A ‘personal history’ of Italian-Russian collaboration

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INFN and University, Firenze

Efforts in Fundamental Research and Perspectives
for Applied S&T and Business Development

Dubna, 17-18 December 2009

Chronology:

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Computer code for 4 particles creation in e+ + e-

C E T I R I

Used in VEPP2 in 1970

Used in ADONE experiments in 1971→

In L3 experiment at LEP:

Uranium-MPC calorimeter
(ITEF+Florence+ETC)

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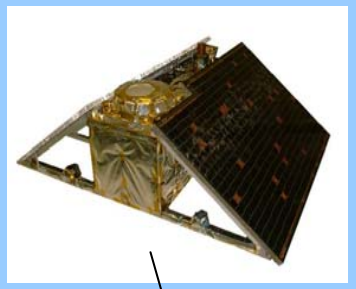
WiZard: → Russian Italian Missions (RIM)

MASS-89, 91, TS-93, CAPRICE 94-97-98

NINA-1

NINA-2



PAMELA

M 89 · M 91 · TS 93 · C 94 · C 97 · C 98 ←*Antimatter search* → PAMELA

…1989 · 1990 · 1991 · 1992 · 1993 · 1994 · 1995 · 1996 · 1997 · 1998 · 1999 · 2000 · 2001 · 2002 · 2003 · 2004 · 2005 · 2006 · 2007..

Solar Physics
Life Science

SILEYE-1

NINA-1

NINA-2

SILEYE-2

Alteino-SILEYE-3

LAZIO-SIRAD

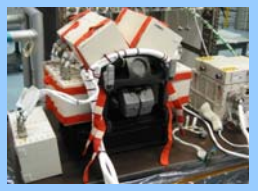
ALTEA-SILEYE-4

SILEYE-1

SILEYE-2

ALTEINO: SILEYE-3

LAZIO SIRAD



ALTEA: SILEYE-4

PAMELA milestones

- **Launch from Baikonur: June 15th 2006, 0800 UTC.**
- **Power On: June 21st 2006, 0300 UTC.**
- **Detectors operated as expected after launch**

- **PAMELA in continuous data-taking mode since commissioning phase ended on July 11th 2006**

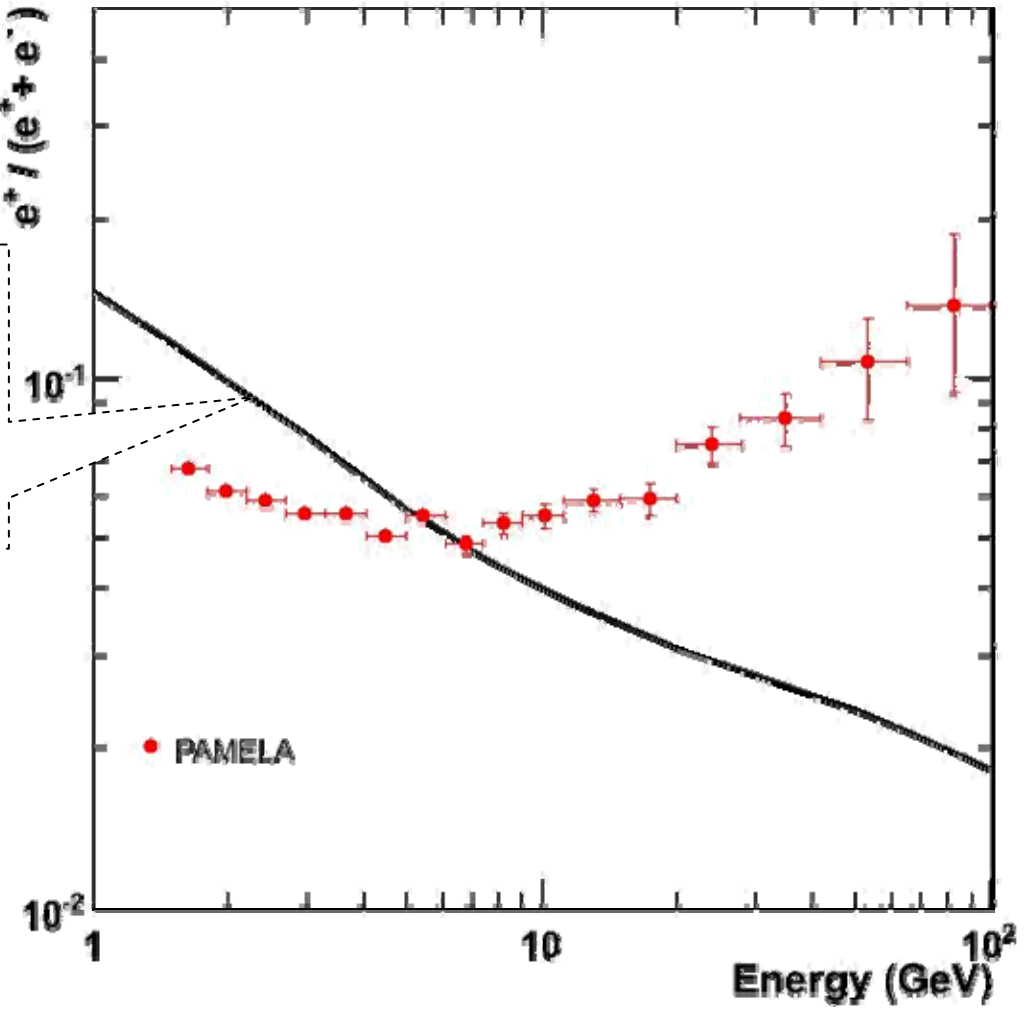
- **As of ~ now:**
  - **~1263 days of data taking (~73% live-time)**
  - **~15 TByte of raw data downlinked**
  - **>10^9 triggers recorded and under analysis**

