Tracking radar "Superfledermaus

1969 model

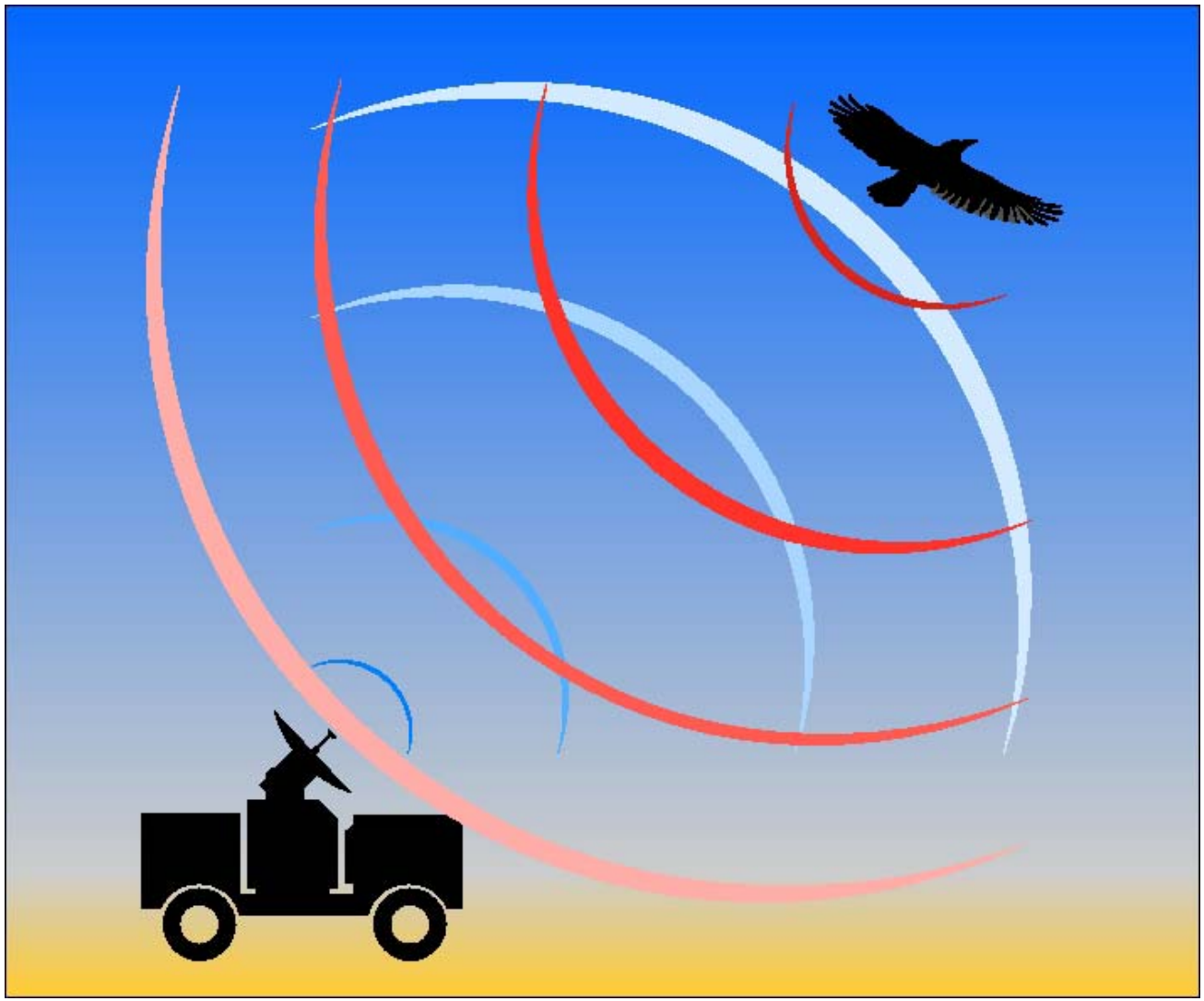
x-band (3.3cm wave)

