New developments in the ISAC-I experimental hall:

This meeting was focused on new developments in the ISAC-I experimental hall including: 1) relocation of GPS and the status of GRIFFIN, 2) relocation of the laser hut that is presently under the TITAN platform, 3) status and plans for the Francium trapping program, 4) new yield station status/plans 5) location the chilled water system evaporator for the new ISAC target conditioning station. This first meeting was a general discussion of the status and requirements of each group with limited discussion on each topic

GPS/GRIFFIN:

 Gordon Ball gave an update on the status of GRIFFIN and the planned move of GPS. In early January, 2011 the GPS fast tape transport system and associated beam line hardware must be moved to a new location in preparation for the Francium Trapping Facility to be installed under the TITAN platform. The proposed location for the GPS facility is shown in figure 141-rev32 stua sept09. It is expected that the GPS will relocated and ready for experiments by fall 2011. The GRIFFIN spectrometer has still not been approved by CFI because \$2M in matching funding from the province of Ontario has not been secured. A descoped proposal has been submitted to CFI for consideration. A decision from CFI is expected in late December 2010.

Relocation of laser hut:

• Matt Pearson gave an update on the plan to relocate the laser hut presently located under the TITAN platform, in preparation for the installation of the Francium Trapping Facility. The lasers located in this hut are required for the collinear laser spectroscopy program. Initially the laser hut was placed here to be in close proximity to the polarizer beam line to allow for the laser beams to be transported in air to the beam line. However, with the recent development in optical fibers this requirement can be significantly relaxed. After considering several possible locations the one chosen is in the north east corner of the ISAC-1 experimental hall (see figure xxx). The room construction would be similar to the BMNR "clean room". However it would have to comply with laser regulation standards, most notably this would include solid, opaque walls as well as temperature and humidity control.

Status/plans for Francium trapping program:

 John Behr reported on the status and plans for the installation of the Francium Trapping facility. This facility has now received funding from the DOE and the principal investigator Luis Orozco is planning to spend part of his sabbatical year at TRIUMF beginning in August 2011 to work on the installation and commissioning of the new facility. Details of the facility and the schedule for installation were given in a presentation by John Behr. (see francium_status_jb_270ct2010 and francium_schedule_jb_270ct2010).

Status of the new yield station:

• Peter Kuntz gave an update on the schedule for the installation and commissioning of the new yield station (see Yieldstation_status_pk_27Oct2010 for details). The plan calls for installation to begin in early January with commissioning to follow. It is expected that the new station will be available for yield measurements in April 2011 when it should also be controlled remotely from the new ISAC control room.

Location of the chilled water system evaporator for the new target conditioning station:

• Curtis Ballard gave a brief presentation on the proposal to locate a chilled water system evaporator in the ISAC-I experimental hall The evaporator is part of the chilled water system that will be required for the north hot cell conditioning station. The condenser will be an air-cooled rooftop unit but the evaporator, 2 pumps, a heat exchanger, resin can and surge tank will be located in the ISAC-I experimental hall. The location for the evaporator is in the ISAC I Experimental Hall against the south wall near the loading bay door. The attached photos (chiller1_location_cb_27Oct2010 and chiller2_location_cb_27Oct2010) show the proposed location. This location is optimal as it is directly above the north hot cell area and provides the shortest access for the chilled water.



Canada's National Laboratory for Particle and Nuclear Physics Laboratoire national canadien pour la recherche en physique nucléaire et en physique des particules

Yield Station Upgrade

Support Frame Vacuum Box Chamber Assembly Detector RailSystem Control/Data Acquisition Hardware Control/Data Acquisition Software EPICS Controls







Owned and operated as a joint venture by a consortium of Canadian universities via a contribution through the National Research Council Canada Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le Conseil national de recherches Canada



New Yield Station Design

- Modular design enables parallel setup, while existing yield station is still in operation
- Partial integration possible (e.g. new detector rail system and data acquisition in combination with existing yield station)
- Does not interfere with existing beamline
- Event-by-Event DAQ (VME, MIDAS)
- Provides basic yield measurement capability, but also room for future extensions



