

# The Real Time Flare Monitor System at HSOS

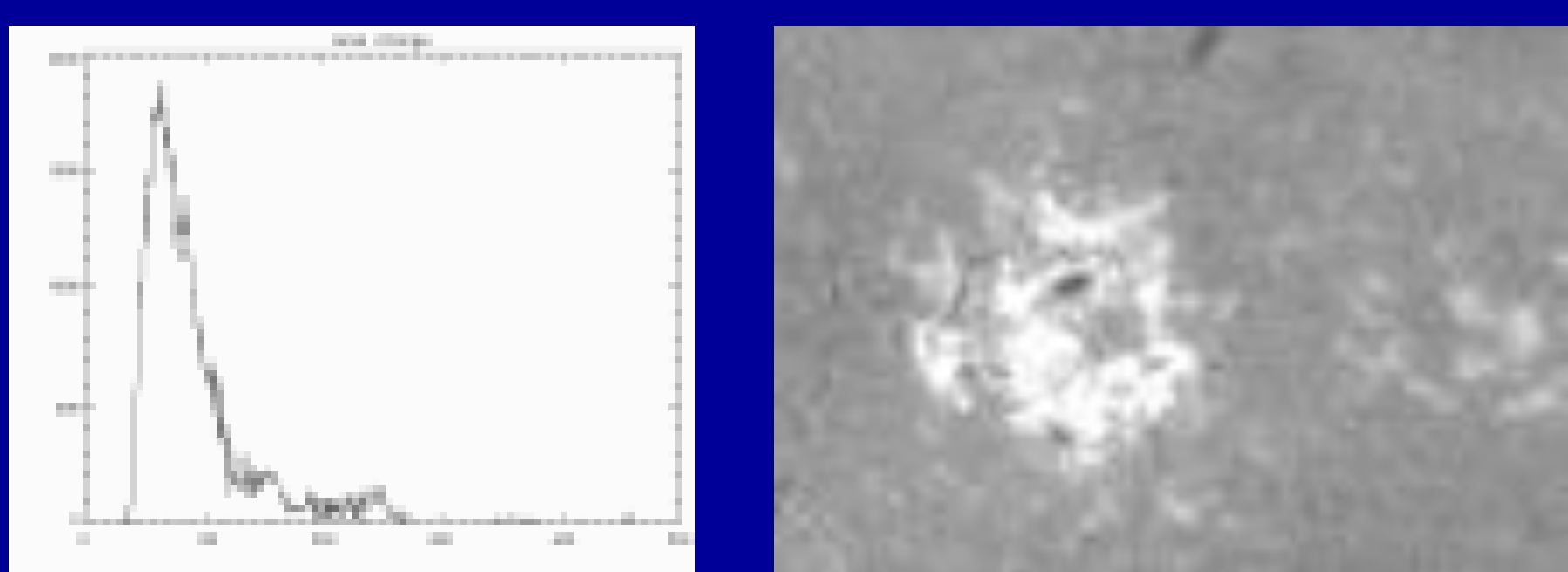
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## ABSTRACT:

Flare is one of the most concerned activities on the solar surface. A Real Time Flare Monitor System (RTFMS) had been founded and put into use at Huairou Solar Observing Station (HSOS) in 2013. In RTFMS, an adaptive threshold algorithm for real time flare detection is designed based on morphological methods and statistical results. In order to reduce the false detections caused by clouds or unintended operations, the raw data from CCD to RTFMS must go through rigorous steps. In the typical clear day, RTFMS could detect C1.X flare. Besides the routine observation mode, RTFMS has a flare mode for high cadence observation, when there is a flare, the local data covered flare could be recorded at the rate of 2f/s and the full disk image at the rate of 1 f/m.

