



Eigenpie

Security Audit Report

September 3, 2024

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# 1 | Introduction

## 1.1 About Eigenpie

Eigenpie is a re-staking 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 Audit Scope

	LINK	Base Commit	Final Commit
1	<a href="https://github.com/magpiexyz/eigenpie.git">https://github.com/magpiexyz/eigenpie.git</a>	297d1ba	72227d5
2	<a href="https://github.com/..../withdrawStakedETH">https://github.com/..../withdrawStakedETH</a>	eda5ddb	57d825e
3	<a href="https://github.com/magpiexyz/eigenpie/pull/14">https://github.com/magpiexyz/eigenpie/pull/14</a>	263ef2f	9c905b1
4	<a href="https://github.com/magpiexyz/eigenpie/pull/15">https://github.com/magpiexyz/eigenpie/pull/15</a>	c3e361a	85c14e5
5	<a href="https://github.com/magpiexyz/eigenpie/pull/15">https://github.com/magpiexyz/eigenpie/pull/15</a>	85c14e5	48889f5
6	<a href="https://github.com/magpiexyz/eigenpie/pull/19">https://github.com/magpiexyz/eigenpie/pull/19</a>	7210994	f2bd5d0
7	<a href="https://github.com/magpiexyz/eigenpie/pull/23">https://github.com/magpiexyz/eigenpie/pull/23</a>	55f6347	c7fd9f6
8	<a href="https://github.com/magpiexyz/eigenpie/pull/31">https://github.com/magpiexyz/eigenpie/pull/31</a>	cf8380c	1afbd98
9	<a href="https://github.com/magpiexyz/eigenpie/pull/34">https://github.com/magpiexyz/eigenpie/pull/34</a>	2f0e46e	dd57100
10	<a href="https://github.com/magpiexyz/eigenpie/pull/35">https://github.com/magpiexyz/eigenpie/pull/35</a>	44b7453	-
11	<a href="https://github.com/magpiexyz/eigenpie/pull/43">https://github.com/magpiexyz/eigenpie/pull/43</a>	294fb83	6aec262
12	<a href="https://github.com/magpiexyz/eigenpie/pull/47">https://github.com/magpiexyz/eigenpie/pull/47</a>	ff44118	0d8a121
13	<a href="https://github.com/magpiexyz/eigenpie/pull/59">https://github.com/magpiexyz/eigenpie/pull/59</a>	fec6782	-

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## 1.3 Changelog

Version	Date
First Audit	February 14, 2024
Second Audit	March 23, 2024
Third Audit	April 8, 2024
Forth Audit	April 12, 2024
Fifth Audit	April 19, 2024
Sixth Audit	May 3, 2024
Seventh Audit	May 23, 2024
Eighth Audit	May 25, 2024
Nineth Audit	June 12, 2024
Tenth Audit	June 18, 2024
Eleventh Audit	July 6, 2024
Twelfth Audit	July 18, 2024
Thirteenth Audit	September 3, 2024

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## 2 | Overall Assessment

This report has been compiled to identify issues and vulnerabilities within the `Eigenpie` project. Throughout this audit, we identified several 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	9	-	-	9
Medium	3	1	-	2
Low	2	-	-	2
Informational	-	-	-	-
Undetermined	-	-	-	-

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## 3 | Vulnerability Summary

### 3.1 Overview

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

- [H-1](#) Revised Pre-Deposit Logic in `EigenpieStaking::depositAsset()`
- [H-2](#) Improper `exchangeRate` Precision in `PriceProvider::updateMLRTPrice(address)`
- [H-3](#) Improper Implementation of `PriceProvider::updateMLRTPrice(address, uint256)`
- [H-4](#) Revised CleanUp of Withdrawal Schedules
- [H-5](#) Reserve ETH for New Validators in `NodeDelegator::receive()`
- [H-6](#) Flawed Exchange Rate Calculation
- [H-7](#) Incorrect `engienpieEnterprise` Initialization in `MLRTWallet`
- [H-8](#) Revisited Logic of `EigenpieEnterprise::burnMLRT()`
- [H-9](#) Incorrect Operation in `ValidatorLib::verifyWithdrawalCredentials()`
- [M-1](#) Potential Risks Associated with Centralization
- [M-2](#) Revised `assetTotalWithdrawAmt` Check
- [M-3](#) Revisited `eigenpieEnterprise` Configuration in `PriceProvider`
- [L-1](#) Integration of Non-Standard ERC20 Tokens
- [L-2](#) Improved Logic of `MLRTWallet::withdrawFromSwellStaking()`

