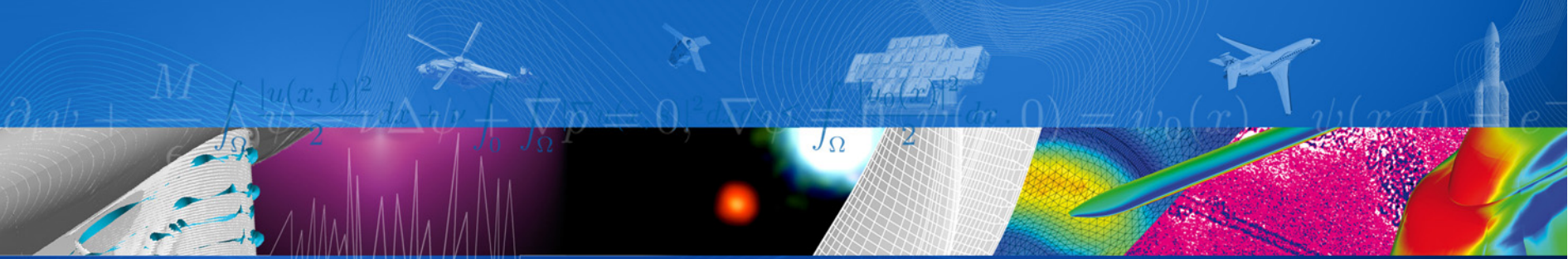


Radiation monitoring hosted payloads: ICARE_NG2

S. Bourdarie, J. Carron, L. N'Guyen, R. Ecoffet, P. Bourdoux,
D. Falguere, M. Ruffenach, P. Caron

EREMS

ONERA
THE FRENCH AEROSPACE LAB

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

retour sur innovation

Introduction

ICARE-NG2 is the present version of the ICARE instrument

Environment measurements (proton and electron fluxes)

Technological board “MEX”, i.e. TID and DDD drifts, SEE records (optional)

Includes connections for an optional external sensor (RS422 serial link, and +5V)

CARMEN is a mission name for space environment hosted payloads

CARMEN-1 : ICARE-NG + 3 micro-debris detectors (SODAD) on SAC-D

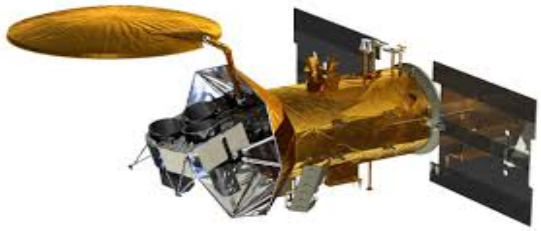
CARMEN-2 : ICARE-NG, associated with LPT from JAXA on JASON-2

