LabVIEW scripts for sensor QC

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QA-QC Meeting

06/11/2019

Goals

- preparation for sensor pre-production
- same tests at every QC site ⇒ reproducibility of results
- same format of data files
- compatibility with database upload
- adaptable to different local setups (e.g. varying GPIB addresses, data directories, etc.)
- easy to include additional/new instruments
- general user-friendliness

Prerequisites

Instrument hardware:

- SMUs
- LCR meter(s)
- Arduino with T/RH readout (+ touchdown feedback)
- switching matrix/multiplexers
- probestation

} for strip testing

Software:

- NI LabVIEW 2013 or newer

Instrument Control

Why class structure?

Case structure

- simple implementation
- tried and tested in old R&D LabVIEW code
- good if only few cases and calling Vis
- including new instruments

  ⇒ all callers need updating

vs.

Class structure

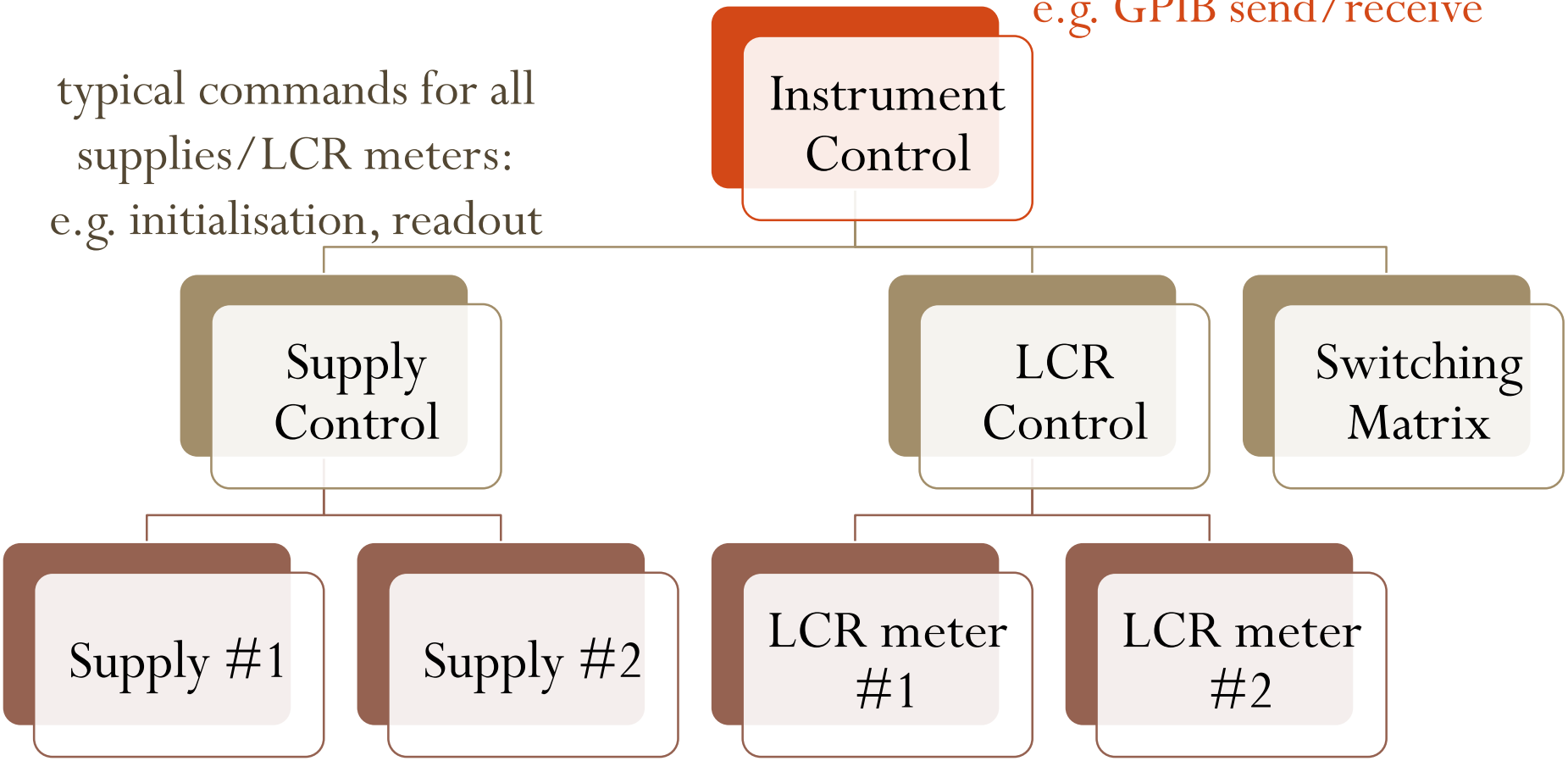
- more complicated to get started
- automatic polymorphism
- including new instruments

  ⇒ independent from measurement scripts
- multiples of same instrument without additional class
- "must override" option makes sure all descendants implement their own versions

