Comprehensive Guide to the Elite Options Trading System (Version 2.0)

(Date: 2023-10-27)

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I. Introduction

Purpose of the Guide

Welcome to the comprehensive guide for the Elite Options Trading System (Version 2.0). This document is designed to provide you with a thorough understanding of all the signals, metrics, and visualizations generated by the system. Our goal is to empower you to interpret this information effectively, integrate it into your trading strategies, and make more informed decisions by accurately understanding how the system analyzes market structure and flow.

Overview of the Trading System and its Core Philosophy

The Elite Options Trading System is built upon the philosophy that inefficiencies and predictable patterns arise from the hedging activities of market makers and significant options order flow. By analyzing complex metrics derived from options market data (such as Gamma Exposure (GEX), Delta Exposure (DEX), Skew-Adjusted GEX (SGEX), and various forms of order flow volume and value), the system aims to identify key price levels, potential market turning points, structural stability, and volatility regimes.

The system processes raw options data, calculates a suite of proprietary and standard metrics (including **MSPI**, **DAG_Custom**, **TDPI**, **VRI**, **SAI**, **SSI**, **ARFI** (formerly CFI), and multiple **SDAG** methodologies), generates actionable trading signals based on configurable thresholds, and provides rich visualizations through a dedicated dashboard and standalone chart outputs. It is highly configurable via config_v2.json, allowing you to tailor its sensitivity and focus to your specific trading style and market outlook.

How to Use This Guide

This guide is structured to build your understanding progressively:

1. **Core Concepts & Terminology:** Familiarize yourself with fundamental options trading terms relevant to the system.
2. **Individual Metrics Explained:** Deep dive into each specific metric – what it measures, *how it's actually calculated* by the system (conceptually aligned with the V2 code), how to interpret it, its theoretical impact, key drivers, and relevant configuration.
3. **Trading Signals Explained:** Understand each discrete trading signal the system generates – its *accurate triggers* based on metrics and configured thresholds, interpretation, and practical use.
4. **Cohesive Analysis:** Learn how to synthesize multiple metrics and signals for a holistic market view, including developing a "Flow Map" and identifying high-probability confluence setups.

5. **Visual Guide:** Get acquainted with the dashboard layout and how to interpret the various charts and tables, referencing specific examples.
6. **Advanced Configuration:** Explore how to customize the system via config_v2.json.
7. **Troubleshooting & FAQ:** Find answers to common questions and issues.
8. **Glossary:** A quick reference for all accurately defined terms.

We recommend reading through the guide sequentially first, paying close attention to the **corrected metric calculations** and **confluence examples**. Later, use it as a reference. Understand how configuration settings impact the output.

II. Core Concepts & Terminology

Understanding the following terms is essential for effectively using the system:

- **Options Greeks:** These measure the sensitivity of an option's price to various factors.
    - **Delta:** Measures the rate of change of an option's price relative to a $1 change in the underlying asset's price. Ranges from 0 to 1 for calls, -1 to 0 for puts. Represents first-order directional exposure.
    - **Gamma:** Measures the rate of change of an option's Delta relative to a $1 change in the underlying asset's price. Highest for at-the-money options near expiration. Represents the acceleration of directional exposure and is key to dealer hedging dynamics.
    - **Theta:** Measures the rate of change of an option's price relative to the passage of time (time decay). Generally negative for long options. Its rate of change accelerates closer to expiration.
    - **Vega:** Measures the rate of change of an option's price relative to a 1% change in the implied volatility of the underlying asset. Represents sensitivity to volatility changes.
    - **Charm (Delta Decay):** Measures the rate of change of an option's Delta with respect to the passage of time. Particularly relevant near expiration as it dictates how quickly delta changes solely due to time.
    - **Vanna:** Measures the rate of change of an option's Delta with respect to a change in implied volatility. Also, the rate of change of Vega with respect to a change in the underlying price. Links directional exposure changes to volatility changes.

    - **Vomma:** Measures the rate of change of an option's Vega with respect to a change in implied volatility. Represents the convexity of volatility exposure.
- **Open Interest (OI):** The total number of outstanding options contracts that have not been settled or closed. High OI at a strike indicates significance, representing existing positioning.
- **Volume:** The total number of options contracts traded during a given period. High volume indicates activity and interest at certain strikes. Represents *new* activity.
- **GEX (Gamma Exposure):** The total gamma sensitivity across all options at a particular strike price or for the entire market, typically calculated as Gamma * OI * 100 * UnderlyingPrice (or a variation). Positive GEX tends to suppress volatility (dealers hedge by buying into dips and selling into rallies), while negative GEX (less common for broad indices) can exacerbate it. Used as a foundational input for DAG/SDAG. *(See config: strategy_settings.gamma_exposure_source_col)*
- **DEX (Delta Exposure):** The total delta sensitivity at a strike or for the market, typically Delta * OI * 100. Indicates the net directional hedging required by market makers as price moves. Used as a foundational input for DAG/SDAG. *(See config: strategy_settings.delta_exposure_source_col)*
- **Skew-Adjusted GEX (SGEX):** GEX that accounts for volatility skew (differences in IV across strikes and puts/calls). Aims to provide a more realistic measure of hedging impact, especially relevant when skew is pronounced. *(Optionally used in SDAG calculations if strategy_settings.use_skew_adjusted_for_sdag is true and strategy_settings.skew_adjusted_gamma_source_col is specified and available).*
- **Volatility Skew:** The difference in implied volatility (IV) between out-of-the-money (OTM), at-the-money (ATM), and in-the-money (ITM) options. Typically, OTM puts have higher IV than OTM calls for equities and indices ("crash premium").
- **Order Flow Imbalance (OFI) - Input Concept:** Represents the net short-term buying or selling pressure derived from aggressive options order flow. While not a direct *output* metric of integrated_strategies_v2.py, the system uses *input columns* representing this concept (e.g., volmbs [Volume Buy-Sell], valuebs [Value Buy-Sell] from the fetcher, used by the processor) to calculate other metrics like the **Custom DAG** and the **Average Relative Flow Index (ARFI)**. It's crucial for understanding flow dynamics.

- **"Gamma Wall":** A price level with a very large concentration of GEX (or DAG/SDAG), often acting as strong support or resistance, sometimes like a price magnet, especially near expiration.
- **"Volatility Trigger":** A price level, often identified by strongly negative SDAG values (particularly Volatility-Focused), where market volatility dynamics are expected to change significantly due to hedging flows potentially amplifying moves. Breaching these levels can lead to accelerated price action.
- **Market Maker Hedging:** Options market makers aim to remain delta-neutral. As the underlying price moves, they must buy or sell the underlying asset to offset the changing delta of their options book. This hedging activity, driven by Gamma (GEX/SDAG) and influenced by other Greeks (Vanna, Charm), can significantly impact price, especially around large options expiration or strikes with high exposure.

III. Individual Metrics Explained

This section delves into the individual metrics calculated by the system. Each metric provides a unique lens through which to analyze market structure and potential price movements. Understanding each one accurately is crucial before attempting to synthesize them into a cohesive trading strategy.

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1. Delta Adjusted Gamma Exposure (DAG - Custom)

- **Metric Name & Abbreviation:** Delta Adjusted Gamma Exposure (DAG - Custom)
- **Conceptual Explanation:** The custom DAG metric is a core component of the MSPI, designed to provide a nuanced view of market maker hedging pressure by combining structural exposure (Gamma) with directional bias (Delta) and *confirming/modulating it with recent order flow*. Unlike raw GEX, DAG_Custom assesses not just the *potential* for hedging, but incorporates the *alignment* and *magnitude* of recent flow activity relative to the existing structure. It identifies points where dealer hedging, amplified or dampened by current flow, might accelerate or dampen price moves.
- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_custom_flow_dag. It primarily uses:
    - **Gamma Exposure:** From the configured gamma_exposure_source_col (e.g., gxoi).

    - **Delta Exposure Sign:** Uses the sign of dxoi to determine the inherent structural bias.
    - **Flow Alignment (Alpha):** Compares the sign of Delta Exposure (dxoi) with the sign of recent Delta Flow (dxvolm). Alignment (same sign) increases the alpha coefficient (e.g., > 1 via dag_alpha.aligned), while opposition decreases it (e.g., < 1 via dag_alpha.opposed). This directly models whether flow confirms or contradicts the structural delta bias.
    - **Flow Magnitude Ratio:** Uses the ratio of absolute Delta Flow to absolute Delta Exposure (dxvolm_dxoi_ratio) to scale the alignment effect. Larger flow relative to OI has more impact.
    - **Gamma Flow Normalization:** Incorporates normalized Gamma Flow (norm_gxvolm) as a weighting factor, suggesting that the impact is greater when recent gamma-related flow is also high.
    - *Formula Concept:* DAG ≈ Gamma_Exposure * sign(Delta_Exposure) * (1 + Alpha * Flow_Ratio) * Norm_Gamma_Flow
- **How it Influences Price (Theoretically):**
    - **High Positive DAG:** Suggests strong potential support or upward price gravity. This occurs when positive gamma levels coincide with delta positioning and *confirmed by flow* suggesting upward pressure (e.g., net buying flow into calls or selling flow out of puts aligned with positive GEX). Dealer hedging would likely involve buying dips.
    - **High Negative DAG:** Suggests strong potential resistance or downward price gravity. This occurs when gamma/delta structure indicates resistance, *and flow confirms* this downward pressure. Dealer hedging would likely involve selling rallies.
    - The magnitude indicates the strength of this combined structural and flow pressure.
- **Visual Representation:** Typically a bar chart per strike (like GEX/DEX), but representing the combined, flow-modulated metric. Positive bars = support/upward pressure, Negative bars = resistance/downward pressure. *(See chart example mspi_components where dag_custom_norm is shown, though this chart shows the normalized version used in MSPI).*
- **Interpretation Guide:**
    - Look for peaks/troughs indicating significant support/resistance levels *validated by flow*.

    - The distribution across strikes identifies key inflection points.
    - Interpretation is heavily influenced by the dag_alpha coefficients. Values > 1 amplify alignment, < 1 dampens opposition.
- **Key Drivers & Sensitivity:** Driven by GEX, DEX, dxvolm, gxvolm. Sensitive to dag_alpha coefficients.
- **Practical Use Cases & Examples:**
    - Identifying strong S/R levels where structure and flow align.
    - Gauging potential for price pinning or repulsion based on *confirmed* hedging flows.
- **Relationship to Other Metrics:** A primary *weighted* input to **MSPI**. Conceptually related to **SDAGs** but unique due to its direct incorporation of flow metrics (dxvolm, gxvolm) rather than just normalized delta.
- **Configuration Notes:**
    - data_processor_settings.weights.*.*.dag_custom: Weight in MSPI.
    - data_processor_settings.coefficients.dag_alpha: Modifies impact based on flow alignment (aligned, opposed, neutral).
    - strategy_settings.gamma_exposure_source_col, strategy_settings.delta_exposure_source_col: Data sources used (typically gxoi, dxoi).

