Quick Summary

What made our situation unique—or at least unusual?
- What that meant we could do.
- What we still couldn't do.

What changes we made (mostly Controls/Software-based) to respond to Covid.

What we're going to keep, what we're going to drop, and what we wish we already had.

Brookhaven
National Laboratory

BNL C-AD: A Quick Overview

Three pre-injectors, three rings (including RHIC) and a fixed-target line. Hundreds of full-time staff.

Then everybody went home. *But*, we have something very few other labs have: Anybody can touch anything if they can log in.

Obviously this lends itself very well to mass remote operations, but as they say "With great power comes great responsibility."

Brookhaven
National Laboratory

Physical Upgrades

Our standard NX servers were not sufficient for the new Covid load.

We introduced a new "Load Balanced" toplogy.

- 6 new machines: 384Gb RAM, 16 core/32 thread CPUs.
- 5 old machines: 92Gb RAM, 24 thread CPUs.

Once set up, no extra man power.

But would people switch? About 50% so far.

Also:

Call forwarding. Ergonomic chairs for all. Mic'd headsets for the MCR. And an OWL.

A Backup Control Room?

With radios, call-forwarding, and an open controls system, a backup Control Room looked like a possibility.

- Ideal if the MCR became contaminated.

- Just one small hitch:

- Access Controls and Fire Alarms cannot be rerouted both physically and by regulation.

(But we did put up a sign.)

Brookhaven National Laboratory

Unlimited Power

Since anyone can do nearly anything when logged in, we need specific controls and procedures to account for that.

Luckily we have this:

> It is the responsibility of the on-shift operating crew to safely operate the accelerator through adherence to written procedures and sound operating practices. The authority for accelerator operations is vested in the on-duty Operations Coordinator, and transferred only through formal turnover to a qualified Operations Coordinator. If a special test or

And this:

> The Operations Coordinator is in charge of all activities relating to the operation of the accelerator. Any work by support groups during operations which might impact the operation of the accelerator, shall be approved by the Operations Coordinator.

That may seem woefully inadequate, but it's been sufficient for us.

Now that everyone is remote—and actively banned from the Main Control Room—we need a little more.

Brookhaven National Laboratory

When the Rogues go Rogue

Aborting a store by inserting a YAG or a diamond detector.

Running a bayesian optimisation script.

Less severe things like:

- Tweaking collimators and other beamline components.
- Tuning sources.
- Updating settings.

Far, far more than we anticipated.

- *"Those that respect the law and love sausage should watch neither being made." ~ Mark Twain*

Mitigation—Leveraging the tools we have, and building on them

Every setting made in the Controls system is saved and timestamped. We also keep the login, process ID, hostname, etc.

- Great for post-mortem diagnosis, but cannot stop anything proactively.

Developed an app for monitoring:

- Logins, settings, and applications

Not enough:

- Process kill and user kill commands.

Still not enough...
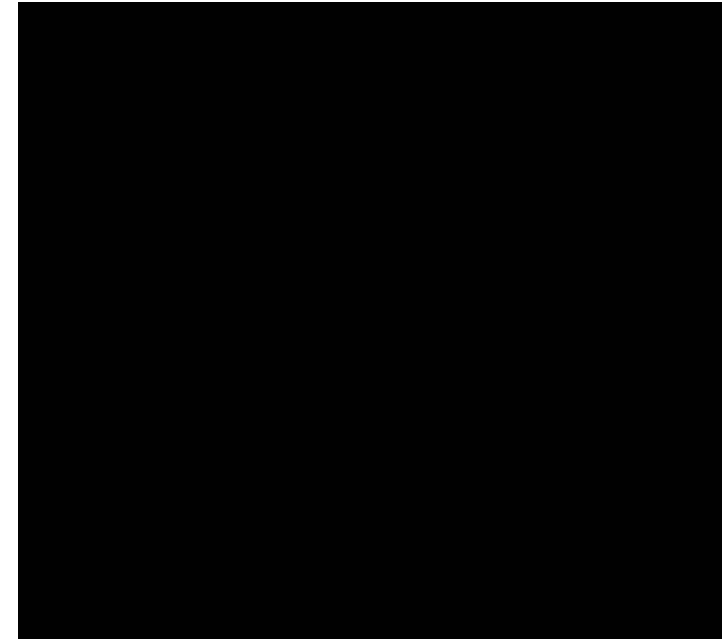
The Rogues' Gallery

Not these guys.

