Overview

- The RPRO system has been designed to outperform standard technical analysis approaches across multiple metrics. This document explains how the system works.
- It is a simple and yet robust approach that combines these elements: (1) breakout and breakdown; (2) trend following; (3) momentum divergence; (4) mean reversion.
- Markets are dynamic and certain technical approaches work better in different regimes. RPRO's advantage is that the algorithm adjusts to work well in a variety of market conditions.
- Innovative data visualisation lets you see the unfolding trend status of multiple securities at once using coloured heatmaps.
- The heatmaps allow you to see tops and bottoms forming; price patterns developing; changes in trend power; how close price is to reversal; as well as multiple timeframes at once. This gives RPRO mass appeal, even to die-hard non technicians.
- Because the underlying system is robust and profitable, the colours actually mean something.

Standard trend following systems comparison

Dow Jones Industrial Index (INDU) Members - Long only backtest, daily data, 1141 day sample

	Start	End	CAGR	P&L	InMarket	AvgDays	AvgWin	AvgLoss	MaxWin	MaxLoss	Trades	Win/Lose
20 DMA cross Close	23/08/2016	08/10/2019	5.1%	18.3%	59.1%	14.7	4.8%	-1.5%	41.7%	-11.4%	47	30%
5/20 DMA cross Close	23/08/2016	08/10/2019	4.9%	18.1%	59.2%	27.9	5.7%	-2.4%	38.0%	-12.5%	25	41%
50 DMA cross Close	23/08/2016	08/10/2019	4.5%	16.6%	62.0%	26.9	7.9%	-1.6%	87.4%	-8.3%	27	25%
20/50 DMA cross Close	23/08/2016	08/10/2019	4.2%	17.8%	62.0%	83.5	12.8%	-4.0%	145.5%	-18.7%	9	42%
200 DMA cross Close	23/08/2016	08/10/2019	5.7%	23.4%	70.5%	71.2	19.8%	-1.9%	157.0%	-9.1%	15	21%
RPRO Conservative	23/08/2016	08/10/2019	10.3%	39.0%	54.9%	14.9	5.1%	-2.4%	43.6%	-9.6%	26	50%
RPRO Aggressive	23/08/2016	08/10/2019	15.8%	55.2%	54.9%	24.4	5.1%	-2.2%	45.9%	-9.6%	26	56%
RPRO Aggressive Comps	**23/08/2016**	**08/10/2019**	**+11.1%**	**+37.5%**	**- 5.7%**	**- 13.8 D**	**- 2.7%**	**+0.2%**	**- 32.3%**	**+3.1%**	**- 1.1**	**+22.1%**

- The table above shows five simple moving average (MA) systems next to the RPRO Conservative and Aggressive systems. The MA systems and RPRO Conservative trade at the close after the signal. RPRO Aggressive trades at the signal (explained overleaf).
- The backtest for each is Long only, daily price bars on a three year lookback (33,089 data points). Positions are full size and no adjustment is made for slippage or costs.
- RPRO Aggressive is also compared to the averages of the first four MA systems. CAGR, P&L and Win Ratio all outperform significantly on less time in the market (55%). The average number of trades per instrument is 26 (or once every 44 days).

The RPRO aggressive system

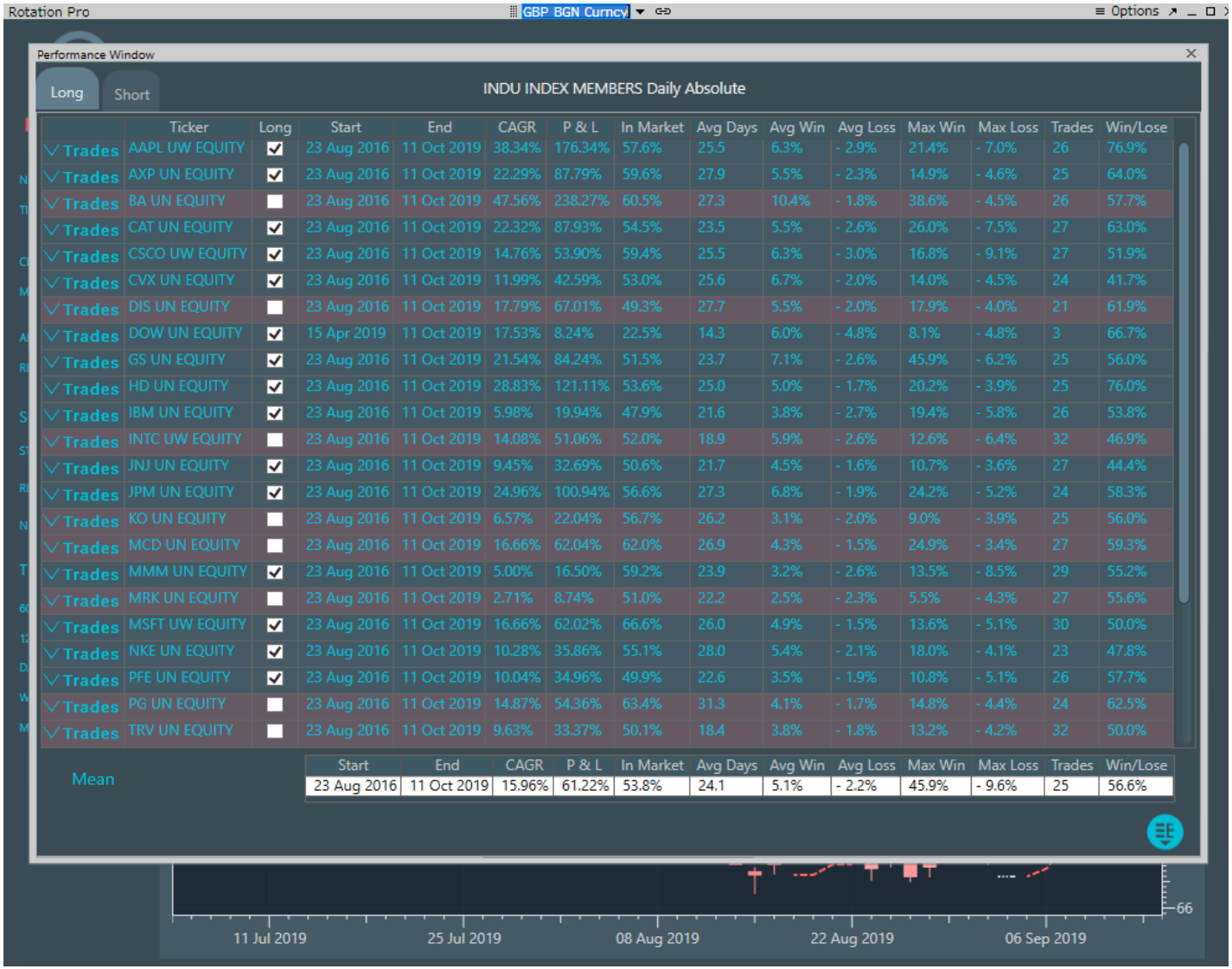
13 Aug 2019	23 Aug 2019	203.25 (1)	208.97 (2)	2.82%
05 Sep 2019	11 Oct 2019	212.64 (3)	236.21 (4)	11.08%

- The RPRO Aggressive Long system Buys when price crosses up through the blue reversal level - (1) and (3) on the chart - and Sells as price crosses down through the red reversal level (2).
- The reversal levels are known in advance in real time and the distance to reversal is shown by the fullness of the risk progress bars on the heatmap (yellow arrow).

The problem with moving averages

- A simple way to isolate trend in price series is to use moving averages.
- In technical analysis texts, MA crossover signals are often cherry picked to show them at their best.
- But the problem with MA systems is twofold: (1) whipsaw - false signals in criss-crossing phases; and (2) late entries and exits. This occurs however the average is calculated.
- The RPRO system design permits more timely entries and exits, allowing it to participate in trends for longer and swerving most minor whipsaw.

