Operating Manual for SkyRadar FreeScopes
The Online Radar GUI

Introduction

The user interface of the SkyRadar Base Unit can be operated locally through wireless LAN, and with the help of the SkyRadar Cloud server through an Intranet (e.g. University or Academy Intranet) and the Internet. In the following document we refer to it as FreeScopes Online Radar GUI. It is possible for multiple users to manipulate the radar raw data and operate different Scopes or filters concurrently. The number of users is just limited by the capacity of the Cloud Server and the legal agreements between the customer and SkyRadar.

The interface is organized into parts that are the same as a real radar system but there are additional controls, which are not provided by classical radar systems.

Access

To access the FreeScopes Online Radar GUI, first connect to the access point "SkyRadar". The password is "skyradar". If you've already added this wireless network, your client is connecting automatically when the system has been booted. When you're connected, start your preferred web browser and enter the following URL: "http://skyradar.lan". Mobile devices don't support all features. One of these features is the DNS service provided by the system. In this case you must open "http://192.168.0.254" in your browser with your mobile device.

First screen

After loading the FreeScopes Online Radar GUI, you will see following screen:
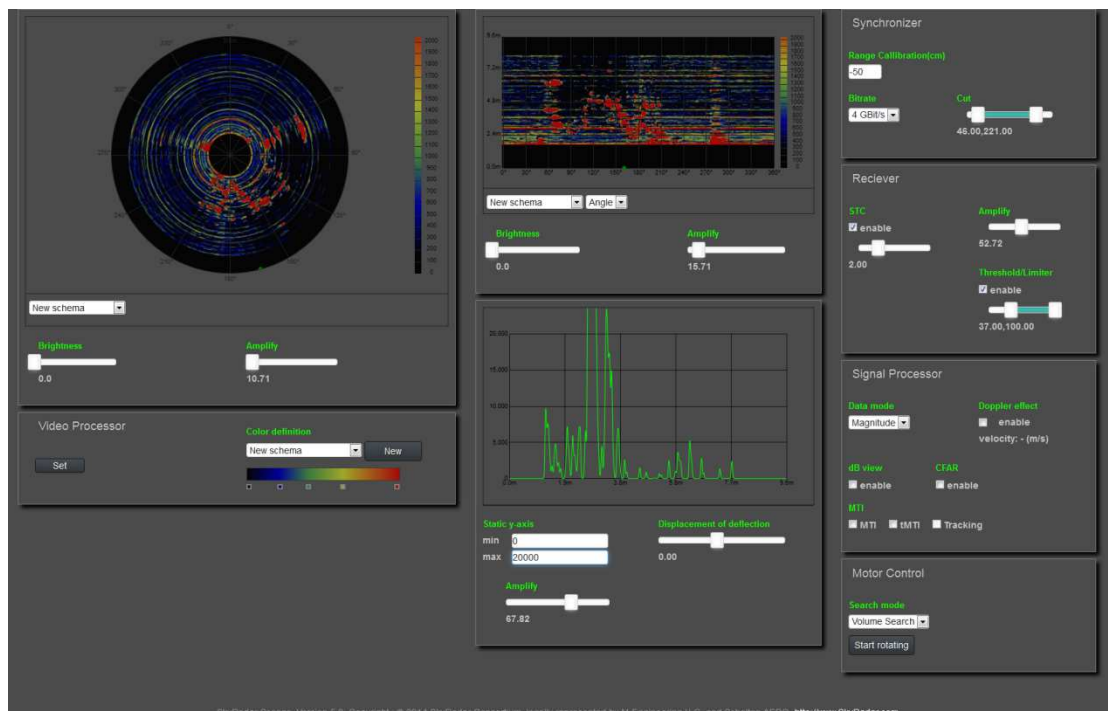
The sections are clearly divided into their logical use.

