

Virgo Commissioning update

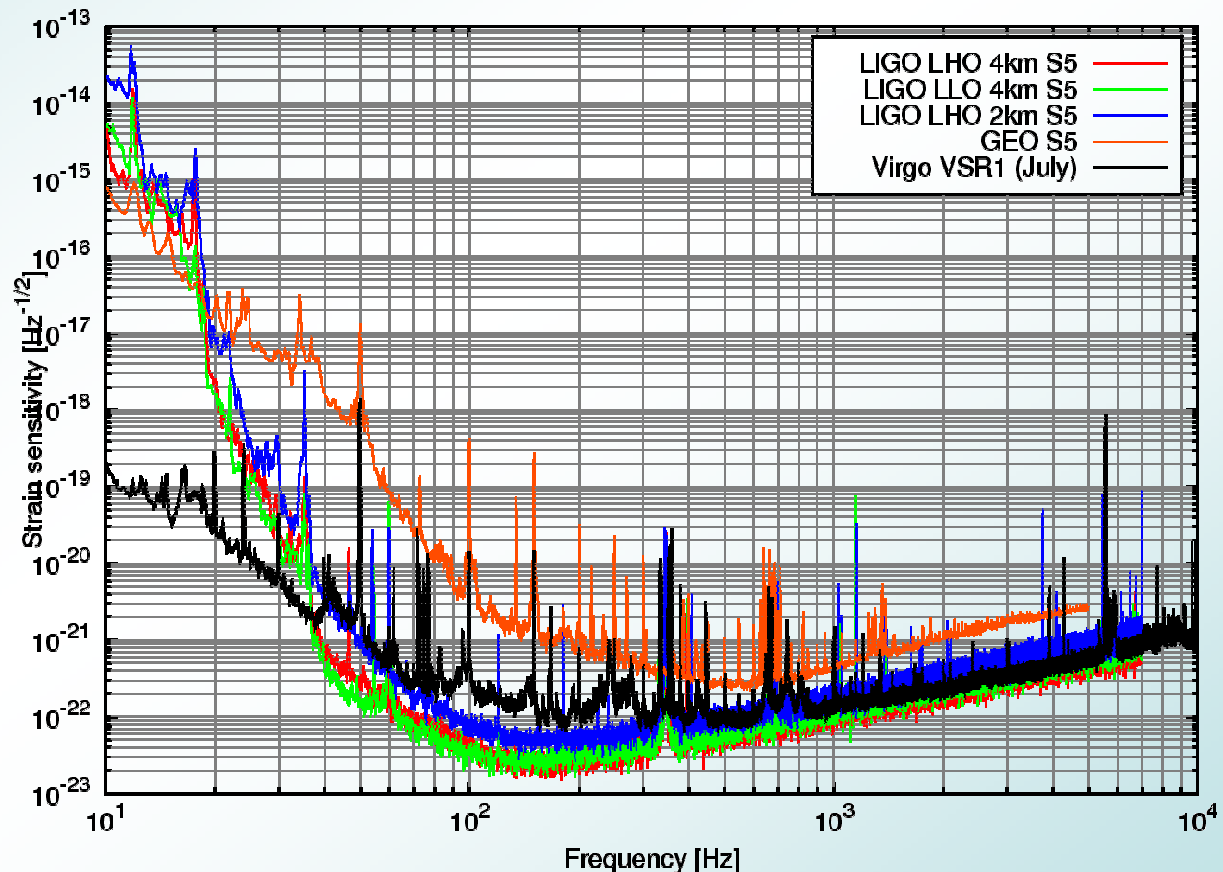


Gabriele Vajente for the Virgo Collaboration
LSC/VIRGO Meeting – MIT 2007, July 23-26

