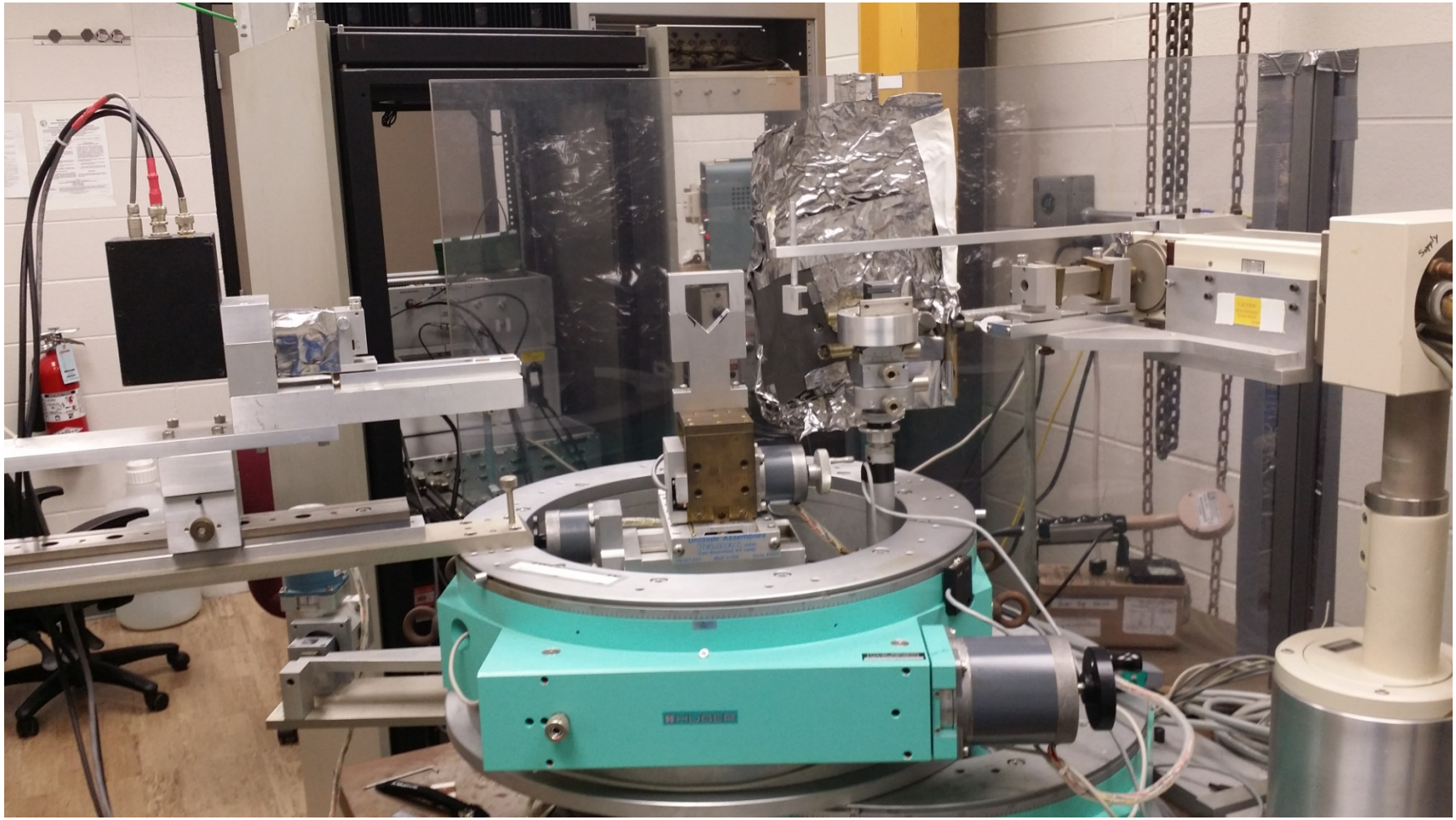
softGlue on Linux:
EPICS Support for Standard Industry Pack Modules on Linux PCs

Mark Rivers

University of Chicago

Motivation

- Want to automate antiquated x-ray on campus at University of Chicago
- Have 4-circle diffractometer used for crystal alignment
- Need motor control, counter/timer for Bede scintillation point detector

