

Quant Atlas

Vertex Use Cases

Institutional Workflows for Systematic Reversal Detection

Quant Atlas

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Abstract

This paper presents concrete institutional workflows for Vertex, the Quant Atlas systematic reversal detection dataset. Vertex is framed around its target users, signal interpretation, decision workflows, integration patterns, validation framework, and operational outcomes. The objective is to show how the dataset can be consumed by systematic research teams, machine learning teams, portfolio managers, traders, cross asset researchers, model validation teams, and risk functions without forcing a change in their existing investment process.

1 Executive Overview

Vertex quantifies when price action is forming a genuine local or structural turning point after reaching abnormal, overextended states. It produces calibrated bullish and bearish reversal probabilities, directional signals, reversal scale, and conviction using only information available at each timestamp.

The dataset is designed as a reversal location overlay and machine learning feature. It can support feature engineering, directional confirmation, entry context, exit and exposure review, cross sectional screening, regime aware modeling, and signal validation. Vertex is explicitly positioned as a diversifying input rather than a standalone trading strategy, standalone alpha source, or volatility and move size timer.

The default production delivery method is R2 object storage. S3, API, SFTP, cloud storage, and other agreed delivery methods remain available according to the client's infrastructure and workflow requirements.

2 Vertex Use Cases

Product summary. Vertex is a systematic reversal detection dataset that quantifies when price action is forming a genuine local or structural turning point after reaching abnormal, overextended states. It produces calibrated bullish and bearish reversal probabilities, directional signals, reversal scale, and conviction using only information available at each timestamp.

2.1 Target Users

- Systematic research and machine learning teams seeking an orthogonal, point-in-time reversal feature.
- Portfolio managers and traders requiring confirmation that an existing directional view is entering near a probable local or structural turn.
- Risk teams monitoring turning point exposure across active positions.
- Cross asset researchers screening instruments by local and structural reversal conviction.
- Volatility and regime modeling teams seeking non-redundant exhaustion information.
- Model validation teams benchmarking internal signals against independently validated turning point events.

2.2 What Vertex Measures

Vertex measures whether price behavior is forming a bullish reversal, associated with a developing trough or bottom, or a bearish reversal, associated with a developing peak or top. The product operates at two scales: local for tactical turning points and structural for broader reversals.

Each per-bar value carries four core fields:

- **Reversal score:** a calibrated probability associated with the relevant bullish or bearish reversal state.
- **Signal direction:** bullish or bearish.
- **Reversal scale:** local or structural.
- **Conviction:** the confidence assigned to the reversal value or triggered signal.

The score is built point in time from structured price behavior. Its components reflect multi scale price extension, trend efficiency decay, volatility transition, range re-entry, persistence, and distance from equilibrium. Discrete causal signals are triggered only when conviction, confirmation, and structural state align.

2.3 Signal Interpretation and Boundaries

Vertex is a reversal location overlay and machine learning feature. It is not a standalone trading strategy or standalone alpha source, and it is not a volatility or move size timer. Its purpose is to identify where a local or structural turn is forming so that the consuming firm can combine that information with its own directional, risk, execution, or portfolio process.

Signal timing is coincident to slightly lagging, typically within one bar of the turn. The directional edge is best in class among the standard indicators used in the stated benchmark, but modest in absolute terms. Vertex is therefore positioned as a diversifying input that is strongest in combination with other features, rather than as a high signal standalone forecaster.

2.4 Use Case 1: Machine Learning Reversal Feature

A systematic research team adds Vertex to the firm's feature library as an orthogonal, point-in-time directional turning point input.

Workflow.

1. The research team ingests historical Vertex values and triggered signals across the selected universe.
2. Reversal score, signal direction, reversal scale, and conviction are added to the internal feature library.
3. Candidate models are evaluated with and without the Vertex fields.
4. The team measures incremental information content and orthogonality against standard momentum and mean reversion factors.
5. Vertex is retained where it improves model diversification, turning point awareness, or conditional performance.

