

# darkfi lottery simulation

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simulate darkfi consensus lottery with a discrete controler

## 1 discrete pid controller.

control lottery f tuning paramter

$$f[k] = f[k - 1] + K_1 e[k] + K_2 e[k - 1] + K_3 e[k - 2]$$

with  $k_1 = k_p + K_i + K_d$ ,  $k_2 = -K_p - 2K_d$ ,  $k_3 = K_d$ , and  $e$  is the error function.

## 2 simulation criterion

find  $K_p$ ,  $k_i$ ,  $K_d$  for highest accuracy running the simulation on  $N$  trials, of random number of nodes, starting with random airdrop (that all sum to total network stake), running for random runing\_time.

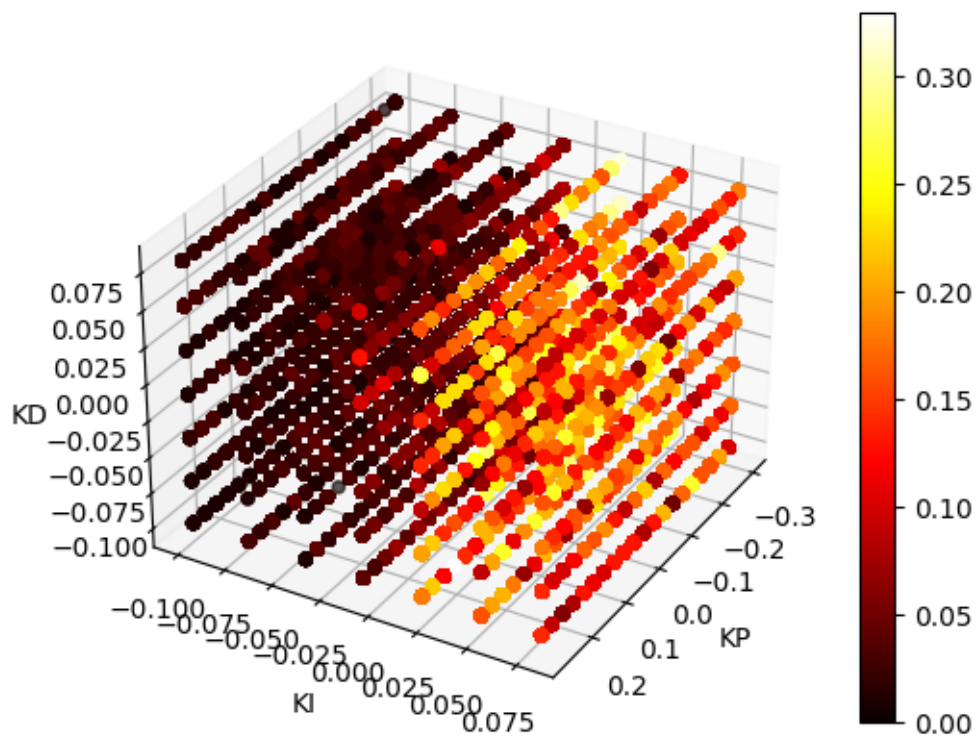


Figure 1: alt text

notice that best parameters are spread out in the search space, picking the highest of which, and running the simulation, running for 600 slots.

