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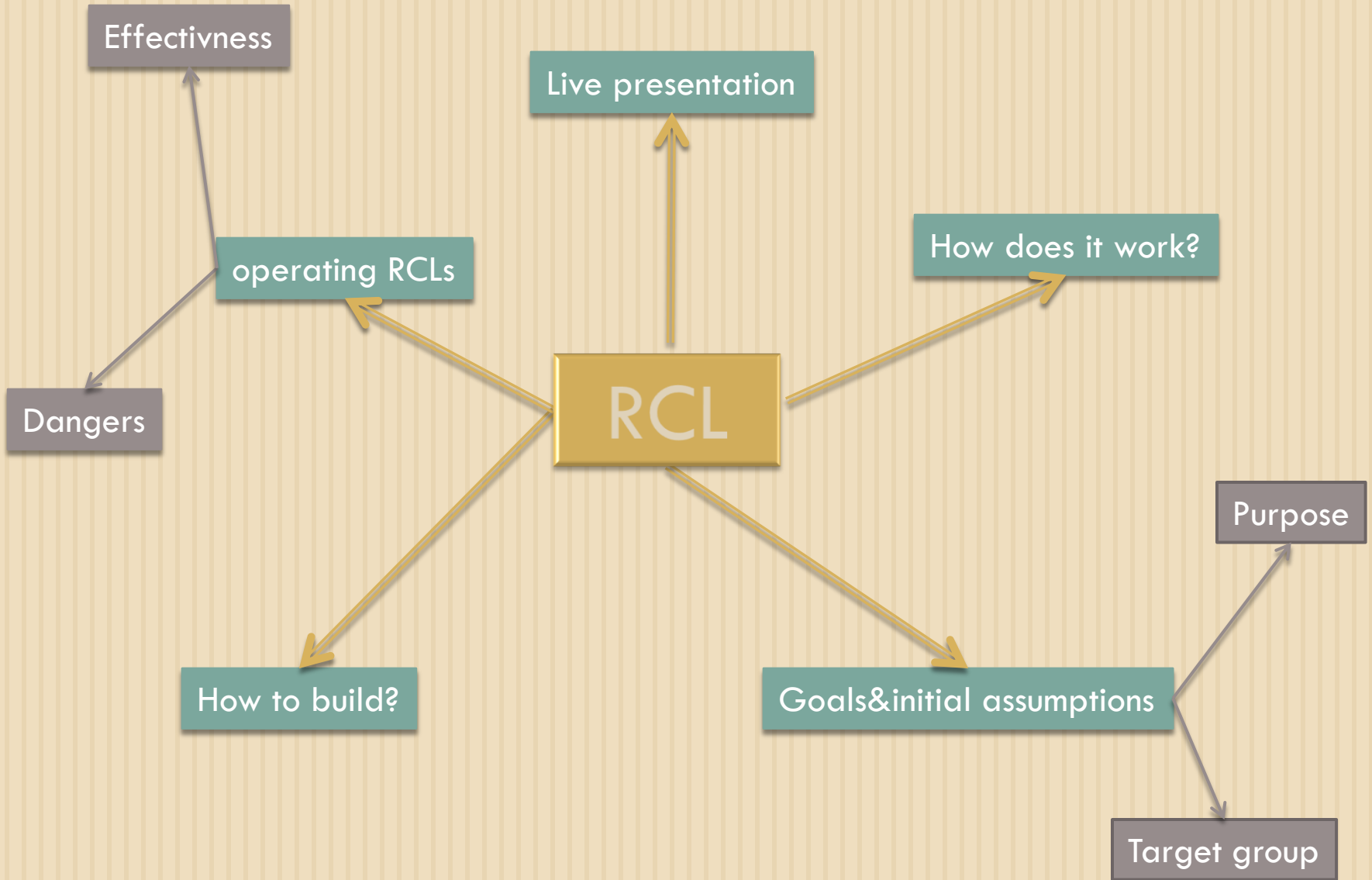