Synchronizer

The synchronizer the user makes the following settings:

- **Range Calibration in cm:**
  Calibrates the distance. In this case the distance between parabolic reflector and the horn antenna of transceiver.

- **Bitrate:**
  This setting affects all clients.
  The transceiver internally samples the received mixed analog signal to a digital signal. The sample rate, in this case the bit rate, determines the resolution and the maximum distance.
  The higher the bitrate is the higher the resolution is.
  The higher the bitrate is the lower the distance is.
  4 Gbit/s: 37.5 mm resolution, max distance is 9.6m + Range Calibration)
  3 Gbit/s: 50 mm resolution, max distance is 12.8m + Range Calibration)
  2 Gbit/s: 75 mm resolution, max distance is 19.2m + Range Calibration)
  1 Gbit/s: 150 mm resolution, max distance is 38.4m + Range Calibration)

- **Cut:**
  The slider on the left side removes data from near distance.
 The slider on the right side removes data from far distance.

Receiver
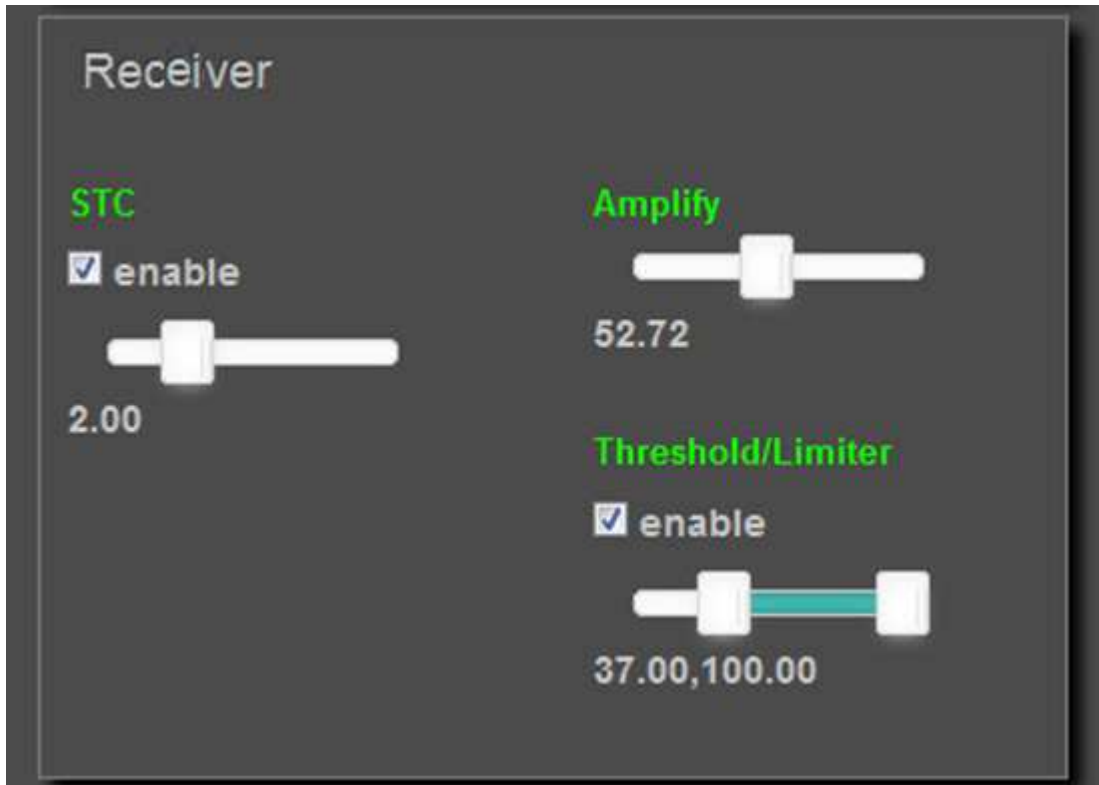
The Receiver box lets the user make the following settings:

- **STC:**
  The sensitivity time control reduces the signal on near distances. The position of the slider sets the n-root for this calculation.