System backtest summaries

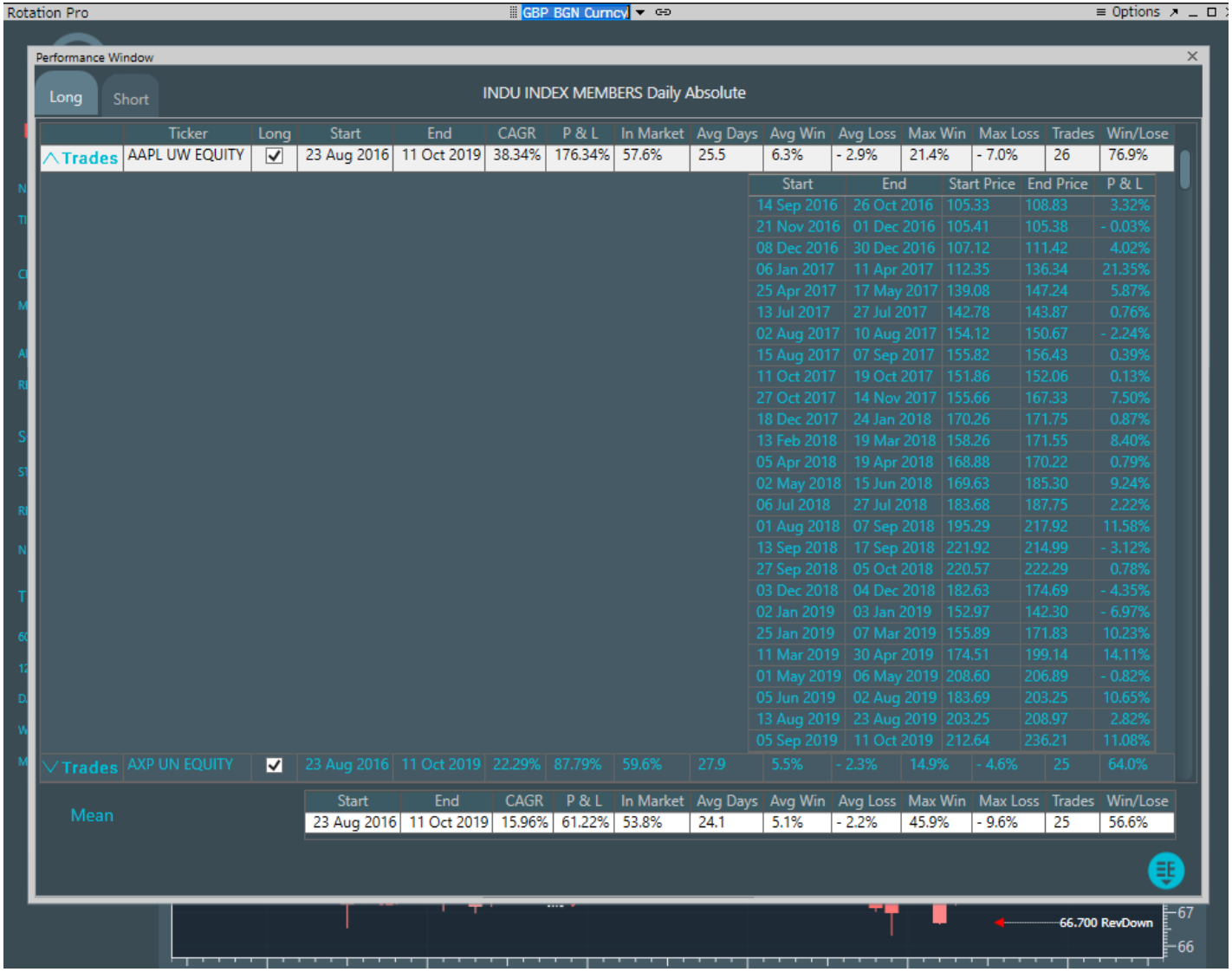


	Ticker	Long	Start	End	CAGR	P & L	In Market	Avg Days	Avg Win	Avg Loss	Max Win	Max Loss	Trades	Win/Lose
Trades	AAPL UW EQUITY	☑	23 Aug 2016	11 Oct 2019	38.34%	176.34%	57.6%	25.5	6.3%	- 2.9%	21.4%	- 7.0%	26	76.9%
Trades	AXP UN EQUITY	☑	23 Aug 2016	11 Oct 2019	22.29%	87.79%	59.6%	27.9	5.5%	- 2.3%	14.9%	- 4.6%	25	64.0%
Trades	BA UN EQUITY	☐	23 Aug 2016	11 Oct 2019	47.56%	238.27%	60.5%	27.3	10.4%	- 1.8%	38.6%	- 4.5%	26	57.7%
Trades	CAT UN EQUITY	☑	23 Aug 2016	11 Oct 2019	22.32%	87.93%	54.5%	23.5	5.5%	- 2.6%	26.0%	- 7.5%	27	63.0%
Trades	CSCO UW EQUITY	☑	23 Aug 2016	11 Oct 2019	14.76%	53.90%	59.4%	25.5	6.3%	- 3.0%	16.8%	- 9.1%	27	51.9%
Trades	CVX UN EQUITY	☑	23 Aug 2016	11 Oct 2019	11.99%	42.59%	53.0%	25.6	6.7%	- 2.0%	14.0%	- 4.5%	24	41.7%
Trades	DIS UN EQUITY	☐	23 Aug 2016	11 Oct 2019	17.79%	67.01%	49.3%	27.7	5.5%	- 2.0%	17.9%	- 4.0%	21	61.9%
Trades	DOW UN EQUITY	☑	15 Apr 2019	11 Oct 2019	17.53%	8.24%	22.5%	14.3	6.0%	- 4.8%	8.1%	- 4.8%	3	66.7%
Trades	GS UN EQUITY	☑	23 Aug 2016	11 Oct 2019	21.54%	84.24%	51.5%	23.7	7.1%	- 2.6%	45.9%	- 6.2%	25	56.0%
Trades	HD UN EQUITY	☑	23 Aug 2016	11 Oct 2019	28.83%	121.11%	53.6%	25.0	5.0%	- 1.7%	20.2%	- 3.9%	25	76.0%
Trades	IBM UN EQUITY	☑	23 Aug 2016	11 Oct 2019	5.98%	19.94%	47.9%	21.6	3.8%	- 2.7%	19.4%	- 5.8%	26	53.8%
Trades	INTC UW EQUITY	☐	23 Aug 2016	11 Oct 2019	14.08%	51.06%	52.0%	18.9	5.9%	- 2.6%	12.6%	- 6.4%	32	46.9%
Trades	JNJ UN EQUITY	☑	23 Aug 2016	11 Oct 2019	9.45%	32.69%	50.6%	21.7	4.5%	- 1.6%	10.7%	- 3.6%	27	44.4%
Trades	JPM UN EQUITY	☑	23 Aug 2016	11 Oct 2019	24.96%	100.94%	56.6%	27.3	6.8%	- 1.9%	24.2%	- 5.2%	24	58.3%
Trades	KO UN EQUITY	☐	23 Aug 2016	11 Oct 2019	6.57%	22.04%	56.7%	26.2	3.1%	- 2.0%	9.0%	- 3.9%	25	56.0%
Trades	MCD UN EQUITY	☐	23 Aug 2016	11 Oct 2019	16.66%	62.04%	62.0%	26.9	4.3%	- 1.5%	24.9%	- 3.4%	27	59.3%
Trades	MMM UN EQUITY	☑	23 Aug 2016	11 Oct 2019	5.00%	16.50%	59.2%	23.9	3.2%	- 2.6%	13.5%	- 8.5%	29	55.2%
Trades	MRK UN EQUITY	☐	23 Aug 2016	11 Oct 2019	2.71%	8.74%	51.0%	22.2	2.5%	- 2.3%	5.5%	- 4.3%	27	55.6%
Trades	MSFT UW EQUITY	☑	23 Aug 2016	11 Oct 2019	16.66%	62.02%	66.6%	26.0	4.9%	- 1.5%	13.6%	- 5.1%	30	50.0%
Trades	NKE UN EQUITY	☑	23 Aug 2016	11 Oct 2019	10.28%	35.86%	55.1%	28.0	5.4%	- 2.1%	18.0%	- 4.1%	23	47.8%
Trades	PFE UN EQUITY	☑	23 Aug 2016	11 Oct 2019	10.04%	34.96%	49.9%	22.6	3.5%	- 1.9%	10.8%	- 5.1%	26	57.7%
Trades	PG UN EQUITY	☐	23 Aug 2016	11 Oct 2019	14.87%	54.36%	63.4%	31.3	4.1%	- 1.7%	14.8%	- 4.4%	24	62.5%
Trades	TRV UN EQUITY	☐	23 Aug 2016	11 Oct 2019	9.63%	33.37%	50.1%	18.4	3.8%	- 1.8%	13.2%	- 4.2%	32	50.0%

