



DVC[®]Analytics Instruction Manual ver. 4.1



S	umr	nary	
1	L	ogin page	4
2	Н	lome Page Overview	4
	2.1	Role-Specific Functionalities in DVC® Analytics:	5
3	D	ata Analysis section	
	3.1	New Analysis	6
	3.2	Data Analysis set up	6
	3.	2.1 Option feature	
	3	2.2 Baseline setting	
	3.3	DVC® Metrics Selection	
	3.4	Charts Selection	
	3.5	Data aggregation selection	
	3.6	REM Selection	
	3.7	Day Filtration	
	3.8	Save configuration	
	3.9	Visualize the analysis	
	3.10	Extra functionalities of the chart	
	3.11	Prepare Download	
4	Μ	1anage Experiment	
	4.1	Cage Groups	
	4.2	Mice groups	
	4.3	Manual Event Management	
5	S	ettings	
	5.1	Unit of Measure	
	5.2	User Groups	
	5.3	DVC® Analytics Users	
	5.4	DVC® Cage Owner Association	
	5.5	Settings	
6	D	VC® Analytics Credits management	
	6.1	Home page	
	6.2	Digital wallet	
	6.3	Use credits	
	6.4	(Credit) Data Analysis	
7	U	Iseful information	
_			

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy www.tecniplast.it	TECNIPLAST innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



7.1	DVC	$\Sigma^{ m e}$ board	
7.2	D	VC® working principle and derived metrics.	
7.	2.1	Animal Locomotion Index	
7.	2.2	Animal Locomotion Index (smoothed)	
7.	2.3	Animal Tracking Distance and Speed	
7.	2.4	Bedding Status Index	
7.	2.5	Fighting-like index	
7.	2.6	RDI (Regularity Disturbance Index)	
7.	2.7	Running Wheel Rotation, Distance and Speed	
7.	2.8	Rest-Wake Bouts	
7.	2.9	Stereotypy	
7.3	F	low data are calculated and aggregated	
7.4	C	Chart visualisation	
7.	4.1	Line Chart Simple	
7.	4.2	Line chart with SEM	
7.	4.3	Line chart with Interquartile	
7.	4.4	Line chart cumulative	
7.	4.5	Bar plot	
7.	4.6	Box Plot	
7.	4.7	Heatmap	
7.	4.8	Actogram	
7.	4.9	Live data	
7.	4.10	Board Heatmap	
7.	4.11	Rest Awake	51
7.	4.12	Bedding Change (response)	
7.	4.13	Light Change	
7.	4.14	Dark Light	
7.	4.15	Daily Rhythm	

Revision History

Date	Version	Author		Summary of Changes			
15/05/17	V1.0	Giorgio Rosati		First Draft			
16/05/17	V1.1	Giorgio Rosati		Explanation of how to download raw data			
27/07/2018	V2.0	Giorgio Rosati		DVC Analytics version 2			
19/09/2019	V3.0	Giorgio Rosati		DVC Analytics version 3			
01/01/2024	V4.0	Giorgio Rosati		DVC Analytics version 4			
10/02/2025	V4.1	Giorgio	Rosati	Refined cosmetics + extra features			
TECNIPLAST Via I Maggio, 6 - 21020 www.tecniplast.it	D BUGUGGIATE (V/	S.p.A. A) Italy	? i n n o	Vation through passion			
https://digitalcage-te	ecniplast.com/		rev.4.1				



1 Login page

To login into the system, go to: <u>https://analytics.dvc.tecniplast.it/login/XXX</u> (XXX provided to you by Tecniplast or got during the registration) and enter your Username and Password that have been previously created.



2 Home Page Overview

In the DVC® Analytics there are two available profiles:

- Facility Manager Profile: Upon login, you gain full access to all platform functionalities.
- **Researcher Profile**: After logging in, you are automatically redirected to the Data Analysis section, where only the cages assigned to you are displayed. The upper section of the home page features a dark blue background and provides essential details about your facility, including the name of the facility.





2.1 Role-Specific Functionalities in DVC[®] Analytics:

Facility Manager:

- Access: Full access to all features within the DVC® Analytics system.
- Main capabilities:
 - View all registered DVC® cages.
 - Register new users and associate them with DVC® cages.
 - Organize DVC[®] users into groups and link them to specific cages.
 - Modify facility settings, including designated dark hours.

Researcher:

- **Access**: Restricted to ensure privacy and prevent data overlap, allowing researchers to view only relevant data.
- Main capabilities:
 - View only the DVC® cages assigned to the researcher.
 - Create and manage cage and mouse groups using only the assigned cages.

3 Data Analysis section

Clicking on the "Data Analysis" button takes you to a menu where, if available, any saved configurations are displayed.

												4
Configuration Name	Owner		Versi	Cr	eation Date		Chart	Туре	Resources	Metrics	Groups	
	V	V	<u> </u>	γ	ad/MM/yyyy B	- V						
rest-wake	adminTi		4	07	/03/2025 15:44		Rest Awake	6	2	4	2	
GEG	adminTi		4	27	/02/2025 10:23		Daily Rhythm	6	2		2	
Pers Awake Dage (see)	admini		4	19	102/2025 12:02		Line	6	۵ ۱	1	-	
Rest Awake Dom	adminis		4	12	/02/2025 15:20		Rest Awake	6	1	1	1	
LIVE GG	admint		4	11	/02/2025 11:22			1	1	1	1	
live data 100260 (2)	adminTi		4	10	/02/2025 16:03		Live	12	1	1	1	
Verificato per Lorenzo EM	temoGE	4	4	10	/02/2025 12:27		Line	19	1	1	1	
Vermesto per corenzo rim	tempGF	 A	4	10	/02/2025 12:26		Line	1	1	1	1	
Simple Chart	adminTi		4	10	/02/2025 12:21		Line	8	1	1	1	
Live 2 Gruppi	adminTi		4	04	/02/2025 17:14		Uve	1	3	1	2	
BLU-ROSSO	adminTi		4	04	/02/2025 12:38		Line	10	2	1	2	
LEDDY-REM-3 Funzionante	adminTi		4	29	/01/2025 10:09		Line	19	3	1	3	
LEDDY-REM-2	adminTi		4	29	/01/2025 09:14		Line	12	3	1	3	
live_data_100260	adminTi		4	28	/01/2025 12:13		Live	8	1	1	1	
TEST (3)	adminTi		4	23	/01/2025 15:03		Line	19	6	1	1	
TEST (2)	adminTi		4	23	/01/2025 14:45		Line	19	6	1	1	
TEST	adminTi		4	23	/01/2025 11:47		Line	19	6	1	1	
								-				18.4

You can delete any pre-saved configuration by simply clicking the corresponding **X** icon. Conversely, to load a pre-saved configuration, click the appropriate icon ^Q to restore all previously selected settings such as cages, groups, metrics, charts, and more.

You can retrieve and update a previously saved configuration at any time. However, remember that the analysis duration was set when the configuration was initially saved. If you access it later, the duration will still reflect the original setting. If the cages are active or running, updating the duration is essential to ensure the analysis remains aligned with your desired timeframe in the system.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



3.1 New Analysis

The "+ New Analysis" button is needed to start a new analysis where all the fields must be filled out stepby-step based on the experiment.



3.2 Data Analysis set up

In any section of the Analysis interface, please make sure to review the yellow-highlighted fields, as they are crucial for generating the analysis.



You begin by setting up the resources of your analysis (cage or animal). By default, the cage is selected as the primary resource. Alternatively, you can search for resources based on the animal's identifier. Keep in mind that DVC[®] data is always associated with cages. Selecting an animal as a resource allows you to locate cage data using the animal's ID.

Then, select your preferred alignment option choosing among the below ones:



Refer to the below example to understand the difference between these three options:







Days Then, decide the granularity of your temporal settings: by day (default) or by minute. Keep in mind that, when you select the day, the analysis starts from 00:00 (midnight).

Then, select whether to apply a Baseline to your original data. This feature is detailed later in this document.

Now, it is time to select the resource(s) by clicking the corresponding icon 🙆 A lateral section opens where all the resources are listed by Cage ID in a big table with different columns:

Cage Id	Status	Туре	Protocol	Experiment		Experiment Group		Add-ons
	γ γ	∇	V		V		7	7
STAB#20181113#1252	Terminated	Stock	DVC Default Protocol					
00804	Terminated	Stock	ProtTuesdayW					
NEW-2019_10_31-01	Terminated	Stock	virus					
saetta	Terminated	Stock	DVC Default Protocol					
LowFood-Em-5	Running	Stock	DVC Default Protocol					
C-123	Terminated	Stock	ProtTuesdayW					
STAB#20190403_1404	Terminated	Stock	DVC_RP_05					
EM_21	Terminated	Stock	DVC Default Protocol					
STAB#20181113#1235	Terminated	Stock	DVC Default Protocol					
F-107	Terminated	Stock	ProtWedWee					
20180717_C_06	Terminated	Stock	DVC_RP_EXT					
20230119-0007	Terminated	Stock	DVC Default Protocol					
BREEDINGCAGE	Terminated	Breeding	DVC Default Protocol					
Q-99	Terminated	Experiment	DVC Default Protocol	SPI-2				
6	Terminated	Stock	mer-tot-w					
S-36	Running	Stock	405.2					
STAB#2019AG00190	Terminated	Stock	DVC Default Protocol					
test-3471-00	Terminated	Stock	DVC Default Protocol					

Suppose you have registered the cages (or animals) with different information, such as the cage type (Stock, Experiment, Breeding), the Study Protocol, the experiment, or the Add-ons (Running Wheel, for instance). In that case, these are displayed in this table and help you immediately find the cages to analyze.

The status of the resources (Running, Terminated or Out of Rack) is directly triggered by the DVC® in the Animal Room.

For your first group of analysis, you can select one or multiple resources. You can retrieve the selected ones by clicking the specific selector

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1

Minutes



When a resource is selected, the first Group is created. "Group o" name is assigned by default, you can

Group 0

rename it (and assign a different colour for the charts)

Then, depending on your previous selection of Realignment type, you are requested to define Start and Stop dates (in case of Realignment by Group), only the Start and duration (in case of Realignment by Cage), or even only the duration (in case of Realignment by Resources).

=_ Cage	🚪 Group	Resource	Cage	1	Group	Resource	age	🚪 Group	Resource
Days	Minutes Baseline	No baseline	Days	Minutes	Baseline	No baseline	Days	Minutes Baseline	No baseline
Group 0	연 2 🎲 Option	* :	Days 1		Start 17/02/2025	睵	Days 1		
13/02/2024	× 崗 17/02/2025	畾	Group 0		1 2 袋 Opti	on ★ :	Group 0	면 2 않 0	ption ★ 🗄

Whenever you select a date, you can either select it directly from the Calendar and then click the "Save" button:

Sta 16	rt /02,	/202	4		Ev	vents	Today
<	:	Fel	•	1	2024	÷	>
	м	т	w	т	F	s	S
				1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29			
	С	ance	el			Save	2

Or leverage the "Events" button to select the date from the list of (DVC) events generated by the cage:

age Id	Timestamp	Тур	e	Subtype	Rack	Coor	dinates
	dd/MM/yyyy 🛱	∇	V		7	7	V
 LowFood-Em-5 (93) 							
LowFood-Em-5	13/01/2025 15:43		Registered				
LowFood-Em-5	13/01/2025 15:43		Rack	INSERTED	21003613A	C7	
LowFood-Em-5	13/01/2025 15:43		Mice	ADDED			
LowFood-Em-5	13/01/2025 15:43		lage Online				
LowFood-Em-5	13/01/2025 15:43		Mice	ADDED			
LowFood-Em-5	15/01/2025 16:22		Updated				
LowFood-Em-5	15/01/2025 16:29		Updated				
LowFood-Em-5	15/01/2025 16:31		age Offline				
LowFood-Em-5	15/01/2025 16:34		Rack	INSERTED	21003613A	C7	
LowFood-Em-5	15/01/2025 16:34		age Online				
LowFood-Em-5	15/01/2025 16:34		Updated				
LowFood-Em-5	16/01/2025 11:41		Rack	REMOVED	21003613A	C7	
LowFood-Em-5	16/01/2025 11:41		Rack	INSERTED	21003613A	C7	
LowFood-Em-5	17/01/2025 16:19		Updated				
LowFood-Em-5	17/01/2025 16:34		age Offline				
LowFood-Em-5	17/01/2025 16:37		Rack	INSERTED	21003613A	C7	
LowFood-Em-5	17/01/2025 16:37		Cage Online				
							Items: 93
CNIPLAST	5.	р.А. 🍞	TF				57
a I Maggio, 6 - 21020) BUGUGGIATE (VA) Ita	aly 🛛 💶					
		1 11 1	1 0 V 0	tion	throw c	n n a	8 8 I O



The DVC[®] system tracks a variety of events that occur within the facility, each categorised by type, subtype, and a brief description:

- Registered: This event marks when a cage is officially registered within the DVC® system.
 - Mice
 - Added: Indicates a new mouse has been added to a specific cage.
 - *Moved*: Reflects an already existing mouse being transferred from one cage to another.
 - **Culled**: Records when a mouse has been culled from the cage.
- Rack:
 - o **Inserted**: Documents when a cage has been placed into the DVC[®] Rack.
 - *Removed*: Notates when a cage has been removed from the DVC[®] Rack.
 - Update: Occurs when any field of the cage's information (such as Owner, Protocol, etc.) is updated.
- **Bedding Change**: Tracks the event of a bedding change within a cage to maintain cleanliness and health standards.
 - **Partial**: only the cage bottom is changed, the cage top is shared
 - *Total*: integral cage change procedure
- Cage Offline: Logs any instances when a cage goes offline, which could be due to network issues.
- **Cage Online**: Captures the moment a cage returns online after a network restoration or similar events.
- Cage Dismiss: the event of termination for the cage

🔅 Option

Once the group is created, the "Option" button becomes available. This feature is detailed later in this document.

