12/16	02/12/16
325	**4616 Amplifier system#2**	**3 days**	**05/12/16**	**07/12/16**
326	Terminate controls cables	3 days	05/12/16	07/12/16
327	**TH116 Amplifiers system#2**	**3 days**	**08/12/16**	**12/12/16**
328	Terminate controls cables	3 days	08/12/16	12/12/16
355	**RF System #2 - Installation**	**139 days**	**05/08/16**	**02/03/17**
356	**4616 Amplifier system #2**	**107 days**	**05/08/16**	**17/01/17**
357	RF System #2 integration starts	0 days	05/08/16	05/08/16
358	Design cable management	2 days	05/08/16	08/08/16
359	Design AC distribution	2 days	09/08/16	10/08/16
360	Produce cable schedules - controls interface	4 days	11/08/16	16/08/16
361	Install cable management	2 days	11/08/16	12/08/16
362	Install AC distribution	3 days	15/08/16	17/08/16
363	Install cables for amplifier and racks	15 days	18/08/16	07/09/16
364	RF System #2 Delivered to RAL	0 days	13/10/16	13/10/16
365	Install 4616 Amplifier	5 days	14/10/16	20/10/16
366	Install 20kV HV Rack	1 day	21/10/16	21/10/16
367	Install Auxiliary Rack	1 day	24/10/16	24/10/16
368	Terminate 4616 Amplifier cables	2 days	25/10/16	26/10/16
369	Terminate HV Rack cables	3 days	27/10/16	31/10/16
370	Terminate Auxiliary Rack cables	3 days	01/11/16	03/11/16
371	Prepare 4616 Dummy Load	4 days	04/11/16	09/11/16
372	Commission Electrical system	5 days	13/12/16	19/12/16
373	Commission RF with Dummy Load	10 days	20/12/16	17/01/17
374	**TH116 Amplifier system #2**	**115 days**	**08/09/16**	**02/03/17**
375	**Design cable management**	2 days	08/09/16	09/09/16
376	Design AC distribution	2 days	12/09/16	13/09/16
377	Produce cable schedules - controls interface	5 days	14/09/16	20/09/16
378	Install cable management	2 days	21/09/16	22/09/16
379	Install AC distribution	2 days	23/09/16	26/09/16
380	Install TH116 Amplifier Mechanically in MICE Hall	15 days	14/10/16	03/11/16
381	Install HV Rack	1 day	04/11/16	04/11/16
382	Install Auxiliary Rack	1 day	07/11/16	07/11/16
383	Install / Terminate HV Rack cables	5 days	08/11/16	14/11/16
384	Install / Terminate Auxiliary Rack cables	7 days	15/11/16	23/11/16
385	Install / Terminate TH116 Amplifier cables	5 days	24/11/16	30/11/16
386	Prepare TH116 Dummy Load	5 days	01/12/16	07/12/16
387	Commission Electrical system	12 days	18/01/17	02/02/17
388	Commission RF with Dummy Load	20 days	03/02/17	02/03/17
389	RF System#2 - Amplifier 4616 & TH116 available for operation	0 days	02/03/17	02/03/17

4616 Installation & test into dummy load

TH116 Installation & test into dummy load



Project: MICE HALL INSTALLATION S
Date: 04/09/15

Inactive Summary
Manual Summary Rollup
Finish-only
Inactive Task
Manual Task
Manual Summary
Inactive Milestone
Duration-only
Start-only

