Fulfillment of SLR daylight tracking of Changchun station

ZHAO You, HAN Xingwei
FAN Cunbo, DAI Tongyu

Changchun Observatory of NAOC, CAS

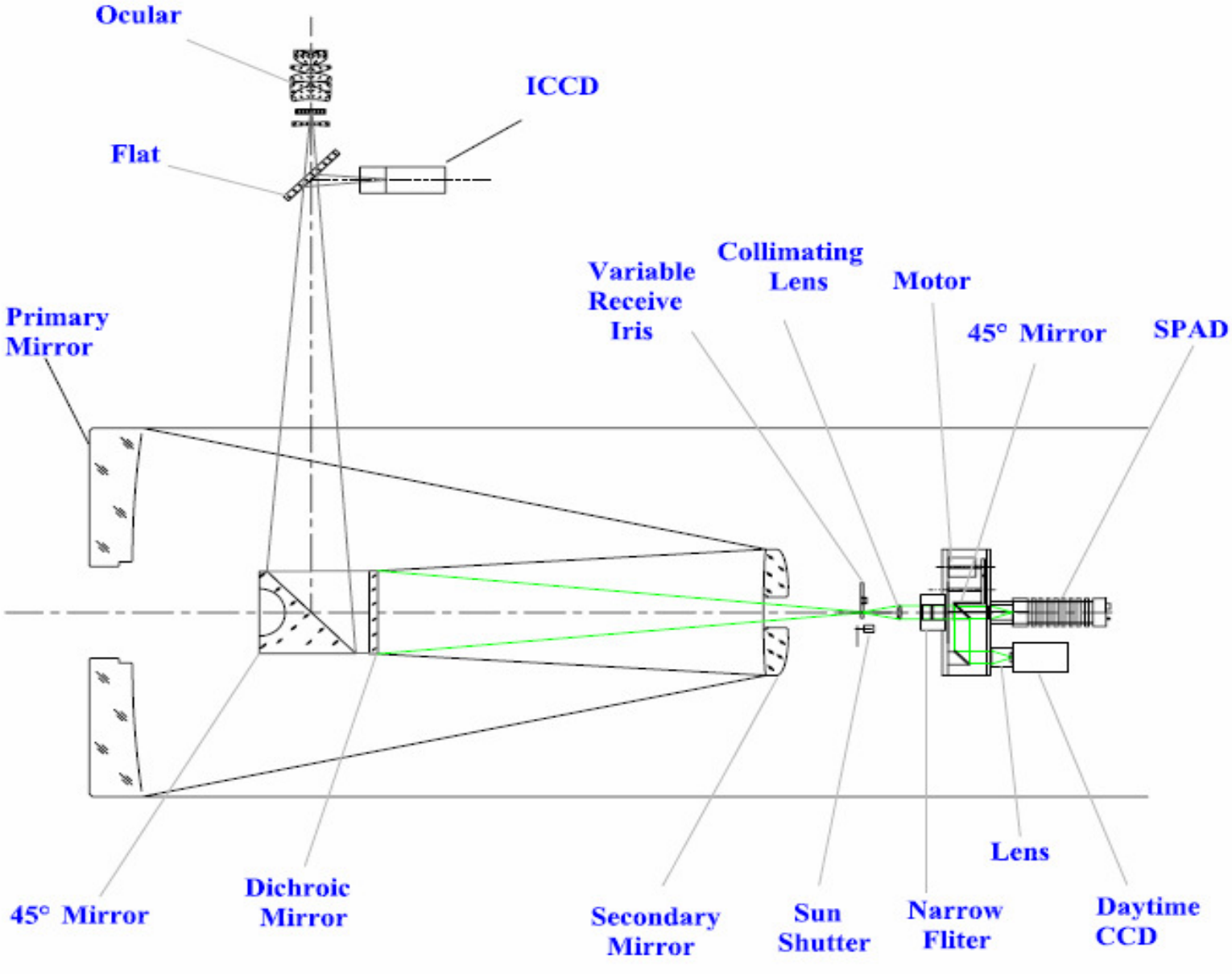
Content

- Some main technologic problems for daylight tracking
- Daylight tracking on Changchun SLR system
- Conclusion

❑ Main technologic problems for daylight tracking

1. Precise orbit prediction
2. Reduce the effect of daylight sky background noise on photoelectric detector
3. Parallelism of transmitting and receiving paths
4. Intensive light protective methods

