Cross-Match en Gaia

Presente y retos para el futuro

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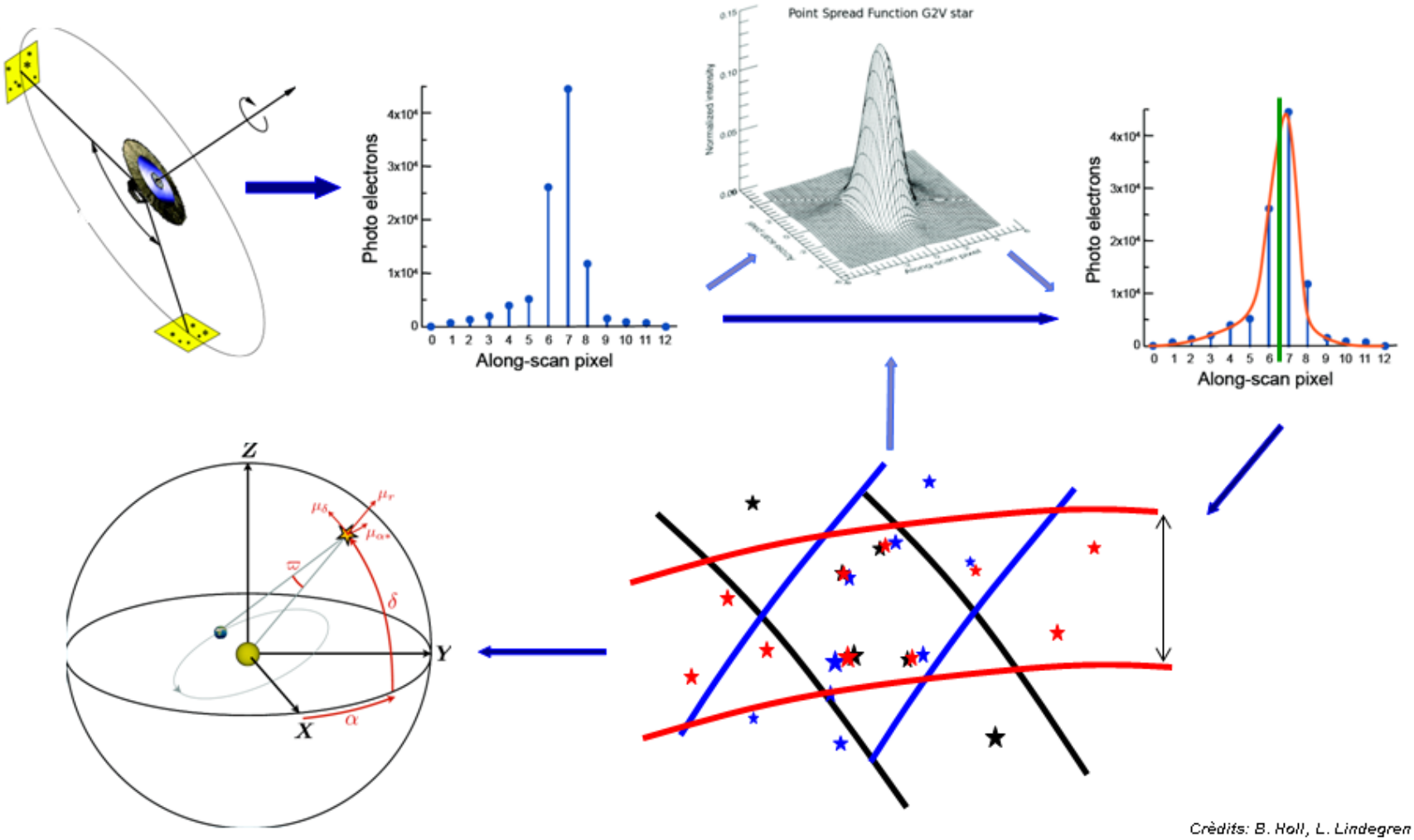
Gaia Data Reduction Concept



