

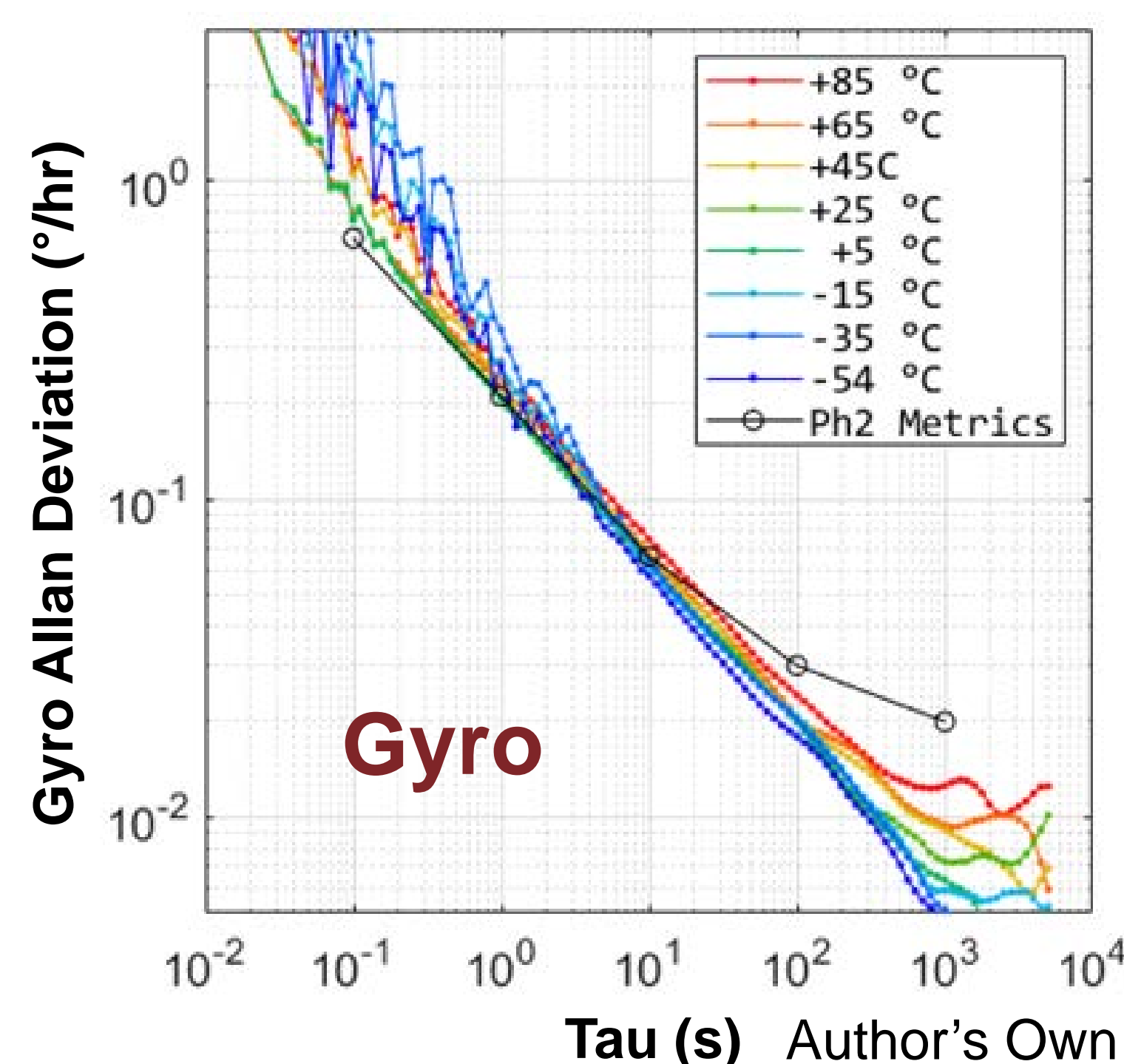
Precise Robust Inertial Guidance for Munitions: Thermally-stabilized Inertial Guidance for Munitions (PRIGM TIGM)

