📘 CRYPTO MIS & RISK ANALYSIS

Professional Metric–Indicator Mapping Document

Version: 2.0
Classification: Institution-Grade
Scope: Execution Analytics, Risk Monitoring, Portfolio MIS

📋 DOCUMENT OVERVIEW

Purpose

This document defines a complete, execution-accurate, institution-grade mapping of:

- **AggTrade Metrics** (Execution & Order-Flow)
- **OHLC Indicators** (Price, Volatility & Risk)
- **Risk Analytics** (Portfolio & Position Monitoring)

Across multiple timeframes for Crypto MIS, Real-Time Risk Analysis & Portfolio Monitoring.

Key Principles

1. **AggTrade = Ground Truth** — Executed trades only, no assumptions
2. **OHLC = Derived Structure** — Technical indicators for context
3. **Multi-Timeframe Confluence** — Micro to macro regime detection
4. **Institutional Standards** — Precise definitions, thresholds, formulas

🔴 PART-1: AGGTRADE METRICS (Execution & Order-Flow)

AggTrade Data Definition

Source: Trade prints (price, quantity, timestamp, aggressor side)
Characteristics: No indicators, no assumptions — only executed reality

Preprocessing: Remove wash trades, filter by min notional ($100+), timestamp normalization

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◆ 1–MINUTE AGGTRADE — TRUE MICROSTRUCTURE

Layer: Execution Causality
Objective: Tick-level behavior, immediate pressure, liquidity stress
Update Frequency: Real-time (streaming)

Metric	Formula	Unit	Threshold	Purpose
Trade Arrival Rate	`Total Trades ÷ 60`	trades/sec	>5 = High Activity	Market intensity
Buy Trade Count	`COUNT(side = 'BUY')`	count	—	Buyer aggression
Sell Trade Count	`COUNT(side = 'SELL')`	count	—	Seller aggression
Buy Volume	`SUM(qty WHERE side = 'BUY')`	base asset	—	Buy pressure
Sell Volume	`SUM(qty WHERE side = 'SELL')`	base asset	—	Sell pressure
Total Volume	`Buy Vol + Sell Vol`	base asset	—	Liquidity usage
Aggressor Ratio	`Buy Vol ÷ Total Vol`	0–1	>0.6 = Buy Dominance <0.4 = Sell Dominance	Directional dominance
Delta Volume (CVD)	`Buy Vol − Sell Vol`	base asset	±σ = Significant	Net execution pressure
Buy Notional	`SUM(price × qty WHERE side = 'BUY')`	quote asset	—	Capital inflow
Sell Notional	`SUM(price × qty WHERE side = 'SELL')`	quote asset	—	Capital outflow
Total Notional	`Buy Notional + Sell Notional`	quote asset	—	Capital activity
Avg Buy Trade Size	`Buy Vol ÷ Buy Trade Count`	base asset	>3σ = Institutional	Buyer sophistication
Avg Sell Trade Size	`Sell Vol ÷ Sell Trade Count`	base asset	>3σ = Institutional	Seller sophistication
Trade Size Imbalance	`Avg Buy Size ÷ Avg Sell Size`	ratio	>1.5 or <0.67	Side dominance

Metric	Formula	Unit	Threshold	Purpose
Large Trade Count	`COUNT(notional > P95)`	count	>10% of trades	Institutional presence
Large Trade Vol Share	`Large Trade Vol ÷ Total Vol`	%	>40% = Whale Activity	Whale impact
1-Min Execution VWAP	`Total Notional ÷ Total Vol`	price	—	Fair execution price
Aggressive Notional Pressure	`(Buy Notional - Sell Notional) ÷ 60`	quote/sec	±2σ = Stress	Execution intensity
Trade Time Clustering Index	`σ(inter-trade time) ÷ μ(inter-trade time)`	CV	<0.5 = High Clustering	Urgency detection
Trade Imbalance Toxicity	`|Aggressor Ratio - 0.5| × Trade Arrival Rate`	index	>0.8 = Toxic Flow	Adverse flow proxy

