

Gungnir Dartstracker

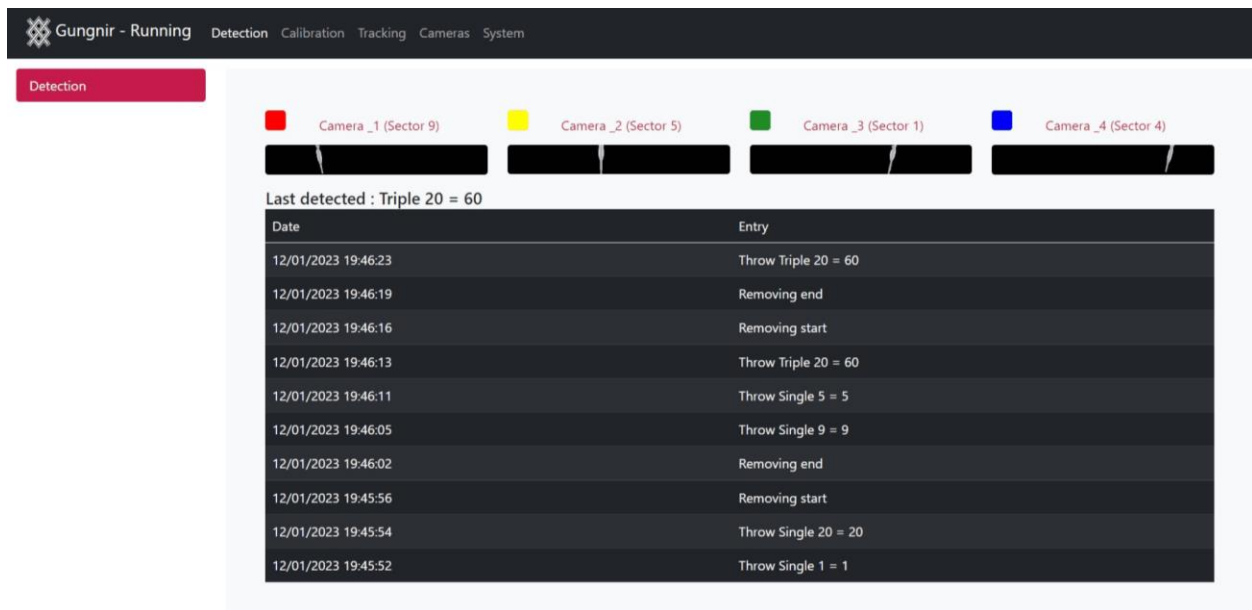
Manual V0.3

| | |
|--------------|---|
| General..... | 3 |
|--------------|---|

- Setup 3
 - Calibration 4
- System - General 5
- System - Network..... 6
- System - Backup 7
- System - API 7
 - System - Bluetooth 8
 - System - Board 9
- System - Detection..... 10
- System - Calibration..... 11
- System - Test 12
 - System - License 13
 - Cameras - General..... 13
 - Cameras - Specific 14
 - Cameras - Distortion..... 15
- Cameras - Post Process 18
- Tracking - Tracking 19
- Detection - Detection 19

General

The Gungnir Dartstracker is an automatic steeltip darts scoring system. After setup and calibration it will be able to detect darts in a range of 99.0 - 99.9% percent overall accuracy. Gungnir has 6 different modes: Setup, Calibration, System, Configuration, Tracking and Detection. The only mode which broadcasts detected throws is the Detection mode. It is also the default mode when the system is started.



| Date | Entry |
|---------------------|----------------------|
| 12/01/2023 19:46:23 | Throw Triple 20 = 60 |
| 12/01/2023 19:46:19 | Removing end |
| 12/01/2023 19:46:16 | Removing start |
| 12/01/2023 19:46:13 | Throw Triple 20 = 60 |
| 12/01/2023 19:46:11 | Throw Single 5 = 5 |
| 12/01/2023 19:46:05 | Throw Single 9 = 9 |
| 12/01/2023 19:46:02 | Removing end |
| 12/01/2023 19:45:56 | Removing start |
| 12/01/2023 19:45:54 | Throw Single 20 = 20 |
| 12/01/2023 19:45:52 | Throw Single 1 = 1 |

Setup

The setup screen takes you through the required steps configuring the system. To get to this screen you will have to get the system on your wifi. You can do this through the Dartstrainer app in the Settings..Gungnir Dartstracker...Network menu. Then you can use a browser to connect to the dartstracker by pointing it to the IP address of the dartstracker.

When connected go to the Setup menu to start configuring the dartstracker for the first time. First the hardware will be setup then the software will be calibrated. In step 1 you can upload a configuration file to use as a base configuration for the system. In the next steps the system will be setup and finally calibrated. Mind that calibration can be done best

through the dartstrainer app, it will show the precise position where to put the calibration darts.

The screenshot shows the 'Calibration' section of the Gungnir - Running application. The navigation bar includes 'Gungnir - Running', 'Detection', 'Calibration', 'Tracking', 'Cameras', 'System', and 'Setup'. A red 'Hardware' button is visible on the left. The main content area is titled 'Status :'. It contains a list of steps: 'Step 1 - Apply configuration' (with an upward arrow), 'Step 2 - Setup Camera 1 at Sector 9' (with a downward arrow), 'Setup the camera [here](#)', 'Step 3 - Setup Camera 2 at Sector 4' (with a downward arrow), 'Step 4 - Setup Camera 3 at Sector 1' (with a downward arrow), 'Step 5 - Setup Camera 4 at Sector 5' (with a downward arrow), 'Step 6 - Camera Height Calibration' (with a downward arrow), and 'Step 7 - Complete Calibration' (with a downward arrow).

Calibration

There are 5 calibration routines to help setting up the system. The complete, camera height, detection area, board and sector calibration. Below a description of each of these routines.

