AstraSec

Eigenpie
Security Audit Report

November 6, 2024

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1 Introduction

1.1 About Eigenpie

Eigenpie is a restaking platform for SubDAO, providing Liquid Stake Token (LST) holders with the ability to re-stake their assets and maximize their profit potential. It achieves this by creating dedicated liquidity restaking for each accepted LST on its platform, effectively isolating risks associated with any particular LST.

1.2 Source Code

The following source code was reviewed during the audit:

- https://github.com/magpiexyz/eigenpie.git
- CommitID: d5b52b2

And this is the final version representing all fixes implemented for the issues identified in the audit:

- https://github.com/magpiexyz/eigenpie.git
- CommitID: a581aa4

2 Overall Assessment

This report has been compiled to identify issues and vulnerabilities within the Eigenpie protocol. Throughout this audit, we identified a total of 6 issues spanning various severity levels. By employing auxiliary tool techniques to supplement our thorough manual code review, we have discovered the following findings.

Severity	Count	Acknowledged	Won't Do	Addressed
Critical	–	–	–	–
High	–	–	–	–
Medium	2	1	–	1
Low	4	1	–	3
Informational	–	–	–	–
Undetermined	–	–	–	–

3 Vulnerability Summary

3.1 Overview

Click on an issue to jump to it, or scroll down to see them all.

~~M-1~~ Unexpected Revert in EigenpieEnterprise::registerReStaking()

M-2 Potential Risks Associated with Centralization

~~L-1~~ Revisited Logic of NodeDelegator::_recordGas()

~~L-2~~ Incompatibility with Non-Standard ERC20 Tokens

L-3 Potential User Asset Loss in EigenpieWithdrawManager::userWithdrawAsset()

~~L-4~~ Timely Burn of Excess MLRT in MLRTWallet::bridgeMLRTToZircuit()

3.2 Security Level Reference

In web3 smart contract audits, vulnerabilities are typically classified into different severity levels based on the potential impact they can have on the security and functionality of the contract. Here are the definitions for critical-severity, high-severity, medium-severity, and low-severity vulnerabilities:

Severity	Acknowledged
C-X (Critical)	A severe security flaw with immediate and significant negative consequences. It poses high risks, such as unauthorized access, financial losses, or complete disruption of functionality. Requires immediate attention and remediation.
H-X (High)	Significant security issues that can lead to substantial risks. Although not as severe as critical vulnerabilities, they can still result in unauthorized access, manipulation of contract state, or financial losses. Prompt remediation is necessary.
M-X (Medium)	Moderately impactful security weaknesses that require attention and re-mediation. They may lead to limited unauthorized access, minor financial losses, or potential disruptions to functionality.
L-X (Low)	Minor security issues with limited impact. While they may not pose significant risks, it is still recommended to address them to maintain a robust and secure smart contract.
I-X (Informational)	Warnings and things to keep in mind when operating the protocol. No immediate action required.
U-X (Undetermined)	Identified security flaw requiring further investigation. Severity and impact need to be determined. Additional assessment and analysis are necessary.

3.3 Vulnerability Details

3.3.1 [M-1] Unexpected Revert in EigenpieEnterprise::registerReStaking()

TARGET	CATEGORY	IMPACT	LIKELIHOOD	STATUS
EigenpieEnterprise.sol	Business Logic	Medium	Medium	Addressed

The registerReStaking() function in the EigenpieEnterprise contract is at risk of reverting because both it and the burnMLRT() (line 169) function it calls are protected by the nonReentrant modifier. Since nonReentrant prevents reentrancy within the same call chain, attempting to call burnMLRT() from within registerReStaking() triggers a revert. This design issue causes registerReStaking() to fail due to the conflicting nonReentrant protections in both functions.

eigenpie-main - EigenpieEnterprise.sol

```
155 function registerReStaking(
156     address underlyingToken,
157     uint256 amountToMintMlt
158 )
159     external
160     nonReentrant
161     onlyAllowedClient
162 {
163     ...
164     // burn excess token minted by client which are no longer restaked
165     address[] memory supportedAssetList = eigenpieConfig.getSupportedAssetList();
166     for(uint256 i=0; i < supportedAssetList.length; i++){
167         (, uint256 mlrtShouldBurn) = restakedLess(msg.sender, supportedAssetList[i]);
168         if(mlrtShouldBurn > 0){
169             burnMLRT(msg.sender, eigenpieConfig.mLRTReceiptByAsset(supportedAssetList[i]), mlrtShouldBurn);
170         }
171     }
172     ...
173 }
```

eigenpie-main - EigenpieEnterprise.sol

```
126 function burnMLRT(address client, address mlrtAsset, uint256 amountToBurn) public nonReentrant {
127     ...
128 }
```

Remediation Refactor an internal function that implements the burn MLRT functionality for the registerReStaking() function to call.