	Start	End	CAGR	P & L	In Market	Avg Days	Avg Win	Avg Loss	Max Win	Max Loss	Trades	Win/Lose
Mean	23 Aug 2016	11 Oct 2019	15.96%	61.22%	53.8%	24.1	5.1%	- 2.2%	45.9%	- 9.6%	25	56.6%

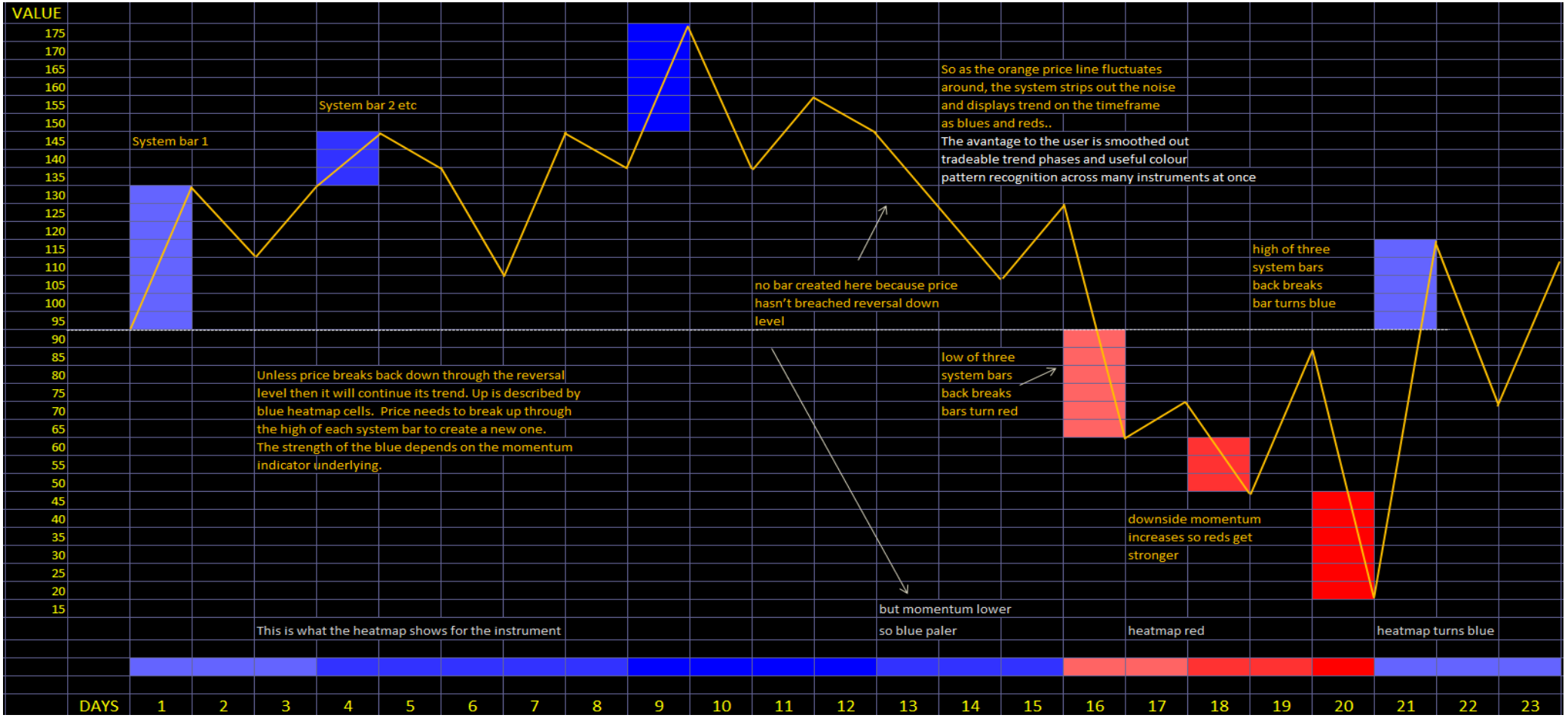
- You can access Long and Short backtests for any list of securities on any timeframe in the platform's interface.

Trades detail



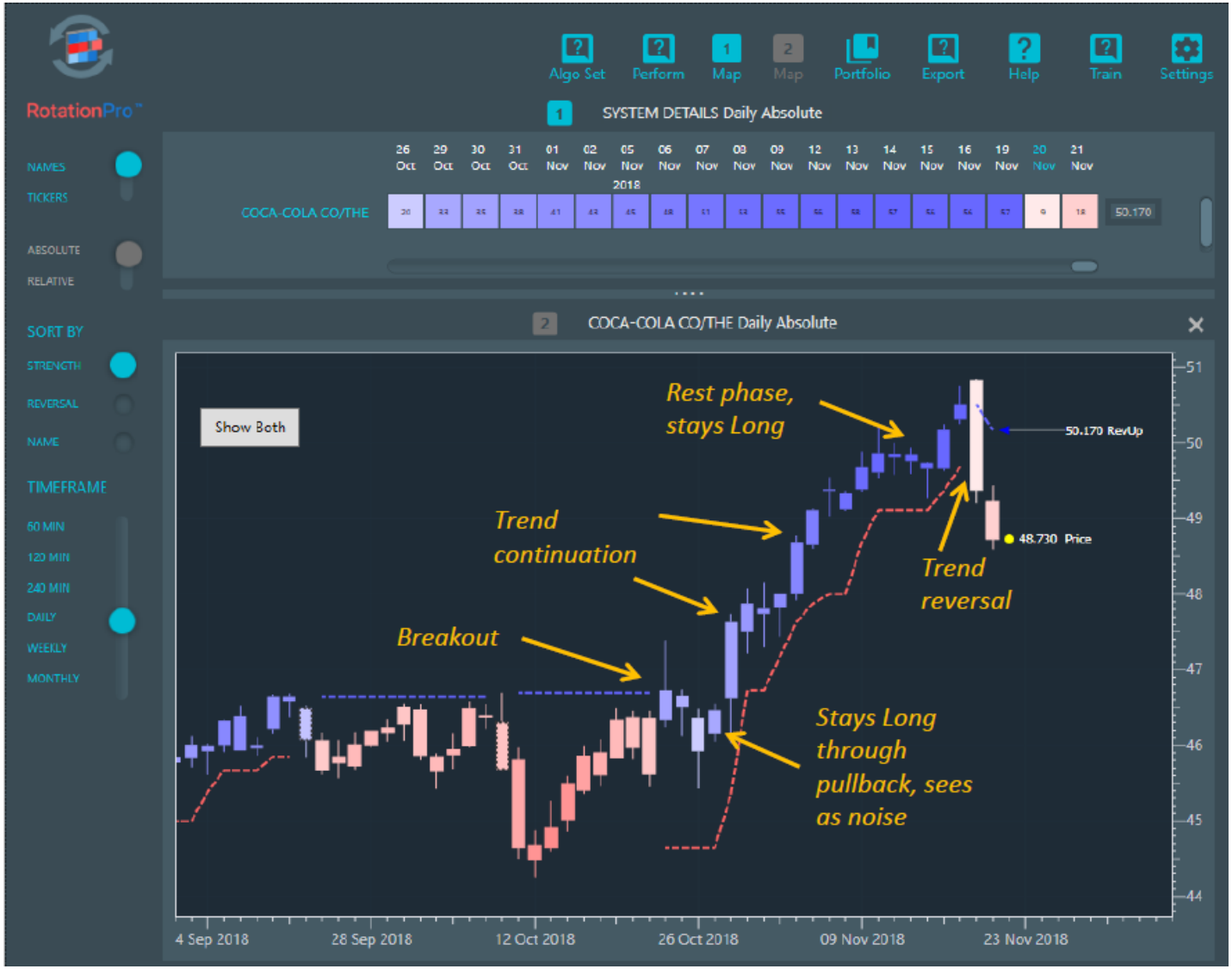
- You can drill down into each trade by instrument.

