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OCM-R: OneChronos Rates Technical Product Guide



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1 Introduction

OneChronos Markets LLC proposes **OneChronos Rates** ("OCM-R"), a trading venue for fixed-income securities on the OneChronos Fixed Income ATS. Following regulatory approvals and launch, OCM-R will be initially focused on US Treasury securities. This document describes OCM-R and highlights the motivations for certain elements of its design.

Today, fixed-income securities are traded over a number of mechanisms, from central limit order books ("CLOBs"), to request-for-quote (RFQ), just to name two. OCM-R differs from these in several ways:

- OCM-R will be based on discrete batch auctions, running continuously throughout a trading session,
- OCM-R will be dark and anonymous,
- OCM-R will support Expressive Bidding.

On OCM-R, a subscriber expresses interest in trading in the form of an Expressive Bid ("EB"). An EB consists of a set of instruments to be traded, alongside constraints that apply when these instruments are filled. The set of fills that result from an EB defines a basket, and constraints relate to properties of that basket. While the focus of EBs is on multi-instrument baskets and constraints, OCM-R supports outrights – intentions to trade one instrument under simple quantity and yield/price limits. We describe below how outrights are represented as EBs.

Unlike some auction models, OCM-R does not limit matching to counterparties that have precisely inverted interest. As a result, an outright EB may match with a spread EB (an EB involving two instruments), and a spread EB may match with a butterfly EB (an EB involving three instruments). Drawing on the principles underlying OneChronos' existing product offerings, OCM-R is designed to match EBs fairly on their expressed terms, so subscribers can focus on directly representing higher-level trading objectives.

To mitigate information leakage, EBs are not published and counterparties are not disclosed. OCM-R is a dark venue. The only information distributed will be through fill messages sent to the parties to a trade.[1]

Matching EBs on OCM-R will be structured around discrete batch auctions (also known as "periodic call auctions"). With batch auctions, EBs will first be accumulated by the venue. Periodically, and at discrete points in time, the EBs that have been accumulated will be jointly evaluated for matches. The OCM-R auction model blurs the distinction between liquidity seekers and liquidity providers. This stands in contrast to a venue that operates on the basis of a price/time CLOB, where the venue seeks to match resting and aggressive liquidity.

[1] Certain trade information will also be disseminated to FINRA's TRACE facility, as required under FINRA rules.

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OCM-R will run auctions approximately 30 times per minute, from 7:00 AM ET to 5:30 PM ET. As with a CLOB, OCM-R subscribers will be permitted to submit and cancel EBs at any time. A trading session on OCM-R consists of a sequence of auctions, each separated by some time period. This time period will be *randomized* and designed to limit the impact of latency arbitrage on the venue.

In each auction, OCM-R's optimization process determines

- which EBs and instruments to fill,
- the quantity of each instrument for each EB that is filled, and
- the transaction yield of each filled instrument.

2 Neutrality Constraints

A primary concern of Rates traders is hedging and risk. An EB is a container for the execution of multiple instruments – the EB's legs. The fills an EB's legs receive in an auction constitute a basket. An EB allows traders to make any fills contingent on the satisfaction of a neutrality constraint applied to this basket. EB fills are "atomic" in the sense that the auction guarantees that the EB receives either

- some fills that collectively satisfy the neutrality constraint, or
- no fills at all.

This guarantee eliminates the "legging" typically associated with the traditional approach to continuous hedging, in which a trader must collectively manage the trading activity of otherwise disconnected instruments.

To illustrate this concept, we start with a contrived example consisting of instruments $\{A, B, C\}$, where the goal is to synthesize a risk-neutral basket. The trader associates with each instrument the DV01 risk metric. Because the ideal is a basket with zero DV01, the trader will also specify a tolerance mandating how risky an executed basket's DV01 could be. The trader's EB, for example, could consist of the following inputs:

instrument	DV01
A	1.23
B	4.56
C	7.89

basket neutrality tolerance, ψ	0.05

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Here, 4.56 is the DV01 of instrument B, etc. The net DV01 of a basket is the quantity-weighted sum of DV01s of its instruments:

$$\sum_i q_i \mathrm{DV01}_i,$$

where q_i is the signed quantity of each instrument in the basket, with positive quantities for long positions and negative quantities for shorts. The neutrality EB implies the following constraint:

$$\frac{\left|\sum_i q_i \cdot \mathrm{DV01}_i\right|}{\sum_i \left|q_i \cdot \mathrm{DV01}_i\right|} \leq \psi$$

