

# FISS Control Program Manual (v 1.1)

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**Original Markdwon File download:** [obs\\_guide.md](#)

**PDF File Download:** [obs\\_guide.pdf](#)

**Info:** This manual is for the upgraded FISS control program developed after 2020.

## 1. Program Information

The currently available FISS control software is written in [Python](#), unlike the previous one written in [CVI](#).

The program is compatible with the Python version 3.6 or higher, and some of the program tools previously written in CVI are loaded in to the dynamic link library (dll). Camera control tool is in *CCD.dll*, grating and camera focus control tool is in *gratfocus.dll* and scanner control with observation mode control is in *scanobs.dll*. Main interface such as GUI program is developed with the PyQt5 package in Python, and 4 to 5 threads will be run until observation. The initial version of the program was successfully debugged at July 20, 2020. This initial version was written by the one of the solar group member in Seoul National University, [Juhyung Kang](#).

The FISS control program is managed with the [GitHub](#) and, that program is located in the "C:\Control\_Program\fiiss\_control\new" directory in the BBSO local desktop. Please contact with the software manager (Heesu Yang or Juhyung Kang) when you modify the control program.

**Danger:** As of July 2020, the main GUI is stuck for 30 seconds to 1 minute sometimes, but that situation may not affect the observation. Please do not force quit the control program.

## 2. Initialization and Observation

### Step 1

Remove the cover (Grating/ Scanner)

**Step 2**

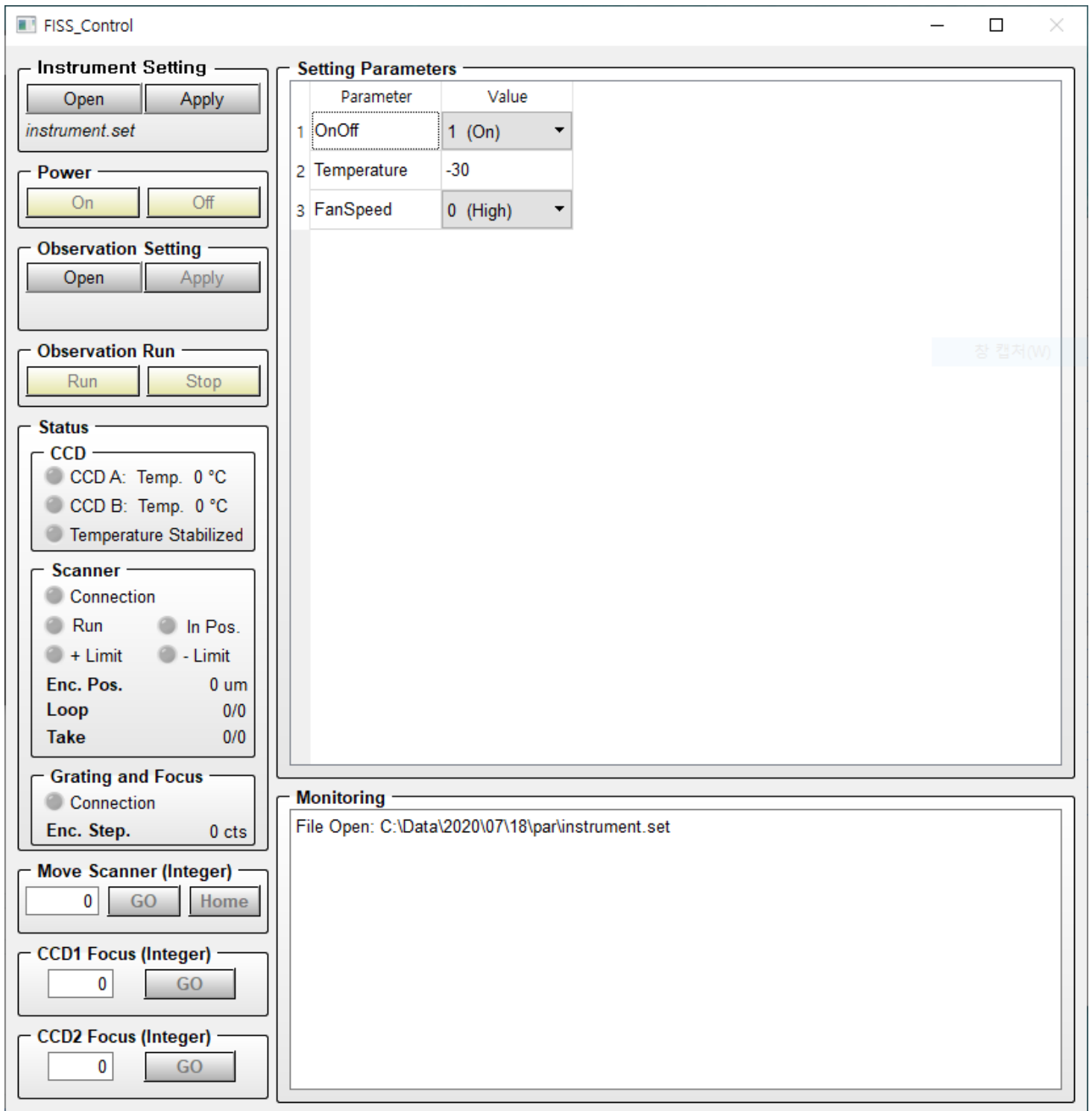
Turn on the FISS control box and computer in server room (connect to the desktop with the chrome remote desktop, Teamviewer or VNC)