Positron fraction

Secondary Production Models

$$\mathrm{CR + ISM} \rightarrow \pi^{\pm} + \ldots \rightarrow \mu^{\pm} + \ldots \rightarrow \mathbf{e^{\pm}} + \ldots$$
$$\mathrm{CR + ISM} \rightarrow \pi^{0} + \ldots \rightarrow \gamma\gamma \rightarrow \mathbf{e^{\pm}}$$

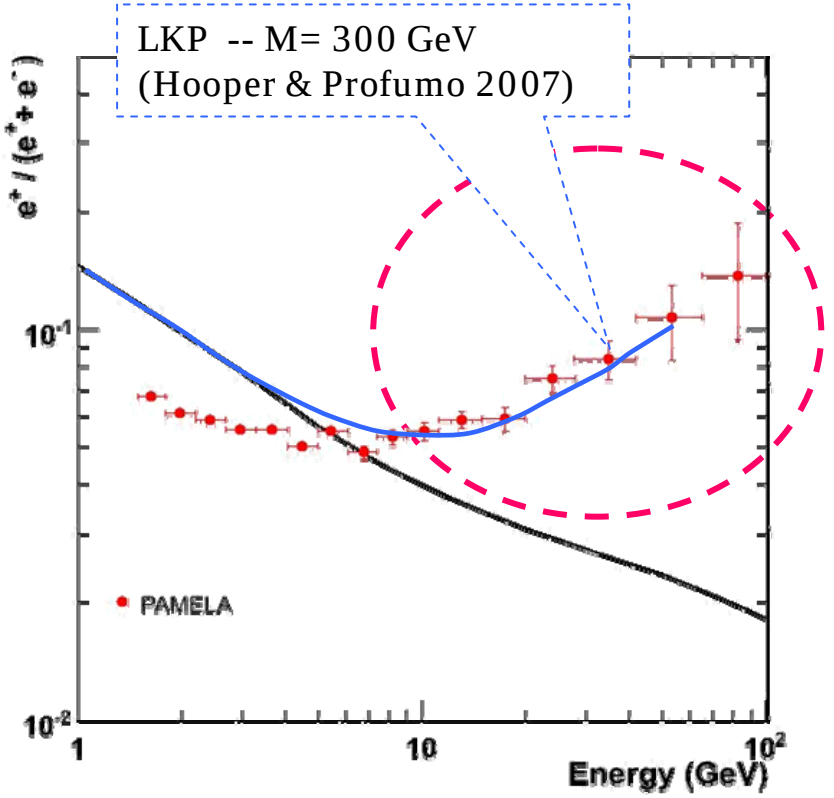
(Moskalenko & Strong 1998)
GALPROP code
• **Plain diffusion model**
• Interstellar spectra



