
# Technology Education Networks A Possible Way to Augment the Laboratory Experience

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# Outline

- Introduction
- Laboratories in Engineering Education
- Remote laboratories
- LASTED.net
- TEN - Technoloy Education Networks

# Introduction

***"Scientists study the world as it is;***

***engineers create the world that has never been."***

Theodore von Kármán

**Individual creation can be a particular engineering solution, design, machine, product, etc.**

**Collective creation of the engineering profession is to manipulate materials, energy, and information, thereby providing benefit for mankind.**

# CAETS Findings and Recommendations (briefly)

1. To prepare the students to deal with technological development and to contribute to the conditions of social welfare

2. globalization and pervasive use of Information Technology.

3. a bridge between science and technology - the need for integrative thinking

4. interaction of engineers in industry and academia;

5. up-to-date research and innovation in educational practices development of a culture of inquiry, invention and discovery.

## CAETS Findings and Recommendations (briefly)

6. the resources, time and rewards to faculty for engaging in innovative engineering education practices.

7. Life-Long Learning, account for the globalization and sensitivity to national interests and values as well.

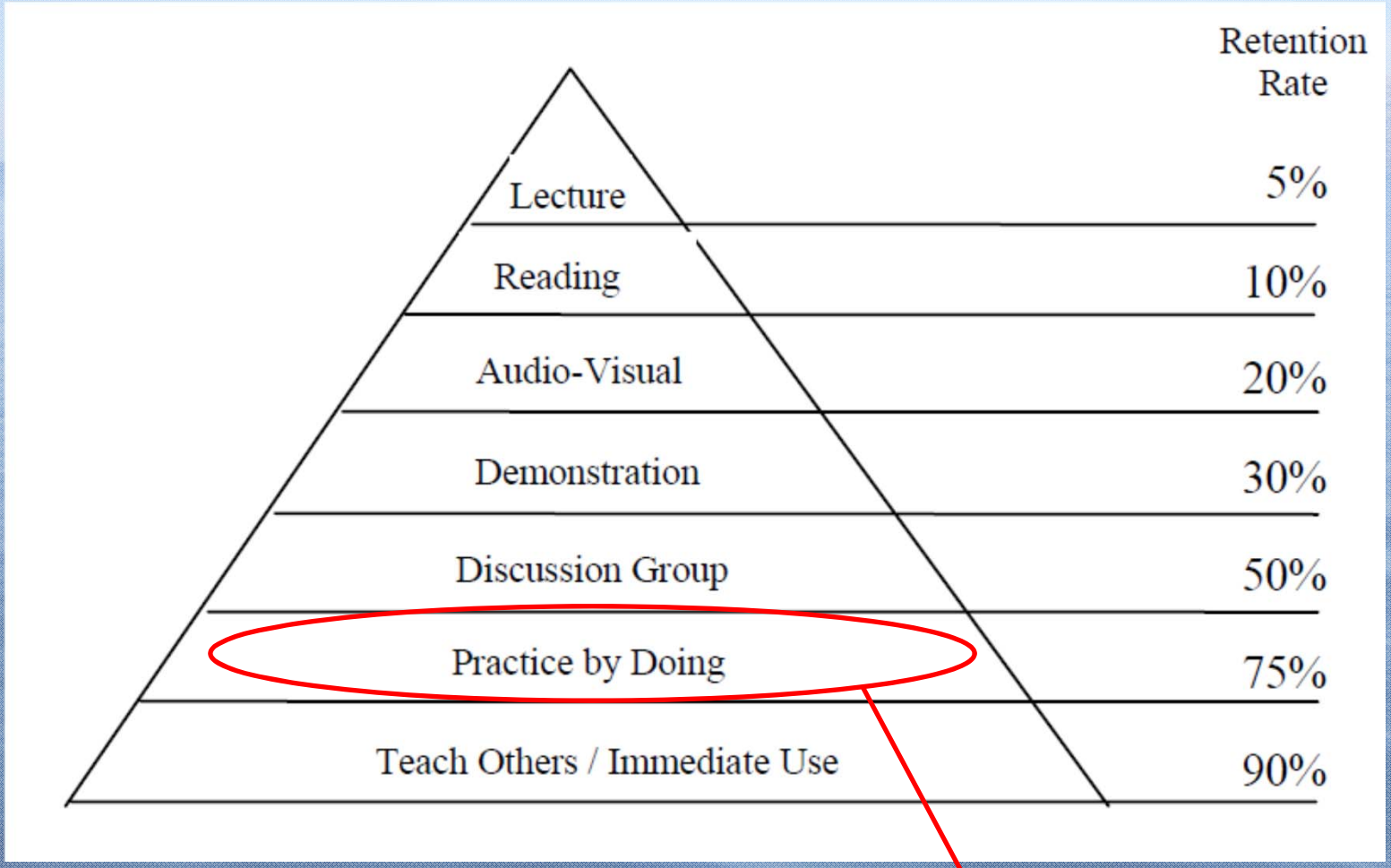
8. Accreditation based on the outcomes realized by graduates to allow maximum flexibility and mobility .

9. to promote the need for technological and scientific advice in policymaking.

# The role of laboratory experience

**Indispensible for the engineering education is the experience gained in laboratories.**

# Lab experience in engineering education




From: Surgenor and Firth, The Role of the Laboratory in Design Engineering Education

**Laboratory experience**

# Laboratories in Engineering Education

**The role of labs:**

- **to test conceptual knowledge**
- **to work collaboratively**
- **to interact with equipment**
- **to learn by trial and error**
- **to perform analysis on student´s own experimental data**
- **to encourage creativity**
- **to establishing experience in measuring, quantifying and evaluating**