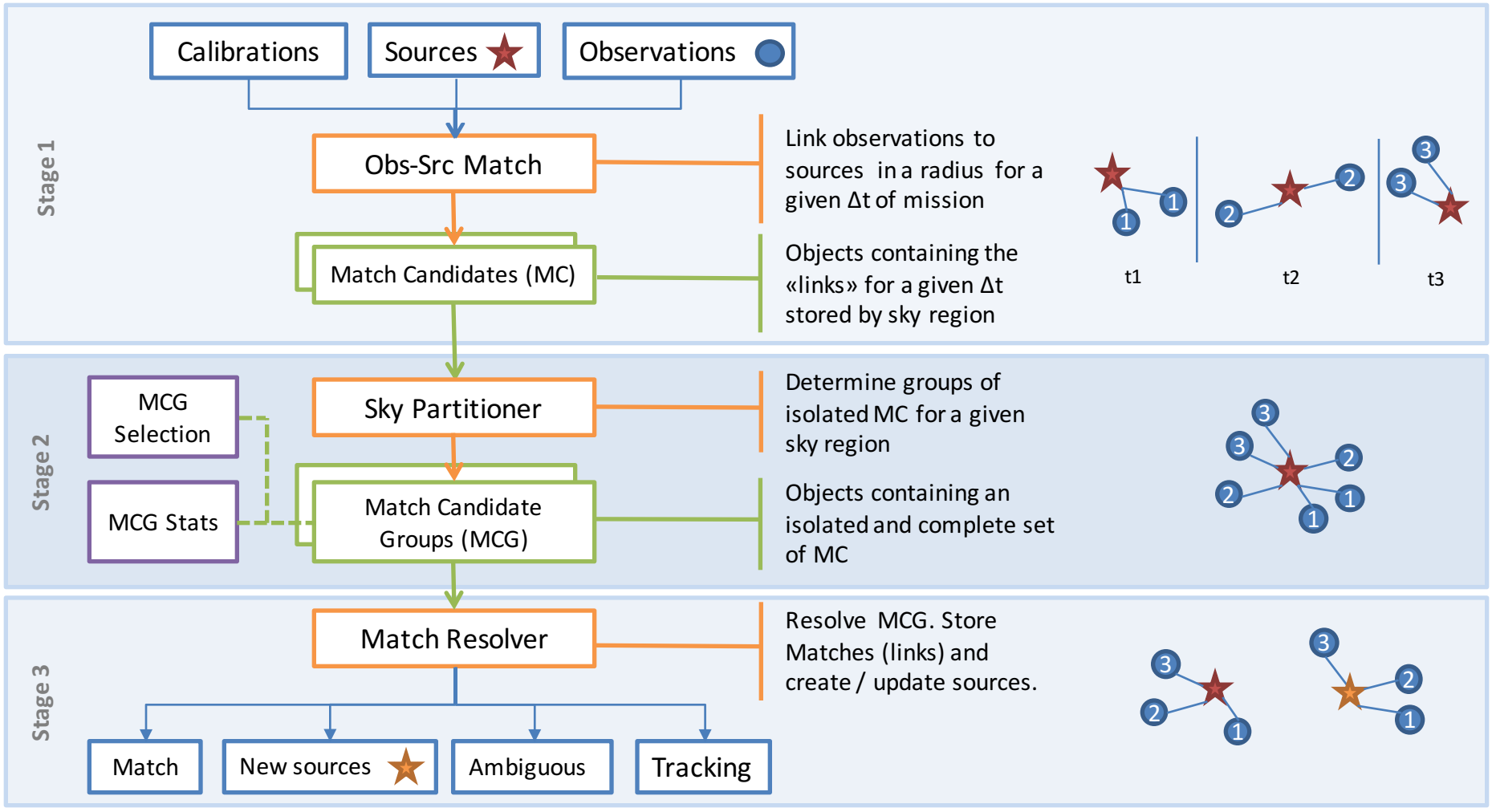
Crèdits: B. Holl, L. Lindegren

Cross Match in DPAC

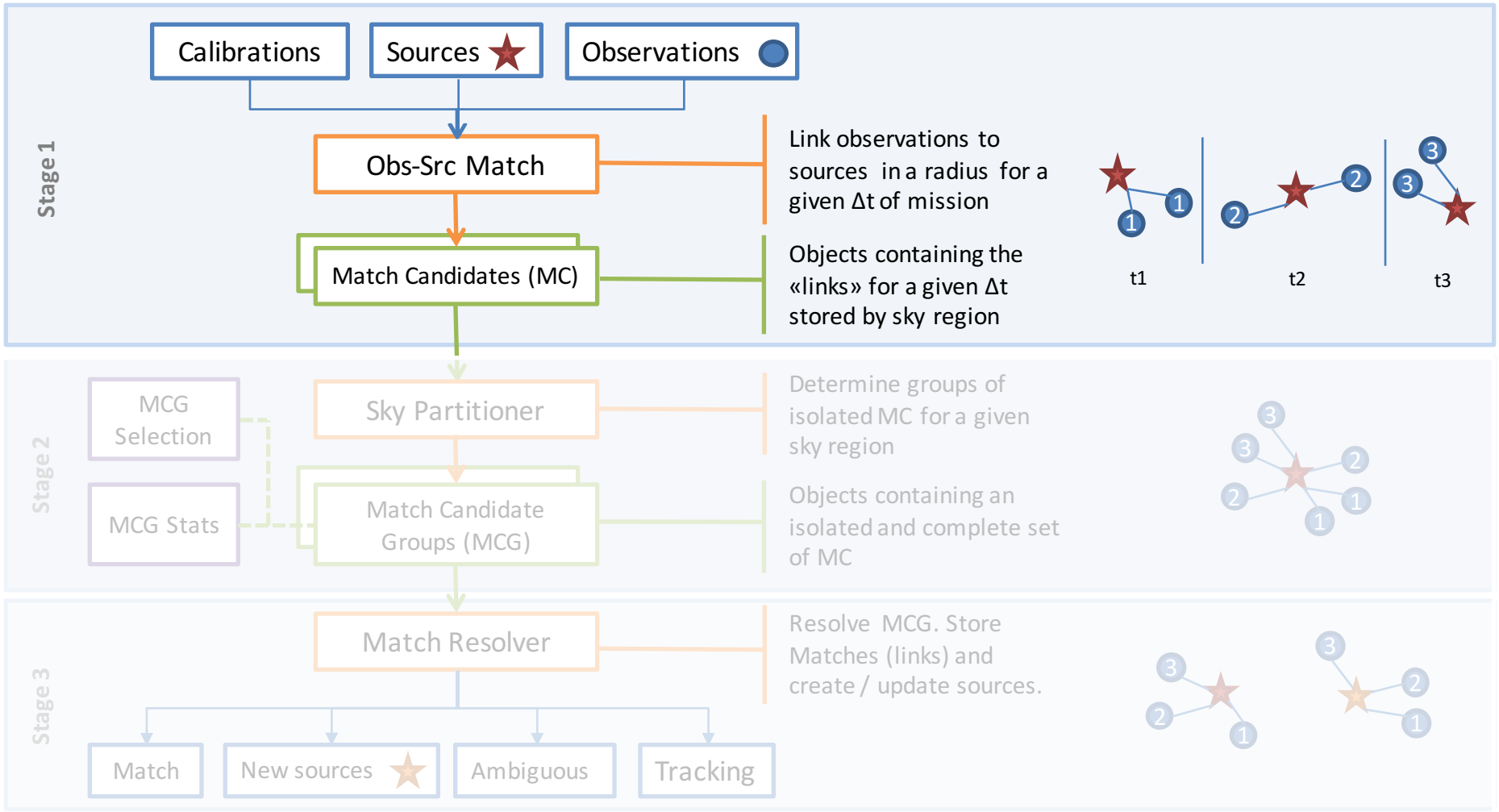
- Daily in IDT
  - Limited in terms of available inputs (delayed telemetry, …)
  - Provides the input for the daily systems across DPAC: First Look, Science Alerts, …
  - Has to be “quick” in terms of computing time requirements