Using the DV01 values specified in our example, the neutrality constraint is:

$$\frac{\left|q_A \cdot \$1.23 + q_B \cdot \$4.56 + q_C \cdot \$7.89\right|}{|q_A \cdot \$1.23| + |q_B \cdot \$4.56| + |q_C \cdot \$7.89|} \leq 0.05$$

We now imagine that this EB received the following fills:

instrument, i	q_i, \$1000	y_i, %
A	7	4.0
B	0	4.1
C	-1	3.8

y_i, the yield at which instrument i is cleared in the auction, will figure in **yield constraints**, presented below. The auction outcome for our EB means that \$7000 par-notional of instrument A was bought at a yield of 4.0%, \$1000 of instrument C was sold at a yield of 3.8%, and instrument B was not executed[2]. Even though instrument B is not executed, the neutrality constraint is satisfied because:

$$\frac{\left|(7) \cdot \$1.23 + (0) \cdot \$4.56 + (-1) \cdot \$7.89\right|}{|(7) \cdot \$1.23| + |(0) \cdot \$4.56| + |(-1) \cdot \$7.89|} = \frac{\$0.72}{\$16.5} \approx 0.0436 \leq 0.05$$

In the definition of basket DV01 risk of the neutrality constraint:

$$\frac{\left|\sum_i q_i \cdot \mathrm{DV01}_i\right|}{\sum_i \left|q_i \cdot \mathrm{DV01}_i\right|}$$

the numerator represents absolute *net* basket DV01, whereas the denominator represents the *gross* basket DV01. The ratio of absolute net to gross makes neutrality a **scale-invariant** property that applies in relative terms. To see this, consider an auction outcome where each fill is scaled by a factor of 100:

[2] Fills on OCM-R are integer multiples of \$1000.

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instrument, i	q_i, \$1000	y_i, %
A	700	4.0
B	0	4.1
C	-100	3.8

Here, A and C are filled at sizes (\$700,000, -\$100,000) instead of (\$7000, -\$1000) as before. The neutrality constraint is still satisfied, despite this scaling, because:

$$\frac{\left|(700)\cdot\$1.23+(0)\cdot\$4.56+(-100)\cdot\$7.89\right|}{|(700)\cdot\$1.23|+|(0)\cdot\$4.56|+|(-100)\cdot\$7.89|}=\frac{\$72}{\$1650}\approx 0.0436\leq 0.05$$

3 Sidedness and Quantity Constraints

In the previous examples, the trader was indifferent as to whether each instrument was to be bought or sold. In many situations, the trader may have a preference (or strong opinion) as to the side of each leg, wanting only to buy some legs and only to sell others. The trader may be indifferent about the side of a third set of legs, aiming for that flexibility to help achieve DV01 neutrality. To illustrate this scenario, we enhance our EB with sidedness constraints:

instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000
A	1.23	`Buy`	20
B	4.56	`Sell`	10
C	7.89	`Buy:Sell`	25:30

basket neutrality tolerance, ψ	0.05

Here, the trader wishes to `Buy` instrument A – up to \$20,000. The trader is also willing to `Sell` up to \$10,000 of B. However, the trader is willing to `Buy` (\$25,000) *or* `Sell` (\$30,000) of C. The following outcome

instrument, i	q_i, \$1000	y_i, %
A	7	4.0
B	0	4.1
C	-1	3.8

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is valid because the neutrality constraint is satisfied, and the newly added size constraints are also satisfied:

$$\begin{array}{rcrcrcr} 0 & \leq & (q_A & = & 7) & \leq & 20 \\ -10 & \leq & (q_B & = & 0) & \leq & 0 \\ -30 & \leq & (q_C & = & -1) & \leq & 25 \end{array}$$