Primary positron sources

Dark Matter

- e^+ yield depend on the dominant decay channel
  - → **LSPs** seem <u>disfavored</u> due to suppression of e^+e^- final states
    - → low yield (relative to p-bar)
    - → soft spectrum from cascade decays
  - →**LKPs** seem <u>favored</u> because can annihilate directly in e^+e^-
    - → high yield (relative to p-bar)
    - → hard spectrum with pronounced cutoff @ M_{LKP} (>300 GeV)



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ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

11-6060

Материалы
1-й сесии
Программно-консультативного комитета
по физике частиц

12—13 апреля 1994 года

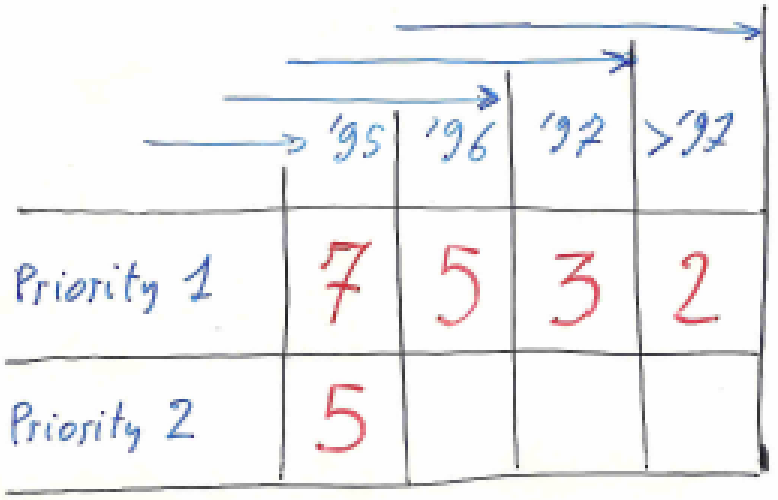
Documents
of the Programme Advisory Committee
for Particle Physics

1st meeting, 12—13 April 1994

Дубна 1994

INTERNATIONAL COLLABORATIONS

(from the 1995 topical plan)



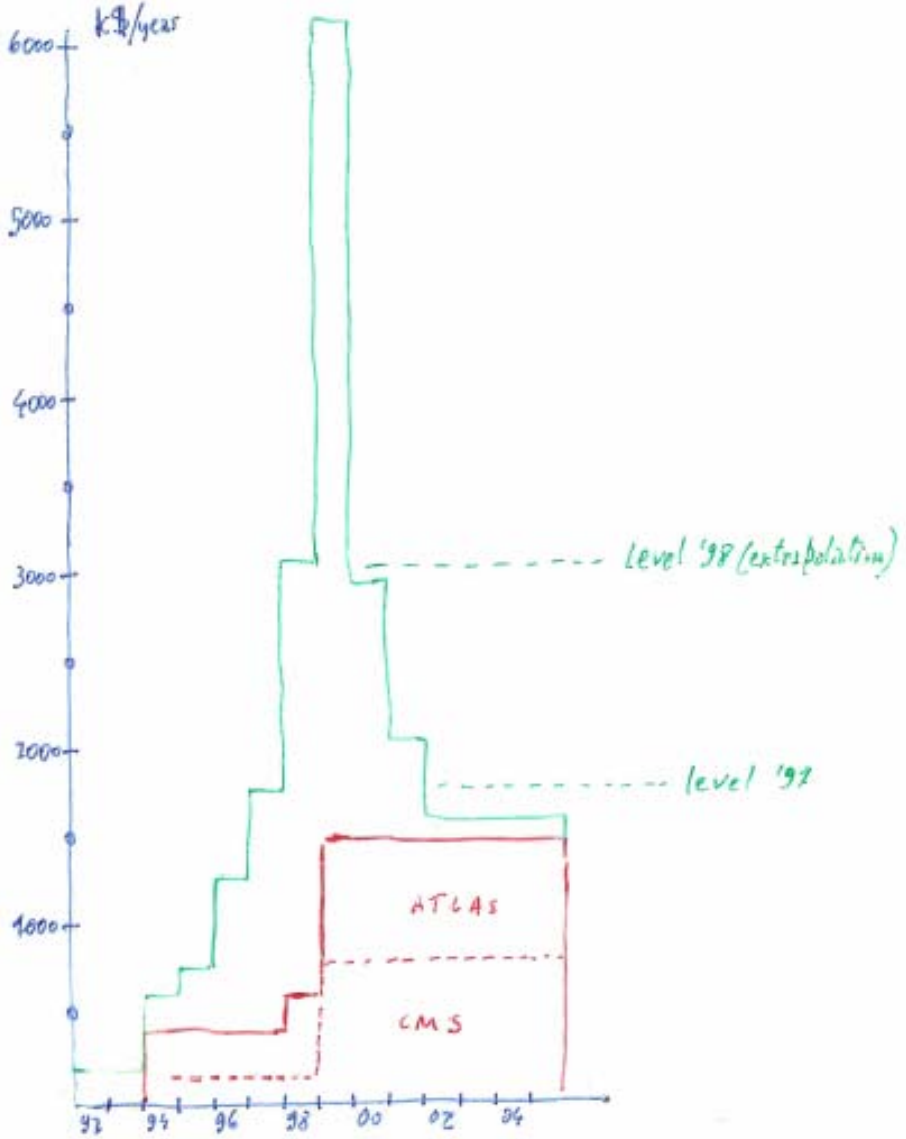
PROJECTS RECOMMENDED BY THE JINR INTERNAL BOARD FOR REVIEW OF RESEARCH ACTIVITIES AND PROJECTS TO BE INCLUDED IN THE JINR SCIENTIFIC PROGRAMME FOR THE YEARS 1999-2001

