First Operation of the Wide-area Remote Experiment System

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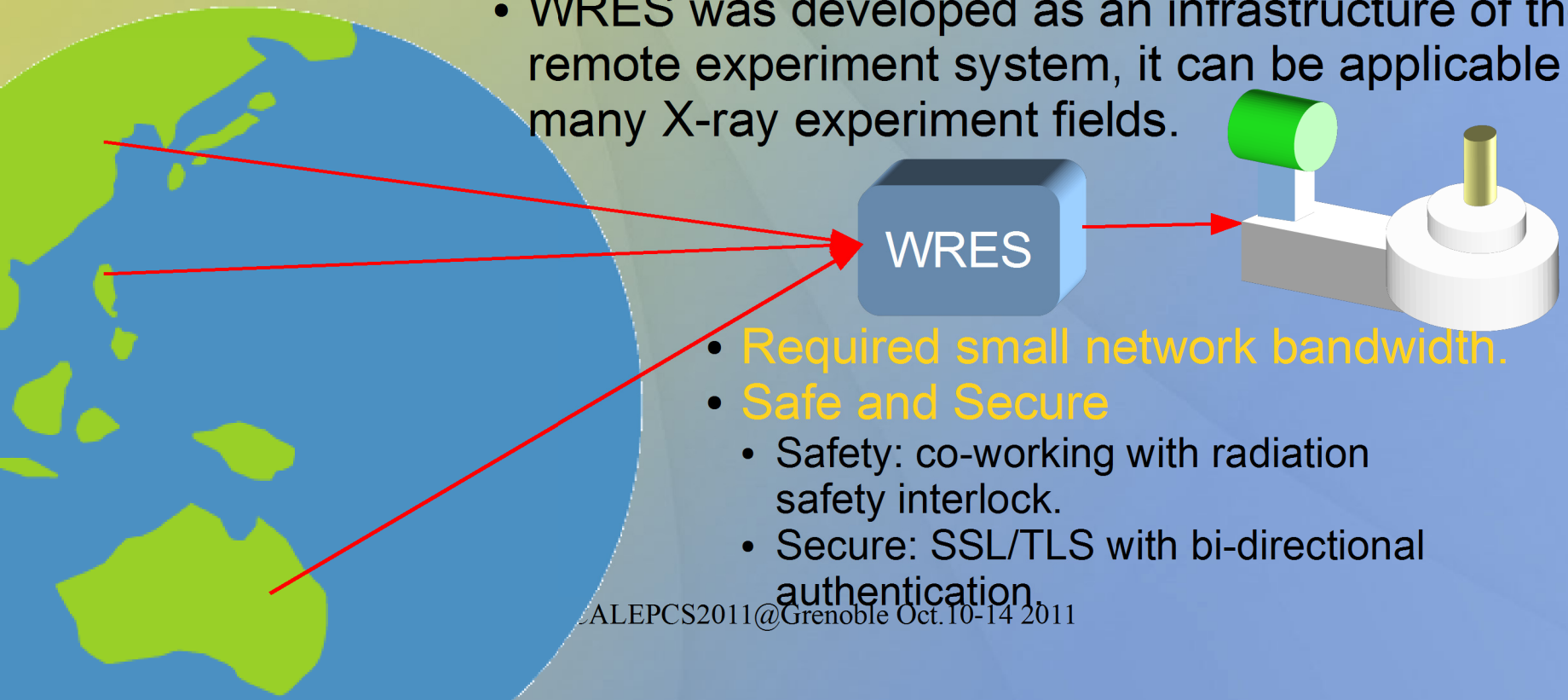
Outline

- 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.

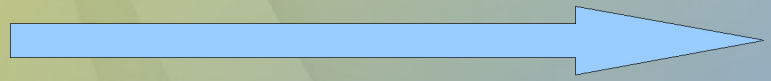


- Required small network bandwidth.
- Safe and Secure
  - Safety: co-working with radiation safety interlock.
  - Secure: SSL/TLS with bi-directional authentication.

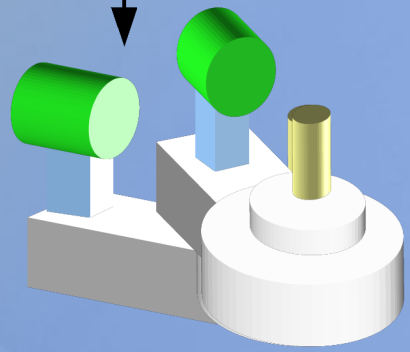
Message Exchanging

"put/detector_arm/60degree"

Remote User



Station Control PC



Experimental Station

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

Remote Experiment Flow

Remote user

SPring-8

Send the certificate to the user.

- Generate user's certificate
- Including Beam time ID

Send samples to SPring-8

Mount the samples

Verify the certificate

Login with the user certificate

Connection Server (WRES component)

Operate experiments via the Internet by sending text based message.