Minimum Quantity A trader may optionally specify a minimum quantity, $q^{\min}$, for an EB. When set, if the EB receives fills in an auction, the aggregate quantity filled across its instruments must be at least $q^{\min}$:

$$q^{\min} \leq \sum_i |q_i|$$

Here, $\sum_i |q_i|$ is the total executed quantity. This constraint may protect a resting EB from the practice of "pinging" – an attempt by counterparties to discover liquidity. The following EB includes a minimum quantity constraint:

instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000
A	1.23	`Buy`	20
B	4.56	`Sell`	10
C	7.89	`Buy:Sell`	25:30

minimum quantity, $q^{\min}$, \$1000	5

This EB requires that at least \$5000 be executed, or nothing at all. For this EB, the constraint is

$$5 \leq |q_A| + |q_B| + |q_C|$$

The following outcome

instrument, i	q_i, \$1000	y_i, %
A	7	4.0
B	0	4.1
C	-1	3.8

satisfies this constraint because

$$5 \leq |7| + |0| + |-1|$$

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4 Initial Positions

The EB described in the previous sections constructs DV01-neutral baskets from scratch while satisfying a tolerance for non-neutrality specified by the trader. The trader may instead want to rebalance a portfolio of instruments by applying an adjustment basket. The focus here is the DV01 of the portfolio *after* this adjustment. As we shall see, this feature also comes into play in the management of an EB's lifecycle, described below.

To facilitate consideration of neutrality beyond the fills of a particular auction, the trader provides initial portfolio positions. The absence of a side constraint marks an instrument as ineligible for trading. We extend our running example with instrument D, which is ineligible for trading but whose initial position still contributes to the consideration of basket risk.

instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000	initial position, q_i^0, \$1000
A	1.23	`Buy`	20	-3
B	4.56	`Sell`	10	12
C	7.89	`Buy:Sell`	25:30	7
D	0.12	–	–	-4

basket neutrality tolerance, ψ	0.05

The DV01 of the portfolio, after adjustment by a basket outcome, is:

$$\sum_i Q_i \mathrm{DV01}_i$$

where $Q_i = q_i^0 + q_i$. In our example, this translates into the following constraint:

$$\frac{\left|Q_A\mathrm{DV01}_A + Q_B\mathrm{DV01}_B + Q_C\mathrm{DV01}_C + Q_D\mathrm{DV01}_D\right|}{\left|Q_A\mathrm{DV01}_A\right| + \left|Q_B\mathrm{DV01}_B\right| + \left|Q_C\mathrm{DV01}_C\right| + \left|Q_D\mathrm{DV01}_D\right|} \leq 0.05$$

where

$$\begin{array}{rcrcrcl} Q_A & = & q_A^0 + q_A & = & -3 & + & q_A \\ Q_B & = & q_B^0 + q_B & = & 12 & + & q_B \\ Q_C & = & q_C^0 + q_C & = & 7 & + & q_C \\ Q_D & = & q_D^0 + q_D & = & -4 & + & q_D \end{array}$$

$$\begin{array}{rcrcr} 0 & \leq & q_A & \leq & 20 \\ -10 & \leq & q_B & \leq & 0 \\ -30 & \leq & q_C & \leq & 25 \\ & & q_D & = & 0 \end{array}$$

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Initial instrument positions are entirely optional. The ability to specify them is available to subscribers that wish to define an EB's neutrality beyond the executions of its legs.

5 Yield Constraints

Yields are of significant interest to Rates traders, and they too can be constrained as part of an EB. For example, to require that the instrument A only be bought at a yield of 3.9% or above, we extend our running example as follows:

instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000
A	1.23	`Buy`	20
B	4.56	`Sell`	10
C	7.89	`Buy:Sell`	25:30
E	0.12	`Buy`	7

basket neutrality tolerance, ψ	0.05
yield of A	$y_A \geq 3.9\%$

With this EB, if no satisfactory match for instrument A is found, instruments $\{B, C, E\}$ may still be filled in any combination that satisfies the neutrality constraint.