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## 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	Description
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 remediation. 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

#### [H-1] Revised Pre-Deposit Logic in EigenpieStaking::depositAsset()

Target	Category	IMPACT	LIKELIHOOD	STATUS
EigenpieStaking.sol EigenpiePreDepositHelper.sol	Business Logic	High	High	<a href="#">Addressed</a>

The `EigenpieStaking::depositAsset()` function serves as a mechanism for users to deposit supported LST (e.g., `ankrETH`, `cbETH`, etc.) and the corresponding `mLRT-LST` token is minted. During the pre-deposit phase of the protocol, users deposit underlying token into the `EigenpieStaking` contract (line 177). However, the corresponding `mLRT-LST` token is not immediately minted for them (lines 166 - 168). Instead, they need to wait until the current pre-deposit cycle is concluded. Upon claiming (line 84), the `mLRT-LST` token will then be minted and allocated to the users (line 93). This may result in the `totalSupply` of the `mLRT-LST` token is not updated in time, which is crucial for calculating the `mLRT-LST/LST` exchange rate. Consequently, it will lead to inaccuracy in the exchange rate calculation.

#### EigenpieStaking::depositAsset()

```
145 function depositAsset(  
146     address asset,  
147     uint256 depositAmount,  
148     uint256 minRec,  
149     address referral  
150 )  
151     external  
152     whenNotPaused  
153     nonReentrant  
154     onlySupportedAsset(asset)  
155 {  
156     // checks  
157     if (depositAmount == 0 || depositAmount < minAmountToDeposit) {  
158         revert InvalidAmountToDeposit();  
159     }  
  
161     if (depositAmount > getAssetCurrentLimit(asset)) {  
162         revert MaximumDepositLimitReached();  
163     }  
  
165     uint256 mintedAmount;  
166     if (isPreDeposit) {  
167         (mintedAmount, ) = getMLRTAmountToMint(asset, depositAmount);  
168         IEigenpiePreDepositHelper(eigenpiePreDepositHelper).feedUserDeposit(msg.  
169             sender, asset, mintedAmount);  
169     } else {
```



```

170         // mint receipt
171         mintedAmount = _mintMLRT(asset, depositAmount);
172     }
173     if (mintedAmount < minRec) {
174         revert MinimumAmountToReceiveNotMet();
175     }

177     IERC20(asset).safeTransferFrom(msg.sender, address(this), depositAmount);

179     emit AssetDeposit(msg.sender, asset, depositAmount, referral);
180 }

```

#### EigenpiePreDepositHelper::userClaim()

```

84 function userClaim(uint256[] calldata _cycles, address[] calldata _assets)
    external nonReentrant {
85     for (uint256 i = 0; i < _cycles.length; i++) {
86         if (!claimableCycles[_cycles[i]]) revert ClaimCycleNotStarted();
87         for (uint256 j = 0; j < _assets.length; j++) {
88             bytes32 cycleUserKey = this._getCycleUserKey(_cycles[i], msg.sender)
                ;
89             UserInfo storage user = userInfo[cycleUserKey][_assets[j]];
90             uint256 amount = user.amount - user.claimed;
91             if (amount > 0) {
92                 address receipt = eigenpieConfig.mLRTReceiptByAsset(_assets[j]);
93                 IMintableERC20(receipt).mint(msg.sender, amount);
94                 user.claimed += amount;
95                 emit Claim(msg.sender, _assets[j], amount, _cycles[i]);
96             }
97         }
98     }
99 }

```

**Remediation** Ensure the totalSupply of the mLRT-LST token is updated in time.

## [H-2] Improper exchangeRate Precision in PriceProvider::updateMLRTPrice(address)

Target	Category	IMPACT	LIKELIHOOD	STATUS
PriceProvider.sol	Business Logic	High	High	<a href="#">Addressed</a>

The PriceProvider::updateMLRTPrice(address) function is utilized to update the mLRT-LST/LST exchange rate for the specified asset. The exchange rate is derived from the current state of the corresponding pool. During our examination of the exchange rate calculation logic, it is apparent

that there is a loss of precision for the result. Given this, we suggest to improve its implementation as below: `uint256` `exchangeRate = totalLST * 1 ether / receiptSupply` (line 69).

