REAL TIME MOSAICING AND CHANGE DETECTION SYSTEM

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Problem Statement

- Surveillance
- Real World Environment
- Real Time Performance
- Area to monitor : Several Kilometers
- Sensor to scene distance : Several Kilometers
- High Accuracy (90% intrusion detection)

What we had to deal with.

- Atmospheric Disturbances
- Fast panning PTZ units
- TI and CCD sensors
- Limited Processing Capacity

Approach

This vast area surveillance problem was broadly handled using –

Mosaicing – For Better view of the scene

Change Detection – For detecting intrusions

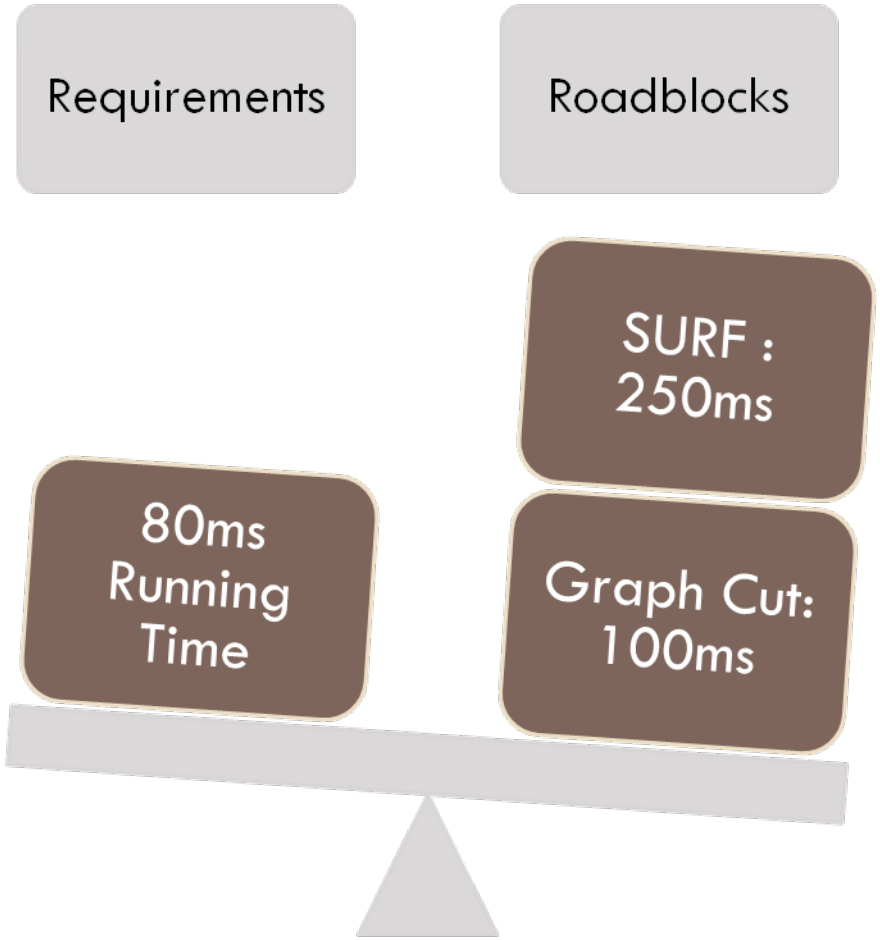
Tracking – For keeping track of the changes

