



CENTRE NATIONAL D'ÉTUDES SPATIALES

CNES Presentation:

- * SPACE DEBRIS ACTIVITIES
- * REGISTRATION ISSUES

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COPUOS LSC, Vienna - April 2011

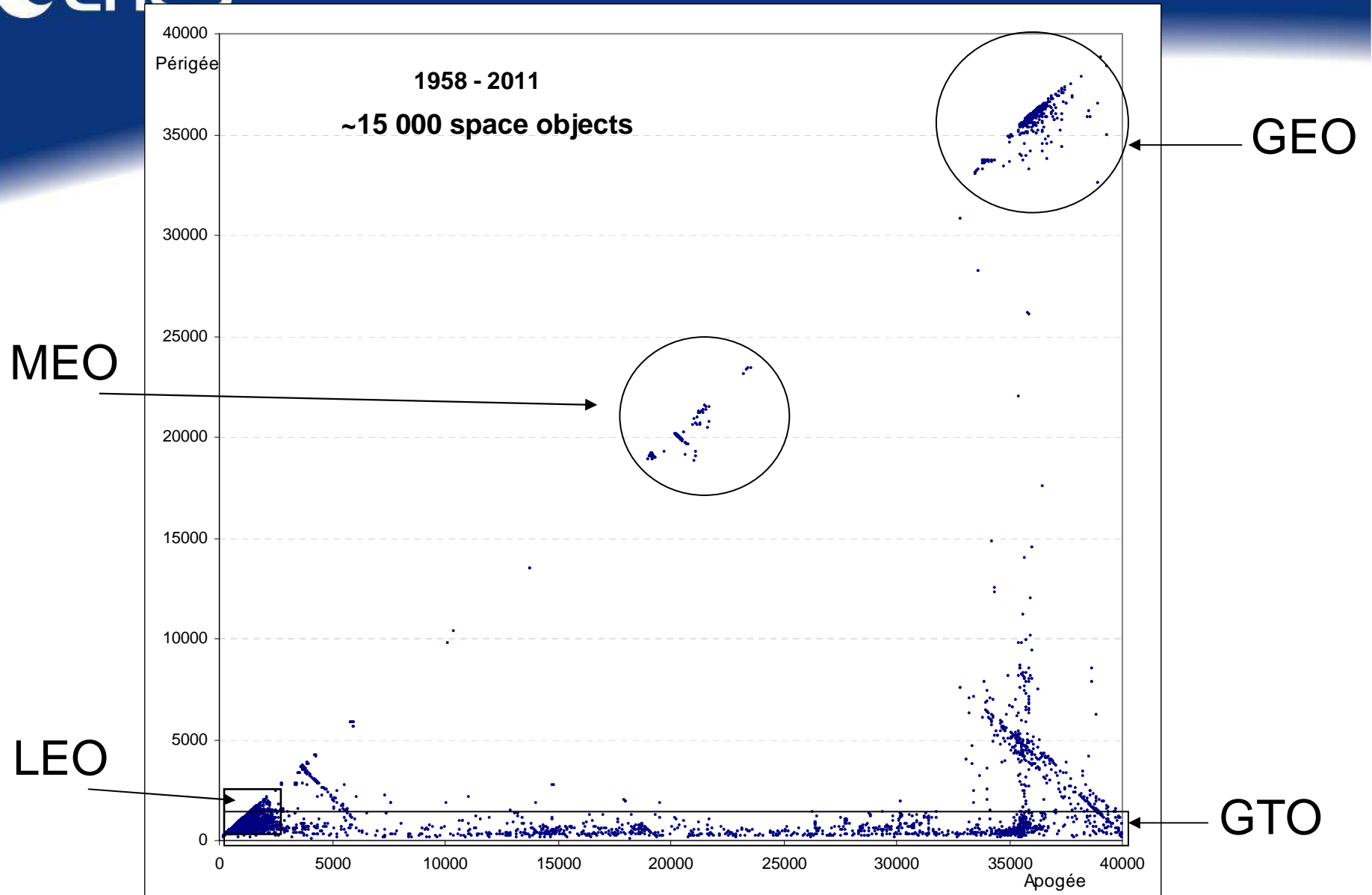
SUMMARY

■ SPACE DEBRIS ACTIVITIES

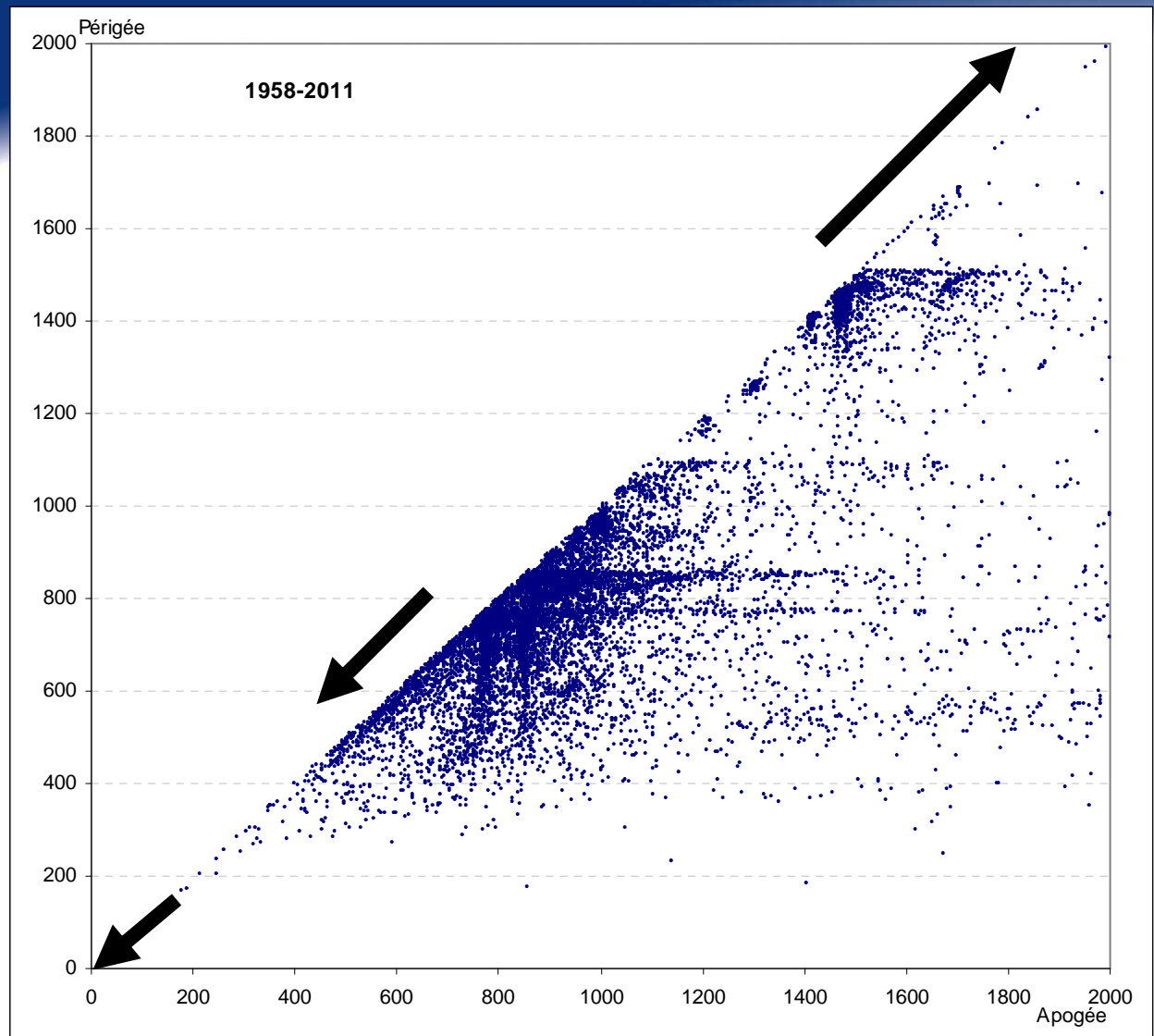
**Reentries, End of life operations, Collision risk monitoring,
Space Act, tools**