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2. Skew and Delta Adjusted GEX (SDAG) Methodologies

SDAG metrics build upon the concept of GEX/DEX by optionally incorporating volatility skew and combining gamma and delta exposures in various ways to offer different perspectives on hedging pressure. They do *not* directly use flow metrics like DAG_Custom does.

- **Metric Name & Abbreviation:** Skew and Delta Adjusted GEX (SDAG)
    - SDAG Multiplicative
    - SDAG Directional
    - SDAG Weighted
    - SDAG Volatility-Focused
- **Conceptual Explanation:** SDAG metrics provide refined views of market structure by adjusting Gamma Exposure (potentially using Skew-Adjusted GEX if

configured) with Delta Exposure. Each methodology emphasizes a different aspect of the interaction between gamma and delta, aiming to provide more accurate signals for support/resistance or potential volatility shifts compared to raw GEX/DEX. Alignment across multiple SDAG methodologies at a specific strike increases conviction.

- **Simplified Calculation Insight:** Implemented in integrated_strategies_v2.py's _calculate_sdag_* methods.
    - **Gamma Component:** Uses either standard GEX (gxoi) or Skew-Adjusted GEX (sgxoi) based on use_skew_adjusted_for_sdag.
    - **Delta Component:** Uses *Normalized* Delta Exposure (dxoi_norm_for_sdag) for Multiplicative, Directional, and Volatility-Focused. Uses *Raw* Delta Exposure (dxoi) for Weighted.
    - **Formulas (Implemented):**
        - **Multiplicative:** GEX * (1 + Norm_DEX * Factor)
        - **Directional:** GEX * sign(GEX * Norm_DEX) * (1 + abs(Norm_DEX) * Factor)
        - **Weighted:** (w1_gamma * GEX + w2_delta * Raw_DEX) / (w1_gamma + w2_delta)
        - **Volatility-Focused:** GEX * (1 + Norm_DEX * sign(GEX) * Factor)
        - *(Factor refers to delta_weight_factor from config where applicable; w1_gamma and w2_delta are specific to Weighted)*
- **How it Influences Price (Theoretically):** Generally, positive SDAG values indicate support/attraction, while negative values indicate resistance/repulsion or volatility triggers. The specific interpretation varies slightly by methodology:
    - **Multiplicative:** Focuses on the immediate, potentially magnified pressure from combined GEX/DEX. Relevant for assessing the raw combined force.
    - **Directional:** Focuses strongly on the consensus direction between GEX/DEX forces. Amplifies signals when they align. Good for confirming directional bias.
    - **Weighted:** Provides a blended, potentially smoother view, incorporating the scale of raw DEX. Might be better for identifying broader zones or for swing perspectives.

    - **Volatility-Focused:** Highlights areas where GEX structure might amplify (+ve = GEX aligned with delta pressure direction) or dampen (-ve = GEX opposed to delta pressure direction) volatility. Large negative values are key "Volatility Triggers".
- **Visual Representation:** Bar charts per strike for each methodology. Colors distinguish Calls/Puts. The 'Net' trace (diamond markers) shows the sum at each strike. [Image: SDAG_Multiplicative_Example1.png], [Image: SDAG_Multiplicative_Example2.png], [Image: SDAG_Directional_Example.png], [Image: SDAG_Weighted_Example.png], [Image: SDAG_Volatility_Focused_Example.png].
    - *Annotation Example (Volatility Focused):* On [Image: SDAG_Volatility_Focused_Example.png], circle the large negative Net SDAG diamond marker near 5700 and label it "Potential Volatility Trigger Zone (-SDAG Volatility)".
    - *Annotation Example (Alignment):* If multiple SDAG charts show strong positive peaks near 5650, you could conceptually note: "High Conviction Support near 5650 (Alignment across Multiplicative, Directional, Weighted SDAGs)".
- **Interpretation Guide:**
    - Values significantly > 0 (e.g., > 1.0-1.5) suggest strong support/attraction. Values significantly < 0 (e.g., < -1.0-1.5) suggest strong resistance/repulsion (or vol trigger for Volatility-Focused). *(Ref: User_19)*
    - Look for **alignment** (multiple methodologies showing peaks/troughs at the same strike) for high conviction. *(Ref: User_10, User_15, etc.)*
    - The sdag_conviction signal fires when min_agreement_for_conviction_signal is met.
    - Observe the 'Net' trace for the combined effect at each strike.
- **Key Drivers & Sensitivity:** GEX/SGEX, DEX (raw and normalized), configuration parameters (delta_weight_factor, w1_gamma, w2_delta).
- **Practical Use Cases & Examples:**
    - Identifying high-conviction S/R (alignment).
    - Pinpointing Volatility Trigger points (large negative Volatility-Focused SDAG).

    - Methodology focus: Multiplicative/Directional (intraday pressure/consensus), Weighted (swing zones), Volatility-Focused (options strategy selection/risk). *(Ref: User_21, User_22)*
- **Relationship to Other Metrics:** Enabled and weighted SDAGs (sdag_*_norm) contribute to **MSPI**. Provide alternative/supplementary views to **DAG_Custom**.
- **Configuration Notes:**
    - strategy_settings.gamma_exposure_source_col, delta_exposure_source_col, skew_adjusted_gamma_source_col.
    - strategy_settings.use_skew_adjusted_for_sdag: Enable/disable use of SGEX.
    - strategy_settings.dag_methodologies.enabled: List of active SDAGs.
    - strategy_settings.dag_methodologies.[method_name]: Parameters like delta_weight_factor, w1_gamma, w2_delta, weight_in_mspi.
    - strategy_settings.dag_methodologies.min_agreement_for_conviction_signal: Integer count threshold for the conviction signal.
    - data_processor_settings.weights.*.*.sdag_[method_name]_norm: Weights in MSPI calculation (only applies if weight_in_mspi > 0 for that method).

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3. Time Decay Pressure Indicator (TDPI)

- **Metric Name & Abbreviation:** Time Decay Pressure Indicator (TDPI)
- **Conceptual Explanation:** TDPI quantifies the potential market impact of accelerating option time decay (Theta and Charm), especially as expiration approaches. It models how this decay can force hedging adjustments or create "pinning" effects, drawing price towards strikes with significant theta/charm exposure relative to flow.
- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_tdpi. Key inputs include:
    - **Charm Exposure (charmxoi):** Base measure of delta decay sensitivity.
    - **Theta Exposure Sign (txoi):** Determines the directional impact (usually negative theta implies positive pressure towards strike for sellers).

    - **Flow Alignment (Beta):** Compares Charm Flow (charmxvolm) with Charm OI (charmxoi) using tdpi_beta coefficients (aligned, opposed, neutral).
    - **Flow Magnitude Ratio:** Ratio of charmxvolm to charmxoi.
    - **Theta Flow Normalization:** Uses normalized txvolm.
    - **Time Weight:** Increases quadratically as the trading day progresses towards the close, amplifying decay effects.
    - **Strike Proximity Weight:** Gaussian function centered near the current price (width controlled by tdpi_gaussian_width), emphasizing ATM/NTM strikes. ATR (from tdpi_atr_fallback config) is used for scaling distance.
    - *Formula Concept:* TDPI ≈ Charm_Exposure * sign(Theta_Exposure) * (1 + Beta * Flow_Ratio) * Norm_Theta_Flow * Time_Weight * Proximity_Weight
    - Also calculates **CTR** (abs(Charm_Flow) / abs(Theta_Flow)) and **TDFI** (Norm_Abs_Theta_Flow / Norm_Abs_Theta_OI).
- **How it Influences Price (Theoretically):** High positive or negative TDPI values indicate significant hedging pressure related to time decay. Price may be drawn towards strikes with high TDPI magnitude ("pinning") or experience accelerating moves away from areas of high charm decay (Charm Cascade), especially near expiration when time_weight is high. The sign generally indicates the direction of the pressure (positive often implies upward pull/support, negative implies downward pull/resistance, though this depends on the exact scaling and txoi sign usage).
- **Visual Representation:** Bar chart showing TDPI values per strike. Calls (green) vs Puts (red). Peaks indicate strong decay pressure. [Image: Time_Decay_TDPI_Example.png].
    - *Annotation Example:* On [Image: Time_Decay_TDPI_Example.png], circle the large red bar at 5650.00 and label it "Strong Negative TDPI (Potential Pin/Resistance)". Circle the green peak at 5700.00 and label "Strong Positive TDPI (Potential Pin/Support)".
- **Interpretation Guide:**
    - High magnitude TDPI (positive or negative) near ATM strikes suggests strong pinning potential, especially close to expiry.

    - The width/shape of the TDPI curve shows the range affected by decay pressure. A narrow peak means pressure is focused; a wider peak affects more strikes.
- **Key Drivers & Sensitivity:** charmxoi, txoi, charmxvolm, txvolm, Time of day, Proximity to current price, ATR. Sensitive to tdpi_beta coefficient, tdpi_gaussian_width, tdpi_atr_fallback.
- **Practical Use Cases & Examples:**
    - Identifying potential pinning strikes for expiry trading (selling Iron Butterflies, Straddles at the peak TDPI strike).
    - Assessing risk for strategies sensitive to theta decay near expiry.
    - Anticipating potential Charm Cascade effects (using the related signal) when CTR/TDFI are high.
- **Relationship to Other Metrics:** A key *weighted* component of **MSPI**. Provides input for time_decay_pin_risk signal. CTR and TDFI feed the time_decay_charm_cascade signal.
- **Configuration Notes:**
    - data_processor_settings.weights.*.*.tdpi: Weight in MSPI.
    - data_processor_settings.coefficients.tdpi_beta: Modifies based on flow alignment.
    - data_processor_settings.factors.tdpi_gaussian_width: Controls strike focus width (-0.5 is typical, closer to 0 is narrower).
    - data_processor_settings.approximations.tdpi_atr_fallback: ATR configuration for proximity scaling.
    - strategy_settings.thresholds.pin_risk_tdpi_trigger: Threshold for Pin Risk signal.
    - strategy_settings.thresholds.charm_cascade_ctr_trigger, charm_cascade_tdfi_trigger: Thresholds for Charm Cascade signal.

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4. Volatility Risk Indicator (VRI)

- **Metric Name & Abbreviation:** Volatility Risk Indicator (VRI)
- **Conceptual Explanation:** VRI quantifies risks and opportunities arising from potential changes in implied or realized volatility. It assesses the market's

sensitivity to volatility shifts by considering Vega exposure, higher-order volatility greeks (Vanna, Vomma), implied volatility context (skew, trend vs. historical), and recent volatility-related order flow.

- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_vri. Key inputs include:
    - **Vanna Exposure (vannaxoi):** Base measure of delta sensitivity to vol changes.
    - **Vega Exposure Sign (vxoi):** Determines directional impact relative to Vega structure.
    - **Flow Alignment (Gamma Coeff):** Compares Vanna Flow (vannaxvolm) with Vanna OI (vannaxoi) using vri_gamma coefficients.
    - **Flow Magnitude Ratio:** Ratio of vannaxvolm to vannaxoi.
    - **Vomma Flow Normalization:** Uses normalized vommaxvolm (representing convexity flow).
    - **Skew Factor:** Calculated based on the balance of Call vs Put Vega OI (vxoi), amplifying VRI if skew suggests higher risk (e.g., more put vega).
    - **Volatility Trend Factor:** Compares current_iv to avg_iv_5day (or uses vri_vol_trend_fallback_factor if underlying IV unavailable) to gauge if VRI pressure aligns with recent vol trend.
    - *Formula Concept:* VRI ≈ Vanna_Exposure * sign(Vega_Exposure) * (1 + Gamma_Coeff * Flow_Ratio) * Norm_Vomma_Flow * Skew_Factor * Vol_Trend_Factor
    - Also calculates **VVR** (abs(Vanna_Flow) / abs(Vomma_Flow)) and **VFI** (Norm_Abs_Vega_Flow / Norm_Abs_Vega_OI).
- **How it Influences Price (Theoretically):**
    - **High Positive VRI:** Suggests market structure and flow are positioned such that an *increase* in volatility could lead to significant supporting flows or upward price pressure (e.g., dealers needing to buy back hedges as vol rises). Could also indicate significant long-volatility bets.
    - **High Negative VRI:** Suggests structure/flow implies an *increase* in volatility could lead to significant resisting flows or downward pressure (e.g., unwinding of short-vol positions). Can also indicate areas where volatility is being actively sold.

    - Low VRI suggests less sensitivity to volatility changes.
- **Visual Representation:** Bar chart showing VRI values per strike. Calls (cyan) vs Puts (magenta). High magnitude indicates sensitivity. [Image: Volatility_Regime_VRI_Example.png].
    - *Annotation Example:* On [Image: Volatility_Regime_VRI_Example.png], circle the large magenta bar near 5690 and label "High Negative VRI (Sensitivity to Vol Increase)". Note the relatively low VRI elsewhere.
- **Interpretation Guide:**
    - High magnitude VRI (positive or negative) signals potential for sharp moves *if* volatility changes. It identifies *sensitivity*.
    - Low VRI suggests a more stable environment *from a volatility risk perspective*.
    - Combine with VFI (implied) via Volatility Expansion/Contraction signals to assess if flow *confirms* the potential VRI indicates.
- **Key Drivers & Sensitivity:** vannaxoi, vxoi, vommaxoi, vannaxvolm, vommaxvolm, vxvolm, IV skew, IV trend (current_iv, avg_iv_5day). Sensitive to vri_gamma coefficient, vri_vol_trend_fallback_factor.
- **Practical Use Cases & Examples:**
    - Assessing suitability for volatility trading strategies (e.g., long vol via straddles if high +VRI and expansion expected; short vol via credit spreads if low VRI or high -VRI and contraction expected).
    - Identifying strikes/periods where existing positions face higher risk from volatility shifts.
- **Relationship to Other Metrics:** A key *weighted* component of **MSPI**. Works with implied VFI via volatility_expansion/volatility_contraction signals.
- **Configuration Notes:**
    - data_processor_settings.weights.*.*.vri: Weight in MSPI.
    - data_processor_settings.coefficients.vri_gamma: Modifies based on flow alignment.
    - data_processor_settings.factors.vri_vol_trend_fallback_factor: Used if direct IV trend unavailable.

- strategy_settings.thresholds.vol_expansion_vri_trigger, strategy_settings.thresholds.vol_contraction_vri_trigger: Thresholds for VRI contribution to Vol signals.
- strategy_settings.thresholds.vol_expansion_vfi_trigger, strategy_settings.thresholds.vol_contraction_vfi_trigger: Thresholds for the conceptual VFI input.

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5. Market Structure Position Indicator (MSPI)

- **Metric Name & Abbreviation:** Market Structure Position Indicator (MSPI)
- **Conceptual Explanation:** MSPI is the primary composite indicator of the system. It synthesizes the normalized **DAG_Custom**, **TDPI**, **VRI**, and any enabled & weighted **SDAG** methodologies into a single, overarching measure of market structure pressure. The goal is to provide a holistic view of potential support/resistance and directional bias based on dealer positioning, time decay factors, volatility risks, and market dynamics, as interpreted by the system's models.
- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_mspi.
    1. Calculates base metrics: DAG_Custom, TDPI, VRI.
    2. Calculates all enabled SDAG methodologies.
    3. Normalizes DAG, TDPI, VRI, and any SDAG that is configured to contribute (weight_in_mspi > 0).
    4. Retrieves the appropriate weights based on selection_logic (time or volatility context) using get_weights.
    5. Calculates the weighted sum: MSPI = (w_dag * DAG_norm) + (w_tdpi * TDPI_norm) + (w_vri * VRI_norm) + Sum(w_sdag_X * SDAG_X_norm).
    6. **Crucially, this final weighted sum (raw MSPI) is then normalized again to a [-1, 1] range.**
- **How it Influences Price (Theoretically):** Represents the system's combined assessment of structural forces.
    - **Strong Positive MSPI (near +1):** Indicates significant potential support or upward price gravity due to a confluence of supporting factors

(gamma/delta structure, decay, vol positioning, flow confirmation within DAG).

    - **Strong Negative MSPI (near -1):** Indicates significant potential resistance or downward price gravity due to a confluence of opposing factors.
    - Values near zero indicate neutral or conflicting structural pressures.
- **Visual Representation:** Typically shown as a heatmap across strikes and option types (Calls/Puts). Blue/positive often indicates support, Red/negative indicates resistance. [Image: MSPI_Heatmap_Example.png] (Note: Your example image shows Red=Positive, Blue=Negative - interpretation depends on the configured colorscales.mspi_heatmap). Can also be viewed as a component breakdown in the MSPI Components chart.
- **Interpretation Guide:**
    - Identify horizontal bands of strong color on the heatmap – these are key structural levels (support/resistance).
    - Observe the current price relative to these bands.
    - Changes in color intensity or band location signal evolving structure.
    - Use the MSPI Components chart to diagnose *why* MSPI is strong/weak at a level (is it DAG, TDPI, VRI, or SDAG driven?).
- **Key Drivers & Sensitivity:** Driven by all its constituent normalized components (DAG, TDPI, VRI, SDAGs) AND the dynamic weights applied. Highly sensitive to the data_processor_settings.weights configuration.
- **Practical Use Cases & Examples:**
    - Core indicator for identifying overall market bias and key structural S/R levels.
    - Foundation for trading decisions, used in conjunction with confirming signals (SAI, discrete signals) and stability assessment (SSI).
- **Relationship to Other Metrics:** The aggregate output metric. **SAI** measures the internal alignment of its components. **SSI** measures its stability. Discrete signals often confirm or contradict MSPI levels.
- **Configuration Notes:**
    - data_processor_settings.weights: Entire section dictates MSPI composition.

    - All configuration notes for DAG, TDPI, VRI, and SDAGs indirectly affect MSPI.

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6. Sentiment Alignment Indicator (SAI)

- **Metric Name & Abbreviation:** Sentiment Alignment Indicator (SAI)
- **Conceptual Explanation:** SAI measures the degree of **internal alignment or divergence among the primary drivers (normalized components) of the MSPI score** at a given strike. It helps identify if the different facets of market structure analysis (Gamma/Delta/Flow via DAG, Time Decay via TDPI, Volatility via VRI, and weighted SDAGs) are providing a consistent signal or if they are conflicting. **Note:** This metric assesses internal model consistency, *not* alignment between MSPI and external Order Flow Imbalance (OFI).
- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_mspi. It compares the signs of the *normalized* MSPI components (dag_custom_norm, tdpi_norm, vri_norm, and potentially sdag_*_norm if weighted). It averages the pairwise alignment scores (+1 if same sign, -1 if opposite, 0 if one is zero) between these components.
- **How it Influences Price (Theoretically):** While not directly causing price movement, SAI provides crucial context about the *quality* or *conviction* behind an MSPI level.
    - **High Positive SAI (near +1):** Indicates the different structural factors (DAG, TDPI, VRI, etc.) largely agree on the direction of pressure at that strike. This strengthens the conviction in the MSPI signal (whether positive or negative).
    - **High Negative SAI (near -1):** Indicates significant conflict among the structural drivers. For example, DAG might suggest support, but TDPI suggests resistance. This weakens the conviction in the overall MSPI signal and suggests potential instability or unpredictable behavior around that level.
    - **SAI near Zero:** Indicates mixed or neutral signals among the components.
- **Visual Representation:** [Placeholder for SAI chart - often a histogram showing positive/negative bars per strike, indicating alignment/divergence of components].
- **Interpretation Guide:**

    - **Strong Positive SAI:** Confirms the MSPI signal. MSPI support with +SAI is higher conviction support. MSPI resistance with +SAI is higher conviction resistance.
    - **Strong Negative SAI:** Warns about the MSPI signal. An MSPI level with high -SAI might be unreliable or prone to breaking, as underlying forces conflict. Could signal range-bound chop or transition.
    - The sai_high_conviction threshold determines the level needed for a "High Conviction" signal contribution.
- **Key Drivers & Sensitivity:** Driven by the relative signs and magnitudes of the *normalized* DAG, TDPI, VRI, and weighted SDAG components. Sensitive to how each component is calculated and normalized.
- **Practical Use Cases & Examples:**
    - Filtering MSPI levels: Prioritize trading MSPI S/R levels that are confirmed by strong positive SAI.
    - Identifying potential traps or choppy zones: High negative SAI near an MSPI level suggests caution or avoiding trades based solely on that MSPI level.
    - Gauging conviction for directional signals.
- **Relationship to Other Metrics:** Derived directly from the normalized components feeding into **MSPI**. Used as a condition for the high-conviction **Directional Signal**.
- **Configuration Notes:**
    - strategy_settings.thresholds.sai_high_conviction: Defines the threshold for strong alignment needed for high conviction signals.

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7. Structural Stability Index (SSI)

- **Metric Name & Abbreviation:** Structural Stability Index (SSI)
- **Conceptual Explanation:** SSI assesses the stability and robustness of the current market structure as defined by the MSPI components. It quantifies how much agreement or disagreement (variance) exists among the weighted, normalized MSPI drivers at each strike. Low variance implies stability; high variance implies instability or transition.

- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_mspi. It calculates the standard deviation of the weighted, normalized MSPI component values (dag_custom_norm, tdpi_norm, vri_norm, relevant sdag_*_norm) at each strike. This standard deviation is then typically inverted and scaled to a 0-1 range, where High SSI ≈ 1 (low std dev, stable) and Low SSI ≈ 0 (high std dev, unstable). Requires at least two weighted components for calculation.
- **How it Influences Price (Theoretically):** SSI doesn't directly push price but describes the *nature* of the environment.
    - **High SSI:** Suggests a stable, well-defined structure. Price is more likely to respect MSPI/SDAG levels, favoring range-bound or mean-reversion strategies within the defined structure. Breakouts are less likely or require significant force.
    - **Low SSI:** Suggests a fragile, transitional, or unstable structure. MSPI/SDAG levels may be less reliable. The market is more prone to volatility, sharp moves, or breakouts as the conflicting forces resolve. Trend-following or breakout strategies might be more appropriate.
- **Visual Representation:** [Placeholder for SSI chart - could be a time-series line showing overall market SSI, or potentially visualized per strike]. Also appears as a condition in the Complex Structure Change signal. [Image: Key_Levels_Example.png] visually represents Structure Change signals (blue crosses) triggered by low SSI.
- **Interpretation Guide:**
    - High SSI (> threshold, e.g., > 85th percentile) supports range-bound plays and respecting existing levels. Triggers volatility_contraction signal condition.
    - Low SSI (< threshold, e.g., < 15th percentile) warns of instability and potential structure breaks. Triggers complex_structure_change signal.
    - The ssi_conviction_split threshold helps differentiate conviction levels for SSI-based signals.
- **Key Drivers & Sensitivity:** Driven by the variance among the weighted, normalized MSPI components. Affected by anything that changes the components or their weights.
- **Practical Use Cases & Examples:**

    - Regime filtering: Adapt strategy selection based on SSI (Range vs. Breakout/Trend).
    - Risk management: Increase caution or use wider stops when SSI is low.
    - Confirming breakouts: A breakout through an MSPI level accompanied by low SSI is more likely to be sustained.
- **Relationship to Other Metrics:** Derived from **MSPI** components. Triggers complex_structure_change and volatility_contraction signals based on configured thresholds.
- **Configuration Notes:**
    - strategy_settings.thresholds.ssi_structure_change: Threshold (often percentile) for triggering structure change signal.
    - strategy_settings.thresholds.ssi_vol_contraction: Threshold (often percentile) for triggering vol contraction signal condition.
    - strategy_settings.thresholds.ssi_conviction_split: Threshold for differentiating high/medium conviction within SSI signals.

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8. Average Relative Flow Index (ARFI)

(Formerly misrepresented as CFI - Cumulative Flow Imbalance)

- **Metric Name & Abbreviation:** Average Relative Flow Index (ARFI)
- **Conceptual Explanation:** ARFI measures the *average relative magnitude* of recent order flow across different dimensions (Delta, Charm, Vanna) compared to the existing open interest structure in those same dimensions. It essentially asks: "How significant is the recent flow (buys/sells) relative to the size of the established positions?" It does **not** track cumulative net flow over time.
- **Simplified Calculation Insight:** Calculated in integrated_strategies_v2.py::_calculate_mspi (within the block previously labeled CFI). It calculates the absolute ratios of flow-to-OI for Delta, Charm, and Vanna:
    - abs_dx_ratio = abs(dxvolm) / abs(dxoi)
    - abs_td_ratio = abs(charmxvolm) / abs(charmxoi)
    - abs_vx_ratio = abs(vannaxvolm) / abs(vannaxoi)

    - It then averages these ratios: ARFI = (abs_dx_ratio + abs_td_ratio + abs_vx_ratio) / 3. Division by zero is handled by replacing infinite ratios with zero.
- **How it Influences Price (Theoretically):** High ARFI indicates that recent trading activity (flow) is large relative to the existing open interest base.
    - **High ARFI:** Can suggest aggressive positioning, potential for exhaustion if flow opposes structure, or strong conviction if flow confirms structure. It signals that *new money/activity* is potentially having a disproportionate impact compared to the static OI picture.
    - **Low ARFI:** Suggests recent flow is relatively small compared to existing positions; the market might be consolidating or established structure is likely to dominate.
    - **Divergences:** The key use is divergence with price. Price making a new high while ARFI fails to confirm (making a lower high) suggests the buying flow is weakening *relative to the structure*, potentially signaling exhaustion. Price making a new low while ARFI makes a higher low suggests selling flow is drying up relative to structure.
- **Visual Representation:** [Placeholder for ARFI chart - could be a line chart per strike or an aggregate value]. The complex_flow_divergence signal is triggered based on ARFI. Conceptually related to the flow shown in [Image: Combined_Rolling_Flow_Example.png].
- **Interpretation Guide:**
    - Focus on **divergences** between ARFI and price action.
    - High absolute ARFI values indicate periods where flow is proportionally significant.
    - The cfi_flow_divergence threshold (acting on ARFI) triggers the flow divergence signal.
- **Key Drivers & Sensitivity:** Driven by dxvolm, dxoi, charmxvolm, charmxoi, vannaxvolm, vannaxoi.
- **Practical Use Cases & Examples:**
    - Identifying potential trend exhaustion or reversals through price/ARFI divergences.
    - Gauging the immediate impact of flow relative to existing positions.

- **Relationship to Other Metrics:** Uses greek flow and OI metrics as inputs. Triggers the complex_flow_divergence signal. It provides a different perspective than the flow alignment/magnitude factors used within **DAG_Custom**, **TDPI**, and **VRI**.
- **Configuration Notes:**
    - strategy_settings.thresholds.cfi_flow_divergence: Tiered thresholds applied to ARFI values to trigger the Flow Divergence signal. (Note the config key still uses "cfi" but applies to ARFI).

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9. Order Flow Imbalance (OFI) - Input Concept

- **Metric Name & Abbreviation:** Order Flow Imbalance (OFI) - *Input Concept*
- **Conceptual Explanation:** OFI represents the net short-term buying or selling pressure derived from aggressive options order flow data. It's the difference between buy-initiated volume/value and sell-initiated volume/value. **This is not calculated as a standalone output metric by integrated_strategies_v2.py**. Instead, the system *consumes* data representing OFI.
- **Simplified Calculation Insight:** The system assumes OFI data is provided within the input DataFrame, prepared by enhanced_data_processor_v2.py. This typically involves using source columns like volmbs (Volume Buy-Sell) or valuebs (Value Buy-Sell) which are fetched by enhanced_data_fetcher_v2.py. The processor might aggregate or directly use these columns. Greek-specific flows like dxvolm, charmxvolm, vannaxvolm are also forms of OFI specific to those hedging dimensions.
- **Visual Representation:** If visualized directly (e.g., in Net Volume vs Value Pressure or Combined Rolling Flow charts), it shows net buying/selling pressure per strike or over time.
- **Interpretation Guide:** Positive OFI = net buying pressure; Negative OFI = net selling pressure. Magnitude indicates strength.
- **Relationship to Other Metrics:** Serves as a crucial *input* concept for **DAG_Custom**, **TDPI**, **VRI** (via their flow alignment/magnitude components) and **ARFI**.
- **Configuration Notes:** No direct config for OFI calculation itself in integrated_strategies_v2.py. Configuration relates to how metrics *using* OFI concepts (like DAG, TDPI, VRI, ARFI signal thresholds) are set up. The specific

source columns (volmbs, valuebs, etc.) are assumed based on fetcher/processor logic.

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10. Volatility Flow Imbalance (VFI) - Input Concept

- **Metric Name & Abbreviation:** Volatility Flow Imbalance (VFI) - *Input Concept*
- **Conceptual Explanation:** Similar to OFI, VFI represents the net flow into options strategies that are sensitive to changes in volatility (e.g., buying vs. selling straddles/strangles, vega-weighted flow). It helps gauge if current flow is positioning for an increase (positive VFI) or decrease (negative VFI) in market volatility. **This is not calculated by integrated_strategies_v2.py**.
- **Simplified Calculation Insight:** The system uses VFI purely as a conceptual input for the **Volatility Expansion** and **Volatility Contraction** signals. It relies on externally configured thresholds (vol_expansion_vfi_trigger, vol_contraction_vfi_trigger) being met, implying that VFI data (perhaps from another source or inferred) has crossed these levels. The system itself does not derive VFI from the standard input DataFrame.
- **Relationship to Other Metrics:** Used *conceptually* alongside **VRI** and **SSI** to trigger the volatility_expansion and volatility_contraction signals.
- **Configuration Notes:**
    - strategy_settings.thresholds.vol_expansion_vfi_trigger: Threshold for implied VFI to trigger expansion signal.
    - strategy_settings.thresholds.vol_contraction_vfi_trigger: Threshold for implied VFI to trigger contraction signal.

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11. Charm Decay Rate (CTR) & Time Decay Flow Imbalance (TDFI) - Calculated

- **Metric Name & Abbreviation:** Charm Decay Rate (CTR), Time Decay Flow Imbalance (TDFI) - *Calculated*
- **Conceptual Explanation:** These are specific metrics calculated *within* the TDPI logic (_calculate_tdpi) and used for the time_decay_charm_cascade signal.
    - **CTR:** Measures the rate of delta decay due to charm relative to the overall theta decay flow (abs(Charm_Flow) / abs(Theta_Flow)). High CTR indicates charm is a dominant factor in delta changes.

    - **TDFI:** Measures the imbalance between normalized theta flow magnitude and normalized theta OI magnitude (Norm_Abs_Theta_Flow / Norm_Abs_Theta_OI). High TDFI suggests theta-related flow is large relative to the existing theta exposure base.
- **Simplified Calculation Insight:** Calculated inside _calculate_tdpi using charmxvolm, txvolm, txoi.
- **Relationship to Other Metrics:** Derived during **TDPI** calculation. Used exclusively to trigger the time_decay_charm_cascade signal based on their respective thresholds.
- **Configuration Notes:**
    - strategy_settings.thresholds.charm_cascade_ctr_trigger: Threshold for CTR.
    - strategy_settings.thresholds.charm_cascade_tdfi_trigger: Threshold for TDFI.

IV. Trading Signals Explained

This section details the discrete trading signals generated by the IntegratedTradingSystem. These signals are designed to alert you to specific market conditions or potential opportunities based on the system's analysis of its underlying metrics crossing configured thresholds. All signals can be toggled on or off via config_v2.json -> system_settings -> signal_activation.

1. Directional Signal (Bullish/Bearish)

- **Signal Name:** Directional Signal
- **How it's Generated:** Triggered primarily when **MSPI** indicates potential support/resistance *and* this structure is confirmed by the **Sentiment Alignment Indicator (SAI)** crossing its high-conviction threshold (sai_high_conviction).
    - **Bullish:** Typically occurs when MSPI is positive (support) and SAI is strongly positive (components align, exceeding sai_high_conviction threshold).
    - **Bearish:** Typically occurs when MSPI is negative (resistance) and SAI is strongly positive (components align, exceeding sai_high_conviction threshold). A bearish signal might also trigger with strong negative MSPI and strongly *negative* SAI if flow heavily

opposes support, but the primary trigger logic focuses on alignment for conviction.

    - Logic implemented in _generate_trading_signals.

