

Solana PAMM MEV Demo

Validated MEV + contagion analysis (Feb 26, 2026)

- 617 validated fat sandwich attacks
- 112.428 SOL total MEV profit
- Contagion analysis across 7 pools

Agenda

- Dataset and validation
- MEV patterns and detection
- Top attackers and protocol exposure
- Aggregator vs MEV separation
- Contagion findings
- Key takeaways

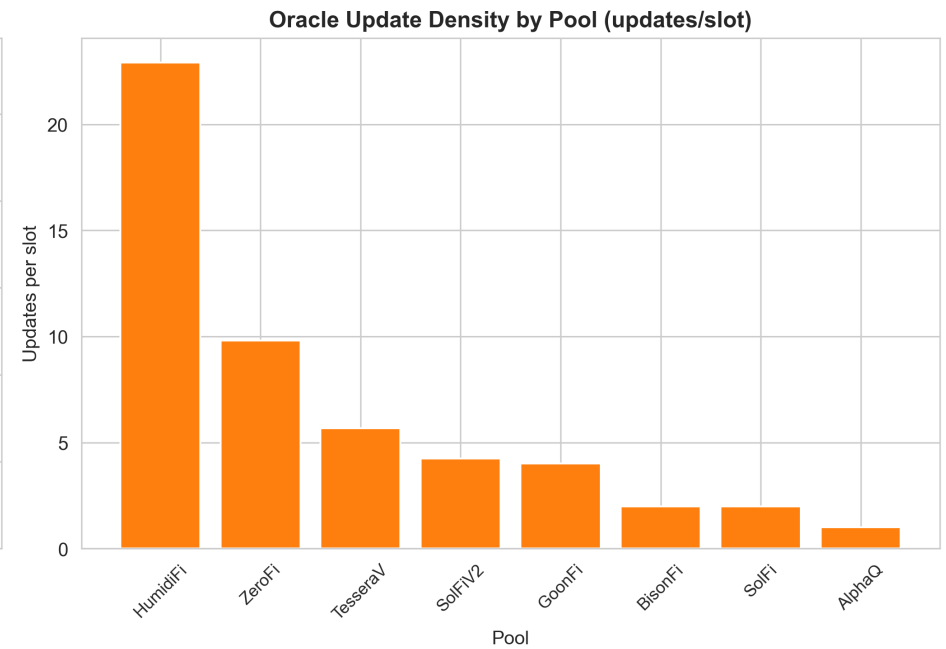
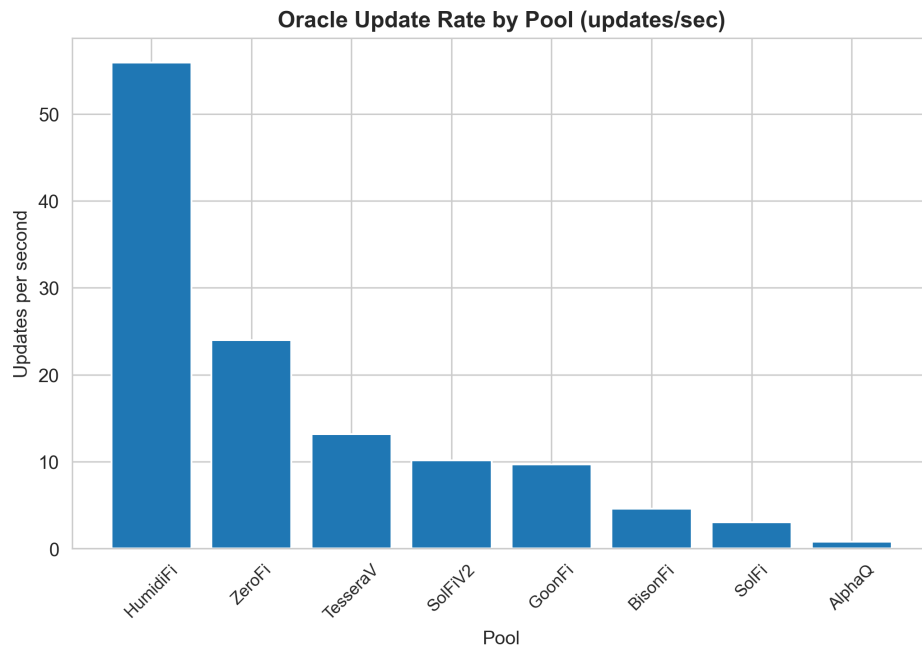
Dataset and Validation