- Cyclic in IDU
  - All the inputs for a given data segment are available beforehand
  - Uses the latest updates on attitude, calibrations, etc.
  - Provides the *links* between observations and sources for all the cyclic processing software
  - Is the Cross-Match that ends up in the different data releases
  - Less restrictions on computing requirements, therefore more advanced algorithms can be used

IDU Cross-Match

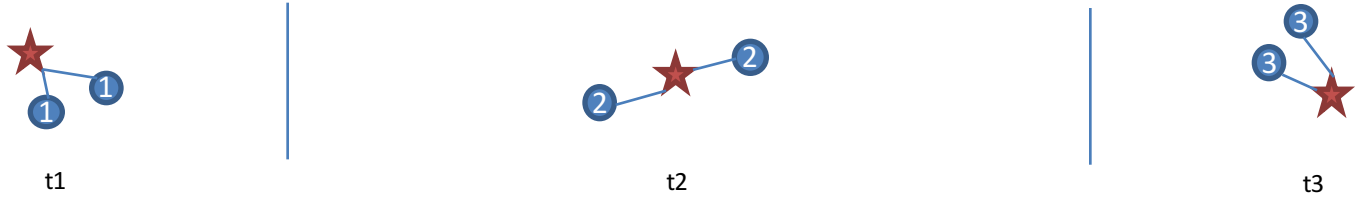


IDU Cross-Match: Obs-Src Match



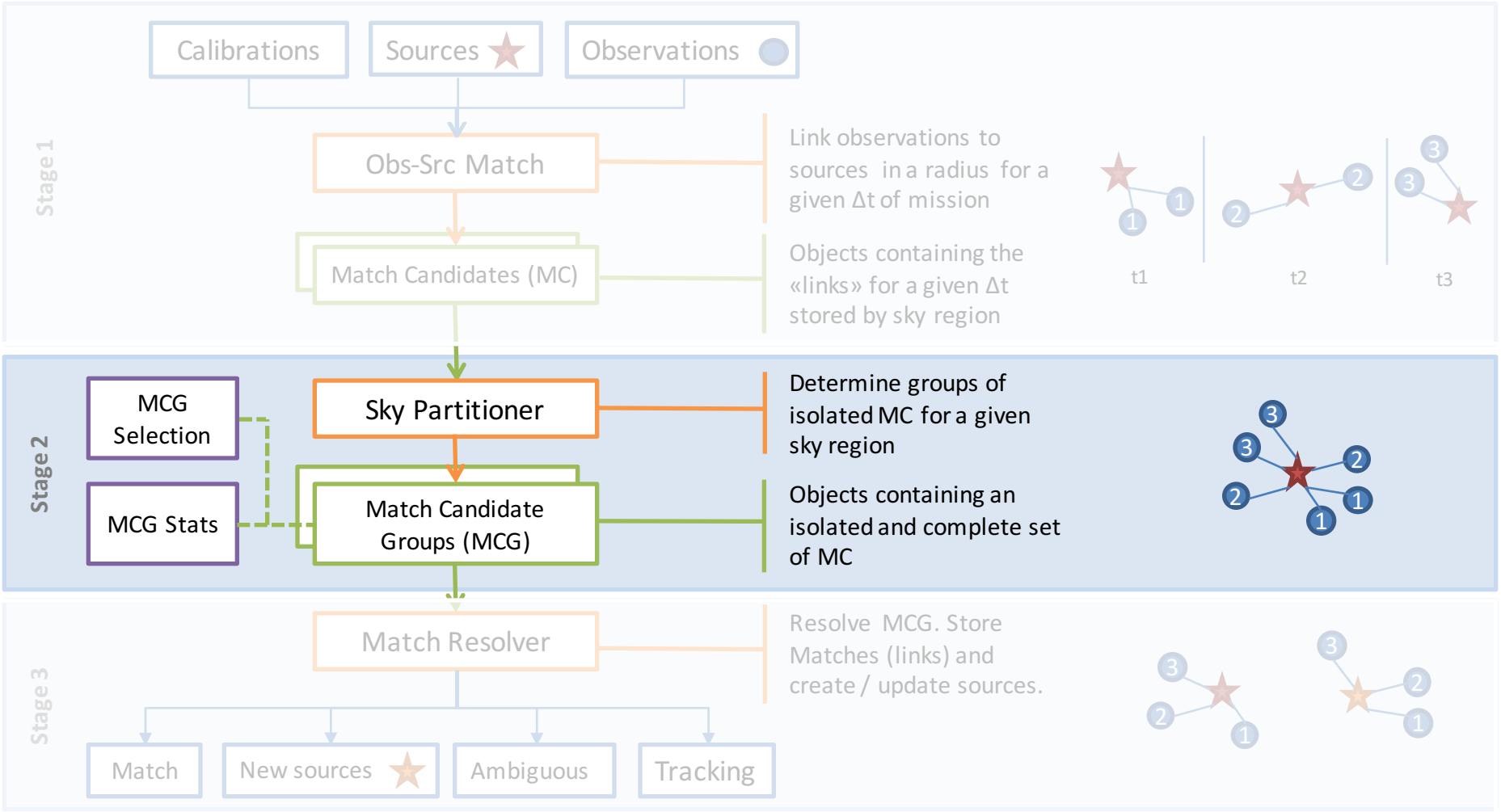