The screenshot shows the 'Complete Calibration' section of the Gungnir - Running application. The navigation bar is the same as in the previous screenshot. A red 'Complete' button is highlighted in the left sidebar. The main content area is titled 'Complete Calibration'. It contains the text: 'The Complete calibration will run all calibration routines one after the other and resets all specific sector calibrations.' Below this text is a red 'Start' button. At the bottom, it says 'Calibration status :'. The sidebar also lists other calibration routines: 'Camera Height', 'Detection Area', 'Fast', 'Board', and 'Sector'.

Complete. The complete calibration executes the camera height, detection area and board calibrations in order while resetting the values found by the Sector calibration.

Fast. The fast calibration executes a special version of the detection area and center calibration to finetune the found calibrations with the regular calibration routines. It is meant to be executed after the dartstracker has been off for a while.

Camera Height. The camera height calibration checks if the position of the cameras relative to the board is ok.

Detection Area. The detection area calibration calibrates the settings in the camera specific pages. Like the ROI and board center. If for some reason these calibrations keep failing or give wrong results, the steps of this calibration can be enabled/disabled in the System...Calibration page. You can also configure these values manually for each camera.

Board. The board calibration finds the default distances of the triples, doubles and singles for your board. The found values can be overridden per sector by the Sector calibration.

Sector. The sector calibration calibrates the distances of the triple, double and single for a specific sector. Due to lens distortion or other factors these settings can be of for specific sectors, causing wrong detections at the wire. The distances found by this calibration will overrule the default board settings found with the board calibration. **When 'Process corrections from client' is enabled in the System..Detection page, these settings are automatically adjusted with every correction.**

System - General

The general screen shows information about the current version and current temperature of the system. A log is shown of the most recent events. It also contains a few buttons described below.

Gungnir - Running Detection Calibration Tracking Cameras System Setup

General

Bluetooth

API

Network

Backup

Detection

Board

Calibration

Test

License

Gungnir Dartstracker Version 1.0.9083.31160 - Core Temp 49.1°C .

Start Stop Refresh Log Full Log Diagnostics Unlink Shutdown Reboot Update

| Date | Entry |
|---------------------|---|
| 17/11/2024 10:02:27 | Switching to mode System |
| 17/11/2024 09:59:33 | Switching to mode Calibration |
| 17/11/2024 09:27:31 | Empty board detected |
| 17/11/2024 09:27:31 | Removal end |
| 17/11/2024 09:27:30 | Removal start |
| 17/11/2024 09:27:30 | Waiting for empty board |
| 17/11/2024 09:27:30 | No active license for websocket or websocket disabled |
| 17/11/2024 09:27:30 | Starting detection websocket |
| 17/11/2024 09:27:30 | Gungnir Dartstracker V2 - 1.0.9083.31160 started |
| 17/11/2024 09:27:29 | Cam _2 reset roi. |

Start & Stop. With the Stop and Start buttons the dartstracker can be stopped and started if it is stuck in an error state.

Refresh Log. Refreshes the log shown on the screen.

Full Log. Downloads the log to your machine. This log contains more details than shown on the screen.

Diagnostics. Download a PDF with the current state of the system.

Unlink. If one or more Gungnirdarts apps are linked to the dartstracker and the password to link/unlink is forgotten. You can use this button to reset the password and unlink all Apps.

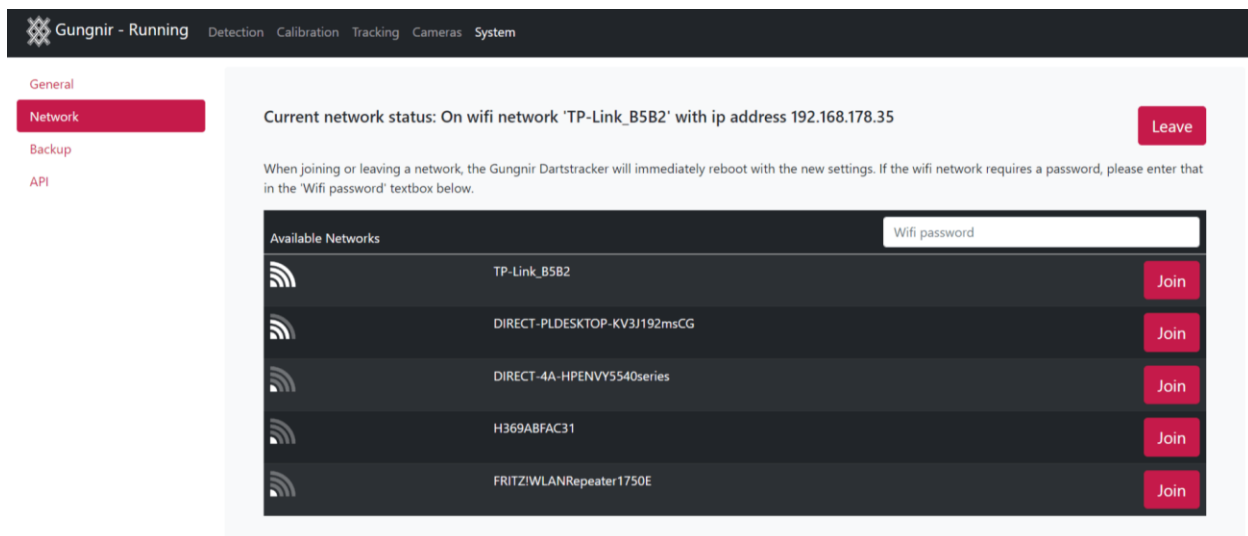
Shutdown. Shuts the tracker down.

Reboot. The Reboot button reboots the whole Raspberry Pi.

Update. The Update button downloads the latest version of the Dartstracker and installs it after which the system is rebooted. This won't affect your configuration. This only works on early images which have the Readonly FS disabled. To make the Update button work, login to the pi and use raspi-config to disable it.

System - Network

The network screen shows the current network state and the available wifi networks to connect to. It is also shown when connected to a wired network. Mind that if you leave a wifi network you will have to join a wifi network again with the app via bluetooth or using LAN (wired network).