Structure

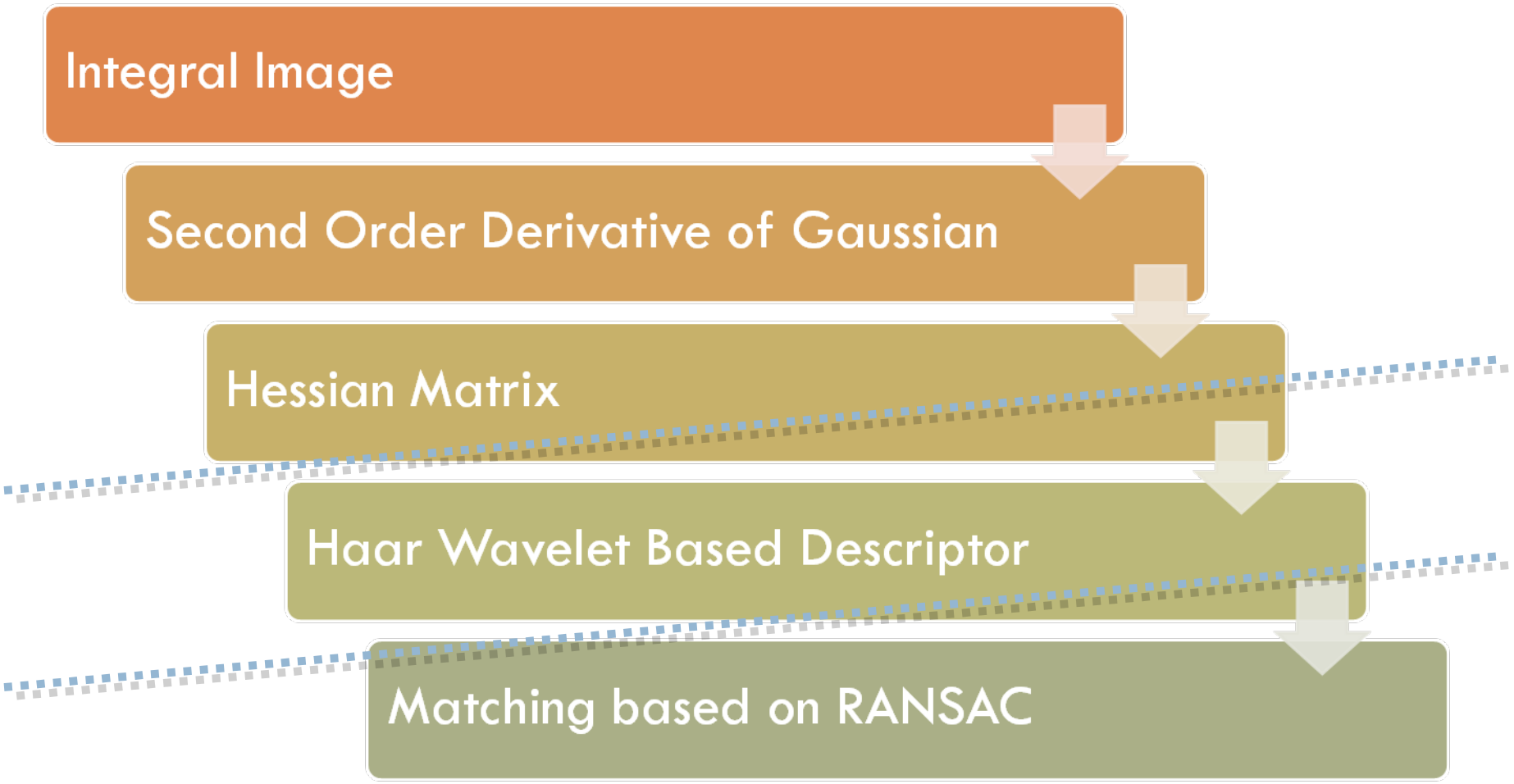

SURF Key-point Detection
Registration
Spatio-Temporal Change Detection
Graph cut based segmentation
Predictive Tracking
Stitching

