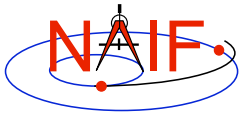


Using the Frames Subsystem

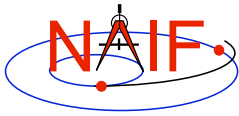
March 2006



What is the power of Frames?

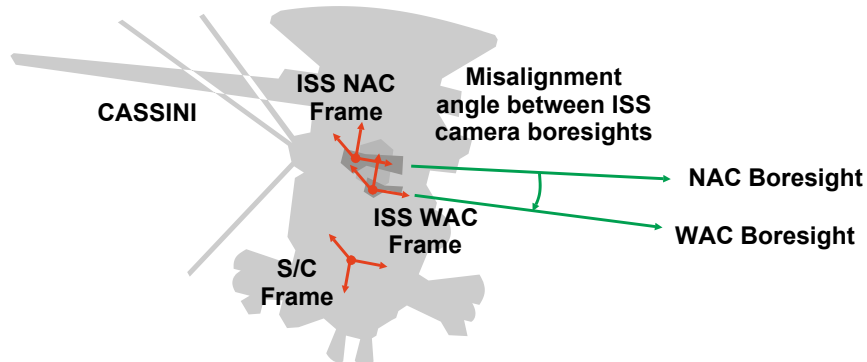
- The “power” of the Frames capability stems from the SPICE system’s ability to construct complex reference frame transformations with no effort required of you - the end user
- The principal benefit from the Frames capability is obtained through the main SPK subsystem interfaces (SPKEZR and SPKPOS) and the Frames subsystem interfaces (SXFOM and PXFORM)
- The remaining pages illustrate typical use of frames
- Several **VERY IMPORTANT** usage issues are mentioned in the core Frames tutorial (fk.*); be sure to also read that.

Remember: “reference frame” \neq “coordinate system”



Offset between Instruments

Navigation and Ancillary Information Facility



Compute the angular separation between the ISS Narrow Angle Camera and Wide Angle Camera boresights:

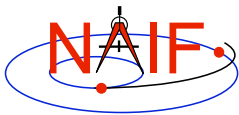
```

C Retrieve the matrix that transforms vectors from NAC to WAC frame
CALL PXFORM( 'CASSINI_ISS_NAC', 'CASSINI_ISS_WAC', ET, MAT )
C Transform NAC boresight to WAC frame and find separation angle
CALL MXV ( MAT, NAC_BORESIGHT_nac, NAC_BORESIGHT_wac )
ANGLE = VSEP( NAC_BORESIGHT_wac , WAC_BORESIGHT_wac )

```

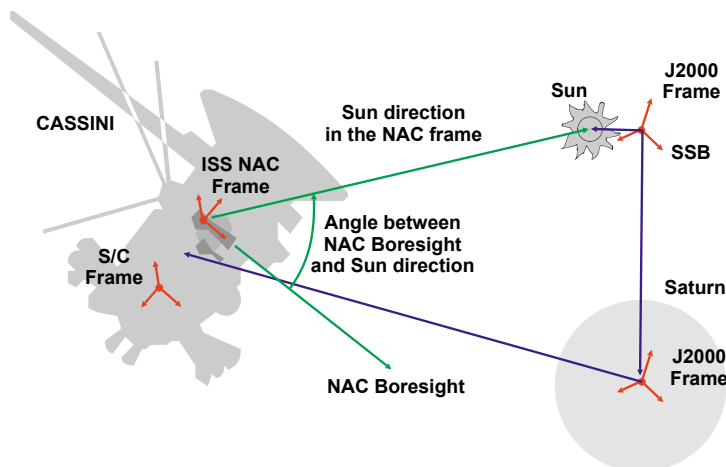
Using Frames

3



Angular Constraints

Navigation and Ancillary Information Facility



Check whether the angle between camera boresight and direction to Sun is within allowed range:

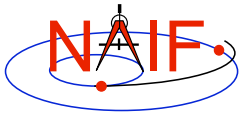
```

CALL SPKPOS( 'SUN', ET, 'CASSINI_ISS_NAC', 'LT+S', 'CASSINI', SUNVEC, LT )
ANGLE = VSEP( NAC_BORESIGHT_nac, SUNVEC )
IF ( ANGLE .LE. CONSTRAINT ) WRITE(*,*) 'WE ARE IN TROUBLE!'

