High Voltage Monitoring and Characterization at KATRIN

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● Mean frequency of mains signal during run campaign: 49.9995 ± 0.0015 Hz

50Hz Monitoring Hardware

● Designed, tested, and constructed a 50Hz grid synchronization box.

● Outputs a synch pulse at the start of each mains power period, which provides a grid synch timing pulse, from November 2017 onwards.

50Hz Monitoring

● Grid synch signal provides information about mains frequency and timing (blue points), which is useful for characterization of systematics.

● Performance of the grid synch box: timing resolution of ~50μsec (~0.25% of average mains power cycle).

Post Regulation Performance

● Mean frequency of mains signal during run campaign: 49.9995 ± 0.0015 Hz

● Long-time mains frequency drift: deviations from ideal 50 Hz period show mains frequency varies (due to active control).

Conclusion

● Together with precision power supplies, achieved voltage stability with relative deviations of < 60mV.

● Using the grid synchronization box, we are able to characterize the 50Hz mains power signal.

● The active post regulation system suppresses any 50Hz power-grid interference.

● Additional tests show no correlation between backgrounds and the 50Hz mains signal.