Sigmadex

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Abstract

This technical light paper explains some of the core components behind the Sigmadex protocol. It covers the proposed midpoint pricing model, Sigma Index concept, token incentive structure and how it differs from current decentralized exchange protocols. It also showcases its several use cases and opportunity in the market to bridge.

Contents

1 Vision

Alternative and Seamless Liquidity Market for Forged Assets

Sigmadex is proposing a creation of a synthetic asset marketplace where tokens tracking the performance of any asset can be created, listed and traded: from BTC, and other cryptocurrencies, to fiat currencies, to stocks and securities, real estate, commodities, art and any basket of any of the assets mentioned above.

Traditional financial markets have to comply with KYC and other regulatory requirements, practically limiting market access to only a small subset ofthe world's population. Sigmadex will allow investors anywhere to have exposure and take positions in any asset, without having to deal with overly complicated paperwork and a lengthy onboarding process, fulfilling the promise of DeFi and distributed ledger technology to, "bank the unbanked."

Sigmadex caters to everyday people and investors, by increasing access and lowering the barrier of entry to the financial markets, while protecting traditional investors from predatory high frequency trading firms and arbitrageurs.

The synthetic tokens issued on Sigmadex will not be collateralized by the asset directly, but instead the tokens will track the price movement of the asset in a transparent and efficient way without relying on external dependencies, such as oracles or external validators, through Sigmadex' dark pool's midpoint pricing algorithm.

Through its dark pool trading and automatic price discovery, Sigmadex Protocol has the potential of becoming a universal worldwide marketplace for any tradable asset, as well as a leading, 24/7, on-chain price discovery mechanism via the Sigma Index.

1.1 Problem Space

There are a number of existing projects on the market that are offering synthetic asset trading to their customers. All these projects suffer from one major problem that none have managed to solve so far: they rely on external third party dependencies to establish current tradable prices, and as a result, these projects require excessive capital deposits, complex trade conflict resolution, and unsustainable artificial incentives to entice market makers to provide liquidity.

There are two conflicting factors that we need to consider as we bring this design to market: the current state of DeFi is not sustainable, and that the demand for synthetic assets is undeniable and growing.

	Sigmadex	CEX	DEX 1.0 (Uniswap, Curve, etc.)
Reliance on External Dependencies	×	✓	✓
Price Discovery Mechanism	Midpoint Pricing	Orderbook	Bonding Curve
KYC Requirement	×	✓	✓
Collateralization	≤ 100%	100%	≥ 100%
Private Trades	✓	×	×
Price Slippage	Low	Medium to High	High

Table 1: Landscape Comparison

Sigmadex intends to solve the aforementioned problems by creating a decentralized exchange with a dark pool based midpoint price discovery mechanism. Just like with Balancer and Uniswap, new pools representing new asset tracker tokens can be created at any time, where every pool could employ different rules determining transaction fees, level of leverage, market maker incentives, margin requirements, and so on.

Our goal is to create a marketplace where any asset can be traded against any other asset in a transparent, truly decentralized way without a need for KYC, or direct link to any traditional asset, or involvement of any traditional bank or custodian institution.

2 Decentralized Dark Pool

Sigmadex is a non-custodial, decentralized, midpoint price matching, dark pool asset exchange.

2.1 What's a Dark Pool?

Dark pools are a type of Alternative Trading System (ATS) that does not publicly display trading orders. Orders in a dark pool are matched within the exchange bid-ask spread without a guarantee of execution. In traditional finance, dark pools allow institutional investors to trade without exposure until after thetrade has been executed and reported.

The liquidity within these pools is called dark pool liquidity, and under natural conditions, adding a dark pool alongside exchanges into the ecosystem concentrates price-relevant information into the exchange and improves price discovery and liquidity.

2.2 Network Actors

Market Makers A market maker (MM) is an individual or an entity that quotes both a buy and a sell price in a financial instrument or asset on an exchange or market, hoping to make a profit on the bid-ask spread or turn.