IDU Cross-Match: Obs-Src Match

- In this first step, we process the input observations in time order to compute the detection sky coordinates and obtain the preliminary source candidates for each individual detections.



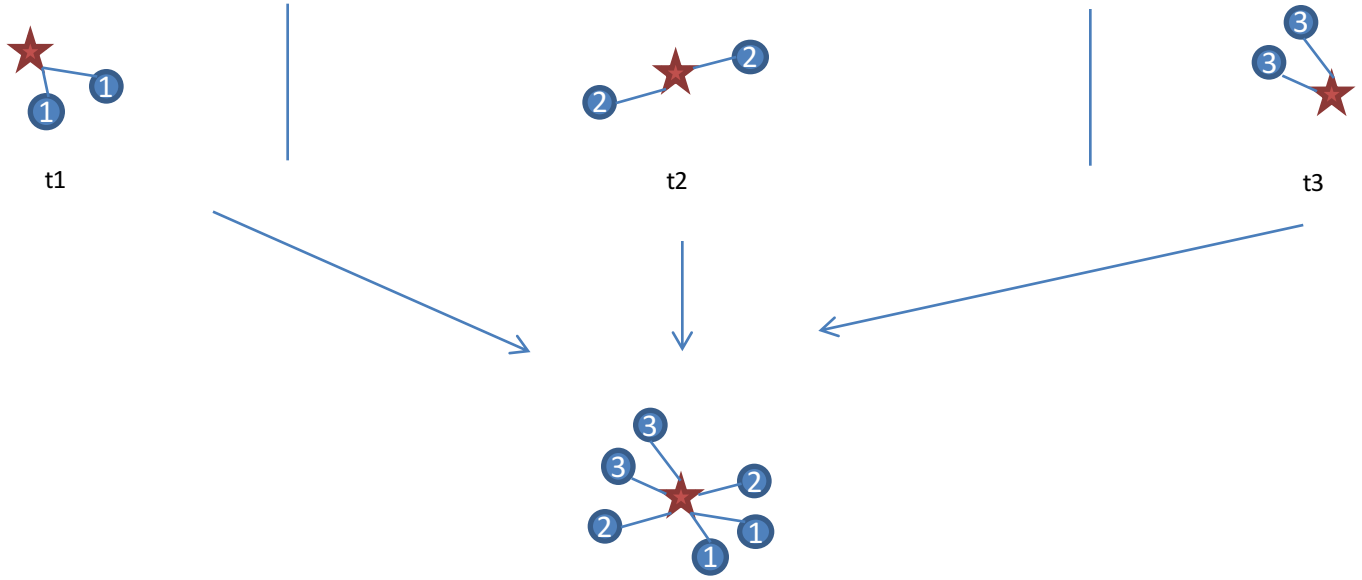
- Process:
  1. Sources are propagated to each relevant epoch (for each task)
  2. Each observation is compared to the nearby sources (distance criterion)
  3. All sources that fall within the given preconfigured radius are stored as *candidates*

