4th Control System Cyber-Security Workshop

More “discipline” is what we need.

Dr. Stefan Lüders (CERN Computer Security Officer)
with contributions from
S. Banerin (UW School of Medicine), E. Bonaccorsi (LHCb),
E. Carrone (SLAC), P. Chochula (ALICE), S. Gysin (ESS),
R. Krempaska (PSI), T. Sugimoto (Spring8), F. Tilaro (CERN)

ICALEPCS, San Francisco (California), October 7th 2013

Why Control System Cyber-Security…

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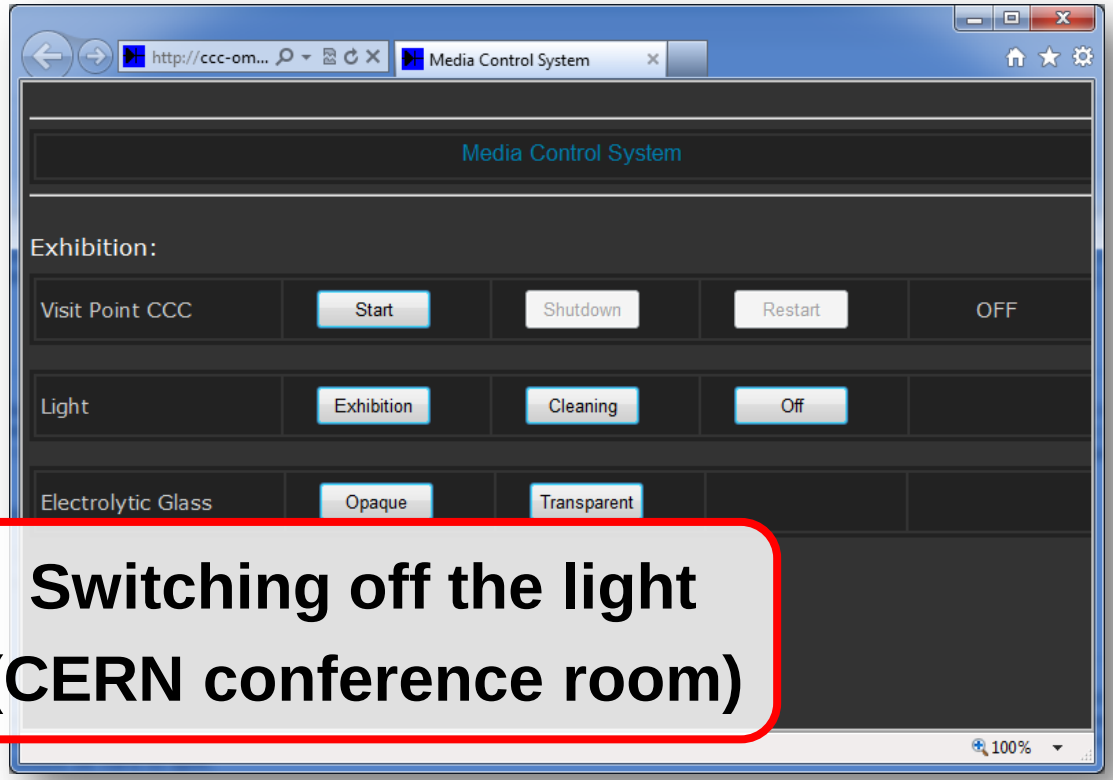

Switching off the light (CERN conference room)

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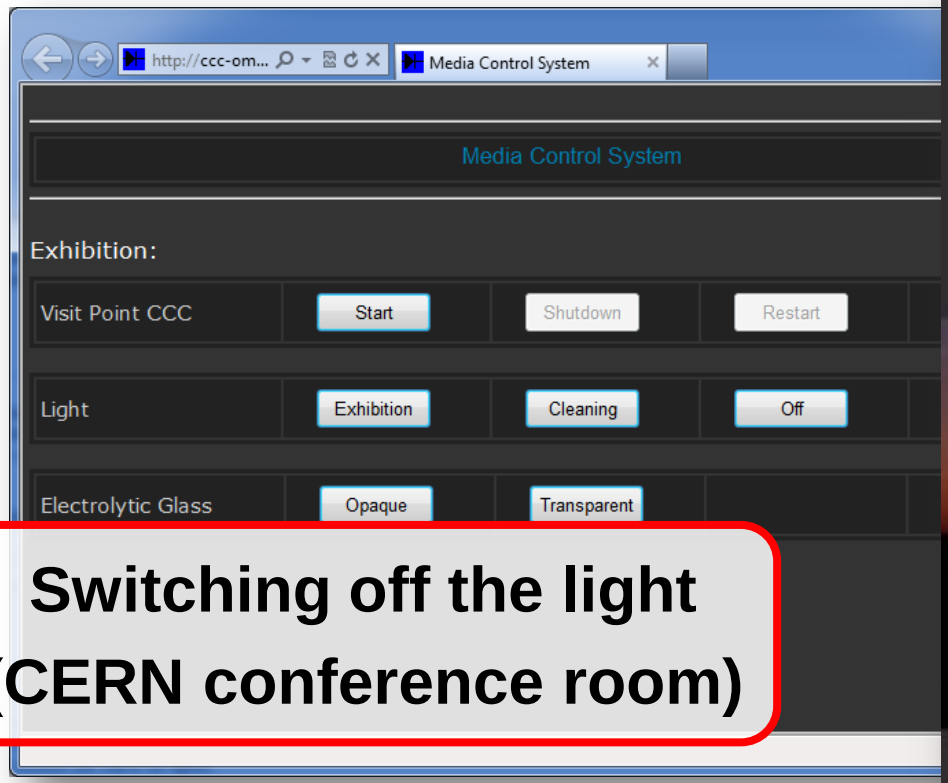

