



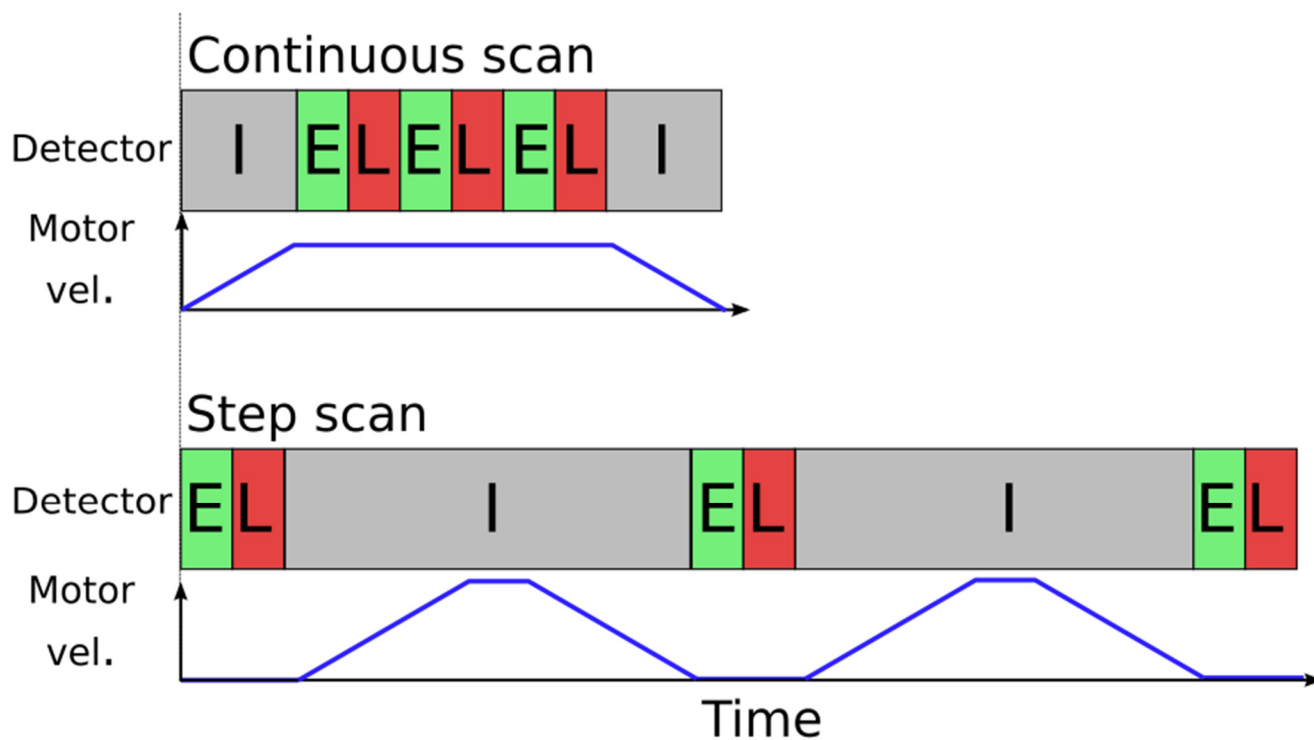
# Continuous scans with position based hardware triggers

H. Enquist, A. Bartalesi, B. Bertrand,  
J. Forsberg, A. Freitas, V. Hardion,  
M. Lindberg, C. Takahashi

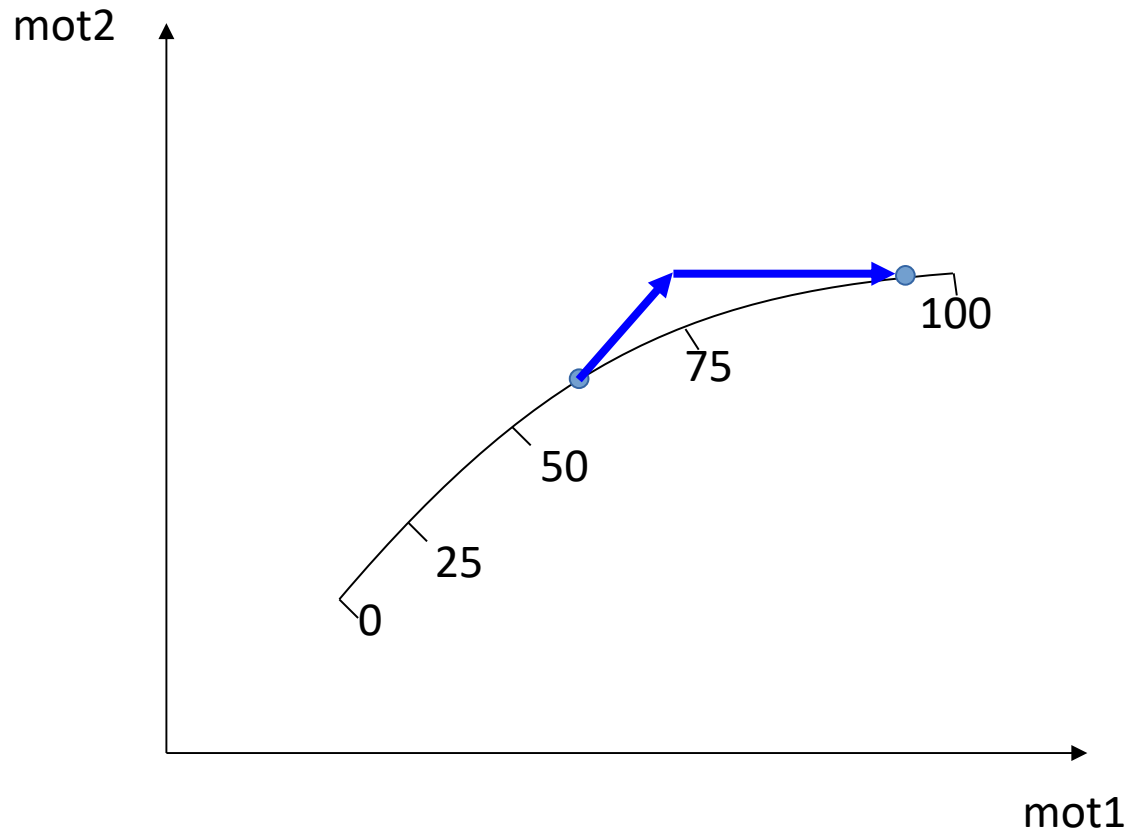
# Outline

- **Why continuous scans**
- **Parametric trajectory motion**
- **Overview of the system**
- **Trigger generation**
- **Scan procedure**
- **Measurements**
- **Challenges**
- **Outlook**
- **Acknowledgements**