The Rogues' Gallery

These guys.

- A manager scans the database for users' last settings.

- Formatted and displayed with mugshots.

- A new version has uid and pid.
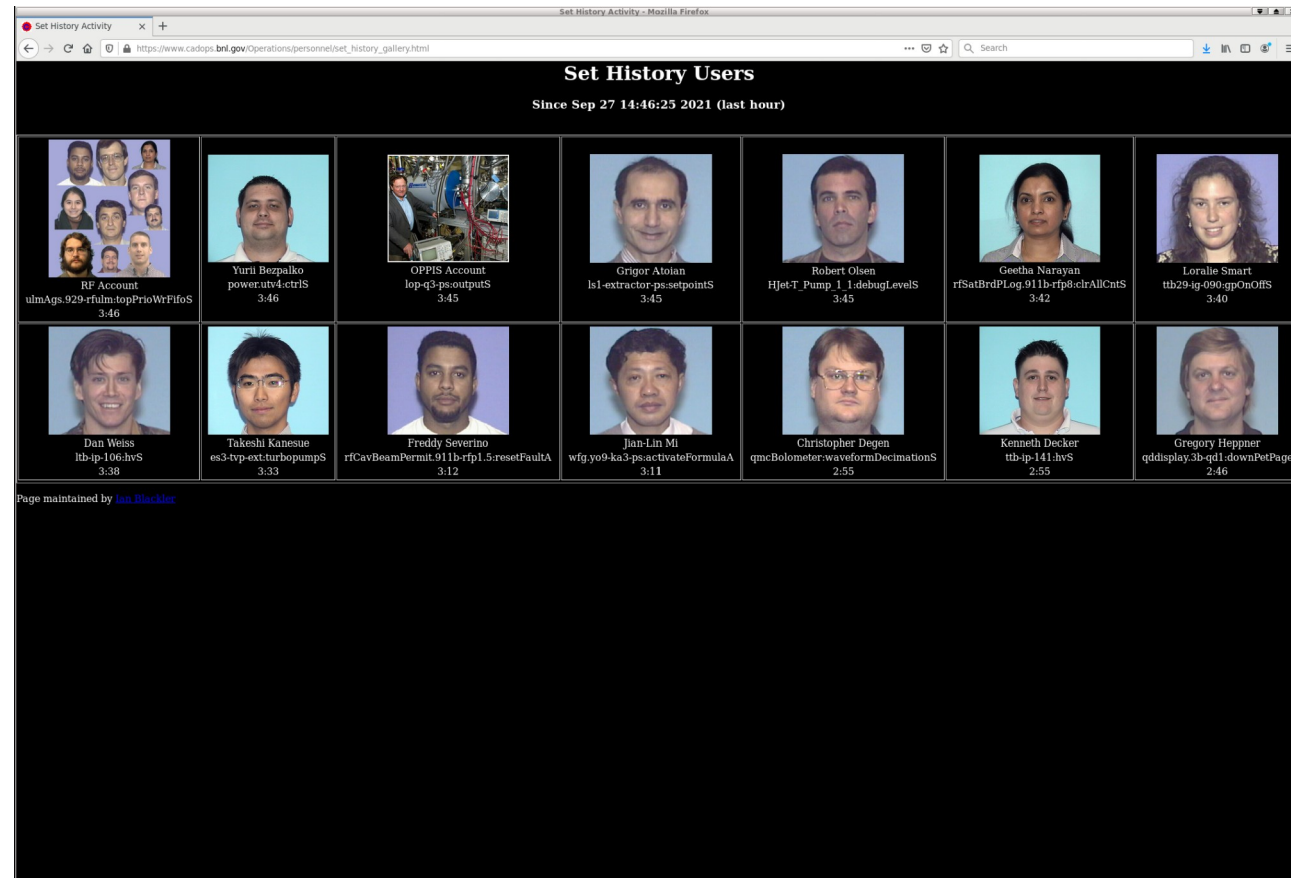
The Other End of the Beampipe

Face-to-face meetings were often the best for more subtle problems. Now completely off the table.

