

Deflection Measurement of GRP in the STF-cryostat B

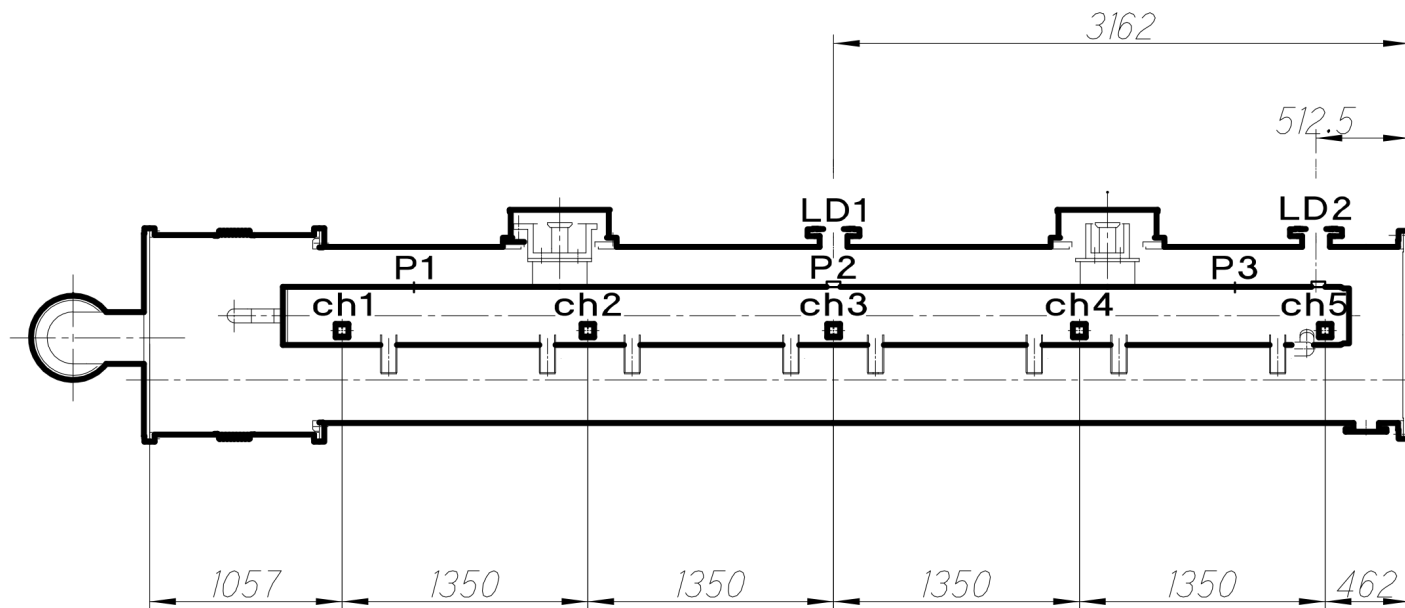
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June 23 2009

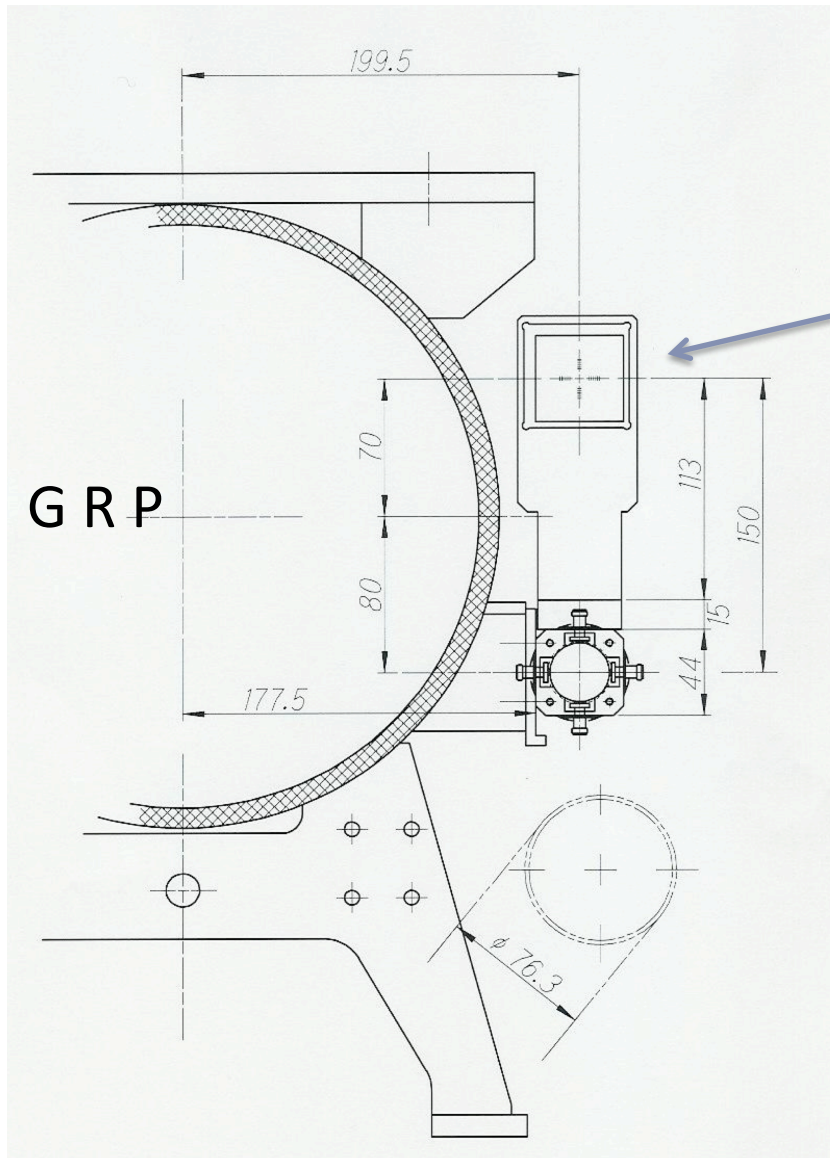
Measurement methods and set up

- 1) Laser displacement: LD1 and LD2, real time measurement distance (ΔY) between GRP and Vac vessel sensor
- 2) Wire Position Monitors: 5 monitors, ΔX and ΔY , real time measurement
- 3) Optical telescope: 5 targets (same position as WPMs), ΔX and ΔY



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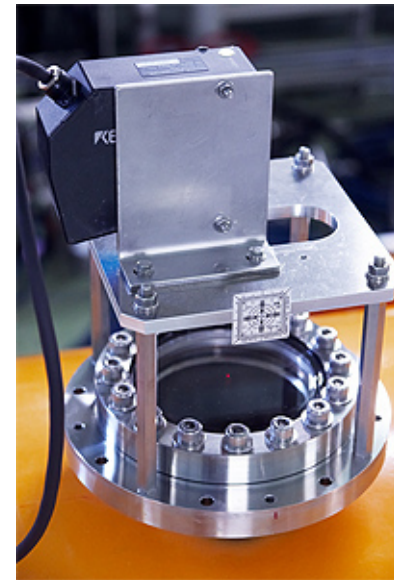
WPM and Optical target



