Current TRENDS in the DORIS SYSTEM

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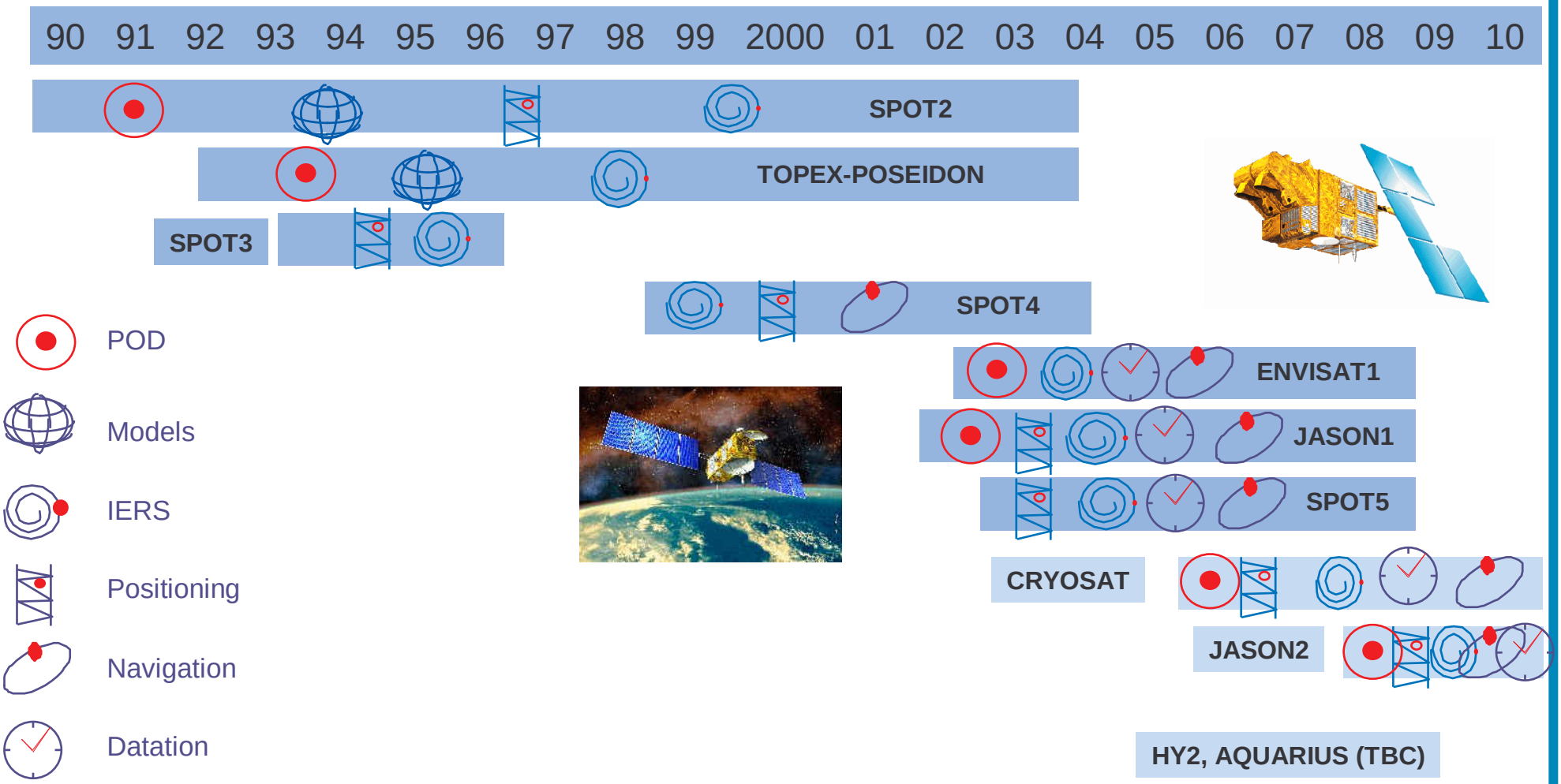
SUMMARY

- Current/Planed DORIS Missions
- On board receivers
  - 2G, 2GM, Cryosat receivers
  - future receivers
- Network
  - 3rd generation beacon
  - New Master Beacon
  - New Time Beacons?
- EGSEs
- DORIS ground segment: SSALTO