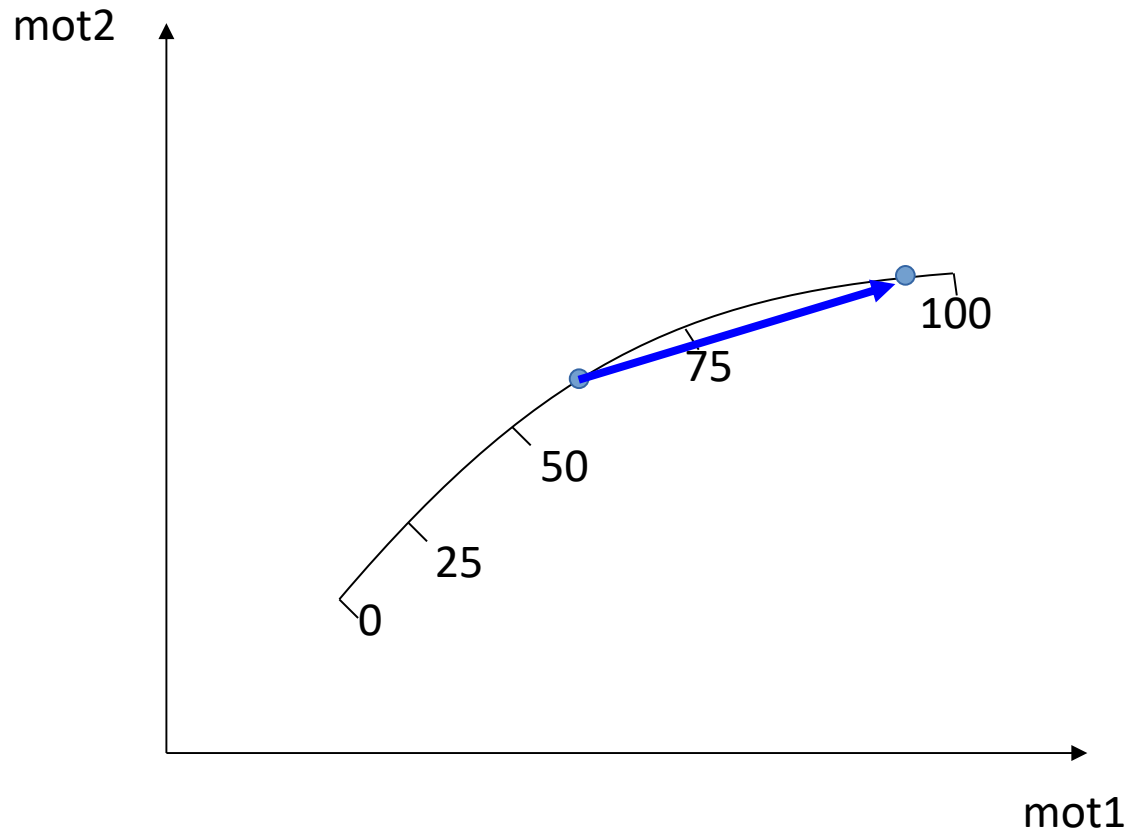
# Step scans vs continuous scans



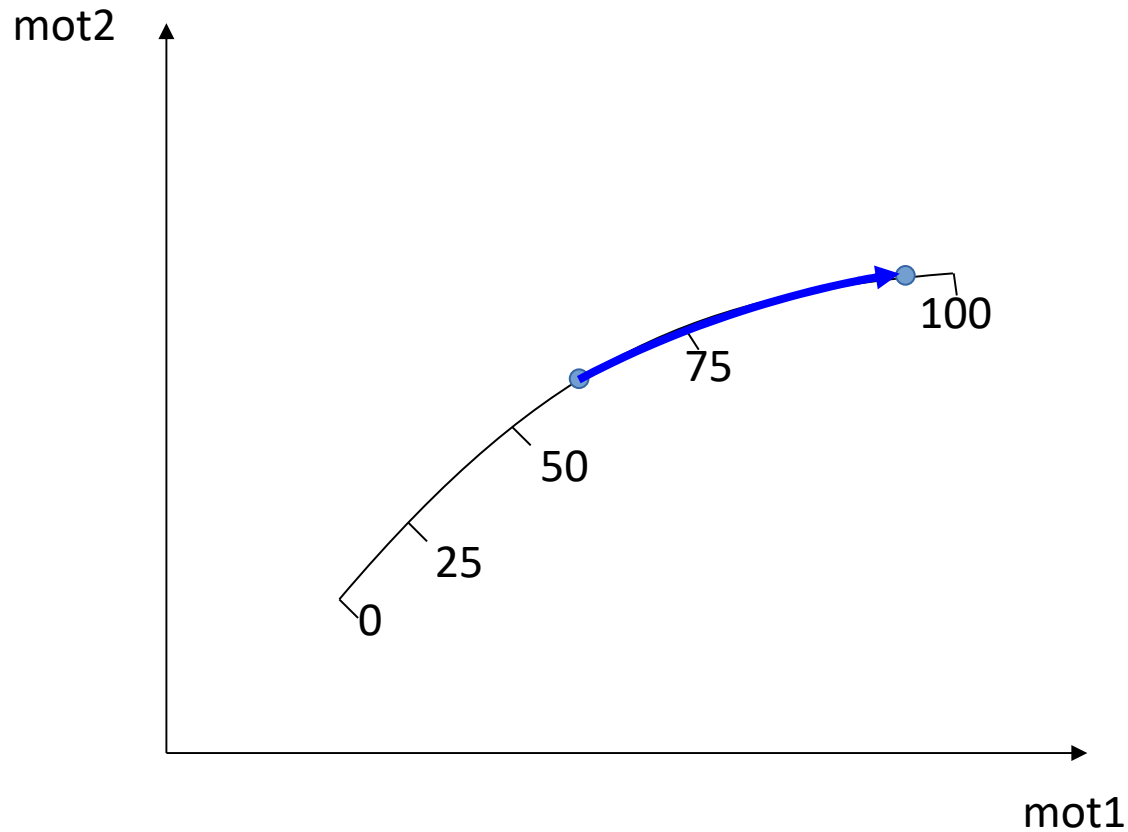
# Standard PseudoMotor, nominal velocities



# Standard PseudoMotor, matched velocities

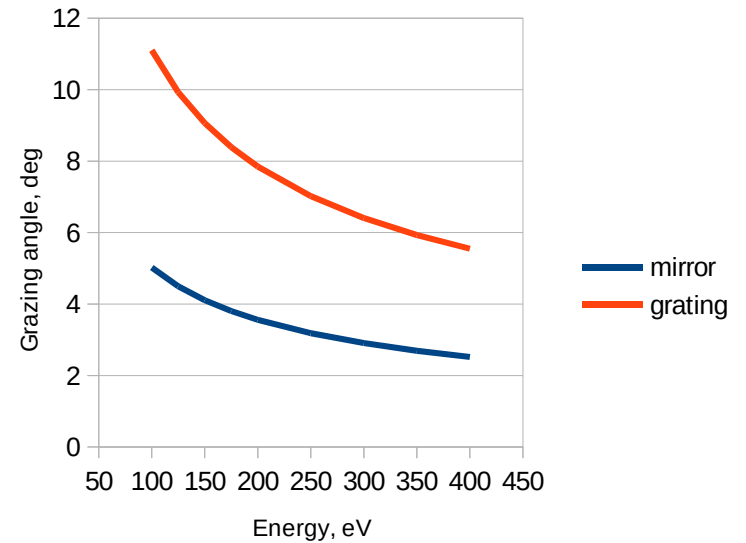
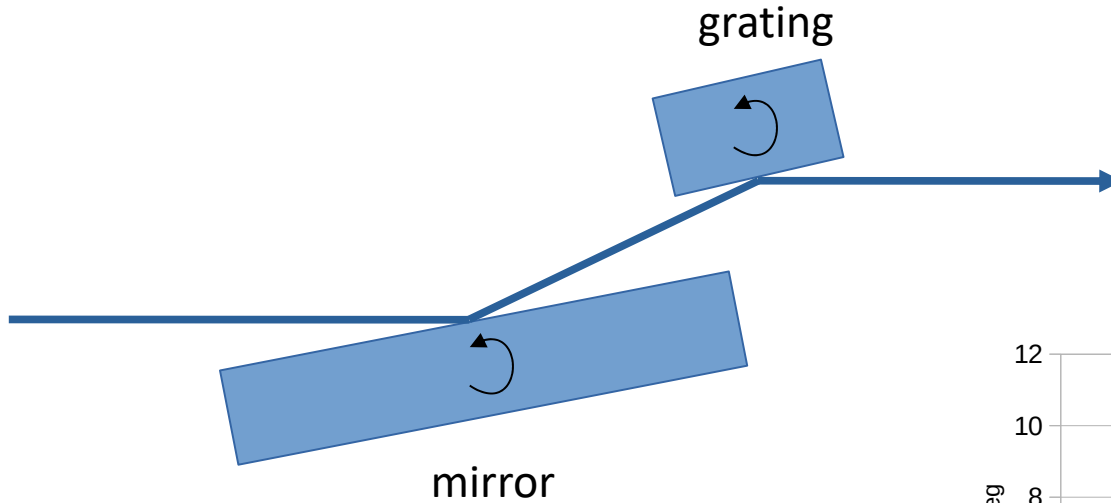