IDU Cross-Match: Sky Partitioner

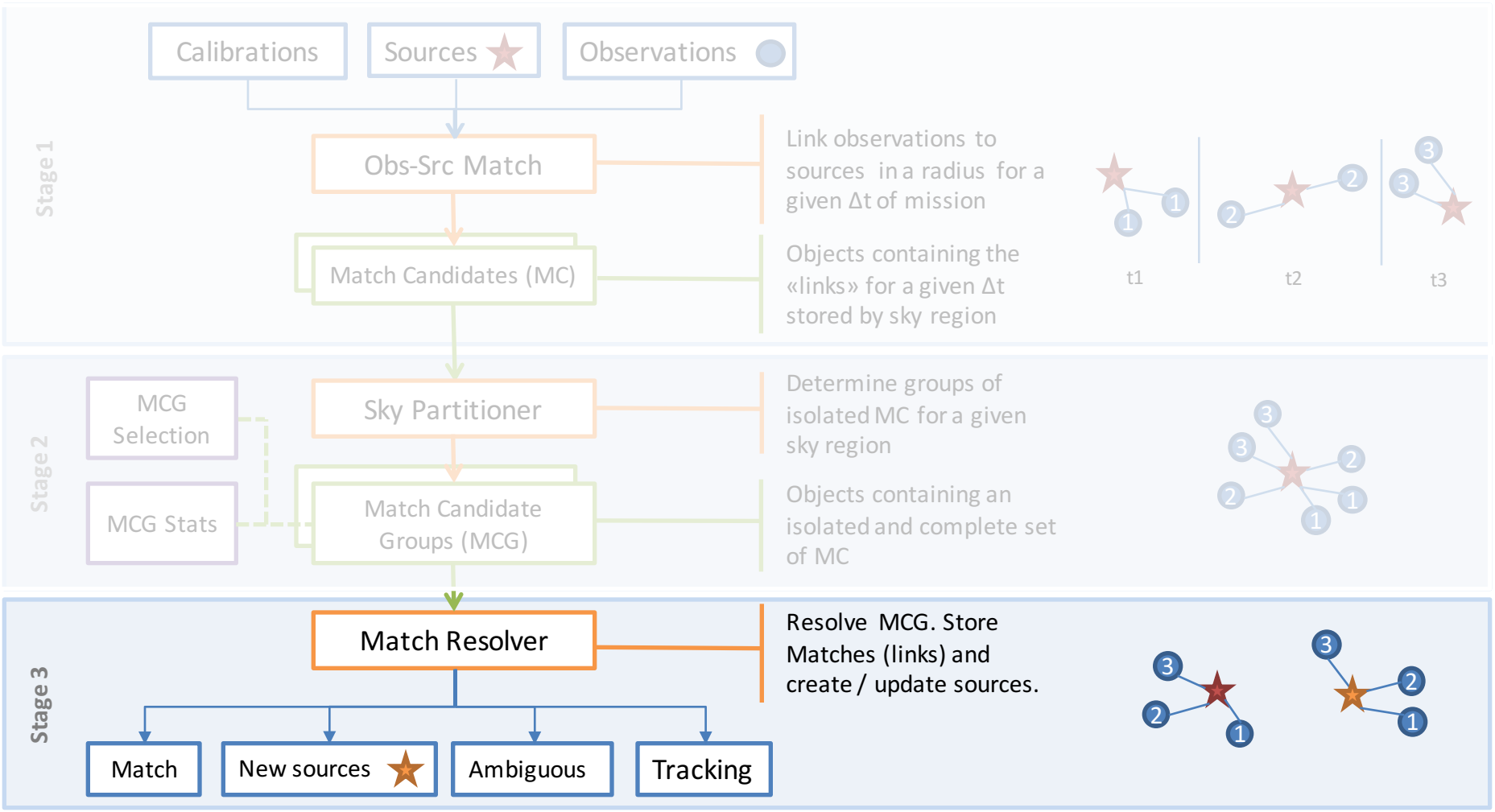


IDU Cross-Match: Sky Partitioner

- This second step groups the results according to the source candidates of each individual detection.
- The objective is to determine isolated groups of detections, avoiding spatial boundary issues (bridge between the time-based and the spatial-based processing).



IDU Cross-Match: Match Resolver



IDU Cross-Match: Match Resolver

- The final step is a spatial-based processing where all detections from a given isolated sky region are resolved together, thus taking into account all observations and sources of that region.

- This step provides a *match* for each detection: a *link* between the observation and a source.

- Resolve conflictive scenarios, for example:
  - Two simultaneous observations but just one source in the current catalogue. New source has to be created.
  - There are observations but no sources in the catalogue. New source has to be created.
  - Other conflicts, such as source merging, splitting, …