**Step 3**

Execute the FISS program link file located in the desktop (

**FISS**

icon)



#### Step 4

Check the temperature parameter of the CCD in Setting Parameter tab and then click the "Apply" button in Instrument Setting tab.

#### Step 5

Click the On button in Power tab to turn on the FISS (The FISS is successfully turned on if the CCD, Scanner and Grating and Focus connection lights are turned on after 5 to 10 seconds.) Since the camera cooling process takes about 30 minutes until cooling at -30 degree celsius, please click the power on button before start to align the optics.

**Danger:** The program is set not to run observation before the CCD cooling process is finished.

### Step 6

Check the FISS slit cover is opened in Coode room.

**Danger:** Since 2020, slit cover motor malfunction occurs. For that reason, you have to open the slit cover manually.

### Step 7

Check the alignment in FISS instrument. Check the incident light enters vertically as you screen the light with the paper gradually (The light should be enters to the top inside the FISS instrument) and also the incident light goes to grating (Please contact with the BBSO in advance when you use FISS because the most of case use VIS instrument before).

### Step 8

Change the filters with wavelength bands to be observed

- Set 1 - CamA: H $\alpha$  6563 Å / CamB: Ca II 8542 Å
- Set 2 - CamA: Na I D2 5890 Å / CamB: Fe I 5434 Å

Replace the filter in front of the CCD. Filter is in the FISS toolbox. The glass surface is outside the CCD, and the mirror surface face to the insde.

### Step 9

After the CCD temperature is stabilized, click the open button to open the observatioal parameter file (.par) in the Observation setting tab. Following figure shows the FISS program after open the parameter file. You can lean how to write the parameter file in [3. Setting Observation Parameter](#) section.