A trader may also want to express a spread constraint: that a difference of two yields is bounded (either above or below). For example, suppose that the trader only wishes to get fills when the difference between instruments A and C is greater than 0.1%, and when the difference between E and B is greater than -0.07%. After the addition of these two spread constraints, our EB becomes:

instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000
A	1.23	`Buy`	20
B	4.56	`Sell`	10
C	7.89	`Buy:Sell`	25:30
E	0.12	`Buy`	7

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basket neutrality tolerance, ψ	0.05
yield of A	$y_A \geq 3.9\%$
A:C yield spread	$y_A - y_C^{\ominus} \geq 0.1\%$
E:B yield spread	$y_E - y_B \geq -0.07\%$

The basket outcome

instrument, i	q_i, \$1000	y_i, %
A	7	4.0
B	0	4.1
C	-1	3.8
E	0	4.0

is valid because the constraints $y_A = 4.0\% \geq 3.9\%$ and $y_A - y_C^{\ominus} = 4.0\% - 3.8\% = 0.2\% \geq 0.1\%$ are satisfied. In this outcome, neither instrument B nor instrument E is filled. Therefore, the E:B spread constraint is not applicable, and the corresponding yield difference ($y_E - y_B = 4.0 - 4.1 = -0.1$) is irrelevant.

The general form of a yield constraint is:

$$\sum_i \alpha_i y_i \geq L$$

where α_i and L are values supplied by the trader. The coefficients α_i allow the trader to compose and constrain more complex relationships (for example, butterflies) among three or more instruments. An EB may include any number of yield constraints.

Although every yield constraint is submitted in this $\geq$ form, an upper bound on a yield (or on a linear combination of yields) is obtained by negating coefficients: for example, $y_i \leq z$ is equivalent to $(-1)\, y_i \geq -z$.

The venue guarantees that:

- Whenever *any one* of the instruments referenced by a yield constraint is filled
  - *all* of the instruments referenced by that yield constraint are filled, and
  - that yield constraint is satisfied.
- When an instrument is filled, all yield constraints that reference that instrument (if any) are satisfied.

The example above highlights the special treatment of double-sided instruments. Its EB expresses that instrument C can either be bought or sold. The

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yield constraint referencing C therefore must specify under which side that yield constraint must apply (should C and A be filled). A yield constraint that includes $y_C^{\ominus}$, as above, is satisfied when C is sold. Conversely, a yield constraint that includes $y_C^{\oplus}$ is satisfied when C is bought. A reference in a yield constraint to an instrument that is single-sided is not qualified with a side, as the trading direction is readily inferred from the declared side.

6 Market-Making

The ability to express that an instrument should be bought under one yield condition and sold under another allows EBs to be used for making markets. In the following example, instrument C can be either bought or sold, depending on distinct yield conditions:

instrument	Side	maximum quantity, $q_i^{\max}$, \$1000
C	`Buy:Sell`	25:30

yield of C when bought	$y_C^{\oplus} \geq 4.0\%$
yield of C when sold	$y_C^{\ominus} \leq 3.8\%$

Here, the market-maker (MM) is willing to buy up to \$25,000 of instrument C at a yield of 4.0% or higher, and is willing to sell up to \$30,000 of that instrument at a yield of 3.8% or lower. The 0.2% gap between these two yield limits is the market-maker's effective bid/ask spread. The sell-side constraint $y_C^{\ominus} \leq 3.8\%$ is encoded in the general $\geq$ form described in section 5.

An EB could also be used to manage a multi-instrument market-making strategy. Consider the following EB for four instruments:

instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000	initial position, q_i^0, \$1000
A	1.23	`Buy:Sell`	20:40	–
B	4.56	`Buy:Sell`	10:39	5
C	7.89	`Buy:Sell`	25:30	-11
E	0.12	`Buy:Sell`	70:100	–

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basket neutrality tolerance, ψ	0.05
yield of A when bought	$y_A^{\oplus} \geq 4.1\%$
yield of A when sold	$y_A^{\ominus} \leq 4.0\%$
yield of B when bought	$y_B^{\oplus} \geq 4.2\%$
yield of B when sold	$y_B^{\ominus} \leq 4.1\%$
yield of C when bought	$y_C^{\oplus} \geq 4.0\%$
yield of C when sold	$y_C^{\ominus} \leq 3.8\%$
yield of E when bought	$y_E^{\oplus} \geq 3.7\%$
yield of E when sold	$y_E^{\ominus} \leq 3.5\%$

