

REM

Observing Software

*M. Stefanon on behalf of Stefano Covino and
the REM team*

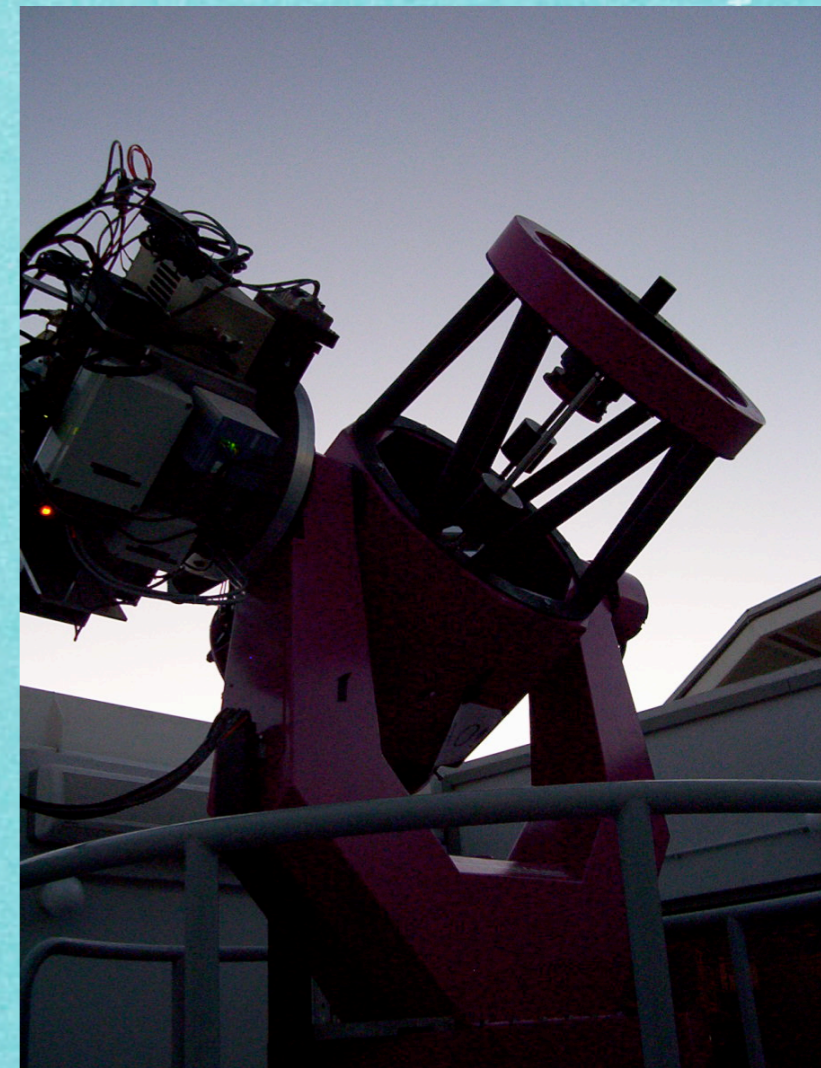
Malaga, May 18-21 2009

Summary

- ▶ REM
- ▶ System description
- ▶ REM Observing Software
 - ▶ What it does
 - ▶ How
- ▶ Conclusions

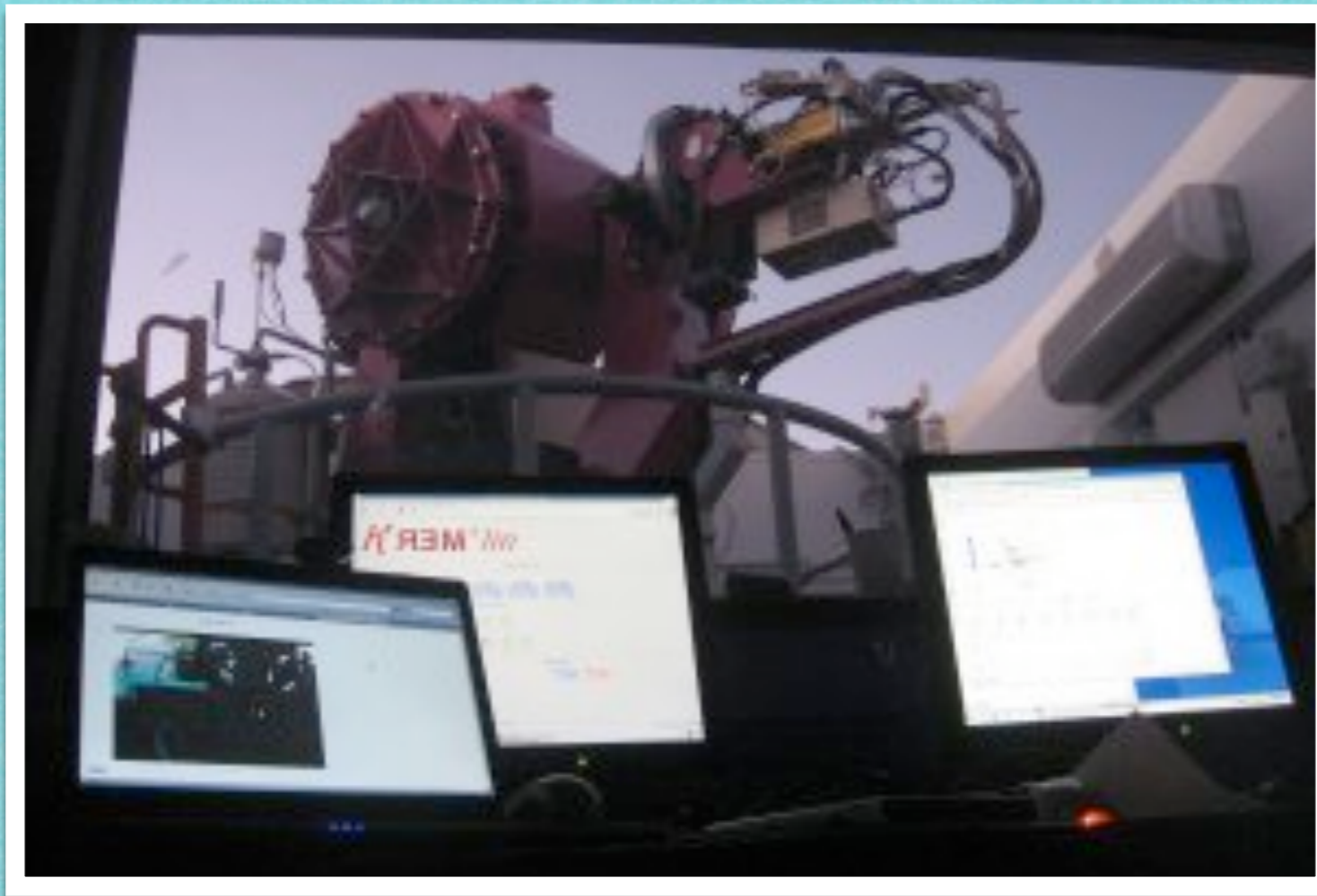
Rapid Eye Mount (REM)