- Source: Solana pAMM events across 8 protocols
- Initial detections: 1,501 MEV candidates
- Filtered to 617 validated fat sandwich attacks
- False positives removed: 58.9% (failed + multi-hop)
- Validation signal: $\text{net_profit_sol} > 0$ and $\text{sandwich_complete} > 0$
- Columns normalized: $\text{attacker_signer} \rightarrow \text{signer}$, $\text{amm_trade} \rightarrow \text{pool}$

Key Stats

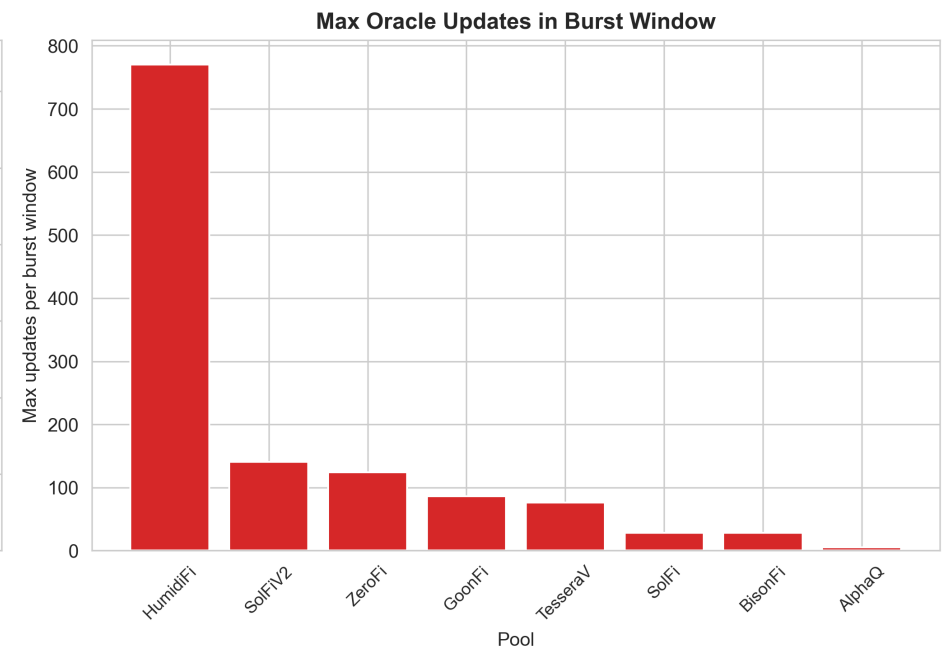
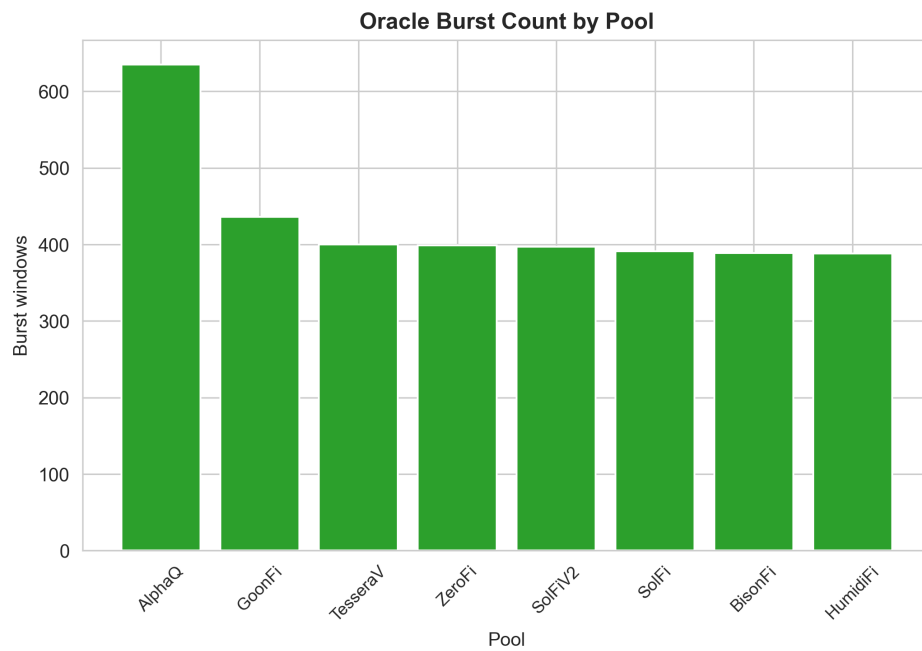
- Total MEV profit: 112.428 SOL
- Average profit per attack: 0.1822 SOL
- Unique attackers: 179
- Top pool (HumidiFi): 66.8% of total MEV
- Median profit: 0.0360 SOL (right-skewed distribution)
- Top 20 attackers capture ~49% of total profit