In this EB, the market-maker will maintain the neutrality of its book of four instruments. Each instrument is subjected to a pair of simple yield constraints: one to buy the instrument, specifying a lower limit on yield; and a second to sell the instrument, specifying an upper limit on yield. (Again, the difference between an instrument's two yield limits constitutes the market-maker's effective spread for that instrument.) The EB's neutrality constraint will guarantee that any fills its instruments receive only happen atomically and in combinations that maintain the four-instrument book's neutrality. Periodically, as the MM's opinions of fair yields evolve, the MM could cancel and replace its EB with limits aligned with the MM's updated view. Any changes to the MM's book that take place as a result of trading an instrument outside OCM-R could be incorporated into an EB's understanding of neutrality: by canceling the EB and replacing it with one whose initial position reflects the new position of that instrument.

7 Lifecycle

When an EB is submitted by a trader to OCM-R, it is available for matching in the auction immediately following the submission, in addition to any auction thereafter. The trader may cancel the EB at any time. An EB is completely filled when every one of its constituent instruments is completely filled, and is considered partially filled otherwise. When an EB is completely filled, it is then canceled by OCM-R and is no longer available for matching. When an EB is partially filled, one of two behaviors is possible:

- the EB can be canceled back to the trader
- the EB can rest on OCM-R. The fill quantity of any filled instrument i decrements the maximum quantity ($q_i^{\max}$) associated with that instrument, resulting in a diminished $q_i^{\max}$.

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While continuing to rest is the default behavior, the choice (of whether to rest) is under the trader's control.

Neutrality Constraint If the EB contained a risk neutrality constraint and the trader opted for the EB to rest once partially filled, one of two behaviors is possible:

- The accumulated fill quantity of every filled instrument of the EB can serve as an initial position q_i^0 in the neutrality constraint, as described in section 4.
- The accumulated fill quantity is ignored.

These two options are also under the trader's control. With the first option, the trader maintains the neutrality of the *accumulated* position of the EB. However, every incremental EB outcome (produced in an auction after the very first) may be non-neutral in isolation. With the second option, the trader insists that every *incremental* outcome associated with the EB is neutral, regardless of the EB's accumulated position. The first option is the default because it will generally produce higher fill rates.

Minimum Quantity Since an EB may rest and accumulate fills across auctions, the minimum quantity constraint admits two interpretations:

- The constraint applies to *every* auction in which the EB receives a fill.
- The constraint only applies to the *first* fill received by the EB, leaving any subsequent partial fills unconstrained. With this setting, the trader can mandate that a substantial block of liquidity is initially discovered. After a first and sizable partial fill, an EB's fills in subsequent auctions may have any size.

The trader can select whichever option they prefer, with the second option being the default.

Persistence Finally, an EB offers two persistence options:

- time-in-force (TIF), denoting the maximum time duration that an EB will persist before being canceled
- auction-in-force, denoting the maximum number of auctions that an EB will persist before being canceled. An auction-in-force of one (1) is roughly equivalent to the immediate-or-cancel (IOC) lifecycle option available in many other venue protocols.

The trader may choose only one of these options.

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8 Interface

An EB consists of constraints applied to one or multiple instruments. It specifies:

- a (non-empty) set of instruments to be traded. Additionally, for each instrument,
  - an optional `Buy` quantity
  - an optional `Sell` quantity

  When both a `Buy` and a `Sell` quantity are specified, the instrument may either be bought or sold. When neither is specified, the instrument is not tradeable.
- an optional neutrality constraint:
  - consisting of the $\mathrm{DV01}_i$ of each instrument i in the instrument set, and
  - the non-neutrality tolerance, ψ.
  - If the constraint is to apply to a portfolio with existing positions, the initial positions q_i^0 of each instrument i are required.
- zero or more yield constraints. Each yield constraint consists of:
  - some number of (i, s_i, α_i) tuples for a subset i of the instrument set. Here α_i is the yield coefficient and $s_i \in \{\texttt{Buy}, \texttt{Sell}\}$ is an optional side qualifier, required only for double-sided instruments.
  - a lower bound L
- an optional minimum quantity, $q^{\min}$: the smallest aggregate quantity the EB will accept if filled in an auction.
- optional lifecycle modifiers.