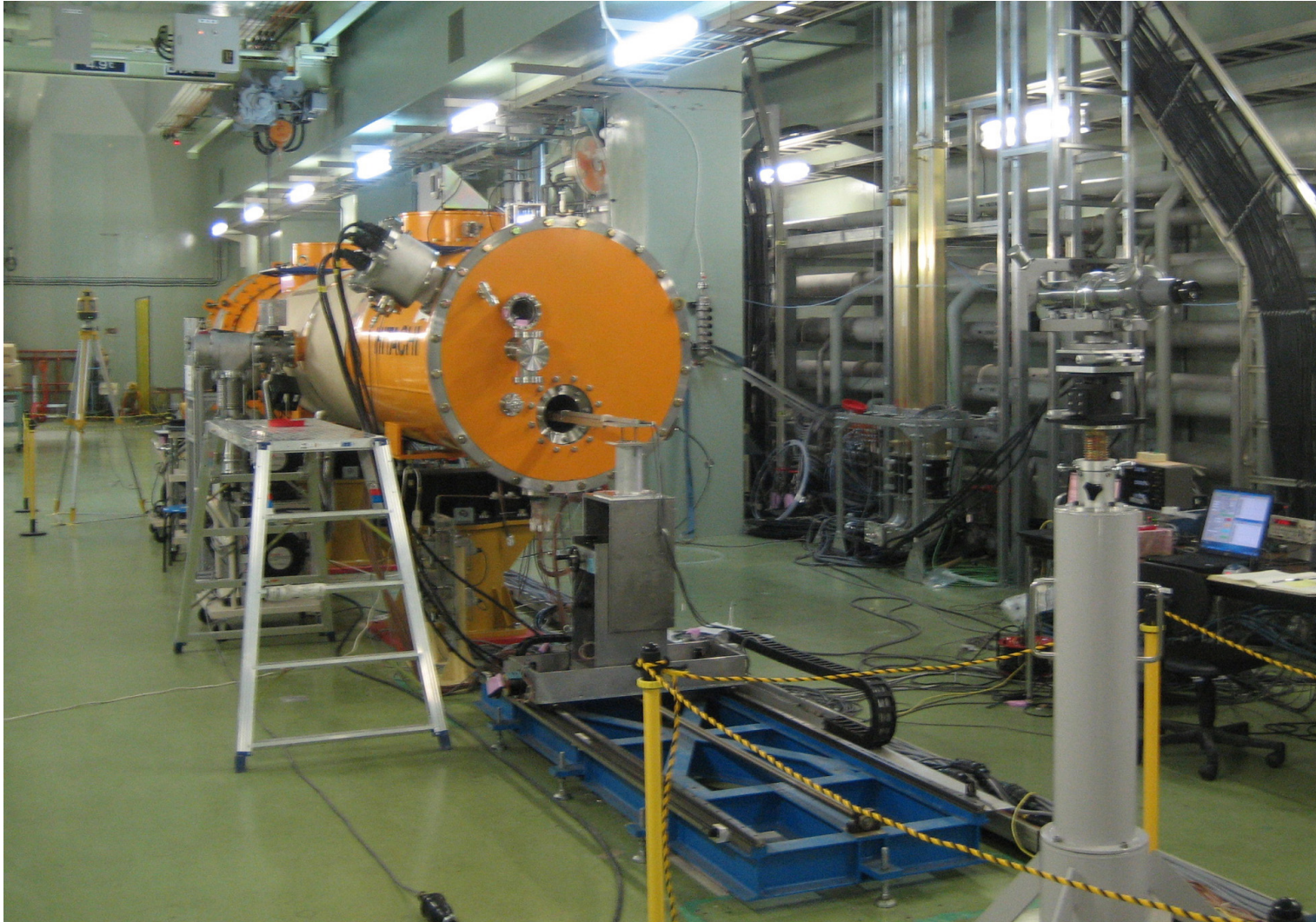
Optical target

WPM

Laser displacement sensor



Cryostat B and telescope (1)



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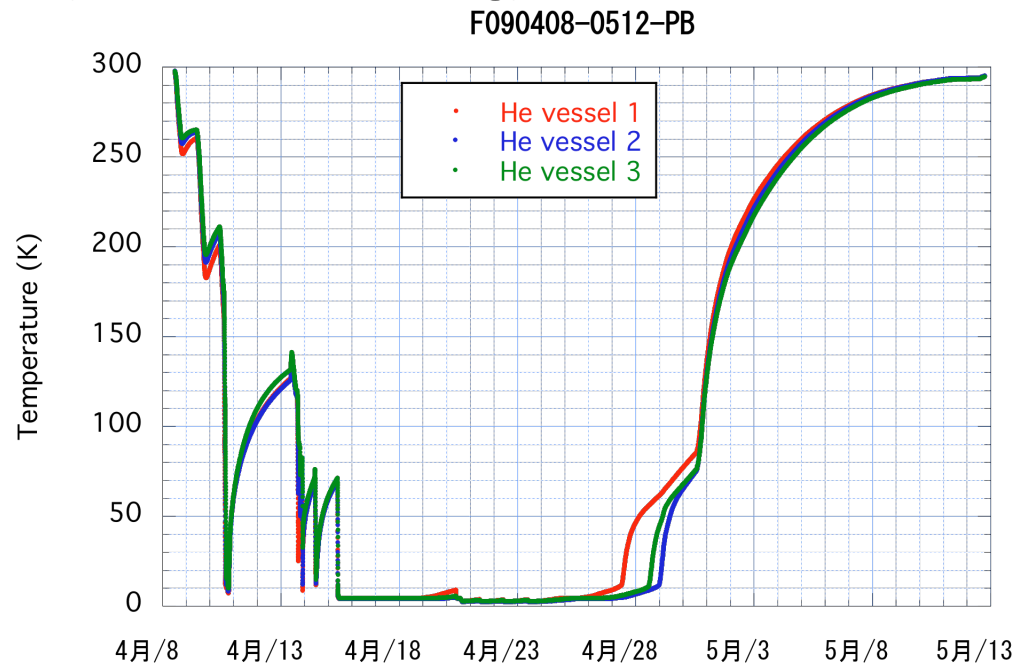
Cryostat and Laser displacement sensors (2)