Instrument control: class hierarchy

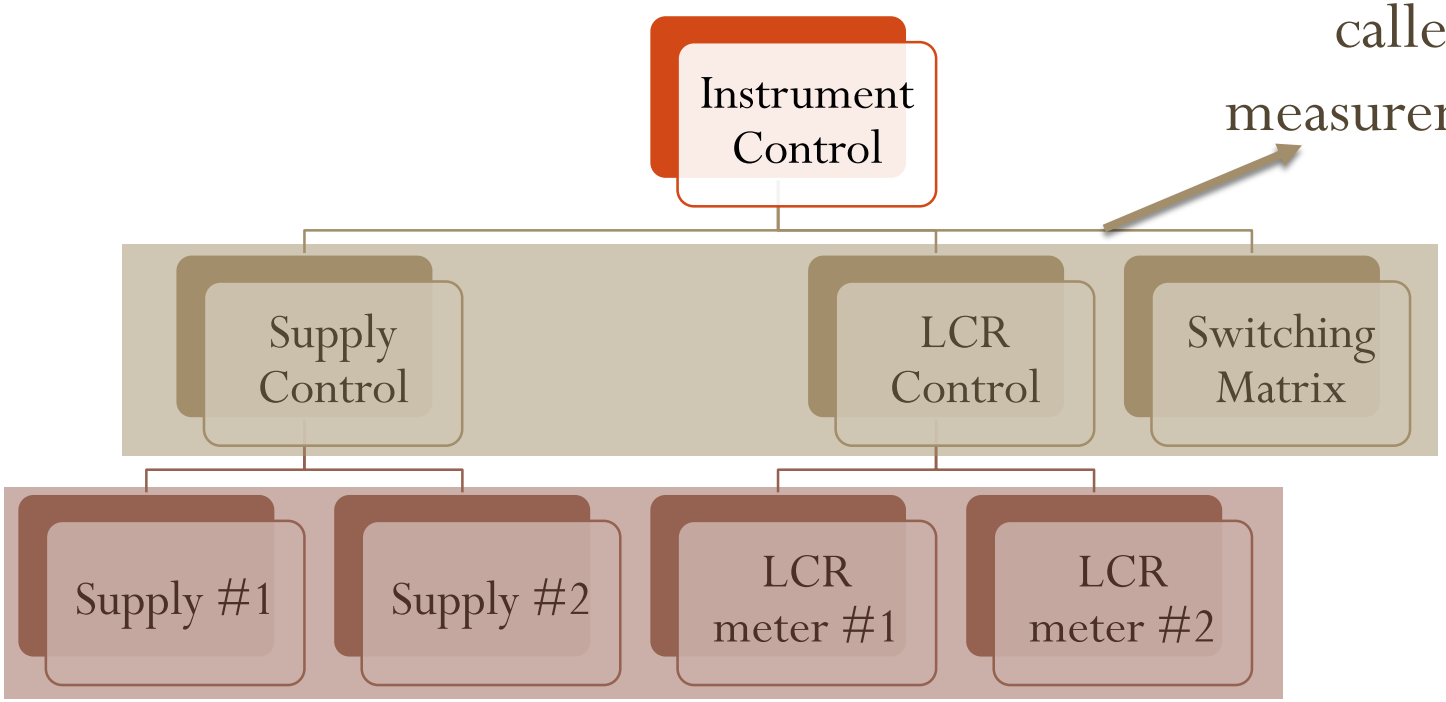
low-level commands:
e.g. GPIB send/receive

typical commands for all supplies/LCR meters:
e.g. initialisation, readout



specific variations of existing commands

Polymorphism

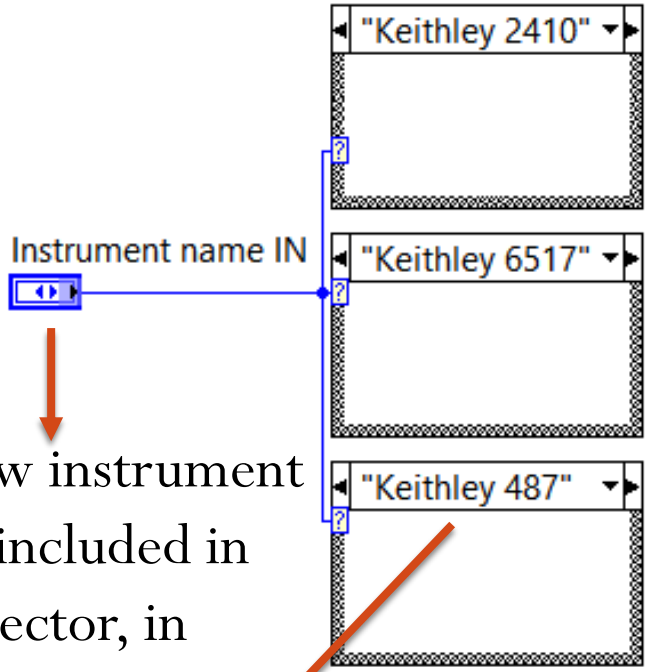


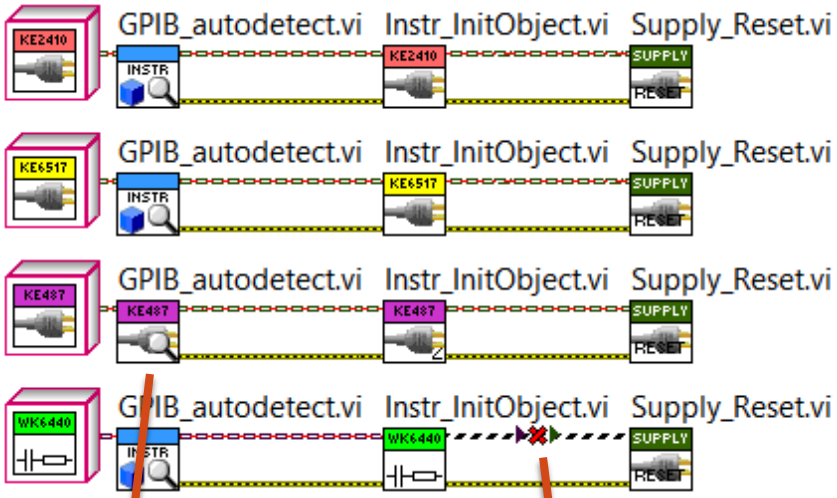
called in measurement VIs

automatically selects specific commands based on instrument selection

Why class structure?

Case structure vs. Class structure





every new instrument must be included in every selector, in every VI

every new instrument needs new case

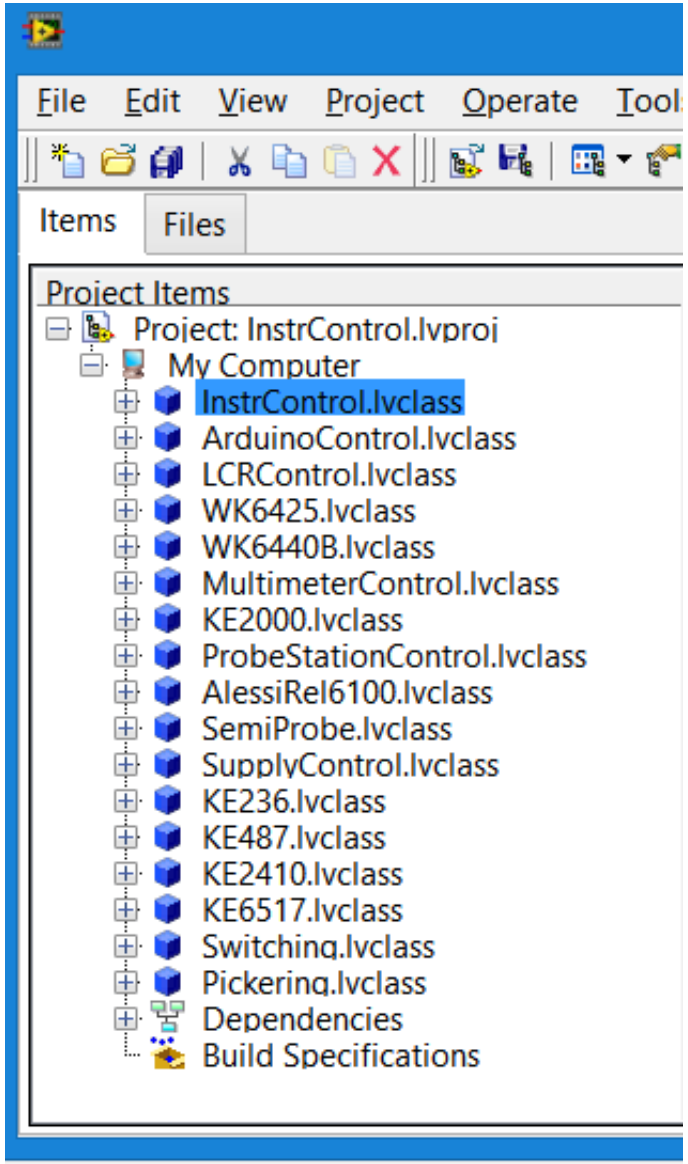
automatic selection of "special cases" where parent class VIs are overwritten

