PROMETHION™

METABOLIC SCREENING

REVOLUTIONIZING **METABOLIC MEASUREMENT**

PROMETHION. **25 YEARS OF RESEARCH.**

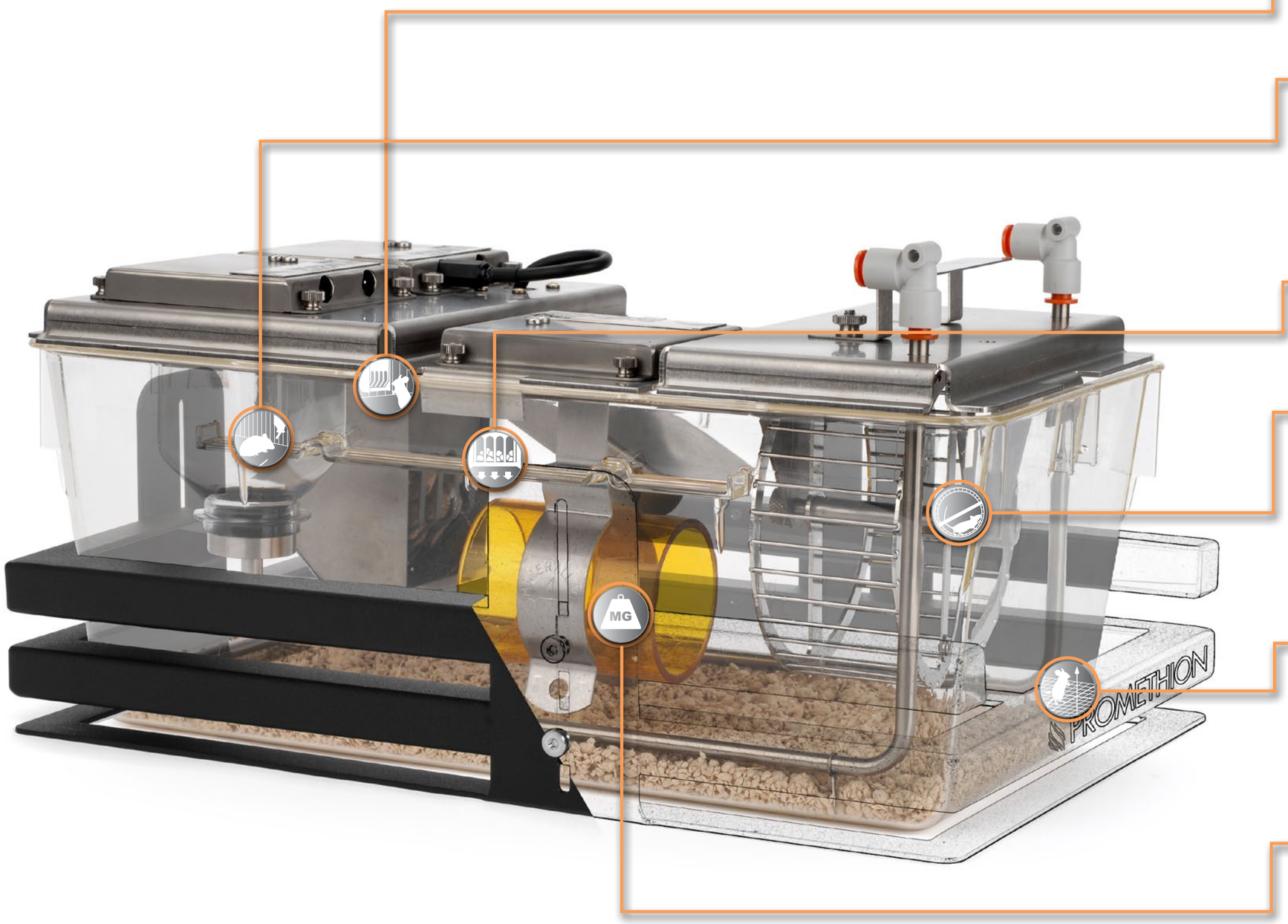
For twenty-five years, Sable Systems International has designed innovative, no-compromise software and hardware for metabolic measurement in exacting scientific applications. The culmination of this legacy is our first product line designed specifically for biomedical researchers, Promethion.

Designed for ease of use, its modular concept provides you maximum flexibility in the configuration of your own, unique system, as well as future extensibility when your research questions inevitably evolve. Raw data storage means there are no secret algorithms, or hidden pre-conditioning of data, just data that is transparent and fully traceable. Data you can trust. The parameters important for your research can be extracted any way you like – energy expenditure, metabolic substrate selection, food and water uptake, meal and drinking patterns, position, total activity and wheel-running, live body mass – even fully automated behavioral analysis is possible. All perfectly synchronized to the system's heartbeat of one second. Nothing is ever lost again.

Conventional systems use sealed cages which cause stress effects and require long acclimation times. The Promethion systems use conventional live-in cages that are not sealed. This is made possible by our unique, patent-pending pull-flow generators. Promethion's patent-pending pull-flow generators allow the use of essentially any standard live-in cage bottom for measurement. All you have to do is to replace the lid. No handling of the mouse, no unfamiliar new environment.

Promethion systems are available for mice and rats. We offer multiplexed systems (Promethion-M) in which multiple cages share a gas analyzer chain, and that offer cycle times up to ten times faster than the competition. If you need still faster metabolic measurement rates, we offer parallel continuous systems (Promethion-C) in which each cage is paired with its own flow generator and gas analyzers. Promethion-C systems accurately track metabolic signals corresponding to even brief periods of activity.

