qPools: Risk-Adjusted Yields

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Somewhere in the Milky Way

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We aim to build an investment protocol that provides steady returns at low risk. This system will take the assets of the participants (users), put them together in a master pool, and redistribute the total amount into different liquidity pools in Decentralized Exchanges (DEXs). The reallocation algorithm will maximize the reward by taking into account the pairs that provide the best annual percentage yield (APY) while minimizing the price volatility of the respective tokens against stable coins (e.g. those pegged to USD). Thus, we will build a low-risk investment opportunity that is accessible to everyone, provide the best APY, and minimize losses due to price fluctuations in the crypto market. Furthermore, our product aims to solves the liquidity issue in DeFi by unifying different platforms under one master pool and one token. The protocol will be implemented in Solana.

1 Introduction

The growing adoption of blockchain technology opens many new avenues of investment for its participants. Professional investors in the traditional financial system take informed actions by using data-driven decision-making and advanced portfolio optimization techniques to manage the risk of their funds while optimally accumulating yields and interest. These methods have so far been inaccessible to the masses in traditional finance and one would need a high amount of starting capital to gain access to such products.

The advent of decentralized finance (DeFi) has brought with it many new and innovative financial products which are accessible to anyone with an internet connection. At its core, DeFi allows for individuals to be more active members of the financial ecosystem. They can stake their tokens in the network to participate in the consensus and earn some income for making the system move forward, they can provide liquidity to different decentralized exchanges (DEX) and earn transaction fees for enabling trades in the market, and so on. The list of applications keeps growing. While the growing number of platforms and protocols opens new avenues of income and participation for users, risk management and choosing the right investment products are becoming more difficult and even intractable for the average user.

With Quantum Pools (*qPools*), we build a new on-chain protocol for automated asset allocation. We offer risk-adjusted products, enabling the average user to earn passive income at low risk. Not only do we provide the average user, regardless of the size of their funds, to state of the art risk management and portfolio optimization methods previously inaccessible to most people, we also

provide liquidity to the *entire ecosystem,* incentivizing token holders to have their funds be an active part of the market, thereby benefiting the entire chain.

For every deposit made into the pool, we will mint our native token (Quantum Pools Token, QPT) which represents the liquidity in the ecosystem. Through auto-compounding, the value of QPT is expected[1] to rise against SOL over time. We aim for this token to be used in as many applications as possible. For example to be used as collateral or to mint Non-Fungible Tokens (NFTs). With this simple mechanism, users can earn passive income, provide liquidity to the chain and not lose out on new opportunities due to locked-up funds.

1.1 Constant Product Markets

In the Solana ecosystem, there are different types of exchanges. One particular type that has emerged in the recent DeFi adoption stage is the emergence of constant product markets such as Uniswap [1], or Orca [2]. These novel DEXes do not use the typical order-book model, as traditional exchanges do, but compute each token-pair price as the negative gradient of the mathematical expression $x \cdot y = k$, i.e.

$$p = -\frac{\delta y}{\delta x} = \frac{L^2}{x} = \frac{y}{x} \qquad (1)$$

where x and y are the reserves of the two tokens, respectively, L is the defined liquidity in the pool and k is an invariant constant. This expression is also known as the constant product market-making (CPMM) formula. Tokens can then be exchanged for the price p, for as long as the pool possesses a sufficient amount of the two tokens x and y.

1.2 Liquidity Mining

Liquidity Mining consists of providing liquidity to constant product market makers. Let us consider an example with the token-pair SOL-ETH. As of the day of writing, the price of ETH is approx. 3157 USD and the price of SOL is approx. 142 USD. The user who wants to accrue trading fees, also called a Liquidity Provider (LP), is required to provide

both tokens, SOL and ETH, at an equal price ratio. For instance, the LP could provide 1 ETH and 22 SOL and, in return, receive a proportional share of all trading fees. In addition to that, in many DEXs the LP also receives some governance tokens that give them voting rights on decision-making campaigns.

