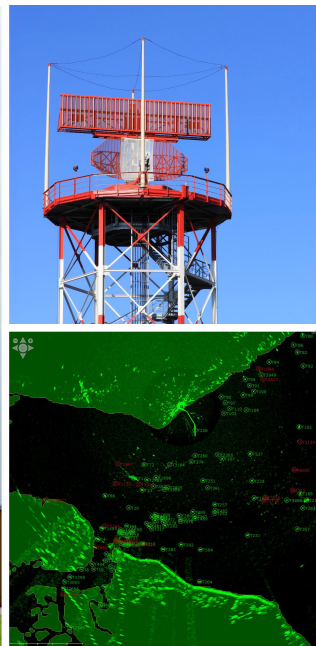


SPx Server

Target Tracking & Video Distribution



SPx Server

SPx Server, a component of Cambridge Pixel's SPx radar processing family of software, is a ready-to-run COTS radar distribution, target extraction and tracking server application. Interfacing to radar signals or network streams, SPx Server accepts polar format radar video and processes it to identify targets, which are then correlated from scan-to-scan to output positional and motion updates. The radar video may optionally be recorded to disk and distributed over a network.

The software is highly configurable and may be used to identify target-like shapes according to defined rules. These candidate tracks may be output directly after detection, for example into an existing correlator, or may be further processed by SPx Server to estimate speed and heading.



Target Tracking

The function of a tracker is to interpret radar observations to distinguish real targets from noise, and to construct models to describe the motion of the true targets. Since measurements from the radar are imperfect, there will be noise from the detection process, in addition to clutter from the environment and unpredicted manoeuvres of targets. This means that the tracker will be presented with noisy, and possibly multiple, measurements from the target of interest. The tracker's responsibility is to provide the best interpretation of the data using assumed or calculated statistics for the noise and the likelihood of change.

Video and Track Distribution

SPx Server supports network distribution of radar video and track reports to remote clients. Video and track messages may be output as UDP packets in a number of different formats including SPx, ASTERIX (CAT-240 for video and CAT-048 and CAT-010 for tracks) and NMEA 0183 “TTM”.

SPx Server provides three separate video distribution channels and each one may contain the raw, processed or auxiliary radar video. The auxiliary video is derived from the primary input source, via a look-up table, and could be a selected portion of the input sample (for example, the second input channel from an HPx radar interface card).



SPx Server outputs plot and track data onto a standard Ethernet network for delivery to remote clients for data fusion or display.

The time-stamped reports are delivered with low latency, and may include both the filtered and measured components of the track's state vector.

Additionally, SPx Server supports target track designation, wherein the user may select a single or multiple tracks to report within a separate stream. This track stream may be used to drive an optical tracker to follow a specific target or simply as a means to output tracks in multiple formats.

On the client side, Cambridge Pixel's SPx software modules receive and decompress the radar video to recover the original data. The full capabilities of the SPx software are then available for processing or scan conversion of the radar video. Track reports may be received and conveniently decoded into data structures for processing or display.

Cambridge Pixel's SPx Fusion product is available for correlation of track reports from multiple instances of SPx Server or for a combination of SPx Servers and secondary source, such as AIS and ADS-B.

