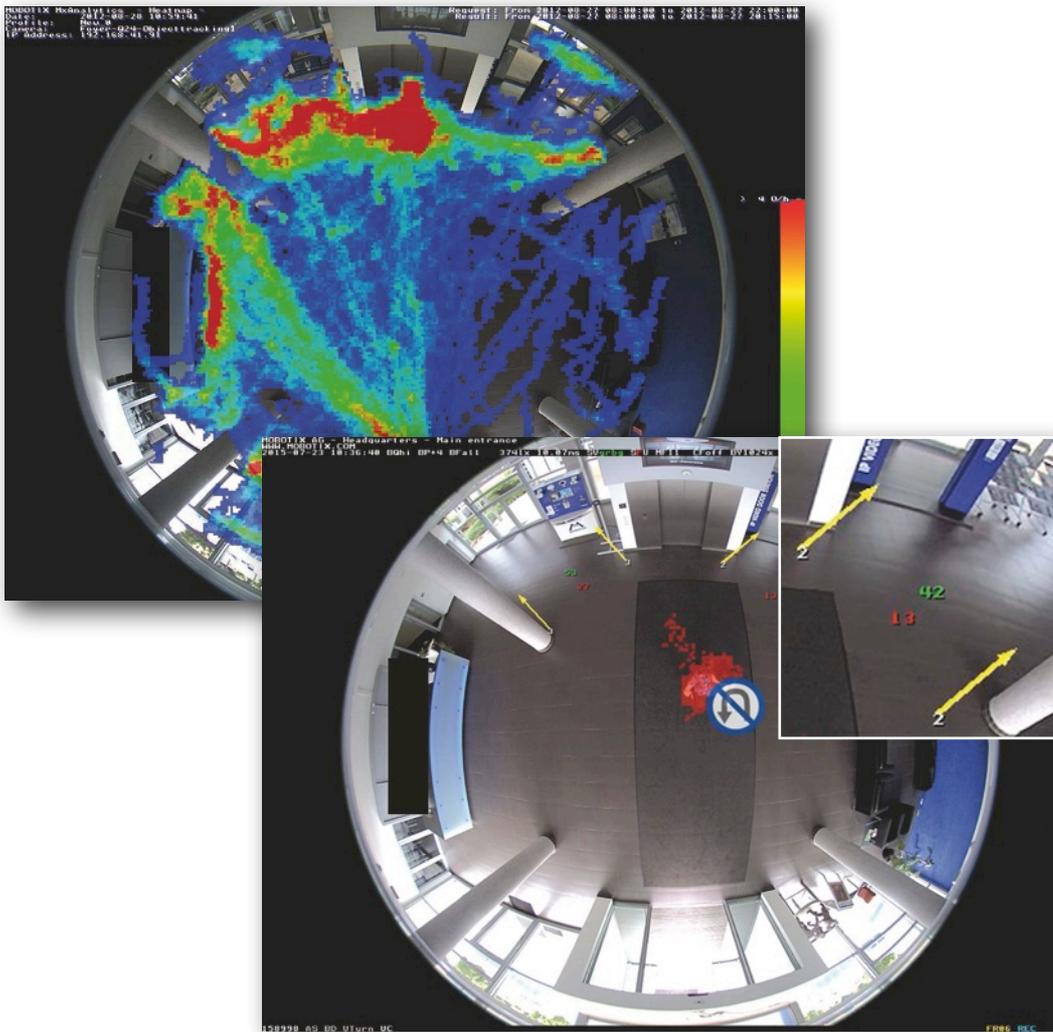# COMPACT GUIDE

Basic Information And Useful Practical Tips For The Optimal Use Of MxAnalytics With 5MP/6MP-Cameras

Camera-Integrated Video Analysis & Behavioral Detection

Content   Page

Compact Guide: MxAnalytics

1. MxAnalytics: Camera-Integrated Video Analysis With MOBOTIX Single Lens Cameras

How many people go in and out of which entrance during the day? How many people take the stairs and how many take the elevator? With the camera-integrated video analysis tool MxAnalytics, MOBOTIX is offering for all single lens cameras valuable added information users can leverage to optimize processes or for marketing purposes.