Moreover, to mitigate potential front-run attacks, we recommend adding access control to this function and execute transactions for updating the exchange rate through private RPC (e.g., `flashbot`).

#### PriceProvider::updateMLRTPrice(address)

```
54 /// @notice updates mLRT-LST/LST exchange rate
55 /// @dev calculates based on stakedAsset value received from eigen layer
56 /// @param asset the asset for which exchange rate to update
57 function updateMLRTPrice(address asset) external {
58     address mLRTReceipt = eigenpieConfig.mLRTReceiptByAsset(asset);
59     uint256 receiptSupply = IMLRT(mLRTReceipt).totalSupply();

61     if (receiptSupply == 0) {
62         IMLRT(mLRTReceipt).updateExchangeRateToLST(1 ether);
63         return;
64     }

66     address eigenStakingAddr = eigenpieConfig.getContract(EigenpieConstants.
        EIGENPIE_STAKING);
67     uint256 totalLST = IEigenpieStaking(eigenStakingAddr).getTotalAssetDeposits(
        asset);

69     uint256 exchangeRate = totalLST / receiptSupply;

71     _checkNewRate(mLRTReceipt, exchangeRate);

73     IMLRT(mLRTReceipt).updateExchangeRateToLST(exchangeRate);
74 }
```

**Remediation** Correct the implementation of the `PriceProvider::updateMLRTPrice(address)` function as above mentioned.

### [H-3] Improper Implementation of `PriceProvider::updateMLRTPrice(address, uint256)`

Target	Category	IMPACT	LIKELIHOOD	STATUS
PriceProvider.sol	Business Logic	High	High	<a href="#">Addressed</a>

As part of its intended functionality, the `PriceProvider::updateMLRTPrice(address, uint256)` function is employed by the privileged account to manually adjust the exchange rate based on off-chain calculations, thereby optimizing gas usage. However, thorough examination of its implementation,

we observed that it lacks any form of access control and does not actually modify the exchange rate, which clearly deviates from the intended design.

#### PriceProvider::updateMLRTPrice(address, uint256)

```
76 /// @notice updates mLRT-LST/LST exchange rate manually for gas fee saving
77 /// @dev calculates based on stakedAsset value received from eigen layer
78 /// @param asset the asset for which exchange rate to update
79 /// @param newExchangeRate the new exchange rate to update
80 function updateMLRTPrice(address asset, uint256 newExchangeRate) external {
81     address mLRTReceipt = eigenpieConfig.mLRTReceiptByAsset(asset);

83     _checkNewRate(mLRTReceipt, newExchangeRate);

85     emit ExchangeRateUpdate(asset, mLRTReceipt, newExchangeRate);
86 }
```

**Remediation** Apply necessary access control and properly update the exchange rate.

## [H-4] Revised CleanUp of Withdrawal Schedules

Target	Category	IMPACT	LIKELIHOOD	STATUS
EigenpieWithdrawManager.sol	Business Logic	High	High	<a href="#">Addressed</a>

The EigenpieWithdrawManager contract exclusively manages the queuing and withdrawal processes of tokens, specifically LSTs (Liquid Staking Tokens). Users queue for the withdrawals of specific assets and proceed with the withdrawal after the withdrawal period expires. Then the withdrawals are removed from the schedules list.

While reviewing the withdraw logic, we notice that the claimed withdrawals may not be correctly removed from the schedules list. There are two key points of concern. Firstly, the `userWithdrawAsset()` function does not accurately count the total number of claimed withdrawals that can be removed (i.e., `claimedWithdrawalSchedulesPerAsset`), but only counts the number of new claimed withdrawals in the current transaction (line 157). This leads to the `_cleanUpWithdrawalSchedules()` function being unable to correctly determine whether to proceed with the removal based on the threshold check (`withdrawalscheduleCleanUp`).

