

TRIUMF LLRF CONTROL SYSTEM UPGRADE

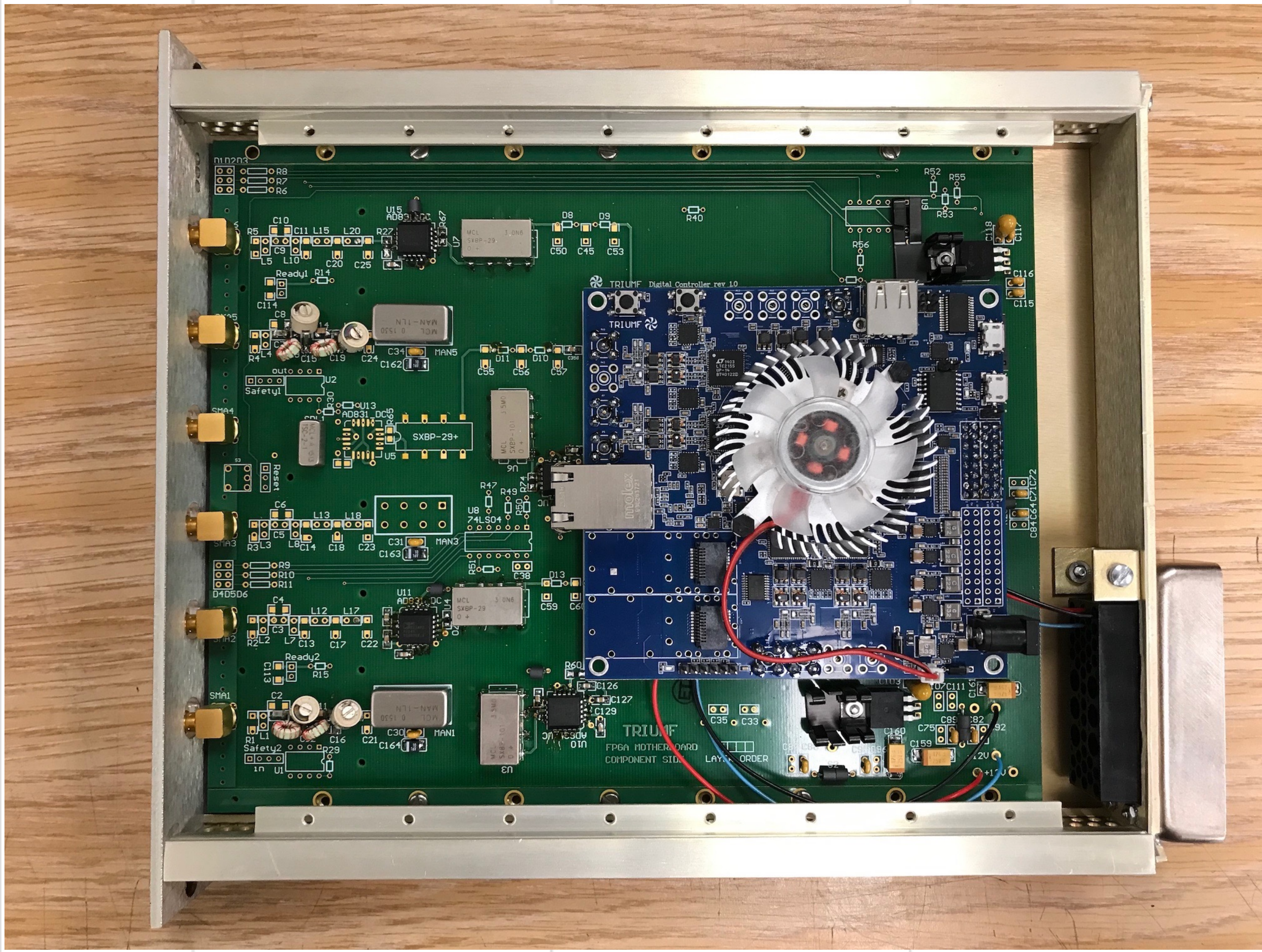
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Motivation

- Analog-digital hybrid system based on VXI mainframe
- The motor control function of the tuning loop has minor problem related to the limit switch.
- Meanwhile, the VXI mainframe is obsolete and hard to buy for the future system.

