

Controlling the XPOL Radar

Starting the Radar

When starting the radar, you will need windows open on both the “xpol” and the “drx” computers, both logged in as “radarop”. These windows should have access to your local X server (so use the “-X” option on your ssh command). You must go through “xpol” to get to “drx”. You can just type `drx` in your “xpol” window to get to “drx”.

The “drx” computer runs the server that controls the radar and acquires the data. We run applications on “xpol” that contact this server.

Before starting DRX, make sure that the processes on “xpol” are stopped. You can do this by running the following command in the “xpol” window:

```
stop_all
```

Starting up the DRX server

To start up the basic system on “drx”, run the following command:

```
start_all
```

The main application running on “drx” is called “xpold”.

Starting the Radar

The radar software comes with a GUI for controlling the radar. To start the GUI, run the following command on “drx”:

```
start_xpol_control
```

It is okay for several versions of the GUI to be running simultaneously, but could be confusing if two people are sending controls to the radar at the same time, so we will ask you to turn the GUI off once the radar is running. You may want to resize the GUI window to get rid of any scrollbars once it comes up. Here is what the GUI looks like when you first bring it up:

Load

Save

Connect

Mode

Pulse pair

☐ Dry air power
☐ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

16

FFT taper

Hanning

Range resolution

30 m

PRI 1, 2

1000

500

usec

Group interval

1000

usec

Filter bandwidth

10 MHz

Range gate spacing

15 m

Range gates

400

Max range:

5.8220 km

Clutter averaging

3

Clutter filter width:

2.656748 m / sec

Post averaging

5

Integration time:

0.030000 sec

Data rate:

33.333333 / sec

Site info

Az offset

1

LO frequency

0.00

MHz

Error

1.000000

MHz

Server estimate:

0.000 MHz

Frequency tracking

Correct

Auto adjust

1.0000

%

Power:

0.000 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: -

El: -

Velocity

Az: -

El: -

Scan type

Sequence code

Action

Point

Apply

Stop

Position

Az

0.00

El

0.00

Velocity

Az

5.00

El

5.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay: Tx delay +

0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center: Tx delay + 0.5 * PW +

387

nsec

Zero range gate:

43.480000

Connect to the xpold server

To connect to the xpold server, click the “Connect” button at the top of the window:

Load

Save

Connect

Mode

Pulse pair

☐ Dry air power
☐ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

16

FFT taper

Hanning

Range resolution

30 m

PRI 1, 2

1000

500

usec

Group interval

1000

usec

Filter bandwidth

10 MHz

Range gate spacing

15 m

Range gates

400

Max range:

5.8220 km

Clutter averaging

3

Clutter filter width:

2.656748 m / sec

Post averaging

5

Integration time:

0.030000 sec

Data rate:

33.333333 / sec

Site info

Az offset

1

LO frequency

0.00

MHz

Error

1.000000

MHz

Server estimate:

0.000 MHz

Frequency tracking

Correct

Auto adjust

1.0000

%

Power:

0.000 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: -

El: -

Velocity

Az: -

El: -

Scan type

Sequence code

Action

Point

Apply

Stop

Position

Az

0.00

El

0.00

Velocity

Az

5.00

El

5.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay: Tx delay +

0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center: Tx delay + 0.5 * PW +

387

nsec

Zero range gate:

43.480000

Once you are connected to the radar, the label for this button will change to “Disconnect”:

The screenshot displays a radar control interface with the following sections:

- Buttons:** Load, Save, and Disconnect (labeled with a crossed-out icon).
- Mode:** Pulse pair. Checkboxes for Dry air power, Clutter filter, RF power, and Record raw I/Q.
- FFT length:** 128. **FFT taper:** Hanning.
- Range resolution:** 75 m.
- PRI 1, 2:** 500. **Group interval:** 2000 usec.
- Filter bandwidth:** 2 MHz.
- Range gate spacing:** 75 m.
- Range gates:** 800. **Max range:** 59.6043 km.
- Clutter averaging:** 32. **Clutter filter width:** 0.199256 m / sec.
- Post averaging:** 1. **Integration time:** 0.080000 sec. **Data rate:** 12.500000 / sec.
- Site info:** A text input field.
- Az offset:** 1.
- LO frequency:** 0.000000 MHz. **Error:** 13.85946 MHz. **Server estimate:** 0.000 MHz.
- Frequency tracking:** Manual. **Auto adjust:** 1.0000 %.
- Power:** 0.000 dBm.
- Zv:** 1.000000 dB. **Zh:** 1.000000 dB. **Pnv:** 1.000000 dBm. **Pnh:** 1.000000 dBm.
- Data file auto-rolling:** ☐ Enabled. Radio buttons for Time (selected), File size, # scans, and # records.
- Server state:** Idle.
- Apply:** A green checkmark button.
- Connected to server:** [localhost]
- Pedestal:** Position (Az: 78.86, El: 89.98), Velocity (Az: 0.00, El: 0.00), Scan type (None), Sequence code (-1), Action (Point), Apply, and Stop buttons.
- Testing:** Tx delay (3), Tx PW, Tx sample switch delay (Tx delay + 0 nsec), Tx sample switch hold off (700 nsec), Tx pulse center (Tx delay + 0.5 * PW + 387 nsec), and Zero range gate (85.520000).

