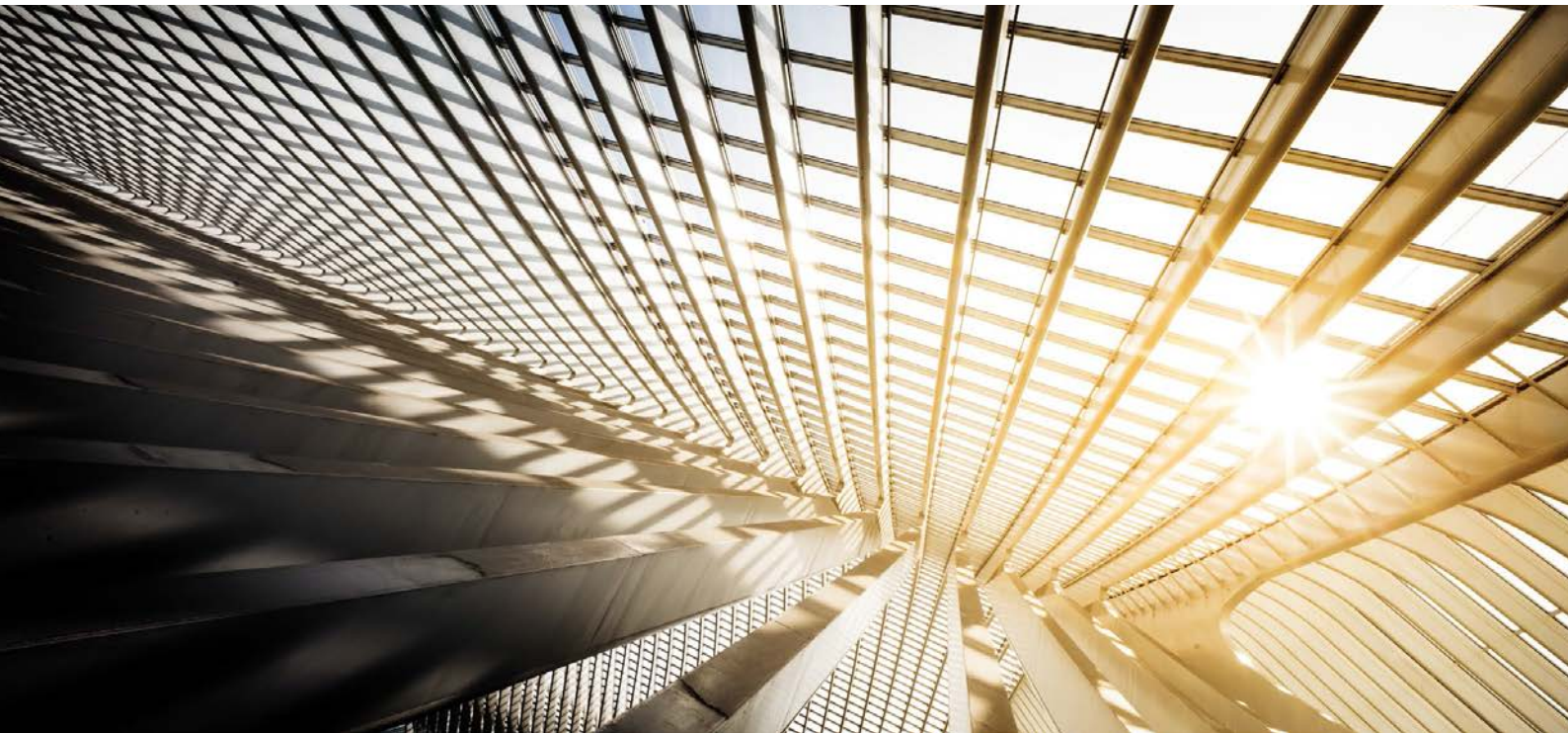


**J.P. Morgan Private Bank Algorithmic Trading Guide
(Asia Markets)**

A new way to trade in a disruptive era



J.P. Morgan



This Guide is an overview of the J.P. Morgan Private Bank Algorithmic Trading Suite (Asia Markets) offering, and is prepared as at the date stated herein and is intended as a general guide only. You must ensure all algorithms offered by J.P. Morgan are used with due skill and care by your authorized personnel only, who understand, are experienced and familiar with algorithmic behavior/patterns.