#### EigenpieWithdrawManager::userWithdrawAsset()

```
139 function userWithdrawAsset(address[] memory assets) external nonReentrant {
140     uint256[] memory claimedWithdrawalSchedules = new uint256[](assets.length);

142     for (uint256 i = 0; i < assets.length; i++) {
```

```

143     bytes32 userToAsset = userToAssetKey(msg.sender, assets[i]);
144     WithdrawalSchedule[] storage schedules = withdrawalSchedules[userToAsset];

146     uint256 totalClaimedAmount;
147     uint256 burnAmount;
148     uint256 claimedWithdrawalSchedulesPerAsset;

150     for (uint256 j = 0; j < schedules.length; j++) {
151         WithdrawalSchedule storage schedule = schedules[j];
152         if (block.timestamp >= schedule.endTime) {
153             uint256 availableToClaim = schedule.queuedWithdrawLSTAmt;

155             if (availableToClaim >= schedule.claimedAmt) {
156                 ...
157                 claimedWithdrawalSchedulesPerAsset++;
158             }
159         }
160     }

162     claimedWithdrawalSchedules[i] = claimedWithdrawalSchedulesPerAsset;

164     if (totalClaimedAmount > 0) {...}
165 }

167 _cleanUpWithdrawalSchedules(assets, claimedWithdrawalSchedules);
168 }

```

Secondly, a redundant for-loop (line 272) is added in `_cleanUpWithdrawalSchedules()` which brings the possibility of claimed withdrawals being removed from the schedules list repeatedly.

#### EigenpieWithdrawManager::\_cleanUpWithdrawalSchedules()

```

262 function _cleanUpWithdrawalSchedules(
263     address[] memory assets,
264     uint256[] memory clamiedWithdrawalSchedules
265 )
266     internal
267 {
268     for (uint256 i = 0; i < assets.length; i++) {
269         bytes32 userToAsset = userToAssetKey(msg.sender, assets[i]);
270         WithdrawalSchedule[] storage schedules = withdrawalSchedules[userToAsset
            ];

272         for (uint256 j = 0; j < clamiedWithdrawalSchedules.length; j++) {
273             if (clamiedWithdrawalSchedules[j] > 0 && clamiedWithdrawalSchedules[
                j] >= withdrawalscheduleCleanUp) {
274                 for (uint256 k = 0; k < schedules.length -
                    clamiedWithdrawalSchedules[j]; k++) {
275                     schedules[k] = schedules[k + clamiedWithdrawalSchedules[j]];

```

```

276         }
277
278         while (claimedWithdrawalSchedules[j] > 0) {
279             schedules.pop();
280             claimedWithdrawalSchedules[j]--;
281         }
282     }
283 }
284 }
285 }

```

**Remediation** Revisit the above mentioned functions to ensure all claimed schedules are accurately counted and properly removed from the schedules list.

### [H-5] Reserve ETH for New Validators in NodeDelegator::receive()

Target	Category	IMPACT	LIKELIHOOD	STATUS
NodeDelegator.sol	Business Logic	High	High	<a href="#">Addressed</a>

The NodeDelegator contract accepts the deposit of native token from the EigenpieStaking contract and initializes validators by depositing specified data onto the Beacon Chain. With the validators, they can participate in Native Restaking in EigenLayer.

However, while reviewing the implementation of the `receive()` routine, we notice that all the received native tokens are transferred to the `rewardDistributor` as rewards (line 48). As a result, there is no native token left for the NodeDelegator to setup validators.

#### NodeDelegator::receive()

```

40 receive() external payable {
41     // If a payment comes in from the delayed withdrawal router, assume it is
42     // from the pending unstaked withdrawal
43     // and subtract that amount from the pending amount
44     if (msg.sender == address(eigenPod.delayedWithdrawalRouter())) {
45         ...
46     }
47
48     address rewardDistributor = eigenpieConfig.getContract(EigenpieConstants.
49         EIGENPIE_REWADR_DISTRIBUTOR);
50     TransferHelper.safeTransferETH(rewardDistributor, msg.value);
51
52     emit RewardsForwarded(rewardDistributor, msg.value);
53 }