IDU Cross-Match in DR1

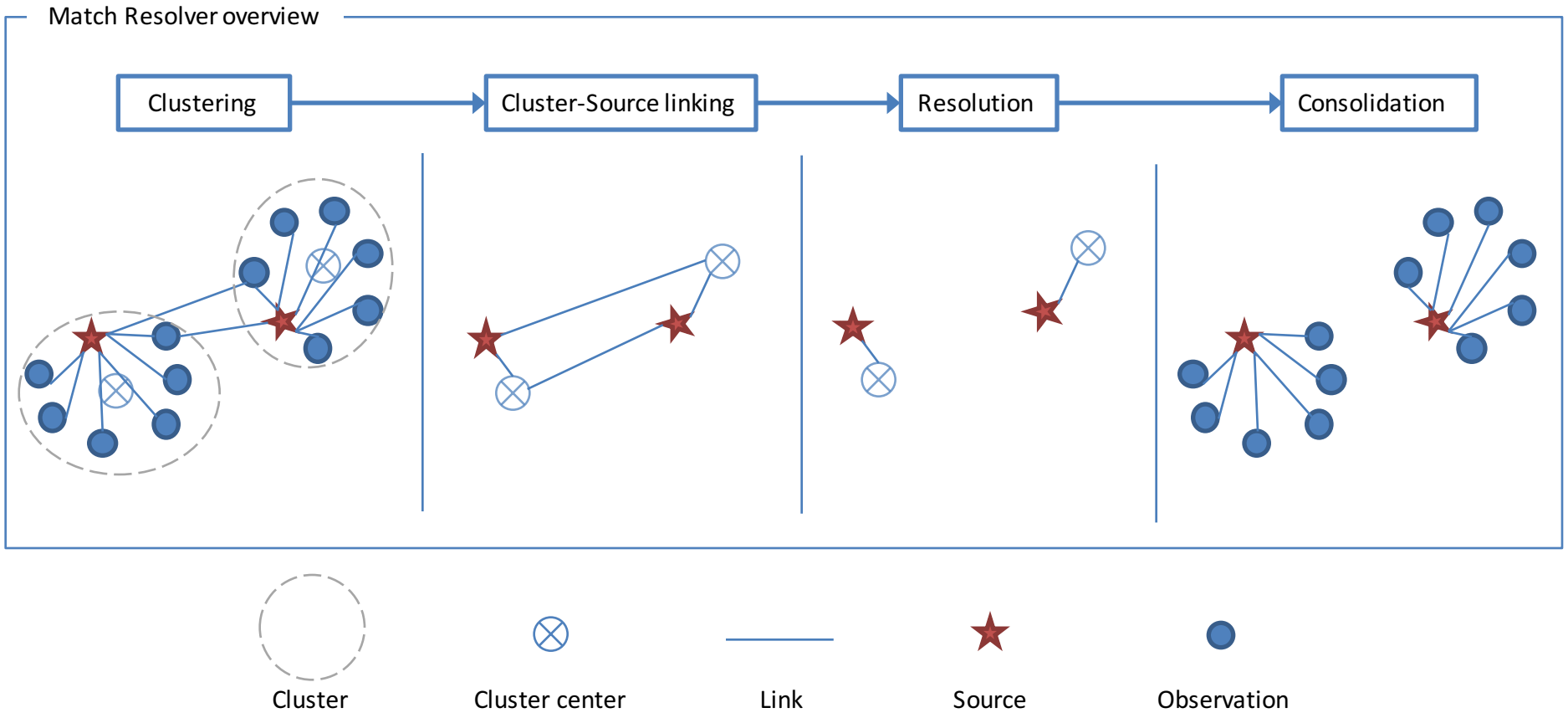
- Current algorithm
  - Local (two-by-two) conflicts resolution
  - Iterative two step process:
  1. Clean conflicts: duplicate matches
  2. Create new sources for unmatched observations

- Advantages:
  - Very fast as no input catalog is required

- Limitations:
  - No source merging or source split
  - No new source minimization
  - Observations scattered between sources
  - New sources created from a single unmatched observation

IDU Cross-Match: new algorithm (I)

- Algorithm split into 3 different stages: Clustering, Cluster-Source linking and Resolution, plus a final consolidation process.



IDU Cross-Match: new algorithm (II)

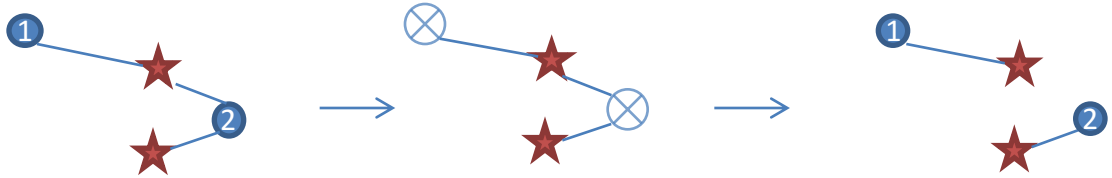
- Source merging:

Initial situation | Clustering and source linkage | Final resolution

- Source splitting:

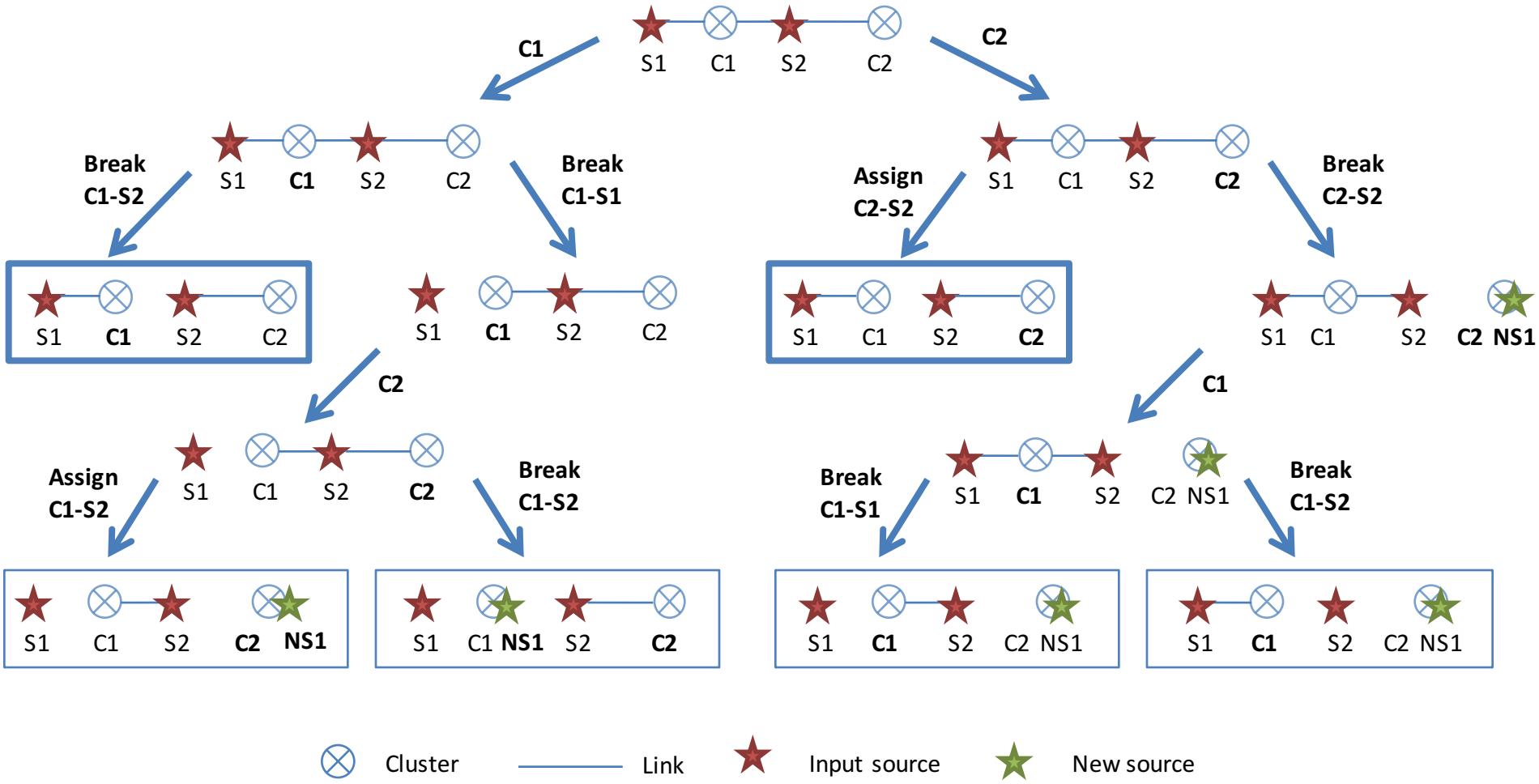
Initial situation | Clustering and source linkage | Final resolution

- "Optimal resolution"