LIGO-G070565-00-Z

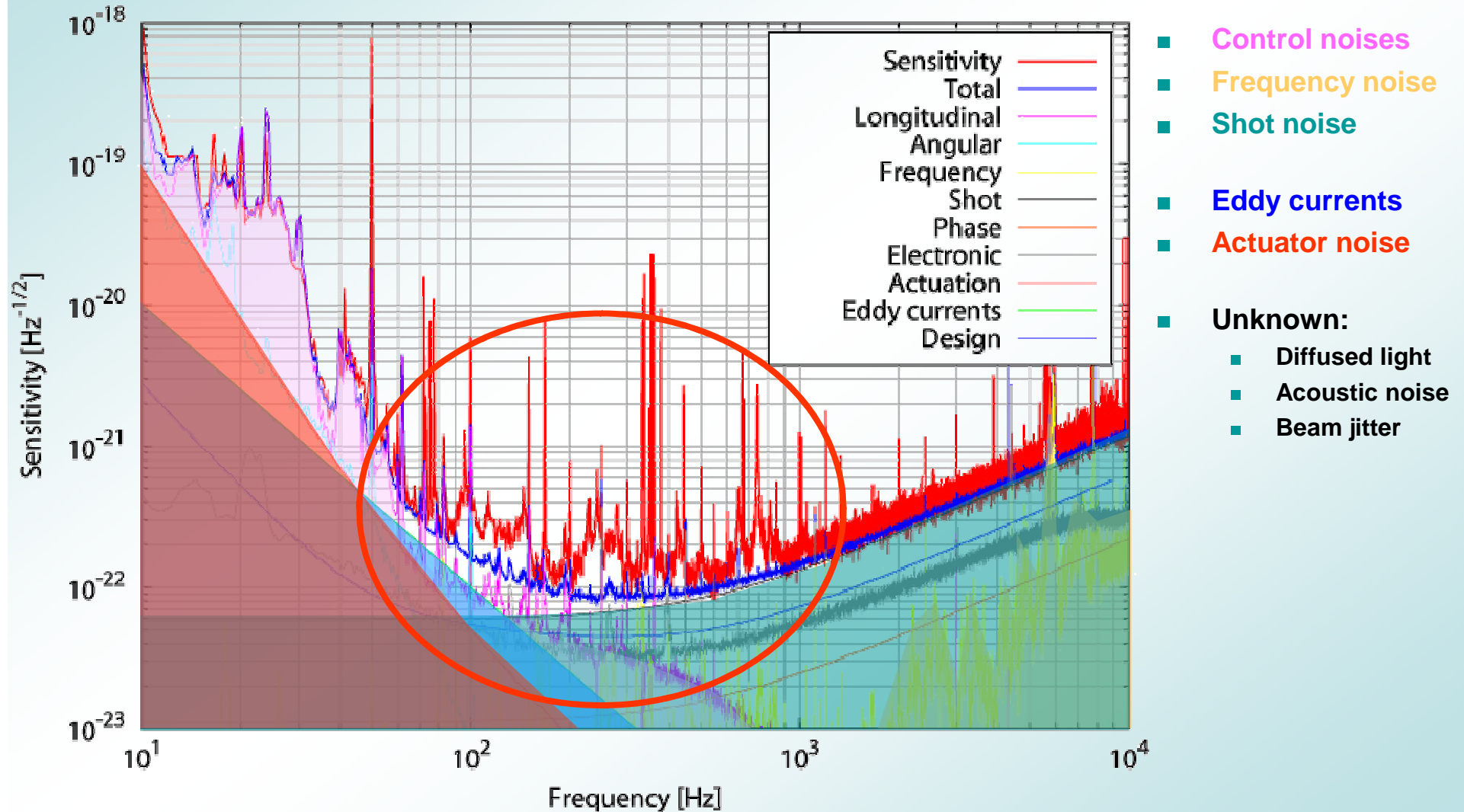
Summary

- Noise budget
- Inspiral range
- Duty cycle and unlock causes
- Recent commissioning activities
- Plans for future commissioning activities