INTEGRATED PHENOTYPING. **SYNCHRONIZED.**



FI-1 Food Intake Monitor

Promethion Metabolic Screening features high precision sensors for measuring real time food intake for mice and rats. With up to 750 grams of food storage and a 3 milligram resolution, individual feeding bouts and total food intake can be monitored for up to 30 days without interruption or re-filling.

WI-1 Water Intake Monitor

Promethion Metabolic Screening features water intake sensors capable of measuring real time water intake for mice and rats. With up to 500mL of water capacity, the water intake monitor may be used uninterrupted for up to 2 weeks without refilling.

FAC-1 Access Control Module

Promethion FAC-1 Access Control Modules provide computer-controlled, automated access to food and water.

WM-1 Running Wheel Module

The Promethion Running Wheel Monitor incorporates a durable, stainless steel wheel into the cage for 180 or 360 degree monitoring of voluntary wheel revolutions. Designed to integrate with calorimetry, the wheel count data can easily be synchronized with RQ, VO_2, or any other parameter of the Promethion system.

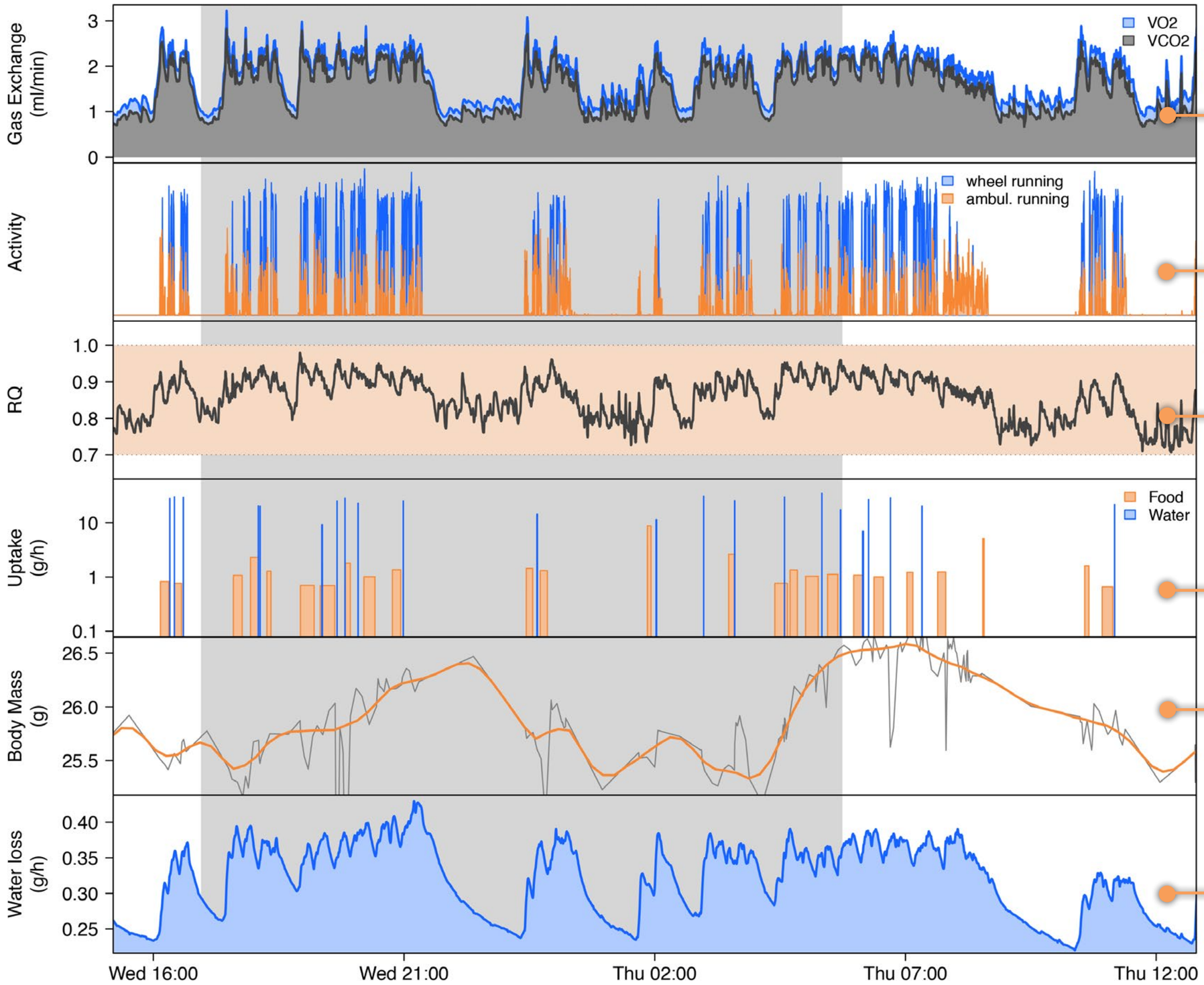
BXZ-1 Total Activity Monitor

Promethion beambreak activity monitors enable real time analysis of total activity and position with a 0.25cm calculated centroid. Designed to be modular, the Promethion beambreak activity monitor can easily be used stand alone, or synchronized with metabolic measurement.