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Cooling

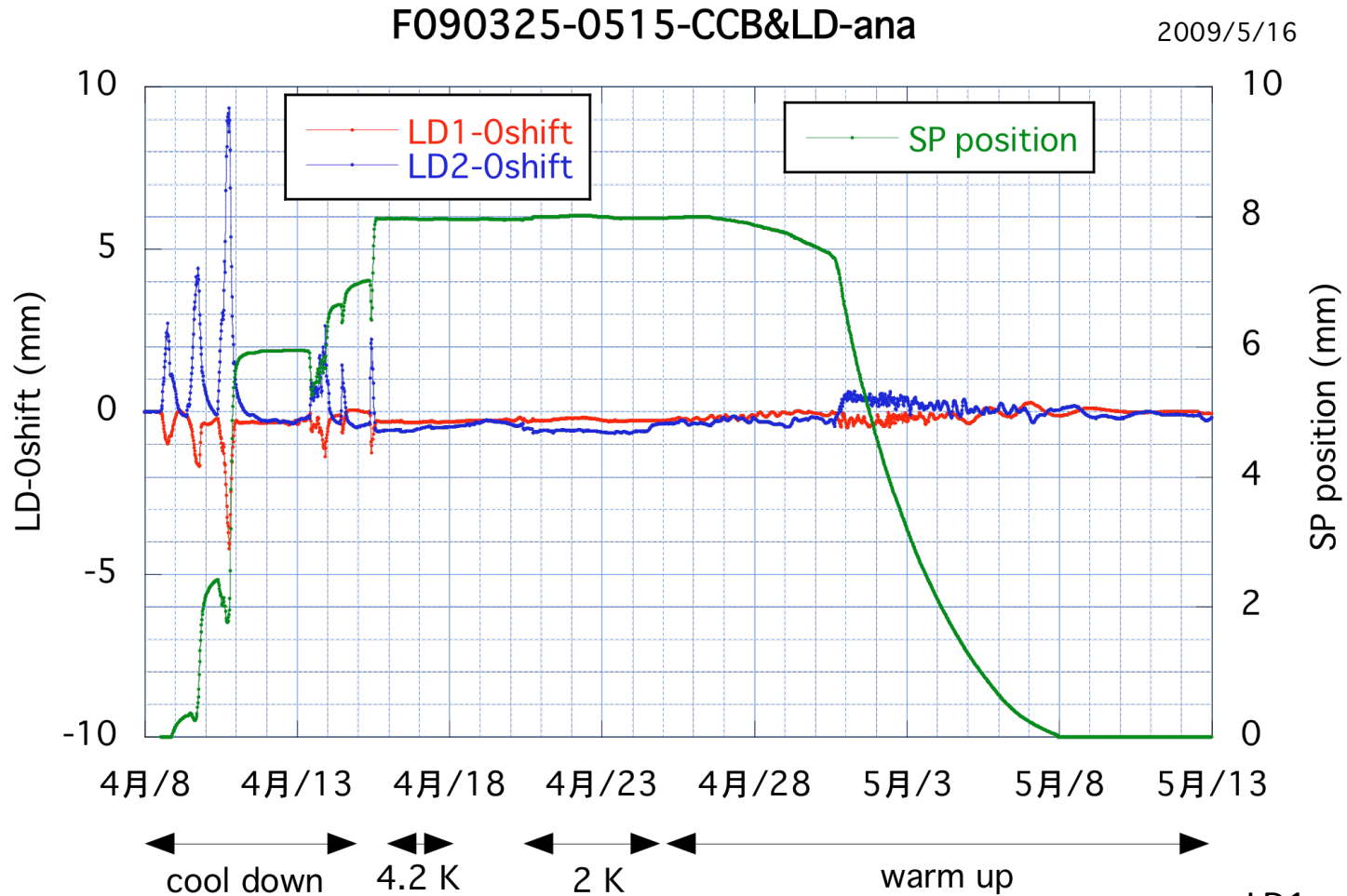
- April 8 and 9 : GHe ($\sim 80\text{K}$), mass flow rate = $\sim 1\text{ g/sec}$
- From April 10 : LHe
 - at 4.2 K mass flow rate = $\sim 0.35\text{ g/s}$
 - at 2 K mass flow rate = $\sim 0.4\text{ g/s}$
- Feature of this cooling: system was operated only in the daytime (intermittent cooling)



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Data of each measurement methods

Laser displacement sensor

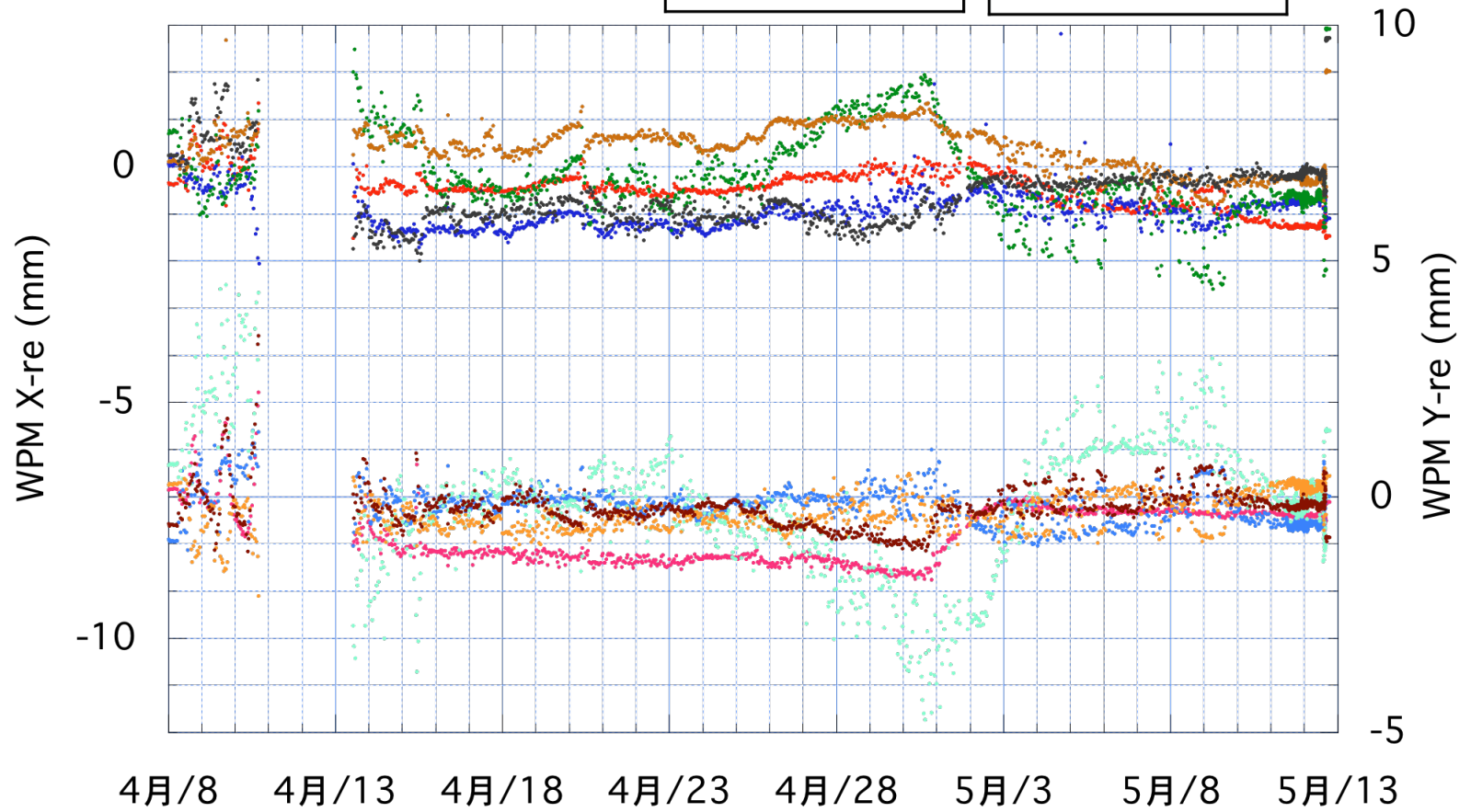
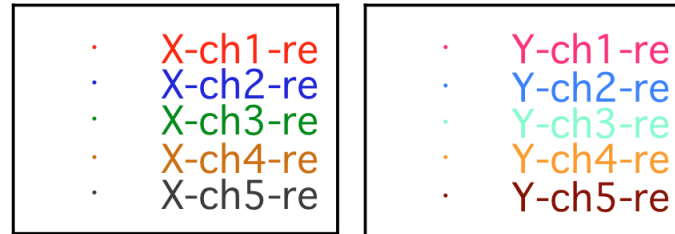