Finally, you can add as many groups as you want by clicking the corresponding button

If you selected a Realignment by Group type, the primary group (by default, the first group to be created) sets the duration of the analysis, as the difference between the Stop and Start dates. All the other groups can only set the Start of the analysis because the primary group fixes the duration.



+ Group

Any group can become the primary one by clicking the little star close to it

Finally, thanks to the little vertical dots at the end of the group section , it is possible to have multiple group features:

saetta
 Resources
 Import Group Resources
 Primary
 Apply Event Time Start/Stop
 Save
 Split
 Clone
 Delete other groups
 Delete

TECNIPLAST S.p.A. Via I Maggio 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Where:

Item	Comment
Resources	Open the side menu to highlight the selected resources.
Import Group Resources	Open the side menu to select groups already created in the past.
Apply event Time	Automatically apply the first and last dates available in the system based on the
Start/Stop	first and last datapoints collected. By default, this is always applied. This feature
	helps to reset it from scratch in case it has been locally modified.
Primary	Set this group as the primary one (if not yet)
Save	Save this group for future retrieval.
Split	Split the group into individual correspondent resources.
Clone	Clone the group with the same resources
Delete other groups	Delete all the other groups (only if this is the primary group)
Delete	Delete itself (only if this is not the primary group)

3.2.1 Option feature

This functionality is enabled when the Realignment type is set to 'Resources'. By default, the start date used to realign all resources is the first data point ('Start Date'). However, you can individually adjust the start date for a specific cage by modifying the corresponding 'Current Start Time' section.

This is possible either by directly clicking the calendar, choosing a specific date, and clicking "Save":



Or by clicking the "Events" button and then select the date ("Use as current start time") from the list of the below (DVC) events generated by this specific cage:

Resource LowFood-Em-5									
Timestamp	т	ype	Subtype		Rack		Coordinates		
dd/MM/yyyy 🗒	∇	V		∇		Y		∇	
13/01/2025 15:43		Registered)						Use as current start time
13/01/2025 15:43		Rack	INSERTED		21003613A		C7		Use as current start time
13/01/2025 15:43		Mice	ADDED						Use as current start time
13/01/2025 15:43		Cage Online							Use as current start time
13/01/2025 15:43		Mire							Use as current start time Items: 93

This Current Start Time then acts as day o for that specific cage, enabling a realignment feature that adjusts the timeline for each selected cage individually.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



3.2.2 Baseline setting

You can click the corresponding button to create a baseline period for cages belonging to a specific group (it is disabled by default).



When enabled, it requires to fill the specific fields:

More specifically, for each cage, it is possible to assign a "Start Baseline" date and specify the duration of this baseline period in days. This baseline period is calculated based on additional settings, including data aggregation methods and selected filters. The calculated baseline is then used to normalise the data for the subsequent days of the analysis period, ensuring consistency and comparability across the dataset.

The formula we apply is the following:

$$Data_{bas} = \frac{data - baseline}{baseline} \%$$

3.3 DVC® Metrics Selection

Once you have selected the resources to be analysed and their settings and realignments, you can select the DVC[®] metrics for the analysis. The availability of these metrics depends on the type of content specified during the cage registration in the DVC[®] system. For instance, metrics such as "Animal Tracking Distance" and "Animal Tracking Speed" are only accessible if the cage has been initially registered with a single animal. Additionally, "Running Wheel Distance/Rotation/Speed" metrics are available only if a Running Wheel is registered as an add-on to the cage.

All other metrics can be applied regardless of the cage content. The final section of this manual provides detailed information on how each metric is calculated.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	TECNIPLAST
www.teenptdst.it	
https://digitalcage-tecniplast.com/	rev.4.1





Specific metrics utilise the DVC[®] board electrodes as individual data points, allowing for a more detailed analysis. For these metrics, you have the option to refine your analysis further by selecting specific electrodes to include in the calculations:



By default, all the electrodes are always selected. Moreover, the advanced option called "Frontality" applies the following calculation:

avg(front)
[avg(front) + avg(rear)]

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Where the:

- Frontal electrodes are (electrodes # 7-8-9-10-11-12)
- Rear electrodes are electrodes # 1-2-3-4-5-6)

Please pay attention to the fact that, to properly select any metric, you have to click the corresponding box:



Charts Selection 3.4

Once you have selected the desired metric(s), the next step is to choose how to visualize the corresponding data. There are several visualization options available to help you interpret and present the data effectively:



The Line plot is a straightforward visualisation option with various subtypes and other options to enhance data interpretation:





Subtype			
Simple	SEM	IQR	Cumulative
Time interval visuali	zation		
Continuous	DAY Daily	WK Weekly	Weeks 1
Events			
Event			
Background			
🚫 None	REM darkness	C: Facility darkness	
Advanced Series opt	tion		
🔕 None	∼^ Interpolation	A Realignment	

Subtypes:

- **Simple:** Displays a continuous line representing data points collected by the DVC[®] system throughout the selected interval.
- **SEM (Standard Error of the Mean):** Features a continuous line with an overlay of the SEM, available only for groups with multiple cages.
- IQR (Interquartile Range): Shows a continuous line with overlays of the 2nd and 3rd quartile limits, also available only for groups with multiple cages.
- **Cumulative:** Summarizes all data to show a cumulative progression over time within the specified interval

Time Interval of Visualization:

- Continuous: Displays data continuously across the chosen time interval.
- **Daily:** Generates seven distinct graphs, one for each day of the week. For intervals exceeding one week, multiple lines represent each weekday repeatedly.
- **Weekly:** Produces a single graph with multiple lines, each representing a week within the selected period.
- Weeks: Allows for the creation of weekly graphs tailored to the number of weeks chosen.

Events:

• (DVC[®] and manual) Events: Can be included to show occurrences within the timeline.

Background:

- None: Applies no background lighting effects.
- **REM Darkness:** Uses actual light conditions if the REM system is installed, reflecting actual light/dark cycles.
- Facility Darkness: The background reflects the dark/light settings of the facility.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Advanced Series and Options:

- None: Standard visualisation without additional modifications.
- Interpolation: Connect the data points for a clearer trend line.
- **Realignment:** Move the data points to recreate a continuous line.

Moreover, there are multiple other charts:

Bar Plot: This plot uses rectangular bars to represent data, with the height of each bar corresponding to the value of the data in the selected interval.

Box Plot: Displays the standard five-number summary (minimum, first quartile, median, third quartile, and maximum) of a dataset for a selected aggregated interval.

Heatmap: This chart aggregates data daily, with each line representing 24-hour data. Each data point corresponds to the selected "Data Time Aggregation" (hour, minute, custom), and the data are colour-coded from blue (low values) to red (high values).

Actogram: Data are aggregated daily, with each line representing 24-hour data and each point corresponding to minute aggregation. The height of each line is proportional to the data value collected.

Live Data: A simple line plot that displays the last 15, 30 or 60 minutes and is updated every minute. This is applicable only if the selected cage is active in the DVC[®] system.

Board Heatmap: Visualizes the magnitude of a metric colour-coded for each corresponding electrode on the DVC[®] board, with each board reflecting a different time interval (week, day, or custom).

Rest-wake Charts: Shows 2 different histograms with the wake and rest bout distribution across system-defined duration intervals. Rest

Bedding Change Response: A line chart that spans a user-defined minute period following a bedding change event. If the analysis period includes multiple bedding change events, the chart displays the average of the events.

Light Change Response: This consists of two line charts spanning a user-defined minute period following the lights on and lights off events, per Facility Settings. If the analysis period includes multiple lights on/off events, the chart displays the average of these events.

Light/Dark: Shows two continuous lines, one for the light phase and one for the dark phase of the selected period, each point representing the metric value in the aggregated time interval.

Daily Rhythm: Displays a single 24-hour cycle, minute by minute, of the selected metric across the overall selected analysis period. Each data point is the smoothed average of all identical time-of-day data points from all included days, illustrating an animal's circadian pattern. This is available only with the activity metric selected.

These different visualisations are designed to offer comprehensive insights into the data collected, allowing for precise analysis and interpretation of various metrics and events.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



3.5 Data aggregation selection

Based on prior selections, data can be aggregated in several ways, including by minute, hour, day, week, or using custom intervals or variables (such as Rest-Wake histogram bins). The available selections depend on the previous metrics and charts that have been selected.

Date and time aggregation				
Week	Day	HR		
Minute	Custom 1	Hours ~		
Rest/Wake Bins				

Additionally, for specific charts, it's necessary to specify the starting point for the data time aggregation. By default, no starting point time is applied.

Starting point	
None	 Q Lights On

The starting point varies depending on the chart selected. For instance, if the Heatmap visualisation is selected, you have the option to start the aggregation from "Day Start" (i.e., midnight) or from "Lights On" (as set in the Facility settings). However, no specific starting point is required if a Simple Line chart is selected. This flexibility allows for tailored visualisation and analysis, enhancing the interpretation of the aggregated data based on the research needs.

Finally, more detailed aggregation options include a new feature called diurnality, which is available only when "Day" or "Week" aggregation is chosen.

	Advanced Ag	gregation	
	None	Diurnality	
TECNIPLAST Via I Maggio, 6 - 21020 BUGUGGI. www.tecniplast.it	S.p.A. ATE (VA) Italy	innovation	h passion
https://digitalcage-tecniplast.com	m/	rev.4.1	



This function calculates the average activity during light and dark periods using the formula:

$$avg(light) * \frac{nsamples(light)}{[avg(light) * nsamples(light) + avg(dark) * nsamples(dark)]}$$

This specific advanced aggregation would be significant for exploring potential deviating patterns occurring during the daylight phase.

3.6 REM Selection

This is an optional section. Depending on your previously performed metrics, charts, and data aggregation selections, you can enable the REM data to be displayed.



A detailed explanation of the various thresholds and metrics used in the REM are the following:

Noise: Measures noise levels within a range of 35 to 112 dB with an accuracy of ± 5 dB. It calculates the maximum noise peak over a 60-second interval.

Temperature: Monitors temperature within a range of -10°C (14°F) to 85°C (185°F) with an accuracy of ± 0.4 °C (± 0.7 °F), calculating the maximum temperature value in a 60-second period.

Brightness: Gauges brightness levels from 0 to 120k lux with an uncertainty of ±10 lux, computing the average value over a 60-second span.

Person Presence: Represents the count of detected events, one every sec, normalized over a 60-second interval, likely indicating human activity or movement within the environment.

Vibration: Reports the highest peak of vibration measured in PGA (Peak Gravity Acceleration) within a 60-second window.

Acceleration (max): Captures the maximum acceleration event detected in a 60-second timeframe, expressed in mm/sec².

Relative Humidity: Tracks humidity within a range of 0 to 80% RH with a 3% margin of error, calculating the average value every 60 seconds.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Acceleration: Reports the average acceleration event detected over a 60-second interval, also expressed in mm/sec^2 .

Please pay attention to the fact that Vibration refers to a metric provided by an older than year 2020 REM device and Acceleration(s) are provided by newer REMs.