Roadblocks

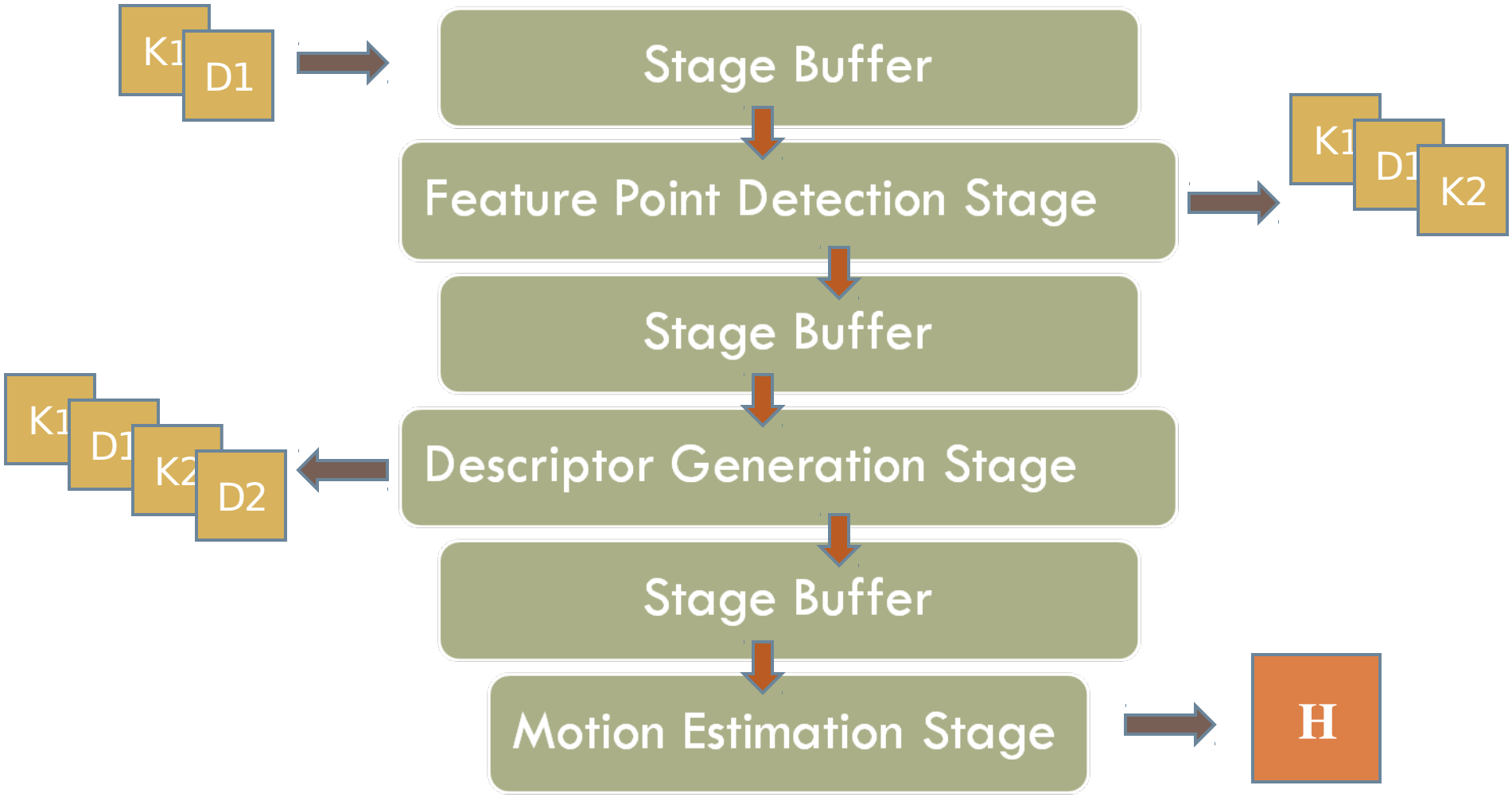
SURF and Graph Cut Together made the system incapable of running faster than 2-3 fps which is woefully insufficient for Real Time Performance.