On Sigmadex, these follow rules apply to market makers:

1. Any customer who is willing to submit both buy and sell orders simultaneously with a spread of less than a present percentage, A (initially set to 0.5%), will be identified as a Market Maker for the current mid-price execution cycle;
2. MM orders will be used to execute customer orders only;
3. MM orders will not be matched with another MMs.

Customers (Market Takers) Most customers or buyers on an exchange are market takers. A market taker is a participant of the exchange, that is agreeing with the current listed prices for the trade, and wishes to fill his or her trade immediately.

On Sigmadex, the following rules apply to customers:

1. Customers will not require KYC onboarding;
2. Anyone with a compatible wallet can execute trades in pools as a customer;
3. Customers will be able to submit their buy and sell orders into these pools continuously, with no market closing;
4. Customers will be able to submit their orders with their desired price:
   (a) This price will determine priority of the order execution in the pool;
   (b) Customers will be able to specify maximum slippage. If they utilize this feature, the transaction would require customers to pay an additional fee.

2.3 Sigmadex Asset Pools

Sigmadex Asset Pools are the central mechanism for buyers and sellers to tradetheir assets or commodities on Sigmadex.

Sigmadex Pools can be created by LPs without the need for any additional KYC or approval process. Sigmadex Pools have the following characteristics:

1. Pool creators will be required to stake a certain amount of SIG tokens (required amount can be adjusted via DAO proposals) to create a new asset pool; these tokens are returned to the original wallet after a preset period of lockup time;
2. All trading will be anonymized, except the following information, which will be public:
   (a) How many pairs of MM orders are submitted for the current midpoint price execution cycle;

(b) Total amount of MM incentive fees available in the current midpoint execution cycle;

(c) Order imbalance: which side (buy or sell) has higher amount of open orders;

3. Every *B* seconds (initially set to every 60 seconds, also known as tick size), the Sigmadex smart contract will calculate the average price for top bid and top offer and use that price as a midpoint execution price;

4. Midpoint Execution Price will be published as Sigmadex Index (Si) which canbe accessed publicly through a Web UI, programmatically through API's,or directly on-chain via the trading pool's smart contract.

Multi-asset Pools and Index Trading Users will be able to create single-asset pools, as well as multi-asset pools for trading on Sigmadex.

Multi-asset pools would trace the price of a basket of assets, similar to how ETF's or indices work in traditional finance.

These pools can contain any number of assets or investments, including cryptocurrencies, commodities, securities, across industries and asset classes, and can follow any number of investment strategies, giving maximum flexibility to buyers and MMs within the Sigmadex ecosystem.

2.4 Order Execution Priority Resolution

Trade orders sent to Sigmadex Pools are executed given the following priority:

1. All collateral call orders will be matched against customers or MMs;

2. Customer buy and sell orders will be matched with other customer orders, if the bid-ask price spread is less than, *C*% (initially set to 0.5%), from the midpoint execution price;

3. The remaining customer orders will be matched with market maker (MM) orders;

4. Remaining customer orders will be left in the pool will be carried over to the next midpoint execution cycle;

5. Remaining MM orders which are not matched will be canceled.

Customers and MMs can cancel their orders at any time prior to the next midpoint execution time.