Remote Access Interlock unit

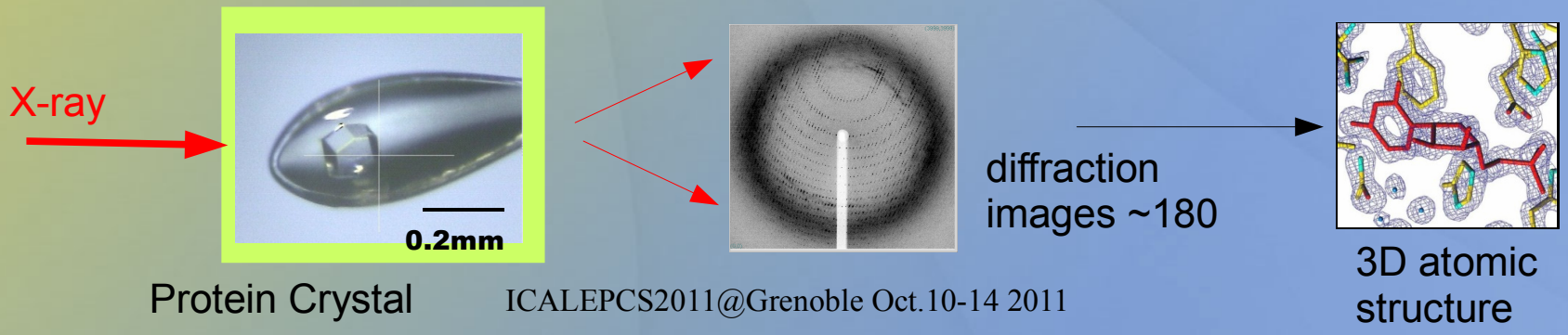
User can watch sample and/or experimental station by video streaming

Radiation shield hutch status

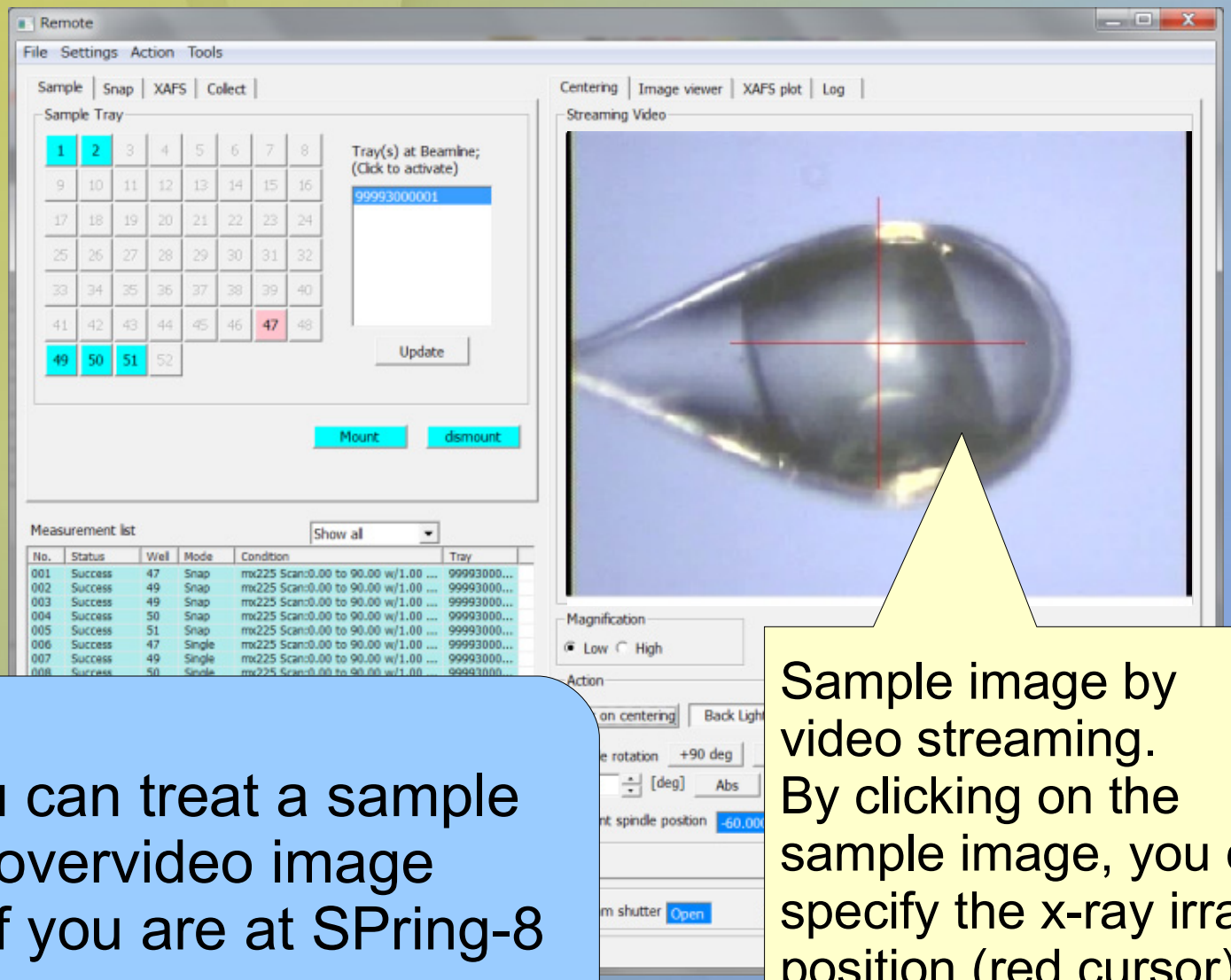
First Application

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.