- ▶ 60 cm fast slewing (~ 10 deg/sec) alt-az Nasmyth focus
- ▶ Opt + NIR simultaneous (2 bands)
 - ▶ +TORTORA
- ▶ La Silla site of ESO LSP Observatory (Chile)



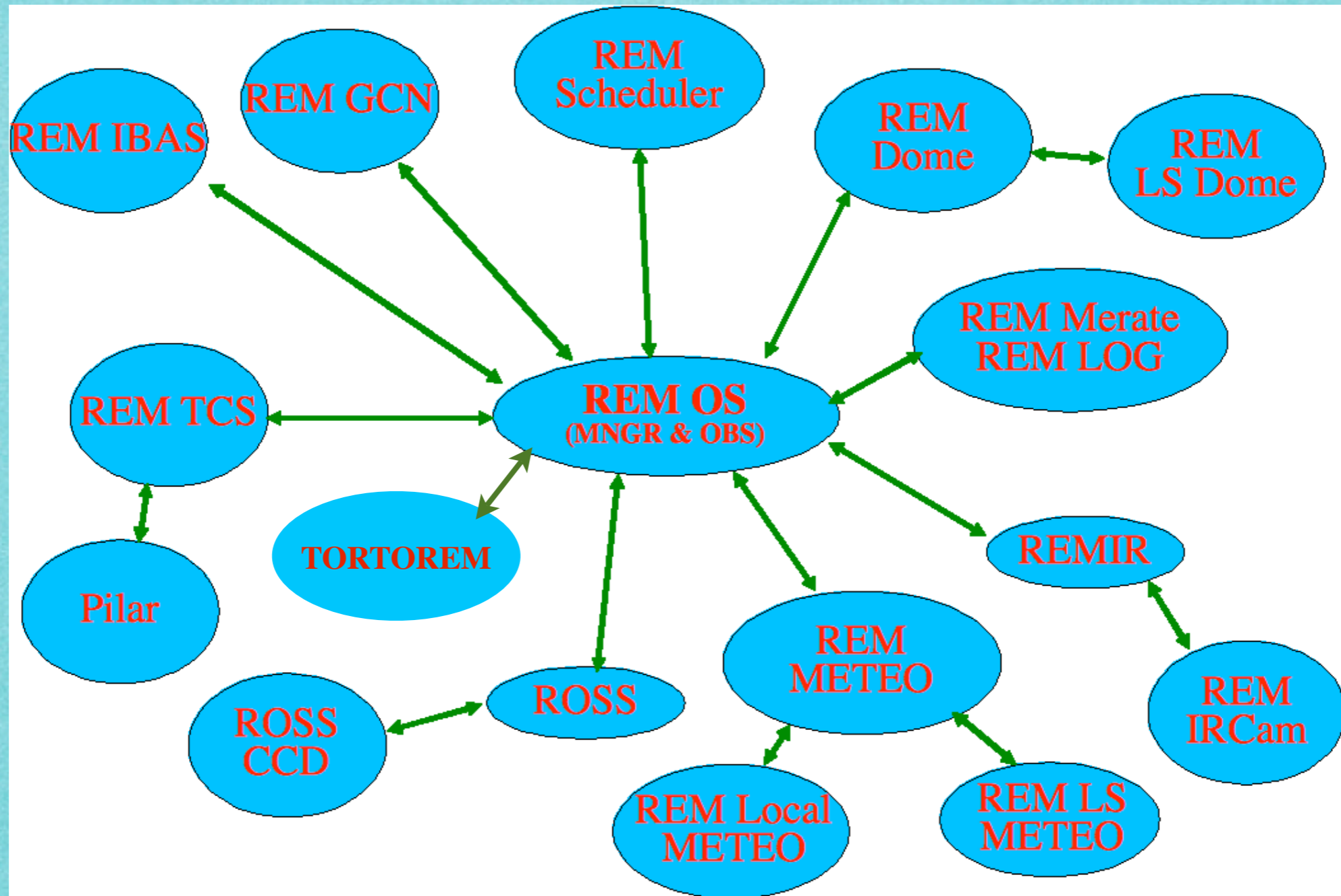
Scientific aim

- ▶ Original project (till 2006):
 - ▶ GRB alert rapid response
 - ▶ Secondary science (any)
- ▶ Today:
 - ▶ REM belongs to INAF
 - ▶ REM TAC
 - ▶ Satellite alerts
 - ▶ ToOs
 - ▶ “Classical” targets



Operations

REMOS



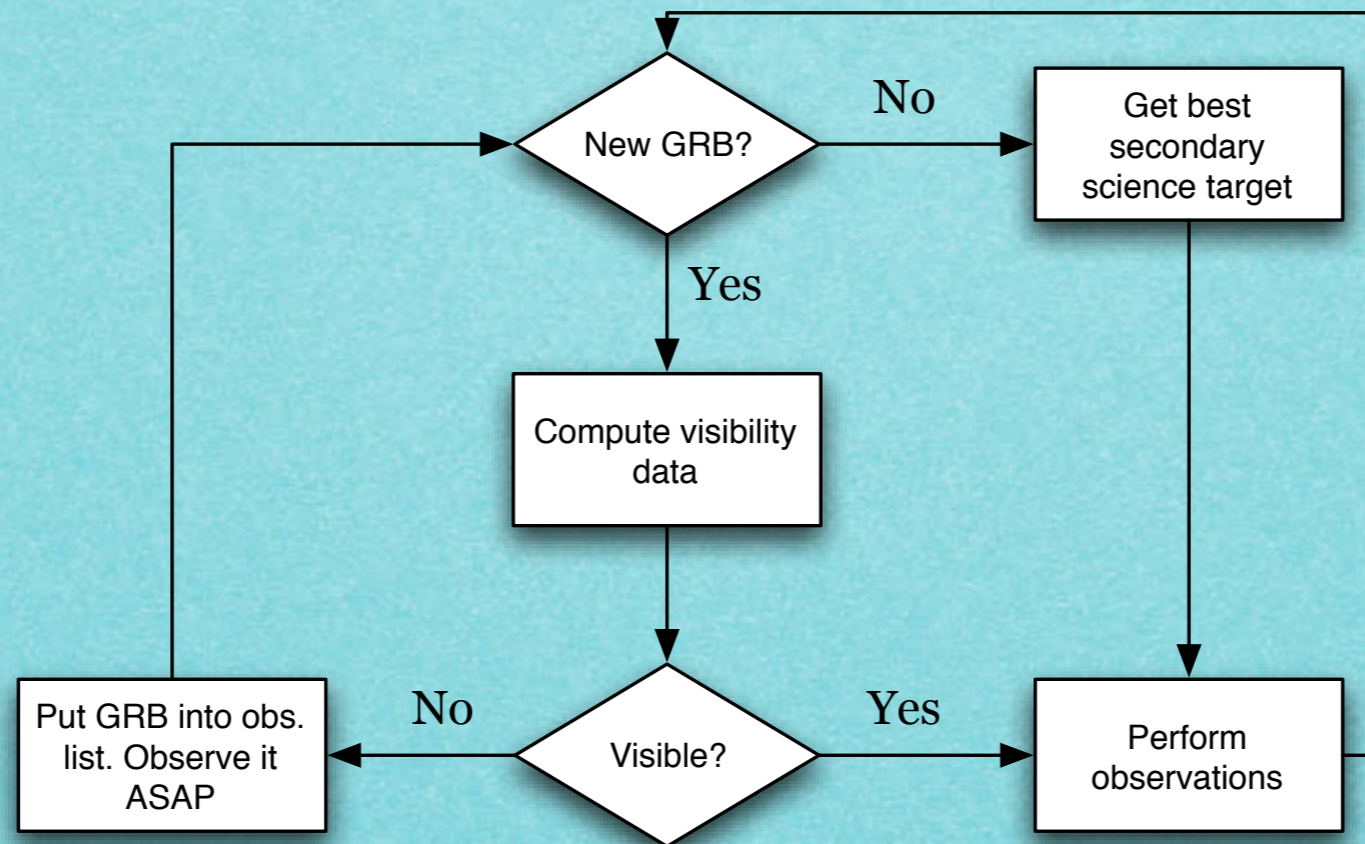
Observation management

- ▶ Two distinct ways to perform observations:
 - ▶ ToOs + normal targets: dedicated process (scheduler) choosing which one to observe
 - ▶ ToO = email sent by PI to remos is automatically processed and target added to queue
 - ▶ Satellite alerts: directly managed by REMMNGR

Non alert observations: OB manager

- ▶ Targets organized on *ESO OB* style
- ▶ Dedicated process for mid to long term scheduling
 - ▶ Seasonal optimization
 - ▶ Syncopal observations
 - ▶ Reallocate targets not satisfying observing constraints