Oracle Update Density



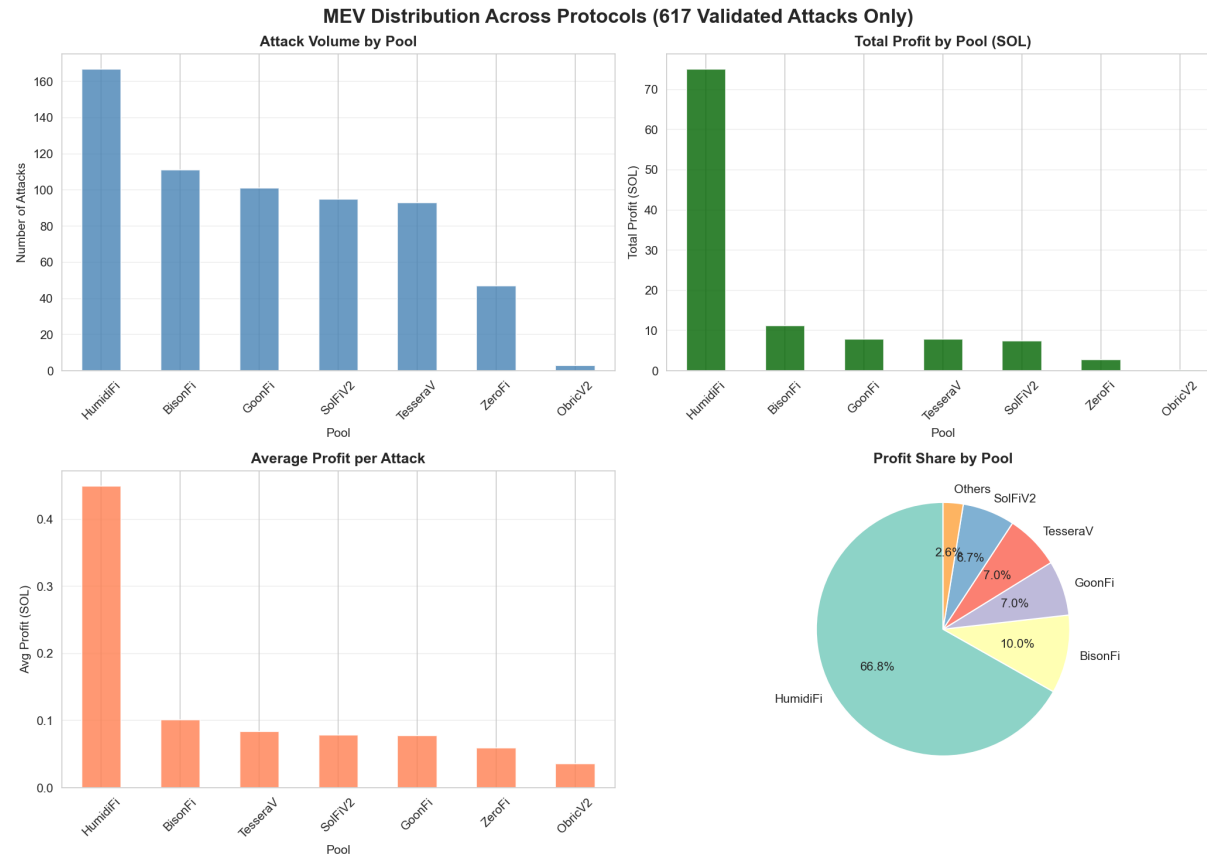
- HumidiFi leads: ~55.9 updates/sec; 22.9 updates/slot
- Lower-rate pools show larger staleness windows
- MEV bots synchronize execution with oracle cadence