Underlying price break system overview



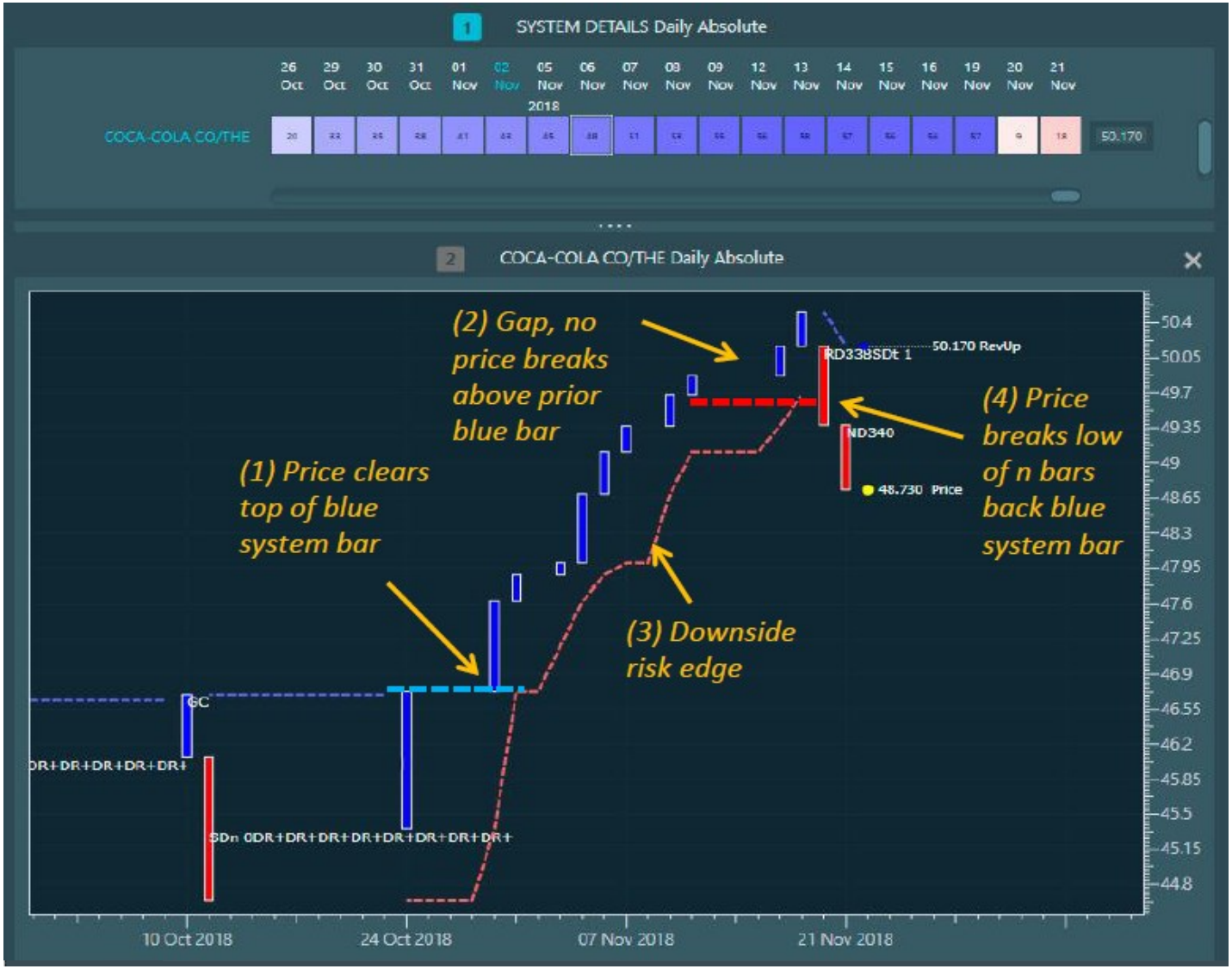
The core of the RPRO algorithm is a time independent breakout system, similar to the Point & Figure method. To maintain a trend, price needs to continue to achieve break out levels up or down. Each breakout creates a new system bar running in the background (shown above: blue is up, red is down). These are the system's building blocks. To change trend direction a stricter rule applies. This allows the system to ignore noise between system bars and drives the colour change reversals.

Uptrends



- A breakout to a blue uptrend reversal towards the end of October 2018 and then to a red downside reversal in mid November.
- The system forces colour change reversals when price passes through the pre determined reversal levels.
- These levels are known in advance in real time which helps the user monitor risk.
- The colour of the chart candles matches that of the heatmap at each date.

Uptrends - system view



- System bars shown for the previous chart slide. Blue bars inform uptrends, red bars downtrends.

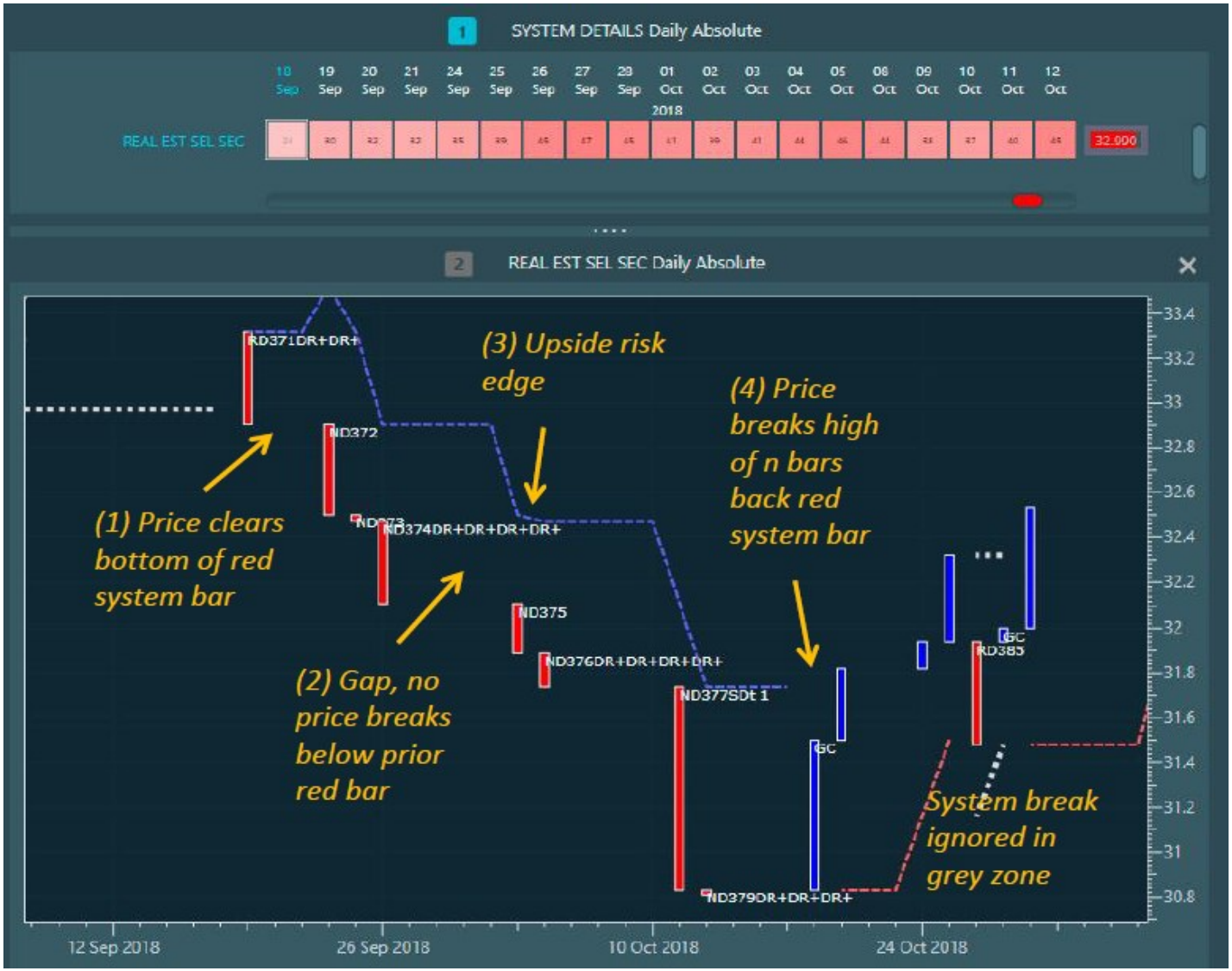
1) When price closes above the last blue system bar high a new blue up bar is created.