The screenshot shows the 'Network' settings page in the Gungnir application. The top navigation bar includes 'Gungnir - Running' and several menu items: 'Detection', 'Calibration', 'Tracking', 'Cameras', and 'System'. On the left, a sidebar lists 'General', 'Network' (highlighted in red), 'Backup', and 'API'. The main content area displays the current network status: 'On wifi network 'TP-Link_B5B2' with ip address 192.168.178.35'. A red 'Leave' button is visible. Below this, a note states: 'When joining or leaving a network, the Gungnir Dartstracker will immediately reboot with the new settings. If the wifi network requires a password, please enter that in the 'Wifi password' textbox below.' A table titled 'Available Networks' lists five networks with their respective SSIDs and a 'Join' button for each. A 'Wifi password' input field is located at the top right of the table.

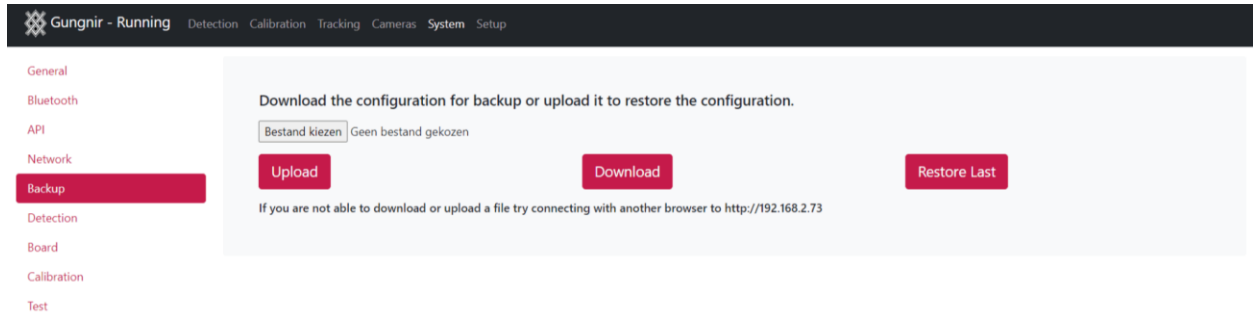
| Available Networks | Wifi password |
|------------------------------|---------------|
| TP-Link_B5B2 | |
| DIRECT-PLDESKTOP-KV31192msCG | |
| DIRECT-4A-HPENVY5540series | |
| H369ABFAC31 | |
| FRITZIWLANRepeater1750E | |

Leave. Leave the current wifi network.

Join. Join the wifi network.

System - Backup

This screen gives the options to download and upload configuration files for backup and restore purposes.



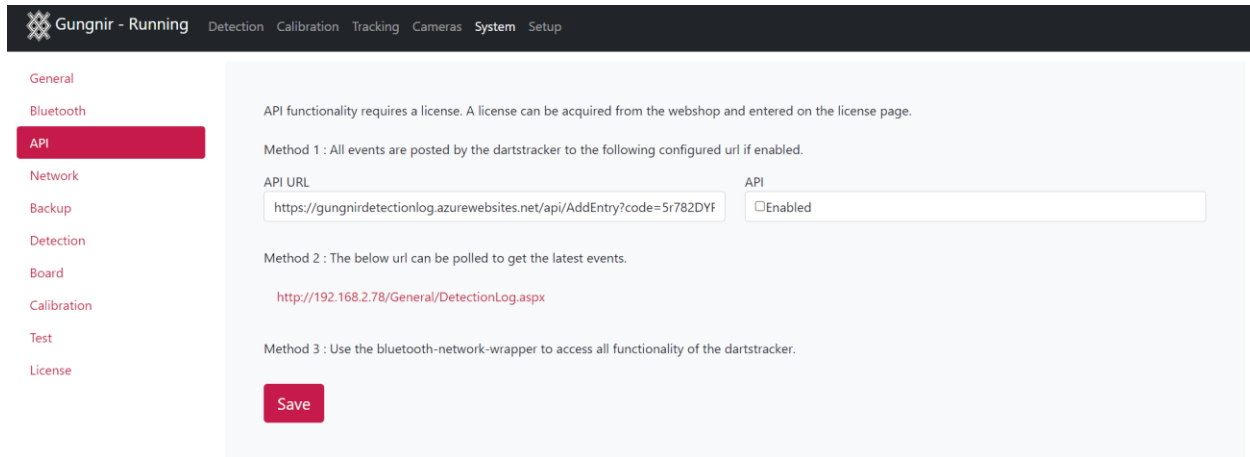
Upload. Upload a json formatted configuration file.

Download. Download the current configuration in the form of a json formatted configuration file.

Restore Last. Restore the last configuration before the current.

System - API

To unlock the API for integration in third party client applications a license is required (see System - License). Contact support@gungnirdarts.com for more information. This screen defines the methods to retrieve the dartboard events.



System - Bluetooth

In this screen the devicename that is broadcasted through bluetooth is shown. The devicename is tied to the Raspberry Pi it's running on. Based on this name a QR-Code is generated which can be printed and put on the dartstracker. The QR-Code has the following functions:

- When a user doesn't have the Gungnirdarts app installed on their phone, the user is directed to the playstore page for download. After installing the app, it will open and connect directly to the dartstracker.
- When a user has the app installed and scans the QR-Code the app will open and connect directly to the dartstracker.
- When a user has the app installed and started. Pressing the scan button will open the camera and after scanning the app will connect directly to the dartstracker.

Mind that this is especially handy when multiple dartstrackers are placed next to each other. The 'Search' option in the Gungnirdarts app connects to the first one available. The 'Scan' option connects exactly to the dartstracker scanned with the QR-Code.


