Receptions of JSATS tag codes within raw autonomous node data files are processed to produce a dataset of accepted tag detection events. A single file is processed at a time, and no information on receptions at other nodes is used. The following two filters are employed during processing:

1. Multipath Filter: For data from each autonomous node, delete all tag-code receptions that occur within 0.156 seconds after an initial identical tag code reception under the assumption that closely lagging signals are multipath. Initial code receptions are retained. The delay of 0.156 seconds is the maximum acceptance window width for evaluating a pulse repetition interval (PRI) and is computed as 2(PRI_Window+12×PRI_Increment). Both PRI_Window and PRI_Increment are currently set at 0.006, which was chosen to be slightly larger than the potential rounding error in estimating PRI to two decimal places.
2. PRI Filter: Retain only those series of receptions of a tag code (or "hits") that are consistent with the pattern of transmissions from a properly functioning JSATS acoustic tag. Each tag code is processed individually, and it is assumed that only a single tag will be transmitting that code at any given time. Each autonomous node data file is processed as follows:

    a. For each hit, select the list of identical hits that follow within [(Nominal_PRI×1.3×12)+1] seconds. Nominal_PRI is the nominal number of seconds between transmissions of the tag code (typically 3, 5, or 10 seconds). The list of Nominal_PRI by tag code must be available as an input and typically is obtained from the tag manufacturer.

    b. Compute a list of candidate PRIs as follows:

$$Candidate\ PRI\ list = \prod_{i=1}^{12} \frac{(Time_{Hit} - Time_{Initial\ Hit})}{i}$$

    where *i* is a counter that steps through the 12 possible PRI intervals that can fit between the initial hit and the end of the time window described in Step a. Round each candidate PRI to the nearest hundredth of a second and exclude candidates ≤ Nominal_PRI × 0.651 or ≥ Nominal_PRI × 1.3.s from the list. These coefficients were chosen to result in a range of candidate PRIs that do not include multiples of any other candidates in the list. Avoiding exact multiples in the candidate PRI list simplifies the process of identifying a mode.

    c. Take the minimum mode of the list of candidate PRIs from Step b as the estimate of PRI to be used in building an event associated with the initial hit. If no mode exists, select the minimum candidate PRI as the estimate of PRI.

    d. Add hits to the accepted list if their time interval from the initial hit falls within narrow bounds around even multiples of the estimated PRI from the initial hit. An acceptance window for a hit is defined by:

$$\text{Acceptance window} = i(Estimated\_PRI) \pm \left[PRI\_Window + i\left(PRI\_Increment\right) \right],$$

    where PRI_Window = 0.006; PRI_Increment = 0.006, as described in Step 1;
    and *i* is the number of PRI intervals from the initial hit obtained by rounding

($((Time_{Hit}-Time_{Initial\ Hit}) / Estimated\ PRI)$ to the nearest integer. The number of intervals, i, can assume any integer value from 1 to 12, inclusive.

e. Create a detection event if at least 4 hits remain (the initial hit plus 3 or more accepted hits).

f. Select the first hit after the initial hit as the new initial hit, and repeat steps a through e above until all hits have been processed.

g. Combine any two or more detection events that overlap in time into a single detection event.

h. Repeat steps a-g for each tag code.

The output of this process is a dataset of events that summarize accepted tag detections for all times and locations where nodes were operating. Each unique event record includes a set of fields that indicate the ID of the fish, the first and last detection time for the event, the location of detection, and how many hits were detected within the event. This dataset is combined with accepted tag detections from the cabled arrays and PIT tag detections for additional QA/QC analysis prior to survival analysis.

One of the most important QC steps is to examine the chronology of detections of every tagged fish after its release to identify any detection sequences that deviate from the expected upstream to downstream progression through arrays in the river. A single detection that occurs on an upstream array after detection of the same tag on downstream arrays may represent a false positive detection if the upstream distance traveled is > 5 km, separated by one or more dams, or the upstream travel time is too fast (> 5 km h) to be reasonable for a tagged smolt. Such false positive detections are very rare (< 0.015%), usually will have close to the minimum of four hits, and are deleted from the event dataset before survival analysis. Some anomalous upstream detection events are difficult to explain (e.g., duplicate tags or predation of tagged fish and subsequent upstream transport of a tag by a predator), but if anomalous detections occur at the end of the chronology of detections on multiple arrays, they are deleted from the event dataset.