This is not intended as a substitute for legal or professional advice, and does not take into account your specific circumstances. You should consult your own legal and/or professional advisers should you have any question or concern as to your regulatory obligations arising out of your use of the J.P. Morgan Algorithmic Trading Suite. Furthermore, it is solely your responsibility to ensure you are in full compliance with all laws and regulations applicable to your use of our Algorithms.

Algorithms Overview



J.P. Morgan's Algorithmic Trading Suite offers a choice of Algorithms to cater for a range of trading styles and objectives across a number of Markets.

Our Algorithms combine sophisticated quantitative models and market micro-structure to drive performance and simplify trading workflow.

Our Algorithmic Trading Suite offers solutions to suit a number of trading styles, goals and order flow, ranging from short duration liquidity taking to over the day benchmark and liquidity seeking strategies.

Market specific logic applied for:



Start & End times



Short-Sell trading restrictions



Open/Intraday/Closing Auction Logic



Exchange Price Limits



Min & Max Lot Sizes



Safeguard & Controls

Algorithm Styles

Schedule Based - VWAP, TWAP, CLOSE

- Primarily follow a pre-determined schedule, with some adaptation based on today's observed/anticipated deviation.
- Schedule Based Algorithms attempt to schedule the entire order quantity, so a volume participation cap should be considered, especially for larger quantities or shorter duration orders.

Volume Tracking - POV

- Trade in line with market volume, with additional logic to determine the target % volume.
- Volume Tracking Algorithms are useful when the expected market volume is not known, however consideration should be given to the target % volume chosen.
- Selection of a higher target % volume generally suggests a Limit Price should be used, and may suggest that a Liquidity Based strategy is more appropriate.
- Typically benchmarked to Order Arrival, however VWAP slippage also gives an indication of execution performance.

Liquidity Seeking - AQUA

- Utilise a number of tactics to extract liquidity from the market.
- AQUA-GetDone require a Limit Price given they will take most displayed quantity within limit.

Passive/Hidden - PEG, ICEBERG

- Slice orders and float with the market or at limit, reloading after fills.

Limit Order Placement

Algorithms differ in their Scheduling of order quantity - macro-level decisions over longer time periods (hours)