All quantities – buy, sell, initial, and minimum – are specified in terms of par-notional dollar values.

9 Outright

An EB can represent an outright – an intention to buy or sell one instrument. An outright is fully specified by three inputs:

- the identity of the instrument i
- a maximum quantity, $q^{\max}$
- the yield limit, z

There are two methods a trader can use to specify an outright. In the first, the trader uses the generic framework described in section 8. To `Buy` an instrument i:

instrument set	i
maximum `Buy` quantities	$(i, q_i^{\max})$
maximum `Sell` quantities	–
yield constraint $y_i \geq z$	$(\alpha_i, L) = (1, z)$

Similarly, to `Sell` instrument i:

instrument set	i
maximum `Buy` quantities	–
maximum `Sell` quantities	$(i, q_i^{\max})$
yield constraint $y_i \leq z$, or $-y_i \geq -z$	$(\alpha_i, L) = (-1, -z)$

Because the trading of outrights is a significant use-case, OCM-R's protocol offers a simpler method of specifying them. This method also supports a clean price limit as an alternative to a yield limit:

- the identity of the instrument i
- a maximum quantity, $q^{\max}$
- a side, either `Buy` or `Sell`
- a limit, z
- an optional indication as to whether z represents a yield or clean price; if not indicated, z is assumed to represent a clean price.

The following table compares these two methods of expressing an outright:

	simple	multi-leg
price limit	✓	
yield limit	✓	✓
lifecycle control	✓	✓
minimum quantity		✓

10 Example: Butterfly

We imagine in this section a trader who believes that medium-term rates will increase relative to both short- and long-term rates. We will detail a butterfly EB that reflects that belief, and consists of three off-the-run instruments: 5-year,

7-year, and 10-year US Treasury notes. The 5y and 10y constitute the "wings" and the 7y is the "belly." Consistent with that view, we will aim to sell the 7y and buy the 5y and 10y while imposing a DV01 neutrality constraint. However, we will transact no more than $200,000 of each. The EB also includes a yield constraint that limits fills to those whose yields align with the rate changes anticipated by the trader.

Sampled on 2026-03-23 at 13:27 ET, the prevailing market prices, yields, and other corresponding details are as follows:

	5y	7y	10y
CUSIP	`91282CPW5`	`91282CPY1`	`91282CPJ4`
Coupon Rate, %	$3\frac{3}{4}$	4	4
Maturity	2031-01-31	2033-01-31	2035-11-15
Coupon, $	1.875	2	2
price, $	$98 - 30\frac{7}{8}$	$99 - 03$	$97 - 11\frac{1}{4}$
interest accrual, days	52	52	129
accrued interest, $	0.538674	0.574686	1.425414
dirty price, $	99.503518	99.668436	98.776977
yield, %	3.985695	4.152532	4.338437
DV01, $	0.0435	0.0588	0.0769

The yield constraint for this butterfly has the general form:

$$\alpha_{5\text{y}} y_{5\text{y}} + \alpha_{7\text{y}} y_{7\text{y}} + \alpha_{10\text{y}} y_{10\text{y}} \geq L$$

Therefore, in designing this EB, we must specify values for $\{\alpha_{5\text{y}}, \alpha_{7\text{y}}, \alpha_{10\text{y}}, L\}$. We choose values

$$\begin{aligned} \alpha_{5\text{y}} &= -1 \\ \alpha_{7\text{y}} &= 2 \\ \alpha_{10\text{y}} &= -1 \end{aligned}$$

though other similar values with the same signs may work equally well. Next, we choose an appropriate value of L. If we were to construct L so the prevailing yields (just barely) satisfy the constraint, then its value would be:

$$L = (-1) \cdot 3.985695 + (2) \cdot 4.152532 + (-1) \cdot 4.338437 = -0.019068$$

We choose a slightly more stringent (higher) value: $L = -0.014$. We complete our EB by selecting a DV01 neutrality tolerance of 0.03, allowing for a 3% deviation from perfect neutrality:

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instrument	DV01	Side	maximum quantity, $q_i^{\max}$, \$1000
5y	0.0435	`Buy`	200
7y	0.0588	`Sell`	200
10y	0.0769	`Buy`	200

basket neutrality tolerance, ψ	0.03
5y:7y:10y butterfly	$(-1)y_{5\text{y}} + (2)y_{7\text{y}} + (-1)y_{10\text{y}} \geq -0.014$

11 Protocol

OCM-R supports the FIX protocol. OCM-R is designed for atomic execution of multi-instrument baskets subjected to cross-instrument constraints. In contrast, the focus of the FIX protocol is trading interest in just one instrument, with simple quantity and price limits. Therefore, some retrofitting is required to support OCM-R's Expressive Bidding over FIX. Please consult OCM-R's Technical Reference Guide for details.

Units and Precision The OCM-R protocol is used to specify EBs, which contain values for quantity, price, yield, and DV01:

- **quantity**: reflects the par-notional (dollar) value of
  - an upper bound on the interest to buy an instrument
  - an upper bound on the interest to sell an instrument
  - a lower bound on the total filled, on either side
  - an initial position

  If specified, the values of the first three elements must be positive integers. Initial quantity may be either a positive number (for a long position) or a negative number (for a short position), encoded either in decimal or floating-point format.

  Even though OCM-R fills are limited to multiples of \$1000, trader-specified quantities need not be. For example, a specification to buy up to \$5123 of an instrument could only result in fills of \$1000, \$2000, \$3000, \$4000, and \$5000. Similarly, specifying \$2978 as a minimum quantity will result in aggregate fills of \$3000 or more (if at all).

- **yield**: yield constraints combine the yields of the referenced instruments, in terms of **percent**. For example, consider a simple yield constraint on

instrument A: $y_A \geq 4$. In determining the outcome of an auction, OCM-R will consider multiple matching configurations by substituting candidate values for y_A, for example { 3.7%, 3.9%, 4.2%, 4.6% }. These yields correspond to the clean prices of the subject instrument. The elements of a yield constraint – α_i's and L – can be specified in decimal or floating-point format.

- **price**: The generic multi-legged formulation of an EB can only reference the yields of instruments. However, the simpler outright-only formulation described in section 9 may indicate either a limit yield or a limit price. When the indicated limit is a price, it represents an upper bound on **clean price** for buying \$100 of par-notional interest (and a lower bound on the clean price for selling \$100 of par-notional interest). While OCM-R will fill instruments at clean prices that are multiples of $\$1/512$, the limits on these prices are specified in decimal or floating-point formats, and need not be $\$1/512$-multiples.

- **DV01**: In an EB's neutrality constraint:

$$\frac{\left|\sum_i q_i \cdot \mathrm{DV01}_i\right|}{\sum_i \left|q_i \cdot \mathrm{DV01}_i\right|} \leq \psi$$

the set of DV01's appears in both the numerator and denominator. Therefore, the scale of the DV01's can be chosen by the subscriber. In other words, the trader can think of DV01's per \$1MM of an instrument, and specify values in the protocol messages accordingly. Alternatively, the trader can think of (and specify) DV01's per \$1000, or any other scale. The DV01's (and neutrality tolerance ψ) can be specified in decimal or floating-point formats.

12 Trading Session

OCM-R will be operational Monday through Friday (except on SIFMA-recommended US holidays)[3], from 7:00 AM ET to 5:30 PM ET. A daily trading session consists of a sequence of auctions. Auctions will take place approximately every two (2) seconds, resulting in approximately 18,900 auctions each day.

A trader may submit and cancel EBs at any time during the trading session. An auction consists of two distinct phases:

- In the **accumulation** phase, no matching activity takes place.