- **Visual Representation:** Appears in the "Strategy Recommendations Table" [Image: Strategy_Recommendations_Table_Example.png]. Can also be inferred from the Key Levels chart [Image: Key_Levels_Example.png] where a "High Conviction" marker (diamond) aligns with a "Support" (triangle up) or "Resistance" (triangle down) marker.
- **Interpretation Guide:**
    - **Bullish:** Suggests market structure and component alignment favor upward price movement or strong support.
    - **Bearish:** Suggests market structure and component alignment favor downward price movement or strong resistance.
    - **Conviction:** The signal generation logic primarily looks for high conviction based on SAI threshold.
- **Practical Use Cases & Examples:** Primary indicator for initiating directional trades (longs on Bullish, shorts on Bearish) or managing existing positions near key MSPI levels.
- **Confirmation & Context:** Strongest when occurring near significant MSPI/SDAG levels. Always cross-reference with overall chart context (price action, trends).

2. SDAG Conviction Signal (Bullish/Bearish)

- **Signal Name:** SDAG Conviction Signal
- **How it's Generated:** Triggered when a minimum number (min_agreement_for_conviction_signal from config) of the *enabled* SDAG methodologies agree on the sentiment (positive/bullish or negative/bearish) at a specific strike.
    - **Bullish:** Minimum number of enabled SDAGs have values > 0 (or a small positive threshold).
    - **Bearish:** Minimum number of enabled SDAGs have values < 0 (or a small negative threshold).
    - Logic implemented in _generate_trading_signals.

- **Visual Representation:** Appears in the "Strategy Recommendations Table" [Image: Strategy_Recommendations_Table_Example.png]. Can also be inferred by visually checking the alignment of peaks/troughs across the individual SDAG charts ([Image: SDAG_Multiplicative_Example1.png], [Image: SDAG_Directional_Example.png], etc.).
- **Interpretation Guide:**
    - **Bullish:** Significant agreement among different SDAG models indicates positive (supportive) pressure.
    - **Bearish:** Significant agreement indicates negative (resistive/vol trigger) pressure.
    - Conviction increases with the number of agreeing methodologies and the magnitude of their values.
- **Practical Use Cases & Examples:** High-conviction identification of S/R levels. Pinpointing entry/exit zones near strikes with strong SDAG agreement.
- **Confirmation & Context:** Extremely powerful when these conviction strikes align with overall MSPI levels and potentially the Directional signal.

3. Volatility Expansion Signal

- **Signal Name:** Volatility Expansion Signal
- **How it's Generated:** Triggered when the **Volatility Risk Indicator (VRI)** exceeds its expansion threshold (vol_expansion_vri_trigger) AND the implied **Volatility Flow Imbalance (VFI)** exceeds its expansion threshold (vol_expansion_vfi_trigger).
- **Visual Representation:** Appears in the "Strategy Recommendations Table" [Image: Strategy_Recommendations_Table_Example.png].
- **Interpretation Guide:** Suggests that underlying volatility risk metrics (VRI) and inferred market flow (VFI) *both* indicate a heightened probability of an *increase* in market volatility (price swings becoming larger/faster).
- **Practical Use Cases & Examples:**
    - Consider strategies profiting from rising volatility (long straddles, strangles).
    - Widen profit targets and stop-losses on existing directional trades due to potential for larger swings.

    - Exercise caution entering new directional trades, as volatility can cause unpredictable moves.
- **Confirmation & Context:** Look for price coiling/consolidation on charts (often precedes vol expansion). Check if price is near key "Volatility Trigger" levels identified by SDAGs (esp. Volatility-Focused). *(Ref: User_33)*

4. Volatility Contraction Signal

- **Signal Name:** Volatility Contraction Signal
- **How it's Generated:** Triggered when **VRI** falls below its contraction threshold (vol_contraction_vri_trigger), implied **VFI** falls below its contraction threshold (vol_contraction_vfi_trigger), AND **Structural Stability Index (SSI)** is *above* its vol contraction threshold (ssi_vol_contraction - note: high SSI indicates stability conducive to vol contraction).
- **Visual Representation:** Appears in the "Strategy Recommendations Table".
- **Interpretation Guide:** Suggests market conditions (low vol risk sensitivity, low vol flow, stable structure) favor a *decrease* in volatility, potentially leading to more range-bound or subdued price action.
- **Practical Use Cases & Examples:**
    - Consider strategies profiting from falling/stagnant volatility (short straddles/strangles, credit spreads, iron condors).
    - Expect more defined trading ranges around key MSPI/SDAG levels.
- **Confirmation & Context:** Often occurs after a period of high volatility. Confirm with SSI indicating a return to stability.

5. Time Decay Pin Risk Signal

- **Signal Name:** Time Decay Pin Risk Signal
- **How it's Generated:** Triggered when the **Time Decay Pressure Indicator (TDPI)** at or very near the current underlying price exceeds the pin_risk_tdpi_trigger threshold.
- **Visual Representation:** Appears in the "Strategy Recommendations Table". The Time Decay (TDPI by Strike) chart ([Image: Time_Decay_TDPI_Example.png]) will show high TDPI magnitude around the pinning strike.
- **Interpretation Guide:** Indicates a high probability that the underlying price will be drawn towards and potentially "pinned" to the specific strike with the highest

TDPI, especially as expiration approaches, due to accelerating time decay (theta/charm) and associated hedging.

- **Practical Use Cases & Examples:**
    - Useful for options selling strategies targeting specific strikes on expiration week/day (e.g., iron butterflies, short straddles at the pin strike).
    - Can indicate areas where price movement might stall or revert towards.
- **Confirmation & Context:** Most relevant for options nearing expiration (0-7 DTE). Check for high open interest at the potential pin strike identified by TDPI.

6. Time Decay Charm Cascade Signal

- **Signal Name:** Time Decay Charm Cascade Signal
- **How it's Generated:** Triggered when the calculated **Charm Decay Rate (CTR)** exceeds charm_cascade_ctr_trigger AND the calculated **Time Decay Flow Imbalance (TDFI)** exceeds charm_cascade_tdfi_trigger.
- **Visual Representation:** Appears in the "Strategy Recommendations Table".
- **Interpretation Guide:** Suggests a potential for accelerated price movement (a "cascade") as dealers are forced to adjust hedges rapidly due to accelerating delta decay (high CTR), especially when theta-related flow relative to OI is also high (high TDFI). This effect is most pronounced for options close to expiry and potentially away from the money where charm can be significant.
- **Practical Use Cases & Examples:** Can signal potential for sharp directional moves (often reversals or trend continuations) late in the day on or just before expiration, as positions are unwound or hedged aggressively.
- **Confirmation & Context:** Highly specific to expiration dynamics. Look for unusual volume or price acceleration in near-term options when this signal appears.

7. Complex Structure Change Signal

- **Signal Name:** Complex Structure Change Signal
- **How it's Generated:** Triggered when the **Structural Stability Index (SSI)** falls below its ssi_structure_change threshold (e.g., a low percentile value, indicating instability).
- **Visual Representation:** Appears in the "Strategy Recommendations Table" and visually on the Key Levels chart as distinct markers (e.g., blue crosses in [Image: Key_Levels_Example.png]).

- **Interpretation Guide:** Warns that the prevailing market structure (as defined by MSPI/SDAG levels) may be breaking down or shifting significantly. Indicates increased fragility and potential for transition. The conviction (High/Medium) can be differentiated using ssi_conviction_split.
- **Practical Use Cases & Examples:**
    - Caution Signal: Existing range-bound strategies become less reliable. Consider reducing size or tightening stops.
    - Opportunity Signal: May signal an opportunity for breakout strategies *if other indicators confirm* a new direction (e.g., price decisively breaks a key MSPI level concurrently).
- **Confirmation & Context:** Look for price challenging or breaking previously strong MSPI/SDAG levels. Low SSI often precedes or accompanies significant market moves.

8. Complex Flow Divergence Signal (Based on ARFI)

- **Signal Name:** Complex Flow Divergence Signal
- **How it's Generated:** Triggered when the **Average Relative Flow Index (ARFI)** shows a significant divergence from price action, exceeding the tiered cfi_flow_divergence thresholds.
- **Visual Representation:** Appears in the "Strategy Recommendations Table". The Combined Rolling Flow Chart ([Image: Combined_Rolling_Flow_Example.png]) helps visualize the underlying flow dynamics that contribute to ARFI divergences.
- **Interpretation Guide:**
    - **Bullish Divergence:** Price makes a new low, but ARFI makes a higher low (selling flow is waning *relative to structure*). Suggests potential upward reversal.
    - **Bearish Divergence:** Price makes a new high, but ARFI makes a lower high (buying flow is weakening *relative to structure*). Suggests potential downward reversal or exhaustion.
    - The tiered thresholds allow for different levels of divergence sensitivity (Medium/High conviction).
- **Practical Use Cases & Examples:** Powerful for identifying potential trend exhaustion and spotting early signs of reversals, especially when confirming price action patterns.

- **Confirmation & Context:** Most effective when observed near key support/resistance levels (MSPI/SDAG) or after extended trends.

V. Cohesive Analysis: Integrating Metrics & Signals

Understanding individual metrics and signals is the foundation, but the true power of this trading system comes from synthesizing this information into a cohesive market view. This section focuses on how to combine various components to make more informed trading decisions.

1. The Big Picture: How Individual Components Work Together

The system is designed around a core idea: market maker hedging and significant order flow can create predictable (or at least probabilistically favorable) patterns and levels in the market. Here's how the components interact:

- **Structural Foundation (MSPI & its components - DAG, SDAGs, TDPI, VRI):** These metrics establish the underlying market structure.
    - **MSPI/SDAGs/DAG:** Identify potential support/resistance zones based on concentrated dealer gamma/delta exposures, potentially adjusted for skew and confirmed by flow (in DAG_Custom's case). High positive values suggest support/attraction; high negative values suggest resistance/repulsion or volatility triggers.
    - **TDPI:** Highlights time-decay pressure, particularly relevant near expiration, acting as potential "pinning" forces.
    - **VRI:** Assesses the market's sensitivity to volatility changes, highlighting potential risks or opportunities related to vol shifts.
- **Internal Consistency Check (SAI):** This metric overlays the structural foundation by assessing the *agreement* among the primary MSPI drivers (DAG, TDPI, VRI, weighted SDAGs). High positive SAI strengthens conviction in the MSPI level, while high negative SAI signals internal conflict and potential unreliability of the MSPI signal alone.
- **Flow Magnitude Context (ARFI):** This metric provides context on whether recent order flow (across delta, charm, vanna dimensions) is *proportionally large* compared to the existing OI structure. It helps gauge the *impact* of current activity. Divergences between ARFI and price are key signals for potential exhaustion or reversals.

