# Drift Analysis

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## Introduction

When mirrors were installed in the Front End Enclosure (FEE), it was noticed that they had changed position significantly over a weekend. After a correction was made, it was still found that the actuator will reach a limit of what it can manage and drift away from its intended position. The task assigned to me was to create a Jupyter Notebook script that would do statistics on MIRR:FEE1:M2H:RBV to determine if the mirror is drifting or stable.

## Research

The first step was to create a Python script to query into the archiver to obtain data for specific EPICS process variables. Luckily a code to perform this task was already written. The script would take the data from the archiver and put it in an xarray format.



I edited some features of this script to fit the assigned task. One thing I noticed was that the script was written in Python 2, so it was converted to Python 3.

If multiple process variables were called, the script would find data with matching time stamps. If the process variables did not have any data with matching time stamps, "NaN", or not a number, which made it difficult to perform statistical analysis. This was due to the script merging the multiple xarrays together.

To overcome this, I changed part of the code and got rid of the merging arrays, so all that was left was a list of xarrays. These xarrays consisted of values, severity and stability. For statistical analysis, the values were what was needed.

The two EPICS process variables I examined were MIRR:FEE1:M2H:VAL and MIRR:FEE1:M2H:RBV, where VAL is the position where the mirror should be at, and RBV is the readback value of the mirror. The script I wrote took the latest entry in VAL and found the average readback value of the mirror, the average deviation of the mirror from where it is supposed to be, the corresponding standard deviation, as well as a plot of the readback value. The way the script was designed was it would ask for how many minutes it should run for.

Then it will take all of the readback value data from the last 10 seconds and perform statistical analysis on it. A ten second delay takes place to allow the next 10 seconds of data to be recorded, and the script repeats for the desired time.
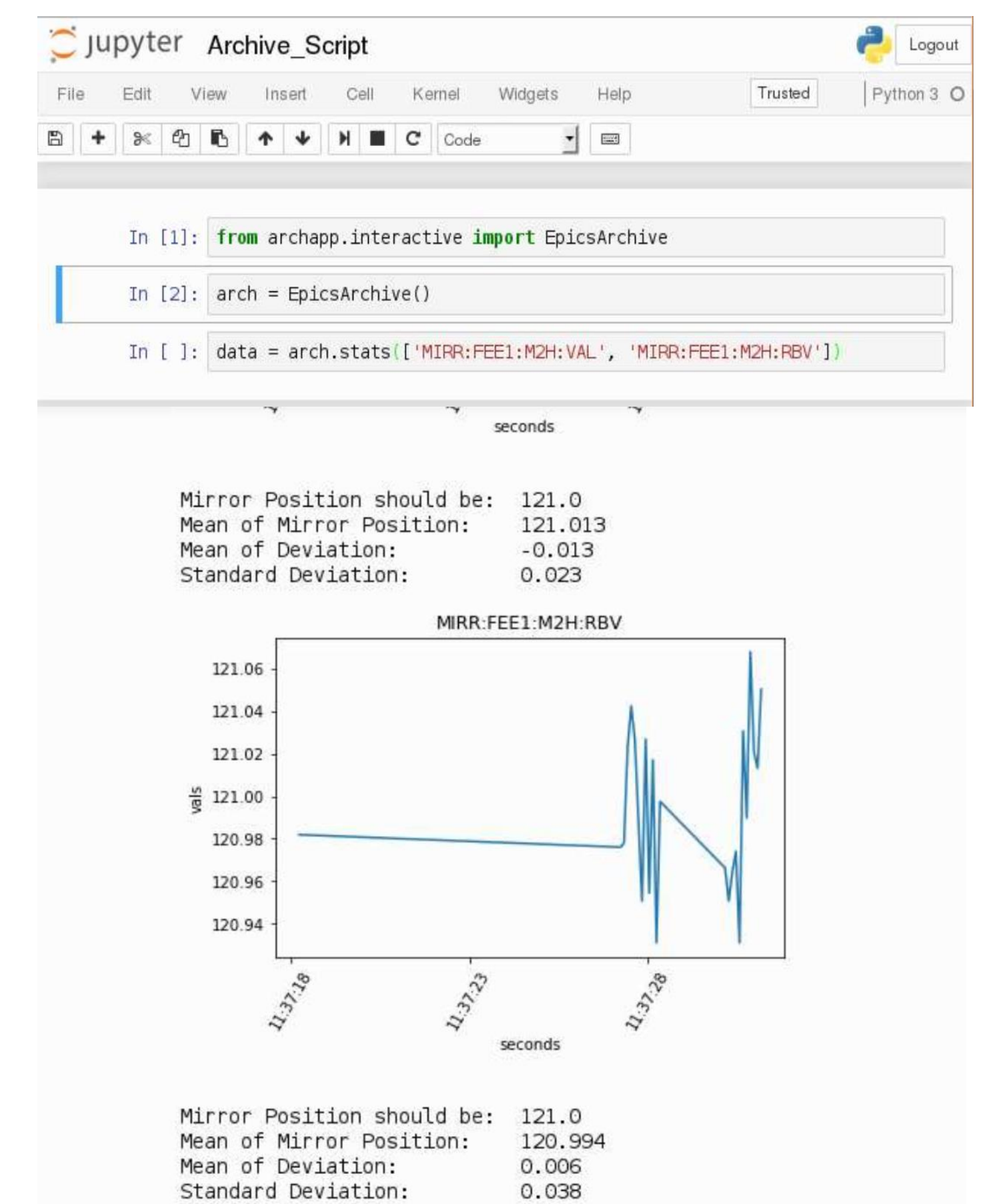


## Conclusions

The script that was created is basic, but it will help check to see if the mirror is drifting from its required position based on its standard deviation.

I would have liked to added a feature that will tell you when the mirror is drifting or stable, based on the statistical analysis.

## Acknowledgments

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