MxAnalytics makes it possible to collect **statistical behavior data on people and objects**. This is done by defining recognition zones (full live feed or a partial area) and counting corridors. The camera then records how often each counting corridor is crossed within a specified period. The most frequented areas in the recognition zone are highlighted in color as a heat map.

MxAnalytics can be activated and deactivated manually, based on a signal, or following a time table. The results are saved in the camera every 15 minutes and can be exported manually or at specified times (report profiles). Only around 30 MB per day or 1 GB per month of the camera's internal memory are required for continuous analysis.

MxAnalytics Available For All Single Lens Cameras Via Firmware (MX-V4.4.0.31 or higher)
MxAnalytics is available with all functions **free of charge for all Q25, D25, M25, i25, c25, p25, S15M and T25** (5MP or 6MP sensor, day or night version, any lens) with **firmware MX-V4.4.0.31** or higher.

For more information and news, please see the **release notes** of the firmware on the MOBOTIX website:
**www.mobotix.com > Support > Software Downloads > Cameras > MX-System Release 4.4.0.31 (or higher)**

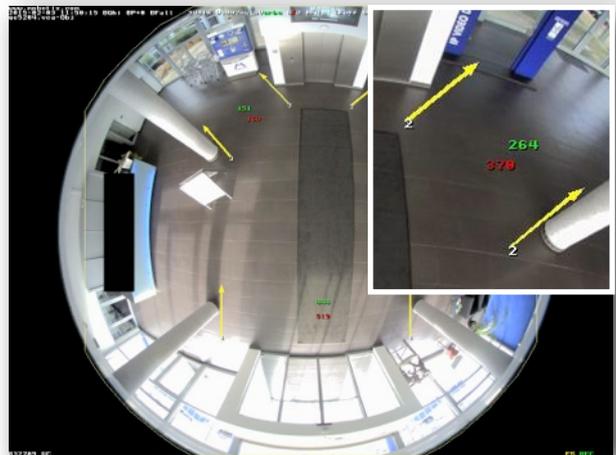| MxAnalytics – Highlights |
|---|
| Live analysis without network load, decentralized in the camera |
| No additional devices like computers, servers or black boxes required |
| Free video analysis software with no usage restrictions |
| Also available for previously installed cameras via firmware update |
| Easy configuration and operation for the user |
| Automatic counting corridor and heat map reports |
| Counting corridor solution can be configured to only count objects that move in a predefined direction (e.g., people who directly move from a supermarket's entrance to a shelf with special offers) |
| Up to 16 different counting corridors can be defined and evaluated in parallel for each camera |

MxAnalytics

Visualize Highly Frequented Areas (Heat Maps)

Which shelves in the shop are attracting the most customers this Saturday? Which paintings by the new artist hold the attention of the visitors most? Which waiting areas in the departure hall are preferred in the afternoon? All movements of objects of a particular size are recorded and evaluated, either in the live image or in a previously defined detection area, to provide answers to questions like these. The frequency of the movements is shown visually by means of different colors in a heat map.
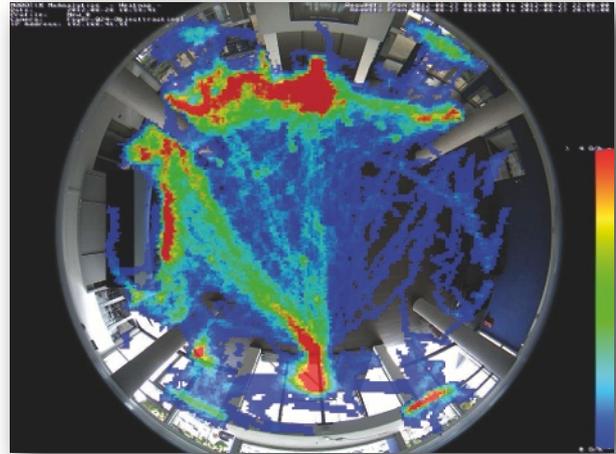
Count People And Objects (Statistics)

You can define counting corridors in appropriate locations in the camera feed to find out, for example, how many people walk in and out of each entrance of a shop over the course of a week (the system always generates two counts). The camera records how often each counting corridor is crossed within a specified period. The reliability of the count depends (a) on the similarity of the sizes and shapes of the persons or objects in the image, (b) on the distance between them (in terms or time or spatial distance), (c) on how effectively they can be visually distinguished from the underlying background, and (d) how close the counting corridor is to the center of the image (camera focus).