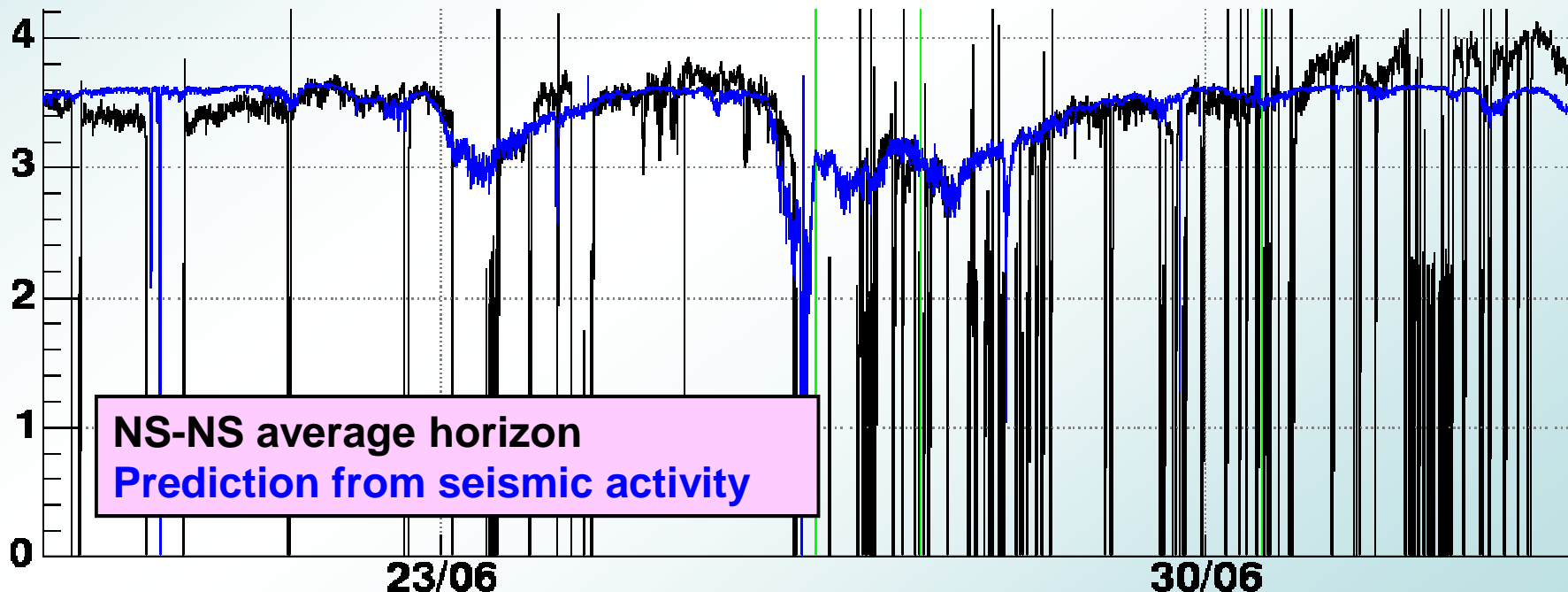
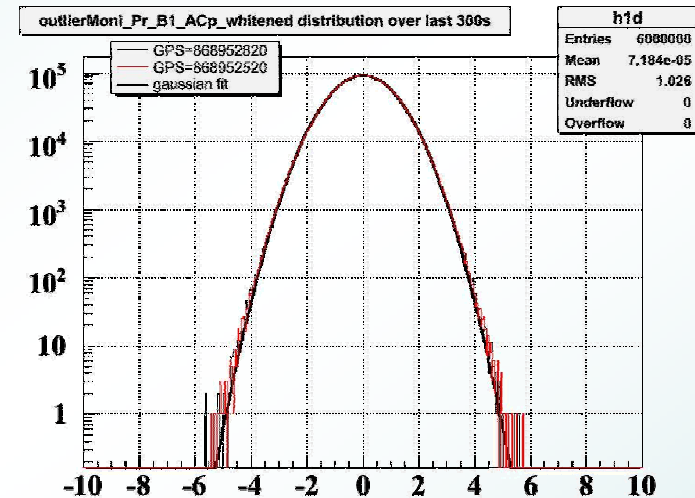
Noise budget