## The need for remote laboratories

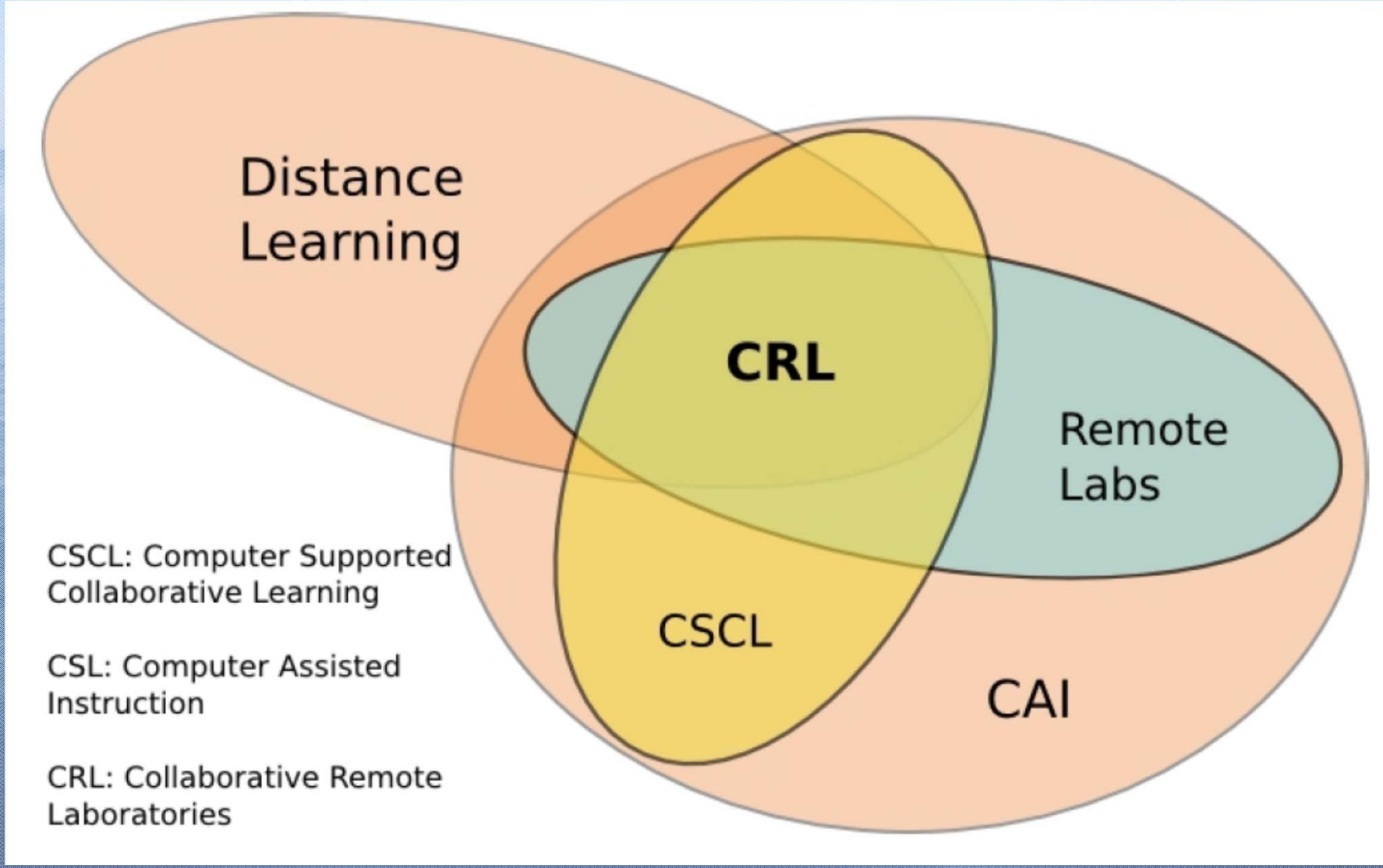
- Rapid development of technologies requires permanent transformation of educational programs.
- Since laboratory experience has always had a central role in engineering programs, permanent modernization of the laboratory facilities is required which represents difficult financial and organizational burden for the universities.
- The reduction of the manual labor and simultaneous increase of the automation and computer-controlled production should also be reflected in the educational process.

# Laboratories in Engineering Education

**The role of REMOTE labs:**

- **a tele-presence in the laboratory**
- **to perform experiments on real equipment**
- **to collaborate**
- **to learn by trial and error**
- **to perform analysis on real experimental data**
- **a flexibility in choosing time and place for performing experiments**
- **are relatively new**
- **development concept but their numbers are exponentially increasing due to recent technological progress and availability of tools for their design**
- **the best alternative to working in a real laboratory**

# Implementation - concept




From: Gravier, Fayolle, Bayard, Ates and Lardon, State of the Art About Remote Laboratories Paradigms - Foundations of Ongoing Mutations