1.3 Concentrated Liquidity

Concentrated liquidity pools allow liquidity providers to specify the lower and upper price range $[p_l, p_u]$ within which liquidity should be provided. The concept was first introduced in Ethereum by Uniswap V3 [1] and is being introduced by Invariant in Solana [3]. Concentrated liquidity pools introduce a set of properties that standard CPMMs do not have:

- **Higher Liquidity Efficiency:** Concentrated liquidity enables providing liquidity at a much higher efficiency ratio. As opposed to the pure constant product markets, liquidity providers must specify a price range $[p_l, p_u]$ for which they are willing to provide liquidity, so that any trade that happens within that range, accruing fees, will benefit them. These trading fees are distributed proportionally among all liquidity providers within that price range. As a positive side-effect, trading fees become much lower, as more liquidity is concentrated within a range for which the maximum slippage is pre-defined.

- **Decrease of Impermanent Loss:** For pure constant product markets, there exists the risk of *impermanent loss.* In the example above, where the pool contains a total of 22 SOL and 1 ETH, a third party may decide to buy 11 SOL in exchange for 0.5 ETH. Assuming that this pool is the only single market in the universe, this would change the price of SOL-ETH by a large margin, and the liquidity providers will only be able to redeem back their assets by accepting this price change. Impermanent loss refers to the concept that the user could have profited more by keeping $44SOL$, instead of splitting his $44SOL$ into $22SOL$ and $1ETH$ (equal market ratio) which was required to provide liquidity. Generally, impermanent loss takes place when the total liquidity provided in the pool is not high enough, when slippage due to large trades occur and the

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[1]Under very volatile market conditions the QPT price may also decrease due to the rebalancing of the distributed assets on the different yield-generating products.
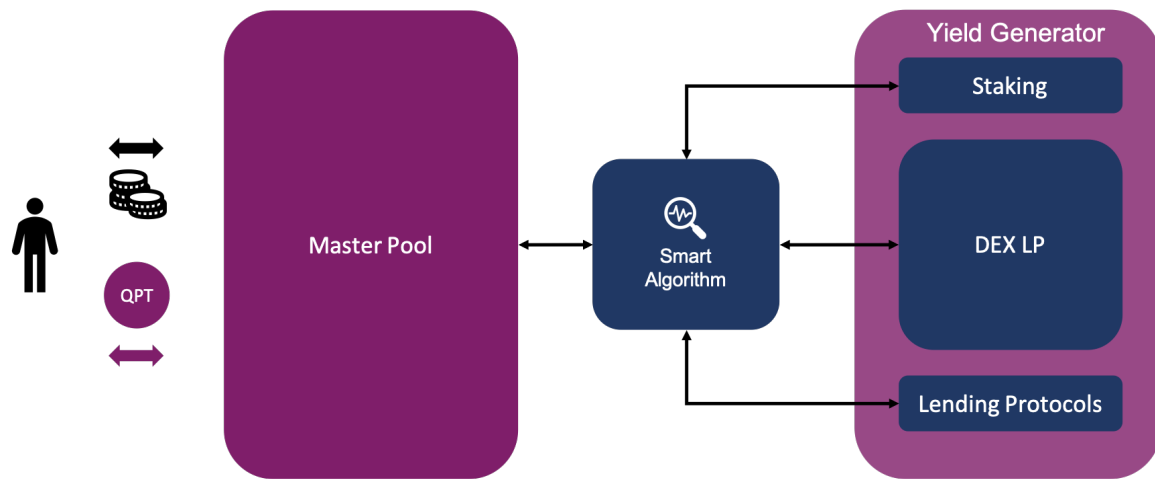
Figure 1: *Brief summary of how qPools works.*

user redeems the provided liquidity prematurely, or when the exchange-price changes significantly. In the case of concentrated liquidity markets, the liquidity providers are required to provide a price range $[p_l, p_u]$ that defines the minimum and maximum token ratio that they agree on, and whenever the price moves below or above that range, no exposure to further impermanent loss takes place.

