# SAMIEdit - Getting Started
About mission input files

SAMIEdit: Input Mission Files - Overview

✳ Each satellite mission makes use of several input files:
- ✓ Orbit File (in folders OSF, POF or TLE)
- ✓ Attitude File (in folders ADF or ATT)
- ✓ Instrument Swath Definition File (in folder SDF) ➡ Optional, it is not required if only the satellite /orbit ground-track is going to be displayed)

✳ Files must be copied into the relevant folder
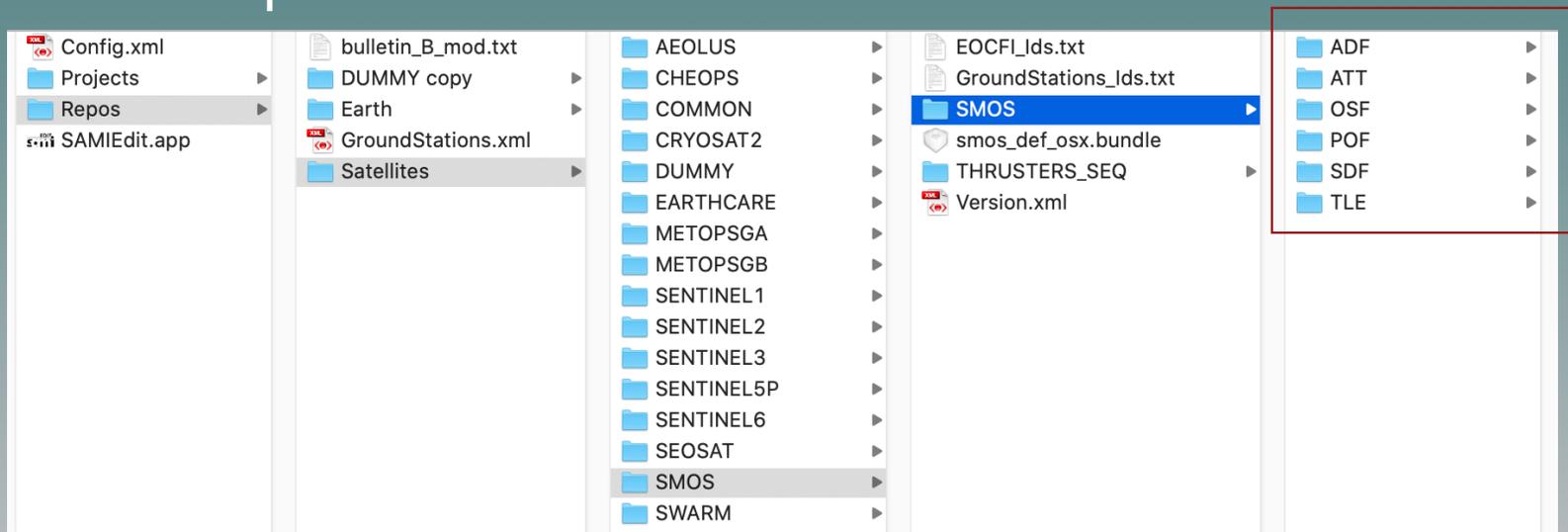
SAMIEdit: Input Mission Files - Orbit Scenario Files

Orbit Scenario Files (OSF) contain orbit definition parameters

```xml
<Data_Block type="xml">
  <List_of_Orbit_Changes count="1">
    <Orbit_Change>
      <Orbit>
        <Absolute_Orbit>1</Absolute_Orbit>
        <Relative_Orbit>15</Relative_Orbit>
        <Cycle_Number>1</Cycle_Number>
        <Phase_Number>1</Phase_Number>
      </Orbit>
      <Cycle>
        <Repeat_Cycle unit="day">3</Repeat_Cycle>
        <Cycle_Length unit="orbit">43</Cycle_Length>
        <ANX_Longitude unit="deg">10.000000</ANX_Longitude>
        <MLST>22:30:00.000000</MLST>
        <MLST_Drift unit="s/day">0.000000</MLST_Drift>
        <MLST_Nonlinear_Drift>
          <Linear_Approx_Validity unit="orbit">99999</Linear_Approx_Validity>
          <Quadratic_Term unit="s/day^2">0.000000</Quadratic_Term>
          <Harmonics_Terms num="0"/>
        </MLST_Nonlinear_Drift>
      </Cycle>
      <Time_of_ANX>
        <TAI>TAI=2017-01-01T21:50:38.272398</TAI>
        <UTC>UTC=2017-01-01T21:50:01.272398</UTC>
        <UT1>UT1=2017-01-01T21:50:01.272398</UT1>
      </Time_of_ANX>
    </Orbit_Change>
  </List_of_Orbit_Changes>
</Data_Block>
```

