

# Remote Participation in Experiments

## ~ Expand Research Capabilities ~

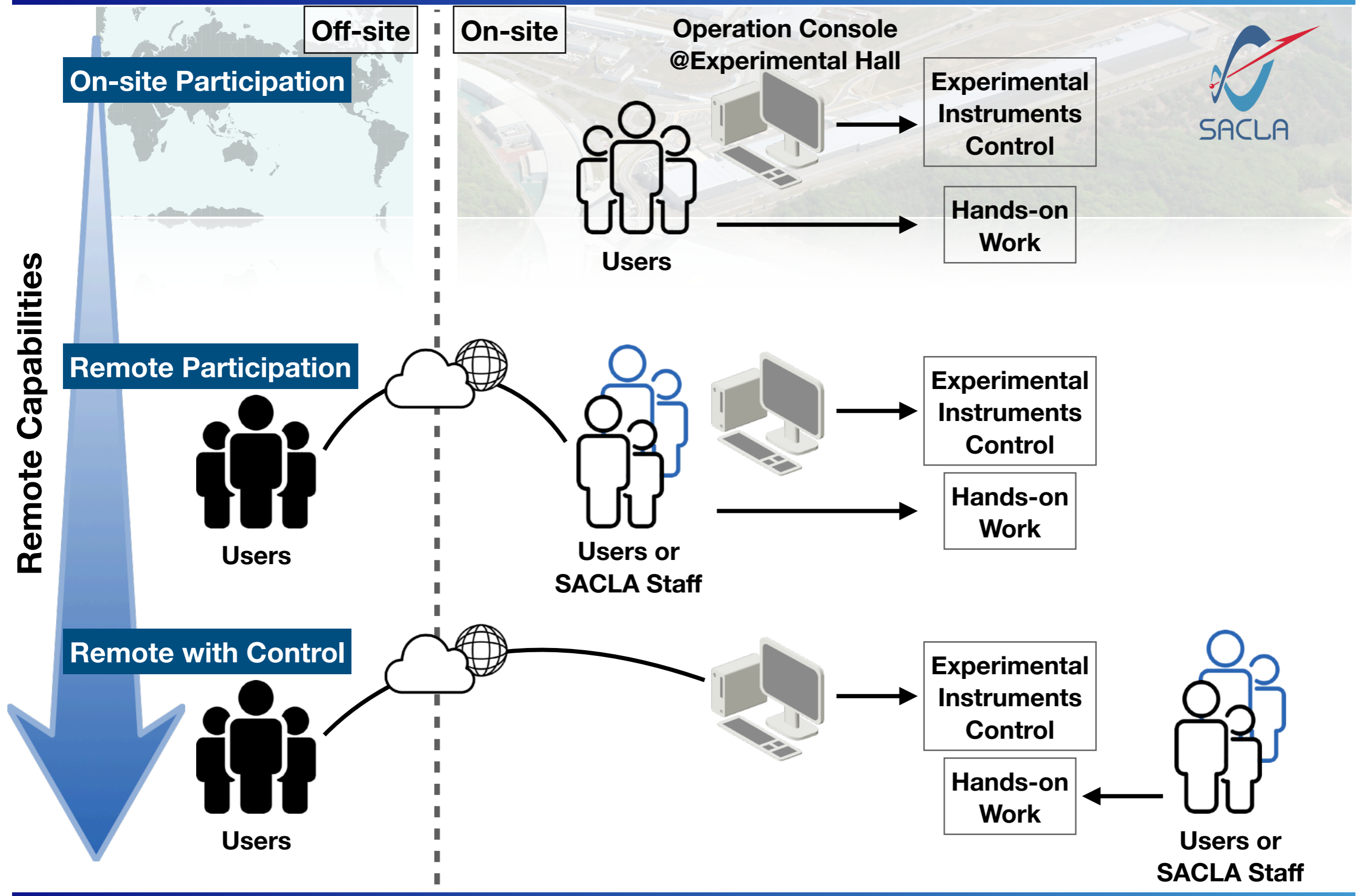
**Toshinori Yabuuchi**

On behalf of SACLA



*SACLA Users' Meeting 2021  
March 9-11, 2021 (Online)*

# What are remote experiments at SACLA?



# *Run has been conducted over the internet for the first time ever with high-power optical laser systems*



Feb. 19, 2021

# Demo: Executing a Run over the Internet

Executed on Browser

VPN Connection

WiFi

**Single shot of high power laser with XFEL**

**Run Control GUI**

Beam frequency : 30Hz Hutch : EH6    XFEL status : Ready    Run status : Running

Mode Setting: Run (selected), Scan

Total Events: 30    Repeat (Interval: 0 sec.)