- **NFTs instead of LP Tokens** Pure constant product markets provide tokens to track the liquidity providers' total share of the pool. These are automatically auto-compounding yields, as the trading fees are consumed into the trading pool. For concentrated liquidity market makers, provisioning LP Tokens, as well as auto-compounding yields, does not make sense, as the users can decide to provide liquidity within an arbitrary range, or set of ranges. Thus, providing liquidity for a range $[p_l^1, p_u^1]$ results in a unique *position*, and therefore, an NFT needs to be mint containing all the details. This NFT can be replaced and/or redeem afterwards.

2 Challenges

Many of the properties described in Section 1 bring challenges to either the liquidity provider, the decentralized exchange, or the traders, such as: mitigating impermanent loss, tracking the number of decentralized exchanges, identifying all pools for each exchange, ordering them by APY, calculating the volatility and fees, and taking into account the non-auto-compounding nature of the concentrated liquidity pools, just to name a few. Even a person familiar with those matters will still find it cumbersome and simply put, too inconvenient to go through the number of steps to consider all these points.

At the same time, there is an increasing interest in deploying capital in products that return high APY, without sacrificing confidence and/or increasing risk too much. Although there are several solutions out there that are focused on maximizing the compound APY, few of those products address the issues of the high volatility of the crypto-markets and risk exposure. Additionally, when providing liquidity the users are forced to lock in their assets or receive hardly usable tokens (for example as collateral), in other protocols, due to the heterogeneous and large number of providers.

On the other hand, a person less familiar with the matters of cryptocurrencies is often drawn away from even understanding concepts such as liquidity mining and how to generate yields using liquidity pools. Many of these products are perceived as too risky due to lack of knowledge or simply because of not identifying correctly where the risk exposure lies. At the same time, traditional banks and financial service providers do not provide satisfying yields, sometimes even for high-risk portfolios. As a consequence, billions of users lose the opportunity of generating passive yields, a privilege that is then limited to a few individuals. Furthermore, due to the few players, many markets face low liquidity and perform sub-optimally, affecting negatively the entire ecosystem.

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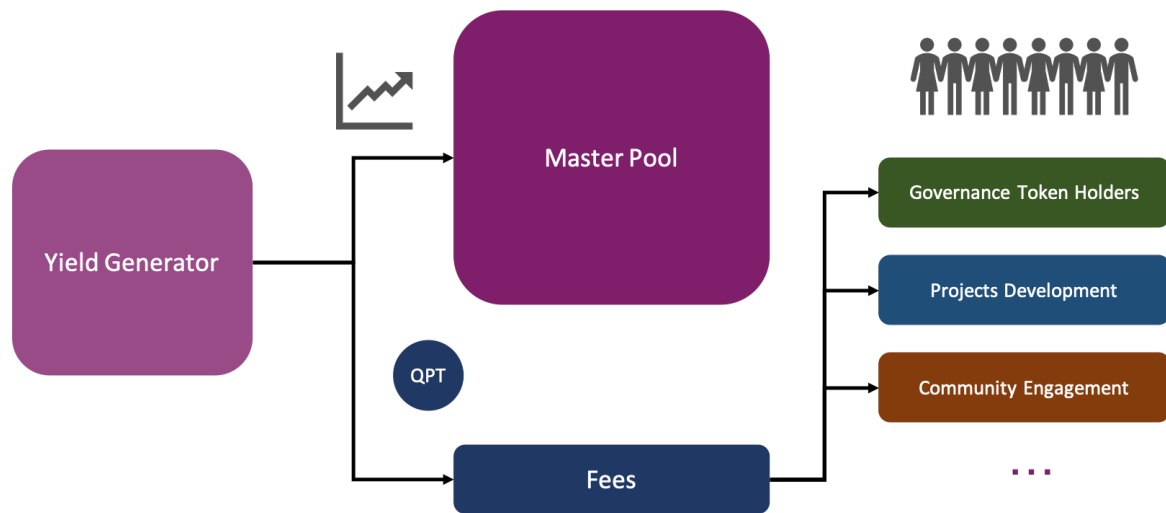
Figure 2: *Fees will be used to develop new products, increase the community engagement, and to reward the governance token holders, who are constantly deciding the direction of the protocol in a decentralized fashion. As the ecosystem grows new venues could also be added and funded by the protocol.*