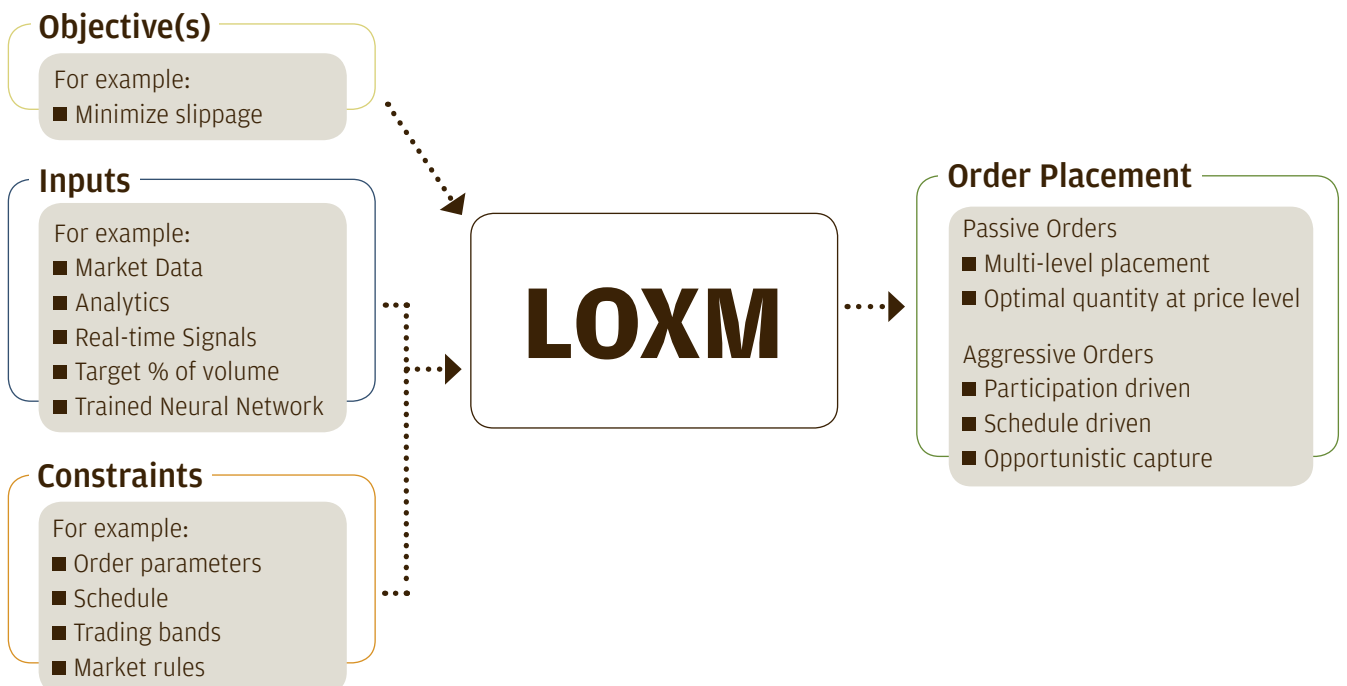
- Schedule tracking
- Volume tracking

The placement of the scheduled quantity into the order book is relatively agnostic to the parent algorithm and concerns decisions made over shorter time periods (seconds / minutes)

This requires a **Limit Order Placement Model**

Algorithms may utilize the machine-learning based **J.P. Morgan LOXM** model for child limit order placement.

- Uses Reinforcement Learning techniques to optimize and adapt over time
- LOXM is not a stand-alone Algorithm, and is generally agnostic to the specific parent strategy (i.e. VWAP vs. AQUA) or high-level goal (Scheduled vs Volume Participation)
- Subject to a number of constraints - for example: schedule, client parameter restrictions, algo controls, exchange rules



Performance Benchmarks

Several metrics are used to measure the performance of trades executed on electronic exchanges. Informed conclusions can be made by understanding what the metric tells us about both the trading strategy and its performance.

J.P. Morgan may provide information upon client request regarding the performance of its algorithms, such as an algorithm's historical benchmark slippage based on different factors (e.g. symbol or size).

Arrival Mid (or Strike)

- Slippage from the mid-point quote at the order's arrival time.
- Attributed to 3 main factors:
 - Permanent Market Shift
 - Temporary Market Move
 - Instantaneous Impact

Period VWAP

- Slippage from the market's Volume Weighted Average Price for the trading period.
- Attributed to 3 main factors:
 - Profile Slippage
 - Timing Slippage
 - Execution Slippage

PWP – Participation Weighted Price

- The price that would have been achieved if we contributed a specified percentage of each trade in the market.
- Can be considered as the VWAP for the volume in the market that would be required for us to contribute the desired percentage.

Close Price

- Trading solely in a Closing Auction will have zero slippage, however this does not mean the order will not have impact.
- Electing to trade part of the order pre-close should typically lead to outperformance, however this is penalized by the addition of variance.

Compliance and Regulatory Requirements

- Increasing global regulatory attention and new regulations on electronic and algorithmic trading (e.g. IOSCO standards and HKSF E-Trading requirements).
- Past regulatory issues related to algorithmic trading include flash crash in US (2010) and India (2012).
- An algorithm user is responsible for:
 - understanding how a specific algorithm operates, including:
 - use of algorithm parameters
 - using limits with careful judgement, e.g. price and volume limits to avoid market impact
 - considering market structure factors that may apply, e.g. closing auction, circuit breakers, etc.
 - ensuring in full compliance with all laws and regulations applicable to use of algorithms to trade.

Algorithm Selection Considerations

Consideration should be given to the choice of Algorithm and Parameters/Limits for a given order. Generally, there is an expected cost of sourcing liquidity, so consider how your demand for liquidity matches the market's ability & willingness to provide.