Zeit	Montag		Mittwoch		Montag-Samstag	
	Nord	Süd	Nord	Süd	Nord	Süd
08:00 - 09:00	0	0	5	9	6	9
09:00 - 10:00	0	0	8	27	8	27
10:00 - 11:00	1	0	2	19	3	20
11:00 - 12:00	0	0	0	60	2	60
12:00 - 13:00	0	0	0	0	0	0
13:00 - 14:00	0	0	6	9	6	9
14:00 - 15:00	0	0	0	0	0	1
15:00 - 16:00	0	0	0	9	0	9
16:00 - 17:00	1	0	2	0	3	0
17:00 - 18:00	0	0	0	3	0	3
18:00 - 19:00	0	0	-	-	0	0
19:00 - 20:00	-	-	-	-	0	0
20:00 - 21:00	-	-	-	-	1	0
21:00 - 22:00	-	-	-	-	-	-
Total	2	0	23	136	29	138

Counting Corridor Report - 07/2015 (2015-02-09 - 2015-02-15) - Corridor 1 - mx10-16-172-42

Example of a counting corridor weekly report (browser view)

2. Behavioral Detection With c25, Q25, S15M

The image analysis events now feature a new type, the "behavioral detection". This means that you can use the results from the "MxAnalytics" image analysis toolbox to directly trigger events. Behavioral detection is only available in the Q25, S15M and c25 with a hemispheric 180° lens (B016/L10) when mounted to the ceiling (with day or night sensor). The camera has to be orientated north: That means that the main direction of movement as a position of the clock face corresponds with 12 o'clock exactly to the north direction in the full image (see picture of "Opposite Direction" below).

Detectable Movements – The Seven Alarm Types

Behavioral detection allows to trigger an event (e.g., recording, alarm, message) based on six different alarm types. The behavior to be detected is defined by special movements of people or objects – hereinafter referred to as objects – in the image area, which are not expected or desired in the application scenario and/or require a direct response: e.g., a message to the branch manager when a customer has to wait longer than four minutes at a supermarket checkout. The position of an object can be detected with an accuracy of +/- 20 centimeters (8 inch).


"Corridor": If an object crosses a defined MxAnalytics counting corridor (see left side of the picture), an event is triggered and optionally a white and blue icon (traffic sign) is shown. You can also activate several different corridors at the same time for this alarm type.
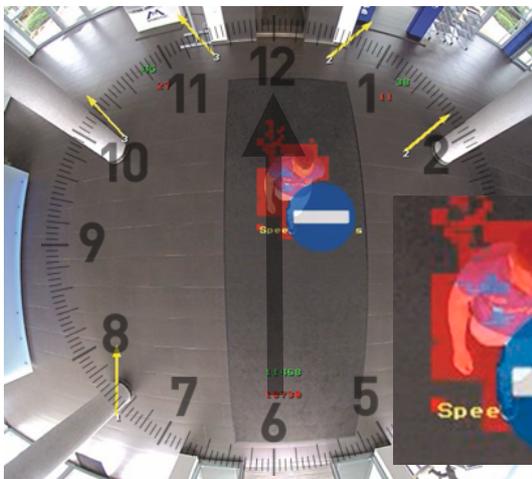

"Opposite Direction": An event is triggered when an object moves opposite to the defined main direction. This direction is set as a position of the clock face. In the example image shown, the main direction "12 o'clock" corresponds with the black arrow from 6 to 12 o'clock or from bottom to top. The person in the image area (detected as a moving object and therefore marked with red pixels) walks opposite to the main direction towards "6 o'clock".