❑ Tracking Optical Scheme on Changchun SLR system



1. Ways to reduce effect of daylight background noise

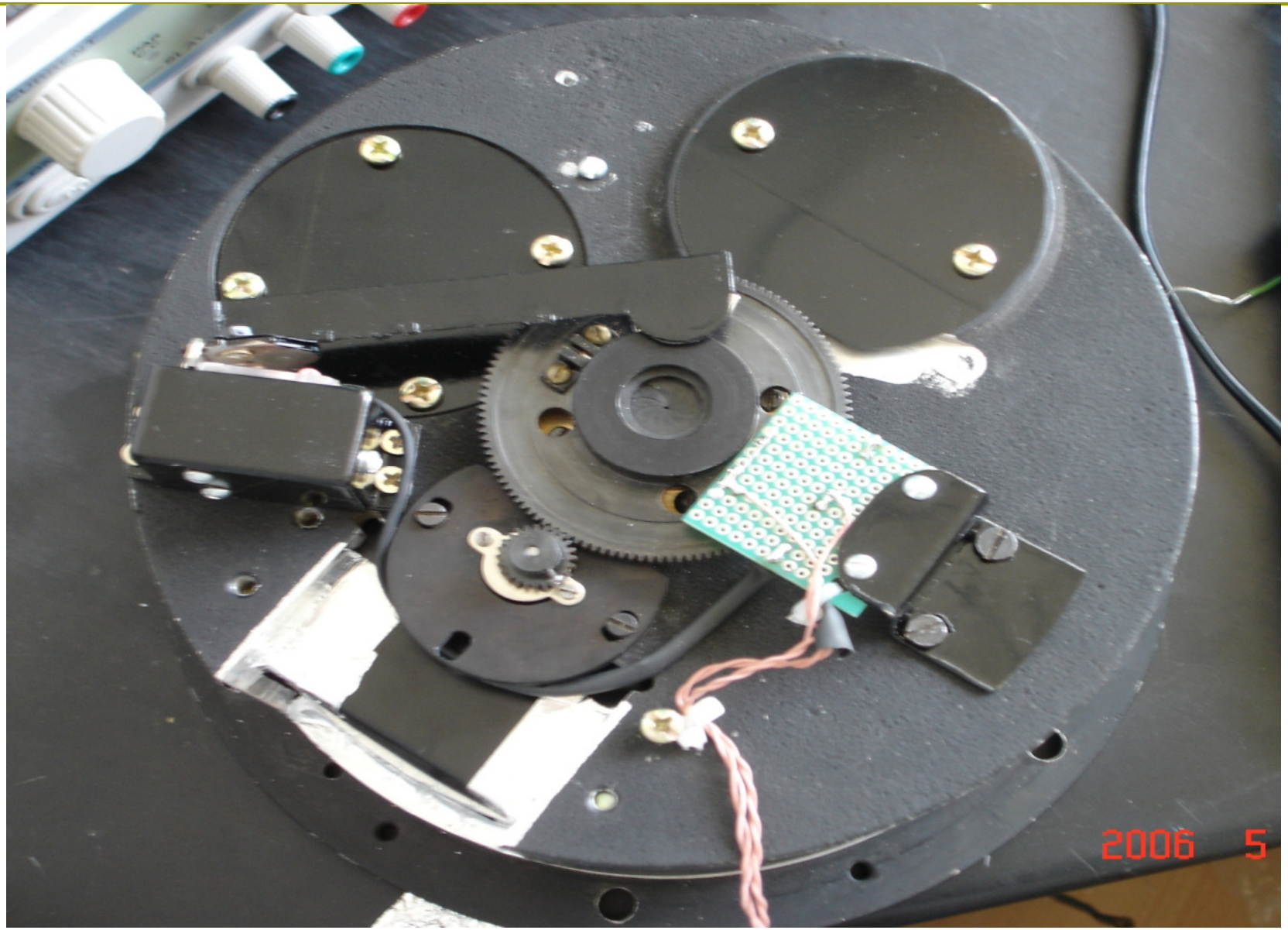
- Space filter
- Timing filter
- Spectrum filter