Box Chamber installation



Box Chamber:

Total weight: 450 kg + max. 200 kg lead shielding (for safety factor calculations this was rounded up to F = 10000N)

Frame construction:

Bosch Aluminium Profiles 90x90 for vertical sections 90x90H for load carrying components



Footprint





Internal Assembly



WTRIUMF Yield Station Data Acquisition





Future Applications

- α, γ spectroscopy and β -counting with tape station (routine yield measurements)
- Target Wheel: Fast α and/or β -decay detection with nearly 100% efficiency
- Delayed Neutron Detection
- Laser Spectroscopy in combination with TRILIS
- Low Energy Transitions (through thin window, or with LEGe directly in vacuum)
- α , β , γ , n coincidence measurements
- Desorption and trapping of ions
- half-live measurements with high precision





Actions

Ac	tions	Date
	Move OLIS Magnet Power Supply	
	Move 8pi LN2, Kicker Controls	
	Move Yield Station Electronics & Kicker electronics	
	Setup of yield station support frame	
	Setup of yield station vacuum chamber , connection to beamline, testing, commisioning	Begin: January - March 2011



Upgrade Timeline

ID	A	Task Name	Duration	Start	Finish	03 Jan '11 10 Jan '11 17 Jan '11 24 Jan '11 31 J
1	•	Yield Station Setup	20 days?	Mon 03/01/11	Fri 28/01/11	
-						
2	⊞%	Moving Olis Powersupply	3 days	Mon 03/01/11	Wed 05/01/11	
3	8 %	Moving 8pi electronics rack	3 days?	Mon 03/01/11	Wed 05/01/11	8pi Group
4		Frame Setup	3 days	Thu 06/01/11	Mon 10/01/11	Kunz P,Ion Source / Targets,Site Services
5		Railsystem Setup	2 days	Tue 11/01/11	Wed 12/01/11	Kunz P, Ion Source / Targets, Site Services
6		Electronics and Controls Rack Setup	1 day	Thu 13/01/11	Thu 13/01/11	Kunz P, Site Services
7		Reconfiguration of electrical lines	2 days	Fri 14/01/11	Mon 17/01/11	.E-Elec
8	8 %	Installation of Yield Station Box Chamber	1 day	Thu 13/01/11	Thu 13/01/11	Kunz P,Site Services,Ion Source / Targets
9		Vacuum and Yield Faraday Cup Controls	2 days	Fri 14/01/11	Mon 17/01/11	
10		Leak Checking	1 day	Tue 18/01/11	Tue 18/01/11	Vacuum Group,Kunz P
11		Tape Drive and Detector connections	3 days	Wed 19/01/11	Fri 21/01/11	Kunz P,.C-Cont,.C-DAQ
12		Comissioning	5 days	Mon 24/01/11	Fri 28/01/11	.OPS-IS

&TRIUMF Status and plans for Francium program

- Experiments and timelines
- Electromagnetically Shielded Room Safety
- Beamline
- 225 Ra $\rightarrow ^{221}$ Fr source

Status/plans for francium program

J.A. Behr, TRIUMF for FrPNC

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FrPNC experiments

The FrPNC collaboration is starting a program of Fr spectroscopy at TRIUMF

S1218 Towards an optical parity violation experiment in Fr (Gwinner, spokesman)

S1065 Weak nucleon-nucleon interaction from nuclear anapole moment (Orozco, spokesman)

S1010 Hyperfine anomaly and spatial distribution of nuclear magnetism (Pearson, spokesman)

All need a trap (part of S1010 is collinear laser)

Status/plans for francium program

J.A. Behr, TRIUMF for FrPNC

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FrPNC collaboration

<u>Manitoba</u>	Maryland	<u>San Luis Potosi</u>	TRIUMF
G. Gwinner	L. Orozco	E. Gomez Garcia	M. Pearson
R. Collister	D. Sheng	William & Mary	J. Behr
C. Oliveira	J. Zhang	S. Aubin	Texas A& M
	J. Hood	New South Wales	D. Melconian
	S. Lynam	V. Flambaum	Stony Brook
			G. Sprouse