# Parametric trajectory

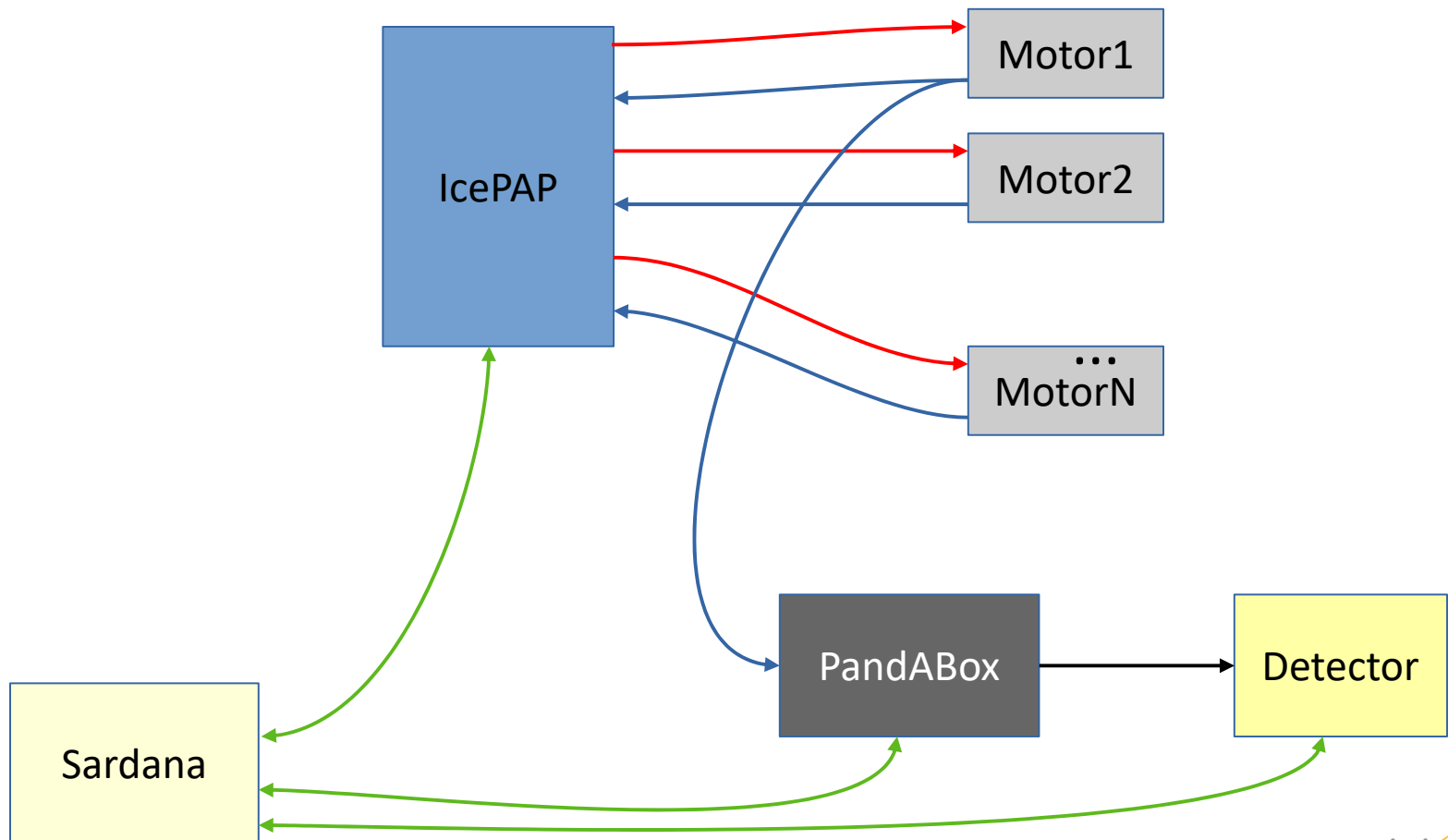


Must follow trajectory, at a constant speed in units/s

# Monochromator

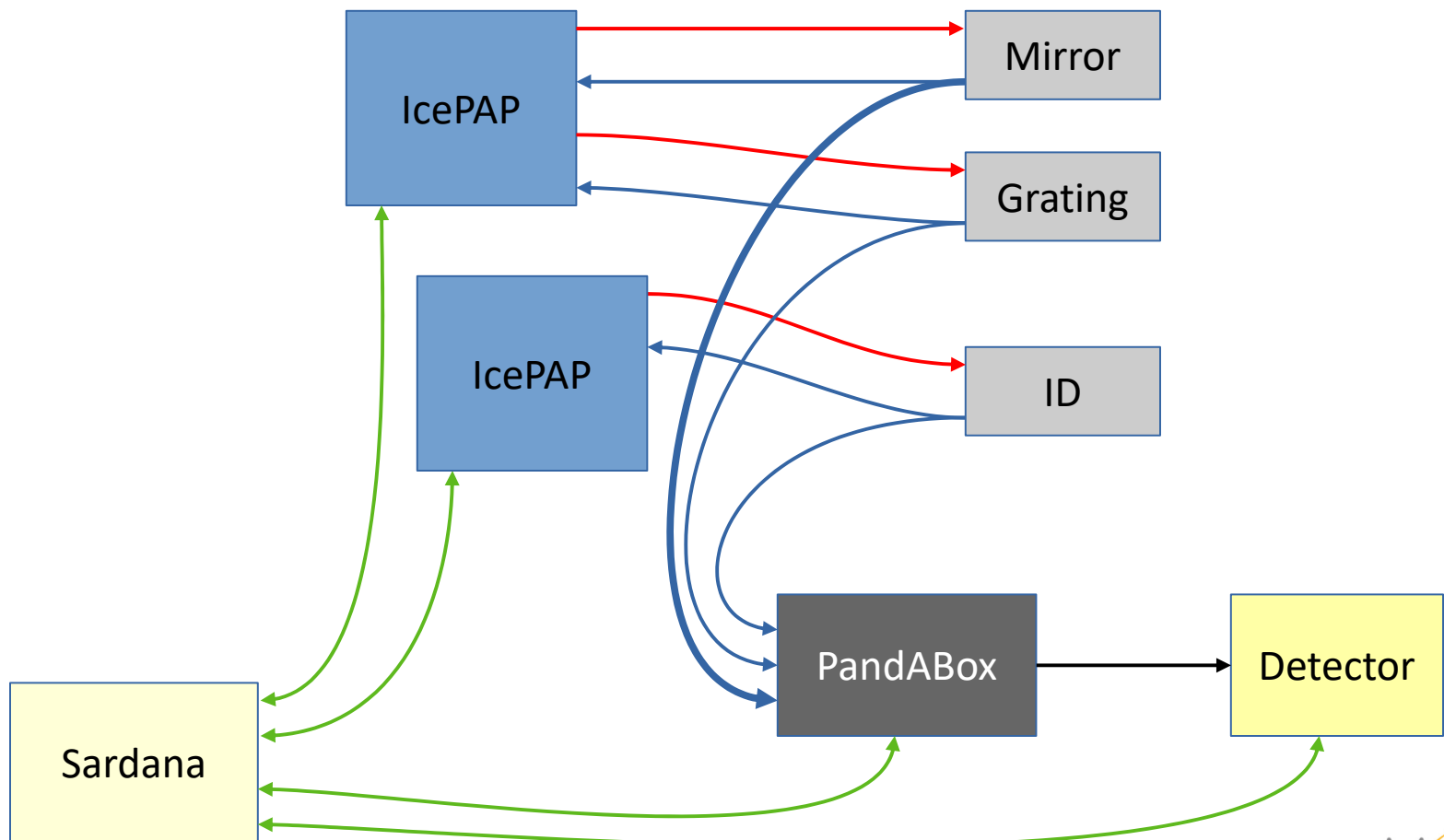


# Position based hardware triggers

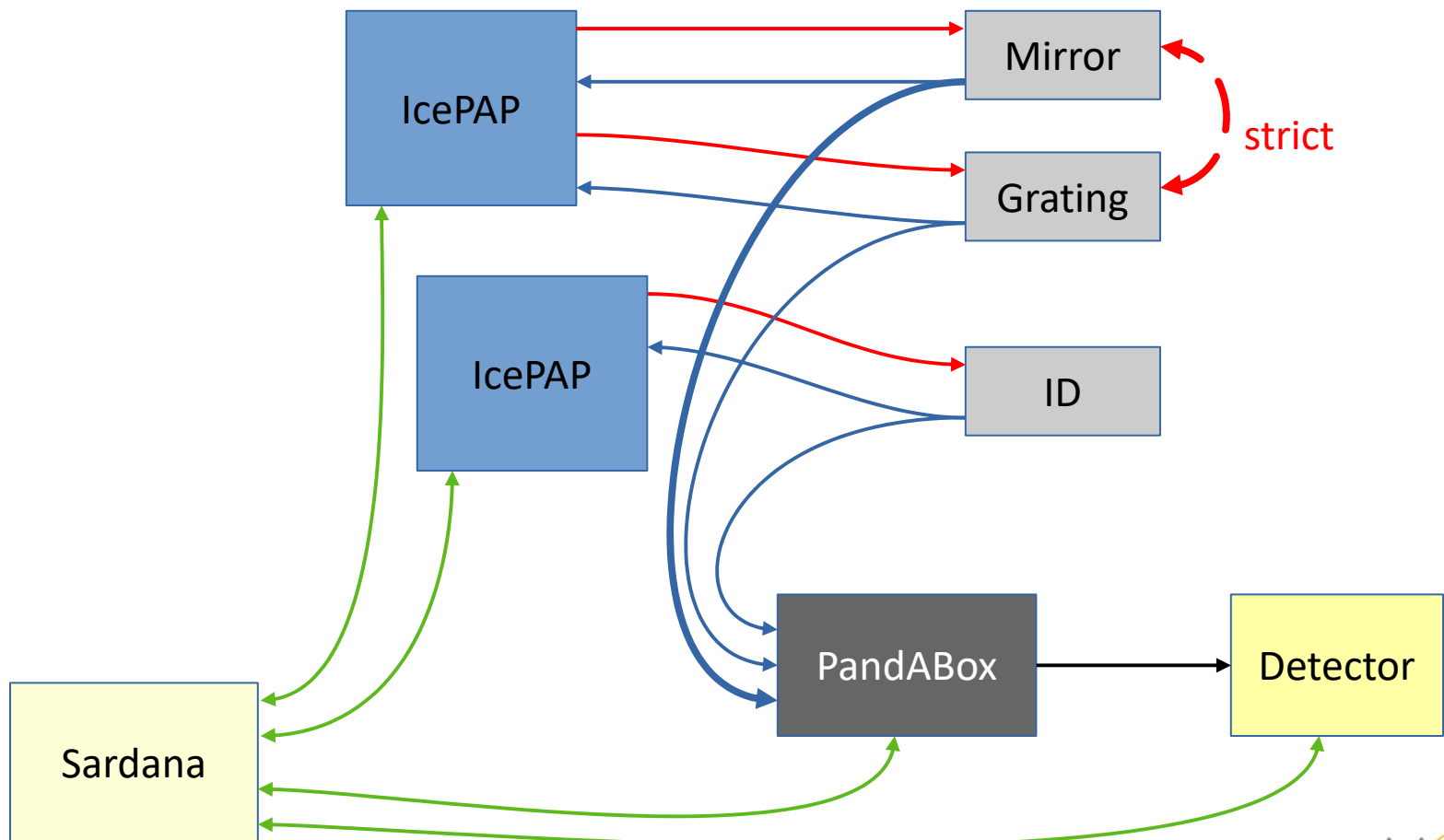