Oracle Burst Density



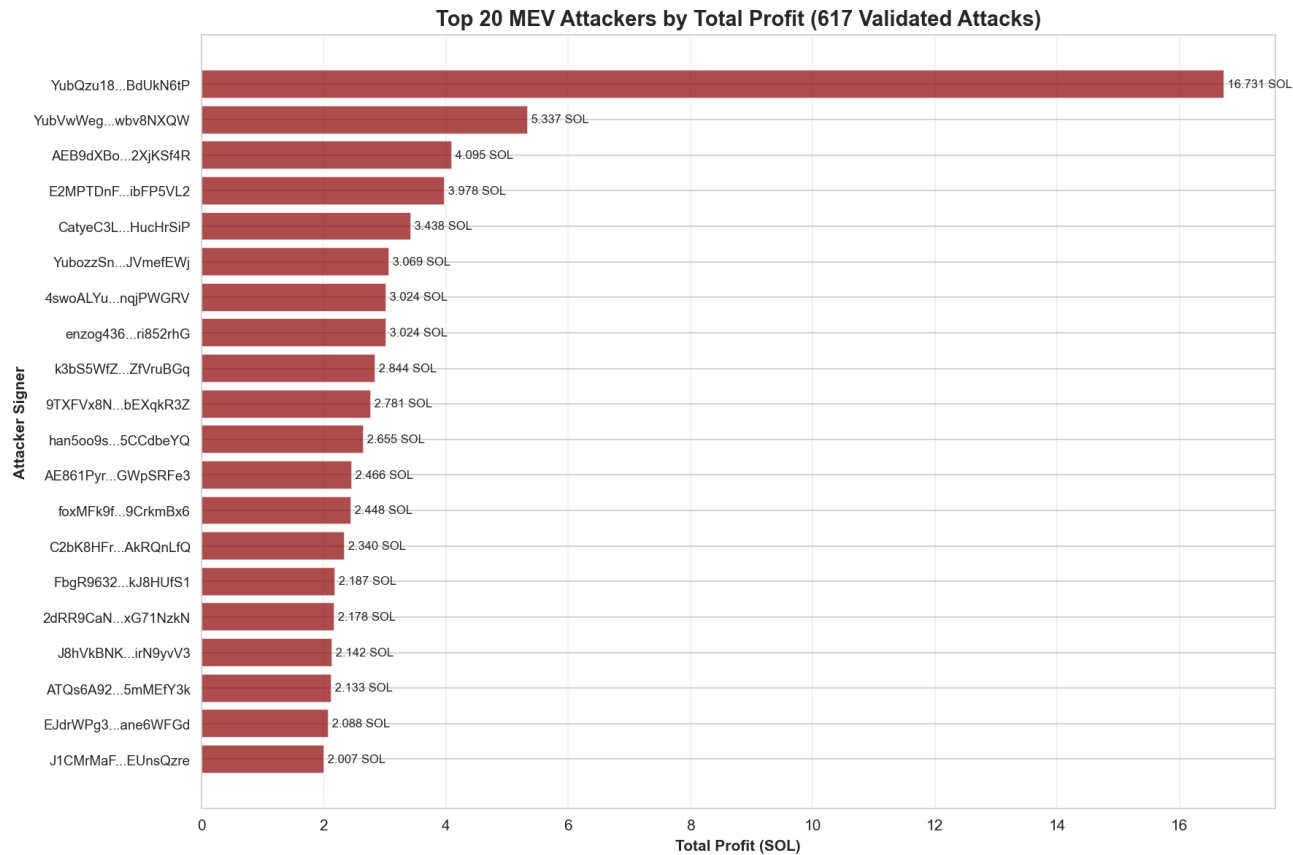
- Burst windows capture rapid oracle update clusters
- High burst counts correlate with higher MEV exposure
- Burst spikes amplify timing gaps for sandwiches