Large Trade Threshold: 95th percentile of 1-hour rolling notional distribution

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◆ 5-MINUTE AGGTRADE — STABILIZED MICROSTRUCTURE

Layer: Noise-Filtered Execution

Objective: Sustained pressure, short-term flow control

Lookback: Rolling 5×1-min windows

Metric	Formula	Unit	Threshold	Purpose
Rolling Delta Volume	`SUM(CVD, last 5 min)`	base asset	±1.5σ	Direction continuity
Buy Volume Share	`5-min Buy Vol ÷ 5-min Total Vol`	%	>60% = Buy Bias	Bias strength
Sell Volume Share	`5-min Sell Vol ÷ 5-min Total Vol`	%	>60% = Sell Bias	Bias strength
Aggressive Participation Rate	`(Buy + Sell) Vol ÷ Total Market Vol`	%	>70% = High Aggression	Taker dominance
Flow Momentum	`CVD(t) - CVD(t-5)`	base asset	Sign consistency	Acceleration
Volume Acceleration	`Vol(t) ÷ Vol(t-5) - 1`	%	>50% = Surge	Activity change
Delta Consistency Score	`% bars with same-sign CVD`	%	>80% = Strong Trend	Trend reliability

Metric	Formula	Unit	Threshold	Purpose
Trade Velocity	`Total Trades ÷ 5`	trades/min	>100 = High Velocity	Execution speed
Avg Trade Notional	`Total Notional ÷ Total Trades`	quote	>P75 = Quality	Participant quality
Buy/Sell Notional Ratio	`Buy Notional ÷ Sell Notional`	ratio	>1.3 or <0.77	Capital skew
Peak Trade Rate	`MAX(1-min trade rate in 5-min)`	trades/sec	>10 = Spike	Stress detection
Flow Stability Score	`1 - (σ(CVD) ÷ μ(|CVD|))`	0–1	>0.7 = Stable	Noise vs signal

◆ 15-MINUTE AGGTRADE — ORDER-FLOW CONTEXT

Layer: Micro → Macro Bridge
Objective: Regime detection & flow persistence
Lookback: 15 min rolling

Metric	Formula	Purpose
Net Delta Trend	`Linear regression slope(CVD, 15-min)`	Directional bias
Cumulative Delta (CVD)	`SUM(Buy Vol - Sell Vol, 15-min)`	Sustained execution
Directional Bias Strength	`|Net Delta| ÷ Total Volume`	Confidence score
Volume Expansion Ratio	`Vol(15-min) ÷ Avg Vol(1-hour)`	Participation change
Flow Continuity Score	`COUNT(same-sign CVD) ÷ 15`	Regime stability
Aggressor Regime	`IF Buy Vol Share >55%: 'Buy', <45%: 'Sell', ELSE: 'Neutral'`	Regime classification
Large Trade Frequency	`Large Trades ÷ Total Trades`	Institutional activity
Buy/Sell Trade Ratio	`Buy Trade Count ÷ Sell Trade Count`	Participation skew
Volume-Weighted Delta	`SUM(CVD × Volume) ÷ SUM(Volume)`	Capital-adjusted flow
Execution Urgency Index	`(Trade Velocity × Avg Trade Size) ÷ Historical Avg`	Speed + size composite

Metric	Formula	Purpose
Delta Momentum Divergence	`Sign(CVD) ≠ Sign(Price Change)`	Flow vs price disconnect
Avg Notional per Trade	`Total Notional ÷ Total Trades`	Capital quality
Notional Velocity	`Total Notional ÷ 15`	Capital flow speed ($/min)

Threshold: Urgency Index >1.5 = Elevated pressure

◆ 1-HOUR AGGTRADE — FLOW REGIME

Layer: Session Control
Objective: Who controlled the hour?
Lookback: 60 min rolling