Supported by NSF and DOE USA, NSERC and NRC Canada, CONACYT Mexico. DOE \$ for the room came through at the end of September

J.A. Behr, TRIUMF for FrPNC

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Experimental timelines

Dec 1: U.S. collaborators to complete room specs must be OK'd by TRIUMF

First 2 weeks of December: Technical review at TRIUMF

Jan 1: Room order in U.S. finalized

Outer boundary: Orozco sabbatical Aug-Dec 2011 Must be ready for beamtime

Status/plans for francium program

J.A. Behr, TRIUMF for FrPNC

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Room location



Room

J.A. Behr, TRIUMF for FrPNC

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Room location issues

Alignment pillar near laser hut

South wall location cleared with Phil Levy

We plan to leave TITAN transformer and AC power feeding it where it is (the 60Hz has to be somewhere) Put Francium transformer on top of it

Room

Air conditioning chiller on top? (chilled liquid going in, saves penetrations, circulating fan inside) U. Maryland is providing design engineering.

Penetrations through electromagnetic shielding: electrical, some cooling water, compressed air.

There is an electronics blue rack at the southeast corner that we want to move (8 feet to the east)

At U. Maryland, one person assembled their room in one day. Do they need crane access?

Status/plans for francium program

J.A. Behr, TRIUMF for FrPNC

Fire and other room safety

Walls from 'metal-clad wood'.

1 ft gap from transformer, assuming this is flammable.

Do we need more than 1 door?

Sprinklers?

We want the particulate sensor monitor Does this remove need for sprinklers?

DOE asks if we need oxygen deficiency sensors.

Status/plans for francium program

J.A. Behr, TRIUMF for FrPNC

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Radiation Safety

• 'metal-clad wood': TSG suggests rad safety OK from decon standpoint.

- $\bullet~\gamma\text{-ray}$ safety during experiments, based on TRINAT, can be managed by flagging
- α emitter safety. Although we plan to open vacuum extremely rarely, this needs careful checks:
- Many Fr chains terminate in relatively safe isotopes. Some terminate in long-lived Po, which is volatile.
- Main roughing through turbos, down to a few mTorr, to the experimental hall monitored exhaust.
- (Remaining roughing: local LN2 sorption pumps.)
- We are looking into the making the neutralizer foil (see below) more reliable and simply replaceable

Air circulation rate will partly determine ALI's: need to coordinate this with temperature stability and clean JA. Behr, TRIUMF for FrPNC

Noise: RF, 60Hz, Acoustic, Temperature Specs from U. Maryland to U.S. company Dec 1 Need approval from TRIUMF tech. review 1st 2 weeks Dec.



U. Maryland two-trap setup to move here Aug 2011



J.A. Behr, TRIUMF for FrPNC

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Room is same size as TRINAT at TISOL



Beamline optics



J.A. Behr, TRIUMF for FrPNC

Status/plans for francium program

Beamline design considerations

Following polarizer/betaNQR: two 550 l/sec turbos for differential pumping,

- 25-30 kV decel Einzel lenses for UHV
- Ceramic break in the wall to isolate grounds
- TRIUMF Einzel lens outside; commercial DREEBIT lens is more compact near the trap
- ion pumps and non-evaporable getter pumps inside the room to avoid vibrations and noise

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Beamline layout 23.00 23.00 -22.15 11.00 - 2.840 2.00 ----to) **₩HC**=0 - 14.80 11.00 4.00 wall 46.00 SECTION A-A 108.5 Ξ Ø 9 Status/plans for francium program J.A. Behr, TRIUMF for FrPNC