2) No new bar is created if price stays below the last blue bar high and above the red down reversal line..

3) ..the downside risk edge.

4) A close below the low of two or three system bars back (adjusted for timeframes) marks a breach of the downside risk edge and turns the system bar red.

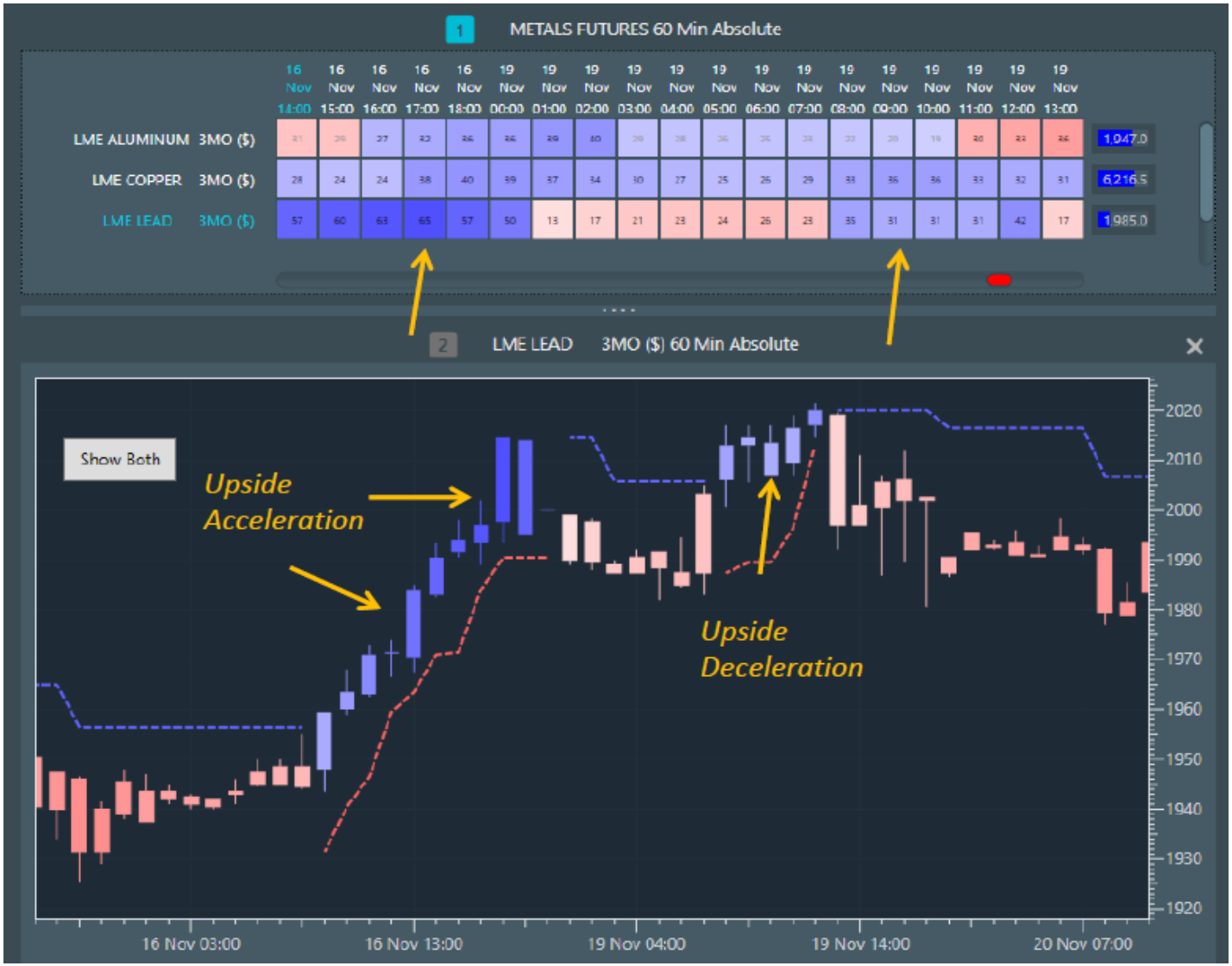
Downtrends - system view



- A breakdown to a red system bar mid September 2018 and a breakout to a blue system bar in mid October.

1) When price closes below the last red system bar low a new red bar is created.
2) No new bar is created If price stays above the last red bar low and below the blue up reversal line..
3) ..the upside risk edge.
4) A close above the high of two or three system bars back marks a breach of the upside risk edge and turns the system bar blue.