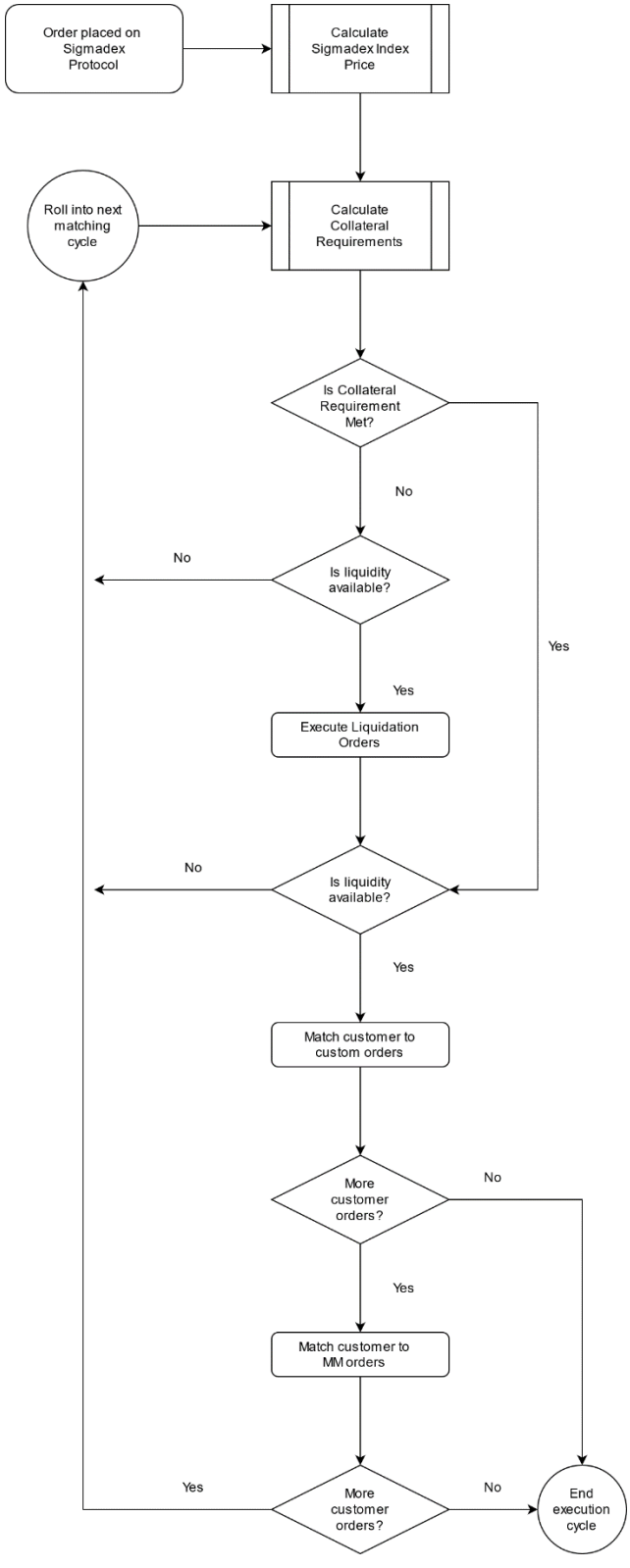

Figure 1: Sigmadex Order Execution Flowchart

2.5 Collateral Requirements

The collateralization model offered by Sigmadex has another benefit that all professional traders would appreciate - collateral requirements will be calculated on the netted bases.

For instance, if a trader buys BTC against USDT and sells ETH against USDT, his exposure to USDT could be negligible and therefore, there would be no collateral requirements for USDT.

Sigmadex will not require over collateralization, or any convoluted and artificial price discovery mechanisms. It will not require an arbitrary dispute resolution process or rely on oracles or any other external third-party dependencies.

Collateralization on Sigmadex will operate under these rules:

1. All customers and MMs will be required to post collateral to submit orders;
2. Customers will be required to post a preset minimum percentage, D (initially set to 100%), of collateral of the notional amount of all buy amounts in the orders;
3. In the case of a collateral call:
   (a) Collateral for all clients will be checked at least once every midpoint execution cycle;
   (b) If at any time collateral falls below a preset percentage, E (initially set to 75%), of notional amount, unless the customer posts additional collateral, the position will be liquidated during the next midpoint execution cycle;
4. Collateral call trades will have the highest priority in the order execution sequence;
5. Anonymous MMs will be required to post the same preset minimum percentage, F (initially set to 100%), collateral of the notional amount of all buy amounts in the orders;
6. Later on, as a governance proposal, MMs meeting certain volume and trading history requirements could qualify for posting a lower percentage of collateral requirements.

2.6 Proposed Fees Schedule

Both buyers and sellers will pay the following fees:

1. Placing order without specifying maximum slippage 0.0%;
2. Placing order with specifying maximum slippage 0.05%;

3. Execution fee 0.2%;
4. Execution fee paid in SIG 0.1%;
5. MM rebates on every transaction 0.05%;
6. Holders of positions in leveraged asset pools will be required to pay an additional leverage fee, ranging 0.00001% to 0.00005% with each midpoint execution cycle. These leverage fees will represent about 5% to 25% annual rate and will vary based on the perceived risk and volatility of the underlying assets.