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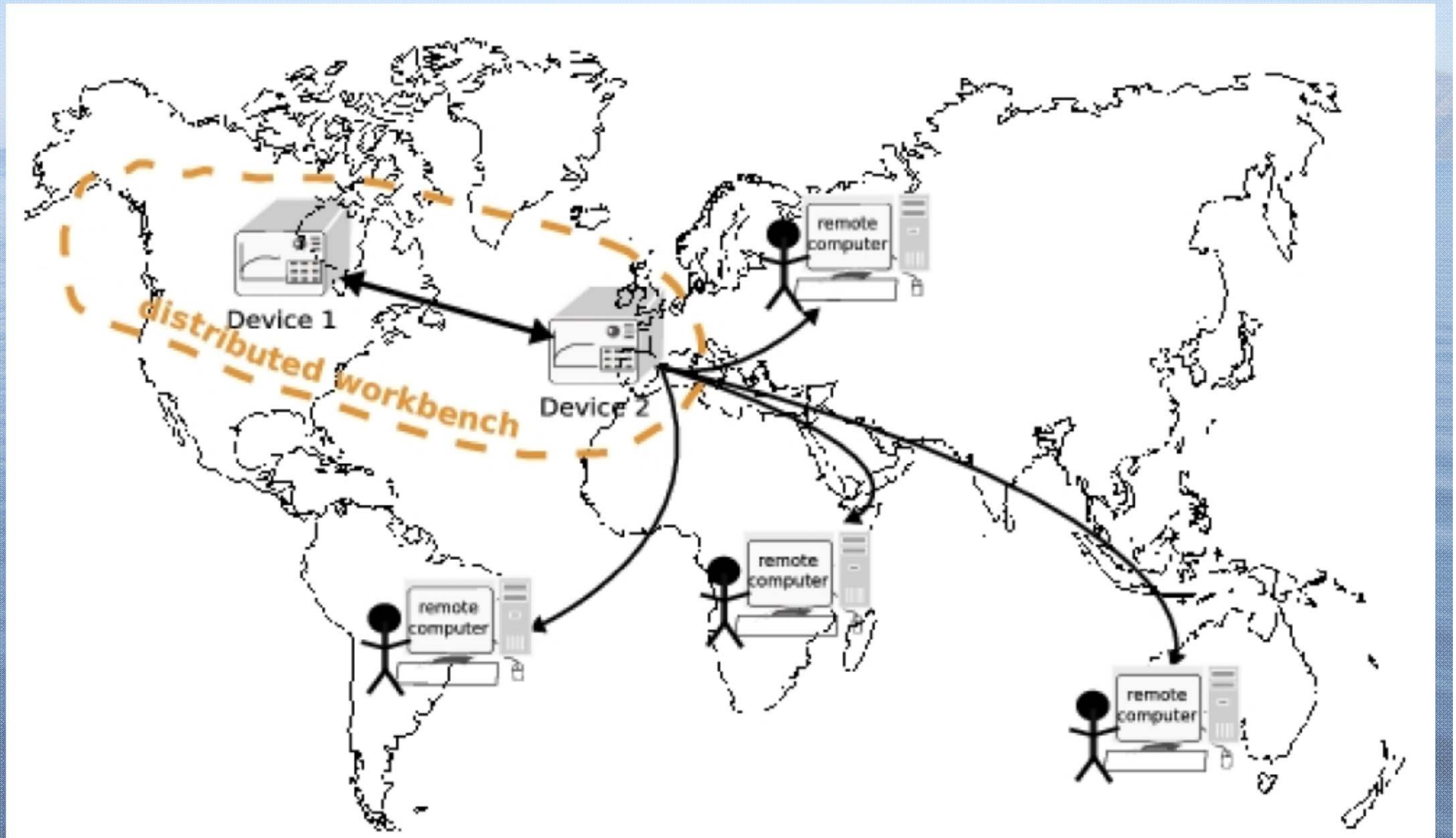


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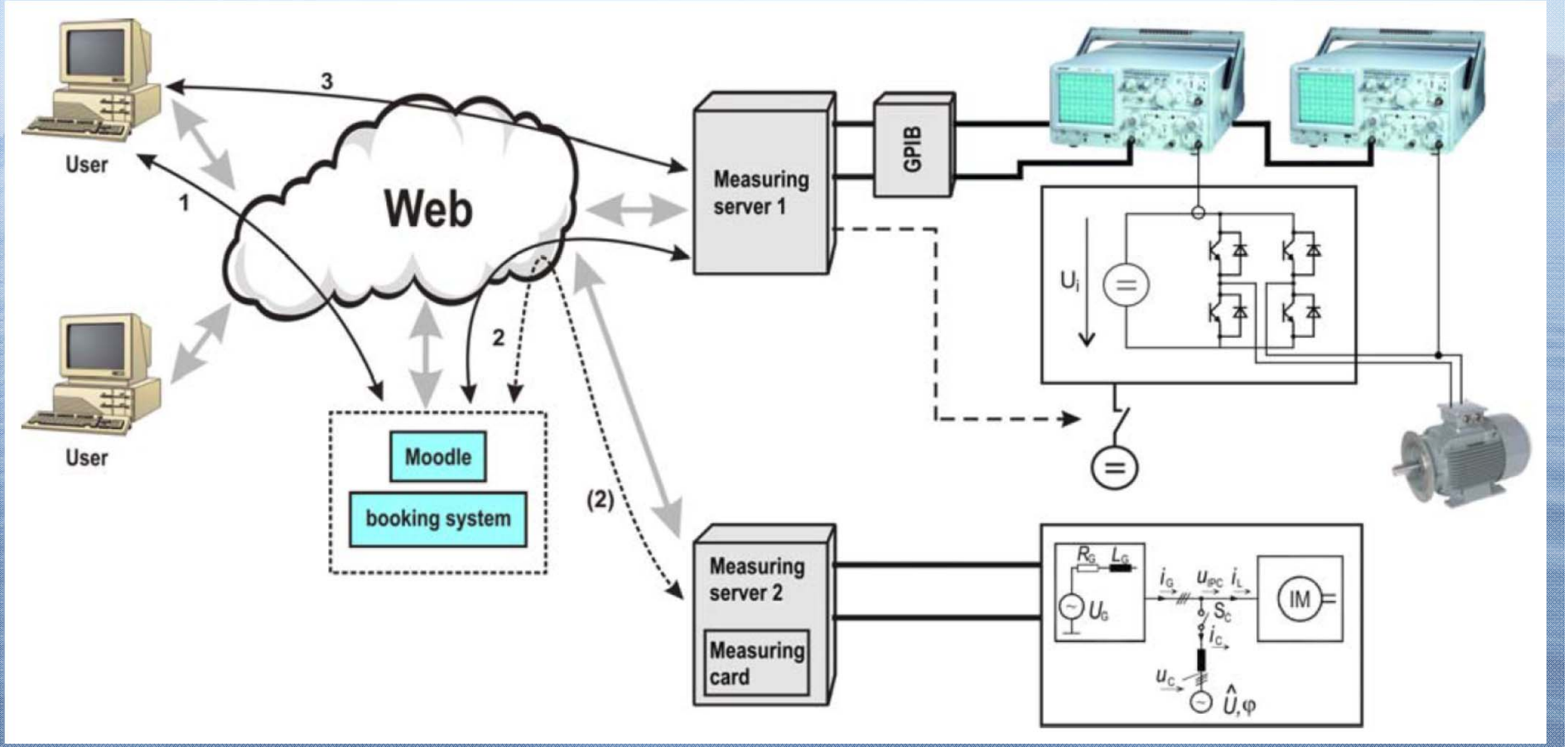