Gungnir - Running Detection Calibration Tracking Cameras System Setup

General
Bluetooth
 API
 Network
 Backup
 Detection
 Board
 Calibration
 Test
 License

Mind that the broadcasted name will be Gungnir-[DEVICENAME]. Print the QR-Code and stick it to the darttracker. Scanning the QR-code will force a connection to this darttracker. When someone doesn't have the darttrainer installed, scanning the qrcode will lead them to the playstore for download. Otherwise the darttrainer app will open and search for the darttracker automatically. It's also possible to scan the qr-code from within the darttrainer app with the Scan option.

Device Name

QR-Code



[Download](#)

System - Board

In the board configuration screen you can enter the dimensions of the triple double and bull regions of the board. Some people use training boards which have dimensions that differ a bit from standard boards. These can be adjusted here. If the calibration step 'Calibrate board dimensions' is enabled these can't be changed manually.

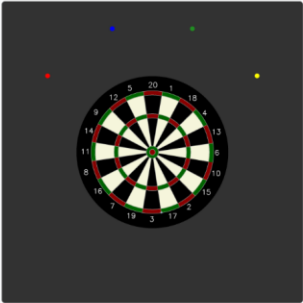
Gungnir - Running Detection Calibration Tracking Cameras System Setup

General
 Bluetooth
 API
 Network
 Backup
 Detection
Board
 Calibration
 Test
 License

These are the default values found by the board calibration routine. Mind that these values are overruled for a sector by values found by the sector calibration routine or corrections from the darttrainer app.

| | |
|---|---|
| Double Bull Radius (mm) - Default 7 <input type="text" value="8.20"/> | Single Bull Radius (mm) - Default 17 <input type="text" value="17.57"/> |
| Triple radius start (mm) - Default 97 <input type="text" value="96.89"/> | Triple radius end (mm) - Default 107 <input type="text" value="108.78"/> |
| Double radius start (mm) - Default 159 <input type="text" value="161.95"/> | Double radius end (mm) - Default 169 <input type="text" value="173.53"/> |
| Distance to wire (mm) <input type="text" value="1.00"/> | Board Rotation (radian) <input type="text" value="0.00872664625997165"/> |

[Save](#)



Double Bull Radius. The radius of the double bull in mm measured from the center of the board. Default is 7 mm.

Single Bull Radius. The radius of the single bull in mm measured from the center of the board. Default is 17 mm. (so single bull default has radius of $17 - 7 = 10$ mm = 1 cm)

Triple radius start. The radius of the start of the triple in mm measured from the center of

the board. Default is 97 mm.

Triple radius end. The radius of the end of the triple in mm measured from the center of the board. Default is 107 mm. (so the triple default has a radius of $107-97=10$ mm=1 cm)

Double radius start. The radius of the start of the double in mm measured from the center of the board. Default is 159mm.

Double radius end. The radius of the end of the double in mm measured from the center of the board. Default is 169mm. (so the double default has a radius of $169-159=10$ mm=1 cm)

Distance to wire (mm). The average distance of a dart point to the wire when a dart is placed exactly against a wire. This is used when calibrating the board settings.

Board rotation (radian). The current boardrotation in radians. When corrections from the client are processed, this value is changed according to the corrections.

System - Detection

The detection settings are used for determining where there is a dart in the image or when darts are extracted from the board. These settings are dependent on the used camera resolution. If the camera resolution is not default, these probably should be changed proportionally.

| Minimal contour arc | Maximal contour arc | Minimal contour area | Maximal contour area | Minimal contour width | Maximal contour width |
|-------------------------------|-------------------------------|------------------------------|------------------------|-----------------------|-----------------------|
| 100 | 450 | 350 | 5000 | 6 | 100 |
| Grab loop delay fastmode (ms) | Grab loop delay slowmode (ms) | Ray intersections range (mm) | Stable background (ms) | | |
| 1 | 200 | 2.00 | 500 | | |
| Detection loop delay (ms) | Pre detection delay (ms) | Post detection delay (ms) | Max parallel cams | | |
| 1 | 200 | 1 | 4 | | |

Save

Minimal contour arc. The minimal contour arc in the image to be seen as a dart. (When the camera resolution has changed this probably also has to be adjusted).

Maximal contour arc. The maximal contour arc in the image to be seen as a dart. (When the camera resolution has changed this probably also has to be adjusted).

Minimal contour area. The minimal contour area in the image to be seen as a dart. (When the camera resolution has changed this probably also has to be adjusted).

Maximal contour area. The maximal contour area in the image to be seen as a dart.

(When the camera resolution has changed this probably also has to be adjusted).

Minimal contour width. The minimal contour width in the image to be seen as a dart. Default 15. (When the camera resolution has changed this probably also has to be adjusted).

Maximal contour width. The maximal contour arc in the image to be seen as a dart. (When the camera resolution has changed this probably also has to be adjusted).

Grab loop delay slowmode. Delay in ms waiting for the first dart.

Grab loop delay fastmode. Delay in ms when waiting for more darts.

Detection loop delay. General detection loop delay.

Pre detection delay. Waiting time after the first contour of a dart is detected.

Post detection delay. Waiting time after a dart is detected to get a stable image for the next dart.

Removal detection delay. Waiting time before processing after removal is detected.

Ray intersections range (mm). The maximum distance to a cluster of ray intersections that is seen as one cluster.

Stable Background (ms). The number of milliseconds before an object or distortion is added to the background image.

Max parallel cams. The maximum number of parallel threads processing the streams from the camera.

System - Calibration

The System...Calibration menu gives the option to disable calibration steps in the wizard if they don't give the right results. You should set the values manually then.

The screenshot shows the 'Calibration' settings page in the Gungnir - Running application. The page has a dark header with the application name and navigation links: Detection, Calibration, Tracking, Cameras, System, and Setup. On the left, a sidebar lists various settings categories: General, Bluetooth, API, Network, Backup, Detection, Board, Calibration (highlighted in red), Test, and License. The main content area is titled 'Enable the calibration steps that should be executed within the Detection Area calibration.' and contains four checkboxes: 'Calibrate Camera Rotation (Method 1)' (unchecked), 'Calibrate Camera Rotation (Method 2)' (checked), 'Calibrate Camera ROI' (checked), and 'Calibrate Camera Center' (checked). Below these is a section for 'Process corrections from client' with an 'Enabled' checkbox checked. A red 'Save' button is located at the bottom of the settings area.

