Multiple Modes of Operation on a Multicore Processor

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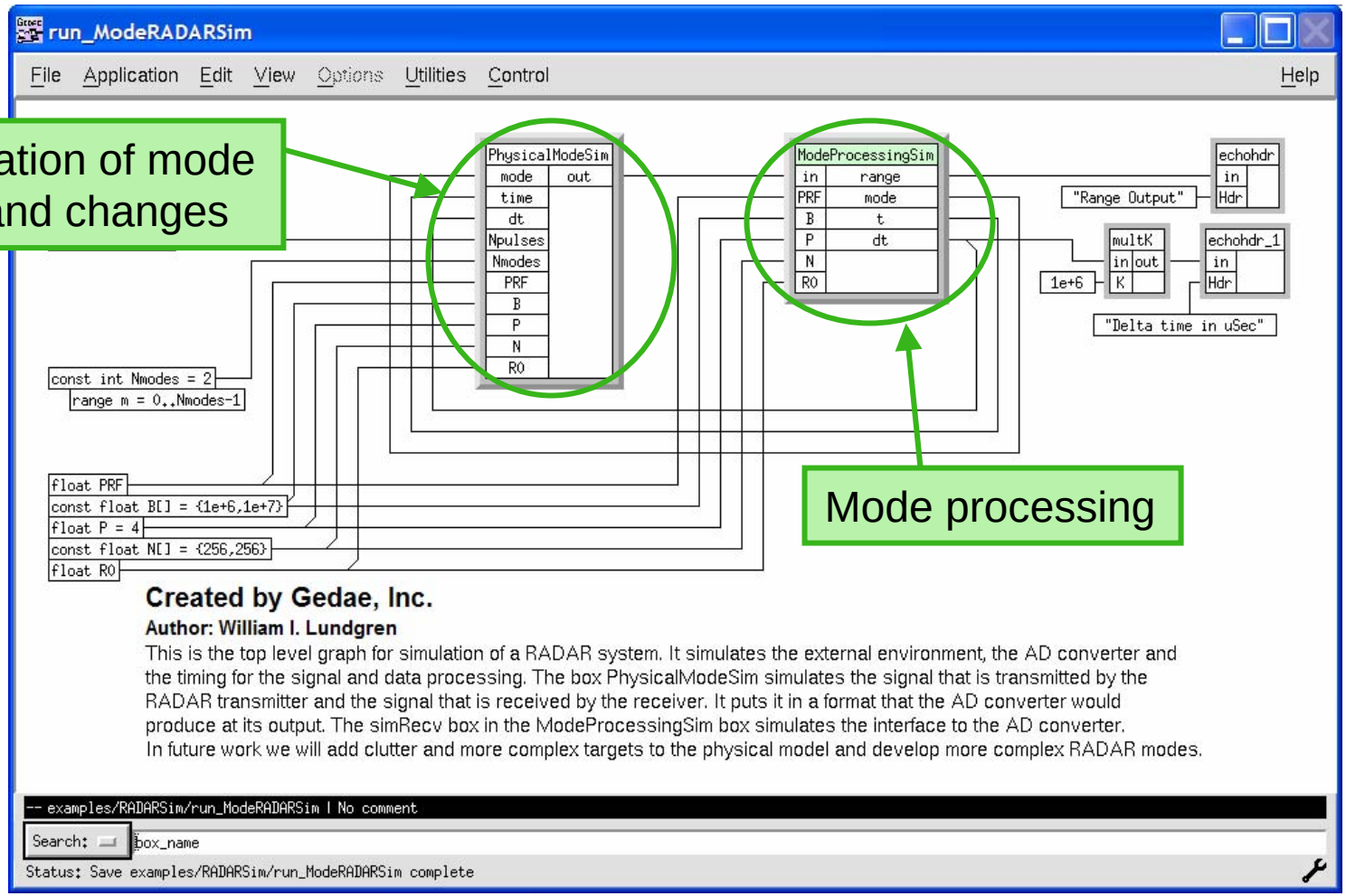
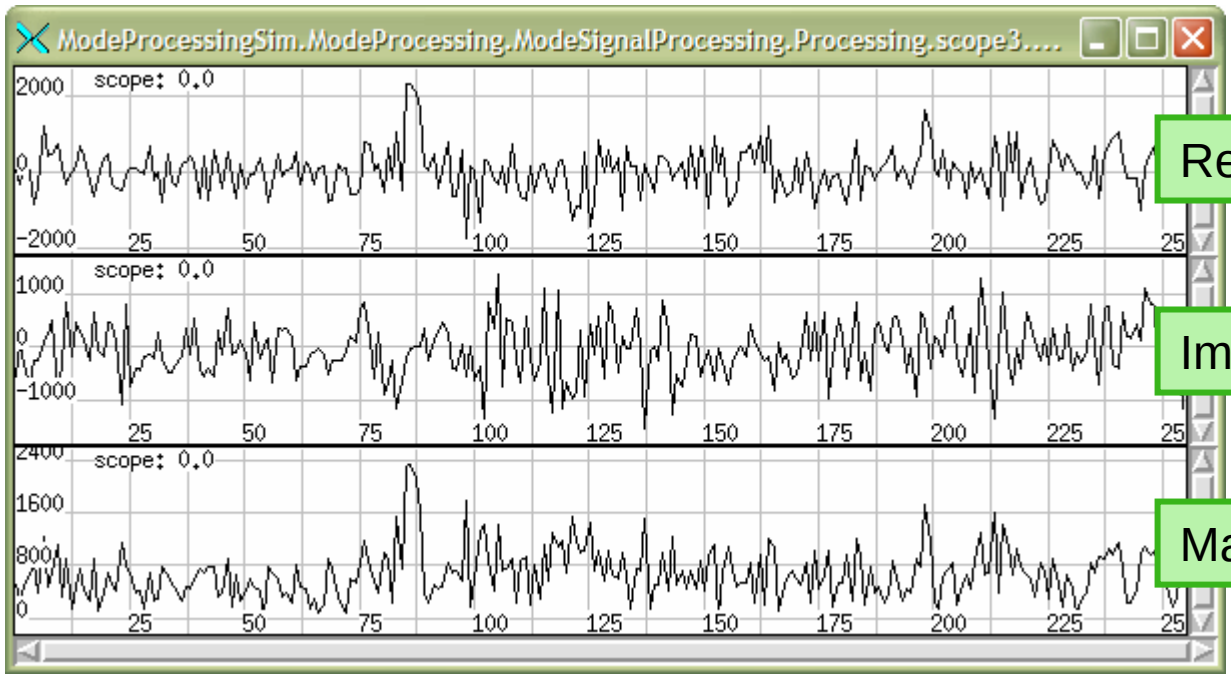
Overview of Presentation

- RADARs often require multiple modes of processing
  - One simple example is search and track
- Multiple modes of operation mean the continuous stream of data coming from the RADAR must be processed using different algorithms or different parameter sets.
  - Requires resetting the software and synchronizing parameter changes.
- Approach in a data flow based model driven development tool should be to:
  - Specify where in the data flow the change takes place,
  - Have the functional components supply a reset method, and
  - Let the autocoding tool implement the application reset.

