Interferometer Lab User Manual

Official user manual for the Interferometer Lab website

Version 1.1, April 2026

Scope
This manual documents the current homepage workflow of the website, covering the four main panels: Telescope Layout, Planetary System, Transmission Map, and Observation Windows.

Audience
Users who want to configure interferometer layouts, inspect transmission and kernel-style maps, load NASA exoplanet systems, and evaluate observation windows with the current scheduling engine.

Document status note. This manual describes the current website implementation. Engineering approximations, fallback assumptions, and internal ranking rules are identified explicitly and should not be interpreted as direct physical results.

Contents

1 Quick Start

Usage note. The homepage is designed as a top-to-bottom workflow. In the most common use case you first define an array geometry, then choose a planetary system, then inspect the map response, and finally evaluate observation windows when a NASA system has enough orbital information.

1.1 Minimal workflow

1. In **Telescope Layout**, choose an interferometer geometry and set its geometric parameters.
2. In **Planetary System**, choose either no system, a mock system, or a NASA system. For a first real-data test, use `51 Peg`.
3. In **Transmission Map**, choose simple or advanced mode, set wavelength and field of view, and inspect the plotted response.
4. If a NASA system is loaded and at least one planet has enough orbital information, use **Observation Windows** to evaluate feasible visit windows.

1.2 Recommended first session

1. Select **LIFE Architecture**.
2. Keep the default collector diameter and baseline values.
3. Set **System type** to **NASA / real system**.
4. Search for `51 Peg` and select it from the result list.
5. In **Transmission Map**, set the **Field of view** to about **15 mas** so that the 51 Peg system is clearly visible in the displayed map.
6. Switch to **Advanced (nuller)** mode and inspect **Transmission T1** on sky axes.
7. Read the **NASA system summary** and the planet row assumptions before interpreting the orbit or the sampled value at the planet.
8. Open **Observation Windows**, keep the default cadence and visit duration, and inspect the best window, timeline, and window table.

Model assumption. The website can evaluate map values at planet positions even when some catalog parameters are missing, but only after replacing missing inputs with explicit fallback assumptions. These should be read before any physical conclusion is drawn from the displayed orbit or observation schedule.

Implementation note. The observation-window engine uses a separate internal advanced T1 map for scheduling. Its internal field of view can differ from the visible homepage field of view. This is intentional and should not be mistaken for a plotting bug.

2 Telescope Layout

Usage note. This panel defines the collector geometry used everywhere else on the homepage. The plot on the right is a direct geometric view in metres; it is not a sky image and it is not a transmission map.

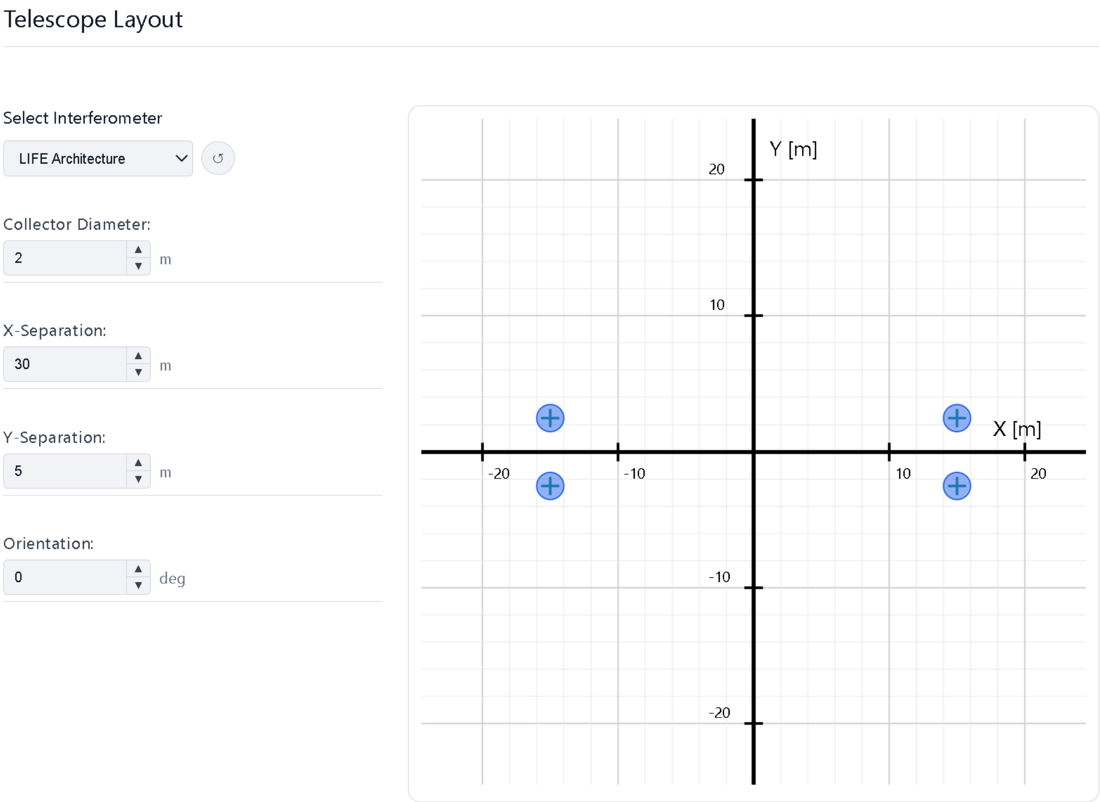


Figure 1: Telescope Layout panel showing array selection, geometric controls, and the collector plot.