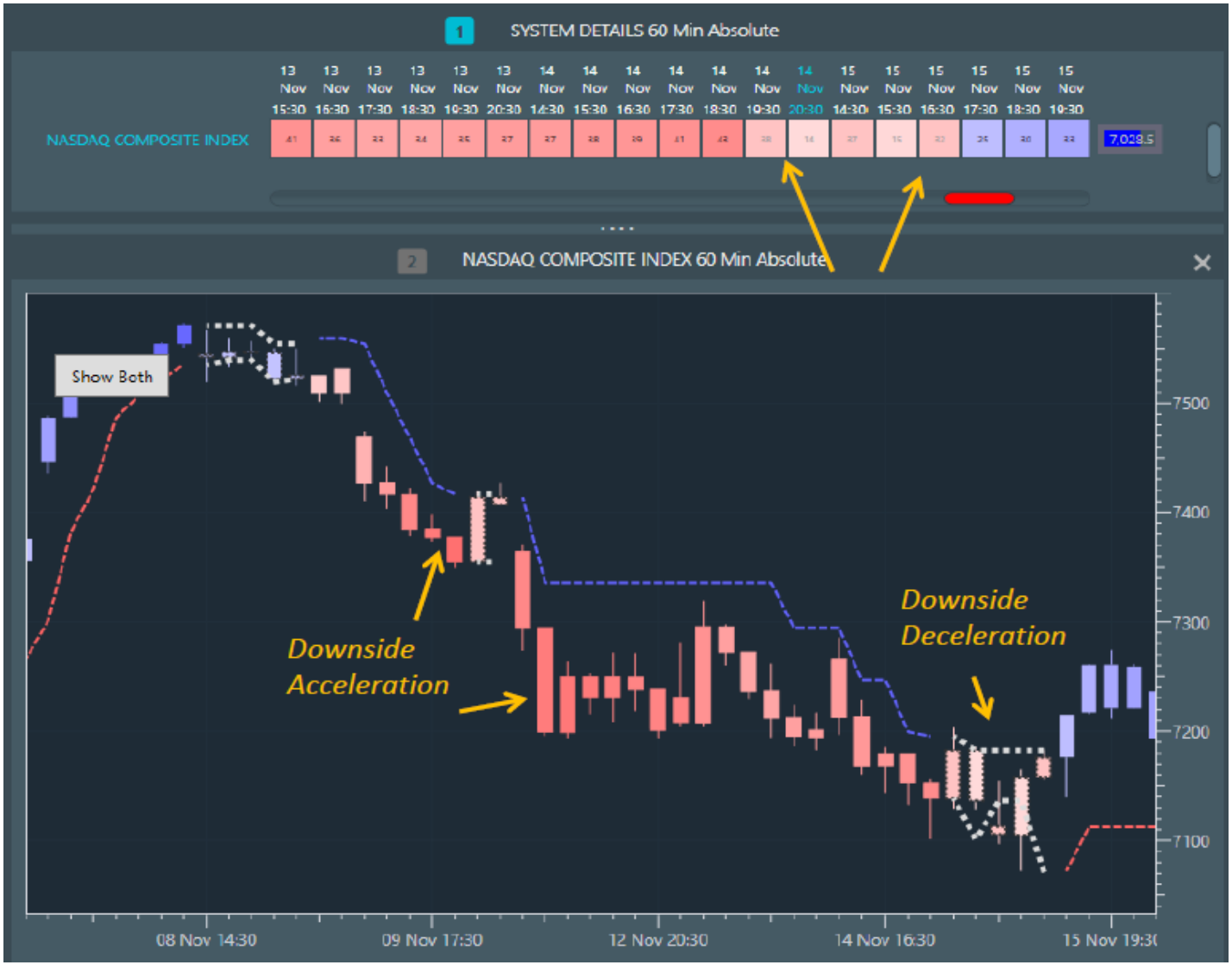
Upside momentum



- An underlying momentum system changes the hue of the heatmap and candle colours. Momentum is a variant of True Strength Index (TSIvar).
- The optional heatmap numbers are normalised TSIvar values (range 0-100) but are mostly 15 to 75.

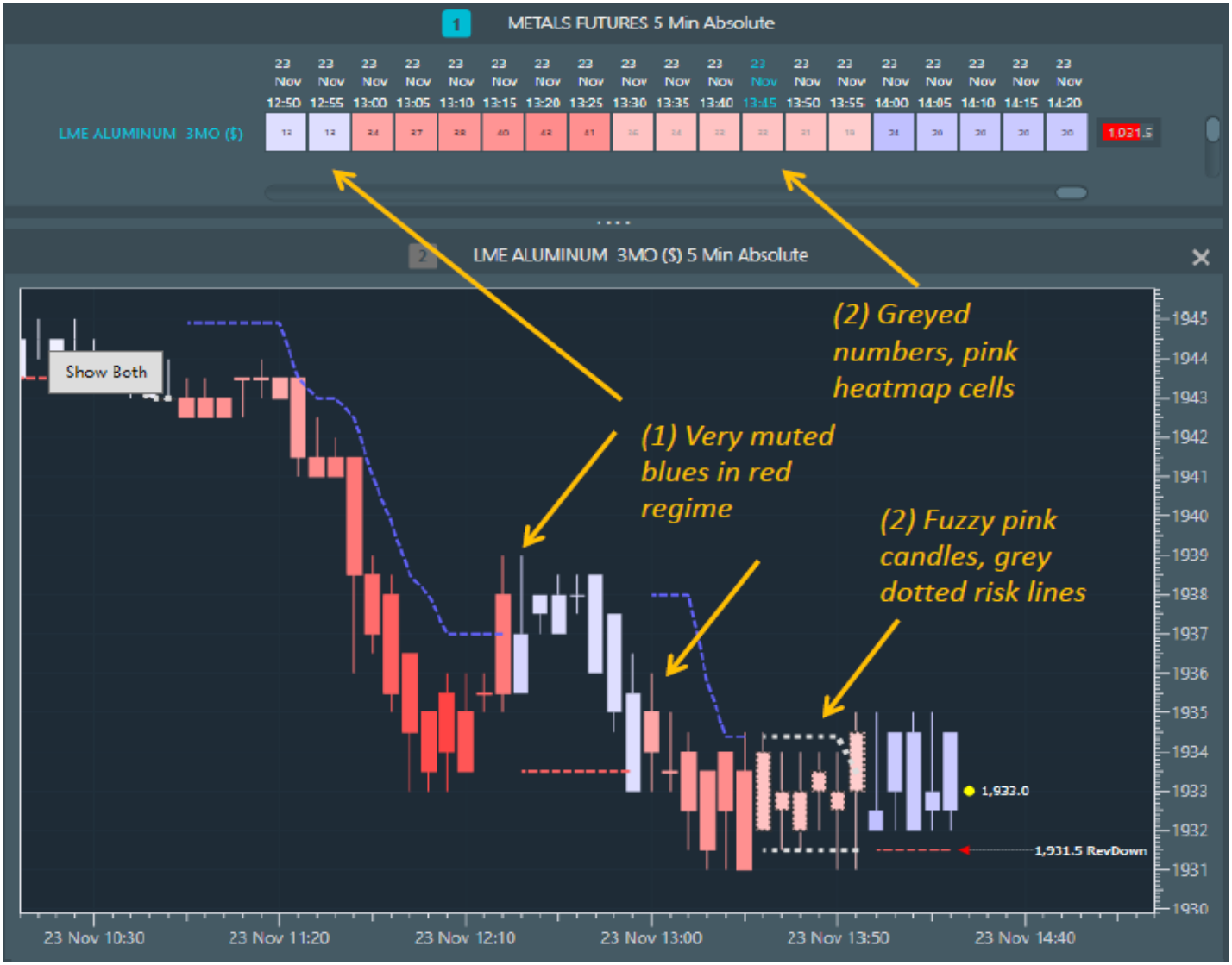
1) Strong blues, high numbers - strong up momentum
2) Pale blues, low numbers - weak up momentum
3) Blues strengthen, numbers rise - up acceleration.
4) Blues fade, numbers fall - up deceleration.
5) Very strong blues, very high numbers, overbought.