- **Amplify:**
  Is the main amplification before passing the signal to the next filters. The slider uses a relative value from 0% - 100%. Internally is a multiplier which operates relative to the signal The default value, when loading the FreeScopes Online Radar GUI, is a amplification of one. All values under this value are an attenuation.

- **Threshold/Limiter:**
  This combined slider is to set a threshold and limit the signal. The values are relative and are calculated internally.

Signal Processor
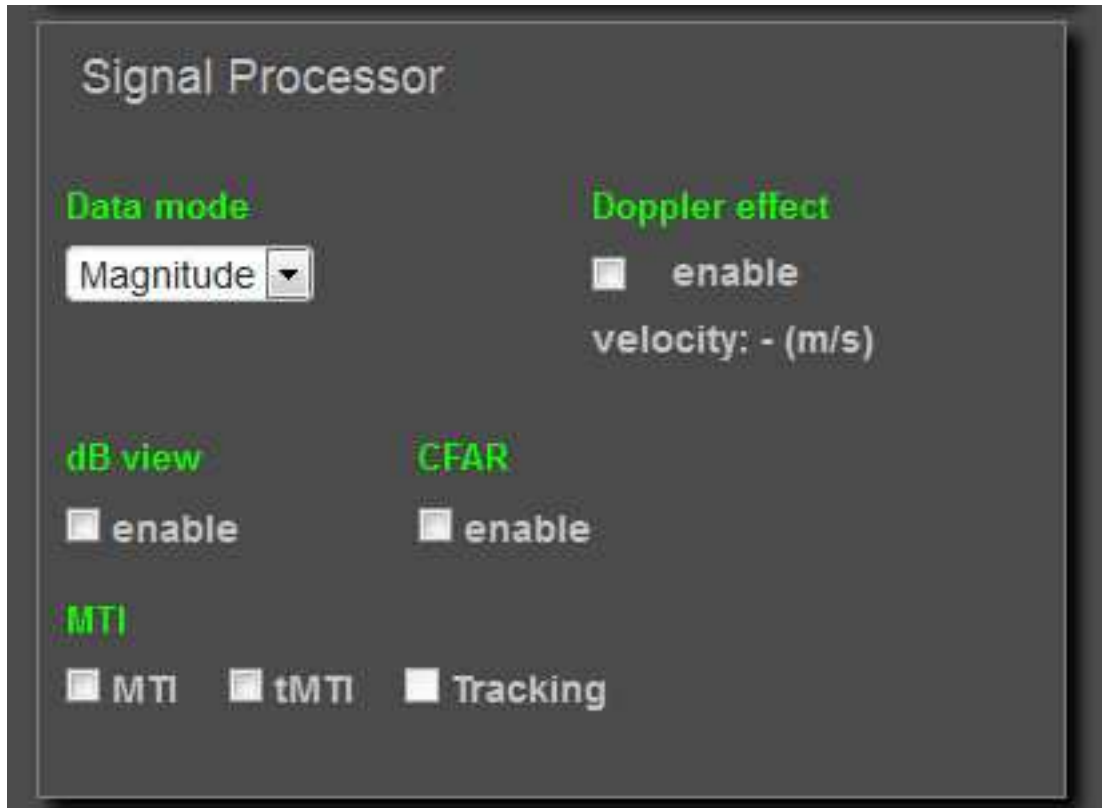
The signal processor does the signal processing after it has been received.

- **Data mode:**
  With the drop down menu the data source can be changed to

  - Magnitude:
    The calculated magnitude from I- and Q-Data
    $Mag = \sqrt{I^2 + Q^2}$

  - I-Data:
    The real part of the signal

  - Q-Data:
    The imaginary part of the signal (90° phase shifted).