LD1 = 0 mm
LD2 = -0.08 mm

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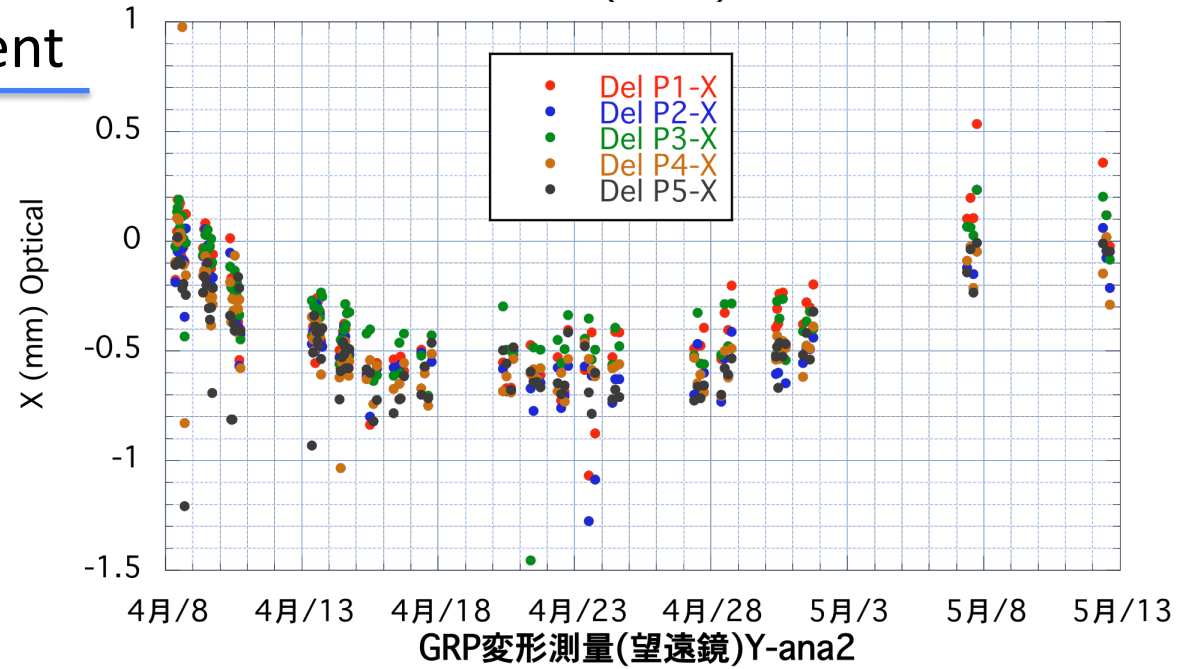
Wire Position Monitor