3 Model Description

Our protocol solves the issues described in the previous section and is made easy to be used by anyone. Our program can automatically choose from a broad range of products to invest the digital assets of the users, optimize for the best yield, and mitigate risk exposure. Our users will receive our native token QPT in return for staking SOL in our master pool. The price of this token will be linked to the number of circulating tokens divided by the total assets staked in the master pool so that the price is expected to increase over time due to the earnings made by providing liquidity to the different pools. We aim for this token to be usable in the entire ecosystem and beyond such that users do not miss out on any other opportunities.

In a later stage, we will also launch a governance token that represents voting rights, a stake in the whole system, and will be used to guide our protocol towards full decentralization. We plan to build a decentralized autonomous organization (DAO) through our communities that own the full supply of governance tokens. The DAO could decide over factors such as the risk policy, the number of fees collected by the protocol, as well as the accrued profits to be re-distributed to the community. As the earnings accrue, and the TVL of the protocol increases, so does the value of the governance token.

Users do not need to have extensive knowledge about how DeFi works to benefit from this technology. During the first launching phase, we will focus on integrating with DEX's liquidity pools. In further upgrades, we plan to integrate with a more diverse set of products such as lending protocols and staking pools among many others. We hope to transform the Solana ecosystem to a more attractive, active, and liquid one, where many great decentralized products can thrive together.

3.1 Yield Generation

As of today, we are focusing on being a liquidity provider to several markets, generating income by collecting their trading fees. We have first integrated our system with Invariant [3], a DEX with concentrated liquidity pools on the Solana network. In a later stage, we are also going to integrate with Saber [4], a traditional constant product market-maker on the Solana network, that provides liquidity to the Serum orders book [5]. For each of the markets, we take into account all available pools and pre-filter them by age, liquidity, volume, volatility, and APY, to build a set of products that is reliable and profitable.

3.2 Portfolio Optimization

The portfolio optimization algorithm takes time series of the historical returns of all tokens involved in the liquidity pools. Then it calculates the covariance matrix and the resulting efficient frontier [6]. The algorithm picks the distribution of assets that minimize the volatility with respect to a pre-defined stable coin (currently USD-pegged). The

final result is a set of weights that represents the fraction of assets in the master pool that should be distributed within the different liquidity pools.

3.3 Architecture

Most of the program logic is executed on-chain, while the portfolio optimization runs off-chain and is fed into the contract as an oracle. The reason for this is that the portfolio optimization contains complex linear algebraic operations that are currently difficult to implement in Rust (the programming language used on Solana). However, in further upgrades, we will attempt to bring them all together on-chain. Our application consists of a frontend [2], the qPools program and software development kit, and components of the programs of the underlying yield-generating protocols.

3.4 QPT Token

Our protocol manages a portfolio and provides all the required technical infrastructure to do swaps between products efficiently. As such, for any yield that is generated for the end-user, a percentage cut of 20% is taken and redistributed among the community (eventually the holders of governance tokens). We chose to introduce a profit-based commission, as we deem to be fairest (as opposed to a management fee, for example). This profit will pay for the software development, the community ecosystem, and the growth of the project as a whole, further increasing the value of the QPT and the governance tokens over time, and generate higher yields over time.

3.5 Governance Token

As we envision a community-driven DeFi product, we intend to introduce a governance token. We believe that decentralized governance is the solution to a long-lasting, scalable project that encapsulates multiple interests from a set of various stakeholders. As such, we envision introducing a governance token, whose holders will: *i)* receive the previously mentioned profit-based-fees from using the qPool protocol; *ii)* decide over which projects and pools to add to the protocol; *iii)* choose which products to offer; *iv)* take decisions on the frontend to facilitate and maximize

the user-experience; and *v)*, help to grow the community even further thus enabling our goal of providing liquidity to the entire DeFi ecosystem and generate risk-adjusted yields for our end-users. We plan to look into DAO mechanisms once our token launch has succeeded, and our mainnet program generates yields for our users.