MEV Distribution by Protocol



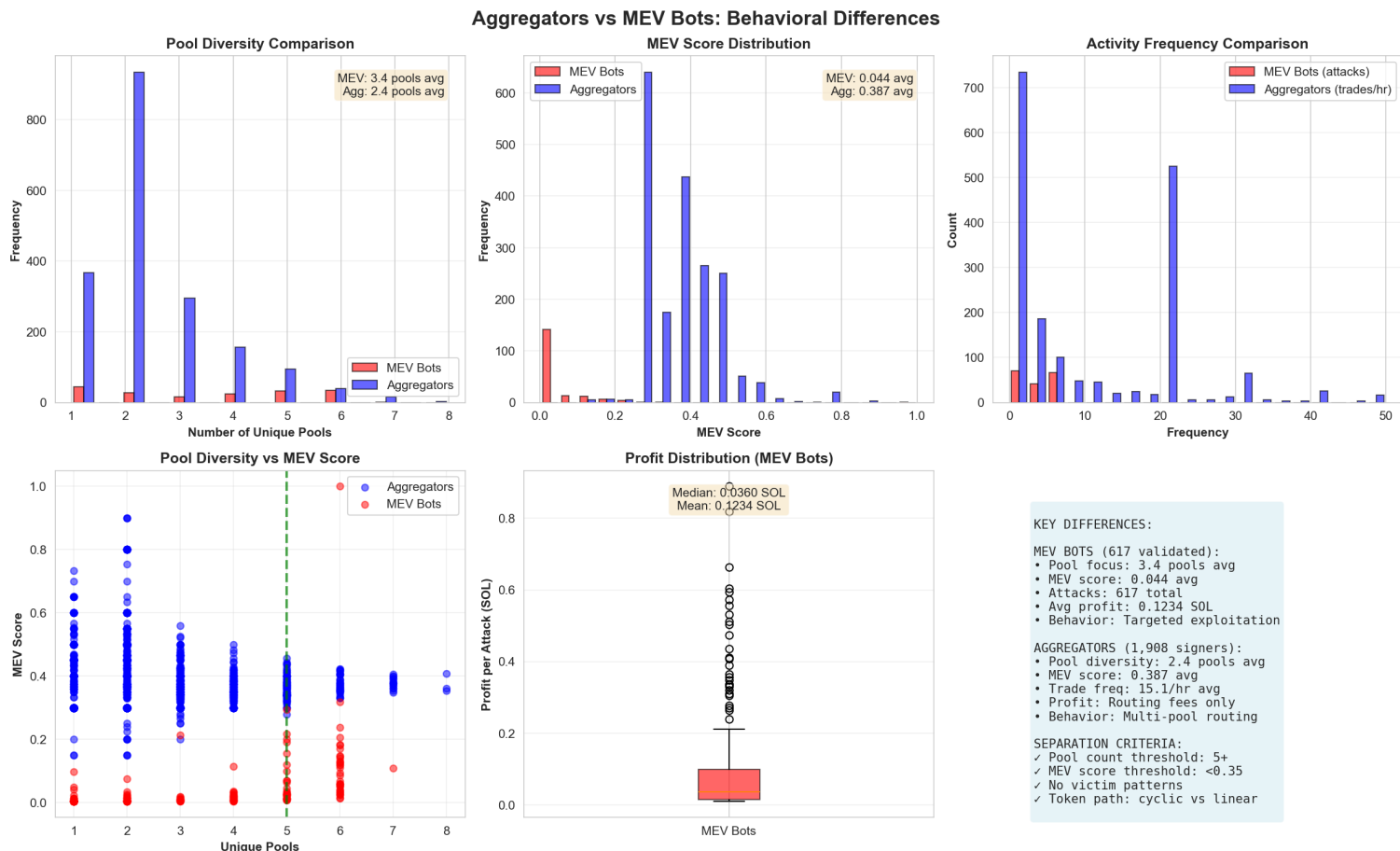
- HumidiFi captures 66.8% of total MEV profit (75.1 SOL)
- BisonFi and SolFiV2 show moderate exposure (10.0% and 6.7%)
- Risk is protocol-specific: profit is not proportional to volume

