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Low temperature RTD calibration system

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2. Motivations
    - NICA development
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5. Realization
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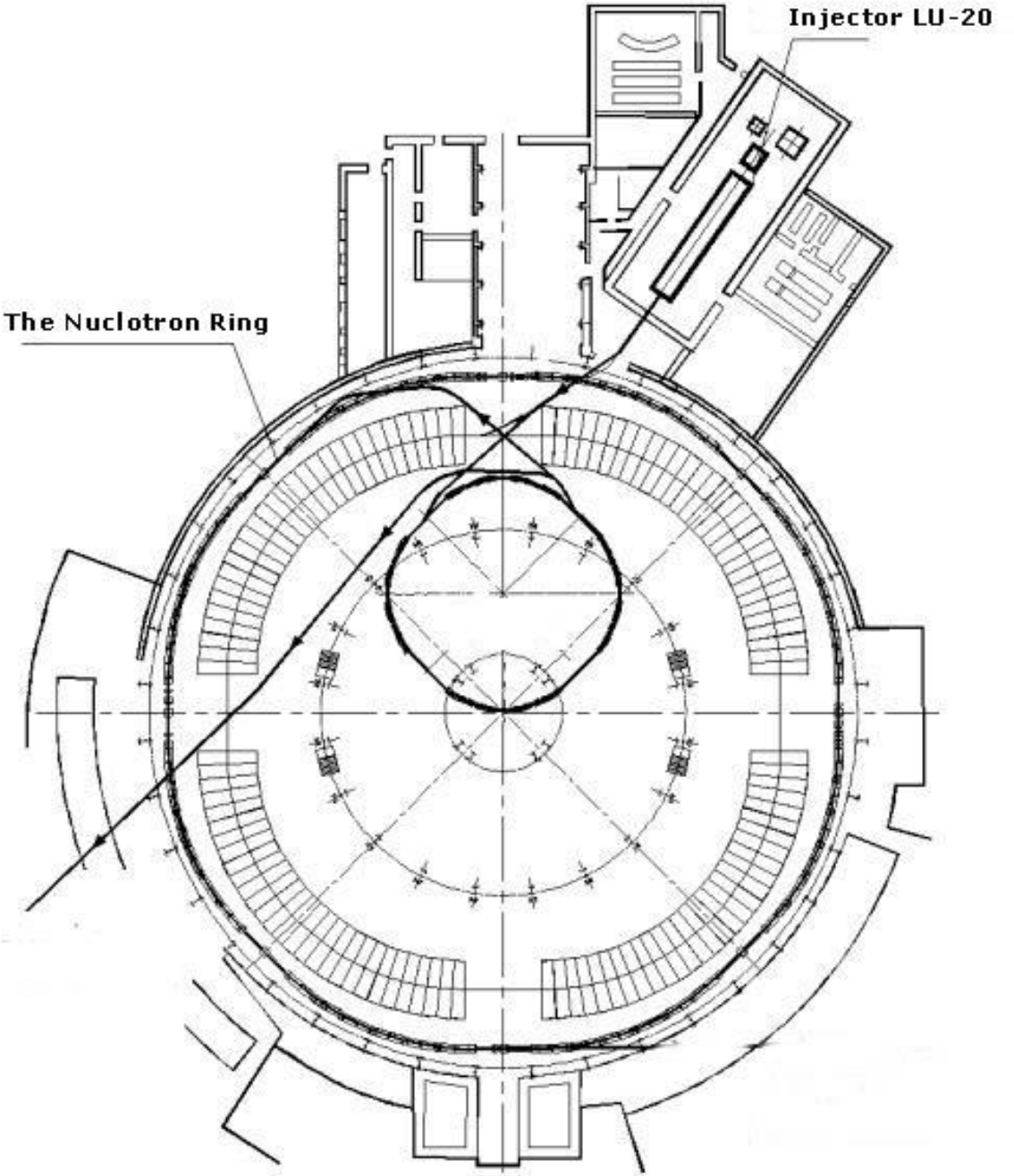
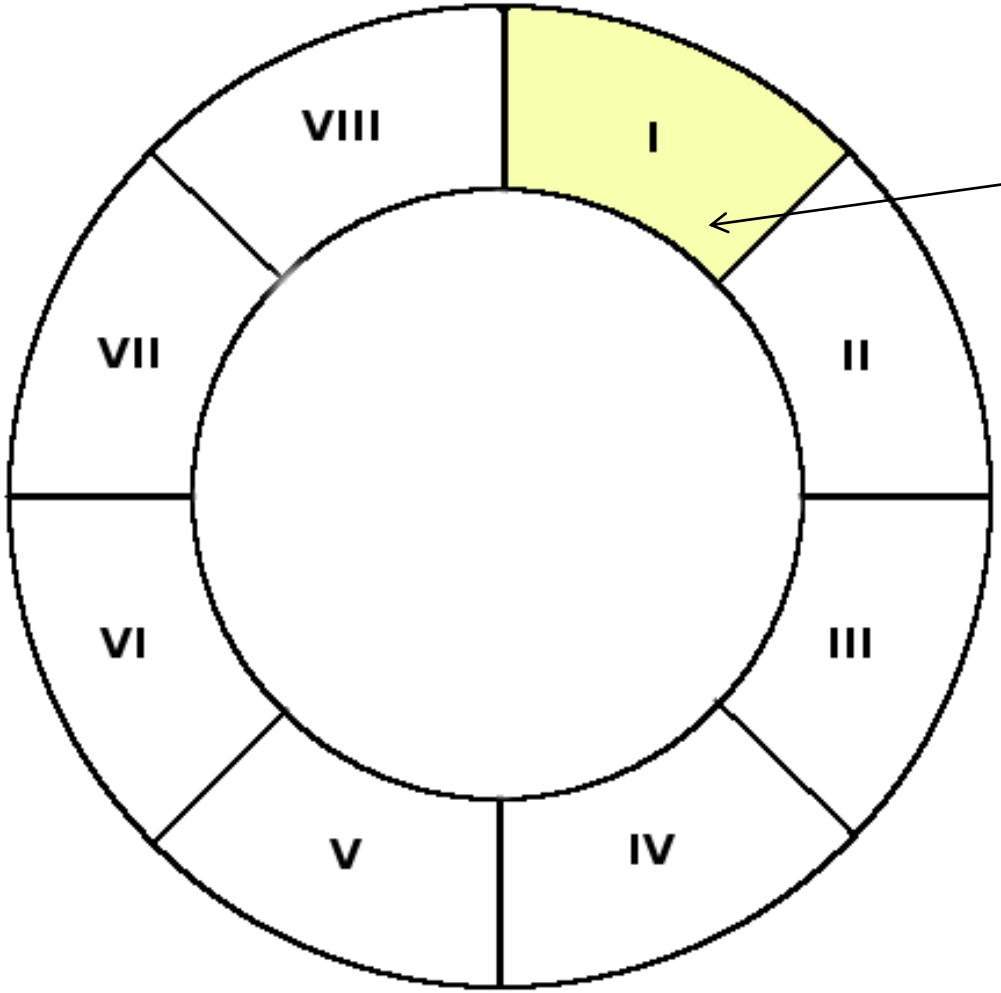
1. Introduction