3.7 Day Filtration

This is an optional section. Depending on your previously performed metrics, charts, and data aggregation selections, you can enable the DAY FILTRATION data to be displayed.



More specifically, you can select to apply a temporal filtration to the data and display only "Day Light" or "Dark Period" data, or even more customised, a specific period of hours and days.

3.8 Save configuration

Once you are happy with your selections, you can easily save your specific settings for future use by



You must name and assign it to a specific Owner who can only use it (or delete it).

Save configuration
Owner
adminTP -
0
Length not less than 3 characters
Confirm Cancel

3.9 Visualize the analysis.

To run the analysis based on your specific multiple settings, click the icon and the corresponding data and charts are displayed:





✓ Group 0	\sim
	Cancel Confirm

<u>I</u> • Do	winkad Ohint - Animal Locomotion Index (Smoothed) Percentage (v100) %	Group 0 Group 1
15		→ Group 0 (samples) → Group 1 (samples)
10		
5		
	M M M M M M M M M M M M M M M M M M M	
0		,
5'	' & & & & & & & & & & & & & & & & & & &	
	✓ expand	

Suppose the request is too big to be displayed (for instance, aggregation by minute of several months). In that case, the system proposes to switch to a more considerable aggregation period (for example, by hour) or directly download the data:

Retrieving data	×
The amount of data requested, assessed based on the number of resources (cages or animals), the selected period, and the data granularity, exceeds the allowed limit by 106% .	
We invite you to switch to hourly aggregated view to obtain the information in a more concise format.	
	Cancel Confirm

The current limit of data to be retrieved for visualization in the system is based on the following limits:

The calculation is performed for each group using the following formula:

w = number of resources * requested duration (in minutes)

There are two thresholds:

- When aggregation is set to minute-level: LIMIT1 = 450 days/resources. For instance, 30 days × 15 resources.
- When aggregation is set to hour-level: LIMIT2 = 1.350 days/resources. For instance, 90 days × 15 resources.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation inrougn passion
https://digitalcage-tecniplast.com/	rev.4.1



Minute-Level Aggregation:

- If w > LIMIT2, download the data instead.
- If LIMIT2 > w > LIMIT1, switch to hourly aggregation instead.

Otherwise, the request is valid.

Hour-Level Aggregation:

- If w > LIMIT2, download the data instead.
- Otherwise, the request is valid.

3.10 Extra functionalities of the chart

In some cases, for some charts, it is possible to resize the Y-axis, by selecting the "Series," clicking the corresponding button ^[I], then inserting the value and clicking "Apply":

<u>=</u> +	Download Ch					
Yaxis	_					
Seri	es 📼					
Max	1000					
Min	800					
Rese	et Apply					

For any displayed chart, it is possible to download it in high resolution by clicking and selecting the proper format:



For specific charts, you can zoom in by clicking on the desired position within the chart and holding down the left mouse button, dragging it across the area you wish to enlarge. To reset the zoom level back to

the original view, click the reset icon associated with the zoomed graph. Additionally, if you need a closer look at any part of the graph for more detailed analysis, you can enlarge the entire chart by

clicking the icon located below the chart

3.11 Prepare Download

When all the selections have been performed, it is also possible to prepare the download of the corresponding selected data.

Clicking on the icon **Download** it is then possible to choose between three different options:

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



	File name					Email Enable Notification (
D	ow	nloa	ad dat	ta																	
am	ne D	own	load o	lata is va	lid!			Ente remi	r a list o nder tri	of comi ggers.	na-sep	parated	addr	ess to v	/hich a	in ema	il shou	ld be s	ent wh	en the	2
Dat	ta ag	gre	gated	by minute	e and exploded	lverti	cal for a	all the	e electr	odes o	f any c	age of ar	ny gro	oup - or	e file p	per me	tric				
	day	hour	minute	relativeTime	timestamp		group	cage	samples	v_1	v_2	v_3	v_4	v_5	v_6	7	v_8	v_9	v_10	v_11	v_1
1	0	0	0	0	2019-01-01 00:00:0	0+0000	Group_0	A-01	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	0	0	d	0	2019-01-01 00:00:0	0+0000	Group_0	A-01	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	0	0	d	0	2015-01-01 00:000	0+0000	csroup_u	A-01	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.1	1.0	1.0
)at	ta ag lude	greg d ca	gated ges.	following	your time agg	regati	on and	explo	 oded ho	orizont	al to in	clude al	 I the I	 basic st	atistic	 for ea	ch grou	up and	all its o	wn	
	day	hour	minute	relativeTime	g1_TIMESTAMP	g1_AVG	g1_SE	M g1_	QRT g1	SAMPLE	S g1_ca	ige1 g2_T	MEST/	AMP g2_	WG g2	SEM g	2_QRT	g2_SAMP	LES g2_	cage1 (32_cat
1	0	0	0	0	0	0	0		0	0	0		0	0)	0	0	0		0	0
	0	0	0	0	0	0	0		0	0	0		0	0)	0	0	0		0	0
2	0	0	0	0	0	0	0			0	0		0	-		0	0	0		0	0
2		oad)	<,Y cor	ordinates	DATA																
2 3	wnlo		Standard Standard Standar			Star	ndard	Sta	ndard	Stan	dard		Sta	Standard							
2 3 	wnlo St	and	ara		metric	Y		У		time	stam	р	ca	ge_uu	id						
2 3 	wnlo St Ca	and ige_	rfi	3	IIIC LT IC	<u>^</u>				1500	7026	17000	01:	25f21	2 - 45	d2-4	771-	9e5f-	0d79	602h	
2 3 2 00 1 2	St Ca	and ige_ 9AE	_rfi 344A	a 855E80	TRACKING	100		200		1590	020	17000	0.4	0560	0 4-	10 1			0.177	0020	ear
2 3)0 1 2 3	St ca 04	and ge_ 9AE	_rfi 344A	a 355E80 355E80	TRACKING	100 251		200		1602	6770	17000	01	25f21	2-45	d2-4	771-	9e5f-	0d79	602b	edf

Type 1 (Upper Choice): Data is aggregated and presented in vertical sequential order by minutes or hours across all group cage electrodes. One file is generated for each metric, incorporating all cages in the global selection. The file includes columns for:

- Day: The day since the start date of observation.
- Hour: The hour of the day (1-24).
- Minute: The minutes of that hour (1-60).
- **Relative Time:** The absolute time in seconds from the previous midnight of the starting date.
- Timestamp: The absolute timestamp in Coordinated Universal Time (UTC).
- Group: The name of the group.
- **Cage:** The name of the cage within the selected group.
- **Samples:** The number of samples collected within the specified timeframe, indicating potential data loss due to cage removal.
- V_1/2/3/.../12: Values of the selected metrics for each electrode on the DVC® board (if available by the metric).

Type 1-bis (Middle - Upper Choice): This format mirrors Type 1 but splits the data into multiple files one for each cage and metric. This format is beneficial for lengthy observation periods spanning several months or years.

Type 2 (Middle - Lower Choice): Data is horizontally aggregated according to your chosen time aggregation and includes essential statistics for each group and its cages. The file structure features columns for:

• Day, Hour, Minute, Relative Time: Similar to Type 1.

• g1_TIMESTAMP, g2_TIMESTAMP: Absolute UTC timestamps for groups 1 and 2.

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	I ECINIPLASI
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



- g1_AVG, g2_AVG: Metric averages for groups 1 and 2.
- **g1_SEM, g2_SEM:** Standard errors for groups 1 and 2.
- **g1_QRT, g2_QRT:** Quartiles for groups 1 and 2 [Minimum, Lower Quartile, Median, Upper Quartile, Maximum].
- **g1_SAMPLES, g2_SAMPLES:** The total samples collected, providing insights into potential data disruptions from cage removal.
- **g1_cage1, g2_cage1, g2_cage2:** Metric averages for the first and second cages in groups 1 and 2, respectively.

Type 3 (Lower Choice): This format is available only when selecting one or more resources that support individual tracking features (i.e., one animal per cage). The downloaded data consists of raw x-y coordinates of the trajectory, as calculated by the DVC board for the chosen resource within the selected timeframe. These coordinates correspond to the spatial representation of the DVC board shown below.:



Then, to start preparing the download, you must fill in the File name section to activate the Download button.

File name	
Giorgio's Test	✓)
Name Giorgio's Test is valid!	

Additionally, you can enable notifications to complete download tasks. Click on the corresponding icon and enter your email address in the provided field to receive alerts when the download is complete.

Email	Enable Notification 🗹							
grosati@tecniplast.it	✓							
Enter a list of comma-separated address to which an email should be sent when the								
reminder triggers.								

TECNIPLAST S.p.A.	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1





PLEASE NOTE: you will find the "Downloaded data" in the dedicated section called Download Area



You can finally download the data on your PC by clicking the 볼 icon or delete it.

ownload	area									¢
File Name	File Size	Owner	Creation		Termination Date	Status	Action	Resourc	Checksum	
	∇	7	dd/MM/yyyy 💼	V	dd/MM/yyyy 💼 🏹					
Test Giorgio2		Tecniplast_grosati	22/02/2025 17:42			Running	Type 1	1		0
Test Giorgio	69.23 KB	Tecniplast_grosati	22/02/2025 17:42		22/02/2025 17:43	Completed	Type 1	1 1 1	4e31e06ea85bd60f6fc53d2b31974bc875d803c1	(i) 🗙 👲
Download data		Tecniplast_mstort	20/02/2025 18:20			Failed	Type 1	1		() ×
Download data		Tecniplast_mstort	20/02/2025 17:35			Falled	Type 1	1		(i) ×
Download data		Tecniplast_mstort	20/02/2025 16:38			Failed	Type 1	1		() ×
Download data		Tecniplast_mstort	20/02/2025 09:09			Failed	Type 1	1		() ×
testXY		Tecniplast_mstort	19/02/2025 20:10			Failed	Type 1	1		() ×
test1	7.67 KB	Tecniplast_mstort	19/02/2025 20:09		19/02/2025 20:11	Completed	Type 1	1	39d29e3d4f3c8061536b47b0393b4dc12e93d79c	(i) 🗙 👲
Download data		Tecniplast_llaino@	12/02/2025 17:43			Failed	Type 1	1		() ×
RestAwakeDom	2.02 KB	adminTP	12/02/2025 15:21		12/02/2025 15:22	Completed	Type 1	1	642f90616a4d44ff3e2e8bd573fb79439b95022d	(i) 🗙 👲
Download data	1.53 KB	Tecniplast_llaino@	12/02/2025 14:52		12/02/2025 14:54	Completed	Type 2	8	Odc67124c44c78ae98a1e3475d7fb0a62ec7ce5d	() 🗙 👲
Download data	8.70 KB	Tecniplast_llaino@	12/02/2025 14:50		12/02/2025 14:52	Completed	Type 2	1	954755f8a6ef985bf8c6f0987b26b33801e9066a	(i) 🗙 👲
Download data	14.46 KB	Tecniplast_grosati	24/01/2025 18:55		24/01/2025 18:56	Completed	Type 1	1	f780f45baf8c38e95782af17d643f77f58e9d630	(i) × ₫
Download data	39.81 KB	Fabbatantuono	23/01/2025 10:33		23/01/2025 10:34	Completed	Type 1	1	I17e7a446cc4feab216e134363fdfc69b78868ff	(i) 🗙 👲
Download data	629.62 KB	Tecniplast_llaino@	22/01/2025 09:21		22/01/2025 09:22	Completed	Type 1	8	63720850365b8c5979b632b1ed466034b279eb65	() 🗙 👲
Download data	22.28 MB	Tecniplast_llaino@	22/01/2025 09:18		22/01/2025 09:22	Completed	Type 1	1	7e250e543457a7e6188969da14008f368d8368fe	(i) 🗙 👲
Download data	7.29 MB	Tecniplast_llaino@	22/01/2025 09:18		22/01/2025 09:20	Completed	Type 1	1	57c058b1c130c0f57917fb74bde4703fdd58dd72	(i) × ₫
Download data	27.42 KB	Tecniplast_llaino@	22/01/2025 09:02		22/01/2025 09:03	Completed	Type 1	1 1 1	3f2dce897493f1b7a20e125f0c06296a95d7ace0	(i) × ₫
Download data		Tecniplast_mstort	20/01/2025 22:51			Failed	Type 1	T		0 ×
Download data		Tecniplast_mstort	17/01/2025 18:03			Falled	Type 1	₫		() ×
Download data		Tecniplast_gveltri	15/01/2025 15:48			Failed	Type 2	1		() ×
RW-test1		Tecniplast gveltri	15/01/2025 10:44			Falled	Type 1	T		() ×
										Items: 165

The file you download is a .zip archive that contains multiple .csv files, each representing a different metric you selected earlier. For example, suppose you chose the Bedding Status Index, Animal Locomotion Index, and DVC events. In that case, there will be a separate .csv file for each of these metrics: one for average values, one for activation levels, and one for event data, respectively. Each file is formatted as a comma-separated value (CSV) document, making it easy to import and analyse in various data processing applications.