Zoom was formally designated for new communications, but Teams chat with senior physicists was often the go-to.

Extra information from online data proved very helpful:
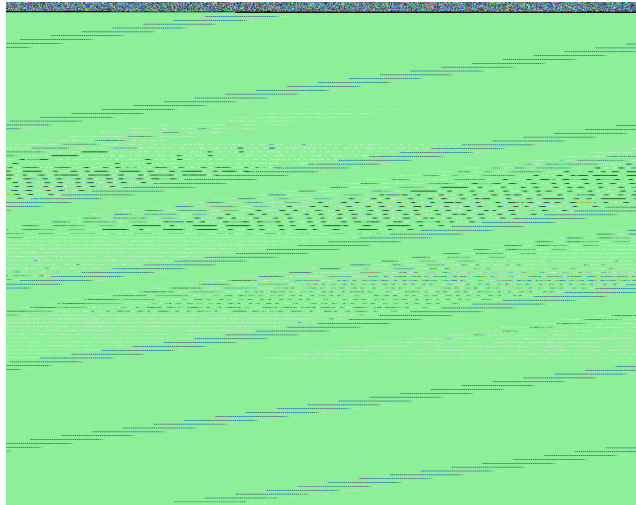
Intra-Group Communications

Face-to-Face in the MCR/office/meeting room has always been one of the gold standards. Now it's off the table.

Initial choices were between Bluejeans (already in use), Zoom (new and untested), MS Teams (also new), and Skype (who?)

Bluejeans was not remotely up to the task, Zoom seemed okay but struggled in our Linux environment. MS Teams took the crown, with Zoom becoming popular for meetings. Nobody seems to know what happened to Skype.

With all the typing in Teams chats, elogs became neglected. People not in particular channels missed information, searching for information was much harder, etc, etc.

Brookhaven National Laboratory

Shift work

To minimise crew overlaps and the risk of quarantining multiple crews at once, we moved to a synchronised 12-hour shift rotation.

3 on, 7 off, 4 on, 7 off.

6 teams cover all of the shifts over 6 weeks.

Week	Day	Day Shift	Owl Shift
1	Mon	■	
	Tue	■	
	Wed	■	
	Thu		
	Fri		
	Sat		
	Sun		
2	Mon		
	Tue		
	Wed		
	Thu	■	
	Fri	■	
	Sat	■	
	Sun	■	

Week	Day	Day Shift	Owl Shift
3	Mon		
	Tue		
	Wed		
	Thu		
	Fri		
	Sat		
	Sun		
4	Mon		■
	Tue		■
	Wed		■
	Thu		
	Fri		
	Sat		
	Sun		

Week	Day	Day Shift	Owl Shift
5	Mon		
	Tue		
	Wed		
	Thu		■
	Fri		■
	Sat		■
	Sun		■
6	Mon		
	Tue		
	Wed		
	Thu		
	Fri		
	Sat		
	Sun		

Brookhaven National Laboratory

13

Shift work revert

The new rotation has become too arduous for some, so we are reverting.

The old schedule is a blend of 8 and 12-hour shifts.

It's less complicated than it looks, but not by much.

