

EOMODEL: A MODEL LIBRARY FOR EARTH OBSERVATION END-TO- END SIMULATORS

AGENDA

1. Why a library of Earth Observation models
2. The EOMODEL/BIBLOS project
3. BIBLOS website
4. Conclusions: added value of the BIBLOS project

BIBLOS

LIBRARY OF EO MODELS

WHY A LIBRARY OF EO MODELS

- Current EO missions develop E2ES
- An E2ES is an **expensive** development
- All EO E2ES share commonalities.
- There are **re-engineering costs that can be avoided.**

- Interesting for early design phases (A)
 - There is not a lot of budget
 - But many EO missions have to prove performances for mission selection (for example in the Earth Explorers)
 - Useful tool for Requirements definition
 - Useful tool for Processing and Calibration testing and validation
 - Useful tool for Retrieval and Science validation
- Later evolution into operational simulators

ARCHEO PROJECT

Survey of past/current/planned EO missions

- **38 ESA**
- **218 non-ESA**

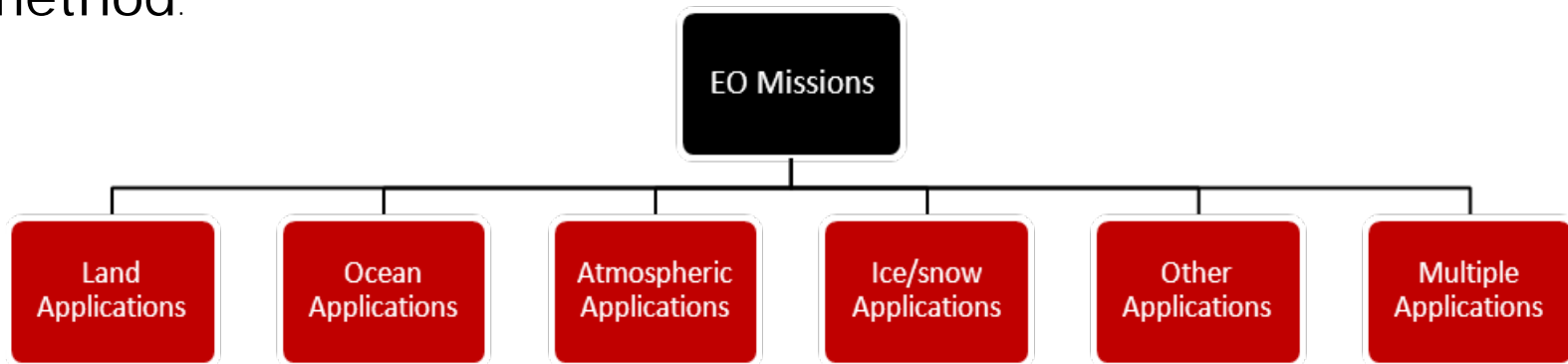
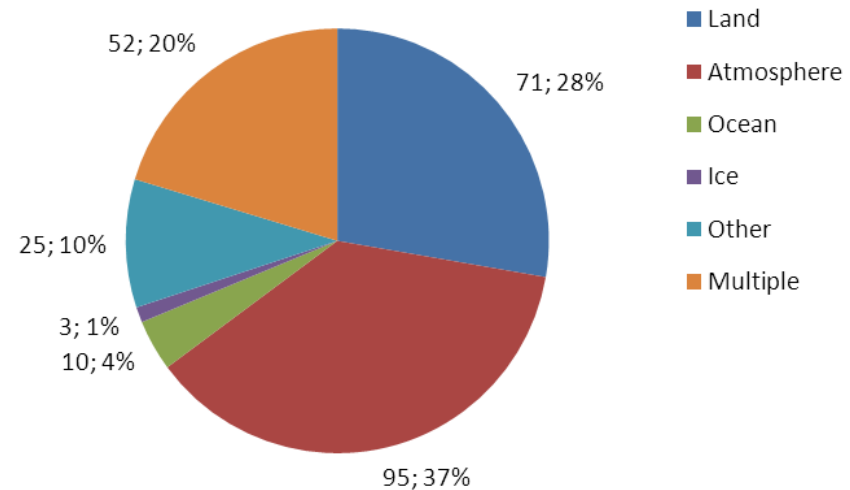
- Categorisation of Earth Observation **Missions**
- Categorisation of Earth Observation **Instruments**

- Definition of a **Reference Architecture**
- Definition of the composing Building **Blocks**