```

---

**Remediation** Properly reserve the received staking of native token within the contract to initialize validators.

## [H-6] Flawed Exchange Rate Calculation

Target	Category	IMPACT	LIKELIHOOD	STATUS
EigenpieStaking.sol EigenpieWithdrawManager.sol	Business Logic	High	Medium	<a href="#">Addressed</a>

Eigenpie calculates the exchange rate of mLRT by dividing the total amount of deposited LSTs by the totalSupply. The total amount of LSTs is obtained by calling `EigenpieStaking::getTotalAssetDeposits()`, which sums up the LSTs in the EigenpieStaking contract, NDCs, and EigenLayer but does not account for the LSTs in the EigenpieWithdrawManager contract. In particular, if the EigenpieWithdrawManager contract holds LSTs for users withdrawals, updating the exchange rate before the user's mLRT is burned would result in an incorrect value.

### EigenpieStaking::getAssetDistributionData

```
102 function getAssetDistributionData(address asset)
103     public
104     view
105     override
106     onlySupportedAsset(asset)
107     returns (uint256 assetLyingInDepositPool, uint256 assetLyingInNDCs, uint256
        assetStakedInEigenLayer)
108 {
109     assetLyingInDepositPool = TransferHelper.balanceOf(asset, address(this));
110
111     uint256 ndcsCount = nodeDelegatorQueue.length;
112     for (uint256 i; i < ndcsCount;) {
113         assetLyingInNDCs += TransferHelper.balanceOf(asset, nodeDelegatorQueue[i])
114         ;
115         assetStakedInEigenLayer += INodeDelegator(nodeDelegatorQueue[i]).
            getAssetBalance(asset);
116         unchecked {
117             ++i;
118         }
119     }
```

**Remediation** It's recommended to include the amount of LSTs held in the EigenpieWithdrawManager contract into the calculation within `EigenpieStaking::getTotalAssetDeposits()`.

## [H-7] Incorrect engienpieEnterprise Initialization in MLRTWallet

Target	Category	IMPACT	LIKELIHOOD	STATUS
MLRTWallet.sol	Business Logic	High	High	<a href="#">Addressed</a>

To facilitate the evolution of the MLRTWallet contract, it is designed to be beacon-upgradeable. The MLRTWallet contract has an engienpieEnterprise state variable that references the EigenpieEnterprise contract. During our code review, we found the engienpieEnterprise state cannot be properly initialized to a valid value in the proxy space because it can only be set in the constructor of MLRTWallet.

In the following, we provide a code snippet demonstrating how engienpieEnterprise is initialized in the constructor of the MLRTWallet contract. Note that the engienpieEnterprise is defined as a regular state variable, not immutable, which limits its initialization to the MLRTWallet contract space only. However, there's no way to initialize it correctly within the proxy space.

As a result, the engienpieEnterprise variable lacks a valid value, which disrupts normal functionality.

### MLRTWallet.sol

```
22  IEigenpieEnterprise public engienpieEnterprise;

24  constructor(address eigenpieConfigAddr, address engienpieEnterpriseAddr) {
25      UtilLib.checkNonZeroAddress(eigenpieConfigAddr);

27      eigenpieConfig = IEigenpieConfig(eigenpieConfigAddr);
28      engienpieEnterprise = IEigenpieEnterprise(engienpieEnterpriseAddr);

30      _disableInitializers();
31  }
```

**Remediation** Update the engienpieEnterprise variable to be immutable, or provide a mechanism to initialize it from the proxy.

## [H-8] Revisited Logic of EigenpieEnterprise::burnMLRT()

Target	Category	IMPACT	LIKELIHOOD	STATUS
EigenpieEnterprise.sol	Business Logic	High	High	<a href="#">Addressed</a>

The burnMLRT() function is designed to burn the amountToBurn specified amount of MLRT token. It checks that amountToBurn does not exceed the maximum burnable MLRT token (line 131), burns the specified MLRT token, and updates the nativeUsed (or 1stUsed) variable accordingly (line 133). Upon thorough examination, we notice it incorrectly updates the nativeUsed (or 1stUsed) variable by using

the collateral amount corresponding to the maximum burnable MLRT token instead of the `amountToBurn` parameter. This allows a malicious actor to manipulate the `nativeUsed` (or `lstUsed`) variable to zero, enabling them to re-mint more MLRT token than permitted.