Retry Mode: off    Wait for beam recovery

Pre-procedure: tRayonix.py --run %RUN% --shots %SHOTS%

Post-procedure: jRayonix.py --run %RUN% --shots %SHOTS%

Comment: Remote Demo (EH6)

Information:

- RunNumber: 96839
- Total Events: 27
- TagNumber: 890684881 - 890684941
- RunTime: 22:05:05 -
- RepeatCount: 1

Detailed Information: Run Information, Image Viewer

Data Acquisition:

- XFEL: 30Hz
- Optical Laser: 1Hz
- 1st Tag for: 1Hz

Start    Stop

Last display update: 2021-02-19 22:05:07    Using ecpy v2.0.0

**LiveView (IMPERX)**

Image view style: Normal (checked), Flip Horizontal, Flip Vertical, Rotation 180

Image color: Terrain chart, 4,096(12bit)

Range Min: 39    Range Max: 104

TagNumber: 890684881    X: 603    Y: 57    Z: 0

**Remote Desktop (Windows, Local CCD)**

SACLA Launcher    RunControl ver.1.1.4    LiveView\_Reserve02-1\_EH6 [1Hz] (Skip mode) Ver. 3.8.0    share - File Browser    bin - File Browser    bl2user    rdesktop -

*†Tools and software for remote operation may be different when they are available for users.*



# ***SACLA offers a variety of ways to carry out user experiments during/after the COVID-19 pandemic***

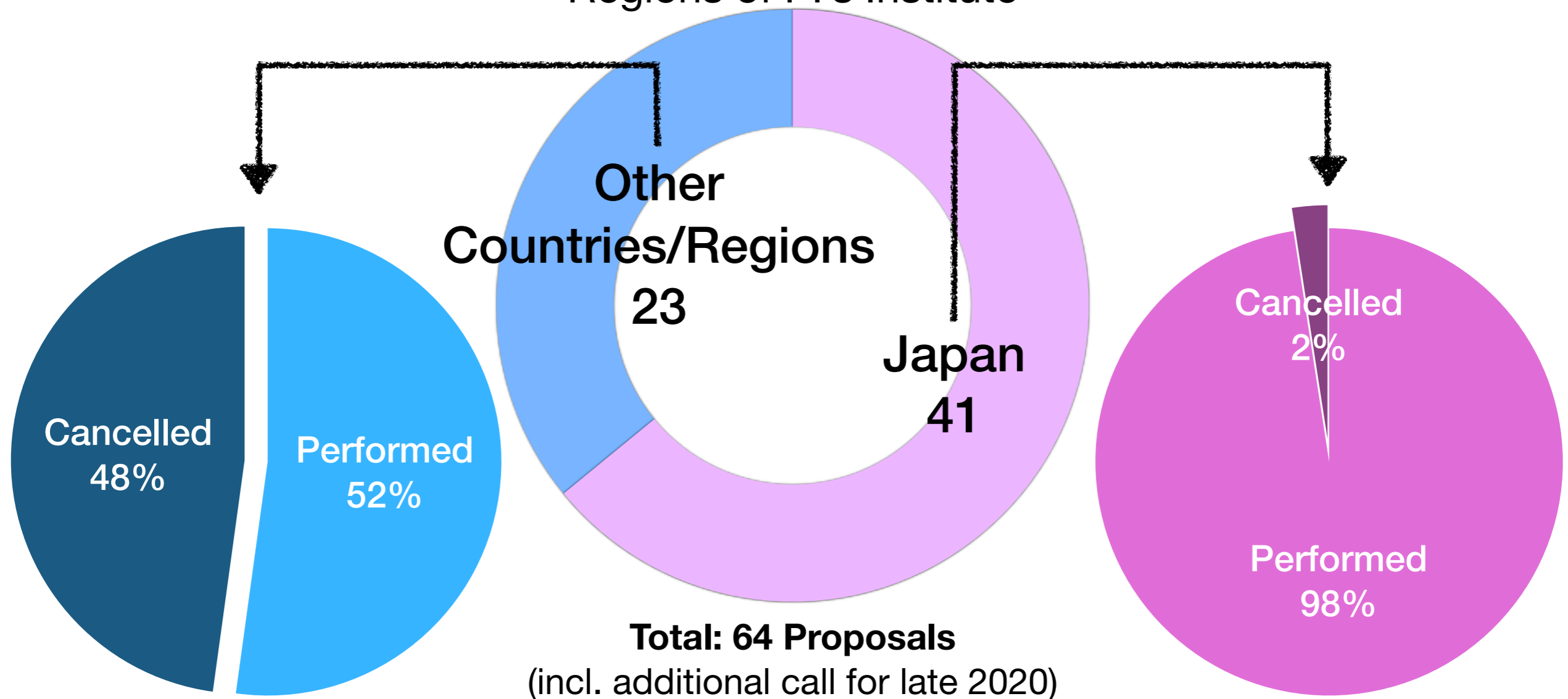
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- User activities at SACLA have been significantly influenced by the pandemic, particularly for international users.
- To maintain and increase the scientific activities at the facility, we develop various ways for users to conduct their experiments:
  - **On-site Participation:** Traditional style (with a limited number of visitors)
  - **Remote Participation:** Most users stay off-site without control
  - **Remote with Control (plan):** Most operations are performed from off-site
  - **Hybrid:** Mixture of above
- “Remote with Control” will be introduced in 2021B expectedly starting with pilot experiments at the high-power laser platforms.
- We are still learning and trying to find a suitable way to support users with remote capabilities.