LCR meter not descendant of "Supply"

How to include a new instrument

1. Open LabVIEW project "InstrControl.lvproj"

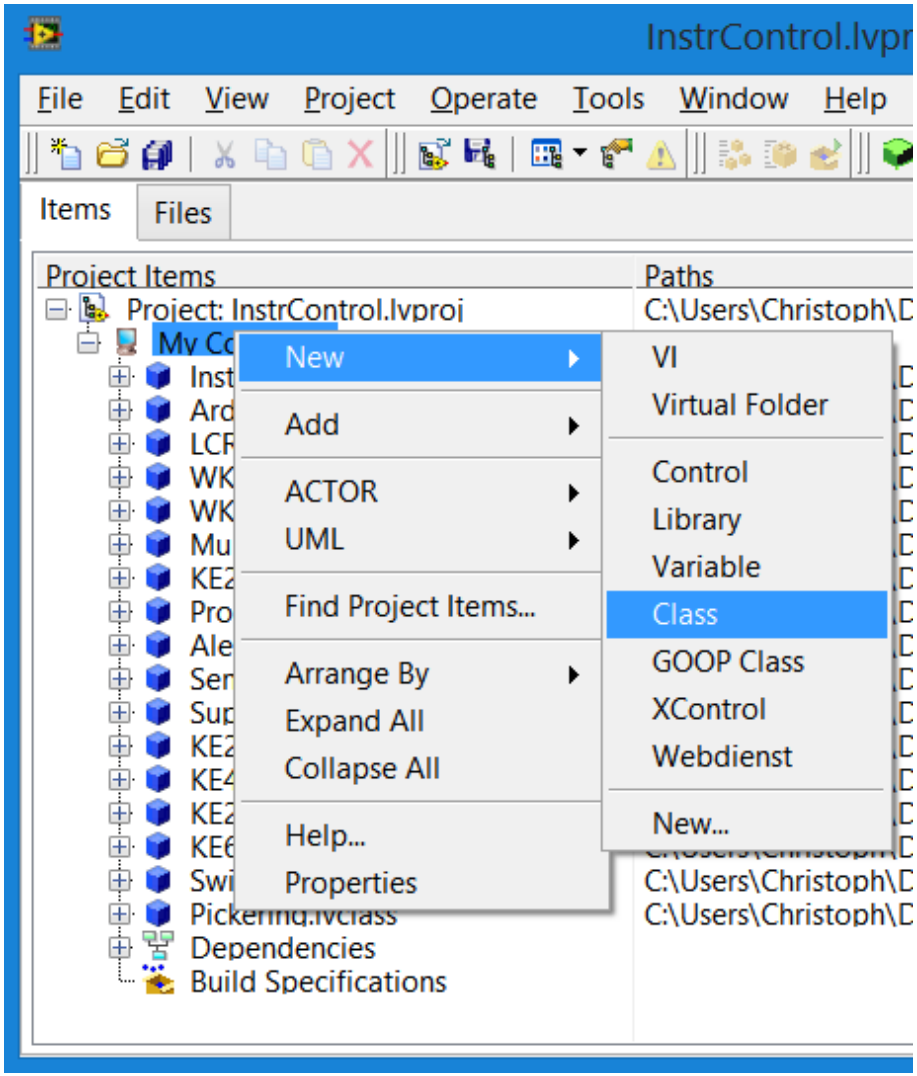
(don't have any other VIs open or editing of the project may be blocked)