Metric	Formula	Purpose
Net Aggressive Volume	`Buy Vol - Sell Vol (60-min)`	Hourly dominance
Dominant Side Control	`MAX(Buy %, Sell %) - 50%`	Control strength (%)
Participation Imbalance	`|Buy Trade Count - Sell Trade Count| ÷ Total Trades`	Buyer vs seller
Flow Persistence Score	`COUNT(consistent CVD sign in 15-min) ÷ 4`	Trend durability
Avg Trade Size	`Total Volume ÷ Total Trades`	Participant profile
Buy/Sell Volume Ratio	`Buy Vol ÷ Sell Vol`	Control strength
Delta Std Deviation	`σ(CVD per 5-min)`	Flow volatility
Aggressive Volume Rate	`Total Volume ÷ 60`	Liquidity stress (units/min)
Hourly VWAP	`Total Notional ÷ Total Volume`	Fair value benchmark
Notional Flow Ratio	`Buy Notional ÷ Sell Notional`	Capital skew
Hour-over-Hour Delta Acceleration	`CVD(current hour) - CVD(prev hour)`	Regime change
Execution Concentration Index	`Herfindahl Index of volume per 5-min`	Liquidity focus

Calculation: `HHI = SUM((Vol_i ÷ Total Vol)²)` where i = each 5-min period

Interpretation: HHI >0.2 = Concentrated, <0.1 = Distributed

◆ 4-HOUR AGGTRADE — POSITIONING FLOW

Layer: Risk & Exposure
Objective: Position build-up / distribution
Lookback: 4 hours rolling

Metric	Formula	Purpose
Long-Duration Delta Bias	`SUM(CVD, 4-hour) ÷ 4-hour Total Vol`	Position direction
Flow Stability Index	`1 - CV(hourly CVD)`	Position confidence
Cumulative Aggressor Ratio	`4-hour Buy Vol ÷ 4-hour Total Vol`	Side control
Delta Trend Slope	`Linear regression(hourly CVD)`	Strength of build-up
Trade Size Consistency	`1 - CV(hourly avg trade size)`	Institutional behavior
Regime Shift Count	`COUNT(Aggressor Regime changes)`	Structural change
Net Flow Magnitude	`|4-hour CVD|`	Exposure scale
Persistent Flow Strength	`% hours with same CVD sign`	Holding conviction
Volume CV	`σ(hourly vol) ÷ μ(hourly vol)`	Participation regularity
Buy/Sell Dominance Duration	`Longest consecutive hours same side`	Control persistence
Notional Flow Trend	`Regression slope(hourly notional)`	Capital migration
Large Trade Clustering	`σ(large trade inter-arrival time)`	Smart money coordination
Directional Conviction Score	`(|CVD| ÷ Total Vol) × Flow Persistence`	Risk signal composite

◆ 1-DAY AGGTRADE — MACRO EXECUTION FLOW

Layer: Daily Capital Allocation
Objective: Institutional capital direction
Lookback: 24 hours (session)

Metric	Formula	Purpose
Daily Net Aggressive Flow	`Daily Buy Vol - Daily Sell Vol`	Capital bias
Buy/Sell Side Dominance	`Daily Buy Vol ÷ Daily Sell Vol`	Control ratio
Hourly Volume Profile	`Distribution of volume across 24 hours`	Timing behavior
Daily Trade Count	`Total trades in 24h`	Market participation
Daily VWAP	`Daily Notional ÷ Daily Volume`	Benchmark price
Flow Direction Consistency	`% hours with same CVD sign`	Signal quality
Large Trade Dominance	`Large Trade Vol ÷ Total Vol`	Institutional impact
Avg Hourly Delta	`AVG(hourly CVD)`	Pressure stability
Peak Volume Hour	`Hour with MAX(volume)`	Liquidity window
Delta Volatility	`σ(hourly CVD) ÷ μ(|hourly CVD|)`	Flow risk
Daily Aggressor Regime	`IF Buy Vol >52%: 'Accumulation', <48%: 'Distribution', ELSE: 'Neutral'`	Capital regime
Volume Concentration Score	`Gini coefficient of hourly volume`	Liquidity focus
Daily Trade Size Avg	`Daily Vol ÷ Daily Trades`	Player profile
Notional Dominance Ratio	`Buy Notional ÷ Sell Notional`	Capital skew
Flow Momentum Score	`(CVD Day T - CVD Day T-1) ÷ σ(7-day CVD)`	Acceleration
Execution Pattern Consistency	`Correlation(today's hourly profile, 7-day avg profile)`	Reliability
Daily Flow Quality Index	`Weighted composite: 0.4×Consistency + 0.3×Magnitude + 0.3×Stability`	MIS summary KPI
Relative Volume vs 7D Avg	`(Today Vol - 7D Avg Vol) ÷ 7D Avg Vol`	Abnormal activity