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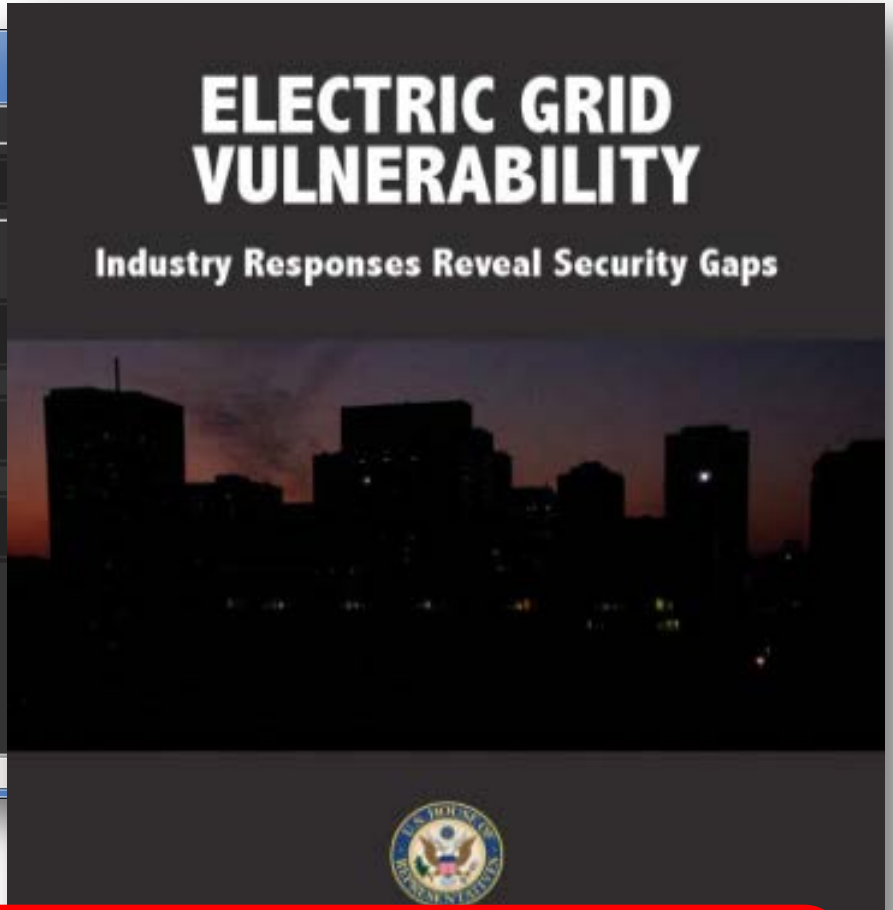

Switching off the light (US cities)

http://democrats.energycommerce.house.gov/sites/default/files/documents/Report-Electric-Grid-Vulnerability-2013-5-21.pdf