Absolute orbit number

Orbit Parameters: Repeat Cycle, Cycle Length MLST ar ANX and MLST drift
ANX_Longitude is associated to Absolute orbit number

Date YYYY-MM-DD
The time within the day (HH:MM:SS.UUUUU) will be internally recalculated as function of MLST and ANX_Longitude

SAMIEdit: Input Mission Files - Predicted Orbit Files

Predicted Orbit Files (POF) contain a list of Orbit State Vectors

```
<Data_Block type="xml">
  <List_of_OSVs count="4802">
    <OSV>
      <TAI>TAI=2020-08-03T01:14:51.407980</TAI>
      <UTC>UTC=2020-08-03T01:14:14.407980</UTC>
      <UT1>UT1=2020-08-03T01:14:14.193318</UT1>
      <Absolute_Orbit>+54704</Absolute_Orbit>
      <X unit="m">-6044774.282</X>
      <Y unit="m">+3719688.950</Y>
      <Z unit="m">-0000000.000</Z>
      <VX unit="m/s">+0422.584191</VX>
      <VY unit="m/s">+0659.887167</VY>
      <VZ unit="m/s">+7492.620884</VZ>
      <Quality>0000000000000</Quality>
    </OSV>
    <OSV>
      <TAI>TAI=2020-08-03T02:54:06.071897</TAI>
      <UTC>UTC=2020-08-03T02:53:29.071897</UTC>
      <UT1>UT1=2020-08-03T02:53:28.857287</UT1>
      <Absolute_Orbit>+54705</Absolute_Orbit>
      <X unit="m">-3920772.366</X>
      <Y unit="m">+5916495.226</Y>
      <Z unit="m">-0000000.000</Z>
      <VX unit="m/s">+0660.766528</VX>
      <VY unit="m/s">+0420.970965</VY>
      <VZ unit="m/s">+7492.474004</VZ>
      <Quality>0000000000000</Quality>
    </OSV>
```

✳ Predicted or Restituted Orbit Files are made available for ESA missions by ESOC FD or by PDGS

✳ Alternatively, the executable tool TLE2ORBPRE transforms a TLE orbit file to Predicted Orbit File format (see next slide for details)
Link:
https://eop-cfi.esa.int/index.php/applications/tools/command-line-tools-tle2orbpre

SAMIEdit: Input Mission Files - TLE Files

Two-Line Elements Orbit Files (TLE) contain a set of orbit parameters

```
CHEOPS
1 44874U 19092B   19354.15736652 -.00000046  00000-0  00000+0 0  9995
2 44874  98.2275 175.8674 0007499 299.9362  60.1092 14.56925462   258
```

Example of TLE file, saved as tle_20_DEC_2019_1.txt

✳ Two-Line Element (only for TLEs from CELESTRAK website, with mission name CRYOSAT 2, SMOS, SWARM A/B/C, SENTINEL-1A, SENTINEL-1B, SENTINEL-2A, SENTINEL-2B, SENTINEL-3A).

✳ For other satellites, TLE files cannot be loaded directly in SAMIEdit as type 'TLE' the executable tool TLE2ORBPRE transforms a TLE orbit file to Predicted Orbit File format. The output POF orbit file can then be ingested in SAMI as type 'POF'

Example of input configuration file

```
GENERIC
CHEOPS
44874
19092B
tle_20_DEC_2019_1.txt
30.0
```

Number of days to propagate

5

SAMIEdit: Input Mission Files - Attitude

✴ **Attitude Definition File (ADF)**
   E.g. Nominal Attitude Law
   - ✓ Geocentric Pointing (=0)
   - ✓ Local Normal Pointing (=1)
   - ✓ Local Normal Pointing + Yaw Steering(=2)
   - ✓ Zero-Doppler + Yaw Steering(=3)