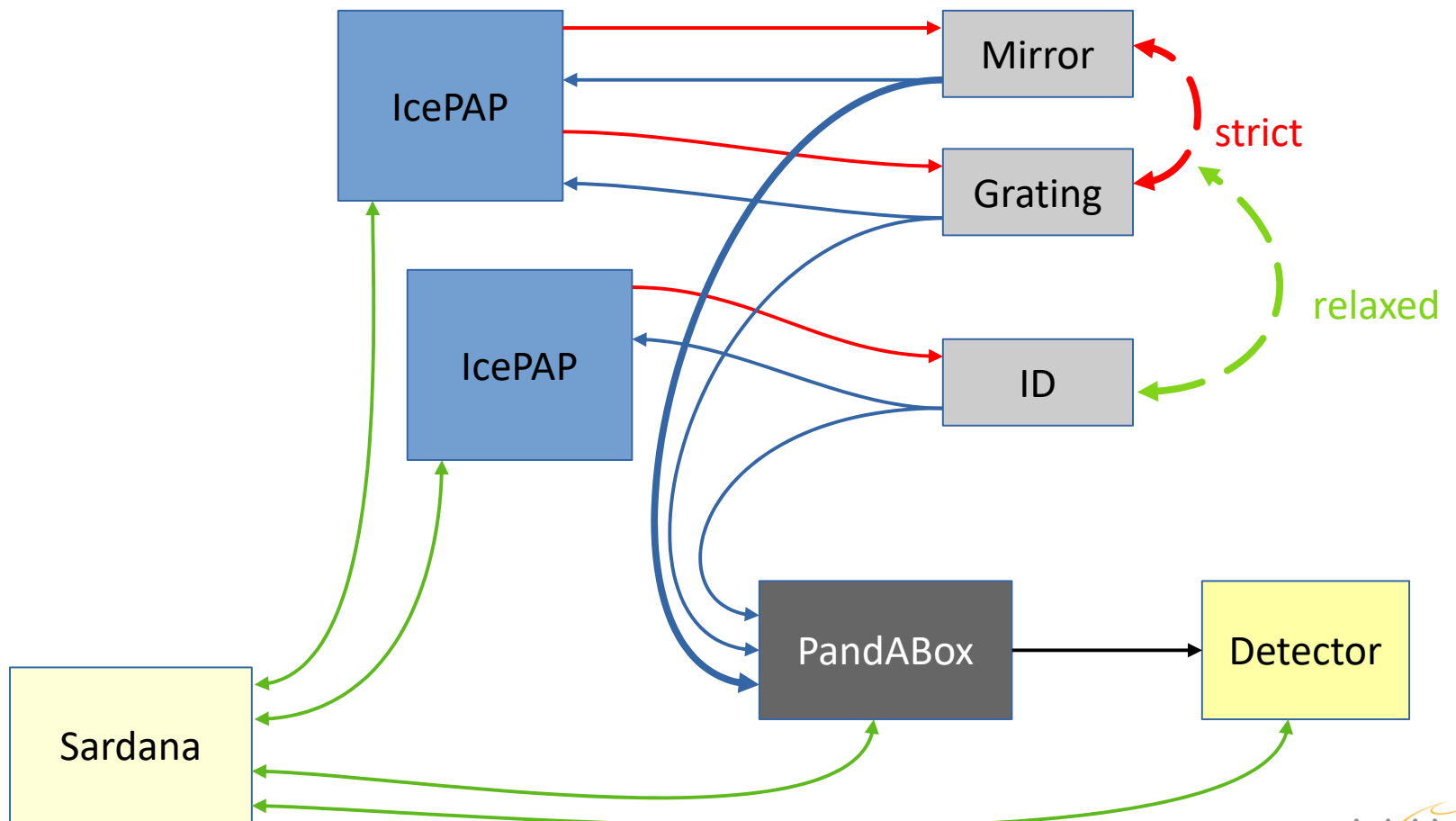
# Monochromator and undulator



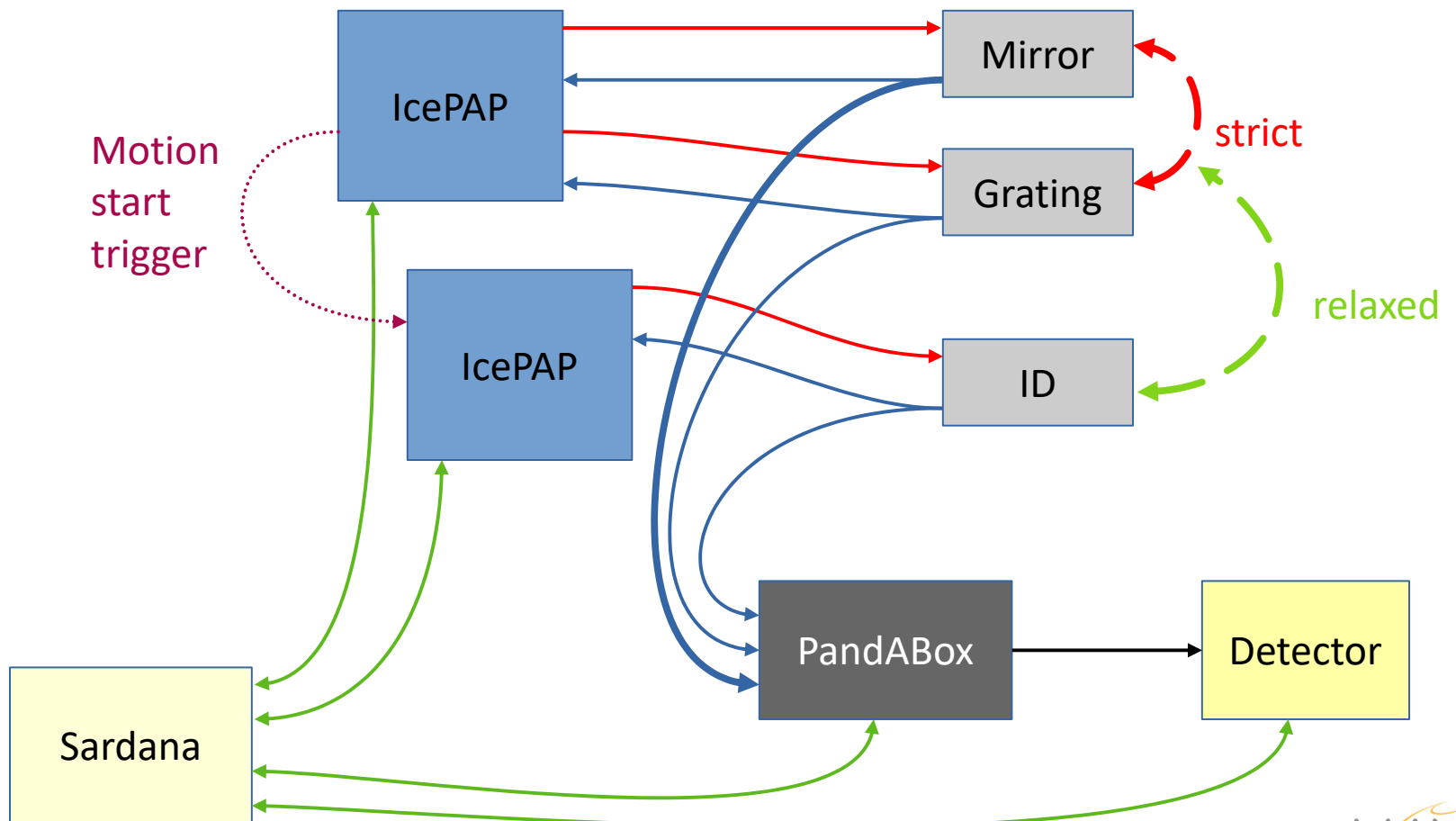
# Monochromator and undulator



# Monochromator and undulator

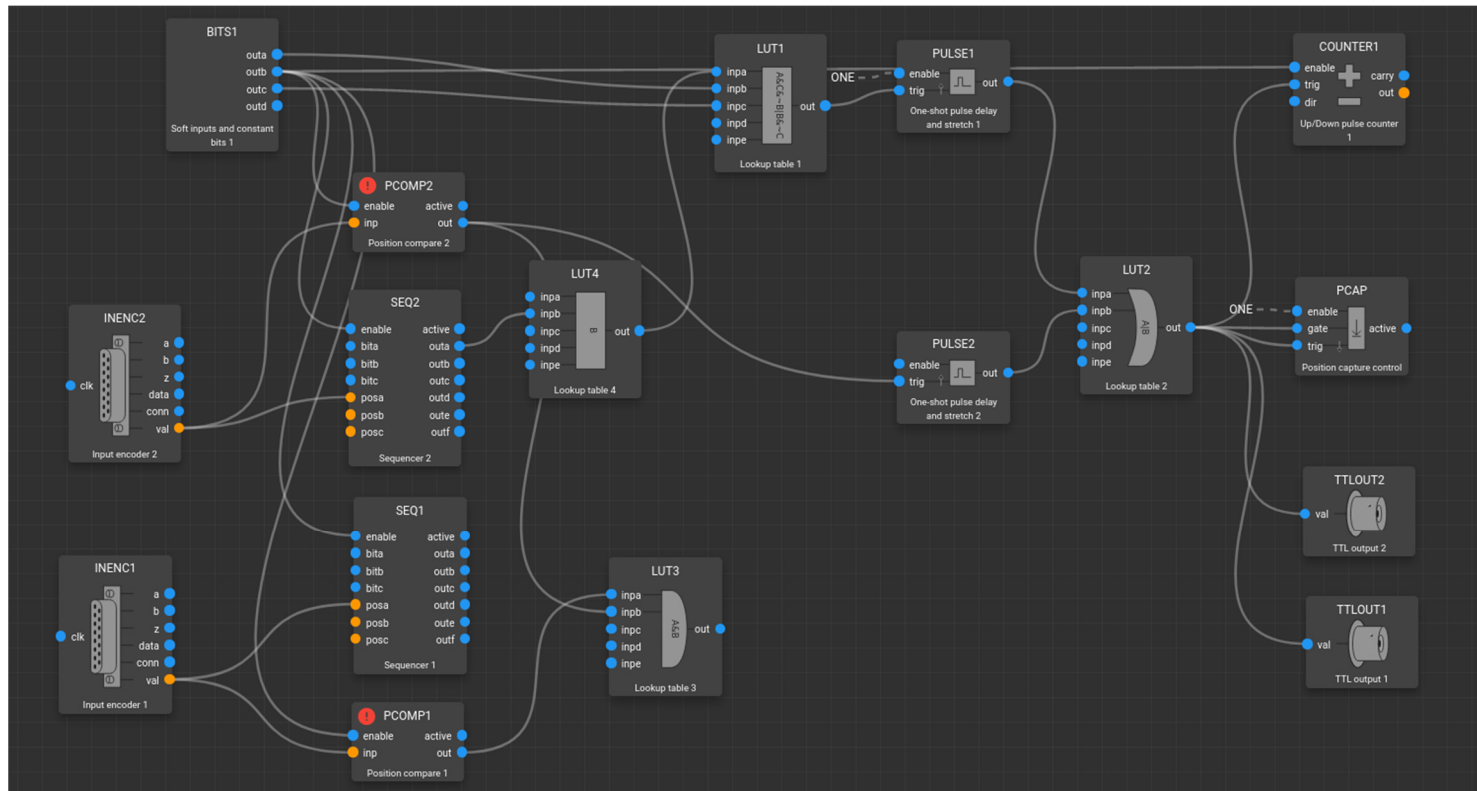


# Monochromator and undulator



# PandABox

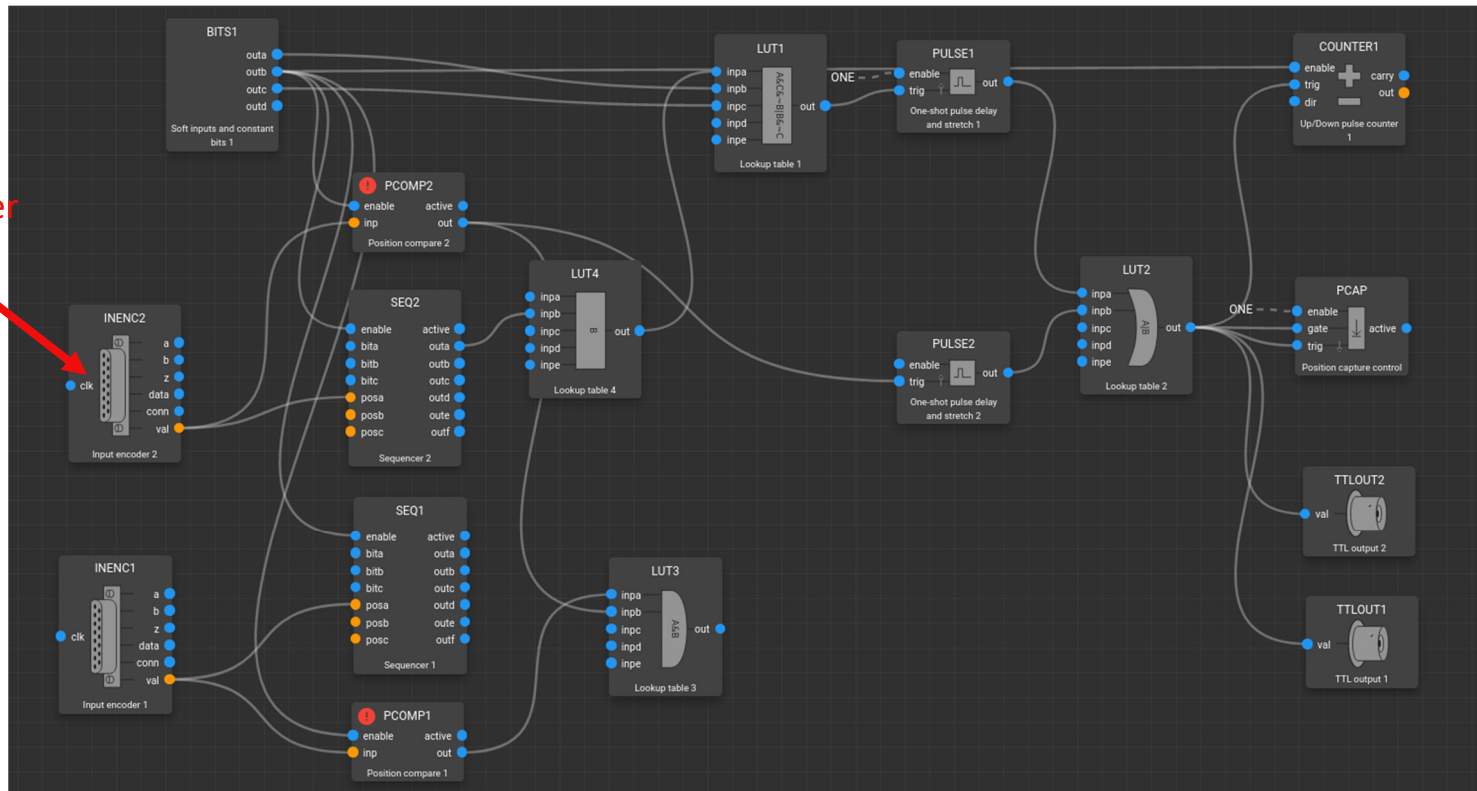