From: Bauer and Fedák, Distance Laboratories in Electrical Engineering

# Some of the existing remote labs

- Labicom
- Netlab, Uni. of South Australia
- Labshare
- Labster
- MIT iCampus iLabs
- Remote Labs, Uni. of Tech. Sydney
- Remotely controlled lab, Palacký Uni. of Olomouc
- iLabs, Uni. of Queensland
- iSES internet School Experiment System
- LiLa project - Library of Labs
- UWA Telerobot
- WebLab, Uni. of Deusto
- iLough-Lab, Uni. of Loughborough
- Free Open Online Labs
- Remote Operation of Engineering Labs – Uni. of Ten. at Chattanooga
- Remote Internet Lab, GymKT, Klatovy
- VISIR (Virtual Instrument Systems In Reality) - Blekinge Inst. of Tech.
- Remote Experimentation Lab, Uni. Federal de Santa Catarina - Brasil
- University Network of Interactive Labs, Spanish Open Uni.
- Moodle EJSApp, Extensions Set for Virtual and Remote Laboratories
- R-DSP Lab, Uni. of Patras
- Remotely Controlled Laboratory, Uni. of Tech. Kaiserslautern

# As an example:

- **LASTED.NET**
- European Leonardo da Vinci project
- 2004-2007

# LASerTechnologyEDucation.NET

The field of laser technology is characterised by rapid advances

a constant challenge for the educational institutions

Laser laboratories usually contain rather expensive equipment , they are dispersed throughout of Europe.

their number throughout Europe is limited and only a few of the students happen to be in the vicinity of one.

high costs and the wide range of sources prevents any laboratory to offer truly comprehensive training.

the access is not easy for students and

The problem of laser safety

# Consortium of LASTED.net

## ☆ Consortium

There are 12 partners involved in the LASTED.net project and the partners are presented in the following order.

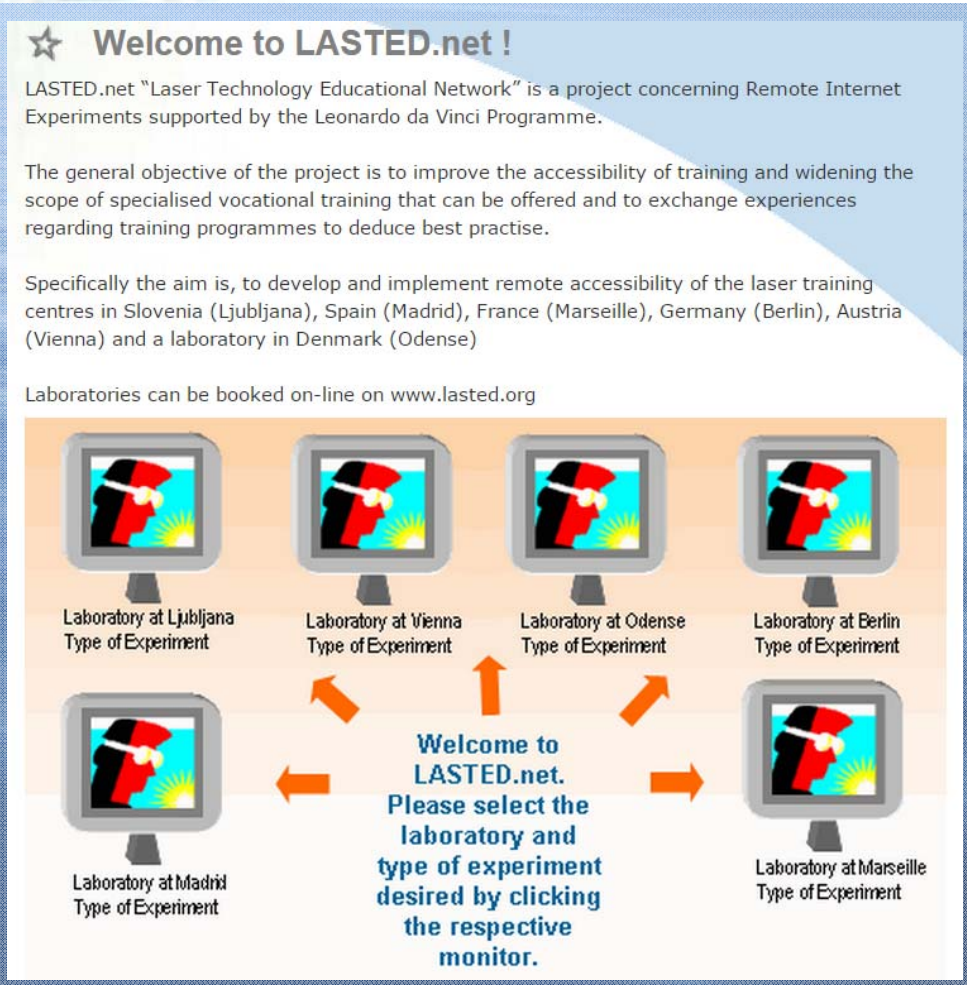
- University of Ljubljana, Department of Optodynamics and Laser Applications, Ljubljana , Slovenia
- ARGELAS, The Austrian Laser Association, Vienna, Austria
- Vienna University of Technology, Institute for Forming and High Power Laser Technology, Vienna, Austria
- Frederick Institute of Technology, Nicosia, Cyprus
- Technical University of Berlin, Optical Institute, Berlin, Germany
- Department of Physics and Chemistry, University of Southern Denmark, Odense, Denmark
- UPM Laser Centre, Polytechnical University of Madrid, Madrid, Spain
- Lasers, Plasmas and Photonic Processing Laboratory, Mediterranean University, Marseille, France
- University of Malta, Department of Metallurgy and Materials Engineering, Msida MSD 06, Malta
- Division of Manufacturing Systems Engineering Lulea University of Technology, Luleå, Sweden
- LPKF Laser & elektronika d.o.o, Kranj, Slovenia
- Abington Consultants, Cambridge, UK