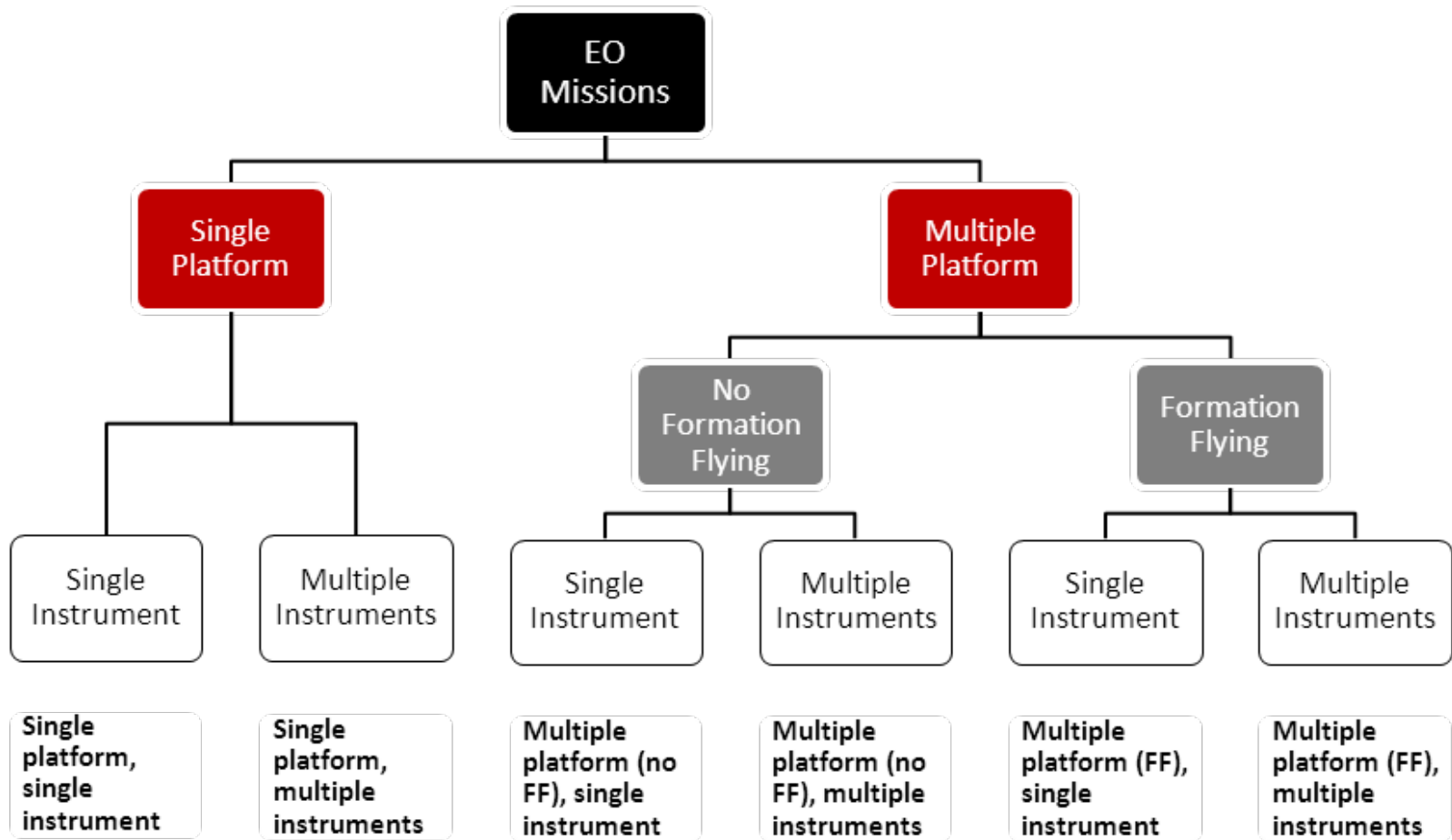
MISSION CATEGORISATION

- **Number of satellites** composing the mission.
- **Number of instruments** on-board the spacecraft.
- **Scientific objective** of the mission.
- Links with other missions: formation flying, processing, retrieval
- Orbit characteristics
- Observation geometry/scanning method.