$^{225}\text{Ra}\ source \rightarrow ^{221}\text{Fr}$

No heating, no radiochemistry, 2 week halflife

Implant ²²⁵Ra at TRIUMF or ISOLDE

place source 3mm from Yt catcher

lpha decay of ²²⁵Ac ejects 100 keV ²²¹Fr into 1 cm spot

remove source

move Yt to trap, heat, trap

heating Yt has been by direct current: CO2 laser?













intro

experiments and timelines

Room

Beamline

Room location



1 2 OAG J.A. Behr, TRIUMF for FrPNC

							Francium beamline	laser clean room at ISAC
ID	Task Name		RESF Dur	Start	Finish	TF 2	May '10 Jun '10 Jul '10 Aug '10 Sep '10 Oct '10	Nov '10 Dec '10 Jan '11 Feb '11 Mar '11 Apr '11 May '11 Jun '11 Jul '11 Aug '11 Sep '11 Oct '11 Nov '11 Dec '11 Jan '12 Feb '12 Mar '12 Apr '12 May '12 J
1	Infrastructure		329 days	Wed 5/12/10	Mon 8/15/11	25 days		
2	Transition	beamline	278 days	Wed 5/12/10	Fri 6/3/11	41 days		
3	Bean	optics	123 days	Wed 5/12/10	Sun 10/31/10	40 days		
4	✓	Prepare beamline optics	1 WK	Wed 5/12/10	Tue 5/18/10	0 wks	Baartman R[50%],Benr[30%],Pearson M[20%]	nnar (159/1 Orozon I A159/1
6	✓	Finalize optics	2.2 WKS 4 WKS	Fri 10/1/10	Fri 10/29/10	8 wks	Contraction of the second seco	Saartman R[40%],Behr J A[25%],Pearson M[25%],Gwinner G[5%],Orozco L A[5%]
7	 ✓	Specify local offline source (Rb)	4.2 wks	Fri 10/1/10	Sun 10/31/10	0 wks		
8	UHV	compontents	86 days	Tue 10/19/10	Tue 2/15/11	61 days		
9		Specify UHV components (incl. Rb source)	2 wks	Tue 10/19/10	Mon 11/1/10	12.2 wks	E	Behr J A[40%],Pearson M[40%],Gwinner G[10%],Orozco L A[10%]
10		Design	4.2 wks	Tue 11/2/10	Tue 11/30/10	12.2 wks		Pearson M[20%],Behr J A[20%],Gwinner G[10%],Designer[50%]
11	(()	Checkout drawings, submit to shop	2 wks	Wed 12/1/10	Tue 12/14/10	12.2 wks		
12	Finze		9 wks	Mon 11/1/10	Tue 3/8/11	12.2 WKS		
14		Specs	3.2 wks	Mon 11/1/10	Mon 11/22/10	8.8 wks	······	Behr J A[30%],Pearson M[30%],Baartman R[40%]
15		Design	4 wks	Tue 11/23/10	Mon 12/20/10	8.8 wks	••••••	Designer[60%],Behr J A[10%],Pearson M[10%],Baartman R[20%]
16		Check out	3.2 wks	Tue 12/21/10	Tue 1/11/11	8.8 wks		FrTrap[70%],E-Elec[30%]
17		abricate and polish	8 wks	Wed 1/12/11	Tue 3/8/11	8.8 wks		Caracteria Contracteria