These initial fee values can be changed as part of the Sigmadex platform governance process.

3 Midpoint Pricing Algorithm

3.1 Midpoint Price Dark Pools

Sigmadex utilizes a blind auction bidding mechanism in its dark pool exchange, and incentivizes participants to bid according to their true price valuation, and periodically matching the closest buy and sell prices at the midpoint execution price.

These types of blind auctions are also known as first-price sealed-bid auctions(FPSBA)[1]. In this type of auction, all bidders simultaneously submit sealed or blind bids so that no bidder knows the bid of any other participant. The highest bidder pays the price that was submitted.

Our implementation of a midpoint price dark pool exhibits the following characteristics:

1. **Bidder Anonymity:** even after the publication of auction results, any customer cannot inform of the identity of the other bids in the pool;
2. **Non-repudiation:** the winning bidder cannot deny that he or she has submitted the highest bid and can accurately obtain the winning identity;
3. **Verifiability:** anyone can publicly verify the validity of the winner and can verify the winning bidder is the first-price bidder in all bidders.
4. **Non-deception:** no one can pretend to be a registered bidder to join in the auction;
5. **Correctness:** the auctioneer should give the correct auction results.

[1] "Secure first-price sealed-bid auction scheme" | SpringerLink | Nov 2017

3.2 Deterministic Index Price and Nash's Equilibrium

In a Sigmadex dark pool bidding process, each buyer is characterized by their internal monetary valuation of the asset or item for sale.

For example, a buyer, Alice, would like to bid the smallest amount that canwin the item, as long as this amount is less than or equal to α, her maximum bid price. Unfortunately, Alice does not know what the other bidders are goingto bid.

On the counter side, a seller, Bob, would like to sell the item for the highest price possible, but he is willing to accept any value that is higher than or equalto, β, his minimum sell price. Bob also does not know what price other sellers are offering for the same item.

Hence, strategically, this situation constitutes a Bayesian Game[2] - a gamein which participants in the game have incomplete information about the other participants.

And because this is a Bayesian Game, there exists the Bayesian Nash Equilibrium[3], which results in a deterministic set of price values given the respective bids from both buyers and sellers, where both the buyers and sellers can satisfy their respective monetary valuations of the items on sale, and achieve a positive payoff.

3.3 Automatic Price Discovery

This innovative design has a number of benefits intended and unintended.

Sigmadex will create the first DEX marketplace where it is as easy to takea short position as a long position; Sigmadex can offer investors the ability to trade leveraged positions. Since any asset can be represented and traded on Sigmadex, when traditional markets such as stocks or commodities markets are closed Sigmadex has the ability to become a natural price discovery mechanism for these assets.

This design allows for definitive price discovery every *B* seconds (initially set to 60 seconds), or per tick. That determination, in turn, makes collateral calculation, collateral call liquidations and dispute resolution straight-forward to implement and achieve. Furthermore, Sigmadex's midpoint execution price could become a de facto definitive price index for specified assets.

Publishing this index will give traders additional confidence in our price discovery mechanism and will create additional revenue generating

[2] "Bayesian Games: Games with Incomplete Information" | Center for the Study of Rationality
[3] "On the Existence of Nash Equilibrium in Bayesian …" | Rutgers University | Jan 2017

opportunities down the line. Unlike Uniswap and other DEX's, Sigmadex will not require an external oracle to publish current prices. Sigmadex midpoint execution price can be the primary price discovery mechanism for any assets it trades, and Sigmadex is naturally suited to offer trading of non-fungible tokens as a result.

3.4 Protection from HFT and Front-running

One factor linked with the rapid rise of dark pool trading is traditional investors' growing demand for alternative venues offering protection from HFT practices. The growth of dark pools followed an increase in the HFT share of total equities trading in the US; the share of trades involving HFT grew from 21% in 2005 to over 50% by 2010, and since then has remained around 15% to 40% of total volume[4].

