THE CURRENT EVOLUTIONS OF THE DORIS SYSTEM

TAVERNIER, G.; GRANIER, J.P.; JAYLES, C.; SENGENES, P. (CNES)
ROZO, F. (COFRAMI)
presented by P. VINCENT (CNES)

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System and missions

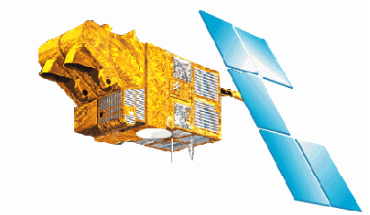
90 91 92 93 94 95 96 97 98 99 2000 01 02 03 04 05 06 07

SPOT2

TOPEX-POSEIDON

SPOT3

SPOT4



DORIS applications

- Orbit determination
- Gravity field
- Earth rotation
- Postioning
- On-board real time orbit
- TAI Time-tagging

7 december 2001

JASON1 TAI

1 march 2002

ENVISAT1 TAI

4 may 2002

SPOT5 TAI

CRYOSAT TAI

JASON2 TAI

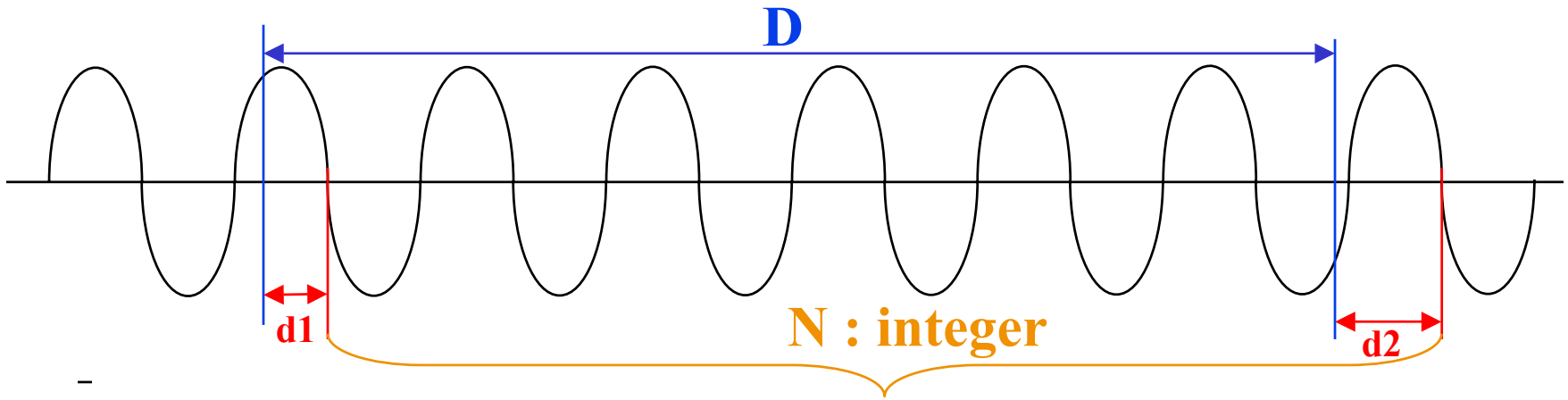
NPOESS, PLEIADES…

new features of the 2nd generation onboard instruments

- New routine measurement operation mode : Autonomous mode
  - based on DIODE directives for beacons signals acquisition
  - no more daily uploads
- 2 beacons tracking capability : ~ x2 measurements /day
- increased instrument operational robustness:
  - more autonomous onboard software
  - radiation-hardened electronic parts : processor, mass memories
- improved DIODE accuracy
  - orbit estimation : ~ 1 m rms 3-D position accuracy
  - TAI estimation : ~ 1-2 µsec rms
- 2nd miniaturized generation (JASON-1, SPOT5)
  - Instrument and DIODE self-initialization : from turn-on to routine mode without any ground commands
  - reception and processing of « system uploads » permanently broadcast by Master Beacons : automatic update of onboard beacons network description

Doppler measurement principle (1)