18	LEBT	section	92 days	Mon 11/1/10	Tue 3/8/11	44 days		
19			3.2 wks	Mon 11/1/10	Mon 11/22/10 Mon 12/20/10	8.8 wks	·····	Pearson M[25%],Behr J A[25%],Baartman R[50%]
20		Check out	3.2 wks	Tue 12/21/10	Tue 1/11/11	8.8 wks		
22		abricate	8 wks	Wed 1/12/11	Tue 3/8/11	8.8 wks		
23	vacu	um (UHV valves, gauges)	214 days	Wed 5/12/10	Mon 3/7/11	81 days	•	
24	✓	Procure turbo and roughing pumps	4 wks	Wed 5/12/10	Tue 6/8/10	0 wks	<u>(111111)</u>	
25		pecify valves, gauges, mounting hardware	2.2 wks	Mon 11/1/10	Mon 11/15/10	16.2 wks		Behr J A[30%],Pearson M[20%],T-BL[20%],E-Cont[20%],E-Vac[20%]
26		lesign	4 wks	Tue 11/16/10	Mon 12/13/10	16.2 wks		Designer
27			2 WKS	Tue 12/14/10	Mon 12/27/10 Mon 2/21/11	16.2 WKS		Pearson M[50%],Gwinner G[50%]
29		assembly	2 wks	Tue 2/22/11	Mon 3/7/11	16.2 wks		Pearson M[30%],Behr J A[30%],Gwinner G[30%]
30	asser	nble transition beamline w/ diagnostics	6.8 wks	Wed 3/16/11	Mon 5/2/11	8.2 wks		T-BL[40%],Behr J A[20%],Pearson M[20%],Gwinner G[20%]
31	install	align and leak-check	3.6 wks	Tue 5/3/11	Thu 5/26/11	8.2 wks		T-BL[40%],Behr J A[20%],Pearson M[20%],Gwinner G[20%]
32	bake	but	1.2 wks	Fri 5/27/11	Fri 6/3/11	8.2 wks		Behr J A[40%],Pearson M[40%],Gwinner G[20%]
33	Cont	rols & interfaces (?? Can't read last word)	120 days	Mon 11/1/10	Fri 4/15/11	72 days		
34	5	pecify controls	1 wk	Mon 11/1/10	Fri 11/5/10	14.4 wks		E-Cont[50%],Behr J A[15%],Pearson M[15%],Gwinner G[10%],Orozco L A[10%]
35		eview and finalize specs	2.2 WKS	Tue 11/23/10	Mon 11/22/10 Mon 12/13/10	14.4 WKS		E-Cont[20%],Benr J A[20%],Fearson M[20%],Gwinner G[20%],Orozco L A[20%]
37		order parts	3.4 wks	Tue 12/14/10	Wed 1/5/11	14.4 wks	•••••••••••••••••••••••••••••••••••••••	L.T-Cont
38	1	abricate and assemble	9 wks	Thu 1/6/11	Wed 3/9/11	14.4 wks		Cont
39	1	est in lab	3.4 wks	Thu 3/10/11	Fri 4/1/11	15 wks		T-Cont
40	1	prepare and install	2 wks	Mon 4/4/11	Fri 4/15/11	15 wks		Cont
41	UHV	Faraday cup	97 days	Mon 11/1/10	Tue 3/15/11	41 days		
42		specify (1) and find (1) cup	3.2 WKS	Mon 11/1/10	Mon 11/22/10	8.2 WKS		Pearson M