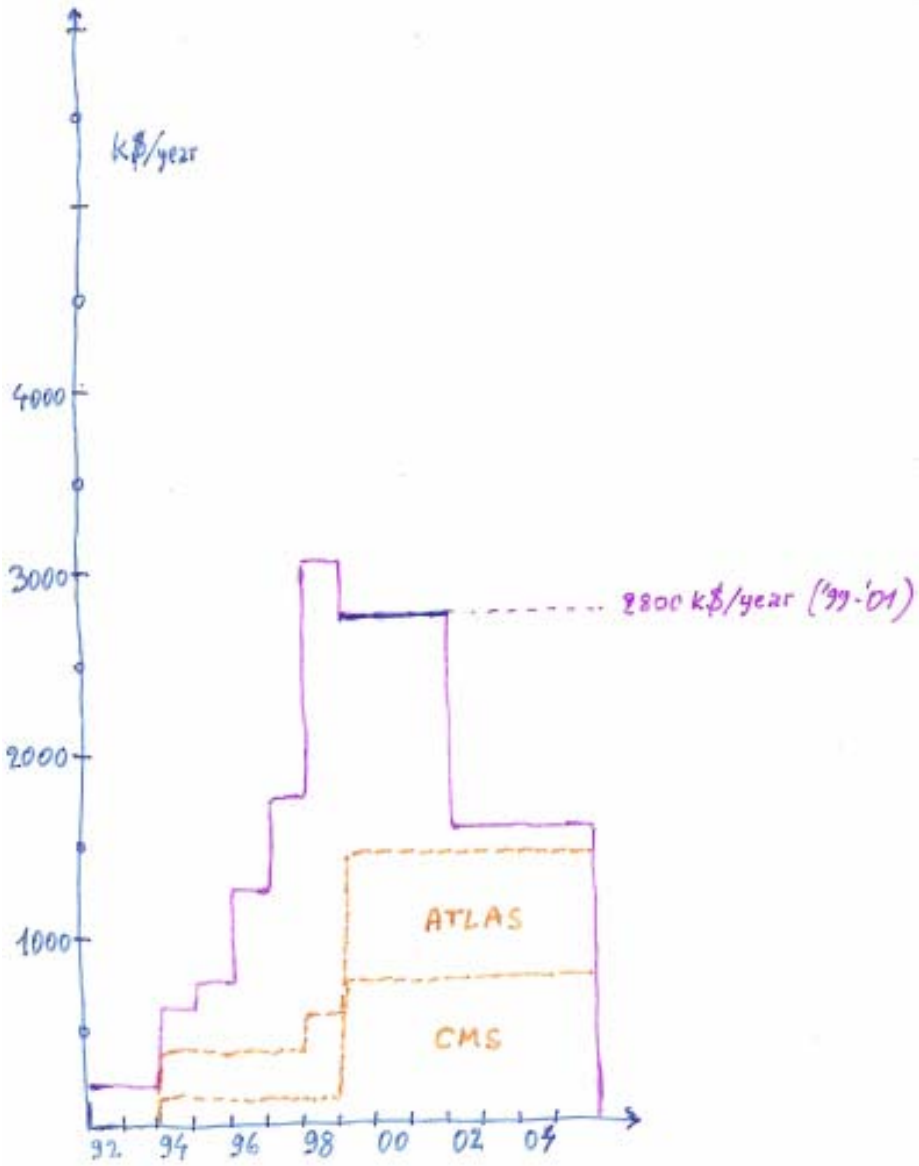
Project	Prio-rity	Period of realization approved by PAC	Project cost on the date of approval (JINR's contribution) k$	Actual Expenditure Till 1998 k$	Proposed time of continuation	Request from JINR budget for 1999-2001 k$	
1	2	3	4	5	6	7	
			Particle Physics				
DELPHI	1	1991-1999	1,648.0	1,400.0	2001	350	
DIRAC	1	1996-2001	947	136	2001	290	X
NOMAD	1	1997-2000	207	15	2000	45	
ATLAS	1	1994-2005	6210	960	2005	1871	X
NA-48	1	1996-2000	380	150	2005	260	
CMS (LPP,LHE)	1	1994-2005	7,220.0	583.3	2005	910	X
COMPASS (NA-58)	1	1998-2000					
LPP		1998-2000	524.5	77.8	2005	585	X
LNP			323		2005	241	
DØ	1	1997-1999	1,285.0	185	2002	150	X
CDF	1	1996-1998	276	162	2002	150	X
STAR	1	1996-2000	2,620.0	105	2001	245	X
HERA-B	1	1996-2002	530	100	2002	43	
HERMES	*	1995-2000	615	167	2000	70	
H1	1	1996-2000	292	15	2005	130	
BOREXINO	2	1997-2005			2005	0	
NN-scattering	2	1992-2001	180	155	2001	15	
ν-Detector	2	1997-2000	20.7	0.7	2001	33	
HYPERON	2	1998-2000	74	5.0	2001	27	
EXCHARM II	1	1996-2000	134	74	2000	23	
Service of JINR at IHEP	2	1993-1999		0		0	
LHC							
LNP	1	1996-2000	285	15	2002	103	X
LPP	1	1996-1999	2,600.0	72.1	2005	325	
TESLA	1	1996-1999	400	308.8	2005	58	
CLIC	1	1996-1999	300		2000	10	
Software for HEP experim	2	1997-1999		0		0	
					TOTAL	**5,934.0**	