2. Motivations

The nuclotron system



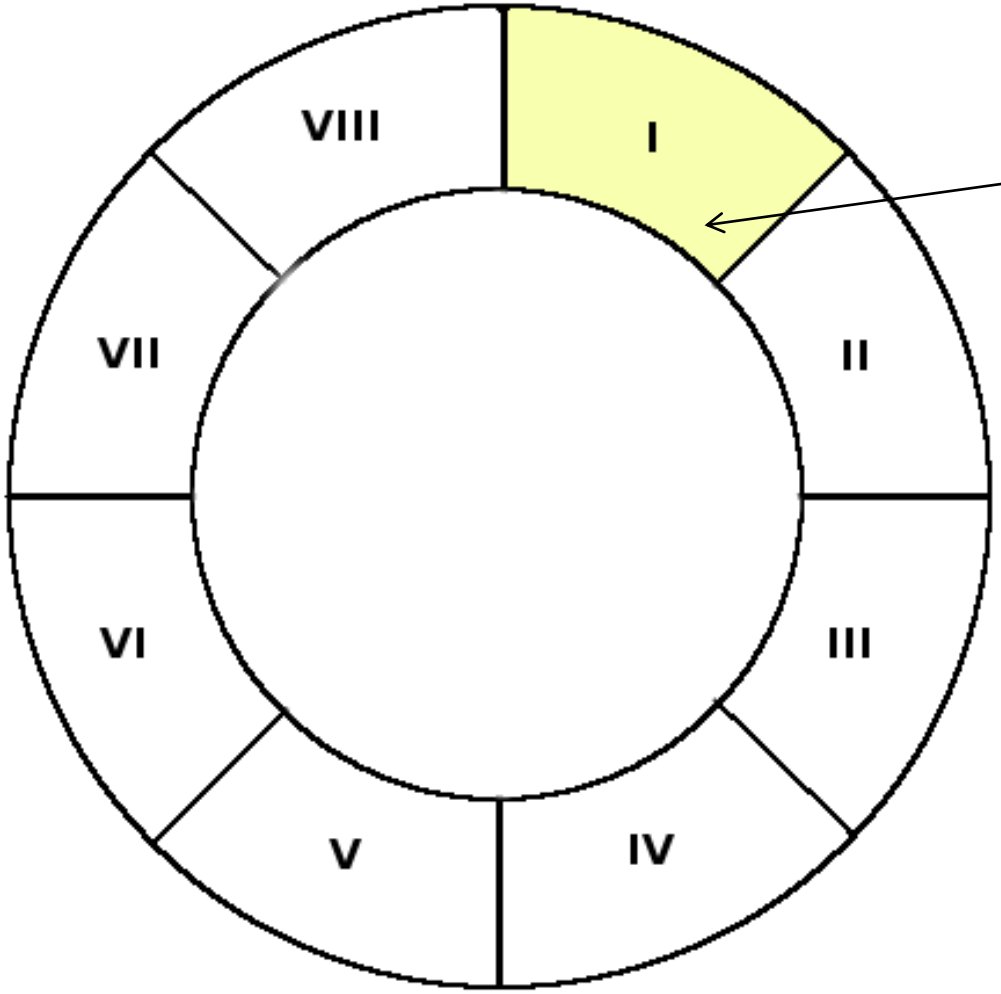
The nuclotron organization



Octant

1 oktant – 10 sectors
1 sector – 10 magnets

The nuclotron organization