✴ **Generic Attitude File (ATT)**
   - ✓ It is also possible to supply attitude quaternion data (in EO XML GS file format) through the "ATT" folder
   - ✓ Useful to display transitions between attitude modes

```xml
<Data_Block type="xml">
    <Attitude_Definition>
    <Sat_Nominal_Att>
        <AOCS_Model>2</AOCS_Model>
    </Sat_Nominal_Att>
    <Sat_Att>
        <Angle_Model>
            <Angle_1>0.0</Angle_1>
            <Angle_2>0.0</Angle_2>
            <Angle_3>0.0</Angle_3>
        </Angle_Model>
    </Sat_Att>
    <Instr_Att>
        <None></None>
    </Instr_Att>
</Attitude_Definition>
```

```xml
<List_of_Quaternions count="61">
    <Quaternions>
        <Time ref="UTC">UTC=2010-03-10T00:00:00.000000</Time>
        <Q1>0.139449</Q1>
        <Q2>0.972486</Q2>
        <Q3>-0.171644</Q3>
        <Q4>0.073228</Q4>
    </Quaternions>
    <Quaternions>
        <Time ref="UTC">UTC=2010-03-10T00:00:10.000000</Time>
        <Q1>0.139772</Q1>
        <Q2>0.971549</Q2>
        <Q3>-0.176772</Q3>
        <Q4>0.072851</Q4>
    </Quaternions>
```
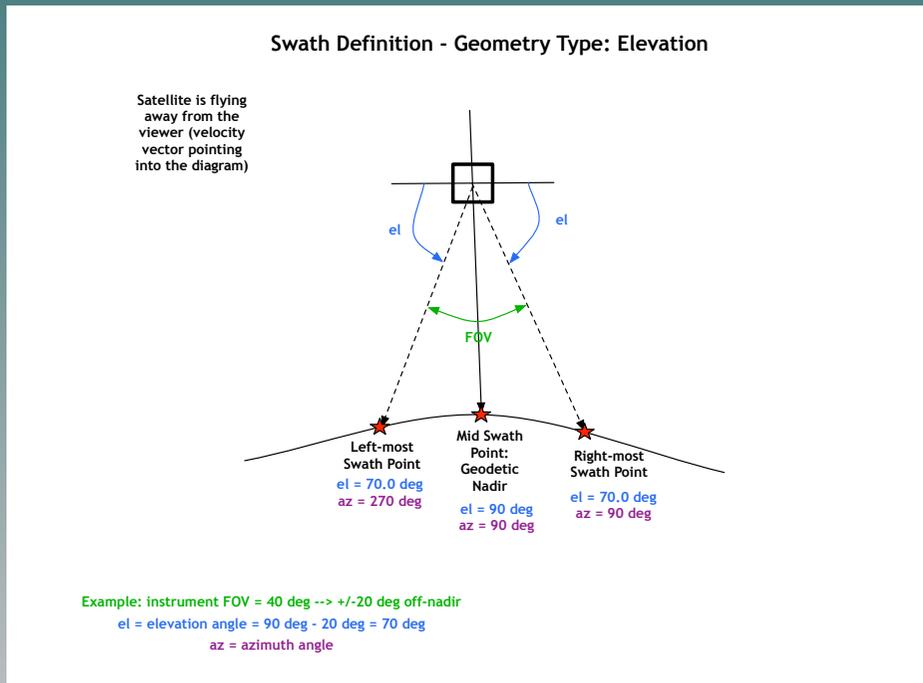
SAMIEdit: Input Mission Files - Swath Definition (I)

✳ Instrument Swath can be defined based on:
- ✓ Elevation Angle
- ✓ Incidence Angle
- ✓ Swath Width

Swath Definition - Geometry Type: Elevation

Satellite is flying away from the viewer (velocity vector pointing into the diagram)