Is the order required to complete within the specified time frame?

The VWAP, TWAP & CLOSE Algorithms target 100% completion. This explicit demand for liquidity may not match the availability on the day, so volume/price constraints should be considered.

Has the order size been considered in the context of the order's duration?

Using % ADV is a popular approach for screening of large orders. However, care should be taken to look at this in combination with the time available to trade. This is also particularly important when amending the limits on an order.

Have limit prices been appropriately set?

Whilst Limit Price is optional on most strategies, consider setting a Limit Price where your demand for liquidity is high, or on illiquid or volatile stocks.

What's the Benchmark?

The choice of Benchmark often drives Algorithm selection. Consider if the Benchmark being used is actually appropriate for the order flow, or a more suitable Benchmark/Algorithm could be used.

Should you be trading quicker / slower?

There is a trade-off between the additional risk incurred in passive trading versus the market impact inherent in aggressive trading. When trading with momentum, following news, it may make sense to trade more aggressively over a shorter timeframe, whereas in a flat market more time can be afforded to the algorithm to capture spread.

Are different strategies/settings required for In-The-Money vs. Out-The-Money?

A reverting market may warrant being more active in the money

A trending market may warrant being more passive in the money, but more active out of the money

Should a combination of strategies be considered?

Algorithms work entirely independently of each other. Careful consideration must be given before entering multiple instances of Algorithms concurrently in the same name. Generally this is not recommended.

Safeguards & Controls

J.P. Morgan Algorithmic Design, Development & Deployment processes are designed to provide robust, reliable and deterministic Algorithms that can adapt to both expected and abnormal market conditions.

An Algorithm's interaction with the market is also subject to a number of typically non-strategy-specific Controls.

Safeguards and Controls may:

- Alert the trader that a threshold has been breached, while trading continues.
- Restrict an Algorithm's actions. E.g. impose a Price or Volume restriction.
- Instruct the Algorithm to cease trading



Safeguards & Controls (continued)

Child Order Price Controls

- Restricts the price of orders released to market & alerts the trader when a threshold has been breached.
- Limits based on deviation from prevailing market, and various Price Benchmarks.
- Where applicable, Exchange Limits are in place.

Max Child Order Size

- Restricts the size of individual orders released to market.
- Where applicable, Exchange Limits are used, else a maximum number of lots is defined.
- Algorithms may elect to send multiple orders of the maximum child size in order to release the desired quantity to market.

Maximum % Volume Participation

- Restricts the Maximum % of in-limit volume that the Algorithm may contribute.
- A client specified Max % Volume is encouraged aside from Liquidity Seeking Algorithms [AQUA-GetDone & ICEBERG],

Child Order Frequency Limits

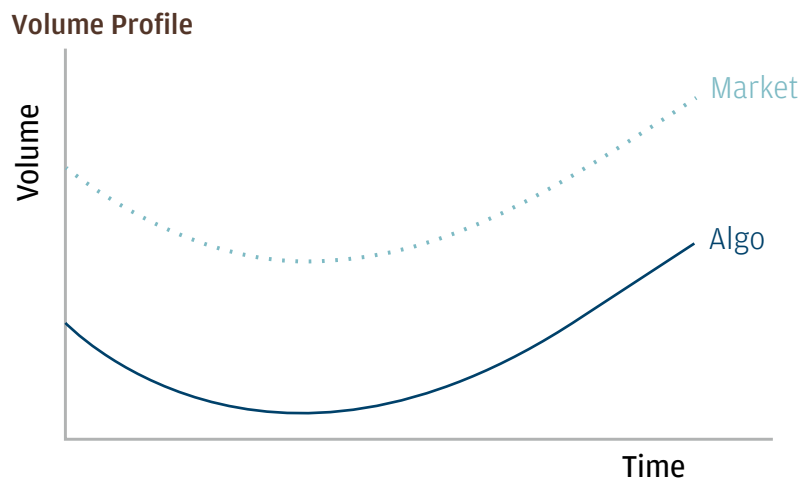
- The frequency of an algorithm's market interaction is tracked.
- Should a threshold be breached, it instructs the Algorithm to cease trading and alerts the trader.