2.1 Available layouts

Layout	Controls	Interpretation
LIFE Architecture	Collector Diameter, X-Separation, Y-Separation, Orientation	Four-aperture X-array style rectangular geometry used as the default project baseline.
Single Telescope	Collector Diameter	Single collector, useful as a reference case.
2-Aperture Bracewell	Collector Diameter, Separation, Orientation	Two-collector baseline with a single separation parameter.
3-Aperture Triangular	Collector Diameter, Separation, Orientation	Three-collector symmetric triangular layout.
4-Aperture Rectangle	Collector Diameter, X-Separation, Y-Separation, Orientation	Four collectors in a rectangular geometry distinct from the LIFE-labelled preset.

Layout	Controls	Interpretation
4-Aperture Kite	Collector Diameter, Short baseline B, Ratio c, Orientation	Four-collector kite parameterised by the short baseline and a dimensionless ratio.
5-Aperture Ring	Collector Diameter, Radius, Orientation	Five collectors on a ring of radius given in metres.
6-Aperture Hexagonal	Collector Diameter, Radius, Orientation	Six collectors on a hexagonal ring.
Custom	Per-row X, Y, D plus add/remove row controls	User-defined collector coordinates and diameters. Current implementation supports 1 to 50 telescopes.

2.2 What the plot shows

- Cartesian collector coordinates in metres.
- For custom layouts, dish labels are shown.
- The plot is purely geometric. It does not display optical phase, transmission, or science performance by itself.

2.3 Input validation and warnings

Current UI behaviour	Meaning
`Enter a valid number.`	The text field does not currently parse to a finite number.
`Smallest separation is ...Value must be > 0 and <= ...`	For non-custom multi-aperture layouts, the collector diameter cannot exceed the smallest pairwise collector spacing used by the current geometry. This prevents overlap in the geometric layout.
`Dish i overlaps Dish j`	Custom rows currently overlap geometrically because the centre-to-centre spacing is smaller than the sum of collector radii.

Model assumption. The diameter limit is a geometry constraint applied in the interface. It is a practical non-overlap rule for the current layout representation, not a general theorem about feasible interferometer design.

Implementation note. Advanced mode is not available for the custom layout because the current backend maps custom arrays to the generic simple-mode architecture only.

3 Planetary System

Usage note. This panel controls whether the map is shown with no overlay, with a synthetic one-planet mock system, or with a NASA system loaded from the Exoplanet Archive. It also reports the currently sampled displayed map value at the star and planets.

