

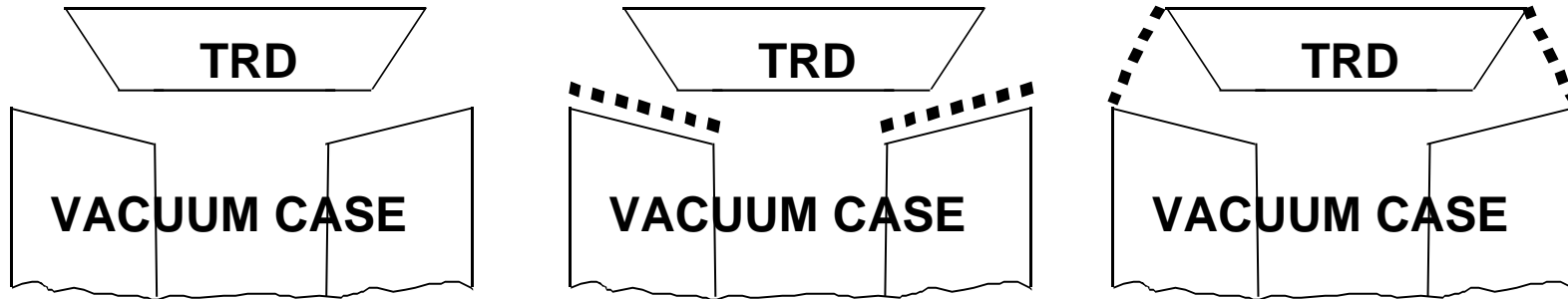


# AMS02 thermal control

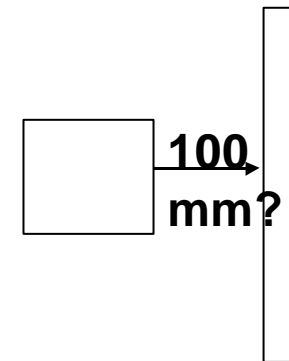
- MLI provision
- CGS-NSPO agreement
- Thermal control ICD in good shape!!
- Thermal Control Mechanical ICD
- Cryocoolers requirements
  
- Mass budget

# Thermal control ICD

- Relevant updates
  - MLI on the vacuum case flange



- ACC new layout
- CRATES thermal interface to radiators



# Mechanical ICD

- Radiators are fixed to the USS-02
- Radiators *may* have boxes attached to them
- Structural assessment (Frequency, Margins of safety)
  - ↳ – Thermal assessment (number of heat pipes, section)
    - ↳ • Debris analysis → probability of puncture
      - ↳ – DEBRIS SHIELDS NEEDED??



---

---

# Cryocoolers

- 0 ° C is the TARGET temperature for the cryocoolers heat rejection collar
- A combined evaluation of:
  - Vacuum case temperature
  - Cryocooler temperaturewill provide a Helium endurance > 3 years
- Cryocoolers experimental dissipation at 0°C will be provided by the end of summer

# AMS 02 –Thermal Control System Design



		MASS, Kg	Allocation
TRD			
	MLI external radiator	7	LM
	MLI btw TOF/Tracker radiators	4	TRD
UP-TOF	Tracker cooling loop radiators	0.9	TRD
TRACKER	Tracker cooling loop radiators	4	TOF
	radiators MLI	80	Tracker system
CRATES	radiators	29	system
	radiators MLI	1	system
	radiators	58	system
	radiators MLI	3.2	system
	crates MLI (hor.surf.)	3.7	system
CRYOS	radiators	31.2	system
	radiators MLI	1.5	system
	heat pipes	1.8	system
VACUUM CASE	vacuum case MLI	10	LM
	vacuum case tape	0	LM
LOW-TOF	radiators	4	TOF
RICH	extended ribs (radiators)	9.5	RICH
	MLI around mirror	2	LM
	MLI (back of ribs)	0.3	RICH
	MLI RICH/ECAL	0.7	RICH
ECAL	winglets / panels	27	ECAL
	Lower MLI	1	LM