- 1st generation (T/P,S2,S4) and 2nd generation (ENVISAT) receivers

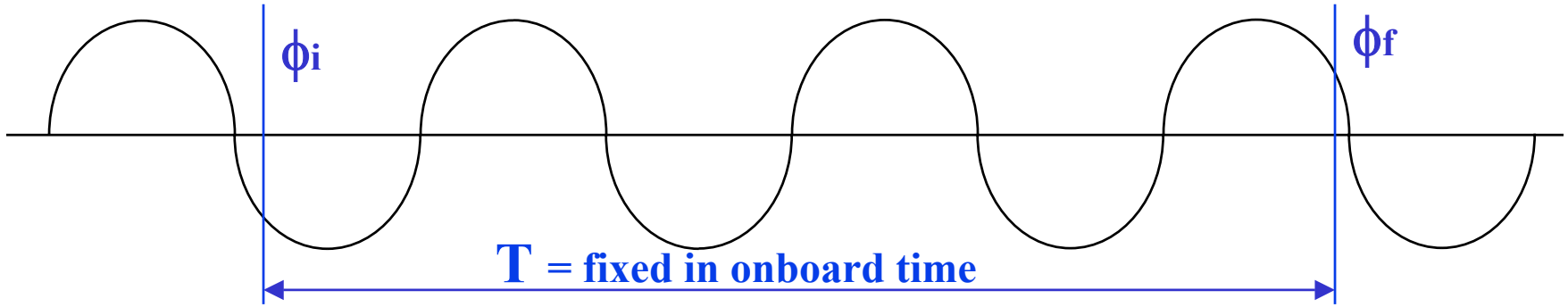


  - Fdoppler = [N / (D + d2 - d1)] - Fc Fc = 125 kHz

- 1st generation receiver
  - quantification error on di = ± 50 nanoseconds
  - => max error on measured Doppler frequency : 1,65 mHz <=> 0,24 mm/sec.
- 2nd generation : same measurement method but
  - reduced quantification error on di = ± 12,5 nanoseconds
  - => error on measured Doppler frequency : 0,41 mHz <=> 0,06 mm/sec

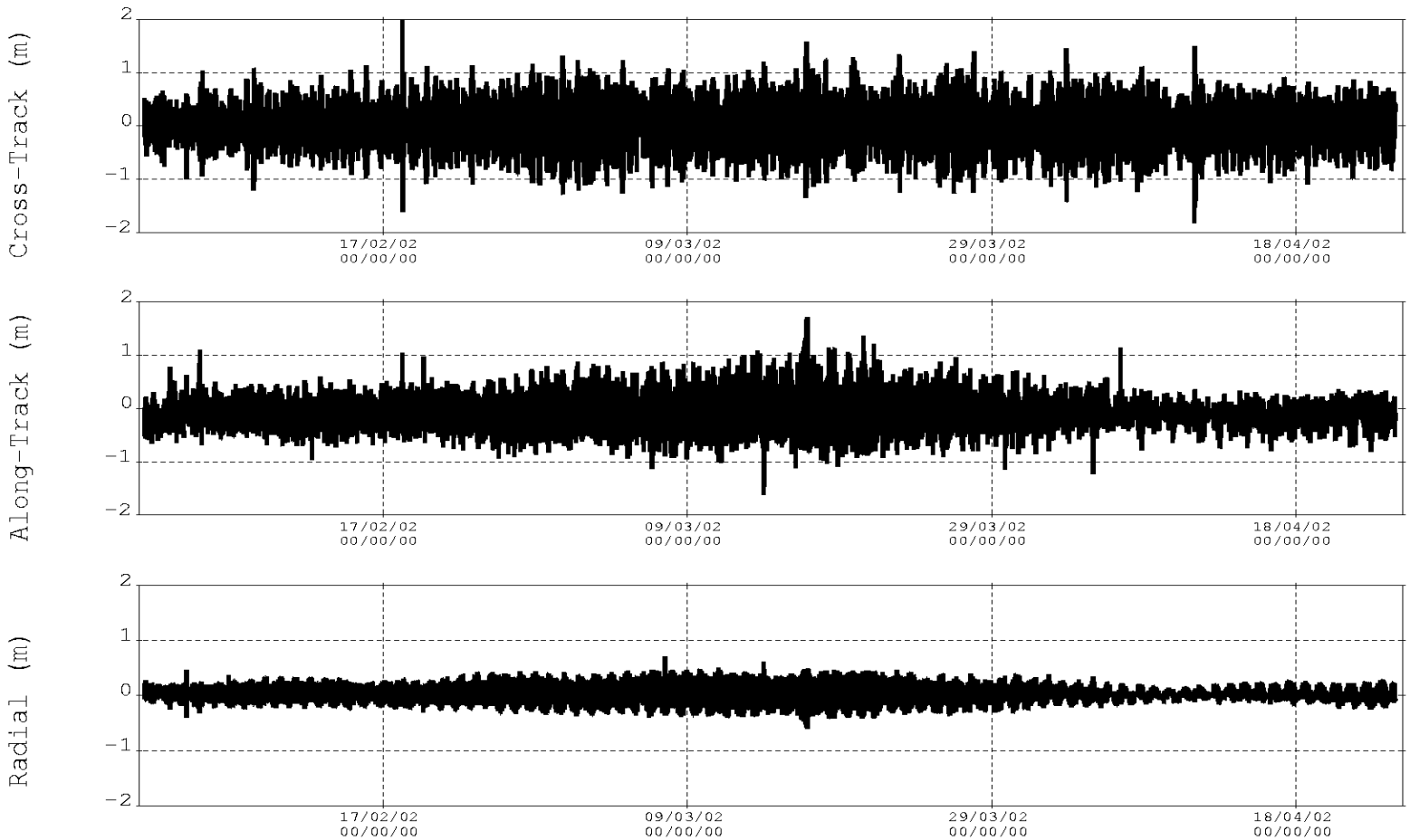
Doppler measurement principle (2)