HFT emerged in recent years as advancements in trading technologies drastically reduced the time for information to travel between venues and participants. HFT relies on the use of algorithms and the superior latency to gather and reactto information on the supply and demand of trades in order books and execute trades more quickly than traditional participants.

These HFT trading strategies such as front-running lead to a higher costof trading and higher expected risk for traditional retail investors. Within this context, the demand for dark pools, which operate similar to blind auctions in terms of pre-trade transparency, has grown.

By not disclosing information about volumes and prices of orders in the order book, and having fixed interval ticks for order crossing, Sigmadex midpoint price dark pool exchange helps to reduce the impact of predatory HFT on traditional retail investors, and reducing unfair advantages obtained through practices suchas front-running.

4 Token Ecosystem and Incentive Structure

4.1 Token Types

Sigmadex Protocol will feature two main types of native tokens to facilitate its midpoint dark pool auction mechanism, and provide a proper incentive structure for MMs and LPs.

Sigmadex Synthetic Tokens Customers will be able to trade any type of asset on Sigmadex, be it cryptocurrencies, traditional financial assets such as stocks, securities, options, commodities like gold and silver, or even real estate assets.

[4] "High Frequency Trading: Evolution and the Future" | Capgemeni

Sigmadex implements a flexible synthetic token system as a cryptographic representation of the underlying assets being traded.

Sigmadex Synthetic Tokens tracking the price of another asset, can be minted by locking the necessary amount of stablecoin tokens or major cryptocurrency such as ETH or wBTC, on the Sigmadex Protocol smart contract.

This allows Sigmadex users to bet on the price of assets without having to own the asset and create any arbitrary level of exposure and desired position on the asset through trading on Sigmadex.

Sigmadex Synthetic Tokens act as perpetual future contracts issued when collaterals are locked up on the Sigmadex smart contract. This allows maximum flexibility with regard to token swaps and allows the best efficiency for token price discovery.

Sigmadex Governance Token Sigmadex also features its own governance token, the SIG token.

SIG will be a utility token, and serves the following purposes:

1. At the consensus level:
    (a) SIG will be required for staking on the Sigmadex parachain and maintaining eligibility as a validator;
    (b) SIG will be paid out to validators for verifying and forging new blocks on the Sigmadex parachain, creating an incentive for users to own and stake SIG tokens;
2. At the protocol level:
    (a) Customers that pay with SIG tokens will enjoy a preset percentage discount (initially set to 50%) on transaction fees;
    (b) MM incentives will be paid in SIG; In addition to the incentives received from the protocol, MMs will receive a portion of the transaction fees paid by the market takers;
    (c) SIG is the governance token of the protocol and will allow holders to vote on proposals involving future developments, rate adjustments, and other issues;
    (d) SIG tokens can be used to post collateral, automatically or manually.

4.2 Market Maker Incentives

To incentivize MM participation in these pools, Sigmadex Protocol will pay all MMs participating in each midpoint execution cycle an incentive fee:

1. Each midpoint execution cycle will distribute a preset amount of SIG tokens (initially set to 1000);

2. Tokens will be distributed based on the total weighted amount of liquidityprovided by each MM;

3. If no MMs participated in one midpoint execution cycle, the incentive fees will accumulate and the next midpoint execution cycle will have double the amount of incentive fees to be distributed;

4. If the second midpoint execution cycle has no liquidity from market makers, the next cycle will see triple the amount of fees, and so on, until the market maker provides liquidity to one of the subsequent cycles.

Sigmadex implements a sustainable incentive structure to LPs and MMs, by hard capping the amount of SIG tokens given out, and dividing up the distribution among the total number of MMs. As the natural volume grows on Sigmadex, MMs will earn a profit from the flow of orders and by clipping the spread, so the need for extra incentive in the form of governance tokens will naturally diminish. Thus, the SIG payout to each MMs will become smaller as volume increases and more MMs become active on the platform.