- **dB view:**
  The scopes will show the calculated logarithmic value in decibels. If this checkbox is activated, the Data mode is automatically set to Magnitude and cannot be changed. The manufacturer's formula to calculate this value is: $dB = 4 \cdot \log(I^2 + Q^2)$

- **CFAR:**
  Activates the algorithm for Constant False Alarm Rate

- **MTI:**
  Activates the Moving Target Indication

- **tMTI:**
  Activates the special algorithm "tracking Moving Target Indication", which eliminates large

static objects from the screen. This algorithm collects data from all angles in a queue and adds them together in a list with predefined multipliers to get a kind of dynamic clutter map, which is subtracted from incoming data from the current angle.

- **Tracking:**
  Activates the Tracking Mode. This works only in Volume Search or Sector Search. It shows all recognized cross sections on the B-Scope with red squares. If a square has been selected by mouse click, the properties are saved. When a cross section meets the conditions, it will be shown on the screen with Code, Distance and Azimuth. The system changes automatically to Sector Search and changes the start and end angle of the sector search to follow slow objects. NB: This system is for indoor use. Radar systems which have a distance of 30 km or more can track fast objects. In relation to that our PSR can detect only slow moving objects. But it works on the same ratio.
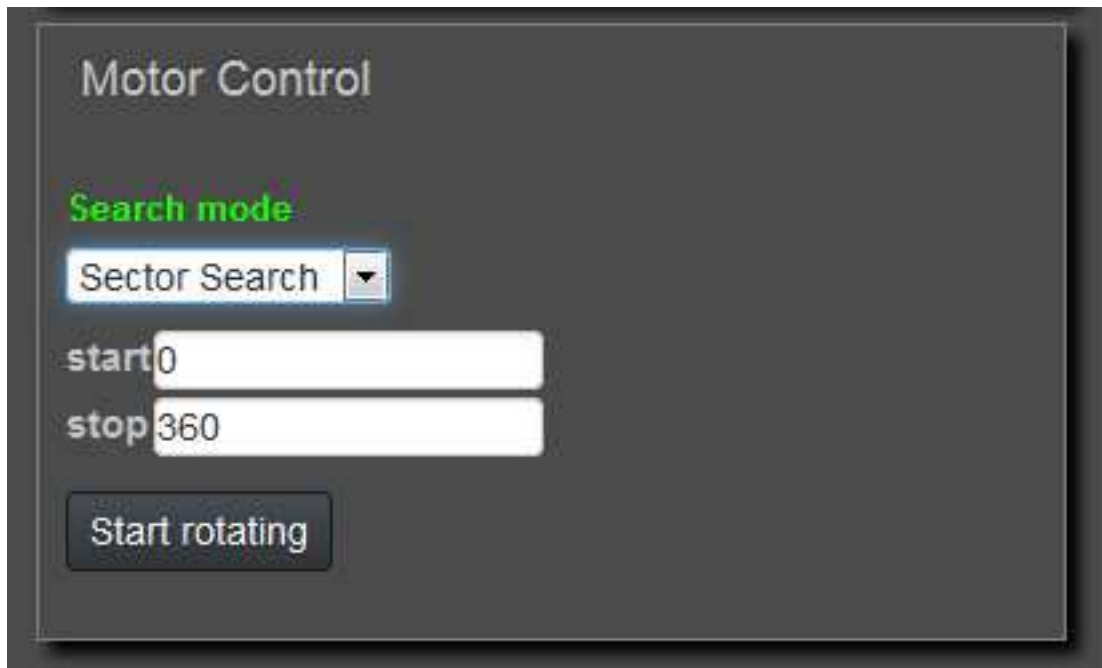
Motor control

Volume search

To start Volume Search first select "Volume Search" in the drop down menu "Search mode" if Sector Search is active. Then click the button "Start rotating". The button "Start rotating" will change into "Stop rotating". To stop the motor, click on Stop rotating.