CARMEN-3 : ICARE-NG + AMBRE (plasma detector) + LPT, on JASON-3

CARMEN-4 : ICARE-NG on E7C

JASON-2

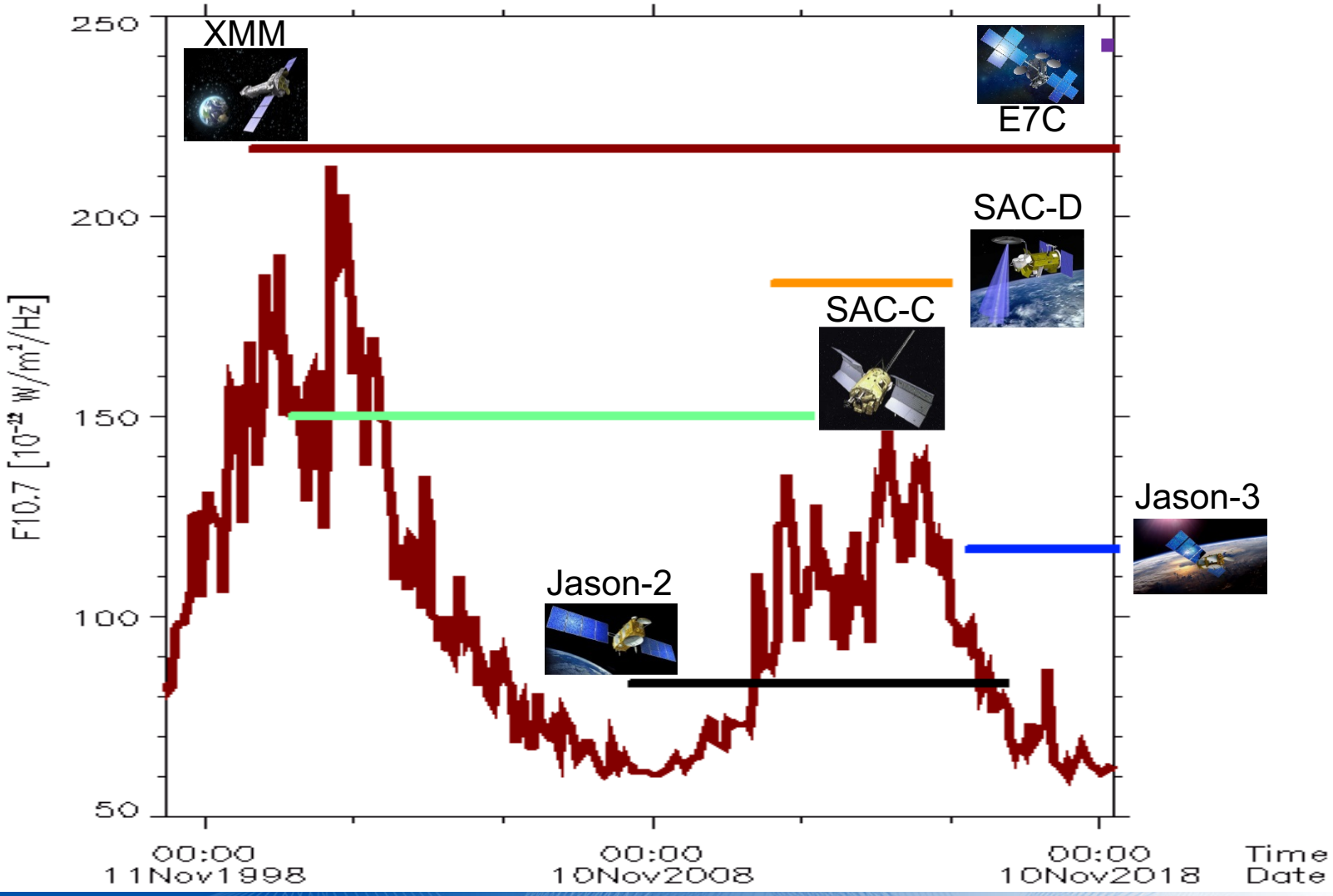
Carmen



SAC-D

Introduction

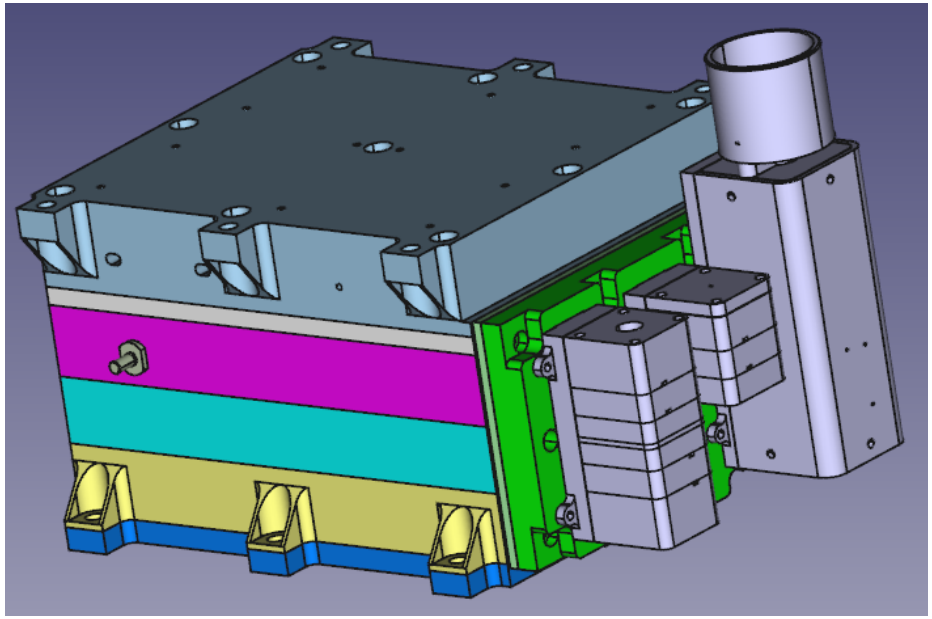
20 years of space environment and effects measurements