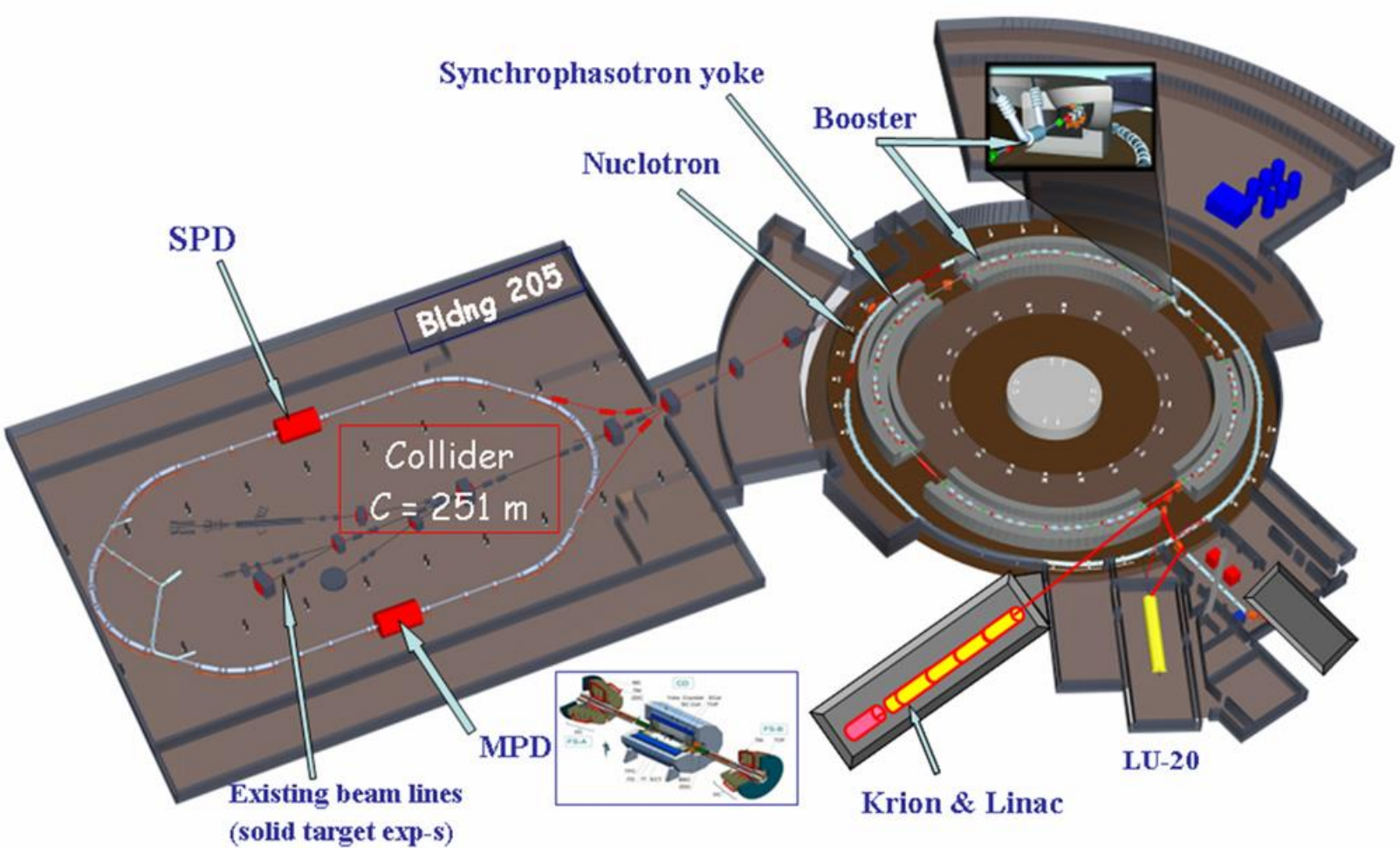
Octant

1 oktant – 10 sectors
1 sector – 10 magnets

1 magnet – 3 sensors

Superconducting accelerator complex NICA

(Nuclotron based Ion Collider fAcility)