Applications

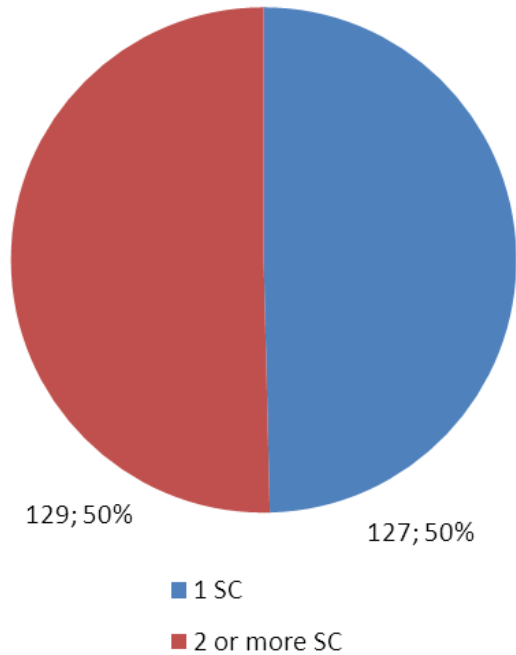


MISSION CATEGORISATION

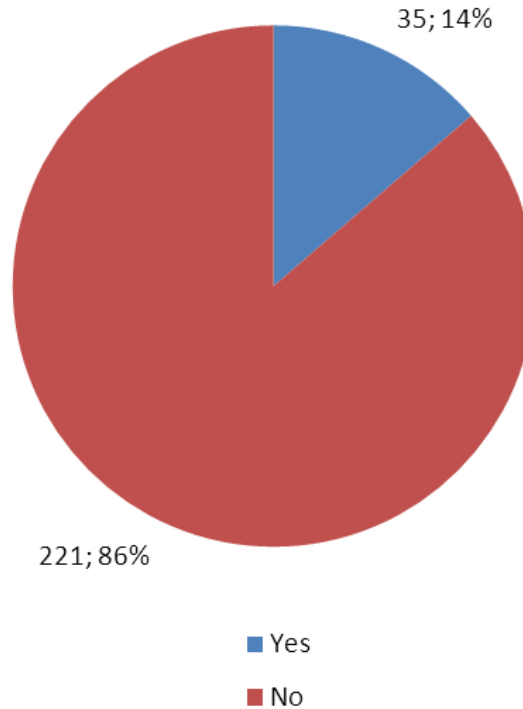


MISSION CATEGORISATION

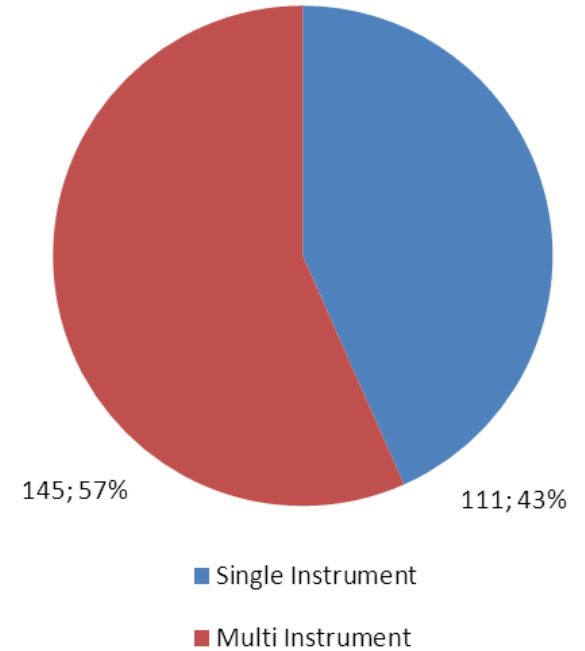
Number of Spacecraft



Formation Flying

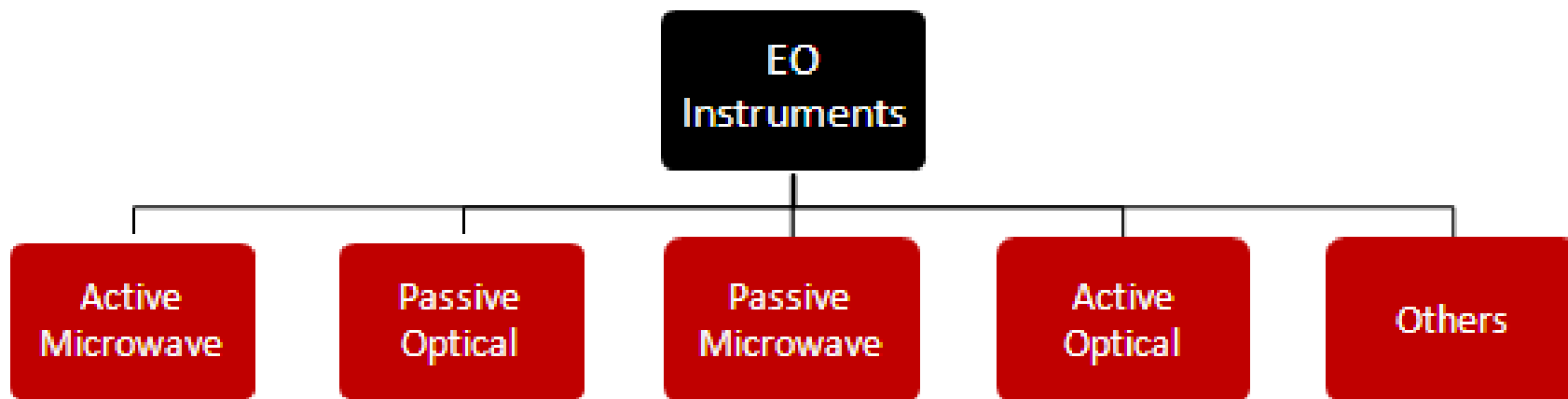


Number of instruments

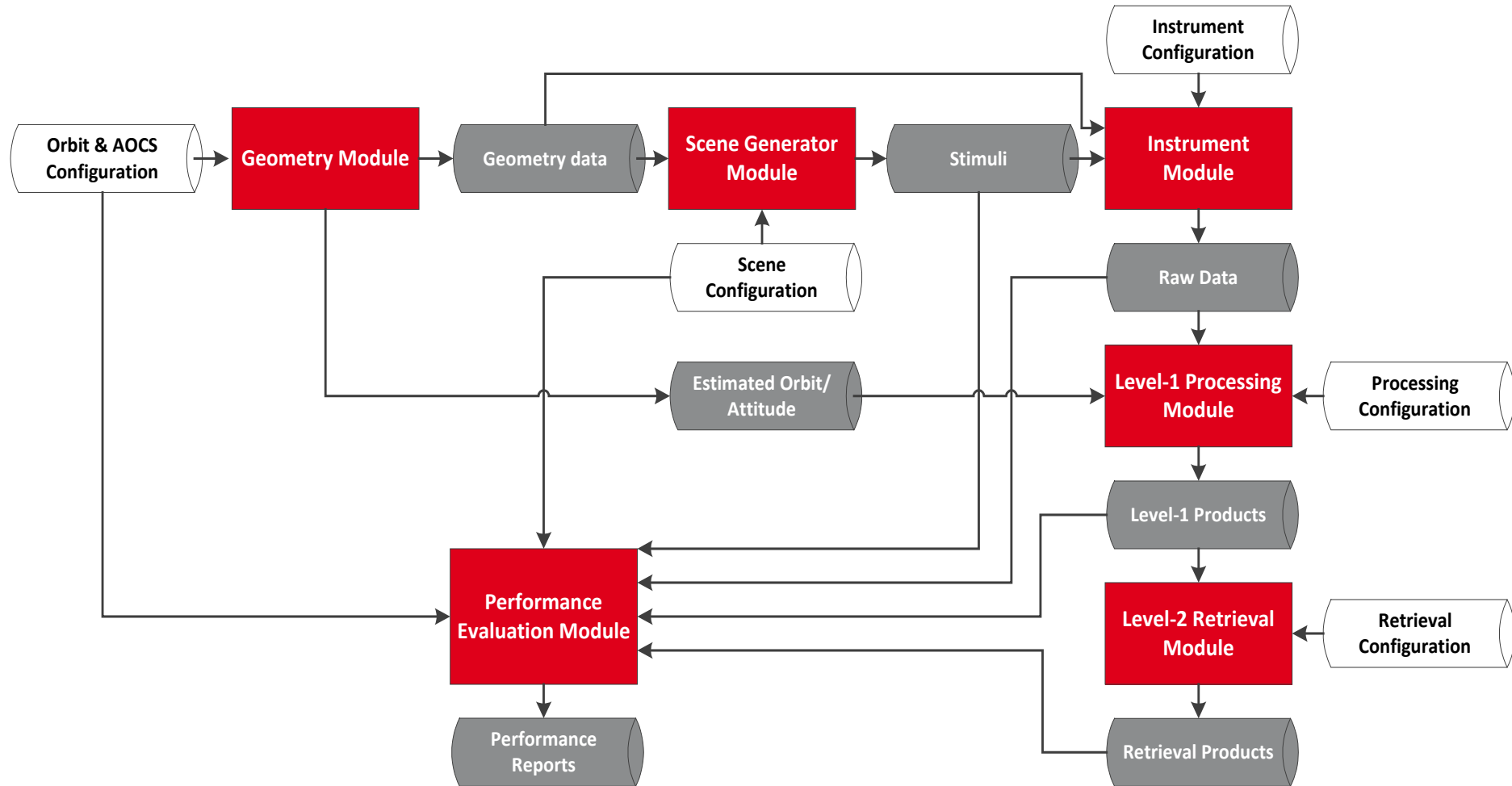


INSTRUMENT CATEGORISATION

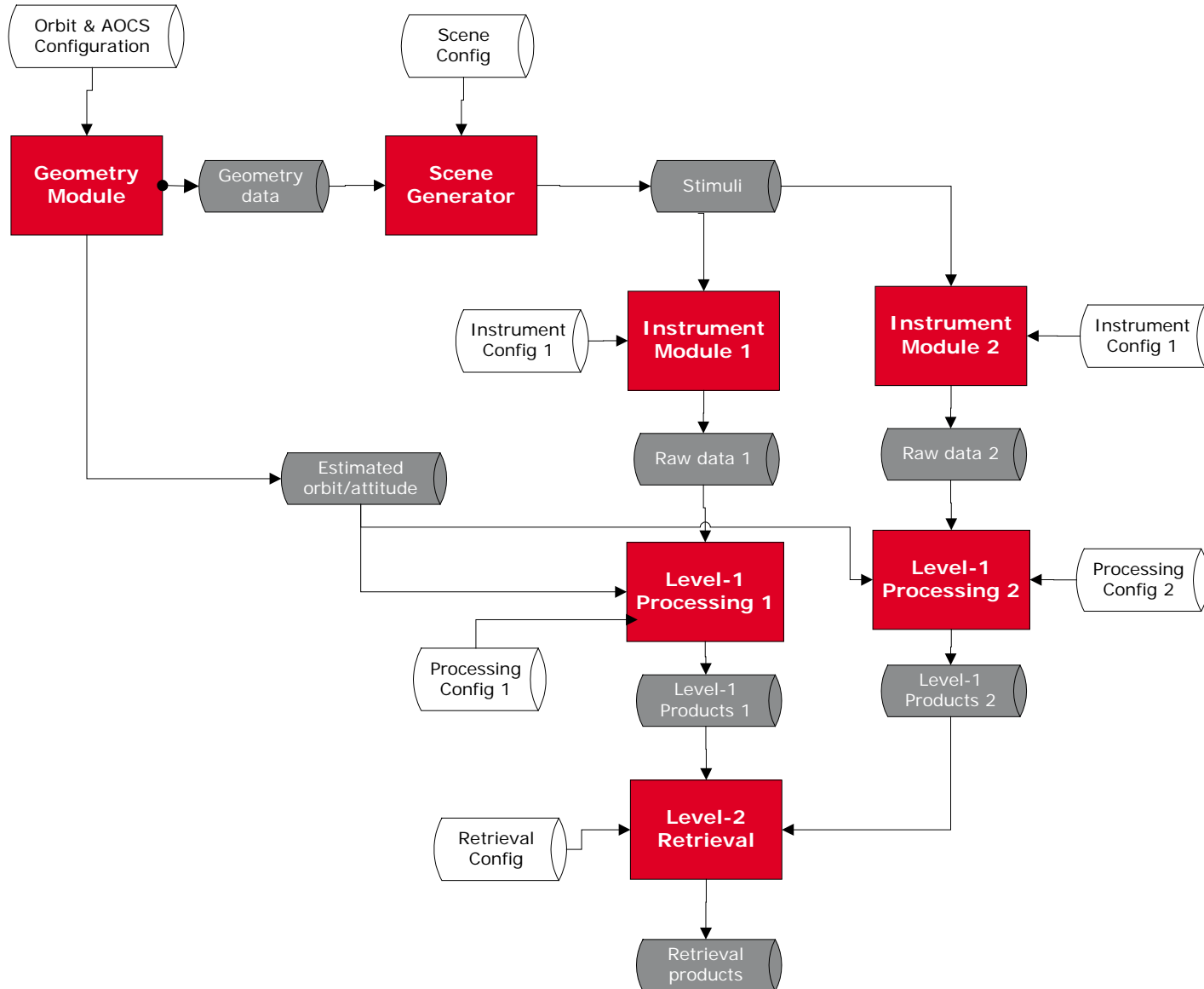
- Region of the **spectrum** they operate
- **Passive vs. active** instruments
- Target of the measurement
