Ephemeris Data Information

Tracking/Pointing Data for ephemeris targets can be made available at LDT in several ways:

1. You may submit a data file prior to your arrival at the site,
2. You may bring your data to the site on a thumb drive,
3. You may have your TO generate the data on your behalf.

Data Submission

Ephemeris tracking is done by the Telescope Control System (TCS), and so any data file the observer chooses to prepare in advance will need to be given to your TO to load into TCS. Please check with your TO at the beginning of the night that your data is available to them (either in email or via USB drive). Regardless of the chosen method of submission, the formatting requirements are the same. Files must be in plain text and should be saved with the **.eph** file extension.

✅ **Data Format**

The 12 data columns are: Year, Month, Day, Hour, Minute, Seconds, RA (hours min sec), and Dec(deg min sec), with the following format:

```
yyyy mm dd hh mm ss h m s.ssssss ±d m s.sssss
```

Note: All dates / times are UT.

⚠️

⚠ The final line of the ephemeris file may include the reference frame for the ephemeris:

For J2000 coordinates:

```
FK5 J2000.0 2000.0
```

For ICRF:

```
ICRS ICRF 2000.0
```

For apparent coordinates: "APPT J20*xx.xx* 20*xx.xx*" where the '*x'* must be replaced by the epoch of your observing night. (*e.g.* the night of 31 October 2020 was J2020.83)

Note: If this line is not included, you need to inform your TO of the reference frame.

ⓘ **Sample Data Format - FK5**

```
2020 10 25 01 43 00 03 17 11.826123 +36 35 33.10001
2020 10 25 01 48 00 03 17 11.869234 +36 35 31.13002
2020 10 25 01 53 00 03 17 11.910345 +36 35 29.15003
FK5 J2000.0 2000.0
```

ⓘ **Sample Data Format - Apparent Coordinates**

```
2020 10 25 01 43 00 03 17 11.826100 +36 35 33.10001
2020 10 25 01 48 00 03 17 11.869200 +36 35 31.13002
2020 10 25 01 53 00 03 17 11.910300 +36 35 29.15003
APPT J2020.83 2020.83
```

On Site Data Generation

Instead of preparing your own ephemeris file, you may have your ephemeris data created from the JPL Horizons database by your TO during your observing run. In all cases it is highly recommended that this process be completed before you are on sky for the night. The box below lists the information that you will need on hand to generate these data.

✅ **Required Information**

1. Target ID or name - the interface requires either the Horizons ID number of the record of interest or the name of the target. If you plan to provide the name you will need to ensure correct formatting of the name (including white spaces e.g., "2014 RC" – note the space, without this no target will be found), you will need to inform the TO of the object type (asteroid, comet, satellite, etc...), and in the case of multiple records you will need to select the desired solution.
2. UT Start and UT End - for these you will want a desired start and end time in hours and minutes as well as a date.
3. Step size of the ephemeris file (typical is ~2 - 10 minutes unless the object is moving at high apparent speed).

⚠ Ephemerides generated from the TCS / Horizons interface may be done in either FK5/J2000 or Apparent Coordinates. If you select Apparent, the apparent RA and Dec is what will appear in your image headers. Similarly the epoch will be reported as the current decimal year. Selecting FK5 will yield the J2000.0 RA and Dec populating the FITS headers.

Detailed instructions for the TOs on the data generation process maybe found here. Note: this process can only be performed by the TOs, as the interface is not accessible from the observer computers.