150 kW peak power

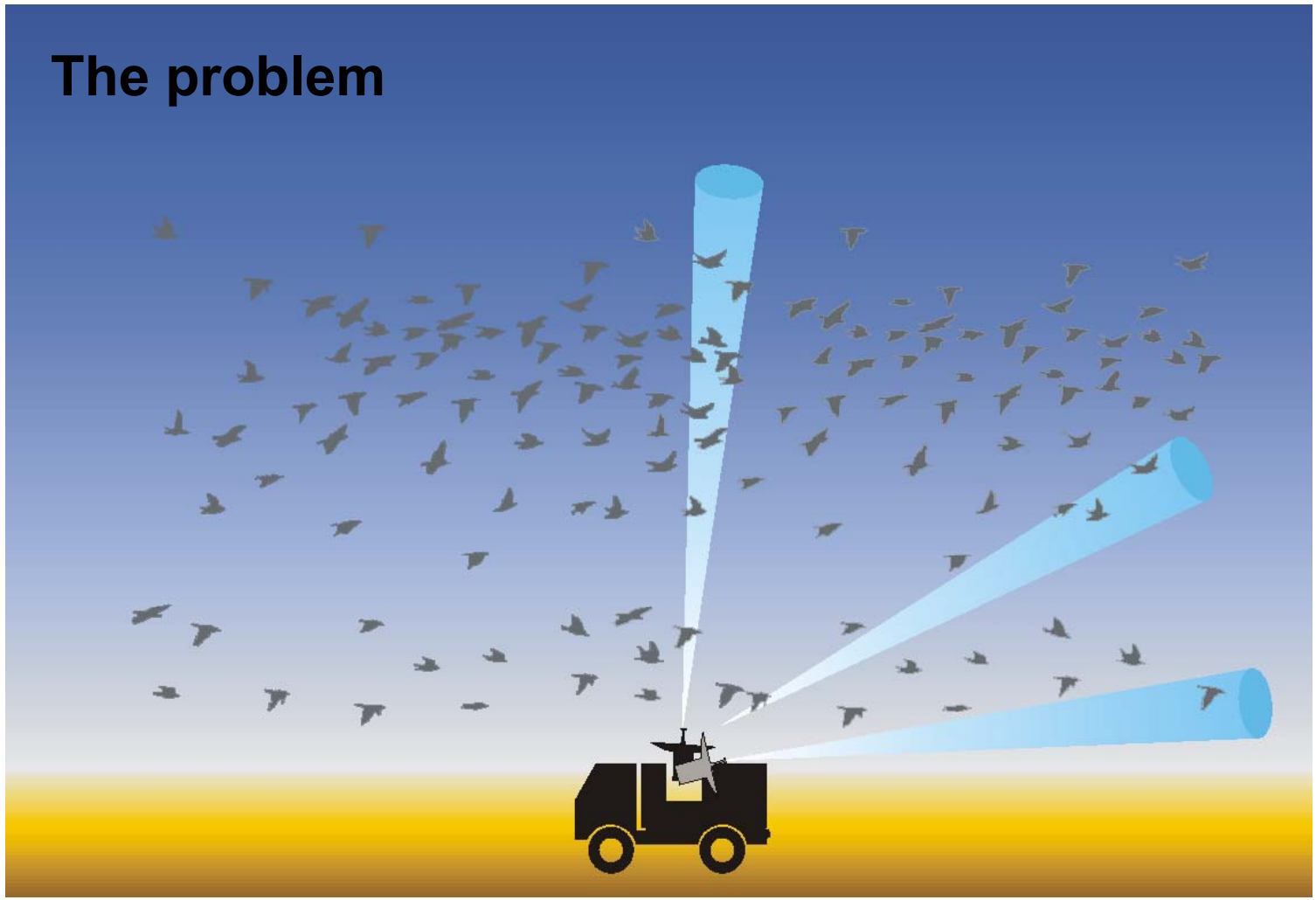
0.3 μs pulse length