ID	Task Name	Duration	Start	Finish
412	**Cavities**	**744 days**	**04/06/14**	**04/05/17**
445	**Off line cavity testing Prep (system 2)**	**47 days**	**03/11/16**	**23/01/17**
446	Install cavity 2 in MICE hall adjacent to wall	4 days	03/11/16	08/11/16
447	Install coax to cavity	2 days	09/11/16	10/11/16
448	Make up all services connections	2 days	11/11/16	14/11/16
449	fit N type transistion to input ports	1 day	15/11/16	15/11/16
450	checks with VNA	2 days	16/11/16	17/11/16
451	Pump down cavity	3 wks	18/11/16	08/12/16
452	<10e6 Torr check tuning operation of cavity	3 days	09/12/16	13/12/16
453	Connect cavity water system	1 day	14/12/16	14/12/16
454	set cavity tempreature and plot tuning range	14 days	15/12/16	18/01/17
455	Check tuners with pneumatic pressure	1 day	19/01/17	19/01/17
456	remove N type transistions	1 day	20/01/17	20/01/17
457	connect coax to input couplers	1 day	23/01/17	23/01/17
458	**Cavity testing sytem 2 - High Power**	**27 days**	**24/01/17**	**01/03/17**
459	Check all cavity interlocks trip RF system off	2 days	24/01/17	25/01/17
460	Set amplifier to <50kW output to cavity (open loop control)	1 day	26/01/17	26/01/17
461	tune cavity	1 day	27/01/17	27/01/17
462	move amplifer up towards 500kW and condition, tune as n	1 day	30/01/17	30/01/17
463	For/Refl monitor signals, add attenuators for range optimis	1 day	31/01/17	31/01/17
464	Reduce power to <100kW and close LLRF loop	1 day	01/02/17	01/02/17
465	raise power level towards 1.5MW	1 day	02/02/17	02/02/17
466	For/Refl monitor signals, add attenuators for range optimis	1 day	03/02/17	03/02/17
467	check tuning range and tempreatures	1 day	06/02/17	06/02/17
468	raise to full RF power limit of LLRF	3 days	07/02/17	09/02/17
469	operate at sustained power level	14 days	10/02/17	01/03/17
470	Off line cavity testing system 2 complete	0 days	01/03/17	01/03/17
471	**Move RF Cavities and Chambers into cooling channel**	**105 days**	**26/10/16**	**06/04/17**
477	**Cavity #2**	**26 days**	**02/03/17**	**06/04/17**
478	Place Cavity #2 online and couple to magnets	6 days	02/03/17	09/03/17
479	Vac Pump cooling channel	3 wks	10/03/17	30/03/17
480	Network analyser tests	1 wk	31/03/17	06/04/17
482	**HPRF tests on cooling channel - NO FIELD**	**40 days**	**10/03/17**	**04/05/17**
496	**Cavity testing sytem 2 - High Power**	**20 days**	**07/04/17**	**04/05/17**
	Check all cavity interlocks trip RF system off	2 days	07/04/17	10/04/17
	Set amplifier to <50kW output to cavity (open loop control)	1 day	11/04/17	11/04/17
	tune cavity	1 day	12/04/17	12/04/17
	move amplifer up towards 500kW and condition, tune as nesscessary	1 day	13/04/17	13/04/17
	For/Refl monitor signals, add attenuators for range optimisation	1 day	14/04/17	14/04/17
	Reduce power to <100kW and close LLRF loop	1 day	17/04/17	17/04/17
	raise power level towards 1.5MW	1 day	18/04/17	18/04/17
	For/Refl monitor signals, add attenuators for range optimisation	1 day	19/04/17	19/04/17
	check tuning range and tempreatures	1 day	20/04/17	20/04/17
	raise to full RF power limit of LLRF	3 days	21/04/17	25/04/17
	operate at sustained power level	7 days	26/04/17	04/05/17
	On line cavity testing system 2 complete	0 days	04/05/17	04/05/17

