

Navigation and Ancillary Information Facility

The Event Finder

(A preview of work in progress)

April 2005

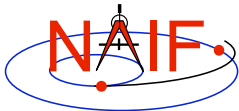
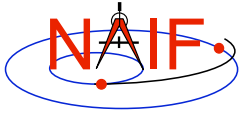


Table of Contents

Navigation and Ancillary Information Facility

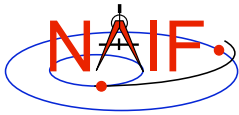
- Introduction
- What is an event?
- Examples of events



Introduction

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- **This tutorial provides a preview to SPICE modules now being developed that will facilitate the calculation of times (epochs) or time periods when certain geometric conditions—”events”— are met.**
 - **Events found by this package fall into two categories.**
 - **Times when a binary-valued condition is satisfied.**
 - Example: something is fully occulted or not.
 - **Times when the geometric relationship between two or more objects satisfies a numerical criterion.**
 - Example: the angular separation of two objects as seen from a third is less than some value.
- **This is work in progress... not yet available in SPICE Toolkits. People interested in participating as Beta-testers should contact someone from NAIF.**

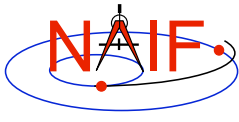


What is an Event? - 1

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Times when a specific condition is satisfied.

- **Currently available events of this type deal with:**
 - » **The eclipse of one object by another.**
 - Full, partial eclipse
 - Umbral, penumbral eclipse
 - Umbral and/or penumbral shadow lie completely on the illuminated face of the eclipsed object
 - » **The occultation of one object by another, as viewed from a third object.**
 - Occultation of a point by a triaxial ellipsoid,
 - Partial occultation of one spherical object by another,
 - Annular occultation of one spherical object by another.
 - » **An object falls within the field-of-view (FOV) of an instrument.**
 - The FOV shape must be a circle, ellipse or polygon.
 - » **The orbital longitude of one object orbiting another as viewed from a third falls within a specified range.**
 - Can be used with a planet orbiting its barycenter.



What is an Event? - 2

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Times when the geometric relationship between two or more objects satisfies a numerical criterion.

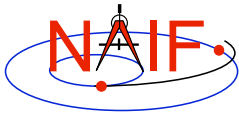
– Comparison operators can be:

- » less than, greater than, or equal to a number;
- » absolute or local minimum, maximum.

– Currently available events of this type deal with:

- » the angular separation, angular velocity, relative velocity or relative distance between two objects,
- » the phase (observer-target-Sun) angle,
- » the elongation (Sun-observer-target) angle,
- » the apparent angular diameter of an object,
- » a coordinate of a reference vector in a specified frame and coordinate system.
 - Vectors are “observer-target” or “sub-observer point on target”
- » a user specified condition

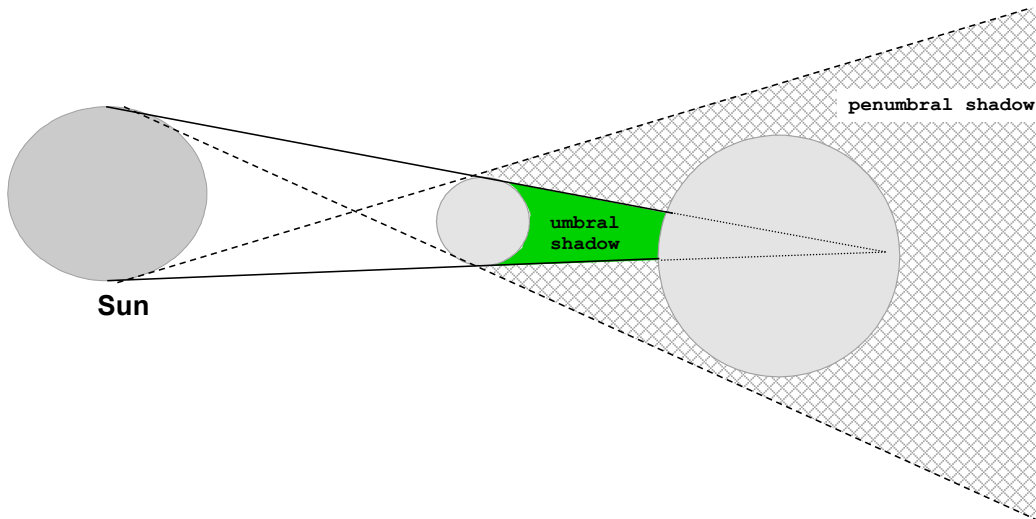
The user is responsible for making sure all required data have been loaded from appropriate kernel files prior to initiating a search.

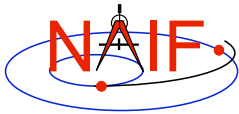


Examples of Binary Events-1

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This diagram shows a partial umbral and full penumbral eclipse. The umbral shadow lies completely on the eclipsed body.