# ***Strict restriction of international travel made a huge impact on research activities in 2020***

## **Approved Proposals for 2020A**

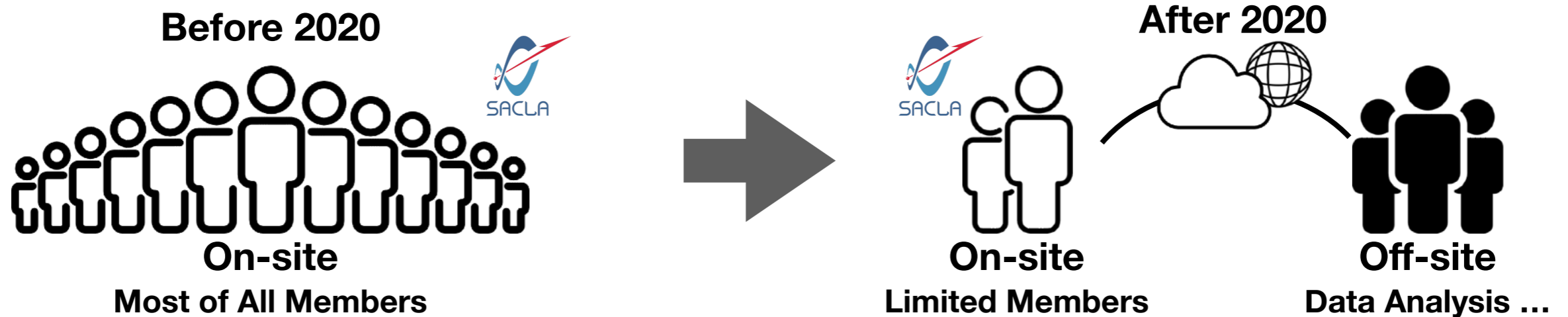
Regions of PI's Institute



**Development of new ways to conduct experiments remotely is essential for the continuous growth of our facility.**

# ***SACLA has been open for all users since the resumption of user operation in June 2020***

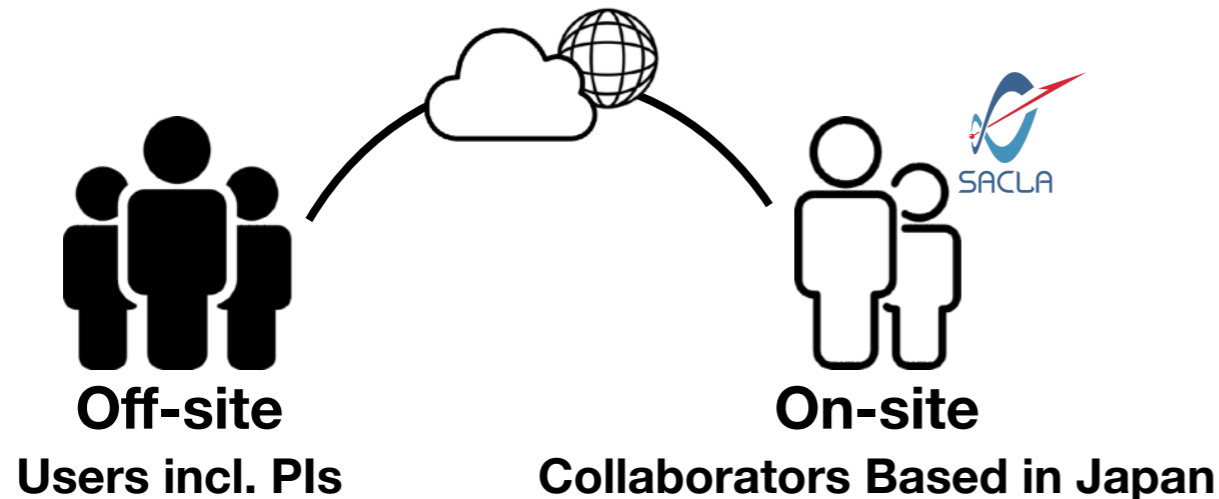
## On-site Participation



- Currently, there is **no restriction to visit the facility**. However, the **entry restrictions to Japan** substantially limit the visit of most international users.
- We request users to **minimize the on-site participants**. Some tools are available for off-site users to involve in the experiments; → **Joti-san (next talk)**
  - **Information sharing** directly from operation consoles at experimental stations (*now connected to Google Docs, Sheets, and Drive*)