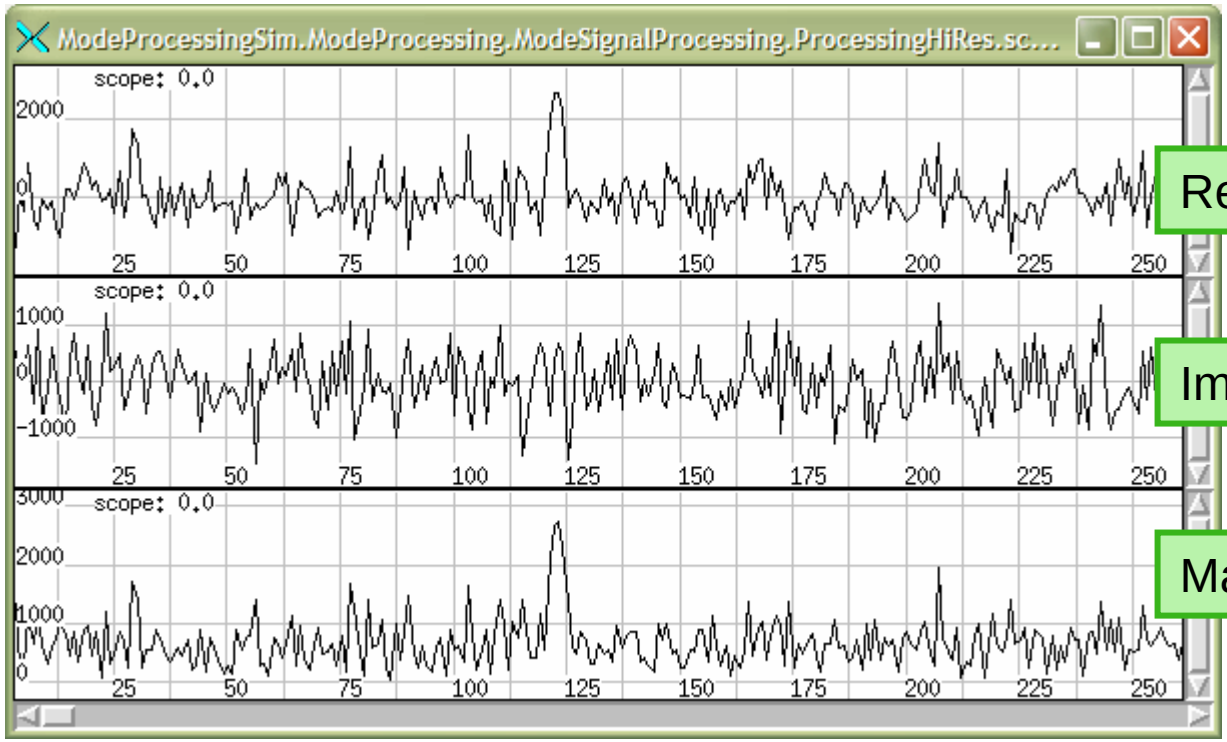
Top Level Graph



Scope Snap Shot Showing Search Mode Data



Scope Snapshot Showing the Target in the High Resolution Mode



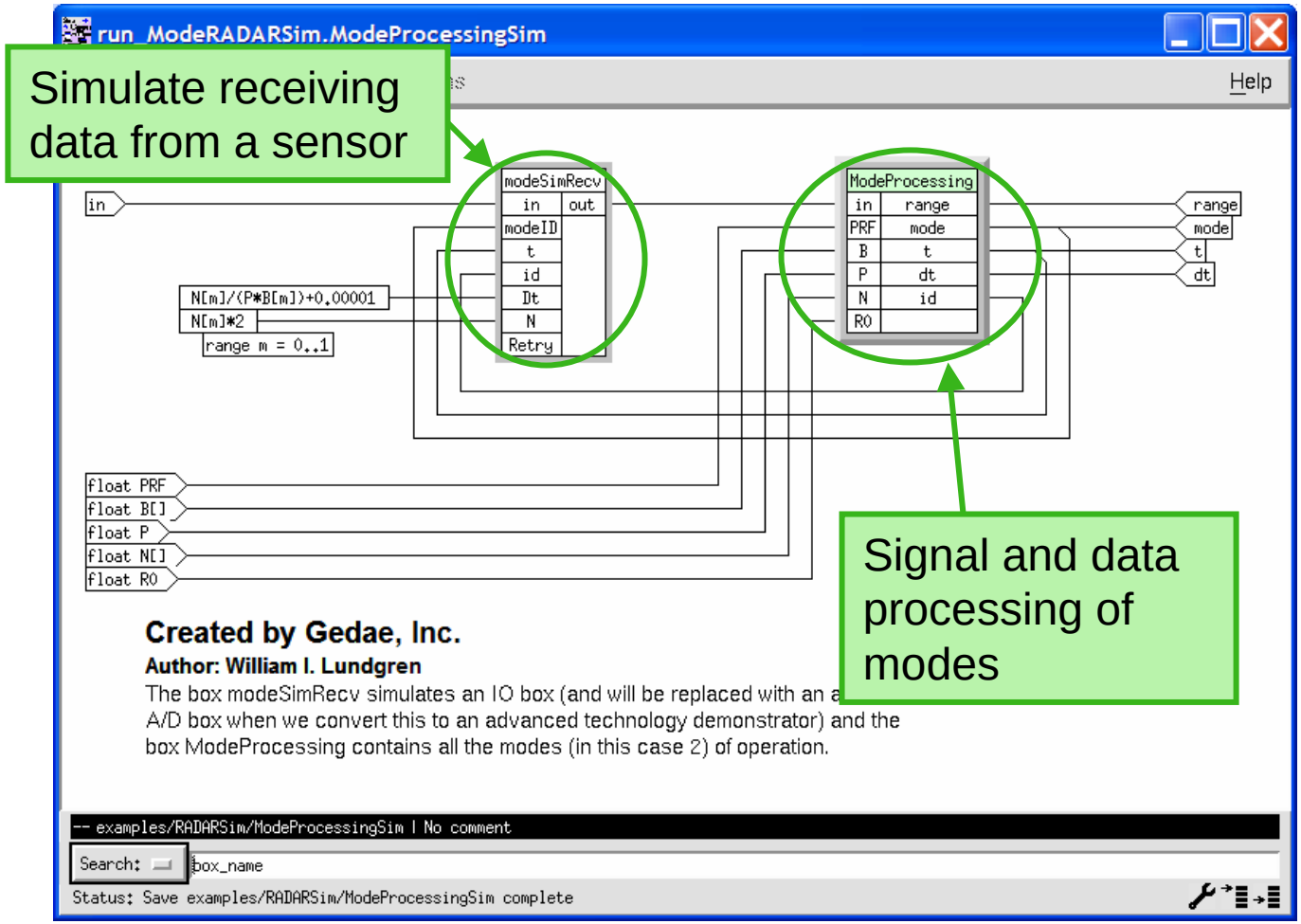