SHIFT SCHEDULE FOR **OPERATIONS COORDINATORS** 8/13/2021

0-7	7-15	15-19	19-23	23-24	UNS	OFF															
D	A	B		C	EF		16-Aug	Mo	27-Sep	Mo	8-Nov	Mo	20-Dec	Mo	31-Jan	Mo	14-Mar	Mo	25-Apr	Mo
C	A	B		C	EF	D	17-Aug	Tu	28-Sep	Tu	9-Nov	Tu	21-Dec	Tu	1-Feb	Tu	15-Mar	Tu	26-Apr	Tu
C	E	B		C	A	DF	18-Aug	We	29-Sep	We	10-Nov	We	22-Dec	We	2-Feb	We	16-Mar	We	27-Apr	We
C	E	B		C	DA	F	19-Aug	Th	30-Sep	Th	11-Nov	Th	23-Dec	Th	3-Feb	Th	17-Mar	Th	28-Apr	Th
C	F		C		DE	AB	20-Aug	Fr	1-Oct	Fr	12-Nov	Fr	24-Dec	Fr	4-Feb	Fr	18-Mar	Fr	29-Apr	Fr
C	F		C			ABDE	21-Aug	Sa	2-Oct	Sa	13-Nov	Sa	25-Dec	Sa	5-Feb	Sa	19-Mar	Sa	30-Apr	Sa
C	F		C			ABDE	22-Aug	Su	3-Oct	Su	14-Nov	Su	26-Dec	Su	6-Feb	Su	20-Mar	Su	1-May	Su
0-7	7-15	15-19	19-23	23-24	UNS	OFF															
C	F	A		B	DE		23-Aug	Mo	4-Oct	Mo	15-Nov	Mo	27-Dec	Mo	7-Feb	Mo	21-Mar	Mo	2-May	Mo
B	F	A		B	DE	C	24-Aug	Tu	5-Oct	Tu	16-Nov	Tu	28-Dec	Tu	8-Feb	Tu	22-Mar	Tu	3-May	Tu
B	D	A		B	F	CE	25-Aug	We	6-Oct	We	17-Nov	We	29-Dec	We	9-Feb	We	23-Mar	We	4-May	We
B	D	A		B	CF	E	26-Aug	Th	7-Oct	Th	18-Nov	Th	30-Dec	Th	10-Feb	Th	24-Mar	Th	5-May	Th
B	E		B		CD	AF	27-Aug	Fr	8-Oct	Fr	19-Nov	Fr	31-Dec	Fr	11-Feb	Fr	25-Mar	Fr	6-May	Fr
B	E		B			ACDF	28-Aug	Sa	9-Oct	Sa	20-Nov	Sa	1-Jan	Sa	12-Feb	Sa	26-Mar	Sa	7-May	Sa
B	E		B			ACDF	29-Aug	Su	10-Oct	Su	21-Nov	Su	2-Jan	Su	13-Feb	Su	27-Mar	Su	8-May	Su
0-7	7-15	15-19	19-23	23-24	UNS	OFF															
B	E	F		A	CD		30-Aug	Mo	11-Oct	Mo	22-Nov	Mo	3-Jan	Mo	14-Feb	Mo	28-Mar	Mo	9-May	Mo
A	E	F		A	CD	B	31-Aug	Tu	12-Oct	Tu	23-Nov	Tu	4-Jan	Tu	15-Feb	Tu	29-Mar	Tu	10-May	Tu
A	C	F		A	E	BD	1-Sep	We	13-Oct	We	24-Nov	We	5-Jan	We	16-Feb	We	30-Mar	We	11-May	We
A	C	F		A	BE	D	2-Sep	Th	14-Oct	Th	25-Nov	Th	6-Jan	Th	17-Feb	Th	31-Mar	Th	12-May	Th
A	D		A		BC	FE	3-Sep	Fr	15-Oct	Fr	26-Nov	Fr	7-Jan	Fr	18-Feb	Fr	1-Apr	Fr	13-May	Fr
A	D		A			BCFE	4-Sep	Sa	16-Oct	Sa	27-Nov	Sa	8-Jan	Sa	19-Feb	Sa	2-Apr	Sa	14-May	Sa
A	D		A			BCFE	5-Sep	Su	17-Oct	Su	28-Nov	Su	9-Jan	Su	20-Feb	Su	3-Apr	Su	15-May	Su
0-7	7-15	15-19	19-23	23-24	UNS	OFF															
A	D	E		F	BC		6-Sep	Mo	18-Oct	Mo	29-Nov	Mo	10-Jan	Mo	21-Feb	Mo	4-Apr	Mo	16-May	Mo
F	D	E		F	BC	A	7-Sep	Tu	19-Oct	Tu	30-Nov	Tu	11-Jan	Tu	22-Feb	Tu	5-Apr	Tu	17-May	Tu
F	B	E		F	D	AC	8-Sep	We	20-Oct	We	1-Dec	We	12-Jan	We	23-Feb	We	6-Apr	We	18-May	We