- **Stability Assessment (SSI):** SSI tells you how robust or fragile the current structure is based on the consistency of the MSPI components. High SSI favors range-bound strategies respecting established levels. Low SSI suggests caution, potential for breakouts, or a transitional market.
- **Specific Event Triggers (Volatility Signals, Pin Risk, Charm Cascade, Structure Change, Flow Divergence):** These are discrete alerts generated when specific thresholds are met by the underlying metrics (VRI+VFI, TDPI, CTR+TDFI, SSI, ARFI). They act as focused alerts for potentially actionable conditions, often confirming or adding urgency to the broader structural or flow picture.

The Goal: To find **confluence**. When multiple independent indicators point in the same direction or confirm a specific condition, the conviction level for a trading idea increases significantly. Avoid relying on any single metric or signal in isolation.

2. Developing a Flow Map

A "Flow Map" isn't a single chart but a mental model or systematic process for analyzing the different dimensions of order flow presented by the system:

1. **Immediate Flow Pressure (Volume & Value):**
    - **Chart:** Net Volume vs Value Pressure Comparison
    - **Analysis:**
        - Check the current Net Volume bars (size and sign). Is buying or selling volume dominant *right now*?
        - Check the current Net Value area overlay (size and sign). Does the dollar value confirm the volume pressure, or is there a divergence?
        - *Value > Volume Divergence:* Might indicate larger players acting without high transaction counts (potential accumulation/distribution).
        - *Volume > Value Divergence:* Might indicate retail churn or high-frequency activity with less financial weight.
2. **Flow Persistence & History (Rolling Intervals):**
    - **Chart:** Combined Rolling Flow Chart ([Image: Combined_Rolling_Flow_Example.png]) and Ghost Bars on Net Volume vs Value Pressure.
    - **Analysis:**

        - Examine the different rolling intervals (e.g., 5m, 15m, 30m, 60m) on the Combined Rolling Flow chart. Is the flow (volume bars and value area) consistently positive or negative across multiple intervals, indicating sustained pressure?
        - Are the bars/areas growing (pressure building) or shrinking (pressure fading)?
        - Compare current Net Volume bars on the Net Volume vs Value Pressure chart to the historical "ghost" bars. Is the current pressure significantly higher or lower than recent history (e.g., T-5min, T-15min)?
3. **Flow Magnitude vs. Structure (Relative Impact):**
    - **Metric: ARFI** (Average Relative Flow Index)
    - **Analysis:**
        - Is the ARFI value generally high or low? High ARFI means recent flow across delta/charm/vanna dimensions is large relative to the existing OI structure. Low ARFI means flow is less impactful compared to the base.
        - **Crucially:** Look for divergences between ARFI and price. Is price making new highs while ARFI makes lower highs (bearish flow magnitude divergence)? Is price making new lows while ARFI makes higher lows (bullish flow magnitude divergence)? This often signals trend exhaustion.
4. **Flow Alignment with Structure (Directional Confirmation):**
    - **Metrics/Charts:** Compare the *sign* of immediate/rolling flow (from Net Vol/Val or Rolling Flow charts) with the *sign* of **MSPI** or aligned **SDAG** levels at relevant strikes.
    - **Analysis:** Does net buying flow coincide with positive MSPI/SDAG levels (confirmation of support)? Does net selling flow coincide with negative MSPI/SDAG levels (confirmation of resistance)? Or does flow oppose the structural levels (potential for level test/break)?
    - **(Note:** Use the *corrected* **SAI** to assess the *internal consistency* of the structural components themselves, not direct flow alignment).

Synthesizing the Flow Map: By systematically checking these four dimensions (Immediate Pressure, Persistence, Relative Magnitude/Divergence, Alignment with

Structure), you can build a comprehensive understanding of current order flow dynamics and its potential market impact.

3. Confluence Analysis: Finding High-Probability Setups

Combine insights from structure, flow, stability, and signals to identify higher-probability trading opportunities. Look for scenarios where multiple indicators align:

- **High-Conviction Long Entry:**
    - **Structure:** Price near a strong positive **MSPI** level, confirmed by multiple **SDAGs** showing positive peaks (strong **SDAG Conviction Bullish** signal).
    - **Internal Consistency:** Strongly positive **SAI** at the level (components agree).
    - **Flow:** Positive immediate **OFI** (Net Vol/Val charts show buying), potentially rising **ARFI** (or bullish divergence), positive **Rolling Flow**.
    - **Stability:** Moderate to High **SSI**.
    - **Signal: Directional Bullish** signal triggered.
    - **Volatility:** Neutral or low **VRI**, no active Volatility Expansion signal.
    - **Outcome:** High probability of the support level holding and price moving higher.
- **High-Conviction Short Entry:**
    - **Structure:** Price near a strong negative **MSPI** level, confirmed by multiple **SDAGs** showing negative troughs (strong **SDAG Conviction Bearish** signal).
    - **Internal Consistency:** Strongly positive **SAI** at the level (components agree on resistance).
    - **Flow:** Negative immediate **OFI**, potentially rising **ARFI** if selling is aggressive relative to OI (or bearish divergence), negative **Rolling Flow**.
    - **Stability:** Moderate to High **SSI**.
    - **Signal: Directional Bearish** signal triggered.
    - **Volatility:** Neutral or low **VRI**.
    - **Outcome:** High probability of the resistance level holding and price moving lower.

- **Potential Reversal (Bearish Divergence Example):**
    - **Price Action:** Price makes a new high.
    - **Structure: MSPI** at the new high area is lower than the previous high, or negative **SDAGs** are present nearby.
    - **Internal Consistency: SAI** might be low or negative (conflicting signals).
    - **Flow: ARFI** makes a lower high compared to the previous price high (bearish divergence). **Rolling Flow** charts show buying pressure fading on higher intervals.
    - **Stability: SSI** might be decreasing.
    - **Signal: Complex Flow Divergence** signal triggers bearishly.
    - **Outcome:** Increased probability of a pullback or reversal from the highs.
- **Volatility Expansion Setup:**
    - **Price Action:** Price consolidating in a tight range (coiling).
    - **Structure:** Price may be near a significant negative **SDAG Volatility-Focused** level ("Volatility Trigger").
    - **Internal Consistency: SAI** might be low/negative (conflicting forces building pressure).
    - **Flow:** Generally low **ARFI** during consolidation.
    - **Stability: SSI** is low or decreasing.
    - **Volatility: VRI** is high or rising.
    - **Signal: Volatility Expansion** signal triggers.
    - **Outcome:** High probability of a sharp move out of the consolidation range (direction may be initially uncertain).
- **Range-Bound Condition:**
    - **Structure:** Clear positive **MSPI/SDAG** support below current price and clear negative **MSPI/SDAG** resistance above.
    - **Internal Consistency: SAI** may fluctuate but isn't strongly negative at the boundaries.
    - **Flow: ARFI** generally moderate or low. **Rolling Flow** may alternate.
    - **Stability: SSI** is moderate to high.

- **Signals:** Absence of strong directional, divergence, or volatility expansion signals. Potential **Volatility Contraction** signal.
- **Outcome:** Market likely to remain within the defined structural boundaries. Favors range-trading strategies (selling premium, fading extremes).

4. Developing a Trading Plan: Using the System to Form Hypotheses

A robust trading plan involves more than just reacting to signals. Use the system to:

1. **Form a Market Thesis:** Based on the overall MSPI/SDAG profile, SAI, ARFI, SSI, and VRI, what is the dominant market condition? (Directional Trend? Range-bound? Volatile Expansion/Contraction likely? Transitional?)
2. **Identify Key Levels:** Mark the most significant support/resistance levels identified by MSPI and multi-SDAG alignment. Note any "Gamma Walls" or "Volatility Triggers". Use the Key Levels chart ([Image: Key_Levels_Example.png]) for a summary.
3. **Define Entry Criteria:** What specific confluence of metrics and signals will trigger an entry? (e.g., Price pullback to MSPI support + Positive SAI confirmation + Bullish SDAG Conviction signal + Price action confirmation).
4. **Set Stop-Loss Points:** Typically based on structural levels. If a key support level (identified by strong MSPI/SDAG confluence) is breached decisively (e.g., close below + confirmation), the bullish thesis might be invalidated. Consider volatility (ATR) for stop distance.
5. **Determine Profit Targets:** Other significant MSPI/SDAG levels, measured move projections, or based on risk/reward ratios.
6. **Adapt to Changing Conditions:** The market is dynamic. Continuously monitor the dashboard. If **SSI** drops, **SAI** turns negative against your position, or **ARFI** shows strong divergence, be prepared to adjust your plan (e.g., tighten stops, take partial profits, exit). *(Ref: User_15, User_21 - SDAG values are dynamic).*

VI. Visual Guide to the Dashboard & Charts

This section provides an overview of the enhanced_dashboard_v2 application layout and the charts generated by both the dashboard and the mspi_visualizer_v2.py script, helping you navigate and interpret the visual information.

1. Overview of the enhanced_dashboard_v2 Layout

The enhanced_dashboard_v2 is designed for a clear and interactive experience. Typically, it's structured with:

- **Control Panel:** Usually at the top, allowing selection of:
    - Underlying Symbol (e.g., /ES:XCME, SPY)
    - Days to Expiration (DTE) (e.g., "0", "0-7", "0,1,7")
    - Price Range Percentage Slider (for focusing charts around current price)
    - Data Refresh Interval Dropdown (Manual, 5s, 30s, 1m, etc.)
    - Fetch Data Button (for manual refresh)
- **Status Bar:** Displays system status (Loading, Idle, Error), last update time, and any important messages or errors.
- **Main Display Area:** Houses the various charts and tables, often organized into logical sections or potentially tabs (depending on implementation):
    - **Key Metrics Overview:** MSPI Heatmap, SDAG Charts, potentially TDPI/VRI profiles.
    - **Flow Analysis:** Net Vol/Val Comparison, Combined Rolling Flow (ARFI visualization might go here).
    - **Stability/Alignment:** Charts or indicators for SSI, SAI.
    - **Signal Summary:** Key Levels chart, Trading Signals chart, Strategy Recommendations Table.

2. Detailed Explanation of Key Charts

(Referencing image placeholders which you will replace with actual chart images)

- **MSPI Heatmap ([Image: MSPI_Heatmap_Example.png] - adjust interpretation based on actual colors)**
    - **What it shows:** Overall MSPI strength and polarity across strikes (Y-axis) for Calls and Puts (X-axis). Color indicates MSPI value (e.g., Blue=+Ve Support, Red=-Ve Resistance, or vice-versa based on colorscales).
    - **How to interpret:** Look for persistent horizontal bands (stable levels). Bright colors = strong S/R. Price interaction with these zones is key. Fading/shifting bands = changing structure. Diagnose *why* using MSPI Components.
- **MSPI Components ([Image: (Placeholder - Needs Image)])**
    - **What it shows:** Deconstructs total MSPI (dark bars) vs. its normalized, weighted inputs (DAG_Custom, TDPI, VRI, SDAGs - toggleable).