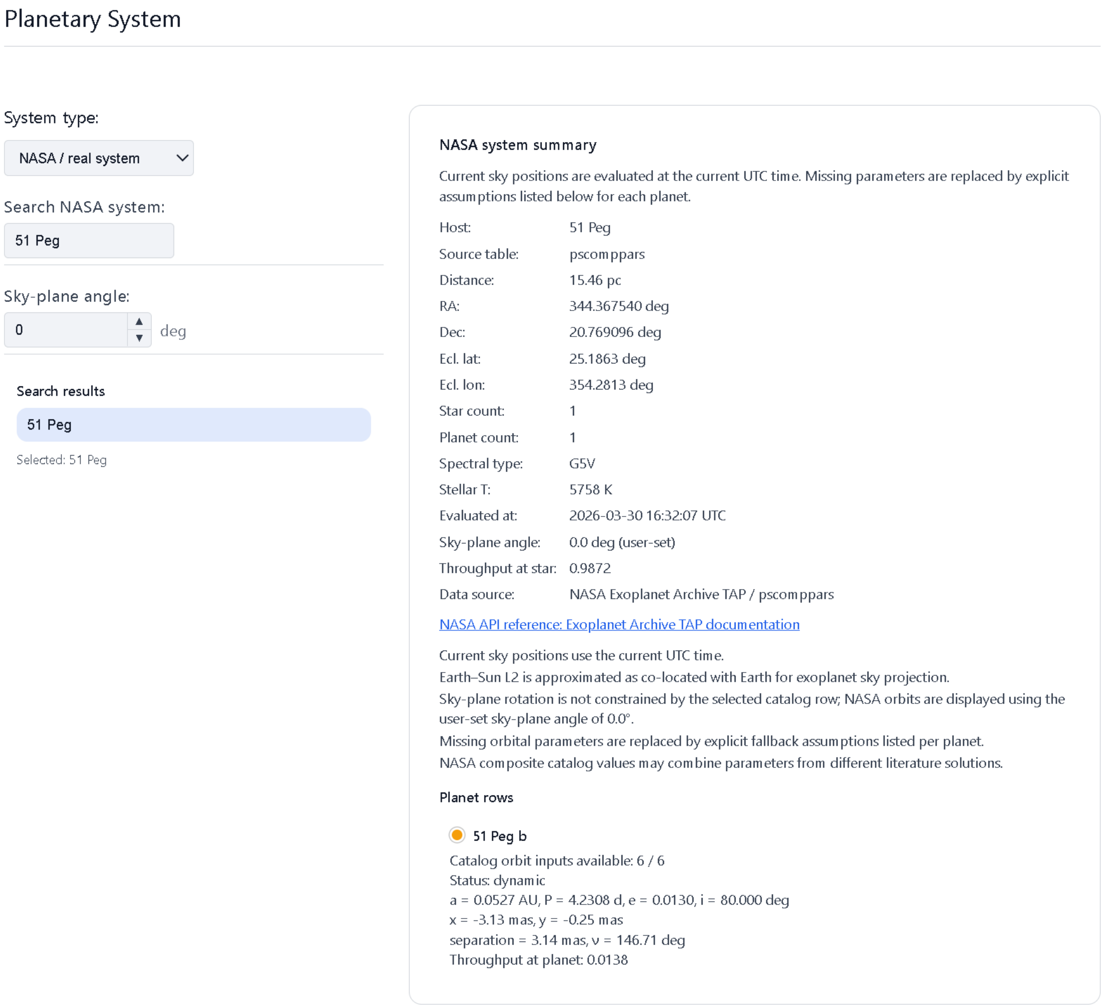


Figure 2: Planetary System panel showing NASA search, host summary, and per-planet rows with assumptions.

3.1 System type options

Option	Behaviour
None	No star, planet, or orbit markers are drawn on the transmission map.
Mock system	A single star at the origin and a single user-defined mock planet are generated from the current synthetic orbital inputs.
NASA / real system	Host systems are searched through the backend, loaded from the NASA Exoplanet Archive, converted to sky-plane positions, and annotated with explicit fallback assumptions where needed.

3.2 Mock system inputs

- **Stellar distance** [pc]
- **Inclination** [deg]
- **Position angle** [deg]
- **Semi-major axis** [AU]
- **Eccentricity**
- **Orbital phase** ν [deg]
- **Planet / star contrast**

The mock summary reports sky coordinates, separation, apparent angular semi-major axis, instantaneous radius, and the sampled displayed value at the star and planet.

3.3 NASA system workflow

1. Enter a host name in **Search NASA system**.
2. Select a result from the returned list.
3. Optionally set a user-controlled **Sky-plane angle**.
4. Read the **NASA system summary** and the per-planet assumption notes before interpreting the orbit.

The summary reports host metadata such as distance, right ascension, declination, ecliptic coordinates, spectral type, stellar temperature, current evaluation time, user-set sky-plane angle, and the currently sampled displayed value at the star.

3.4 Important interpretation rules

Implementation note. NASA composite catalog values may combine parameters from different literature solutions. As a result, the displayed orbit or current position should sometimes be interpreted as approximate rather than as the output of one fully self-consistent orbital fit.

Implementation note. The displayed sky-plane rotation is currently user controlled. It is not inferred from the catalog row. The panel explicitly states that NASA orbits are displayed using the user-set sky-plane angle. The current default control value is 0.0°, but that angle is a display parameter rather than a catalog completeness field.

Implementation note. Current sky positions are evaluated at the current UTC time. The displayed planet position is therefore a current-epoch placement at "now", not a generic observing epoch unless a dedicated time-selection feature is added.

Implementation note. The current model treats Earth–Sun L2 as co-located with Earth for exoplanet sky projection. This is an engineering approximation for the present tool, not a full time-dependent orbital calculation.

Implementation note. NASA composite catalog values may combine parameters from different literature solutions. The current `pscomppars` workflow is practical because it is relatively complete, but the displayed orbit should not automatically be interpreted as coming from one fully self-consistent orbital fit.

3.5 Orbit input completeness

For each NASA planet row, the current simulator checks whether the following six orbit inputs are available:

- orbital period P,
- semi-major axis a,
- eccentricity e,
- inclination i,
- argument of periastron ω,
- one phase reference: time of periastron or, if missing, transit midpoint.

If all six are available, the summary shows **6 / 6**. This means that all inputs required by the current simulator model are available. It does **not** mean that the full absolute on-sky orientation is known observationally.

Model assumption. The user-set sky-plane angle is intentionally not part of the 6 / 6 completeness count. In the current simulator it is a separate display parameter because the catalog row usually does not provide the absolute sky orientation on the detector plane.

Two planets can have the same completeness count but still differ in reliability, because the count alone does not encode which parameters are missing.

3.6 Common fallback rules and messages

Current rule or message	**Meaning**
Missing eccentricity; assumed $e = 0$	The orbit is treated as circular. This removes periastron and apastron variation and simplifies phase propagation, but can shift the true projected position for genuinely eccentric systems.
Missing inclination; borrowed from another system planet if available, otherwise assumed $i = 0°$	The current fallback first tries a temporary coplanarity assumption using another planet in the same system. If no such reference exists, the orbit is treated as face-on. This is a display fallback and can be very wrong for systems that are actually close to edge-on.
Missing argument of periastron; assumed $\omega = 0°$	This fixes the ellipse orientation within the orbital plane. It mainly affects where periastron lies and therefore changes the projected position for eccentric orbits.