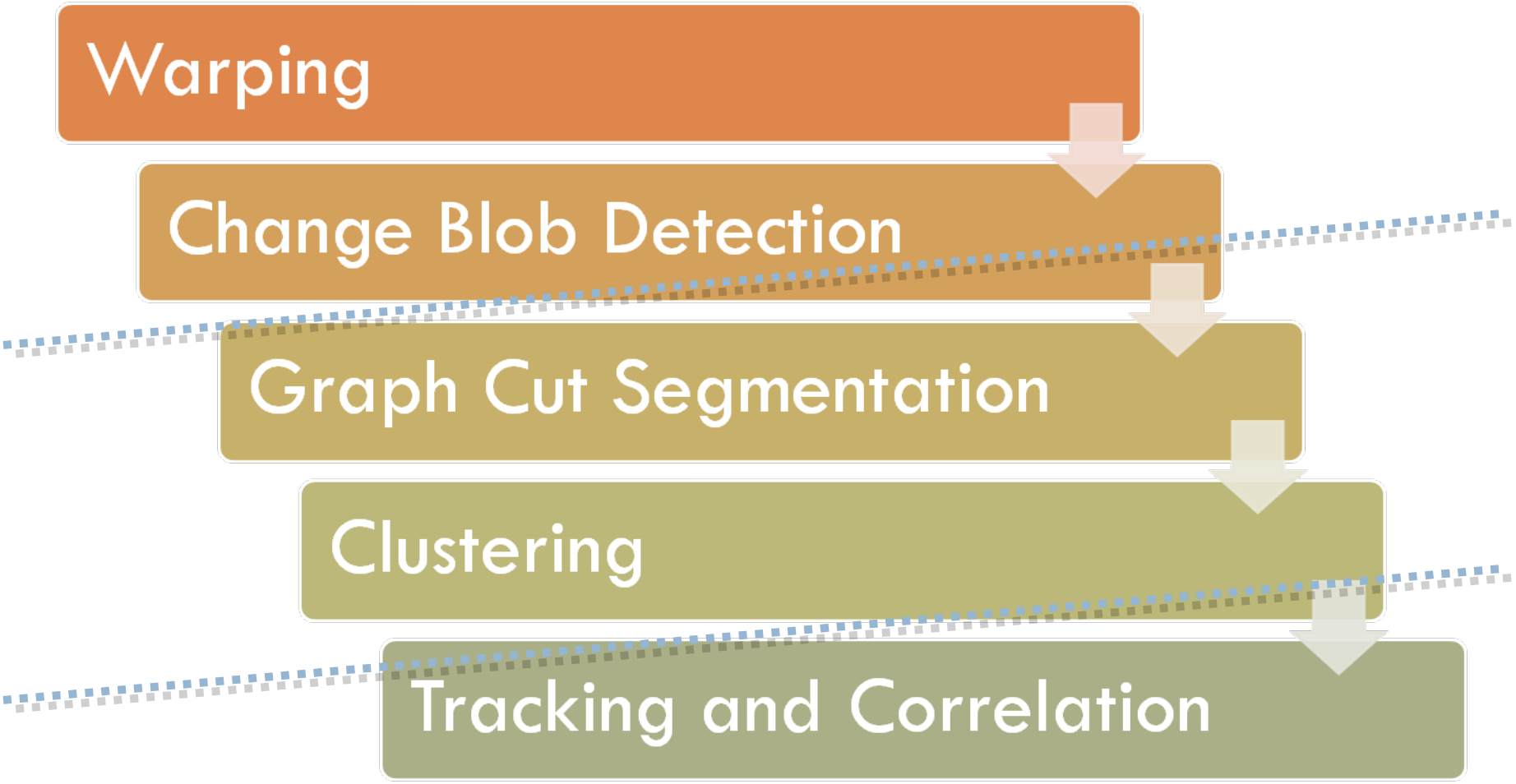
SURF Registration



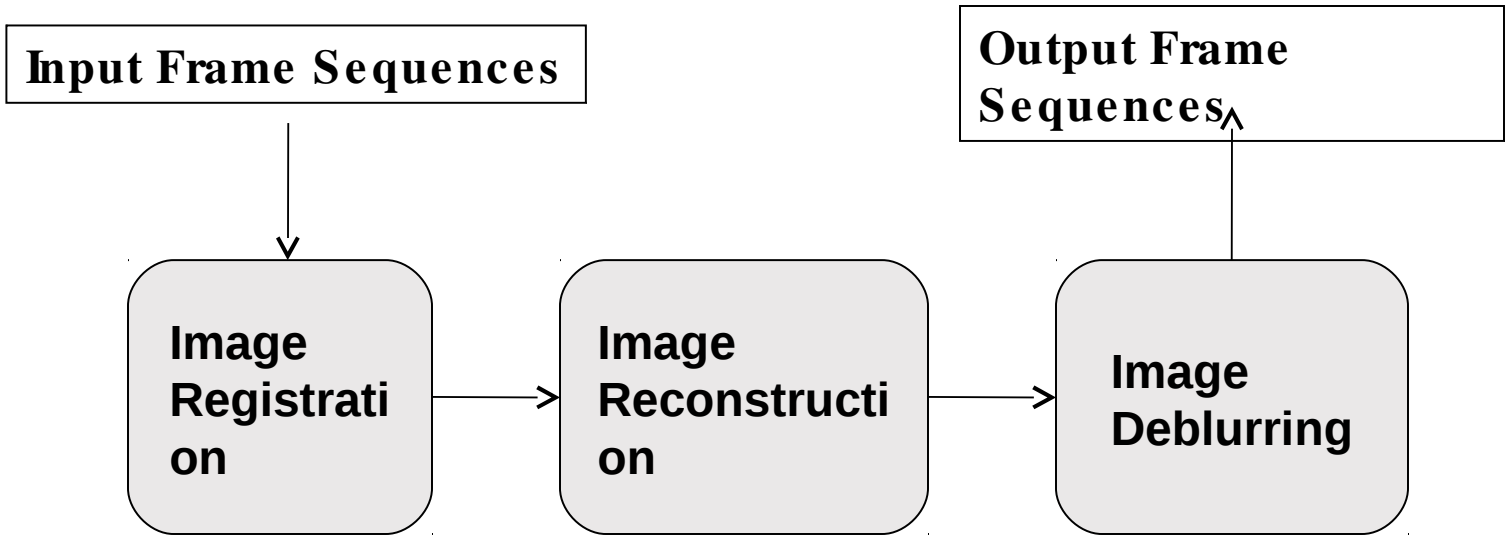
Pipelined Architecture



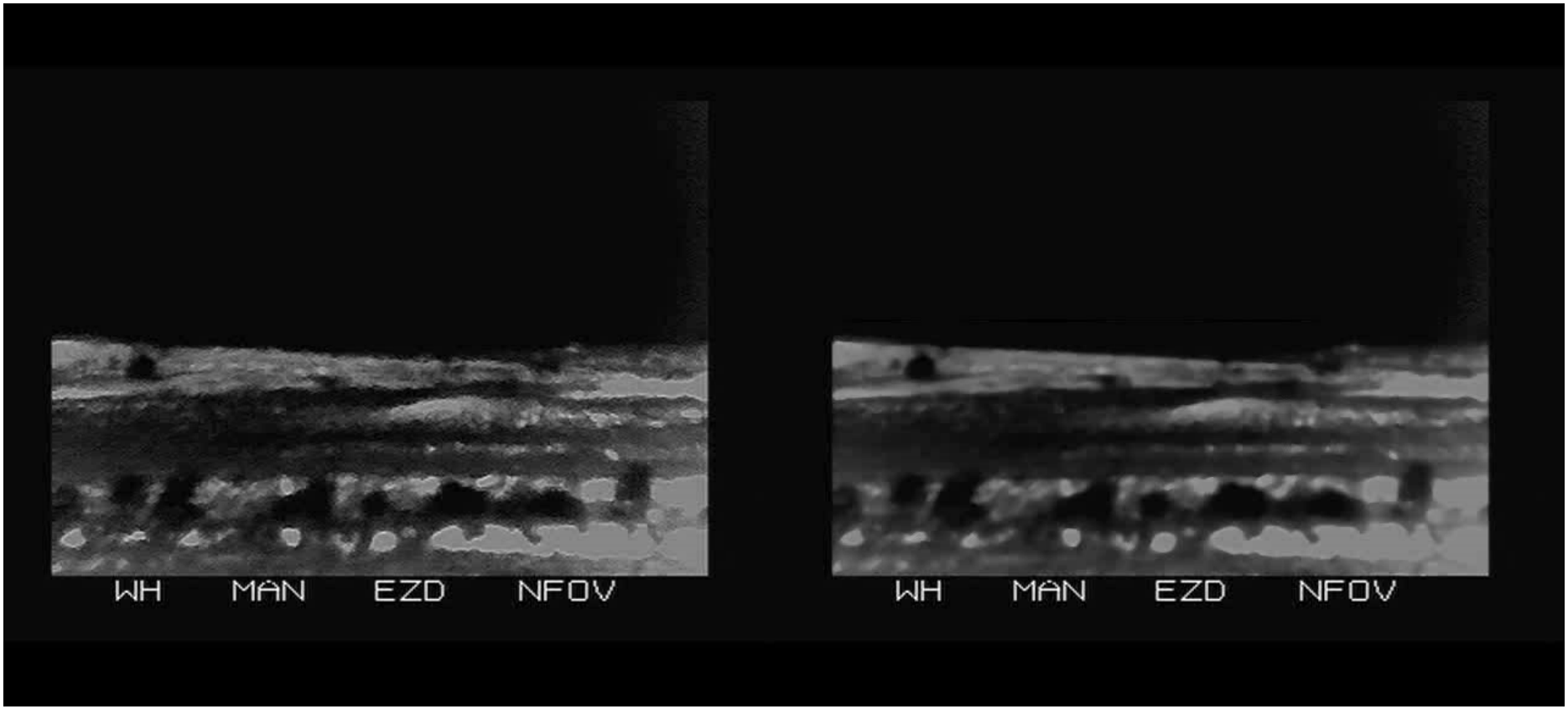
Change Detection



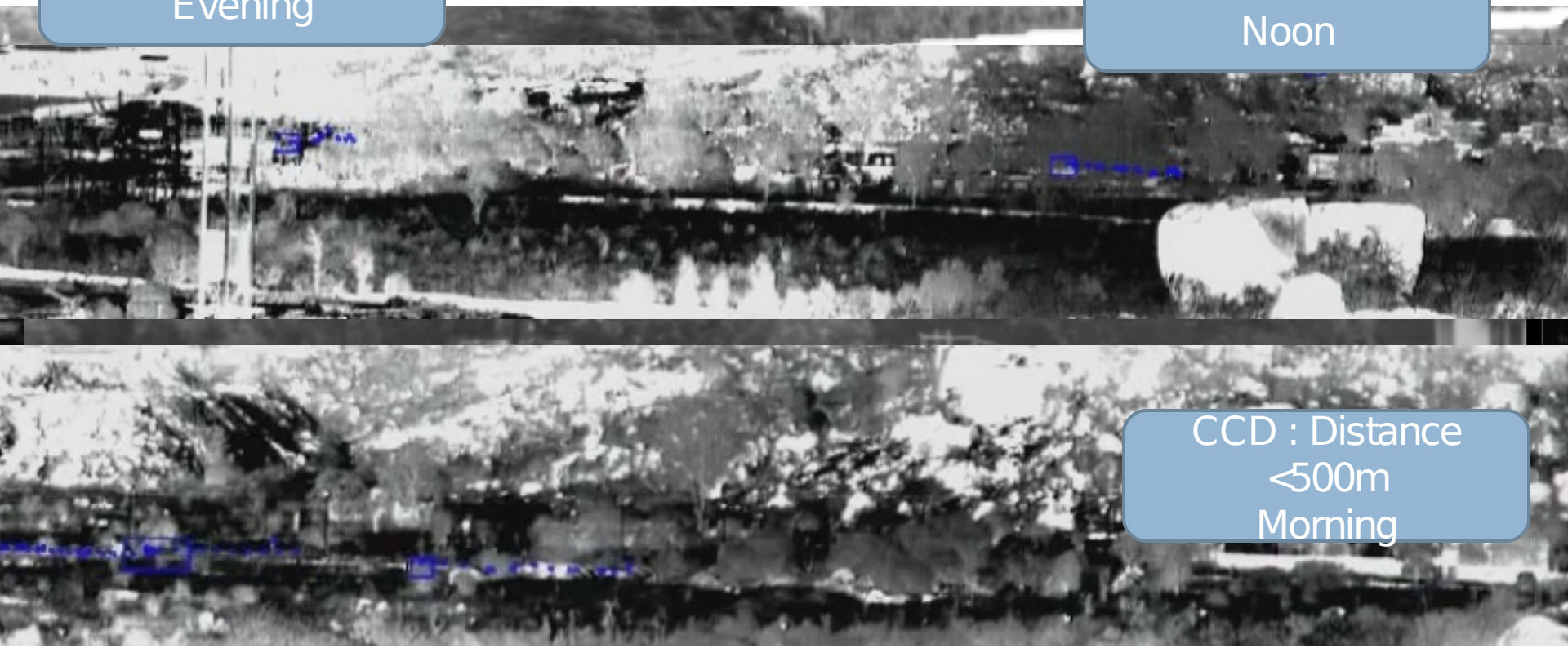
Atmospheric Turbulence



Atmo Noise Restoration



Results