Real

Imaginary

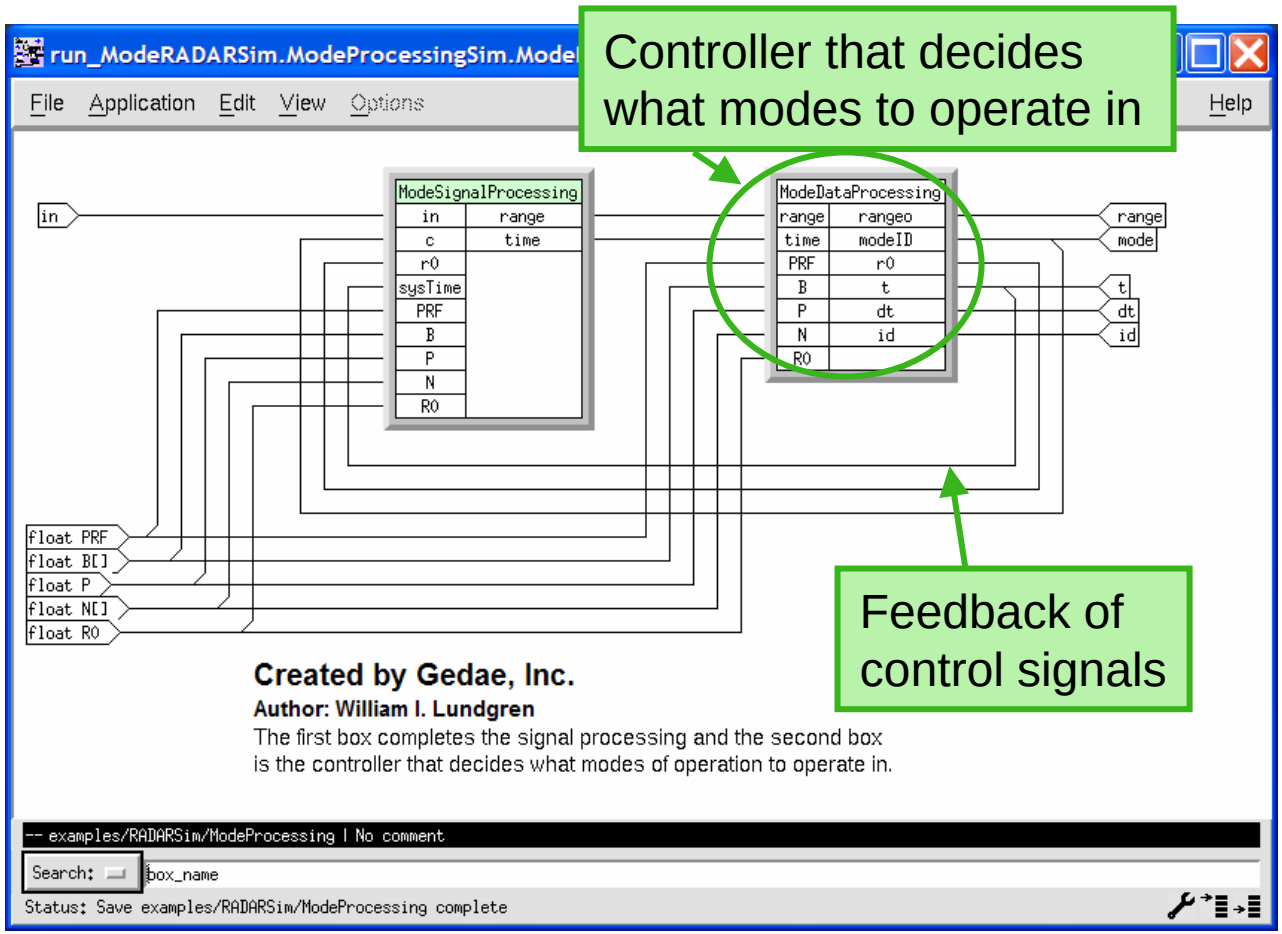
Magnitude

Note that the target is in the middle of the scope output. The application centers the track window on the target.