## Trigger on motor position



# PandABox

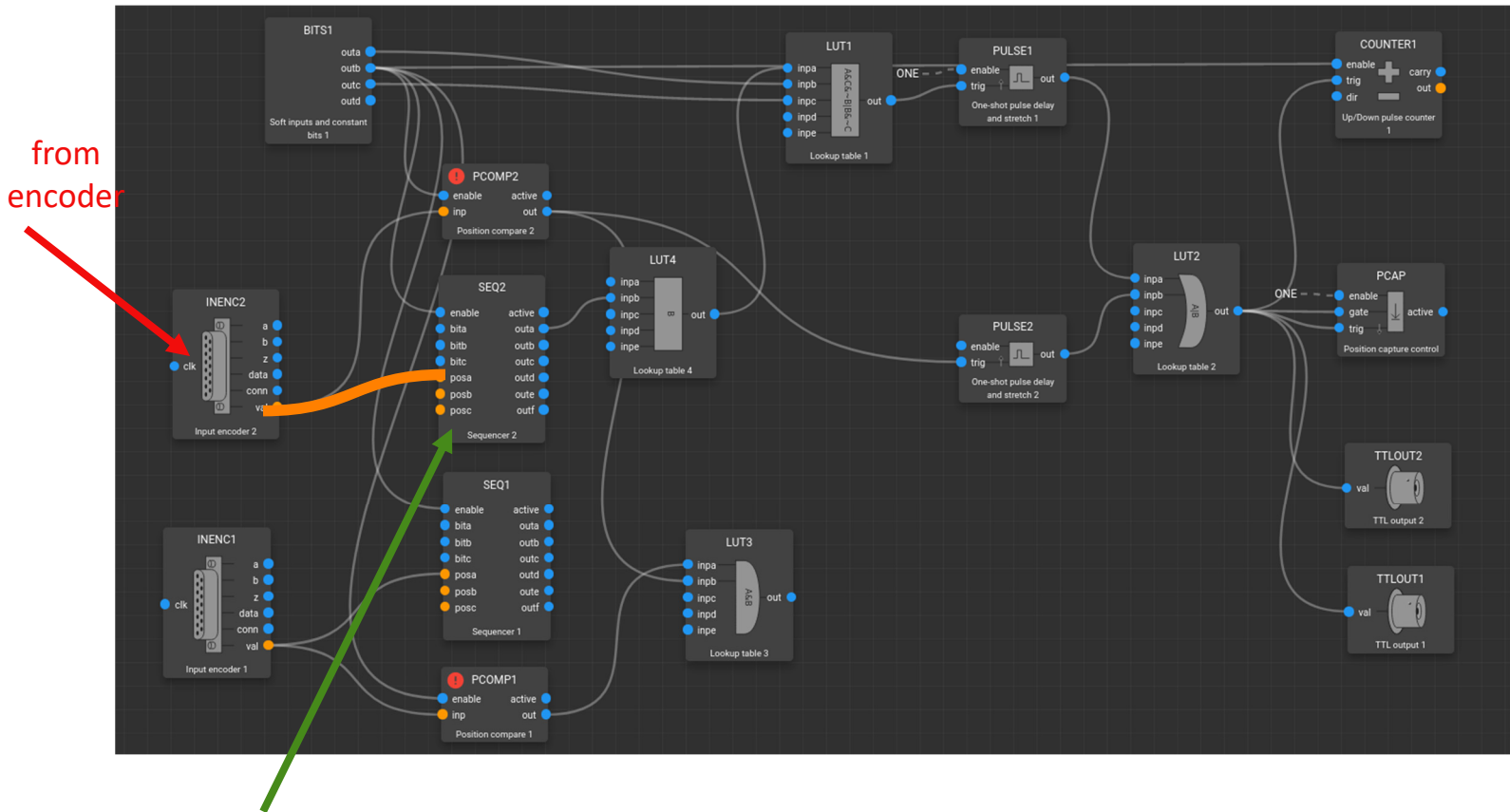
## Trigger on motor position

from encoder



# PandABox

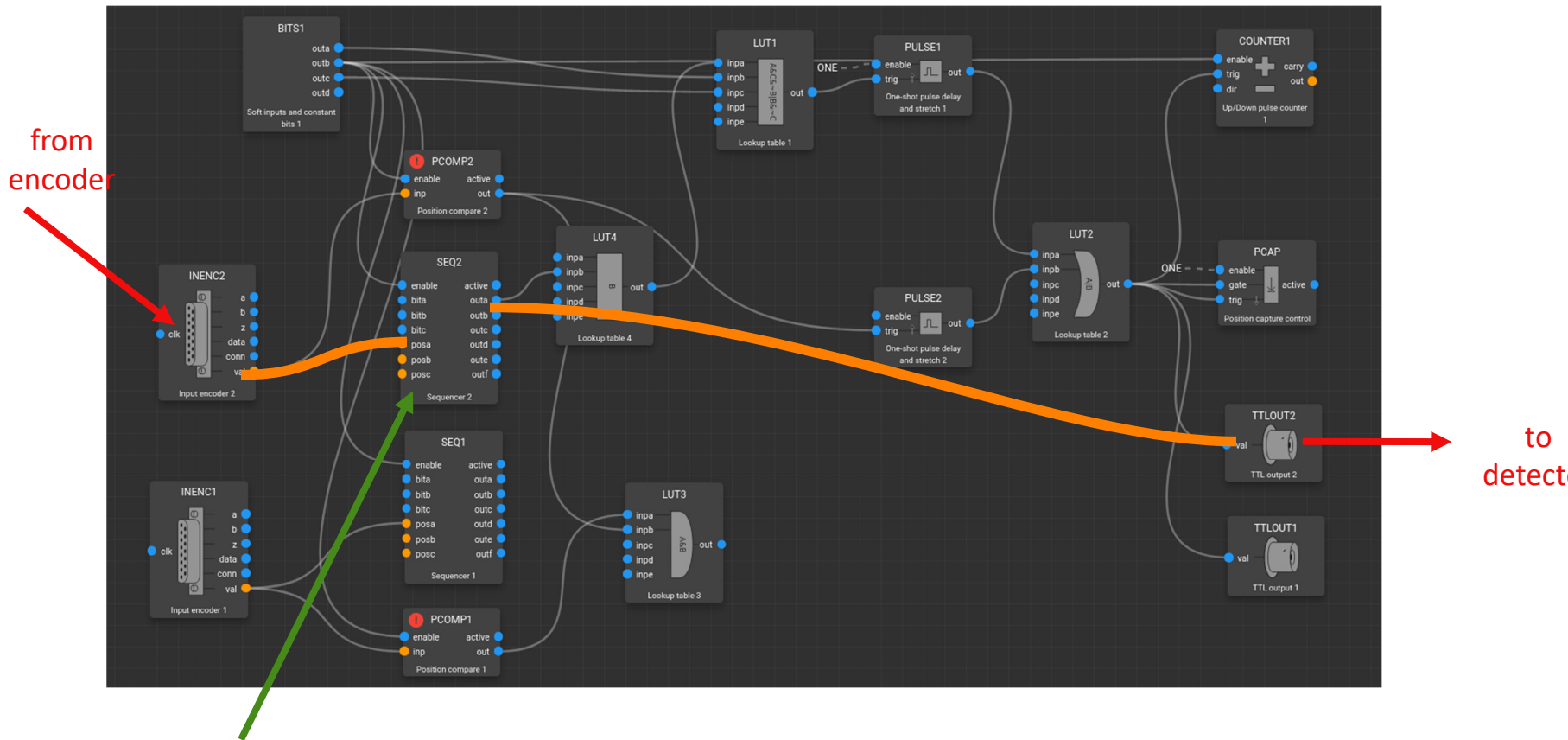
## Trigger on motor position



Sequencer generates triggers