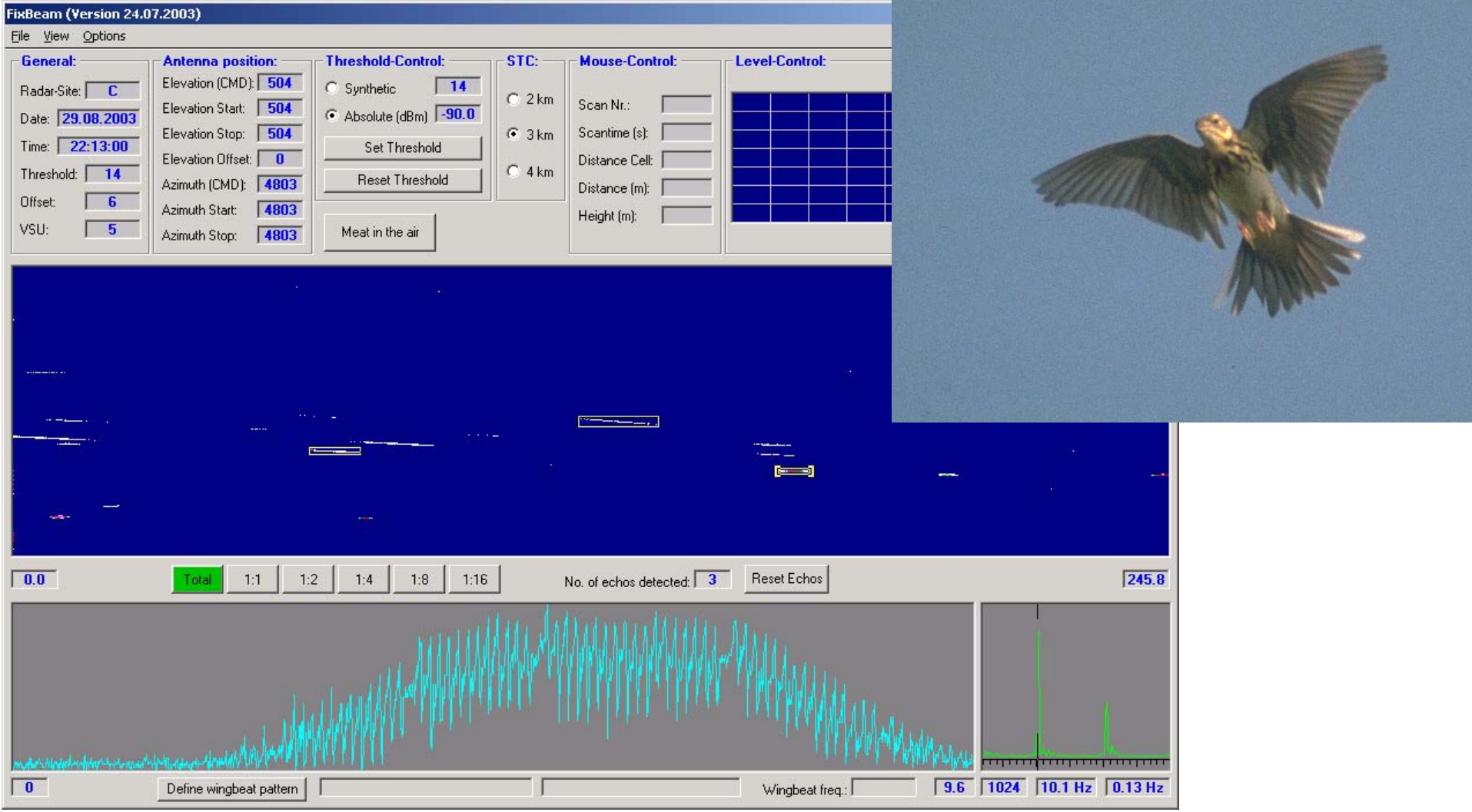
2082 pulse rep. freq.