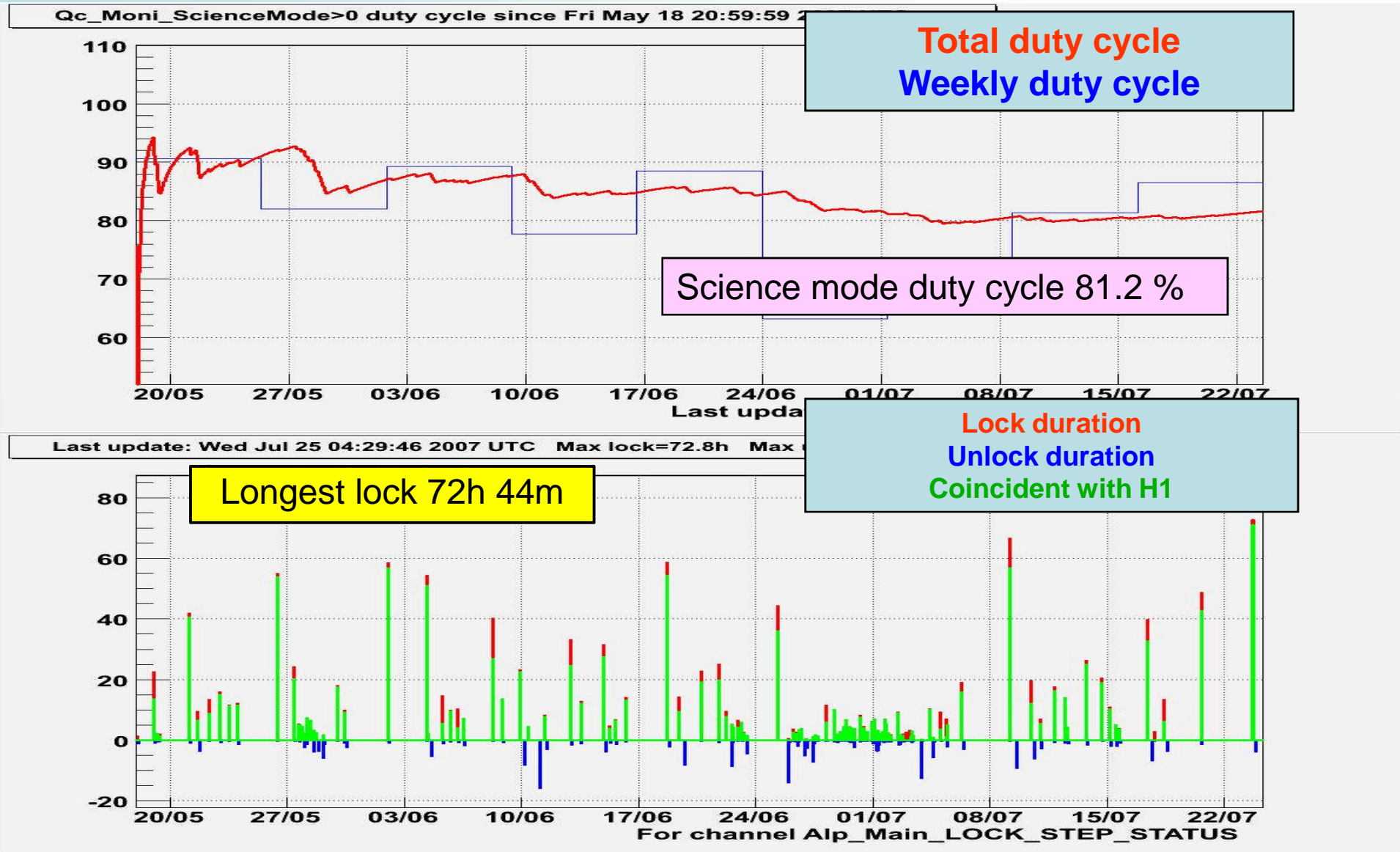
Inspiral range and data gaussianity

- There is still some dependence on seismic conditions
 - Wind activity 30-100 mHz
 - Sea activity 200-500 mHz
- Mainly dependence comes from the injection system (short) suspensions (improvements still possible)