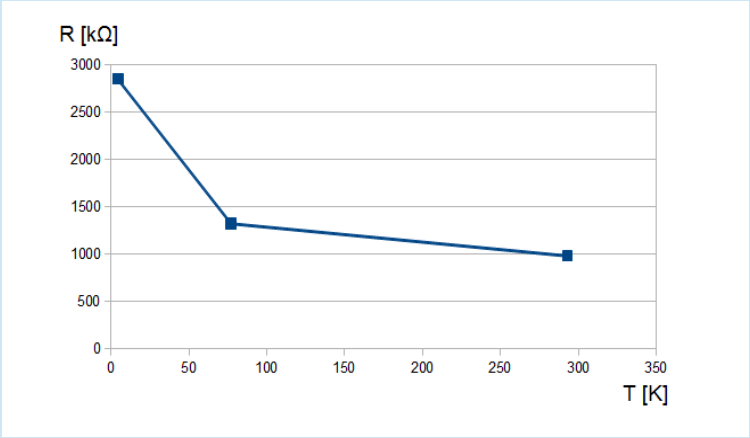


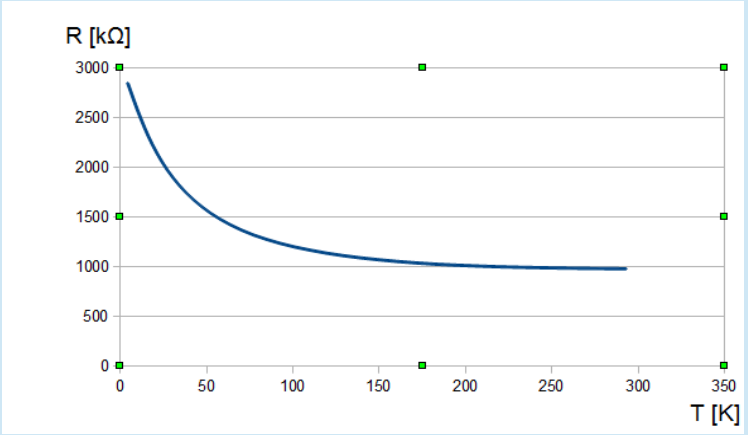
Problems:

- About 4-5k RTD callibrated in the helium temperature
- Time of realization by the nuclotron RTD callibration system – about 2 years
- Manpower

The early assumptions

- Improvement of the resolution)
- Minimalization the role of the system operator
- Improvement of the efficiency
- Allow diffferent callibration modes

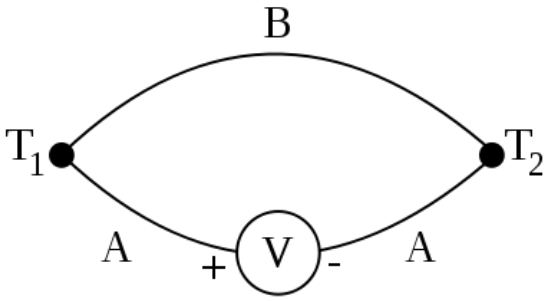




- Make space for future improvement
- Measurement stabilization improvement

Problems to solve

- Seebeck effect reduction



- current stabilization

- minimalization of the temperature coefficient of electrical components

- choice of the material of the resistors


Realization

Hardware

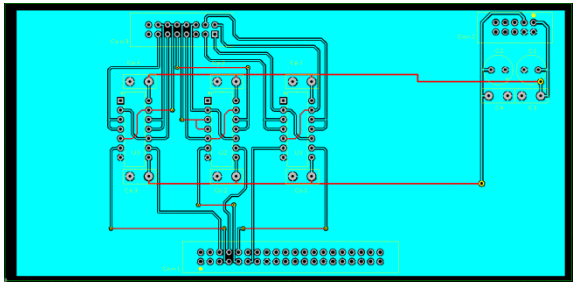
Inputs

- 3x14 channels

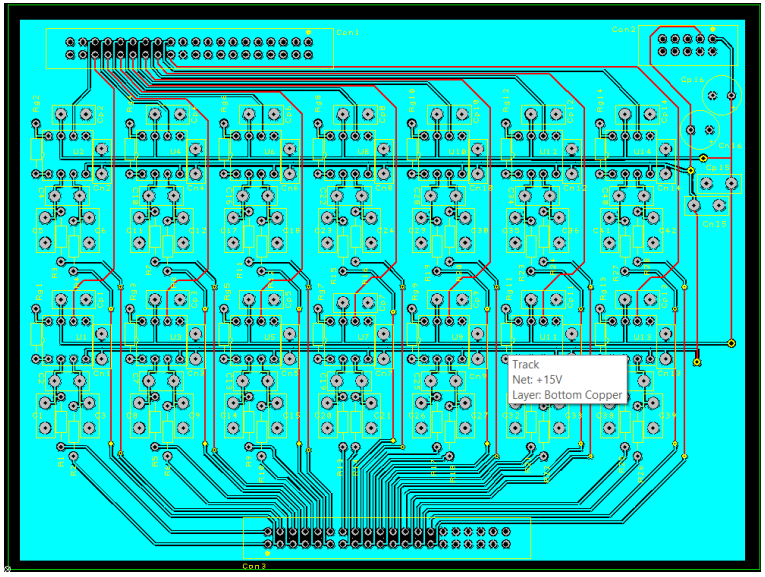
30	Callibrated RTD
2	Refference sources
1	Current measurement
9	Backup, Development