Common Parameters

- Limit Price** < The ultimate limit price that the algorithm may not breach.
- Urgency** < Varies by strategy, but generally used to indicate the preference for liquidity vs. market impact.
- Max % Volume** < The maximum % of the live in-limit period market volume that the Algorithm may contribute. May act as a target or a cap, depending on the Algorithm being used.
- Would Price** < A price level at which the Algorithm should take all available liquidity, regardless of the Algorithm's primary trading schedule.
- Participate on Open / Close** < Indicate whether the Algorithm should participate in the Open and/or Closing auctions. VWAP [& CLOSE] schedule quantity specifically for auctions, whereas other Algorithms trade whatever leaves may be remaining.

VWAP

Target an average execution price in line with the market VWAP for the specified trading period.



Features

- Combines historical and dynamic volume profiles to proportionally distribute trading across the trading period. Automatically adjusts for special events, including Futures & Options expiry days and abbreviated trading sessions.

Parameter Name	Type	Default	Mandatory parameter?	Comments
Limit Price	Number			
Maximum Percentage of Volume	Percent	50		Orders will be subject to a max of 50% of Volume. Order submitted for this parameter higher than 50% will be rejected.
Would Price	Number			
Participate on Open	Y/N			
Participate on Close	Y/N			
Start Time*	Default to "now" or "start of trading section" (whichever later), no other values supported.			
End Time*	Default to "End of trading section" of respective exchanges, no other values supported.			

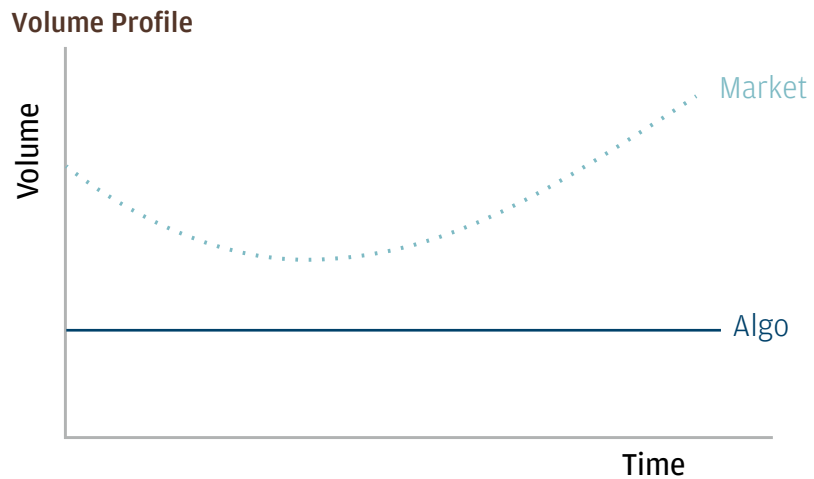
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Notes

- VWAP orders are generally expected to complete unless constrained by Limit Price or Maximum % Volume. VWAP would not normally be considered an 'aggressive' Algorithm, however expected liquidity should be reviewed when setting these constraints, as demanding liquidity in thinly traded securities or over short timeframes may lead to adverse market impact.

TWAP

Trade at a constant rate over the duration of the specified trading period.



Features

- Works on both sides of the bid / offer spread, whilst staying close to the time/volume target.

Parameter Name	Type	Default	Mandatory parameter?	Comments
Limit Price	Number			
Maximum Percentage of Volume	Percent	50		Orders will be subject to a max of 50% of Volume. Order submitted for this parameter higher than 50% will be rejected.
Would Price	Number			
Start Time*	Default to "now" or "start of trading section" (whichever later), no other values supported.			
End Time*	Default to "End of trading section" of respective exchanges, no other values supported.			