Non-alert observation

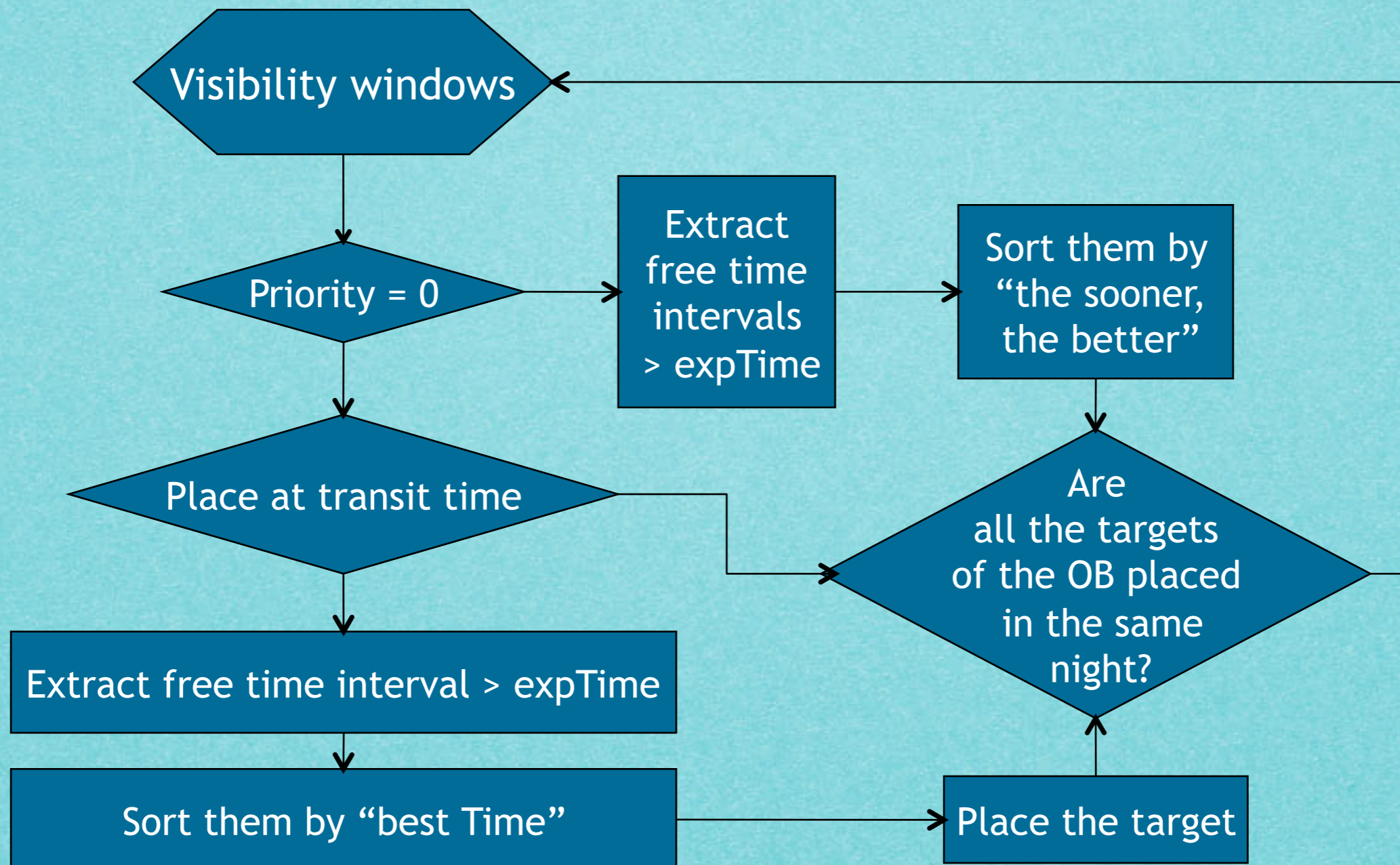


Non-alert observations - II

Short-term scheduling

- ▶ Observe targets when they are better visible (transit) respecting their priority
- ▶ Classes of targets:
 - ▶ Calibrations:
 - ▶ Sky flat
 - ▶ Photometric standard stars
 - ▶ Focus offset
 - ▶ Science Obs:
 - ▶ Periodical
 - ▶ Grouped
- ▶ Constraints:
 - ▶ Common visibility constraints (moon, timing, airmass..)
 - ▶ Camera(s) availability (automatically detected)