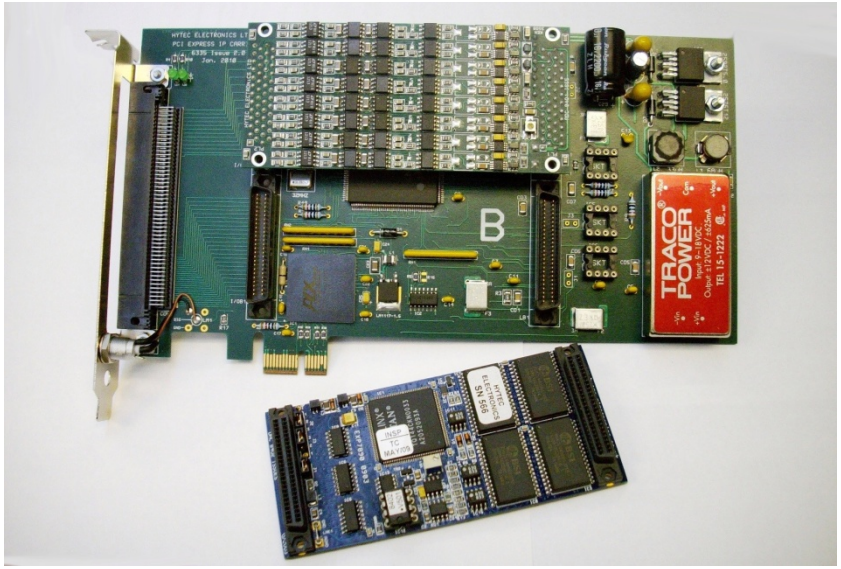


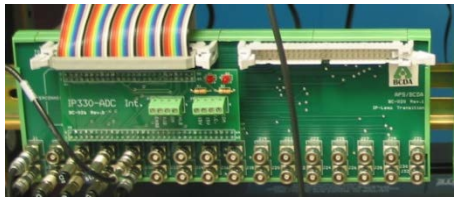
Motivation

- Delta-Tau GeoBrick to run the motors
- Want to use SPEC with EPICS
- Need an EPICS counter/timer for Linux
- Measurement Computing CTR-08 is Windows-only at present
- Hytec makes a PCI-E Industry Pack carrier and an IP scaler/timer
- Generally it would be nice to have support for Industry Pack modules (A/D, D/A, Digital I/O) on Linux

Hytec 6335

- Industry Pack Carrier card for ‘X1’ PCI Express slot
- Accommodates two Industry Packs
- Linux driver
- 50 pin I/O connections of each Industry Pack fed via a single high-density 100 way header on the card bracket
  - External 100-pin high-density ribbon cable, terminated in two high-density 50-pin (SCSI-2) connectors.
  - We convert these high-density 50-pin to low-density 50-pin with $10 commercial adapter
- +12-volt and +3.3-volt power from the PCIe connector, uses these to produce +5 volts and -12 volts for the Industry Packs.
  - Isolated + and -12 volt power provided by an on-board DC-DC converter. These supplies are intended as front-end power for isolated ADC or DAC Industry Packs and are selected by jumpers for each site.