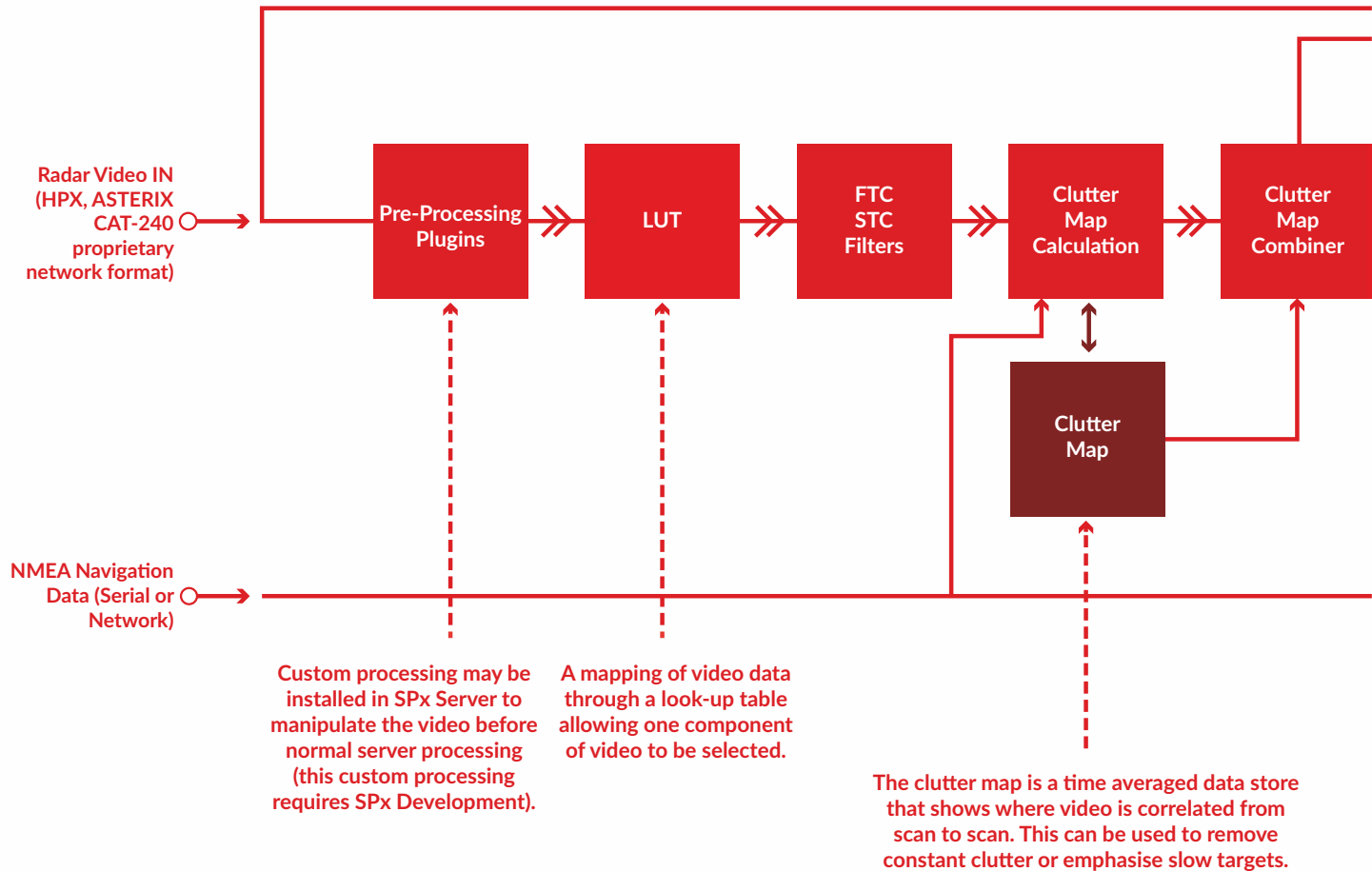
Remote Client Control

SPx Server presents a network interface for control and monitoring. Commands may be sent to the server to configure and modify parameters of high-level processing, including:

- Change current radar source
- Change parameters of source object
- Change network addresses for output
- Enable/disable processing objects
- Change parameters of processing objects
- Start/stop radar recording
- Start/stop network distribution of video
- Control HPx hardware input source
- Manually initiate, repair or delete a track
- Download new tracking area polygons and range-azimuth segments

SPx Server Modules

Processing from Video to Tracks.