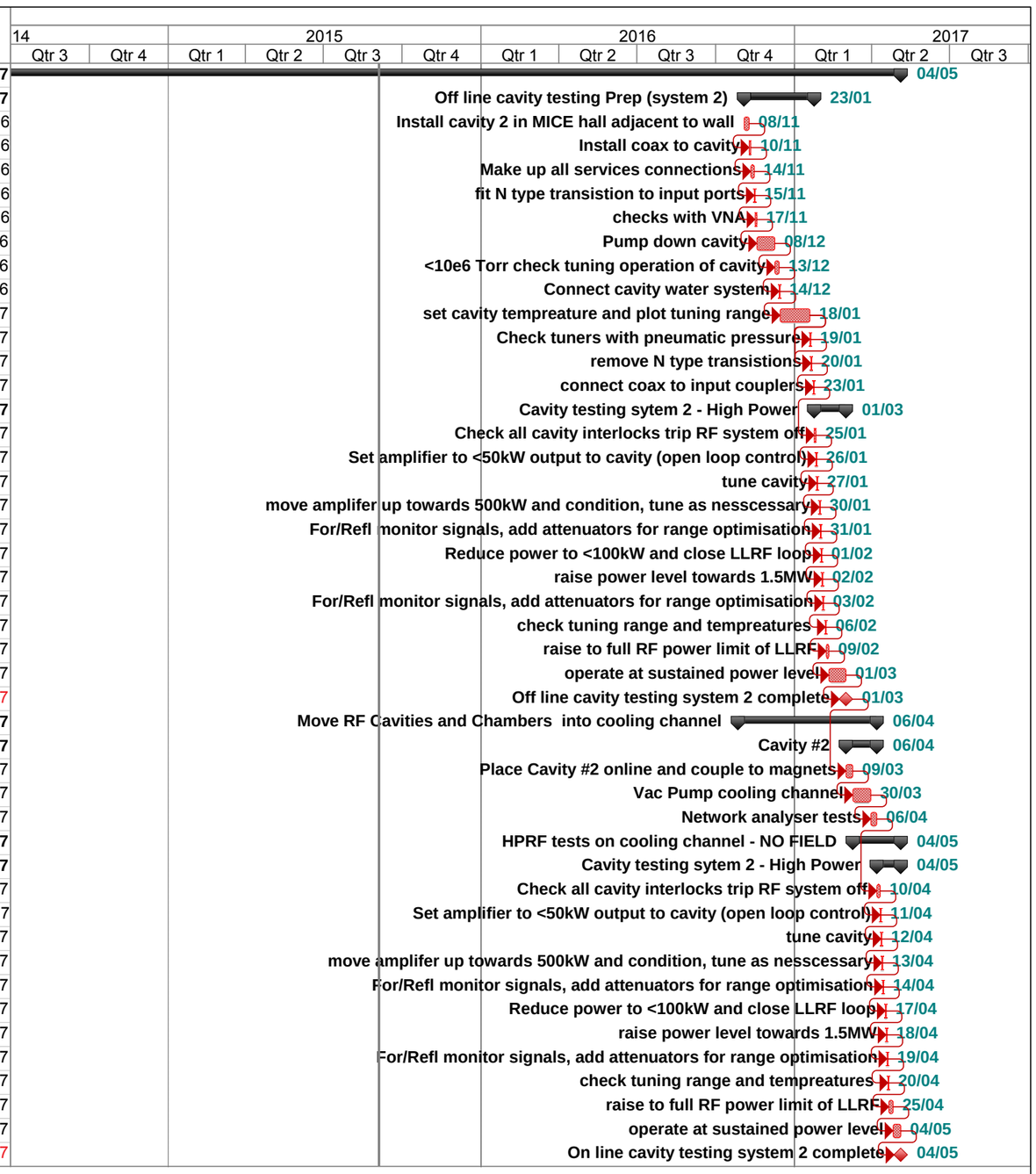
Off line High Power Tests against North shield wall.

High power tests carried out with system#1 amplifiers & racks

North PRY plates not installed at this point.

