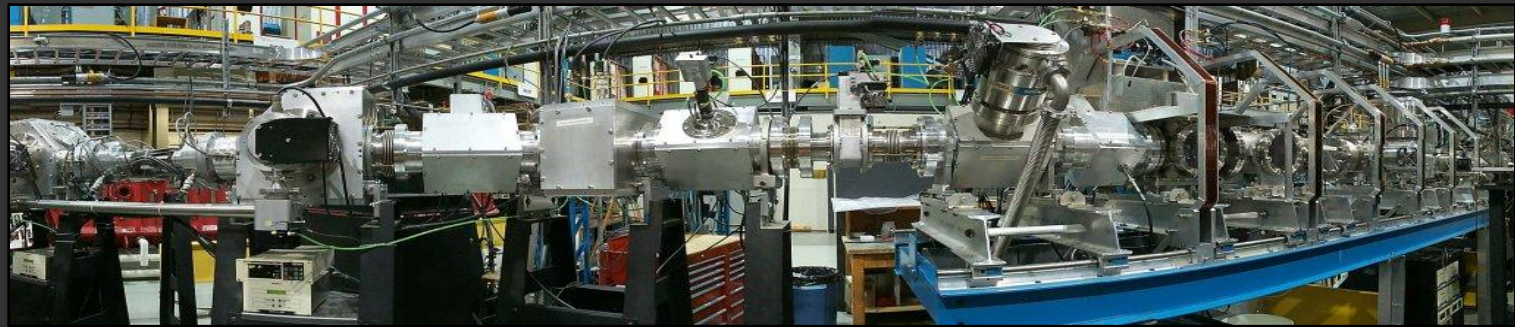


Maintenance Coordination at TRIUMF's Cyclotron & ISAC Facilities

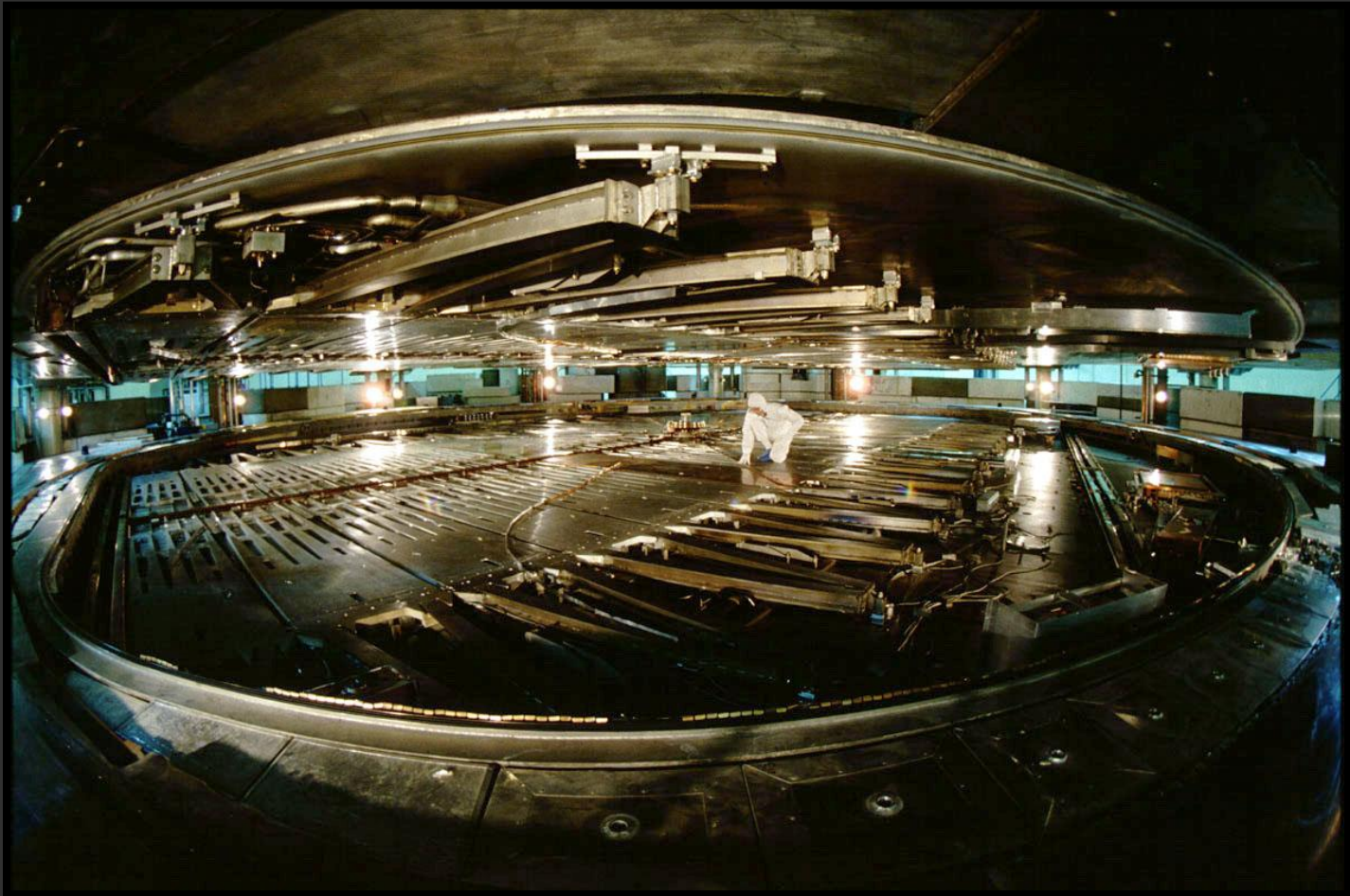


Rene Tanaja, TRIUMF, Vancouver, Canada, magua@triumf.ca

The TRIUMF Cyclotron

- A collaboration of 13 Canadian universities
- At University of British Columbia (U.B.C.), Vancouver, Canada
- 18 m (59 ft) in diameter
- Protons accelerated to 520 MeV
- December, 1974: first beam