Thermal Mass  
Budget  
259.8Kg

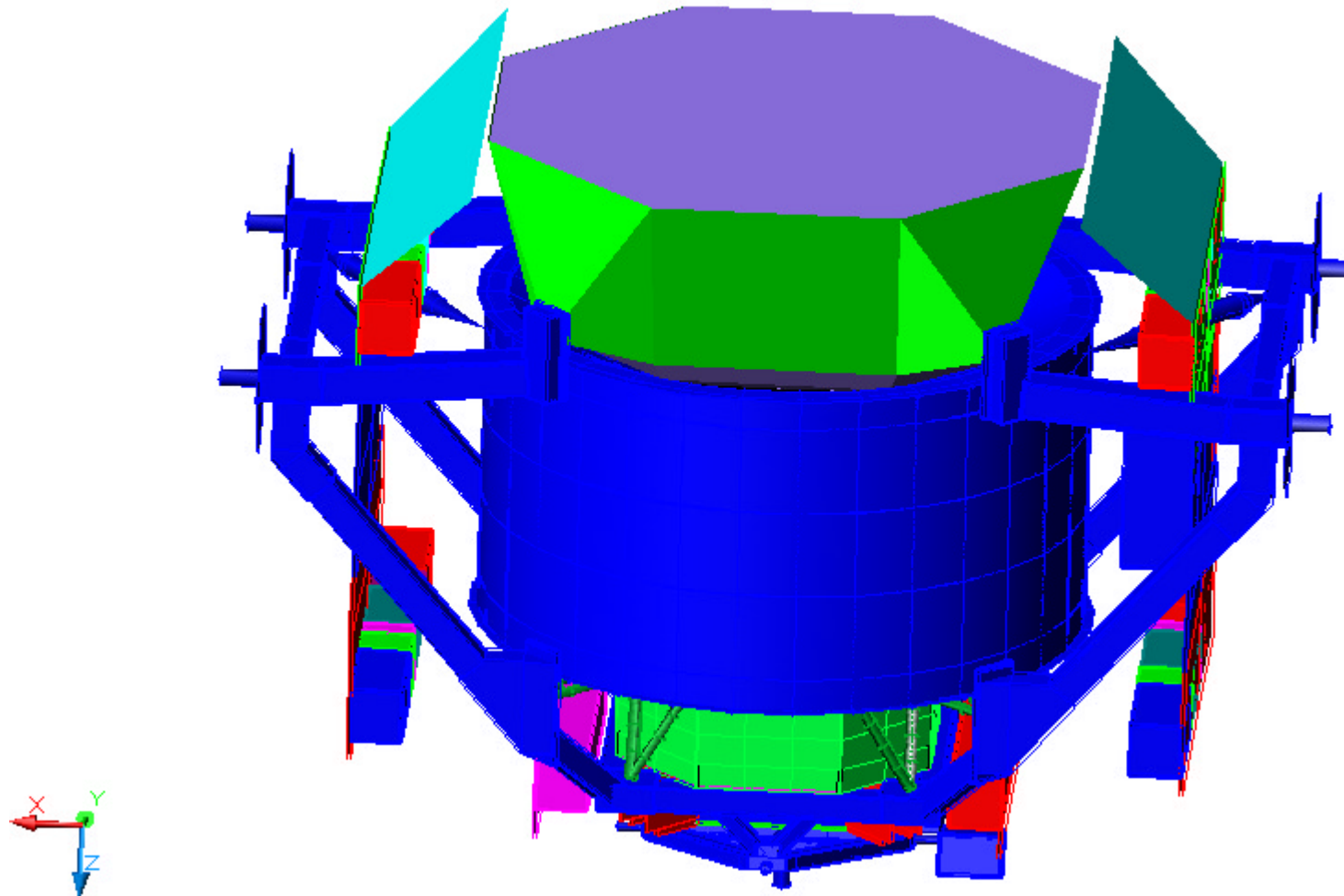
TRD	4.9
TOF	8.0
TRACKER	80.0
RICH	10.5
ECAL	27.0
System	129.4
<b>TOTAL</b>	<b>259.8</b>
LM	20.0



# ICD review - HW Provision

TRD	ITEM	PAID BY ...
	MLI external	LM
	Radiator	Aachen
	MLI between TOF and Tracker	Aachen
<b>UP- TOF</b>	Radiators	INFN Bo
<b>TRACKER</b>	Tracker cooling loop	NLR
	Radiators	System thermal team
	Radiators MLI	System thermal team
<b>CRATES</b>	Radiators	system thermal team
	Radiators MLI	system thermal team
<b>CRYOS</b>	Radiators	system thermal team
	Radiators MLI	system thermal team
	Heat pipes	system thermal team
<b>VACUUM CASE</b>	Vacuum case MLI	LM
	Vacuum case tape	LM
<b>LOW- TOF</b>	Radiators	INFN BO
<b>RICH</b>	extended ribs (radiators)	INFN BO
	MLI around mirror	LM
	MLI (back of ribs)	INFN BO
	MLI between RICH and ECAL	INFN BO
<b>ECAL</b>	winglets / panels	INFN PISA
	Lower MLI	LM

# AMS 02 –Thermal Control System Design





# CONTACTS for phase 2

	Thermal Control Responsibility	Technical Contact	Collaboration Contact	Other contacts
SYSTEM thermal control	CGS	M. Molina	H. Hofer – J. Burger	C. Vettore
TRD	OHB system	R. Schlitt	S. Schael	K. Luebelsmeyer
Tracker	NLR	A. Woering	E: Perrin	R. Battiston M. Pohl, NLR
ECAL	CGS	C. Pini	F. Cervelli	F. Cadoux
RICH	CGS	G. Sardo	G. Laurenti	
TOF	CGS	C. Vettore	G. Laurenti	
MAGNET	ETH/Space Cryomagnetics, Ltd.	S. Harrison C. Clark	H. Hofer – J. Burger	K. Bollweg
USS-02	NASA/LMSO	C. Clark	J. Bates	K. Bollweg
Vacuum Case	NASA/LMSO	C. Clark	J. Bates	K. Bollweg
Exterior Thermal Blanket(s)	NASA/LMSO	C. Clark	J. Bates	K. Bollweg
Cryocoolers	Goddard / MIT	C. Clark M. Molina	R. Foster, S. Breon	K. Bollweg
Electronic Crates	CGS	M. Molina	M. Capell	
Interfaces with ISS	NASA/LMSO	C. Clark	J. Bates	K. Bollweg
ACC	Aachen	Siedling	Schael	K. Luebelsmeyer