```

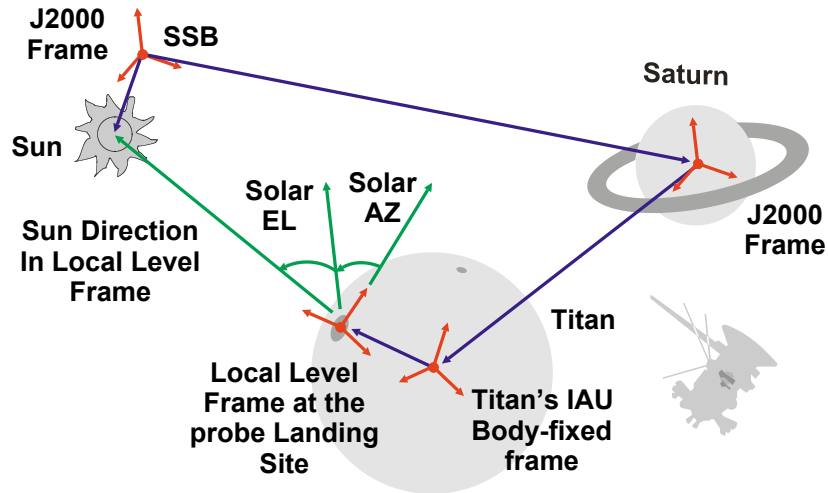
Using Frames

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Angles at the Surface

Navigation and Ancillary Information Facility

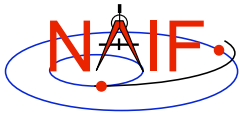


Compute solar azimuth and elevation at the Huygens probe landing site:

```
CALL SPKPOS ('SUN', ET, 'HUYGENS_LOCAL_LEVEL', 'LT+S', 'HUYGENS_PROBE', SUNVEC, LT)
CALL RECRAD (SUNVEC, R, AZIMUTH, ELEVATION)
```

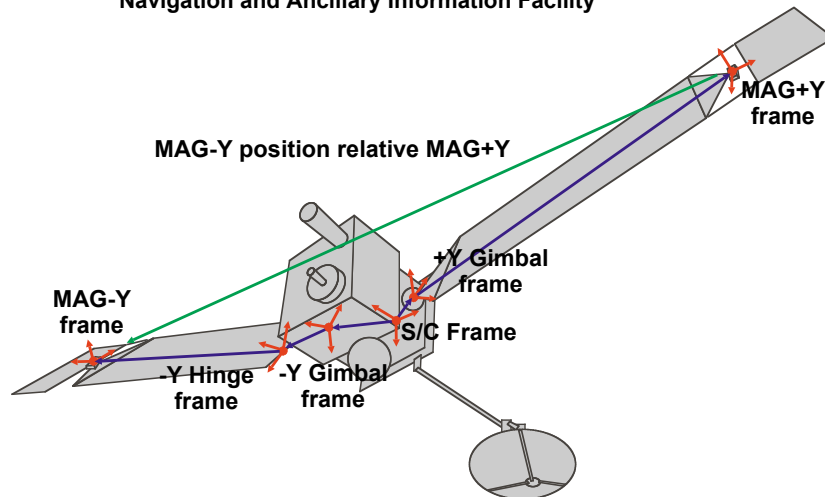
Using Frames

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Relative Position of Sensors

Navigation and Ancillary Information Facility

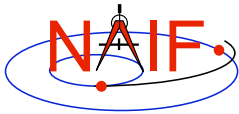


Find the position of one MGS MAG sensor with respect to the other in the MGS s/c frame. Also find the relative orientation of sensors:

```
CALL SPKEZR ('MGS_MAG-Y', ET, 'MGS_SPACECRAFT', 'NONE', 'MGS_MAG+Y', STATE, LT)
CALL PXFORM ('MGS_MAG +Y_SENSOR', 'MGS_MAG -Y_SENSOR', ET, MAT)
```