BW-1 Body Weight Module

Promethion Metabolic Screening Body Weight Modules are in-cage enrichment devices attached to a Promethion universal MM-1 load cell. The body weight monitor allows the real time recording of body weight when the animal interacts with the device.

PROMETHION. **THE NEW STANDARD.**



Gas Exchange

Metabolic measurement is a core function of Promethion. Many refinements have yielded gas analysis instrumentation that is uniquely accurate and of unsurpassed resolution. Oxygen consumption and carbon dioxide release of the animal are measured.

Activity Monitoring

Promethion's activity detectors provide precise information about wheel and ambulatory running that can be directly correlated with metabolic data.

RQ

Track changes in substrate utilization as they happen. Whether animals rely on their fat reserves or activity bouts activate carbohydrate catabolism - Promethion will register it.

Food and Water Uptake

Food and water uptake are measured differentially and do not suffer from common severe baseline drifts due to changes in cage humidity.

Body Mass

Instead of relying on interpolation over hours, see the effects of eating and drinking immediately.

Water Loss

Only Promethion measures water loss rate. For the first time, water balance can be inferred in a cage setting. This includes both water consumed and water metabolically produced.

Data shown is from one cage over a 20 hour period.

PROMETHION. **VERSATILE METABOLIC MEASUREMENT.**

Calorimetry
Sable Systems has spent the last 25 years developing instrumentation that improves the investigator's ability to acquire calorimetry data. Promethion combines Sable Systems' expertise in animal respirometry, instrument design, and system integration to create turnkey systems for biomedical research.

Integrated Tri-Gas Analyzers
The accurate, fast responding Promethion Tri-Gas Analyzer simultaneously measures water vapor, oxygen, and carbon dioxide. Its automated corrections for the effects of drift and water vapor dilution require no scrubber chemicals.

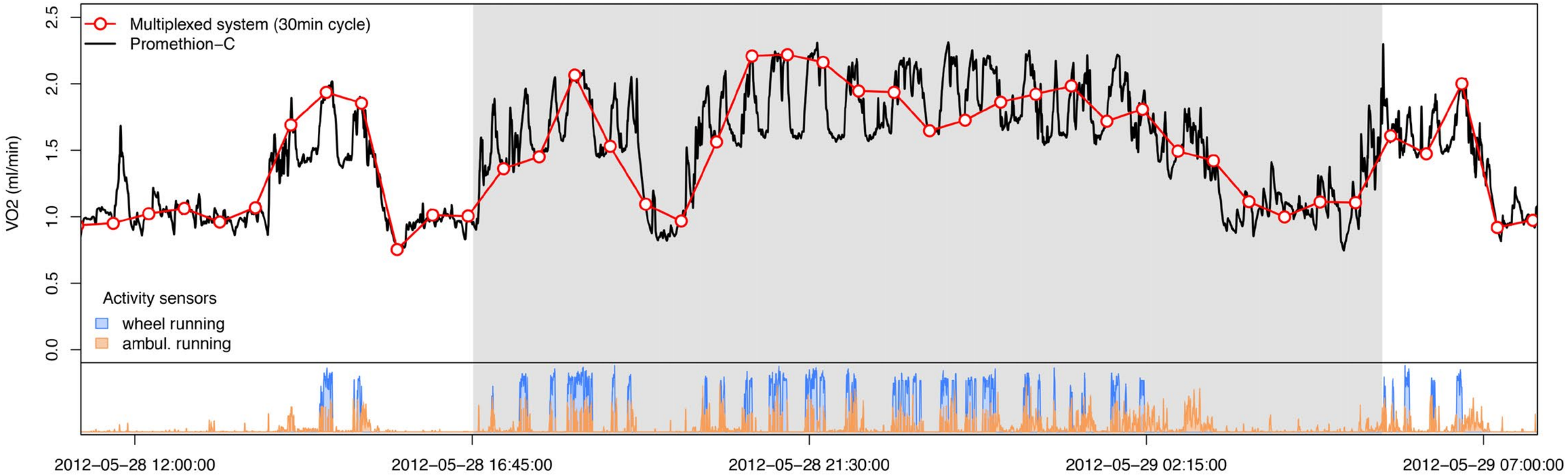
Intelligent, Automated Flow Control
Optimized for pull mode respirometry, the Promethion pull flow controllers continuously orchestrate multiple flow channels and are calibrated against NIST-Traceable flow standards.

Multiplexed or Continuous Metabolic Monitoring
Promethion systems can be configured either in multiplexed mode, sharing gas analyzers and thus reducing overall system costs, or in truly parallel and continuous mode with the highest level of metabolic detail possible.

Simultaneous 128-Cage Integration
Promethion mouse or rat cages can be used individually or in sets of up to 128. Available sensors include food and water monitors, food access control, environmental monitors, and activity sensors. All sensors in all cages are recorded continuously to create the richest possible data set.

Synchronous Behavior Monitoring
Wheel monitoring and networked infrared arrays are available for mouse and rat cages allowing collection of beam break counts, position, distance traveled, and rearing data.

PROMETHION. **CAPTURE WHAT OTHERS MISS.**



Continuous versus Multiplexed Metabolic Measurement:

The chart above shows the temporal resolution of a typical competitor's multiplexed system in which several cages share a gas analysis chain (red line), compared to our new parallel, continuous system (black line). In particular you will see how our new system accurately tracks the energy expenditure accompanying even brief episodes of activity or inactivity.