**Information:** If you turn on the power, the sample paramter files is created at C:\Data\YYYY\MM\DD\par directory.

FISS\_Control

**Instrument Setting**

Open Apply

*instrument\_01.set*

**Power**

On Off

**Observation Setting**

Open Apply

*obs.par*

**Observation Run**

Run Stop

**Status**

**CCD**

- CCD A: Temp. 5 °C
- CCD B: Temp. 4 °C
- Temperature Stabilized

**Scanner**

- Connection
- Run  In Pos.
- + Limit  - Limit

Enc. Pos. 0.0 um

Loop 0/0

Take 1/1000

**Grating and Focus**

- Connection

Enc. Step. 0 cts

**Move Scanner (Integer)**

GO Home

**CCD1 Focus (Integer)**

GO

**CCD2 Focus (Integer)**

GO

**Setting Parameters**

	Parameter	Value (Run 1)
1	CameraMode	2 (Both)
2	wIndex	1 (6562.800)
3	gWv	6562.8
4	gOrder	34
5	gStep	-7870
6	gAngle	62.279
7	nSteps	100
8	nScan	1000
9	CCD1_exptime	0.03
10	CCD2_exptime	0.03
11	CCD1_PGain	1
12	CCD2_PGain	2
13	CCD1_Gain	0
14	CCD2_Gain	0
15	Target	None
16	Observer	None
17	TelXpos	0

**Monitoring**

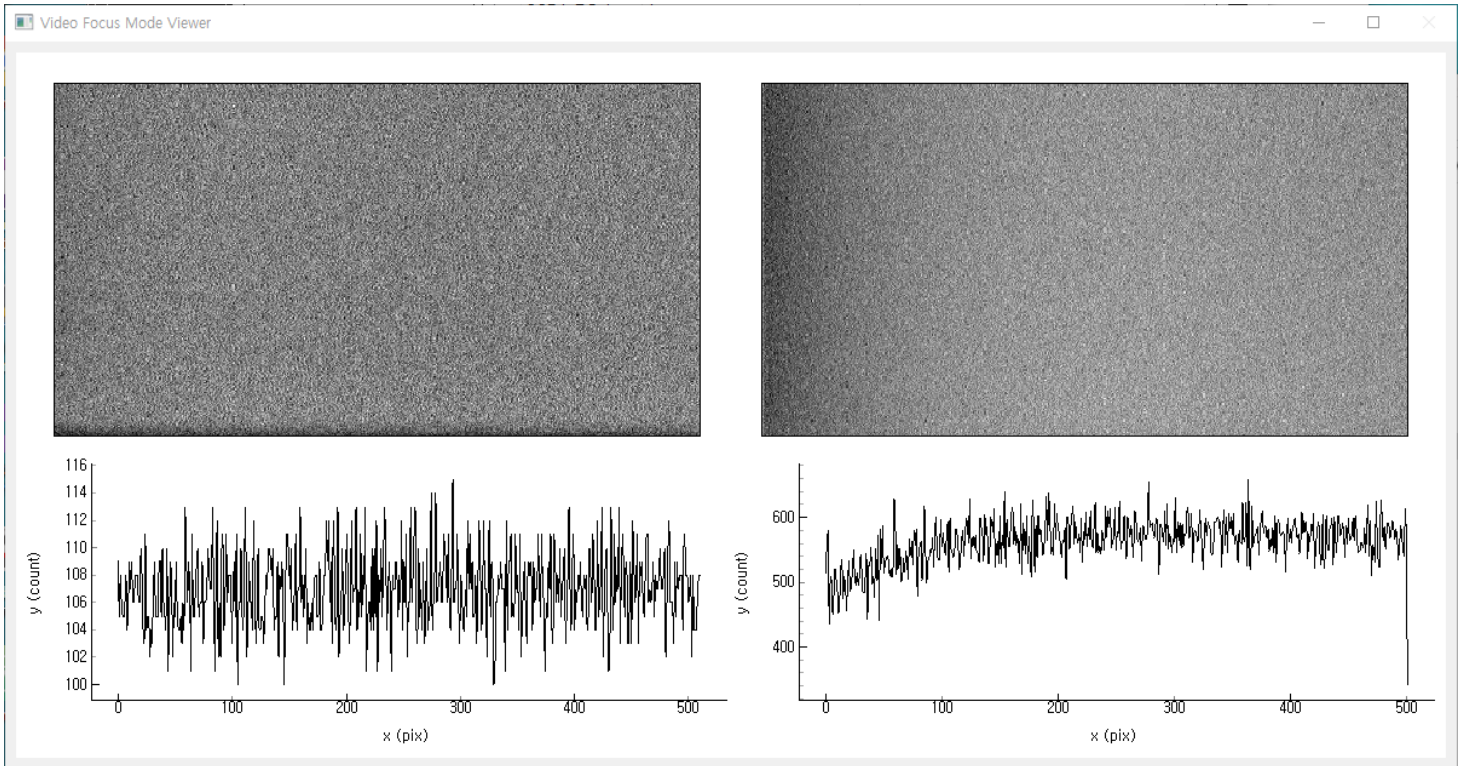
File Open: C:/Data/2020/07/18/par/obs.par