EuroPhysicsFun

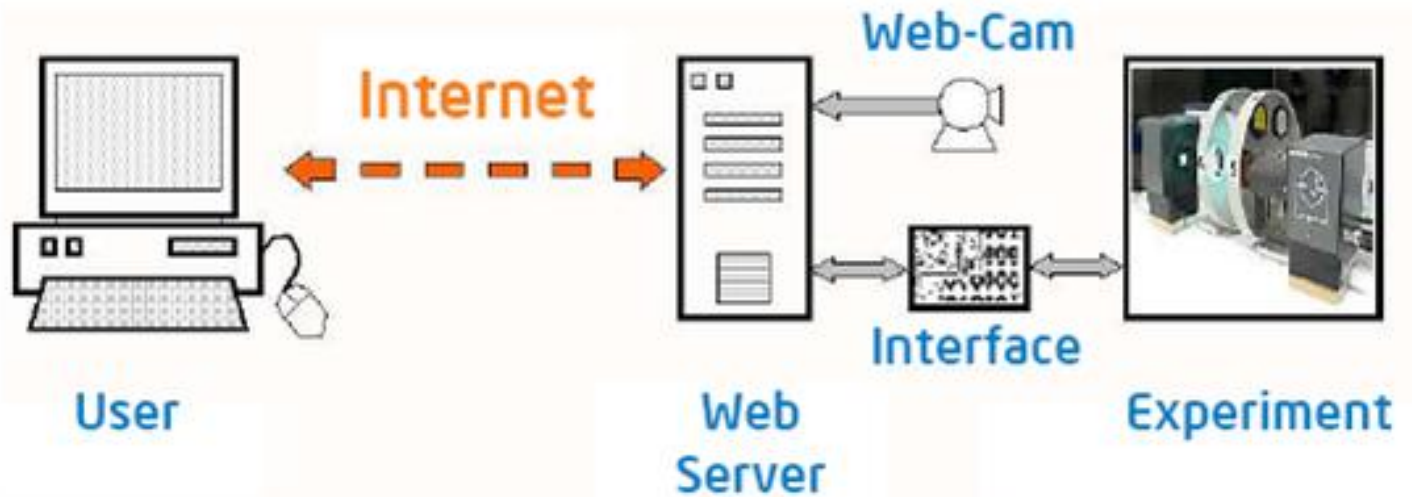
REMOTE CONTROLLED LABORATORIES

Show Physics 2008
Tartu, 11th April 2008

Principle of working & goals

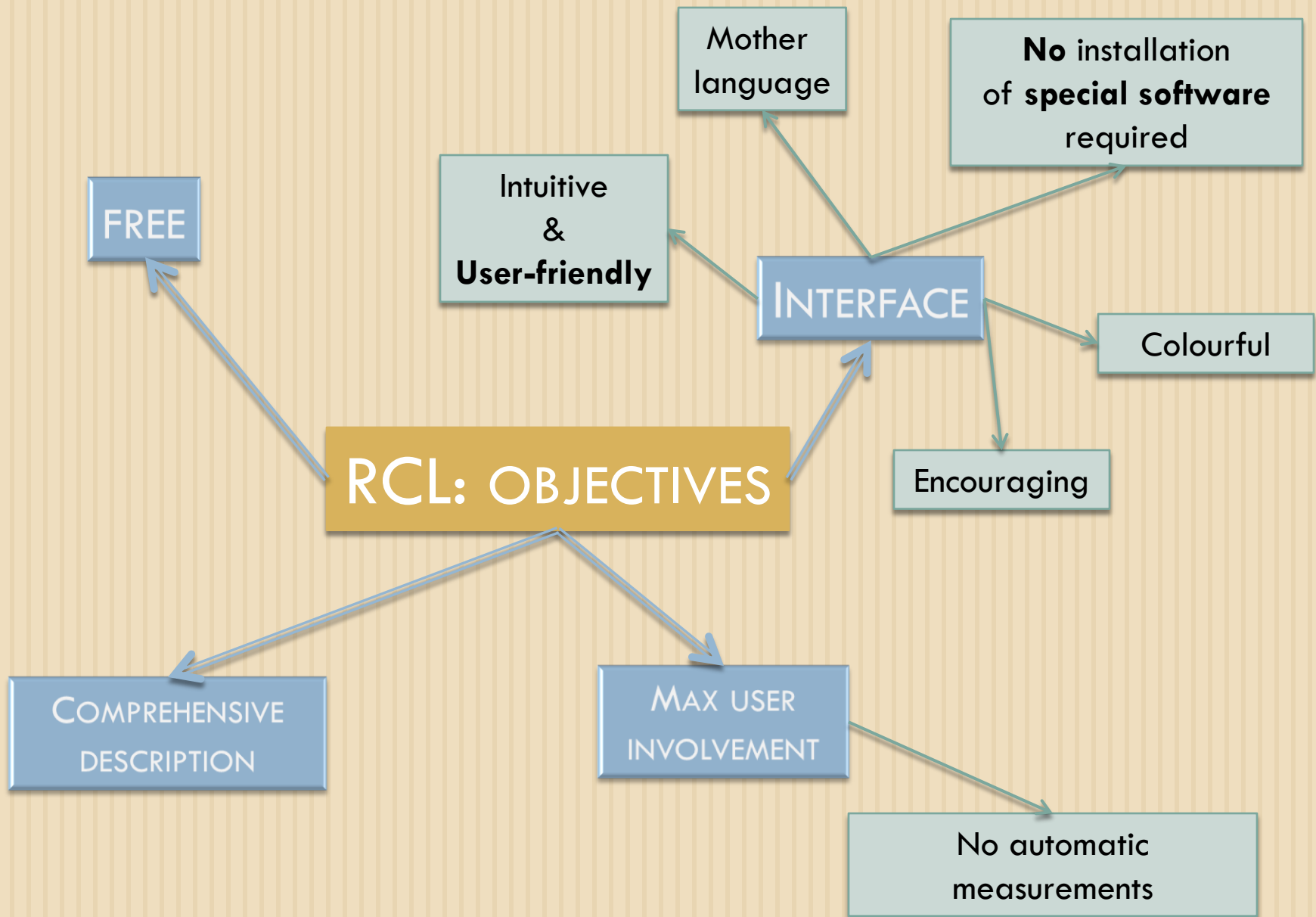


Principle of an RCL



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Basic idea – simple and ingenious!



Build your own RCL

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How?

Modifying existing

Who?

Student

detailed **instructions** on how to **build** a microcontroller based **interface** including:

- **circuit** diagrams and wiring,
- necessary **electronic devices** (e.g. resistors) and mounting,
- how to **program the microcontroller**,
- how to **install** the web **server**,
- detailed procedure to **set up a simple RCL** as sample,
- comments on **extension devices** (relays, motors, switches etc.).

software

Instruction?

Article:

http://rcl.physik.uni-kl.de/docs/Tutorial_RCL.pdf

(in German)