The record-breaking temporal resolution of Promethion-C allows quantification of rapid, subtle metabolic signals from multiple animals for the first time. It also allows for much more accurate allocation of energy costs to specific behaviors than has previously been possible.

Not all research needs such high temporal resolution. For many researchers, the more economical Promethion-M multiplexed system, which has up to sixfold faster cycle times than the 30 minute cycle time of a competitor's system (red line), will work well.

Promethion-M Multiplexed systems:

- Share gas analyzers between cages
- Patent-pending, self-calibrating pull-mode generator for cage air flows
- Cycle times for metabolic data as quick as 2-5 minutes for 8, 16 or 24 animals
- Metabolic data can be non-linearly interpolated between cycle times, yielding a pseudo-"continuous" record
- Typical deployment: Multiples of eight cages
- Economical

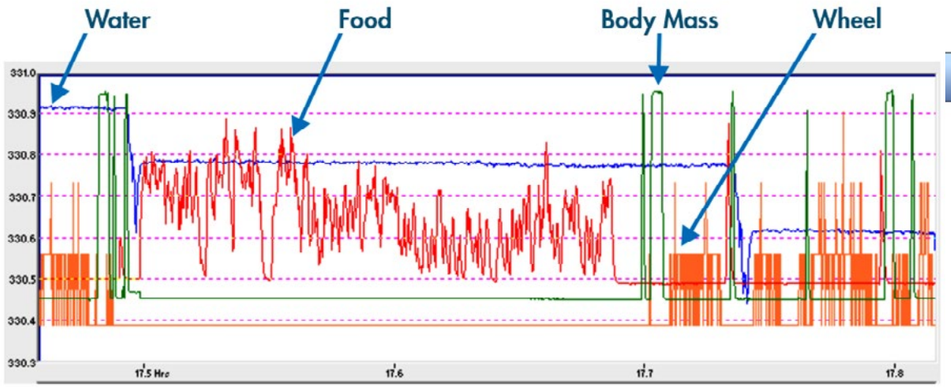
Promethion-C Continuous systems:

- Each cage has its own, dedicated gas analyzers
- Patent-pending "background baselining" available for totally continuous monitoring
- Very rapid response to transient events due to one second temporal resolution
- All metabolic and sensor data perfectly synchronized without interpolation
- Typical deployment: Multiples of four cages
- Z-transform can be applied to metabolic data to further enhance response speed

All Promethion systems acquire data every second from all sensors

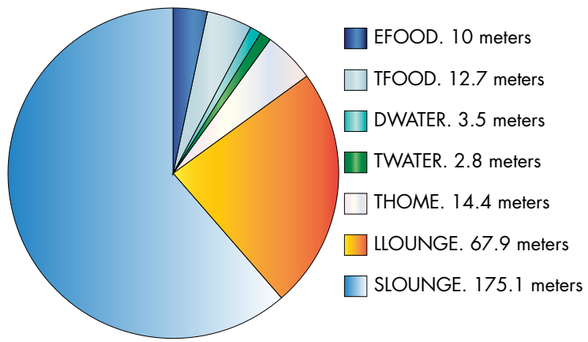
ETHOSCAN. **AUTOMATED BEHAVIOR ANALYSIS.**

Animal #3

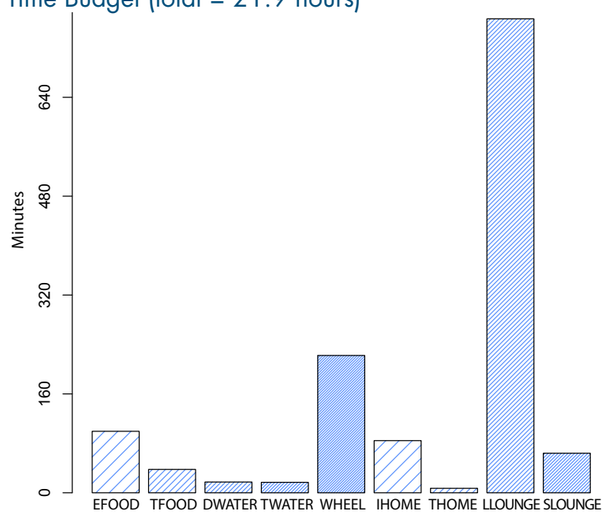


A	B	C	D	E	F	G
Sample	Start_Date	Start_Time	End_Time	Durat_Sec	Activity	Amount
62809	5/29/2012	3:37:54	3:39:45	112	WHEEL	80
62921	5/29/2012	3:39:46	3:39:57	12	SLNGE	29
62933	5/29/2012	3:39:58	3:40:12	15	IHOME	25.295
62948	5/29/2012	3:40:13	3:40:26	14	SLNGE	23
62962	5/29/2012	3:40:27	3:40:28	2	TFODA	0
62964	5/29/2012	3:40:29	3:40:39	11	SLNGE	11
62975	5/29/2012	3:40:40	3:40:48	9	DWATR	0.134
62984	5/29/2012	3:40:49	3:40:55	7	SLNGE	0
62991	5/29/2012	3:40:56	3:52:18	683	EFODA	0.202
63674	5/29/2012	3:52:19	3:53:03	45	SLNGE	6
63719	5/29/2012	3:53:04	3:53:24	21	IHOME	25.626
63740	5/29/2012	3:53:25	3:53:43	19	SLNGE	55