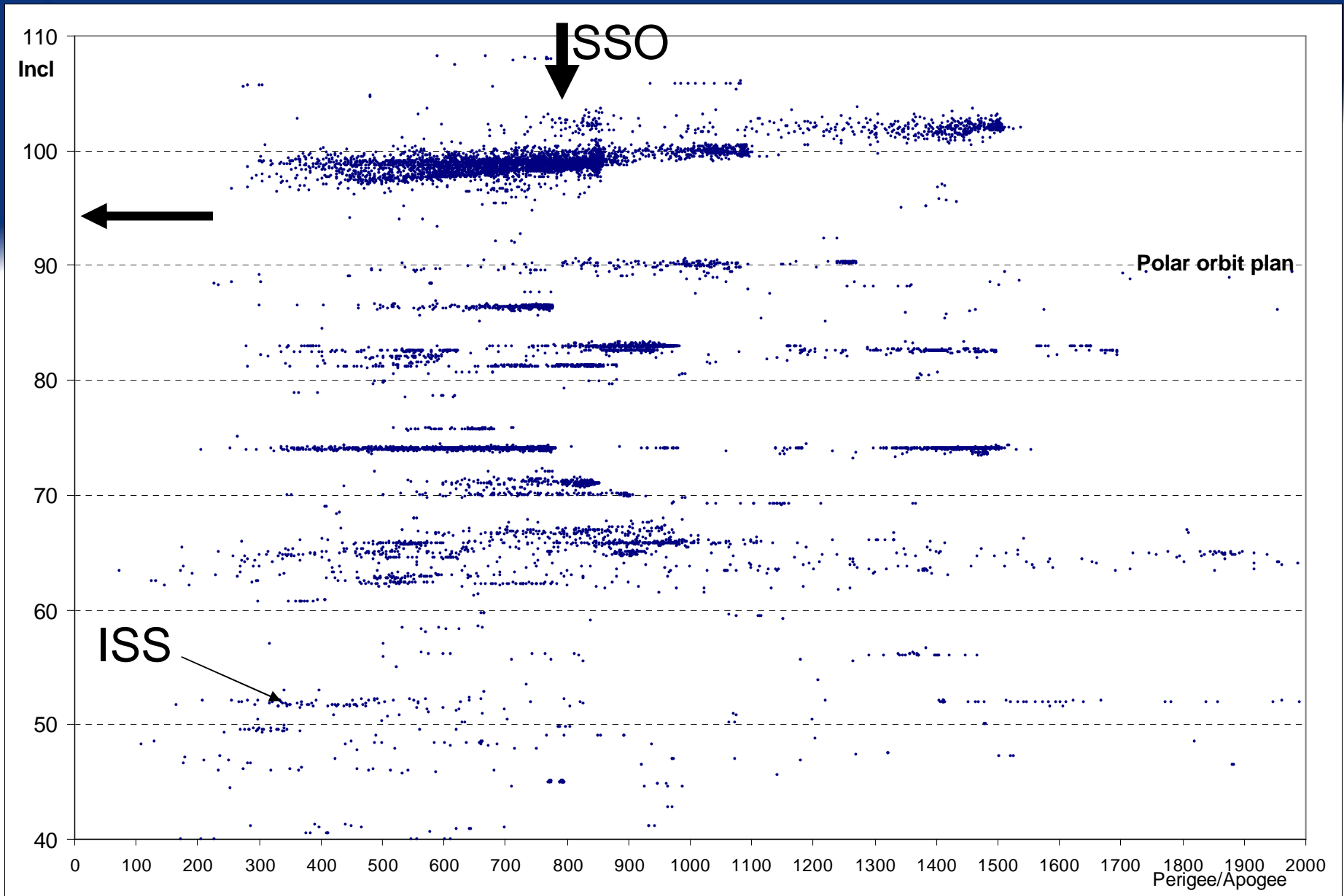
■ REGISTRATION ISSUES

**CNES Registration Office, French Registry, Non-registration
issue**

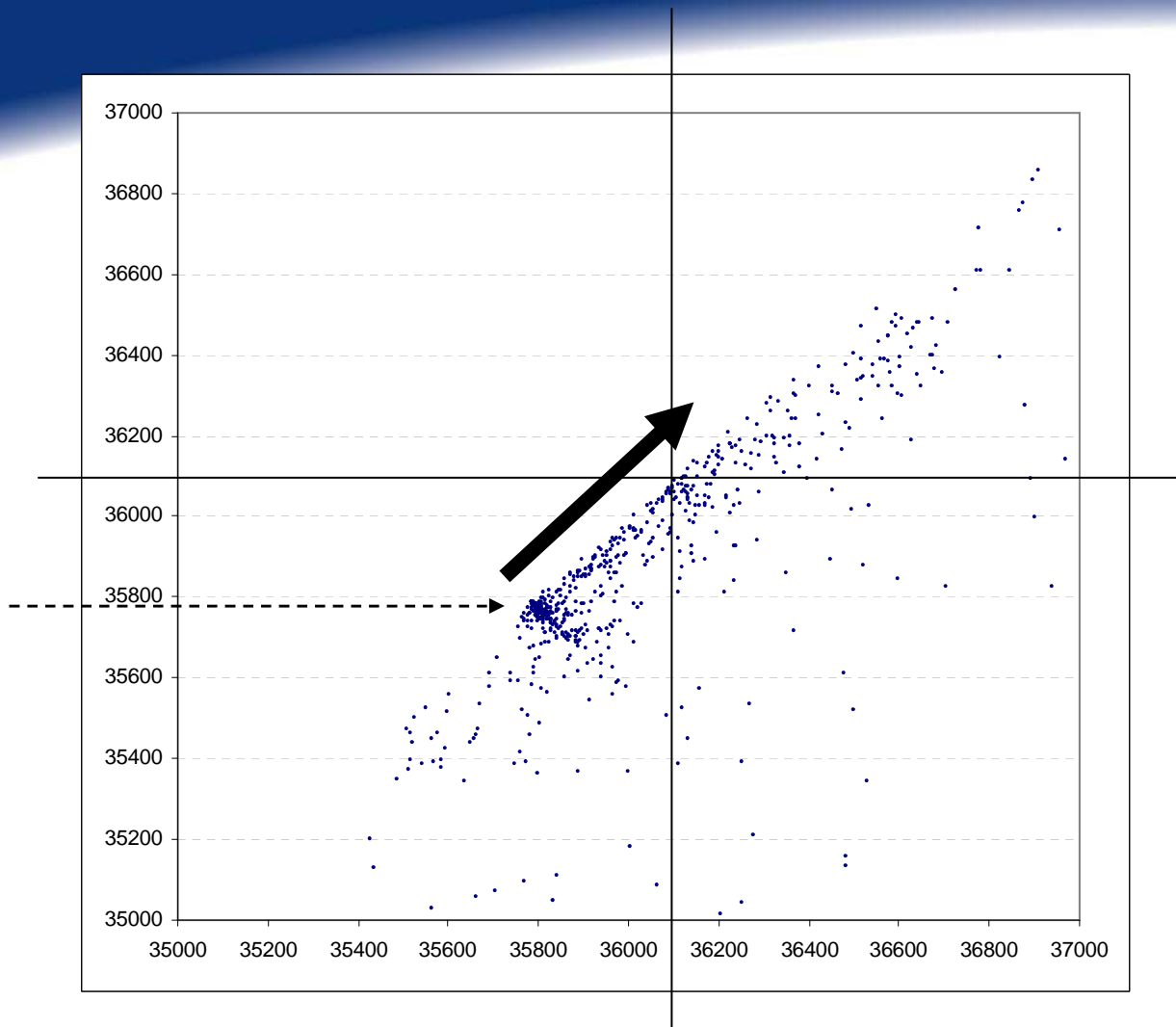


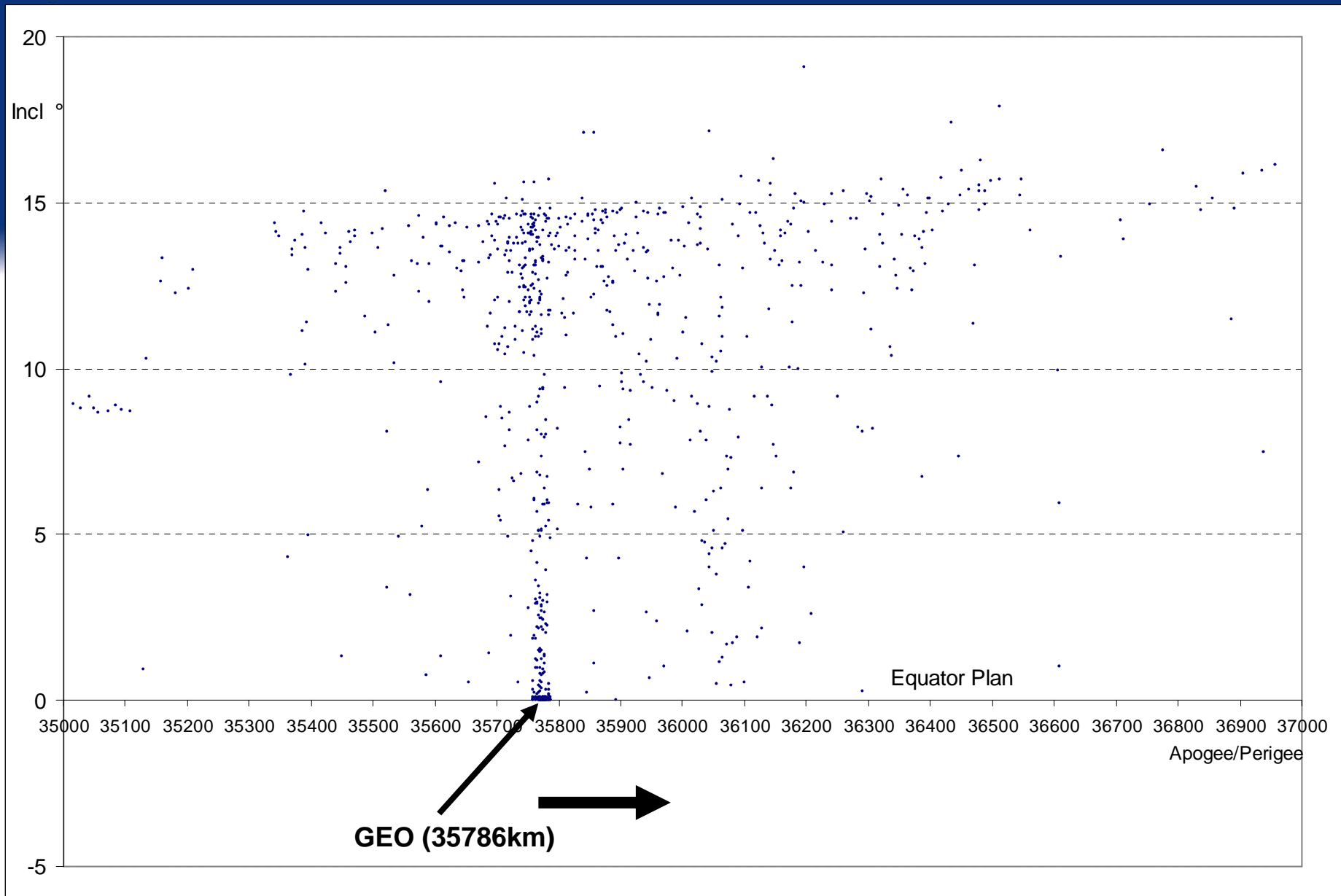
LEO
($< 2000\text{km}$)





GEO





ATMOSPHERIC REENTRIES

- Two French registered objects reentered into the atmosphere in 2010 :

<u>Identification</u>	<u>Launch date</u>	<u>Description</u>	<u>Reentry date</u>
2009-058D	29 Oct 2009	SYLDA Ariane 5 (V192)	9 Sept 2010
2001-029D	12 July 2001	SYLDA Ariane 5 (V142)	6 Oct 2010

- **4 « ESSAIM » satellites launched December 18, 2004**
- **« Myriade » platform: ~120 kg, formation flying**
- **Quasi heliosynchronous orbit around 700 km altitude**
- **Mission: characterization of the electromagnetic environment**
- **Operated by CNES**

- **End of life operations in September and October 2010**
- **1st step: altitude lowering in order to:**
 - ◆ reduce the orbital lifetime
 - ◆ empty the tanks
 - ◆ manage the collision risks between the 4 satellites
- **2nd step: electrical passivation**
 - ◆ Battery discharge
 - ◆ Satellites switch-off
- **Final orbit: the 4 satellites are compliant with the 25-year rule**