Scheduling algorithm



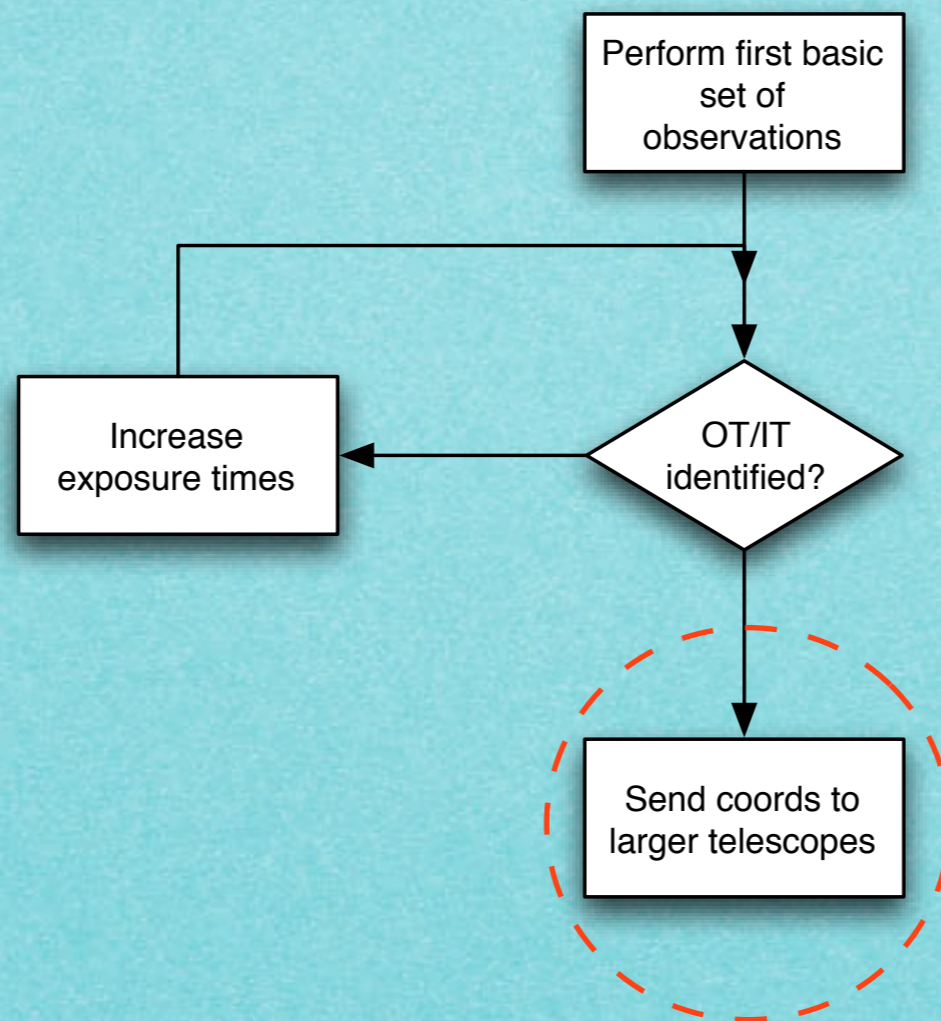
Special targets

- ▶ GRB follow-up: observation strategy left to each camera
- ▶ TORTORA targets whenever Swift pointing available & no other target is observable