Current rule or message	Meaning
Sky-plane angle is user-set	The archive usually does not provide the full absolute detector-plane rotation of the orbit. The website therefore uses a user-set sky-plane angle. Orbit shape and scale can still be useful while the absolute rotation on the sky remains unconstrained.
Semi-major axis inferred from catalog angular separation and distance	If a is missing but catalog angular separation and host distance exist, the website uses them to estimate an orbital size. This is weaker than a direct catalog semi-major axis and should be read as an approximate fallback.
Current phase anchored to catalog transit midpoint; treated as projected conjunction	If time of periastron is missing but a transit midpoint exists, the current implementation propagates phase approximately from the transit epoch. This is not identical to using a direct periastron epoch, especially for eccentric orbits.
Missing period or epoch; displayed at reference phase $\nu = 0°$	If there is not enough timing information to place the planet at the current epoch, the orbit can still be drawn and the planet is shown at a reference position. This is a visualization fallback only, not a real current position.
Host distance missing in catalog	Without host distance, the website cannot convert AU-scale orbital size into angular sky separation in milliarcseconds. No defensible sky placement is then possible.
No usable orbital size found in catalog	If neither semi-major axis nor a defensible proxy is available, the orbit cannot be placed on the sky. In that case, the planet is marked as insufficient rather than being assigned a speculative sky position.
Current sky positions use the current UTC time	The displayed planet position is computed at the current time of evaluation.
Missing orbital parameters are replaced by explicit fallback assumptions listed per planet	Different planets in the same host system may be displayed with different levels of data completeness.
NASA composite catalog values may combine parameters from different literature solutions	NASA composite catalog values may combine parameters from different literature solutions. As a result, the propagated orbit or current position should sometimes be interpreted as approximate rather than as the output of one single self-consistent orbital fit.

3.7 Current status labels

Status	Meaning
dynamic	Enough orbital information is available to propagate the position at the current time.
dynamic (approx.)	The position is propagated using fallback timing assumptions, most importantly a transit-midpoint anchor rather than a direct periastron epoch.

Status	Meaning
static	The orbit can be drawn, but the current planet position is only a reference placement rather than a fully time-propagated state.
insufficient	Not enough information is available for a defensible current sky placement.

4 Transmission Map

Usage note. This panel is the main optical-response view. It can show either a generic simple-mode response or architecture-specific advanced-mode observables. The map can also be sampled at star and planet positions defined in the Planetary System panel.