Calibrate Camera Rotation. Finds the 'Rotation' value of the "Cameras - Specific" configuration screen.

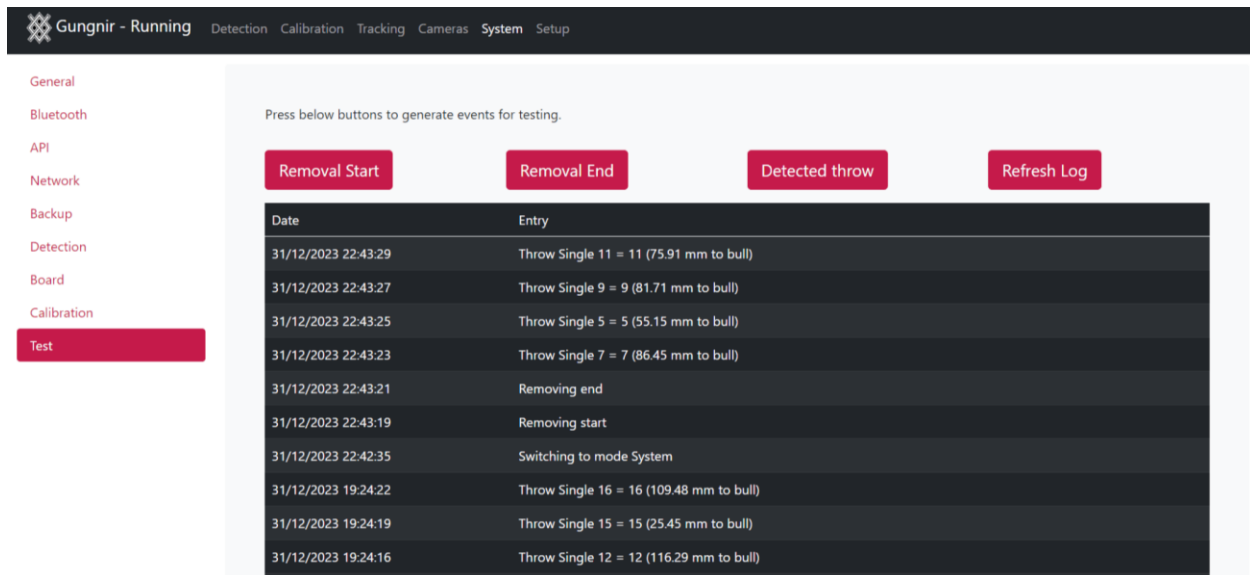
Calibrate Camera ROI. Finds the 'ROI Height' value of the "Cameras - Specific" configuration screen.

Calibrate Camera Center. Finds the 'Surface Center' value of the "Cameras - Specific" configuration screen

Process corrections from client. Should corrections from the client be used as reinforcement learning data to adjust the sector specific calibration automatically.

System - Test

The System...Testmenu gives the option to generate the events the dartstracker generates manually for testing API interfaces.



The screenshot shows the 'Gungnir - Running' interface with a navigation menu on the left and a main content area. The 'Test' menu item is highlighted in red. The main content area contains four red buttons: 'Removal Start', 'Removal End', 'Detected throw', and 'Refresh Log'. Below these buttons is a table with two columns: 'Date' and 'Entry'. The table contains 12 rows of log entries, including 'Throw Single 11 = 11 (75.91 mm to bull)', 'Removing end', and 'Switching to mode System'.

| Date | Entry |
|---------------------|--|
| 31/12/2023 22:43:29 | Throw Single 11 = 11 (75.91 mm to bull) |
| 31/12/2023 22:43:27 | Throw Single 9 = 9 (81.71 mm to bull) |
| 31/12/2023 22:43:25 | Throw Single 5 = 5 (55.15 mm to bull) |
| 31/12/2023 22:43:23 | Throw Single 7 = 7 (86.45 mm to bull) |
| 31/12/2023 22:43:21 | Removing end |
| 31/12/2023 22:43:19 | Removing start |
| 31/12/2023 22:42:35 | Switching to mode System |
| 31/12/2023 19:24:22 | Throw Single 16 = 16 (109.48 mm to bull) |
| 31/12/2023 19:24:19 | Throw Single 15 = 15 (25.45 mm to bull) |
| 31/12/2023 19:24:16 | Throw Single 12 = 12 (116.29 mm to bull) |

Removal Start. Generates the removal start event.

Removal End. Generates the removal end event.

Detected throw. Generates a random detected throw event.

Refresh Log. Refreshes the log shown on the page.

System - License

To unlock the API for integration in third party client applications a license is required. Contact support@gungnirdarts.com for more information.

The screenshot shows the 'License' section of the Gungnir - Running System Setup interface. The left sidebar contains navigation options: General, Bluetooth, API, Network, Backup, Detection, Board, Calibration, Test, and License (highlighted). The main content area includes a message: 'For commercial api usage of the dartstracker request a license from the [Gungnirdarts](#) webshop with the license key below.' Below this, there are two text boxes: 'Key' containing 'd86222b374ad234cd566fe7c7cdef16c5d696698d4ef6ccd714701c4fedb013' and 'License' containing a long alphanumeric string. A 'Download Key' button is positioned below the key field. Below the license field, there is a 'Status' section with 'License valid : True' and 'Expiration 17/03/2025 15:46:18'. A 'Save' button is at the bottom.

Cameras - General

In the general screen some camera configuration parameters are configured that count for all the configured camera's.