Sector search

To start Sector search, click on the drop down menu and select Sector search. The Two text fields start and stop appears after the selection. You can enter there your start and stop azimuth to swivel between this two angles. The button "Start rotating" will change into "Stop rotating". To stop the motor, click on Stop rotating.

Video processor
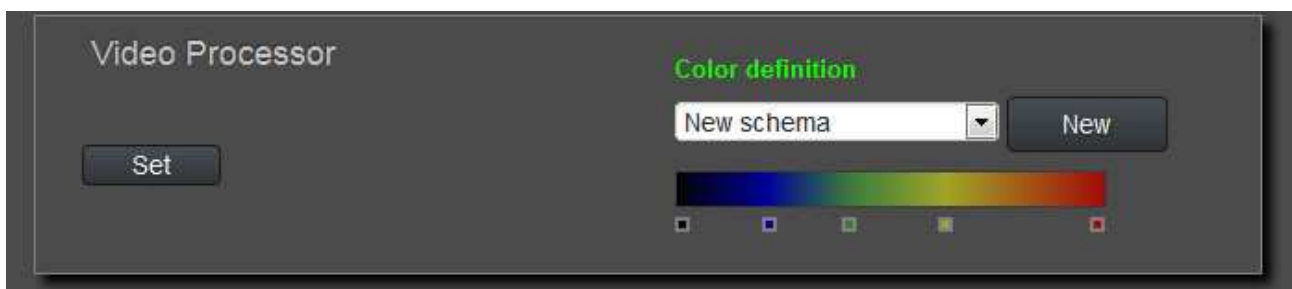
It is possible to set your own color definitions to use them in later the B-Scope and/or PPI-Scope. With the