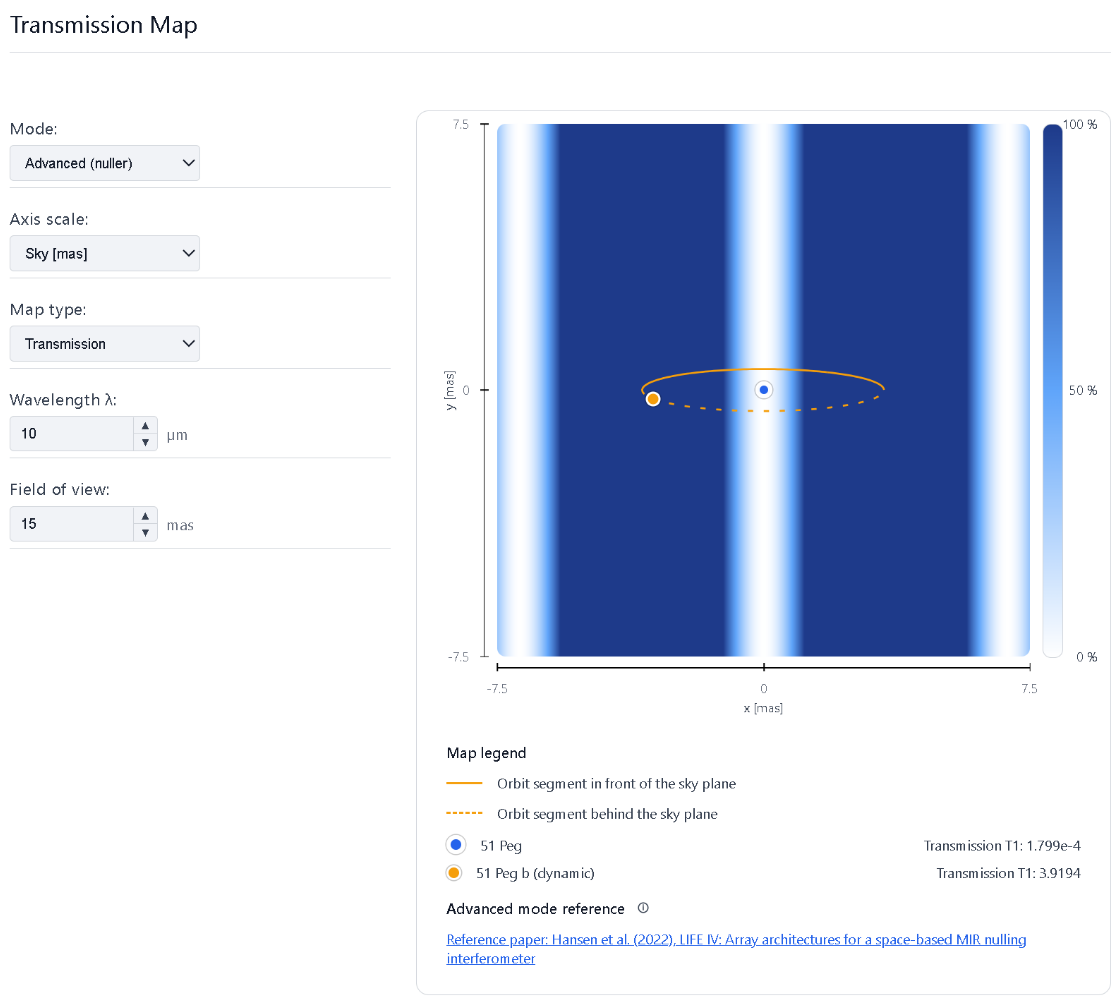


Figure 3: Transmission Map panel showing mode selection, optical map, orbit overlay, sampled legend values, and the advanced-mode reference note.

4.1 Inputs

Control	Meaning
Mode	**Simple** uses a generic coherent sum with a common Airy envelope. **Advanced (nuller)** uses architecture-specific combiner logic where available.
Simple observable	In simple mode only: choose **Throughput** or **Rejection-like (1 - T)**.
Axis scale	In advanced mode only: choose **Sky [mas]** or **Normalized (alpha B / lambda)**.
Map type	In advanced mode only: choose **Transmission** or **Kernel**.
Channel	In advanced mode, select T1, T2, or T3 (for Kernel: K1, K2, or K3) when the selected architecture exposes multiple channels.
Wavelength λ	Wavelength in micrometres.
Field of view	Angular field of view in milliarcseconds for the currently displayed map.
Pointing center	In simple mode only: user-controlled map-centre offset in milliarcseconds, plus arrow-button nudging and reset.

4.2 Current architecture support in advanced mode

Homepage layout	Advanced architecture	Current exposed observables
LIFE Architecture / 4-Aperture Rectangle	x_array	One transmission channel T1 and one kernel channel K1.
3-Aperture Triangular	kernel3	One transmission channel T1 and one kernel channel K1.
4-Aperture Kite	kernel4	Three transmission channels T1-T3 and three kernel channels K1-K3.
5-Aperture Ring	kernel5	Two transmission channels T1-T2 and two kernel channels K1-K2.
Single, Bracewell2, 6-Aperture Hexagonal, Custom	not available	These layouts currently fall back to simple mode only.

4.3 How to read the map

- **Transmission maps** show a throughput-like response on the sky.
- **Kernel maps** show a signed differential observable derived from paired nulled outputs.
- The star marker is drawn at the origin of the selected planetary overlay.
- Planet markers and orbit curves are overplotted in sky coordinates.
- The legend reports the currently sampled displayed quantity at the star and planets.

Model assumption. In advanced mode, the backend normalises outputs through the bright channel and then the project applies a common single-aperture Airy envelope to all advanced outputs. This means collector diameter changes the radial sky response even in advanced mode. That Airy-envelope step is a project extension rather than a direct statement of the reference-paper combiner algebra.

Implementation note. The normalised axis label uses alpha B / lambda with a frontend baseline choice. It is a useful comparison coordinate but not a complete physical state descriptor.

4.4 Current warning and error states

Current message	Meaning
`Advanced mode is not available for this layout.`	The chosen layout is currently mapped to the generic simple-only architecture.
`Architecture ... expects N apertures, got K.`	The selected advanced combiner requires a fixed aperture count that does not match the current geometry.
`Simple mode needs at least 1 aperture.`	A simple-mode map cannot be computed without any aperture.
`Missing transmissions.T1 ...` or `Missing kernels.K1 ...`	The backend response did not return the expected observable channel.
`Transmission API error`	Backend request failed or returned a non-success response.

5 Observation Windows

Usage note. This panel is shown only when **System type** is set to **NASA / real system**. It evaluates candidate visit windows for one selected NASA planet using the current array geometry, wavelength, and an internal transmission map.

5.1 When the panel appears

The panel is hidden unless a NASA system is selected. Even then, a usable planet is required. A planet is considered usable for observation windows only if the host distance, a usable orbital size, an orbital period, and one epoch anchor are available.

5.2 Inputs

Control	Meaning
Start date / End date	UTC evaluation range for the schedule search.
Sampling cadence	Time spacing between sampled orbital states and schedule checks.
Visit duration	Required full visit length in hours. A midpoint is only valid if the full visit around it remains valid.

Control	Meaning
Minimum relative T1 required	Relative response threshold expressed as a percentage of the best raw T1 reached by the selected planet track over the chosen date range.
Sun exclusion	Minimum allowed target-Sun elongation angle in degrees.
Plot	Choose the plotted timeline metric: separation vs time, raw T1 vs time, or scheduler priority vs time.
Planet selector	Appears when more than one usable NASA planet exists.

5.3 Outputs

The summary box reports:

- selected planet,
- date range,
- cadence,
- visit duration,
- current relative-T1 threshold,
- raw T1 range on the sampled track,
- equivalent raw T1 cutoff,
- Sun exclusion,
- visible map field of view,
- internal evaluation field of view and grid,
- track maximum separation,
- evaluation margin,
- feasible-window count,
- valid-midpoint count,
- Sun-allowed maximum separation.