# LASTED.net

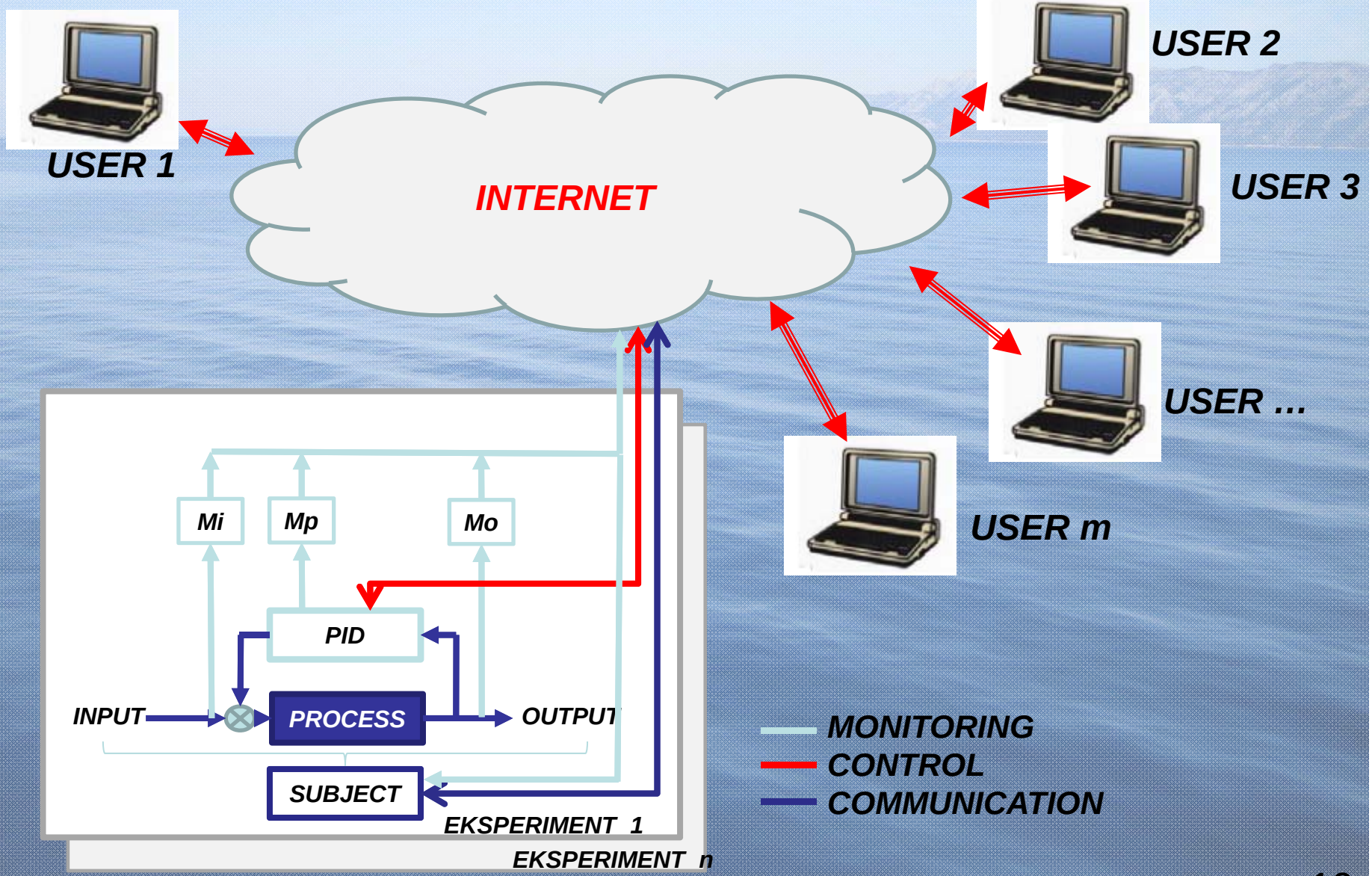
Education and Culture
Leonardo da Vinci

**Laser Technology Educational Network**

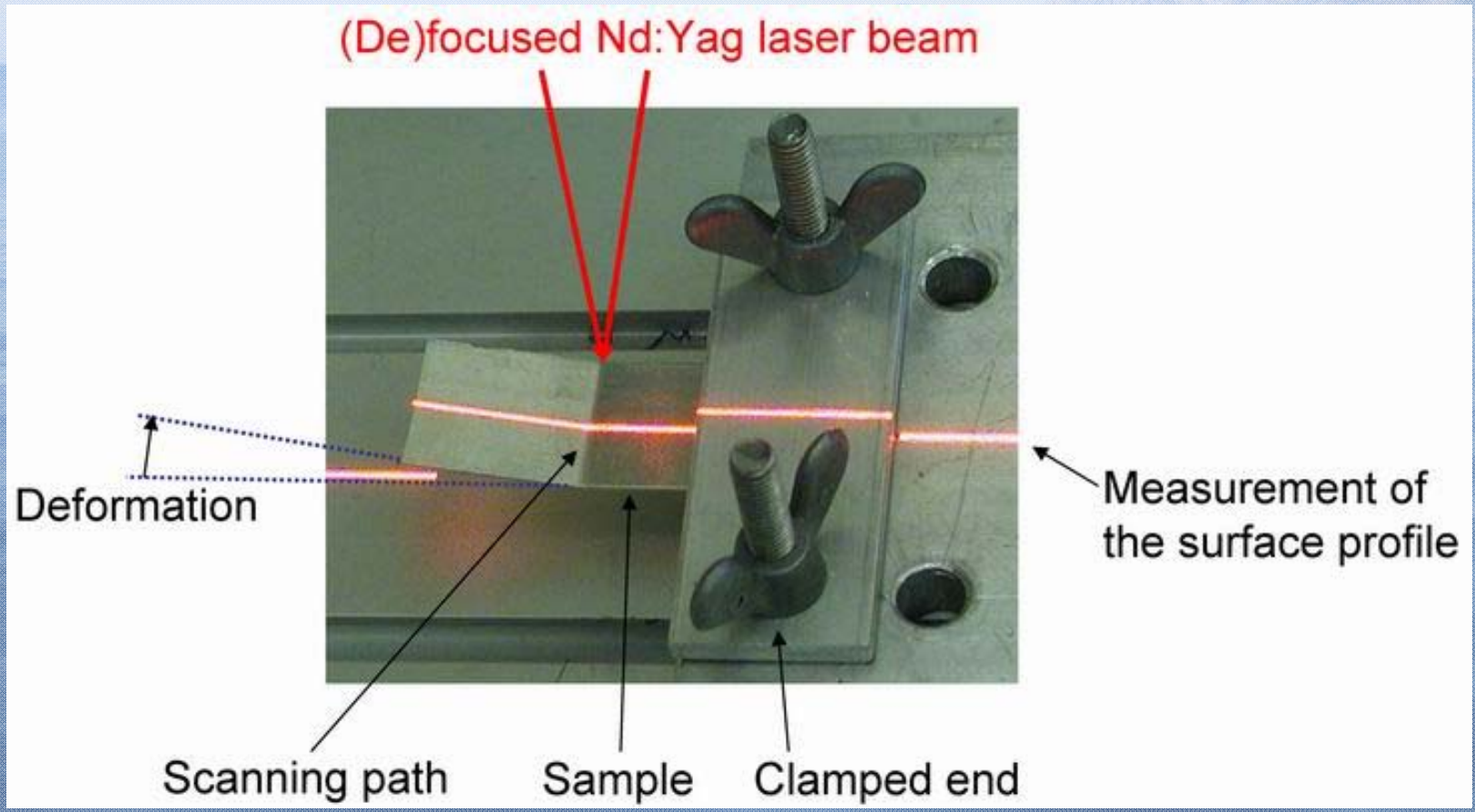
**- a network of a selection of the most reputed educational institutions in laser technology throughout Europe.**