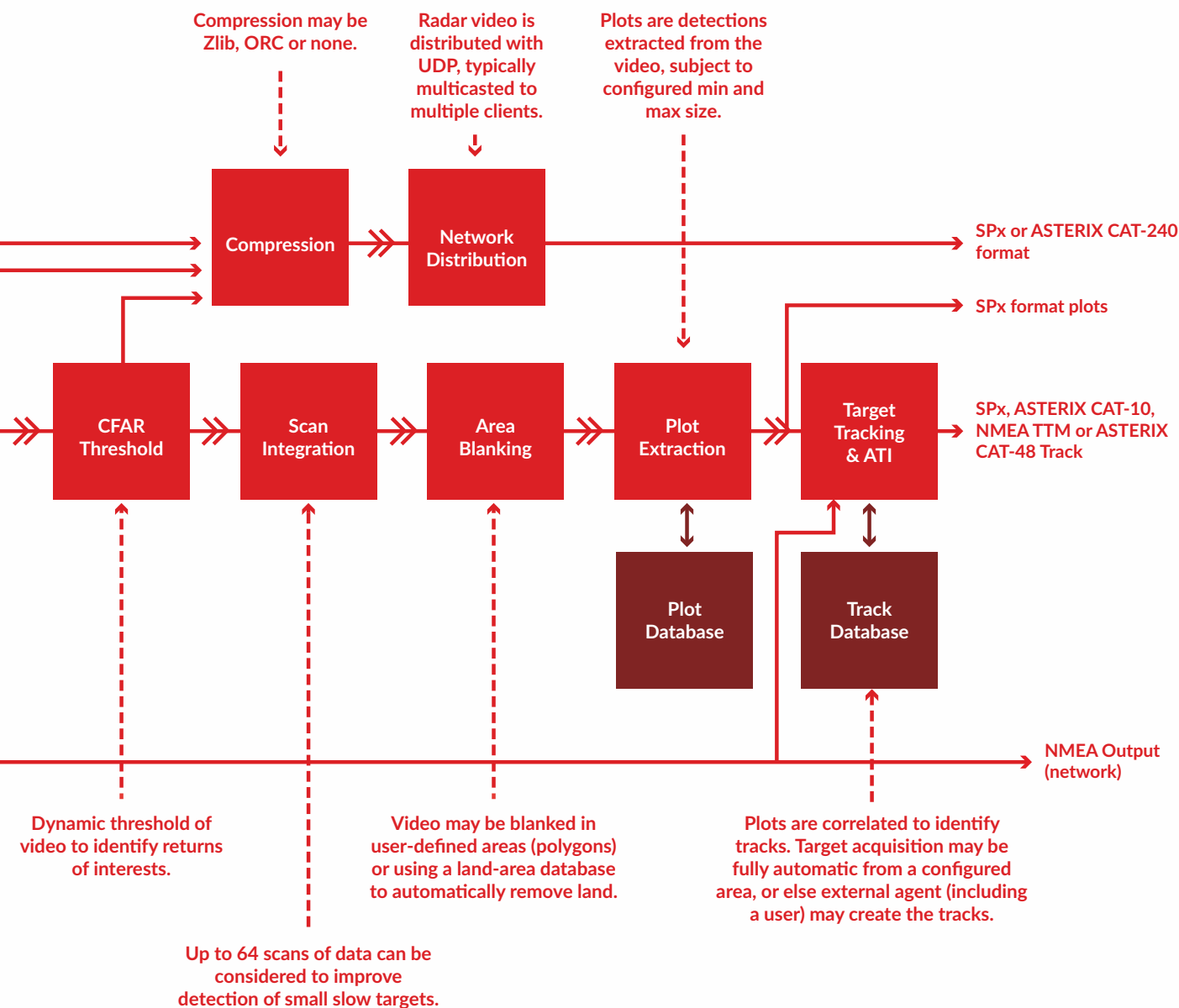
Target Extraction

The target extraction process examines the processed video to search for returns that form a connected target-like shape. A set of configurable parameters define the target size of interest, eliminating small noise returns or larger clutter or land masses early in the processing.

Track Initiation

The tracker maintains an active track database. The contents of the database are updated with new plot data derived from the extraction stage. New tracks are added to the database either from a manual request or else automatically.

The automatic track creation occurs when plots entered into the database are seen to be uncorrelated with any existing known target. A new preliminary track is created and is updated with future detections until confidence is established that the track is likely to be a target of interest.



Track Association

Established tracks are updated using new measurements provided by the extraction process. The first stage of this is association, by which a measurement is attached to the most likely track. In a simple situation, a true target will give rise to a single plot that can be directly associated with the expected target position. However, in the general case, there may be ambiguity as to which measurement relates to which track. A gating function is used to calculate an area around the expected position of a track, within which the next measurement must lie for it to be considered for association.

Track Filtering

The tracker updates the current estimated position using the new measurement. If the measurement were known to be completely accurate, the update process would entirely believe the measurement and the new estimate would be exactly the measured value. However, the measurement will contain errors, so the update process must use filtering to take a weighted combination of the expected position and the measured position. The filter works by computing a dynamic gain, based on estimated system noise and measurement noise models.

Local Engineering and Maintenance Display

SPx Server provides a local display capability for set-up, monitoring and configuration. The server software can be configured without this interface, but for most situations it provides an extremely valuable display capability to assist in the initial deployment and maintenance of the tracker.



Submenus for application and processing control.

Server health indicators provide an instant visual warning of any problems.

Input source selection.

Local radar display control (colour, fading and brightness). Raw and processed video may be displayed simultaneously.

Radar video and track distribution controls (enable/disable, set distribution address, message format, compression method).

Radar Video Recording

The server features a built-in radar video recorder, which can capture, compress and store radar video to disk. This happens without affecting tracking or network distribution activities. If available, platform navigation data and AIS data is also captured, allowing the recorded scenario to be analysed in full at a later date.