when the encoder reaches values in a list.  
Values generated by Sardana controller.

# PandABox

## Trigger on motor position



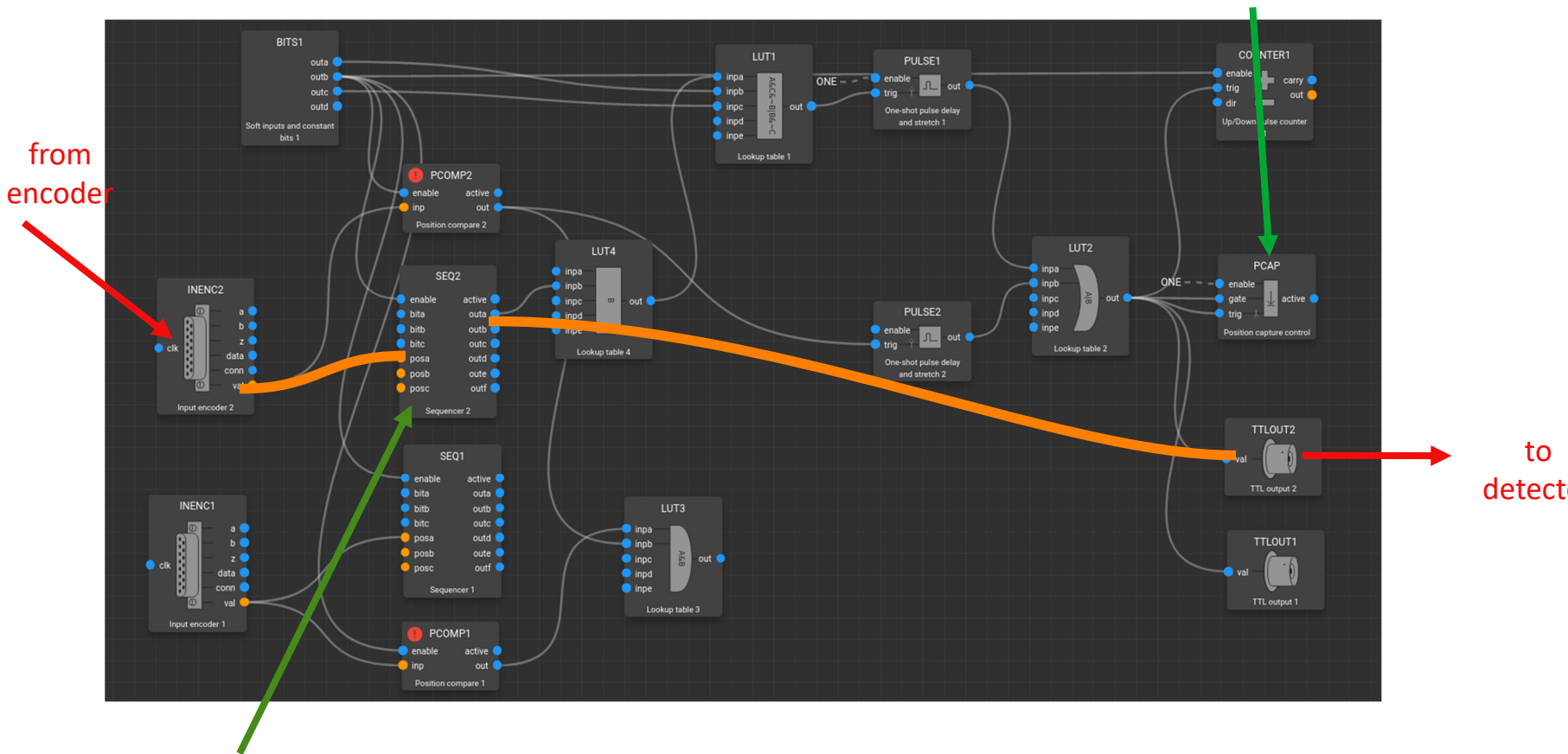
Sequencer generates triggers when the encoder reaches values in a list.  
Values generated by Sardana controller.