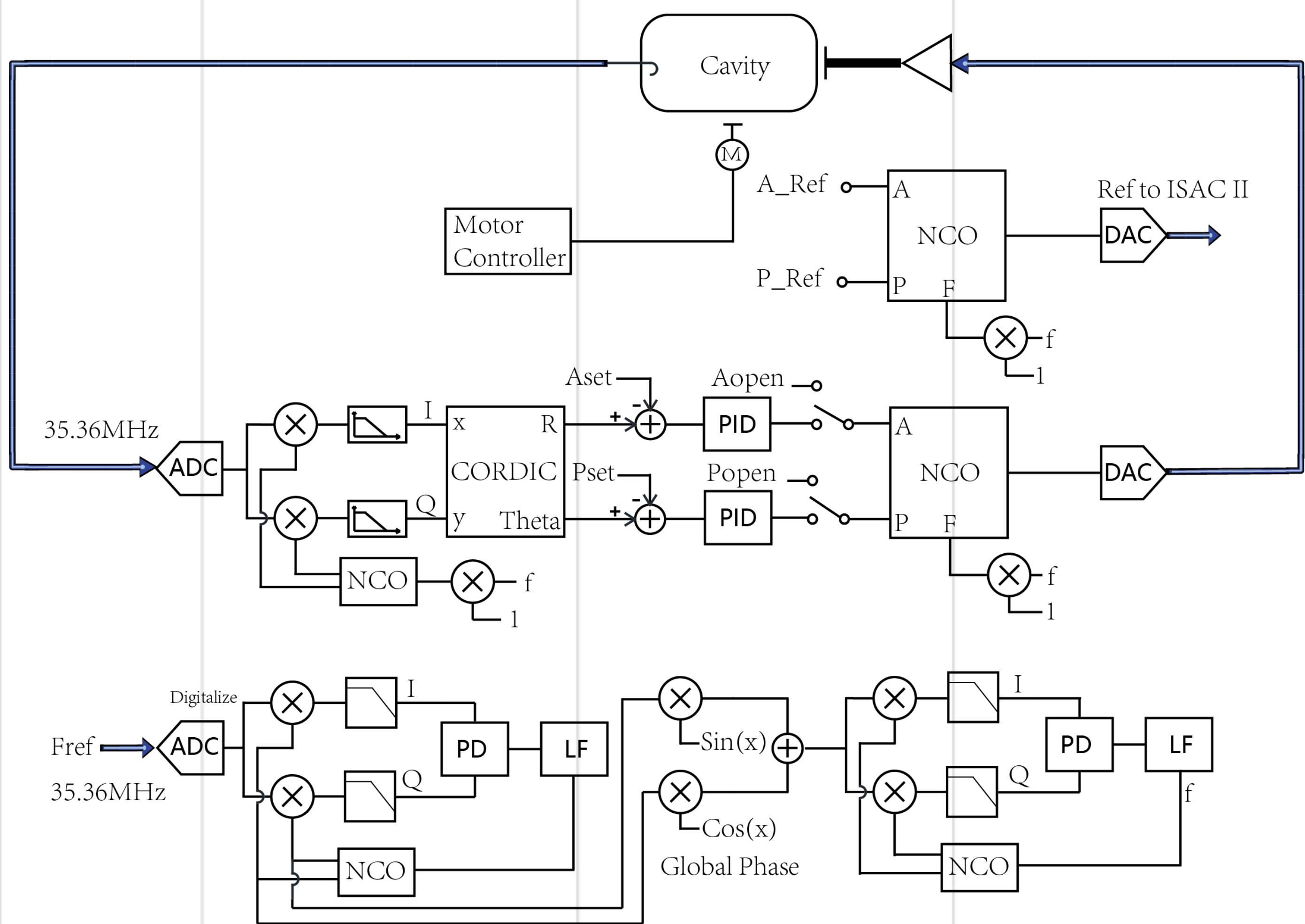
Hardware Design

- NIM bin Crate
- TRIUMF's universal ZYNQ based hardware
- USB HID
- Ethernet
- Motherboard