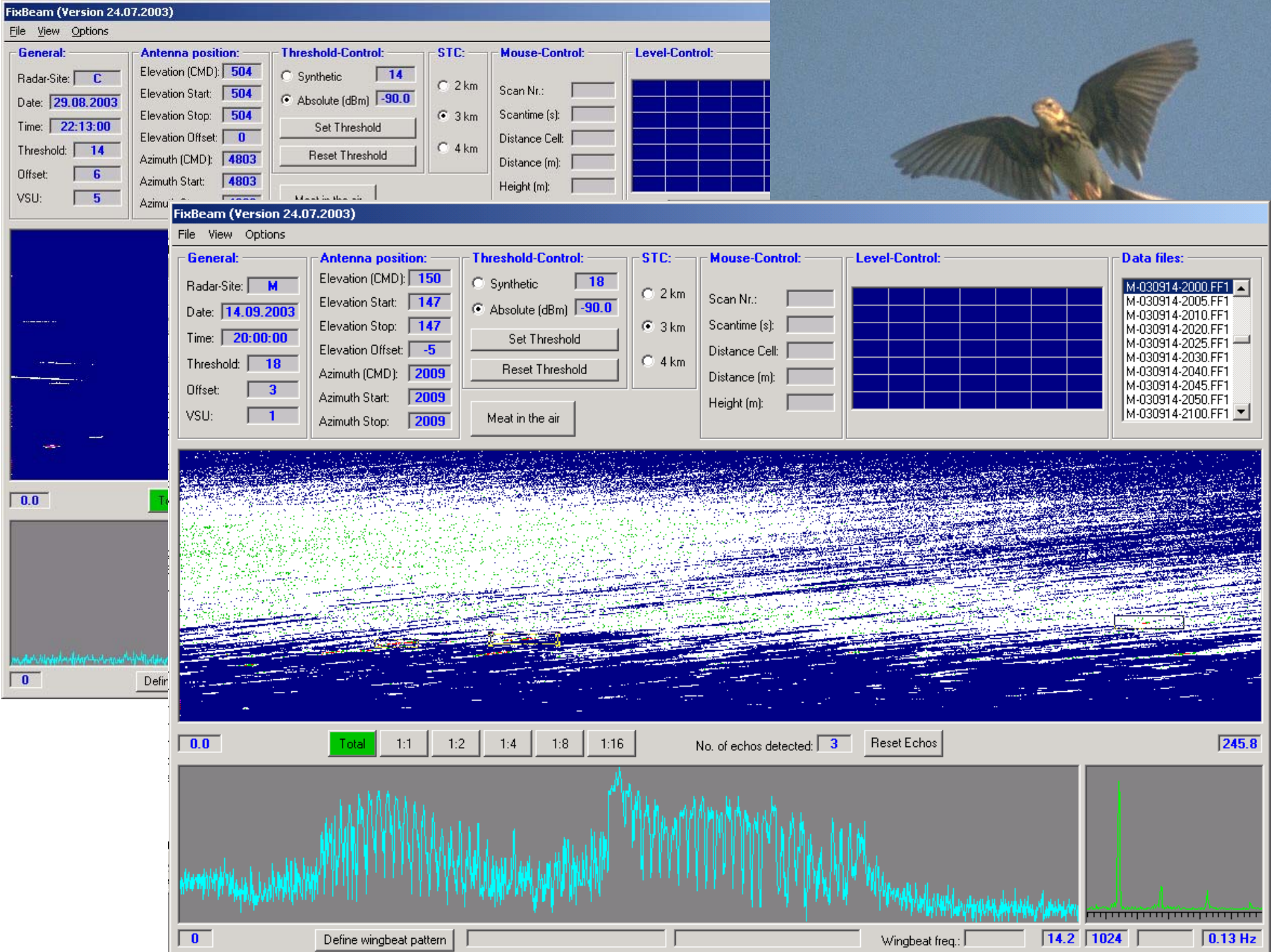
2.2° nom. beam width



Automatic identification




FixBeam (Version 24.07.2003)
File View Options
General:
Radar-Site: C
Date: 29.08.2003
Time: 22:13:00
Threshold: 14
Offset: 6
VSU: 5
Antenna position:
Elevation (CMD): 504
Elevation Start: 504
Elevation Stop: 504
Elevation Offset: 0
Azimuth (CMD): 4803
Azimuth Start: 4803
Azimuth Stop: 4803
Threshold-Control:
Synthetic 14
Absolute (dBm) -90.0
Set Threshold
Reset Threshold
Meat in the air
STC:
2 km
3 km
4 km
Mouse-Control:
Scan Nr.:
Scantime (s):
Distance Cell:
Distance (m):
Height (m):
Level-Control:
0.0
Total
1:1
1:2
1:4
1:8
1:16
No. of echos detected: 3
Reset Echos
245.8
0
Define wingbeat pattern
Wingbeat freq.:
9.6
1024
10.1 Hz
0.13 Hz


FixBeam (Version 24.07.2003)
File View Options
General:
Radar-Site: C
Date: 29.08.2003
Time: 22:13:00
Threshold: 14
Offset: 6
VSU: 5
Antenna position:
Elevation (CMD): 504
Elevation Start: 504
Elevation Stop: 504
Elevation Offset: 0
Azimuth (CMD): 4803
Azimuth Start: 4803
Threshold-Control:
Synthetic 14
Absolute (dBm) -90.0
Set Threshold
Reset Threshold
STC:
2 km
3 km
4 km
Mouse-Control:
Scan Nr.:
Scantime (s):
Distance Cell:
Distance (m):
Height (m):
Level-Control:
FixBeam (Version 24.07.2003)
File View Options
General:
Radar-Site: M
Date: 14.09.2003
Time: 20:00:00
Threshold: 18
Offset: 3
VSU: 1
Antenna position:
Elevation (CMD): 150
Elevation Start: 147
Elevation Stop: 147
Elevation Offset: -5
Azimuth (CMD): 2009
Azimuth Start: 2009
Azimuth Stop: 2009
Threshold-Control:
Synthetic 18
Absolute (dBm) -90.0
Set Threshold
Reset Threshold
Meat in the air
STC:
2 km
3 km
4 km
Mouse-Control:
Scan Nr.:
Scantime (s):
Distance Cell:
Distance (m):
Height (m):
Level-Control:
Data files:
M-030914-2000.FF1
M-030914-2005.FF1
M-030914-2010.FF1
M-030914-2020.FF1
M-030914-2025.FF1
M-030914-2030.FF1
M-030914-2040.FF1
M-030914-2045.FF1
M-030914-2050.FF1
M-030914-2100.FF1
0.0
0
0.0
Total
1:1
1:2
1:4
1:8
1:16
No. of echos detected: 3
Reset Echos
245.8
0
Define wingbeat pattern
Wingbeat freq.:
14.2
1024
0.13 Hz