- LabJack U6 pro ADC
- Instrumentation amplifiers TI INA121R YCJ
- Temperature stabilized electronics

Hardware



- 3 separate circuit polarization control
- Maxim DG303 ACJ analog keys

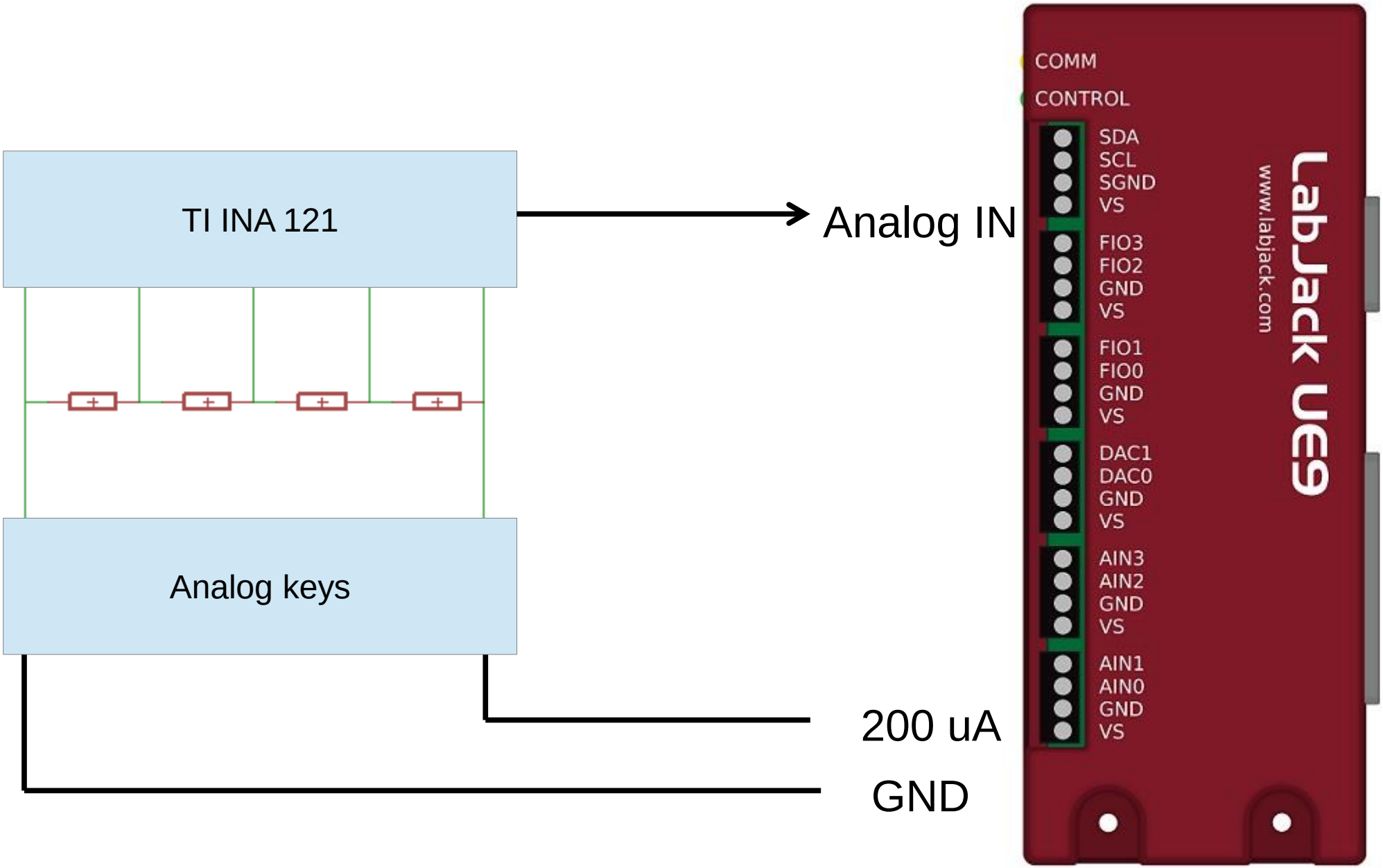


- 14 inputs