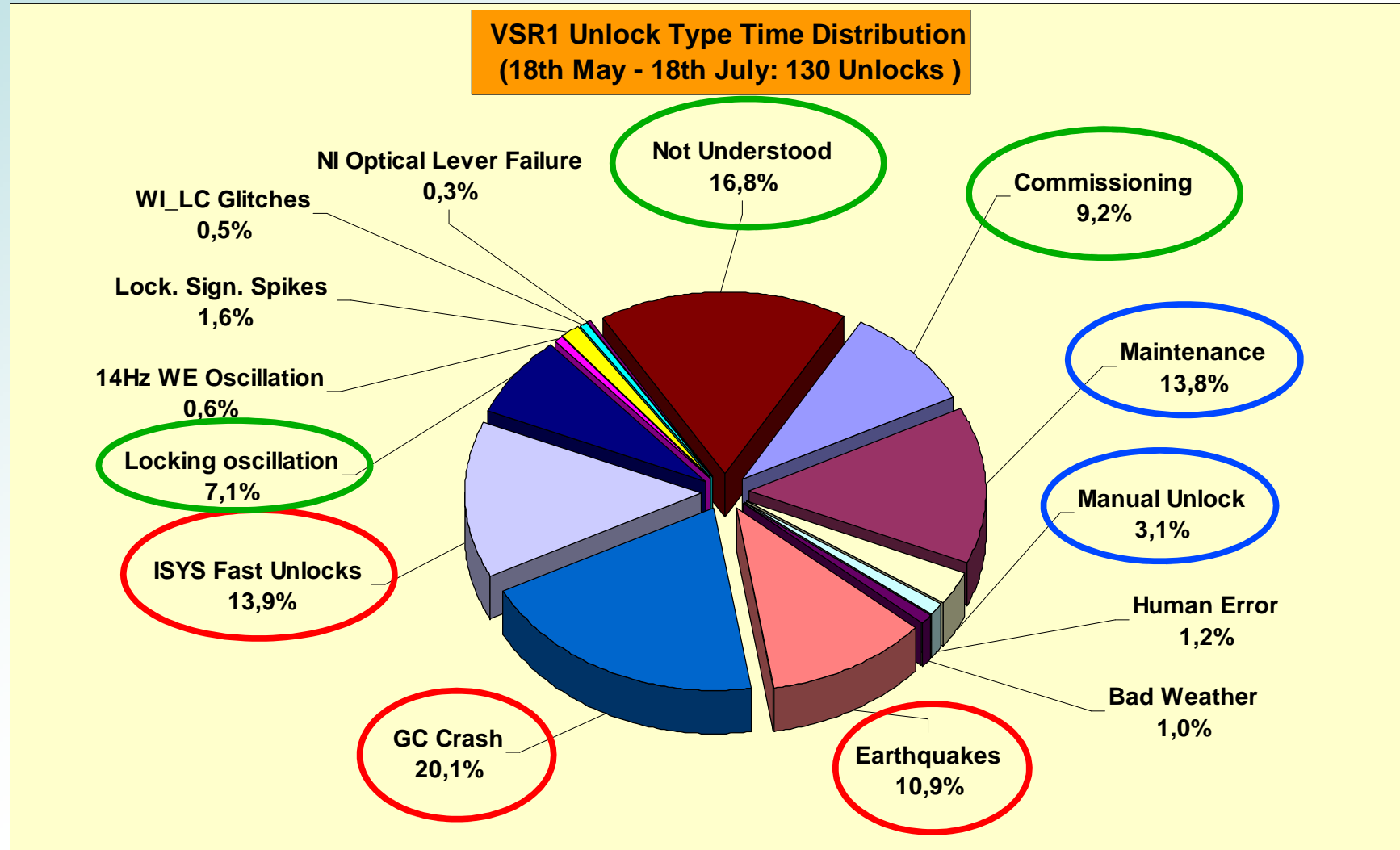


Duty cycle





Unlock causes, time loss



Troubles

- At the beginning of the run difficult start after weekly maintenance (temperature variation in laser lab)
 - Half day lost after each
- One big **storm**
- Crashes of the **Global Control System** (longitudinal and angular sensing and control)
 - Several hours for recovering
- **Fast unlocks** of the injection systems
 - One week of short losses (about 2 h)
- Failures in local control systems
- Broken quadrant photodiode detector

IMPROVED

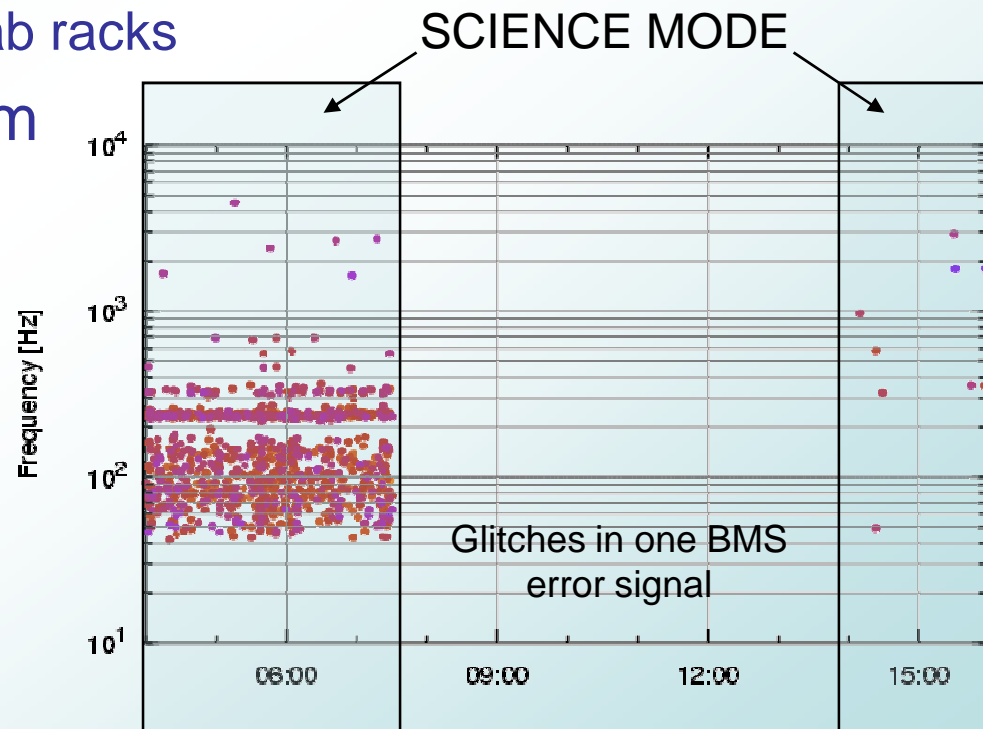
SOLVED

REPAIRED



Commissioning activities /1

- Environmental investigations
 - To understand origin of noise at low and medium frequency
 - New probes (magnetometers, microphones) installed
 - Identified seismic noise in the laser lab
 - Better isolation of laser lab racks
- Beam Monitoring System
 - Source of glitches in dark fringe
 - Broken piezo actuator
 - Repaired