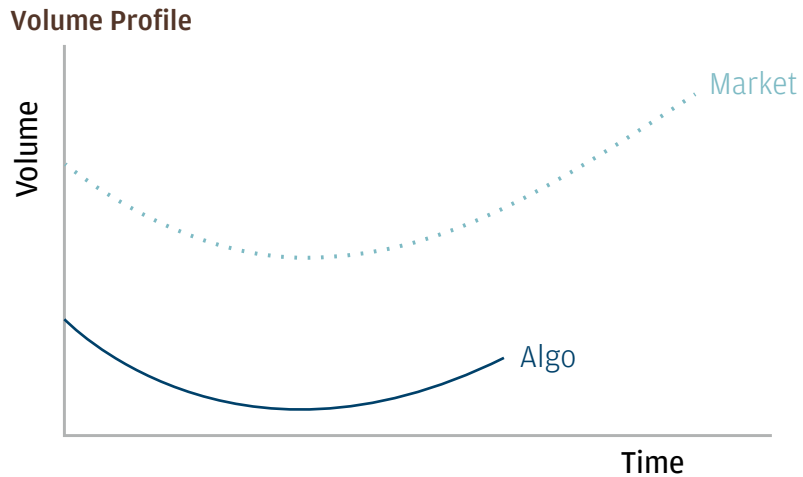
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Notes

- TWAP orders are generally expected to complete unless constrained by Limit Price or Maximum % Volume. TWAP would not normally be considered an 'aggressive' Algorithm, however expected liquidity should be reviewed when setting these constraints, as demanding liquidity in thinly traded securities or over short timeframes may lead to adverse market impact.

POV

Trade in-line with a specified percentage of live tradable market volume.



Features

- Works on both sides of the bid / offer spread, whilst staying close to the volume target.
- Using the 'Urgency' parameter, clients may indicate their preference for allowable target rate deviation vs. expected economic performance.

Parameter Name	Type	Default	Mandatory parameter?	Comments
Target Percentage of Volume	Percent		Yes	Orders will be subject to a max of 50% of Volume. Order submitted for this parameter higher than 50% will be rejected.
Limit Price	Number			
Would Price	Number			
Participate on Open	Y/N			
Start Time*	Default to "now" or "start of trading section" (whichever later), no other values supported.			
End Time*	Default to "End of trading section" of respective exchanges, no other values supported.			

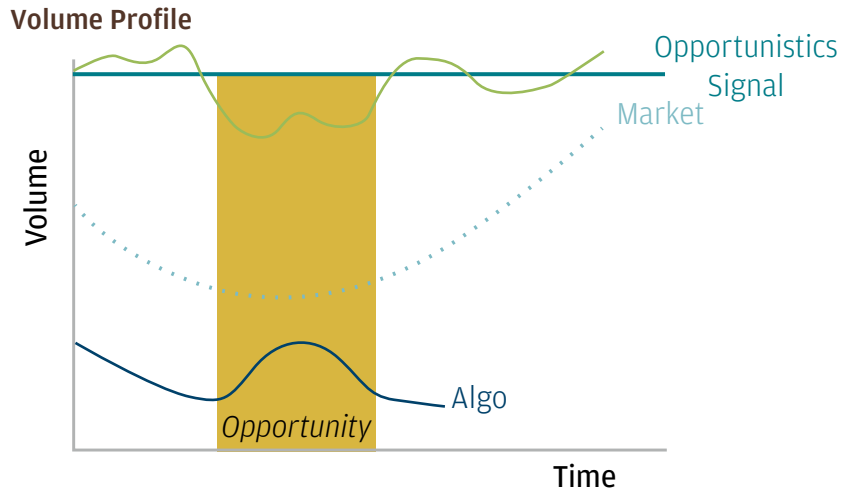
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Notes

- Suitable for when market volumes are unpredictable, however there is no guarantee of completion.
- Selection of a high target % volume may be an indication that a limit price should be used and an alternative trading strategy may be more suited.
- When selecting a target % volume, consider the potential impact of multiple market participants having similar volume tracking algorithms live in a single name at any given point in time.