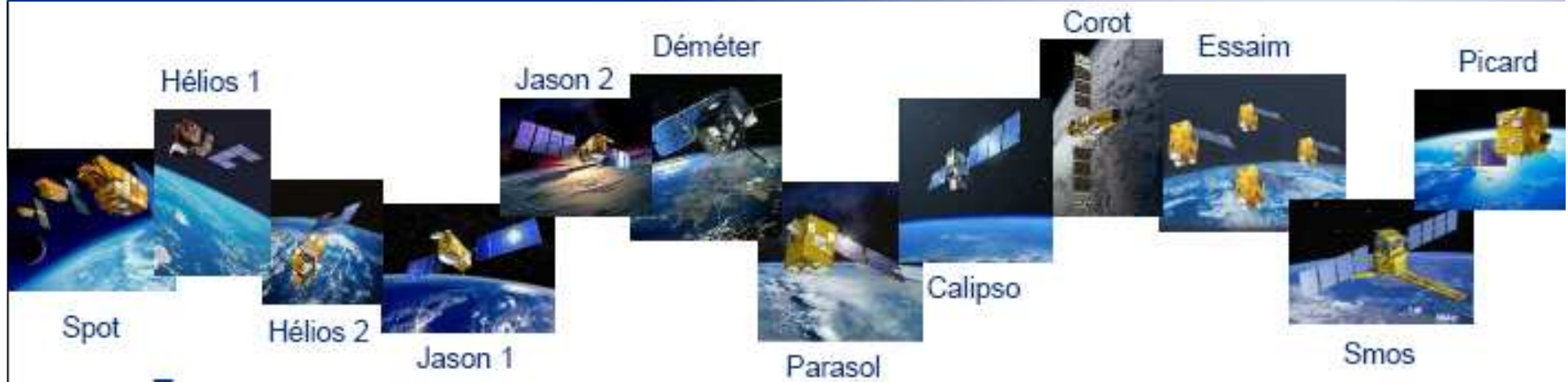


- **EUTELSAT W2**
- **Platform : 3t**
- **Launched October 1998 by Eutelsat IGO**
- **Decommissioned in March 2010 by Eutelsat SA**

- **Final orbit:**
 - ◆ **Perigee 281 km above GEO**
 - ◆ **Apogee 290 km above GEO**

- **Will not reenter into the GEO protected region**

- **Compliant with UN space debris guidelines (A/Res/62/217, Dec 2007)**



- **17 LEO satellites and 1 GEO satellite controlled by CNES**
- **Permanent collision risk monitoring and avoidance maneuvers when necessary**
- **Improvements of the procedure:**
 - ◆ **Use of Conjunction Summary messages received from US Joint Space Operations Center**
 - ◆ **Use of the Radar Graves catalogue and measurements**

COLLISION RISK MONITORING

■ 2010 synthesis:

- ◆ **18 satellites monitored**
- ◆ **353 risks identified by the automated process (probability of collision $> 10^{-4}$)**
- ◆ **92 risk alerts received from US JSpOC**
- ◆ **21 requests for radar measurements or support to JSpOC (probability of collision $> 10^{-3}$)**
- ◆ **13 avoidance maneuvers**

SPACE OPERATIONS ACT

- **Law entered into force on December 10, 2010**
- **Objectives: protection of people, property, public health and environment (including on orbit)**
- **Applicable to**
 - ◆ **Operators carrying out operations from French territory**
 - ◆ **French operators anywhere in the world**
- **Operators shall demonstrate compliance w.r.t. regulations**
- **Authorizations are granted by the Ministry of Research after analysis by CNES**

SPACE OPERATIONS ACT

- **Associated Technical Regulations prepared by CNES in 2009 and 2010 with participation of industry and operators**
- **In line with the UN-COPUOS and IADC Mitigation Guidelines**
- **Content:**
 - ◆ **Ground safety requirements (controlled and uncontrolled reentry)**
 - ◆ **Space debris limitation**
 - ◆ **End of life operations**
 - ◆ **Collision risk reduction**
 - ◆ **Planetary protection**
 - ◆ **Nuclear safety**

SPACE OPERATIONS ACT

- **Methods and tools are proposed to support the implementation of the Technical Regulations:**
 - ◆ **Fragmentation modeling during reentry**
 - ◆ **Estimation of ground risk in case of reentry**
 - ◆ **Determination of compliance with the 25-year rule**
 - ◆ **Long term stability of the GEO graveyard orbit**
 - ◆ **Collision risk during launch phase**