Downside momentum



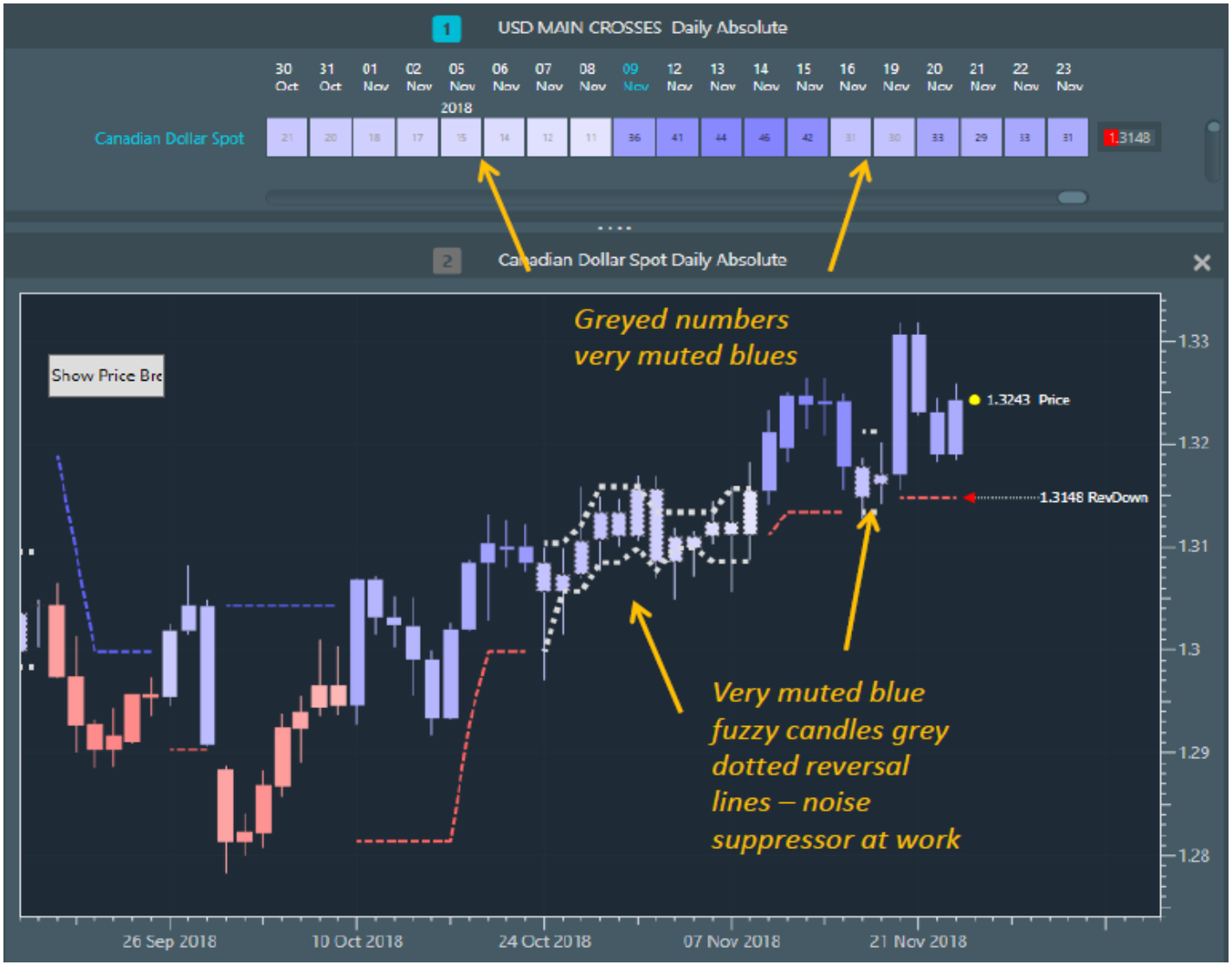
1) Strong reds, high numbers - strong down momentum
2) Pale red, low numbers - weak down momentum
3) Reds strengthen, numbers rise - down acceleration.
4) Reds fade, numbers fall - down deceleration.
5) Very strong reds, very high numbers - oversold.

Downtrend whipsaw suppression



- A red down regime which shifts to very pale blues with momentum numbers at 20 or lower can mark a downtrend rest phase.
- Grey numbered pink heatmap cells, fuzzy pink candles with grey dotted risk lines carry the same message.
- The stance is Hold Sell or lighten Short.
- Momentum is being suppressed by the system to prevent a stronger blue Buy signal and potential whipsaw.

Uptrend whipsaw suppression



- A blue up regime which shifts to grey numbered, very pale blue heatmap cells, fuzzy pale blue candles with grey dotted risk lines indicates an uptrend rest phase.
- The stance is Hold Long or lighten at discretion.

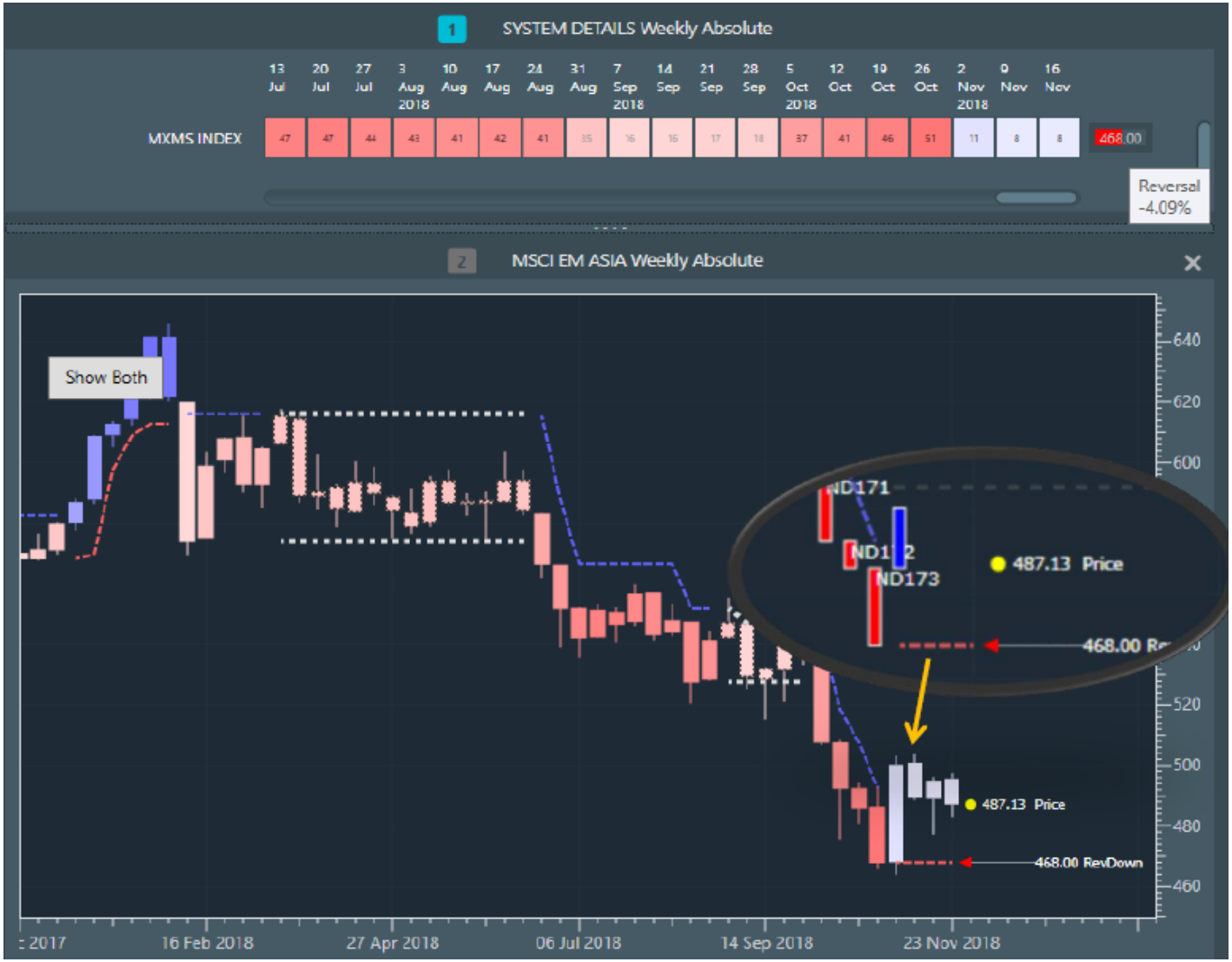
Downside reversal warning

- A downside reversal set up is similar to an upside rest.
- The highlighted area shows the red reversal level hit intraday which triggers a noise suppression rule. This greys out the candle and heatmap cell to avoid potential whipsaw, but the risk progress bar in the heatmap would fill red providing a warning.
- Two sessions later we turn red as price properly breaches the red reversal line. We would have stayed greyed out had price not triggered the reversal.
- There are several different suppression rules and all detect reduced volatility.