  - **Fast X server** (FastX) for GUIs on high-performance computing (HPC) system (*improved user experience using GUI software on HPC*)
  - **Online storage server** (Nextcloud) for convenient data sharing

# ***We recognized strong user collaborations: Representative collaborators carried out experiments***

## Remote Participation



## On-site Work

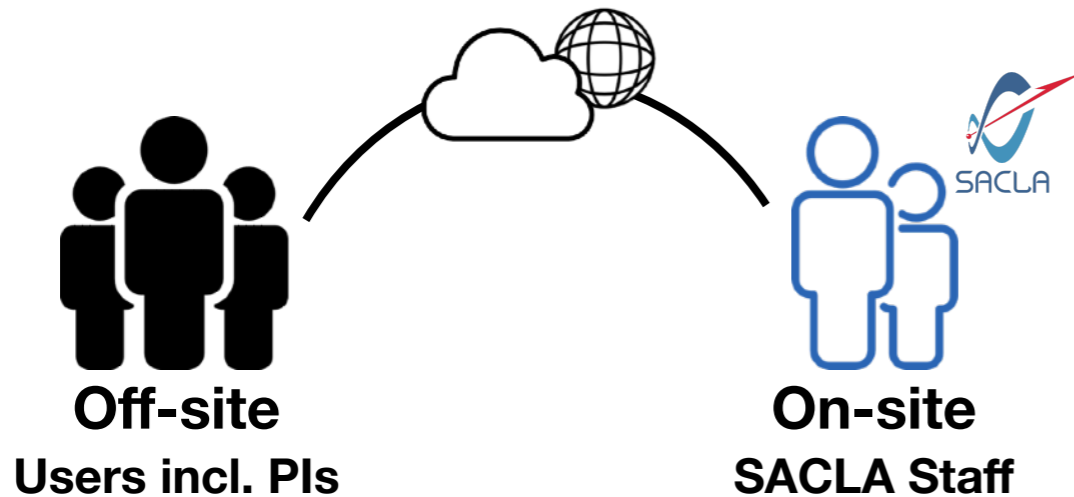
- Sample preparation and alignment
- Setup and operation of equipment, including owned by users
- All work using operation consoles, typically except data analysis

- In some cases, the collaboration across countries enabled performing experiments with the support of communication technologies.
- Key points for success: **Nothing special!**
  - Collaborators in Japan with a deep understanding of the experiments
  - Before beam time: Well defined role sharing and experimental plan
  - During beam time: Smooth communication and information/data sharing
- A load for on-site collaborators is much heavier than that in the usual (i.e. old-style) collaborations.