Cavity#2 installed in upstream position

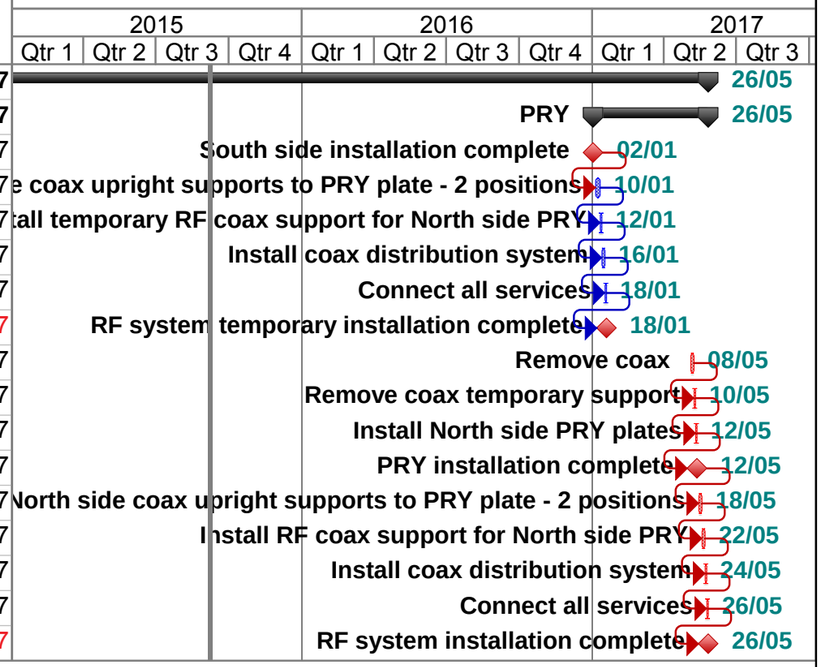
High Power Tests repeated in cooling channel final position with access from north side.



Project: MICE HALL INSTALLATION S
Date: 04/09/15

Inactive Summary · Manual Summary Rollup · Finish-only
Inactive Task · Manual Task · Manual Summary
Inactive Milestone · Duration-only · Start-only

ID	Task Name	Duration	Start	Finish
1	**MICE RF Work Package**	**2198 days**	**01/09/08**	**26/05/17**
511	**PRY**	**102 days**	**02/01/17**	**26/05/17**
512	South side installation complete	0 days	02/01/17	02/01/17
513	Install South side coax upright supports to PRY plate - 2 positions	4 days	05/01/17	10/01/17
514	Install temporary RF coax support for North side PRY	2 days	11/01/17	12/01/17
515	Install coax distribution system	2 days	13/01/17	16/01/17
516	Connect all services	2 days	17/01/17	18/01/17
517	RF system temporary installation complete	0 days	18/01/17	18/01/17
518	Remove coax	2 days	05/05/17	08/05/17
519	Remove coax temporary support	2 days	09/05/17	10/05/17
520	Install North side PRY plates	2 days	11/05/17	12/05/17
521	PRY installation complete	0 days	12/05/17	12/05/17
522	Install North side coax upright supports to PRY plate - 2 positions	4 days	15/05/17	18/05/17
523	Install RF coax support for North side PRY	2 days	19/05/17	22/05/17
524	Install coax distribution system	2 days	23/05/17	24/05/17
525	Connect all services	2 days	25/05/17	26/05/17
526	RF system installation complete	0 days	26/05/17	26/05/17



Project: MICE HALL INSTALLATION S
Date: 08/09/15

Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Inactive Task
Manual Summary Rollup
Manual Summary
Start-only
Finish-only

RF Deployment Summary

Off Line Tests – *Carried Out Using System # 1 Amplifier & Racks*

Cavity 1	Date
Control Rack Delivered from DL system#1	06/06/2016
Cavities delivered to RAL (2 off) – Stored in R9 until required	16/06/2016
Install cavity # 1 in off line test position	17/06/2016
Cavity # 1 test prep complete	22/08/2016
System #1 amplifier racks commissioned into dummy loads	24/08/2016
High power tests begin	20/09/2016
Off line cavity testing system # 1 complete	26/10/2016
Cavity 2	
Install cavity # 2 in off line test position	3/11/2016
Cavity # 2 test prep complete	23/01/2017
High power tests begin	24/01/2017
Off line cavity testing system # 2 complete	1/03/2017