## Step 10

Focusing. Screen the some portion of slit and check wheter the boundary is clear in display. The second way is to check wheter the brightness in slit (y) direction varies ahrply in spectrogram. (It is quite useful to run the video focus mode to check the spectrogram and line profile simultaneously. Set the AcqMode equal to 0 (video mode) and then click the Apply button in Obseravtion Setting tab then click the run button in Observation Run tab.)

**History:** you may be focusing with the flat mirror in front of the scan mirror, focus position is 23 at 2017.

When the Video mode, the video image viewer windows is popped up as like the following figure.



### Step 11

Take Flat image. We recommend to take a flat image at least 2 (before and after the observation) and also take the flat if you changed the filter set. When you take the flat image, please require the operator then operator move the telescope to the Disk center without AO. Set the AcqMode equal to 10 (Take Flat). If modify this parameter click the Apply button and then click the Run button. The flat image will be saved in C:\Data\YYYY\MM\DD\cal directory.

**Information:** The flat image is not shown at realtime because of the system structure, but you can check the running the taking flat from the the Take(nScan) number shown in status tab.

**History:** Old program average the 100 number of flat images, but it may not be good because the last frame of the scan is not be loaded sometimes. For that reason, the new program take 101 image and dump the last frame to avoid that problem.

## Step 12

Set the observational parameters. You can use the parameter files directly also modify the parameters in the Setting Parameter table (Please see the [3. Setting Observation Parameter](#) section if you are not familiar with this). You can check the general observational parameters is in [sample\\_files.zip](#). We highly recommend that double check the PGain, Gain and exptime parameters before run observation. The common setting parameters for each filter sets are shown in following table.

Filter Set	Set1 - A: H $\alpha$ / B: Ca II	Set2 - A: Na I D2 / B: Fe I
wvIndex <sup>[1]</sup>	1	2
PGain	A: 2 / B: 2	A: 2 / B: 1 or 0
Exp. Time (ms)	A: 30 / B: 30	A: 30 / B: 10

**Danger:** One of the most important parameters in the parameter file is a "Target". The "Target" parameter is equal to the directory name of observed data. For that reason, we highly recommend to change that parameter when you change the observational target.

## Step 13

After modifying the parameters, click the Apply then the temporary applied parameter will be saved at "*applied.par*" file in C:\Data\YYYY\MM\DD\par directory. After clicked the Apply button, the Run button will be enabled. Then click the run button to run observation. If you stop the observation click the Stop button.

### Step 13-1

Before starting the observation loop, you have to check that the target of observation is located at the center of FOV. To check this, we recommend that Scan the large FOV at first and move the scanner. At this sequence you set the nScan equal to 1 to take only one raster image. If scan is done, insert the value to move scanner in Move Scanner tab then click the Go button. After reach the scanner at that position click the Home button to set this point to the zero (home) position. Repeat this sequence after reduce the FOV to the observed size until the target will be located in the correct position.