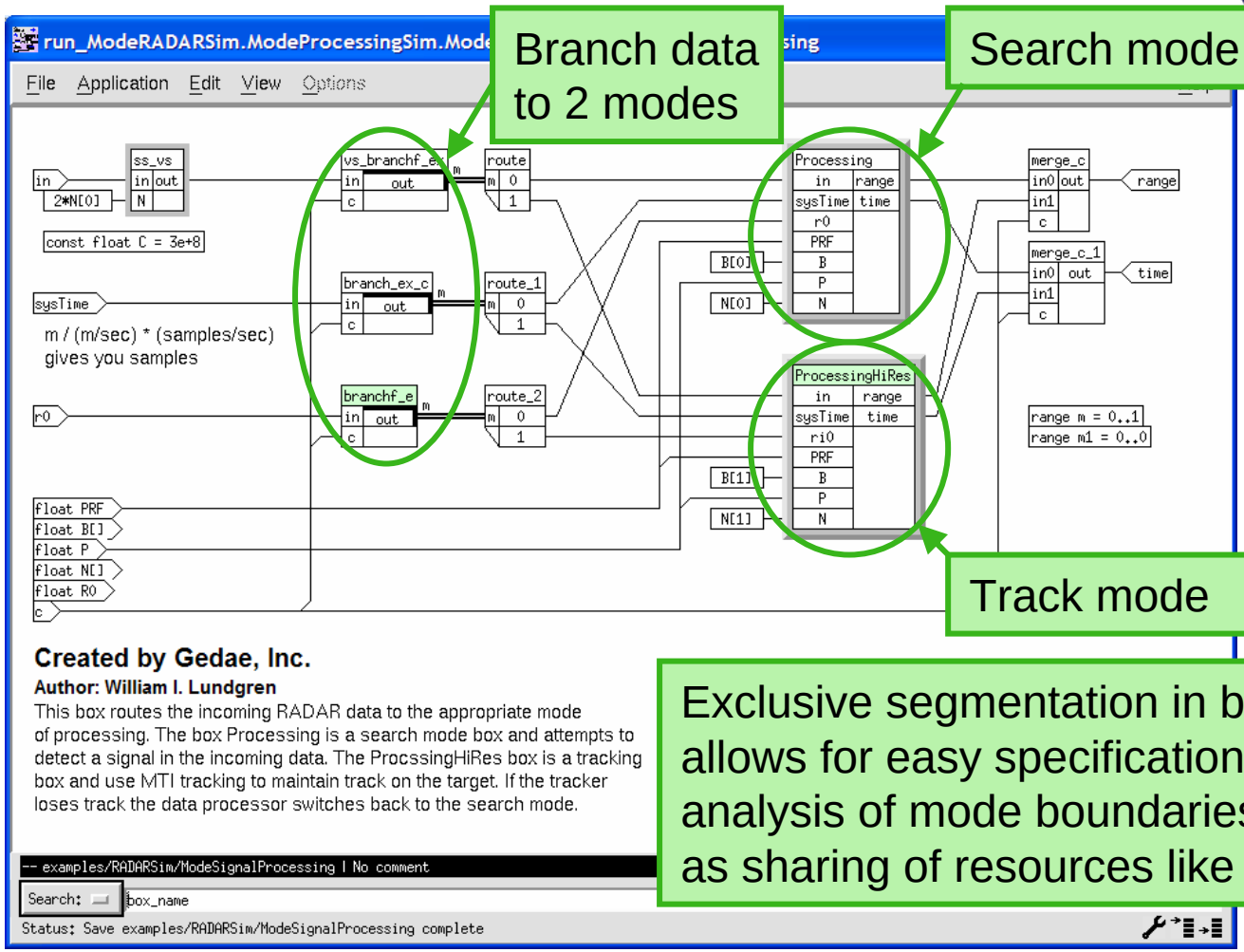
Providing Simulated Data for the Modes



Signal and Data Processing of Modes

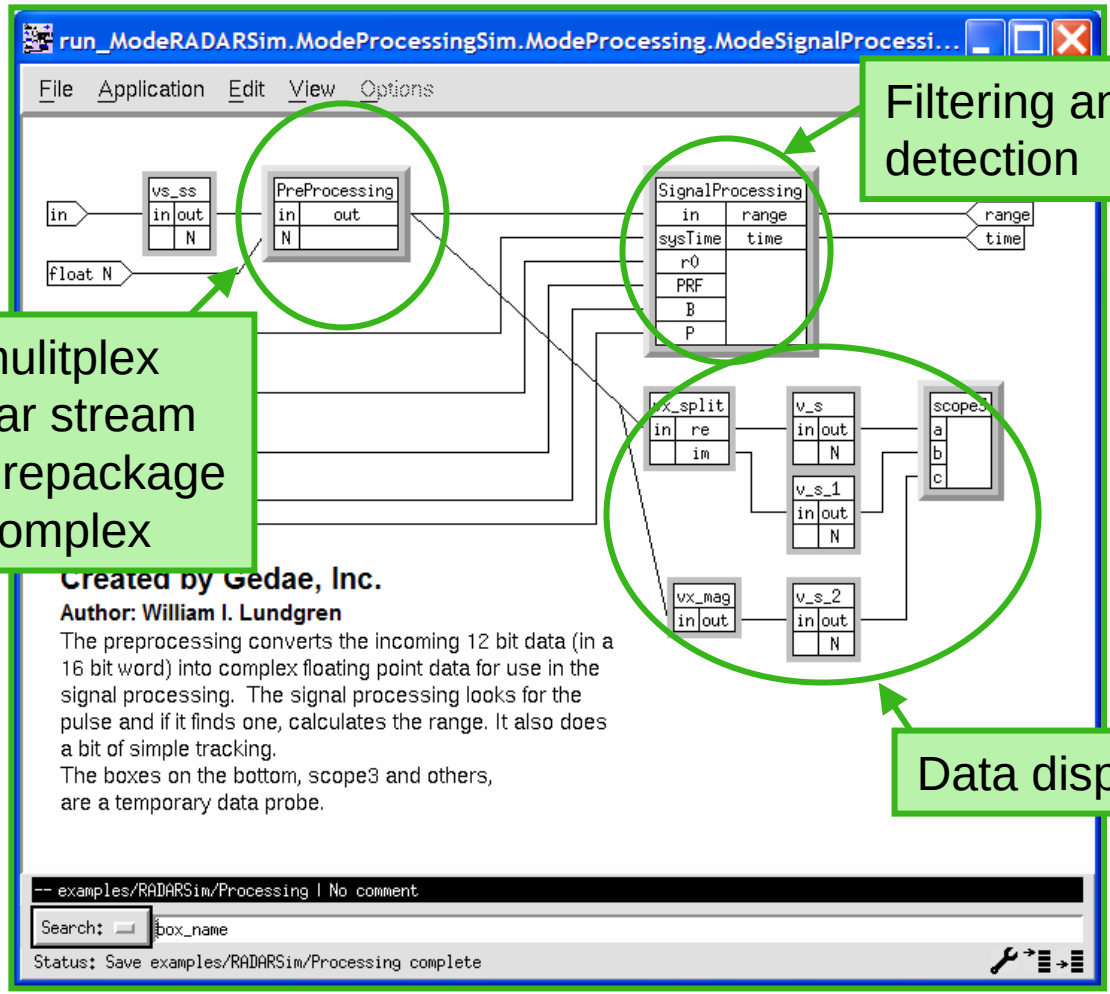


Specification of Search and Track Modes



Exclusive segmentation in branching allows for easy specification and analysis of mode boundaries, as well as sharing of resources like memory