4.3 Sigmadex Treasury Wallet

The Sigmadex Treasury Wallet is an integral part of the Sigmadex Protocol. Transaction fees collected from participants, net of the distribution of MM incentives, and fees collected from the monetization of Sigmadex Index (See Section 5), net the costs for validators and network participants, will be collected into Sigmadex's Treasury Wallet to serve the following purposes:

1. The funds within the Treasury Wallet are primarily to provide additional collateral for settlement, in the unlikely scenario of any collateral liquidation settlement resulting in a negative collateral balance to the protocol;

2. The risks of negative collateral balance events can be mitigated through requiring a higher percentage of collateral requirement to be met or triggering a collateral call earlier; this can be dynamically adjusted by the protocol depending on the macro trading conditions;

3. Treasury funds could be also be used as a collateral to provide insurance policy on Sigmadex, in case of protocol failures;

4. Through governance proposals, the treasury funds can be lent out to a nominated DeFi platform or a collection of DeFi providers to manage in a decentralized and secure fashion, and provide additional yield and leverage to the protocol.

5 Sigma Index (Si)

5.1 Index Generation

Unlike dark pools in traditional finance that rely on outside exchange for order execution and price discovery, often based on the national best bid and offer (NBBO) spread, and the volume-weighted average price (VWAP)[5], Sigmadex Protocol is self-contained in terms of price discovery and generates price index data at every midpoint execution cycle.

As a byproduct of Sigmadex's Midpoint Pricing Algorithm and implementation of decentralized midpoint dark pool, at each cycle (with initial tick interval set to 60 secs), the smart contract will calculate the midpoint price of the top bid andtop offer in each Sigmadex asset pool, and use that data as the midpoint execution cycle price for that period. All orders submitted for execution in that cycle willbe matched according to that price.

The collection of midpoint execution prices for all Sigmadex Asset Pools with valid bids and offers will be published as Sigmadex Indices which can be accessed publicly through a Web UI, programmatically through Sigmadex API's, or directly on-chain via the trading pool's smart contract.

5.2 Monetization

The Sigma Index can potentially serve as an alternative to existing blockchain oracle services, or can be used as an additional data source for price oracles such as Chainlink.

What are Blockchain Oracles? Blockchain oracles are third-party services that provide smart contracts with external information, and serve as the bridge between blockchains and the real world.

One of the most often used types of oracle-based information is the real-time prices of different assets, such as cryptocurrencies, stocks, commodities, and so on. Sigma Index makes this information openly available, and because the pricing indices on Sigmadex are all tradable data with real assets and capital behind them, therefore the quality of the information is extremely high and reliable, allowing Sigmadex to potentially monetize access to this feed.

Sigma Index (or Si) has the potential to become the gold standard for on-chain price discovery, and one of the first oracle-like services on Polkadot, that can be offered as a service in parallel to Sigmadex's midpoint, dark pool auction services.

[5] "Do Dark Pools Harm Price Discovery?" | MIT | July 2012

There are a number of options for the monetization of the Sigma Index as an oracle-like service:

1. Sigmadex blockchain can request a fee in SIG tokens or major stablecoin currencies for the retrieval of Sigma Index data from external networks such as Ethereum. The price of data access can be set through governance proposals and voted on by Sigmadex stakeholders and ecosystem participants.

   Because Sigmadex Protocol is built on Polkadot, the majority of Layer-1 networks will have interoperability, and can request Sigma Index data access and transfer the necessary fees in one transaction;

2. Sigmadex Protocol can also be an API data provider of Chainlink, the current leader for blockchain oracle services.

   This allows Sigmadex to leverage the existing infrastructure and partnerships created by Chainlink oracle network, and monetize its high-quality price index data without having to directly compete with Chainlink.

6 Summary

Through its decentralized, midpoint price matching, dark pool exchange, and automatic price discovery feed, Sigma Index, Sigmadex Protocol is well positioned to become a fundamental part of blockchain and DeFi infrastructure, and allow investors who cannot easily access traditional markets an open, fair and transparent platform to buy, sell, and trade any kind of assets they desire, as well as offer highly accurate, and reliable price discovery to other protocols and services in the ecosystem.

The internet liberated information, Sigmadex will liberate capital.