button New, you can create a new color defintion. A message box appears. You should enter a name for the new color schema. The old one will be copied to the new definition. On the color bar are squares. If you click on them, a box with the current color appears. To remove the color, click on the arrow down on the top left of the box. If you click on the color in the box, a color picker appears. There you can change the color for this position. To set a new color on a position, just click on the preferred position of the color bar. A new square will be added and you can chose the color for this position. To save the changes, click on the button "Set".
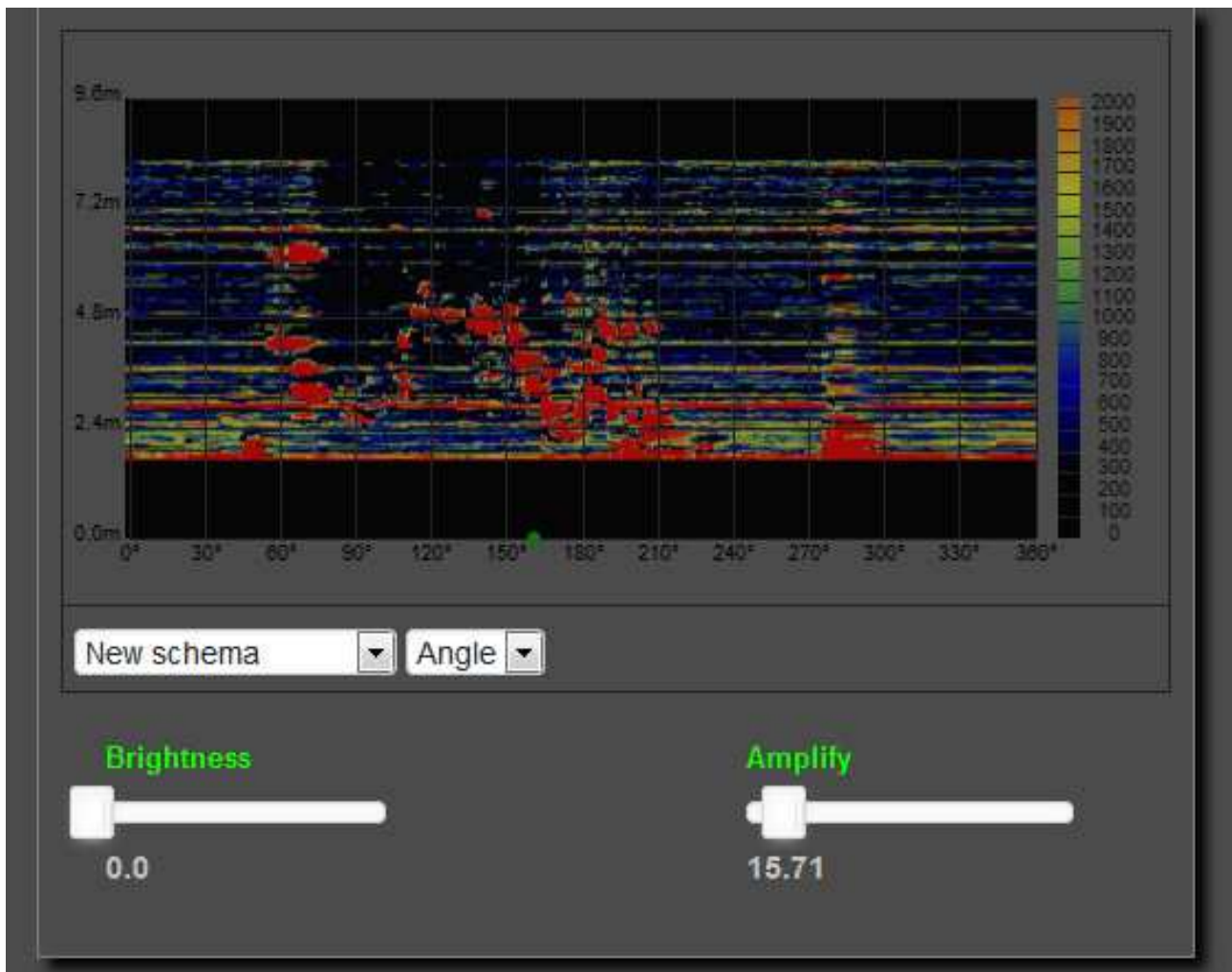
A-Scope
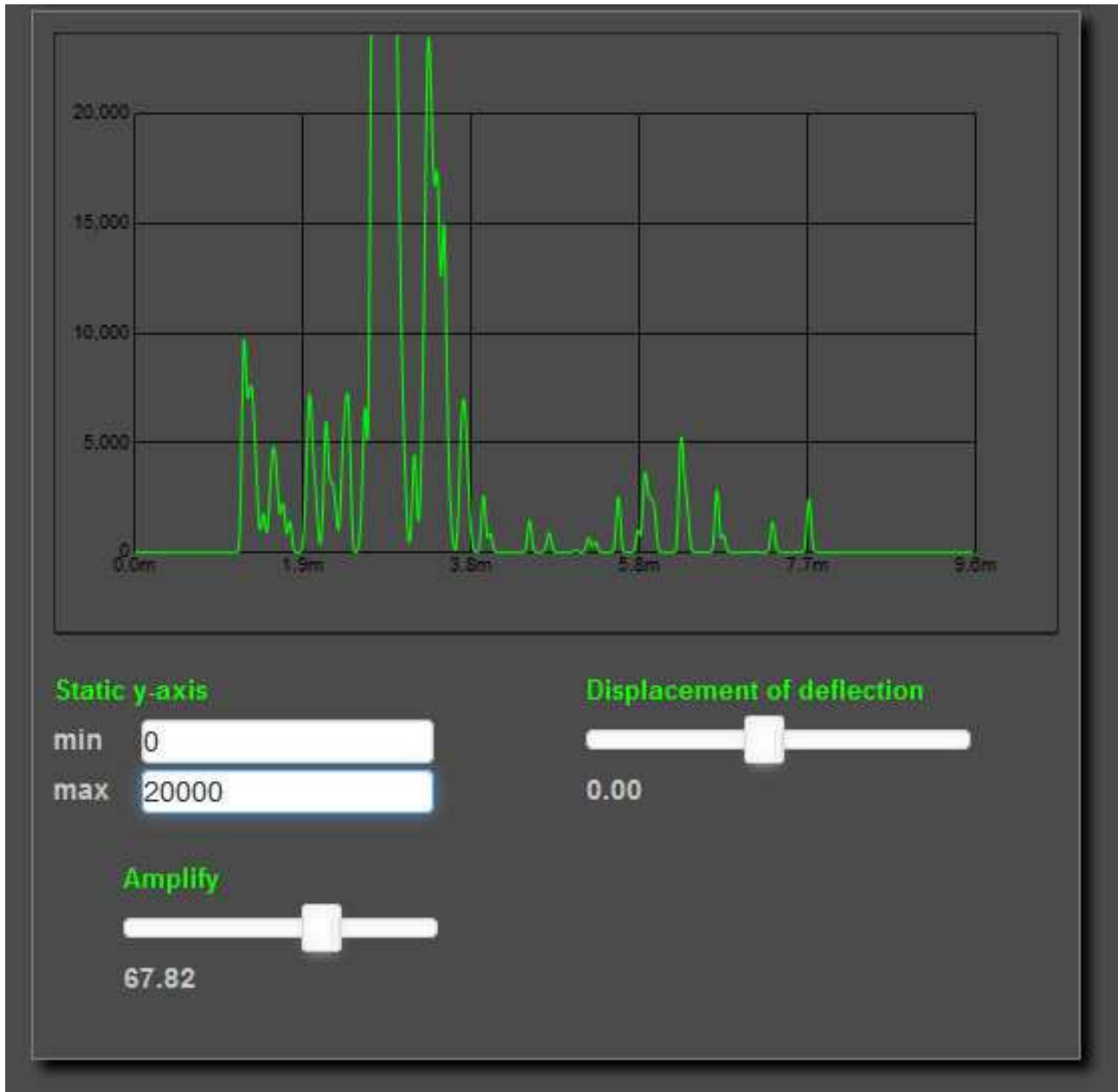
The A-Scope shows the signal in a graph. If you double click on this graph, this graph changes into fullscreen mode. Again a double click in full screen mode changes back into overview mode. On the x-axis are the current distances. The y-axis is the amplitude/magnitude.