#### EigenpieEnterprise::burnMLRT()

```
125 function burnMLRT(address client, address mlrtAsset, uint256 amountToBurn)
    external nonReentrant {
126     address asset = IMLRT(mlrtAsset).underlyingAsset();

128     (uint256 valuedAssetLess, uint256 shouldBurn) = _checkCollateralLess(client,
        asset);

130     if (valuedAssetLess == 0) revert EnoughCollateral();
131     if (amountToBurn > shouldBurn) revert BurnTooMuch();

133     _burnFromWallet(client, asset, valuedAssetLess, amountToBurn);

135     emit BurnMLRTFromWallet(client, asset, valuedAssetLess, amountToBurn);
136 }

138 function _burnFromWallet(
139     address client,
140     address asset,
141     uint256 lessAmount,
142     uint256 shouldBurn
143 ) internal {
144     address receipt = eigenpieConfig.mLRTRceiptByAsset(asset);
145     ClientData storage clientData = allowedClients[client];
146     IMLRT(receipt).burnFrom(clientData.mlrtWallet, shouldBurn);

148     if (asset == EigenpieConstants.PLATFORM_TOKEN_ADDRESS) {
149         if (clientData.mlrtMinted > shouldBurn)
150             clientData.mlrtMinted -= shouldBurn;
151         else
152             clientData.mlrtMinted = 0;

154         if (clientData.nativeUsed > lessAmount)
155             clientData.nativeUsed -= lessAmount;
156         else
157             clientData.nativeUsed = 0;
158     } else {
159         LSTData storage lstData = clientAssetMapping[client][asset];

161         if (lstData.mlrtMinted > shouldBurn)
162             lstData.mlrtMinted -= shouldBurn;
163         else
164             lstData.mlrtMinted = 0;

166         if (lstData.lstUsed > lessAmount)
```



```

167         lstData.lstUsed -= lessAmount;
168     else
169         lstData.lstUsed = 0;
170 }

172 if (totalMintedMlrt[receipt] > shouldBurn)
173     totalMintedMlrt[receipt] -= shouldBurn;
174 else
175     totalMintedMlrt[receipt] = 0;
176 }

```

**Remediation** Adjust the function to correctly calculate and update the `nativeUsed` and `lstUsed` variables based on the `amountToBurn` parameter to prevent unauthorized manipulation.

## [H-9] Incorrect Operation in ValidatorLib::verifyWithdrawalCredentials()

Target	Category	IMPACT	LIKELIHOOD	STATUS
ValidatorLib.sol	Business Logic	High	High	<a href="#">Addressed</a>

As the Node Delegator contract continues to expand, the contract size increases correspondingly. To address this, the Magpie development team utilizes libraries to modularize the reusable code, thereby reducing the overall contract size and optimizing performance. When examining the `verifyWithdrawalCredentials()` function in the `ValidatorLib` contract, we notice that the current implementation returns an incorrect value, and the execution of this function will revert. Specifically, the current implementation decrements the `stakedButNotVerifiedEth` value when it should increment it (line 126). Moreover, this will cause the function to revert because the subtraction operation on `stakedButNotVerifiedEth` will underflow.

### ValidatorLib::verifyWithdrawalCredentials()

```

106 function verifyWithdrawalCredentials(
107     IEigenPod eigenPod,
108     uint64 oracleTimestamp,
109     BeaconChainProofs.StateRootProof calldata stateRootProof,
110     uint40[] calldata validatorIndices,
111     bytes[] calldata withdrawalCredentialProofs,
112     bytes32[][] calldata validatorFields
113 ) external returns (uint256 stakedButNotVerifiedEth) {
114     eigenPod.verifyWithdrawalCredentials(
115         oracleTimestamp,
116         stateRootProof,
117         validatorIndices,
118         withdrawalCredentialProofs,

```

```

119         validatorFields
120     );

122     // Decrement the staked but not verified ETH
123     for (uint256 i = 0; i < validatorFields.length; ) {
124         uint64 validatorCurrentBalanceGwei = BeaconChainProofs
125             .getEffectiveBalanceGwei(validatorFields[i]);
126         stakedButNotVerifiedEth -= (validatorCurrentBalanceGwei *
127             EigenpieConstants.GWEI_TO_WEI);

129         unchecked {
130             ++i;
131         }
132     }
133 }

```

**Remediation** Correct the operation to increment `stakedButNotVerifiedEth`.

## [M-1] Potential Risks Associated with Centralization

Target	Category	IMPACT	LIKELIHOOD	STATUS
Multiple Contracts	Security	Medium	Medium	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.