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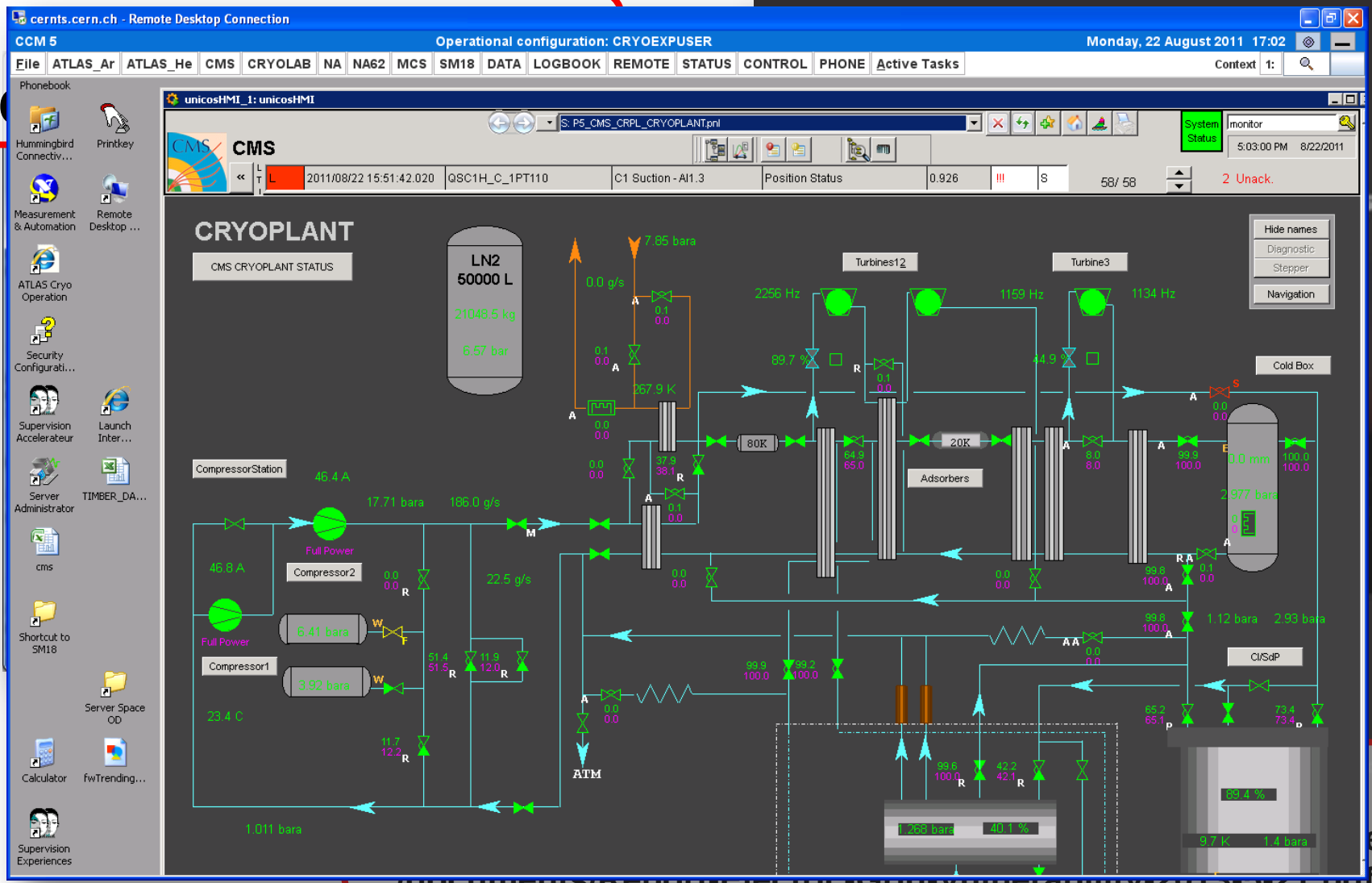

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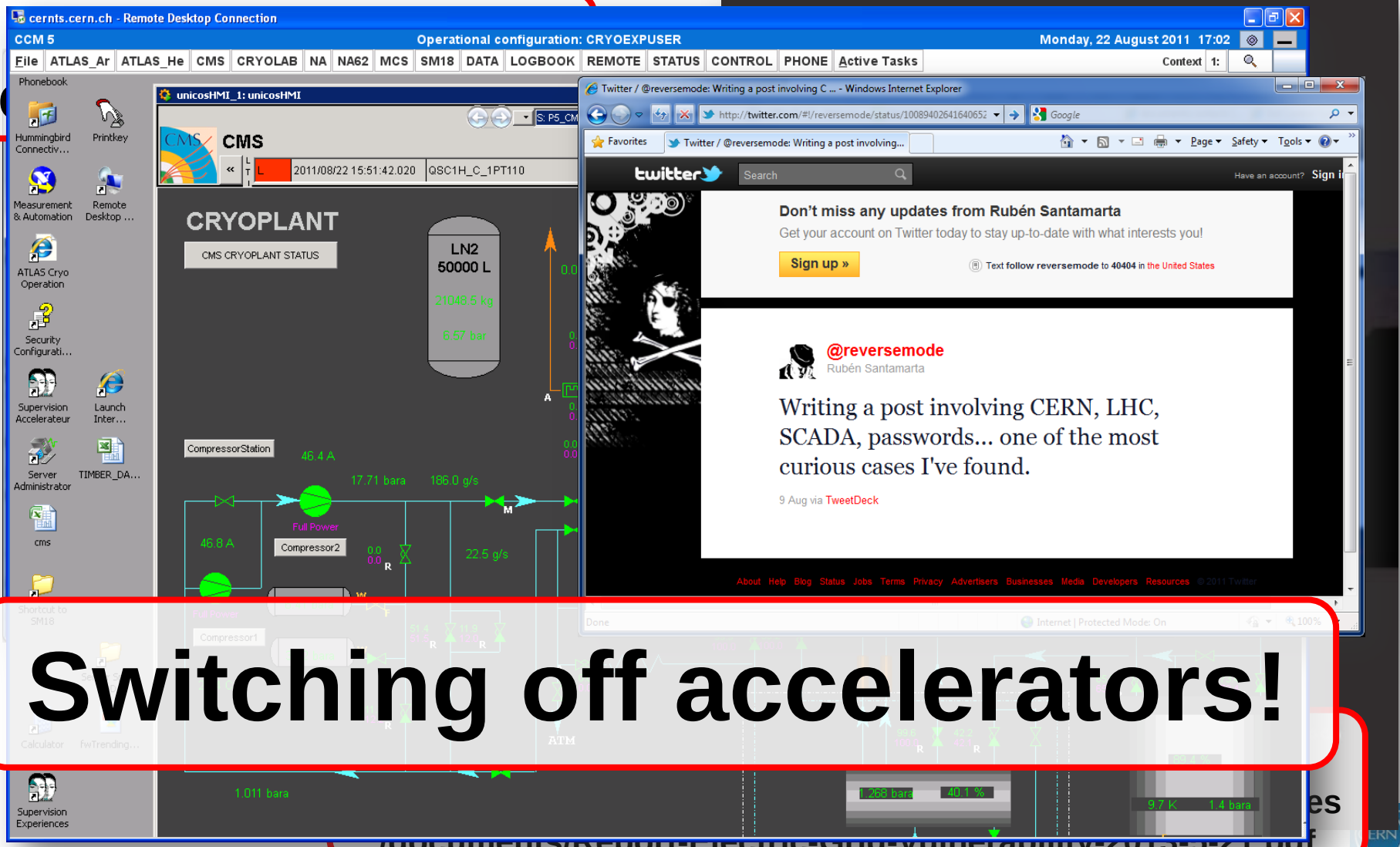

Switching off accelerators!