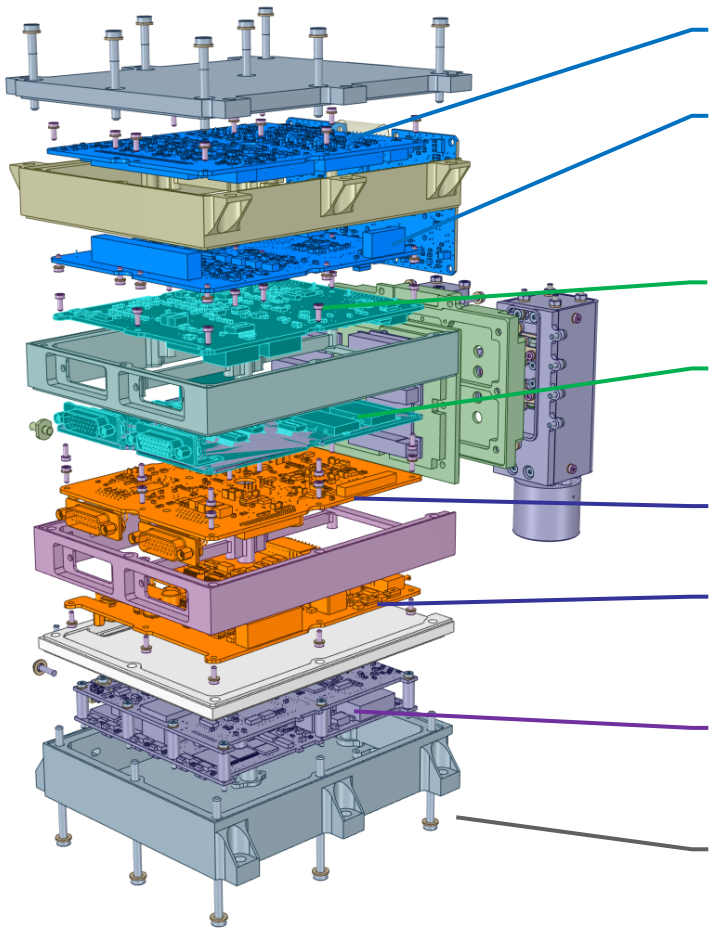
ONERA
THE FRENCH AEROSPACE LAB

ICARE-NG2 : The payload

	CARMEN-5 characteristics
Size (mm)	~218 x 148 x 105
Housing material	Alu 6082 T651
Surface finishing	Surtec 650 and PUK black paint
Sensors	2 × telescopes (stack of 2 diodes) and one single diode
Mass	~ 4,18Kg
Power	6W typ (10W with MEX ON)
Power supply interface	100V regulated power bus
Interface links with spacecraft	CAN bus
Operating temperature range	-35° C to +66° C
Lifetime	8 years



ICARE-NG2 : The payload



Analog spectrum

- (256 or 128) channels ×5
  - 2 coincidences
  - 2 anti-coincidences
  - 1 single

Digital spectrum

Microcontroler

- compatible interface: CAN, MIL-STD-1553, Spacewire, RS-422
- 2Gb of data storage onboard
- TID and TNID sensors onboard

Interface

Power: primary

Primary DC/DC converter

- ➢ Compliant with 100V interface
- ➢ Variant also compliant with 50V and 28V for future missions

Power: secondary

MEX

Optional (TID and DDD drifts, SEU, SEL, SET, SEB)

Mechanical structure

Thickness of periphery wall = 7mm for TID shielding
Foot of the instrument for mounting option in +/-Z
Mechanical assembly optimized for AIT

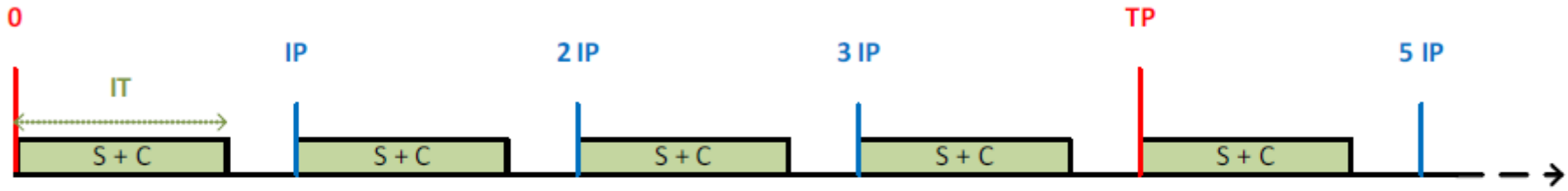
ICARE-NG2 : The payload

ICARE-NG2 can accomodate any TM budget (i.e. strong constraint in EOR phase)

IT = Integration time (250 ms – 62 s < IP-2)
IP = Integration period (8s, 16s, 32s, 64s)
TP = Telemetry period (8s, 16s, 32s, 64s, 128s or 256s)
M = Mode (Full or Light)

} Can be set by TC

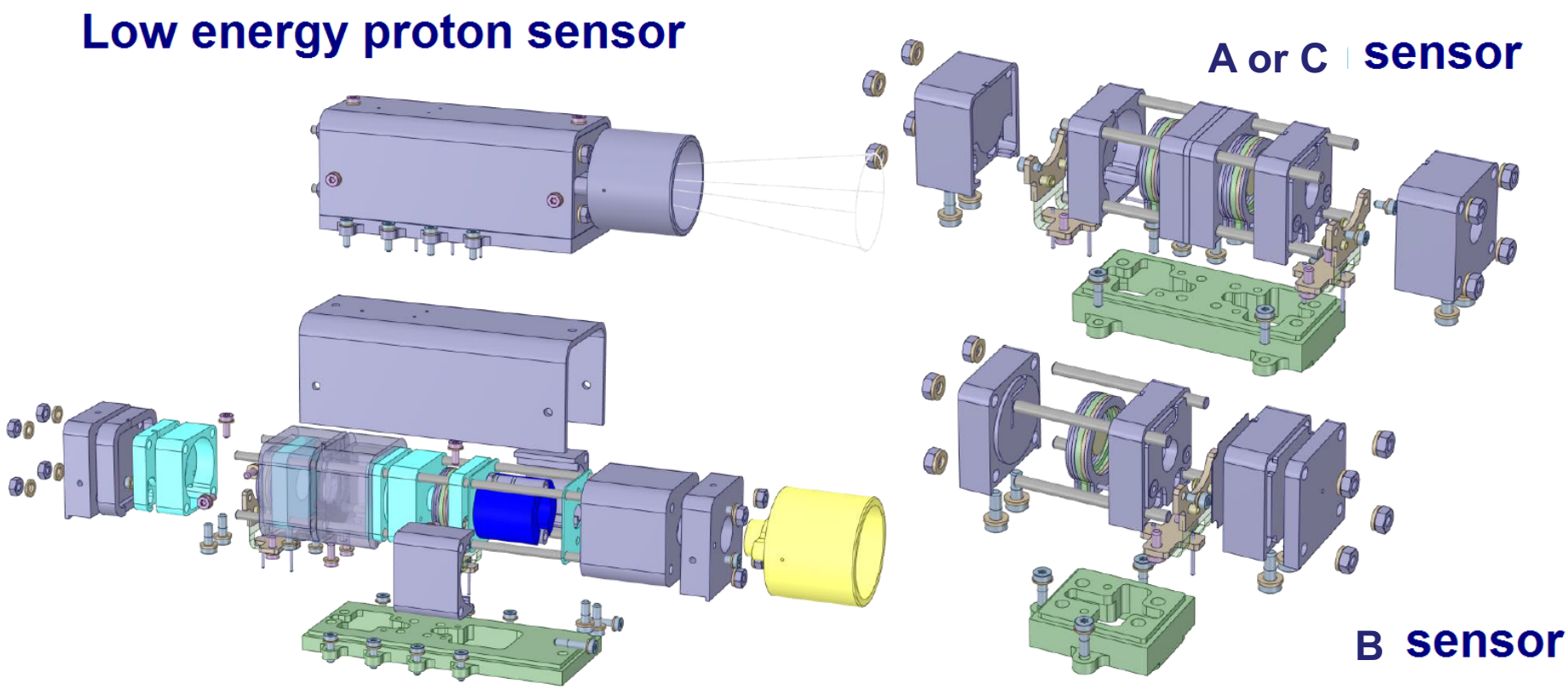
Full Mode:



Light Mode:

S=640 bytes and C=20 bytes

ICARE-NG2: The sensors



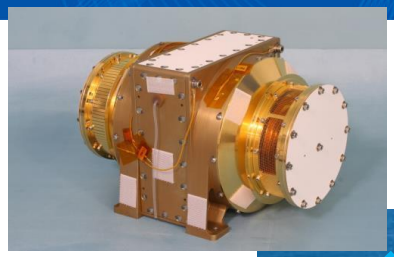
ICARE-NG2: The sensors

SENSOR A (Coincidence – Anti-coincidence)		SENSOR B (Single)		SENSOR C (Coincidence – Anti-coincidence)		PROTON LOW ENERGY (Coincidence – Anti-coincidence)		ION SENSOR (Coincidence – Anti-coincidence)	
Electron (MeV)	Proton (MeV)	Electron (MeV)	Proton (MeV)	Electron (MeV)	Proton (MeV)	Electron (MeV)	Proton (MeV)	Ions (MeV/cm²/mg)	Proton (MeV)
>0,87	12,9	>0,249	>80	>2,68	31		2.5	0.1-0.5	
>0,93	18,6	>0,270	>85	>2,77	47,3		3.	0.5-1.5	
>,0986	63	>0,299	>95	>2,85	61		3.5	1.5-3.	
>1,078	65	>0,320	>105	>2,93	64		4.	3.-5.	
>1,135	69	>0,342	>115	>3,01	67		4.5	5.-7.5	
>1,226	74	>0,363	>130	>3,09	75		5.	7.5-10.	
>1,3	81	>0,384	>160	>3,17	80		5.5		
>1,359	90	>0,413	>190	>3,25	85		6.		
>1,508	100	>0,455			90		7.		
>1,657	115	>0,505			100		8.		
>1,823	>54	>0,505			>56		9.		
>1,974	>60	>0,554			>60		10.		
>2,106	>66	>0,604			>65		12.		
>2,254	>73	>0,653			>70		14.		
>2,404	>81	>0,703			>75		16.		
>2,567	>90	>0,752			>80		18.		
	>100	>0,802			>90		20.		
	>110	>0,895			>100				
		>0,994							
		>1,093							
		>1,192							