Graph for Search Mode

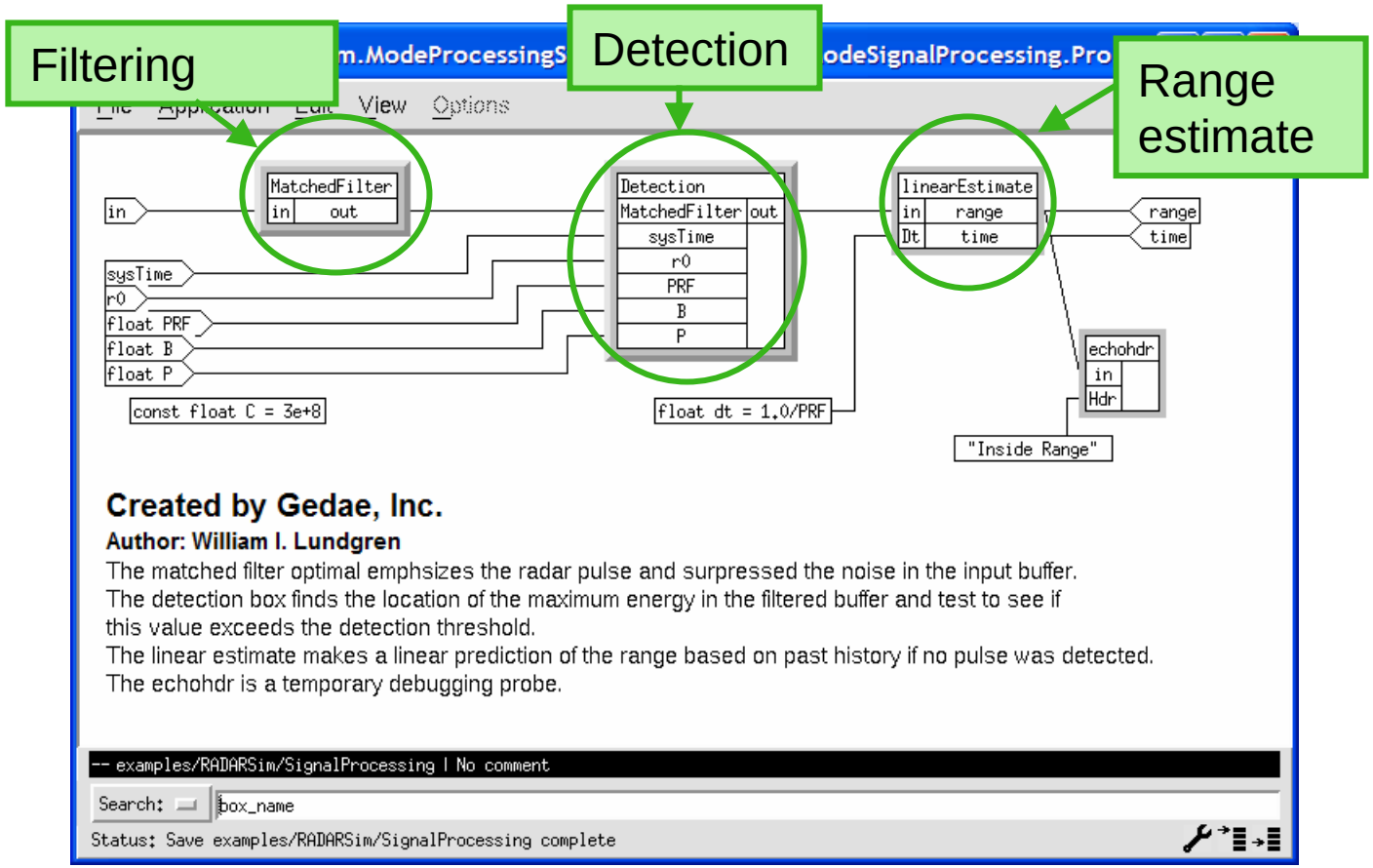


Filtering and detection

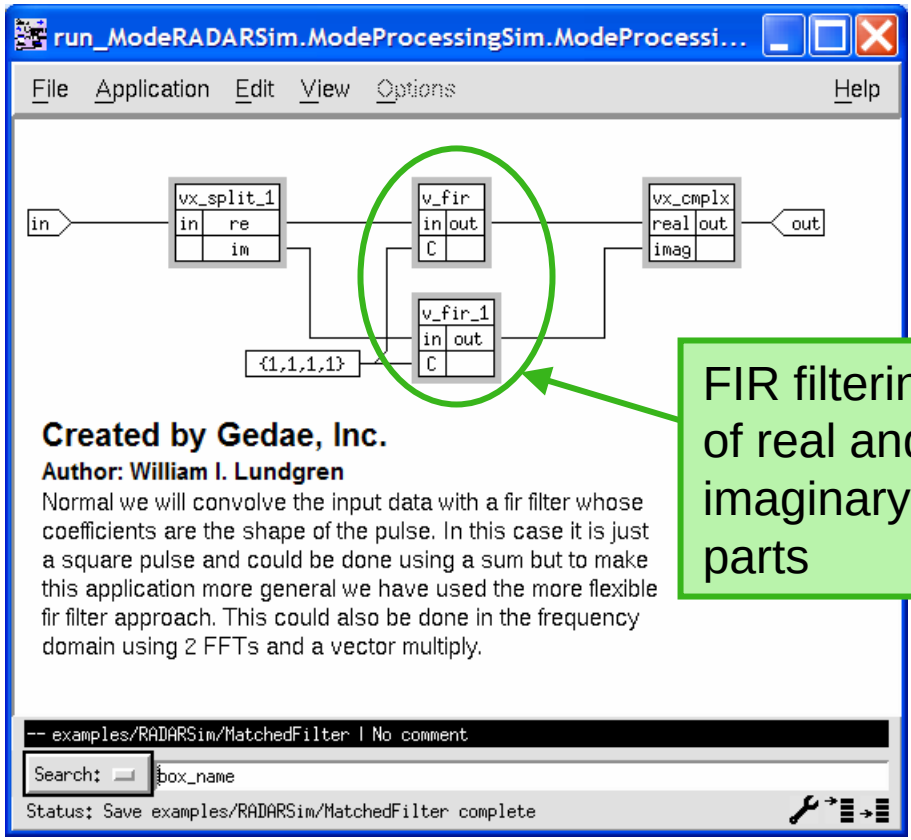
Demulitplex scalar stream and repackage as complex

