The *CS* framework as a control system for the HITRAP facility at GSI

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Abstract

At GSI / Darmstadt the linear decelerator HITRAP will be used to deliver highly-charged ions up to U^{92+} at cryogenic temperatures. The aim of this presentation is to give an overview about the control system used at HITRAP. For this, an adopted version of the *CS* framework [1], also developed at GSI is used. The *CS* framework is based on native LabVIEW from National Instruments and adds an object oriented approach to that. The result is an highly flexible framework which can be adopted relatively easy to different facilities or experiments. For HITRAP several specific add-ons were developed to improve the usability of the facility.

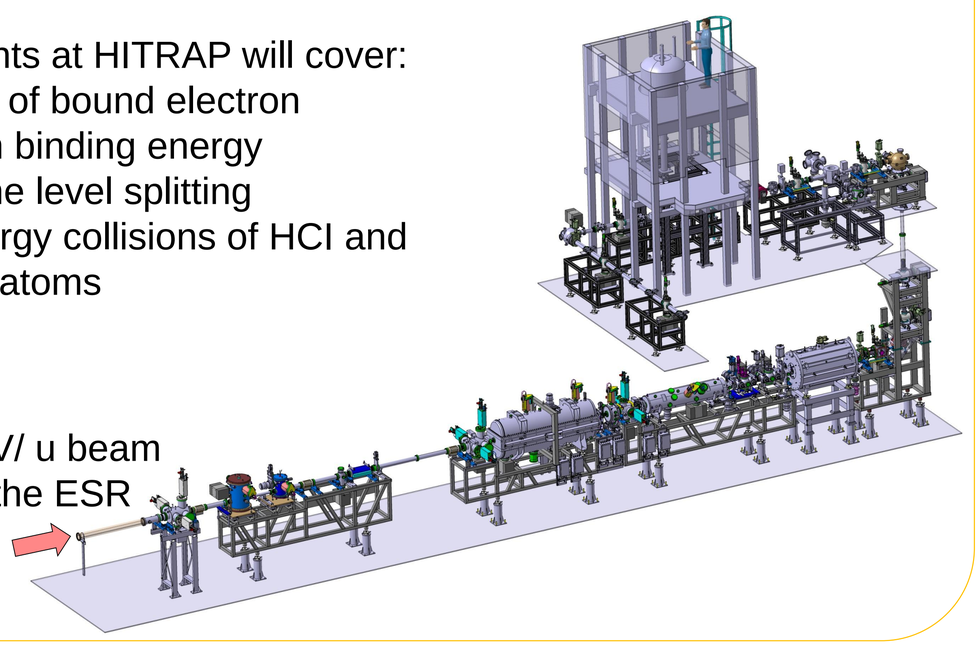
The HITRAP facility

HITRAP [2] will deliver a cool beam of highly-charged ions for precision experiments:

Type of ions	A / q < 3 (for example U^{92+})
Ions / pulse	up to 10^5
Energy	keV / q ... meV / q

In total: Deceleration from 1 GeV / u down to 0.3 meV (4K).
These are **13** orders of magnitude!

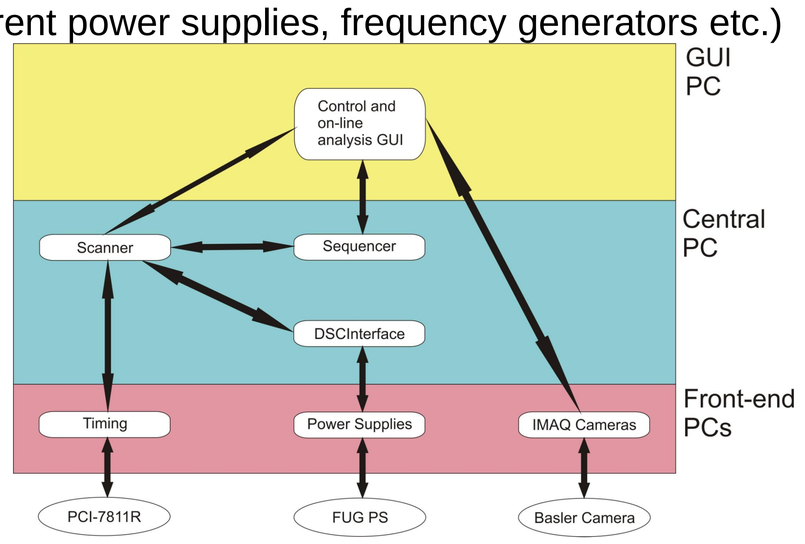
Experiments at HITRAP will cover:
- g-factor of bound electron
- electron binding energy
- hyperfine level splitting
- low energy collisions of HCI and neutral atoms



The *CS* framework

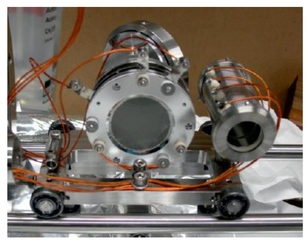
The *CS* framework was developed to support especially small and medium size experiments. It combines the intuitive programing language LabVIEW with an object oriented approach, which has several advantages:

- minimal static code, so one object per hardware device
- due to the modularity of the framework code can be reused across different experiments
- highly flexible (configuration can be changed during runtime)
- network communication over DIM, so the control system can be fully distributed without a central server
- event-driven communication between objects
- already a large amount of different classes available (different power supplies, frequency generators etc.)