The screenshot shows the 'Cameras - General' section of the Gungnir - Running System Setup interface. The left sidebar contains navigation options: General, Camera 1, Camera 2, Camera 3, and Camera 4. The main content area is divided into four columns for Camera 1, Camera 2, Camera 3, and Camera 4. Each column has a dropdown menu for camera selection (e.g., '2 : USB HD Camera: USB HD Camer', '6 : USB HD Camera: USB HD Camer', '4 : USB HD Camera: USB HD Camer', '0 : USB HD Camera: USB HD Camer') and an 'Enabled' checkbox (all are checked). Below these are shared configuration fields: 'Resolution width (px)' (1280), 'Resolution height (px)' (720), 'Processing zoomfactor' (1.40), 'FPS' (15), 'FOV Angle' (65.00), and 'Focus Threshold' (12). At the bottom, there are 'Save & Reset Cameras' and 'Refresh' buttons.

Camera 1-4. A dropdown from which the camera's to use by the system can be selected. The defaults are 0,2,4 and 6.

Enabled 1-4. Enable/Disable the camera for processing.

Resolution width/height

The resolution of the videostreams used by all camera's specified in pixels. The default is

1280 x 720 pixels. A higher resolution tends to stress the RPI too much, so be cautious using higher resolutions.

Processing zoomfactor

If running the camera's on a high resolution this factor is used to reduce the image size with the given factor to reduce the image processing load. The system is tuned for processing images of 1280 width. So make sure the horizontal camresolution * zoomfactor = 1280.

FOV Angle - Horizontal Field Of View

The horizontal field of view of the camera's as defined by the manufacturer specified in degrees. The default camera's have a FOV of about 65.5 degrees.

Focus Threshold

The minimum value of the algorithm which determines if the camera view is out of focus. Below this value the camera is out of focus, equal or above the camera is in focus.

Cameras - Specific

This screen shows a live view of the camera, which can be used to align the camera with the side of the board. Some settings are for the specified camera only, a few are shared with the other camera's.

The screenshot displays the 'Gungnir - Running' interface with a navigation menu on the left containing 'General', 'Camera 1', 'Camera 2', 'Camera 3', and 'Camera 4'. The main area is divided into two sections: settings and a live preview.

Settings Section:

- Specific:** Flip Vertical (checked), Sector offset in degrees from center (-9.0 - 9.0) (-6.03), Distance (cm) (22.0 - 100.0) (37.00), ROI Height (137).
- Distortion:** Setup sector (9), Surface center (640), Rotation (-10.0 to 10.0) (-0.60), Board Surface (344).
- Color:** (Empty)
- Postprocess:** (Empty)

Live Preview Section:

- Camera_1 (1280x720) Preview Quality
- Three stacked frames showing a top-down view of a dartboard.
- Status: No dart found. In Focus : True (55-12)

A 'Save' button is located at the bottom left of the settings area.

Flip Vertical. Flip the image 180 degrees. In case the camera is upside down.

Setup Sector. The sector where the camera is placed.

Sector Offset. If there was a construction error so the camera is not exactly in the middle of the sector, or the build just has a default offset, you can specify it here. Use values ranging from -9.0 to 9.0 degrees.

Distance. The distance of the front of the camera to the bull. Mind that although it is specified in cm it is very important to specify this in 1 decimal behind the comma. (So in mm).

Rotation. The rotation of the camera relative to the dartboard in degrees. To manually change this field disable the 'Calibrate Rotation' step in Calibration Settings.

ROI Height. The height of the ROI. To manually change this field disable the 'Calibrate ROI' step in Calibration Settings.

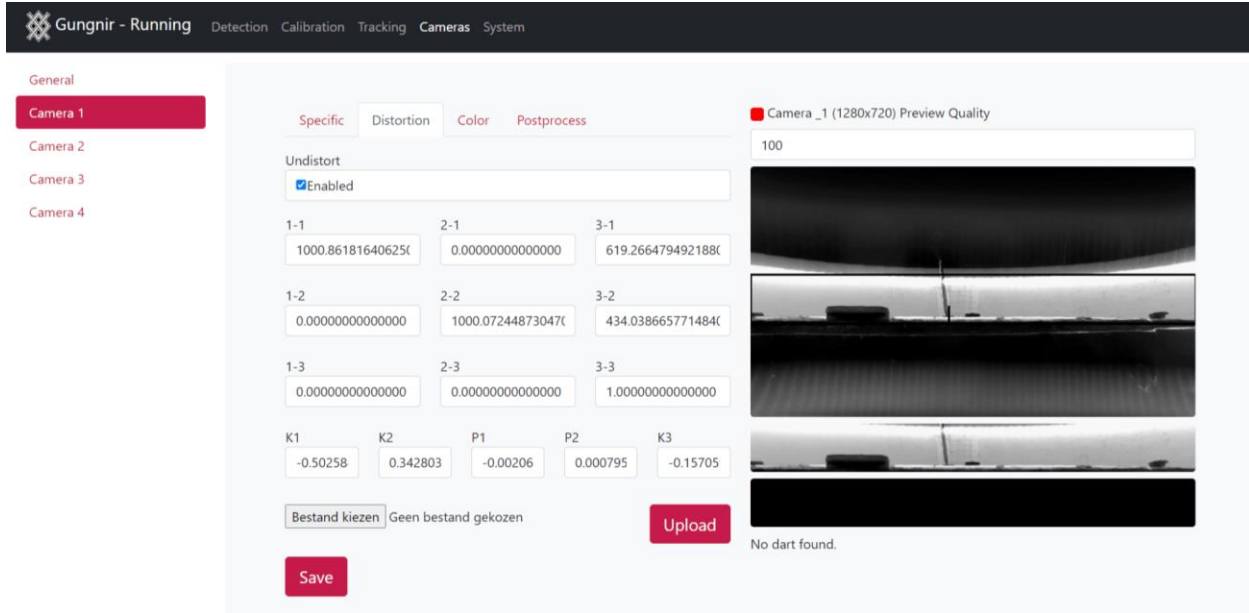
Board Surface. The Y value of the box for checking darts it should be equal to the edge of the board. (Where the darts enter the board). To manually change this field disable the 'Calibrate Board Surface' step in Calibration Settings.