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



C:\Users\grosati\Desktop\Test_Giorgio (1).zip\					
Nome	Dimensione	Dimensione co	Ultima modifica	Creato	Ult
Revents.csv	1 888	517	2019-09-19 16:01		
🔊 average.csv	466 052	138 334	2019-09-19 16:01		
🔊 activation.csv	508 162	182 857	2019-09-19 16:01		

A	1	* E	\times	\checkmark	fx	day,ho	our,min	ute,rel	lativeT	īme,Gr	oup_1_	TIMES	STAMP,	Group_1	_AVG,Gr	oup_1	_SEM,Gr	oup_1_QR	T,Group_	1_SAMP	LES,Gro	up_1_120	67_DX_					
4	A	В		c	D		E	F		G	н		I	J		к	L	м	N		0	р	Q	R	S	т	U	
1	day,hour,	minute,	relative	Time,	Group_	1_TIM	ESTAM	P,Group	p_1_A	VG,Gro	up_1_S	EM,GI	roup_1_	QRT,Gr	oup_1_S	AMPLES	S,Group	1_1267_D	<_									
2	0,15,50,57	019,201	9-09-251	13:50	:19.443	3+0000,	0.06209	150326	579738	6,NaN,	[0.062	09150	3267973	86,0.06	20915032	679738	6,0.0620	915032679	7386,0.06	2091503	3267973	86,0.0620	915032679	97386]",153	3.0,0.06209	1503267973	386	
з	0,15,51,57	060,201	9-09-251	13:51	:00.164	+0000,	0.03908	554572	227138	7,NaN,	"[0.039	08554	5722713	87,0.03	0855457	227138	7,0.0390	855457227	1387,0.03	9085545	5722713	87,0.0390	855457227	71387]",220	5.0,0.03908	5545722713	887	
4	0,15,52,57	120,201	9-09-251	13:52	:00.176	5 +0000 ,	0.05162	241887	790560	46,NaN	,"[0.05	16224	1887905	6046,0.0	05162241	887905	6046,0.0	516224188	79056046	,0.05162	2241887	9056046,0	0.05162241	1887905604	6]",226.0,	0.051622418	87905604	6
5	0,15,53,57	180,201	9-09-251	13:53	:00.229	+0000,	0.03666	666666	566666	i6,NaN,	[0.036	56666	6666666	566,0.03	56666666	666666	6,0.0366	666666666	6666,0.03	6666666	5666666	66,0.0366	6666666666	56666]",225	5.0,0.03666	66666666666	566	
6	0,15,54,57	240,201	9-09-251	13:54	:00.062	2+0000,	0.04203	539823	300885	,NaN,"	0.0420	35398	2300885	5 ,0.0 420	35398230	0885,0	.0420353	982300885	,0.042035	3982300	0885,0.0	42035398	2300885]"	,226.0,0.04	203539823	00885		
7	0,15,55,57	300,201	9-09-251	13:55	:00.089	+0000,	0.04166	666666	566666	8,NaN,	[0.041	56666	6666666	568,0.04	16666666	666666	8,0.0416	666666666	6668,0.04	1666666	5666666	68,0.0416	666666666666666666666666666666666666666	56668]",220	5.0,0.04166	666666666666666666666666666666666666666	568	
8	0,15,56,57	360,201	9-09-251	13:56	:00.164	+0000,	0.04977	876106	519469	04,NaN	,"[0.04	97787	6106194	16904,0.0	04977876	106194	6904,0.0	497787610	61946904	,0.04977	7876106	1946904,0	0.04977876	5106194690	4]",226.0,	0.049778761	1061946904	4
9	0,15,57,57	420,201	9-09-251	13:57	:00.262	2+0000,	0.03592	592592	259259	24,NaN	,"[0.03	59259	2592592	25924,0.0	03592592	592592	5924,0.0	359259259	25925924	,0.03592	2592592	5925924,0	0.03592592	2592592592	4]",225.0,	0.035925925	92592592	4
10	0,15,58,57	480,201	9-09-251	13:58	:00.030)+0000,	0.02986	725663	371681	.43,NaN	,"[0.02	98672	5663716	58143,0.0	2986725	663716	8143,0.0	298672566	37168143	,0.02986	5725663	7168143,0	0.02986725	6663716814	3]",226.0,	0.029867256	63716814	3
11	0,15,59,57	540,201	9-09-251	13:59	:00.076	5+0000,	0.03576	696165	519174	,NaN,"	0.0357	56961	6519174	1,0.0357	56961651	9174,0.	.0357669	616519174	,0.035766	9616519	9174,0.0	35766961	.6519174]"	,226.0,0.03	576696165	19174		
12	0,16,0,576	00,2019	-09-25T1	4:00:0	00.185+	-0000,0	.029498	525073	374631	2,NaN,	[0.029	49852	5073746	5312,0.0	29498525	073746	312,0.02	949852507	3746312,0	0.029498	3525073	746312,0.	029498525	5073746312]",226.0,0	.0294985250	73746312	
13	0,16,1,576	60,2019	-09-25T1	4:01:0	00.216+	-0000,0	.022222	222222	222222	3,NaN,	[0.022	22222	2222222	2223,0.0	22222222	222222	223,0.02	2222222222	2222223,0	0.022222	2222222	222223,0.	.022222222	2222222222]",225.0,0	.0222222222	222222223	
14	0,16,2,577	20,2019	-09-25T1	4:02:0	00.011+	0000,0	.031342	182890	085545	5,NaN,	[0.031	34218	2890855	6455,0.0	31342182	890855	455,0.03	134218289	0855455,0	0.031342	2182890	855455,0.	.031342182	2890855455]",226.0,0	.0313421828	390855455	
15	0,16,3,577	80,2019	-09-25T1	4:03:0	0.108+	-0000,0	.041666	666666	566666	4,NaN,	[0.041	66666	6666666	5664,0.04	1666666	666666	664,0.04	166666666	6666664,0	0.041666	5666666	666664,0.	.041666666	5666666666]",226.0,0	.0416666666	666666666666666666666666666666666666666	
16	0,16,4,578	40,2019	-09-25T1	4:04:0	00.133+	-0000,0	.039823	008849	955752	,NaN,"	0.0398	23008	8495575	52,0.039	32300884	955752	,0.03982	300884955	752,0.039	8230088	3495575	2,0.03982	300884955	5752]",226.	0,0.039823	0088495575	52	
17	0,16,5,579	00,2019	-09-25T1	4:05:0	0.197+	+0000,0	.037037	037037	703703	5,NaN,	[0.037	03703	7037037	7035,0.0	37037037	037037	035,0.03	703703703	7037035,0	0.037037	7037037	037035,0.	.037037037	7037037035]",225.0,0	.0370370370	37037035	
18	0,16,6,579	60,2019	-09-25T1	4:06:0	00.031+	0000,0	.011430	678466	507669	6,NaN,	[0.011	43067	8466076	5696,0.0	1430678	466076	696,0.01	143067846	6076696,0	0.011430	0678466	076696,0.	.011430678	3466076696]",226.0,0	.0114306784	66076696	
19	0,16,7,580	20,2019	-09-25T1	4:07:0	0.054+	0000,0	.029867	256637	716814	3,NaN,	[0.029	86725	6637168	3143,0.0	29867256	637168	143,0.02	986725663	7168143,0	0.029867	7256637	168143,0.	.029867256	5637168143]",226.0,0	.0298672566	537168143	
20	0,16,8,580	80,2019	-09-25T1	4:08:0	0.116+	0000,0	.027654	867256	563717	3,NaN,	"[0.027	55486	7256637	7173,0.0	27654867	256637	173,0.02	765486725	6637173,0	0.027654	1867256	637173,0.	.02765486	7256637173]",226.0,0	.0276548672	256637173	
21	0,16,9,581	40,2019	-09-25T1	4:09:0	0.219+	0000,0	.028518	518518	351851	.6,NaN,	[0.028	51851	8518518	3516,0.0	28518518	518518	516,0.02	851851851	8518516,0	0.028518	3518518	518516,0.	.028518518	3518518516	j",225.0,0	.0285185185	18518516	
22	0,16,10,58	200,201	9-09-251	14:10	:00.006	5+0000,	0.02148	148148	314814	8,NaN,	[0.021	48148	1481481	148,0.02	4814814	814814	8,0.0214	814814814	8148,0.02	1481481	481481	48,0.0214	814814814	18148]",225	5.0,0.02148	1481481481	.48	_
23	0,16,11,58	260,201	9-09-251	14:11	:00.064	+0000,	0.02765	486725	566371	.66,NaN	,"[0.02	76548	6725663	37166,0.0	02765486	725663	7166,0.0	276548672	56637166	,0.02765	6486725	6637166,0	0.02765486	5725663716	6]",226.0,	0.027654867	25663716	õ
24	0,16,12,58	320,201	9-09-251	14:12	:00.167	+0000,	0.02986	/25663	3/1681	46,NaN	,"[0.02	98672	5663/16	8146,0.0	12986725	663/16	8146,0.0	2986/2566	3/168146	,0.02986	5/25663	/168146,0	0.02986725	663/16814	6]",226.0,	0.029867256	63/16814	ò
25	0,16,13,58	380,201	9-09-251	14:13	:00.198	\$+0000,	0.04166	000000	000000	8,NaN,	[0.041	56666	0000000	68,0.04	100000000	000000	8,0.0416	0000000000	6668,0.04	1000000	0000000	68,0.0416	00000000000	06668]",220	0.0,0.04160	0000000000000	068	_
26	0,16,14,58	440,201	9-09-251	14:14	:00.233	3+0000,	0.01444	444444	144444	46,NaN	,"[0.014	14444	4444444	4446,0.0)1444444	444444	4446,0.0	144444444	44444446	,0.01444	1444444	4444446,0	0.01444444	14444444444	6]",225.0,	0.014444444	44444444	ò
27	0,16,15,58	500,201	9-09-251	14:15	:00.066	s+0000,	0.02507	374631	126843	7,NaN,	[0.025	0/3/4	6312684	137,0.02	0/3/463	126843	7,0.0250	/3/463126	8437,0.02	5073746	312684	37,0.0250	737463120	58437J",220	0.0,0.0250	3746312684	137	_
28	0,16,16,58	560,201	9-09-251	14:16	:00.115	+0000,	0.02074	074074	107407	44,NaN	,"[0.02	07407	4074074	10744,0.0	12074074	074074	0744,0.0	207407407	40740744	,0.02074	1074074	0740744,0	0.02074074	10/40/40/4	4]",225.0,	0.020740740	0/40/40/44	4
29	0,10,17,58	020,201	9-09-251	14:17	:00.158	s+0000,	0.03037	03/03/	/03/03	o /, NaN	, "[U.03	03/03	/03/03/	10367,0.0	1303/03/	03/03/	0307,0.0	303703703	/03/036/	,0.03037	/03/03/0	0370367,0	0.0303703	/03/03/036	/j [~] ,225.0,	0.030370370	137037036	-
30	0,16,18,58	080,201	9-09-251	14:18	:00.009	+0000,	0.02359	882005	0/9995	o, NaN,	10.023	59882	0058997	105,0.02	5988200	589970	5,0.0235	988200589	9705,0.02	3598820	1058997	05,0.0235	988200589	99705]",220	0.0,0.02355	8820058997	105	
31	0,16,19,58	740,201 200,201	9-09-251	14:19	.00.001	+0000,	0.03355	437227	113804	s,nan,	[0.033]	22457	22/1380	243,0.03	000000000000000000000000000000000000000	248002	ia,U.U335	045/22/13	0025.0.03	0000000	22/1380	45,0.0335	045/22/1	00043]",220	.0,0.03355	43/22/1380	943	
32	0,10,20,58	800,201	9-09-251	14:20	:00.081	L+0000,	0.03392	330383	548082	o, ivalv,	[0.033]	92330	3834808	\$20,0.03	59233038	348082	0,0.0339	233038348	0820,0.03	3923303	3834808.	20,0.0339	233038348	50820]",220	0.0,0.03392	3303834808	520	
-33	0,16,21,58	860,201	9-09-251	14:21	:00.176	+0000,	0.03834	808259	358/02	u,naN,	[0.038	34808	2595870	021,0.03	\$3480825	958/02	1,0.0383	480825958	/021,0.03	8348082	2595870	21,0.0383	480825958	\$7021]",226	0.0,0.03834	18082595870	121	

PLEASE NOTE: TIMESTAMP are produced in UTC

(<u>https://en.wikipedia.org/wiki/Coordinated_Universal_Time</u>). If you use MS Excel to open these files, remember to set the "." as the decimal separator.