RF Deployment Summary

On Line Downstream Position – *Uses System # 2 Amplifiers & Racks*

Cavity 1	Date
Installation of the RF Cavities & Chambers starts	27/10/2016
RF system # 2 delivered from DL – racks and amplifiers	13/10/2016
System # 2 amplifier racks commissioned into dummy loads	2/03/2017
High power tests begin	10/03/2017
On line cavity 1 high power testing complete	6/04/2017

- Commissioning into dummy loads allowed 10days for each amplifier ~ total approx 1mth
- Delivery of RF system # 2 may be delayed possibly upto 2-3mths…effort driven
- Assumes same test procedure and time frame as off line testing
- On line high power tests carried out with access to north side of the cooling channel ….. north pry plates not installed.

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RF Deployment Summary

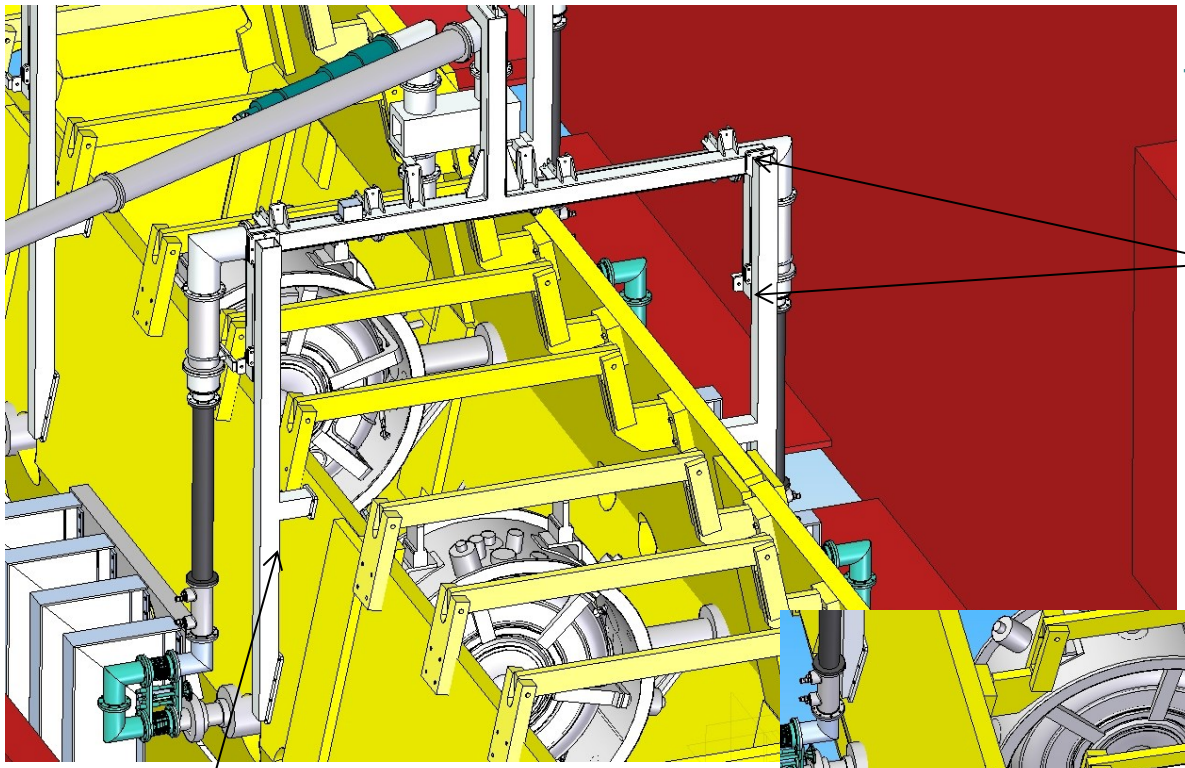
On Line Upstream Position – *Uses System # 1 Amplifiers & Racks*

Cavity 2	Date
Installation of the RF Cavities & Chambers starts	2/03/2017
High power tests begin	7/04/2017
On line cavity 2 high power testing complete	4/05/2017

- Assumes same test procedure and time frame as off line testing
- On line high power tests carried out with access to north side of the cooling channel ….. north pry plates not installed.