F090402-0512-WPM-ana

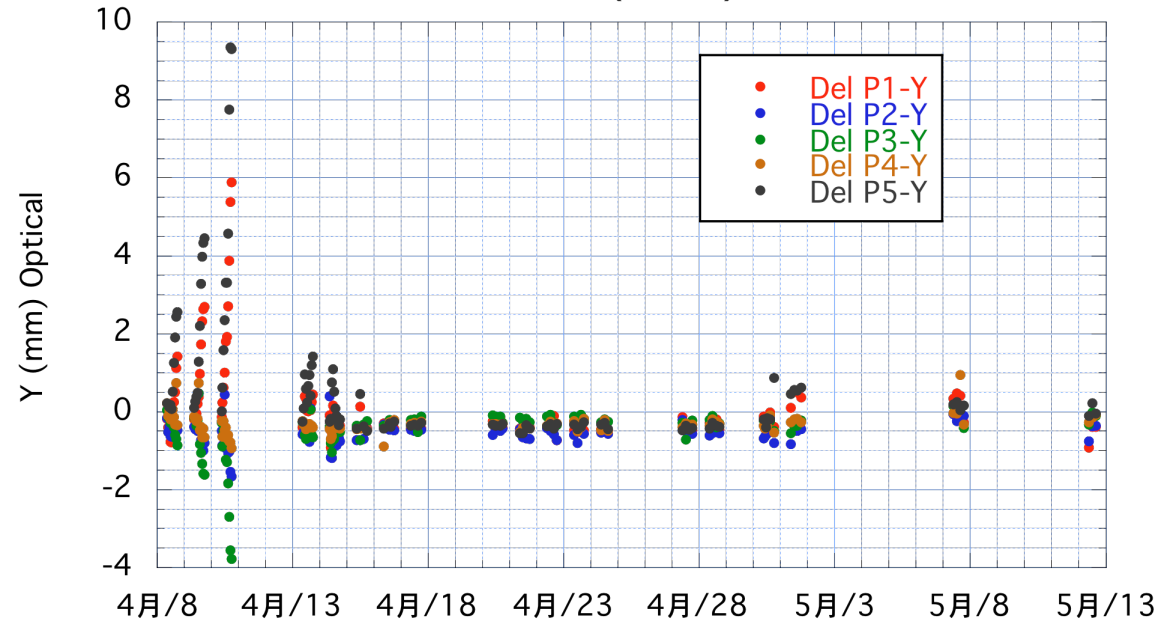


Optical measurement

GRP変形測量(望遠鏡)X-ana2

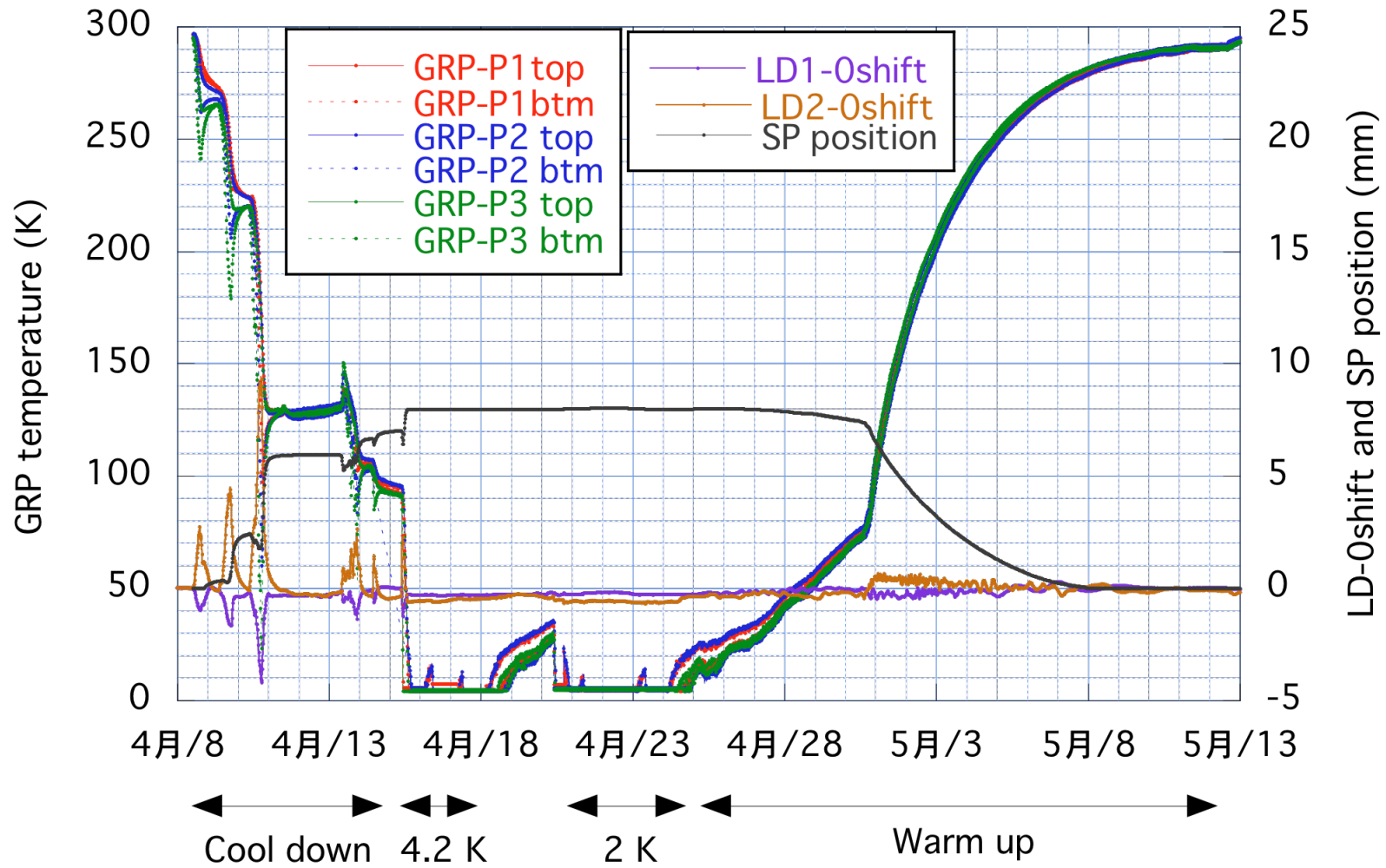


GRP変形測量(望遠鏡)Y-ana2



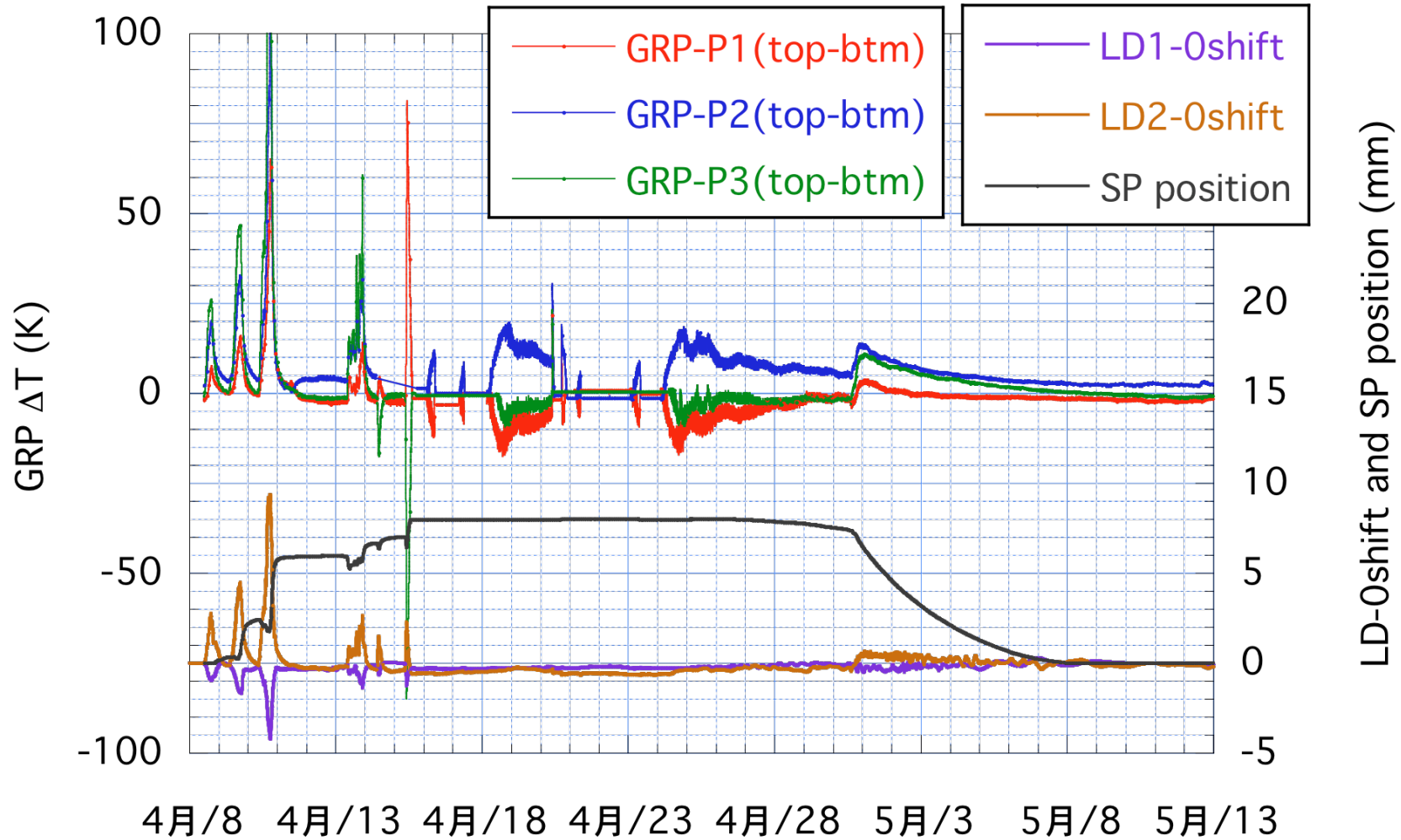
GRP Temperature and LD data