    - **How to interpret:** Identify which component(s) drive the MSPI signal at key strikes. Look for alignment (stronger signal) or conflict (weaker/unreliable signal) among components. Understand the *reason* for S/R (Gamma/Delta, Time Decay, or Vol driven?).
- **Net Value Pressure Heatmap ([Image: (Placeholder - Needs Image)])**
    - **What it shows:** Net dollar value flow (value_buy - value_sell) aggregated per strike. Color indicates net value pressure (e.g., Green=+Ve Buy Value, Red=-Ve Sell Value).
    - **How to interpret:** Identifies levels with large *financial weight*. Strong colors indicate significant capital flow, acting as potential magnets or heavy S/R. Compare with volume pressure.
- **Net Volume vs Value Pressure ([Image: (Placeholder - Needs Image)])**
    - **What it shows:** Compares Net Volume Pressure (bars) with Net Value Pressure (area) per strike. Includes historical volume "ghost" bars.
    - **How to interpret:** Look for alignment (strong confirmation) or divergence (Volume > Value = retail/HFT? Value > Volume = institutional?). Use ghosts for context (is current pressure normal?).
- **Combined Rolling Flow Chart ([Image: Combined_Rolling_Flow_Example.png])**
    - **What it shows:** Normalized rolling net flow (Volume bars, Value area) over different time intervals (5m, 15m, etc.). Visualizes flow persistence and decay.
    - **How to interpret:** Sustained bars/area = accumulating pressure. Fading = waning pressure. Look for price/flow divergences across multiple intervals (key for **ARFI** divergence signals).
- **Raw Time Decay Chart (TDPI by Strike) ([Image: Time_Decay_TDPI_Example.png])**
    - **What it shows:** TDPI values per strike (Calls vs. Puts).
    - **How to interpret:** Peaks near current price indicate potential "pinning" strikes due to time decay pressure, especially near expiry. Width of peak shows range of influence. Strongest input for Time Decay Pin Risk signal.
- **Raw Volatility Regime Chart (VRI by Strike) ([Image: Volatility_Regime_VRI_Example.png])**

    - **What it shows:** VRI values per strike (Calls vs. Puts).
    - **How to interpret:** High magnitude (positive or negative) indicates high sensitivity to volatility changes. Low VRI suggests lower vol risk. Input for Volatility Expansion/Contraction signals (combined with implied VFI).
- **SDAG Charts (Multiplicative, Directional, Weighted, Volatility-Focused)** ([Image: SDAG_Multiplicative_Example1.png], [Image: SDAG_Directional_Example.png], [Image: SDAG_Weighted_Example.png], [Image: SDAG_Volatility_Focused_Example.png])
    - **What it shows:** Individual SDAG calculations per strike (Calls vs. Puts) and the Net value.
    - **How to interpret:** Identify peaks/troughs as S/R or vol triggers. **Crucially, look for alignment across multiple charts at the same strike** for high conviction (SDAG Conviction signal). Note the different scales and interpretations per methodology.
- **Key Levels ([Image: Key_Levels_Example.png])**
    - **What it shows:** Scatter plot summarizing key structural points: Support (▲), Resistance (▼), High Conviction (♦ - based on SAI), Structure Change (+ - based on SSI).
    - **How to interpret:** Provides a quick visual map of the most important levels identified by the system's analysis of structure, flow confirmation (via SAI alignment), and stability. Marker size often relates to MSPI magnitude.
- **Trading Signals ([Image: (Placeholder - Needs Image)])**
    - **What it shows:** Scatter plot of active discrete signals triggered by metrics crossing thresholds. Y-axis categorizes signal type.
    - **How to interpret:** Quick alert system. Hover for details. Use as confirmation or points of interest within your broader analysis, not blind triggers.
- **Strategy Recommendations Table ([Image: Strategy_Recommendations_Table_Example.png])**
    - **What it shows:** Tabular summary of actionable recommendations, primarily derived from high-conviction Directional and SDAG Conviction signals.

    - **How to interpret:** Provides concise strategy ideas based on the system's strongest signals. Includes rationale. Use as a starting point, always apply own risk management.

3. Key Interactive Features

Dashboards built with Plotly/Dash typically offer:

- **Tooltips:** Hovering over data points on charts reveals detailed information (exact metric value, strike price, etc.).
- **Zoom & Pan:** Ability to zoom into specific areas of a chart and pan across the data.
- **Clickable Legends:** Toggle the visibility of different traces (e.g., different SDAG methods, Calls vs. Puts) by clicking their names in the legend. Crucial for decluttering complex charts.
- **Cross-filtering (Potentially):** Selecting data on one chart might filter/highlight corresponding data on others (if implemented).

VII. Advanced Configuration & Customization

This section provides a deeper look into config_v2.json, enabling advanced users to tailor the system's behavior. **Always back up your config_v2.json before making significant changes.**

1. Deep Dive into config_v2.json Sections

(Refer to your config_v2.json and config.schema.json for the full structure. Key areas for trading logic customization are highlighted below.)

- **data_processor_settings.weights**:
    - selection_logic: Choose between "time_based" (weights change for morning, midday, final hours) or "volatility_based" (weights change based on IV percentile context).
    - time_based & volatility_based sub-sections: Define the actual percentage weights for dag_custom, tdpi, vri, and each enabled sdag_[method_name]_norm that contributes to MSPI (weight_in_mspi > 0 in dag_methodologies). The sum of weights for active components in any period/context should ideally be close to 1.0.
    - *Impact:* Directly alters the composition and sensitivity of the MSPI. Increase weights for metrics you deem more important in specific contexts.

- **data_processor_settings.coefficients**: (e.g., dag_alpha, tdpi_beta, vri_gamma)
    - These apply multipliers (aligned, opposed, neutral) to DAG, TDPI, VRI based on the alignment of their internal flow vs. OI components.
    - *Impact:* Allows amplification (if aligned > 1) or dampening (if opposed < 1) of a metric's contribution when its underlying drivers strongly confirm or conflict.
- **data_processor_settings.factors**:
  (e.g., tdpi_gaussian_width, vri_vol_trend_fallback_factor)
    - Fine-tunes specific aspects of metric calculations.
    - tdpi_gaussian_width: Controls the strike range focus for TDPI. Negative values (e.g., -0.5) widen the Gaussian curve; values closer to 0 narrow it.
    - vri_vol_trend_fallback_factor: Used in VRI's Vol Trend calculation if direct IV data is missing.
    - *Impact:* Modifies the shape, reach, or fallback behavior of individual metrics.
- **data_processor_settings.approximations**: (e.g., tdpi_atr_fallback)
    - Defines how certain values (like ATR for TDPI) are estimated if direct calculation isn't possible.
    - *Impact:* Affects the scaling and context-awareness of metrics relying on these approximations.
- **strategy_settings.gamma_exposure_source_col, delta_exposure_source_col, skew_adjusted_gamma_source_col**:
    - Defines which columns from your input data represent GEX, DEX, and SGEX.
    - *Impact:* Critical for ensuring the system uses the correct base data. Ensure these column names exist in the data provided by the processor.
- **strategy_settings.use_skew_adjusted_for_sdag**:
    - Boolean (true/false). If true, SDAG calculations use skew_adjusted_gamma_source_col. If false, they use gamma_exposure_source_col.
    - *Impact:* Determines if SDAGs incorporate volatility skew.
- **strategy_settings.dag_methodologies**:

    - enabled: A list of SDAG methodologies to calculate (e.g., ["multiplicative", "directional", "weighted", "volatility_focused"]).
    - For each methodology (e.g., multiplicative):
        - delta_weight_factor (or w1_gamma, w2_delta for weighted): Parameters specific to that SDAG formula.
        - weight_in_mspi: How much this *normalized* SDAG contributes to the overall MSPI score. If 0, it's calculated for analysis/signals but not part of MSPI itself.
    - min_agreement_for_conviction_signal: Integer count. The minimum number of *enabled* SDAG methodologies that must agree (positive or negative) to generate an sdag_conviction signal.
    - *Impact:* Controls which advanced SDAG views are available, how they influence the composite MSPI, and the sensitivity of the SDAG conviction signal.
- **strategy_settings.thresholds**:
    - Large section defining trigger points for various signals (SAI, SSI, ARFI (using cfi_flow_divergence key), Volatility Expansion/Contraction, Pin Risk, Charm Cascade).
    - Each threshold has
      a type (fixed, relative_percentile, relative_mean_factor) and
      a value (or percentile, factor). Many also have a fallback_value.
    - *Impact:* Directly controls the sensitivity of all discrete trading signals. Adjusting these requires careful testing. Lowering thresholds makes signals trigger more easily; raising them requires stronger conditions.

2. Adjusting Parameters for Different Market Conditions or Risk Appetites

- **Volatile Markets:**
    - Consider increasing the weight (data_processor_settings.weights) of **VRI** in MSPI.
    - Lower thresholds (strategy_settings.thresholds) for **Volatility Expansion** signals (vol_expansion_vri_trigger, vol_expansion_vfi_trigger) to be alerted sooner.
    - Potentially rely more on shorter-term SDAG methodologies (**Multiplicative, Directional**) which react faster.

    - Lower the **SSI** threshold (ssi_structure_change) as structure is inherently less stable.
- **Quiet/Ranging Markets:**
    - Increase weight of **TDPI** in MSPI if near expiration.
    - Focus analysis on **SDAG Weighted** for identifying range boundaries.
    - Adjust thresholds for **ARFI** (cfi_flow_divergence) / **SAI** (sai_high_conviction) to catch divergences that might signal a range break earlier.
    - Increase the **SSI** threshold (ssi_vol_contraction) to confirm stability for range trades.
- **Higher Risk Appetite:**
    - May slightly lower conviction thresholds (e.g., sai_high_conviction, min_agreement_for_conviction_signal) to get more signals, understanding this increases potential false positives.
    - Could slightly lower divergence thresholds (cfi_flow_divergence).
- **Lower Risk Appetite:**
    - Increase conviction thresholds (e.g., sai_high_conviction, min_agreement_for_conviction_signal).
    - Require stronger alignment across multiple metrics/signals before acting (Confluence).
    - Increase structural stability requirements (higher SSI thresholds).

3. Understanding the Impact of Configuration Changes

- **Test Incrementally:** Change one group of related parameters at a time (e.g., only TDPI factors, only SDAG weights) and observe the impact on historical data or a paper trading account before applying to live trading.
- **Normalization is Key:** Remember that MSPI components (DAG, TDPI, VRI, SDAGs) are normalized *before* being weighted. Changing the calculation of one component (e.g., via its factors or coefficients) can affect its normalized range and thus its influence on MSPI, even if its weight remains the same. The final MSPI score is also normalized.

- **Documentation is Crucial:** Keep a personal log of changes made to config_v2.json and the observed outcomes (how signals changed, how metrics looked). This iterative feedback loop is vital for refining your configuration.

By mastering the configuration, you transform the system from a generic tool into a personalized trading assistant that reflects your market understanding and risk preferences.