➢ Space filter

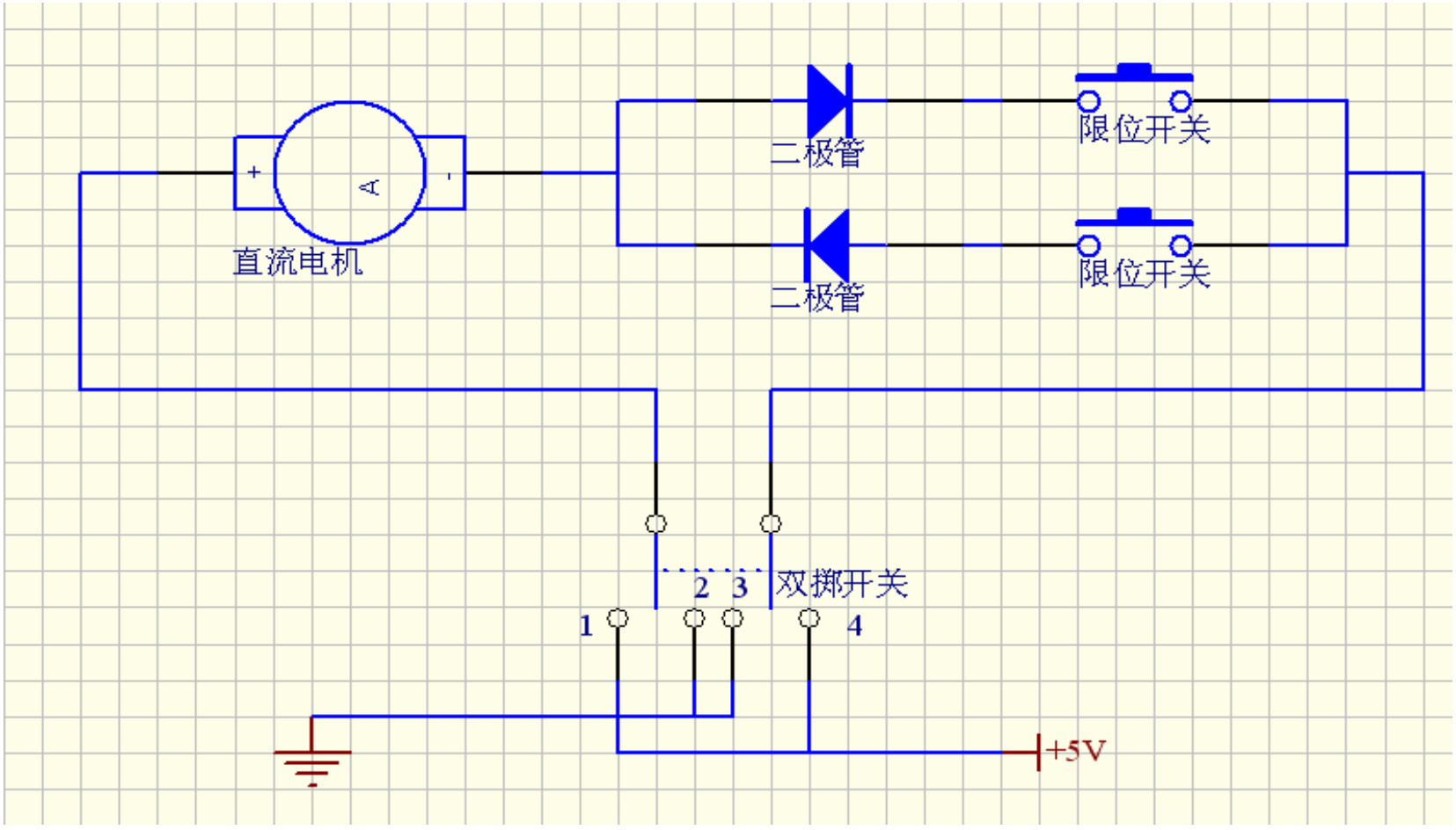
Variable Receiving Iris diaphragm

Receiving Field of view： 45"--12'