F090325-0515-CCB&LD-ana



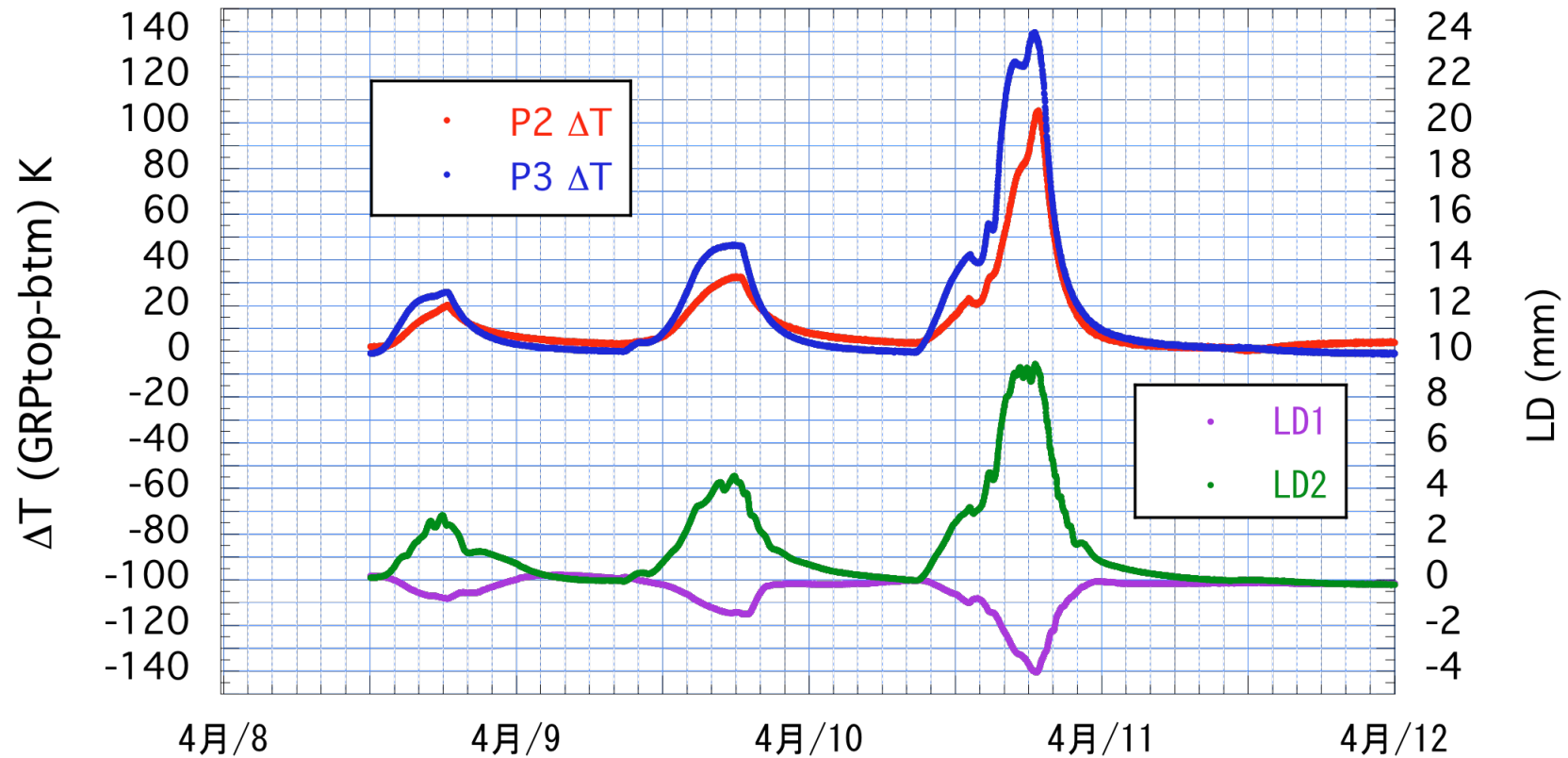
GRP Temperature Difference and LD data (1)

F090325-0515-CCB&LD-ana



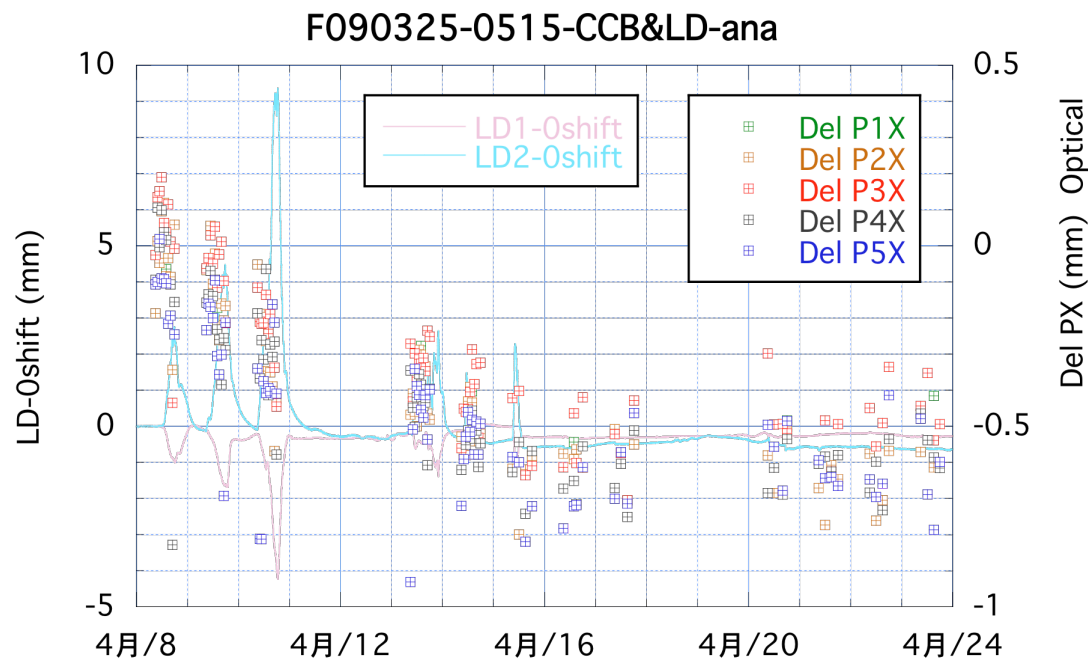
GRP Temperature Difference and LD data (2)