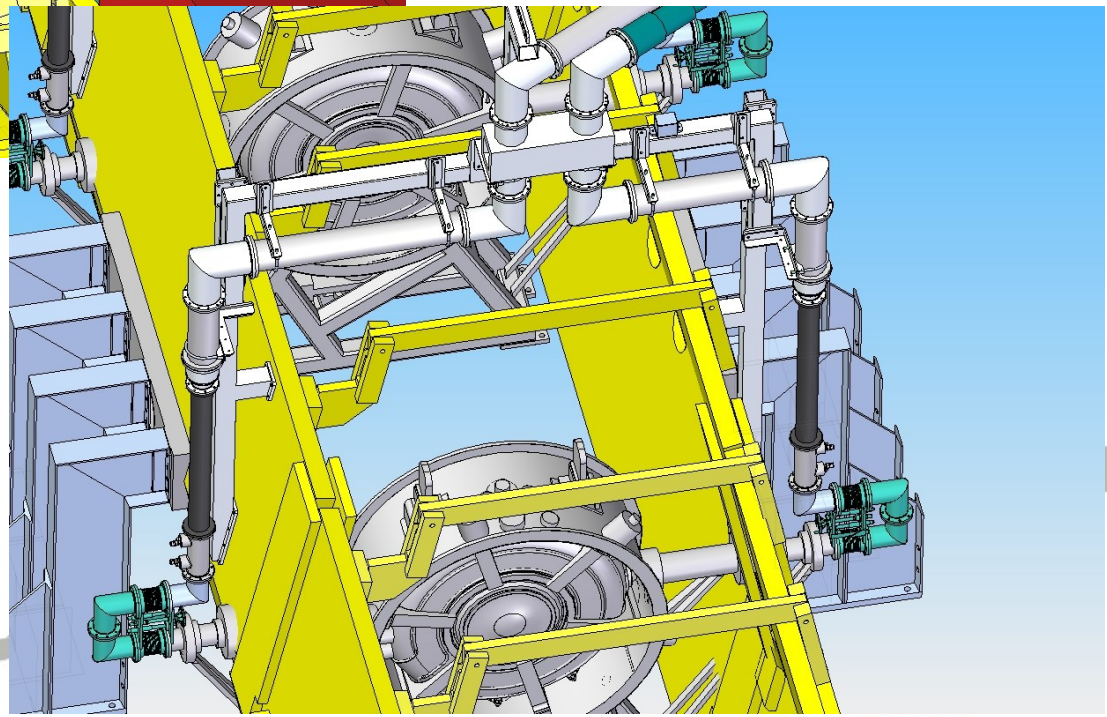
RF Coax Support

Coax support structure

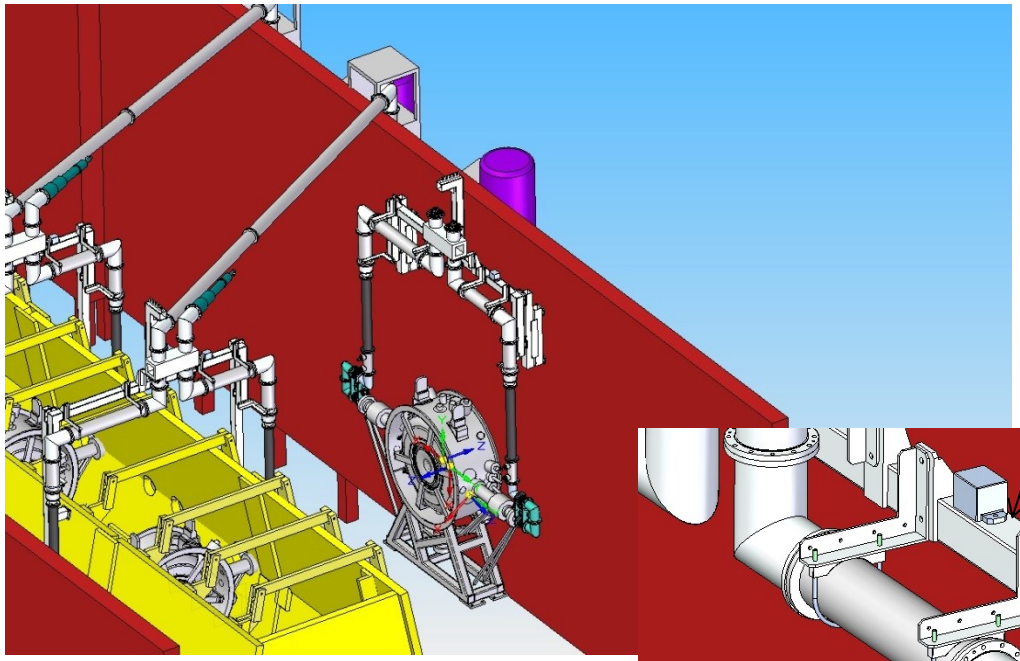


- Fasten Coax support frame to uprights

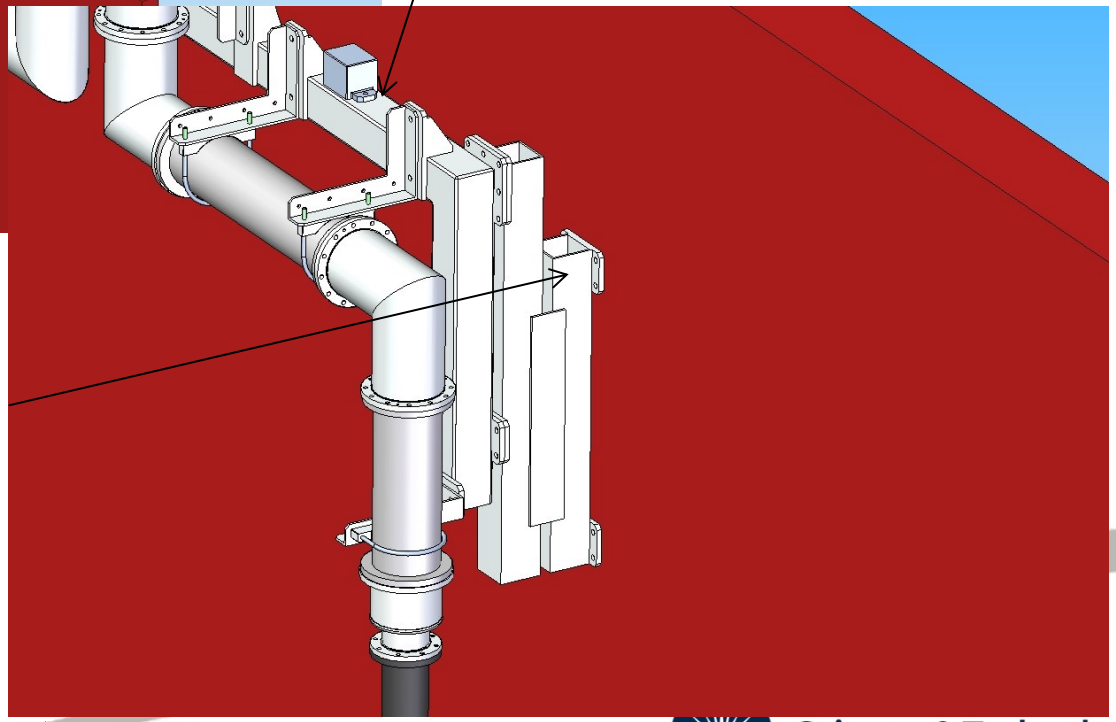
- Drill and tap PRY for 2 off vertical upright supports
- Steve Plate & Holger don’t see this as a problem



Off Line Installation



- Coax support frame



- Wall support bracket

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