

# First Operation of the Wide-area Remote Experiment System

Yukito Furukawa<sup>☆</sup>, Kazuya Hasegawa

SPring-8(JASRI)

Go Ueno

SPring-8(RIKEN)

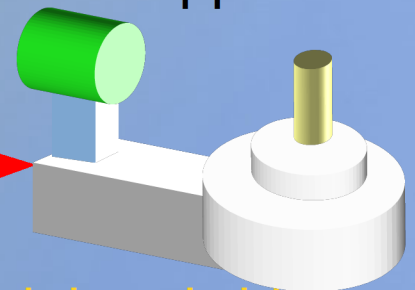
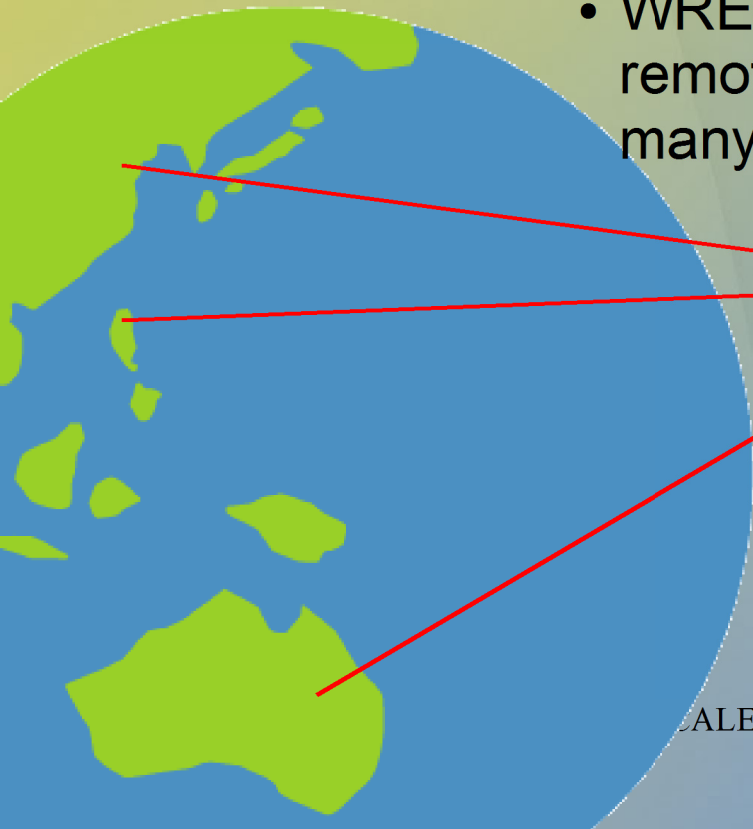
# Outline

- Wide-area Remote Experiment System “WRES”
- First application (Protein Crystallography Exp.)
- First Operation Result
- Current Status
- Summary

# “WRES”

## Wide-area Remote Experiment System

- “WRES” connects remote users and SPring-8 experimental stations safely, securely and certainly.
  - WRES was developed as an infrastructure of the remote experiment system, it can be applicable many X-ray experiment fields.



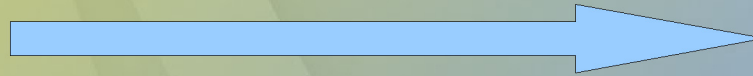
- Required small network bandwidth.
- Safe and Secure
  - Safety: co-working with radiation safety interlock.
  - Secure: SSL/TLS with bi-directional authentication.

# Message Exchanging

“put/detector\_arm/60degree”