- Type of retrieval products
- Calibration method
- Scanning geometry



REFERENCE ARCHITECTURE OF AN E2ES

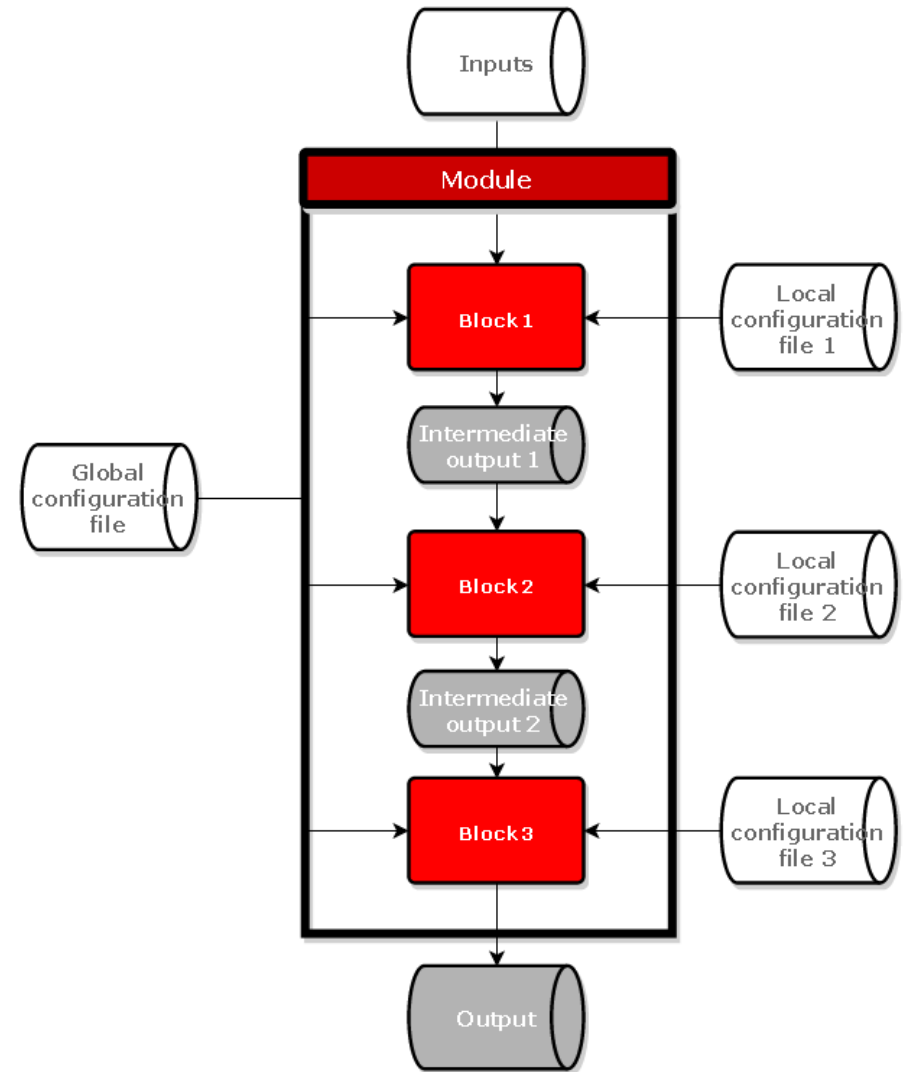


AN ARCHITECTURE FOR EACH MISSION



BUILDING BLOCKS

- Each Module (Geometry, Scene Generation, Instrument, L1, L2, PEM) is composed of building Blocks
- A Blocks is a unit of SW that performs a distinguishable activity. They are the '**bricks**' of the E2ES.
- A chain of blocks builds the Module.
- The communication between the blocks is data driven. So they are **flexible**.