…needs a disciplined approach!

Acceptance Factors

SLAC

Implementation of Cyber Security is hard:

Not much love from **users** (aka *"I need to access the machine and change the beam parameters on my iphone while I'm waiting for the traffic light to become green"* syndrome).

Not much love from **organizations removed from Engineering**: we do theoretical *[insert any hard science here]* and data analysis, we don't need all this CS controls.

Not much love from **Cost Account Managers**: Whoa! These **Cyber Security** guys are so expensive! This facility has been up from *[insert any time after WWII]* without any problem…!


With some discipline, people managed to have…

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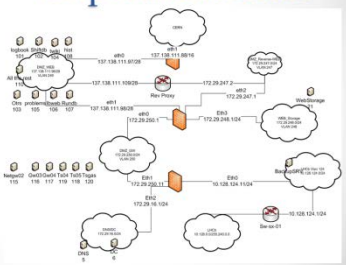
Are we really autonomous?

- Absence of external services could trigger immediate shutdown
  - Pixel detectors might melt in absence of cooling
  - Photon spectrometer might freeze if frontend electronics turns off while cooling is present
- ALICE operation is impossible without DCS feedback
- We are almost autonomous……

Network Security implementation

- General public and log in services/ Terminal services
  - RDP windows remote desktops
  - SSH gateways
  - NX linux remote desktops
  - Web services
- Network segmentation and trusted zones
  - three tiers level of trust based on the sensitivity of the data being processed



Control System Network Security

Controls Network and Rules

- Control system for accelerators is separated in private machine networks.
- Control system for SLS beamlines is in separated sub-nets, behind a firewall. Users from one beamline cannot influence the control system of another beamline.
- Remote access from the PSI office network to machine and beamline networks is possible through a dedicated ssh gateway.
- Login to ssh gateway is restricted for a well defined list of users and allowed only during facilities shutdown and machine shifts. The „on-call" service Controls members can get the access on request from the control room. The shift leader operator in the Control room can close the remote network access at any time.

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Enrico Bonaccorsi –4th Control System Cyber-Security Workshop(CS)2/HEP ICALEPCS – San Francisco 12

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R. Krempaska, October, 2013

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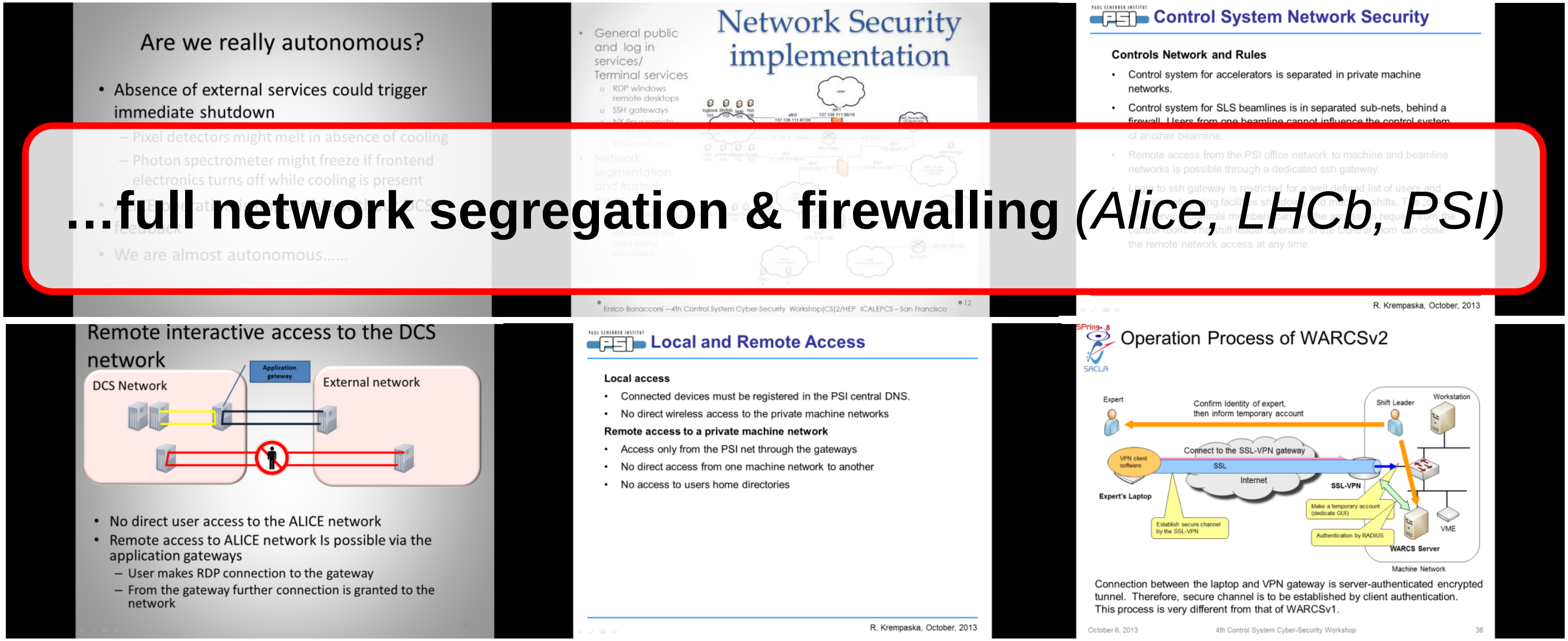