090408-0413-CCB&LD-ana

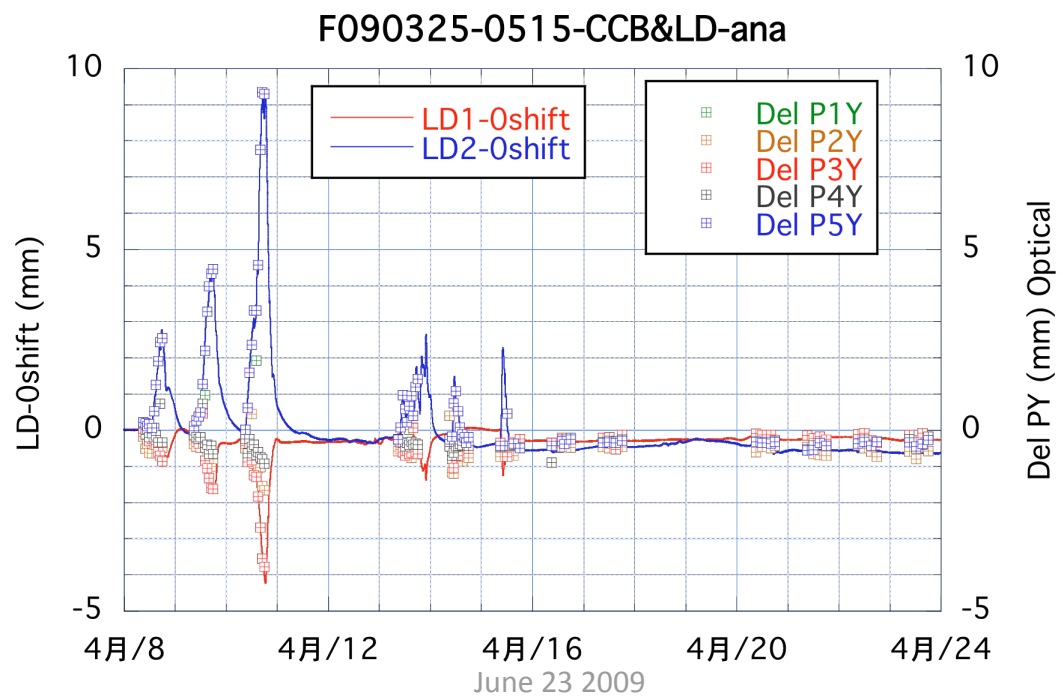


Clear correlation between ΔT and LD data

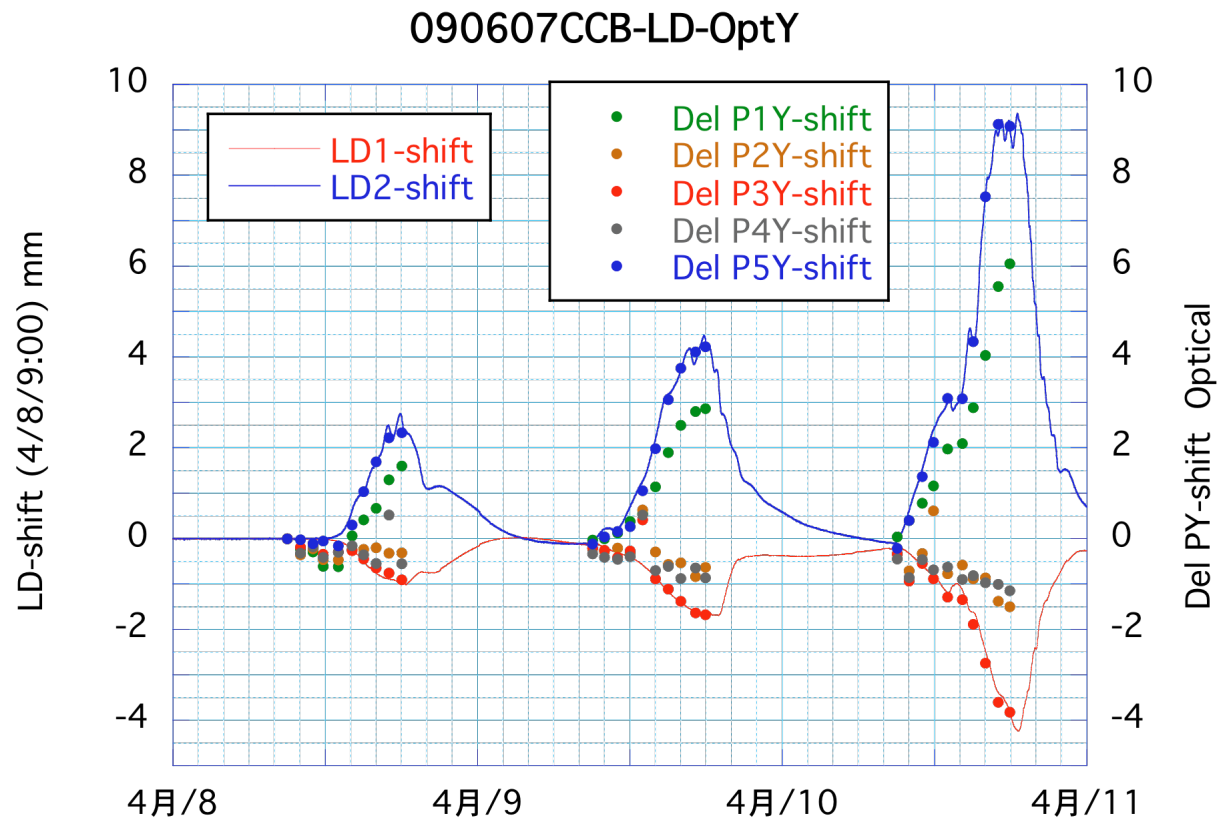
Optical
measurement
and
LD



Thermal contraction
of GRP = 0.56 mm

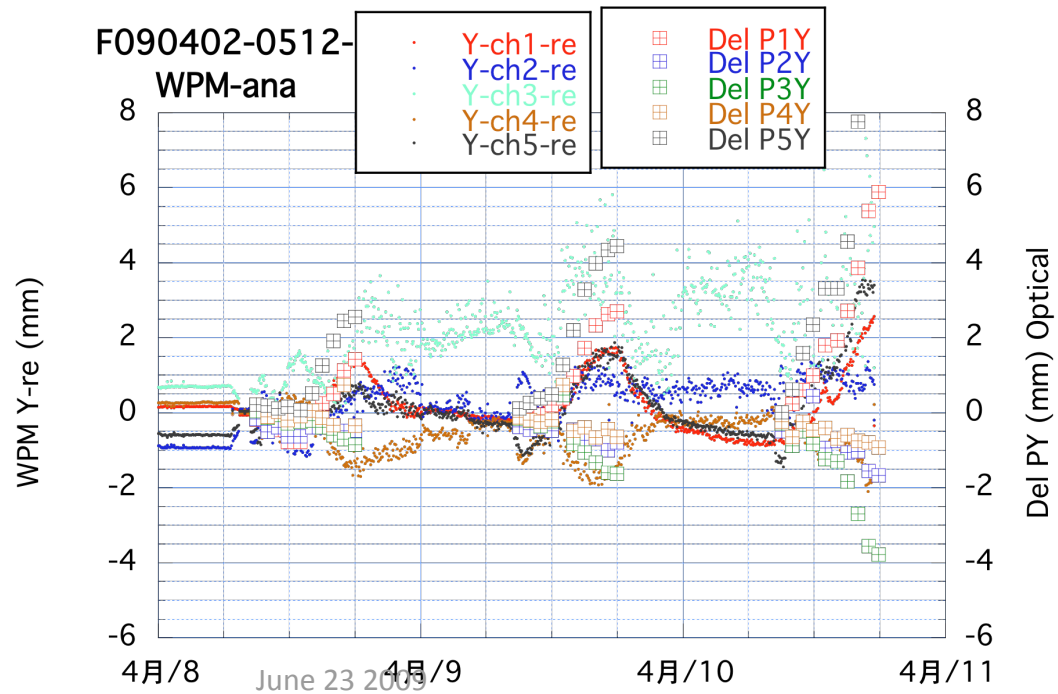
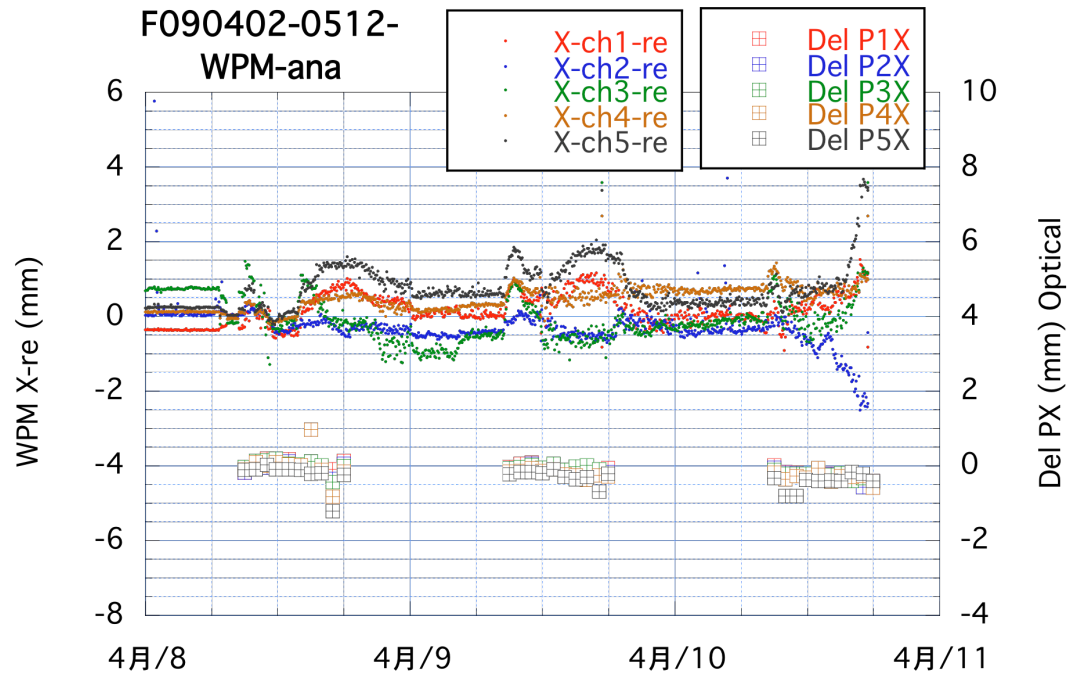


