

# In-EVM Mina State Verification Proof System Description

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## 1 Introduction

### WIP

To prove Mina blockchain's state on the Ethereum Virtual Machine, we use Redshift SNARK[1]. RedShift is a transparent SNARK that uses PLONK[2] proof system but replaces the commitment scheme. The authors utilize FRI[3] protocol to obtain transparency for the PLONK system.

However, FRI cannot be straightforwardly used with the PLONK system. To achieve the required security level without huge overheads, the authors introduce *list polynomial commitment* scheme as a part of the protocol. For more details, we refer the reader to [1].

The original RedShift protocol utilizes the classic PLONK[2] system. To provide better performance, we generalize the original protocol for use with PLONK with custom gates [4], [5] and lookup arguments [6], [7].

## 2 RedShift Verification

### WIP

## References

1. Kattis A., Panarin K., Vlasov A. RedShift: Transparent SNARKs from List Polynomial Commitment IOPs. Cryptology ePrint Archive, Report 2019/1400. 2019. <https://ia.cr/2019/1400>.
2. Gabizon A., Williamson Z. J., Ciobotaru O. PLONK: Permutations over Lagrange-bases for Oecumenical Noninteractive arguments of Knowledge. Cryptology ePrint Archive, Report 2019/953. 2019. <https://ia.cr/2019/953>.
3. Fast Reed-Solomon interactive oracle proofs of proximity / E. Ben-Sasson, I. Bentov, Y. Horesh et al. // 45th international colloquium on automata, languages, and programming (icalp 2018) / Schloss Dagstuhl-Leibniz-Zentrum fuer Informatik. 2018.
4. Gabizon A., Williamson Z. J. Proposal: The Turbo-PLONK program syntax for specifying SNARK programs. [https://docs.zkproof.org/pages/standards/accepted-workshop3/proposal-turbo\\_plonk.pdf](https://docs.zkproof.org/pages/standards/accepted-workshop3/proposal-turbo_plonk.pdf).
5. PLONKish Arithmetization - The halo2 book. <https://zcash.github.io/halo2/concepts/arithmetization.html>.
6. Gabizon A., Williamson Z. J. plookup: A simplified polynomial protocol for lookup tables. Cryptology ePrint Archive, Report 2020/315. 2020. <https://ia.cr/2020/315>.

7. Lookup argument - The halo2 book. <https://zcash.github.io/halo2/design/proving-system/lookup.html>.