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

ONERA THE FRENCH AEROSPACE LAB

ICARE-NG: Examples

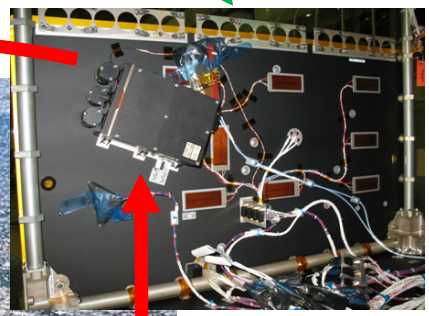


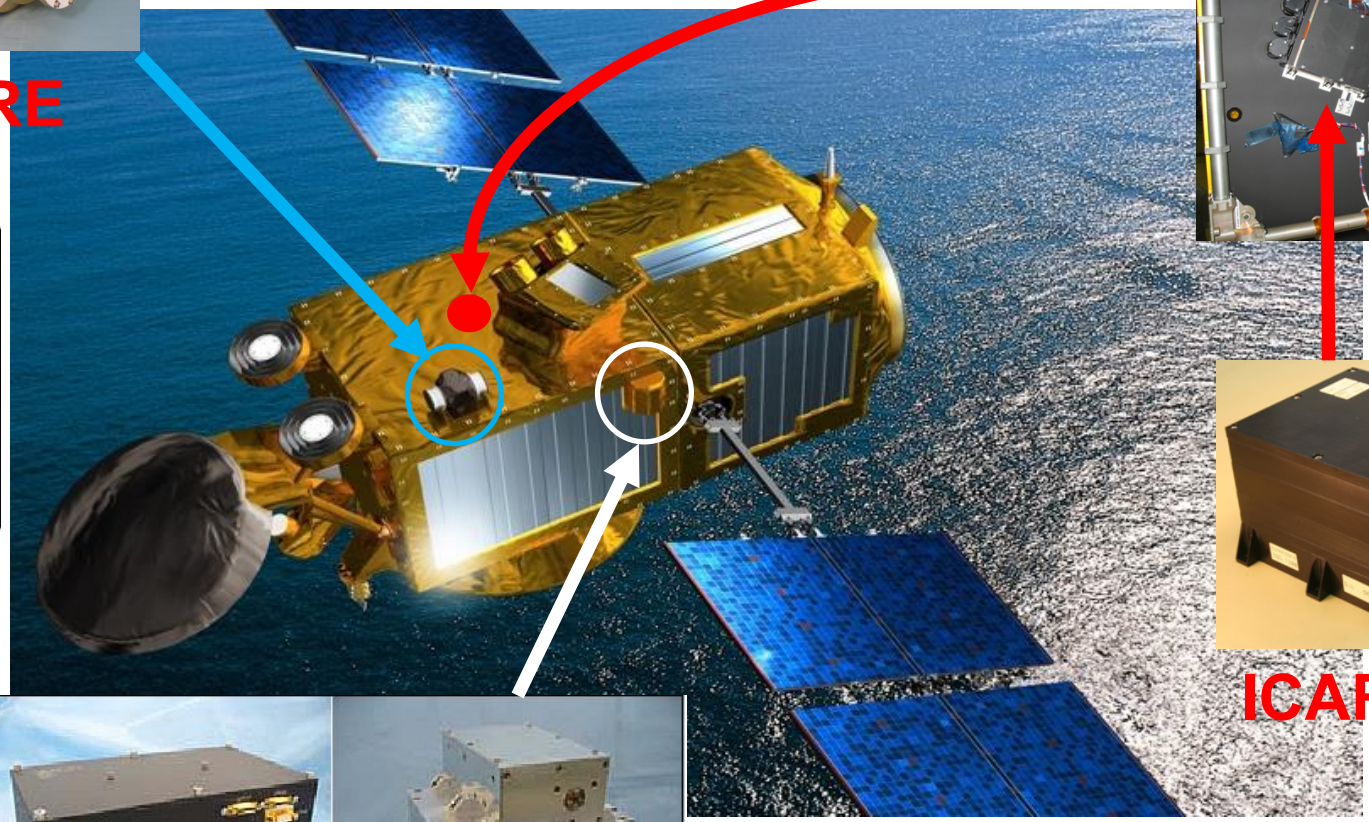
AMBRE

ICARE-NG & LPT "Sky View" -Z