44		check out drawings and put in shop	1 wk	Wed 12/15/10	Tue 12/14/10	8.2 wks		Pearson M
45	1	abricate and assemble	10 wks	Wed 12/22/10	Tue 3/1/11	8.2 wks		M-Shop
46		prepare to install	2 wks	Wed 3/2/11	Tue 3/15/11	8.2 wks		T-Cont[50%],Pearson M[50%]
47	Bean	profile monitor	96 days	Mon 11/1/10	Mon 3/14/11	42 days		
48		pecify	3.2 wks	Mon 11/1/10	Mon 11/22/10	8.4 wks		Behr J A[50%],Pearson M[50%]
49		esign	3 wks	Tue 12/14/10	Mon 12/13/10	8.4 wks		Luesigner[/U%],Bénr J A[30%]
51		abricate and assemble	10 wks	Tue 12/14/10	Mon 2/28/11	8.4 wks		M-Shop
52		prepare to install	2 wks	Tue 3/1/11	Mon 3/14/11	8.4 wks		FrTrap
53	Laser roo	n infrastructure	271 days	Mon 8/2/10	Mon 8/15/11	25 days		
54	Тгар	chamber	22 days	Fri 7/1/11	Mon 8/1/11	0 days		(: : : : : : : : :
55		lecide on date to get trap chamber shipped to TRIL	JMF 2 days	Fri 7/1/11	Mon 7/4/11	0 days		
56		eceive trap chamber at I RIUMF	3 Wks	Tue 7/5/11	Mon 7/25/11	0 wks		Pearson M
58	Optic	s tables	93 dave	Fri 1/14/11	Tue 5/24/11	49 days		
59		pecify	2 wks	Fri 1/14/11	Thu 1/27/11	9.8 wks	······	FrTrap
60		order	2 wks	Fri 1/28/11	Thu 2/10/11	9.8 wks		Orozco L A
61		procure optics tables	13 wks	Fri 2/11/11	Thu 5/12/11	9.8 wks		
62		eceive at TRIUMF	2 days	Fri 5/13/11	Mon 5/16/11	49 days	·····	Pearson M[33%] Gwinner G[33%],Behr J A[33%]
63	0-1	orepare to install	1.2 wks	Tue 5/17/11	Tue 5/24/11	9.8 wks		Bearson M[33%],Behr J A[33%],Gwinner G[33%]
65	Safet	r prepare overall safety plan	8 wks	Mon 8/2/10	Fri 9/24/10	38.4 wks	Behr. I ΔΙ	0%].Pearson M[20%].Gwinner G[20%].Orozco L A[20%]
66		eview	2 wks	Mon 9/27/10	Fri 10/8/10	38.4 wks	Behr	J A[20%],Pearson M[20%],Gwinner G[20%],Orozco L A[20%],safety group[20%]
67	1	inalize safety documents for laser and HV	4 wks	Mon 10/11/10	Fri 11/5/10	43.2 wks		Pearson M[20%],Behr J A[20%],Gwinner G[20%],Orozco L A[20%],safety group[20%]
68		stimate radiation levels and types	3 wks	Mon 10/11/10	Fri 10/29/10	38.6 wks		Behr J A[60%],safety group[40%]
		Tarl		`				
		Lask (Actual	0	<u></u>	Actu	ai millestone e Rolled Up Lask	Solit Group RV Summary
			Critical	Ailestone	 ✓ △ 	Slac	k Rolled Un Milestone	External Tasks Critical Task