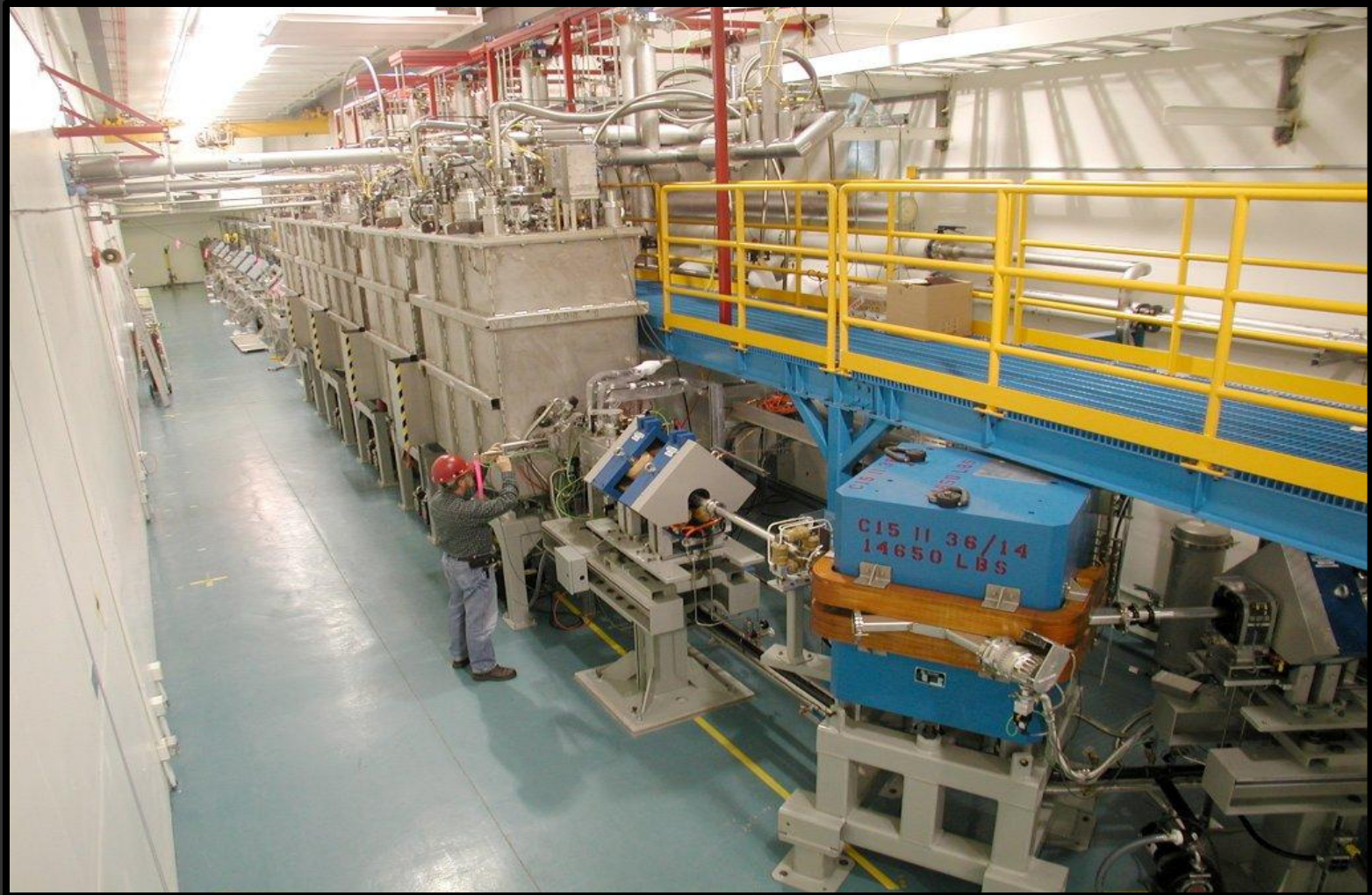
The TRIUMF Cyclotron



The ISAC Facility

- ISAC target treated as “experiment” for the cyclotron
- Heavy ions are separated, accelerated, delivered to experiments
- 2001: First accelerated radioactive ion beam (RIB)
- 2006: First RIB through superconducting accelerator
- Expected maximum acceleration $> 6.5 \text{ MeV/u}$

ISAC Superconducting Linac



Maintenance Coordination

- Organized at ISAC or TRIUMF control room (some activities require work permits from both)
- Operators:
 - Document maintenance activities
 - Can assist if needed

Maintenance at TRIUMF

- Three periods:
 - Winter shutdown
 - Scheduled maintenance days
 - Autumn mini-shutdown
- More maintenance days scheduled as issues arise



Winter Shutdown

- Over 2 or more months, starting in January
- Most significant & time-consuming jobs
- Installations & upgrades
- Experiment changes



Winter Shutdown Coordination

- Weekly meeting with group representatives
 - Discuss progress
 - Plan coming week
- Weekly schedule updated & posted online