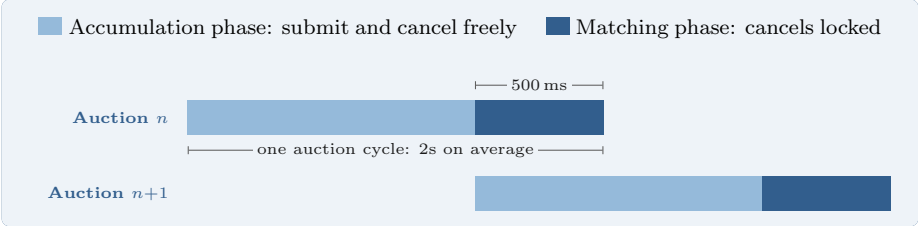
- In the **matching** phase, lasting 500 milliseconds, OCM-R attempts to match all of the active EBs. Any fills resulting from matching are communicated to the counterparties to a trade.

[3] https://www.sifma.org/resources/guides-playbooks/holiday-schedule

– **Cancellation:** In the matching phase, a trader is "locked-out" from canceling EBs. Therefore, an EB canceled during the matching phase may still result in fills. During the matching phase, OCM-R will respond to attempts to cancel an EB with a notification that the cancel is pending. At the end of the matching phase, OCM-R will respond with a second message notifying the trader of the cancellation of the EB.

– **New EB Submission:** any new EB submitted in the matching phase is not eligible for inclusion in the current auction, but will be included in the next auction (if not canceled in the interim).

The period between the start of the accumulation phase and the end of the matching phase is called an "auction cycle." An auction cycle lasts anywhere from 600 milliseconds to 3.4 seconds, with an average of two (2) seconds. The duration of each auction cycle is randomly chosen within this range:



13 Matching

Each possible way of matching EBs in an auction is called a "solution," and involves determining transaction prices/yields and quantities that satisfy the EBs in the auction. In matching EBs, OCM-R will consider clean prices in increments of $1/16$ of a $\$1/32$ (equivalently: $\$1/512 = \$0.001953125$), and yields corresponding to those prices. It will consider fill quantities in increments of $1000.

OCM-R's matching algorithm evaluates EBs fairly on their expressed terms, so subscribers can focus on directly representing higher-level trading objectives. Outright and MultiLeg EBs are evaluated together, allowing liquidity to interact across eligible configurations.

The following properties of an EB, commonly found in other matching algorithms, *do not* factor into the OCM-R matching algorithm:

- the duration that the EB has rested on the OCM-R book
- the identity of the EB's trader, the trader's classification (e.g. "market-maker", "bank", etc.).

Finally, we note that while a trader may submit multiple EBs, OCM-R does not prevent self-matching.

14 Central Clearing and Novation Risk

OCM-R submits fills to FICC for central clearing through its clearing agent, anticipated to be ABN AMRO. An OCM-R subscriber is responsible for promptly submitting its fills separately to FICC – either directly or through its own clearing agent. OCM-R is notified once FICC has successfully compared and accepted these two independent submissions, and when this happens, those fills are considered "novated." Any fills that have yet to novate contribute to a subscriber's novation risk, defined as

$$R = \sum_{i \in U} \Big(\frac{\mathrm{DV01}_i}{\mathrm{DV01}_{10\mathrm{y}}} \Big) x_i$$

where:

R	novation risk metric
U	set of instruments whose fills have yet to novate
i	instrument index
x_i	the par notional value of instrument i (of any side) that has yet to novate; this could have accumulated through fills spanning any number of auctions.
$\mathrm{DV01}_i$	DV01 of instrument i, determined by OCM-R at prevailing market prices
$\mathrm{DV01}_{10\mathrm{y}}$	DV01 of the 10y on-the-run, determined by OCM-R at prevailing market prices

This metric represents novation risk in terms of equivalent 10-year on-the-run US Treasury par notional.

OCM-R will assign to each subscriber a maximum novation risk, $R^{\max}$. The subscriber is considered "in breach" of the novation risk limit when $R > R^{\max}$. The EBs of a breached subscriber will not be considered for matching in auctions. However, new EBs will not be rejected. As the fills of a breached subscriber successfully novate, the subscriber may no longer be in breach. Once $R \leq R^{\max}$, the subscriber's EBs (if any) will be considered for matching yet again. As part of the OCM-R protocol, a subscriber will be notified regularly of the most recently computed value of R and the ratio $R/R^{\max}$. The subscriber may elect to receive emails alerting that 70% of the maximum novation risk has been exceeded – that is, when $R/R^{\max} > 0.70$.

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15 Disclaimers

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