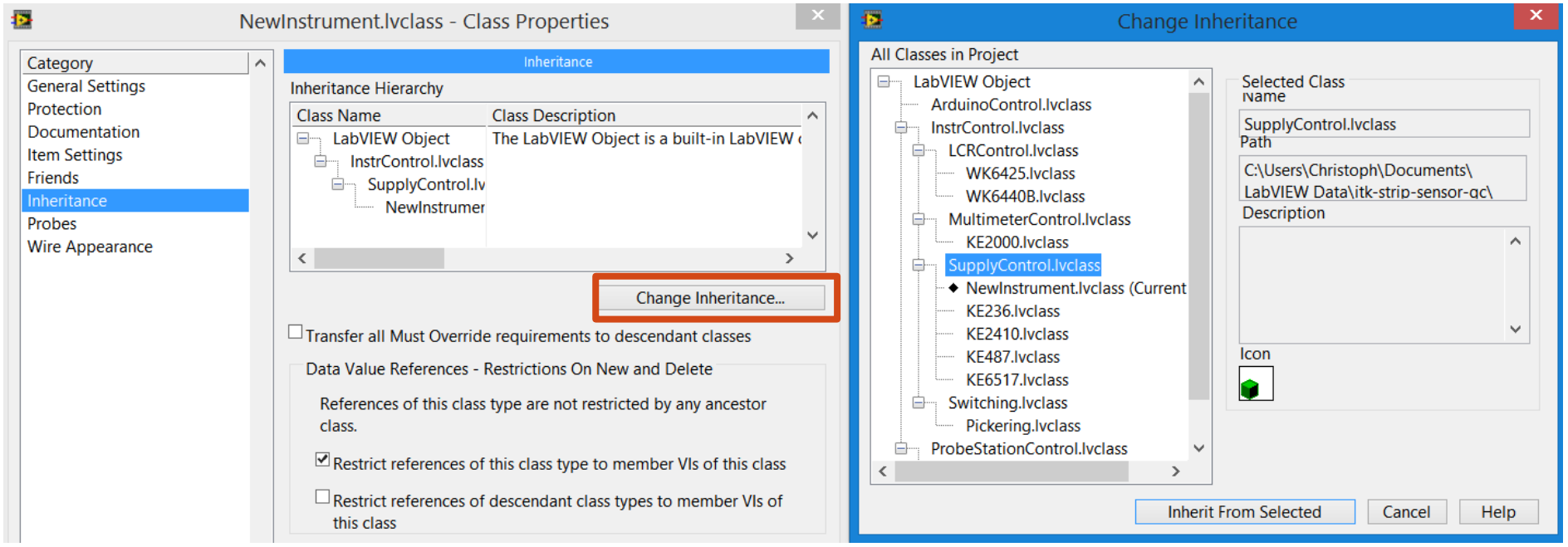
How to include a new instrument

2. Right-click "My Computer", select "New → Class"

(options may look slightly different depending on the LV version and installed add-ons)

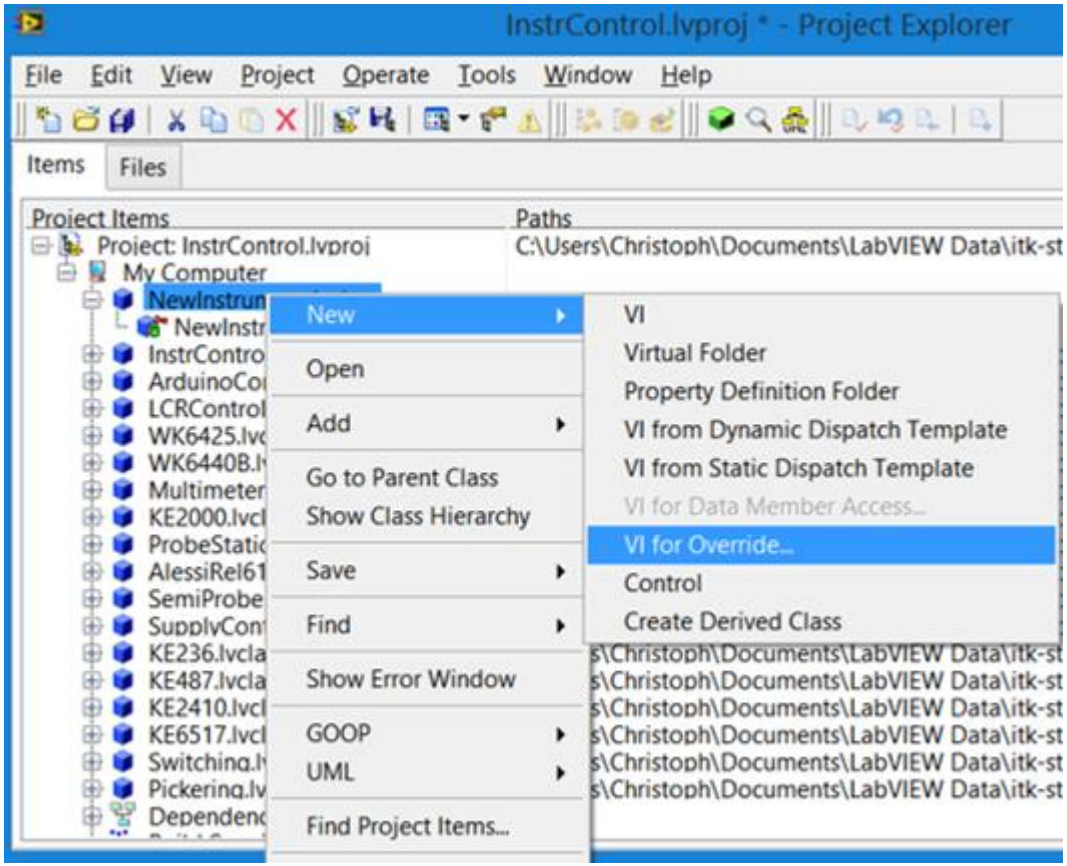


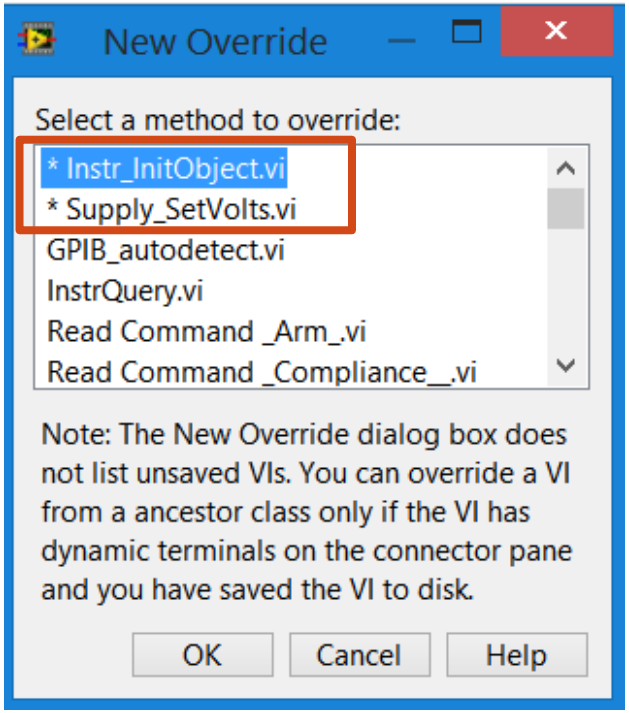
How to include a new instrument



3. give your class a name
4. Right-click new class, select "Properties → Inheritance" and change inheritance accordingly