# PandABox















## Trigger on motor position

Capture encoder readings at each trigger



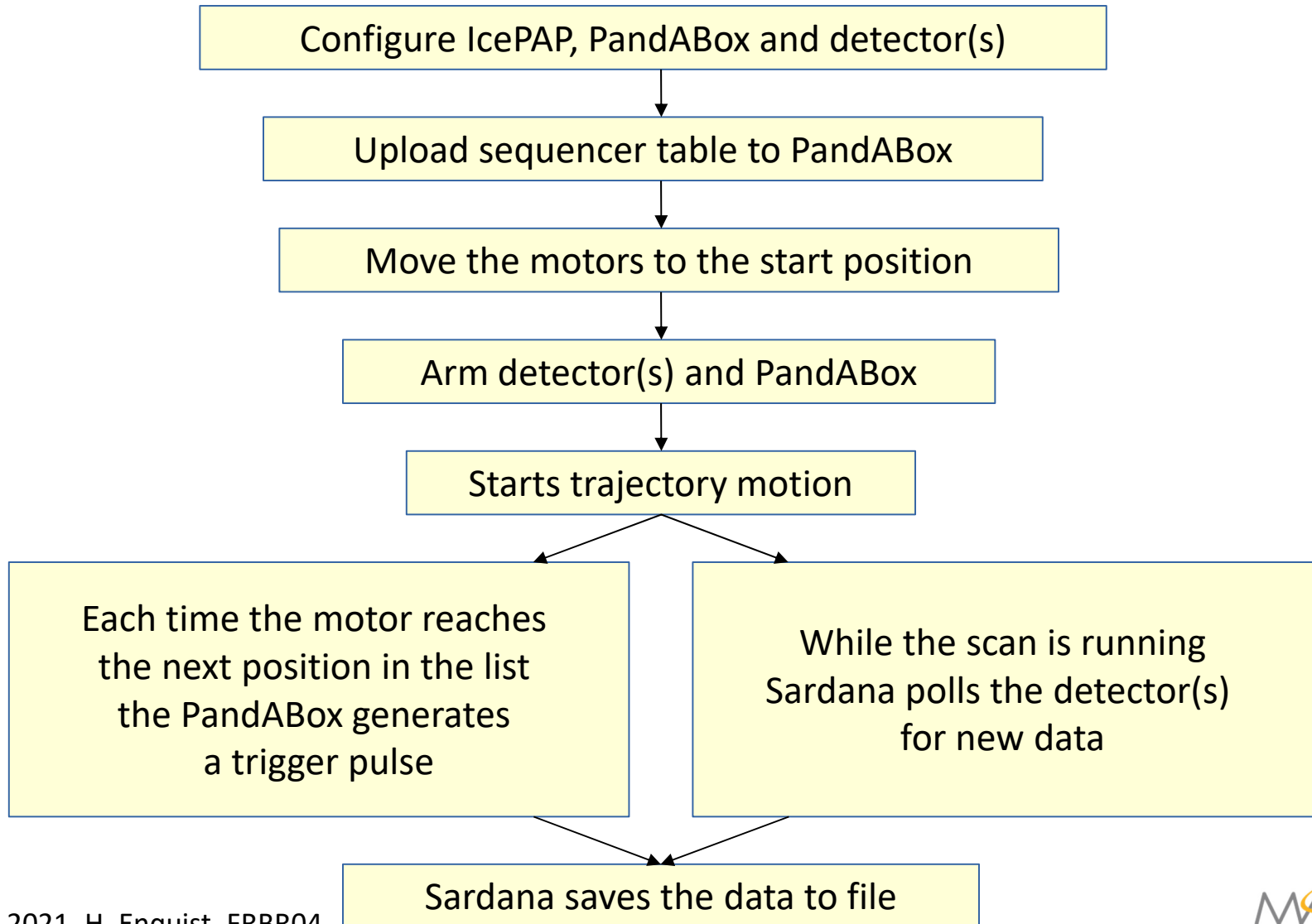
Sequencer generates triggers when the encoder reaches values in a list.  
Values generated by Sardana controller.