"Turn": Using the behavioral detection it is possible to detect whether an object is leaving the path defined as main direction. An event is triggered when an object deviates in an angle larger than 45° and smaller than 135° from the defined main direction axis (here: from the virtual line between 12 and 6 o'clock).
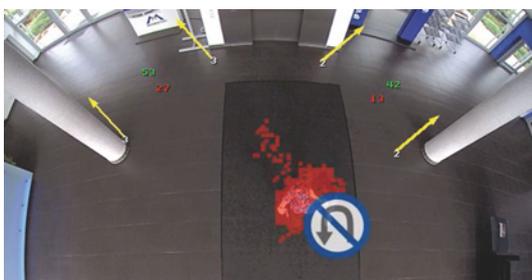
"U-Turn": In case MxAnalytics detects an object that deviates from the defined main direction axis in an angle of in between 135° and 180°, this change is interpreted as U-turn and an event is triggered.
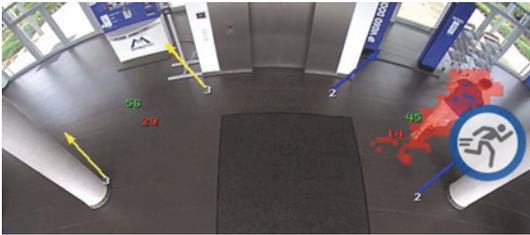
"Speed": This type sets a speed limit of 1 to 6 meters per second. Events are triggered whenever an object is detected in the image that moves faster. A value of 1 m/s corresponds to a speed of 3.6 km/h, i.e. the speed of an average pedestrian.
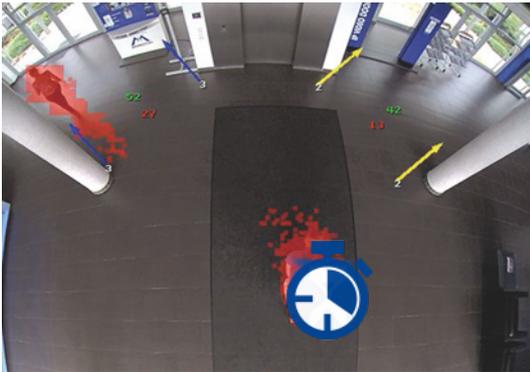
"Duration of Stay": Whenever a detected object stays or moves within the image longer than the defined maximum duration of stay (values between 1 and 300 seconds), an event is triggered. For optimum detection results constant lighting conditions are decisive (ideal: artificial light, no shadows). With direct sun and diffuse shadows it is in most cases only possible to detect durations of stay of a few seconds reliably. The "Duration of Stay" is not suitable for left-luggage detection.

"Restricted Area": With camera firmware version MX-V4.4.0.31 or higher an event can also be triggered if something enters a "digitally marked," rectangular restricted area within the image. Up to 20 different restricted areas can be activated simultaneously for each camera by creating multiple profiles. Active restricted areas can be hidden or made visible within the image by selecting the desired color and transparency.

Behavioral detection – the most important conditions:

▸ Only available in the models Q25, S15M and c25 when mounted to the ceiling (lens "looks" downwards)

▸ Only with hemispheric lens (B016/L10) and with camera software 4.4.0.31 or higher for all functions

▸ The white and blue alarm type icons shown on this double page are very CPU intensive and should only be enabled during the setup

▸ Installation height of the camera should be at least 2.5 m (8 ft), better more than 3–4 m (10–13 ft)

▸ To define a main direction, the camera must be orientated "north" (north = 12 o'clock in the full image)

▸ Ambient brightness not less than 10 lux, better more than 30 lux

▸ Sidelight should be avoided because of strong shadow impact

▸ A constant light situation (artificial light, no shadows) will help to avoid false alarms mainly caused by fast and strong changes in brightness

▸ Common MxAnalytics settings are valid for MxAnalytics and behavioral detection

▸ Changes of settings for behavioral detection also change MxAnalytics settings, even if MxAnalytics is not activated and you don't see setting pages there

▸ MxAnalytics algorithms are automatically (de-)activated as soon as a behavioral detection sensor (alarm type) is (de-)activated

3. Defining Counting Corridors

The three factors that define a counting corridor in the live feed, **direction**, **length** and **width**, are easily configured using the shift and control key (Shift and Ctrl) and a mere **three clicks of the mouse**:

Click 1 (for 1st reference point):   Shift+Ctrl+mouse click   (Apple: Cmd instead of Ctrl)
Click 2 (for length and direction):   Ctrl+mouse click   (Apple: Cmd instead of Ctrl)
Click 3 (for width):   Single mouse click

Using Apple computers, you have to press the **Cmd/Command** button instead of **Ctrl/Control**. Clicks 2 and 3 can be corrected (repeated) at any time. When redoing click 1, the other points are cleared.