Data display

Signal Processing of Search Mode

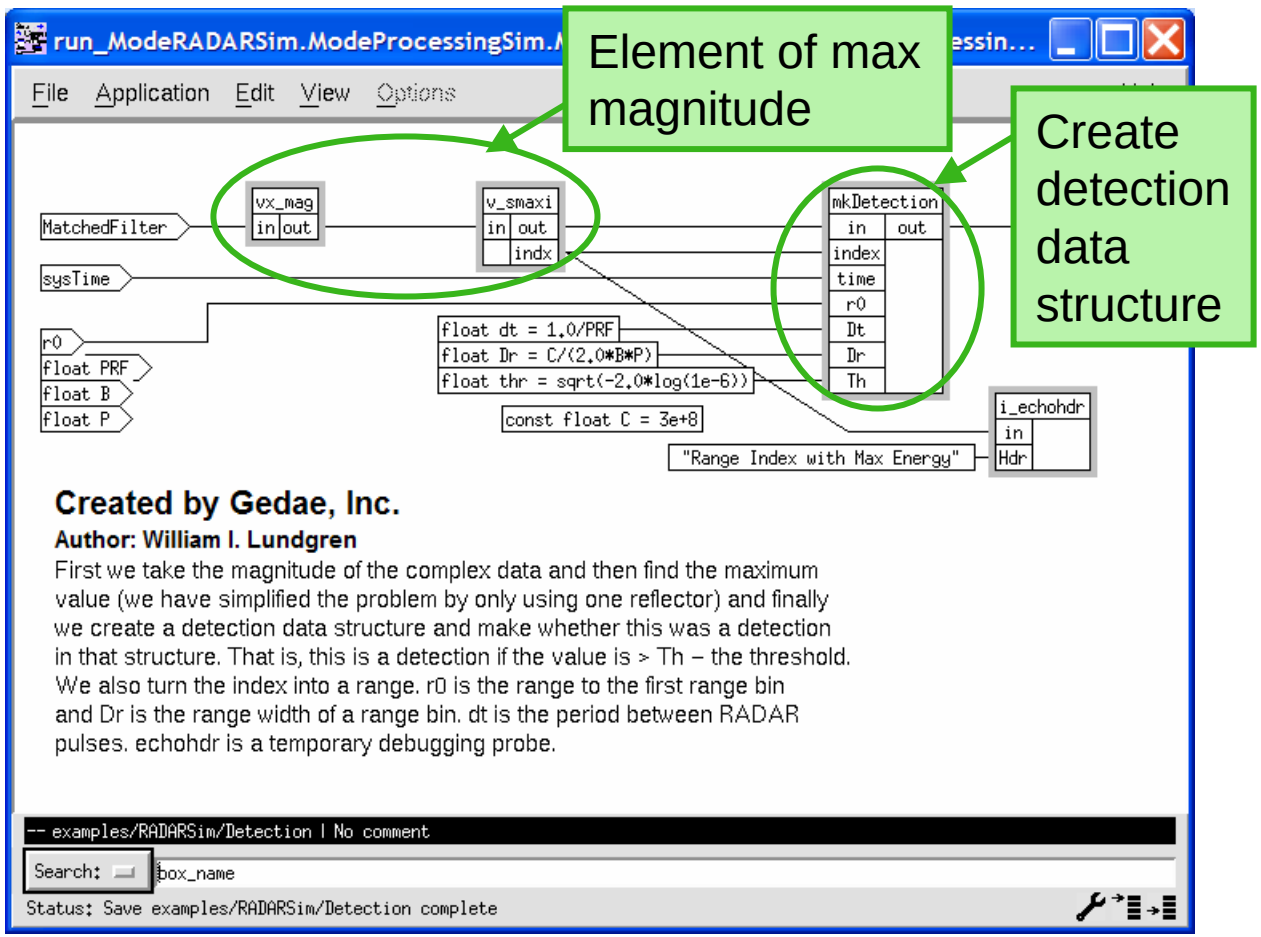


Filtering

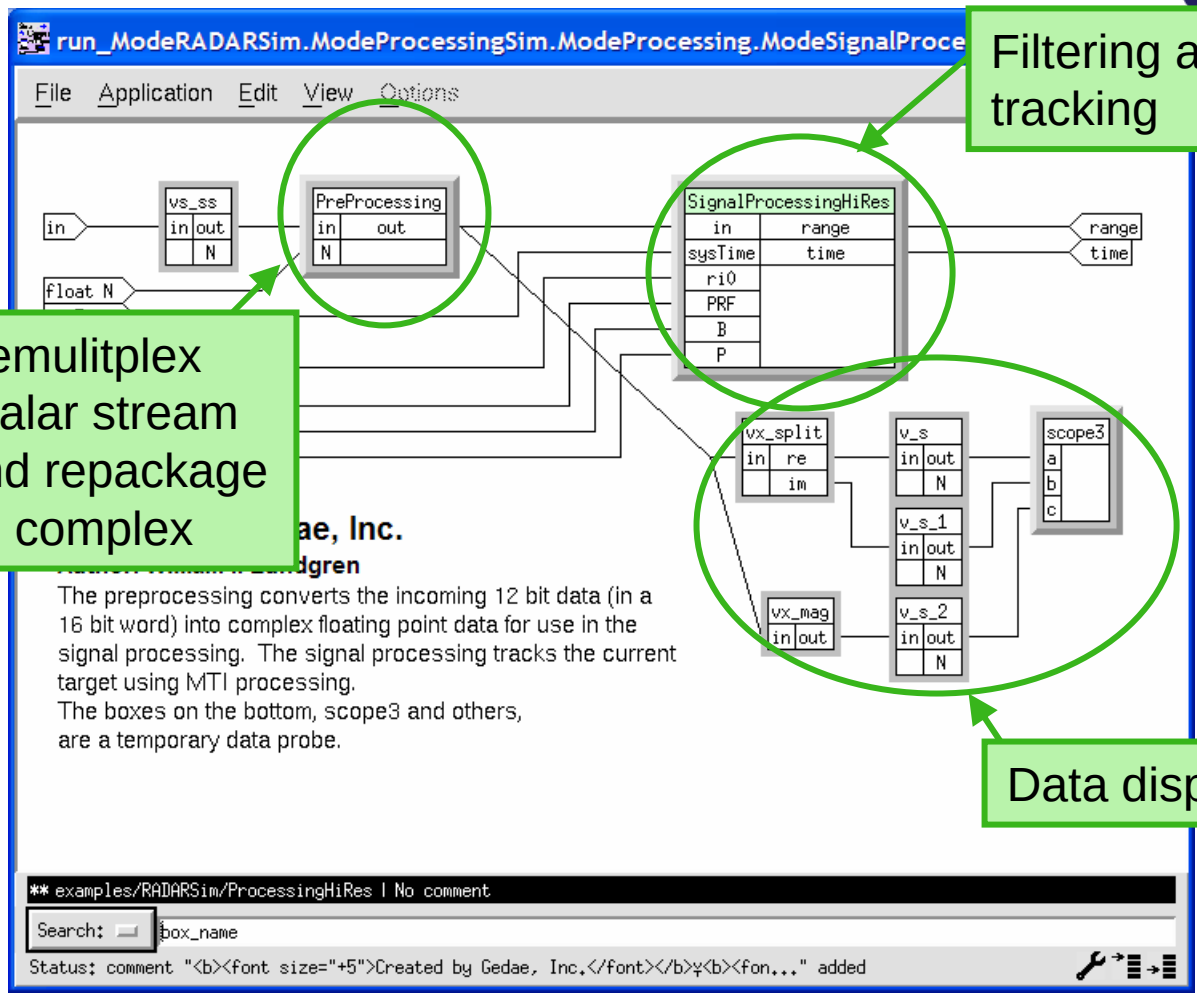


FIR filtering of real and imaginary parts

Detection


Element of max magnitude
Create detection data structure
File Application Edit View Options
vx_mag
in out
v_smaxi
in out
indx
mkDetection
in out
index
time
r0
Dt
Dr
Th
MatchedFilter
sysTime
r0
float PRF
float B
float P
float dt = 1.0/PRF
float Dr = C/(2.0*B*P)
float thr = sqrt(-2.0*log(1e-6))
const float C = 3e+8
i_echohdr
in
Hdr
"Range Index with Max Energy"
Created by Gedae, Inc.
Author: William I. Lundgren
First we take the magnitude of the complex data and then find the maximum value (we have simplified the problem by only using one reflector) and finally we create a detection data structure and make whether this was a detection in that structure. That is, this is a detection if the value is > Th – the threshold. We also turn the index into a range. r0 is the range to the first range bin and Dr is the range width of a range bin. dt is the period between RADAR pulses. echohdr is a temporary debugging probe.
-- examples/RADARSim/Detection | No comment
Search:
box_name
Status: Save examples/RADARSim/Detection complete