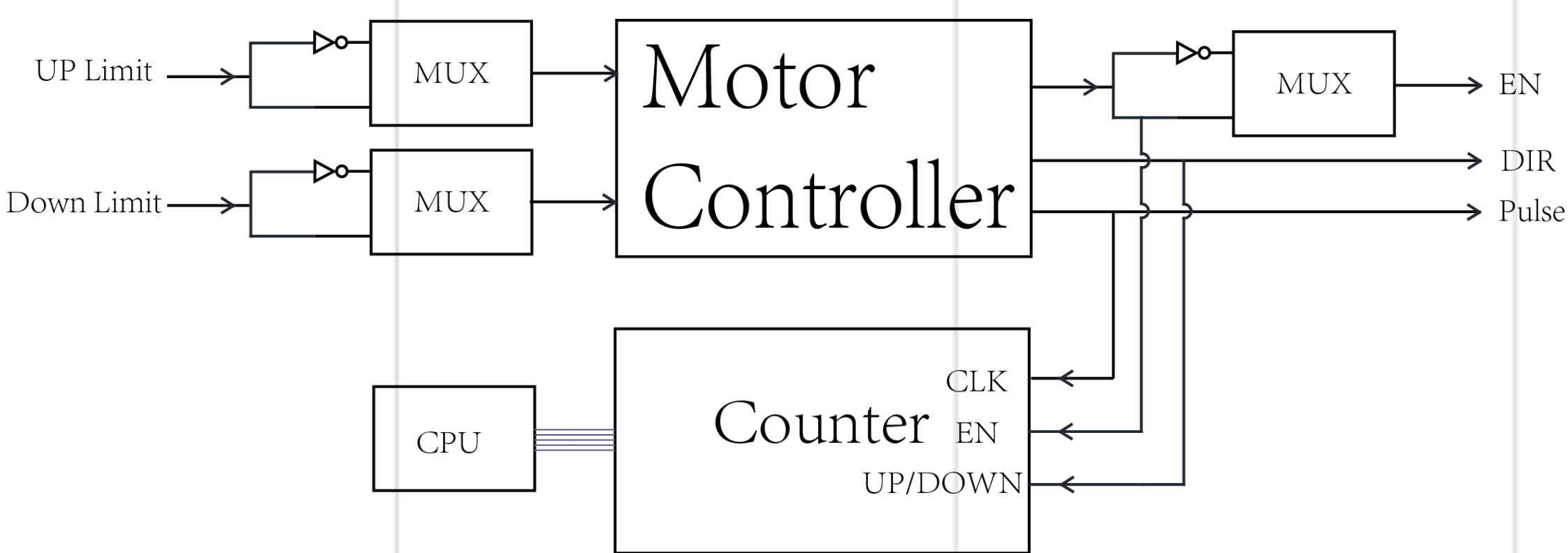
Firmware Design

- Phase-locked loop
- Amplitude/phase control
- Motor controller
- Global phase shifter