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Build your own RCL

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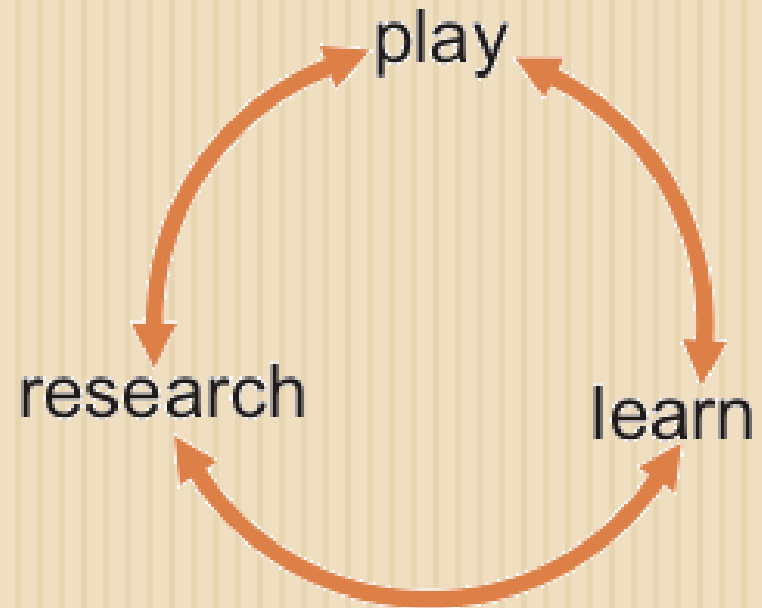
- base* {
- Computer,
 - Microcontroller,
 - Webcamera.
- } \$1000
- Other: step motor, X-y positioning etc.

- Programming:
ca. 1-2 person months/RCL
- Maintenance:
several person hours/month

Organizing description: basic scheme

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1. Introduction
2. Set-up
3. Theory
4. Exercises and problems
5. Laboratory
6. Analysis
7. Discussion



Target group

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1. Teachers and students

New ways of teaching and learning

2. Interested people

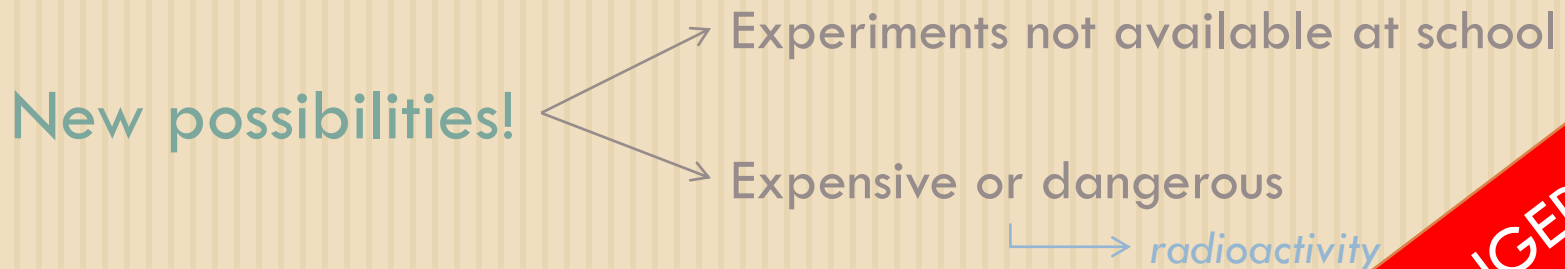
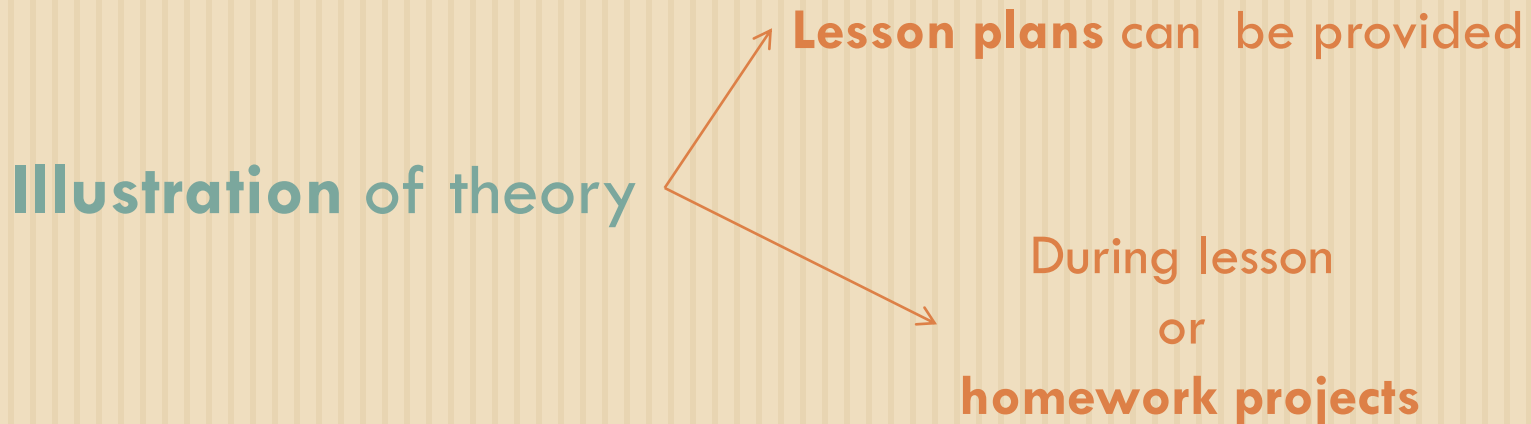
ex. How does the tomography work?