Non-wheel XY Ambulatory Budget (total = 286.3 meters)



Time Budget (total = 21.9 hours)

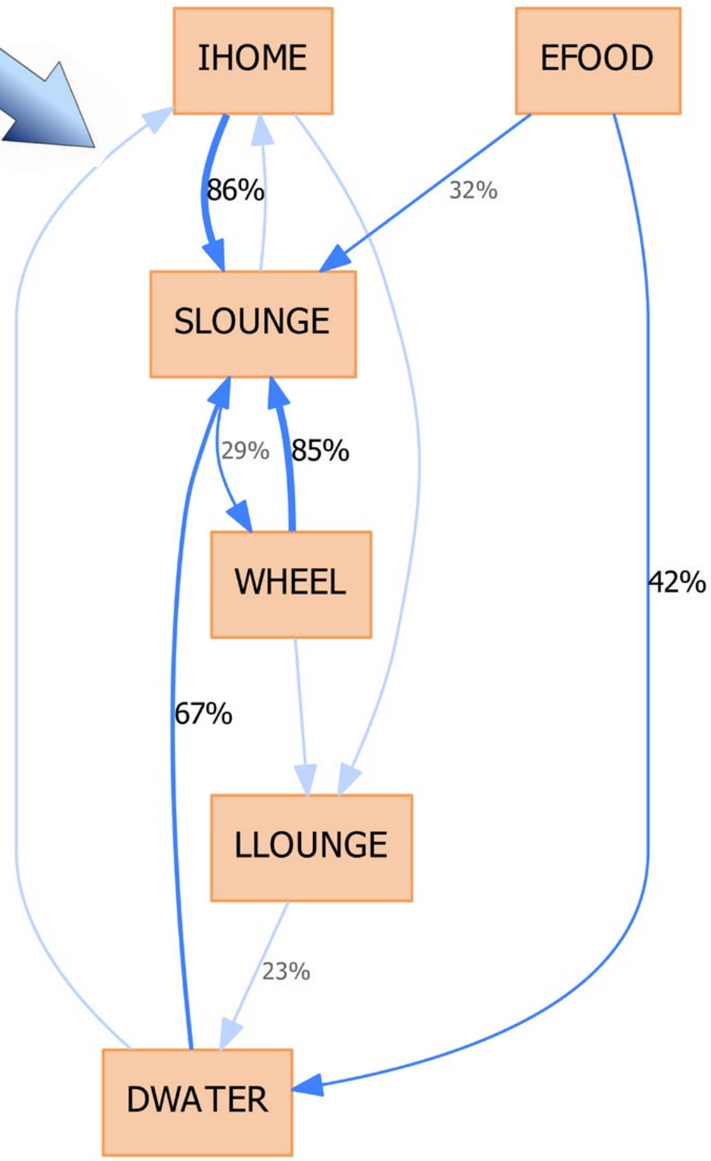


Promethion's synchronized data on body mass, food intake, water intake, mouse movement and wheel revolutions provide a comprehensive platform for behavior analysis. At top left, a very short section of a data record shows a mouse alternating between different behaviors - drinking water, eating food, entering its habitat (thus weighing itself) or running on its wheel.

To the right of that graph, Promethion's EthoScan utility extracts the time-stamped sequence and quantified list of behaviors (a tiny section from a much longer list is shown). From this list, EthoScan can create time and locomotion budgets and behavioral transition matrices for advanced behavior analysis (at right).

Legend:

EFOOD	Interaction with food hopper (significant uptake found)
TFOOD	Interaction with food hopper (no significant uptake found)
DWATER	Interaction with water dispenser (significant uptake found)
TWATER	Interaction with water dispenser (no significant uptake)
WHEEL	Interaction with wheel (>=1 revolution)
IHOME	Entered habitat (stable mass reading)
THOME	Interaction with habitat (no stable mass reading)
LLNGE	Long lounge (> 60 sec, no non-XY sensor interactions)
SLNGE	Short lounge (5 - 60 sec, no non-XY sensor interactions)



