Introducing Concentrated CoW AMM: Maximizing Capital Efficiency and Returns for Liquidity Providers

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We are excited to announce the Concentrated CoW AMM, an enhancement of the classic CoW AMM that integrates concentrated liquidity to significantly improve capital efficiency and potential returns for liquidity providers (LPs). This advancement enables LPs familiar with concentrated pools to allocate their capital within specific price ranges where trading activity is highest, optimizing fund utilization while maintaining protection against MEV exploitation.

[Github repository.

](https://github.com/ivanvolov/Concentrated-CoW-AMM/tree/main)

Overview

The classic CoW AMM effectively mitigates Loss-versus-Rebalancing (LVR) by batching trades and executing them at a unified clearing price, safeguarding LPs from arbitrage based on stale prices. However, like traditional AMMs such as Uniswap V2, it distributes liquidity uniformly across the entire price spectrum from zero to infinity. This leads to capital inefficiency, as most trading occurs within a narrow price range—particularly for stable assets.

The Concentrated CoW AMM addresses this inefficiency by allowing LPs to concentrate their liquidity within specified price intervals. For example, in a stablecoin pair like DAI/USDC, an LP can allocate capital exclusively within the $0.99 to $1.01 range, where most trading happens. This approach increases capital efficiency, provides deeper liquidity around the market price, and enhances fee earnings for LPs.

Key Features

- Concentrated Liquidity: Specify upper and lower price bounds (sqrtPriceUpper

and sqrtPriceLower

) to focus your capital where it’s most effective.

- Unified Price Execution: Trades are executed at a unified clearing price through batch auctions, ensuring fairness and efficiency.
- MEV Protection: Continues to safeguard LPs against MEV exploits, maintaining a secure trading environment.
- Enhanced Returns: LPs familiar with concentrated pools can now leverage this model to maximize their returns while benefiting from unified price execution.

Technical Details

- Price Parameters: Utilizes square root prices for sqrtPriceUpper

, sqrtPriceLower

, and sqrtPriceDeposit

to facilitate concentrated liquidity calculations.

- Concentrated Math Library: A new library consolidates mathematical functions related to price, liquidity, and reserve calculations, leveraging proven Uniswap V3 math libraries.
- Order Flow: The AMM generates orders aiming to rebalance towards the reference price from a price oracle. Solvers can use these orders or create custom ones to suit market conditions.
- Post-Trade Hook: After each swap, the postHook function must be called to update the lastSqrtPrice, ensuring accurate liquidity management.

Benefits for the Ecosystem

- Maximized Capital Efficiency: Concentrated liquidity ensures that LPs’ capital is effectively utilized where trading activity is highest.
- Increased Fee Earnings: Deeper liquidity around the market price attracts more trading volume, resulting in higher fees for LPs.
- Improved Market Depth: Traders benefit from reduced slippage and better execution prices, enhancing overall market efficiency.

- Continued MEV Protection: Maintains a fair trading environment by preventing MEV exploits, benefiting all ecosystem participants.

Current Limitations

- Single-User Pools: Currently, liquidity pooling among multiple users is not supported. Each LP must deploy a new AMM instance.
- Single Price Range: Each AMM instance supports only one price range. To cover multiple ranges, deploy separate contracts.
- Oracle Support: At present, only Uniswap V3-based price oracles are implemented, which return square root prices.

Future Developments

- Multi-User Support: Enable multiple LPs to contribute to a single AMM instance, fostering greater liquidity.
- Dynamic Range Adjustments: Allow LPs to adjust price ranges without deploying new contracts.
- Expanded Oracle Integration: Incorporate additional oracles like Balancer and Chainlink etc.

Conclusion

The Concentrated CoW AMM offers a significant improvement in capital efficiency and potential returns for LPs, especially those familiar with concentrated pools. By combining concentrated liquidity with unified price execution and MEV protection, LPs can enhance their earnings while contributing to a more efficient and secure ecosystem.

We invite LPs and developers to engage with the Concentrated CoW AMM, provide feedback, and contribute to its ongoing development.