3.3.2 [M-2] Potential Risks Associated with Centralization

TARGET	CATEGORY	IMPACT	LIKELIHOOD	STATUS
Multiple Contracts	Security	High	Low	Acknowledged

In the Eigenpie protocol, the existence of a series of privileged accounts introduces centralization risks, as they hold significant control and authority over critical operations governing the protocol. In the following, we show the representative function potentially affected by the privileges associated with the privileged accounts.

eigenpie-main - PriceProvider.sol

```
69 // /// @notice updates mLRT-LST/LST exchange rate
70 // /// @dev calculates based on stakedAsset value received from eigen layer
71 // /// @param asset the asset for which exchange rate to update
72 function updateMLRTPrice(address asset) external onlyOracle {
73     uint256 exchangeRate = _calculateExchangeRate(asset);
74     _checkNewRate(asset, exchangeRate);
75
76     _updateMLRTPrice(asset, exchangeRate);
77 }
78
79 /// @notice updates mLRT-LST/LST exchange rate manually for gas fee saving
80 /// @dev calculates based on stakedAsset value received from eigen layer
81 /// @param asset the asset for which exchange rate to update
82 /// @param newExchangeRate the new exchange rate to update
83 function updateMLRTPrice(address asset, uint256 newExchangeRate) external onlyOracleAdmin {
84     _checkNewRate(asset, newExchangeRate);
85
86     _updateMLRTPrice(asset, newExchangeRate);
87 }
```

Remediation To mitigate the identified issue, it is recommended to introduce multi-sig mechanism to undertake the role of the privileged accounts. Moreover, it is advisable to implement timelocks to govern all modifications to the privileged operations.

Response By Team This issue has been confirmed by the team.

3.3.3 [L-1] Revisited Logic of NodeDelegator::_recordGas()

TARGET	CATEGORY	IMPACT	LIKELIHOOD	STATUS
NodeDelegator.sol	Business Logic	Low	Low	Addressed

The NodeDelegator contract has an issue in the _recordGas() and _refundGas() functions, where gas refunds may not be handled correctly if the privileged bot account is a contract instead of an EOA. This is due to the use of msg.sender (line 414) in _recordGas() and tx.origin (line 421) in _refundGas() . If a contract bot calls these functions, it will not receive the gas refund as intended, potentially causing unexpected behavior and inefficient gas usage.

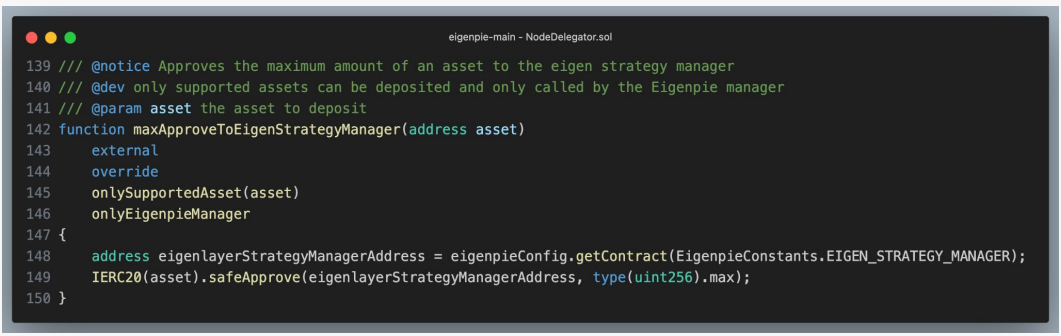
Remediation Ensure consistent handling of gas refunds, especially for contract callers.

3.3.4 [L-2] Incompatibility with Non-Standard ERC20 Tokens

TARGET	CATEGORY	IMPACT	LIKELIHOOD	STATUS
NodeDelegator.sol	Business Logic	Low	Low	Addressed

Although there is a standard ERC-20 specification, many token contracts may not strictly follow this specification or may have additional functionalities beyond it. The following is an example using the maxApproveToEigenStrategyManager() function in the NodeDelegator contract.