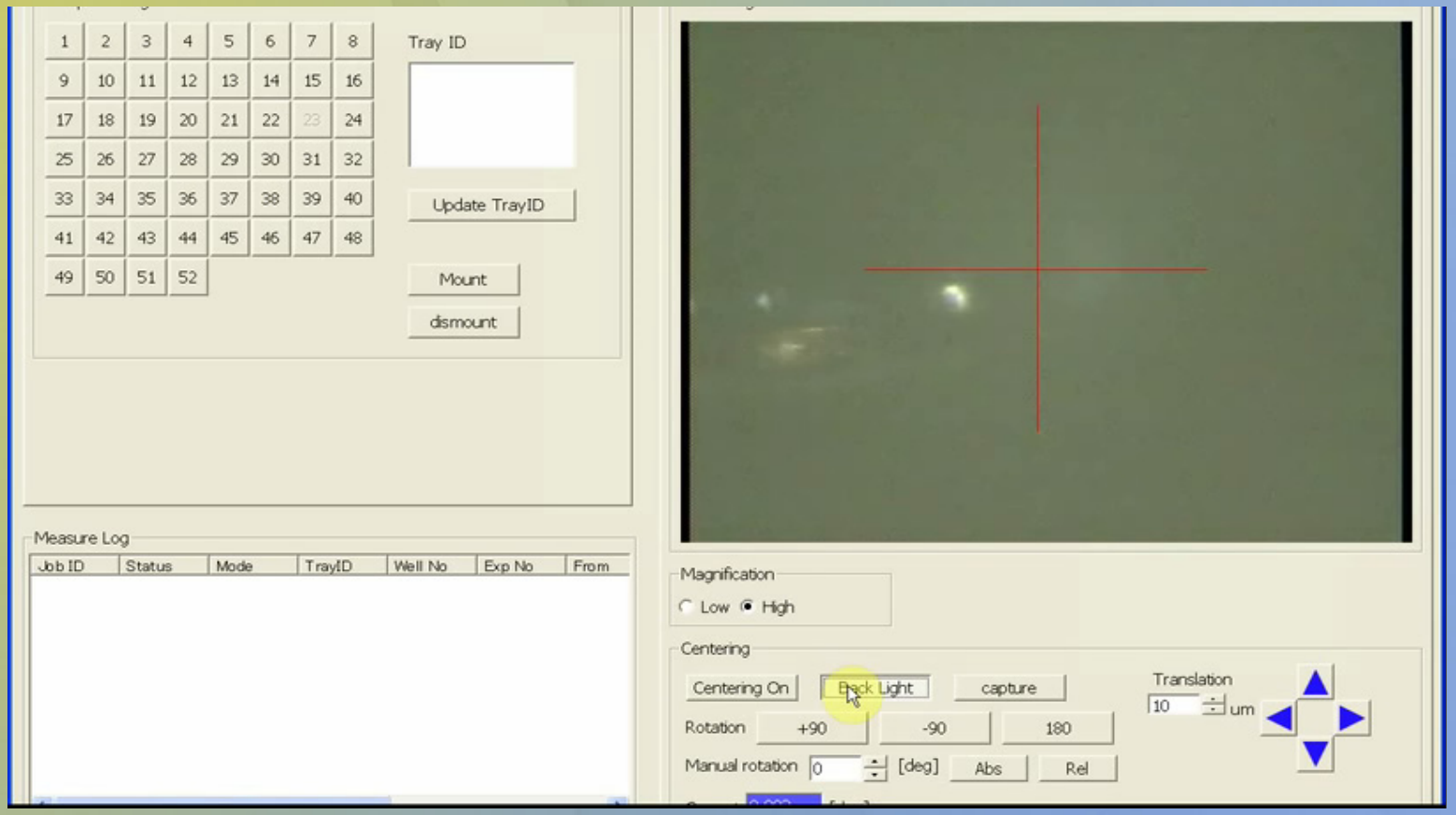
GUI for remote user



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


1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52
Tray ID
Update TrayID
Mount
dismount
Measure Log
Job ID
Status
Mode
TrayID
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Exp No
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First Operation

First Operation F… RIKEN-…
Wako …

SINET3

Science Information NETwork 3
Academic Internet backbone, 40Gbps

SPring-8

480km

RIKEN
Wako

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.