Laboratório Nacional de Luz Síncrotron

CNPEM

First steps with Flyscan

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Scan @ LNLS

- Step-by-step scan is widely used

1) Vary a parameter (beam energy, temperature, magnetic field)
2) Trigger a measurement
3) Loop

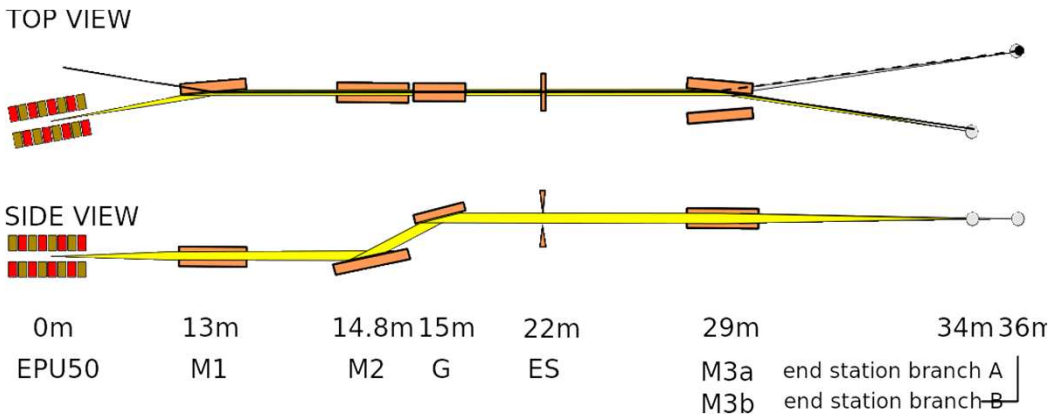
- Result: measurement vs. varied pararameter

The basics work: what are the next steps to improve operation ?

The problem: scan @ PGM

Plane grating monochromator

- X-ray Photoelectron Spectroscopy (XPS) / X-r
- Extreme ultra violet/soft X-ray spectroscopy (1
- Uses both the monochromator and the undula



The problem: scan @ PGM

- The problem: the undulator software is old and “owned” by the control room
- PGM software connects to the control room software to move it
- Undulator settling time and software dead times are high (~4 seconds per mo
- Experiments with **step-by-step scans take 40 minutes**

On-the-fly scan

- Start the undulator and monochromator movement together and trigger meas
- a way to overcome the undulator dead time in a non invasive way
- Only moves undulator once
- Does not change the undulator code

Analysis

- Requires hardware trigger pins
- Monochromator grating, monochromator mirror and undulator gap
- Monochromator movement is not linear
- Undulator sends trigger signal when the movement starts (and nothing else)
- No way to synchronize the monochromator and undulator in the middle of the movement
- Movement repetition tests: do the undulator and the monochromator always move in the same
- Answer is YES: the movements are very precise
- Monochromator and undulator can synchronize very well with just the start trigger signal (giver

Proof of Concept

- GUI in LabView
- Galil with custom firmware
- ECAM mode (table based non-linear coordinated movement based on virtual
- Matlab to generate ECAM table (uploaded by hand)
- Measurement triggers from Galil to 2 Keithley current meters
- Undulator and monochromator speeds very slow, yet, **experiments required**

Final implementation

- Python
- Smaller and more generic galil firmware code (suitable for other beam lines t
- Requires running in parallel with EPICS (conflicts were found)
- The python script does not move the undulator (per operator request)

Operation example

- From Control System Studio, move the undulator to the initial position
- From the terminal, execute:

```
00 1 2 > data.out
```

- The flyscan script reconfigures galil, 2 keithleys and then galil sleeps, waiting
- From CS Studio, move the undulator to the final position
- The undulator starts moving and simultaneously triggers galil
- Galil triggers the 2 Keithleys in a loop
- After scanning, the script collects all the timestamps, positions and measuren

Conflicts with EPICS

- Needs to send the encoder readback PV to the galil controller
- After the scan, EPICS doesn't know the motors moved
- No free thread for flyscan firmware
- Changing the number of running threads breaks Galil 1.5 IOC
- After patching the IOC, both EPICS and flyscan are working

Next steps

- Reimplement flyscan support using EPICS
- ECAM mode, hardware triggers and flyscan firmware in Galil IOC
- Buffer mode and hardware triggers in Keithley IOC
- The python script should contain only high level logic
- Flyscan in more beam lines