Surface center. The horizontal position of the bull's eye on the Surface vertical position line. This field is disabled for manual configuration if it's part of the calibration wizard steps. To manually change this field disable the 'Calibrate Center' step in Calibration Settings.

Below the image is shown if the camera is determined to be in or out of focus. The value 55 in this case is the value determined by the algorithm, the value 12 is the threshold value. This is set in the Cameras..General settings.

Cameras - Distortion

If your using cameras with fisheye lenses or other cameras with lens distortion you need to find the camera calibration parameters first. With a camera calibration tool you can find these parameters and then enter them manually in this screen or upload a file that contains them. A calibration tool and a description of the calibration routine can be found [here](#).



Enabled. Enable distortion correction for this camera. Default enabled.

1-1 3-3: The intrinsic camera calibration matrix

K1,K2,P1,P2, K3: Lens distortion parameters.

Upload: Upload a calibration file in the following format =>

```
{
  "CameraParameters": {
    "name": "Camera",
    "id": 0,
    "type": 0,
    "resolution": {
      "width": 1280,
      "height": 720
    },
  },
  "intrinsic": [
    1027.5303955078125,
    0.0,
    685.58251953125,
    0.0,
    1027.0186767578125,
    385.26263427734375,
    0.0,
```



```

0.0,
1.0
],
"distortion": [
-0.5185481905937195,
0.32503053545951843,
0.0025660181418061256,
0.0016927189426496625,
-0.1125984713435173
]]
}

```

Cameras - Color

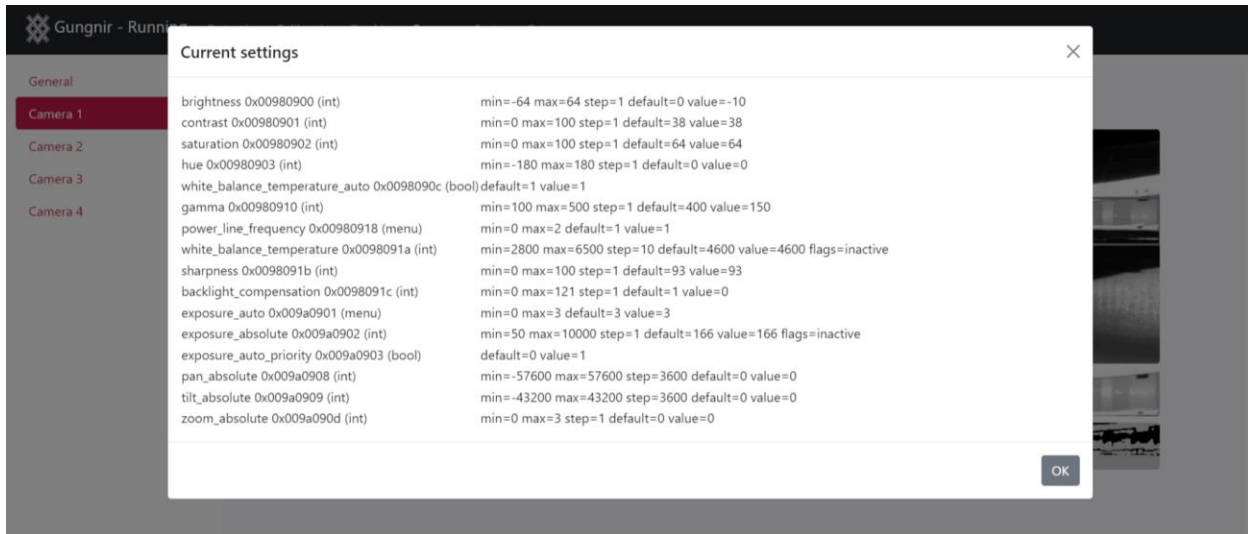
In this tab the camera settings can be changed. Usually it's used for changing color settings, but if your camera has other specific settings these can be changed here probably too.

The screenshot shows the Gungnir - Running web interface. The top navigation bar includes 'Gungnir - Running', 'Detection', 'Calibration', 'Tracking', 'Cameras', and 'System'. The left sidebar has 'General' selected, and 'Camera 1' is highlighted. The main content area has tabs for 'Specific', 'Distortion', 'Color', and 'Postprocess'. The 'Color' tab is active, showing a text input field for V4l2 configuration commands. The current command is:


```
--set-ctrl=brightness=0 --set-ctrl=contrast=38 --set-ctrl=saturation=64 --set-ctrl=hue=0 --set-ctrl=gamma=400 --set-ctrl=power_line_frequency=1 --set-ctrl=white_balance_temperature_auto=4600 --set-ctrl=sharpness=93 --set-ctrl=backlight_compensation=1 --set-ctrl=exposure_auto=3 --
```