4 Manage Experiment

The section "Manage Experiment" contains several options:

Manage Experiment



TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



4.1 Cage Groups

In this section, it is possible to create specific groups of cages and assign them to (already) existing DVC® Analytics users.

QA QAtest (Buguggiate)			▲ 0 5973	37	€ 🛓
Cage Groups Manage groups of cages					
Home / Cage Groups					
Group Name	Cages	Owner		Ð	Ð
18/05/001	0	adminTP	(2 🔁	0
18/05/005	2	adminTP		2 🕀	0
19_05	0	adminTP	(0
19_054	0	adminTP			0
26_0_001	1	adminTP			0
26_0_002	2	adminTP			0
B2342#666 Minut	8	adminTP			O
CAGES_NO_RACK_BUT_RUNNING	5	adminTP		2 🕀	0
Cristian_cages	8	adminTP			
DA GABBIE	2	adminTP			
DA GRPPI	9	adminTP			
gabbie con dati	2	adminTP			
Group 0	1	adminTP			0
group_06_06_001	3	adminTP			0

Items per page: 14 💌 1 - 14 of 48 <

The first step is to create the group by clicking the corresponding icon \oplus . A pop-up area appears, and you are requested to insert the group's name and owner.

Test Group			
Owner *			
GiorgioM			
	_	_	
	6.77	lool	Confirm

Then, you can add cages to this group by clicking on the icon / and selecting the cages to be included.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



DVC® Cag	je List							
	Cage Id	Protocol	Registr. DVC Owner DVCA Ov	vner Animals	Position	Status -		
	101	9F5F5.220	12/10/2018	0				
	102	9F5F5.220	12/10/2018	0				
	103	9F5F5.220	12/10/2018	0				
	103 A wt	DVC Default Protocol	17/06/2022Piccirillo	2	D6	ē		
	103 B wt	DVC Default Protocol	17/06/2022Piccirillo	2	E6	ē		
	106 wt	DVC Default Protocol	09/01/2023Piccirillo	0				
	110A WT	DVC Default Protocol	09/01/2023Piccirillo	0				
	110B WR	DVC Default Protocol	09/01/2023Piccirillo	0				
				Items per page: 8	▼ 1 - 8 o	f 1352 < < > >		
					Deselect	all [1] Cancel Confirm		

PLEASE NOTE: The same cage(s) can be assigned to different groups.

PLEASE NOTE: to delete a group, you must deselect all the cages before being able to delete the Cage Group with the corresponding icon

4.2 Mice groups

To create a Mouse group, please follow the previous workflow, with the only difference being that you must choose between available mouse IDs (instead of cage IDs).

				DVC [®] Mice List					
					Animal Id	Protocol	Registration	DVC Owner D	VC Analytics O
	Mice Groups				006T	DVC Default Protocol	23/10/2023 11:00 +0200		z 🕰
		Manage groups of mice.			0073	DVC_RP#01	18/07/2019 10:10 +0200	Rei	z <mark>6</mark> 2
					0074	DVC_RP#01	18/07/2019 10:10 +0200	Rei	200
Group Name	Animals	Owner	· · · ·		0077	DVC_RP#01	18/07/2019 22:19 +0200	Rei	200
A	1	GLavigna	🖉 🔼 🚺		0078	DVC_RP#01	18/07/2019 22:19 +0200	Re1	200
в	0	GLavigna			007T	DVC Default Protocol	23/10/2023 11:02 +0200		۲ 🕰
с	1	GLavigna			0087	DVC_RP#01	18/07/2019 10:43 +0200	Re1	2
D	0	GLavigna			0088	DVC Default Protocol	22/07/2019 13:39 +0200		266
Group A	0	r.chiesa			0088	DVC Default Protocol	18/07/2019 22:19 +0200		z📤 -
Group B	1	r.chiesa			008T	DVC Default Protocol	23/10/2023 11:02 +0200		۲ 🕰
Group C	0	r.chiesa			0091	DVC_RP#01	18/07/2019 10:11 +0200	Rei	266
Group D	0	r.chiesa							Deselect all [3] Cancel Confirm
Group D	0	r.chiesa							Deselect all [3] Cancel Confi

4.3 Manual Event Management

The DVC[®] events are generated automatically by using the DVC[®] system in the animal room. But now, generating "custom" events by entering them into this section is also possible.





Manual Event Man	agement	
Create and delete manual events		
Home / Manual Event Managem	ent	
Caro/Apimal	Туре	
Cage/Animai	Cages	Search
		Select the resource and search associated events.

Step 1 is to Search for the specific resource to apply the manual event; it is possible to create it manually (and look for all the ones generated by the DVC[®]). It is also possible to generate an event to be added to the entire Resource Group:

T	
Cages	
Cage Groups	
Animals	
Animal Groups	

Manual E	event Management								
Home / Manu	al Event Management								
Cage/Animal LowFood-I	Em-5 Type Cages	▼ S	earch						
Resource Id:	LowFood-Em-5 (116 events found) nt only								
#	UUID	RFID	Date	Event Type	Event Sub Type	Dvc Event	Manual Event	Inserted By	+ 😏 🔒
3583902	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	21/02/2025	RACK	INSERTED	~			
3583901	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	21/02/2025	CAGE_ONLINE		~			
3583153	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	21/02/2025	CAGE_OFFLINE		~			
3581830	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	20/02/2025	RACK	INSERTED	~			
3581829	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	20/02/2025	CAGE_ONLINE		~			
3581526	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	20/02/2025	CAGE_OFFLINE		~			
3580844	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	20/02/2025	RACK	INSERTED	~			
3580843	002e1fcf-a8d5-4d0a-98b5-26308d9a4b84	0428B282850F95	20/02/2025	RACK	REMOVED	~			

By clicking the $\stackrel{ullet}{\longrightarrow}$ button, a specific pop-up appears where you can provide the name of the manual event and its timestamp.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Timestamp			
22/02/2025 17:59	e		
Description			
est_Giorgio			

PLEASE NOTE: you can only edit or delete Manual events (not the DVC®'s ones):

Manual EN Create and delete man	vent Managemer	it							
Home / Manual	Event Management								
Cage/Animal LowFood-Er	n-5	Type Cages	• Searct						
Resource Id: L	owFood-Em-5 (117 ever only	nts found)							
#	JUID	RFID	Da	te Event Type	Event Sub Type	Dvc Event	Manua <mark>l E</mark> vent	Inserted By	+ 😏 💧
3584174	002e1fcf-a8d5-4d0a-98b5-2	6308d9a4b84	31	/01/2023 MANUAL	Test_Giorgio		~	Giorgio	0

This generates the corresponding icon on the timeline of the events in the chart of the data



5 Settings

As described in section 2.1, this section is available only for the DVC® Analytics users registered as Facility Managers and not available to the users registered as Researchers. There are different options you can set.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Setting: Create and r	S nanage users and overall settings
	Unit of Measure Configuration of unit of measure
	User Groups Manage groups of users and associate cages
	DVC® Analytics Users Manage DVC Analytics users
	DVC® Cage Owner Association Associate DVC Analytics existing users to DVC cage owners inherited from registered cages in the facility
0,0	Settings Set facility parameters (e.g., dark period)

5.1 Unit of Measure

By clicking on the corresponding button, you can view your current settings, which are set by default, and change some of them if needed.

• / bita Masure	Unit of Measure artiguration of unit of measure	
عال المالية المعالية المحالية المعالية	ome / Unit of Measure	
Animal Loc. Index Personage Indox Bedding Status Index Image Index REM Nole Image Index REM Nole Image Index REM Relative Humdity Image Index Relative Index Image Index Relative Index Image Index Runding Wheel Rotation Image Index Runding Wheel Rotation Image Index Runding Wheel Rotation Image Index Runding Wheel Rotatind Index Image Index <	Label	Unit Of Measures
Beding Statu Index Image: St	Animal Loc. Index	Percentage(x100) [0,100] (0,100]
REM Nole Set Person Person Rem Rem </th <td>Bedding Status Index</td> <td>None (0.1024)</td>	Bedding Status Index	None (0.1024)
REM Person Presence In yone Personage REM Aladove Humidhy Kehnin Salaren Humidhy Celsius REM Vibration Kehnin Salaren Humidhy Celsius Animal Tracking Distance Meters from meters Red meters from meters Red meters from meters Animal Tracking Distance Image: Salaren Humidhy Meters from meters Red meters from meters Running Wheel Rotation Image: Salaren Humidhy Meters personal Rest from meters Running Wheel Speed Kilometers perform Meters personal Centimeters Running Wheel Speed Kilometers perform Meters personal Centimeters Running Wheel Speed Kilometers perform Meters personal Centimeters Running Wheel Speed Image: Salaren Humidhy Centimeters Personal Run Lour Arbate Image: Salaren Humidhy Meters personal Centimeters Run Acceleration (max) Image: Salaren Humidhy Meters personal Centimeters Red Acceleration (max) Image: Salaren Humidhy Meters personal Centimeters Red Acceleration (max) Image: Salaren Humidhy Image: Salaren Red Meters <th>REM Nolse</th> <th>Decibel (0, 500)</th>	REM Nolse	Decibel (0, 500)
RR Adation Humidity Image: Addition of the section of the sectin of the section of the section of the section	REM Person Presence	None [0,4]
REM Temperature Mething Fahrenhets Calabian REM Vibration Mething Fahrenhets Mis2 Stand Animal Tracking Distance Metars (from metars) Centimetars) Stand Stand Animal Tracking Speed Image: Stand Metars (from metars) Stand <	REM Relative Humidity	Percentage (0, 100)
Ret Vibration Meters (from meters) (is.com Meters) (is.com Meters) (is.com Meters) (is.com Meters) (is.com Meters) (is.co	REM Temperature	Kelvin (0, 324) Fahrenheit (0, 104) Celsius (0, 40)
Animal Tracking Distance Metters (from metters) (s. 100) Cendmeters (from metters) (s. 100) Animal Tracking Speed Image: State (State) Image: State (State) Image: State) Image: Sta	REM VIbration	m/s2 (0.400)
Animal Tracking Speed mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm	Animal Tracking Distance	Meters (from meters) (0, 000) [0, 100] [0, 100]
Running Wheel Rotation Imate: Second Sec	Animal Tracking Speed	cm/s (0,100)
Running Wheel Distance Instance Instanc	Running Wheel Rotation	Revolutions (0, 5034)
Kinning Wheel Speed Kilometers per nearing in the series of the seri	Running Wheel Distance	meters (0. 12000) [0. 120000]
Animal Loc Index smoothed Animal Loc Index smoothed ADI - Dark Phase ADI - Dark Phase ADI - Light Phase ADI - Dark Phas	Running Wheel Speed	Kilometers per hour (0, 100) Meters per second (0, 100) (0, 100) (0, 100)
RDI-Dark Phase RDI-Light Phase RDI-Light Phase RDI-Light Phase REM Acceleration REM Liminosity REM Liminosity REM Liminosity REM Acceleration (max) REM Acceleration (max) Remote Phase Rem	Animal Loc. Index smoothed	Percentage (0, sog)
RDI-LIght Phase RDI-Light Phas	RDI - Dark Phase	Percentage (0, sog)
Rem Acceleration Gunit (t. stor) Millimeters per second square (s. stor) REM Erightness Image: Store S	RDI - Light Phase	Percentage (0, 500)
REM Brightness Lux REM LumInosity None REM Acceleration (max) Metra presenta square Stereotypy Numbers Fighting-Like Numbers Wake bouts Percentage Rest bouts Percentage	Rem Acceleration	Gunit [0, soo] Millimeters per second square [0, too]
REM LumInosity None I.0.11 REM Acceleration (max) Meter second square (0.100) Stereotypy Numbers (0.100) Fighting-Like Numbers (0.100) Wake bouts Percentage (0.100) Rest bouts Percentage (0.100)	REM Brightness	Lux (0, 100)
REM Acceleration (max) Meters per second square (p. 100) Stereotypy Numbers (p. 100) Fighting-Like Numbers (p. 100) Wake bouts Per centage (p. 100) Rest bouts Per centage (p. 100)	REM Luminosity	None [0,1]
Stereotypy Numbers (5, 100) Fighting-Like Numbers (5, 100) Wake bouts Percentage (5, 100) Rest bouts Percentage (5, 100)	REM Acceleration (max)	Meters per second square (0, 100)
Fighting-Like Numbers (0.00) Wake bouts Percentage (0.00) Rest bouts (0.00)	Stereotypy	Numbers (0,100)
Wake bouts Percentage [5.100] Rest bouts [5.100]	Fighting-Like	Numbers (0.100)
Percentage (0.100)	Wake bouts	Percentage (0.100)
	Rest bouts	Percentage (0.100)

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



5.2 User Groups

This functionality allows a group of DVC[®] Analytics users to access a selected number of available cages.