Make sure the server is in run mode

The current server state is displayed in the lower left-hand side of the GUI:

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000 MHz

Error

13.85946 MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000 %

Power:

0.000 dBm

Zv

1.000000 dB

Zh

1.000000 dB

Pnv

1.000000 dBm

Pnh

1.000000 dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Idle

Apply

Connected to server

[localhost]

Pedestal

Position

Az: 78.86 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 0.00

Velocity

Az 5.00 El 5.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

To change the server state to run, click in the “Server state” choice box and select “Run”. Then click the “Apply” button in the center bottom of the window:

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000 MHz

Error

13.85946 MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000 %

Power:

-53.568 dBm

Zv

1.000000 dB

Zh

1.000000 dB

Pnv

1.000000 dBm

Pnh

1.000000 dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Connected to server

[localhost]

Pedestal

Position

Az: 77.86 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 0.00

Velocity

Az 5.00 El 5.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

After clicking the “Apply” button, you will see some messages in the status area in the lower left-hand corner of the display indicating what the server is doing:

The screenshot shows a radar control interface with the following sections:

- Buttons:** Load, Save, Disconnect.
- Mode:** Pulse pair. Checkboxes: Dry air power, Clutter filter, RF power, Record raw I/Q.
- FFT length:** 128. **FFT taper:** Hanning.
- Range resolution:** 75 m.
- PRI 1, 2:** 500. **Group interval:** 2000 usec.
- Filter bandwidth:** 2 MHz.
- Range gate spacing:** 75 m.
- Range gates:** 800. **Max range:** 59.6043 km.
- Clutter averaging:** 32. **Clutter filter width:** 0.199256 m / sec.
- Post averaging:** 1. **Integration time:** 0.080000 sec. **Data rate:** 12.500000 / sec.
- Site info:** (Empty field).
- LO frequency:** 0.000000 MHz. **Error:** 13.85946 MHz. **Server estimate:** 0.000 MHz.
- Frequency tracking:** Manual. **Auto adjust:** 1.0000 %.
- Power:** 0.000 dBm.
- Zv:** 1.000000 dB. **Zh:** 1.000000 dB. **Pnv:** 1.000000 dBm. **Pnh:** 1.000000 dBm.
- Data file auto-rolling:** ☐ Enabled.
 - ☒ Time: 0 d 0 h 1 m.
 - ☐ File size: 0 MB.
 - ☐ # scans: 0.
 - ☐ # records: 0.
- Server state:** Idle.
- Apply:** (Green checkmark button).
- Status:** Connected to server [localhost] (indicated by a red arrow).
- Pedestal:**
 - Position:** Az: 78.86, El: 89.98.
 - Velocity:** Az: 0.00, El: 0.00.
 - Scan type:** None.
 - Sequence code:** -1.
 - Action:** Point. **Buttons:** Apply, Stop.
 - Position (secondary):** Az: 0.00, El: 0.00.
 - Velocity (secondary):** Az: 5.00, El: 5.00.
- Testing:**
 - Tx delay:** 3. **Tx PW:** (empty).
 - Tx sample switch delay:** Tx delay + 0 nsec.
 - Tx sample switch hold off:** 700 nsec.
 - Tx pulse center:** Tx delay + 0.5 * PW + 387 nsec.
 - Zero range gate:** 85.520000.

You must wait until the status area clears before making any more changes to the GUI. This is true whenever you click this “Apply” button.

Point the antenna vertically

Make sure the antenna is pointed vertically up, so there is no radiation hazard. This is done in the “Pedestal” section. Set the indicated values in this section and then click the “Apply” button in that area:

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000 MHz

Error

13.85946 MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000 %

Power:

-53.089 dBm

Zv

1.000000 dB

Zh

1.000000 dB

Pnv

1.000000 dBm

Pnh

1.000000 dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 77.86 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 90.00

Velocity

Az 10.00 El 10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

Wait until the elevation is close to 90 degrees, i.e. the antenna is pointing vertically, before proceeding:

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000 MHz

Error

13.85946 MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000 %

Power:

-52.893 dBm

Zv

1.000000 dB

Zh

1.000000 dB

Pnv

1.000000 dBm

Pnh

1.000000 dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 359.9 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 90.00

Velocity

Az 10.00 El 10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

Once the antenna is pointing vertically, click “Stop” to set the brakes:

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000 MHz

Error

13.85946 MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000 %

Power:

-52.893 dBm

Zv

1.000000 dB

Zh

1.000000 dB

Pnv

1.000000 dBm

Pnh

1.000000 dBm

Data file auto-rolling

☐ Enabled

☒ Time

0 d 0 h 1 m

☐ File size

0 MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 359.98 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 90.00

Velocity

Az 10.00 El 10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

Turn on dry air power

Next you should turn on the dry air power to keep the antenna ventilated. To do this, click on “Dry air power” to get a check mark and then click “Apply”:

Load

Save

Disconnected

Mode

Pulse pair

☒ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000 MHz

Error

13.85946 MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000 %

Power:

-52.722 dBm

Zv

1.000000 dB

Zh

1.000000 dB

Pnv

1.000000 dBm

Pnh

1.000000 dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 359.94 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 90.00

Velocity

Az 10.00 El 10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay: Tx delay + 0 nsec

Tx sample switch hold off: 700 nsec

Tx pulse center: Tx delay + 0.5 * PW + 387 nsec

Zero range gate: 85.520000

Turn on the transmitter

Now it's time to turn on the transmitter. First, click on "RF power" to get a check mark, set "Frequency tracking" to "Manual" and click "Apply":

Load

Save

Disconnect

Mode

Pulse pair

☒ Dry air power
☒ Clutter filter
☒ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000

MHz

Error

13.85946

MHz

Server estimate:

0.000

MHz

Frequency tracking

Manual

Auto adjust

1.0000

%

Power:

-52.975 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 359.94

El: 89.98

Velocity

Az: 0.00

El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az

0.00

El

90.00

Velocity

Az

10.00

El

10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

Then, set "LO Frequency" to 17.0 and click "Apply":

Load

Save

Disconnect

Mode

Pulse pair

☒ Dry air power
☒ Clutter filter
☒ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

17.000000

MHz

Error

13.85946

MHz

Server estimate:

17.000

MHz

Frequency tracking

Manual

Auto adjust

1.0000

%

Power:

-84.105 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 359.94

El: 89.98

Velocity

Az: 0.00

El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az

0.00

El

90.00

Velocity

Az

10.00

El

10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay:

Tx delay + 0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center:

Tx delay + 0.5 * PW + 387

nsec

Zero range gate:

85.520000

You must put the frequency tracking into manual mode before setting the frequency value or the GUI will ignore the value that you enter.

Monitor the “Power:” value. This starts around -85 dBm or nan. The power should increase to around -12 dBm. This can take a few minutes as the transmitter warms up.

The screenshot shows a radar configuration interface with the following sections and values:

- Buttons:** Load, Save, Disconnect.
- Mode:** Pulse pair. ☒ Dry air power, ☒ Clutter filter, ☒ RF power, ☐ Record raw I/Q.
- FFT length:** 128. **FFT taper:** Hanning.
- Range resolution:** 75 m.
- PRI 1, 2:** 500. **Group interval:** 2000 usec.
- Filter bandwidth:** 2 MHz.
- Range gate spacing:** 75 m.
- Range gates:** 800. **Max range:** 59.6043 km.
- Clutter averaging:** 32. **Clutter filter width:** 0.199256 m / sec.
- Post averaging:** 1. **Integration time:** 0.080000 sec. **Data rate:** 12.500000 / sec.
- Site info:** (Empty field). **Az offset:** 1.
- LO frequency:** 17.00000 MHz. **Error:** 13.85946 MHz. **Server estimate:** 17.000 MHz.
- Frequency tracking:** Manual. **Auto adjust:** 1.00000 %.
- Power:** -84.105 dBm (indicated by a red arrow).
- Zv:** 1.000000 dB. **Zh:** 1.000000 dB. **Pnv:** 1.000000 dBm. **Pnh:** 1.000000 dBm.
- Data file auto-rolling:** ☐ Enabled. Radio buttons for Time (0 d, 0 h, 1 m), File size (0 MB), # scans (0), and # records (0). **Apply** button.
- Server state:** Run.
- Pedestal:**
 - Position:** Az: 359.9, El: 89.98. **Velocity:** Az: 0.00, El: 0.00.
 - Scan type:** None. **Sequence code:** -1.
 - Action:** Point. **Apply** and **Stop** buttons.
 - Position (secondary):** Az: 0.00, El: 90.00.
 - Velocity (secondary):** Az: 10.00, El: 10.00.
- Testing:**
 - Tx delay:** 3. **Tx PW:** (Empty).
 - Tx sample switch delay:** Tx delay + 0 nsec.
 - Tx sample switch hold off:** 700 nsec.
 - Tx pulse center:** Tx delay + 0.5 * PW + 387 nsec.
 - Zero range gate:** 85.520000.