- TI INA 121 amps programmed for 10x amplification

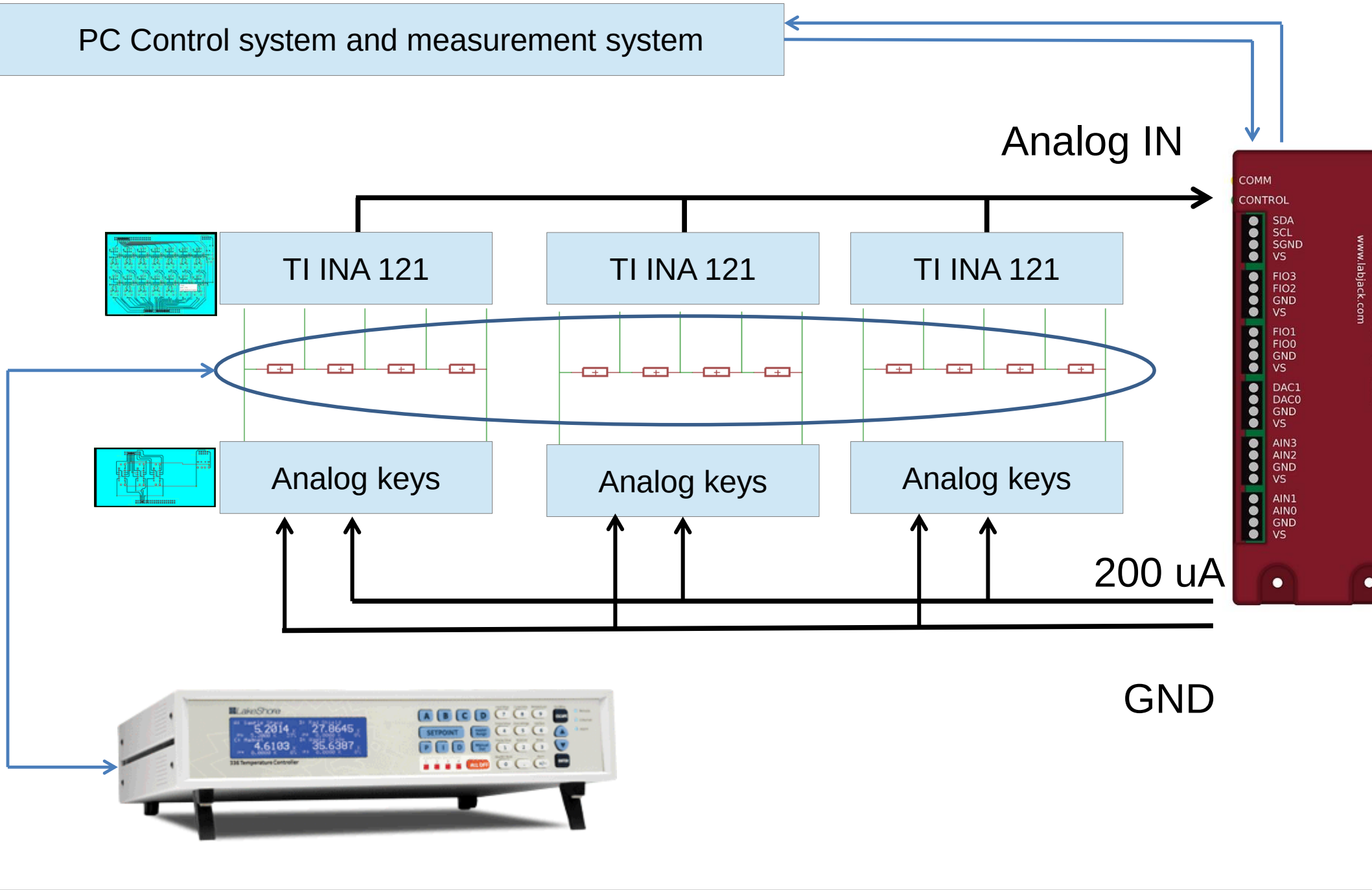
LabJack U6-Pro

- 14 analog inputs (16-18 bit)
- Input extension cards
- Integrated MUX
- Integrated Amplifier
- Additional Sigma-Delta ADC (22-24 bit)
- Current sources (10uA, and 200uA)