Recordings may be replayed back through the tracker for processing or distribution. The recordings may also be removed from the tracker and transferred to a remote replay client, for example for incident analysis. The operation of the recording process can be controlled across the network interface, allowing a remote client to start and stop the recording as required.

Current status information, including an indication of the source PRF and current antenna bearing.

SPx Server - VTS Demo - (c) 2008 - 2018 Cambridge Pixel Ltd.

Server Preprocess Clutter Threshold SSI Blanking Plots MBTI Tracking Help

SPx Server
V1.80.2 P110
CPL-999-0031

Health
Initialisation ■
License ■
Source ■
Processing ■
Nav Data ■

Input Source
File ■

Signal Analysis
■ ■ ■

Radar Display
☒ Raw
☐ Processed

Distribution
☐ Radar Video
☒ Tracks

Recording
☐ Enable

Information
CPU Load: 3 %
Azimuth: 6°
PRF: 1786 Hz
Av. PRF: 1786 Hz
Period: 5.9 s
Plots: 26699
Tracks: 145
MBT Trks: 0
Track CIs: 0

Oct 17 14:12:34 Static radar

MHT Tracker

Command: Execute

Inspector
ID: Clear All Tracks
Create
Area Edit...
Lost Tracks... Reread Class

Parameter Display
☐ Basic ☒ Full ☐ Custom ☐ Global

Track: ATI Plots General Radar Assoc Filter Advanced

mhtTrackCanExist
Track can only exist if this parameter = 1

mhtGenerateReport
Generate track reports if this parameter = 1

mhtMinTrackingRange
The minimum range for tracking (metres)

mhtMaxTrackingRange
The maximum range for tracking (metres) (-1 means no limit)