# Implementation (LASTED.net)



# Laser forming – case study



# Remote lab in Lj. – on-line instructions

## LASER FORMING

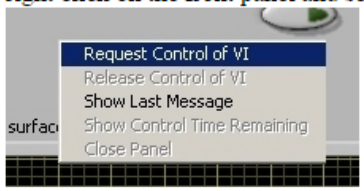
1. How to start experiment
2. Theory
3. Description of the experimental setup
4. User interface

Sample video of laser forming.

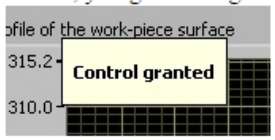
## How to start experiment

First: Proceed to the reservations web site to apply for a time slot
(laboratory staff will prepare experiment .. run Nd:YAG laser, samples, ..)

Than:
1) Ensure that you have installed LabView RunTime engine ver 7.0!
You can download it here or at National instruments .
2) Use Microsoft Internet Explorer version at least 5.0.
3) Visual inspection of the experiment is available by IP camera.
Camera username is: Guest; Password is: guest.
It is recommended to observe camera on a separate monitor.
4) Run the Experiment.
If you don't get control over the experiment,
right click on the front panel and select Request Control of VI

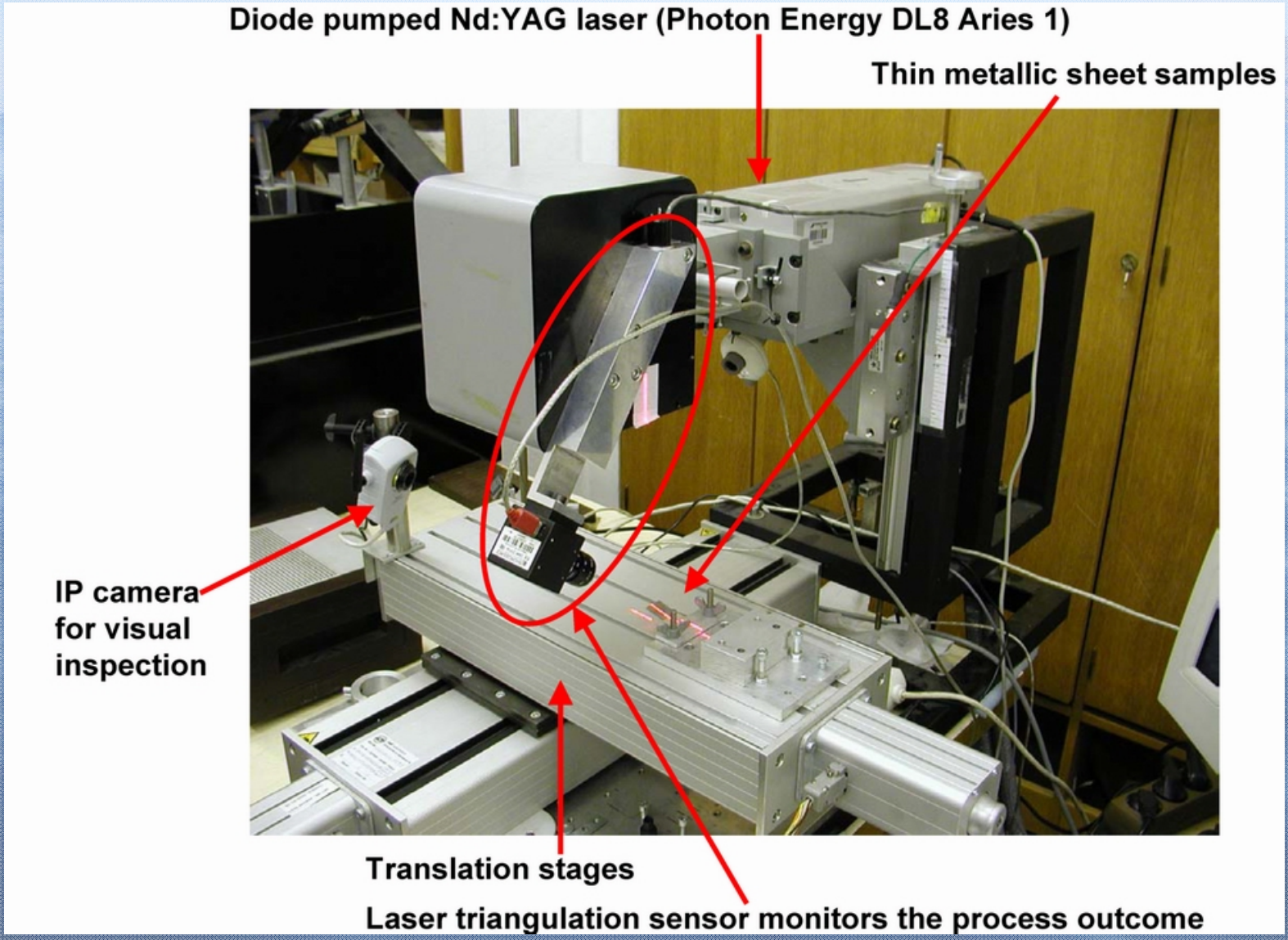



If OK, you get message Control granted.