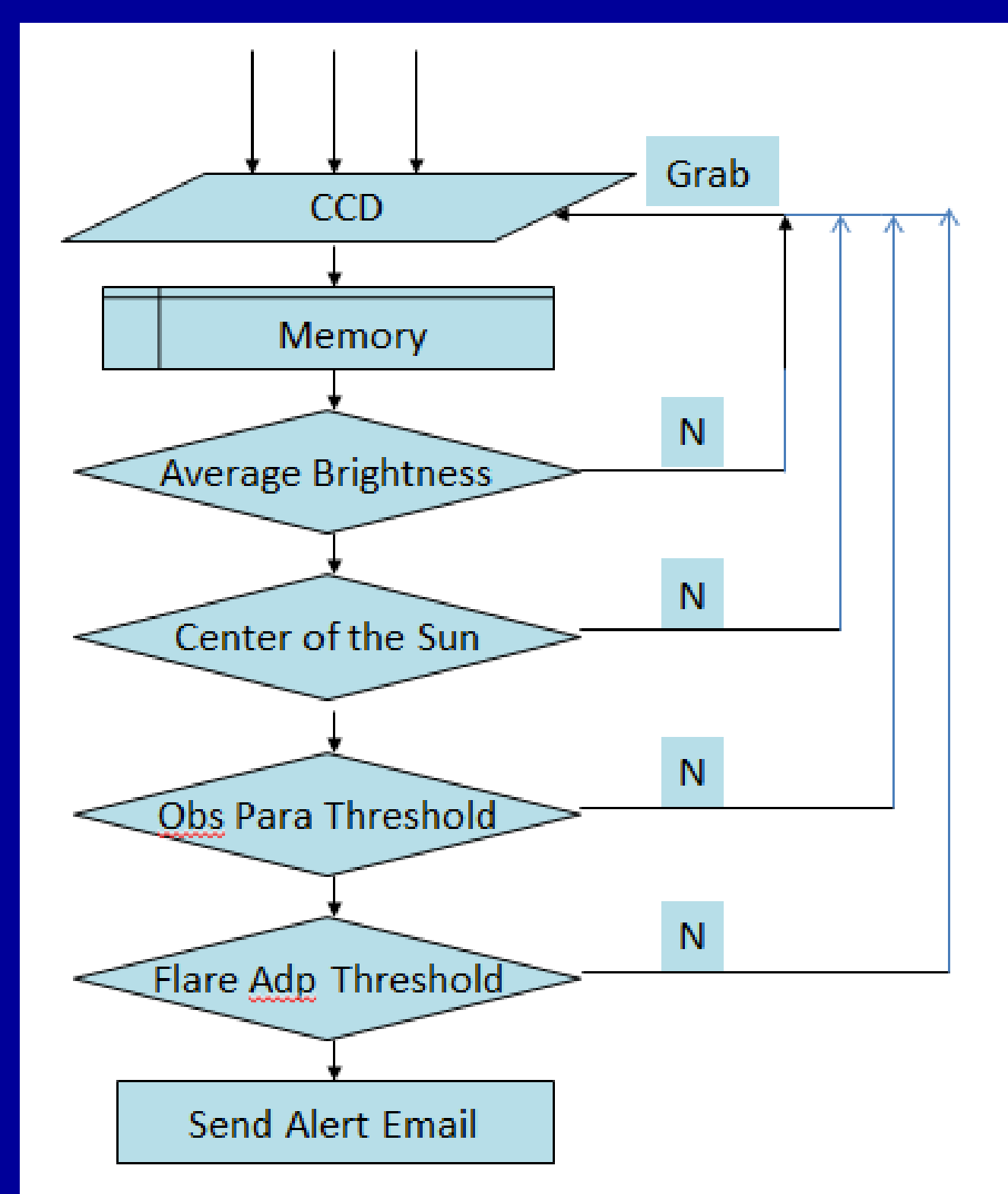
## Flare detection Algorithm:

### 1) Key feature of Ha flare



Typical intensity change profile of a flare    Data overflow -- no information

## Flow chart of the algorithm:



## Conclusion:

RTFMS could detect flares in real time. By four layers logic judgments, the accuracy of the algorithm for flares above C5.0 is 100%. There are missed flares due to bad weather, data cross check with other observatories could greatly improve the ability of RTFMS. Flare mode of RTFMS could be trigger by flare onset and record data at a rate of 2f/s. Every detected flare has a record in the obs log.