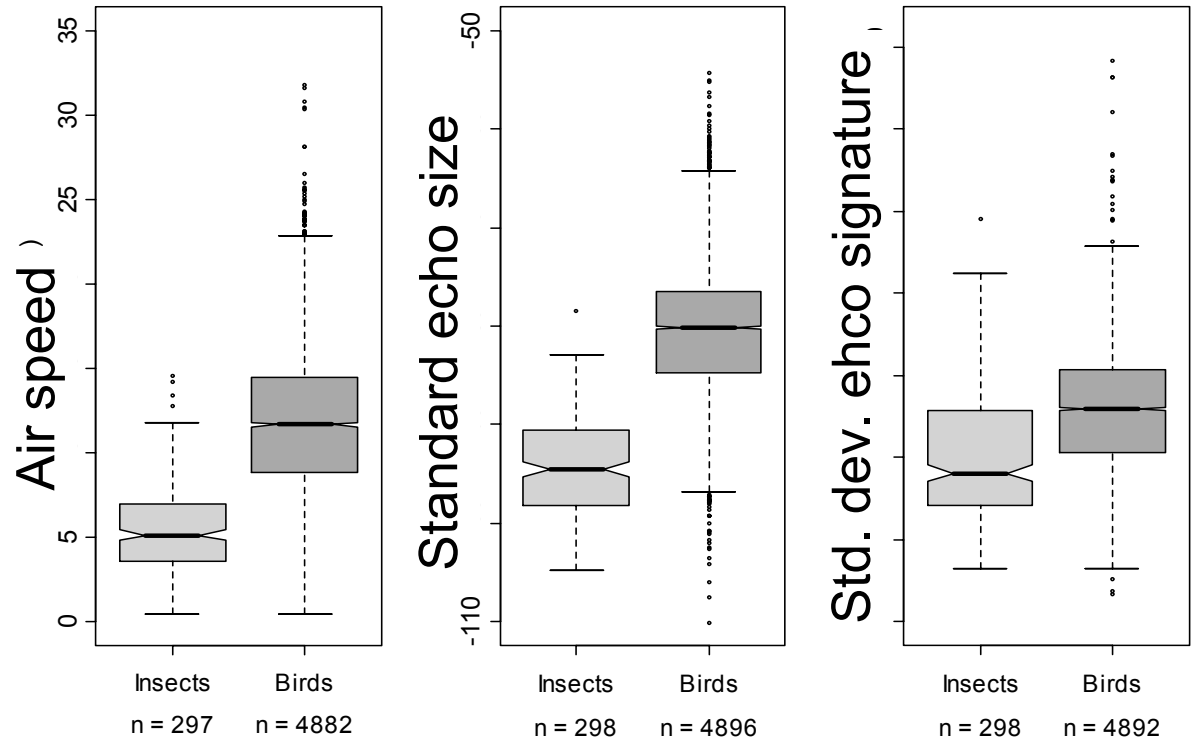
Possible targest in fixed beam data

- single bird (small – large)
- flock of birds
- single insect
- swarm of insects
- UFO's
- clouds
- clutter, noise

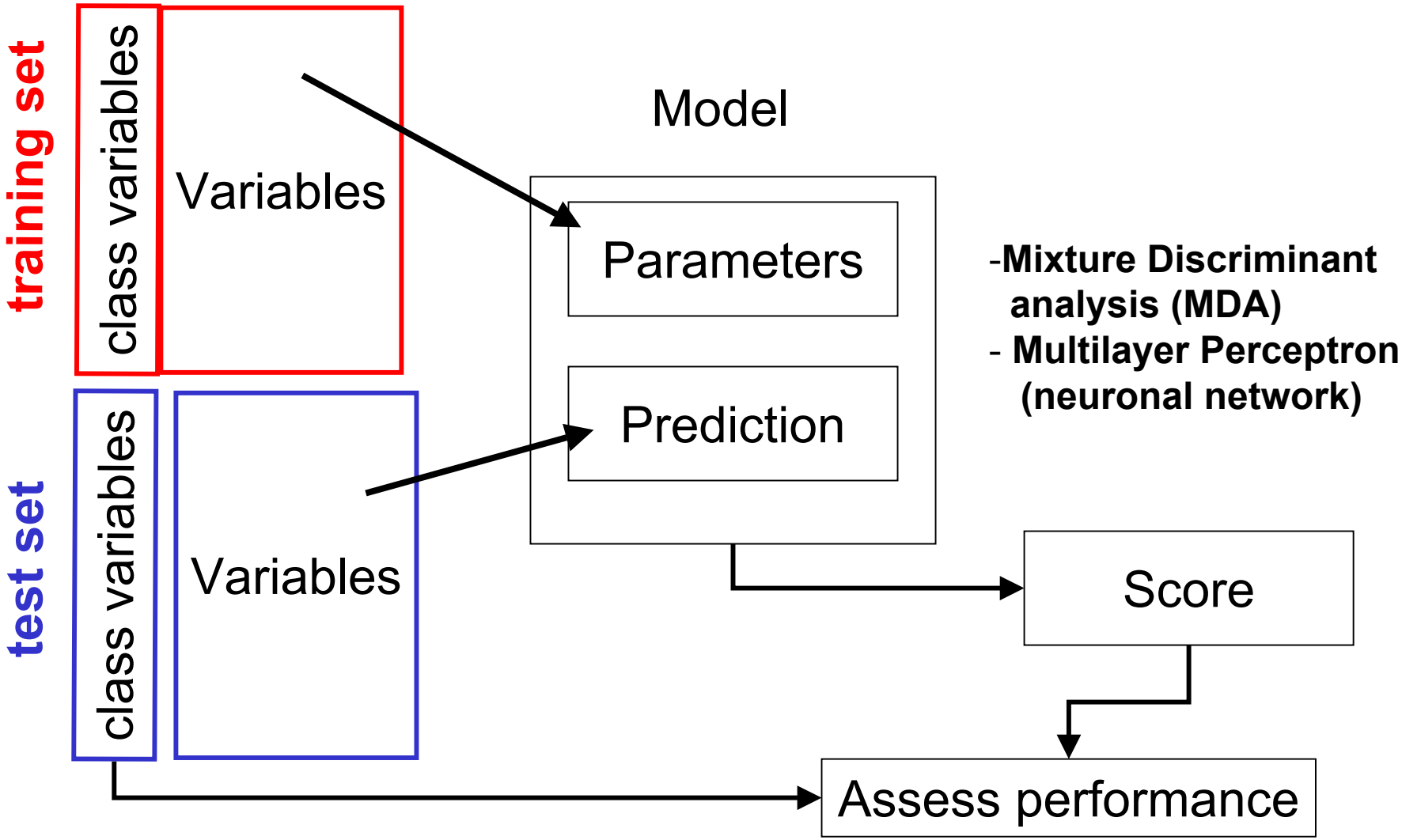
Available information from fixed beam data