The image shows a counting corridor at the entrance of a foyer, indicated by two yellow arrows, which was defined with three mouse clicks (click 1–3): **Click 1** defines the first reference point, **click 2** determines the north direction and length of the corridor, while **click 3** defines the width. The system counts all objects that cross the entire corridor (from north to south and vice versa). Since the counting started, 444 people entered the foyer (green upper number in the center of the corridor; i.e., objects crossing the corridor alongside the arrow towards the north), and 519 people crossed the counting corridor in the opposite direction (red bottom number, movement from top to bottom).

Examples Providing Additional Details

Image A: Object x crosses the counting corridor and is **counted**. It will even be registered if the object moves very quickly or remains within the counting corridor for a long time before leaving it.

Image B: Object x enters the corridor somewhat to the side of the lower border, but the distance covered within the corridor (red line) is long enough for the system to **count** it.

Image C: Object x enters the corridor even farther up and to the side of the lower border. The distance covered within the corridor is too short, so the system **does not count** it.
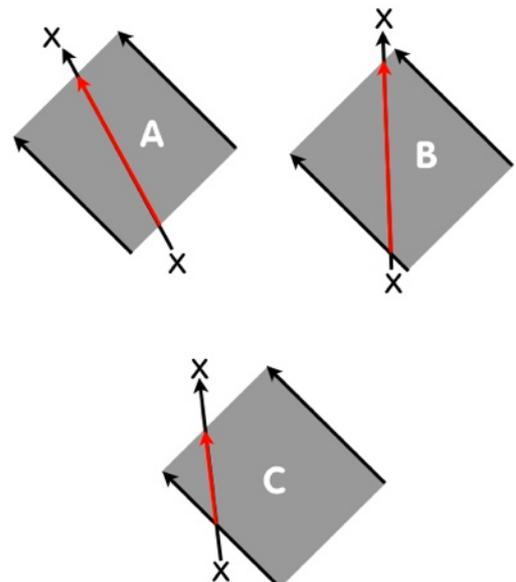
4. Tips & Tricks For Optimized Analysis Results

Create consistent lighting conditions
It is crucial to keep lighting both as constant as possible and sufficiently bright to obtain optimal results. All optical factors that may negatively impact MxAnalytics results should be avoided. The results may be flawed if this is not possible.

The following factors may negatively affect MxAnalytics:
- Direct sunlight
- Constantly changing lighting
- Insufficient light
- Overexposed areas
- Reflective surfaces (mirrors, windows, etc.)

The MxAnalytics environment settings provide the option to diminish the adverse effects of disruptive lighting such as sunlight glare or shadows in order to improve the analysis result.

Limit detection areas (for heat maps only)
Always mark only the areas in the camera live image that you actually want to evaluate in the heat map using MxAnalytics. Omitting non-relevant areas (for example, window surfaces, walls, ceilings, etc.) reduces the processing power required by the camera, which in turn leads to higher frame rates and improved analysis results.

Limit object size
A minimum object size for detection should be specified to ensure that the system only tracks and evaluates movement of the relevant objects inside this detection area.

Use time tables for MxAnalytics
If the camera should only be used for MxAnalytics during specific times (for example, Monday to Friday, 9 a.m. to 12 p.m.), it makes sense to configure the camera to use an appropriate time table. This provides an advantage by freeing up the full processing power of the camera in the remaining time for other (security) functions such as event-controlled recording and makes more efficient use of the storage space on the microSD card.

Reduce image resolution
The current resolution of the camera should be kept as low as possible (MOBOTIX recommend using VGA) to achieve the highest possible frame rates for MxAnalytics.

Use a high-contrast underlying surface
The more the objects to be recognized differ in color from the underlying surface or background, the more reliable are the MxAnalytics results. An underlying surface with high contrasts (for example, large black and white checkerboard pattern) further improves analysis results.

MxAnalytics online help in the browser
A comprehensive description of the individual MxAnalytics setting options is available in the online help of the camera's user interface. To open the help, go to **Setup Menu** > **MxAnalytics Control** and then click the **question mark icon** in the top right corner.