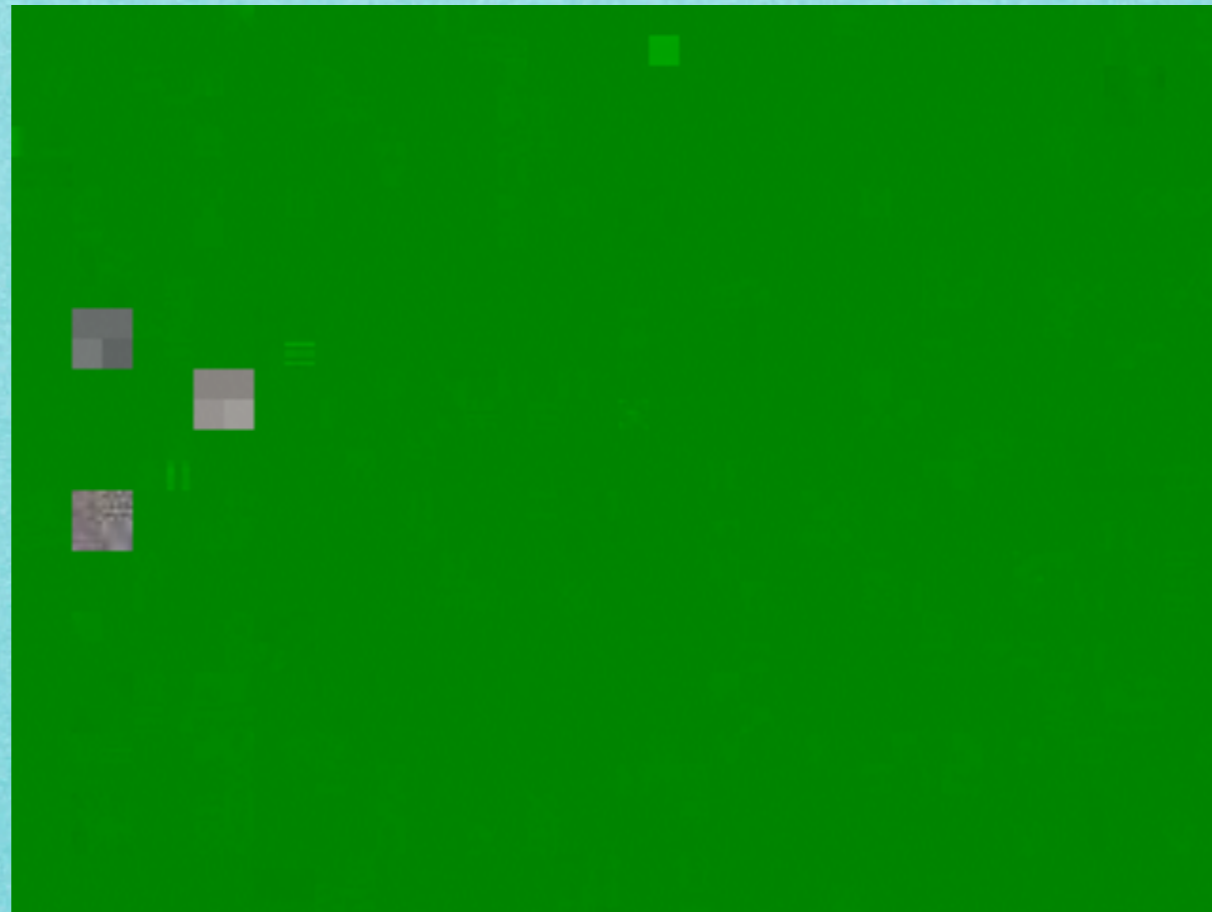
Alert response

- ▶ No scheduling, but directly managed
- ▶ Particular strategy left to each camera
- ▶ Newest alert have higher priority (interrupt current GRB observation)
- ▶ Send email to list of people + SMS
- ▶ Time on Target: 30-40 sec

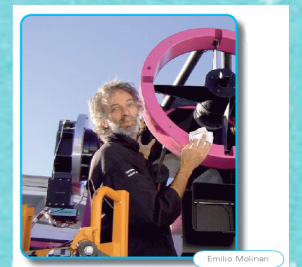
Alert response



Night in a glance



Credits: Emilio Molinari



Meteo and dome

- ▶ Meteo conditions checked every 5 minutes
 - ▶ Meteo stations:
 - ▶ Local
 - ▶ La Silla
- ▶ REM dome status
 - ▶ Condition to open: at least DIMM + 1 LS dome open



Telescope Control System

- ▶ Low level telescope control provided by external SW (Pilar, by Halfmann-4PI)
- ▶ REMOS role:
 - ▶ sends pointing information through socket server
 - ▶ acts as inspector
 - ▶ restarts Pilar if not responding
 - ▶ sends email if not successful (ex. red button)

