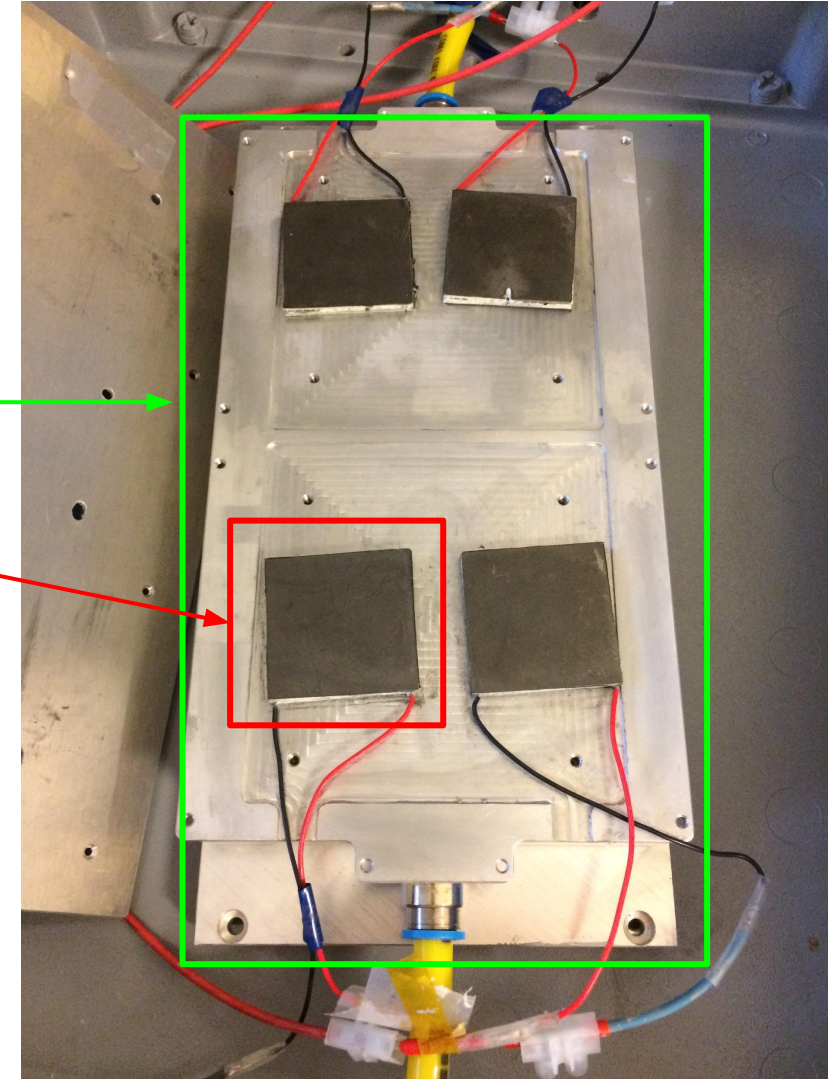
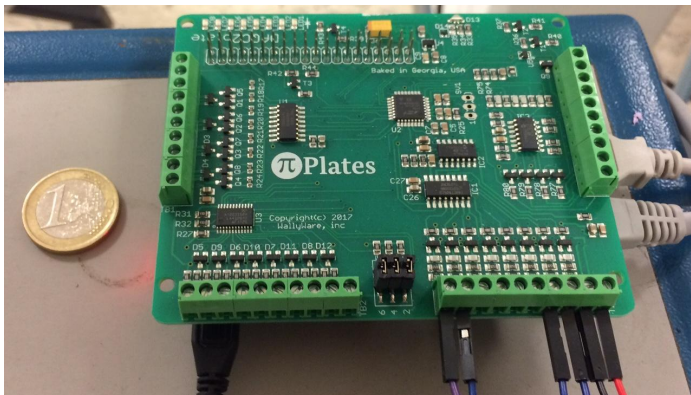


Automated thermal cycling and testing of ATLAS Inner Tracker detector modules using a microcontroller

- At DESY developing automated testing for ITk detector modules
- We will test the noise levels and durability of the modules during thermal cycling between -35°C and $+40^{\circ}\text{C}$
- The **Coldbox**: a thermally insulated box containing 4 chucks
 - Heat sinks connected to a chiller, with **peltier** elements on top
- A tiny LINUX machine (**microcontroller**) will be used to automate the thermal cycling and data taking