Operational outcome. Vertex becomes a non-redundant reversal feature that can diversify internal models without being treated as a standalone alpha source.

2.5 Use Case 2: Reversal Confirmation Overlay

A portfolio manager has an existing directional view and uses Vertex to assess whether the intended entry is occurring near a probable local or structural turn rather than directly against one.

Workflow.

1. The directional thesis is formed independently of Vertex.
2. The manager checks the latest Vertex direction, scale, score, and conviction for the relevant asset.
3. Alignment with a probable turn supports confirmation of the proposed entry context.
4. Opposition from a high conviction local or structural reversal prompts additional review, delayed entry, or reduced exposure.
5. The decision is logged so that the effect of Vertex alignment, opposition, or neutrality can be evaluated later.

Operational outcome. The manager receives a systematic turning point reference that can improve entry context without replacing the original investment thesis.

2.6 Use Case 3: Exit and Exposure Management

A risk team or portfolio manager maps active positions to Vertex direction, reversal scale, and conviction to identify turning point risk and support exposure decisions.

Workflow.

1. Active positions are matched to the latest Vertex values and signals.
2. A bullish position facing a bearish reversal signal, or a bearish position facing a bullish reversal signal, is flagged for review.
3. Local signals support tactical profit taking or stop review, while structural signals support broader exposure reassessment.
4. Conviction is used to prioritize which positions require immediate attention.
5. The desk records whether it maintained, reduced, exited, or otherwise adjusted the position.

Operational outcome. Vertex creates a structured turning point risk layer for profit taking, stop review, and de-risking decisions.

2.7 Use Case 4: Cross Sectional Reversal Screening

A multi asset team uses Vertex to identify where probable local or structural reversals are concentrated across the selected universe.

Workflow.

1. The latest Vertex stream is ingested across selected global macro assets.
2. Assets are ranked by bullish or bearish reversal conviction at the local and structural scales.
3. The team reviews the highest ranked turning point candidates.
4. Selected assets are escalated to the firm's deeper fundamental, macro, technical, or quantitative process.
5. Subsequent outcomes are evaluated against the original Vertex score, scale, direction, and conviction.

Operational outcome. The team receives a reproducible cross sectional screening process for probable local and structural turning points.

2.8 Use Case 5: Volatility and Regime Aware Modeling

A research team uses Vertex as a secondary, orthogonal input in volatility and regime aware models. The objective is to capture exhaustion information that remains largely independent of a realized volatility factor model.

Workflow.

1. Vertex reversal values are aligned with the firm's existing volatility or regime features.
2. The research team tests whether Vertex adds non-redundant information about exhaustion and forward move magnitude.
3. Model performance is segmented by Vertex direction, scale, conviction, and alignment with the firm's existing regime state.
4. Vertex is retained as an auxiliary feature where it improves conditional modeling without being used as a volatility timer.

Operational outcome. Vertex contributes secondary exhaustion information to volatility and regime aware models while preserving the boundary that it is not a direct move size or volatility timing forecast.

2.9 Use Case 6: Signal Validation and Benchmarking

A research or validation team segments internal signal performance by alignment, opposition, or neutrality relative to Vertex turning point events.

Workflow.

1. Internal signals are mapped to contemporaneous Vertex values and triggered events.
2. Performance is segmented by Vertex alignment, opposition, neutrality, scale, and conviction.
3. The team compares internal outcomes around Vertex identified extrema with random timing, random direction, and constant or all bar baselines.
4. The review measures whether Vertex helps identify stronger or weaker contexts for the internal signal.
5. Findings are incorporated into model documentation, filters, or research priorities.

Operational outcome. Vertex provides an EPI validated turning point benchmark for testing whether internal signals behave differently near probable local and structural reversals.

2.10 Validation Framework

Vertex is evaluated as a reversal location dataset. The principal question is whether its signals coincide with realized tops and bottoms more precisely and consistently than relevant null and baseline comparisons.