PROMETHION. **ADDITIONAL SERVICES**

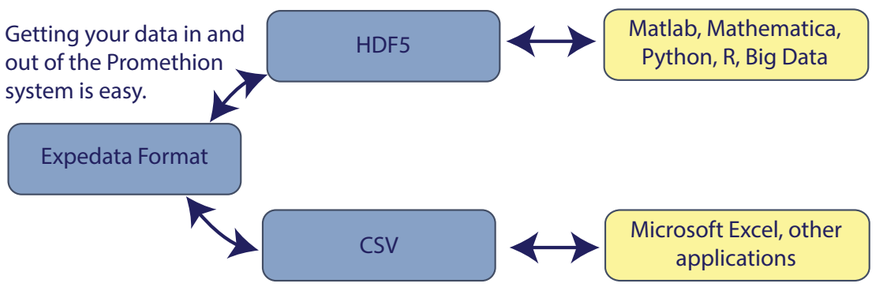
CONSULTING

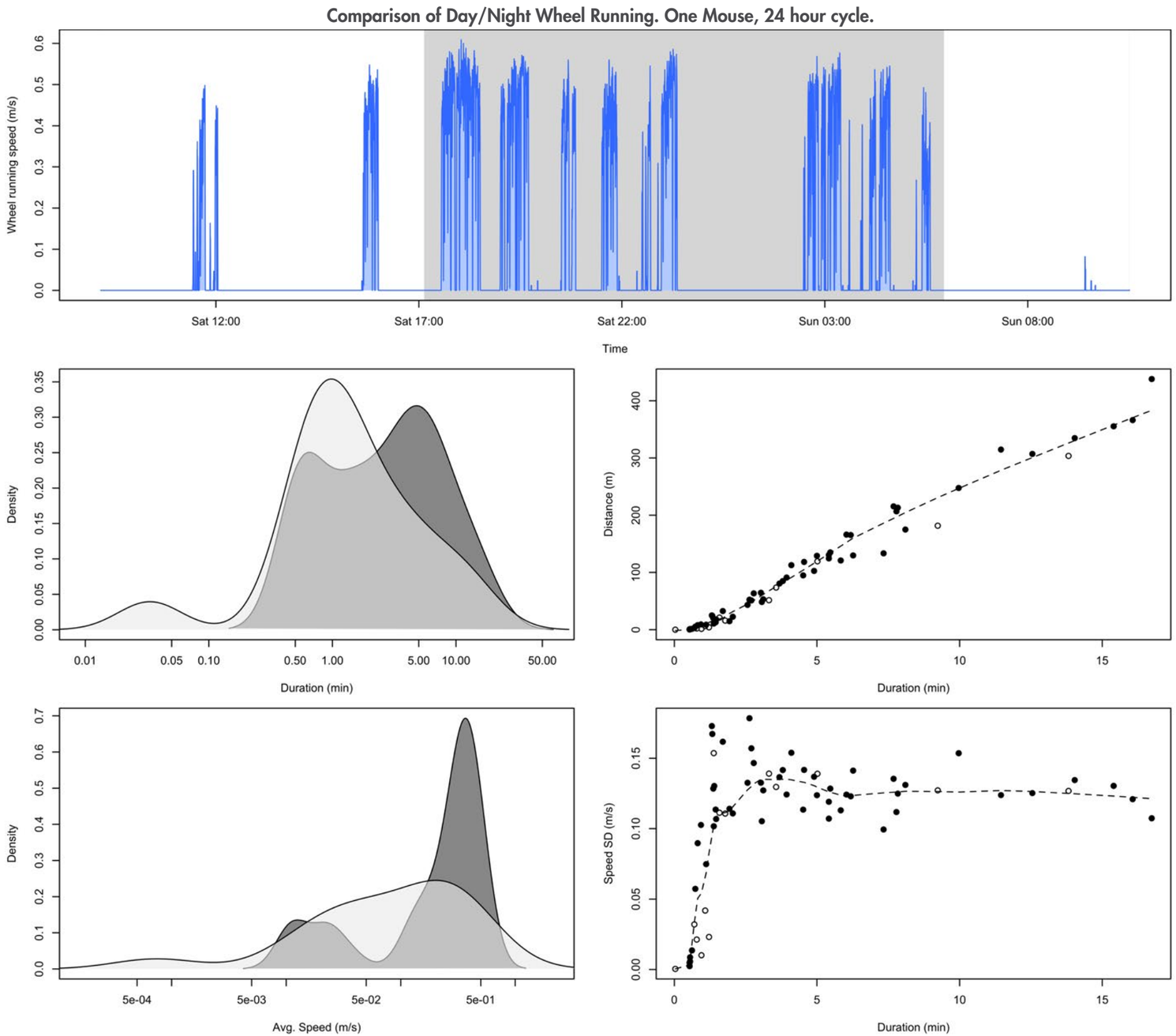
Promethion's data are rich enough to allow novel and extremely sophisticated analyses: meal pattern analysis, behavioral classification and time budgeting, or cross referencing behavior and energy expenditure are only some of the reports that we have already implemented for customers. At the simplest level, we can provide analytical macros that are tailored to your particular research question, and that extract the data you need in the format you specify. At a more sophisticated level, we can implement complete data analysis chains including the generation of overview or detailed per-cage reports (PDF and online) and data visualizations according to your requirements. The outputs will comply with your organization's identity standards (i.e. logos, color schemes) if you provide them. And, of course, you always retain full control over your data, both in raw and extracted form.

We draw on the in-house expertise of real scientists with relevant expertise and publications. As scientists themselves, we are as excited about novel insights as you are.