Deflection of GRP during the cool down - LD and Optical data -



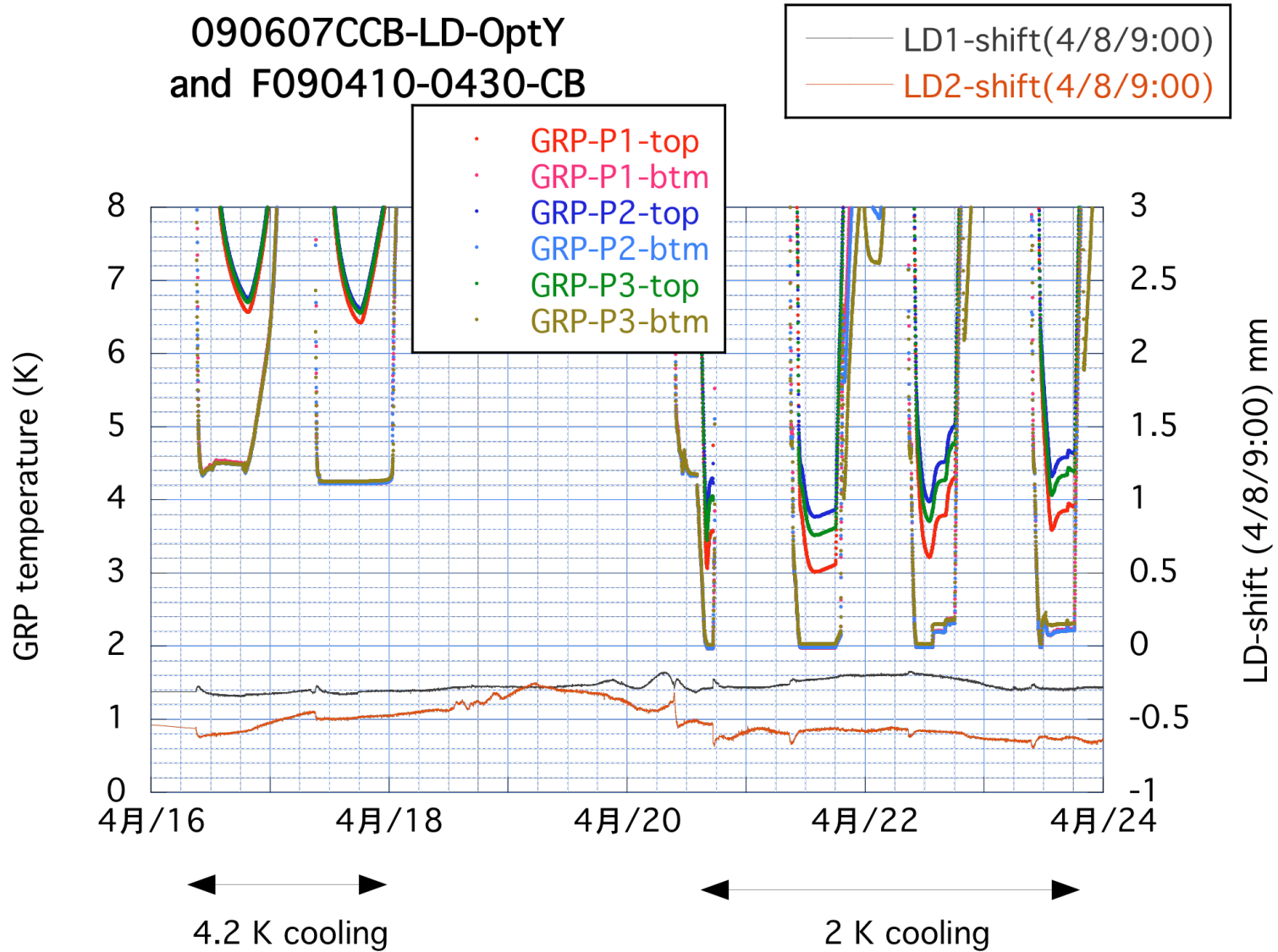
Banana shape deflection of GRP

WPM and Optical measurement



Deflection of GRP at 4.2 K and 2 K

090607CCB-LD-OptY
and F090410-0430-CB



Summary (1)

➤ Deflection of GRP

- Laser displacement sensor: Vertical displacement

* Rather large deflection (max 9 mm) was observed at the end of GRP during the cooldown

* Summary of LD data;

	before cooling	4.2 K	2 K	after warm up
GRP center(LD1)	0	- 0.3 mm	- 0.2 mm	0 mm
GRP end (LD2)	0	- 0.5 mm	- 0.58mm	-0.08 mm

(Thermal contraction of Support post = - 0.25 mm)

- Optical measurement: Horizontal and Vertical displacement

Horizontal displacement @ cold: 0.5- 0.6 mm

Vertical displacement @ cold: almost the same as that of LD

* Accuracy of this measurement was ~ 0.2- 0.3 mm

* Banana shape vertical deflection of GRP can be seen in the data

* The deflection of GRP must be due to the temperature difference between top and bottom of GRP

Summary (2)

➤ Sensors:

- Laser displacement sensor is very reliable
- Accuracy of optical measurement was 0.2~0.3 mm
- Improvement of KEK WPM system is necessary to get reliable data.

➤ Next step:

At this point we don't have enough data to fully understand the deflection of GRP. No data about the stability of GRP position at cold and the reproducibility of the position change after the thermal cycles.

- More detailed study of GRP position at 2 K should be performed, if ILC requires the alignment accuracy of < 0.1 mm.