Winter Shutdown Schedule

V.VERMA / MKEYZER		JANUARY 2010 SHUTDOWN						Mar 15, 2010
		MARCH						
		MON	TUE	WED	THU	FRI	SAT	SUN
		15	16	17	18	19	20	21
CYCLOTRON & VAULT	<ul style="list-style-type: none"> •Run RF to full power •ISIS tests (source performance) •RF OFF (Briefly) for Vacuum (time TBD by Ops & RF) 			<ul style="list-style-type: none"> •C/P Cond. •Inflector Cond. & C/O. 	<ul style="list-style-type: none"> •Vault lockup list received back •Turn on RF booster •Vault lockup & ready for injection 	<ul style="list-style-type: none"> •Safety critical devices tests 	<ul style="list-style-type: none"> •Inject, tune & extract down 1A, 2A, 2C 	
	M-HALL	<ul style="list-style-type: none"> •Check BL1A & ready for blocks 	<ul style="list-style-type: none"> •Shielding blocks Back IN 		<ul style="list-style-type: none"> •Location of monument of total station •Triplet flushing •M15 Beam blocker 		<ul style="list-style-type: none"> •BL/1A Ready for Beam 	
ISAC	<ul style="list-style-type: none"> •Cool down High Beta modules & rdy for checkout •Prepare RF controls H/W to checkout •Controls recommissioning of ITE PLC controlled devices •Test HP Ta tgt for TM3 •SEBT-1 installation •Prepare ISAC-2 area for ICM tests 		<ul style="list-style-type: none"> •High Beta system •Move TM3 to ITW & start roughing 	<ul style="list-style-type: none"> •Connect & test TM3 @ ITW 	<ul style="list-style-type: none"> •Leak check TM3 	<ul style="list-style-type: none"> •BL/2A Ready for Beam •Move blocks over ITW •Safety critical tests BL2A •Condition TM3 @ ITW 		
				<ul style="list-style-type: none"> (to be continued) 				
		<ul style="list-style-type: none"> 🚩 Milestone 	<ul style="list-style-type: none"> →◆ Activity End Date 	<ul style="list-style-type: none"> → (Month-day) Activity continues 			WEEK 13	

Scheduled Maintenance Days

- About every 3 weeks, when cyclotron proton source filament needs to be changed
- Sometimes scheduled with cyclotron development or training day
- Scheduled for 12 - 36 hours



Scheduled Maintenance Days

- Sometimes additional ~ 4 hour maintenance day scheduled if needed
- Organizers and department heads meet to decide if this is necessary, and for how long

Autumn Mini-Shutdown

- A week in September
- Like a longer “scheduled maintenance day”
- For some major maintenance issues that can’t wait until winter shutdown
- Also used to plan the operating schedule for the remainder of the year



Cyclotron Control Room



(circa 2005)

Cyclotron Facility Maintenance

- Issue permits for work in TRIUMF cyclotron area
- Maintain cyclotron, ion source, other equipment
- Replace, upgrade old equipment

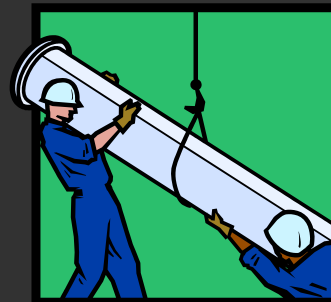


ISAC Control Room



ISAC Facility Maintenance

- Issue permits for work in ISAC buildings
- Maintain equipment in ISAC facility
- Install new experiments and facility equipment
 - Components of superconducting accelerator & experiments
 - New diagnostics



Cyclotron Facility Work Permits

- ❑ Paper prior to March 24, 2010
- ❑ Permit filled the day of job
- ❑ Operations makes a copy
- ❑ Worker takes the original
- ❑ Operator enters details in database
- ❑ When work is finished, original completed & filed
- ❑ Copy is destroyed

TRIUMF OPERATIONS TRIUMF WORK PERMIT

Issued to _____ Group _____ Number _____
Signature _____ Date _____

DESCRIPTION OF WORK _____

Any Safety-Critical Beam Control Device Affected by Work? NO YES Recommissioning Req'd
Crane Lift / Job-Dose / Special Hazards? NO YES Fill Out Reverse Side
Will There Be Radioactive Waste? NO YES Fill Out Reverse Side *
Is Shielding Affected by Work? (Moved, Removed etc.) NO YES Key Defeat # _____ Init _____

Related Defaults?: # _____ Desc. _____ ; # _____ Desc. _____
Work Area _____ Start Time _____ Est. Duration _____

Note: Workers and their Group Supervisors Are Responsible For Their Own Safety

WORKERS COVERED BY PERMIT _____

APPROVAL TO START WORK (Signatures)
Note: Work Involving Safety-Critical Beam Control Devices MUST have approval from categories 1, 2, and 3 below BEFORE starting work.