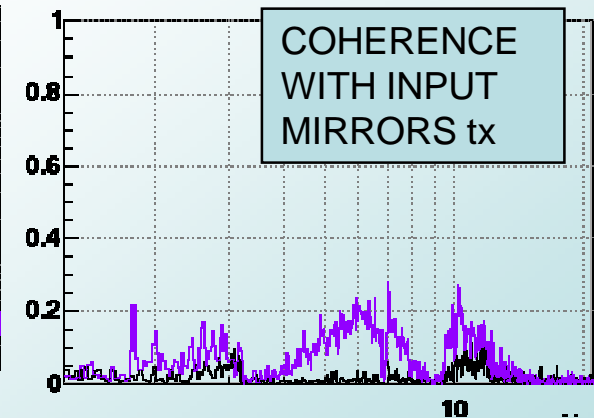
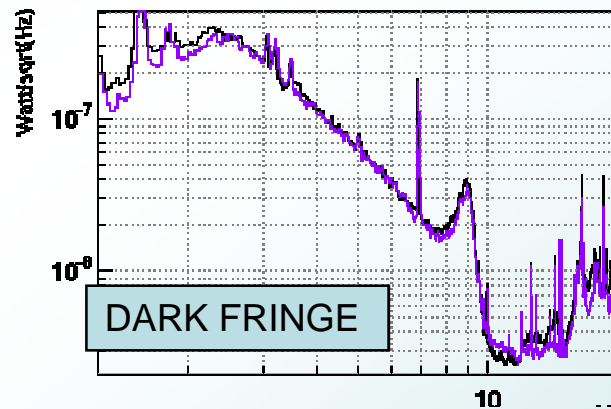
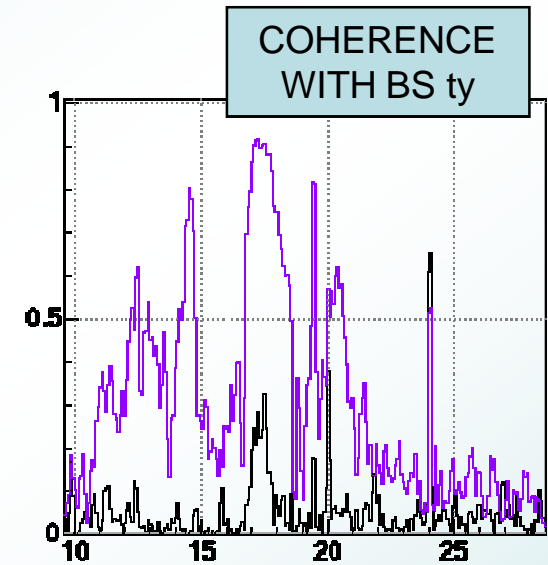
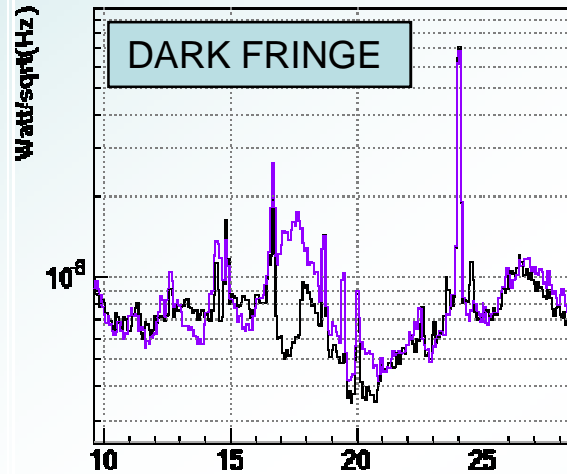
Commissioning activities /2

- Fix of fast unlocks
 - Caused by
 - Laser lock on input mode cleaner loop
 - Slave laser lock on master laser
 - Modified slave laser pumping diodes power supplies
 - Optimized laser injection loop
- No more fast unlock after intervention (three weeks)