Variable Receiving Iris diaphragm



Electronic Control Diagram



Timing filter

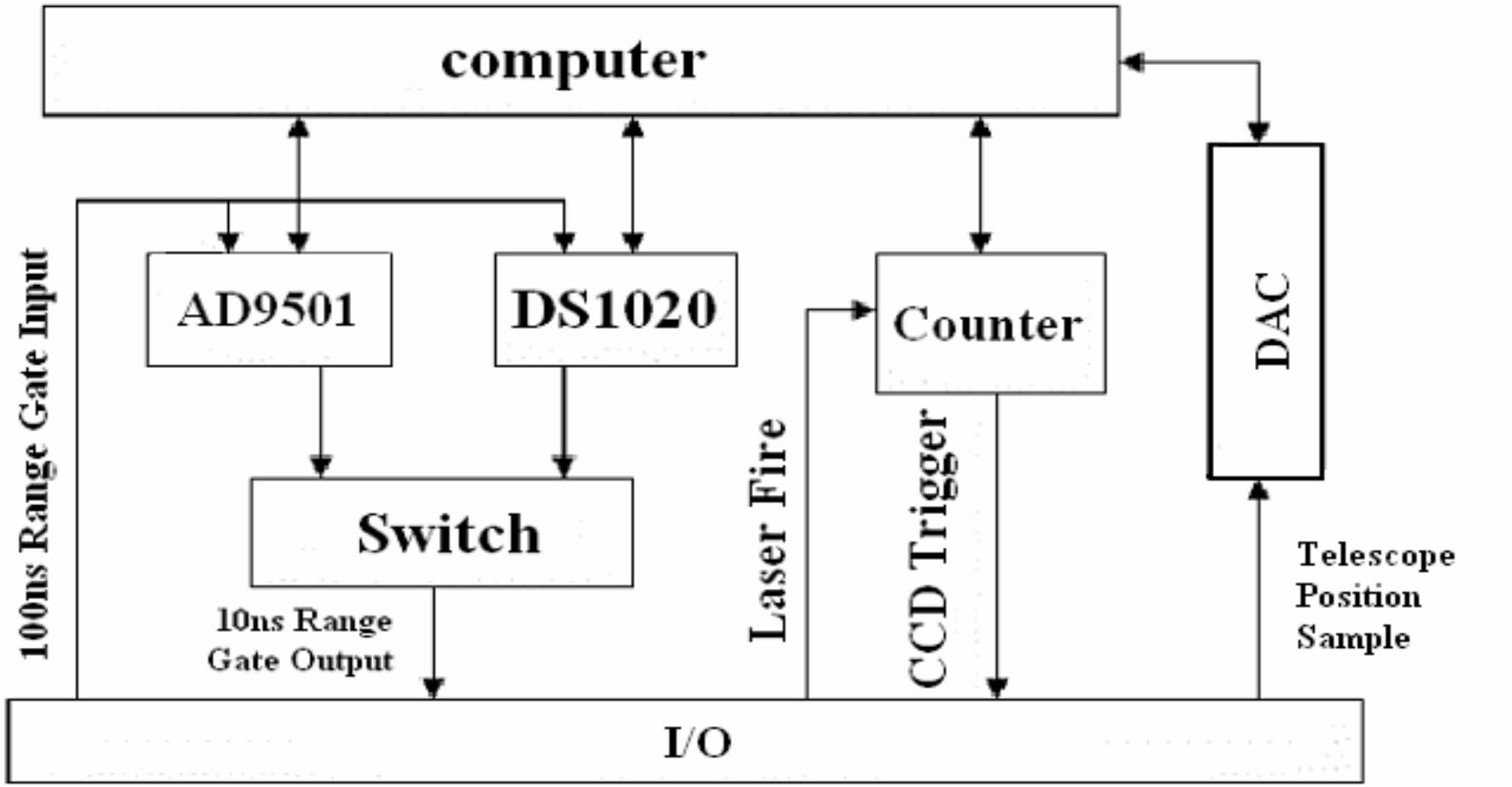
Control precise range gate

AD9501: programmable digital delay generator. 10ps precision time delay,delay: 2.5ns--10us (capacitance and resistor)

DS1020: 8 bits programmable delay device,serial parallel mode. Max.delay time: 48.25ns (fast mode),520ns (slow mode)