4 Roadmap

Although we are impatiently working on improving and bringing this protocol to mainnet, we believe in a reliable, robust, and battle-tested protocol. As part of our roadmap, we propose the following milestones, which are mostly in chronological order. However, many of them may be intertwined. Note that we have also included fundraising milestones, as many of the subsequent goals require audits, as well as regulatory compliance.

4.1 Minimum Viable Product (MVP)

We first test the feasibility of the idea. We have worked for a few months since the Solana Ignition Hackathon 2021 full-time on Solana, and have been developing on this project since the beginning of November. Building an MVP includes setting up a user-friendly frontend, implementing the Solana program logic that performs liquidity farming, creating and testing RPC calls that connect the frontend to the backend, and building the portfolio optimization program. However, at this stage, we are not going to integrate the Solana program with the portfolio algorithm since it does not make sense to use real price data for the portfolio optimization and invest assets in the devnet that contains artificial prices. For this reason, and to still show the feasibility of our protocol, we will be setting all weights to be equal among the targeted liquidity pools, and also show separately a functioning oracle that provides the weights to the best liquidity pools. In a follow-up stage we will replicate and simulate trading behavior based on mainnet data to get an idea of how our algorithm performs, however.

4.2 Grants

Receiving grants will allow us to focus on the early stage of this project on a full-time basis. Funding for about six months should provide us enough

time to explore, test, and validate this concept well, and make all necessary adjustments to go live on Mainnet.

4.3 Deployment on Devnet

We would like to first use the MVP to build an initial community, validate and pivot the idea further by receiving their feedback, thus optimizing for user experience and users' expectations. Deploying to Devnet will provide for a sandbox where we can quickly iterate and test new versions of our program, without incurring monetary penalties.

4.4 NFT Fundraising

We plan to raise funds by offering to the community and early adopters an NFT collection. Each NFT holder will receive part of the total governance token supply which will be distributed at a later stage. We plan to use the majority of the raised funds to provide liquidity into our pools, such that future governance token holders can further benefit from the earnings generated via fees. The remaining portion of the funds will be used for developer salaries, as well as to pay for regulatory and technical audits.

4.5 Security Audit & Regulatory Audit

Performing a security audit before we go live is of utmost importance. The best way to ensure security and reliability is by having many qualified professionals review our code, going through security audits. This will be followed by deploying to Testnet, which - at this point - will be an identical version as the one on Devnet. We also need to adhere to regulatory compliance as cryptocurrencies are becoming an increasingly important topic in fiscal discussions, mainly to protect token holders from irregular operations.

4.6 Deployment on Mainnet

After all the previous steps have been accomplished, the code fully battle-tested and audited, and the token properly regulated, we plan to deploy the protocol into Mainnet for liquidity mining.

This step will proceed in multiple tranches, beginning with small investment amounts, and later opening up to larger tickets as the live system shows robustness.

5 Final Remarks

By building this protocol, we aim to provide a new on-chain service for automated asset allocation, providing liquidity to different existing protocols and, consequently, benefiting the entire Solana ecosystem. Our product will offer a risk-adjusted opportunity to earn passive income accessible to everyone by using state-of-the-art portfolio optimization techniques.

Furthermore, this project will become a fully decentralized system governed by a community that will profit from its daily operations and will also decide on its future. Decentralized governance is the solution to a long-lasting project that compromises multiple opinions from a set of various stakeholders.

Finally, we will also work on further extensions of this idea into other blockchains and even explore the possibility of integrating a multi-chain solution that could bring all earning products in the crypto-market together in a single protocol.

Acknowledgements

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White Paper