Commissioning activities /3

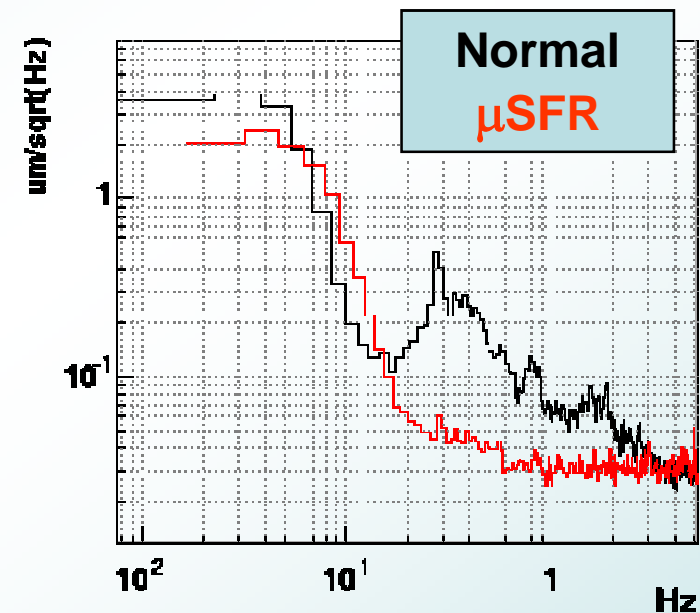
- Improvement of BS angular control
- Better centering of input mirrors
- Resulted in noise reduction between 10-20 Hz





Commissioning activities /4

- **Micro-seismic Free Reconstruction (μ SFR)**
 - Control of top stage suspension of PR mirror using a combination of PR and NI local signals
 - Reduce the effect of micro-seismic peak at 200-400 mHz
- **Earthquake Guardian**
 - Based on RMS of top stage suspension signals
 - Switch off **GIPC** to put suspensions in robust configuration
 - Allows to survive to most of EQ



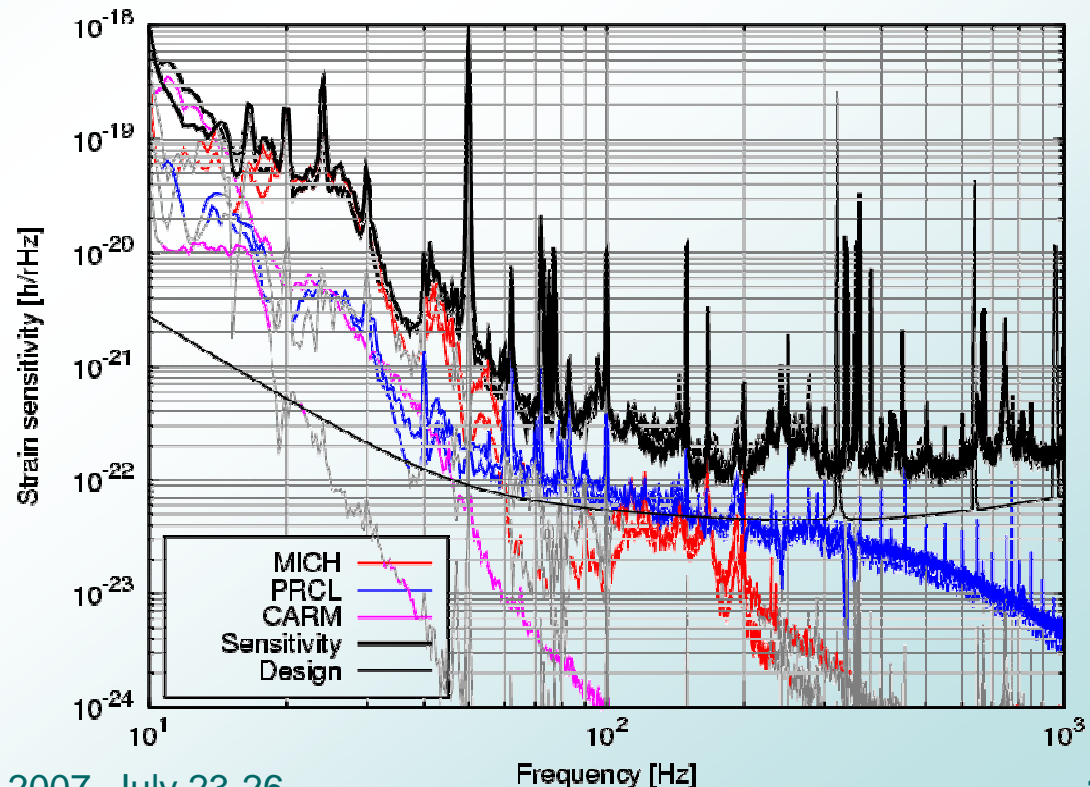
Global Inverted Pendulum Control:
use global signals to replace local sensors for top stage suspension longitudinal control