This function's purpose is to approve the maximum amount (type(uint256).max) of a specified asset to the Eigenlayer strategy manager. If the specified asset is USDT, there will be a compatibility issue with non-standard ERC20 tokens when this function is executed. This is due to the use of safeApprove() without resetting the current allowance to zero before setting it to type(uint256).max. Since USDT does not allow increasing an allowance from a non-zero value, this can cause the function to fail when the initial allowance for Eigenlayer strategy manager is not zero.



Remediation To improve compatibility, the maxApproveToEigenStrategyManager() function should first reset the allowance to zero before setting it to the desired value.

3.3.5 [L-3] Potential User Asset Loss in userWithdrawAsset()

TARGET	CATEGORY	IMPACT	LIKELIHOOD	STATUS
EigenpieWithdrawManager.sol	Business Logic	Low	Low	Acknowledged

By design, when a user wants to withdraw previously deposited LST, they first need to queue their request using userQueuingForWithdraw(). At the end of the epoch, a privileged bot gathers all withdrawal requests and processes a bulk withdrawal from Eigenlayer. Once this is done, users can claim their assets via userWithdrawAsset().

Upon reviewing userWithdrawAsset(), we observe that if the contract lacks sufficient assets during a user's claim, the user only receives the available balance, potentially resulting in asset loss (lines 183–185). This issue arises if the bot fails to promptly withdraw assets from Eigenlayer, leaving the contract underfunded. We recommend enhancing the function to prevent users from claiming if the contract lacks sufficient funds, thereby avoiding potential losses.

eigenpie-main - EigenpieWithdrawManager.sol

```
178 function userWithdrawAsset(address[] memory assets) external nonReentrant {
179     ...
180     for (uint256 i = 0; i < assets.length;) {
181         ...
182         claimedWithdrawalSchedules[i] = claimedWithdrawalSchedulesPerAsset;
183         if(totalClaimedAmount > IERC20(assets[i]).balanceOf(address(this))) {
184             totalClaimedAmount = IERC20(assets[i]).balanceOf(address(this));
185         }
186
187         if (totalClaimedAmount > 0) {
188             IERC20(assets[i]).safeTransfer(msg.sender, totalClaimedAmount);
189             emit AssetWithdrawn(msg.sender, assets[i], totalClaimedAmount);
190         }
191
192         unchecked {
193             ++i;
194         }
195     }
196
197     _cleanUpWithdrawalSchedules(assets, claimedWithdrawalSchedules);
198 }
```

Remediation Improve the function to prevent users from claiming if the contract lacks sufficient funds

3.3.6 [L-4] Timely Burn of Excess MLRT bridgeMLRTToZircuit()

TARGET	CATEGORY	IMPACT	LIKELIHOOD	STATUS
MLRTWallet.sol	Business Logic	Low	Low	Addressed

The bridgeMLRTToZircuit() function facilitates the cross-chain transfer of MLRT tokens from Ethereum to Zircuit. However, it lacks a check to verify if the client's MLRT holdings exceed their required collateral before initiating the bridge. Without this check, the excess MLRT can be bridged unnecessarily, potentially leading to an imbalance in the client's collateral. Given this, we recommend burning any excess MLRT before initiating the bridge, ensuring that only the necessary MLRT amount is transferred to Zircuit.

Moreover, the depositToZicruit() and depositToSwellStaking() functions share the similar issue.

eigenpie-main - MLRTWallet.sol

```
167 function bridgeMLRTToZircuit(
168     address _mlrt,
169     uint256 _amount,
170     uint256 _minAmount
171 ) external payable whenNotPaused onlyClientOrAllowedOperator nonReentrant {
172     ...
173     // Approve the adapter to lock the mLRT token and bridge it
174     IERC20(_mlrt).safeApprove(address(mlrtAdapter), _amount);
175     mlrtAdapter.bridgeMLRT{value: fee.nativeFee}(
176         EigenpieConstants.LZ_ZIRCUIT_DESTINATION_ID,
177         0,
178         _amount,
179         _minAmount,
180         mlrtWalletZircuit,
181         msg.sender
182     );
183
184     emit BridgeMLRTToZircuit(client, msg.sender, _mlrt, _amount);
185 }
```

Remediation Improve the implementation of these functions as above-mentioned.

4 Appendix

4.1 About AstraSec

AstraSec is a blockchain security company that serves to provide high-quality auditing services for blockchain-based protocols. With a team of blockchain specialists, AstraSec maintains a strong commitment to excellence and client satisfaction. The audit team members have extensive audit experience for various famous DeFi projects. AstraSec's comprehensive approach and deep blockchain understanding make it a trusted partner for the clients.

4.2 Disclaimer

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4.3 Contact

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