1) Area Supervisor _____ 2) Head of Safety Systems _____
3) OPS Shift Supervisor _____ 4) Rad Waste Co-Ord _____
5) TSG / OPS Surveyor _____ 6) Lead Rigger [Or By Phone] _____
OPS / TSG Instructions _____

PERMIT EXPIRES Date _____ Time _____

END-OF-JOB STATUS _____

Is Shielding Restored? YES NO n/a Rad Waste Coord notified? YES NO n/a
Have Safety-Critical Beam Control Device(s) Been Recommissioned? YES NO n/a
If YES, Attach the Completed Recommissioning Checklist for EACH Device.

Is the System Operational YES NO Date _____ Time _____ Workers Init _____
If "NO", when is it expected to be? Date _____ Time _____ OPS Shift Supr. Init _____
Is a DEFEAT Required? YES Device _____ OPS D/F # _____

Return This Permit to Operations When Job is Complete

T:\WPFW\DOCUMENTS\TYPEFORMS\Work Permits\WPD 090616.PJ.Y

ISAC Work Permits

- ❑ Online work permits
- ❑ Permit required 1(+) day in advance
- ❑ Requestor contacts approving personnel
- ❑ Operations activates permit if approved
- ❑ Before work starts, worker:
 - ❑ Makes sure permit active
 - ❑ Reviews comments
- ❑ When finished, worker completes permit with description of what was done

TRIUMF Work Permit System (ISAC) v3.0

Logged In As: Rene Tanaja

ISAC WORK PERMIT

Issued to: Group: Number: 2010-3-20-
Entered By: Local: 7500 Status:

DESCRIPTION OF WORK

Work Facility: Start Time: Est. Duration:
Start Date: (y/m/d) 2010

Permit Expires:

Is Any Shielding Affected By This Job? (ie. Moved Removed, etc.) Yes No
IF YES: Shielding Key Defeat # e.g. 2A OPS Ignition key
Welding Permit # Other Work Permit #'s

WORKERS COVERED BY PERMIT

Available Workers:

Selected Workers:

Job Dose / Special Hazards Sheet Required? Yes No

APPROVAL TO START WORK (signatures)
Note: Workers and Their Group Supervisors Are Responsible For Their Own Safety

Facility Coordinator (or Alternate): Instructions:
In Consultation With:

RPO/OPS Supervisor: Instructions:
In Consultation With:

ISAC Operations: Instructions:
In Consultation With:

PERMIT EXPIRES: Status:

COMMENTS:
Add New Comment:

Resetting a previously entered permit undoes any changes made since you opened it.

The Two Work Permit Systems

Electronic

- Can be filled, viewed & adjusted from anywhere on site
- Details immediately filed
- More efficient

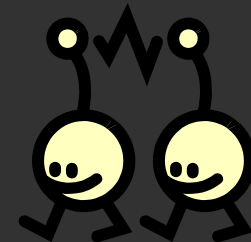


Paper

- Face-to-face interaction allows direct instruction to workers
- Worker keeps information at hand while working
- Easier to notice overdue work permits

Combining Operations Groups

- Cyclotron and ISAC operations groups recently joined into one group
- Cyclotron log book and work permit system both online as of March 24, 2010
- Looking for a way to combine advantages of paper and electronic permits
- Discussing assimilation of electronic facilities of both control rooms



Summary

- Maintenance coordinated from each facility's control room
- Three main maintenance times, plus more if needed
 - Winter maintenance most extensive
- Work permit systems are now all online
- Combining the two operations groups means harmonizing the systems of the two control rooms
 - Efforts in progress