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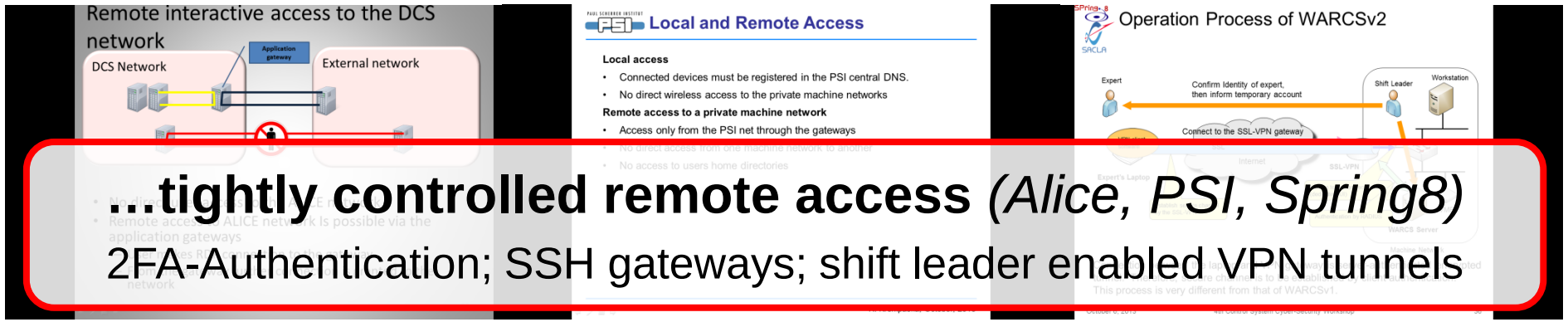

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2FA-Authentication; SSH gateways; shift leader enabled VPN tunnels

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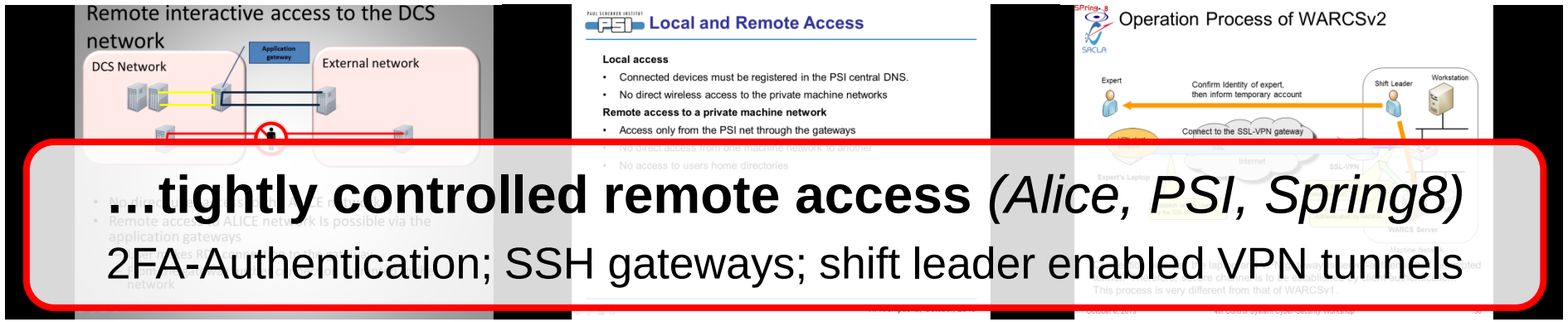

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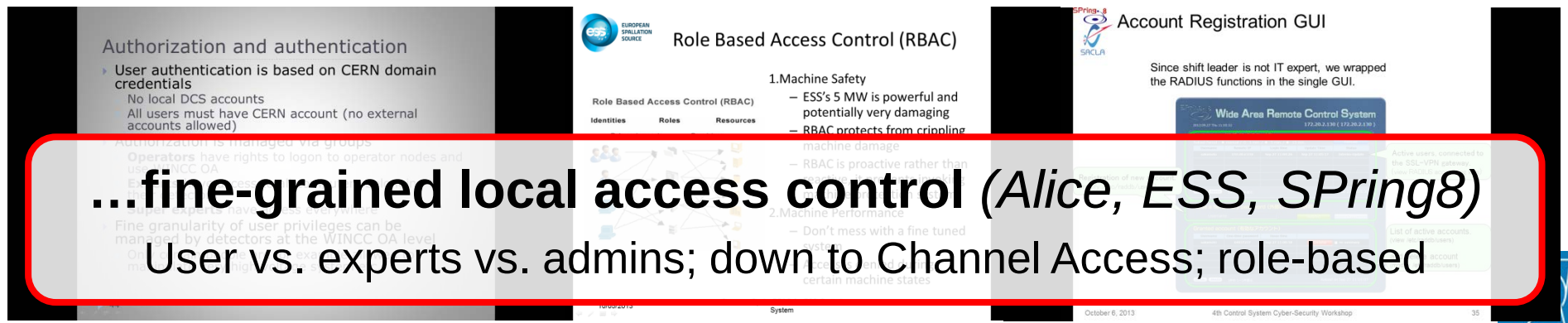