Below the summary, the panel shows a best-window box, a timeline plot, a window table, and a PDF export button for the dedicated observation report.

5.4 Interpretation rules

Model assumption. The scheduler uses the NASA sky-projected orbit at each sampled time, evaluates raw T1 on a separate internal advanced T1 map, and applies an approximate Sun keepout based on host sky coordinates.

Figure 4: Observation Windows panel showing scheduler settings, best-window summary, timeline, and window table.

Implementation note. The internal scoring field of view is decoupled from the visible homepage field of view. It is derived from the selected system, the date range, the chosen planet, and a safety margin.

Implementation note. The scheduler priority is currently an internal ranking quantity,

$$\text{priority} = 0.7\,\frac{s}{s_{\max,\odot}} + 0.3\,\frac{T1_{\text{raw}}}{T1_{\text{ref}}},$$

with clipping to the unit interval where needed. Here s is the projected separation, $s_{\max,\odot}$ is the maximum Sun-allowed projected separation over the selected date range, $T1_{\text{raw}}$ is the sampled raw $T1$ value, and $T1_{\text{ref}}$ is the raw-$T1$ reference used for normalization. It is not a physical detection probability and it is not an SNR.

Model assumption. A preferred near-maximum-separation region is defined at 95% of the Sun-allowed maximum projected separation over the selected date range. This 95% rule is a scheduling geometry preference. It is separate from the user-selected relative T1 threshold.

5.5 Current unavailable or failure states

Current message	Meaning
`Load a NASA system to evaluate observation windows.`	No NASA system is currently loaded.
`No planet has enough orbital information ...`	No planet in the loaded system satisfies the current usability requirements.
`Start date is invalid.` / `End date is invalid.` / `End date must be on or after start date.`	Date inputs do not define a valid UTC range.
`Loading observation-scoring transmission map ...`	The internal advanced T1 map is still being fetched.
`Failed to load the internal observation-scoring transmission map.`	Backend request for the scheduler map failed.
`Observation result not available.`	A result object could not be built from the current inputs.
`No feasible full-visit window found ...`	No midpoint survived the current relative-T1, Sun-exclusion, and full-visit checks.

6 Worked Example Systems

Usage note. The examples below are included to help users explore different behaviours of the current tool. They are not presented as a ranked science target list.

6.1 51 Peg

- Good first real-data demonstration.
- Simple host search string and a compact one-planet case.
- Useful for checking the full NASA loading path, sampled map values, and the current observation-window engine.

6.2 TRAPPIST-1

- Good multi-planet demonstration for the NASA system summary and planet-row display.
- Useful for testing planet selection, assumption visibility, and crowded small-angle orbital geometry.
- Useful for stress-testing interpretation discipline: displayed planets can have different data completeness and should not be treated uniformly.

6.3 Upsilon Andromedae (ups And)

- Useful as a low-inclination demonstration system with planets closer to the star than in wide direct-imaging examples.
- Good for checking how the current tool displays a more face-on-like geometry than a transiting edge-on system.
- Useful for testing whether the NASA summary, planet-row assumptions, and projected orbit display remain interpretable when the system is not viewed close to edge-on.