## Acknowledgements:

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## References:

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## Hardware & Software

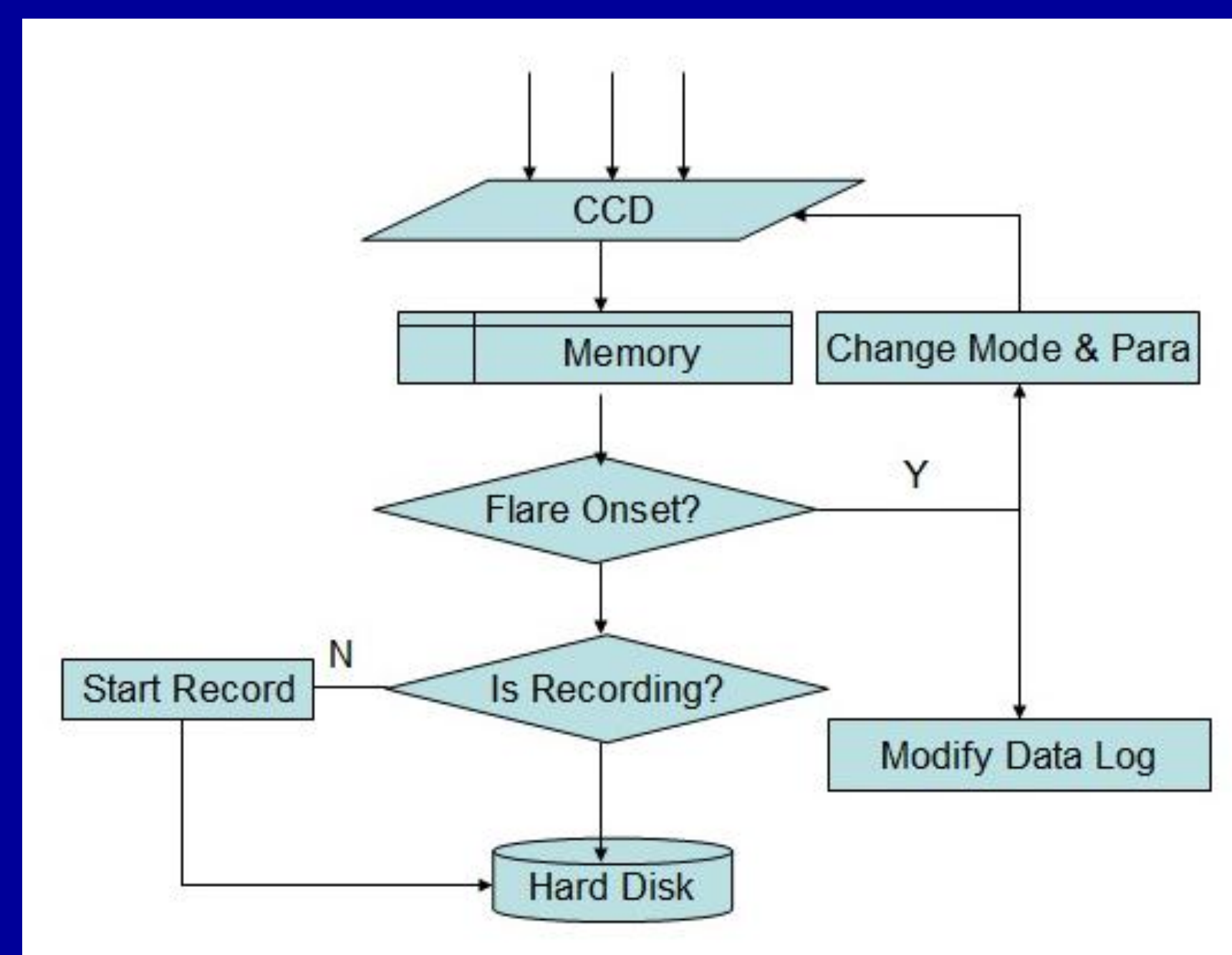
CCD: PI EP16000, 4872×3248, 7.4μm×7.4μm, ROI: 2712×2712; 12bits.