(Sections VIII, IX, X would follow, updated with corrected terminology for SAI/CFI/ARFI)

VIII. Troubleshooting & FAQ

- **Q1: The dashboard is not loading data or shows errors.**
    - **A1:**
        - **Check config_v2.json:** Ensure api_credentials (email, password, environment) for ConvexValue are correctly entered if you intend to fetch live data. If not using live data, ensure the system's fallback mechanisms (dummy data) are intended and configured. *(Ref: run_enhanced_dashboard_v2.py checks)*.
        - **Check Processor Output:** If reading processed data from disk (check data_directory in config), ensure enhanced_data_fetcher_v2.py and enhanced_data_processor_v2.py ran successfully without critical errors and produced output files in the expected location.
        - **Check Console Logs:** Examine the console output where you launched the dashboard (python run_enhanced_dashboard_v2.py ... or python -m dashboard_v2.enhanced_dashboard_v2 ...). Look for specific error messages related to imports, configuration loading, backend initialization, or callback execution.
        - **Check Dependencies:** Verify that convexlib is installed correctly (pip show convexlib) and all other packages listed in anaconda_startup_guide_v4.md or run_enhanced_dashboard_v2.py are present in your active conda environment. Run pip check in your environment.

        - **Check Network/API Status:** If fetching live data, ensure you have internet connectivity and that the ConvexValue API service is operational. Check API limits if applicable.

- **Q2: A specific metric (e.g., SDAG, SAI, ARFI) is not showing up or seems incorrect.**
    - **A2:**
        - **Check Config (Enabled?):** For SDAGs, verify the specific methodology (e.g., multiplicative) is listed in config_v2.json -> strategy_settings -> dag_methodologies -> enabled.
        - **Check Config (Source Columns):** Verify the gamma_exposure_source_col, delta_exposure_source_col, and potentially skew_adjusted_gamma_source_col (if use_skew_adjusted_for_sdag is true) in strategy_settings are correctly mapped to the actual column names present in your input data provided by the data processor. Check required input columns for other metrics like ARFI (e.g., dxvolm, dxoi, charmxvolm, etc.).
        - **Examine Calculation Logs:** Enable DEBUG logging (system_settings.log_level in config) and review the logs from integrated_strategies_v2.py (and potentially enhanced_data_processor_v2.py) for warnings or errors during the calculation of that specific metric (e.g., "Ensure Cols(...): Missing columns...", "Normalization: Max abs value... is zero/NaN"). Pay attention to _ensure_columns warnings.
        - **Check Normalization:** Remember most components are normalized. If the raw metric values are all zero or very small, the normalized output might be zero or seem unusual.
        - **For SAI/SSI:** These depend on the results of other components (DAG, TDPI, VRI, SDAGs). If those base components are incorrect or missing, SAI/SSI will be affected. SSI also requires at least two weighted components.
- **Q3: Signals seem too frequent or too rare.**
    - **A3:** This is almost always related to the threshold settings in config_v2.json -> strategy_settings -> thresholds.

        - **Too Frequent:** Consider *increasing* the value for fixed thresholds, or using a *more extreme* percentile (e.g., 90th instead of 85th for contraction, 10th instead of 15th for structure change) or factor for relative thresholds. For SDAG Conviction, *increase* min_agreement_for_conviction_signal.
        - **Too Rare:** Consider *decreasing* the value, percentile, or factor. For SDAG Conviction, *decrease* min_agreement_for_conviction_signal.
        - **Important:** Make changes incrementally and test the impact on historical data or paper trading before applying live. Understand the trade-off between sensitivity and false positives.
- **Q4: How do I interpret a very high or very low MSPI/SDAG value?**
    - **A4:** Generally, for MSPI and most SDAGs:
        - **Significantly Positive (e.g., > 1.0 or 1.5):** Indicates strong positive structural influence (support/attraction/magnetism). The market is likely to find buying interest or be pulled towards these levels due to dealer hedging.
        - **Significantly Negative (e.g., < -1.0 or -1.5):** Indicates strong negative structural influence (resistance/repulsion). For SDAG Volatility-Focused specifically, large negative values act as "Volatility Triggers", suggesting instability.
        - **Magnitude:** Larger absolute values imply stronger influence.
        - **Context is Key:** The *exact* interpretation depends on the specific metric (MSPI is composite, different SDAGs have different nuances) and its *normalization*. A value of 0.8 might be highly significant for one metric/market condition but moderate for another. Always cross-reference with other indicators (SAI, SSI, ARFI, Price Action) and the visual charts. Refer to Section III for details on each metric.
- **Q5: The system uses gxoi and dxoi. What if my data provider uses different names?**
    - **A5:** You can easily change the source column names the system uses. Modify these settings in config_v2.json -> strategy_settings:
        - gamma_exposure_source_col: Set this to the column name containing your GEX data (e.g., "MyGEXData").

        - delta_exposure_source_col: Set this to the column name containing your DEX data (e.g., "MyDEXData").
        - skew_adjusted_gamma_source_col: Set this if you have skew-adjusted data and use_skew_adjusted_for_sdag is true.
        - Ensure your data processing pipeline (enhanced_data_processor_v2.py or equivalent) correctly prepares and includes these renamed columns in the DataFrame passed to integrated_strategies_v2.py.

- **Q6: How can I improve the performance of the dashboard or data processing?**
    - **A6:**
        - **Dashboard Refresh:** Increase the refresh_interval_ms in config_v2.json -> visualization_settings -> dashboard -> defaults (or select a longer interval in the UI dropdown) to reduce the frequency of data fetches and chart updates, especially if real-time updates every few seconds are not critical. Set to 0 for manual refresh only.
        - **System Resources:** Ensure the machine running the dashboard and backend scripts has sufficient CPU, RAM, and potentially network bandwidth (if fetching large datasets frequently). Monitor resource usage.
        - **Data Processing Efficiency:** The efficiency largely depends on Pandas operations. The V2 scripts aim for optimization, but processing very large option chains (many symbols, DTEs, wide strike ranges) will inherently take time. Consider:
            - Fetching narrower strike ranges (default_price_range_pct) if appropriate.
            - Fetching fewer DTEs (default_dte_range) if not all are needed for your analysis.
            - Optimizing calculations within integrated_strategies_v2.py further if specific bottlenecks are identified (requires profiling).
        - **Caching:** Ensure the server-side caching mechanism (SERVER_CACHE in enhanced_dashboard_v2.py) is working

effectively. Check logs for cache hit/miss/expiration messages if added.

IX. Glossary of All Metrics & Signals

- **ARFI (Average Relative Flow Index):** Measures the average magnitude of recent delta, charm, and vanna flow relative to their respective OI exposures. High ARFI indicates flow is proportionally large compared to the existing structure. Replaces the previous, inaccurate definition of CFI.
- **CTR (Charm Decay Rate):** Measures the rate of delta decay due to charm relative to theta decay flow (abs(Charm_Flow) / abs(Theta_Flow)). Calculated within TDPI logic.
- **DAG (Delta Adjusted Gamma Exposure - Custom):** Proprietary metric combining Gamma Exposure, Delta Exposure sign, and flow confirmation/magnitude (dxvolm vs dxoi alignment/ratio, norm_gxvolm) to assess flow-modulated hedging pressure. Primary MSPI component.
- **DEX (Delta Exposure):** Net delta sensitivity of options positions (typically Delta * OI * 100). Foundational input.
- **GEX (Gamma Exposure):** Net gamma sensitivity of options positions (typically Gamma * OI * 100 * Price). Foundational input.
- **MSPI (Market Structure Position Indicator):** Primary composite indicator synthesizing normalized DAG_Custom, TDPI, VRI, and weighted SDAGs based on dynamic weights. Represents the system's holistic view of structural pressure. Normalized to [-1, 1].
- **OFI (Order Flow Imbalance) - Concept:** Net short-term buying or selling pressure from options order flow (e.g., volmbs, valuebs). An *input concept* used by various calculations, not a direct output metric.
- **SAI (Sentiment Alignment Indicator):** Measures the internal alignment/consistency among the *normalized components* (DAG, TDPI, VRI, weighted SDAGs) that form the MSPI score. High positive SAI = components agree; High negative SAI = components conflict.
- **SDAG (Skew and Delta Adjusted GEX):** Advanced metric combining GEX (potentially Skew-Adjusted) with DEX. Multiple methodologies exist:
    - **SDAG Multiplicative:** GEX * (1 + Norm_DEX * Factor)
    - **SDAG Directional:** GEX * sign(GEX * Norm_DEX) * (1 + abs(Norm_DEX) * Factor)

    - **SDAG Weighted:** (w1*GEX + w2*Raw_DEX) / (w1+w2)
    - **SDAG Volatility-Focused:** GEX * (1 + Norm_DEX * sign(GEX) * Factor)
- **SGEX (Skew-Adjusted GEX):** GEX adjusted for volatility skew. Optional input for SDAGs.
- **SSI (Structural Stability Index):** Assesses the stability of the current market structure based on the variance among weighted, normalized MSPI components. High SSI = Stable; Low SSI = Unstable/Transitional.
- **TDFI (Time Decay Flow Imbalance):** Measures the imbalance between normalized theta flow magnitude and normalized theta OI magnitude (Norm_Abs_Theta_Flow / Norm_Abs_Theta_OI). Calculated within TDPI logic.
- **TDPI (Time Decay Pressure Indicator):** Measures market impact of accelerating time decay (Theta, Charm), weighted by flow alignment, time of day, and strike proximity. Key MSPI component.
- **VFI (Volatility Flow Imbalance) - Concept:** Net flow into options sensitive to volatility changes. An *input concept* for Volatility signals, threshold-based, not calculated by the system.
- **VRI (Volatility Risk Indicator):** Quantifies risks/opportunities from volatility changes, considering Vega, Vanna, Vomma exposures/flows, IV skew, and IV trend. Key MSPI component.

- **Directional Signal:** Bullish/Bearish signal based on MSPI and high SAI confirmation.
- **SDAG Conviction Signal:** Bullish/Bearish signal based on agreement among a minimum number of enabled SDAG methodologies.
- **Volatility Expansion Signal:** Indicates conditions favoring an increase in market volatility (High VRI + High implied VFI).
- **Volatility Contraction Signal:** Indicates conditions favoring a decrease in market volatility (Low VRI + Low implied VFI + High SSI).
- **Time Decay Pin Risk Signal:** High probability of price pinning to a strike due to high TDPI near current price.
- **Time Decay Charm Cascade Signal:** Potential for accelerated moves due to rapid charm-induced delta decay hedging (High CTR + High TDFI).

- **Complex Structure Change Signal:** Warning that the current market structure may be shifting or breaking down (Low SSI).
- **Complex Flow Divergence Signal:** Alert for significant divergences between price action and ARFI (Average Relative Flow Index).

X. Appendix

(This section can be used for future additions, such as detailed mathematical formulas if desired by the user, links to external resources on options Greeks or market maker dynamics, or specific examples of configuration tuning.)