- 2nd miniaturized receivers (JASON-1, SPOT5)

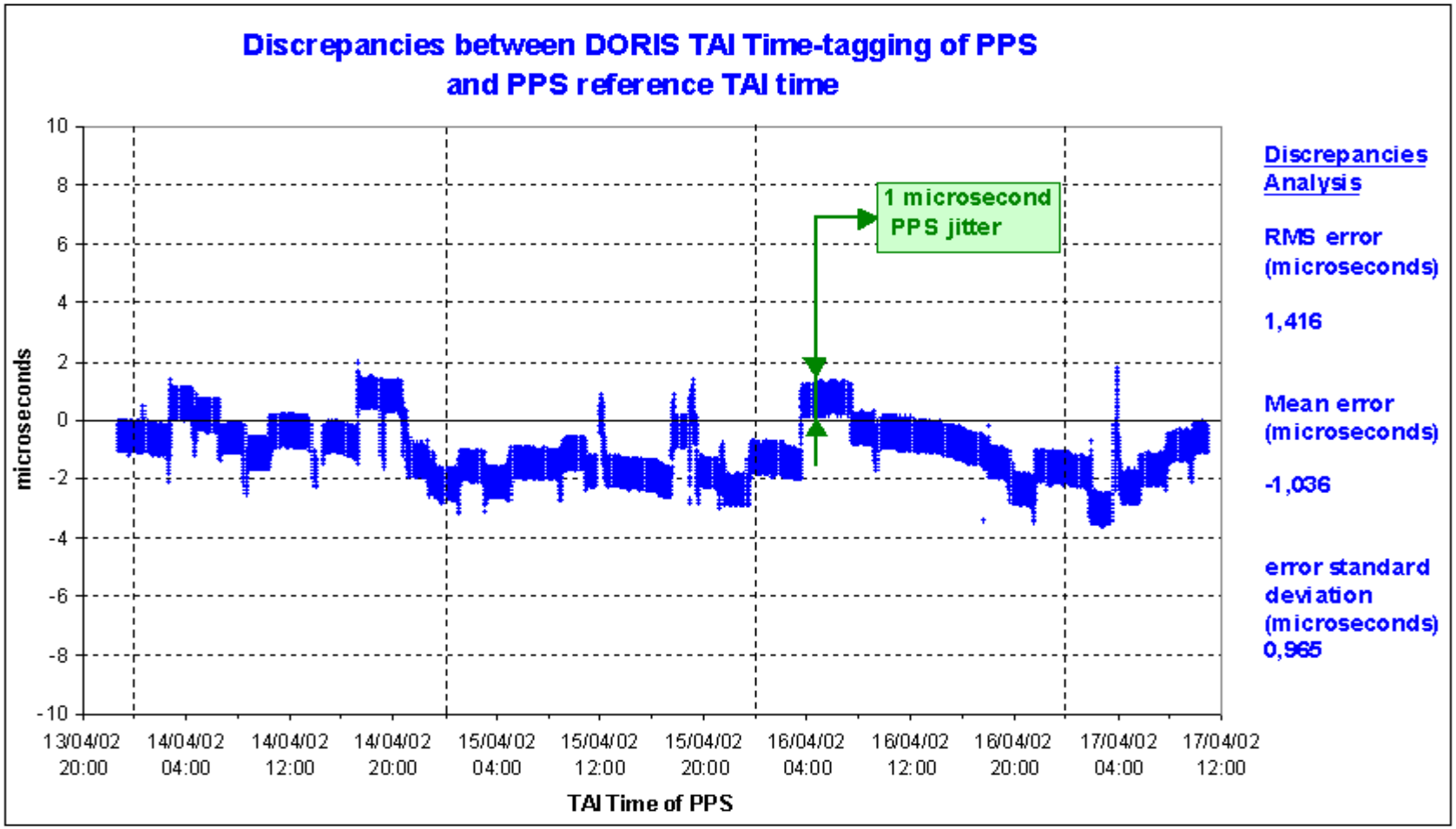


- no more Fc : Doppler measurements are realized on Doppler signal
- Fdoppler = (ϕf - ϕi) / 2 πT
  - (ϕf - ϕi) : cumulated phase variation of « Doppler signal » during T
  - T = 7 (unchained mode) or 10 (chained mode) « onboard seconds »
  - quantification error on ϕ : $\pm$ 3 milliradians