- **Static y-axis**
  This allows you to change the zero point (min) and the upper limit (max) of the y-axis.

- **Dispalcement of deflection**
  Changes the position of the Graph in the scope to left or right.

- **Amplify**
  Changes only for the A-Scope the amplification

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B-Scope

To change the B-Scope into fullscreen mode, double click on the scope. A double click in fullscreen mode changes the FreeScopes Online Radar GUI back into overview mode. The B-Scope has two modes. The first mode is a time based x-axis to watch moving objects, when the system doesn't rotate. To get better results, you have to activate MTI mode. The other mode is "Angle". This shows the current angle on the x-axis. To change between this two modes, click on Time or Angle and choose the other mode. The drop down menu on the left side, selects the color scheme. There are a few predefined schemes, but also user defined color schemas can be selected. On the x-axis is the time or the current azimuth. The y-axis shows the distance. On the right side is the color gradient assigned to the values.

- **Amplify**
  Amplification, which affects only the B-Scope.

- **Brightness**
  Changes the brightness of the color definition.

PPI-Scope
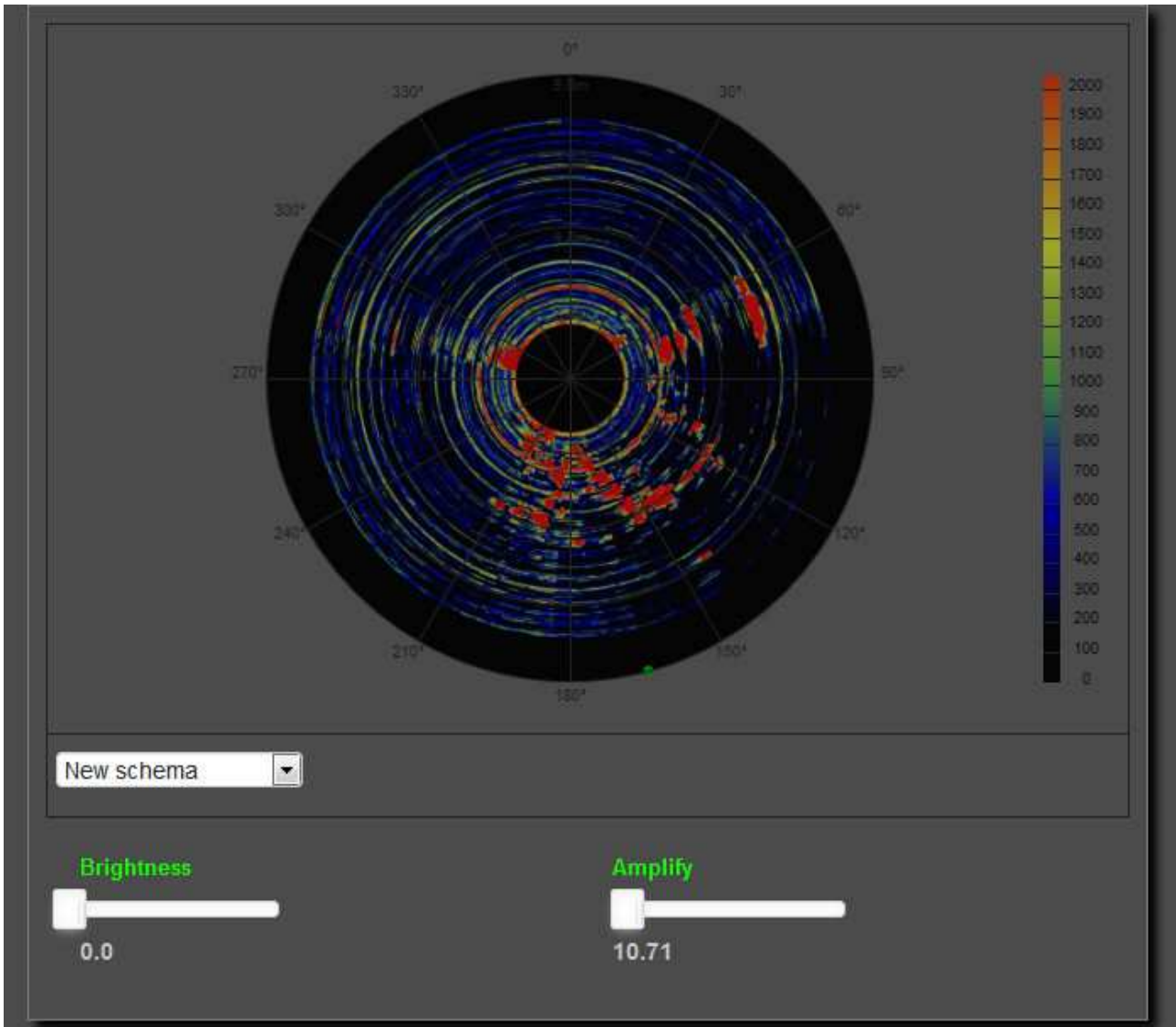
The PPI-Scope can be changed into fullscreen mode with double click on the scope. A double click in fullscreen mode changes the FreeScopes Online Radar GUI back into overview mode. On the x-axis is the time or the current azimuth. With the left drop down menu the color schema can be selected. On the right side the color bar shows the current color gradient assigned to the values.

- **Amplify**
  Amplification, which affects only the PPI-Scope.

- **Brightness**
  Changes the brightness of the color definition.