3. Students from developing countries

self-studying possibilities!

New ways of teaching and learning

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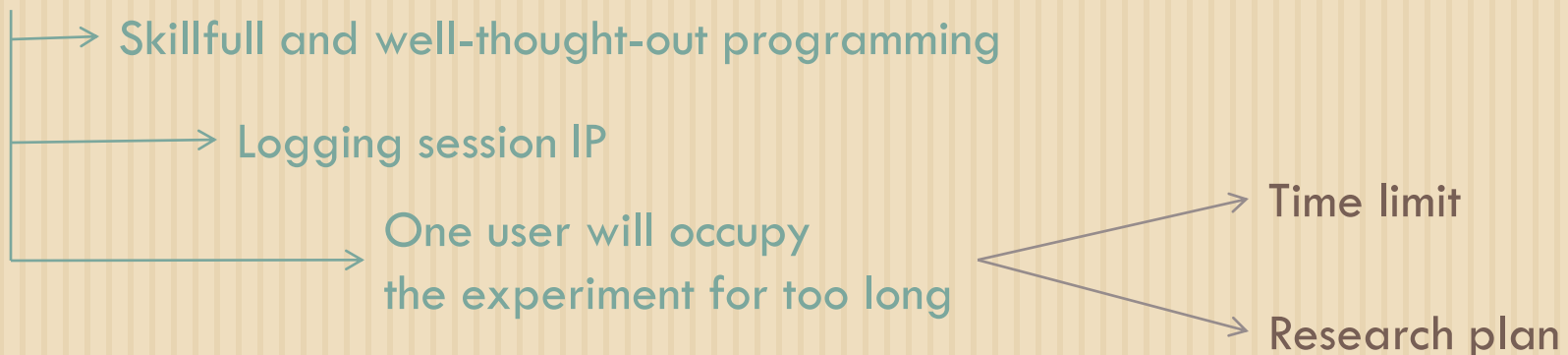
Dangers

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Possible hijack

Uncontrolled changes
of parameters beyond
the safe range + dangerous
experiment = **HAZARD!**

Precautions and prevention



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Does it really work?

Some statistics...

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Year	Total number of remote labs	Free to access *	Worked without problems *	Subjects *
2004	~ 70	~ 70 %	~ 15 %	~ 90 % engineering
2006	~ 120 (~ 60 projects)	~ 20 %	~ 20 %	~ 60-70 % engineering ~ 30 % physics *** < 10 % other disciplines

Some statistics...

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b) Electron Diffraction in Kaiserslautern via Internet, exemplary

July 2002 - October 2002	2-3 a day
July 2003 - December 2003	1-2 a day
Mid December 2004 - Mid January 2005	4-5 a day
January 2006 – February 2006 *	14-15 a day

* Usage: variation of voltage ca. 4-6 times per session

Visitor's country: Germany, Czechia, India, Ireland, Greece, Belgium, Austria and others
(frequency of usage in this order)

Future?

Let's have fun!

<http://rcl.physik.uni-kl.de/>

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The end

Thank you for your attention!