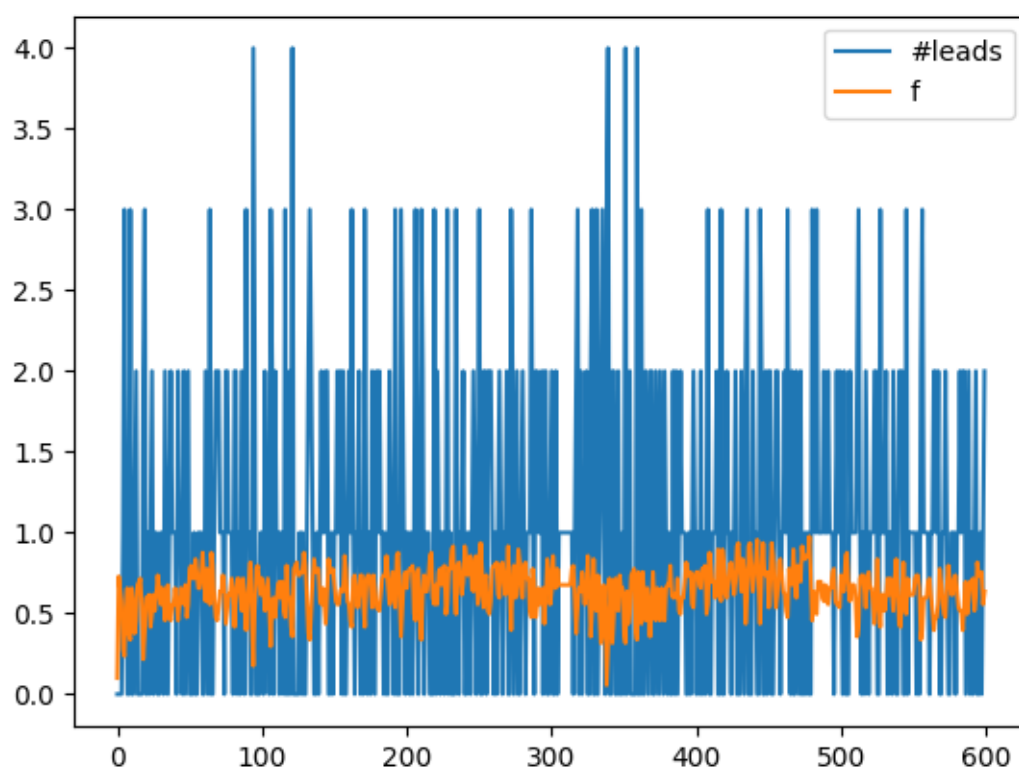


Figure 2: alt text

### 3 comparing range of target values between

notice below that both  $y, T$  in the pallas field, and simulation have same range.

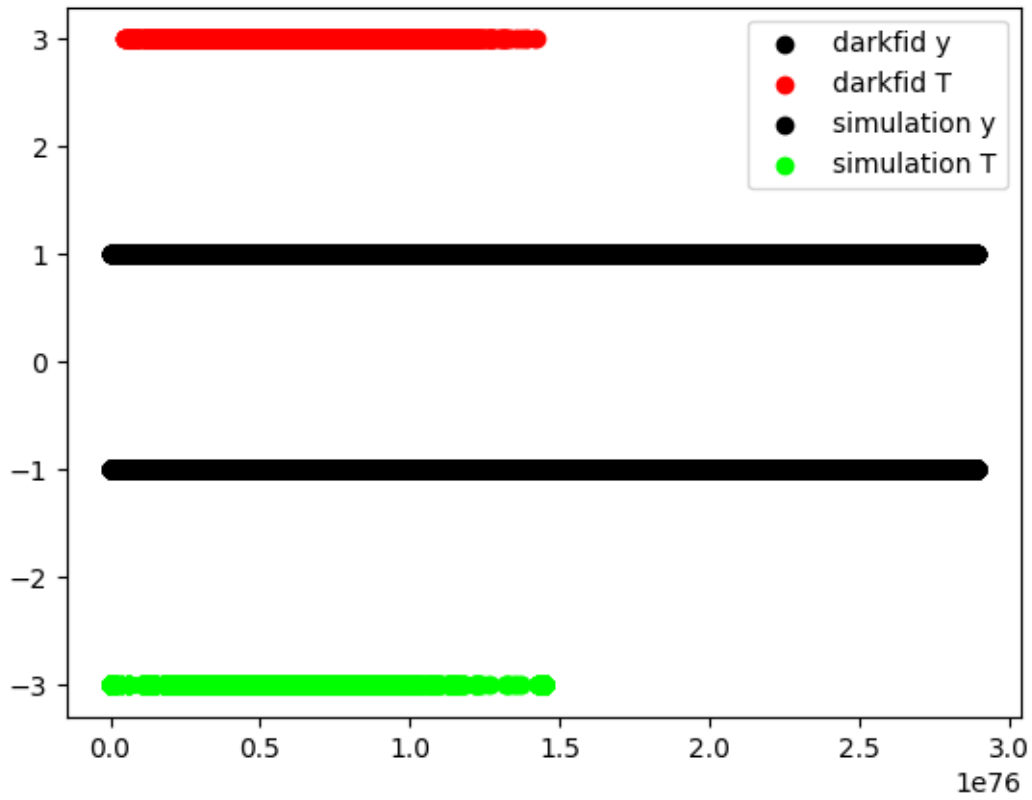


Figure 3: alt text

## 4 conclusion

using discrete controller the lottery accuracy  $> 33\%$  with randomized number of nodes, and randomized relative stake. can be coupled with khonsu<sup>1</sup> to achieve 100% accuracy and instant finality.

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<sup>1</sup><https://github.com/ertosns/thunderbolt>