Graph for Tracking Mode

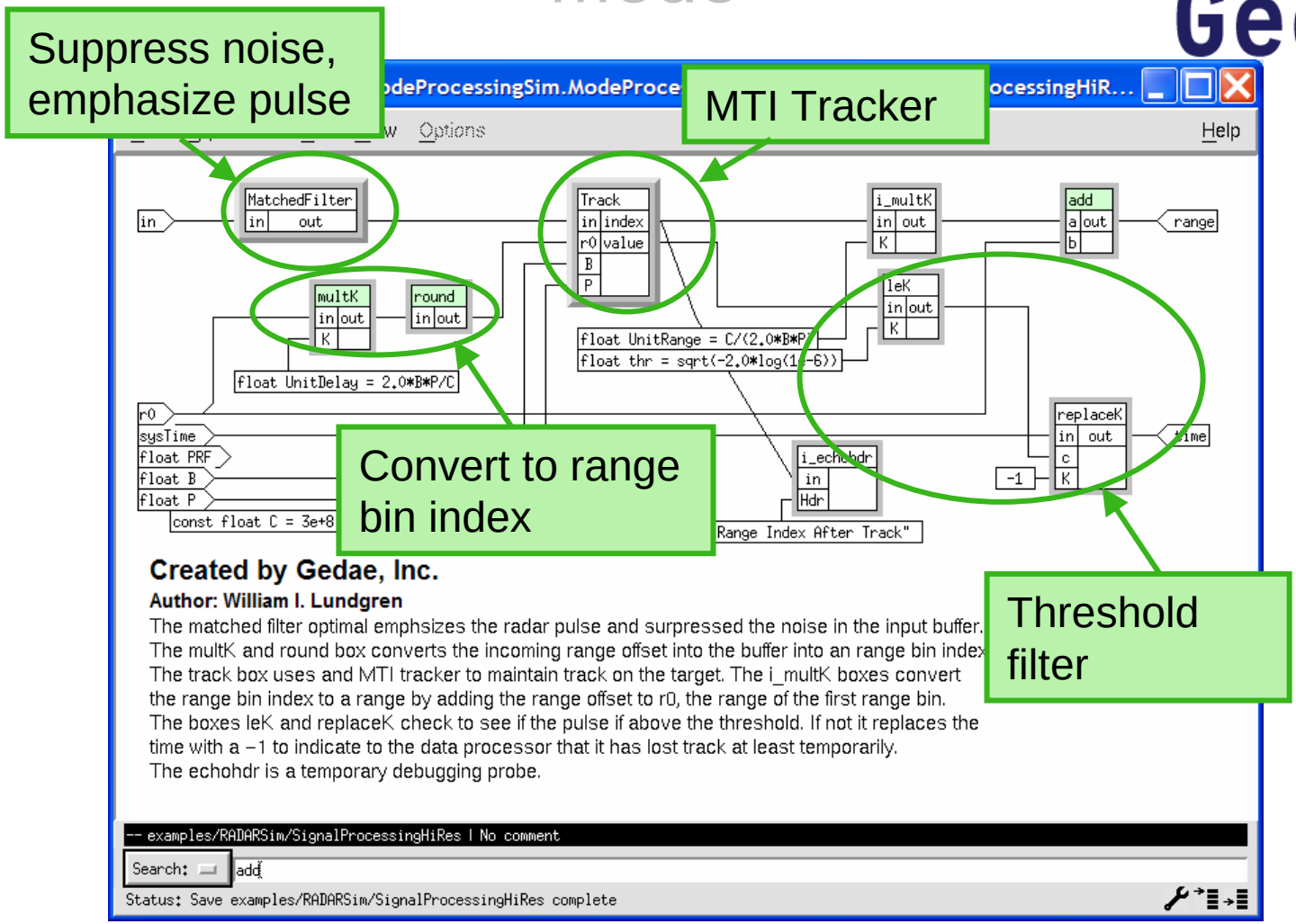


Filtering and tracking

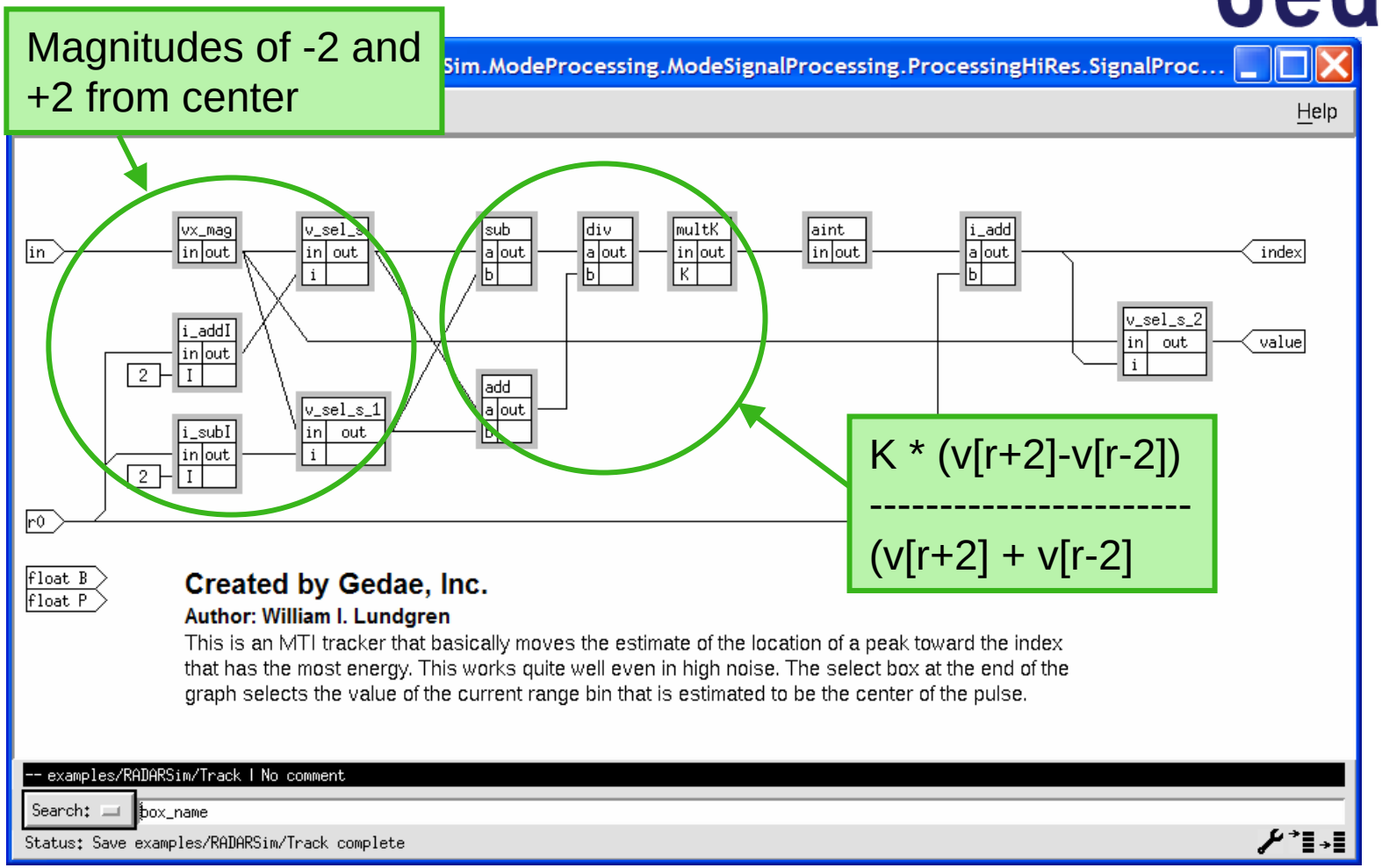
Demulitplex scalar stream and repackage as complex

Data display

Signal Processing of Tracking Mode



MTI Tracker


Magnitudes of -2 and +2 from center
Sim.ModeProcessing.ModeSignalProcessing.ProcessingHiRes.SignalProc...
Help
in
vx_mag
v_sel_s
sub
div
multK
aint
i_add
index
i_addI
2
v_sel_s_1
add
v_sel_s_2
value
i_subI
2
r0
K * (v[r+2]-v[r-2])
(v[r+2] + v[r-2]
float B
float P
Created by Gedae, Inc.
Author: William I. Lundgren
This is an MTI tracker that basically moves the estimate of the location of a peak toward the index that has the most energy. This works quite well even in high noise. The select box at the end of the graph selects the value of the current range bin that is estimated to be the center of the pulse.
-- examples/RADARSim/Track | No comment
Search:
box_name
Status: Save examples/RADARSim/Track complete

Future Work

- We plan to create other modes
  - Doppler processing across a number of cells
  - Integration across a number of pulses to improve the SNR
- If you would like a copy of this application please contact Gedae, Inc. at bill@gedae.com

Conclusions

- Gedae's language is idea for processing continuous streams of data
- Real world applications on continuous streams often have several modes, e.g., Searching and Tracking
- Modal software can be easily specified in Gedae using segmentation to branch data
- Gedae simplifies modal software development by automatically generating much of the software control


Gedae