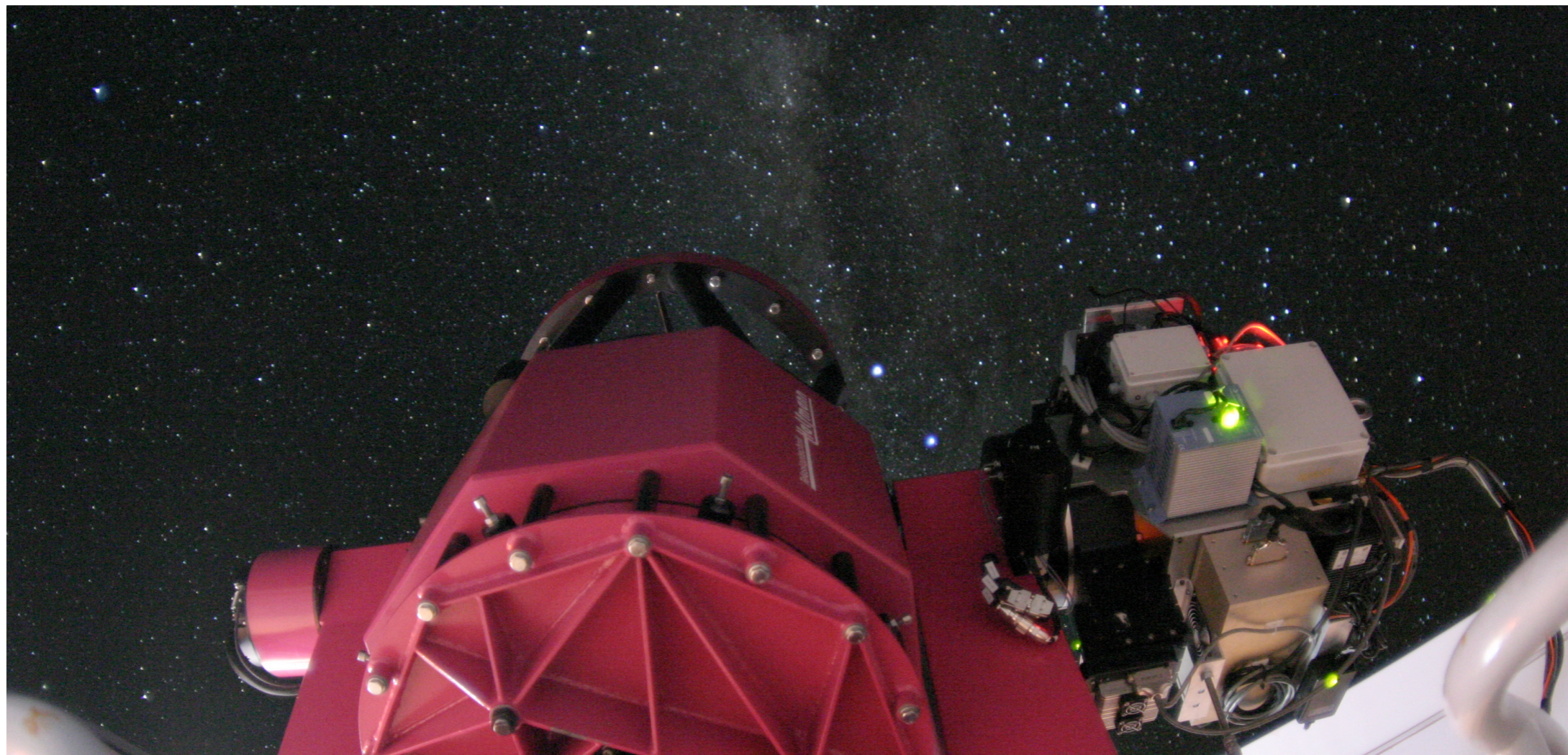


Image credits: P. Aniol