REGISTRATION ISSUES

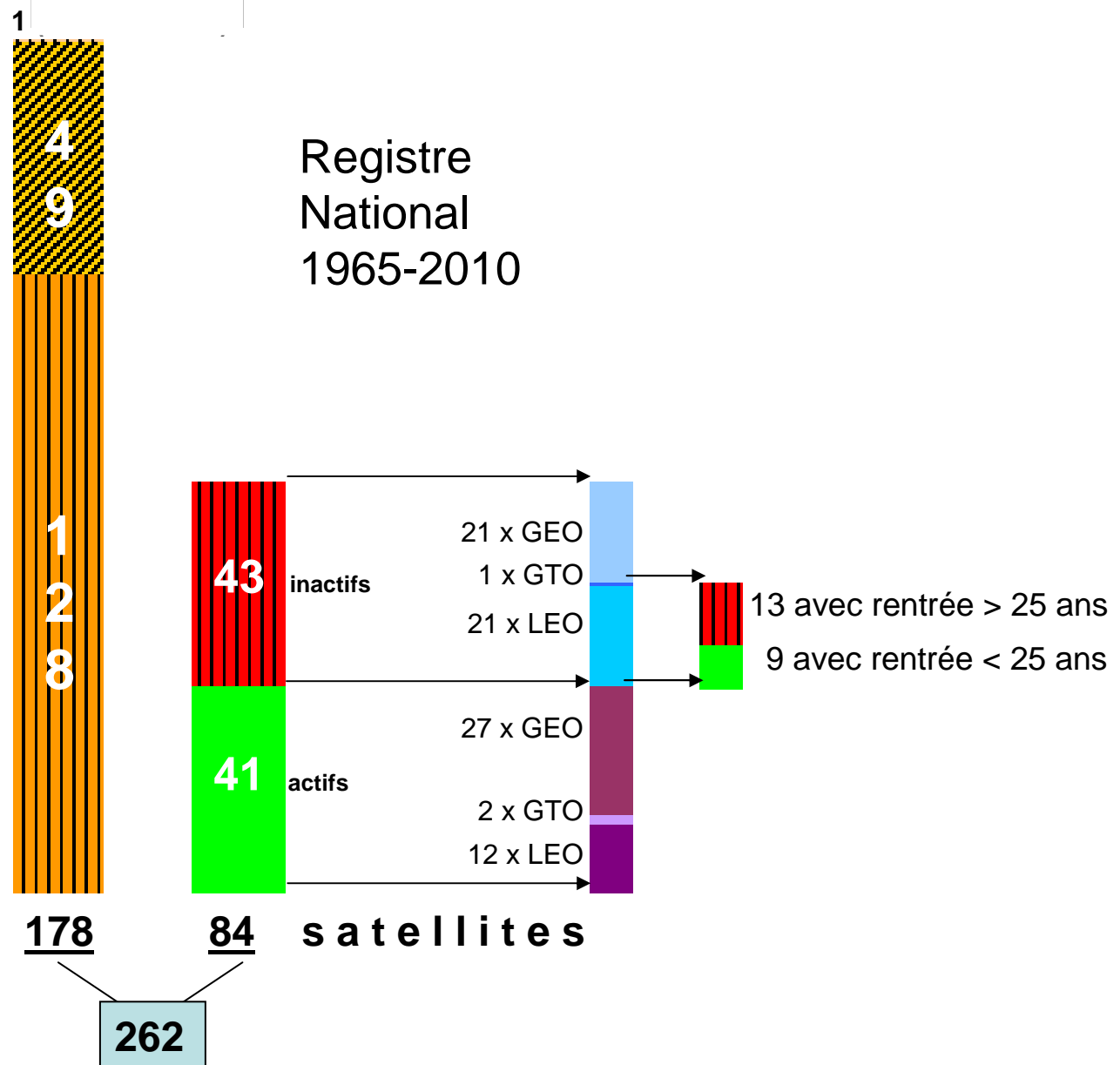
- **New Registration Office (ref to National Legislation)**

- **French Registry for 2010:**

- + **3 satellites (Picard (LEO), W3B (GTO), KA-SAT (GEO))**
- + **12 launcher elements (GTO) (cf 6xAriane launches)**
- **2 reentries**

Total (1965-2010) = 262 space objects (84 satellites)

Registre National 1965-2010



**+ Declaration of launches in 2010 for 11 satellites :
*To be registered soon !...***

→ Non registration issue:

→ 318 (/ 3503) in-orbit satellites are not registered (=> **9 %)**

→ 323 satellites launched by Ariane [1979-2010] & still in-orbit

→ 82 satellites are not registered (1983-2010)

→ 25%

→ 20 States/International Organizations



Vega



Soyouz