5. Configuring MxAnalytics In The Web Browser

| Procedure Step 1 – 10	Details
1. Update the camera firmware (when needed).	MxAnalytics for all MOBOTIX 5MP/6MP single lens cameras is contained in the version 4.4.0.31 (and higher) and can only be configured via its web user interface.
2. Format the microSD card for MxAnalytics (Admin Menu > Storage).	Any recordings that need to be preserved need to be exported first Open the required menus by clicking the Player button and then the Save button in the browser (see figure).
3. Configure camera presettings for optimal analysis results	Full image, VGA, Recording: Off
4. Open the special MxAnalytics menus	Under MxAnalytics Control in the Setup menu
5. Enable MxAnalytics under "General MxAnalytics Settings."	The settings under "More" are normally not necessary.
6. Edit the "Time Table" selection list.	Specify here the times at which MxAnalytics should be enabled in the camera. If "(no time table)" is selected, MxAnalytics will be enabled permanently. It is also possible to automatically deactivate MxAnalytics if light falls below a configurable minimum luminous intensity (5/10/15/20 lux).
7. Specify detection areas, counting corridors, object sizes and other relevant settings. Click "Set" and then "Close."	Detection areas are only relevant for the heat maps (not for counting corridors).
8. Create report profiles (Setup Menu > MxAnalytics Control > Counting Corridors/ Heat Map Report Profiles).	All collected MxAnalytics data will be saved on the microSD card according to the "time table." It is possible to view selected data only using report profiles (for example, last week's values for counting corridor 3). Common report profiles are predefined in the system.
9. Manually create reports (Setup Menu > MxAnalytics Control > Counting Corridors/ Heat Map Report Profiles).	MxAnalytics reports (heat map and counting corridor value tables) are displayed using a selected report profile in the browser ("Create report" function). They can then be printed and saved locally to the computer.
10. Generate reports automatically and send via e-mail (Setup menu > MxAnalytics Control > MxAnalytics Overview).	Counting corridor and heat map reports can also be prepared regularly and sent as an e-mail attachment. Click the **left red point** under "E-mail profile" (red point = no e-mail profile configured yet, green point = e-mail profile successfully configured) in the "Report profiles" section. Then add a new e-mail profile and click "Set" and "Close." By clicking on the **right red point** under "E-mail profiles" in the "Report profiles" section, it is possible to set the sending time of the e-mail (green point = time control already set up) for the new e-mail profile just created (profile name is shown). Next, click "Set" and "Close."

Configuring Behavioral Detection

To configure the behavioral detection, see the Image Analysis Events section of the **Setup Menu > Event Control > Event Overview** dialog. You can also use behavioral detection **without** having to activate MxAnalytics (in the **General MxAnalytics Settings** dialog). Note that neither the heatmap nor other elements unused by behavioral detection are displayed and there is no storage of MxAnalytics results on the SD card. In such a case, MxAnalytics automatically works "in the background".
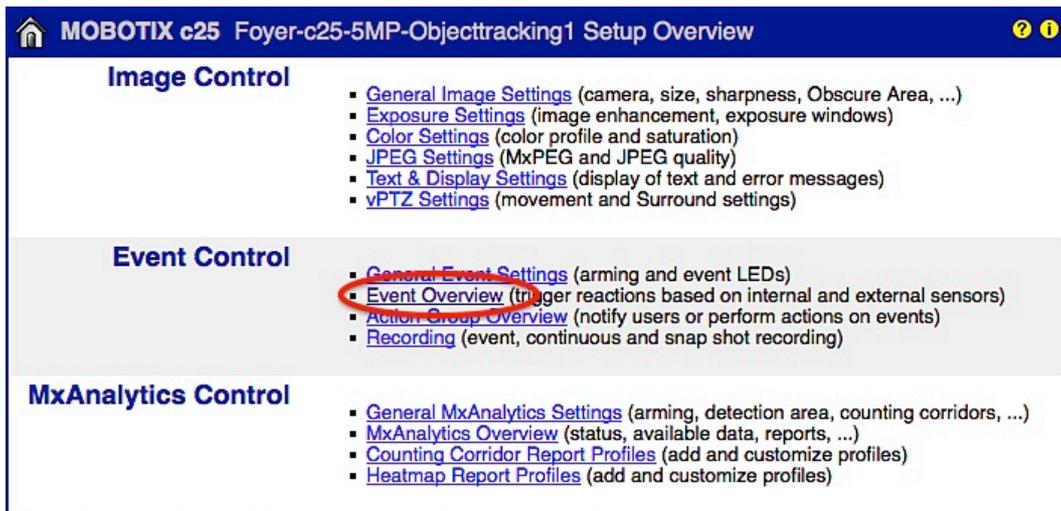
The Image Analysis Events section allows adding the event sensor type **Behavioral Detection**.