A Long Life System

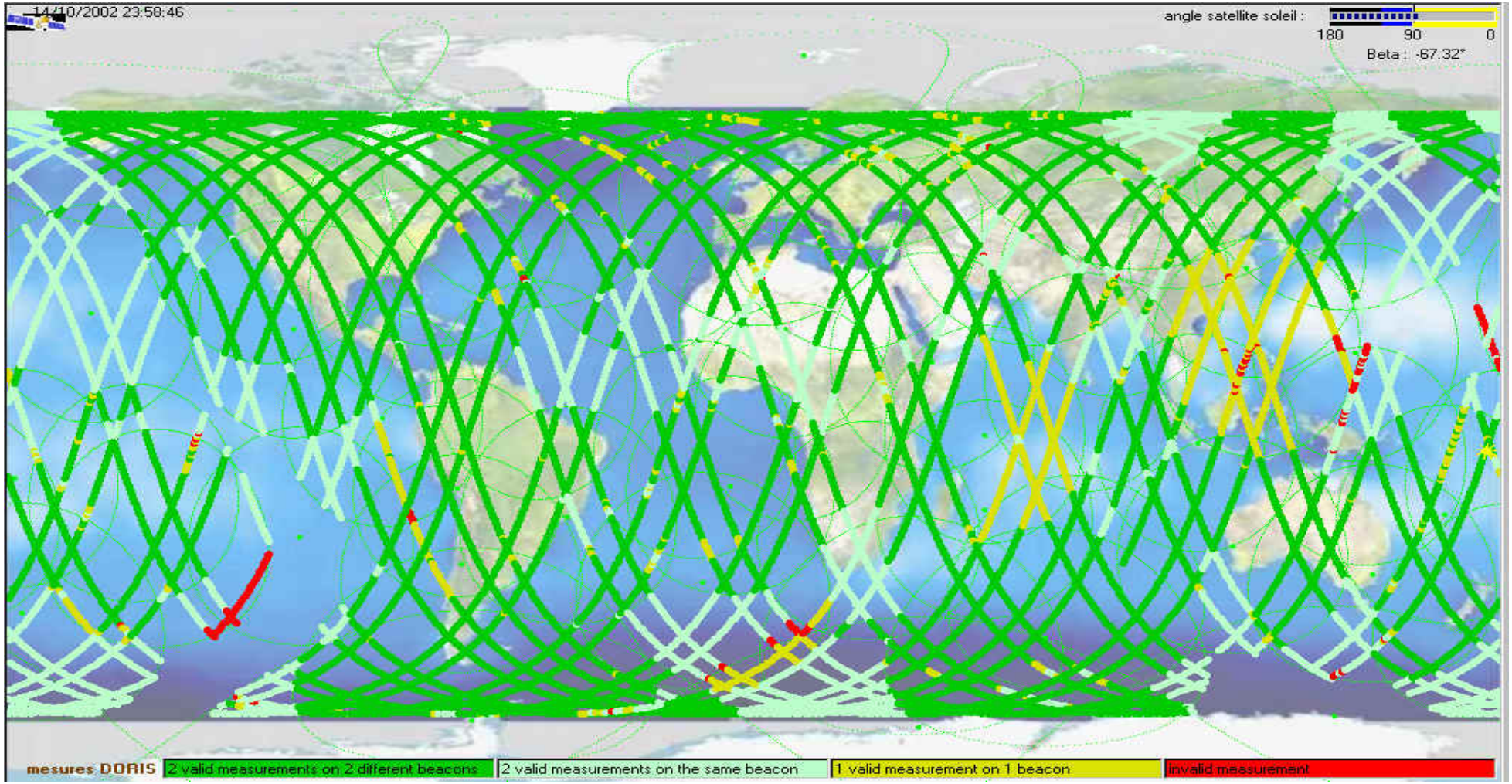


2G DORIS receiver: ENVISAT

- **Dual tracking ability : 2 beacons tracked simultaneously**
- **measurement resolution improved (1/4)**
- **New routine measurement mode : Autonomous mode**
  - **DIODE directives for beacon signal acquisition**
  - **daily uploads no longer needed**
- **Increased instrument operational robustness:**
  - **more autonomous onboard software**
    - wide range time correction
    - DIODE navigation function included in the flight sw and "lost in space" start
    - measurement mode autonomous management
  - **radiation-hardened processor,**
  - **EDAC and scrubbing task to prevent from mass memory upsets**
- **improved DIODE real time orbit accuracy**
  - **orbit estimation : ~ 20-30 cm radial rms, 1 m 3-D rms position accuracy**
  - **TAI estimation : ~ 1-2 µsec rms**