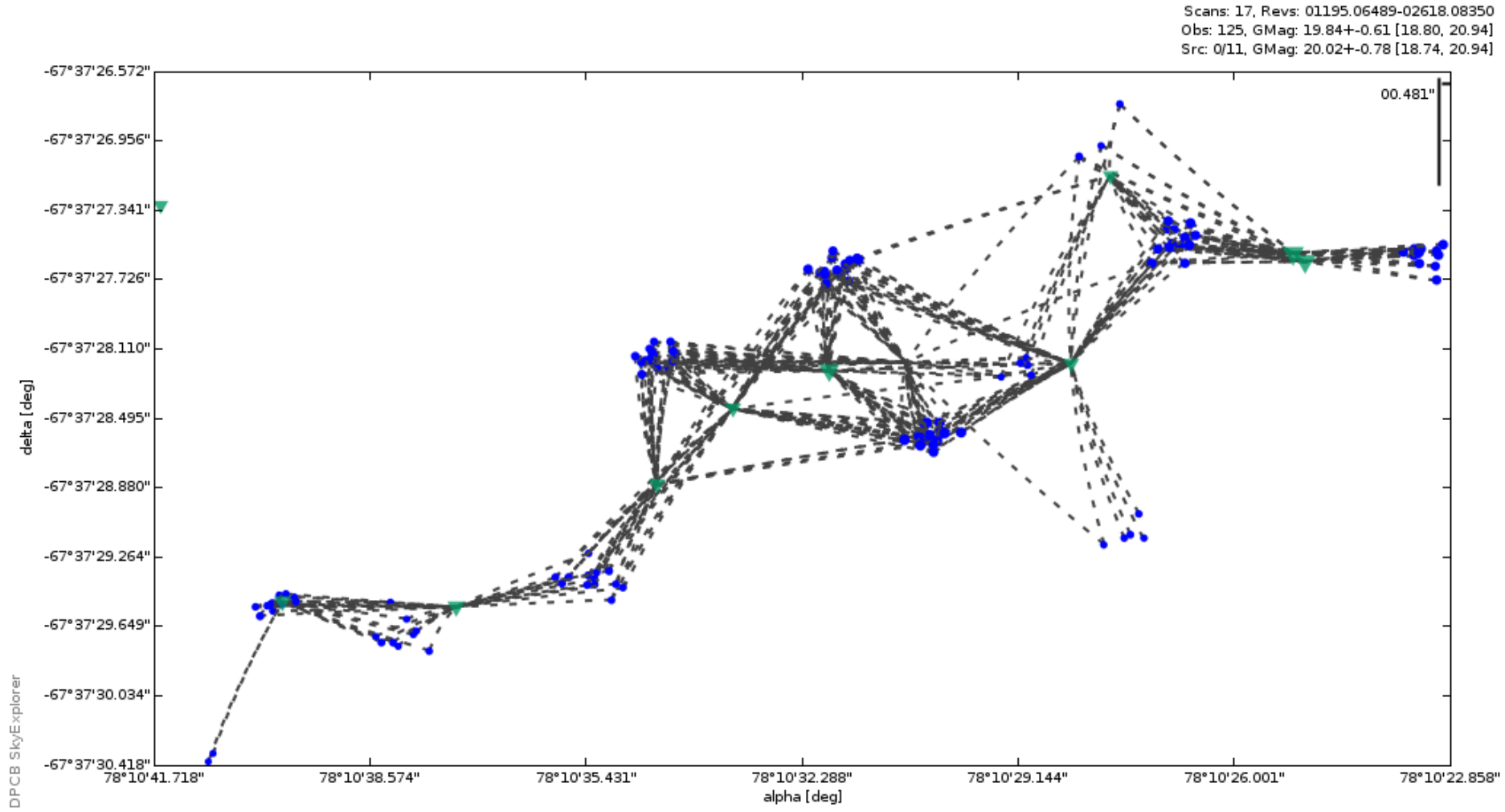


Initial situation | Clustering and source linkage | Final resolution

IDU Cross-Match: optimal resolution

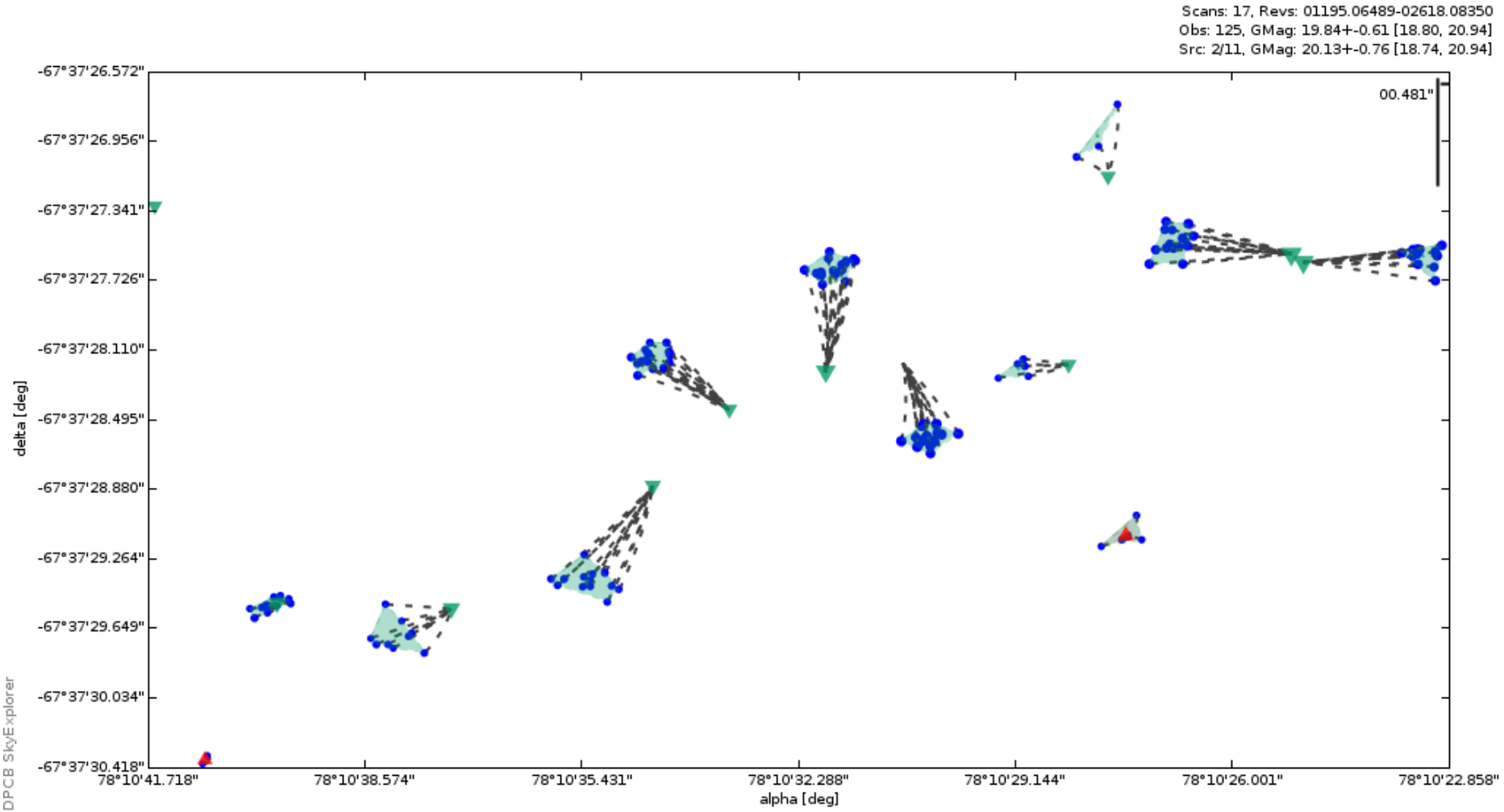


Example: input scenario



Observation Link Input source New source

Example: resolution



Thank you