

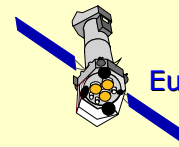
Calibration management

What does that mean ?
Do we need that ?

Would we like it?

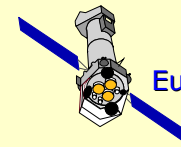
14 June 2006

Marcus G. F. Kirsch



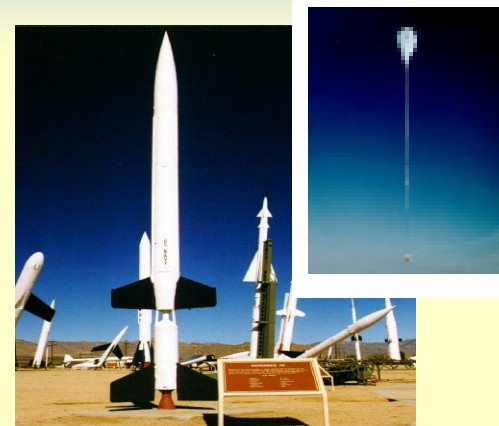
menu

- X-ray calibration in the last century
- Can we do better
- Calibration management
- Committee for X-ray calibration
- Calibration mission scenario

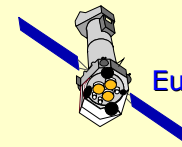
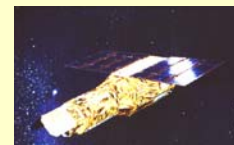
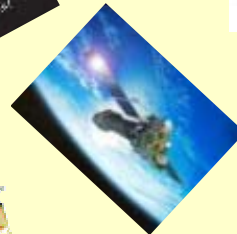
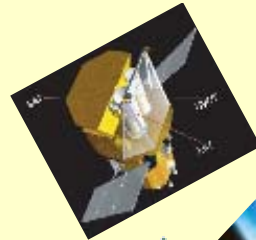


calibration in 20th century

- Balloons → observation time hours
- Rockets → observation time hours
- Satellites → observation time years, decades



- UHURU
- COS-B
- Einstein (4 y)
- EXOSAT (3 y)
- ROSAT (9 y)
- RXTE (>11 y)
- Chandra (> 7 y)
- XMM-Newton (> 6 y)
- Integral (> 4 y)
- Swift (> 2 y)
- Suzaku (> 1 y)

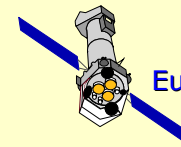


organisation

- Balloon and rocket **experiments**:
construction, operation, calibration, data analysis → **one team**

- Satellite **observatories**:
 - development takes many years by institutes (instruments) and agencies (spacecraft)
 - operation is performed by agencies or other entities
 - calibration done by various entities

→ need of tracking of information

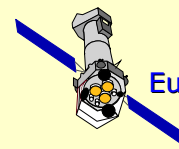


XMM, one of the last missions on paper

- Pre launch documents partly exist only as paper copies
- Ground calibration data is archived on CDs or hard disks in various institutes (if at all☺)
- Calibration team completely exchanged after launch at ESA site
- PI teams are big and not always clear on calibration strategy
- Calibration targets firstly chosen by trial and error → no clear concept or strategy
- Calibration plan was refined and stratetigly designed only after some years of operation and some issues of the instruments (MOS patch, RGS effective area losses)

- Information flow is not secured 100 %

- Calibration could have been coordinated better pre and in early mission

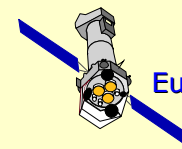


calibration accuracy

- UHURU: ??
- EINSTEIN: > 15 %
- EXOSAT: > 15 %
- ROSAT: < 15 %
- Chandra: < 10 %
- XMM: < 10 %

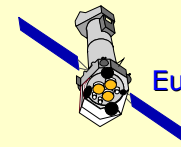


- **effective area gets bigger and bigger**
- **statistical errors get very small**
- **calibration for future science goals needs to be better than 1 %**



can we do better

- Yes we can !!!
 - More knowledge on calibration sources
 - Lessons learned
 - Currently 6 high energy missions in orbit that provide the chance to define a standard set of calibration targets for various instruments
- Agencies and institutes need to maintain better knowledge on calibration (issue clearly related to staff: we need more experienced people from former missions on new missions, that remember what they did before)
- International standard on high energy calibration
 - Ground calibration standards
 - In orbit calibration standards
- Committee to control international calibration

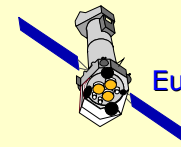


Committee for X-ray calibration

- Defines standard ground calibration requirements
- Defines standard orbit calibration targets
- Reviews calibration of missions
- May provide independent judgment of cross calibration status of a single mission with regard to the standard

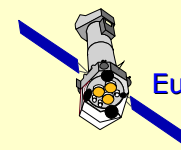


→ “certified by ICWG”



calibration management

- Calibration is developed in cooperation with instrument PI team but implementation and coordination need to be independent
- Task and project management + quality control
 - Agency or special PI institute responsible to track and archive calibration from development till end of mission (with sufficient manpower)
 - data archive and document archive for EVERY ground and in orbit cal measurement
 - Instrument can only be delivered for launch together with complete ground calibration
- Yearly assessment on calibration by calibration committees
 - Mission committees (User groups) AND international standard
- Ground calibration assessment and comparison early in mission (before launch)
 - Verification of calibration components before launch
 - Cross calibration before launch
- Clear definition of in orbit calibration plan
 - Set of targets in same instrument configuration per defined period in order guarantee early detection of instrument changes
 - Set of targets to verify ground calibration
 - Standard candle observation and mandatory cross calibration



Possible calibration scenario