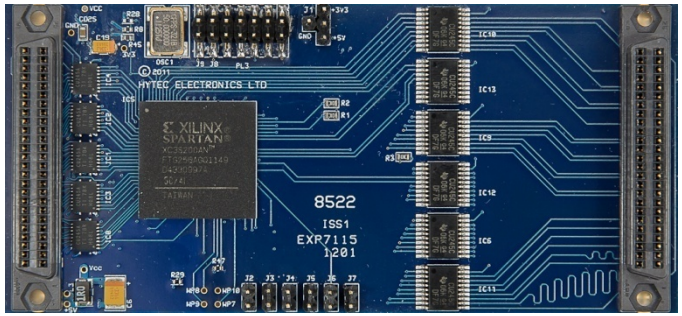


Hytec 6335 – Initial Problems

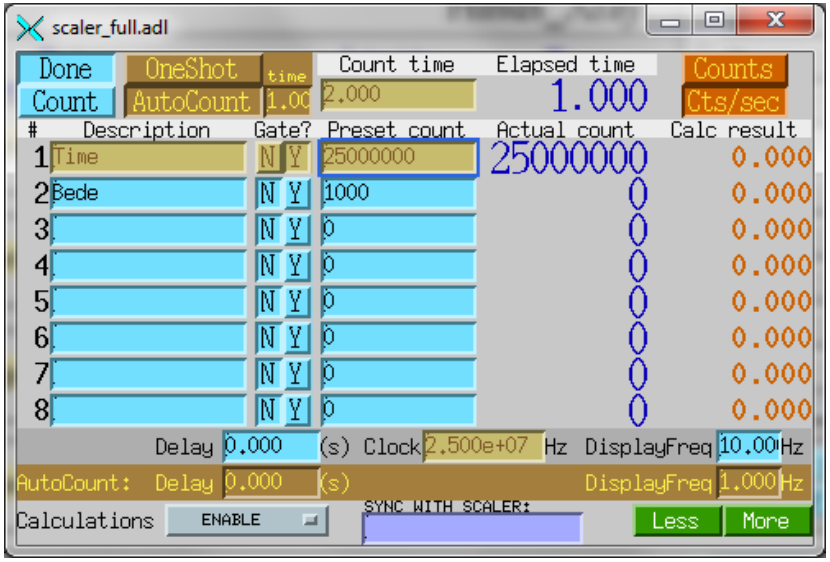
- Hytec Linux driver did not work with Fedora 15
  - Each version of the Linux kernel requires changes to kernel mode drivers
  - Hytec have now put conditionals in the kernel driver to build on several versions of Linux
- Hytec Linux driver did not work on 64-bit Linux
  - Hytec modified the kernel driver and their drvIpac driver to fix this
- Their 6335 hardware did not work with other vendor's IP modules
  - Read operations seemed to work OK
  - Write operations did not work.
  - I sent them a DAC-128V and an IP-UD-I for them to test with
  - It was a problem with byte access, A0 address line which they don't use but other vendors do
  - Hytec modified the 6335 firmware to fix this
- System would not boot with DAC128V installed
  - Hytec modified the 6335 firmware to fix this
- Interrupts did not work correctly on the modules I tested (IP-UD-I, IP-330)
  - Hytec modified their drvIpac driver to re-enable interrupts after each interrupt service routine completes. This is expected by the drvIpac API.
  - Hytec reports that IP-UD-I interrupts now work OK, I have not been able to test yet

Hytec 8522
16 channel Scaler/Multi-channel Scaler

- 16 independent counting channels.
- Each scaler has a shadow register to allow on-the-fly reading.
- Full 32 bits binary count capacity and 64 bit histogram capability.
- 200MHz Count rates (LVDS, LVPECL and NIM), 100MHz for TTL.
- Coincidence mode allows counting for coincidence on multiple inputs.
- Gate interval register determines the gate interval for all scalers.
- Gate intervals may be programmed from 100usec to 65secs
- Programmable memory depth (number of time bins) per triggered cycle of gate intervals
- Number of cycles register determines number of add-to-memory cycles.
- Interrupt generated at end of each completed number of cycles.
- External hardware trigger (software enable) or software trigger
- Trigger output to allow Trigger In / Out daisy-chain connection for synchronization.



The Lab is Running!



Hytec 8522 scaler

8 motors, GeoBrick-LV

- spec is scanning motors, reading scaler, enabling rapid crystal alignment
- In future may use for crystallographic measurements

Industry Pack Modules

Module	Description	Status
Hytec 8522	16-channel scaler/timer	Works now with interrupts MCS mode needs to be made more compatible with SIS23820 support. Change modes with EPICS PV.
Systran DAC128V	8-channel 12-bit D/A	Works now
GE IP-UD-I	24-bit binary I/O	Works in programmed I/O Interrupts claimed to be working by Hytec
Acromag IP-330	16-channel 16-bit A/D	Needs to be tested. How many interrupts/s? 1 kHz is OK in vxWorks.
Acromag IP-EP201	Soft Glue; software programmable logic	Needs to be tested
GE IP-Octal-232	8-channel RS-232	Not tested. Needed? Can just use Moxa-type terminal server.
GE IP-488	IEEE-488 (GPIB) controller	Not tested. Needed? Can use Agilent Ethernet/GPIB VXI converter.

Future Plans

- Hytec is loaning me another 6335 PCI-E card and 8522 scaler/timer
- I will test the remaining IP modules (except perhaps IP-Octal and IP-488?)
- I will re-write the 8522 driver to be compatible with the SIS3820 and Measurement Computing USB-CTR08 drivers.
  - Use the same PV names, have the same functionality
  - Switch between counting modes via EPICS PV, not iocsh command.
- This is definitely a viable option for getting lots of EPICS I/O under Linux for the small laboratory