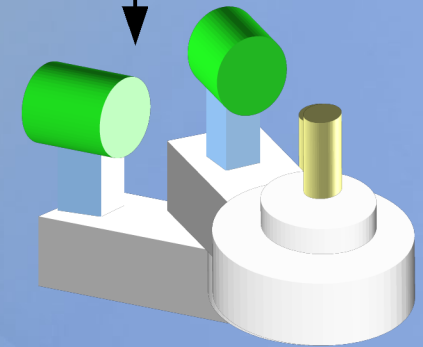


Remote User



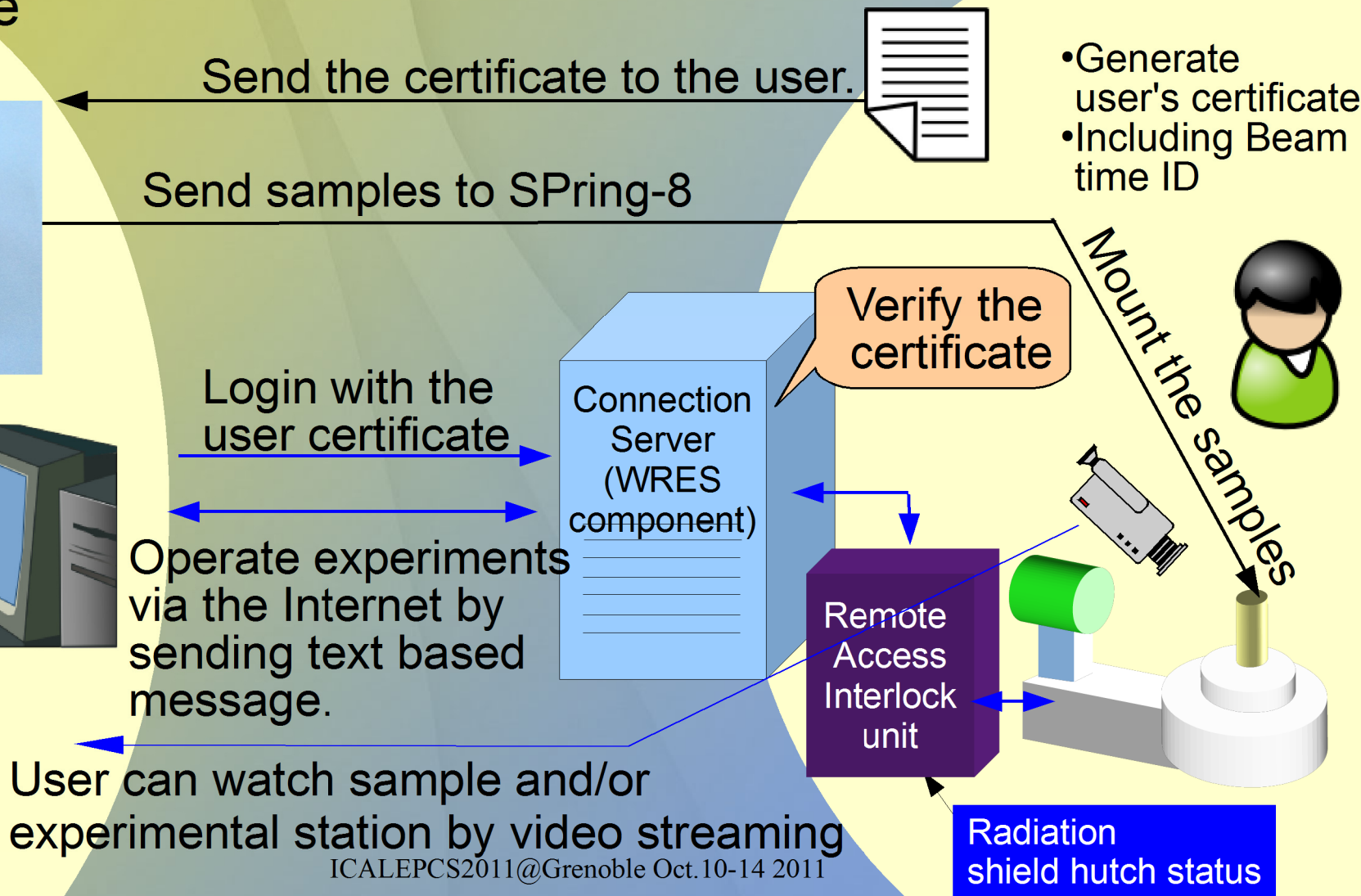
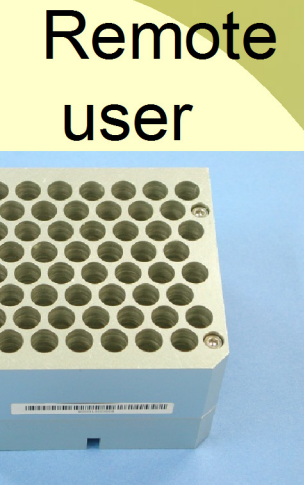
Station  
Control PC

