Leak-optimized fast-LQG-IC HPF; gain\_slow=1.52, fast LQG noise=7.943, f\_cutoff=26.0  $leak_slow=0.9$ ,  $leak_fast=0.999999$ , r0 NCP = 0.6m 10<sup>3</sup> 2.0 Closed-loop residual (rad²/ 1.0 This controller atm\_error at f X ncp\_error\_at\_f\_X (1.4, 0.4) integrator 10<sup>1</sup> Reference ro -ncp\_error\_at\_f\_Y X error (rad) 0.5 1.5 -noise\_error\_at\_f\_X -cost cutoff freq. 10<sup>-1</sup> 0.0 1.0 -0.510<sup>-3</sup> -1.010<sup>-5</sup> 0.5  $10^{-3} \ 10^{-2} \ 10^{-1} \ 10^{0}$ 10<sup>1</sup> 0.6 0.8 1.0 1.4.6 2.0 4.0 6.0 -1.0-0.50.0 0.5 NCP ro (m) Frequency (Hz) Y = 1.32 radX = 0.986 rad10<sup>2</sup> 10<sup>2</sup> Open-loop atm 10<sup>0</sup> 10<sup>0</sup> Open-loop NCP Power (rad<sup>2</sup>/Hz) 10<sup>3</sup> Open-loop noise 10<sup>-2</sup> 10<sup>-2</sup> Closed loop at X Closed loop at Y 10<sup>0</sup>  $10^{-4}$  $10^{-4}$ phi\_to\_X|² Lfast\_to\_X|² |phi\_to\_Y|² |Lfast\_to\_Y|² 10<sup>-6</sup>  $10^{-6}$ 10<sup>-3</sup> Lslow\_to\_Y|2 Lslow to X|2 10<sup>-8</sup> 10<sup>-8</sup> |Nfast\_to\_Y|2 Nfast\_to\_X|2 Nslow to X Nslow to Y 10<sup>-10</sup>  $10^{-10}$ 10<sup>-3</sup> 10<sup>-2</sup> 10<sup>-1</sup> 10<sup>0</sup>  $10^{-3} \ 10^{-2} \ 10^{-1} \ 10^{0}$  $10^{-3} \ 10^{-2} \ 10^{-1} \ 10^{0}$ 10<sup>1</sup>  $10^{1}$ 10<sup>2</sup> 10<sup>1</sup> 10<sup>2</sup> 10<sup>2</sup> Frequency (Hz) Frequency (Hz) Frequency (Hz) 1.100 0.9869 0.9950 0.9868 1.075 0.9867 error 0.9925 1.050 0.9866 0.9900 0.9865 1.025 0.9864 1.000 0.9875 0.9863 25 0.5 1.0 20 30 1.45 1.50 1.55 1.60 0.0 1.5 35 f\_cutoff gain\_slow log\_lqg\_noise 1.20  $9.862920\times10^{-1}$ 1.15 9.862910×10 X error  $9.862900\times10^{-1}$ 1.10  $9.862890 \times 10^{-1}$  $9.862880 \times 10^{-1}$ 1.05  $9.862870 \times 10^{-1}$ 1.00 9.999900**9.**9**9** $\frac{1}{2}$ 5**9**.9**9** $\frac{1}{2}$ 5**9**.9**9** $\frac{1}{2}$ 5**09**.9**9** $\frac{1}{2}$ 5**09**.99 $\frac{1}{2}$ 5**09** 0.50 0.75 0.00 1.00 0.25 leak\_slow leak\_fast

ETF