mhtCoastScans
Number of scans to coast before delete

mhtCoastAgeMin
Age of track (from candidate creation) before coasting allowed

mhtCoastAgeMax
Age of track (from candidate creation) for maximum coasting

mhtCoastExtendedTime
Extended coasting time (secs) for overlapping targets

mhtCoastMatureExtension
Additional coasting time (secs) for slow mature targets

mhtTargetTurnRate
Maximum target turn rate in degrees per second

mhtTargetTurnAccel
Maximum target turn acceleration in m/s/s

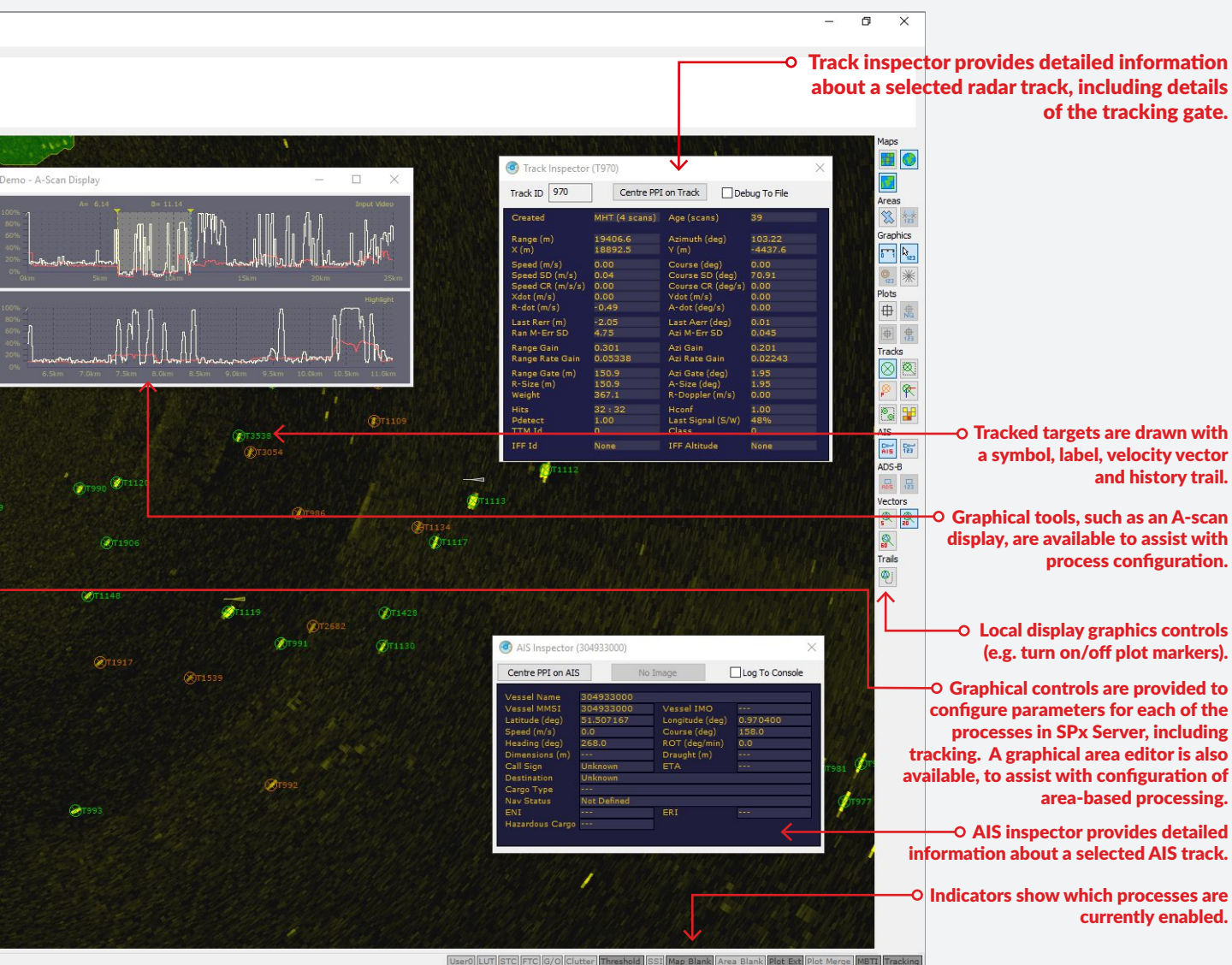
Area Based Processing

SPx Server supports the processing of the radar video in user-defined areas. These areas may be sectors or complex polygons and may be relative to the platform or fixed, in world coordinates. The built-in world vector shoreline database may also be used to provide a processing boundary, for example suppressing tracking over land. The maintenance display provides a convenient graphical tool for defining areas.

Areas may also be used within the tracking process, so that different parameter values may be set in each defined area. This is an extremely powerful capability, allowing a single tracking process to be optimised for each area. For example, in areas of high noise (woodlands, sandbanks, windfarms etc.), it may be desirable to suppress automatic initiation of tracks whilst still permitting established tracks to be maintained.

Model Based Tracking (MBT)

The MBT extensions to SPx Server (Windows version only) provides a method for different sets of tracking parameters to be used to process the same input data. Models may be created that are tuned to look for specific types of target.



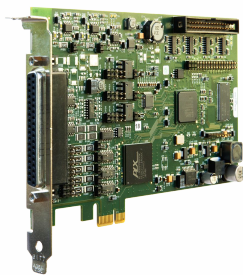
Radar Input Sources

SPx Server works with Cambridge Pixel's HPx range of radar interface cards and is also capable of receiving network radar video from SPx applications that distribute radar video or from radars that provide a network video output directly (ASTERIX CAT-240 and various proprietary formats).

HPx Radar Interface Cards

HPx cards are compatible with a wide range of commercial and military radars using video, trigger and ACP/ARP or parallel azimuth signals. HPx cards provide a flexible range of options to support dual analogue and up to eight digital video inputs. The cards are software programmable to allow the analogue and digital video inputs to be mixed to a single intensity level for each sample.

HPx cards are available in PCI, PCIe, PMC form-factors and as a box-level radar to network solution.



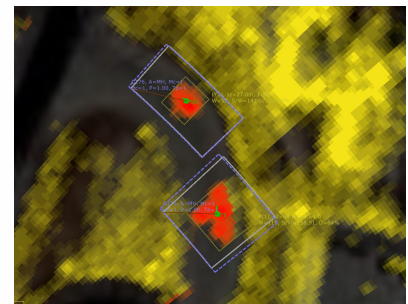
Network Sources

SPx Server can accept network radar video input directly in a number of different formats, including SPx format and ASTERIX CAT-240. This makes it possible for software applications to send data into SPx Server for processing. It is also possible for SPx Server to receive the network video data directly from certain radars, such as Kelvin Hughes' SharpEye and Simrad's Broadband radars.



Simulation and Test

SPx Server supports a built-in test generator to create radar video for testing. A more sophisticated option is to use SPx Radar Simulator which permits complex target and radar movements to be modelled. The ASTERIX CAT-240 output of SPx Radar Simulator may then be input directly into SPx Server.



SPx Server Ordering Information	Part Number (Linux)	Part Number (Windows)
SPx Server for target tracking and radar video distribution	110-702	110-703
SPx Server radar video distribution only (does not include target extraction and tracking)	110-640	110-641
Upgrade of SPx Server to include radar video record and replay	110-715	110-715



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