BUILDING BLOCKS

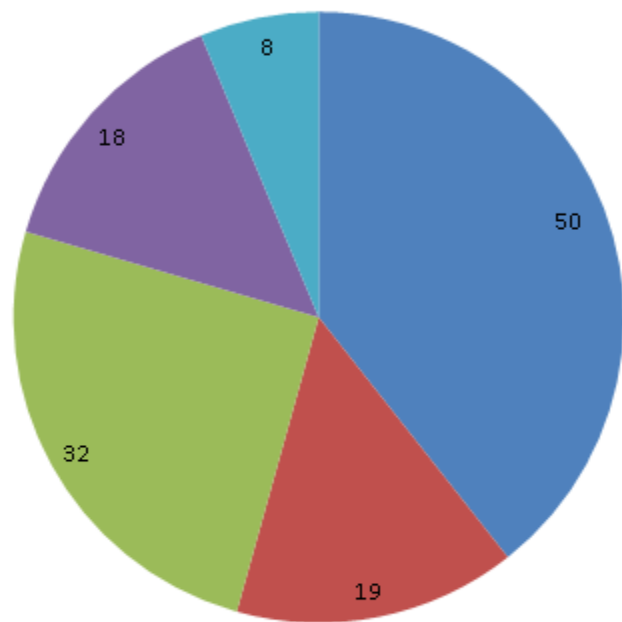
In ARCHEO Blocks were defined

- For each main **Instrument** type (Passive/Active Opticals & Microwaves)
 - For each **Module** (Geometry, Scene Generation, Instrument, L1, L2, PEM)

A total of **127** Blocks were identified.

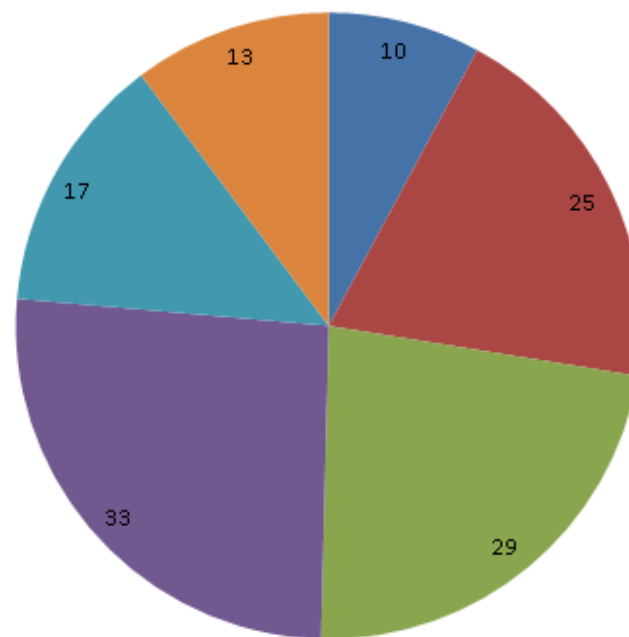
BUILDING BLOCKS

ARCHEO BBs classification according to Instrument



- Active Microwave
- Passive Optical
- Passive Microwave
- Active Optical
- Generic

ARCHEO BBs classification according to Module



- Geometry
- Scene Generator
- Instrument
- Level-1 Processing
- Level-2 Retrieval
- Performance Evaluation

WHAT BLOCKS ARE COMMON FOR EO MISSIONS

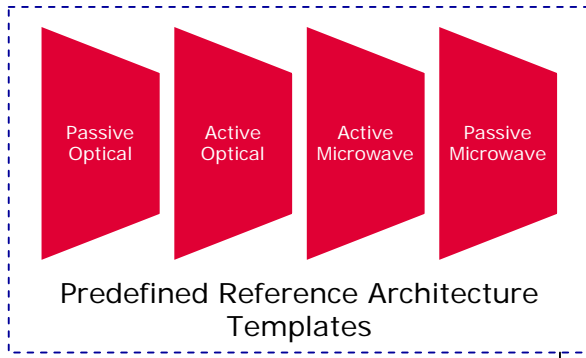
The most common Blocks are:

- All the blocks from the **Geometry Module** as it common for all EO missions (Orbit, Attitude, AOCS, Scene Interaction Blocks)
- **Passive Opticals** and **Active Microwaves** are the most typical EO missions, so it is useful to implement blocks belonging to the **Scene Generation and Instrument Modules**
- Part of the **L1-Processing** chain is common for all missions (Geolocation, Removal of Radiometric Errors, Coregistration)

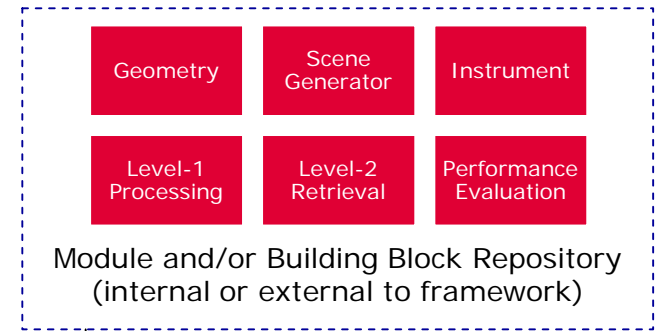
On the other hand, the most mission-specific Blocks (least common) are:

- Forward Model
- L2-Retrieval
- Some calibration processes

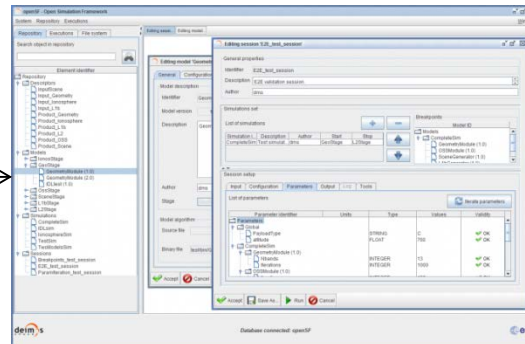
WORKFLOW



- Reference architectures defined in scope of present activity (Task 2).
- Number of architectures minimised by trade-offs.