Once the power value is around -12, set the values as indicated below and click “Apply”:

The screenshot shows a radar control interface with various configuration panels. Red arrows highlight the following settings:

- Range resolution:** 75 m
- Filter bandwidth:** 2 MHz
- Range gate spacing:** 75 m
- Frequency tracking:** Auto
- Rate adjust:** 1.0000 %
- Apply button:** Located in the bottom right of the main configuration area.

Other visible settings:

- Mode:** Pulse pair
- FFT length:** 128
- FFT taper:** Hanning
- PRI 1, 2:** 500
- Group interval:** 2000 usec
- Range gates:** 800
- Clutter averaging:** 32
- Post averaging:** 1
- Max range:** 59.6043 km
- Clutter filter width:** 0.199256 m / sec
- Integration time:** 0.080000 sec
- Data rate:** 12.500000 / sec
- LO frequency:** 13.84 MHz
- Server estimate:** 13.844 MHz
- Power:** -12.458 dBm
- Frequency tracking:** Auto
- Rate adjust:** 1.0000 %
- Power:** -12.458 dBm
- Zero range gate:** 85.520000

Pedestal section:

- Position:** Az: 359.9, El: 89.98
- Velocity:** Az: 0.00, El: 0.00
- Scan type:** None
- Sequence code:** -1
- Action:** Point
- Apply/Stop buttons:** Present

Testing section:

- Tx delay:** 3
- Tx PW:** (empty)
- Tx sample switch delay:** Tx delay + 0 nsec
- Tx sample switch hold off:** 700 nsec
- Tx pulse center:** Tx delay + 0.5 * PW + 387 nsec
- Zero range gate:** 85.520000

Ensure safety radius

The radar has a 30 meter safety radius. This applies when the antenna is pointing below 10 degrees or so. Make sure no one is close to the radar before turning it on. We have a Web cam pointing at the radar at Marshall so you can check the safety radius. To view the camera, first open an xterm window and type in the following command, replacing <login> with your user login:

```
ssh -L 8080:192.168.99.101:80 <login>@cumulus
```

Then, open a Web browser and use the following for the address:

```
localhost:8080
```

Start processes on xpol server

You are now ready to start the control processes on "xpol". In your "xpol" window run:

```
start_all
```

This will start up the data acquisition and xpol control processes.

Also run:

```
start_RadMon.xpol
```

```
start_RadMon.xpol_raw
```

to monitor the FMQ data streams. It can take a little while before you see data in the RadMon windows. You will first see data in the xpol_raw window as the raw data starts to flow. The xpol window will only show data that is actually within our scan strategy.

If you want to see the beam-by-beam data, run:

```
start_HawkEye.xpol
```

Disconnect from GUI

When finished with the start up, you need to disconnect from the GUI by clicking on the “Disconnect” button:

The screenshot shows the HawkEye GUI interface. At the top, there are buttons for 'Load', 'Save', and 'Disconnect'. A red arrow points to the 'Disconnect' button. The main area contains various configuration settings for radar parameters. On the right, there are sections for 'Pedestal' (Position and Velocity) and 'Testing' (Tx delay, Tx PW, Tx sample switch delay, Tx sample switch hold off, Tx pulse center, Zero range gate). The 'Server state' is shown as 'Idle' and 'Connected to server [localhost]'.

Mode: Pulse pair
☐ Dry air power ☒ Clutter filter
☐ RF power ☐ Record raw I/Q

FFT length: 128 **FFT taper**: Hanning

Range resolution: 75 m

PRI 1, 2: 500 500 usec **Group interval**: 2000 usec

Filter bandwidth: 2 MHz

Range gate spacing: 75 m

Range gates: 800 **Max range**: 59.6043 km

Clutter averaging: 32 **Clutter filter width**: 0.199256 m / sec

Post averaging: 1 **Integration time**: 0.080000 sec **Data rate**: 12.500000 / sec

Site info: **Az offset**: 1

LO frequency: 0.000000 MHz **Error**: 13.85948 MHz **Server estimate**: 0.000 MHz

Frequency tracking: Manual **Auto adjust**: 1.0000 % **Power**: 0.000 dBm

Zv: 1.000000 dB **Zh**: 1.000000 dB **Pnv**: 1.000000 dBm **Pnh**: 1.000000 dBm

Data file auto-rolling ☐ Enabled

☒ Time 0 d 0 h 1 m

☐ File size 0 MB

☐ # scans 0

☐ # records 0

Server state: Idle **Apply**

Connected to server [localhost]

Pedestal

Position: Az: 78.86 El: 89.98 **Velocity**: Az: 0.00 El: 0.00

Scan type: None **Sequence code**: -1

Action: Point **Apply** **Stop**

Position: Az: 0.00 El: 0.00

Velocity: Az: 5.00 El: 5.00

Testing

Tx delay: 3 **Tx PW**:

Tx sample switch delay: Tx delay + 0 nsec

Tx sample switch hold off: 700 nsec

Tx pulse center: Tx delay + 0.5 * PW + 387 nsec

Zero range gate: 85.520000

The button label will change to “Connect” when you are disconnected. At this point, you can exit from the control GUI. Multiple versions of this GUI can run at the same time so killing the GUI should save some confusion.