AMBRE –Y/-Z/+Y plane

Orientation of detectors



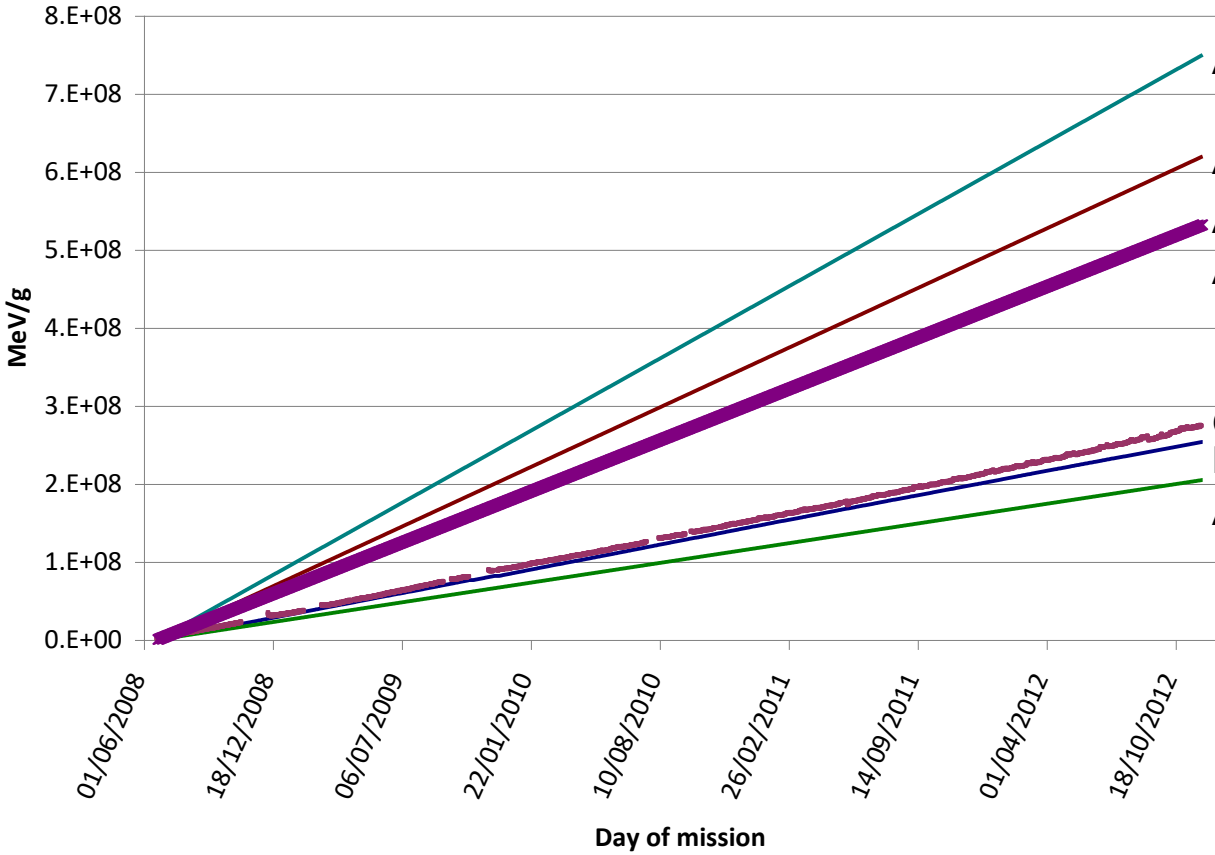


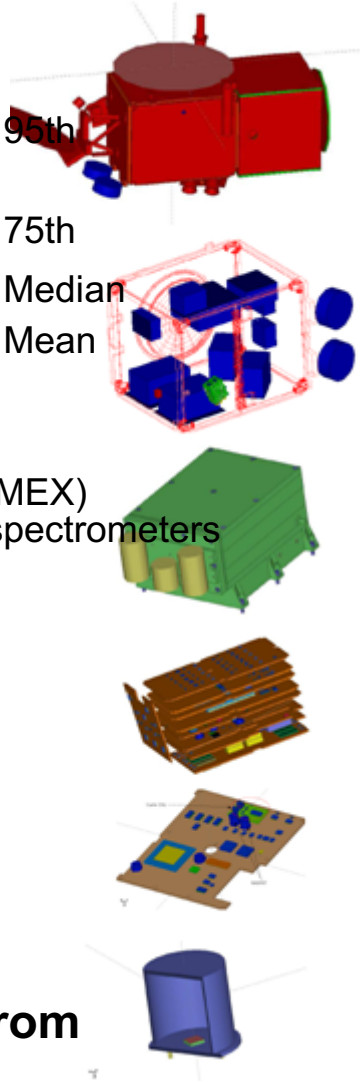
ICARE-NG

LPT-E and -S

ONERA
THE FRENCH AEROSPACE LAB