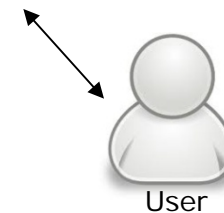


- Building blocks and/or modules are stored in a dedicated repository.
- They are used to fill-in the stages created in the framework by selecting the reference architecture template.



EO E2E Simulator Framework

- Pre-creates interconnected stages and templates for configuration files according to selected reference architecture.
- Input/output interfaces defined according to Building Blocks definition (Task 3).



BIBLOS

EOMODEL/BIBLOS

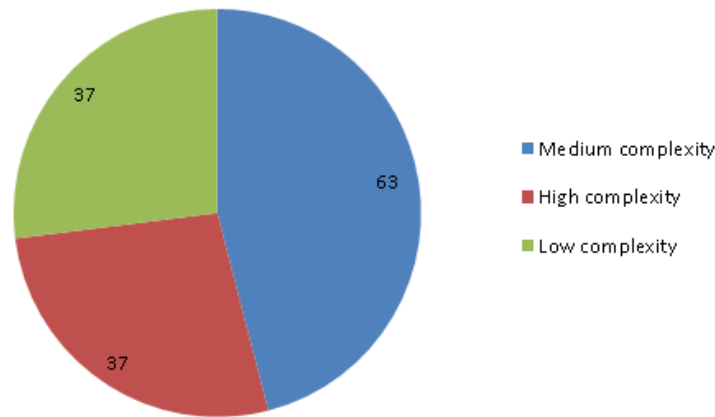
THE BIBLOS PROJECT

There are 3 main activities in the BIBLOS project

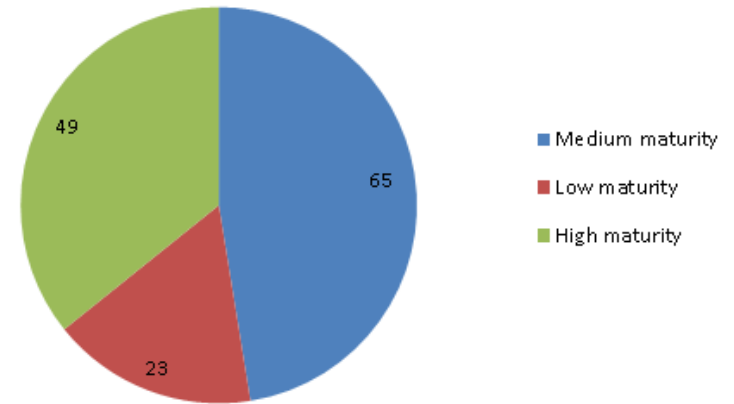
1. Definition of the **Technical Specifications** for all of the Modules and for each of the Blocks. Each Block's technical specification contains
 - Overview
 - Requirements
 - Algorithms
 - Architecture
2. **Implementation** of some of the Blocks
3. Design and production of a **Website**
 - The website includes a step-by-step guide on how to create an E2ES
 - The website contains the available SW (Modules/Blocks)

BUILDING BLOCK CLASSIFICATION FOR BIBLOS

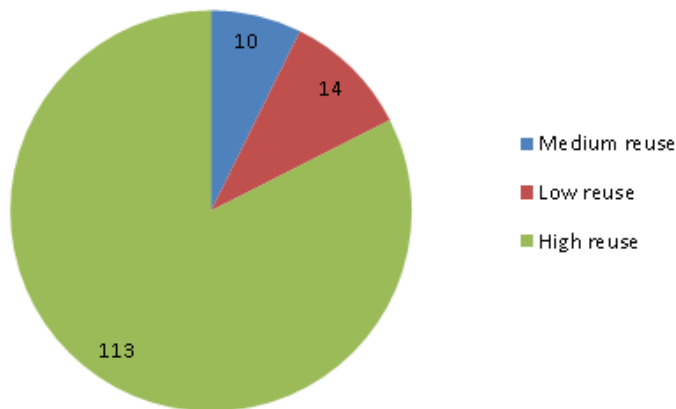
BBs classification according to Complexity



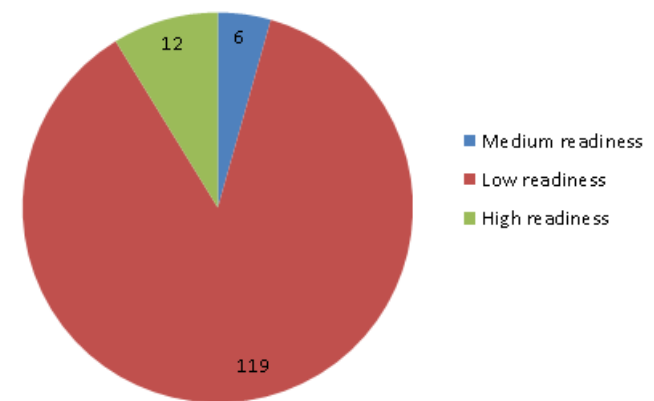
BBs classification according to Maturity