el   el

FOV

Left-most Swath Point
el = 70.0 deg
az = 270 deg

Mid Swath Point: Geodetic Nadir
el = 90 deg
az = 90 deg

Right-most Swath Point
el = 70.0 deg
az = 90 deg

Example: instrument FOV = 40 deg --> +/-20 deg off-nadir
el = elevation angle = 90 deg - 20 deg = 70 deg
az = azimuth angle


```xml
<List_of_Swath_Points count="3">
  <Swath_Point>
    <Pointing_Geometry>
      <Azimuth unit="deg">+270.000000</Azimuth>
      <Elevation unit="deg">+070.000000</Elevation>
      <Altitude unit="m">+000000.000</Altitude>
    </Pointing_Geometry>
  </Swath_Point>
  <Swath_Point>
    <Pointing_Geometry>
      <Azimuth unit="deg">+090.000000</Azimuth>
      <Elevation unit="deg">+090.000000</Elevation>
      <Altitude unit="m">+000000.000</Altitude>
    </Pointing_Geometry>
  </Swath_Point>
  <Swath_Point>
    <Pointing_Geometry>
      <Azimuth unit="deg">+090.000000</Azimuth>
      <Elevation unit="deg">+070.000000</Elevation>
      <Altitude unit="m">+000000.000</Altitude>
    </Pointing_Geometry>
  </Swath_Point>
</List_of_Swath_Points>
```
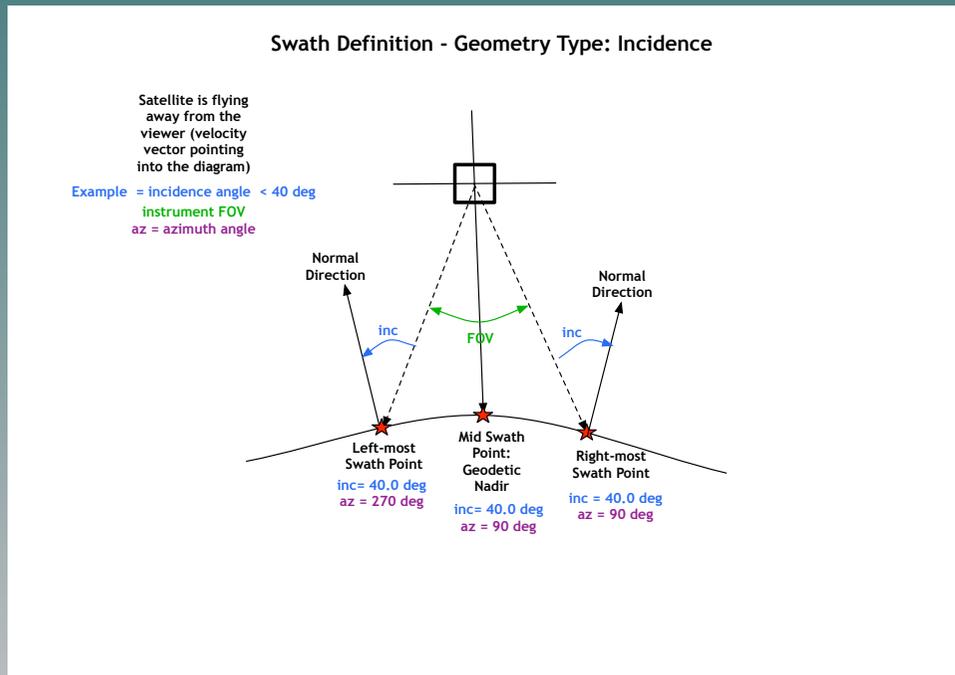
* Instrument Swath can be defined based on:
  - ✓ Elevation Angle
  - ✓ Incidence Angle
  - ✓ Swath Width

Swath Definition - Geometry Type: Incidence

Satellite is flying away from the viewer (velocity vector pointing into the diagram)