# As a tentative solution, SACLA staff fully supported some user experiments on-site

## Remote Participation



## Limited On-site Work

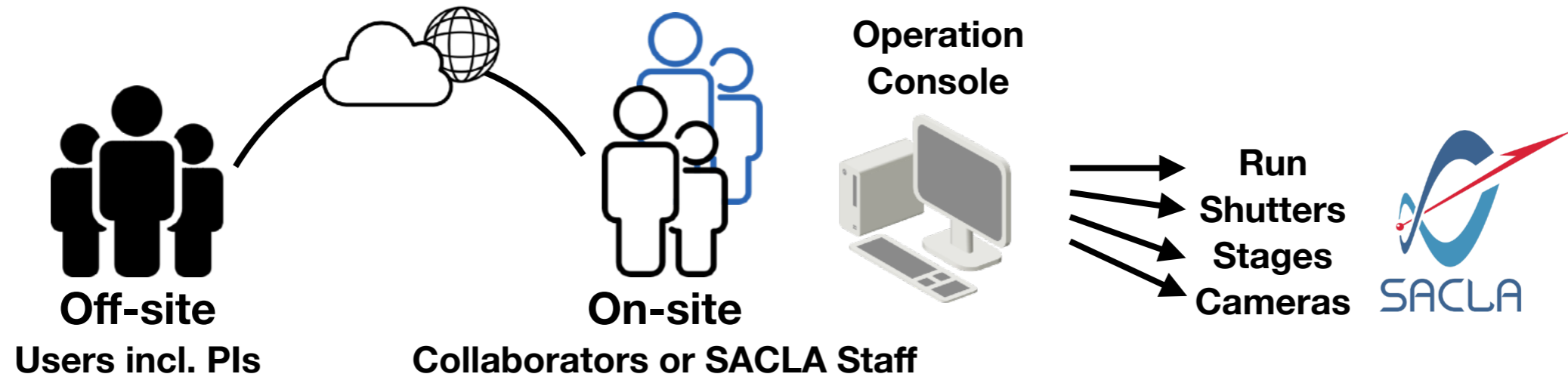
- Just placing **samples prepared by users**
- Setup and operation of equipment, **excluding owned by users**
- All work using operation consoles, **except data analysis**

- Some experiments have been carried out in “**mail-in**” style after strong requests from users who do not have suitable collaborators in Japan.
- This kind of support will be available in 2021 continuously but **limited to experiments that use only standard instruments** of SACLA. **Some experiments are not applicable**, for example, if those require;
  - **User-owned equipment** **X**
  - **Unestablished methods or complex procedures** **X**
  - **On-site sample preparation** **X**
  - **24-hour on-site operations** **X**

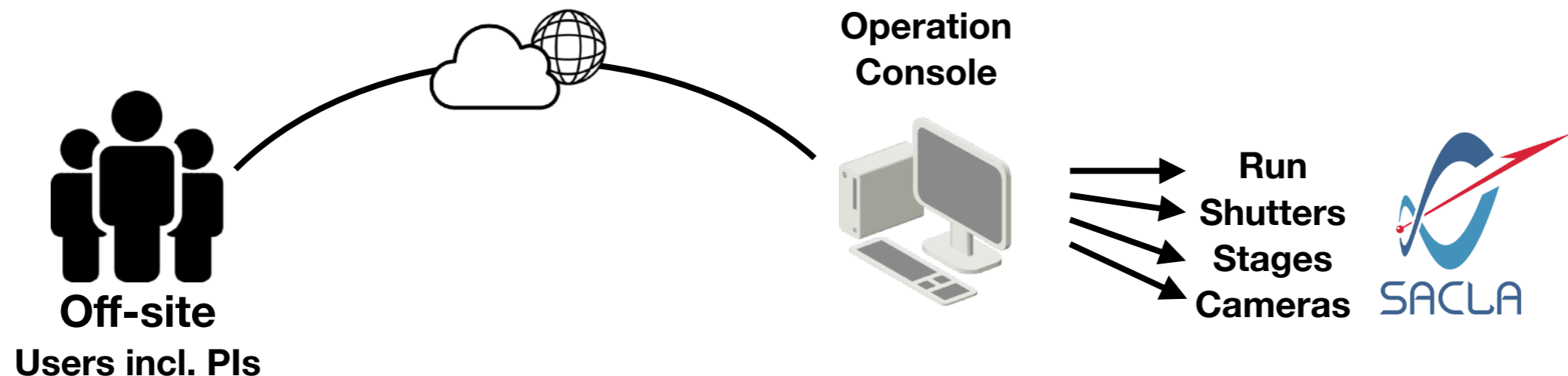
**Please ask the beamline scientists if your experiment scheduled in 2021A can be carried out in this style.**