Alert Threshold: Relative Volume >100% = Spike, <-50% = Drought

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🟢 PART-2: OHLC INDICATORS (Price, Volatility & Risk)

OHLC Data Definition

Source: Aggregated candle data (Open, High, Low, Close, Volume)
Characteristics: Derived indicators — not execution truth
Purpose: Structure, trend, volatility, risk context

◆ 1-MINUTE OHLC — MICRO PRICE REACTION

Objective: Immediate price response to execution flow

Indicator	Formula	Purpose
Log Returns	`ln(Close / Close_prev)`	Micro movement
High-Low Range %	`(High – Low) ÷ Close × 100`	Intrabar noise
Micro Volatility	`σ(log returns, 20 bars)`	Price instability
EMA 9 / 21	`EMA(Close, 9), EMA(Close, 21)`	Ultra-short trend
Session VWAP	`Cumulative(Price × Volume) ÷ Cumulative(Volume)`	Fair price anchor
VWAP Deviation	`(Close – VWAP) ÷ VWAP × 100`	Over/under extension
Candle Efficiency Ratio	`|Close – Open| ÷ (High – Low)`	Trend vs noise
Noise Index	`1 – Efficiency Ratio`	Market disorder

Alert: VWAP Deviation >±1% = Extreme

◆ 5-MINUTE OHLC — SHORT-TERM STRUCTURE

Objective: Intraday tactical structure

Indicator	Formula	Purpose
ATR(14)	`Average True Range, 14 periods`	Risk expansion

Indicator	Formula	Purpose
EMA 20 / 50	`EMA(Close, 20), EMA(Close, 50)`	Short structure
Bollinger Bands (20,2)	`SMA(20) ± 2σ(20)`	Volatility envelope
RSI(14)	`100 − [100 ÷ (1 + RS)]` where `RS = Avg Gain ÷ Avg Loss`	Momentum
Range Expansion	`ATR(current) ÷ ATR(prev) − 1`	Breakout prep
Volatility Spike	`IF ATR >1.5× 20-period avg`	Shock detection
VWAP Deviation Bands	`VWAP ± [α × σ(Price − VWAP)]`	Mean reversion zones

Thresholds: RSI >70 = Overbought, <30 = Oversold

◆ 15-MINUTE OHLC — INTRADAY BIAS

Objective: Session directional bias

Indicator	Formula	Purpose
EMA 20 / 50	`EMA(Close, 20), EMA(Close, 50)`	Bias direction
SMA 50	`SMA(Close, 50)`	Trend filter
ATR(14)	`ATR, 14 periods`	Intraday risk measure
BB Width	`(Upper BB − Lower BB) ÷ SMA`	Compression/expansion
RSI(14)	`Standard RSI`	Momentum state
Price Acceptance	`% time spent in value area (±1σ from VWAP)`	Fair value zone
Trend Efficiency	`|Close − Open(session)| ÷ SUM(|bar movements|)`	Direction quality

◆ 1-HOUR OHLC — MARKET STRUCTURE

Objective: Structural levels and momentum shifts

Indicator	Formula	Purpose
SMA 20 / 50 / 100	`Simple Moving Averages`	Structure hierarchy

Indicator	Formula	Purpose
EMA 20 / 50	Exponential Moving Averages	Responsive structure
MACD(12,26,9)	EMA(12) - EMA(26), Signal: EMA(9 of MACD)	Momentum shift
ADX(14)	Trend strength indicator (0-100)	Trend strength
Bollinger Bands (20,2)	SMA(20) ± 2σ	Volatility bands
Hourly Volatility	σ(log returns, 24 periods)	Risk measure
Trend Stability Index	R²(linear regression, 20 bars)	Trend reliability
Breakout/Fakeout Detection	IF High >prev resistance BUT Close <resistance: 'Fakeout'	Trap detection