Range gate: <20ns

Generate Circuit Chart



➢ Spectrum filter

Andover Narrow Band Interference Filter

Center Wavelength : 531.9 nm

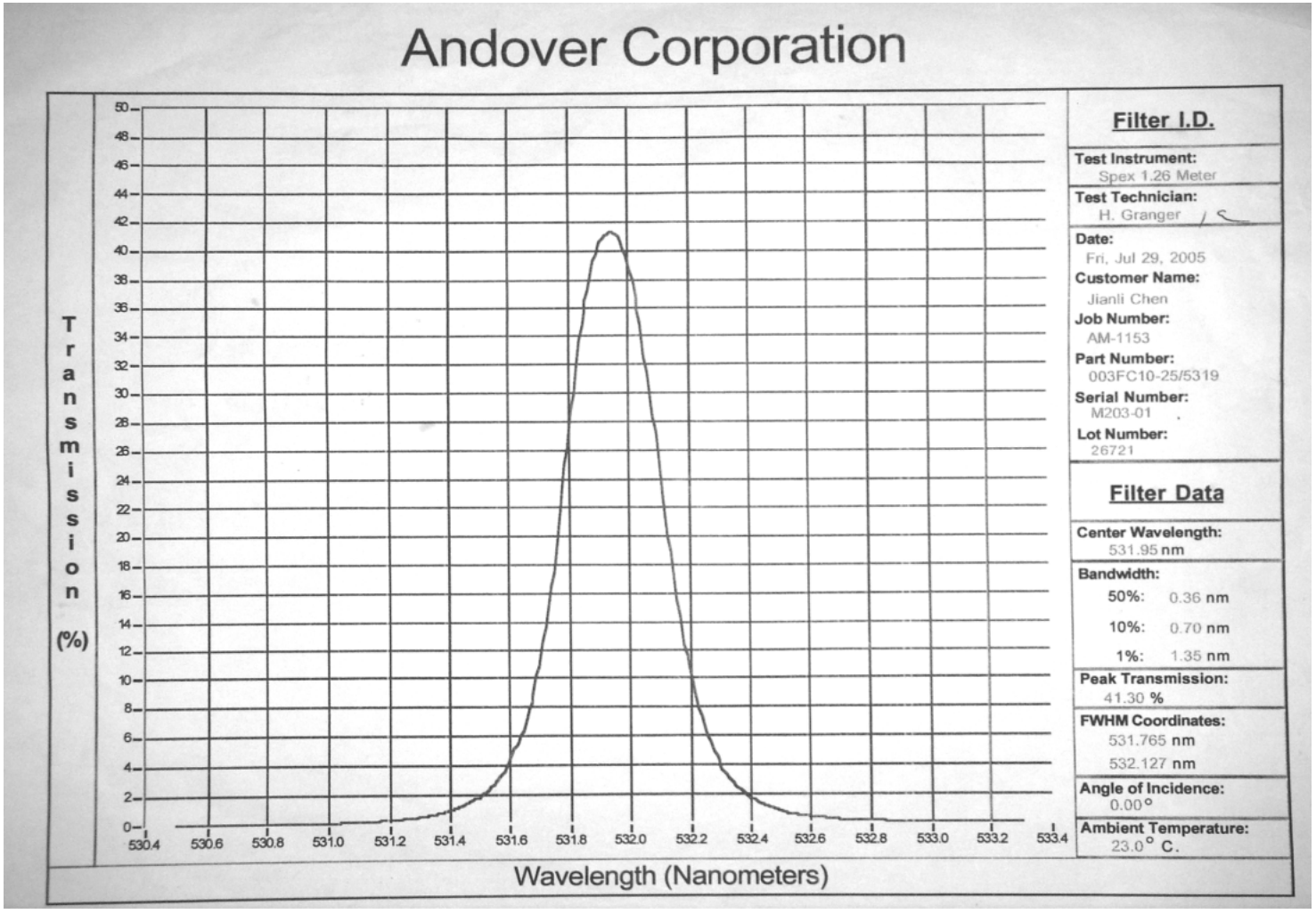
Bandwidth : 0.3±0.1 nm

Peak transmission: 41.30 %

Ambient temperature: 23℃

Size : Φ25.0+0/-0.25 mm

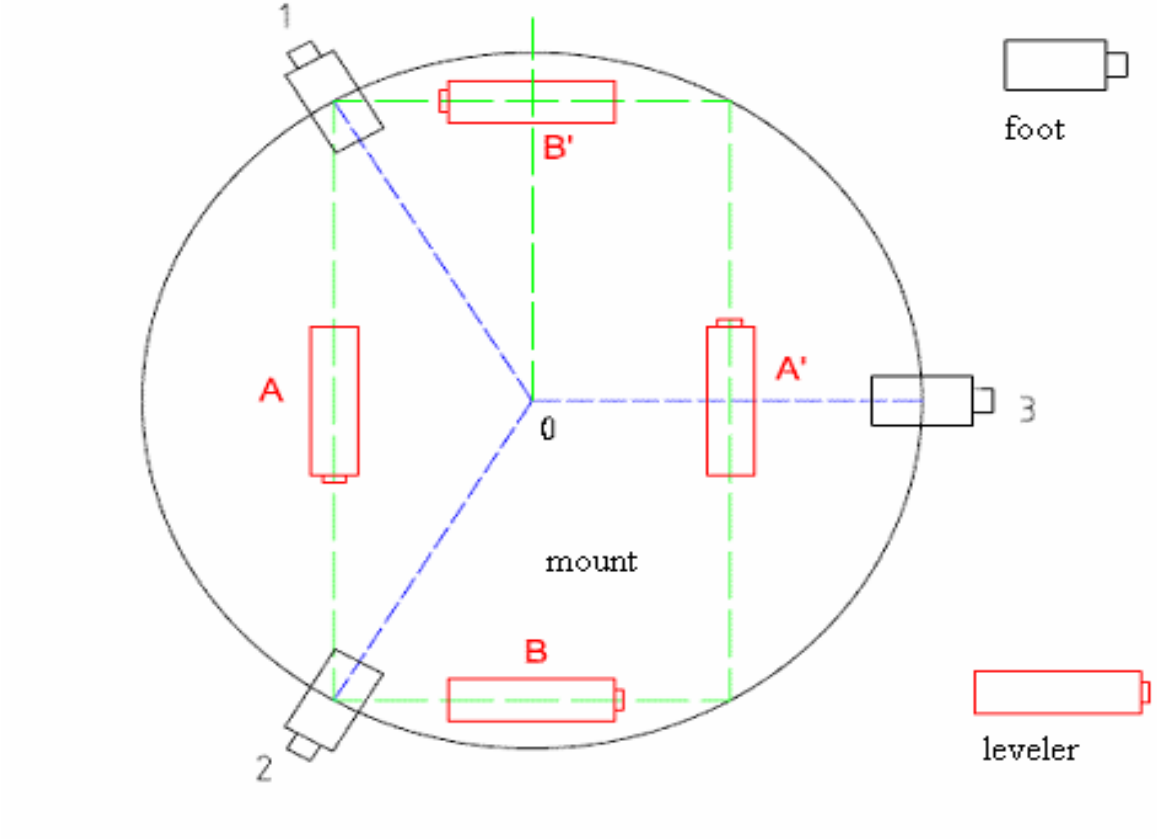
The temperature controller provides protection against the influences of ambient temperature fluctuation.



0.3nm滤光片检测报告

2. Parallelism of transmitting and receiving paths

- ✓ Mount leveling



after leveling:

$$i = \sqrt{a_1^{\,2} + b_1^{\,2}}$$

where

$$A = \arctan\left(\frac{a_1}{b_1}\right)$$

$$a_1 = \frac{1}{6}\sum_{j=0}^{11} f(\alpha_j)\cos(30^\circ \cdot j); b_1 = \frac{1}{6}\sum_{j=0}^{11} f(\alpha_j)\sin(30^\circ \cdot j)$$

after calculation:

The slant error of perpendicular axis:0.5 "

The azimuth angle perpendicular to the slant direction :0.1 "

- ✓ Collimation measurement

$$c = \frac{1}{2}(A_R - A_L \pm 180)$$

$$\mathrm{RMS} = 3'02''$$

- Zero error measurement of encoder

polestar observation

the error of encoder zero position:

$$\Delta A_0 = 180.682431^{\circ}$$

$$\Delta E_0 = 0.016084^{\circ}$$

- ✓ Application of mount model

（RMS）： Azimuth： 5.5 "

Altitude： 4.8 "

- ✓ Adjustment of sensitive area of detector
- ✓ COUDE path fine adjustment
- ✓ Directional adjustment of output laser beam