SABLE CLOUD

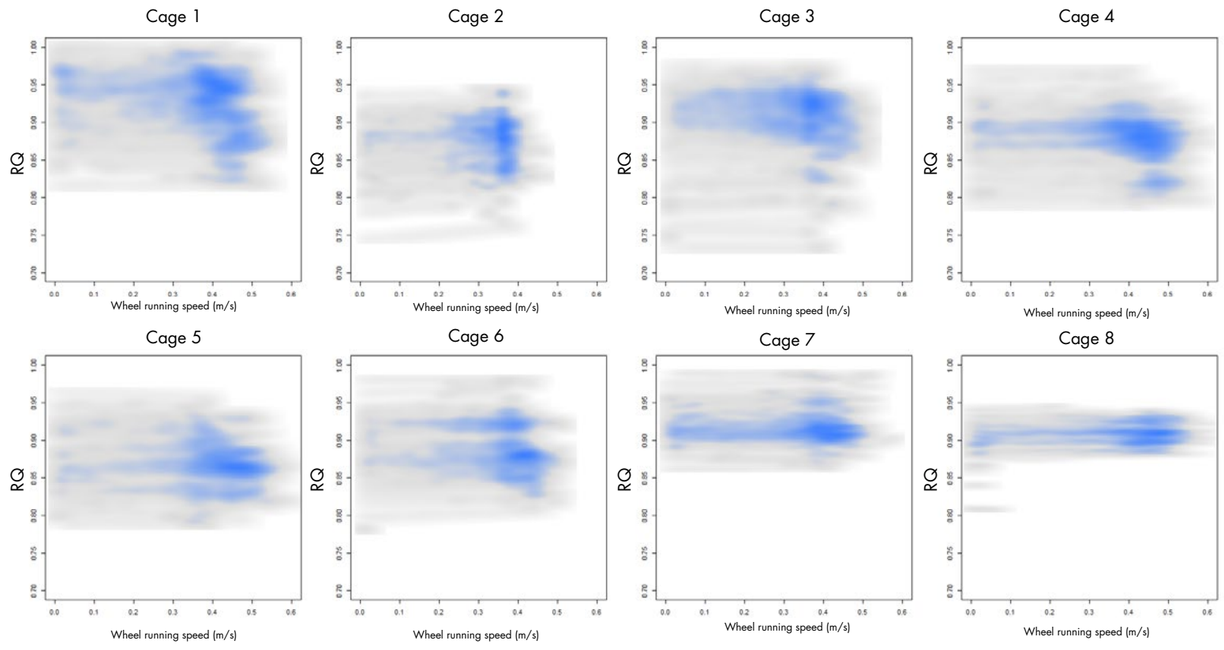
Cloud computing is alive and well at Sable. Integrating sophisticated analyses can now be as simple as uploading your data, selecting the desired analytical protocol and receiving the results. We provide two models of on-demand data analysis: an annual subscription fee, or pay per use. On-demand data analysis can be combined with consulting to develop your own proprietary analytic chain, which can then be run on demand in the Sable cloud.