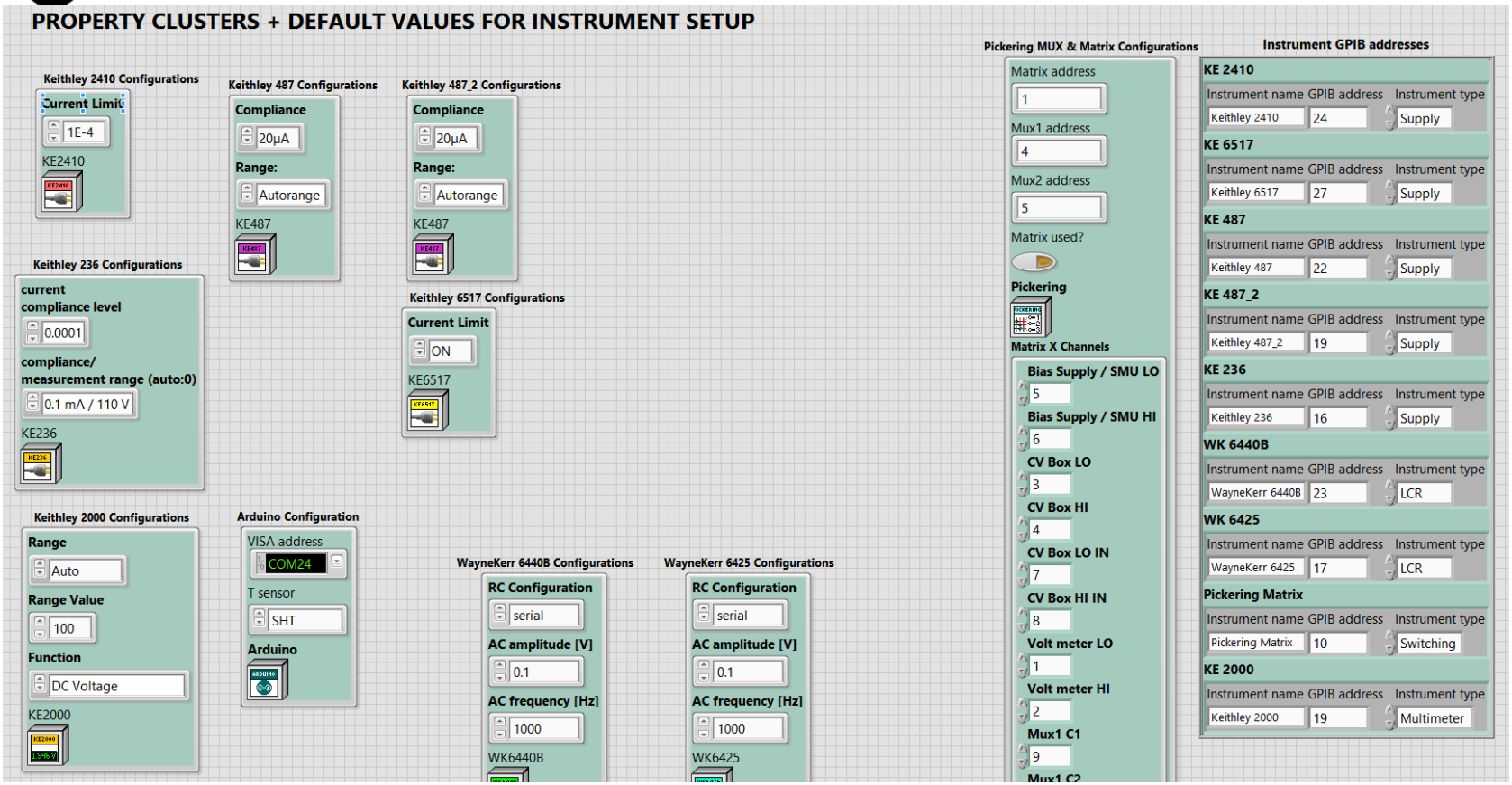
How to include a new instrument





5. Right-click new class, select "New → VI for Override"
6. VIs with * must be overwritten; all others can be, if necessary

How to include a new instrument

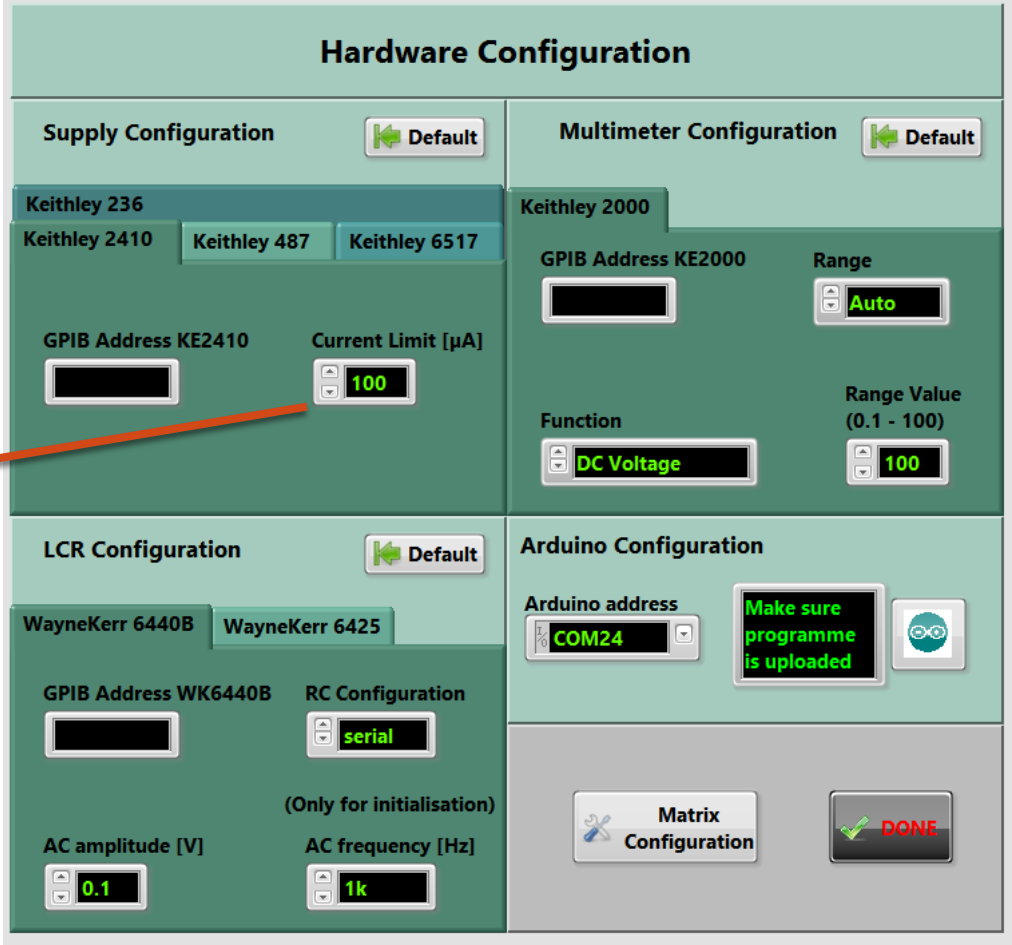


7. "InstrumentSetup" global: add default properties cluster and add instrument (name, address, type) in GPIB address cluster