Viewing Volume Data

The volume data can be viewed using either Jazz or CIDD. Jazz is the preferred method. To view the data using Jazz, open a browser window and use the following address:

<http://www.rap.ucar.edu/projects/xpol/jazz/xpol.jnlp>

This display can be used both behind and outside of the firewall.

If you can't use Jazz for some reason and you know the ice login on vapor, you can use CIDD to view the volume data. This is discouraged because we want to be careful of the load on vapor, but it is available. To use CIDD, log into vapor as ice and run:

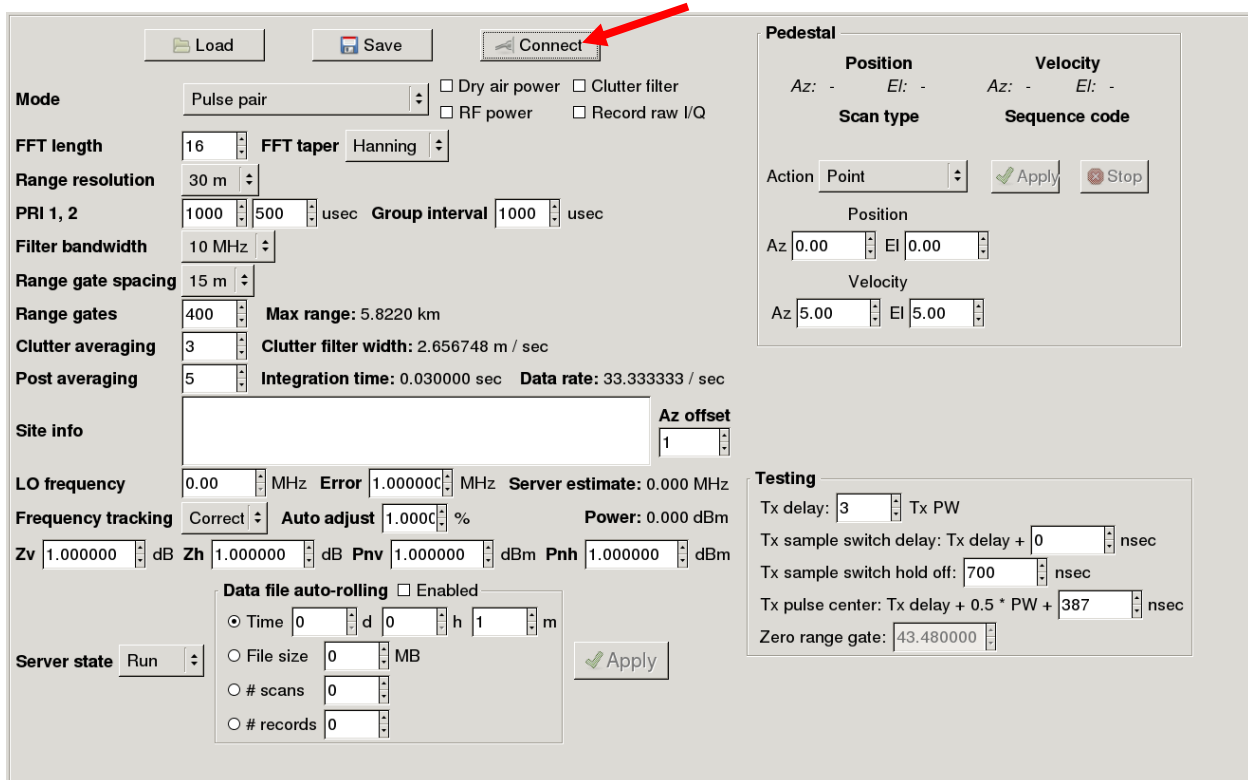
```
start_CIDD.xpol_vapor
```

Stopping the Radar

When stopping the radar, you will again want to have xterm windows open on both “xpol” and “drx” and you will want to bring up the xpol control GUI. Instructions for opening these windows are given above.