…fine-grained local access control *(Alice, ESS, SPring8)*

User vs. experts vs. admins; down to Channel Access; role-based

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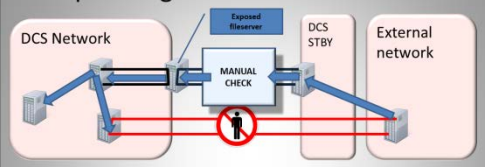
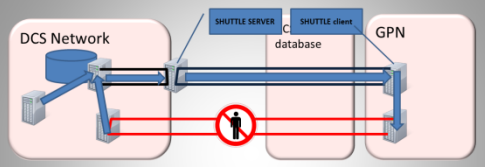
Uploading files to DCS network



- No direct user access to DCS fileservers
- Files are uploaded on request
- No teleport

Exposing DCS database to OFFLINE



- Database replication latency would delay processing
  - Trusted OFFLINE client requests data
  - SHUTTLE server retrieves data from database and sends it to OFFLINE
    - Protection against excessive requests

Data Security

- Shared filesystem
  - served by a cluster of five nodes on redundant hardware
  - High Availability granted by Cluster of NFS/SMB servers that export the filesystem to the entire experiment
  - Data protection:
    - Short term based on different storage raid set using RSYNC for immediate user access (file deleted by mistake by the user, etc)
    - Long Term based on tape using CASTOR for… ever? ☺
    - Backup sent to CASTOR and stored on type
- Servers and Control PCs
  - High availability granted by RAID 1
    - SW RAID used when HW raid is not available
  - Daily Backup based on Tivoli (Thanks to IT dep.)

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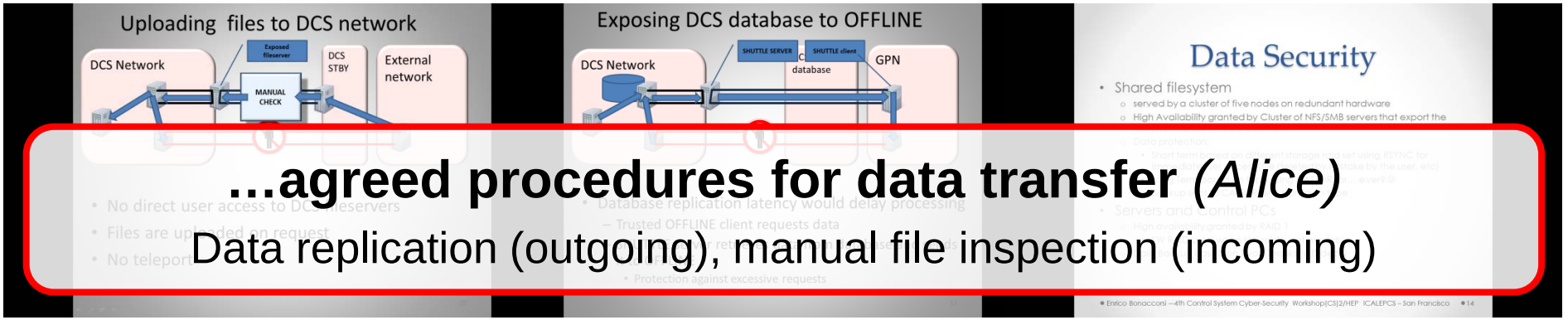

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Data replication (outgoing), manual file inspection (incoming)


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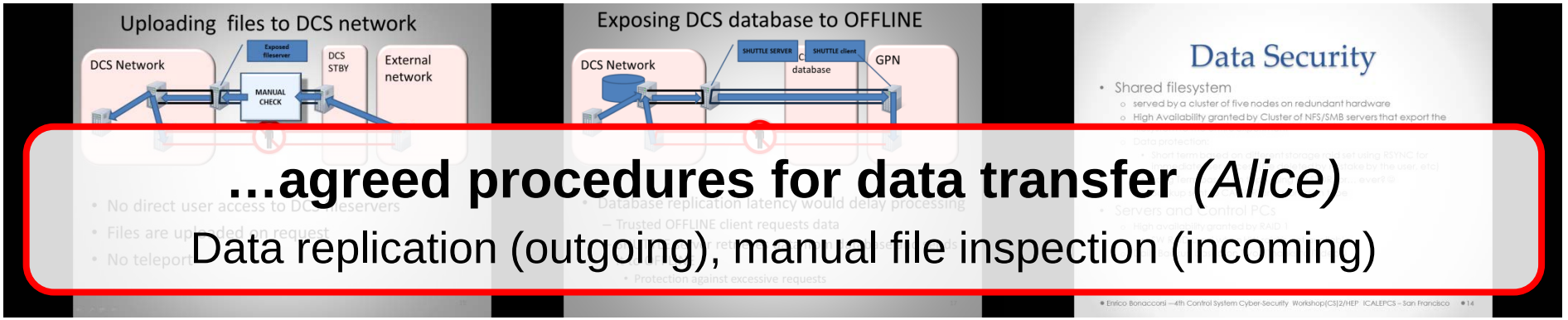