Dual channel receivers orbit coverage

ex, Jason1 Oct 13-14 2002



At least 1 beacon : 93.4 % ; 2 different beacons : 62.9 %

2G miniaturised DORIS receiver

- 50 % size & mass reduction compared with ENVISAT 2G receiver
- Numerical processing
  - accurate phase measurements
- Cold start => from Switch On to routine w/o any ground commands
  - Thanks to TAI date transmitted by 3rdG beacons, and Time beacons
- Automatic update of onboard network description via Master Beacon broadcast
- Operated on board JASON1, SPOT5

CRYOSAT receiver

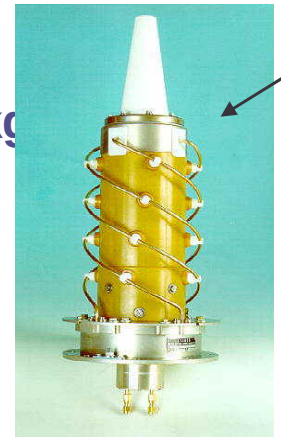
- **New processor**
  - **Sparc ERC 32**
  - **improved arithmetic (improves quality of on-board processing)**
- **2 redounded EEPROM banks to store the OBSW**
  - **no more PROM**
  - **OBSW maintenance improved**
- **New SoftWare**
  - **Full SW upload w/o any mission interruption**
  - **Provision of real time navigation in J2000 (SCAO use)**
  - **Self-content raw measurements TM Packets**
    - TAI dating (1µs RMS) for raw measurements
    - on-board frequency estimation
    - time delays
  - **Improved RAIM and FDIR**
    - deletion of IDLE and Incident modes
    - simplified operations

DGXX receivers

- At least 6 channels => capacity to track 6 beacons simultaneously
- New USO
  - increased stability
  - less sensitive to radiation
- Spectral analysis
  - beacon frequency search using FFT => shorter cold start (SCAO use)
  - spectral analysis mode maintained on one chanel
    - new/unknown beacon (network, positioning)
    - safe mode
  - Jamming measurements performed simultaneously with main mission
- Satellite attitude taken into account on board (quaternions)
- 5 boxes (2GM, Cryosat) --> 1 box
  - simplified integration on the satellite
- Planed on JASON2

Doris DGxx instrument digest

- mass : BDR 16.5 kg - antenna 2 kg
- overall dimensions (mm)
  BDR : 388 x 366 x 165
  Antenna : ϕ 160 x 428
- power consumption : < 24 W
- TM rate : ~ 1 Kbits/sec
- internal redundancy
  # 2 independent complete DORIS receivers in the same box
  # Antenna RF signals are automatically switched to the active DORIS receiver
- provides 3 reference frequency outputs (10 MHz USO) for POSEIDON-3 altimeters & WSOA



Beacons Network

- Antenna change
- Antenna support stability Improvement
- Antenna positioning improvement