- **Do not require wide network bandwidth**
  - up to 100kbps data rate  
(Including video streaming up to 1Mbps)
  - You can perform experiments **over 3G cellular phone network.**
- Restrict commands by **message filtering.**



Experimental Station

# Remote Experiment Flow SPring-8

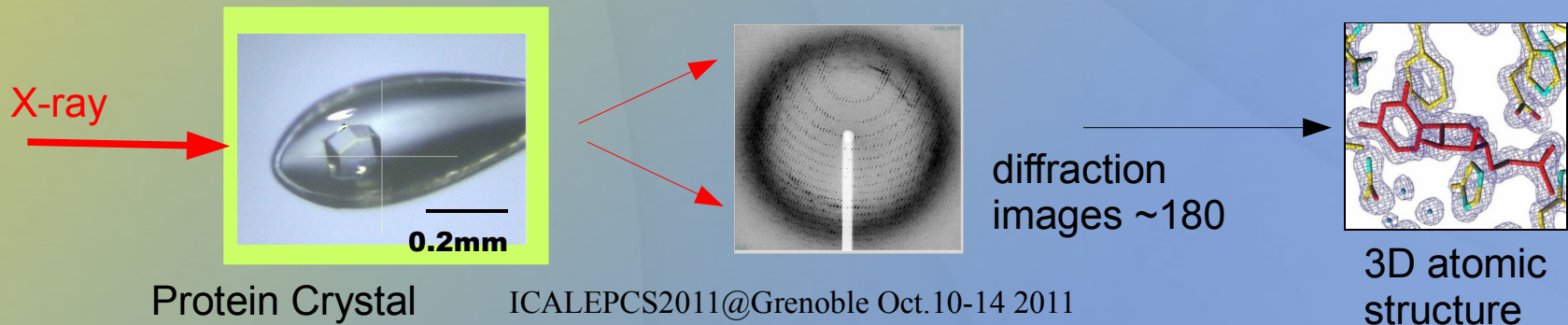


# First Application

ICALEPCS2011@Grenoble Oct.10-14 2011

# First application

- Protein crystallography (PX) was chosen for the first remote experiment.
  - Many demands for remote experiment on PX.
  - Highly automated experimental stations for PX at SPring-8
    - Adaptation of remote experiment required automated station controls.



# GUI for remote user

The screenshot displays the 'Remote' software interface. On the left, there is a 'Sample Tray' grid with 52 slots, where slots 1, 2, 49, and 50 are highlighted in cyan, and slot 47 is highlighted in red. Below the tray are 'Mount' and 'dismount' buttons. To the right of the tray is a 'Tray(s) at Beamline;' field containing '99993000001' and an 'Update' button. Below the tray is a 'Measurement list' table with columns for No., Status, Well, Mode, Condition, and Tray. The table contains 8 rows of data, all with a 'Success' status. On the right side of the interface is a 'Streaming Video' window showing a close-up of a metallic, teardrop-shaped sample. A red crosshair cursor is centered on the sample. Below the video window are controls for 'Magnification' (Low/High), 'Action' (including 'on centering', 'Back Light', 'e rotation +90 deg', 'nt spindle position -60.00', and 'm shutter Open').

No.	Status	Well	Mode	Condition	Tray
001	Success	47	Snap	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
002	Success	49	Snap	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
003	Success	49	Snap	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
004	Success	50	Snap	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
005	Success	51	Snap	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
006	Success	47	Single	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
007	Success	49	Single	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...
008	Success	50	Single	mx225 Scan:0.00 to 90.00 w/1.00 ...	99993000...

You can treat a sample overvideo image as if you are at SPring-8

Sample image by video streaming. By clicking on the sample image, you can specify the x-ray irradiate position (red cursor).