BBs classification according to Reuse



BBs classification according to Readiness

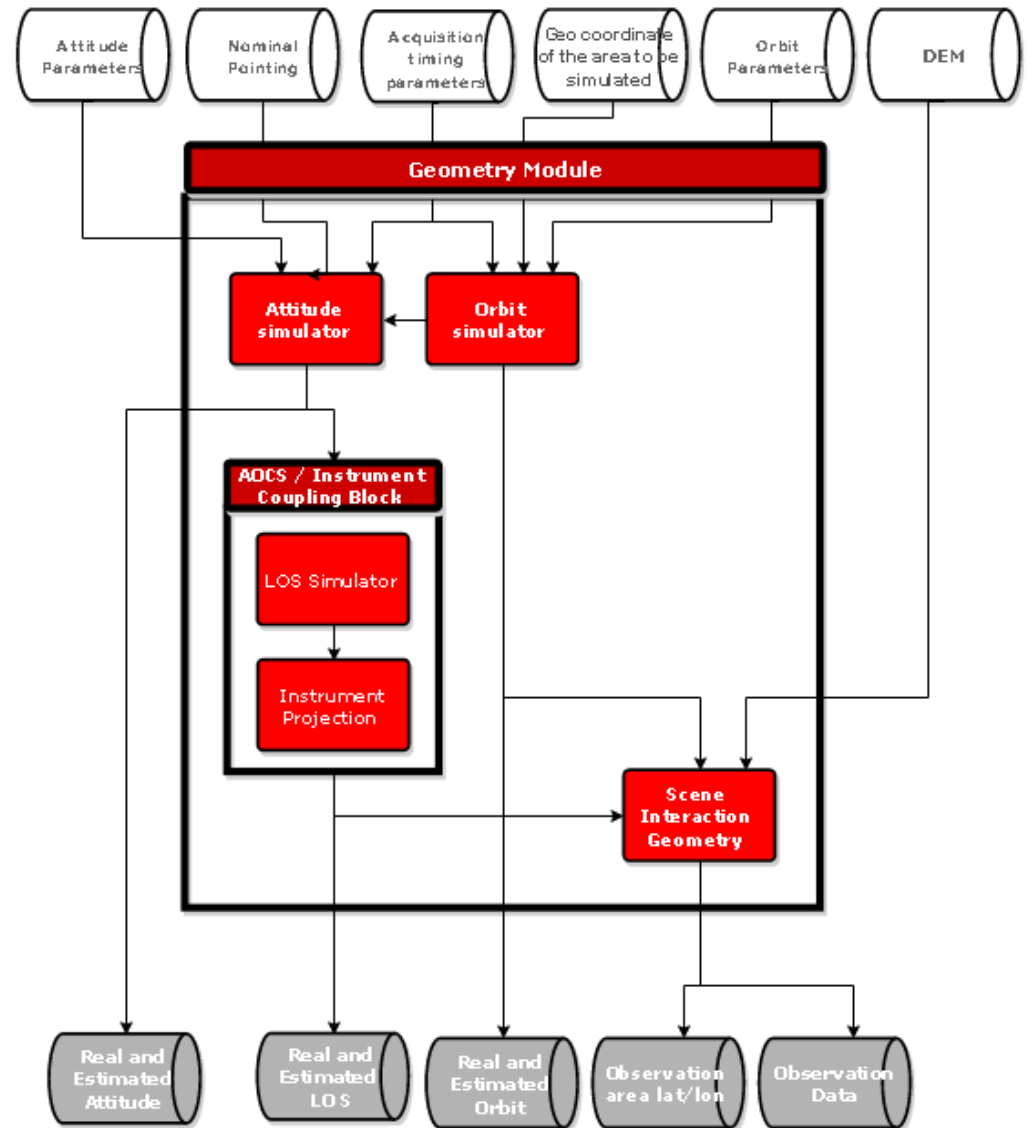


BIBLOS PRIORITIES FOR IMPLEMENTATION

- Starting point: Generation of **satellite images (raw data) for a Passive optical imaging mission**
- Purpose of generating test data for ground processing SW validation
- Focus on the Geometry, Scene Generator and Instruments Modules
- Aiming at a **phase A** E2ES. But is designed with later phases (B/C) into account.
 - Programming language
 - Image processing capability
 - Performances (limited).

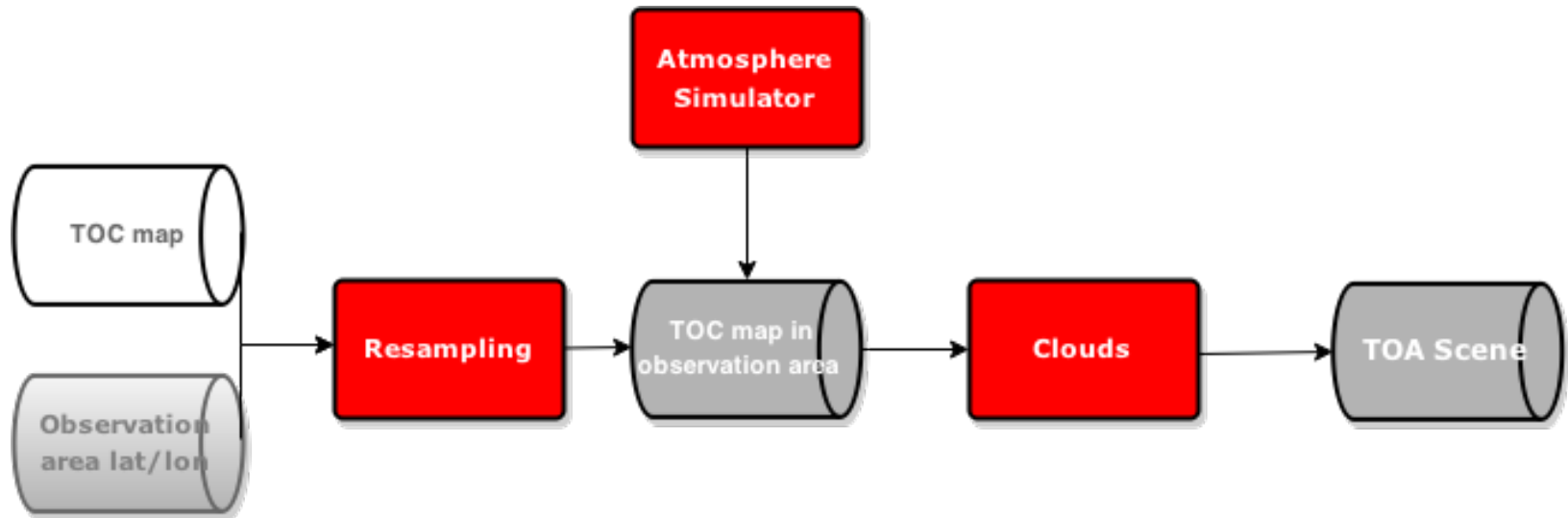
GEOMETRY MODULE

- Blocks to be implemented:
 - Orbit Simulator
 - Attitude Simulator
 - AOCS Simulator
 - Scene Interaction