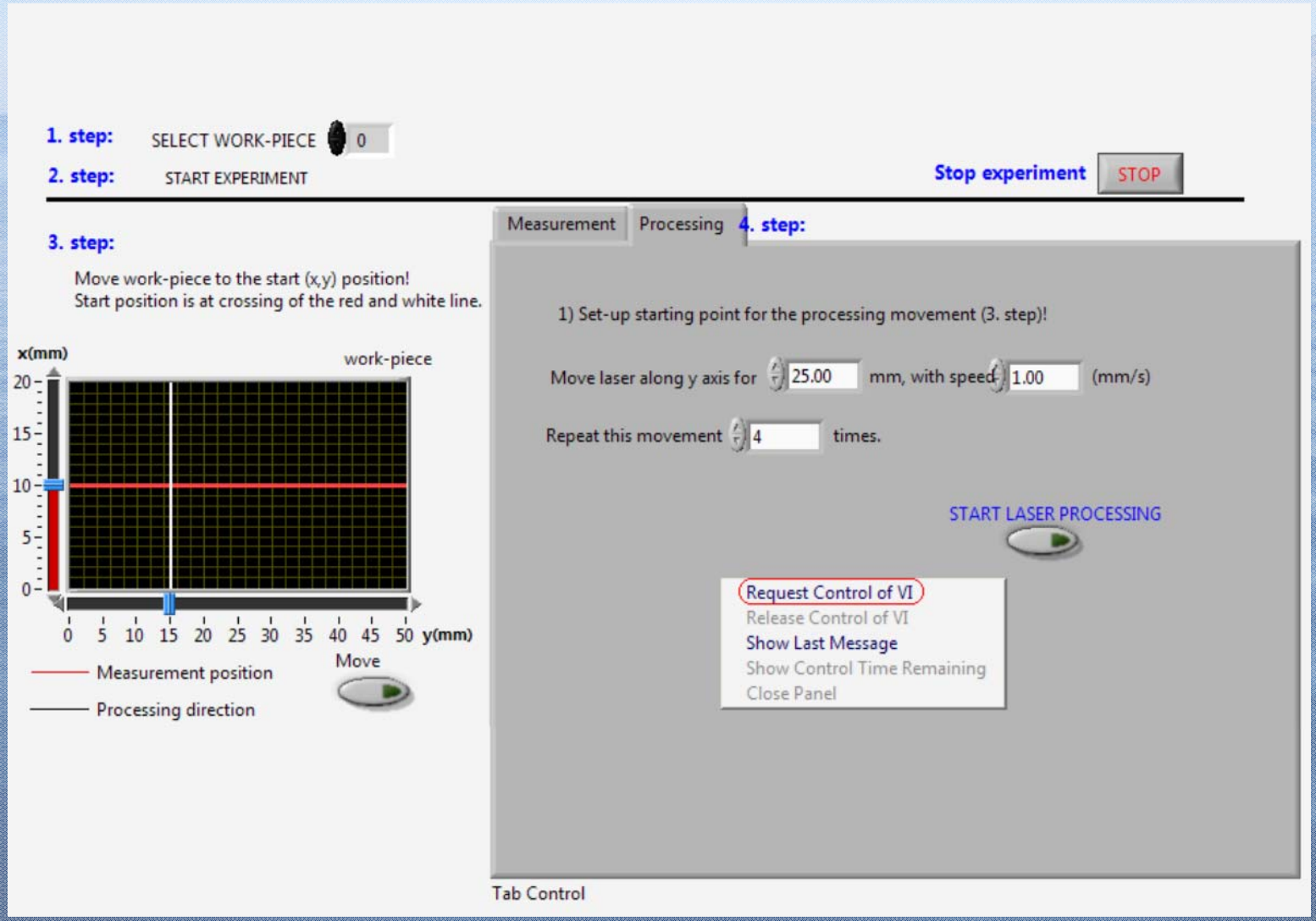



5) During experiment, on-line contact with the laboratory staff is recommended (Skype chat).