User Groups Manage groups of users and associate cages				
Home / User Groups				
Group Name Ru	Owner	Users	Cages	(+)
Running Wheel	ggottardo	3	4	

Everything starts by creating the new Group by assigning the name and the owner of this new group:



Then, by clicking the button *times*, it is possible to add multiple existing users:

	Username	Name	Surname	Email Role	-
	adminTP	Admin	Admin	admin@gfmintegration.it	
	cypress	cypress	cypress	cypress@test.com	
	Enpa	Enpa	Enpa	Enpa@gmail.com	
	Fabbatantuono	Francesca	Abbatantuono	digitalreality.fa@libero.it	
	fsinelli	Federica	Sinelli	fsinelli@tecniplast.it	
	gfmiR	Giovanni	Giannone	giovannigiannone84@hotmail.com	
×	ggottardo	Guido	Gottardo	guido.gottardo@tecniplast.it	
/	Giorgio	Giorgio	Rosati	grosati@tecniplast.it	
	GiorgioRes2	Giorgio	Rosati	grosati1978@gmail.com	
	Giorgio_Test	Giorgio	Rosati		
	llaino_FM	Lorenzo	Laino	lorenzo.laino@tecniplast.it	
~	lorenzo	lorenzo	ravera	femijod731@morxin.com	
	lorenzo_2	lorenzo	ravera	lorenzoravera@hotmail.com.ar	
	Iro	Iro	Iro	haxaga3568@furnato.com	

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	I EGNIPLASI
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



And finally, by clicking the icon 🕬 , the cages become available to the gr
--

) 🔁

DVC [®] Cag	e List						
	Cage Id LowFoo	Protocol	Registra DVC Owner	DVCA Ow	Animals	Position	Status 💌
	LowFood- 395green-02	DVC Default Protocol	20/05/2024		3	E9	Ē
	LowFood395Gre	DVC Default Protocol	10/04/2024		0		
~	LowFood- DoubleA-7	DVC Default Protocol	05/03/2024		8	H1	Ē
~	Lowfood- DoubleA-8	DVC Default Protocol	05/03/2024		1	G3	Ē
~	Lowfood- DoubleA-9	DVC Default Protocol	05/03/2024		2	F1	Ē
~	LowFood- DoubleB-10	DVC Default Protocol	07/03/2024		1	01	Ē
Image: A start of the start	LowFood- DoubleB-11	DVC Default Protocol	13/06/2024		0		
Image: A start of the start	LowFood- DoubleB-11	DVC Default Protocol	13/01/2025		3	P1	Ē
	LowFoodDoubleB- 11	DVC Default Protocol	07/03/2024		0		
	LowFood- DoubleB-12	DVC Default Protocol	07/03/2024		1	N3	Ē
	LowFood-Em-3	DVC Default Protocol	22/02/2024Research30		5	В7	Ē
	Lowfood-Em-4	DVC Default Protocol	13/01/2025		2	A9	Ē
	Lowfood-Em-4	DVC Default Protocol	11/04/2024		0		
	LowFoodem-4	DVC Default Protocol	22/02/2024		0		
						Dese	elect all [6] Cancel Confirm

PLEASE NOTE: to delete a user group, you must deselect all the users and all the cages from the User group.

5.3 DVC[®] Analytics Users

Leveraging the already existing AMAZON cloud service, we implemented a critical package called Amazon COGNITO to manage user credentials securely.

(https://docs.aws.amazon.com/cognito/latest/developerguide/what-is-amazon-cognito.html).

Thanks to this functionality, now the process of a new user registration follows the below steps:

You can create unlimited users by clicking the corresponding icon .

In this window, you must enter the email address of the new User and the "Role" ("Researcher" or "Facility manager"):

Add new user		
Email *		
Enter email		
Researcher		
Facility manager		
	Cancel	Confirm

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	I ECINIPLASI
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Once you "Confirm" the information, an invitation email is sent to the new User.

Add new user		
	Thank You! Please check email	
	grosati@tecniplast.it	
	to activate your subscription	
		Close

The new User receives the email and must click "here" to properly register in the DVC® Analytics.

DVC Analytics invitation						
DVC Analytics <dvcanalytics@dvc.tecniplast.it></dvcanalytics@dvc.tecniplast.it>	© 5	Reply	« Reply All	\rightarrow Forward	ij	
To Giorgio Rosati - Tecniplast S.p.A.				giovedì 20	/07/2023	18:53
(i) If there are problems with how this message is displayed, click here to view it in a web browser.						
Start your reply all with: I signed up for this. I registered. I accept! (i) Feedback						
SCIENTIFIC PLATFORM						
Welcome in DVC Analytics						
Click here to register in DVC Analytics						

The new User is redirected to the DVC® Analytics registration page, where credential pieces of information are requested:

Sign up	×
Username *	-
Name *	.
Surname *	.
Email *	.
Password *	.
Confirm password *	
Confirm	

Remember that the password has some requirements: "Use min 8 characters or more, minimum one number and one symbol and minimum one special symbol as [@\$!%*?&~()_{}:"<>,€]"

Once all the information is inserted, you can click "Confirm", and a confirmation pop-up appears.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



gn up	×
Thank You! Please check your email to activate your subscription	
Username *	
Giorgio78	
Name *	
Giorgio	
Surname *	
Rosati	
Email *	
grosati1978@gmail.com	

It is time to validate the email entered for the new User (that can be different compared to the invitation email). A confirmation email has been sent to the new User, who must accept it to confirm the email address (this is important for password recovery).



Clicking "here", the process of new user authentication is completed and confirmed.



The new User can now finally log in to the DVC® Analytics platform.

In case any user has lost credentials, it is possible to click on the corresponding section "Forgot password?" on the login page:







The User must enter the Username and then click "Next":

	Domain marionegri Username Giorgio78	■ ■
welcome to the DVC® Analytics login page. Please insert your username and password. If you are experiencing any problem or you need more support, please kindly write your enquire using the ticketing system or directly write to digilab- service@tecniplast.it and we will take care of your request shortly.	Cancel Ne:	ĸt

A "Verification Code" is sent to the email address of the User:



Inserting it in the corresponding field altogether with a new (valid) password, then clicking on "Next", the User can finally login again (with the new password):



TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



5.4 DVC[®] Cage Owner Association

This section is fundamental, especially if you have "Researcher users" because it is the only way to analyse cages using this profile.

DVC® Cage Owner Association Associate DVC Analytics existing users to DVC cage owners inherited from registered cages in the facility						
Home / DVC®Cage Owner Association	Home / DVC*Cage Owner Association					
DVC Cage Owner	DVC Analytics User	Secondary Owner	E			
Anonymous		1	😑 🐼 🛎			
Re5			😑 🐼 😩			
Re1			😑 🐼 😩			
Dr.ssa Zina Del Ceresio			(C)			
Re4			(3)			
BAU			(3)			

Every cage prepared in the DVC[®] system can have a DVC[®] Owner associated (it is not mandatory but highly suggested when combined with DVC[®] Analytics – if not, it is defined as "Anonymous"). If so, this DVC[®] Owner is pushed to the DVC[®] Analytics and can be manually associated with existing DVC[®]

Analytics users by clicking the 😑 icon. This will be set as the primary user.

Then, by clicking the ^(a) button, it is now possible to associate "secondary users" to the same cages created with this DVC[®] Owner:

Secondary Owners DVC Cage Owner: Rheuma				
	Username			
	adminTP			
~	ASch			
~	langan			
	rschoene			
<u>~</u>	SeBra			
	snr			
	TierarztCCO			
	TierarztCCR			
	1 - 8 of 8 < >			
	Items per page: 8 💌			
	Deselect all Cancel Confirm			

The main difference between this feature and the "User Groups" described earlier is that, in this latter feature, any new cage created in the Animal room with the specific Cage Owner will become automatically available to all the primary and secondary users, while in the "User Groups" feature, only the selected ones are available to the entire group of users.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



5.5 Settings

This button allows you to set different Facility information.

Settings Create and manage users and overall settings		
Home / Settings		
Dark Period		
Start	End	
18:30	07:00	Reset Save
Timezone Timezone settings:		
Facility timezone:		
Europe/Rome		Reset Save
Starting day of the week Select the starting day of the week		
Day		
Monday 👻		Reset Save

Essential to click the "Save" button.

6 DVC® Analytics Credits management

The DVC[®] Analytics platform can be enabled for the entire Facility (full), by Rack Level (serial number), or credits (cage/day). However, these functionalities cannot work simultaneously. Moreover, switching from any mode to credits mode makes the previous cages unavailable (unless credits are used to enable them).

6.1 Home page

After the login, the home page shows specific sections where the credits are managed.



Use Credits Select cages and use credits to enable them

6.2 Digital wallet

This section recaps the status of the credits at the Facility level (1.608 in this example). and how many credits are assigned to the different registered Researchers (15 to Pippo, in this example).

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



c	Digital Wallet theck your digital wallet status and perform credits transactions				
F	lome / Digital Wallet				
					A
	Facility Name	Credits	Last Update	Last Update Made By	
	qa	1608 crd	22/02/2025 18:28:25	Tecniplast SuperUser	
	Researcher User	Credits	Last Update	Last Update Made By	
	pippo	15 crd	06/02/2025 11:58:04	Fabbatantuono	Transfer Credits
	test1	0 crd			Transfer Credits
	test	0 crd			Transfer Credits
	Enpa	0 crd			Transfer Credits
	cypress	0 crd			Transfer Credits
	fsinelli	0 crd			Transfer Credits

By clicking the button "Transfer Credits," credits can be moved from the Facility level to the specific selected Researcher by selecting the quantity and optionally leaving a comment.

readles *	
100	CI
Notes	
Gift	
	Next Close

Once confirmed, the amounts of credits are updated, and the last transaction is tracked (performed by whom and when)

Digital Wallet Check your digital wallet status and perform cred	its transactions			
Home / Digital Wallet				
				*
Facility Name	Credits	Last Update	Last Update Made By	
qa	1508 crd	22/02/2025 18:30:19	Giorgio	
Researcher User	Credits	Last Update	Last Update Made By	
pippo	115 crd	22/02/2025 18:30:19	Giorgio	Transfer Credits

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



6.3 Use credits

This section has been designed to support the selection of the cages to be enabled and the use of the corresponding credits:

Shopping cart Use your credits to select cages and their time interval					
Home / Shopping cart					
+ Select Cages					Select period for all Apply 3
Status Cage Id	Registration Date	Termination Date	Periods (From/To)	Credits	
				Total:	0 crd
				Credits:	1508 crd
				Residual:	1508 crd Remove All Buy All

By clicking the button + Select Cages, you can select from all the registered cages (terminated, out of rack, running).