    - max error on measured Doppler frequency : 0,1 mHz <=> 0,015 mm/sec
- on 2nd miniaturized receivers : phase measurements ϕi and ϕf are realized simultaneously on each RF channel (400MHz, 2GHz), for both tracked beacons signals.

DIODE / Jason1
On-orbit Results



DIODE / Jason1
Time determination Results



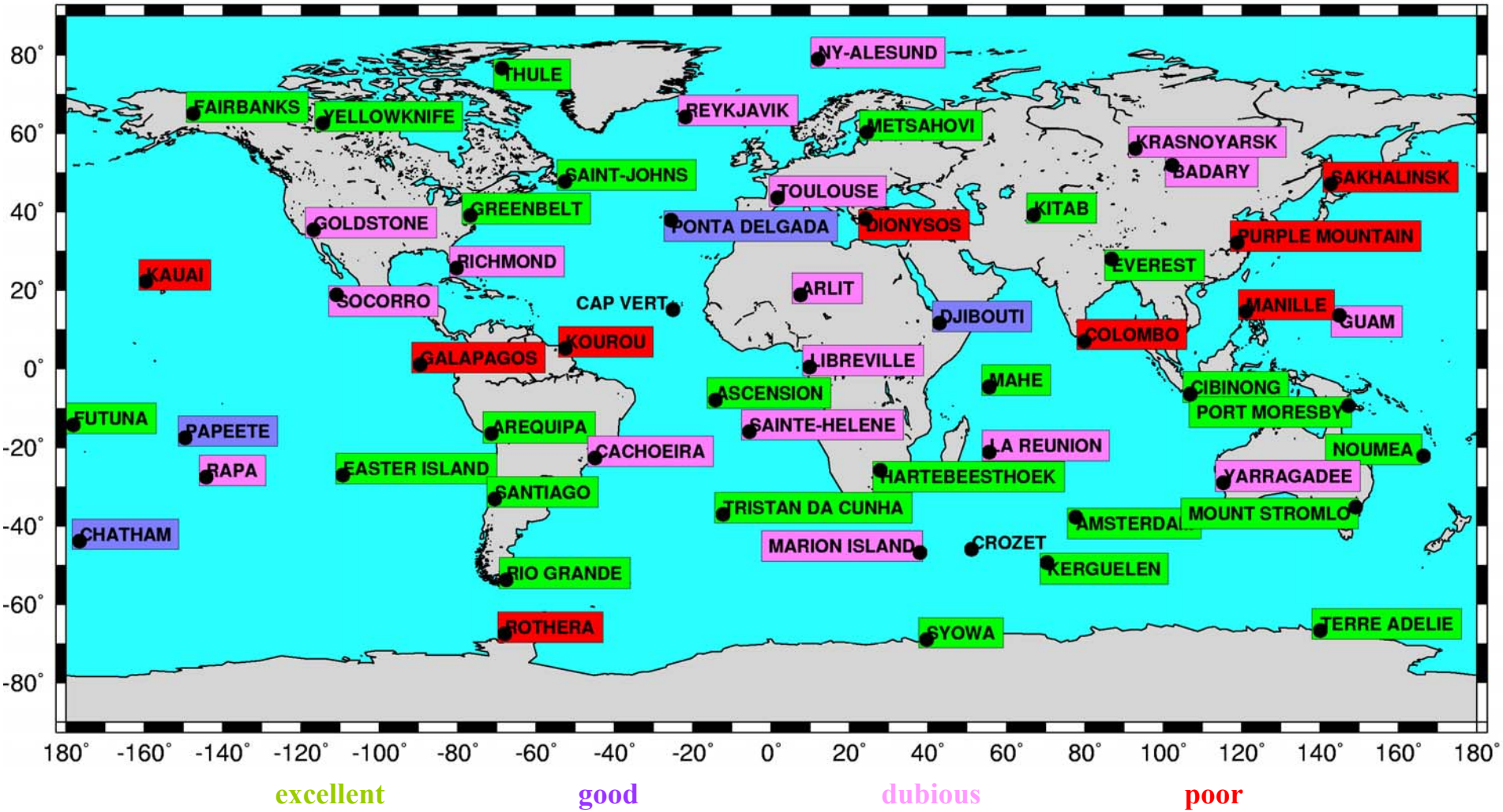
3rd generation beacon : main new features