**History:** The moderate scanner position is about -3500 at 2017.

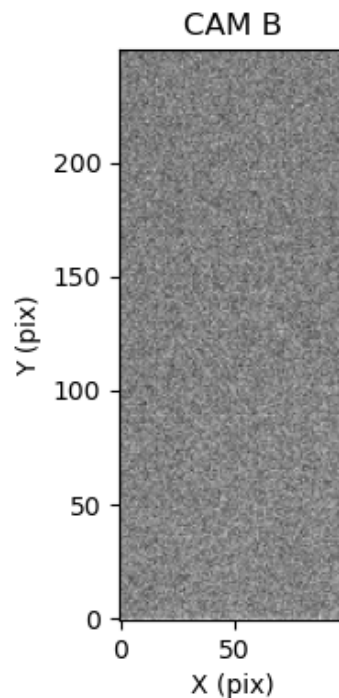
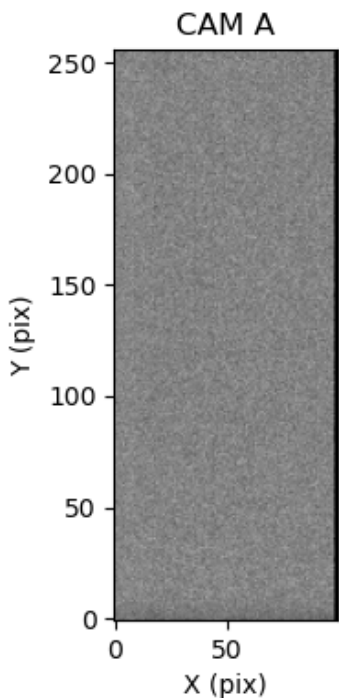
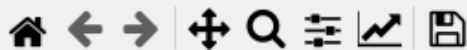
### Step 13-2

Set the observational parameter to fit the your observation loop. It is the good way to set the *nScan* value to the high value and then stop the observation to run observation continuously. Again, the one of the most important parameters is **Target** since that parameter is the directory name of the observed

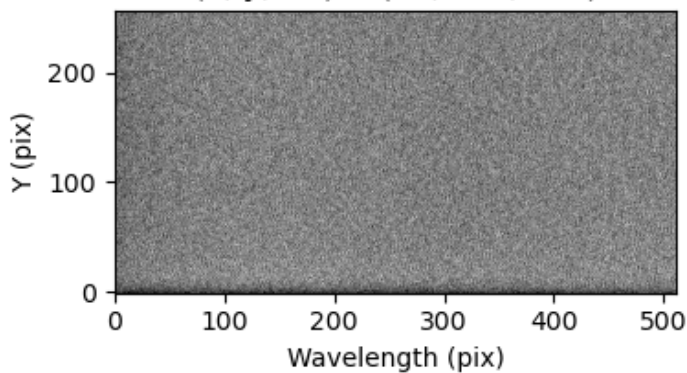
data. Please set this value to fit the each observation target. The observed data will be saved in C:\Data\YYYY\MM\DD\raw\ {Target} directory. The data filename is scan start time for example FISS\_YYYYMMDD\_HHMMSS.SSS\_A.fts. The details of the parameters and the cadence for each number of nSteps is in [3. Setting Observation Parameter](#)

When you run observation the image viewer will be popped up like follows:

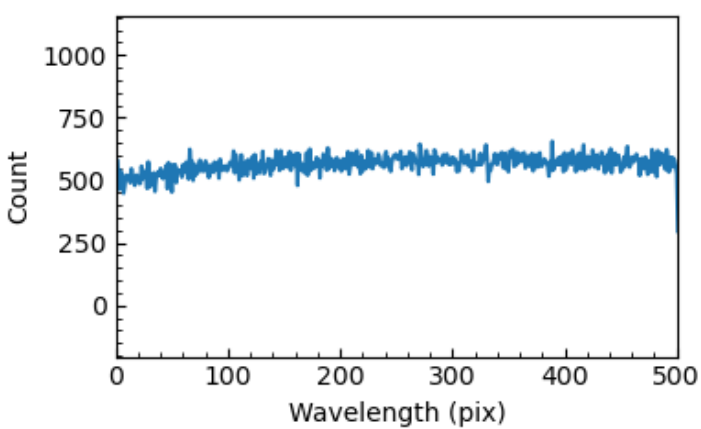
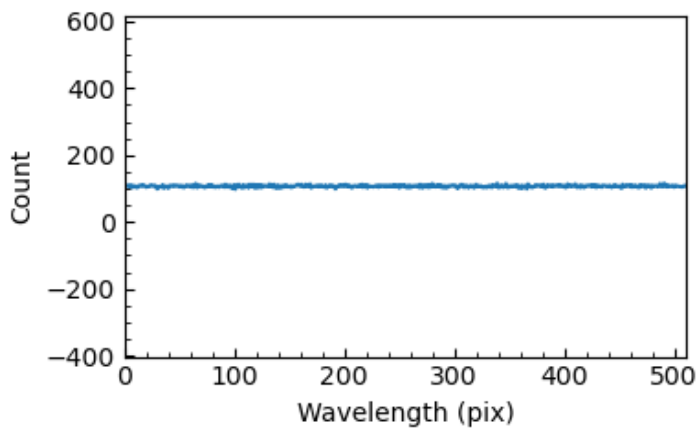
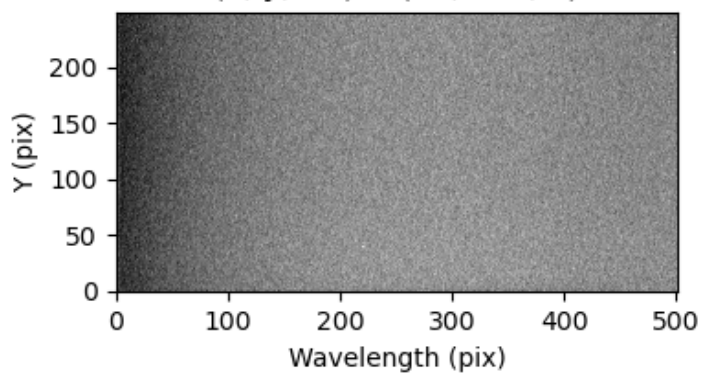




$(x, y, wv) = (50, 128, 106)$



$(x, y, wv) = (50, 125, 6)$



**Information:** This Image viewer will be closed after 15 seconds as click the stop button or done observation. You can run next observation after close this viewer window.

#### Step 14

Take a Flat image after final observation end.

#### Step 15

Turn off the power by click the Power Off button. When you click Power Off button, the program will be closed automatically after heating the CCD at 5 degree celsius. Since It takes a lot of time, we recommend to cover the grating and scanner during the heating time.

**Danger:** Do not force quit the program until heating process running.

#### Step 16

Download the observed data on your portable hard driver. If control program is turned off, than power off the control box except for the desktop and go to lodge (you download the data remotely).