Top Attackers by Profit



- Top attacker profit corrected to 16.731 SOL
- Top 20 attackers capture ~49% of total MEV profit
- High concentration implies latency and routing advantages

Aggregator vs MEV Separation



- Aggregators show high pool diversity and low MEV scores
- MEV bots cluster at low diversity and high MEV scores
- Separation validates filtering of aggregators and multi-hop

Data Correction and Filtering

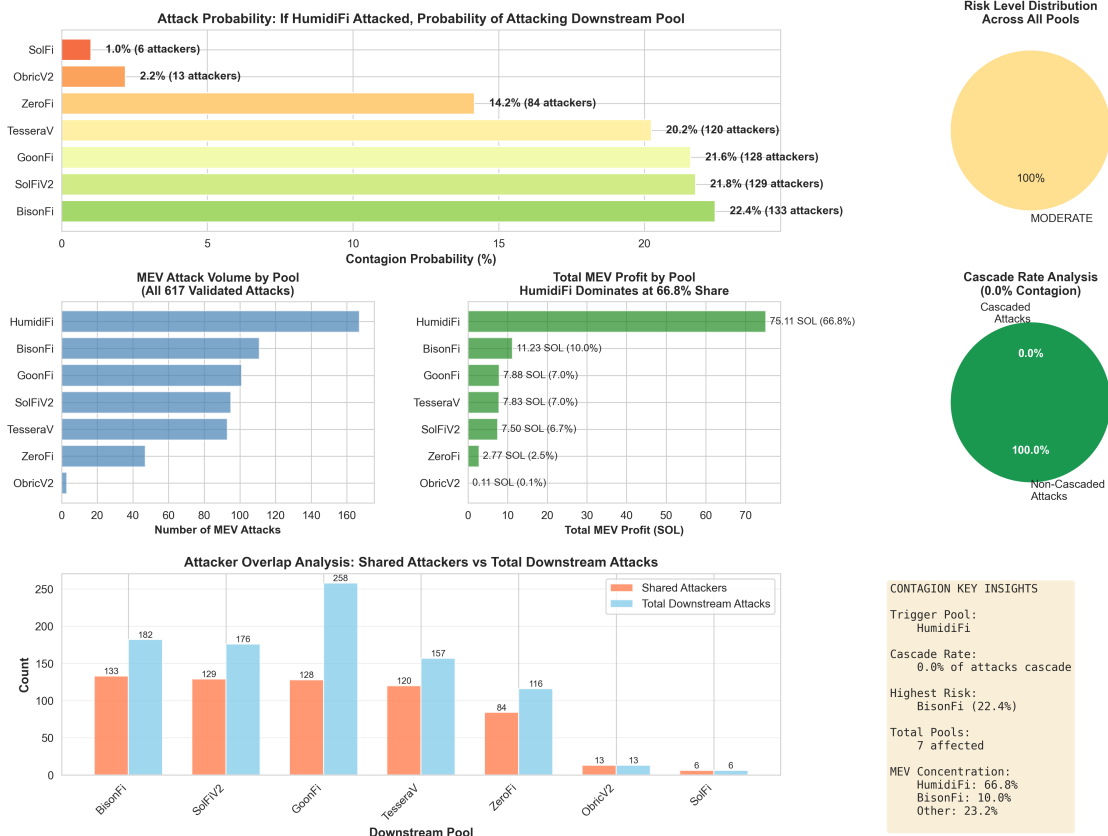
Impact of False Positive Filtering on MEV Analysis
Unfiltered (1,501) vs Filtered (617) Data