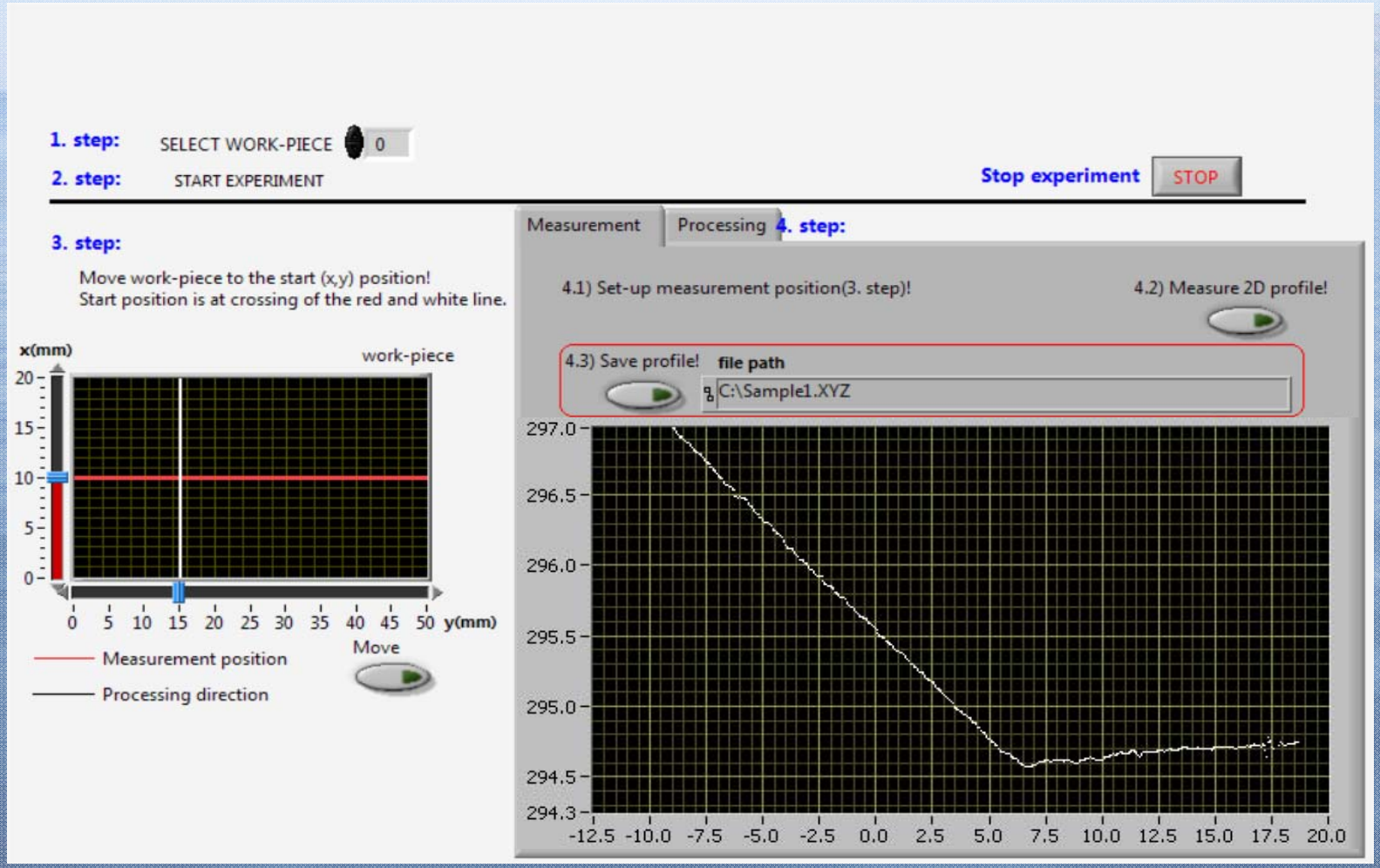
# Laser forming – experimental setup



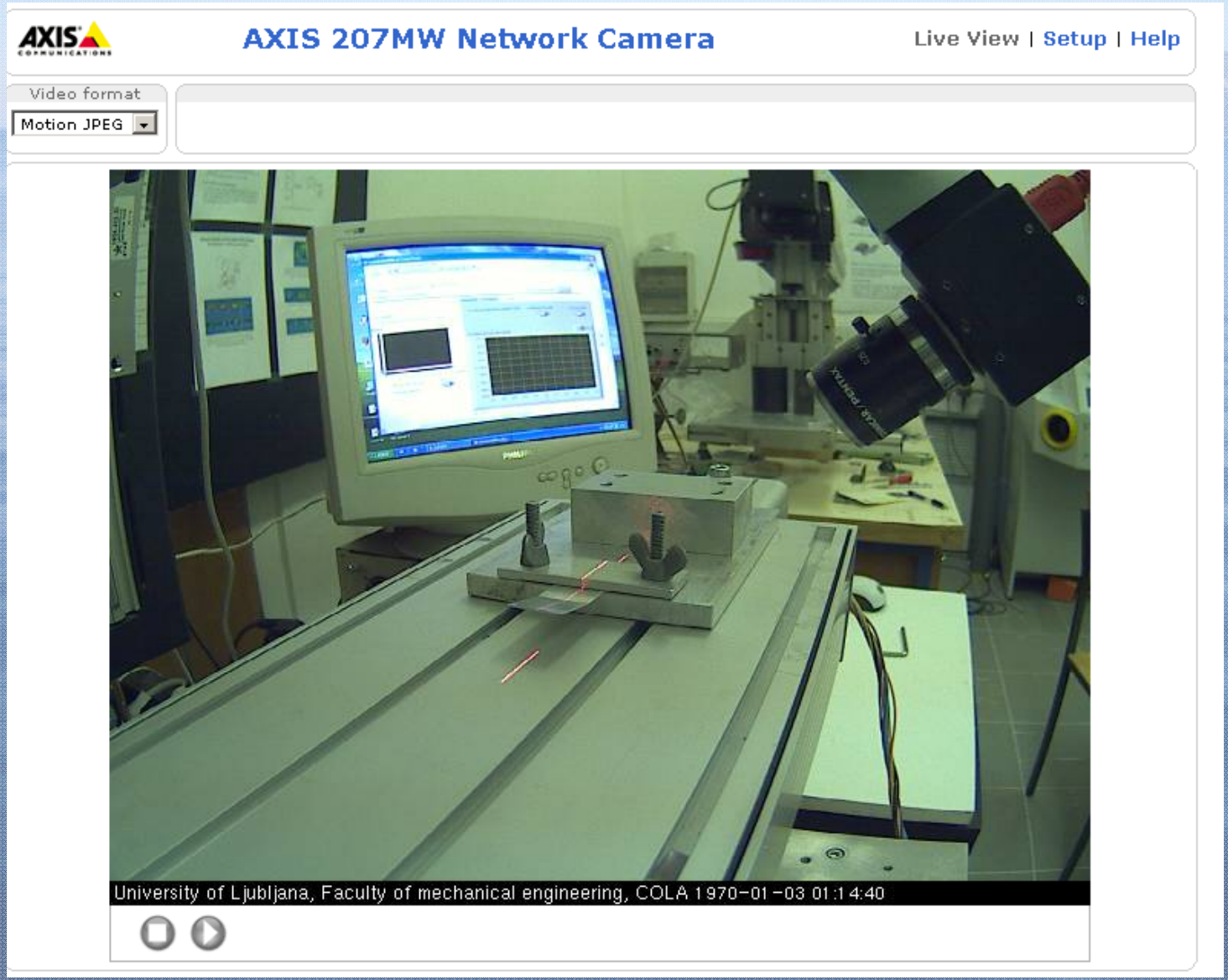
# Laser forming – remote control



# Laser forming – deformation measurement



# Laser forming – visual IP camera



# Possible solution:

## Technology EducationNetwork

- Cooperation among several engineering universities
- Each participating member provides a part of infrastructure for remote laboratory exercises
- Students of all participating universities are given access to dislocated experimental facilities
- lab work can be performed over-the-web from their primary institution.
- Synergy effect : inclusion of industrial partners

# TEN - Technoloy Education Networks

- Interconnect educational institutions and industry
- Reflect the increasing automation and computer-controlled production
- Reduce the financial and organizational burden
- Improve quality of labs through the ability to pool development resources when labs are shared across multiple institutions
- Remove time-related and physical constraints on lab access
- Are safe to operate, prevent potential injuries (hazardous environmets)
- give students an opportunity to become acquainted with the contemporary industry-driven aimed education

# Thank you for your attention!