- mean echo intensity
- echo length (duration)
- distance
- echo signature (variation of echo intensity in time)

Automatic identification



Supervised classification of radar signals

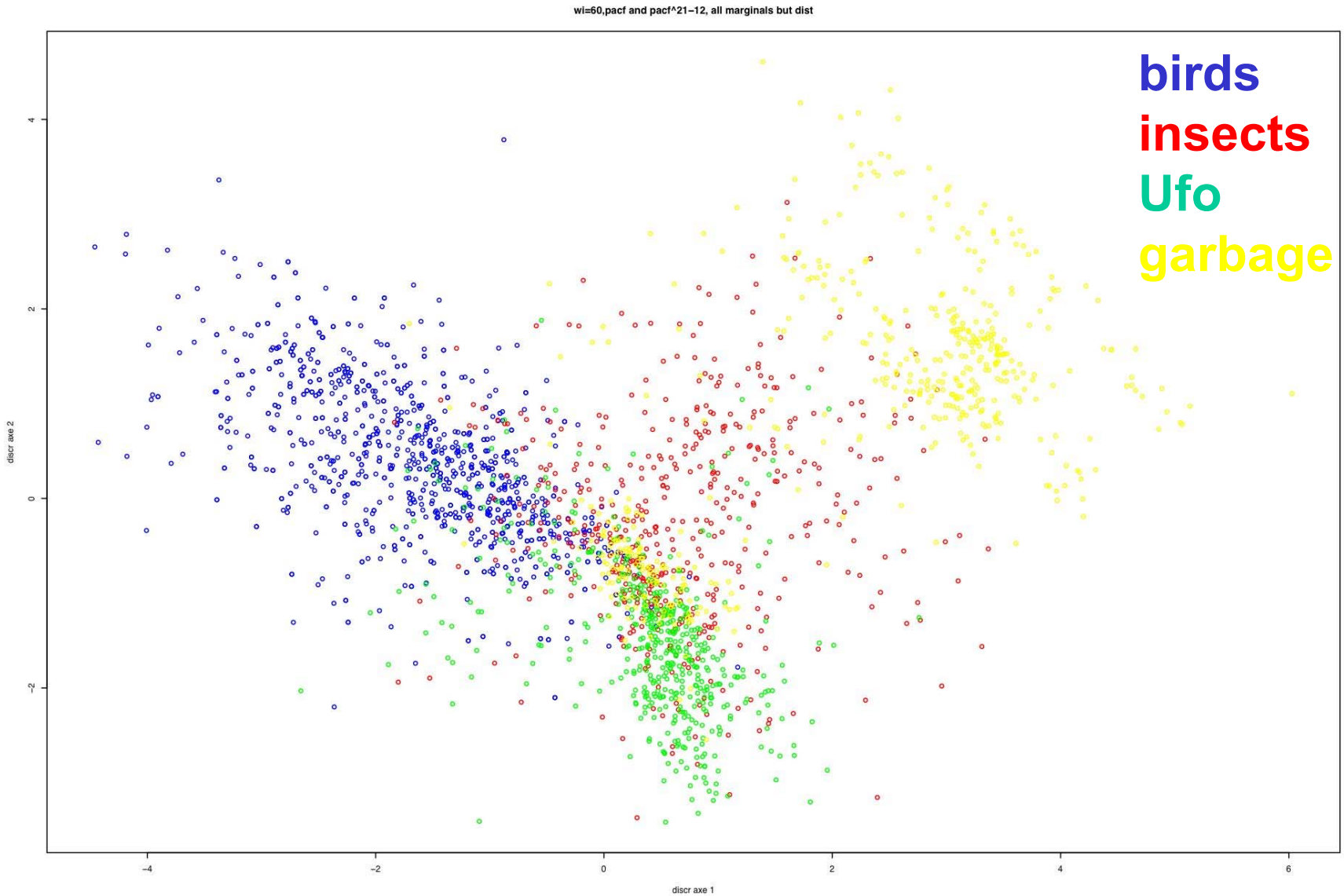


Performance

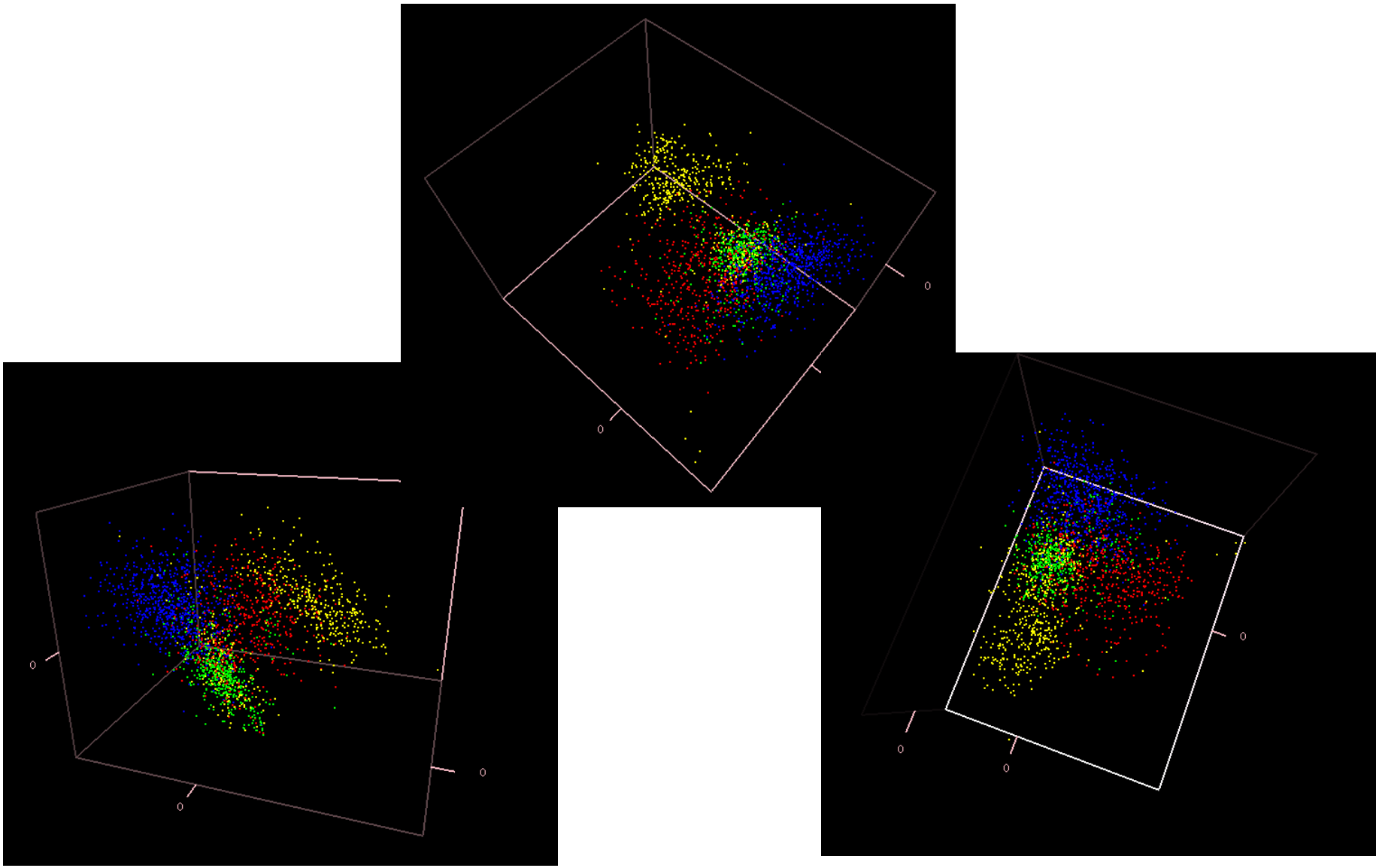
Input
- 46 variables
- 37285 echoes classified by an expert (from 1 site)
- only 2500 used due to restricted computation facilities.

Results
- 44 variables selected with MDA
- 14 variables selected with MLP
- with a positive predictive value of 98% and a false negative rate of 2% the models (MDA and MLP allowed to classify 82% (86%) of the targets properly.
  With a threshol of 95% and 5%, 98% could be classified.