Connect to the xpol server

In the xpol control GUI, click “Connect” to connect to the xpol server:



The screenshot shows the xpol control GUI. A red arrow points to the 'Connect' button at the top. The GUI is divided into several sections:

- Mode:** Pulse pair (dropdown), with checkboxes for Dry air power, Clutter filter, RF power, and Record raw I/Q.
- FFT length:** 16 (dropdown), **FFT taper:** Hanning (dropdown).
- Range resolution:** 30 m (dropdown).
- PRI 1, 2:** 1000 (dropdown), 500 (dropdown) usec, **Group interval:** 1000 (dropdown) usec.
- Filter bandwidth:** 10 MHz (dropdown).
- Range gate spacing:** 15 m (dropdown).
- Range gates:** 400 (dropdown), **Max range:** 5.8220 km.
- Clutter averaging:** 3 (dropdown), **Clutter filter width:** 2.656748 m / sec.
- Post averaging:** 5 (dropdown), **Integration time:** 0.030000 sec, **Data rate:** 33.333333 / sec.
- Site info:** (text field), **Az offset:** 1 (dropdown).
- LO frequency:** 0.00 (dropdown) MHz, **Error:** 1.000000 (dropdown) MHz, **Server estimate:** 0.000 MHz.
- Frequency tracking:** Correct (dropdown), **Auto adjust:** 1.0000 (dropdown) %.
- Power:** 0.000 dBm.
- Zv:** 1.000000 (dropdown) dB, **Zh:** 1.000000 (dropdown) dB, **Pnv:** 1.000000 (dropdown) dBm, **Pnh:** 1.000000 (dropdown) dBm.
- Data file auto-rolling:** ☐ Enabled, with radio buttons for Time (0 d 0 h 1 m), File size (0 MB), # scans (0), and # records (0).
- Server state:** Run (dropdown), with an Apply button.
- Pedestal:** Position (Az: -, El: -), Velocity (Az: -, El: -), Scan type, Sequence code, Action (Point dropdown), Apply, and Stop buttons.
- Testing:** Tx delay: 3 (dropdown) Tx PW, Tx sample switch delay: Tx delay + 0 (dropdown) nsec, Tx sample switch hold off: 700 (dropdown) nsec, Tx pulse center: Tx delay + 0.5 * PW + 387 (dropdown) nsec, Zero range gate: 43.480000 (dropdown).

When you are connected, the label for this button will change to “Disconnect”:



Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range: 59.6043 km

Clutter averaging

32

Clutter filter width: 0.199256 m / sec

Post averaging

1

Integration time: 0.080000 sec

Data rate: 12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000

MHz

Error

13.85946

MHz

Server estimate: 0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000

%

Power: 0.000 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Idle

Apply

Pedestal

Position

Az: 78.86 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az: 0.00 El: 0.00

Velocity

Az: 5.00 El: 5.00

Testing

Tx delay: 3

Tx PW

Tx sample switch delay: Tx delay + 0

nsec

Tx sample switch hold off: 700

nsec

Tx pulse center: Tx delay + 0.5 * PW + 387

nsec

Zero range gate: 85.520000

Connected to server [localhost]

Make sure the server is in run mode

Set "Server state" to "Run" and click "Apply":

Load

Save

Disconnect

Mode

Pulse pair

☒ Dry air power
☒ Clutter filter
☒ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range: 59.6043 km

Clutter averaging

32

Clutter filter width: 0.199256 m / sec

Post averaging

1

Integration time: 0.080000 sec

Data rate: 12.500000 / sec

Site info

Az offset

1

LO frequency

14.04

MHz

Error

16.15961

MHz

Server estimate: 14.044 MHz

Frequency tracking

Auto

Auto adjust

1.0000

%

Power: -11.808 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 175.8 El: 3.944

Velocity

Az: 9.95 El: 0.00

Scan type

9: Volume

Sequence code

0

Action

Point

Apply

Stop

Position

Az: 0.00 El: 90.00

Velocity

Az: 10.00 El: 10.00

Testing

Tx delay: 3

Tx PW

Tx sample switch delay: Tx delay + 0

nsec

Tx sample switch hold off: 700

nsec

Tx pulse center: Tx delay + 0.5 * PW + 387

nsec

Zero range gate: 85.520000

After clicking “Apply”, you will see a message saying that the server configuration is updating:

The screenshot shows a radar configuration GUI with the following sections:

- Buttons:** Load, Save, Disconnect.
- Mode:** Pulse pair. Checkboxes: Dry air power, Clutter filter, RF power, Record raw I/Q.
- FFT length:** 128. **FFT taper:** Hanning.
- Range resolution:** 75 m.
- PRI 1, 2:** 500. **Group interval:** 2000 usec.
- Filter bandwidth:** 2 MHz.
- Range gate spacing:** 75 m.
- Range gates:** 800. **Max range:** 59.6043 km.
- Clutter averaging:** 32. **Clutter filter width:** 0.199256 m / sec.
- Post averaging:** 1. **Integration time:** 0.080000 sec. **Data rate:** 12.500000 / sec.
- Site info:** (Empty text box). **Az offset:** 1.
- LO frequency:** 14.04 MHz. **Error:** 16.15961 MHz. **Server estimate:** 14.039 MHz.
- Frequency tracking:** Auto. **Auto adjust:** 1.000000 %.
- Power:** -11.841 dBm.
- Zv:** 1.000000 dB. **Zh:** 1.000000 dB. **Pnv:** 1.000000 dBm. **Pnh:** 1.000000 dBm.
- Data file auto-rolling:** ☐ Enabled. ☒ Time. 0 d 0 h 1 m.
- File size:** 0 MB. **# scans:** 0. **# records:** 0.
- Server state:** Run. **Apply** button.
- Server configuration is changing.** (Message with a red arrow pointing to it).
- Pedestal:**
 - Position:** Az: 302.1, El: 6.010. **Velocity:** Az: 0.00, El: 0.00.
 - Scan type:** None. **Sequence code:** -1.
 - Action:** Point. **Apply** and **Stop** buttons.
 - Position:** Az: 0.00, El: 90.00.
 - Velocity:** Az: 10.00, El: 10.00.
- Testing:**
 - Tx delay:** 3. **Tx PW:** (Empty).
 - Tx sample switch delay:** Tx delay + 0 nsec.
 - Tx sample switch hold off:** 700 nsec.
 - Tx pulse center:** Tx delay + 0.5 * PW + 387 nsec.
 - Zero range gate:** 85.520000.

You need to wait for this status area to clear before continuing. This is true whenever you click the “Apply” button.

Point the antenna vertically

Make sure the antenna is pointed vertically up so there is no radiation hazard. This is done in the “Pedestal” section of the GUI. Set the indicated values and click apply:

Load

Save

Disconnect

Mode

Pulse pair

☒ Dry air power
☒ Clutter filter
☒ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

14.01

MHz

Error

16.15961

MHz

Server estimate:

14.006 MHz

Frequency tracking

Auto

Auto adjust

1.0000

%

Power:

-11.863 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 302.14 El: 6.010

Velocity

Az: 0.000 El: 0.000

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 90.00

Velocity

Az 10.00 El 10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay: Tx delay +

0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center: Tx delay + 0.5 * PW +

387

nsec

Zero range gate:

85.520000

Make sure the elevation is close to 90 degrees, i.e. the antenna is pointing vertically, then click "Stop" to set the brakes:

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range:

59.6043 km

Clutter averaging

32

Clutter filter width:

0.199256 m / sec

Post averaging

1

Integration time:

0.080000 sec

Data rate:

12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000

MHz

Error

13.85946

MHz

Server estimate:

0.000 MHz

Frequency tracking

Manual

Auto adjust

1.0000

%

Power:

-52.893 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 359.94 El: 89.984

Velocity

Az: 0.000 El: 0.000

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 90.00

Velocity

Az 10.00 El 10.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay: Tx delay +

0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center: Tx delay + 0.5 * PW +

387

nsec

Zero range gate:

85.520000

Turn off the transmitter

Set “Frequency tracking” to “Manual”, click on “RF power” to remove the check mark and click “Apply”:

The screenshot shows a radar configuration window with various settings. At the top, there are buttons for 'Load', 'Save', and 'Disconnect'. The 'Mode' is set to 'Pulse pair'. Under the 'Mode' section, there are checkboxes for 'Dry air power' (checked), 'Clutter filter' (checked), 'RF power' (unchecked), and 'Record raw I/Q' (unchecked). A red arrow points to the 'RF power' checkbox. The 'FFT length' is 128, and the 'FFT taper' is 'Hanning'. The 'Range resolution' is 75 m. The 'PRI 1, 2' is 500 usec, and the 'Group interval' is 2000 usec. The 'Filter bandwidth' is 2 MHz. The 'Range gate spacing' is 75 m. The 'Range gates' are 800, with a 'Max range' of 59.6043 km. The 'Clutter averaging' is 32, and the 'Clutter filter width' is 0.199256 m / sec. The 'Post averaging' is 1, and the 'Integration time' is 0.080000 sec. The 'Data rate' is 12.500000 / sec. The 'Site info' field is empty, and the 'Az offset' is 1. The 'LO frequency' is 0.000000 MHz, and the 'Server estimate' is 0.000 MHz. The 'Frequency tracking' is set to 'Manual', and the 'Auto adjust' is 1.000000 %. The 'Power' is -53.286 dBm. The 'Zv' is 1.000000 dB, 'Zh' is 1.000000 dB, 'Pnv' is 1.000000 dBm, and 'Pnh' is 1.000000 dBm. The 'Data file auto-rolling' is disabled. The 'Server state' is 'Run'. A red arrow points to the 'Apply' button. The 'Pedestal' section shows 'Position' (Az: 77.86, El: 89.98) and 'Velocity' (Az: 0.00, El: 0.00). The 'Scan type' is 'None', and the 'Sequence code' is -1. The 'Action' is 'Point', and there are 'Apply' and 'Stop' buttons. The 'Testing' section shows 'Tx delay' (3), 'Tx PW', 'Tx sample switch delay' (Tx delay + 0 nsec), 'Tx sample switch hold off' (700 nsec), 'Tx pulse center' (Tx delay + 0.5 * PW + 387 nsec), and 'Zero range gate' (85.520000).