Other: Navigation

Background

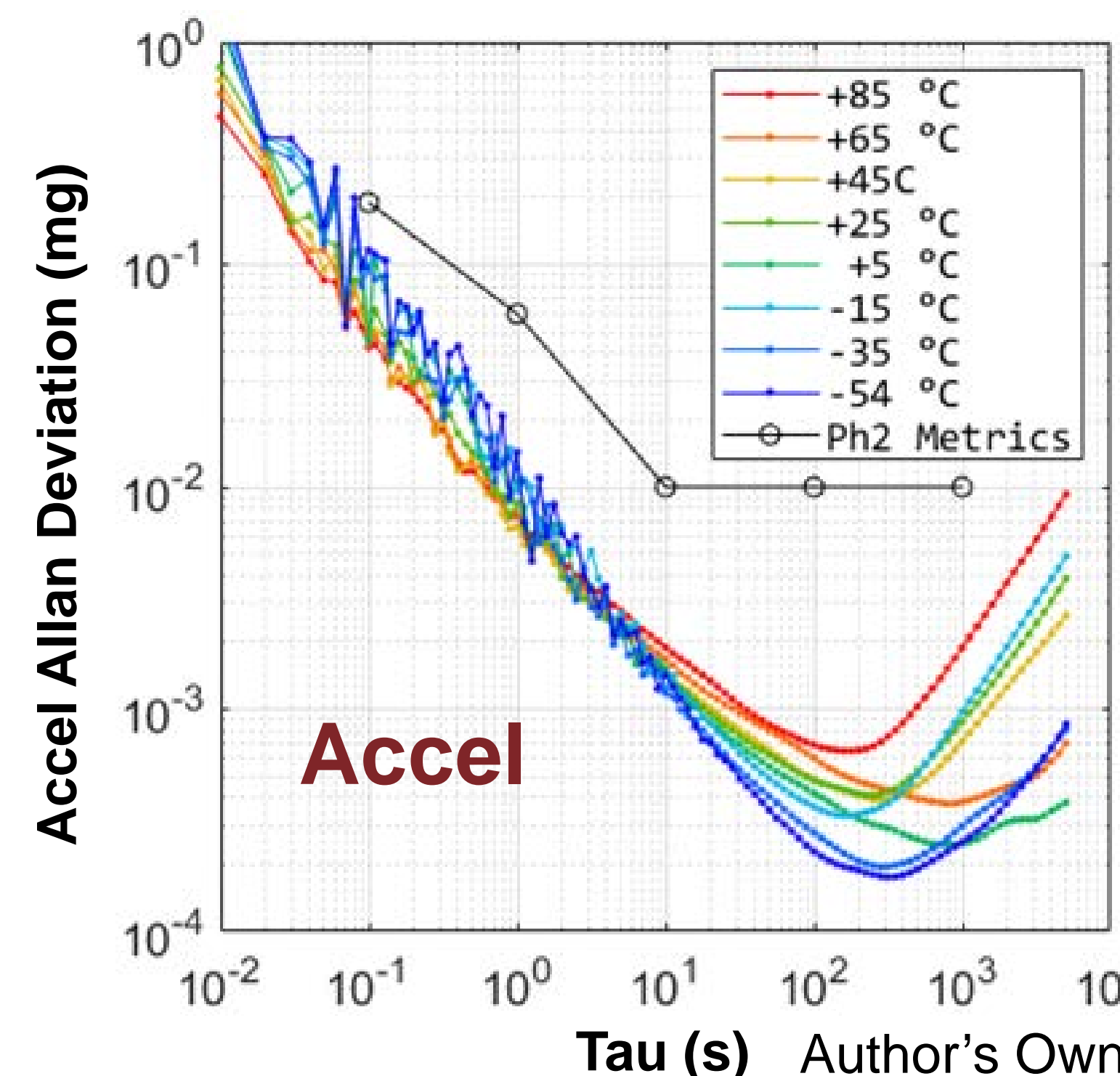
- **Problem to be solved:** Navigation in GPS-denied, harsh environments (high-g, high vibration), in a small form factor
- **Objective:** Dual-use, navigation-grade MEMS-based inertial measurement unit (IMU) to replace existing tactical-grade MEMS IMUs
- **Applications:**
 - Missiles
 - Smart munitions
 - Gyro-compassing
 - Target location
 - Avionics
 - Commercial marine
 - GPS-unavailable navigation for autonomous vehicles and avionics
 - Inertial navigation aiding

Gyro and accel Allan deviations over temperature are meeting Phase 2 metrics



Approach

- Leveraging Honeywell tactical-grade MEMS IMU expertise, e.g. HG1930 IMU
- Developing gyro and accel sensors and electronics for navigation-grade performance
- Sensors in the IMU:
 - 3 navigation-OPGs (out-of-plane gyros)
 - 3 high performance in-plane MEMS accelerometers
- Gyro has non-zero drive-sense frequency separation
 - **Wide gyro bandwidth**
 - **High gyro fabrication yield**
- Gyro and accel wafer fab and packaging processes similar to Honeywell's tactical-grade production MEMS sensors
 - **Enables rapid transition to production**
- **Honeywell HG7930 future IMU product**



Results and Impact

- **IMUs delivered to CCDC AvMC for Government testing**

Gyro and accel performance is meeting DARPA PRIGM NGIMU Phase 2 metrics

Data from 4 IMUs delivered to DARPA:

Performance Metric	Units	Existing Performance	Phase 2 Metric
Gyroscope			
Operating range	°/s	> 990	± 900
Bias repeatability*	°/hr, 1σ	0.06	0.1
Scale factor repeatability*	ppm	13	80
Bandwidth at IMU output (freq. of 90° phase lag)	Hz	150	> 70
Accelerometer			
Operating range	g	± 60 (functional to ±120)	± 60
Bias repeatability*	μg, 1σ	2.9	50
Scale factor repeatability*	ppm	2.2	50
Bandwidth at IMU output (freq. of 90° phase lag)	Hz	140	> 70

*Std. deviation of 4 turn-on to turn-on shifts in bias or scale factor (4 hrs on, 24 hrs off, 4 hrs on); median value in the population of 12 sensors in 4 IMUs

HG7930 IMUs delivered to DARPA