Good against wind and sea, bad against earthquakes



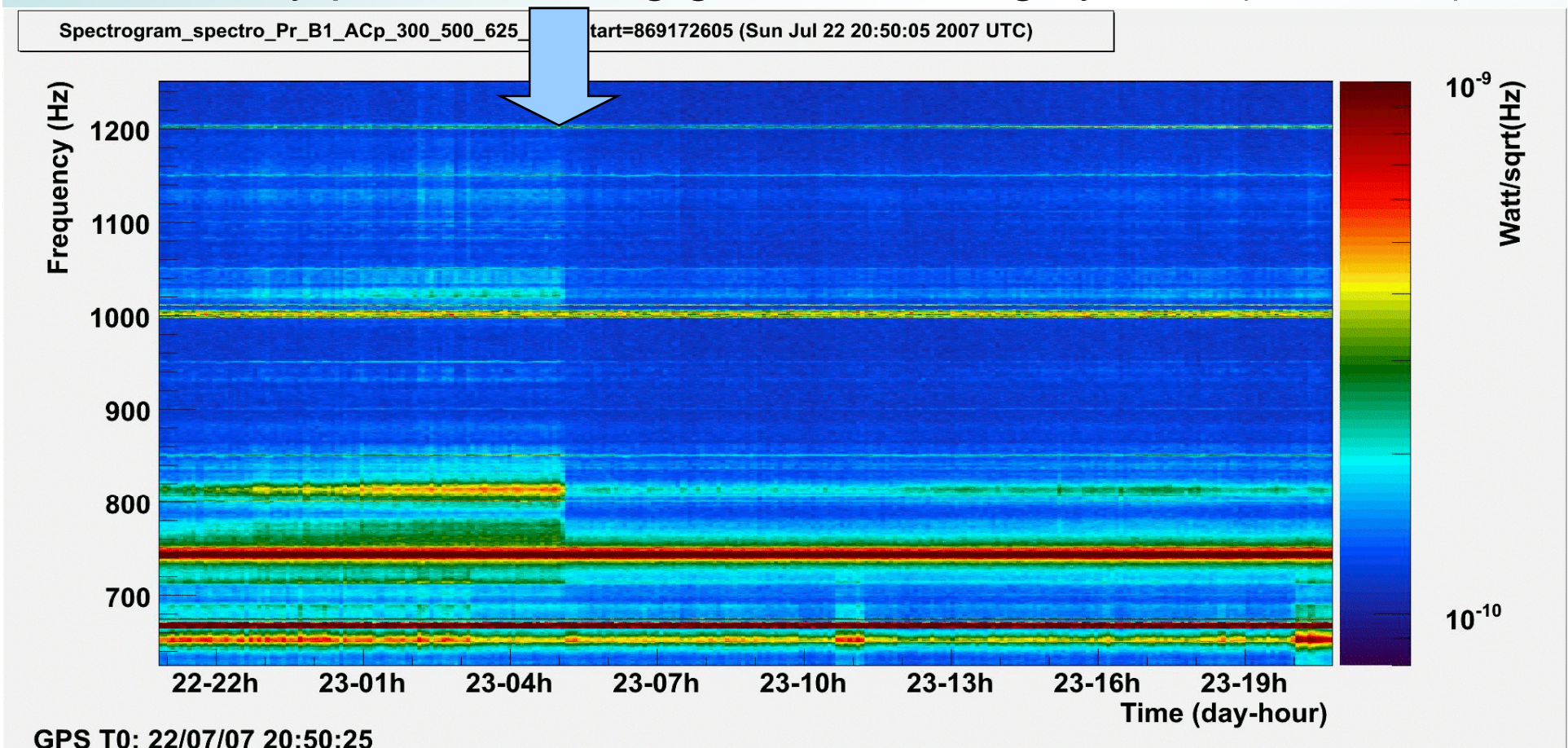
Commissioning activities /5

- Reduction of arm actuators noise
 - This noise was limiting around 100 Hz
 - Added additional emphasis / de-emphasis filters to reduce DAC noise
 - Reduced DAC noise by a factor 5 at 100 Hz
- Reduction of longitudinal control noise
 - Common Mode of end mirror (not laser frequency control) improvements
 - No more limiting at low frequency



Alignment drifts

- Caused by mis-centering of quadrant in terminal station
- Quadrants mounted on translation stages, **too noisy**
- Already plans for using galvo centering system (GEO600)





Future commissioning activities

- Focus on noise between 100 and 1000 Hz
 - Environmental investigations
 - Beam jitter and power stabilization
- Global Control problems
- Low frequency control noise reduction
- Improvements in injection suspension controls
- Fix quadrant mis-centering