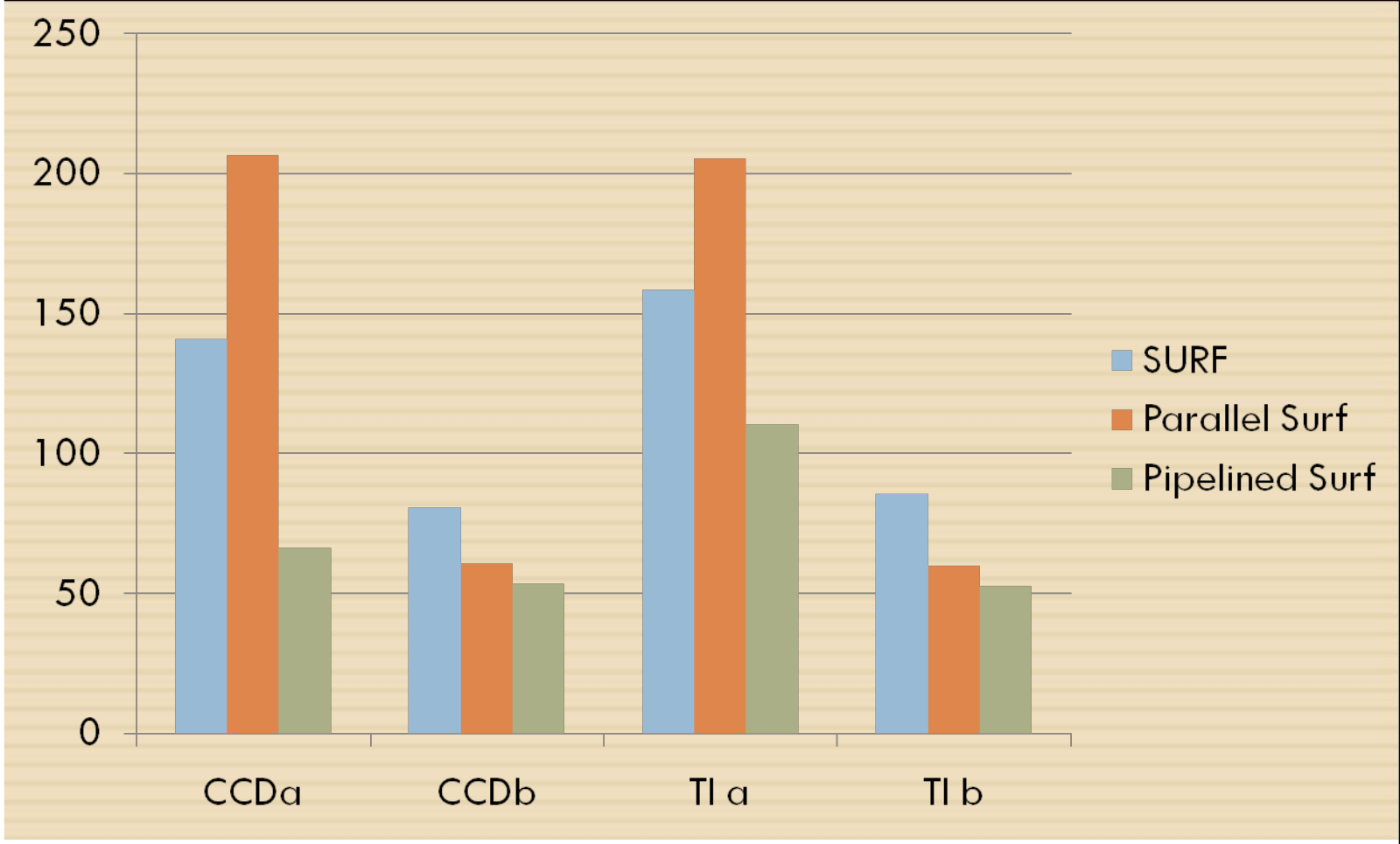

CCD : Distance 4Km
Evening
TI : Distance 4-5Km
Noon
CCD : Distance
<500m
Morning

Tracking Results

CCD Tracking results

TI Tracking results

Stress Testing



Timing Analysis

These experiments were performed using a custom generated dataset of varied sceneries such as city roads, forests, hazy nights etc. This particular result was on an i5 processor with turbo boost. (Parallel SURF is slower due to the inherent parallel processing employed by OpenCV)

Into the future

- Failsafe options for Registration
- Atmospheric Noise Restoration ON
- Tackle faster panning
- Tackle motion blur

To sum up

- Real world performance achieved
- Pipelined SURF outperforms other methods
- Atmo-Noise removal : a huge asset
- Architecture of the system results in very robust change detection

Phew! That went rather well !