Click on the button **Edit...**. To configure such a new profile, you can select one of the "alarm types" (Corridor, Duration of Stay ....) and set other parameters as required.
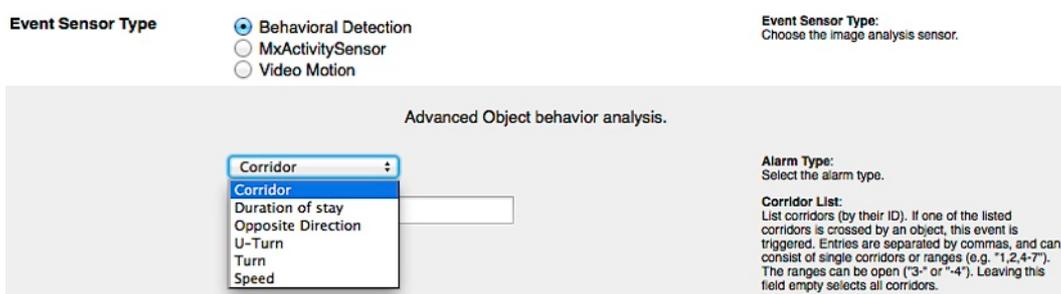
For detailed information on this topic, please see the camera's **online help** of the dialogs. To open it just click on the **question mark icon** top on the right side.

6. Basic Technical Specifications

MxAnalytics With 6MP Cameras	
Required camera	D25, M25, Q25, S15M, T25, i25, c25 or p25 with 5MP/6MP day or night sensor IMPORTANT: Behavioral detection is available only with ceiling-mounted cameras c25, Q25 and S15M with a hemispherical lens!
Camera firmware required	Min. MX-V4.3.4.83, complete range of functions with MX-V4.4.0.31 or higher
Lens	Behavioral detection only with B016 hemispherical lens, otherwise no restrictions, but lenses B016, B036 or B041 recommended (180°, 103° or 90°)
Camera view	Full image (recommended)
Resolution	VGA (recommended)
Ambient brightness	> 30 lux (recommended), not less than 10 lux Sidelights should be avoided (shadow impact)!
Installation site	Ceiling mounting indoors Wall installation only suitable for heatmaps
Installation height 180° lens	2.5 to 6 m / 8 to 19 ft
Installation height 90°–103° lens	6 to 10 m / 19 to 33 ft
Storage location	Camera-integrated microSD card, specially formatted for MxAnalytics: When formatting the card using the special one-time procedure (memory card partitioning for MxAnalytics and for all other camera recordings), any recorded data you need to preserve needs to be transferred to another storage medium first (for example, a hard drive).
Max. storage requirement	1 GB/month (to save MxAnalytics results data daily and around the clock)
MxAnalytics activation	- Manual (on/off) - Via time table (for example, Mon–Fri, 8 a.m.–6 p.m.) - Via camera signal inputs (for example, possible with MX-Input-Box)
Counting precision	Very high given suitable lighting conditions and when individual persons/objects are far enough apart
Detection areas (for heat maps)	1 to n areas individually definable (defined areas can be excluded)
Heat maps and counting corridors	- Results selectable by report profile - Automatic e-mail notification or FTP upload - A maximum of 16 counting corridors can be defined
Report profiles	Freely configurable, predefined default profiles (day/week/month)
Export format	- Heat map: JPEG (displayed in last live image or reference image) - Counting corridor report: HTML or CSV (table view)
Specific information	It is no longer necessary to define an "event dead time."

In General:
The quality of the MxAnalytics results improves depending on the attainable frame rate. For this reason, processor-intensive camera functions should not be additionally used while analyses are running (recommendation: only use a low VGA live image resolution, avoid image distortion correction, avoid event recording, audio, etc.).