# Sequencer table

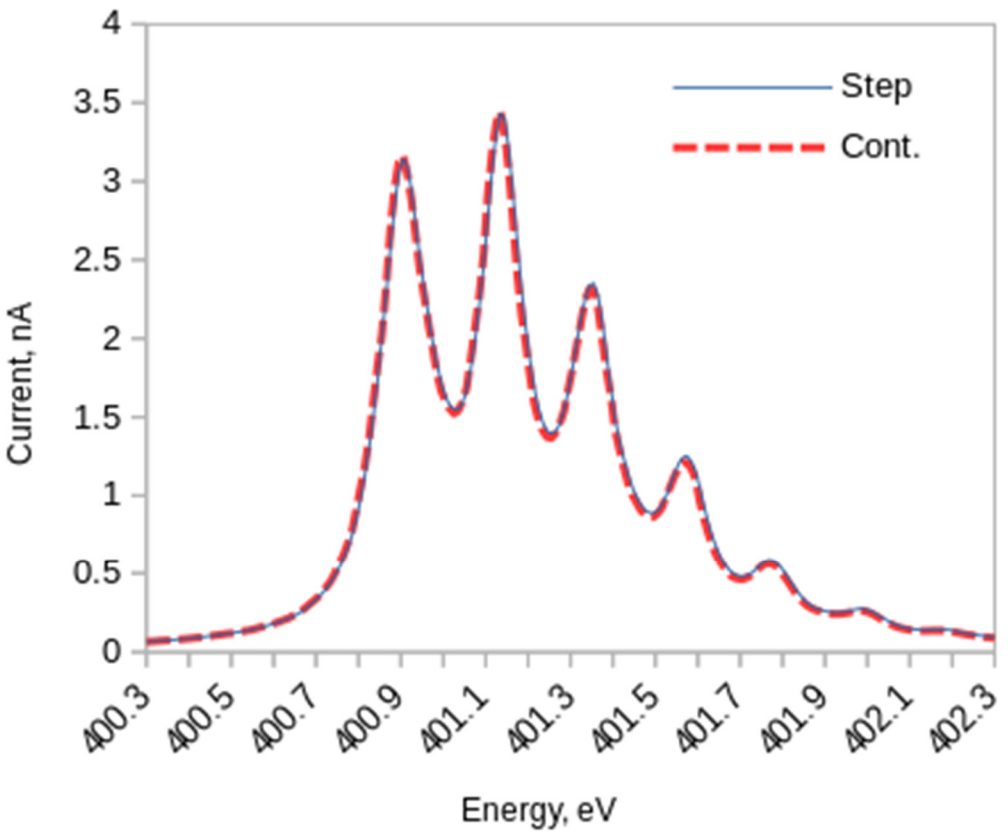
	REPEATS	TRIGGER	POSITION
	1	POSA<=POSITION	-429359
	1	POSA<=POSITION	-429387
	1	POSA<=POSITION	-429414
	1	POSA<=POSITION	-429442
	1	POSA<=POSITION	-429469
	1	POSA<=POSITION	-429497
	1	POSA<=POSITION	-429524
	1	POSA<=POSITION	-429552
	1	POSA<=POSITION	-429579
	1	POSA<=POSITION	-429607
	1	POSA<=POSITION	-429634
	1	POSA<=POSITION	-429662
	1	POSA<=POSITION	-429689
	1	POSA<=POSITION	-429717

Trigger positions  
in encoder counts

# Scan procedure

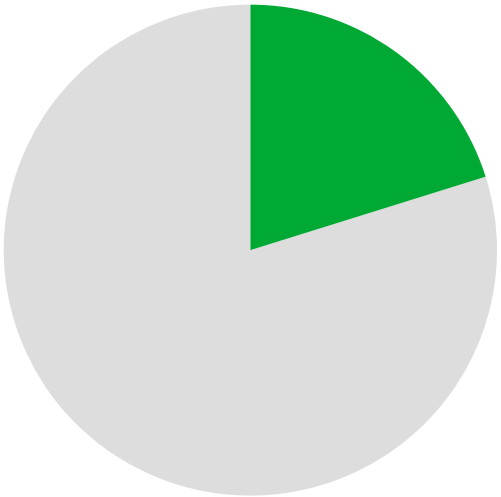


# Scans on N<sub>2</sub>

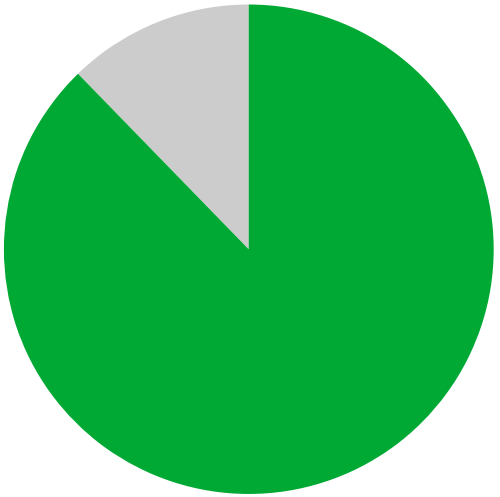


# Scans on N<sub>2</sub>

250 steps of 0.2s = 50 seconds of acquisition



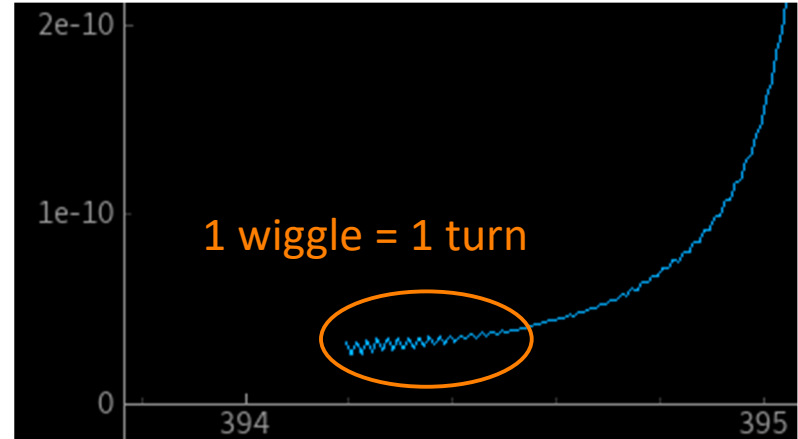
Step scan  
248 seconds



Continuous scan  
57 seconds

# Challenges

- Position accuracy in motion
  - Vibrations
  - Mechanical precision
    - Closed loop tuning
    - Minimize mechanical errors
- Detector speed
  - Trigger rate
  - Analog bandwidth



# Outlook

## **Parametric trajectory for insertion device**

- **For long scans**

## **Extend to more beamlines and applications!**

- **Sample translation and rotation stages**
- **All monochromators**

# Acknowledgements

**Controls & IT Software**

**Controls & IT Hardware**

**Insertion Devices Group**

**FlexPES beamline**

**DanMAX beamline**

**Bloch beamline**





**Thanks!**

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