Upside reversal warning

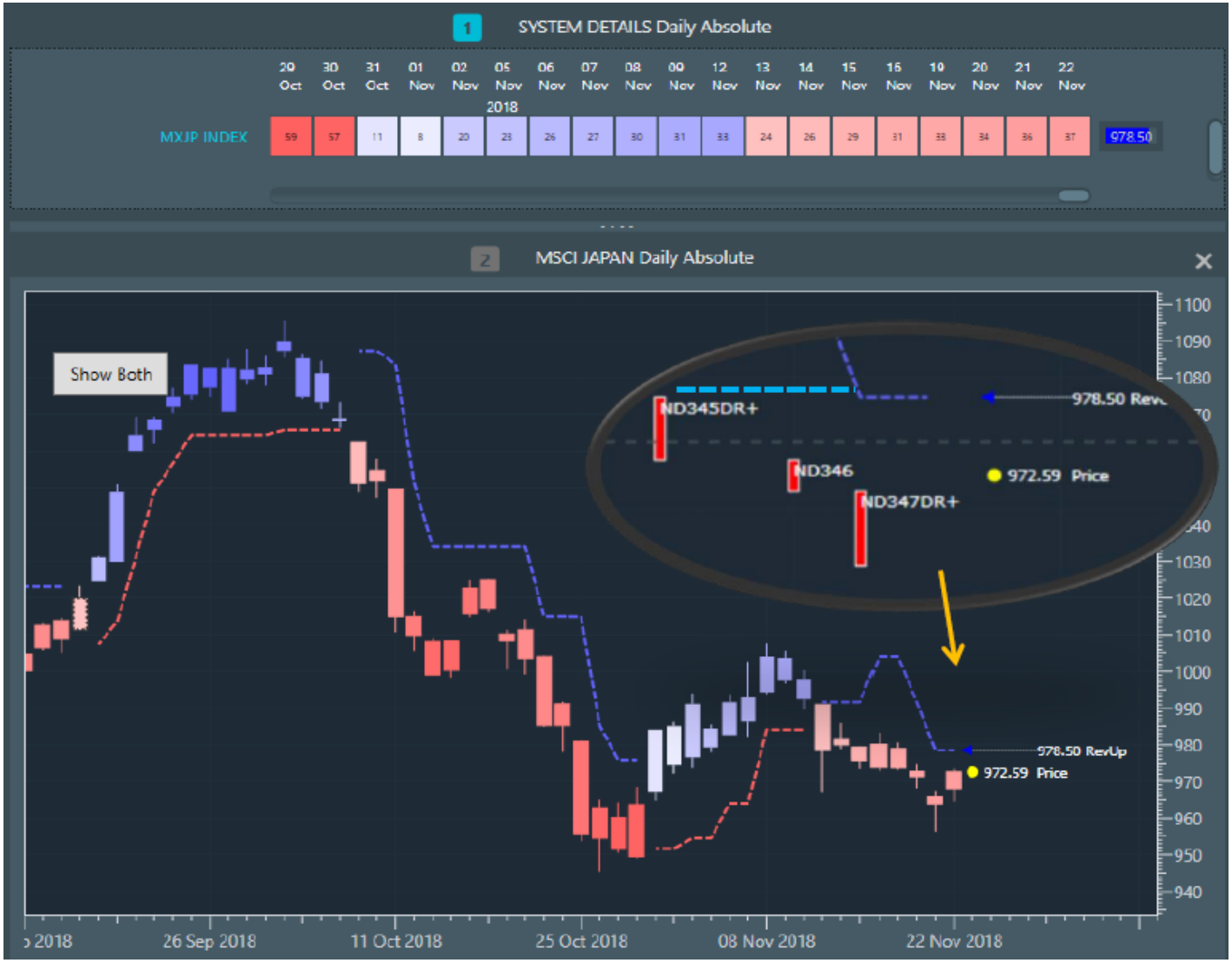
- An upside reversal set up is similar to a downside rest or consolidation phase.
- The chart's highlighted area shows a pink down stall zone which lasts three months. At the last date, price breaks free of the range and turns the heatmap and candle blue.
- Throughout the pink rest phase, price is continually testing the upper grey reversal line. This would have shown as a full blue risk progress bar in the heatmap and warned that an upside resolution was a high probability outcome.

Red risk progress bars



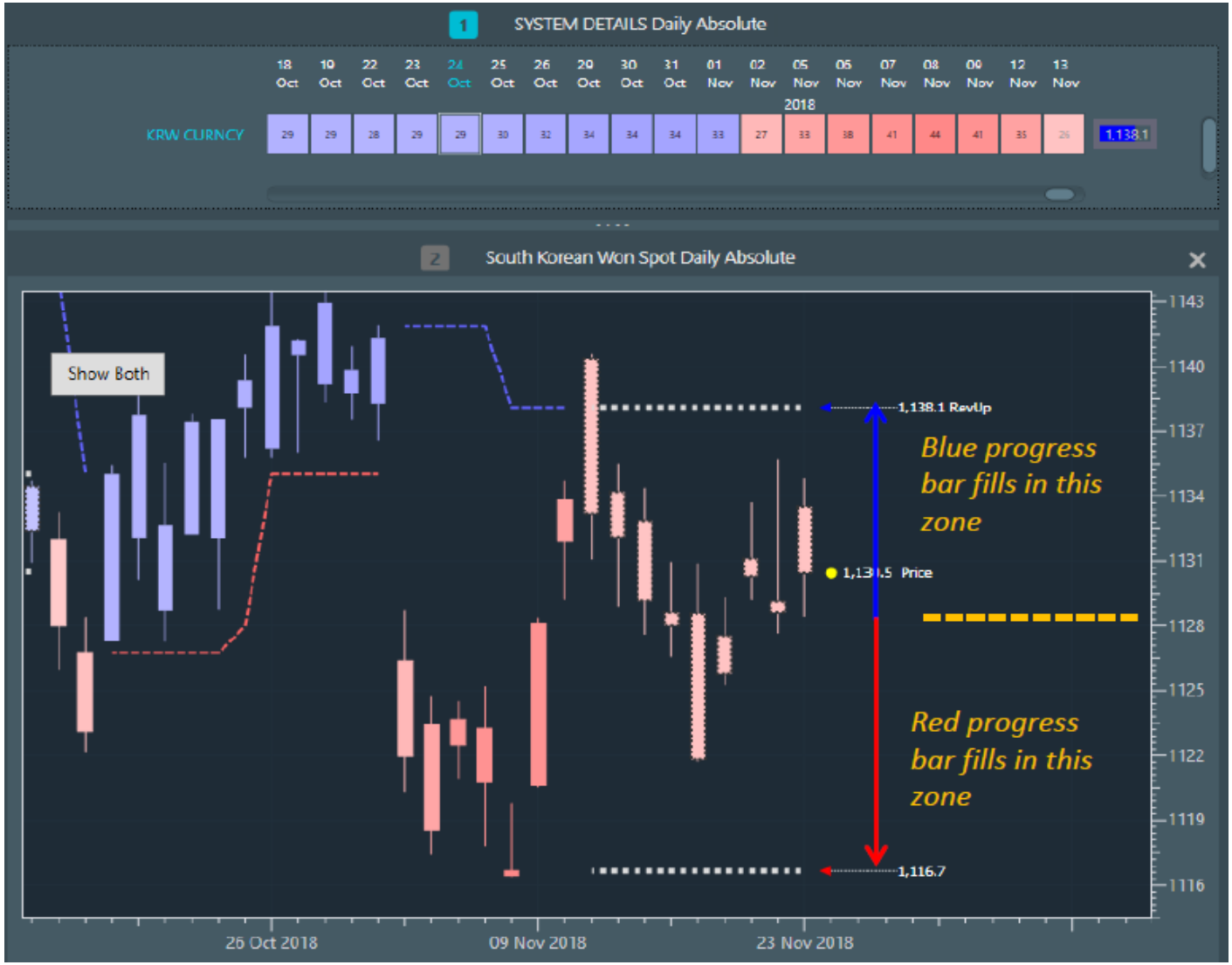
- A red progress bar to the right of the heatmap shows how far price is from the downside risk edge. It is the delta between last price and the red risk line in the custom chart. A full red bar means downside reversal risk is close and an empty bar shows that it is distant.

Blue risk progress bars



- A blue progress bar shows how far price is from the upside risk edge and is the delta between last price and the blue risk line in the chart. A full blue bar means upside reversal risk is close and an empty bar shows that it is distant.

Progress bars in trendless phases



- In grey stall / congestion zones, the blue and red risk lines in the chart are replaced by grey lines.
- The colour of the progress bar is determined by how close price is the upper or lower boundary.
- Closer to the top shows as a blue progress bar and closer to the bottom a red progress bar.