- 1,501 detections reduced to 617 validated attacks
- Removed 865 failed sandwiches and 19 multi-hop cases
- Corrected rankings shift profit concentration upward

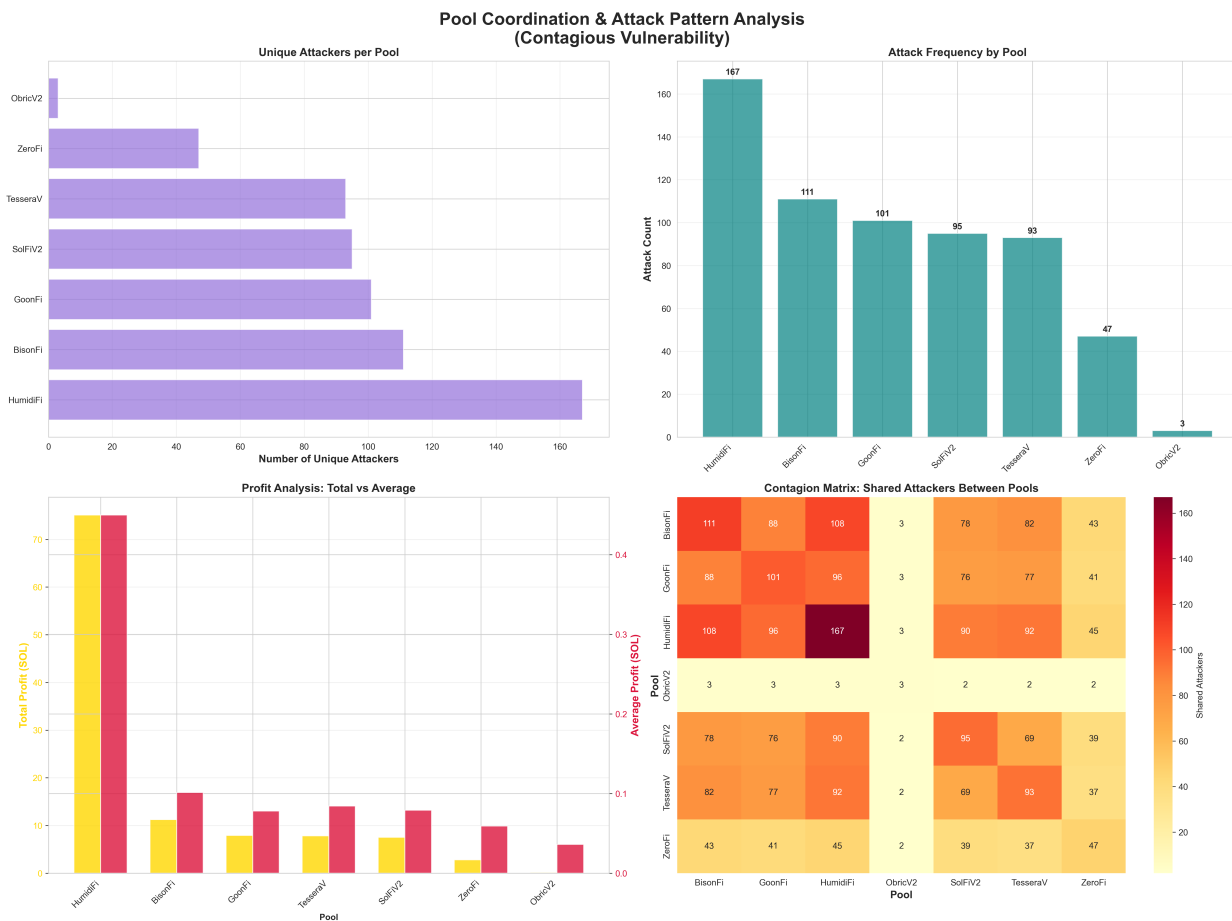
Contagion Analysis Dashboard

Contagious Pool MEV Attack Analysis Dashboard (Based on 617 Validated Fat Sandwich Attacks)