Sel	ect Cages								
		Cag	ges List			TT.			
	Cage Id Iowfood 1	Protocol	Registration	DVC Owner	DVCA Owner	Animals	Position	Status All 👻	
	LowFood-395green- 02	DVC Default Protocol	20/05/2024			3	E9	Ē	- 1
	LowFood395Green/02	DVC Default Protocol	10/04/2024			0			- 1
	LowFood-DoubleA-7	DVC Default Protocol	05/03/2024			8	H1	Ē	- 1
	Lowfood-DoubleA-8	DVC Default Protocol	05/03/2024			1	G3	Ē	- 1
	Lowfood-DoubleA-9	DVC Default Protocol	05/03/2024			2	F1	Ē	- 1
	LowFood-DoubleB-10	DVC Default Protocol	07/03/2024			1	O1	F	- 1

When you confirm the cages, it is time to select the dates (days) to enable the data.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Shopping cart Use your credits to select cages and their time interval				
Home / Shopping cart				
+ Select Cages			Select per	riod for all Apply G
Status Cage Id	Registration Date Termination Date Periods (From/To)	Credits		
LowFood-Em-3	22/02/2024 09:39		0 crd	😥 💼 Buy
LowFood-Em-5	13/01/2025 15:43		0 crd	😥 💼 Buy
Lowfood-Em-4	13/01/2025 15:42		0 crd	🖽 🚺 Buy
		Total: Credits:	0 crd 1508 crd	
		Residual:	1508 crd	Remove All Buy All

This is possible by clicking the corresponding icon for each individual cage or even applying the same period to all the cages by clicking the corresponding icon set period to all the cages by clicking the corresponding icon.

Ę

<		February 2025						
Su	Мо	Tu	We	Th	Fr	Sa		
26	27	28	29	30	31	1		
2	3	4	5	6	7	8		
9	10	11	12	13	14	15		
16	17	18	19	20	21	22		
23	24	25	26	27	28	1		
23	24	25	26	27	28	1		

Please note that you can only select a valid period for which corresponding data are available. Moreover, you can select multiple periods for the same cage.

	Shoppin Use your credits to	g Cart o select cages and their time interval										
	Home / Shop	pping cart										
	+ Selec	t Cages				01/02/2025 0	7/02/2025 23:59	:59 📩 🔞	Apply	G		
	Status	Cage Id	Registration Date	Termination Date	Periods (From/To)	Credits						
	F	LowFood-Em-3	22/02/2024 09:39		26/02/2024 28/02/2024 00:00:00 23:59:59 29/02/2024 01/03/2024 00:00:00 23:59:59 01/02/2025 07/02/2025 00:00:00 23:59:59		12 crd	<u>1</u>	0	Buy		
	Ē	LowFood-Em-5	13/01/2025 15:43		01/02/2025 07/02/2025 00:00:00 23:59:59	5 🛗 😣	7 crd	17	0	Buy		
	Ē	Lowfood-Em-4	13/01/2025 15:42		01/02/2025 07/02/2025 00:00:00 23:59:59	5 🛗 🐵	7 crd	17	0	Buy		
						Total: Credits:	26 crd : 1508 crd					
						Residua	II: 1482 crd	Remov	e All E	Buy All		
TECNIPL Via I Mag www.tec	_AST ggio, 6 :niplas	- 21020 BUGU st.it	IGGIATE (VA	S.p.A. A) Italy	innova	EC t i o n		P o u	g h		i o n	2
https://d	digital	cage-tecniplas	st.com/		rev.4.1						 	



The total number of credits to be used for the specific selections is displayed, as well as the residuals. Clicking the button Buy All, the order is recapped and it needs your final approval before proceeding:

	26/02/2024 00:00:00	28/02/2024 23:59:59	
Cageld: LowFood-Em-3 Registration Date: 22/02/2024 09:39:09	29/02/2024 00:00:00	01/03/2024 23:59:59	
	01/02/2025 00:00:00	07/02/2025 23:59:59	
Cageld: Lowfood-Em-4 Registration Date: 13/01/2025 15:42:21	01/02/2025 00:00:00	07/02/2025 23:59:59	÷••
Cageld: LowFood-Em-5 Registration Date: 13/01/2025 15:43:33	01/02/2025 00:00:00	07/02/2025 23:59:59	
	То	tal 26	cr

Finally, to see the "purchased" cages, click on the small icon placed on the top right side of the interface:



The entire list is shown with its correspondent periods:

Purchased cages	eed Cages and periods are listed here							
Home / Pur	chased Cages							
G								
Status	Cage Id	Registration Date	Termination Date	Owner	Protocol Pe	rlods (From/To)		
	+++++	11/07/2023 14:20:29	11/07/2023 14:20:46		DVC Default Protocol	11/07/2023 14:20:29	11/07/2023 14:20:46	
	0000032	22/11/2024 12:35:48	29/11/2024 16:04:12		DVC Default Protocol	22/11/2024 12:35:48	29/11/2024 16:04:12	
	01/ISO	04/08/2021 11:32:58	30/08/2022 14:52:00		IsoProtocolloGiovediW	09/08/2021 00:00:00	30/08/2021 23:59:59	
	04A6FE7A024A80	11/07/2019 14:35:50			DVC_Stefy2	29/01/2025 00:00:00	31/01/2025 23:59:59	
	06/ISO1	04/08/2021 11:39:57	30/08/2022 14:52:00		IsoProtocolloGiovediW	04/08/2021 11:39:57	30/08/2022 14:52:00	
Ē	LowFood-Em-3	22/02/2024 09:39:09			DVC Default Protocol	01/02/2025 00:00:00 26/02/2024 00:00:00 29/02/2024 00:00:00	07/02/2025 23:59:59 28/02/2024 23:59:59 01/03/2024 23:59:59	
Ē	LowFood-Em-5	13/01/2025 15:43:33			DVC Default Protocol	01/02/2025 00:00:00	07/02/2025 23:59:59	
đ	Lowfood-Em-4	13/01/2025 15:42:21			DVC Default Protocol	01/02/2025 00:00:00	07/02/2025 23:59:59	
	!!"£%%&/((=?^	30/08/2021 16:07:14	30/08/2021 16:11:19		ProtocolloVenerdiW	30/08/2021 16:07:14	30/08/2021 16:11:19	

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



6.4 (Credit) Data Analysis

In the "Data Analysis" section, all cages are always visible as potential selections, but the availability of the corresponding data depends upon your purchases.

More specifically, if you select a wider temporal range than the one enabled by using the credits, only the corresponding purchased days are displayed (and downloadable), while the other period is not visible.

Invalid range detected. Show it		×
Animal Locomotion Index (Percentage N)	 ◆ Group 1 ◆ Group 1 (samples) 	ŧ
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		

A specific "Invalid range detection" message appears. By clicking "Show it", you can quickly discover the missing days:



And only the purchased days (1st April in this example) are downloaded:

1	Α	В	С	D	E	F	G	н	1	J
1	day	hour	minute	relativeTime	Group_1_TIMESTAMP	Group_1_AVG	Group_1_SEM	Group_1_QRT	Group_1_SAMPLES	Group_1_C9_10
2	1	0	0	86400	2022-04-01T00:00:00.171+0200	0	NaN	[0.0,0.0,0.0,0.0]	225	0
3	1	0	1	86460	2022-04-01T00:01:00.104+0200	0,110619469	NaN	[0.11061946902654868, 0.11061946902654868, 0.11061946902654868, 0.11061946902654868, 0.11061946902654868]	226	0,110619469
4	1	0	2	86520	2022-04-01T00:02:00.196+0200	0,073746313	NaN	[0.07374631268436578,0.07374631268436578,0.07374631268436578,0.07374631268436578,0.07374631268436578]	226	0,073746313
5	1	0	3	86580	2022-04-01T00:03:00.209+0200	0,037037037	NaN	[0.037037037037037037035, 0.037037037037037037035, 0.0370370370370370370370370370370370370370	225	0,037037037
6	1	0	4	86640	2022-04-01T00:04:00.036+0200	0	NaN	[0.0,0.0,0.0,0.0]	226	0
7	1	0	5	86700	2022-04-01T00:05:00.132+0200	0	NaN	[0.0,0.0,0.0,0.0,0.0]	226	0

7 Useful information

In this section, we would like to provide some tips and information to help you better understand how DVC Analytics works and maximise its benefits.

7.1 DVC[®] board

The DVC[®] board is the core of the DVC[®] system. Twelve different electrodes map the entire base of the cage. These electrodes are numbered in the following way:





	Cage rear	
1	2	3
4	5	6
7	8	9
10	11	12

For some metrics (Animal Activity Index and Bedding Status Index), selecting ONLY some electrodes (corners, walls, etc.) can help analyse specific patterns deeply.



For some other metrics, such as Running Wheel or Animal Tracking, it is impossible to select specific electrodes because the data are calculated using the Running Wheel or the entire DVC[®] board.

7.2 DVC[®] working principle and derived metrics.

The working principle of the DVC[®] system is based on an electrical capacitance sensing technology (CTS). The DVC[®] board comprises twelve electrodes connected to an integrated circuit, continuously measuring their electrical capacitance every 250 msec (roughly). Since the matter influences capacitance in each electrode's surroundings, its measurements are affected by the presence of, e.g., water and animals. Note that materials with high water content are characterised by large values of relative permittivity (concerning air), which directly affects capacitance (high relative permittivity means higher capacitance). Since mice are characterised by high water content, their movements are performed. At the same time, close to an electrode induces significant capacitance changes, and thus, by properly tracking these changes over time, it is possible to monitor animal activity. Note that capacitance remains unchanged when material compositions around an electrode are unvaried.

Additionally, the capacitance readings are affected by the presence of water (due to, e.g., bottle leakage) or urine. However, animal activity occurs on a time scale different than water leakage or urine; thus, the two variables can be easily distinguished. Furthermore, the system's capability to discern animal movements is unchanged even when water/urine is present in an electrode surrounding (not a flooded cage, but a typical amount of water/urine in a dirty cage). Water/urine can change absolute capacitance readings but not capacitance variations due to animal movements.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1





Keeping this working principle in mind, some important metrics can be applied. The currently available metrics in the DVC[®] Analytics systems are:

- Animal Locomotion Index
- Animal Locomotion Index (smoothed)
- Bedding Status Index
- Animal Tracking Distance
- Animal Tracking Speed
- RDI Dark Phase
- RDI Light Phase
- Running Wheel Rotation
- Running Wheel Distance
- Running Wheel Speed
- Rest Bouts
- Wake Bouts
- Fighting-like
- Stereotypy

PLEASE NOTE: Every element (cage or animal) has specific capabilities assigned by the DVC[®] system that enable or disable the correspondent DVC[®] metrics (e.g., a cage without a Running Wheel does not enable the Running Wheel metric).

7.2.1 Animal Locomotion Index

This DVC[®] metric is highly robust because it uses the so-called "Activation Density" metric that has been extensively validated in the field across different experiments and validation processes (you can find detailed information in this publication: <u>https://www.heliyon.com/article/e01454</u>).

An electrode is activated when its measurements are significantly perturbed over a limited time interval, occurring when a mouse performs activity sufficiently close to an electrode (see below). Density indicates that the total number of activations is divided by the duration of the time interval and the number of electrodes of interest (up to twelve).

Any drop/increase of the signal higher than the electronic noise (1 count) is considered accurate activation.

TECNIPLAST S.p.A. Via Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1





$ACT_e = |\mathbf{e}_k(\mathbf{t}) - \mathbf{e}_k(\mathbf{t-1})| > \mathbf{1} \rightarrow 1$ (activation), otherwise 0

Where $e_k(t)$ is the kth electrode at time t

The Animal Locomotion Index is expressed in % of arbitrary units, and it is normalised between 0% and 100\%

$\sum_{e=1}^{12} ACTe / #$ Electrodes/#samples

7.2.2 Animal Locomotion Index (smoothed)

This is an improved version of the historical metric "Animal Locomotion Index" (ALI). The statistical reason is that the smoothed process increases robustness to noise and provides more sensitivity to the intensity of mice movements.

More specifically, to calculate the minute data aggregation, instead of performing a sample-by-sample difference (remember that every sample is collected every 250 msec), the ALI_{smoothed} considers the moving difference between two groups of 4 consecutive samples each. If the module of this difference is above a minimum threshold, the current group of samples is counted as a valid activation.



 $ACT_{smoot} = |\mu(e_k(t;t-4)) - \mu(e_k(t-4;t-8))| \ge 1,25 \rightarrow 1$ (activation), otherwise 0

Where $\mu(e_k(t;t-4))$ is the average of 4 consecutive samples of the kth electrode.

$\sum_{e=1}^{12} ACTsmoot / #Electrodes / #samples$

The Animal Locomotion Smoothed Index is expressed in % of arbitrary units, and it is normalised between 0% and 100%

The main benefits of this (smoothed) metric are:

- **Electrode 2** of the DVC[®] board was considered generally "less sensitive" because the RFID antenna uses part of its area to read the below cage. Applying this new mathematical method and a dedicated threshold (1.01) allows us to assess its activity better for up to 50% more activations. This helps to evaluate activity, e.g., in the rear of the cage, with a better resolution.
- It reduces "**background noisy baseline activity**" and emphasises "**spikes in activity**" over a longer time window. Since the primary behaviour of mice, especially at baseline levels, does not change in

TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



time windows below 1 second, this new metric calculation will not affect the behaviours identified via DVC®-based algorithms to date.