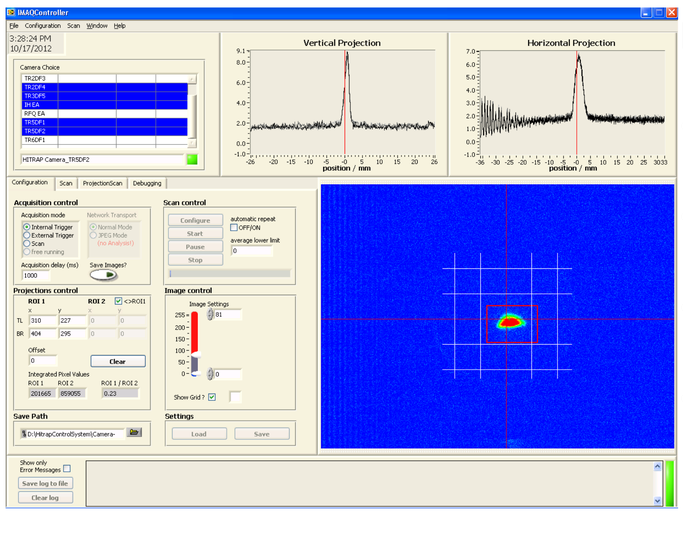


Ion detection at HITRAP

For the detection of ions Faraday cups as well as MCP detectors combined with phosphor screens and CCD cameras are used.
At HITRAP Firewire and GigabitEthernet cameras are used. The NI-IMAQdx driver library provides an optimal starting point for the implementation.



During a feasibility study at GSI driver classes were developed which use LabVIEW OOP [3]. In a second step this driver class structure was integrated into the *CS* framework.
The integration is very easy: LVOOP classes will be copied to the attribute data of the *CS* classes.



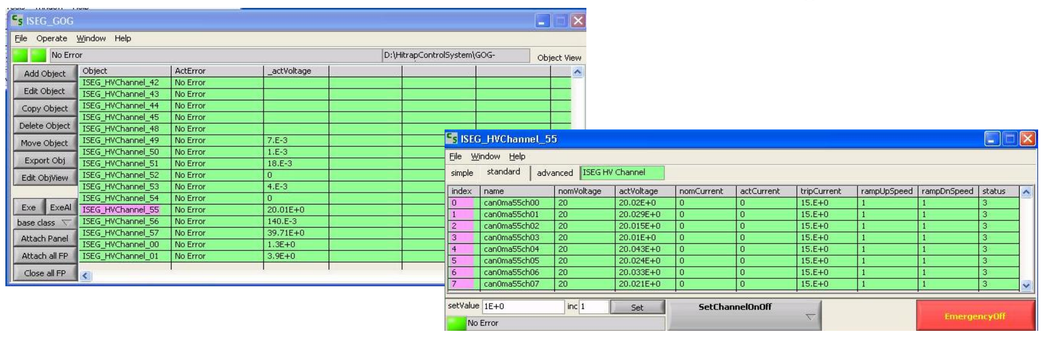
Beam profile measurement:

- also energy and intensity measurement
- communication between camera and GUI over DIM
- handling as easy as possible
- automated scans of parameters (e.g. voltages) possible

The easy usage of the IMAQ LVOOP classes within the *CS* framework has created the idea to develop new CS base classes based on LVOOP base classes. In a first step the driver layer will be changed to the new architecture.

GUI development within the *CS*

The *CS* framework is designed to be as flexible as possible so that it can be easily adopted to new experiments. A standard GUI is already provided, the so-called User-GOGs. They are used at almost all experiments now and are originally built-in as support during the commissioning procedure. For HITRAP we are developing a new base GUI, which should also improve the handling.



New GUI should:
- be easy to configure for other facilities
- allow the user to execute a function relatively easy
- also allow new users to have a fast overview about the facility and its controls

Refs:
[1] http://wiki.gsi.de/CSframework
[2] F. Herfurth et al., Hyp. Int. **173** (2006) 93.
[3] H. Brand and D. Beck, GSI Scientific report (2008) 260.