	Francium beamline / laser clean room at ISAC												
ID	Task Name RES	SF Dur	Start	Finish	TF May '10 Jun '10								
69	prepare radioactivity safety plan	3.2 wks	Mon 11/1/10	Mon 11/22/10	38.6 wks	14 11 0221 [0 132223] 12 1320] 3 101 1243 [1 1 13223] 10 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 1322230 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 1322230 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 1322230 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 1322230 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 1322230 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 1322230 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 132021 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 13202 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 13202 [3 1032230] 12 13203 10 11243 [1 1 1320] 10 13202 [3 1032230] 12 13203 10 11243 [1 1 1323] 10 13202 [3 1032230] 12 13203 10 11243 [1 1 1320] 10 13202 [3 1032230] 12 13203 10 11243 [1 1 1320] 10 13202 [3 1032230] 12 13203 10 11243 [1 1 1320] 10 13202 [3 1032230] 12 13203 [1 1 1320] 10 13202 [3 1032230] 12 13203 [1 1 1320] 10 13202 [3 1032230] 13 10 11243 [1 1 1320] 10 13202 [3 1032230] 13 10 11243 [1 1 1320] 10 13202 [3 103202 [3 103202] 10 11243 [1 1 1320] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 11243 [1 1 1320] 10 13202 [3 103202] 10 11243 [1 1 1320] 10 13202 [3 103202] 10 11243 [1 1 1320] 10 13202 [3 103202] 10 11243 [1 1 1320] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103202] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13202 [3 103200] 10 13200 [3 103200] 10 13200 [3 10000] 10 13200 [3 10000] 10 10000[3 10000] 10 10000[3 10000] 10 10000[3 10000] 10 10000[3 10000] 10 10000[3 1000							
70	review	2.2 wks	Tue 11/23/10	Tue 12/7/10	38.6 wks	Giring, FrTrap[60%], safety group[40%]							
71	finalize safety document	2 wks	Wed 12/8/10	Tue 12/21/10	38.8 wks	Behr J A [50%], Gwinner G [50%]							
72	Laser trap setup from Maryland (other than trap chamk	32 days	Fri 7/1/11	Mon 8/15/11	13 days								
73	decide on shipping date	1.2 wks	Fri 7/1/11	Fri 7/8/11	2.6 wks	Orozcol A							
74	ship and receive at TRIUMF	3 wks	Mon 7/11/11	Fri 7/29/11	2.6 wks	Orozco L A							
75	prepare installation	2.2 wks	Mon 8/1/11	Mon 8/15/11	2.8 wks	_Orozcρ L A[50%],Behr J A[20%],Pearson M[20%],Gwinner G[10%]							
76	Francium room	251 days	Thu 8/12/10	Thu 7/28/11	2 days								
77 🔳	concept design + (can't read)	16 wks	Thu 8/12/10	Wed 12/1/10	0 wks	Orozco L A[20%],Behr J A[20%],Pearson M[20%],Gwinner G[20%],E-Civil[20%]							
78	review	3 wks	Thu 12/2/10	Wed 12/22/10	0 wks	Orozco L A[20%],Behr J A[20%],Pearson M[20%],Gwinner G[20%],E-Civil[20%]							
79	finalize room specs	3.2 wks	Thu 12/23/10	Thu 1/13/11	0 wks	Orozco L A[20%],Behr J A[20%],Pearson M[20%],Gwinner G[20%],E-Civij [20%]							
80	prepare specs and bids	2 wks	Fri 1/14/11	Thu 1/27/11	0 wks	Orozco L A[70%],Behr J A[10%],Pearson M[10%],Gwinner G[10%]							
81	bid time	4 wks	Fri 1/28/11	Thu 2/24/11	0 wks								
82	evaluate bids and place order	2 wks	Fri 2/25/11	Thu 3/10/11	0 wks	Orozco L A[85%],Behr J A[5%],Pearson M[5%],Gwinner G[5%]							
83	procure francium room	13 wks	Fri 3/11/11	Thu 6/9/11	0 wks	OrozcoLA							
84	wait till experiments are done with tape station and old laser hut	0 wks	Tue 11/23/10	Tue 11/23/10	1 wk	<mark>♦ 4</mark> jov 23							
85 🔟	relocate old experiments	5 wks	Wed 12/1/10	Tue 1/4/11	22.4 wks								