Thresholds: ADX >25 = Trending, <20 = Ranging

◆ 4-HOUR OHLC — REGIME & SWING RISK

Objective: Market regime and swing position risk

Indicator	Formula	Purpose
SMA 50 / 100 / 200	Long-term moving averages	Regime structure
EMA 50 / 100 / 200	Long-term EMAs	Dynamic regime
ADX(14) HTF	Higher timeframe ADX	Regime strength
Volatility Regime	IF σ >μ(σ): 'High Vol', ELSE: 'Low Vol'	Risk mode
Drawdown from Swing High	(Swing High - Current) ÷ Swing High × 100	Risk exposure
Trend Continuity	% bars above/below key MA	Holding confidence
Support / Resistance Levels	Pivot points, swing highs/lows, volume profile POC	Structure levels
Breakout Confirmation	Volume >1.5× avg AND Close beyond level	Validation

Swing High: Highest high in last 20 4-hour bars

◆ 1-DAY OHLC — RISK & MIS BACKBONE

Objective: Portfolio risk monitoring and performance attribution

Indicator	Formula	Purpose
Daily Returns	`(Close − Close_prev) ÷ Close_prev × 100`	Daily performance
Rolling Volatility (20D)	`σ(daily returns, 20 days) × √252`	Annualized risk
Max Drawdown	`MAX((Peak − Trough) ÷ Peak)`	Worst capital loss
Ex-Post Sharpe Ratio	`(Avg Return − Risk Free) ÷ σ(returns)`	Risk-adjusted return
Ex-Post Sortino Ratio	`(Avg Return − Risk Free) ÷ Downside Deviation`	Downside risk-adjusted
Beta vs Benchmark	`Cov(Asset, Benchmark) ÷ Var(Benchmark)`	Systematic risk
Correlation Matrix	`Pearson correlation with other assets`	Diversification check
Trend Persistence	`% days in same regime (bull/bear/neutral)`	Regime stability
Time Under Water	`Days since last equity high`	Recovery duration
Value at Risk (95%)	`5th percentile of return distribution`	Tail risk (1-day)
Conditional VaR (95%)	`Avg return below VaR threshold`	Expected tail loss
Ulcer Index	`√(Σ(DD²) ÷ n)` where DD = drawdown %	Drawdown depth & duration
Calmar Ratio	`CAGR ÷ Max Drawdown`	Return/risk efficiency

Downside Deviation: `√[Σ(min(return − MAR, 0)²) ÷ n]` , MAR = Minimum Acceptable Return (typically 0%)

◆ HOLDING-PERIOD OHLC — INVESTOR LAYER

Objective: Position-level performance and risk

Indicator	Formula	Purpose

Indicator	Formula	Purpose
Absolute P&L	`(Exit Price - Entry Price) × Position Size`	Outcome
Holding Period Return	`(Exit - Entry) ÷ Entry × 100`	Performance %
CAGR	`[(Exit ÷ Entry)^(365 ÷ Days)] - 1 × 100`	Annualized growth
Realized P&L	`P&L on closed positions`	Locked gains/losses
Unrealized P&L	`P&L on open positions`	Mark-to-market
Holding Drawdown	`MAX drawdown during hold period`	Risk endured
Risk-Adjusted Return	`HPR ÷ Holding Volatility`	Quality of return
Recovery Time	`Days to recover from max DD`	Resilience
Win Rate	`Winning Trades ÷ Total Trades`	Success frequency
Profit Factor	`Gross Profit ÷ Gross Loss`	Efficiency

🔵 PART-3: CROSS-TIMEFRAME CONFLUENCE & ALERTS

Confluence Rules for Trade Signals

Strong Buy Confluence (5+ criteria):

1. 1-min CVD >+2σ
2. 5-min Aggressor Ratio >0.65
3. 15-min Net Delta Trend >0 for 3 consecutive periods
4. 1-hour Flow Persistence Score >0.75
5. 15-min Close >EMA(20) AND EMA(20)>EMA(50)
6. 1-hour ADX >25 AND +DI >−DI
7. RSI(14) on 5-min: 40-70 (not overbought)

Strong Sell Confluence (inverse):

1. 1-min CVD <−2σ
2. 5-min Aggressor Ratio <0.35
3. 15-min Net Delta Trend <0 for 3 consecutive periods
4. 1-hour Flow Persistence Score >0.75 (bearish)