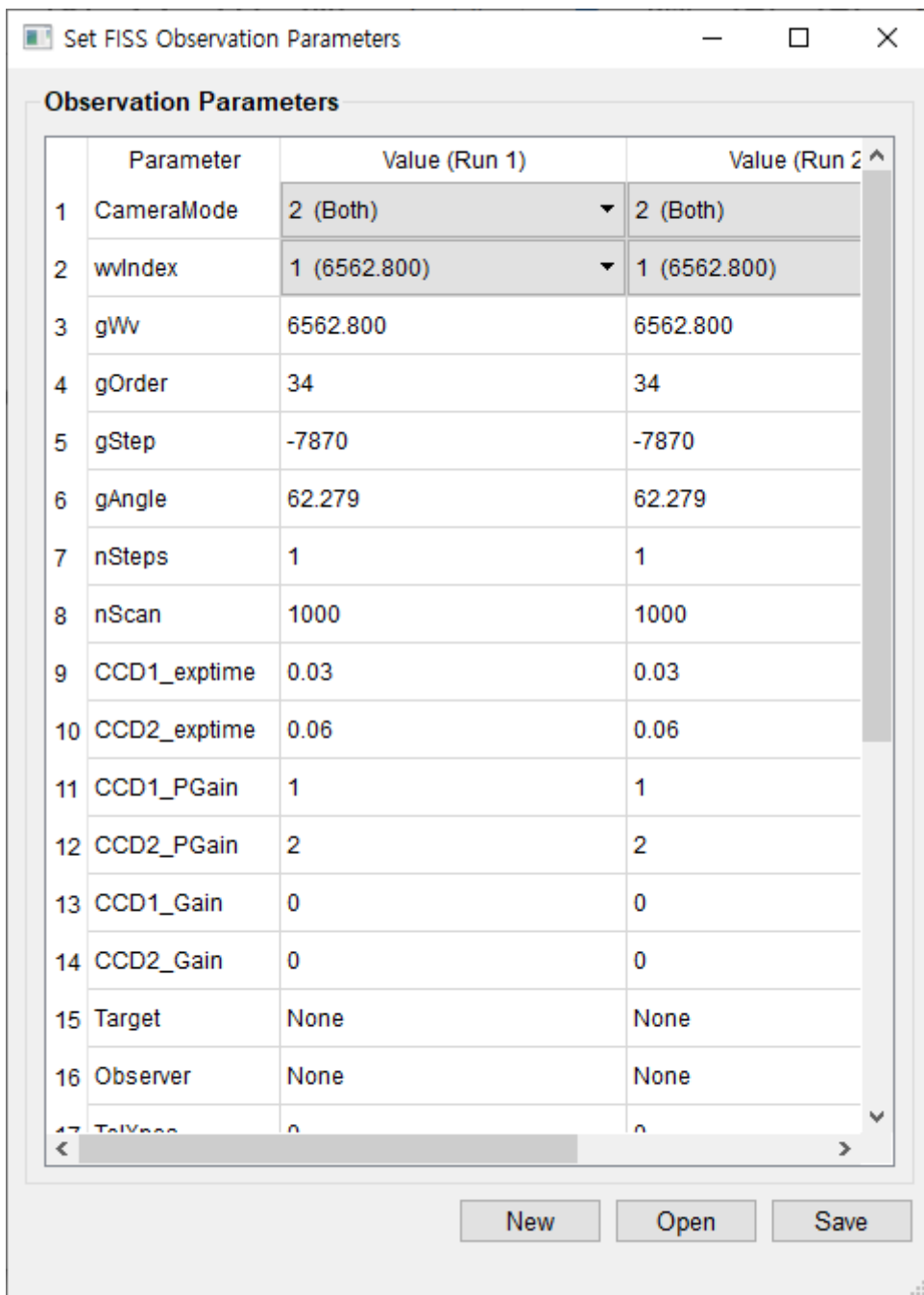
## 3. Setting Observation Parameter

Unlike the previous control program, the new program use the parameter file (.par). You can download the ([sample\\_files.zip](#)). Check these files to learn how to write the parameter file. You can also download the program which generate the parameter files ([mk\\_obspar.exe](#)). You can also modify the parameter in FISS control program, but you can not define the number of observation loops (nRun). The number of observation loops is only set or modified in parameter file by set the nRun value or in the parameter generating program.