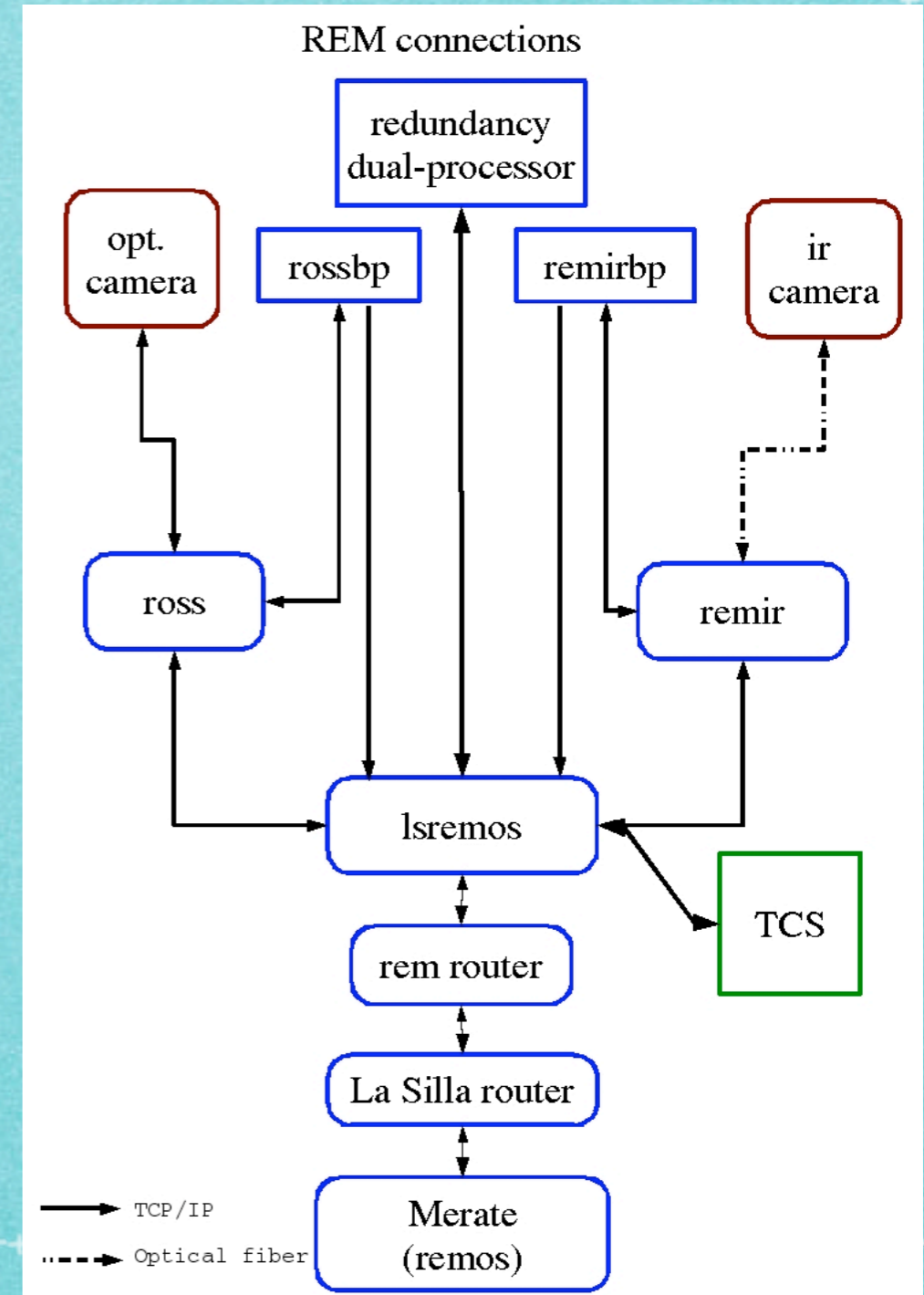
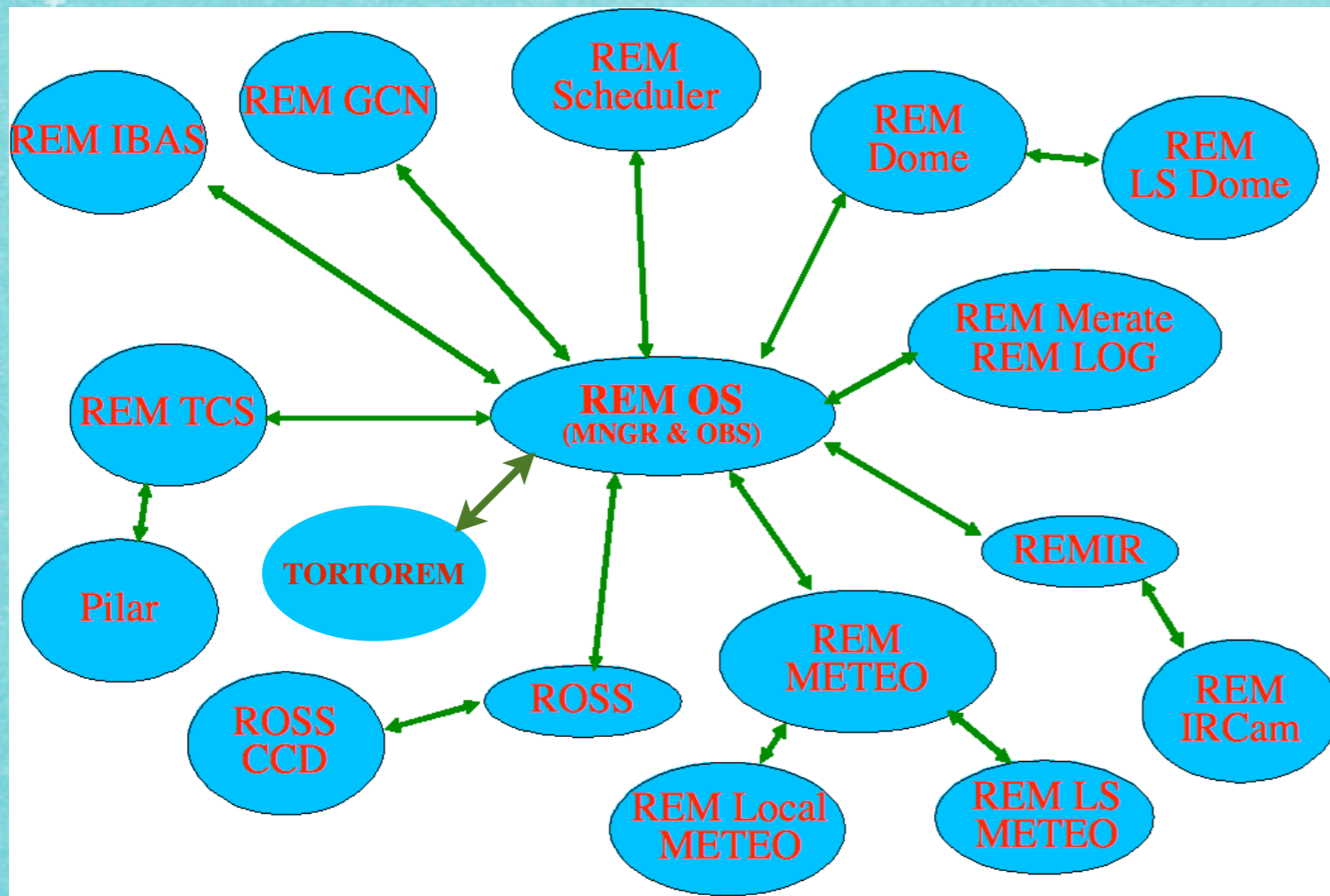
Implementation