Motor controller

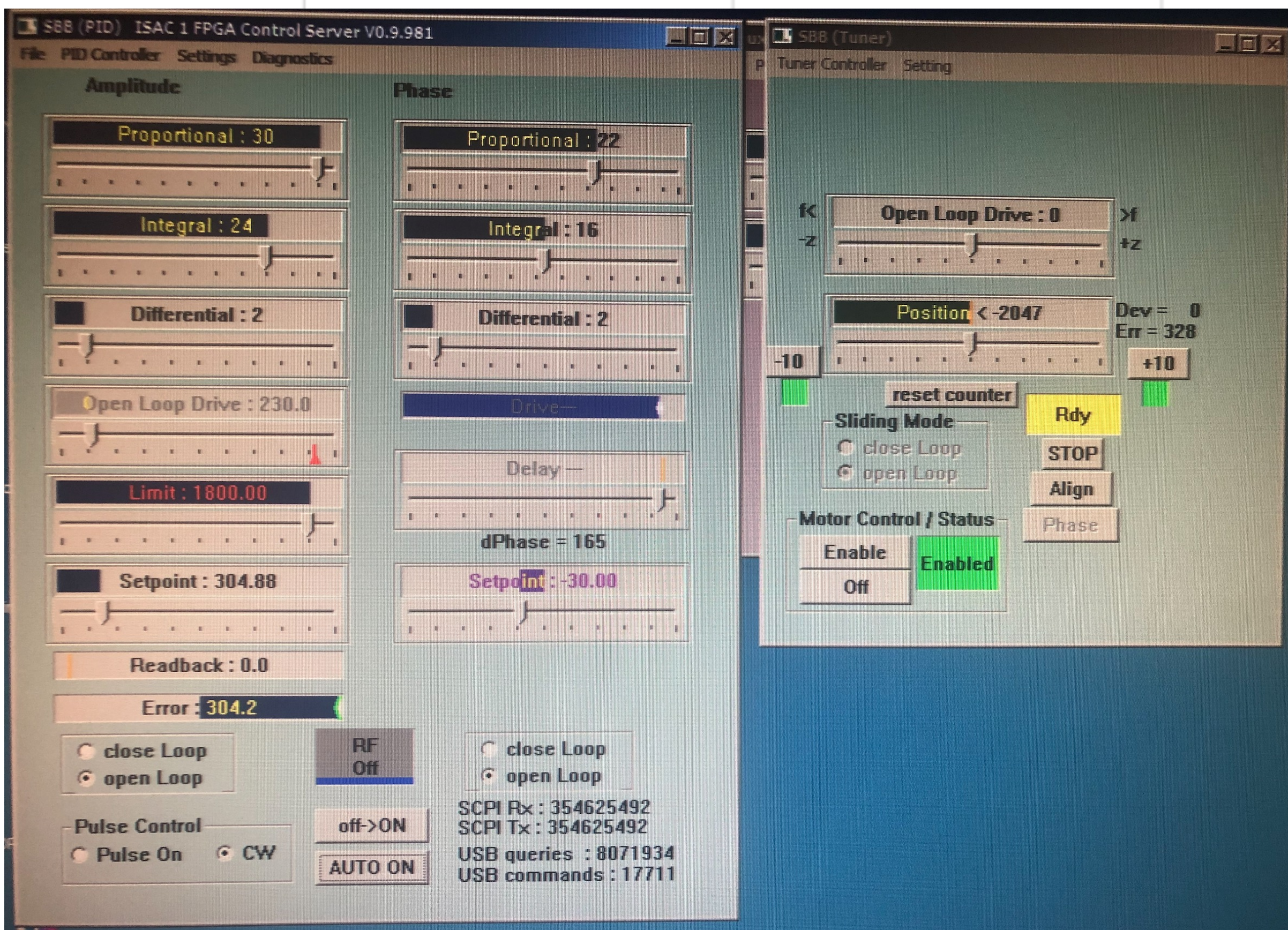
- Frequency, duty factor, operation mode
- Programmable polarity
- Position counter



Linux OS and Python

- Compiled from Debian 11 source code
- Python3
- 48 bytes HID based on HID gadget
- AXI-GPIO Linux driver
- Jupyter notebook
- Pyllrf library

Local control PC



Test and tune

- Auto-on test
- 10kW long term test
- ISAC II reference phase noise
- PLL parameters tuning