The following figures show an example parameter file and the parameter generator.

```
obs.par — C:\Control_Program\#fiss_control\#new\#v2\#sample — Atom
File Edit View Selection Find Packages Help

obs.par
1 # FISS Observation Parameter Settings
2 # "#" is the comment operator. If a parameter is commented out, then it set to be the default value.
3 # Initially a sample observation parameter setting file is automatically copied in the today data directory.
4 # This control version support the observation loop. You can generate the number of loop. For example, Take 100 frame I
5 # You must be the define the number of loop at first.
6 # You can identify the each loop by the "begin" and "endbegin" parameter
7 # You can change one single parameter or whole of the parameter in each loop
8 # Note: You have to double check the "begin" and "endbegin" is correctly inserted.
9
10
11 # Set the number of loops
12 nRun = 1 # Default is 1 (Note: It must be higher than 1)
13
14
15 # -----
16 # first loop begin
17 begin
18
19 # Set Camera for observation (0: CCD A, 1: CCD B, 2: Both)
20 CameraMode = 2 # Default is 2
21
22
23 # Set the Shutter Mode (0: Fully Auto, 1: Permanently Open, 2: Permanently Close)
24 # Default is 1.
25 ShutterMode = 1
26
27
28 # Set the Acquisition Mode (0: Video(Focus), 1: Single (Step), 6: Frame Transfer, 8: Single (continuous), 10: TakeFlat)
29 # If you want to take without moving the scanner (i.e. single slit mode), you set AcqMode = 1 and nScan = 1.
30 AcqMode = 1 # Default is 1
31
32
33 # Set the Scanning Mode (0: Spectrograph, 1: Imaging)
34 ScanMode = 0 # Default is 0
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```



Each observation loops is distinguished by "begin" and "endbegin". For the first loop, you have to define all parameters, but for the following loop, you just define the parameters to be modified. You can check what I mean in the example\_nloop.par file from the ([sample\\_files.zip](#)).

Observational parameters in .par file are follows:

- **nRun:** The number of observation loop.
- **CameraMode:** Set the camera to be used, Default is 2 (both).
- **wvIndex:** Set the wavelength band to observe. 1 means Set1 (A: H $\alpha$  / B: Ca II 8542 Å) and 2 means Set2 (A: Na I D2 5890 Å / B: Fe I 5434 Å). If you want to set the grating angle manually,

set this value as 0 and should set the *gWv*, *gOrder*, *gStep* and *gAngle*.

- **nSteps:** is the number of step to take frame (nFrame). In case of nStep equal to 1, the scanner is stopped at origin.
- **nScan:** The number of repeat to scan.
- **CCD1\_exptime:** exposure time of the CCD camera in second.
- **CCD1\_PGain:** Set PGain Value. Default is 2. Refer to table in **Step 12**. (0 - 2, integer)
- **CCD1\_Gain:** Set Gain Value. (0 - 255, integer)
- **Target:** Target name. We recommend to change this when you change target.

**경고:** This parameter is the directory name of the observed data. For that reason you have not to use space and special characters.

- **Observer:** Name of observer.
- **TelXpos:** Position of the pointing of the telescope.
- **stepSize:** Step size to move scanner in um.
- **HBin:** Horizontal (spectral direction) Binning.
- **VBin:** Vertical (slit direction) Binning.
- **AcqMode:** Acquisition Mode. In general observation, this value is 1 (Single Step). 0: Video Focus / 1: Single Step / 5: Scan Stop / 6: Frame Transfer / 8: Scan Continuous / 10: Take Flat. Among these value, you can use 0, 1 and 10, 5 and 8 will be deleted, and 6 will be added.
- **ScanMode:** Mode of scanning. Currently 0 is only available value.
- **Trigger:** Camera trigger method. Default is 0 (internal) and external trigger will be added soon
- **ReadMode:** Camera readout method . 1: full vertical binning, 4: imaging. In general observation, use 4.
- **ShutterMode:** Camera shutter open/close. In general observation, use 1: open. 0: auto, 1: open, 2: close

## 4. Cadence

The cadences of the FISS for each number of steps are follows (that comes from the test observation in 2020):

exptime: 30 ms / 30 ms

100 steps (frames, 16 arcsec): 13.4 sec

125 steps (frames, 20 arcsec): 16.1 sec

150 steps (frames, 24 arcsec): 18.8 sec

200 steps (frames, 32 arcsec): 24.1 sec

1. Set to the pre-setting grating angle (*gAngle*), wavelength (*gWv*) and diffraction order (*gOrder*) values corresponding to grating motor step (*gStep*). If you set this parameter to 0, you have to set the *gWv*, *gOrder*, *gStep*, *gAngle* parameters manually. The *gStep* is the step count of the motor. ↩