A Theory Appendix

A.1 Simple mode versus advanced mode

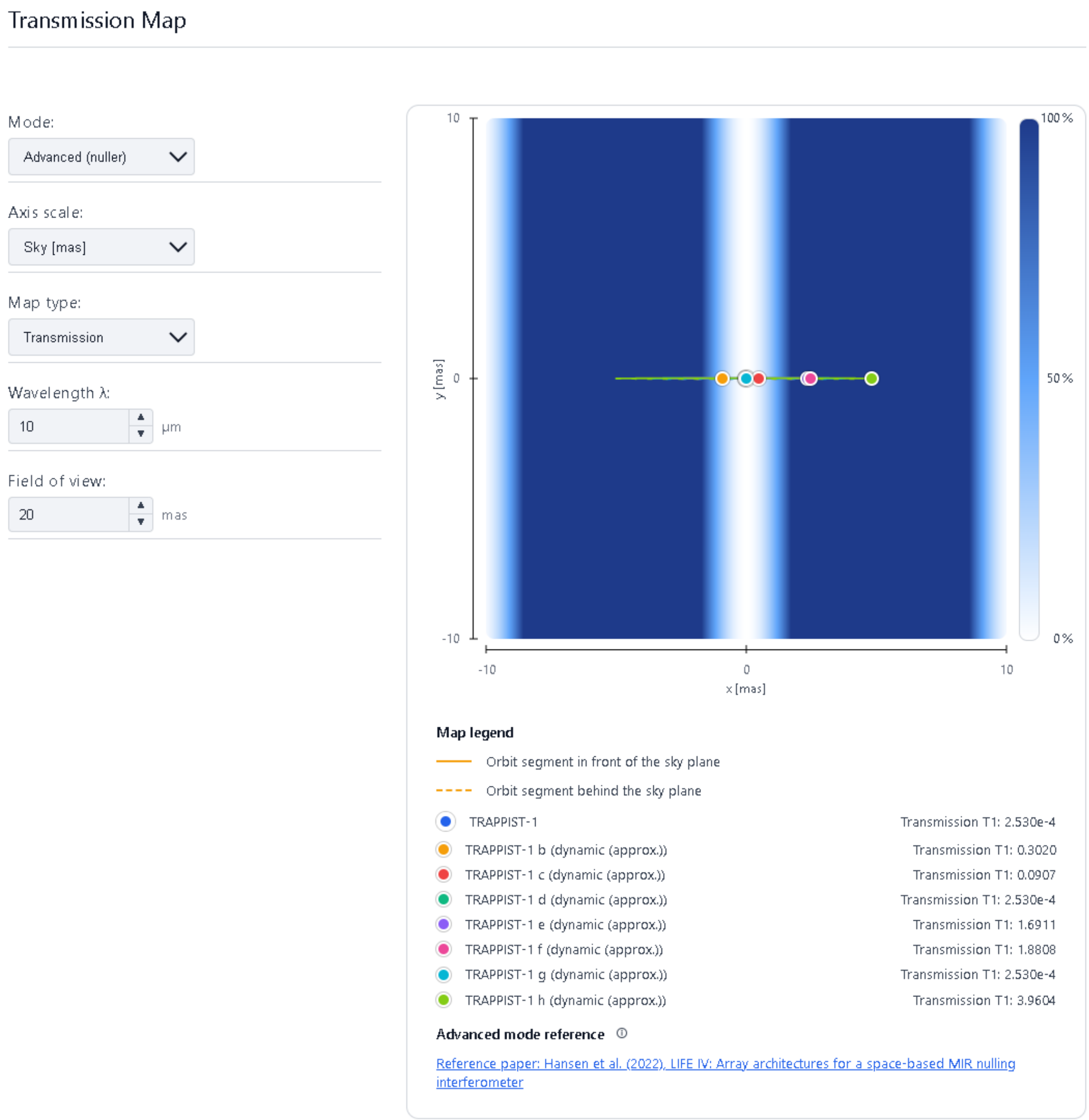
Simple mode. Simple mode computes a generic coherent sum of the aperture phases and multiplies the result by a single-aperture Airy envelope. It is a useful intuition tool and supports arbitrary simple-array geometries, including the custom array.

Advanced mode. Advanced mode uses architecture-specific beam-combination logic for supported layouts. It returns transmission-like observables and, where available, kernel-style signed observables derived from paired nulled outputs.

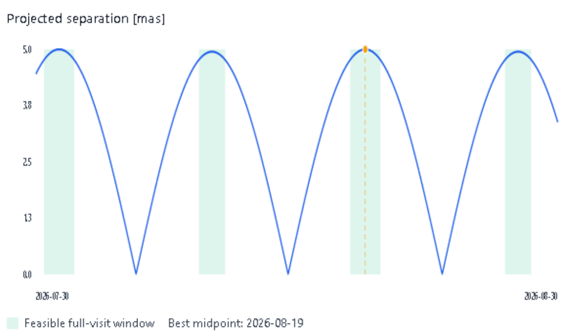
A.2 Airy envelope

For a circular aperture of diameter D observed at wavelength λ, the single-aperture diffraction response introduces a radial envelope. In this project, the backend applies that envelope in simple mode and also applies a common Airy envelope in advanced mode as a project extension.

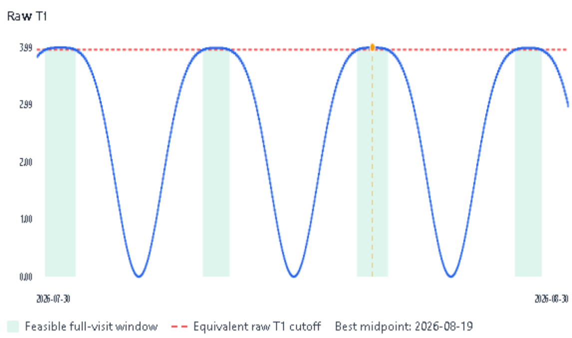
Model assumption. In advanced mode, the displayed map includes an additional Airy-envelope step added by this project. This step is separate from the architecture-specific combiner formulas themselves.



TRAPPIST-1 transmission-map view



Projected separation timeline



Raw T1 timeline

Figure 5: TRAPPIST-1 worked-example montage showing the transmission-map view together with projected-separation and raw-T1 scheduler diagnostics.

A.3 Fourier and interferometric intuition

An interferometer samples spatial-frequency information through phase differences between separated collectors. Changing baselines changes the angular fringe scale. In practical terms for this website:

- larger baselines narrow the angular structure of the response,
- changing orientation rotates the effective response pattern,
- collector diameter modifies the radial primary-beam envelope,
- the displayed map is a sky-response representation, not a direct reconstructed image of the source.

A.4 Transmission versus kernel-style outputs

Transmission map. This is the throughput-like response of a selected channel on the sky. A large value means that the currently selected observable transmits that sky direction more strongly.

Kernel map. This is a signed differential observable obtained from paired nulled outputs. Positive and negative regions indicate opposite differential response signs, not negative flux.

A.5 T1 and observables

The interface currently labels the exposed transmission channels as T1, T2, and T3 where applicable. In advanced mode these labels refer to the transmission quantities built from the architecture-specific backend outputs. For observation windows, the current scheduler uses the advanced T1 channel only.