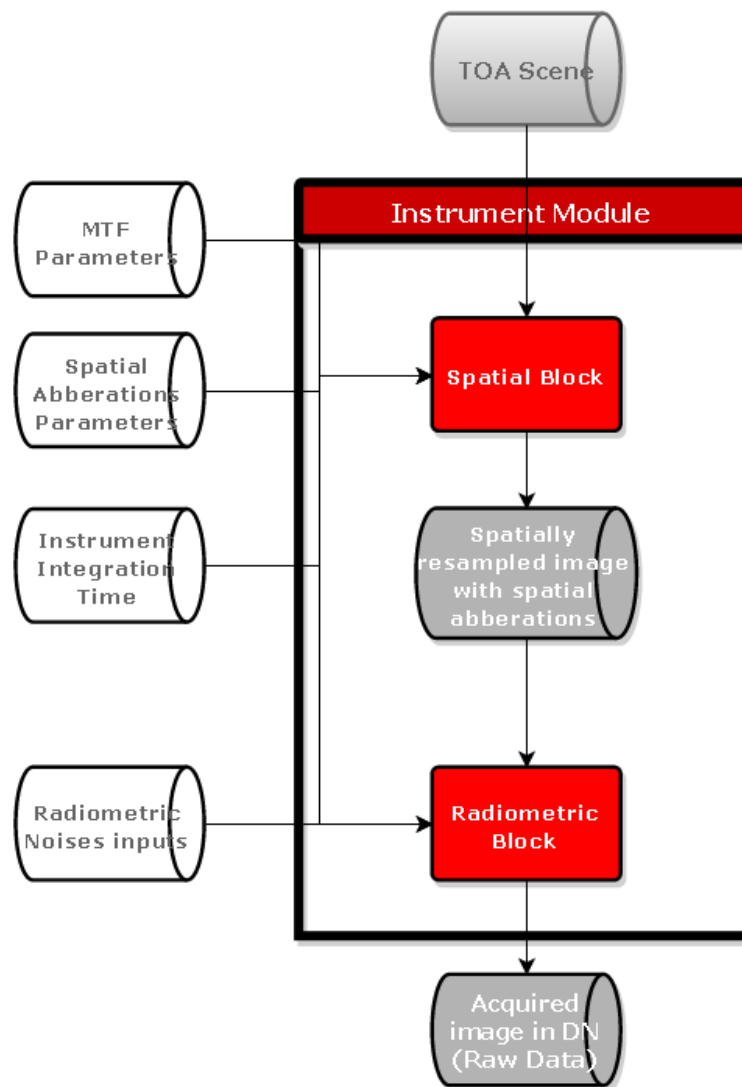
SCENE GENERATION MODULE

- Blocks to be implemented:
 - Resampling Block
 - Atmospheric RTM



INSTRUMENT MODULE

- Blocks to be implemented
 - Spatial Block
 - Radiometric Block



BIBLOS

WEBSITE



INSTRUMENTS

- Active Microwave
- Active Optical
- Passive Microwave
- Passive Optical

BIBLOS: BUILDING BLOCKS FOR SIMULATORS

This is an example page. It's different from a blog post because it will stay in one place and will show up in your site navigation (in most themes). Most people start with an About page that introduces them to potential site visitors.

Login Status

You are not logged in.

Username

Password

[Forgot?](#) [Register](#)

INSTRUMENT > MODULE

The screenshot displays the BIBLOS web application interface. At the top left, there is a 'Management' link with a folder icon. At the top right, there is a 'My profile' link. The main header area features the 'BIBLOS' logo and the tagline 'Building BLOcks for EO mission performance Simulators' on the left, and the 'esa' logo on the right. Below the header is a navigation bar with 'HOME' and 'INSTRUMENTS' (with a dropdown arrow). A search bar is located on the left side of the main content area, containing the text 'To search type and hit enter'. The 'INSTRUMENTS' section on the left lists four categories: 'Active Microwave', 'Active Optical', 'Passive Microwave', and 'Passive Optical'. The main content area is titled 'Active Microwave' and lists several sub-modules: 'Geometry', 'Scene Generator', 'Instrument', 'Level-1 Processing', 'Level-2 Retrieval', and 'Performance Evaluation'. On the right side, there is a 'Login Status' section indicating that the user is logged in as 'administrator' and providing a link to 'click here to log out'. The background of the interface features a satellite view of Earth from space.

INSTRUMENT > MODULE > BLOCK

HOME INSTRUMENTS ▾

Q To search type and hit enter

INSTRUMENTS

- Active Microwave
- Active Optical
- Passive Microwave
- Passive Optical

Active Microwave

Geometry

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[More Info](#)

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[More Info](#)

Login Status
You are logged in as **administrator**
[click here to log out](#)

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INNOVATING SOLUTIONS

NEXT STORY
Block 2 >

INSTRUMENTS

- Active Microwave
- Active Optical
- Passive Microwave
- Passive Optical

Block 1

BY MJRG · FEBRUARY 13, 2015

Lorem ipsum dolor sit amet, consectetur adipisicing elit. Consectetur, culpa itaque odio similique suscipit

Module: Geometry

Instrument: Generic, Passive Optical

Higher-level Building Blocks: Lorem ipsum dolor sit amet, consectetur adipisicing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.

Composing Building Blocks: Lorem ipsum dolor sit amet, consectetur adipisicing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.

Algorithms Description: Lorem ipsum dolor sit amet, consectetur adipisicing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.

Scope of Application and Limitations: Lorem ipsum dolor sit amet, consectetur adipisicing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.

Project Phase: Pre-phase A

Please login to download

Downloads	13
File Size	0.01 KB
Create Date	February 13, 2015

Login Status

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BIBLOS

CONCLUSIONS

BIBLOS' ADDED VALUE

- Easy guide to creating an Earth Observation End-to-End Simulator for all types of EO missions
- Offers the common blocks to avoid re-engineering and lower E2ES cost
- Puts together information now scattered around the web
- Currently aiming at phase A design
- Important for design of the system, definition of requirements
- Important for validation of the processing and calibration
- Important for validation of the retrieval algorithms and science.
- Important for mission selection



Thank you

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