Graber: Xcelera-CL PX4 Dual, Teledyne DALSA

RAID: RAID0 4\*72000 r/m

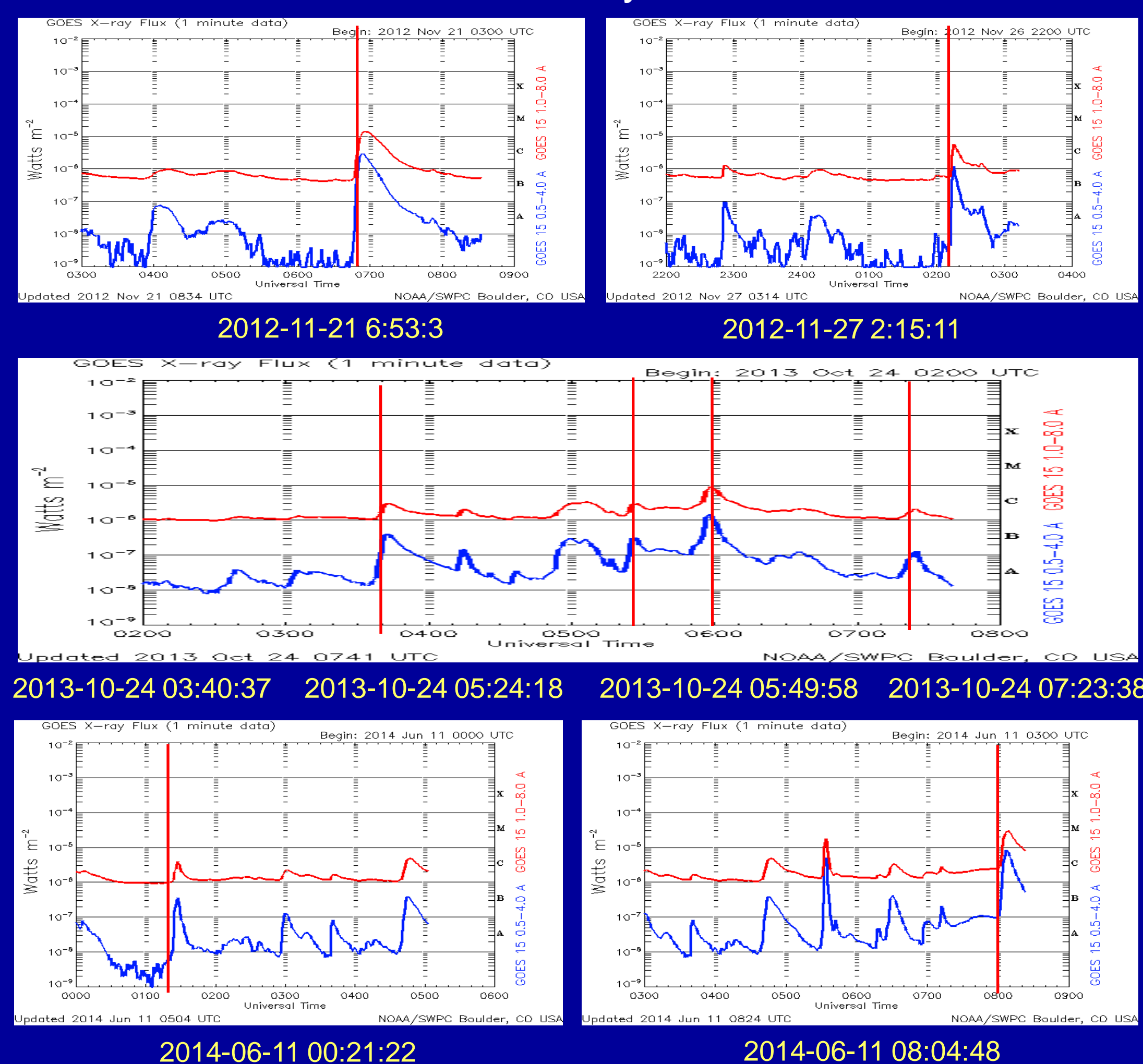
Host Computer: DELL T7500

## Program Flow Chart:



## DATA:(RTFMS flare onset alert Email is like this:)

RTFMS at HSOS detects a possible Ha flare on-set at : **2014-06-11 08:04:48**. Area: 340 (Sun size 4080744 pixels), at the same time the GOES Xray flare class is C5.8.



RTFMS missed some flares due to bad weather, collaborate observations could greatly improve the ability of detection.

## Results:

- 1) From 12 May ~ 19 Nov 2013, in the observable periods of HSOS, RTFMS detected 34 flares (All GOES Xray above C5.0 Flares) and sent 241 alert Emails.
- 2) Recognition Algorithm realized in real time(2 f/s). The alert Email will be sent every five minutes according to the Flare status. The alert Email could arrive the forecaster in 20 seconds after the on set of the flare.

## What's Next:

- 1) Higher frame rate CCD;
- 2) Bilinear CCD.
- 3) Sun spots and filaments monitor will be combined in future.
- 4) Joint observation with other telescopes.

**Comments, Suggestions or Collaborations are welcome! Email: jiaben.lin@163.com**