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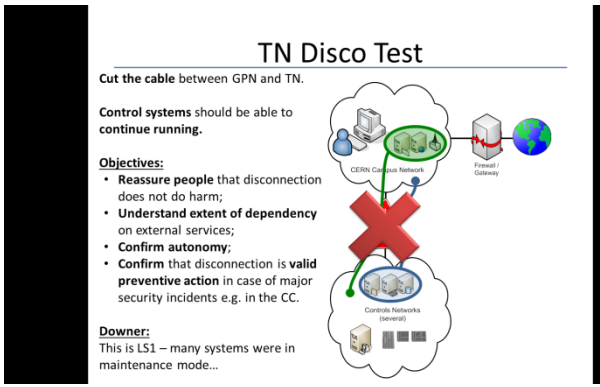

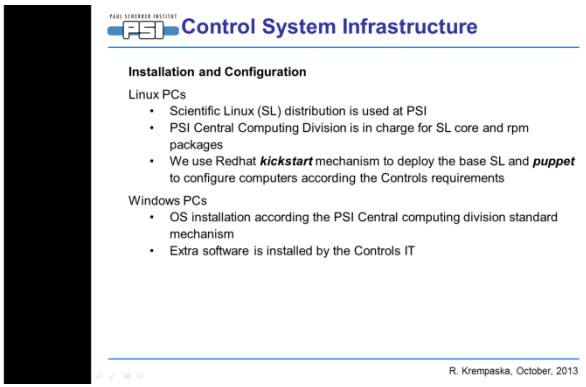

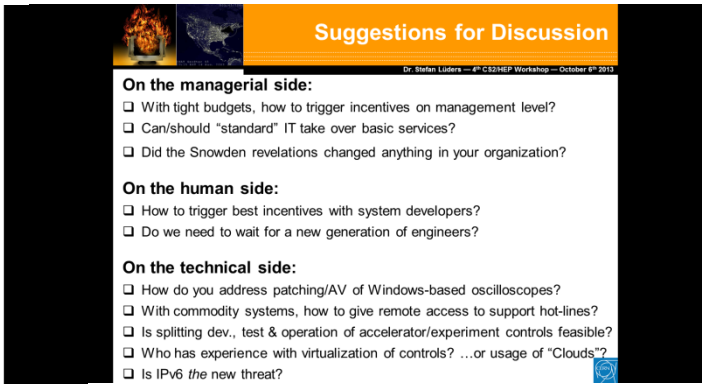


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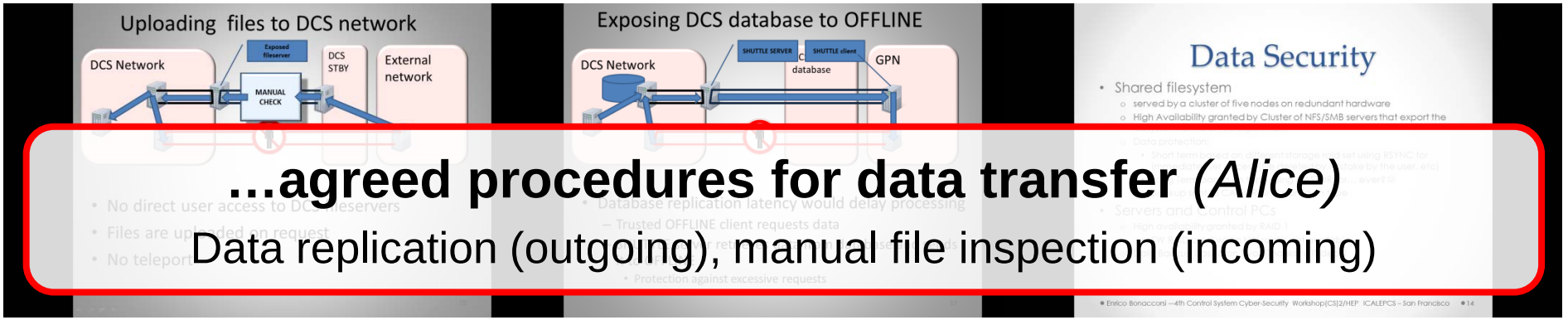