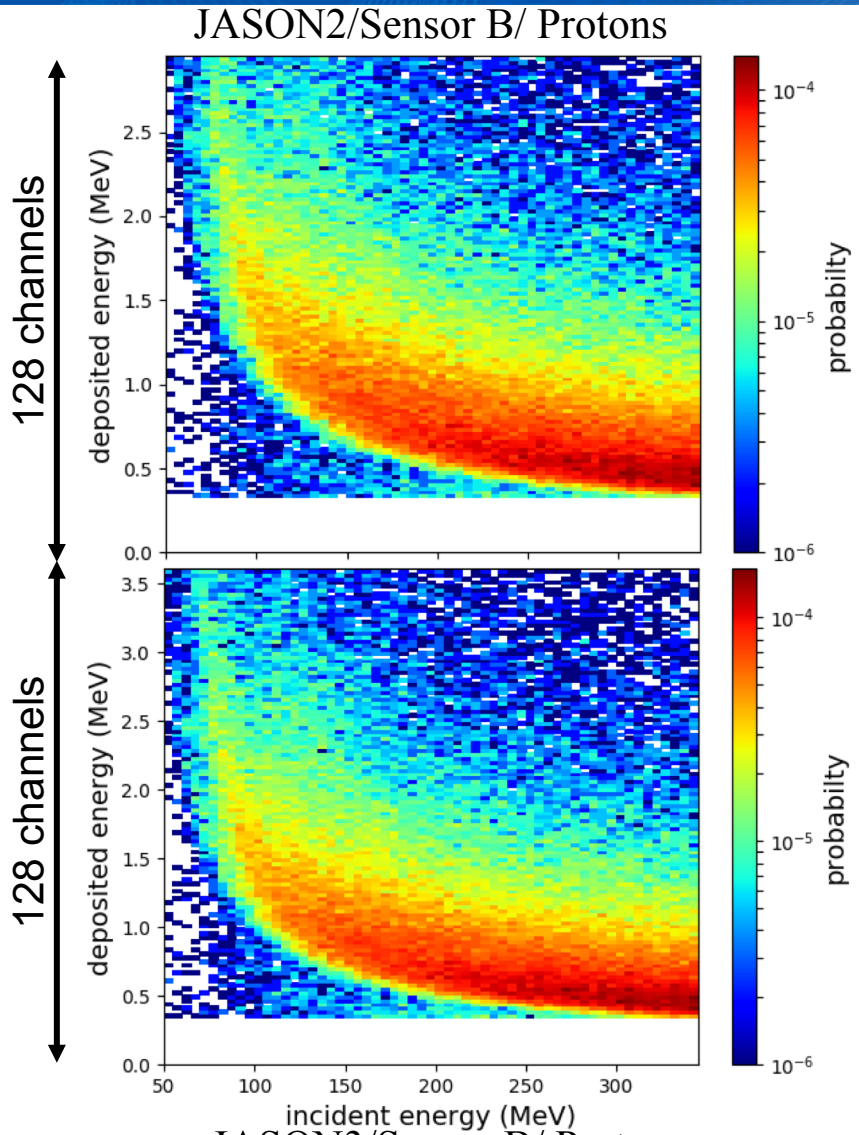
ICARE-NG: Examples

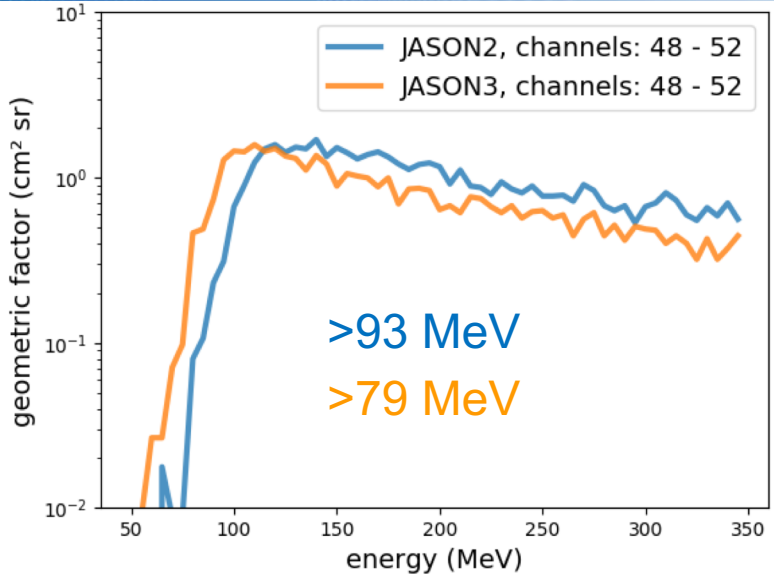


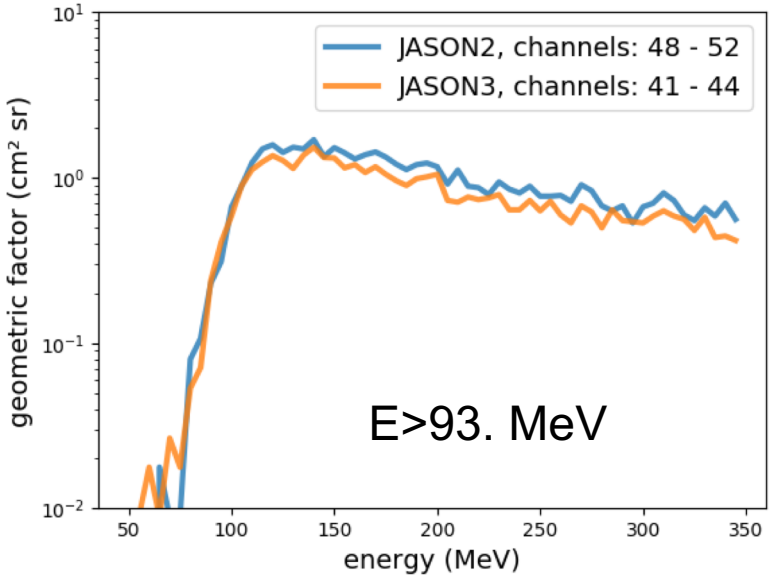


Excellent match between OSL measurements and predictions from spectrometers (within 5%)