- 400 MHz & 2 Ghz emitted frequencies can be shifted with respect to DORIS nominal frequencies : ± 50 kHz / 2GHz ; ± 10 kHz / 400 MHz
- Beacon modulation (beacon message and synchronization word) is transmitted on 400 MHz & 2 GHz frequencies
- Broadcasting of current TAI date (with a LSB of 10 seconds)
- Improved observability of beacon operation status
- auto-initialization mode : 3rd generation beacon can be received without any time set-up
- possibility of remote control
- can be easily upgraded into Master Beacon

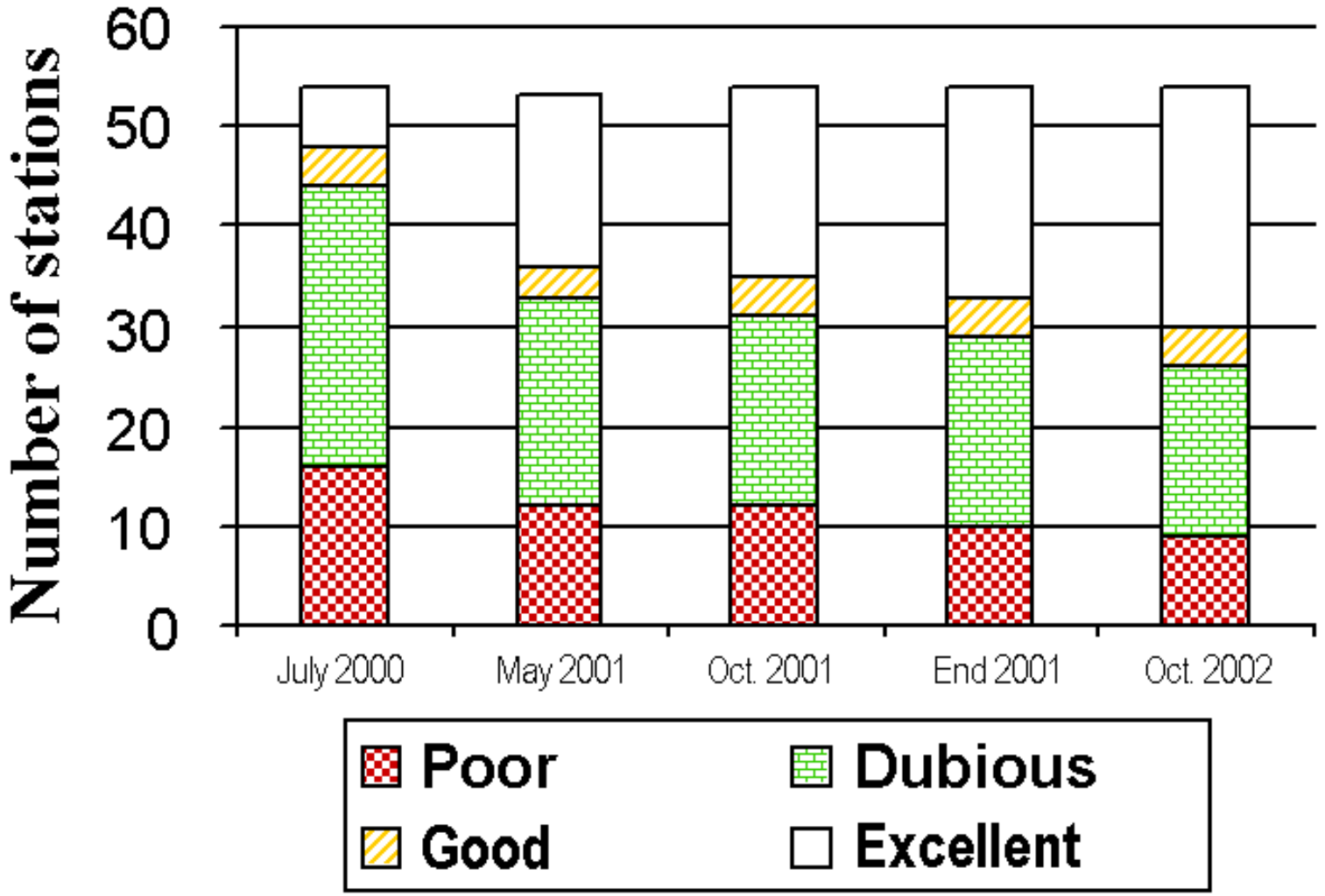
Network renovation and extension

- **Third generation beacons deployment**
  - 6 (Toulouse, Tristan Da Cunha, Mahe, Cibinong, Sainte Helene &Thule)
  - 4 to come (Terre Adélie, Crozet, Cabo Verde, Easter Island)
- **Network renovation**
  - Global network renovation action decided at the end of 1999
  - Main objective: improve the antenna long term stability, to make it compatible with the current and future positioning accuracy of the DORIS system
  - Results to date: more than half of the stations meet the new stability requirement (vs 1/6 two years ago)
- **Network extension**
  - global orbit coverage
  - collocations with tide gauges(CNES/GRGS/LEGOS research proposal)
  - IDS proposals for new stations

Network renovation and extension



Network renovation progress



SSALTO
the new multi-missions orbitography and altimetry center

➨ Early and new instruments and/or missions

- Early missions (SPOT 2 & 4, TOPEX/Poseidon)
- + JASON (DORIS, GPS, Laser, altimeter, radiometer)
- + ENVISAT (DORIS, altimeter, radiometer)
- + SPOT 5 (DORIS)
- expected increasement of DORIS system performances