2 D view of two linear discriminant axes



3 D view on three linear discriminant axes



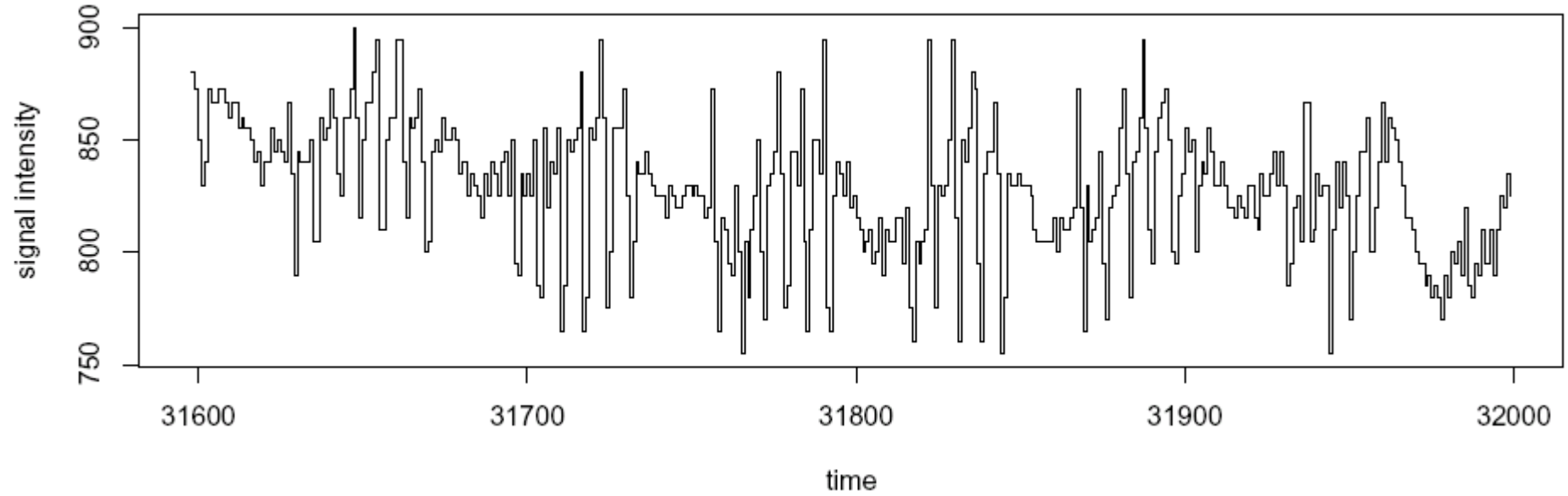
Future work

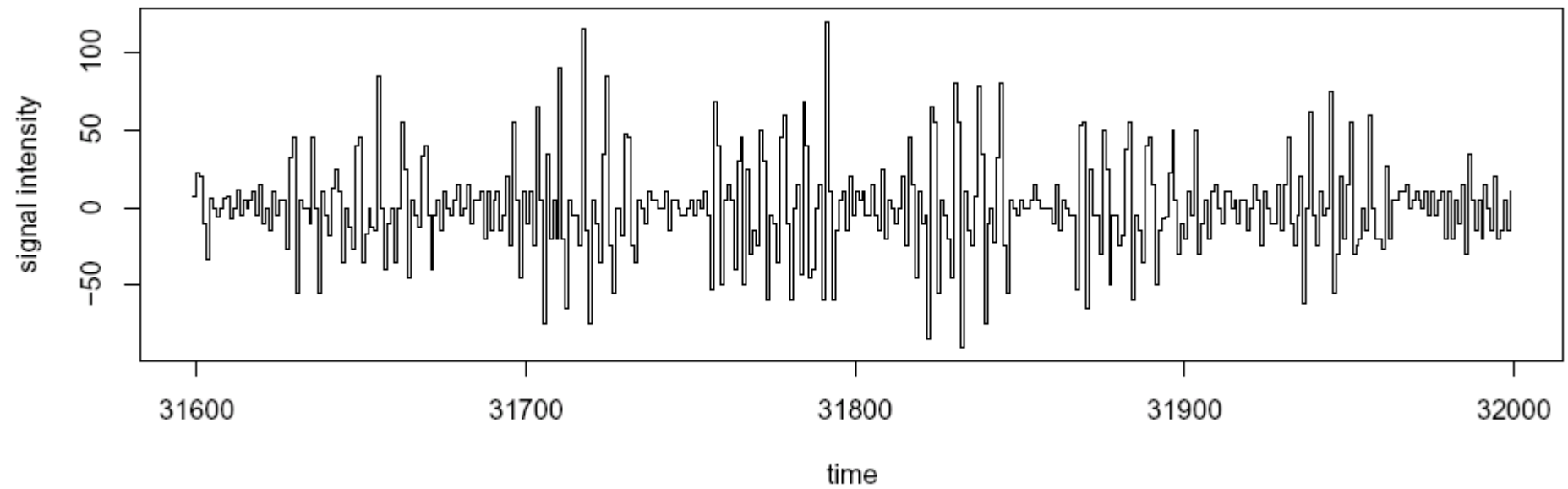
- tuning the algorithm with more data

- applying it to samples from other sites

- implementing the algorithm in the echo detection software to achieve automatic detection of birds versus non-birds

- investigate an algorithm to distinguish between the birds (passerine – wader – swift).


signal intensity
900
850
800
750
31600
31700
31800
31900
32000
time


signal intensity
100
50
0
−50
31600
31700
31800
31900
32000
time