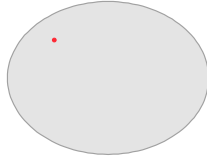


Examples of Binary Events-2

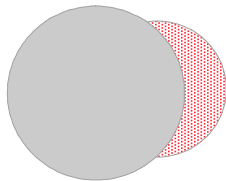
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Occultations as seen by an observer

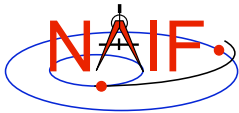
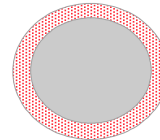
- Occultation of a point by a triaxial ellipsoid



- Partial occultation of one spherical body by another



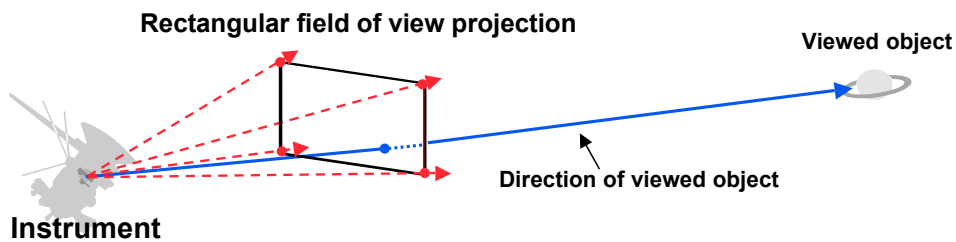
- Annular occultation of one spherical body by another

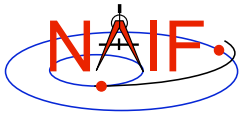


Examples of Binary Events-3

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- The center of an object falls within the field-of-view (FOV) of an instrument.

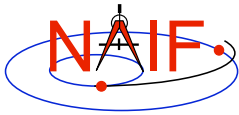
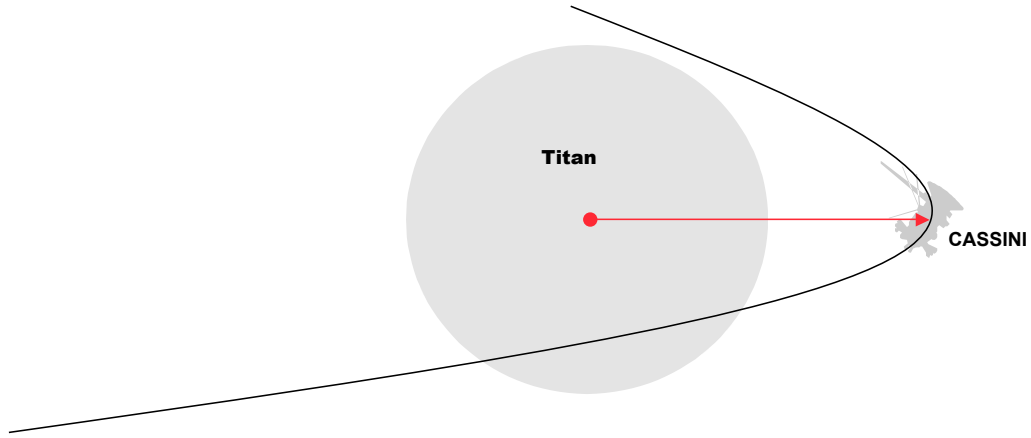




Examples of Numerical Events-1

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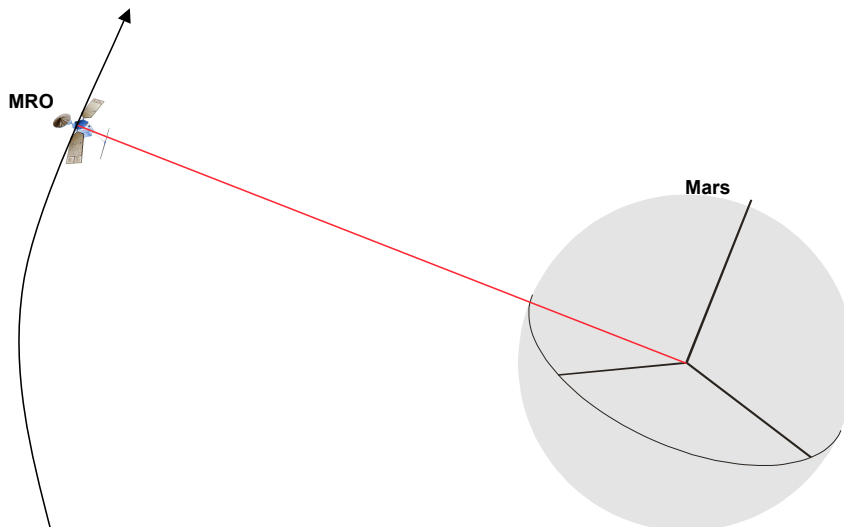
- Find times when the Cassini spacecraft makes its closest approach to Titan.

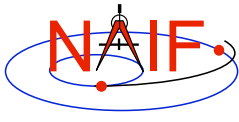


Examples of Numerical Events-2

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- Find times when the MRO spacecraft crosses the equatorial plane of Mars while in the ascending part of the orbit.





Examples of Numerical Events-3

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- Find time intervals when the solar elevation at the Huygens probe landing site is greater than 45° .