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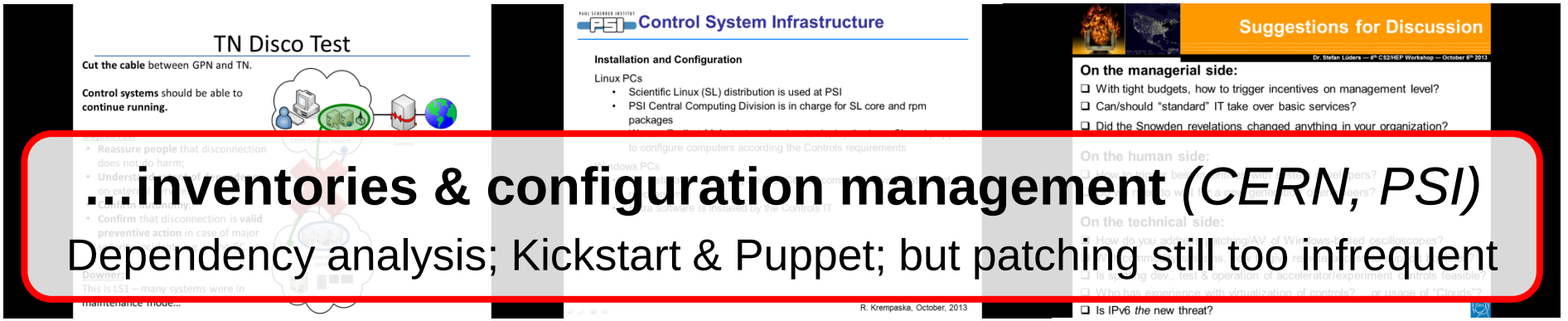

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Dependency analysis; Kickstart & Puppet; but patching still too infrequent

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…standards & regulations compliance *(CERN, SLAC, UW)*

IEC61850 robustness;800-53(IT) vs. 800-82(ICS); HIPPAA/FERPA/FDA


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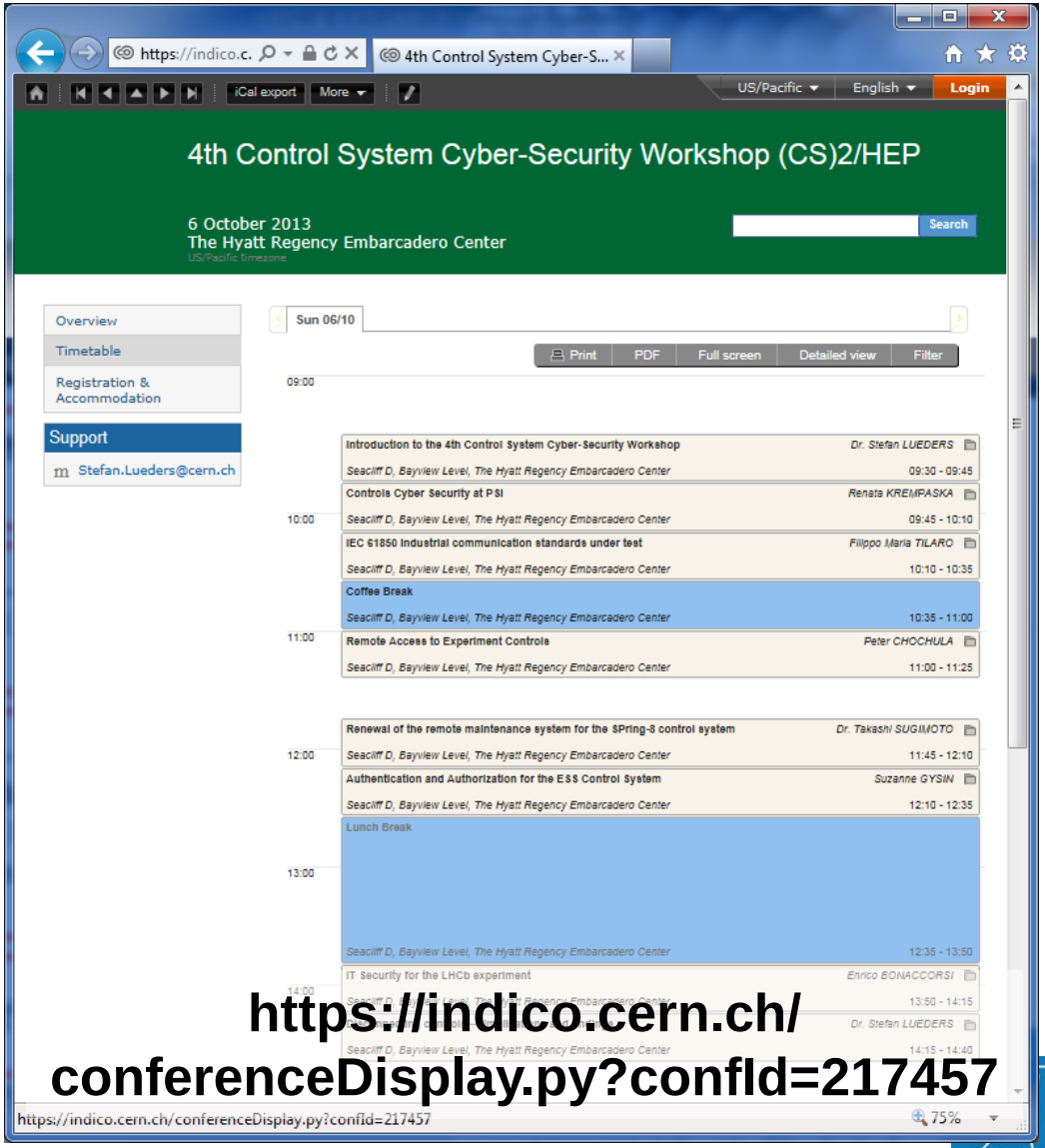

https://indico.cern.ch/conferenceDisplay.py?confId=217457


Thank you very much!!!

In particular to
~35 participants &
esp. to all presenters…

…as well as to the Organizing Committee!!!