- 3rd G beacon deployment

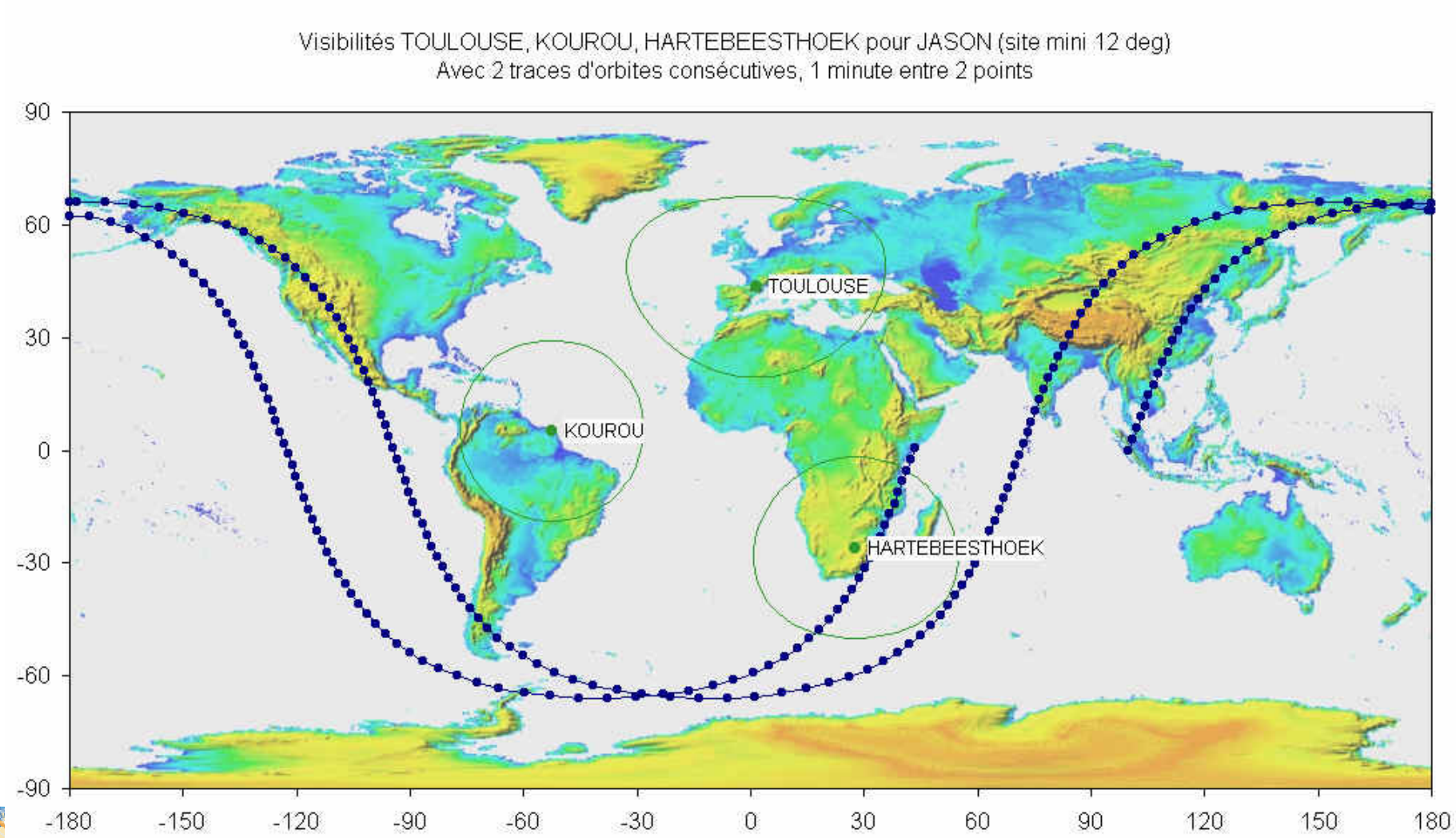
3G beacon : main new features

- Frequency shift : ± 50 kHz / 2GHz ; ± 10 kHz / 400 MHz
  - => network density may be increased
- Beacon message and synchro. word transmitted on both 400 MHz & 2 GHz signals with EDAC code on 2GHz
  - => improves datation accuracy
  - => improves data reception on board
- Transmission of current non ambiguous TAI date
  - => allows receivers cold start
- Improved monitoring of beacon operation status (USO Warm-up)
  - => avoid erroneous processing
- Restart mode
  - => beacon switched ON without any time set
  - => beacon switch Off detection ; avoid erroneous processing
- remote control capacity
- can be easily upgraded into Time or Master Beacon

A new Master Beacon

- **Why ?**
  - **Faster cold start of the receivers (SCAO users)**
  - **robustness**
- **Where ?**
  - **Any reliable site (power and data link with DORIS Ground Segment)**
  - **coverage improvement (no co-visibility with already existing MB)**
    - HBK : installation planed before end of 2004

A new Master Beacon



New Time Beacons (TBC)

- **Why ?**
  - **improved on-board USO monitoring (JASON1)**
  - **faster cold start of the receivers (SCAO users)**
- **Where ?**
  - **Any site assuming a reliable atomic clock is available**
    - **St Johnes site currently under study**

New EGSEs

- simulation of RF signals as seen by the on board receiver in flight including beacon messages, beacon time scales, broadcast transmission
  - ground tests representativity improved
  - useful for system investigations
- Already successfully used for DORIS/CRYOSAT OBSW validation

SSALTO multi-missions orbitography and altimetry center

- Taking into account new missions
- System control
  - broadcast generation
  - monitoring tools
- Pre-processing improvements
  - datation, beacons time correction
  - data edition (centre frequency wrong measurements)
- POD Processing improvements
  - troposphere effect
  - USO frequency modelling currently under study
- SSALTO improved characteristics
  - modular conception allowing new instruments to be easily integrated
  - centralised data archiving
  - includes public results interface and distribution
  - beacons positioning is included in operational processing

Conclusion

- DORIS System evolutions
  - to be closer to users needs
  - to increase reliability
  - to reduce cost

- Any suggestions ?