- Monitor laser beam during daylight

JAI CV-M10SX CCD

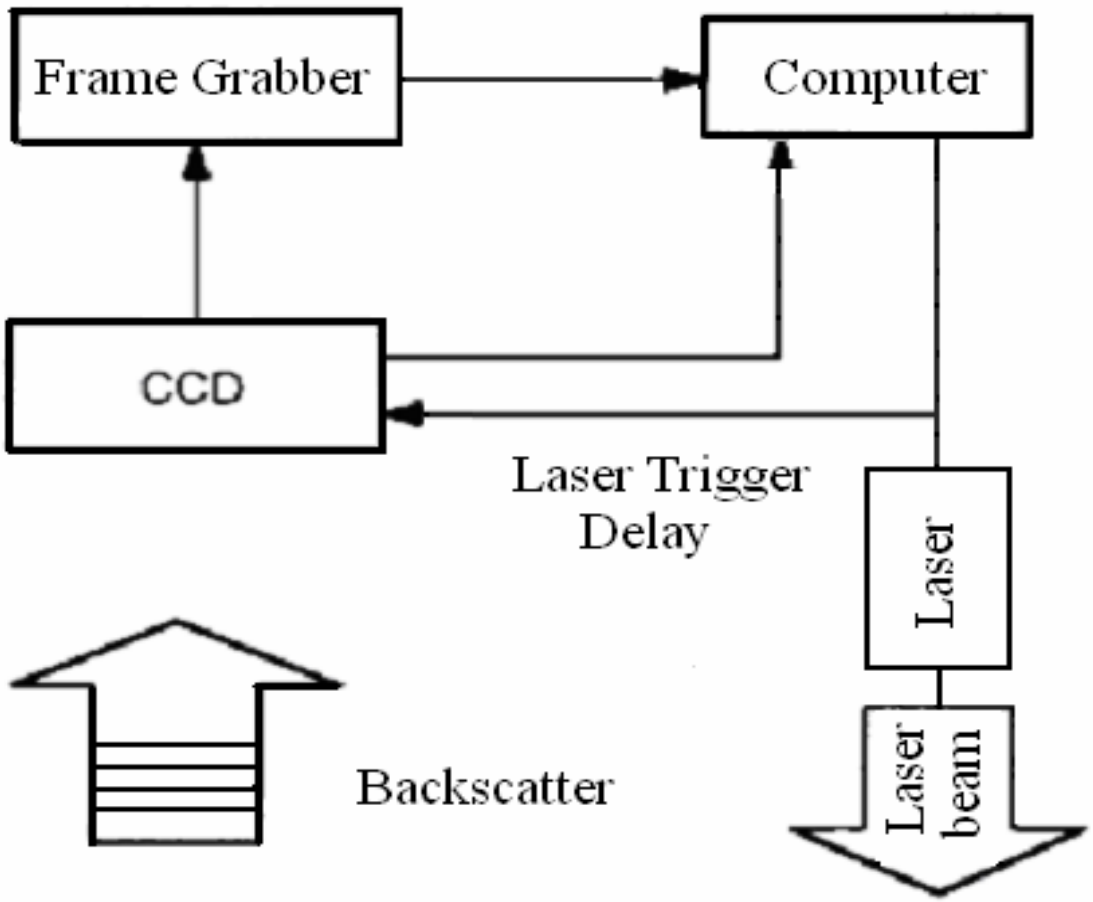
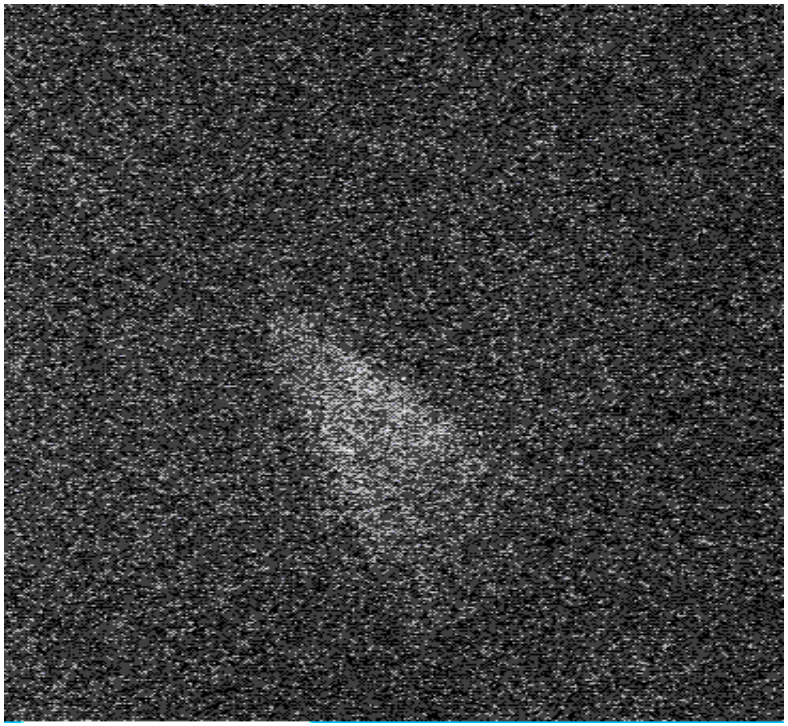
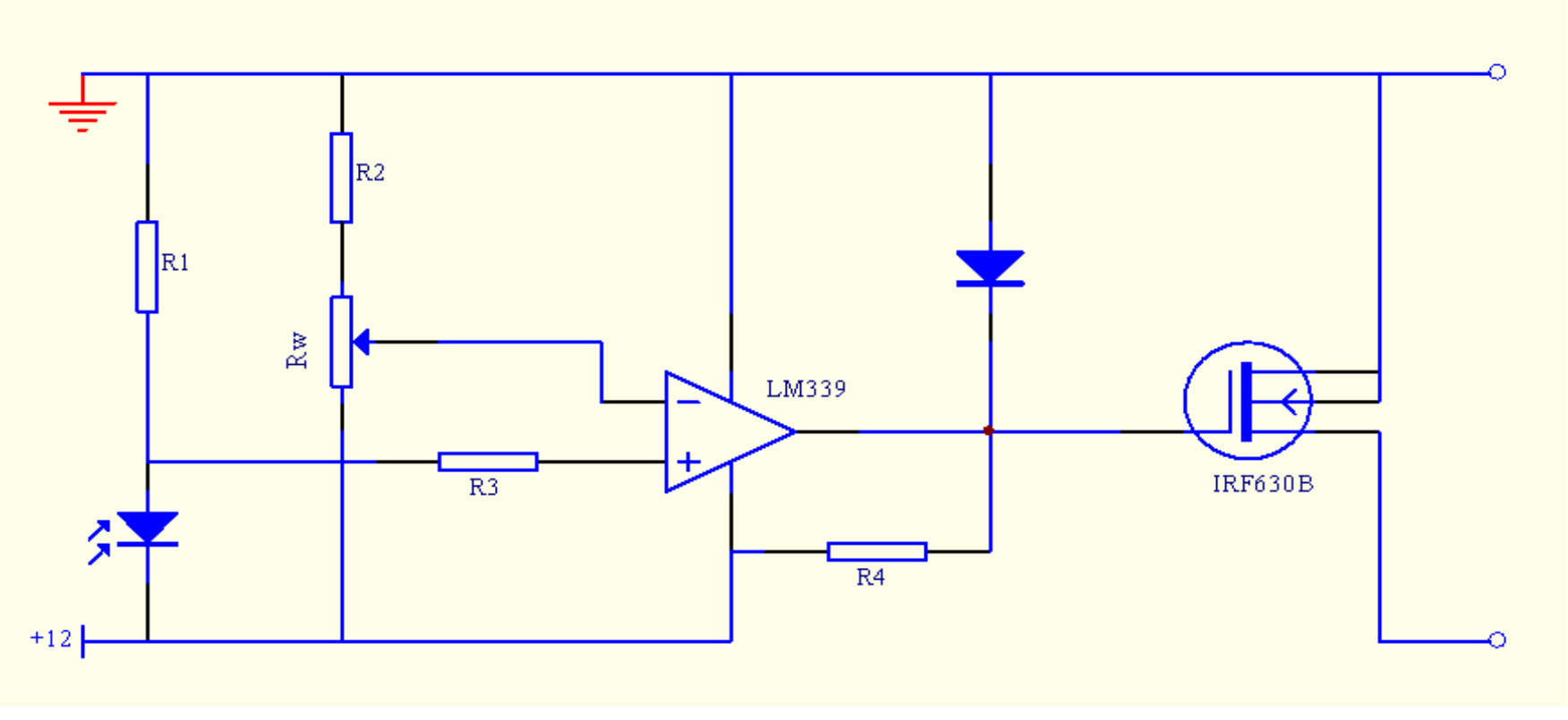


Image of Daylight Laser Beam



3. Intensive light protective methods



Electronic diagram of light protective

4、Conclusion

- Almost everything, including hardware and software, is ready since the end of last year. Because of the cold weather we decided to do the test at the beginning of this year.
- In March of 2006, Galileo project was launched. Changchun station was selected to track Galileo satellite by Chinese government and ESA. So we have to change our plan and daylight tracking test has to be delayed.
- The Galileo project of first phase was finished, but the acceptance is not done. We have to wait for until it is over.
- But we are sure the condition is suitable for daylight tracking. And we will try the daylight tracking at the end of this year or the beginning of next year.

Thanks