### MLRT::mint()/burnFrom()

```

67 /// @notice Mints EGETH when called by an authorized caller
68 /// @param to the account to mint to
69 /// @param amount the amount of EGETH to mint
70 function mint(address to, uint256 amount) external onlyRole(EigenpieConstants.
71     MINTER_ROLE) whenNotPaused {
72     _mint(to, amount);
73 }

74 /// @notice Burns EGETH when called by an authorized caller
75 /// @param account the account to burn from
76 /// @param amount the amount of EGETH to burn
77 function burnFrom(address account, uint256 amount) external onlyRole(
78     EigenpieConstants.BURNER_ROLE) whenNotPaused {
79     _burn(account, amount);
80 }

```

**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. The multi-sig mechanism will be used to mitigate this issue.

### [M-2] Revised assetTotalWithdrawAmt Check

Target	Category	IMPACT	LIKELIHOOD	STATUS
EigenpieWithdrawManager.sol	Coding Practices	Medium	Medium	<a href="#">Addressed</a>

The `EigenpieWithdrawManager::completeAssetWithdrawalFromEigenLayer()` function is responsible for completing asset withdrawals initiated from the `EigenLayer`. It aims to complete all withdrawals for the given assets in the specified epoch. Therefore, it checks if the total amount of assets to be withdrawn in that epoch (i.e., `assetTotalWithdrawAmt`) can be fulfilled by the current input parameters. However, we notice that the current implementation incorrectly checks the `assetTotalWithdrawAmt`. Specifically, the current implementation requires withdrawing the `assetTotalWithdrawAmt` amount of assets from each NDC (line 228), while the expectation is to withdraw the `assetTotalWithdrawAmt` amount of assets from all NDCs combined.

#### EigenpieWithdrawManager::withdrawAssetsFromEigenLayer()

```
222 for (uint256 i = 0; i < nodeDelegators.length; i++) {
223     if (nodeToAssets[i].length != nodeToAmount[i].length) {
224         revert LengthMismatch();
225     }
226     for (uint256 j = 0; j < nodeToAssets[i].length; j++) {
227         bytes32 assetToEpoch = assetEpochKey(nodeToAssets[i][j], epochTime);
228         if (assetTotalWithdrawAmt[assetToEpoch] != nodeToAmount[i][j]) revert
            InvalidWithdrawAmt();
229     }
230 }
```

**Remediation** Revisit the implementation of `completeAssetWithdrawalFromEigenLayer()` function to improve the check for `assetTotalWithdrawAmt`.

### [M-3] Revisited eigenpieEnterprise Configuration in PriceProvider

Target	Category	IMPACT	LIKELIHOOD	STATUS
PriceProvider.sol	Business Logic	High	High	<a href="#">Addressed</a>

The `PriceProvider` contract is designed as an upgradable contract. In this upgrade, a new `eigenpieEnterprise` variable (line 27) is added to store the address of the `EigenpieEnterprise` contract. However, upon thorough examination, we observe there is no interface provided to configure this `eigenpieEnterprise` variable. This oversight means that the `eigenpieEnterprise` address cannot be set or updated after deployment, rendering the new variable effectively unusable.