5. 15-min Close <EMA(20) AND EMA(20) <EMA(50)
6. 1-hour ADX >25 AND –DI >+DI
7. RSI(14) on 5-min: 30-60 (not oversold)

Divergence Warning:

- Price making higher highs BUT CVD making lower highs = Bearish divergence
- Price making lower lows BUT CVD making higher lows = Bullish divergence

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🟡 PART-4: MIS DASHBOARD ALERTS & THRESHOLDS

Real-Time Alert Framework

Alert Type	Condition	Priority	Action
Toxic Flow	Trade Imbalance Toxicity >0.8	🔴 Critical	Review execution, widen spreads
Whale Activity	Large Trade Vol Share >40%	🟠 High	Monitor price impact
Liquidity Stress	Trade Arrival Rate >2× hourly avg	🟠 High	Assess slippage risk
Regime Shift	4-hour Regime Shift Count >3	🟡 Medium	Re-evaluate bias
Volatility Spike	ATR >1.5× 20-period avg	🟡 Medium	Adjust stop-loss
Volume Anomaly	Relative Volume >+100% or <–50%	🟡 Medium	Investigate catalyst
Risk Breach	Daily VaR exceeded	🔴 Critical	Reduce exposure
Drawdown Alert	Position DD >–10%	🟠 High	Review thesis
Divergence Signal	Price/CVD divergence confirmed	🟡 Medium	Potential reversal

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📊 PART-5: DATA QUALITY & PREPROCESSING

Minimum Data Requirements

AggTrade:

- Fields: `timestamp, price, quantity, side (buy/sell), trade_id`

- Frequency: Tick-level (every trade)
- Latency: <100ms for real-time
- Completeness: >99.5% (gaps handled via interpolation)

OHLC:

- Fields: `timestamp, open, high, low, close, volume`
- Frequency: 1m, 5m, 15m, 1h, 4h, 1D
- Source: Aggregated from AggTrade or exchange candles
- Validation: `High ≥ max(Open, Close)`, `Low ≤ min(Open, Close)`

Preprocessing Steps

1. **Timestamp Normalization:** Convert all to UTC, align to period boundaries
2. **Wash Trade Filter:** Remove trades where buyer = seller (if detectable)
3. **Outlier Handling:** Flag trades >5σ from rolling mean price
4. **Minimum Notional:** Exclude trades <$100 to reduce noise
5. **Gap Filling:** Forward-fill missing 1-min candles (max 5-min gap)
6. **Volume Correction:** Remove exchange-reported test trades

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🎯 PART-6: IMPLEMENTATION PRIORITIES

Phase 1: Foundation (Week 1-2)

- ✅ AggTrade ingestion pipeline (1m, 5m, 15m)
- ✅ Core CVD, Aggressor Ratio, VWAP calculations
- ✅ Basic OHLC indicators (EMA, RSI, ATR)
- ✅ Real-time dashboard: 1m, 5m, 15m metrics

Phase 2: Risk Layer (Week 3-4)

- ✅ 1h, 4h, 1D AggTrade aggregations
- ✅ VaR, CVaR, Sharpe, Sortino calculations
- ✅ Alert system for toxic flow, whale activity
- ✅ Position-level P&L tracking

Phase 3: Intelligence (Week 5-6)

- ✅ Regime detection algorithms
- ✅ Cross-timeframe confluence scoring

- ✅ Flow quality index composite
- ✅ Divergence detection module

Phase 4: Optimization (Week 7-8)

- ✅ ML-based threshold tuning
- ✅ Backtesting framework for alerts
- ✅ Performance attribution engine
- ✅ Automated reporting

📖 GLOSSARY

CVD (Cumulative Volume Delta): Running sum of (Buy Volume – Sell Volume)

Aggressor Side: The party that "took" liquidity (market order)

Notional: Dollar value = Price × Quantity

Toxicity: Measure of adverse selection risk in order flow

VWAP: Volume-Weighted Average Price

ATR: Average True Range (volatility measure)

ADX: Average Directional Index (trend strength)

P95: 95th percentile

HHI: Herfindahl–Hirschman Index (concentration measure)

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