  - **x2 in-flight instruments ; x3 tracking capability**

SSALTO
the new multi-missions orbitography and altimetry center

SSALTO improved characteristics

- modular conception allowing new instruments to be easily integrated
- centralized data archiving
- includes public results interface and distribution
- beacon positioning is included in operational processing
- capability to deliver from SSALTO a DORIS instrument Control Center for a « DORIS user » project => to be embedded in the Satellite Control Center

International DORIS Service

Central Bureau:

- http://ids.cls.fr
- All about DORIS: network site logs
- Reports, ftp server

IDS Workshop: 13-14 June 2002 - Biarritz

- DORIS system evolutions, IDS status
- DORIS analysis results, IDS analysis campaign
- Analysis Workshop
- Network workshop
- http://ids.cls.fr/html/report/ids_workshop_2002/programme.html

Data Centers

- Data Flow Coordination: Carey Noll (NASA/GSFC)
- GSFC/CDDIS: Carey Noll
- IGN/LAREG: Edouard Gaulué (in progress)

International DORIS Service

Analysis Coordination

- Martine Feissel-Vernier (IGN/LAREG Observatoire de Paris)
- http://lareg.ensg.ign.fr/IDS/
- 2002 Analysis Campaign (http://lareg.ensg.ign.fr/IDS/events/camp_2002.html)
- 2003 Analysis Workshop (Marne la Vallée - France)

Stations Selection Group

- Frank Lemoine (NASA/GSFC)
- http://phys-geophys.colorado.edu/~kristine/doris.html
- Ajaccio (Corsica): altimeter calibration site
- Sorsdal (Antarctica): moving ice field monitoring by Geoscience Australia
- Gavdos (Crete): altimeter calibration site
- TIGO (Chile): four geodetic techniques (SLR, DORIS, GPS, VLBI)
- Burnie (Australia) : long-standing altimeter calibration site in Bass Strait