7.2.3 Animal Tracking Distance and Speed

The distance walked accounts for the total distance covered by the mouse within a given time interval, while the average speed is the distance walked divided by the duration of the time interval considered. We assume that the mouse position on the cage floor is identified in terms of its centroid, while the distance walked is computed via the sum of the Euclidean distances of the mouse centroid in successive frames within the time interval of interest. The distance walked is defined as follows. Let $\mathbf{p}(t) = [p_x(t), p_y(t)]$ be a 2 ×1 vector of coordinates on the plane (cage floor) representing the position of the centroid of the mouse at time *t*. Then, the distance walked within the time interval t_1 , and t_2 can be computed as:

$$S(t_1, t_2) = \sum_{t=t_1+1}^{t_2} d(t)$$

Where:

$$d(t) = \sqrt{(p_x(t) - p_x(t-1))^2 + (p_y(t) - p_y(t-1))^2}$$

is the Euclidean distance between two positions in adjacent frames.

The average speed is instead defined as the ratio between the cumulative walked distance and the duration of the time interval:

$$V(t_1, t_2) = \frac{1}{t_2 - t_1} S(t_1, t_2)$$

7.2.4 Bedding Status Index

This metric was initially designed to evaluate the level of moisture in bedding. Indeed, it is the core metric of the DVC[®] Bedding Algorithm and the DVC[®] water flooding algorithm.

Its mathematical formula is straightforward and robust. It considers the absolute values (i.e., the capacityrelated measurements or arbitrary Units) of each electrode and performs an average of these values among the selected time interval:

$$\sum_{e=1}^{12} \frac{El \, value}{\# \, Electrodes}$$

Where *El*_{value} is the absolute value of the electrode.

7.2.5 Fighting-like index

This metric value is derived from a Convolutional Neural Network (CNN) that has been extensively trained on several thousand examples of fighting and non-fighting events. Every minute of data is ingested in the CNN and continuously evaluated to produce the outcome.

7.2.6 RDI (Regularity Disturbance Index)

This is a derived metric based on the ALI_{smoot}. RDI has been developed to capture irregular patterns of animal activity. To quantitatively capture these patterns, we designed this metric based on the sample entropy mathematical formula (Richman and Moorman, 2000), which serves as the core metric.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



RDI is a metric that measures irregularities of a time series (e.g., home cage activity), and the absolute amount of the activity itself does not influence it.

Currently, the DVC® analytics provides one data point per light or dark period (i.e., 12 hours).

7.2.7 Running Wheel Rotation, Distance and Speed

Using the DVC Running Wheel product, it is possible to automate several metrics. The diameter of the plastic DVC[®] Running wheel is 110.4 mm (4.35 inches), which corresponds to a perimeter of approximately 33.75 cm (13.3 inches).



The minimum time resolution is the minute, and the metrics are expressed in:

- Running Wheel rotation: # Complete rotations in the selected time resolution (minute, hour, custom)
- Running Wheel distance: # complete rotations * 33,75 cm (13,3 inch) in the selected time resolution
- Running Wheel Speed: expressed in cm/min (inch/min) or m/min (feet/min)

7.2.8 Rest-Wake Bouts

This is a derived metric based on the ALI_{smoot}. It has been designed to work only in combination with its Rest-Wake Chart, which displays the quantity of rest and wake bouts in the selected period divided into system-specific bins (see later in the corresponding chart section)

7.2.9 Stereotypy

This metric value is derived from a Convolutional Neural Network (CNN) that has been extensively trained on several thousand examples of stereotypic and non-stereotypic events. Every minute, data is ingested into the CNN and continuously evaluated to produce the outcome.

7.3 How data are calculated and aggregated

Considering the various data and charts, it is essential to understand how they are calculated.

Considering all the available DVC[®] metrics, below you can find the recap of the aggregations:

Metric	Aggregation in the selected time interval
Animal Locomotion Index	Average
Animal Locomotion Index (smoothed)	Average
Animal Tracking Distance	Sum

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



Animal Tracking Speed	Average
Bedding Status Index	Average
Rest Disturbance Index during Dark	Average
Rest Disturbance Index during Light	Average
Running Wheel Distance	Sum
Running Wheel Rotation	Sum
Running Wheel Speed	Average
Rest-Wake	Time-weighted
Fighting-like	Sum
Stereotypy	Sum

7.4 Chart visualisation

Multiple charts are available, designed to help users better and clearer understand the behaviour and phenomena under analysis. The availability of a chart depends on the previous metric selection.

7.4.1 Line Chart Simple

Every point of the line is calculated in the following way:

SPATIAL AGGREGATION: average of the selected DVC[®] boards electrodes (by default, the twelve electrodes). The result is one single data point (if you select only the corners, the data point is the average of the four electrodes).

TEMPORAL AGGREGATION: The default temporal window (minute and hour) is automatically calculated by the DVC system as it occurs. On the other hand, if you have selected a custom temporal window, the result is the average of all the minutes included in the customised temporal interval if the time is not a multiple of the hour.

Activation (3min) = [activation (min 1°) + activation (min 2°) + activation (min 3°)] / 3

If the custom temporal interval is a multiple of the hour:

Activation (3h) = [activation (hour 1°) + activation (hour 2°) + activation (hour 3°)] / 3

GROUP AGGREGATION: the data point in the graph is calculated as the average of the single calculated metric.

Activation (3 cages) = [activation (cage 1°) + activation (cage 2°) + activation (cage 3°)] / 3

7.4.2 Line chart with SEM

As explained previously, SEM is enabled by selecting multiple cages in the same group. Everything is calculated the same as above in terms of spatial and temporal aggregation, and then, the SEM (Standard Error of the Mean) is calculated as:



TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	TECNIPLAST
https://digitalcage-tecniplast.com/	rev.4.1



Where SD is the Standard Deviation.

The corresponding Line chart is the average (central data point) ± SEM.

7.4.3 Line chart with Interquartile

As explained previously, the INTERQUARTILE is enabled by selecting multiple cages in the same group. Everything is calculated the same as above in terms of spatial and temporal aggregation, and then, the INTERQUANTILE feature enables six different points per data sample:

- Average
- Median
- Quantile
- 3* Quantile
- Interquartile min range
- Interquartile max range



7.4.4 Line chart cumulative

Spatial and temporal aggregation follow the abovementioned scheme, and in this specific case, every data point is the sum of the previous ones:

d(0) = A(0)

d(1) = A(0) + A(1)

d(2) = A(0) + A(1) + A(2)

d(n) = A(0) + A(1) + A(2) + ... + A(n)

7.4.5 Bar plot

In the Bar plot chart, each rectangular bar represents the value of the selected metric in the aggregated time interval.

The height of the bar is proportional to the value of the metric.







7.4.6 Box Plot

Spatial aggregation is similar to the Line Chart. Temporal aggregation must be calculated within 24 hours (you must select between "start of the day" or "Lights-on"). The result is a single data point for each selected element (cage or animal). The Box Plot chart is available only when multiple elements (cages or animals) are selected.

The BOX PLOT feature enables five different points per data sample:

- Median
- 1st Quantile
- 3rd Quantile
- Min
- Max



7.4.7 Heatmap

Spatial, temporal and group aggregation are precisely calculated as above. The only difference with the Line Chart is the chromatic visualisation (from blue as a lower value to red as a higher value). Every block is representative of the Data Time Aggregation chosen.

TECNIPLAST S.p.A. Via Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1





7.4.8 Actogram

This chart is a simple graph showing the selected metric over a given period, day after day. The vertical line's length determines the metric's magnitude in a specific aggregated time.

											(Group ()											
	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h 2	22h	23h
2023/05/23													and some		la tella la sta cara			.	hinda ta	والمتعادية والمتعاد	anti di .		. i.i.ib.	
2023/05/24	<u>.</u>	والعد والغرا	ul Harvet			Lale de			للا د.	L		dites.			<u>u.</u>	lak				ليابيك بر	والم المرور ال	الألباسات	a. k	
2023/05/25	- 1984 - 1 - 11		والقدر بغله	i	A., _ 41144	للغاء بغبيه	بالسال			.						. K an			.		liliti .		ىر ئەللەر	يتدار النظار
2023/05/26	• • • •	يساهيدو				. 	يريغه تعلى				100. Lat. 1		• • • • •			tan did.	-				L	. المقط	. .	
2023/05/27	ul		alifed a los	6.1.4fz		لعاسما الأرابا	ي الم الكان ال					u a he an		L	. 1	4 lai	A	المار الع		indu . (44)	هد. علمه	b .	<u></u>	di na
2023/05/28		ليمالك عا أألمة		يالية.	بط الد		الم الليو	kan				1	. Lati		يت ألغ			1	<u>4</u>				. Antikaa	a. a. a
2023/05/29	. ida. i		k	مغظم			ر طولون هار ا	haa				a 1									فا كتملس			
2023/05/30	<u>. 14</u>		h		i		ةريا لدينة (إورا ا	L	1	A	است	s. 114	4.	، السائد .	<u>k</u> .		L		.				1	Mar. J. &
2023/05/31	. a. k				ille a	الفارين وا	يفر بالا			.	ыh.					1	k	the state		بالفل	J			Å

7.4.9 Live data

This chart can be applied only to "running" cage(s) (or animal(s)). You can visualise the last minutes of data (15-30-60 min) of the selected metric through a simple line chart. The data are updated every minute.



7.4.10 Board Heatmap

This chart can be applied to those metrics that consider the 12-electrodes as a data source (i.e., the ALI, the ALI smoothed and the Bedding Status Index). It is a colour-code representation of the DVC board with its 12 electrodes. The standard granularity of the data aggregation is the day.

TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



It can be helpful to discriminate, for instance, the latrine preference (by selecting the Bedding Status Index as a metric):



And the corresponding Animal Activity preference (by selecting the "ALI smoothed" as metric):



The minimum granularity is the minute. By clicking over one DVC board, it is possible to drill it down to the below granularity if available (i.e., starting from the day aggregation, clicking on a specific date, it is possible to explore the 24 hrs of that day, and so on, clicking on a specific hour of the day, you can explore the below 60 min of that hour).

7.4.11 Rest Awake

The selection process yields two independent charts, each representing a time-weighted frequency histogram with distinct interval bins. The bins are defined as follows:

- < 40 sec
- 40 69 sec
- 70 149 sec
- 150 309 sec
- 310 629 sec
- 630 1269 sec
- 1270 2549 sec
- > 2549 sec



TECNIPLAST S.p.A. Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	7 TECNIPLAST
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



For any given analysis period, the duration of each resting (or waking) event is measured and assigned to the appropriate bin. The final output is normalised to facilitate comparisons.

For the Rest chart, please consider that any continuous inactivity < 40 sec is removed because it is not considered sleep (https://wellcomeopenresearch.org/articles/1-2/v2).

7.4.12 Bedding Change (response)

This chart is a modified Simple Line chart applied to the Bedding Change event. It shows the 300-minute response to the event. Data are aggregated by the minute, but there is the opportunity to increase the aggregation interval:

← Bedding Change					
Aggregation in minutes					
Minutes	1				

This visualisation helps interpret the impact of bedding changes on animal activity. If multiple bedding change events occur within the analysis period, their average is calculated and displayed.

Please note there is a limitation in data analysis: any bedding change task performed outside the light period will result in the event (and its data) being discarded..

7.4.13 Light Change

This chart is a modified Simple Line chart applied to the Lights On and Lights Off events, as defined in the Facility Settings section. It shows the 60 minutes before and after the response to the event.



This visualisation helps analyse the impact of light changes on animal activity. Their average is calculated and displayed if multiple light change events occur during the analysis period.

Two dedicated Simple Line charts are provided: one for Lights On events and another for Lights Off events.

7.4.14 Dark Light

This is a simple Line plot chart showing light and dark data simultaneously for each selected analysis day.

TECNIPLAST S.p.A.	7 TECNIPL AST
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1





7.4.15 Daily Rhythm

This chart is calculated by averaging and smoothing, minute by minute, all the data points of the 24-hour cycle of each selected interval day.



TECNIPLAST S.p.A.	
Via I Maggio, 6 - 21020 BUGUGGIATE (VA) Italy	I EGNIPLASI
www.tecniplast.it	innovation through passion
https://digitalcage-tecniplast.com/	rev.4.1