F	B	E		F	AD	C	9-Sep	Th	21-Oct	Th	2-Dec	Th	13-Jan	Th	24-Feb	Th	7-Apr	Th	19-May	Th
F	C		F		AB	DE	10-Sep	Fr	22-Oct	Fr	3-Dec	Fr	14-Jan	Fr	25-Feb	Fr	8-Apr	Fr	20-May	Fr
F	C		F			ABDE	11-Sep	Sa	23-Oct	Sa	4-Dec	Sa	15-Jan	Sa	26-Feb	Sa	9-Apr	Sa	21-May	Sa
F	C		F			ABDE	12-Sep	Su	24-Oct	Su	5-Dec	Su	16-Jan	Su	27-Feb	Su	10-Apr	Su	22-May	Su
0-7	7-15	15-19	19-23	23-24	UNS	OFF															
F	C	D		E	AB		13-Sep	Mo	25-Oct	Mo	6-Dec	Mo	17-Jan	Mo	28-Feb	Mo	11-Apr	Mo	23-May	Mo
E	C	D		E	AB	F	14-Sep	Tu	26-Oct	Tu	7-Dec	Tu	18-Jan	Tu	1-Mar	Tu	12-Apr	Tu	24-May	Tu
E	A	D		E	C	BF	15-Sep	We	27-Oct	We	8-Dec	We	19-Jan	We	2-Mar	We	13-Apr	We	25-May	We
E	A	D		E	CF	AF	16-Sep	Th	28-Oct	Th	9-Dec	Th	20-Jan	Th	3-Mar	Th	14-Apr	Th	26-May	Th
E	B		E		AF	DC	17-Sep	Fr	29-Oct	Fr	10-Dec	Fr	21-Jan	Fr	4-Mar	Fr	15-Apr	Fr	27-May	Fr
E	B		E			ACDF	18-Sep	Sa	30-Oct	Sa	11-Dec	Sa	22-Jan	Sa	5-Mar	Sa	16-Apr	Sa	28-May	Sa
E	B		E			ACDF	19-Sep	Su	31-Oct	Su	12-Dec	Su	23-Jan	Su	6-Mar	Su	17-Apr	Su	29-May	Su
0-7	7-15	15-19	19-23	23-24	UNS	OFF															
E	B	C		D	AF		20-Sep	Mo	1-Nov	Mo	13-Dec	Mo	24-Jan	Mo	7-Mar	Mo	18-Apr	Mo	30-May	Mo
D	B	C		D	AF	E	21-Sep	Tu	2-Nov	Tu	14-Dec	Tu	25-Jan	Tu	8-Mar	Tu	19-Apr	Tu	31-May	Tu
D	F	C		D	B	AE	22-Sep	We	3-Nov	We	15-Dec	We	26-Jan	We	9-Mar	We	20-Apr	We	1-Jun	We
D	F	C		D	BE	A	23-Sep	Th	4-Nov	Th	16-Dec	Th	27-Jan	Th	10-Mar	Th	21-Apr	Th	2-Jun	Th
D	A		D		FE	BC	24-Sep	Fr	5-Nov	Fr	17-Dec	Fr	28-Jan	Fr	11-Mar	Fr	22-Apr	Fr	3-Jun	Fr
D	A		D			BCFE	25-Sep	Sa	6-Nov	Sa	18-Dec	Sa	29-Jan	Sa	12-Mar	Sa	23-Apr	Sa	4-Jun	Sa
D	A		D			BCFE	26-Sep	Su	7-Nov	Su	19-Dec	Su	30-Jan	Su	13-Mar	Su	24-Apr	Su	5-Jun	Su

A => PKA	B => CEG	C=> NAK	
D => IMCB	E => DAM	F=> KAH	

Concluding

Almost everything you saw, we're keeping, but we also want a few more changes…

- Docusign or equivalents. We are all surprised we took so long on this one.

- A more coherent directory of call-in information.

- 12-hour shifts are going away. They caused far too much burnout.

- Teams meetings and chat will be reduced. Too much information was lost.

- We're all still a little scared of the owl, so the jury is out on that one.

Assuming we return to "normal" "soon."

Brookhaven
National Laboratory