# *Not all “on-site work” is necessarily conducted by “on-site participants” if remote-control is realized*

## Remote Participation

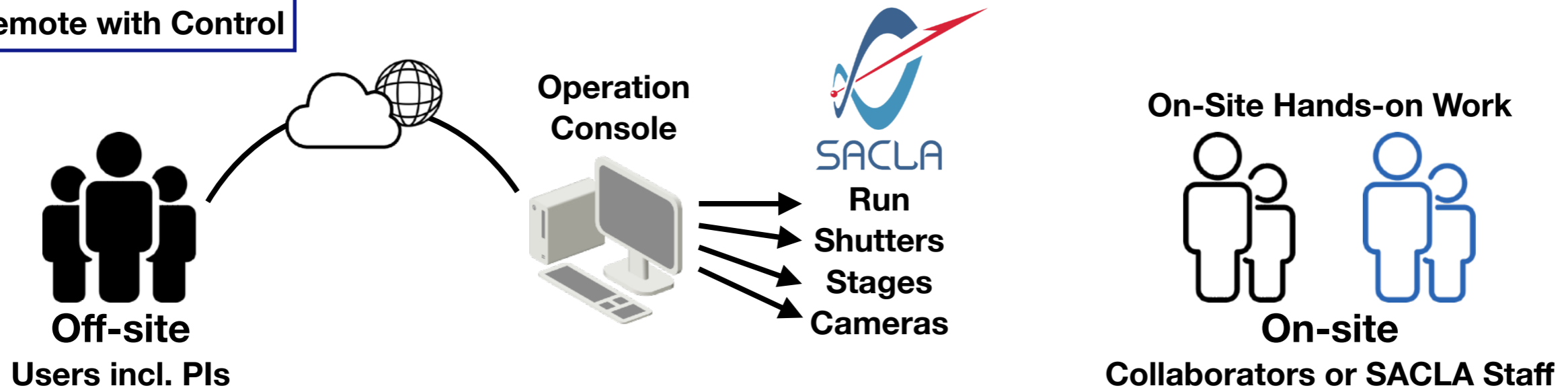


## Remote with Control



# Conducting experiments remotely is beneficial to users and also the facility

## Remote with Control



- On-site participants can focus on hands-on work in the facility.
- Off-site participants can conduct routine processes for data acquisitions.
- A **hybrid style**, in which **limited users visit SACLA and others joined remotely with control**, can be also realized with the remote-control capability.
  - On-site users may not need to make 2-3 teams for the 24-hour operation, since the off-site team can take over a part of the shifts.
  - A few users may be enough just to prepare samples on-site or setup user-owned equipment, which are not done by the facility staff.

# Demonstration shows technical feasibilities to control beamline equipment over the internet

Executed on Browser

VPN Connection

WiFi

The screenshot shows a web browser window displaying a remote control interface for a synchrotron beamline. The interface is divided into several sections:

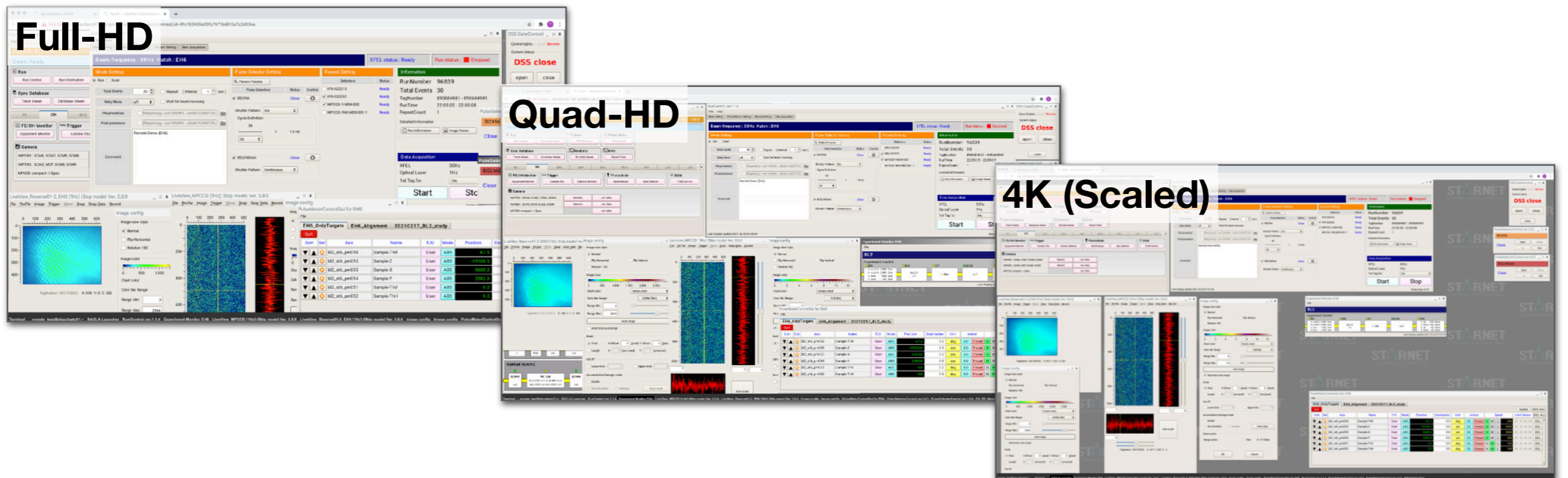
- Top Bar:** Shows the experiment information: "Exp Info: BL2 EH6 2021/02/17~2021/02/20" and "FEL Rep: 30Hz". The status is "Beam: Ready".
- Main Control Panel:** Contains various equipment status indicators and controls, including "Front End", "Optical Hutch1", and "Optical Hutch2".
- LiveView\_MPCCD [1Hz]:** A plot showing the MPCCD data with a color scale from 0 to 120.
- LiveView\_Reserve01-2\_EH6 [1Hz]:** A plot showing the Reserve data with a color scale from 0 to 2500.
- Image Config:** A dialog box for configuring the image view style, color, and scale.
- PulseMotorControlGui for EH6:** A table showing the current status of various pulse motors.

Sort	Set	Axis	Name	F/U	Mode	Position	Destination	Unit	Action	Speed	Limit	Sensor	DEL		
▼	▲	▲	bl2_st6_pm050	Sample-ThR	User	REI	-67.5	0.0	deg	GO	Preset	H M L	200	-H -S +S +H	DEL
▼	▲	▲	bl2_st6_pm053	Sample-Z	User	REI	-19200.0	-100	um	GO	Preset	H M L	2000	-H -S +S +H	DEL
▼	▲	▲	bl2_st6_pm055	Sample-X	User	REI	-9600.0	0	um	GO	Preset	H M L	2000	-H -S +S +H	DEL
▼	▲	▲	bl2_st6_pm054	Sample-Y	User	REI	2700.0	-1000	um	GO	Preset	H M L	200	-H -S +S +H	DEL
▼	▲	▲	bl2_st6_pm051	Sample-ThV	User	REI	0.0	0.0	deg	GO	Preset	H M L	100	-H -S +S +H	DEL
▼	▲	▲	bl2_st6_pm052	Sample-ThH	User	REI	0.0	0.0	deg	GO	Preset	H M L	100	-H -S +S +H	DEL

†Tools and software for remote operation may be different when they are available for users.

# “Remote with Control” worked as expected in the demo when the network speed is fast enough

- What we have learned from the demos so far...
  - The system worked smoothly when the network is faster than ~10 Mbps.
  - Very high spec PCs are not necessarily for the remote control. Modern laptops seem to be good enough to do the job.
  - Displays are an important factor to improve the user experience.
- Please be aware that the remote control system is still under development. **Not only the look and feel but also the available software is subject to change.**



# ***Safety and security need to be ensured before “Remote with Control” is offered to users***

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- **Ensuring safety is the highest priority** in the experimental area either the users are on-site or not.
  - **Work Safety:** appropriate policy and new safety system are necessary for remote experiments
  - **Radiation Safety:** available safety interlock system works fine also for remote experiments
  - **Laser Safety:** minor modification on available laser interlock system is necessary just for high-power laser systems
- **Ensuring security** for the facility network is essential. An appropriate system will be prepared for remote experiments.