Languages

- ▶ General rule: freedom of choice
- ▶ Mostly python (REMOS, cameras telemetry, tREMometer)
 - ▶ OO paradigm
 - ▶ Portability
- ▶ C/C++ (cameras SW, pipelines, scheduler)
- ▶ MySQL (image archive)
- ▶ PostgreSQL (mid-term scheduling)
- ▶ PHP (kREmlin)
- ▶ TPL: TCS/TSS (higher level language)



Communication



Communication

- ▶ Technically speaking, REMOS is not a Real Time System, but experience demonstrated it is not necessary
- ▶ Each subsystem managed by its own process
- ▶ How do they interact?
 - ▶ TCP/IP: allows separate processes to run on different machines
 - ▶ YAMI

Yet Another Messaging Infrastructure (YAMI)

- ▶ Author: Maciej Sobczak: very available in providing support and customization
- ▶ Portability (FreeBSD, GNU/Linux, LynxOS, Mac OS X, MS Windows).
- ▶ Programming languages: C, C++, Python, Tcl (+Java and PHP) (Babel compliant)
- ▶ Easy and straightforward API for scripting languages.
- ▶ Extremely small size of the compiled library (100kB).
- ▶ Low memory and resource consumption
- ▶ Automatic recovery from connectivity problems.
- ▶ Comprehensive thread management options.
- ▶ Ability to "bypass" firewalls with reverse message routing.

Communication - II

- ▶ Continuous check of processes running on the other machines
- ▶ Twin process
 - ▶ feedback to manager
 - ▶ inform cameras about observing conditions

No network...



- ▶ ...no party!
- ▶ REMOS continuously checks the network connection to LS and the World
 - ▶ Remains in a safe status (dome closed) while not connected
 - ▶ Soon after network connection is re-established, operations are automatically resumed

Time



- ▶ GPS antenna installed in the TCS cabinet provides accurate time information used by
 - ▶ Pilar/TCS
 - ▶ REMOS
- ▶ Consistency crosscheck with timeserver



Logging

- ▶ One process takes care of receiving all log entries from each process
- ▶ Log informations are instantly duplicated to the Italian server

Performance

- ▶ After “commissioning”, REMOS demonstrated to be very reliable
 - ▶ No major crashes which prevented observation
 - ▶ Smaller problems generally given by low-level SW
- ▶ Its modularity (and communication scheme) has proven to be successful:
 - ▶ TORTORA as add-on instrument
- ▶ Continuous improvement of SW:
 - ▶ ToO management
 - ▶ Communication with tREMometer