**MLRTWallet.sol**

```

20 contract PriceProvider is IPriceProvider, EigenpieConfigRoleChecker,
    Initializable {
21     uint256 public rateIncreaseLimit; // as a protection
22     uint256 public rateChangeWindowLimit; // as a protection

24     mapping(address asset => address priceOracle) public override
        assetPriceOracle;
25     mapping(address receipt => uint256 timestamp) public rateLastUpdate;

27     IEigenpieEnterprise public eigenpieEnterprise;

29     ...
30 }

```

**Remediation** Implement a setter function to configure the `eigenpieEnterprise` variable.

## [L-1] Integration of Non-Standard ERC20 Tokens

Target	Category	IMPACT	LIKELIHOOD	STATUS
Multiple Contracts	Business Logic	Low	Low	<a href="#">Addressed</a>

Inside the `EigenpieStaking::depositAsset()` function, the statement of `if (!IERC20(asset).transferFrom(msg.sender, address(this), depositAmount)) {revert TokenTransferFailed();}` (line 69) is employed to transfer the user's asset into the `EigenpieStaking` contract. However, in the case of USDT-like token whose `transferFrom()` lacks a return value, it would lead to a revert. Given this, we recommend employing the widely-used `SafeERC20` library (which serves as a wrapper for ERC20 operations while accommodating a diverse range of non-standard ERC20 tokens) to address this case.

**EigenpieStaking::depositAsset()**

```

128 function depositAsset(
129     address asset,
130     uint256 depositAmount,
131     uint256 minRec,
132     address referral

```

```

133 )
134     external
135     whenNotPaused
136     nonReentrant
137     onlySupportedAsset(asset)
138 {
139     // checks
140     if (depositAmount == 0 || depositAmount < minAmountToDeposit) {
141         revert InvalidAmountToDeposit();
142     }

144     if (depositAmount > getAssetCurrentLimit(asset)) {
145         revert MaximumDepositLimitReached();
146     }

148     if (!IERC20(asset).transferFrom(msg.sender, address(this), depositAmount)) {
149         revert TokenTransferFailed();
150     }

152     // mint receipt
153     uint256 mintedAmount = _mintMLRT(asset, depositAmount);
154     if (mintedAmount < minRec) {
155         revert MinimumAmountToReceiveNotMet();
156     }

158     emit AssetDeposit(msg.sender, asset, depositAmount, referral);
159 }

```

**Remediation** Replace `transfer()/transferFrom()` with `safeTransfer()/safeTransferFrom()`.

## [L-2] Improved Logic of MLRTWallet::withdrawFromSwellStaking()

Target	Category	IMPACT	LIKELIHOOD	STATUS
MLRTWallet.sol	Business Logic	Low	High	<a href="#">Addressed</a>

The `withdrawFromSwellStaking()` function is used to withdraw the staked MLRT tokens from the `swellSimpleStaking` contract. Typically, only privileged accounts of the wallet can perform this withdrawal operation. However, if the user's collateral is insufficient, anyone can withdraw the excess MLRT tokens and burn them. While examining its implementation, we notice that if a malicious actor withdraws the excess MLRT tokens without burning them, he can repeatedly withdraw MLRT tokens until all tokens are exhausted, which clearly undermines the original design of the protocol.

---

#### MLRTWallet::withdrawFromSwellStaking()

```
96 function withdrawFromSwellStaking (address mlrt, uint256 amount) external
    nonReentrant {
97     _checkValidWithdrawCondition(msg.sender, amount);

99     ISimpleStakingERC20 swellSimpleStaking = ISimpleStakingERC20(eigenpieConfig.
        getContract(EigenpieConstants.SWELL_SIMPLE_STAKING));
100    swellSimpleStaking.withdraw(IERC20(mlrt), amount, address(this));

102    emit WithdrawFromSwellStaking(msg.sender, mlrt, amount);
103 }

105 function _checkValidWithdrawCondition(address caller, uint256 amountToWithdraw)
    internal {
106     bool isClient = caller == client;
107     bool isClientOperator = allowedClientOperators[caller];
108     bool isManager = IAccessControl(address(eigenpieConfig)).hasRole(
        EigenpieConstants.MANAGER, caller);
109     // if client or eigenpie manager calling, then all good
110     if (isClient || isClientOperator || isManager) return;
111
112     (, uint256 mlrtLess) = eigenpieEnterprise.nativeRestakedLess(client);
113     if (amountToWithdraw > mlrtLess) revert PublicWithdrawTooMuch();
114 }
```

**Remediation** Improve the implementation of the `withdrawFromSwellStaking()/withdrawFromZicruit()` functions to prevent above-mentioned attack.

---

## 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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