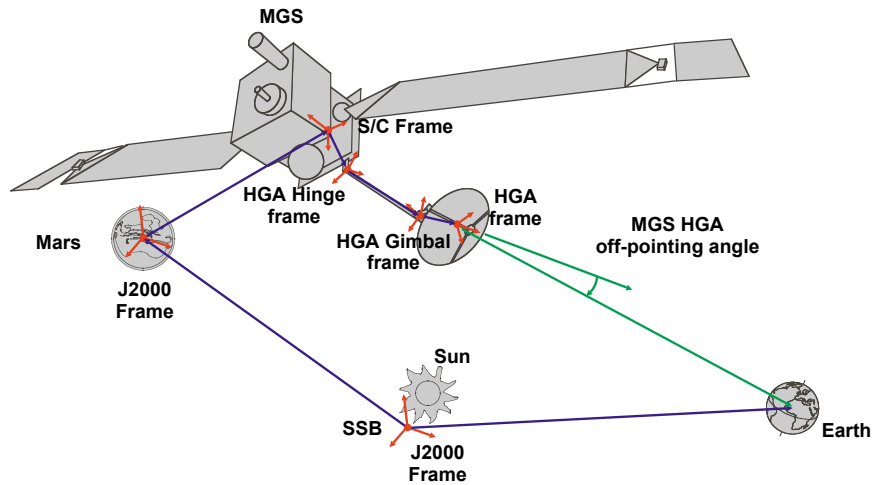
Using Frames

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Manipulators - 1

Navigation and Ancillary Information Facility

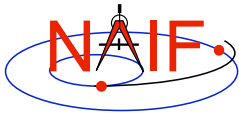


Compute the angle between the direction to Earth and the MGS HGA boresight:

```
CALL SPKEZR( 'EARTH', ET, 'MGS_HGA', 'LT+S', 'MGS', EARTH_STATE, LT )
ANGLE = VSEP( HGA_BORESIGHT, EARTH_STATE )
```

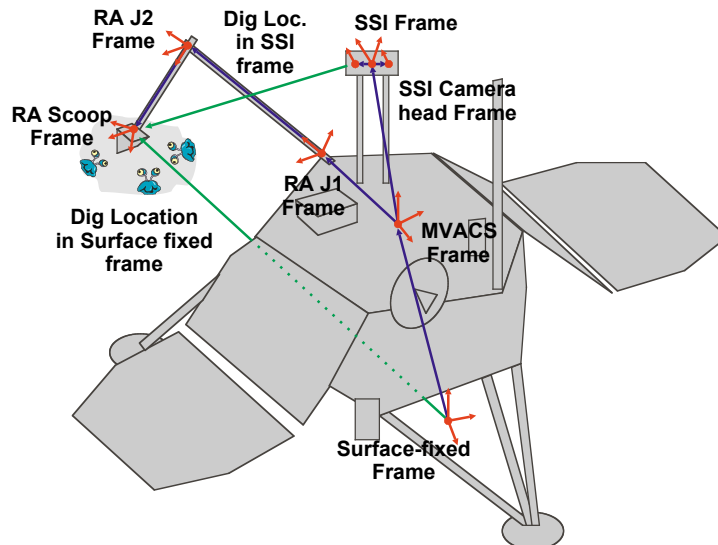
Using Frames

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Manipulators - 2

Navigation and Ancillary Information Facility



Compute the dig location in MPL surface-fixed and camera left eye frames:

```
CALL SPKEZR( 'MPL_RA_SCOOP', ET, 'MPL_SURFACE_FIXED', 'NONE', 'MPL_SURF', ST1, LT )
CALL SPKEZR( 'MPL_RA_SCOOP', ET, 'MPL_SSI_LEFT', 'NONE', 'MPL_SSI', ST2, LT )
```

Using Frames

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