Example = incidence angle < 40 deg
instrument FOV
az = azimuth angle

Normal Direction

Normal Direction

inc   FOV   inc

Left-most Swath Point
inc= 40.0 deg
az = 270 deg

Mid Swath Point: Geodetic Nadir
inc= 40.0 deg
az = 90 deg

Right-most Swath Point
inc = 40.0 deg
az = 90 deg

```xml
<List_of_Swath_Points count="3">
<Swath_Point>
  <Incidence_Angle_Geometry>
    <Azimuth unit="deg">+270.000000</Azimuth>
    <Incidence_Angle unit="deg">+040.000000</Incidence_Angle>
    <Altitude unit="m">000000.000</Altitude>
  </Incidence_Angle_Geometry>
</Swath_Point>
<Swath_Point>
  <Incidence_Angle_Geometry>
    <Azimuth unit="deg">+090.000000</Azimuth>
    <Incidence_Angle unit="deg">+040.000000</Incidence_Angle>
    <Altitude unit="m">000000.000</Altitude>
  </Incidence_Angle_Geometry>
</Swath_Point>
<Swath_Point>
  <Incidence_Angle_Geometry>
    <Azimuth unit="deg">+090.000000</Azimuth>
    <Incidence_Angle unit="deg">+040.000000</Incidence_Angle>
    <Altitude unit="m">000000.000</Altitude>
  </Incidence_Angle_Geometry>
</Swath_Point>
</List_of_Swath_Points>
```
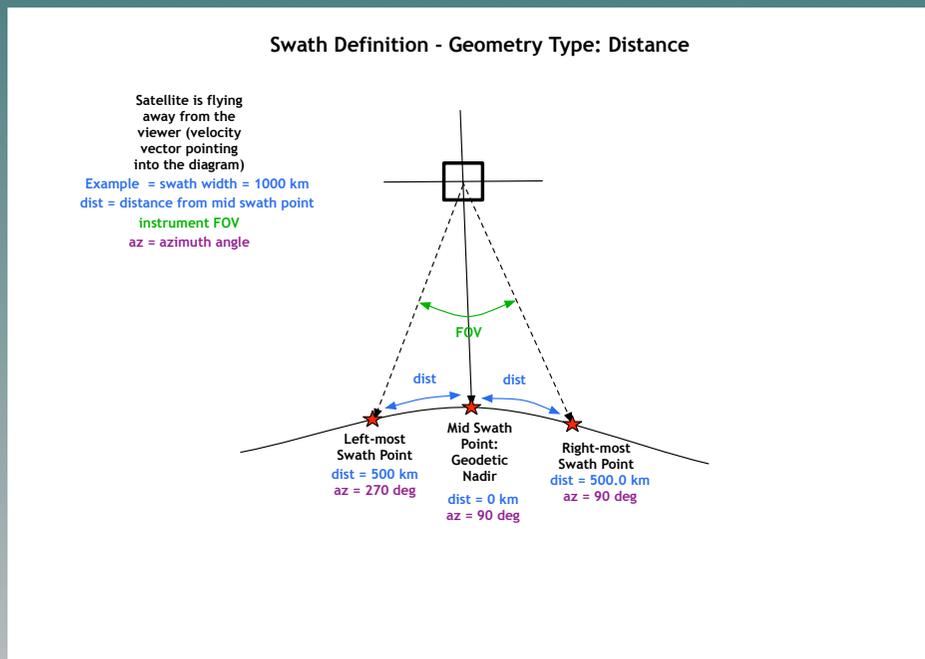
SAMIEdit: Input Mission Files - Swath Definition (III)

✳ Instrument Swath can be defined based on:

   ✓ Elevation Angle

   ✓ Incidence Angle

   ✓ Swath Width

Swath Definition - Geometry Type: Distance

Satellite is flying away from the viewer (velocity vector pointing into the diagram)

Example = swath width = 1000 km
dist = distance from mid swath point
instrument FOV
az = azimuth angle

FOV

dist   dist

Left-most Swath Point
dist = 500 km
az = 270 deg

Mid Swath Point: Geodetic Nadir
dist = 0 km
az = 90 deg

Right-most Swath Point
dist = 500.0 km
az = 90 deg

```xml
<List_of_Swath_Points count="3">
  <Swath_Point>
    <Distance_Geometry>
      <Azimuth unit="deg">+270.000000</Azimuth>
      <Elevation unit="deg">+090.000000</Elevation>
      <Altitude unit="m">000000.000</Altitude>
      <Distance unit="m">500000.000</Distance>
    </Distance_Geometry>
  </Swath_Point>
  <Swath_Point>
    <Distance_Geometry>
      <Azimuth unit="deg">+090.000000</Azimuth>
      <Elevation unit="deg">+090.000000</Elevation>
      <Altitude unit="m">000000.000</Altitude>
      <Distance unit="m">000000.000</Distance>
    </Distance_Geometry>
  </Swath_Point>
  <Swath_Point>
    <Distance_Geometry>
      <Azimuth unit="deg">+090.000000</Azimuth>
      <Elevation unit="deg">+090.000000</Elevation>
      <Altitude unit="m">000000.000</Altitude>
      <Distance unit="m">500000.000</Distance>
    </Distance_Geometry>
  </Swath_Point>
</List_of_Swath_Points>
```

SAMIEdit: Mission Input Files - User Support

✳ SAMI User Support contact e-mail

sami@eopp.esa.int

✳ For further details on the application interface and available features, please have a look to the SAMI Quick Start Guide

https://eop-cfi.esa.int/Repo/PUBLIC/DOCUMENTATION/APPLICATIONS/SAMI/SAMIEdit_Quick_Start_Guide_Desktop_v1_4_0_6.pdf