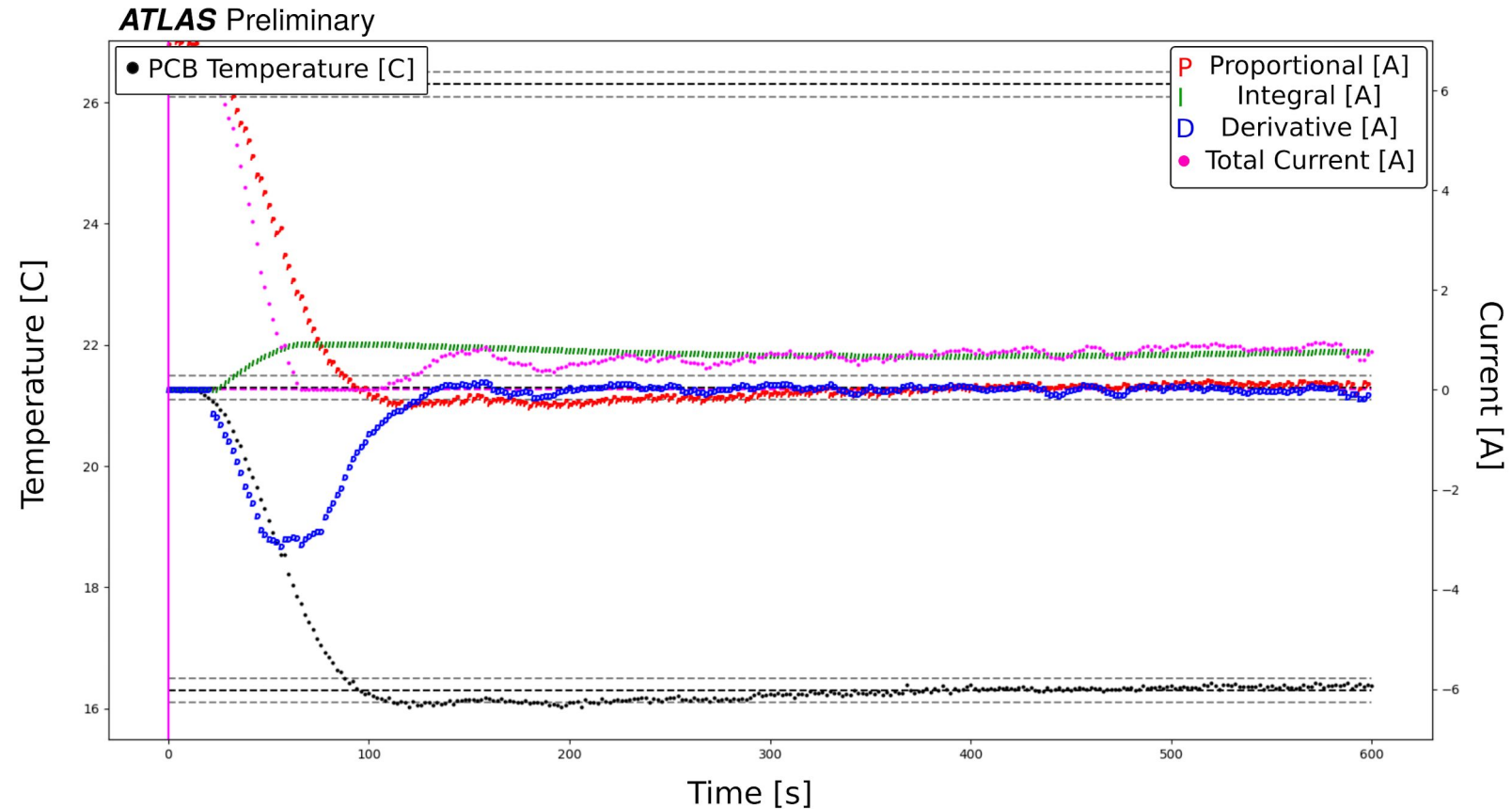
PID temperature control

- Controlling the peltier current to maintain a desired module temperature
- Basic idea: set the peltier current based on the temperature difference

- **PID** control:

- **P**: Proportional
- **I**: Integral
- **D**: Derivative

$$u(t) = K_p e(t) + K_i \int_0^t e(t') dt' + K_d \frac{de(t)}{dt},$$



A much larger project than temperature control

- Cold boxes will be produced by DESY and sold to the different institutes
- Automation software provided by ColdJig team
- It should work out of the box and be easy to implement with different hardware
- It should be easy to run, with a intuitive web-based graphical user interface
- It needs to work on multiple flavours of Coldboxes:
 - DESY
 - Warwick
 - BNL