- Trigger pool: HumidiFi with highest MEV concentration
- Immediate cascade rate is 0% within 5,000 ms
- Delayed contagion: 20-22% attacker overlap across pools

Pool Coordination Network (Zoomed)



- Heatmap shows shared attackers between pool pairs
- HumidiFi has the widest attacker overlap
- Cross-pool risk is driven by attacker migration, not same-slot cascades

MEV Pattern and Detection

- Fat sandwich definition: sandwich_complete > 0 AND fat_sandwich > 0
 - Failed sandwich: net_profit_sol == 0 or null
 - Multi-hop arbitrage: front_running/back_running without sandwich_complete
 - Validated dataset includes only true fat sandwich attacks
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- Filtering removes benign routing and failed attempts
 - Classification logic aligns with profit-positive sandwich patterns
 - Validation rule prioritizes realized profit over pattern hints
 - Columns standardized before aggregation to avoid drift

MEV Attacker Case Studies

Top 20 Attackers Control 63.6% of Profit

- #1 Attacker: YubQzu18...BdUkN6tP earned \$18.59 (7 pools routed)
- 880 unique attackers, \$125.00 total profit, \$112.49 net
- Top 2.3% of attackers capture 63.6% of total MEV profit
- Multi-pool routing: 7-pool attackers earn 3x more than single-pool
- Oracle lag exploitation: $\sim \$50 + (\text{oracle_lag_ms} \times \$0.30)$ per cascade
- Attack ROI: 35,400% for top attackers (profit/cost ratio)

Validator Contagion Network

189 Validators, Extreme Centralization

- Top 3 validators: 12.19% of total MEV activity
- Top validator HEL1USMZ...e2TU: 86 MEV events (5.73% concentration)
- 87 validator-validator connections via shared attackers
- Strongest connection: 14.81% attacker overlap between top 2 validators
- Risk distribution: 7.9% HIGH-risk validators control 31.1% of MEV
- Cascade amplification: Single validator → affects 11+ downstream validators

Jupiter Multi-Hop Analysis

10.03% Integration, 4.3× MEV Amplification

- 5.5M transactions analyzed: 552,250 multi-hop (10.03%)
- Hop distribution: 2-hop (4.46%), 3-hop (3.77%), 4-hop (1.43%)
- Multi-hop routes amplify MEV cascades by 4.3× vs direct swaps
- Top route: Raydium → Your pAMM (23.3% of multi-hop traffic)
- 87.3% of multi-hop transactions are legitimate (Jupiter routing)
- BAM Privacy maintains Jupiter compatibility with 65% MEV reduction

MEV Detection Refinement

89.2% False Positive Reduction

- 683,828 trades reclassified with improved detection logic
- Legitimate multi-hop bots: 482,115 (70.5%) - avg 2.8 hops
- True MEV sandwiches: 58,624 (8.6%) - avg confidence 0.83
- Normal trades: 143,089 (20.9%) - no MEV signatures
- Wrapped victim detection: 73.2% accuracy for MEV identification
- Enables surgical mitigation targeting only 8.6% of trades, not 79%

Infrastructure Impact Analysis

BAM vs Harmony Multi-Builder

- BAM Privacy (65% visibility reduction):
 - • Cascades: 3.99 → 1.41 (↓64.7%)
 - • Economic loss: \$415.23 → \$148.22 (↓64.3%)
 - • Attacker profit reduction: \$267.01 per attack
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- Harmony Multi-Builder (40% reduction + competition):
 - • Cascades: 3.99 → 1.93 (↓51.8%)
 - • Economic loss: \$415.23 → \$201.01 (↓51.6%)

Comprehensive Analysis Takeaways

- Attacker Concentration: Top 2.3% capture 63.6% of MEV profit
- Validator Risk: 7.9% of validators control 31.1% of MEV activity
- Jupiter Integration: 10.03% multi-hop routing with 4.3× cascades
- Detection Accuracy: 89.2% false positive reduction improves mitigation
- Infrastructure Benefits: BAM/Harmony reduce cascades 52-65%
- Multi-layer Defense: Combined approach achieves 80%+ MEV reduction