# GUI Video

The screenshot displays a software interface for a microscope system, divided into several functional areas:

- Tray Selection:** A grid of 52 numbered wells (1-52) is shown. Well 23 is highlighted. To the right is a 'Tray ID' input field, an 'Update TrayID' button, and 'Mount' and 'dismount' buttons.
- Measure Log:** A table with columns for Job ID, Status, Mode, TrayID, Well No, Exp No, and From. The table is currently empty.
- Video Feed:** A large window showing a live video of a sample with a red crosshair centered on a bright spot.
- Control Panels:**
  - Magnification:** Radio buttons for 'Low' and 'High', with 'High' selected.
  - Centering:** Buttons for 'Centering On', 'Back Light' (highlighted with a yellow circle), and 'capture'.
  - Rotation:** Buttons for '+90', '-90', and '180' degrees.
  - Manual rotation:** A numeric input field set to '0', a unit selector '[deg]', and radio buttons for 'Abs' and 'Rel'.
  - Translation:** A numeric input field set to '10', a unit selector 'um', and a four-way directional pad.

# First Operation

ICALEPCS2011@Grenoble Oct.10-14 2011

# First Operation of RIKEN Wako

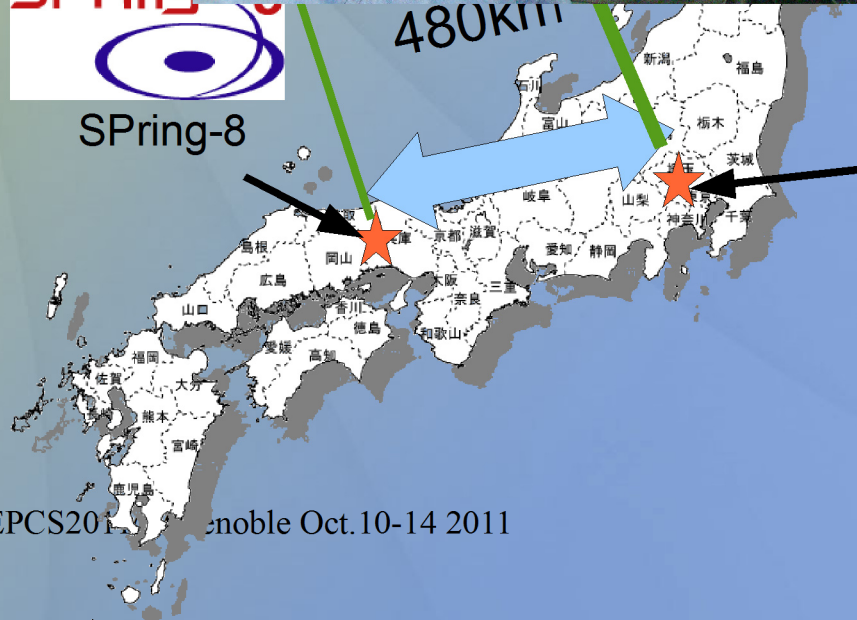


SINET3

Science Information NETwork 3  
Academic Internet backbone, 40Gbps



SPRING-8



RIKEN  
Wako



LEPCS2011 Grenoble Oct.10-14 2011

# Operation Result

- All functions of remote experiment including centering of crystals worked well.
- Latency (from clicking on video image to start centering) was less than 1 sec. Main part of the latency was video encoding.
  - Latency is small enough for protein crystallography users.
- Obtained data quality was same as the obtained by ordinary experiment.

# Current Status and Future

- Remote experiment for protein crystallography is just opened in this autumn beam time.
- For the first international operation, we are now preparing experiment from Taiwan because the NSRRC at Taiwan has their own BLs at SPring-8.
- We are now developing a remote experiment for XAFS (X-ray Absorption Fine Structure) beamline and will start testing next year.
- Application to X-ray small angle scattering experiments are now under discussion.

# Summary

- The Wide-area Remote Experiment System (WRES) has been developed and applied to SPring-8 protein crystallography BLs and we successfully performed the first remote experiment at the end of Oct. 2010.
- The system is opened for protein crystallography users and is being expanded to international and other X-ray experiment fields.