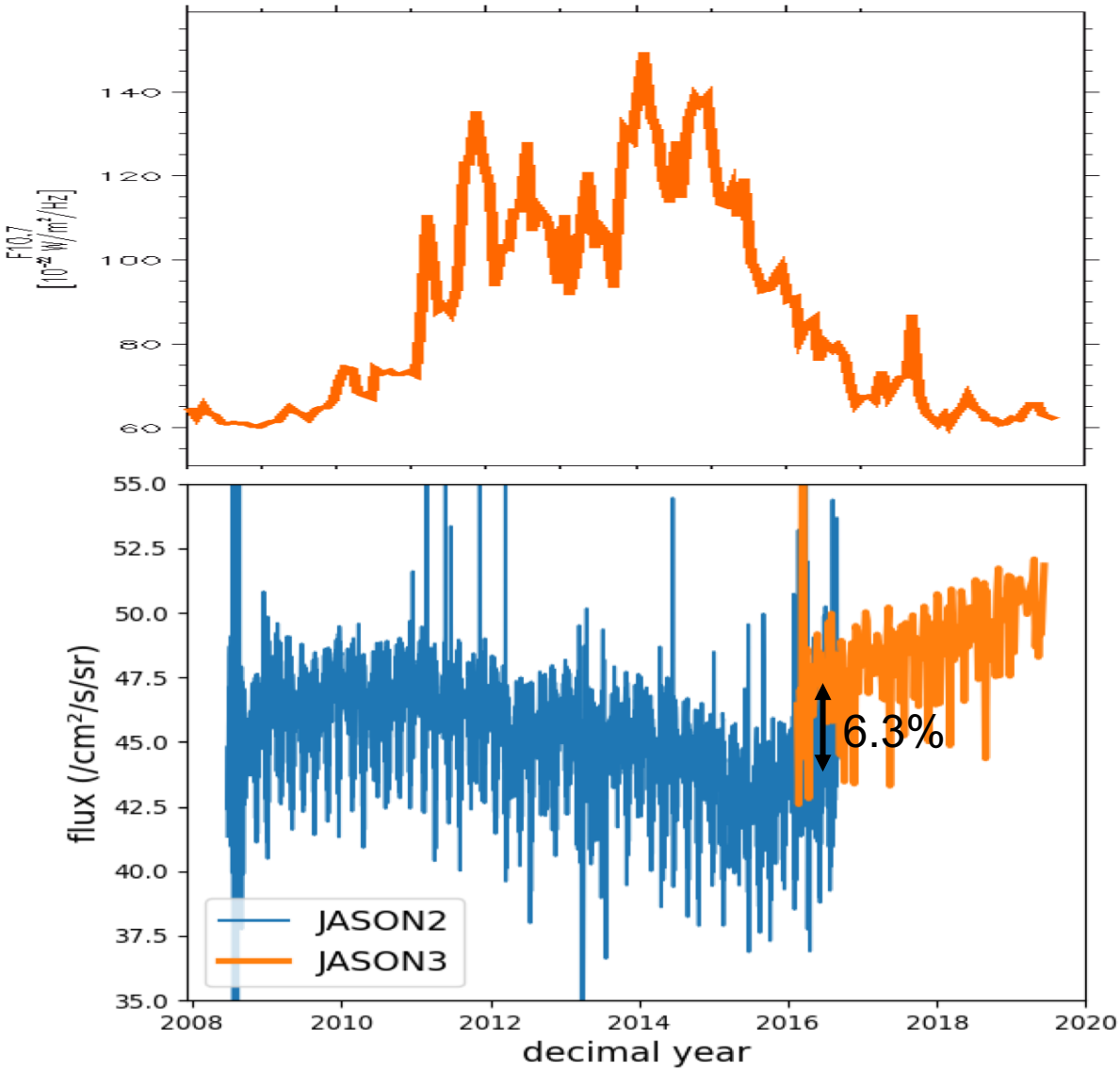
ICARE-NG: Examples







ICARE-NG: Examples



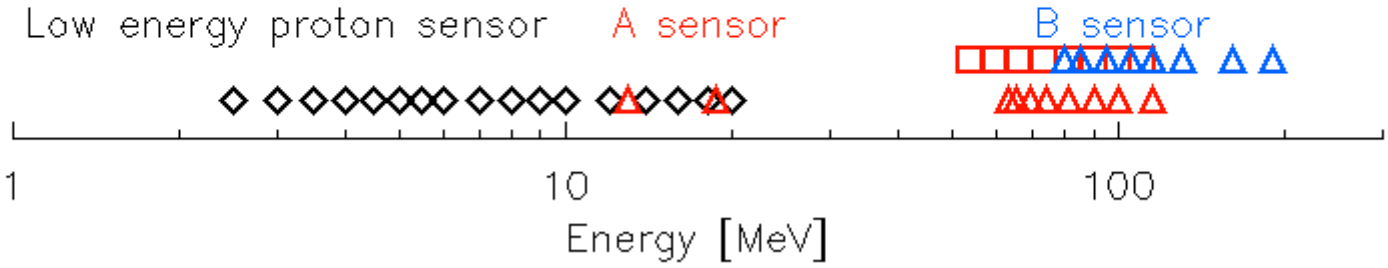
Protons
> 93 MeV

ONERA
THE FRENCH AEROSPACE LAB

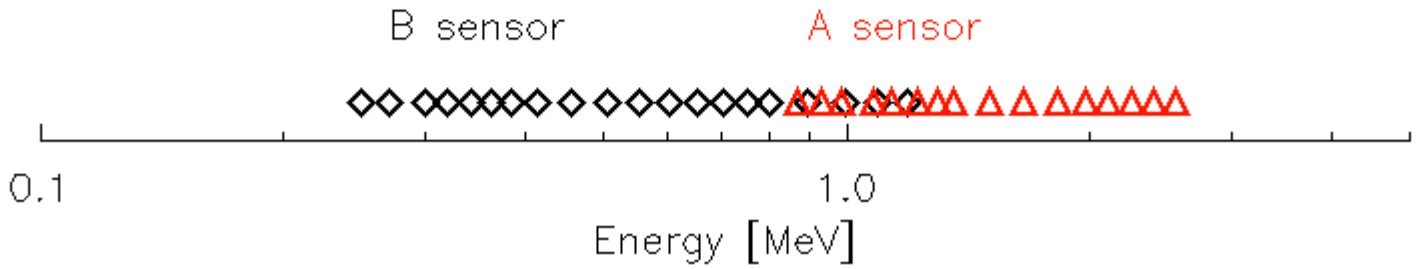
ICARE-NG2: Future missions

- HotBird F2 (Eutelsat)
  - Manufacturer: ADS
  - Ariane launch in 2021
  - EOR + GEO
  - CAN bus + 100V

Proton energy coverage



Electron energy coverage



- 2 ICARE-NG2 will be delivered to ESA part of SSA program
  - Baseline: CAN bus + 100V
  - Flight opportunities TBD