AQUA

Liquidity seeking strategy, optimized to minimize Arrival Price slippage for a desired trading urgency



Features

- Actively participates in displayed markets and additionally uses J.P. Morgan’s Fair Value Model to help identify opportunities for liquidity taking.
- “Urgency” parameter can be used to indicate desire to take liquidity, ranging from Low Urgency (Min 5% volume) through to GetDone Urgency (take all liquidity available within limit).

Parameter Name	Type	Default	Mandatory parameter?	Comments
Urgency	Text	“Medium”	Yes	"Low" or "1", "Medium" or "2", "High" or "3"
Limit Price	Number			
Maximum Percentage of Volume	Percent	50%		Orders will be subject to a max of 50% of Volume. Order submitted for this parameter higher than 50% will be rejected.
Would Price	Number			
Start Time*	Default to “now” or “start of trading section” (whichever later), no other values supported.			
End Time*	Default to “End of trading section” of respective exchanges, no other values supported.			

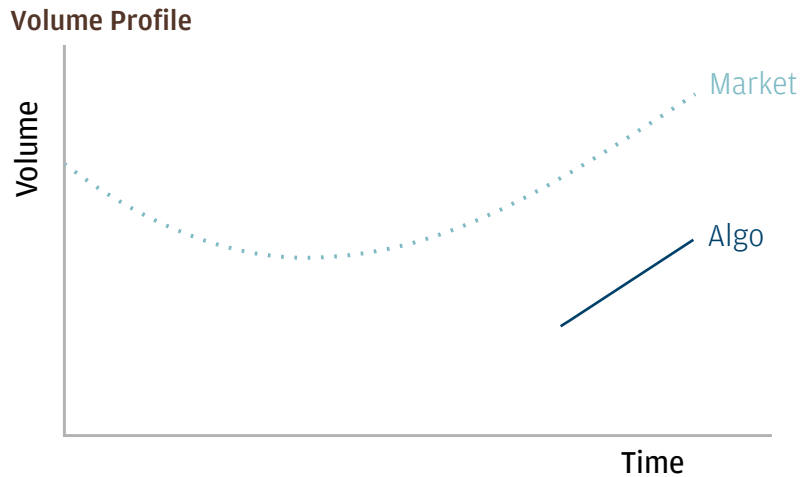
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Urgency Levels

Urgency Levels	Objective
Low	Work order at lower % volume, capture liquidity in the event of favorable price and spread/size.
Medium	Actively participate in market, capture liquidity in the event of favorable price and spread/size.
High	Decisively take liquidity from the market, participating at higher % volume.

CLOSE

Targets the eventual Closing Price of the day.



Features

- Configured to handle the nuances of each market’s closing auction methodology.
- Indicative Auction Volumes [where available] are used to control % volume participation in the Auction period.
- Algo is aware of major Index rebalance events, and expected additional trading volume and volume profile.

Parameter Name	Type	Default	Mandatory parameter?	Comments
Limit Price	Number			
Maximum Percentage of Volume	Percent	50		Orders will be subject to a max of 50% of Volume. Order submitted for this parameter higher than 50% will be rejected.
Only Trade at Close	Y/N	No		
Start Time*	Default to “now” or “start of trading section” (whichever later), no other values supported.			

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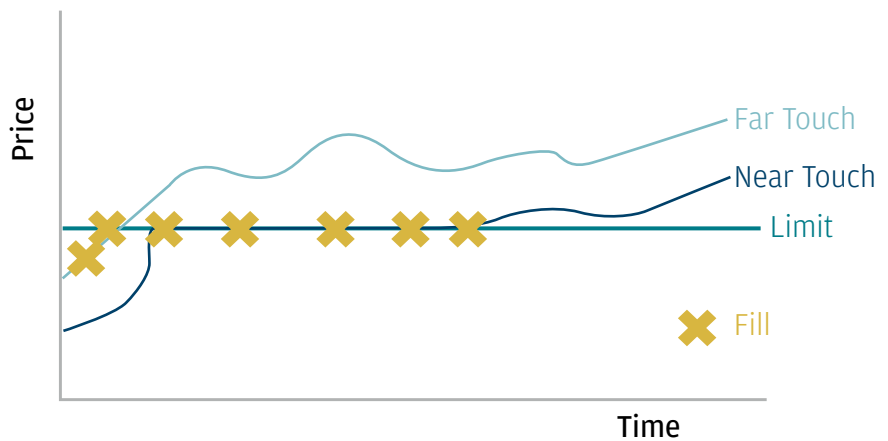
Notes

- Consider the impact that trading a large quantity in the close may have, especially where actual volume deviates from anticipated/historical.
- Closing Auction orders that are capped in the Auction by the Max Auction % Volume may return residuals. If residuals must be avoided, consider allowing the algorithm to start trading pre-Auction.