A.6 Physical quantity versus display or ranking quantity

Quantity	Interpretation status
Collector geometry plot	Pure geometric display in metres.
Displayed transmission map	Physical sky-response surrogate within the current model.
Displayed kernel map	Signed differential observable within the current model.
Sampled value at star or planet	Current map sample at the nearest grid point.
Relative T1 threshold	User-defined scheduling filter, not a fundamental observable.
Scheduler priority	Internal ranking rule only. Not a detection probability and not an SNR.
Preferred 95% region	Scheduling geometry preference only.

B Assumptions and Limitations Appendix

B.1 Planetary-system assumptions

Per-planet fallback rules. The current simulator does not use the orbit-input count alone. It checks which fields are missing and then applies fixed fallback rules.

Fallback rule or note	Interpretation
Missing eccentricity $\to e = 0$	The orbit is treated as circular. This removes periastron and apastron variation and simplifies phase propagation, but it can shift the projected position for genuinely eccentric systems.
Missing inclination $\to$ borrow another planet's inclination if available, otherwise $i = 0°$	The current fallback first tries a temporary coplanarity assumption within the same system. If no such reference exists, the orbit is treated as face-on. This is a display fallback and can be very wrong for systems that are actually close to edge-on.
Missing argument of periastron $\to \omega = 0°$	This fixes the ellipse orientation within the orbital plane. It mainly affects where periastron lies and therefore changes the projected position for eccentric orbits.
Missing direct semi-major axis $\to$ infer from angular separation and distance when possible	If a is missing but catalog angular separation and host distance exist, the simulator uses them to estimate an orbital size. This is weaker than a direct semi-major axis measurement.
Missing time of periastron but transit midpoint available	The current implementation can propagate phase approximately from the transit epoch. This is not identical to using a direct periastron epoch, especially for eccentric systems.
Missing period or epoch $\to$ reference phase $\nu = 0°$	If there is not enough timing information to place the planet at the current epoch, the orbit can still be drawn and the planet is shown at a reference location. This is a visualization fallback only, not a real current position.
Missing host distance	Without host distance, the simulator cannot convert AU-scale orbital size into angular separation in milliarcseconds. No defensible sky placement is then possible.
No usable orbital size	If neither semi-major axis nor a defensible proxy is available, the orbit cannot be placed on the sky. In that case, the planet is marked as insufficient rather than being assigned a speculative sky position.

B.2 Orbit input completeness

See Section 3.5 for the definition of the current 6 / 6 orbit-input completeness check and its interpretation.

Status labels.

- **dynamic**: enough orbital information to propagate position at the current time.
- **dynamic (approx.)**: propagated using fallback timing assumptions, especially a transit-midpoint anchor.
- **static**: orbit drawn, but current position is only a reference placement.
- **insufficient**: not enough data for a defensible sky placement.

General system-level notes.

- Earth–Sun L2 is approximated as co-located with Earth for exoplanet sky projection.
- Current sky positions use the current UTC time.
- Missing orbital parameters are replaced by explicit fallback assumptions listed per planet.
- NASA composite catalog values may combine parameters from different literature solutions, so some displayed propagated positions should be interpreted as approximate.

B.3 Map-model limitations

- Advanced mode is currently available only for the supported fixed-architecture layouts.
- The normalised-axis coordinate depends on a frontend baseline choice and is therefore a comparison aid rather than a standalone physical invariant.
- Planet samples are taken at the nearest grid point of the returned map, not through sub-pixel interpolation.

B.4 Observation-window limitations

- Only NASA systems are currently supported.
- The scheduler uses an internal T1 map even if the user is visually focused on some other currently displayed map setting.
- Full-visit midpoint validity is checked on a cadence-limited sample grid, not in continuous time.
- Sun exclusion uses an approximate sky-geometry model based on host ecliptic coordinates with L2 treated as Earth-coincident.
- Times falling outside the internal scheduling map field of view are treated as unavailable.

C Error Codes, Warnings, and Troubleshooting Appendix

C.1 Frontend messages currently visible in the UI

Message	What it means in practice
`Searching...`	NASA hostname search request is in flight.
`No matching host systems found.`	The current search query returned no hostnames.
`NASA system load failed.`	The selected NASA system could not be loaded through the backend.
`Search for a NASA host system and select one from the result list.`	No NASA system is currently active.
`No planetary system overlay. The map is shown without star, planet, or orbit markers.`	System type is set to None.
`Computing...`	The transmission map request is running.
`Generating PDF...`	The observation report export is being generated.
`PDF export failed.`	Observation report generation or download failed.

C.2 What to check first

1. Confirm that the chosen advanced architecture matches the number of collectors currently defined.
2. Confirm that the current field of view is wide enough to include the orbit region of interest.
3. For NASA systems, read the planet-row assumptions before treating the displayed orbit as well constrained.
4. If observation windows are empty, reduce the relative-T1 threshold, widen the date range, or verify that the selected planet is usable in the current data set.
5. If a scheduler map fails to load, verify the transmission backend first; the observation-window engine depends on it.

C.3 Interpretation guidance

Usage note. Labels such as approximate, user-set, fallback, and internal indicate how a quantity should be interpreted. They mark quantities that are not direct physical measurements or fully constrained orbital results.