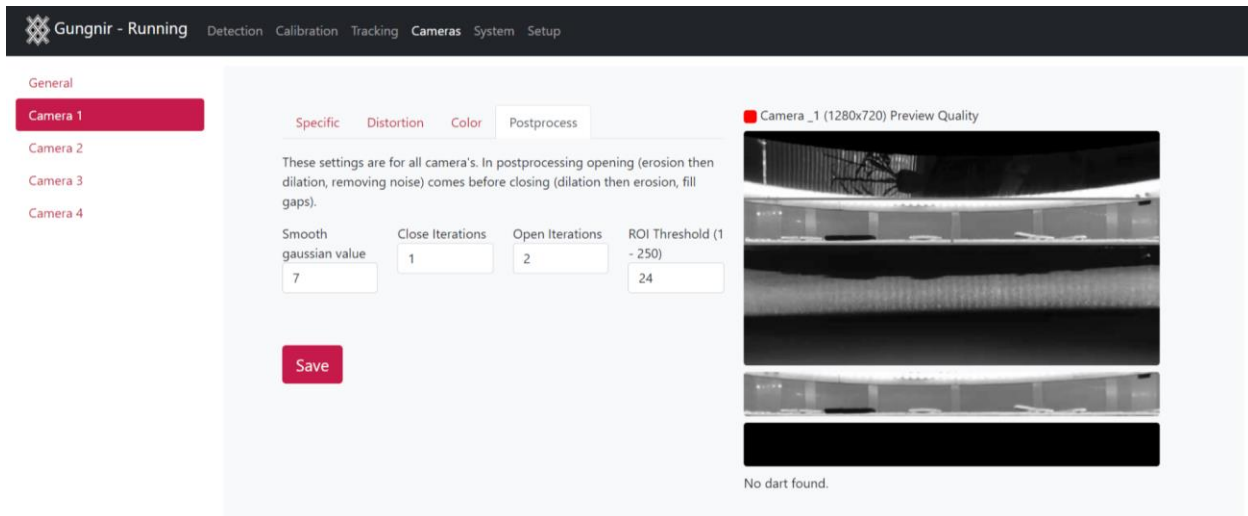
 Below the input field are 'Save' and 'Show Current Settings' buttons. To the right is a video preview window titled 'Camera_1 (1280x720) Preview Quality' showing a camera feed of a boat on water. The video player has a volume control set to 100 and a timestamp 'Arc:314 Area:2494 Width:27'.

Clicking the "Show Current Setting" button shows a dialog with the current v4l2 information for this camera. The camera defaults can also be found here if you want to change the settings back to default.



Cameras - Post Process

These settings adjust some values for postprocessing the image before it goes through the detection loop.



Smooth gaussian value. Blurs the image so the most prominent contours stay visible. Default value is 7.

Close Iterations. Morphological operation used for removing gaps in contours. (For example the grip structures on the dart shaft). The value specifies the nr of iterations. Default is 1.

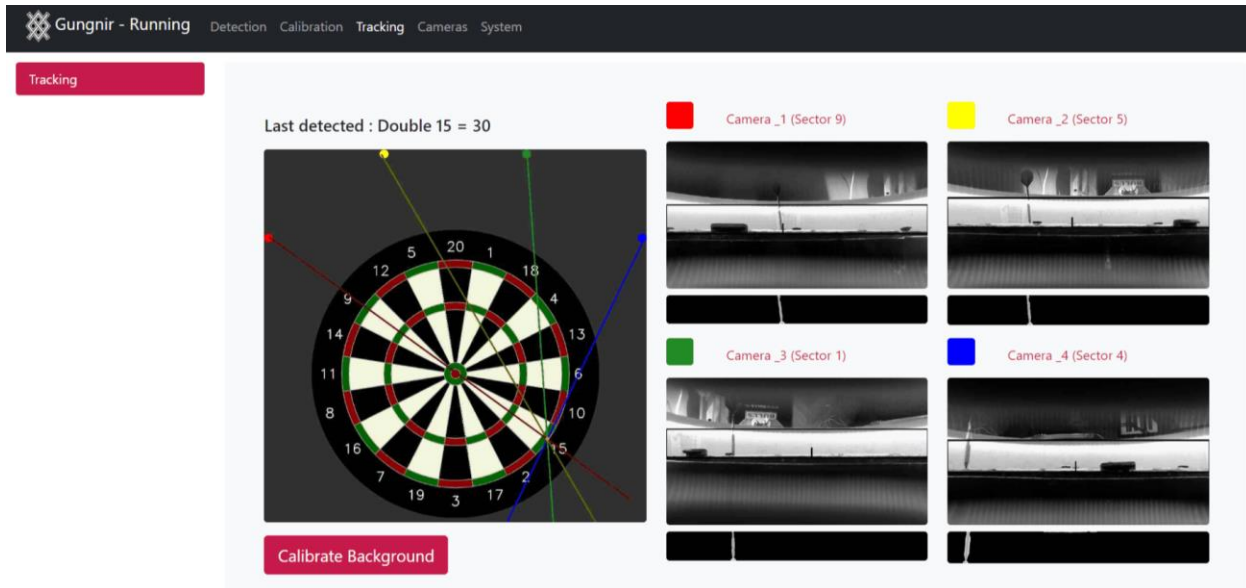
Open Iterations. Morphological operation used for removing small particles of dust from the image. Default is 2.

ROI Threshold. The threshold level at which the dart is separated from the background. Default

value is about 23.

Tracking - Tracking

This screen shows the live camera feeds of the configured camera's and the detected position of 1 dart on the board. Mind this is a memory heavy process. If the ROI's of the cameras are not completely black when no dart is in the board. Press the 'Calibrate Background' button to reset it.



Detection - Detection

The detection screen shows information about the default runmode of the system. It shows a log of the last events and also the resulting images it was based on. A gray line is drawn through the last detected darts. Mind that this page refreshes every second and doesn't reflect the true speed of darts detecting, which is much faster communicated via bluetooth.

Detection

Camera_1 (Sector 9) Camera_2 (Sector 5) Camera_3 (Sector 1) Camera_4 (Sector 4)

Last detected : Triple 20 = 60

| Date | Entry |
|---------------------|----------------------|
| 12/01/2023 19:46:23 | Throw Triple 20 = 60 |
| 12/01/2023 19:46:19 | Removing end |
| 12/01/2023 19:46:16 | Removing start |
| 12/01/2023 19:46:13 | Throw Triple 20 = 60 |
| 12/01/2023 19:46:11 | Throw Single 5 = 5 |
| 12/01/2023 19:46:05 | Throw Single 9 = 9 |
| 12/01/2023 19:46:02 | Removing end |
| 12/01/2023 19:45:56 | Removing start |
| 12/01/2023 19:45:54 | Throw Single 20 = 20 |
| 12/01/2023 19:45:52 | Throw Single 1 = 1 |