(not GPIB instrument: use arbitrary address, but still give name + type)

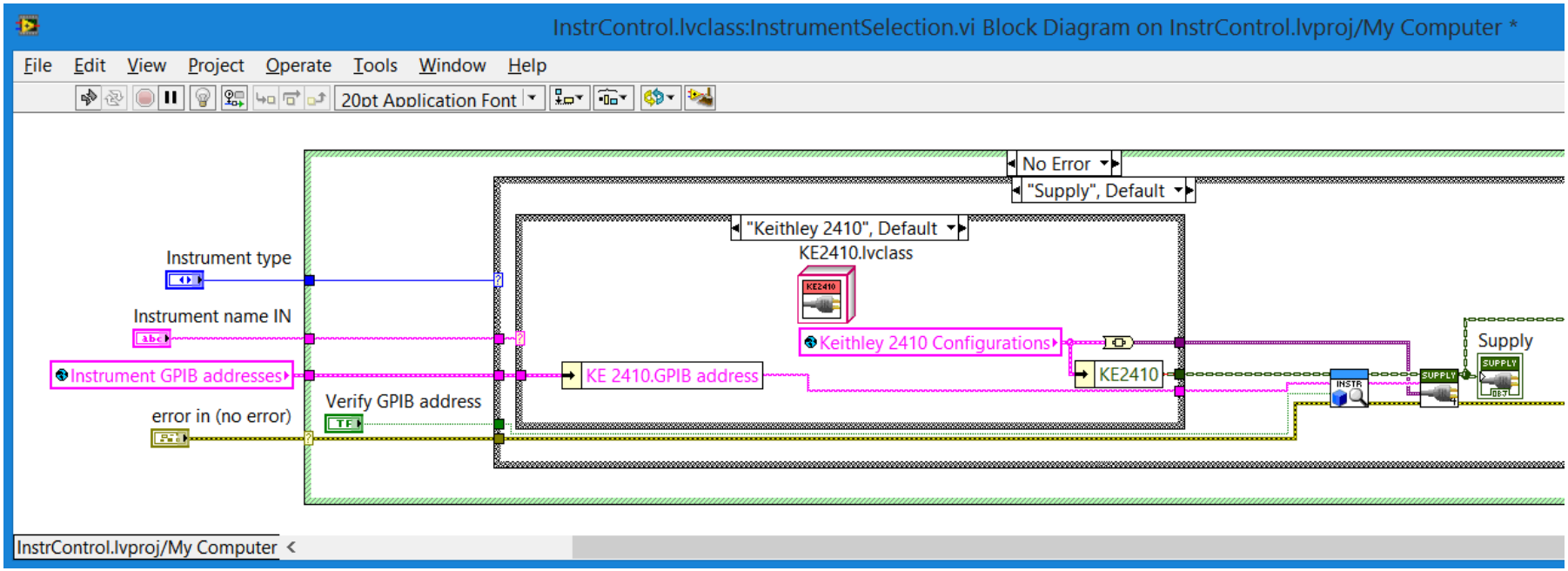
How to include a new instrument

not all parameters which can be configured are also relevant; select only those necessary to be configured by the user, all others can be hardcoded



8. add instrument with relevant parameters in "HardwareConfiguration.vi"

How to include a new instrument



9. add instrument in "InstrumentSelection.vi" with correct type + name

QC Measurements

Getting started

local configuration file:

- slight differences between different sites
- read local configuration from simple text file

  ⇒ change accordingly, file in directory […]\QCtests\general_VIs\LocalConfig

Exception: directory for screenshots and automatic data backup

no need to create folders for all data files:

- LabVIEW code creates file structure automatically starting from parent directory given in local config
- [parent directory] \ [sensor type] \ [batch] \ [wafer number] \ [HPK or database serial no.]

Getting started

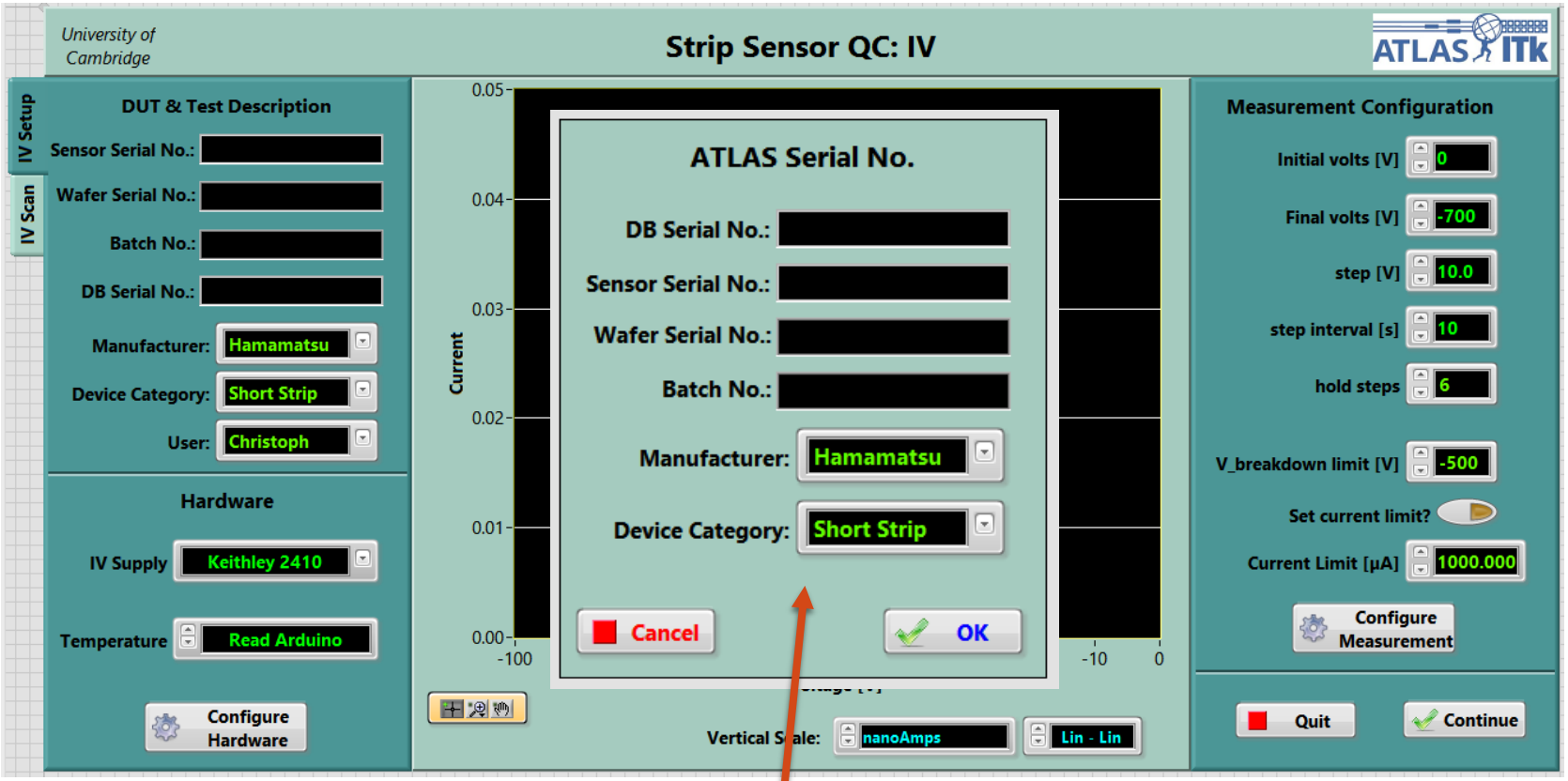
measurement VIs ready to be used:

- IV, CV, C_{is}, R_{is}, striptest
- data file header for all measurements according to QC document

notes:

- VIs are intended to be used for "QC only" (of course, can be used for R&D, as well)
- minimal user input necessary for IV, CV, C_{is}, R_{is}
- therefore:
  - ideally, user just needs to type in serial no.
  - measurement settings according to QC specs used by default
  - user has to actively change scan params to deviate from QC specs

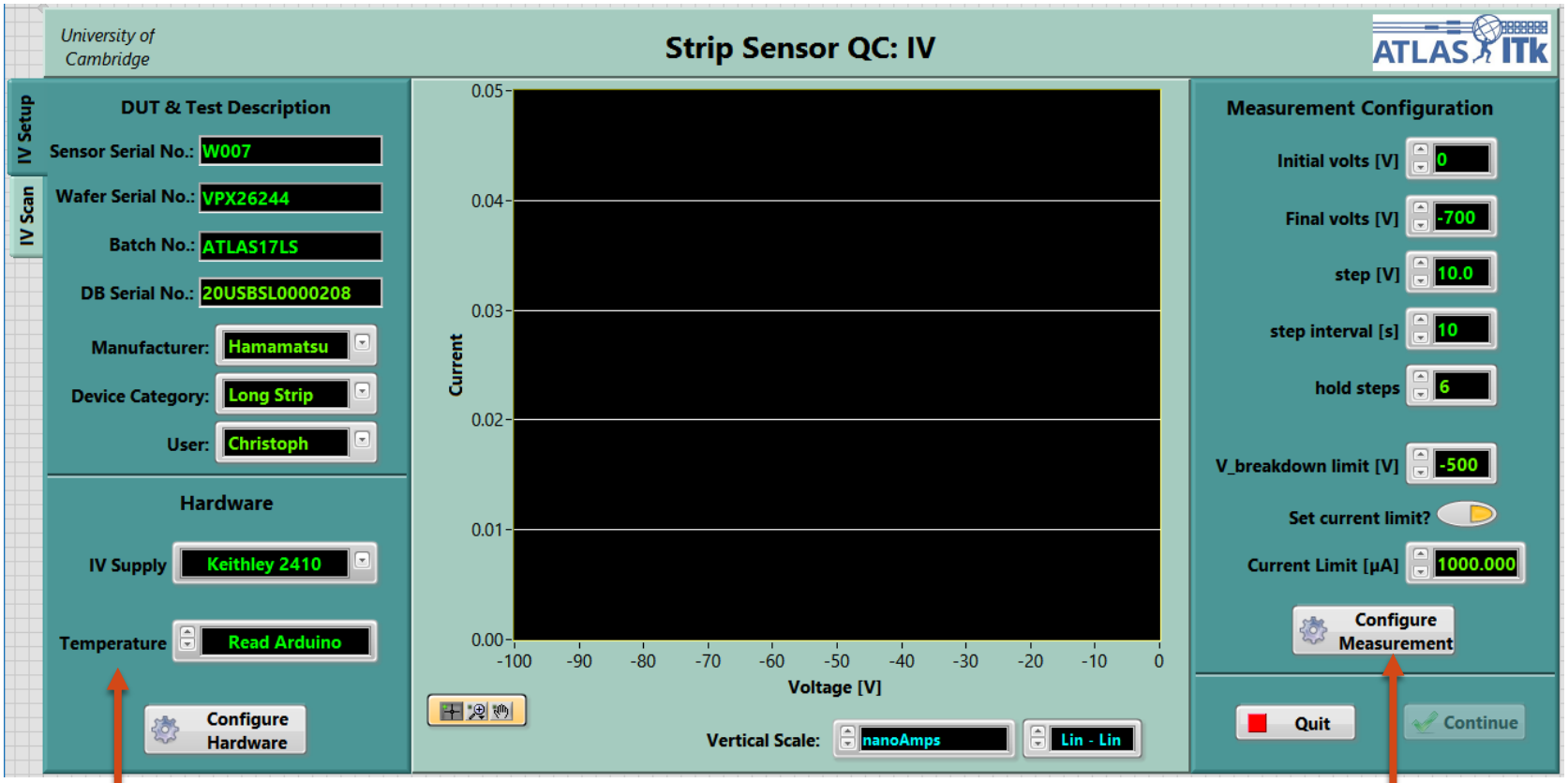
Example: IV scan



setup step before start of scan:

- enter serial number, etc. in prompt (barcode scanner?)