ICEBERG

Display a fraction of the order to the market at the Limit Price, reloading after each clip is filled or a specified refill level is reached.

Order Book Interaction



Features

- If not set, the Algo can determine an appropriate Display Size based on the prevailing order book.

Parameter Name	Type	Default	Mandatory parameter?	Comments
Limit Price	Number		Yes	
Refill Size	Number			
Display Size	Number			
Participate on Open	Default to “No”, no other values supported.			
Participate on Close	Default to “No”, no other values supported.			
Start Time*	Default to “now” or “start of trading section” (whichever later), no other values supported.			
End Time*	Default to “End of trading section” of respective exchanges, no other values supported.			

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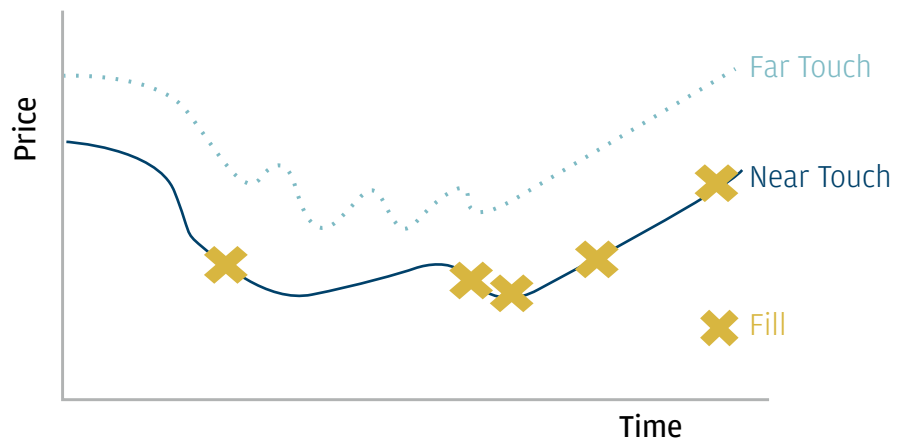
Notes

- The Algorithm will take all liquidity within Limit, so the Limit Price should be carefully considered especially the impact of entering a marketable limit price.

PEG

Passively display a specified size to the market, “pegging” the price to a user-specified target on or within the bid/ask spread.

Order Book Interaction



Features

- If not set, the Algo can determine an appropriate Display Size based on the prevailing order book.
- The “Imbalance” Urgency can be used to combine passive posting with taking logic designed to maintain a small % participation of far touch executed volume, or take when the far touch quote volume is depleting.

Parameter Name	Type	Default	Mandatory parameter?	Comments
Limit Price	Number			
Urgency	Text	“Low”		“Low” or “1”, “Medium” or “2”, “High” or “3”, ‘Asia_Imbal’ or ‘5’
Display Size	Number			
Would Price	Number			
Participate on Open	Default to “No”, no other values supported.			
Participate on Close	Default to “No”, no other values supported.			
Start Time*	Default to “now” or “start of trading section” (whichever later), no other values supported.			
End Time*	Default to “End of trading section” of respective exchanges, no other values supported.			

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Notes

- PEG is a passive trading strategy that is intended to minimize market impact. Whilst it may be useful for passive accumulation, consideration should be given to the additional timing risk that may be incurred versus other less passive strategies.

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As a general matter, we prefer J.P. Morgan managed strategies. We expect the proportion of J.P. Morgan managed strategies will be high (in fact, up to 100 percent) in strategies such as, for example, cash and high-quality fixed income, subject to applicable law and any account-specific considerations.

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