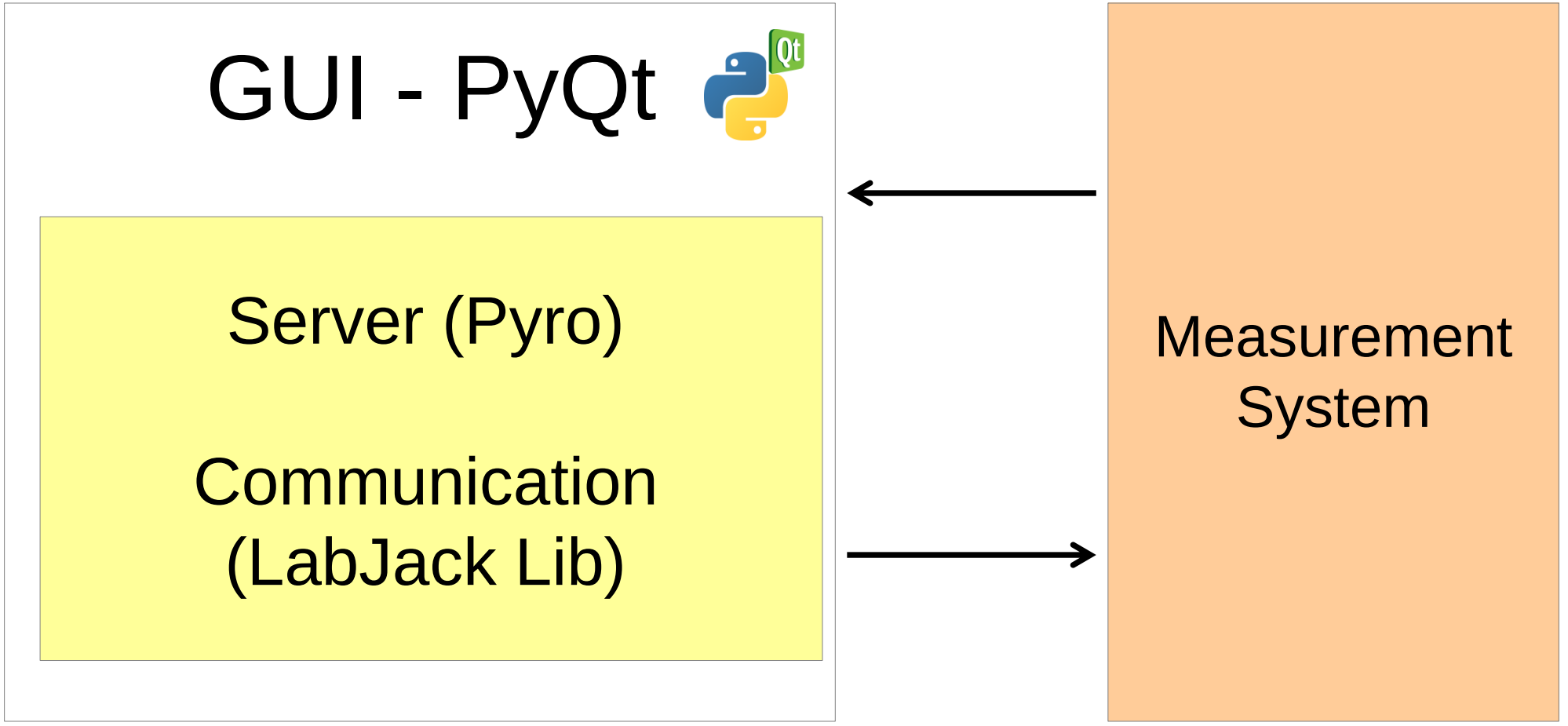
Measurement circuit

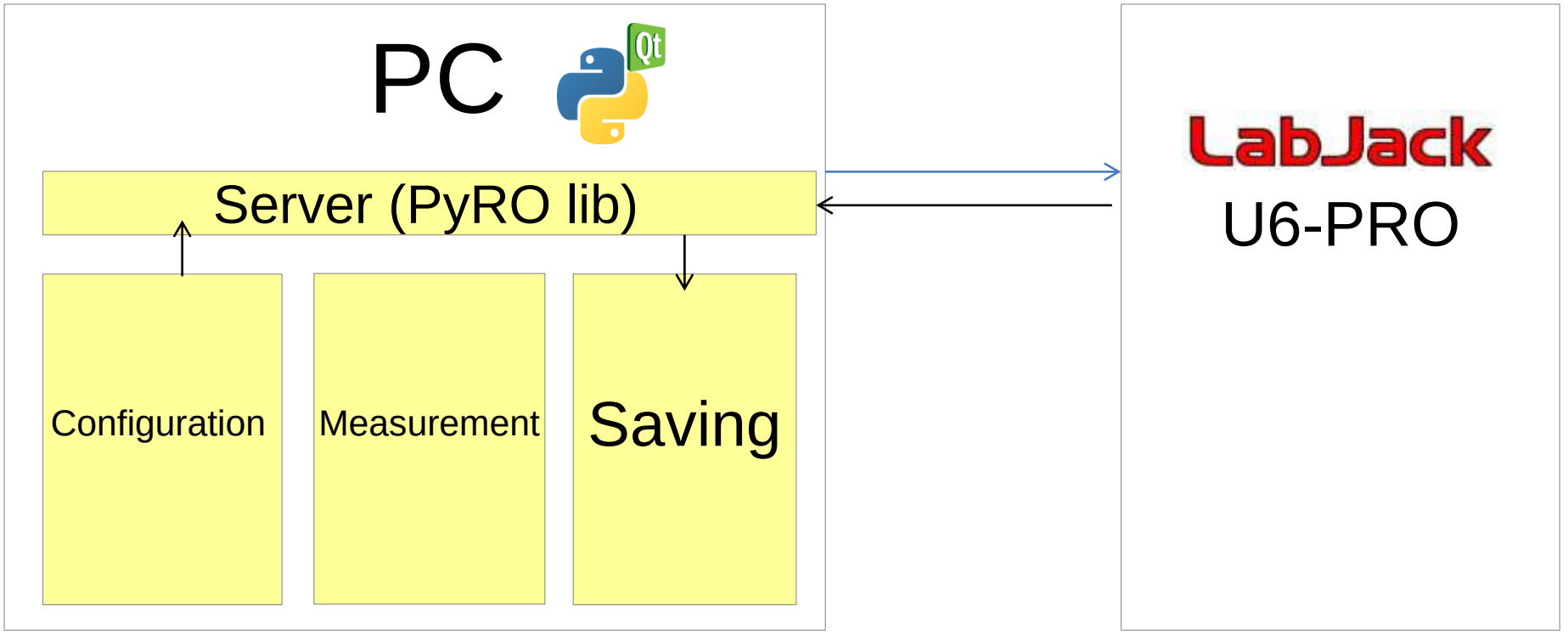


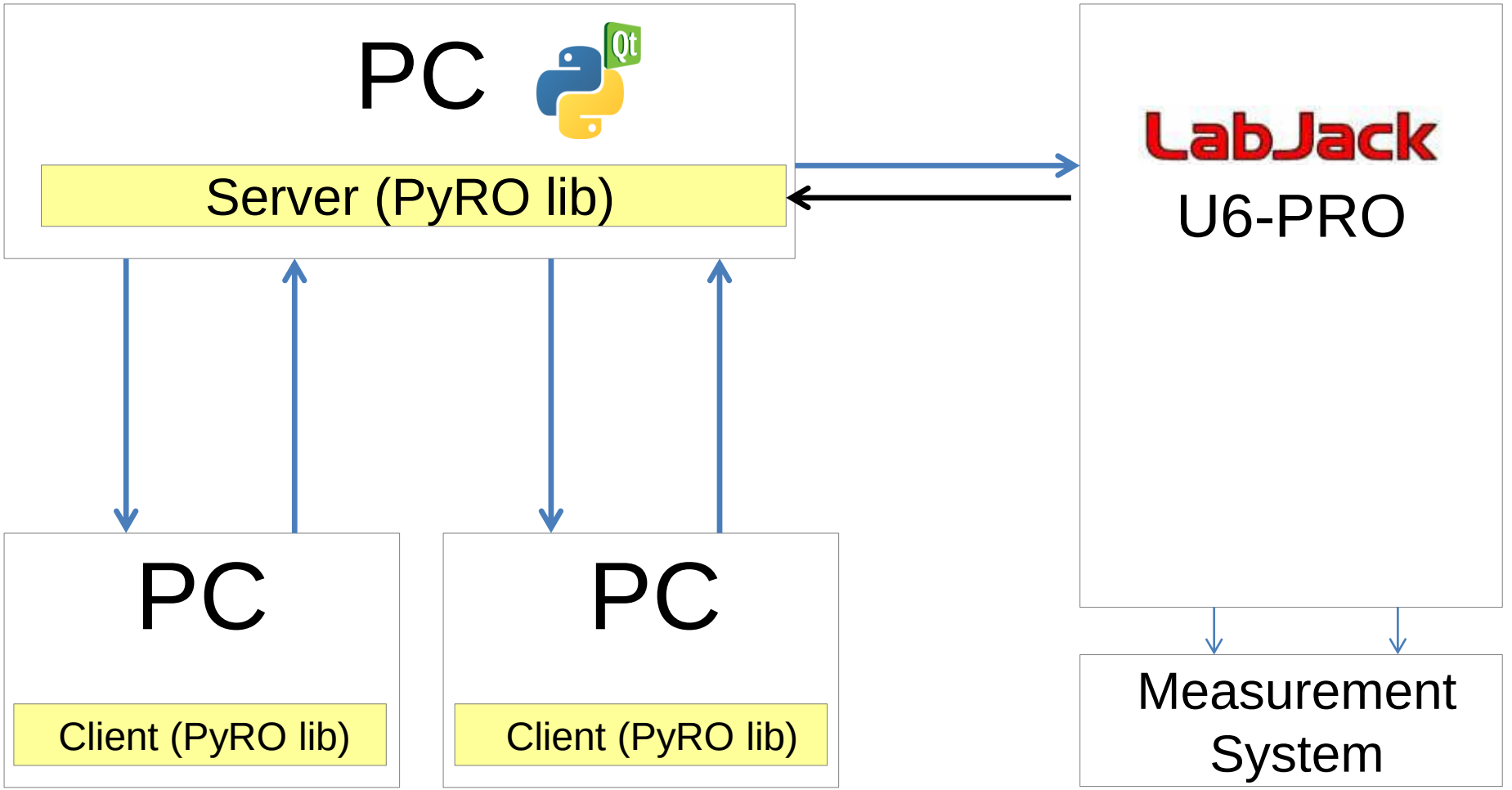
Full diagram




Software


GUI - PyQt
Server (Pyro)
Communication
(LabJack Lib)
Measurement
System


PC
Server (PyRO lib)
Configuration
Measurement
Saving
LabJack
U6-PRO


PC
Server (PyRO lib)
LabJack
U6-PRO
PC
Client (PyRO lib)
PC
Client (PyRO lib)
Measurement
System

Conclusions

- Status of the project
- Replacement of the old calibration system was necessary
- Current efficiency is much higher
- RTDs are calibrated with higher precision
- The new system parameters complies with all of the early assumptions of the project

Thank You for attention