Monitor the “Power:” value:

Load

Save

Disconnect

Mode

Pulse pair

☒ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range: 59.6043 km

Clutter averaging

32

Clutter filter width: 0.199256 m / sec

Post averaging

1

Integration time: 0.080000 sec

Data rate: 12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000

MHz

Error

13.8594E

MHz

Server estimate: 0.000

MHz

Frequency tracking

Manual

Auto adjust

1.0000

%

Power: -53.286 dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 77.86 El: 89.98

Velocity

Az: 0.00 El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az 0.00 El 0.00

Velocity

Az 5.00 El 5.00

Testing

Tx delay

3

Tx PW

Tx sample switch delay: Tx delay +

0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center: Tx delay + 0.5 * PW +

387

nsec

Zero range gate:

85.520000

This value starts around -12 dBm. The power should decrease to around -85 dBm or nan before continuing.

Turn off dry air power

Click on “Dry air power” to remove the check mark then click “Apply”.

Load

Save

Disconnect

Mode

Pulse pair

☐ Dry air power
☒ Clutter filter
☐ RF power
☐ Record raw I/Q

FFT length

128

FFT taper

Hanning

Range resolution

75 m

PRI 1, 2

500

500

usec

Group interval

2000

usec

Filter bandwidth

2 MHz

Range gate spacing

75 m

Range gates

800

Max range: 59.6043 km

Clutter averaging

32

Clutter filter width: 0.199256 m / sec

Post averaging

1

Integration time: 0.080000 sec

Data rate: 12.500000 / sec

Site info

Az offset

1

LO frequency

0.000000

MHz

Error

13.8594E

MHz

Server estimate: 0.000

MHz

Frequency tracking

Manual

Auto adjust

1.0000

%

Power: -53.692

dBm

Zv

1.000000

dB

Zh

1.000000

dB

Pnv

1.000000

dBm

Pnh

1.000000

dBm

Data file auto-rolling

☐ Enabled

☒ Time

0

d

0

h

1

m

☐ File size

0

MB

☐ # scans

0

☐ # records

0

Server state

Run

Apply

Pedestal

Position

Az: 77.86

El: 89.98

Velocity

Az: 0.00

El: 0.00

Scan type

None

Sequence code

-1

Action

Point

Apply

Stop

Position

Az

0.00

El

0.00

Velocity

Az

5.00

El

5.00

Testing

Tx delay:

3

Tx PW

Tx sample switch delay: Tx delay +

0

nsec

Tx sample switch hold off:

700

nsec

Tx pulse center: Tx delay + 0.5 * PW +

387

nsec

Zero range gate:

85.520000

At this point, the radar should be stopped. To leave things in a clean state, set the “Server state” to “Idle” and click “Apply”.

Mode Pulse pair
☐ Dry air power
 ☒ Clutter filter
 ☐ RF power
 ☐ Record raw I/Q

FFT length 128
FFT taper Hanning

Range resolution 75 m

PRI 1, 2 500 500 usec
 Group interval 2000 usec

Filter bandwidth 2 MHz

Range gate spacing 75 m

Range gates 800
Max range: 59.6043 km

Clutter averaging 32
Clutter filter width: 0.199256 m / sec

Post averaging 1
Integration time: 0.080000 sec
 Data rate: 12.500000 / sec

Site info

LO frequency 0.000000 MHz
 Error 13.85946 MHz
 Server estimate: 0.000 MHz

Frequency tracking Manual
Auto adjust 1.0000 %
 Power: 0.000 dBm

Zv 1.000000 dB
 Zh 1.000000 dB
 Pnv 1.000000 dBm
 Pnh 1.000000 dBm

Data file auto-rolling ☐ Enabled

☒ Time 0 d 0 h 1 m
 ☐ File size 0 MB
 ☐ # scans 0
☐ # records 0

Server state Idle

Connected to server [localhost]

Pedestal

Position
 Az: 78.86 El: 89.98
Velocity
 Az: 0.00 El: 0.00

Scan type None
Sequence code -1

Action Point

Position
 Az: 0.00 El: 0.00

Velocity
 Az: 5.00 El: 5.00

Testing

Tx delay: 3 Tx PW

Tx sample switch delay: Tx delay + 0 nsec

Tx sample switch hold off: 700 nsec

Tx pulse center: Tx delay + 0.5 * PW + 387 nsec

Zero range gate: 85.520000

Now you can disconnect the GUI and exit, as described above.

Stop processes on xpol

Stop the processes on "xpol" by entering this command in your "xpol" window:

```
stop_all
```

Everything should now be stopped. You can close the xpol control GUI at this point.