The validation framework includes:

- **Extrema Precision Index:** EPI with precision, recall, and F1 for coincidence with realized extrema.
- **Actionable and timeliness adjusted EPI:** evaluation that accounts for usability and the timing relationship between signal and turn.
- **Extrema coverage and timing profiles:** coverage, lead time, and timing error distributions.
- **Baseline comparisons:** random timing, random direction, and constant or all bar baselines.
- **Empirical significance:** coincidence p-values from the validation process.
- **Lift analysis:** precision lift, actionable lift, and conviction lift.
- **Information content:** information coefficient and orthogonality versus standard factors.
- **Horizon and decay:** behavior across forecast horizons and signal decay profiles.
- **Chronological stability:** stability across the test sample.
- **Ranking and calibration:** average precision, ROC AUC, and Brier score.

Across the stated 60 instrument validation universe, covering FX majors and crosses together with equities spanning every sector, overall EPI coincidence was statistically significant at the simulation floor with $p < 0.05$ on 60 of 60 instruments. The structural layer was significant on 59 of 60 instruments. Precision lift ranged from $2.2\times$ to $4.5\times$ over the random timing null.

The methodology is strictly point in time and causal. Every signal uses only information available at its timestamp, verified through an independent bar by bar replay. Validation is out of sample with purge and embargo and contains no look-ahead.

In benchmark testing against approximately 22 standard indicators, Vertex was the strongest single directional reversal feature among the tested mean reversion, momentum, and random alternatives. It was approximately 70% orthogonal to standard momentum and mean reversion factors. The product also carried secondary forward move magnitude information that remained largely independent of a realized volatility factor model. Vertex beat its stated benchmarks and passed all stress tests included in the supplied validation framework.

2.11 Universe and Coverage

Vertex is delivered as a regular stream of reversal scores and triggered signals on selected assets from the global macro universe. Each value carries calibrated conviction.

The stated validation universe contains 60 instruments comprising FX majors and crosses together with equities spanning every sector. The product supports both local and structural reversal analysis within the delivered asset set.

2.12 Integration Patterns

- **Default delivery:** R2 object storage for the regular stream of reversal scores and the discrete signals they trigger.
- **Alternative delivery:** S3, API, SFTP, cloud storage, and other agreed methods are available according to the client workflow.
- **Core fields:** Reversal score, signal direction, reversal scale, and conviction.
- **Scale structure:** Separate local and structural reversal probabilities and signals.
- **Point in time construction:** Values generated using information available at each timestamp.
- **Signal triggering:** Discrete causal events generated when conviction, confirmation, and structural state align.

2.13 Why Vertex

- Detects probable local and structural reversal locations after abnormal, overextended price states.
- Uses structured price behavior and is strictly point in time and causal.
- Produces calibrated bullish and bearish reversal probabilities with direction, scale, and conviction.
- Demonstrates statistically significant EPI coincidence across the stated 60 instrument validation universe.
- Beat its stated benchmarks and passed all stress tests included in the supplied validation framework.
- Provides precision lift of $2.2\times$ to $4.5\times$ over the random timing null in the stated validation.
- Acts as an approximately 70% orthogonal input relative to standard momentum and mean reversion factors.
- Adds secondary exhaustion information that remains largely independent of a realized volatility factor model.
- Is explicitly positioned as a reversal location overlay and diversifying model feature, not as standalone alpha and not as a volatility or move size timer.

3 Conclusion

Vertex is designed to fit into institutional workflows without requiring research teams, portfolio managers, traders, or risk functions to abandon their existing models or discretionary processes. It can be consumed as a machine learning feature, directional confirmation overlay, exposure review input, cross sectional screening feed, regime aware modeling variable, or signal validation benchmark.

Its role is narrowly defined: to identify probable local and structural turning points after abnormal, overextended price states using a strictly causal and point-in-time methodology. Each workflow can be logged, attributed, and evaluated against the consuming firm's own process, preserving operational auditability from research through production use.

This document is intended for institutional product evaluation and research workflow discussion. It does not constitute investment advice or a recommendation to trade any financial instrument.