# ***Remote control cannot be a perfect solution to all experiments, however, it is certainly a valuable option***

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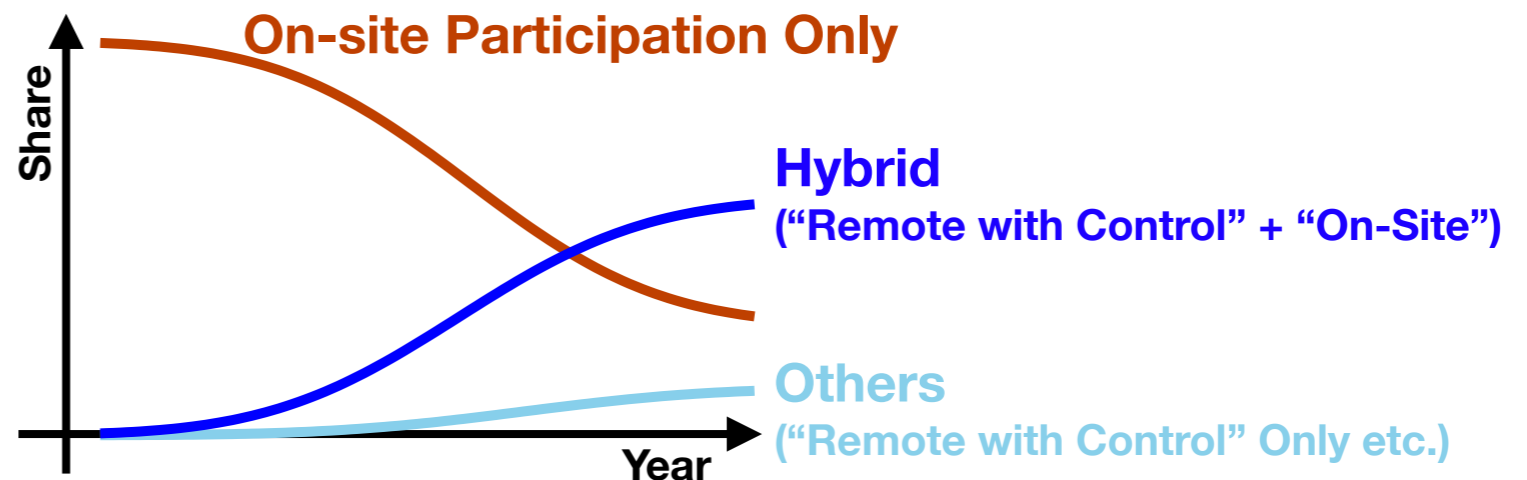
- **Any hands-on work should be done in person** by people on site. That includes, for example, sample preparation and initial setup.
- **Fully Remote Style: on-site facility staff acts on behalf of users**
  - Similar to “Remote participation with SACLA staff”, there will be some limitations, for example (not confirmed yet):
    - ▶ Set up and procedures: Limited to well-established or standard
    - ▶ User-owned Equipment: Not applicable
    - ▶ Sample: Need to be delivered to SACLA
    - ▶ Support Time: Limited to be in the daytime
- **Hybrid Style: on-site collaborators (users) act on behalf of off-site users**
  - Limitations depend on the capability and availability of on-site users.

First pilot experiments of “Remote with Control” are expected at the high-power laser platforms since standard setups are available and most of the hands-on work has been done by the facility staff at the platforms.

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- User activities at SACLA have been significantly influenced by the pandemic, particularly for international users.
- To maintain and increase the scientific activities at the facility, we develop various ways for users to conduct their experiments:

- **On-site Participation**
- **Remote Participation**
- **Remote with Control**
- **Hybrid**



- “Remote with Control” will be introduced in 2021B expectedly starting with pilot experiments at the high-power laser platforms.
- We are still learning and trying to find a suitable way to support users with remote capabilities.

**We appreciate your input on the ways and capabilities of remote experiments.**