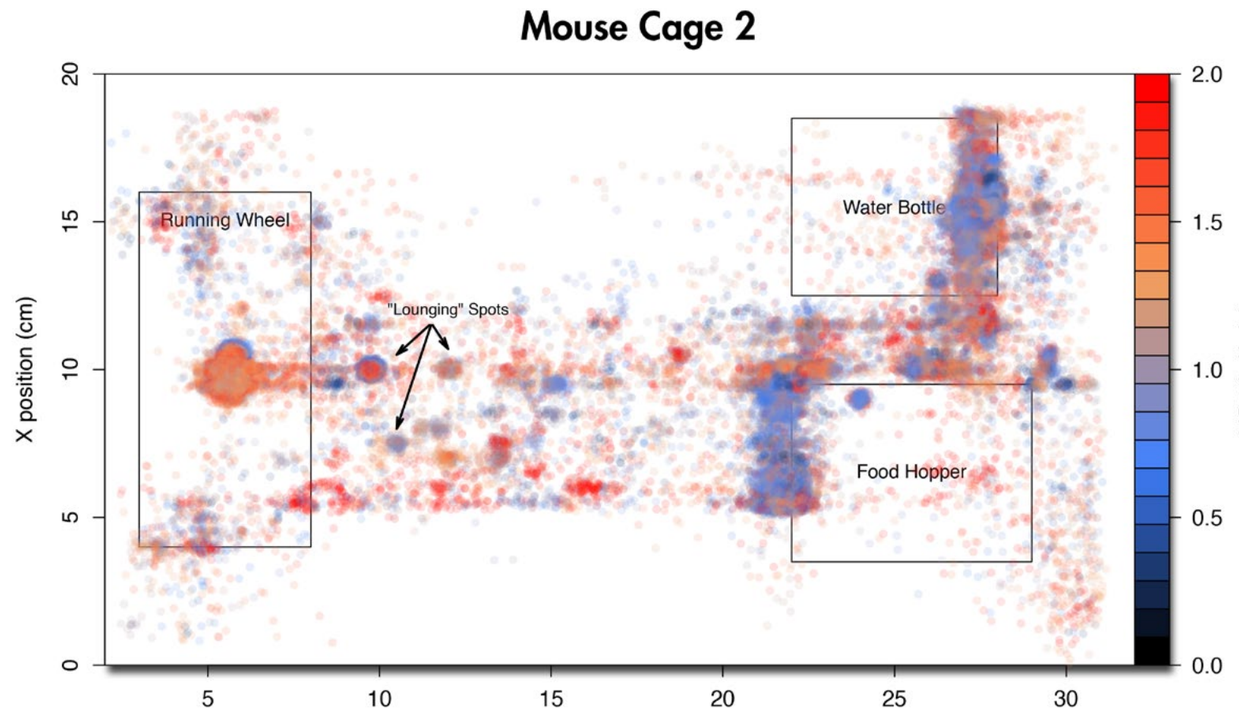


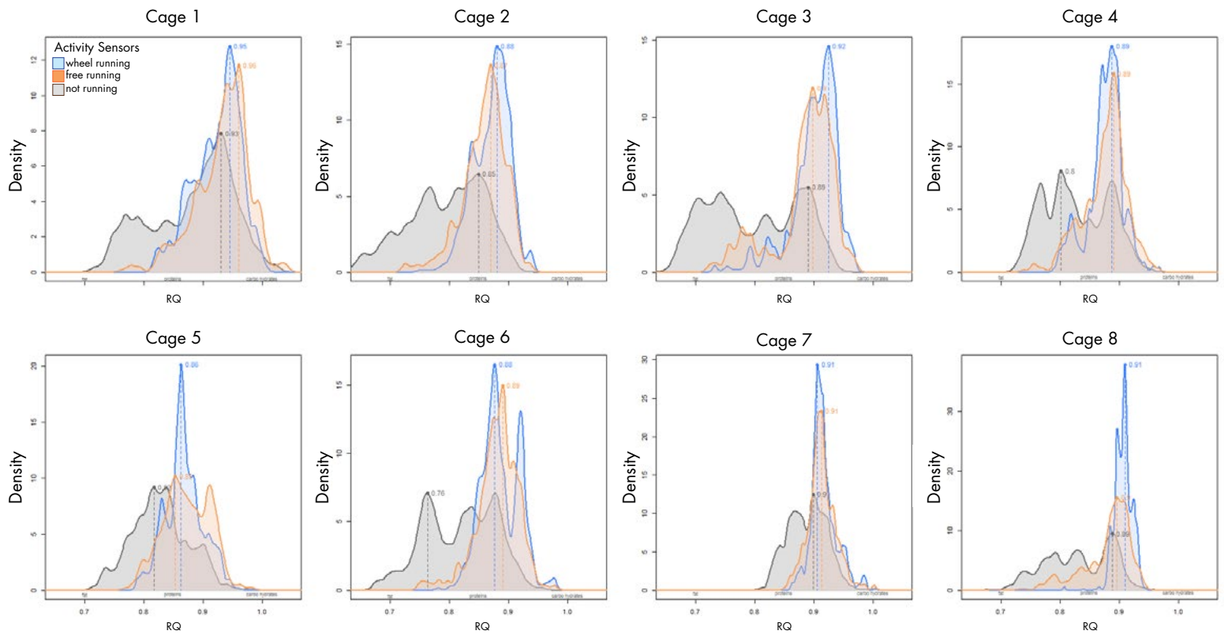


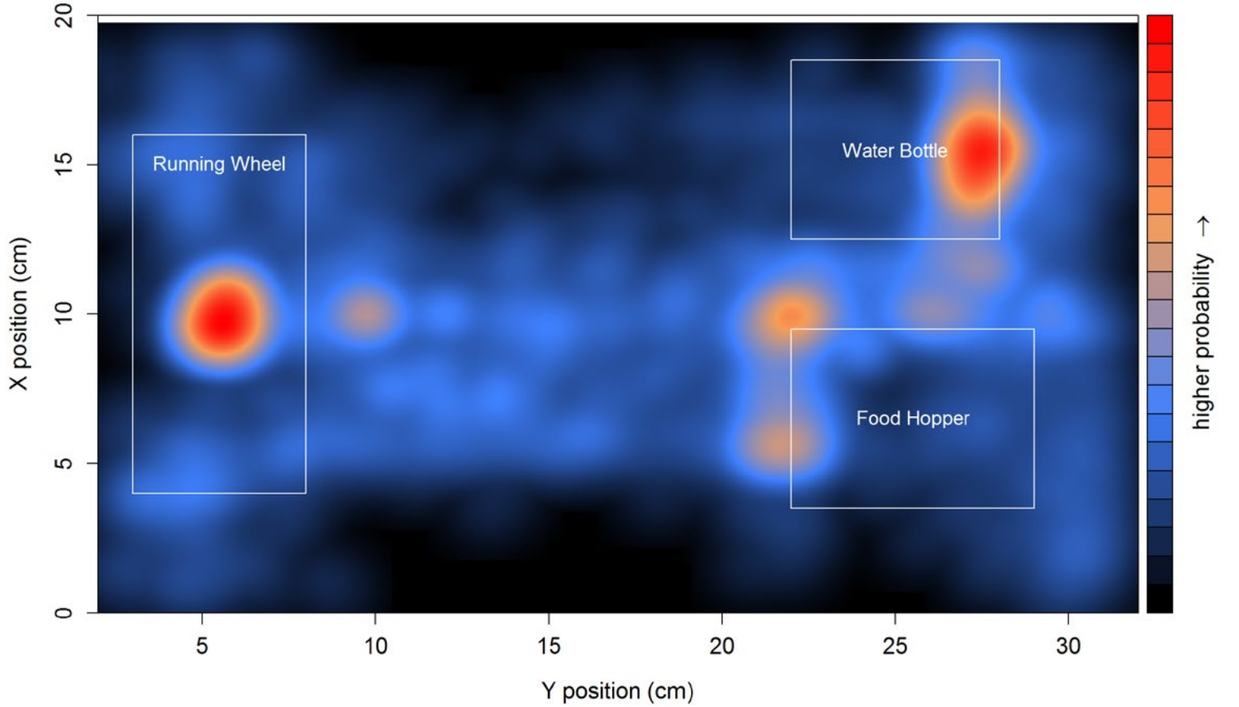
Reports like these can be created from your data set. Just upload your file, select the analysis you want to run and retrieve the PDF reports.

PROMETHION. **INTEGRATED INSIGHT.**









EFFICIENT WORKFLOW.
HIGH THROUGH-PUT.
ACCURATE RESULTS.

PROMETHION DELIVERS.

PROMETHION™

METABOLIC SCREENING

Let us help you with your metabolic and behavioral measurement requirements.

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