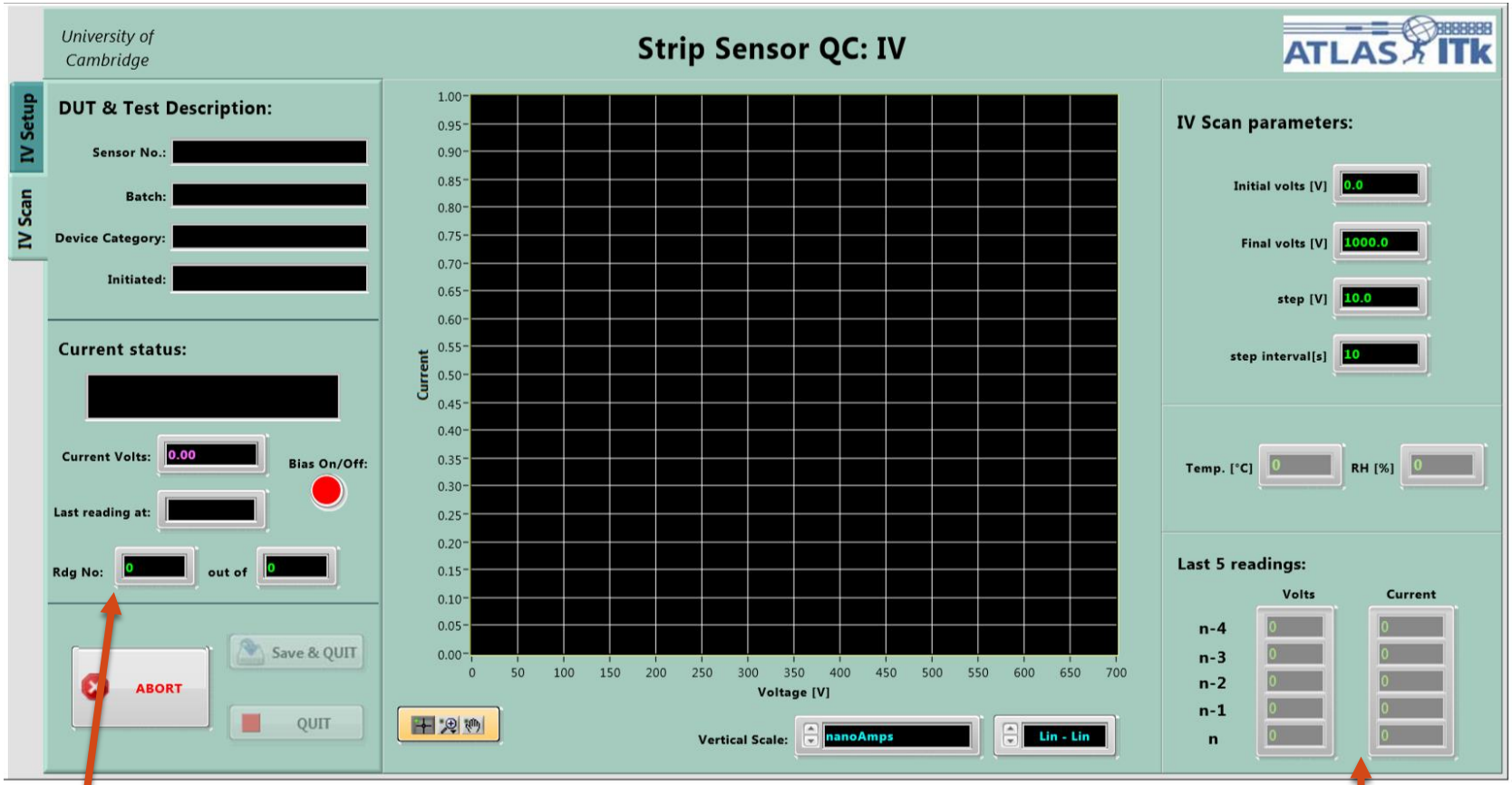
Example: IV scan



setup step before start of scan:

- select hardware, change configuration
  - change scan parameters (only for non-QC measurements!)

Example: IV scan



during scan:

- information about status and progress of measurement
  - display IV curve and last readings of current + T/RH

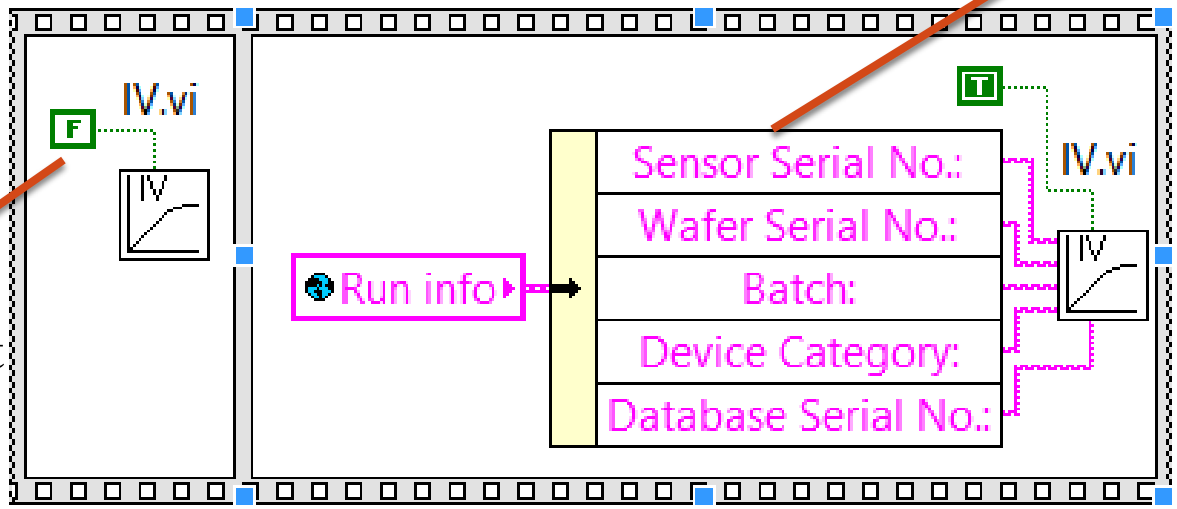
DIY measurement sequence

- all QC measurement VIs are standalone scripts
- they can be used in top-level VIs without the need for any user input (exception: striptest)

  ⇒ chain QC measurements for test sequence, e.g. IV → CV

  ⇒ measure multiple sensors on a rack

saved in global from 1st IV



flag to run with/without user input

Summary and Outlook

- implementation of class structure in instrument control allows for easy addition of all types of new instruments
- this includes:
  - instruments with communication protocols other than GPIB
  - replacements for legacy hardware (e.g. Pickering Matrix)
  - different probestations at individual QC sites
- measurement VIs are ready to be used
- ongoing optimisation and adaption to changing requirements
  - distribute to QC sites for testing and feedback

https://github.com/chtklein/itk-strip-sensor-qc


PRE-
PRODUCTION
IS
COMING
HERE