86	prepare to install	1 wk	Fri 6/10/11	Thu 6/16/11	0 wks	T-BL[25%],Behr J A[20%],Fearson M[20%],Gwinner G[10%],T-Plant[25%]							
87	installation of room	2 wks	Fri 6/17/11	Thu 6/30/11	0 wks	Contractdr90%]E-Civil[10%]							
88	install and connect services	4 wks	Fri 7/1/11	Thu 7/28/11	0.4 wks	-Plant[40%],.Tr-Elec[40%],computing services[20%]							
89	decision on A/C system (comes with room or separate)	4 wks	Fri 3/11/11	Thu 4/7/11	0 wks	Orozco L A[20%],Behr J A[20%],Bearson W[20%],Gwinner G[20%],Gwinner G[20%],Civil[20%]							
90	procure A/C components	9 wks	Fri 4/8/11	Thu 6/9/11	0 wks								
91	order (or find) racks	2 wks	Fri 1/14/11	Thu 1/27/11	14.4 wks	Pearson M[50%],Behr J A[50%]							
92	procure racks	8 wks	Fri 1/28/11	Thu 3/24/11	14.4 wks								
93	Isolation transformer	85 days	Fri 1/14/11	Thu 5/12/11	20 days								
94	specify	2 wks	Fri 1/14/11	Thu 1/27/11	4 wks	E-Elec[50%],Pearson M[10%],Behr J A[10%],Gwinner G[10%]							
95	order	2 wks	Fri 1/28/11	Thu 2/10/11	4 wks	Carries Pearson M[50%], E-Elec[50%]							
96	procure	13 wks	Fri 2/11/11	Thu 5/12/11	4 wks								
97	Electric services	90 days	Fri 1/14/11	Thu 5/19/11	30 days								
98	design	4 wks	Fri 1/14/11	Thu 2/10/11	6 wks	-E-Elec[60%],Pearson M[20%],Behr J A[10%],Orozoo L A[5%],Gwinner G[5%]							
99	order components	2 wks	Fri 2/11/11	Thu 2/24/11	6 wks	E-Elic							
100	procure components and pre-fab (if possible)	12 wks	Fri 2/25/11	Thu 5/19/11	6 wks								
101	Water services	90 days	Fri 1/14/11	Thu 5/19/11	32 days								
102	design	4 wks	Fri 1/14/11	Thu 2/10/11	6.4 wks								
103	order	2 wks	Fri 2/11/11	Thu 2/24/11	6.4 wks	T-Plant							
104	procure	12 wks	Fri 2/25/11	Thu 5/19/11	6.4 wks								
105	Communications (phone, ethernet)	51 days	Fri 1/14/11	Fri 3/25/11	68 days								
106	design	4 wks	Fri 1/14/11	Thu 2/10/11	13.6 wks	Contenting Orozco L A[25%], Gwinner G[25%], Behr J A[25%], Pearson M[25%]							
107	order	2.2 wks	Fri 2/11/11	Fri 2/25/11	14 wks	computing services							
108	procure	4 wks	Mon 2/28/11	Fri 3/25/11	14.2 wks								
109	Laser trap facility	86 days?	Tue 8/2/11	Tue 11/29/11	0 days?								
110	Install optics table and trap chamber	2.4 wks	Tue 8/2/11	Wed 8/17/11	0 wks	Orozco L A[20%],Behr J A[20%],Behr J A[20%],Gwinner G[20%],T-BL[20%]							
111	interface to beamline, commissioning	2.4 wks	Thu 8/18/11	Fri 9/2/11	0 wks	Behr J A[15%],Pearson M[15%],Gwinner G[10%],Orozco L A[20%],.T-Cont[20%],OPS-ISAC[20%]							
112	install laser trap (Maryland setup)	2.2 wks	Mon 9/5/11	Mon 9/19/11	0 wks	Orozco L A[40%],Behr J A[20%],Pearson M[20%],Gwinner G[20%]							
113	bring up Rb trap with internal atom source	3 wks	Tue 9/20/11	Mon 10/10/11	0 wks								
114	prepare for experiments taking beam	4 wks	Tue 10/11/11	Mon 11/7/11	0 wks								
115	trap Rb from beam (OLIS)	1 wk	Tue 11/8/11	Mon 11/14/11	0 wks								
116	prepare for Fr trapping	2 wks	Tue 11/15/11	Mon 11/28/11	0 wks								
117	ready for online work	1 day?	Tue 11/29/11	Tue 11/29/11	0 days?	Nov 29							
118	Online experiments	60 days	Wed 11/30/11	Tue 2/21/12	0 days								
119	francium trapping, hyperfine anomalies	12 wks	Wed 11/30/11	Tue 2/21/12	0 wks	$\frac{1}{2} + \frac{1}{2} + \frac{1}$							
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Task	(Actual	(Actual Milestone	♦	Rolled Up Task	(Rolled Up Progress	Project Summary	\bigtriangledown
Critical Task	()	Milestone	•	Summary	ŢŢ	Rolled Up Critical Task	<u>(1999) - 1999</u>	Split	 Group By SummTask	~
Progress		Critical Milestone	•	Slack		Rolled Up Milestone	\diamond	External Tasks	Critical Task	$\hat{\mathbf{r}}$