*) The priority for the HERMES experiment is to be reviewed at this meeting of the PAC.

x Σ 4870 (81%)

The column "Project cost on the date of approval" indicates the direct expenditures excluding salaries and the Labs' infrastructure costs. As seen from the Table, the budget distribution over the fields of research (Particle Physics-17%, Relativistic Nuclear Physics- 16,5%) corresponds to the Lab's direct expenditures requested for the years 1999-2001, provided 100% budget is available.
The same correspondence for Relativistic Nuclear Physics is to be achieved by the intention of the LHE Directorate to redistribute, beginning 1999, the funds allocated for this field of research.


k$/year
6000
5000
4000
3000
2000
1000
level '98 (extrapolation)
level '97
ATLAS
CMS
92
94
96
98
00
02
04


k$/year
4000
3000
2000
1000
2800 k$/year ('99-'01)
ATLAS
CMS
92
94
96
98
00
02
04

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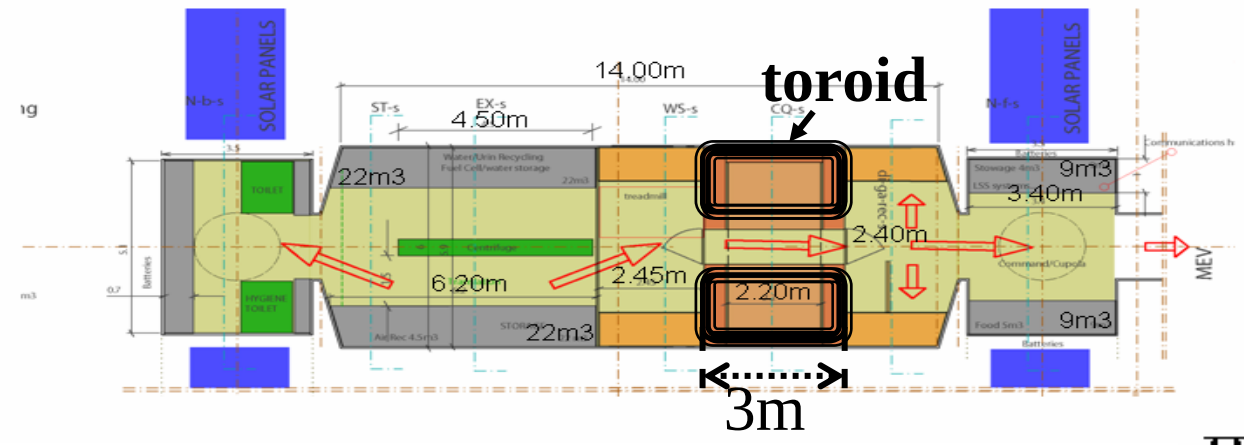
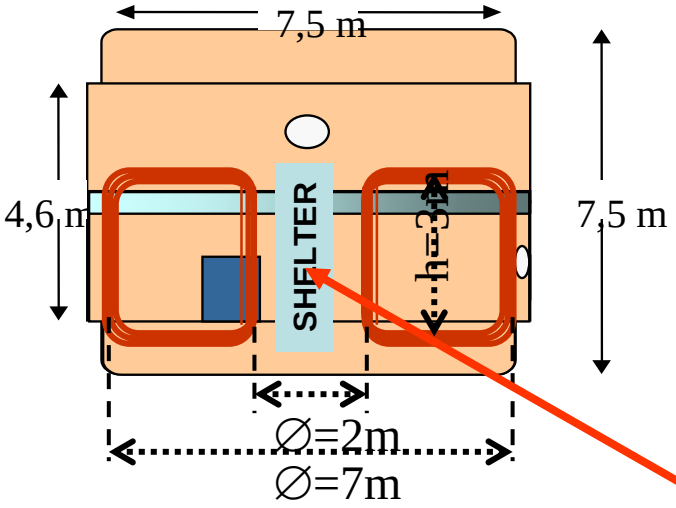
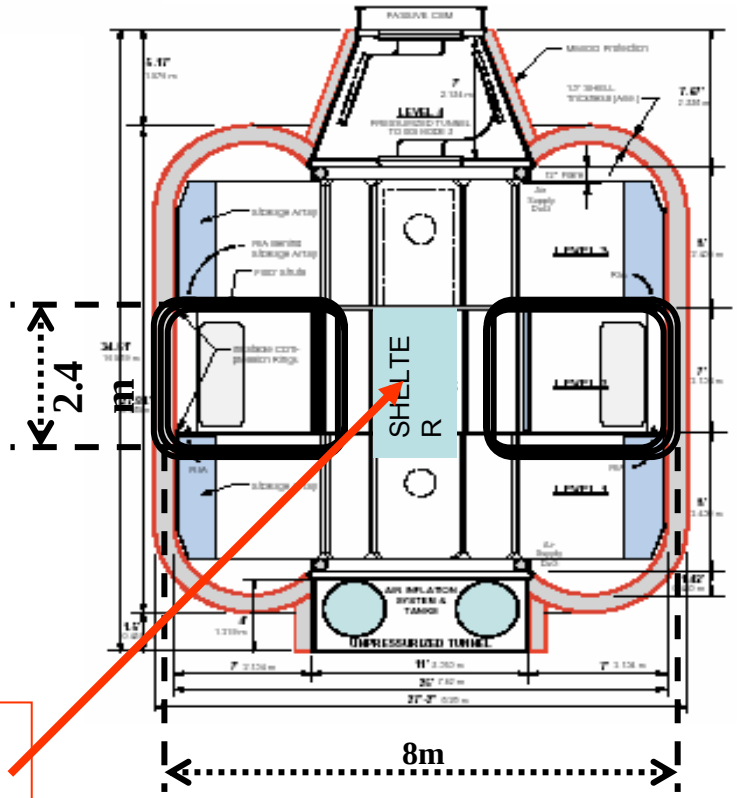


AURORA CDF concept

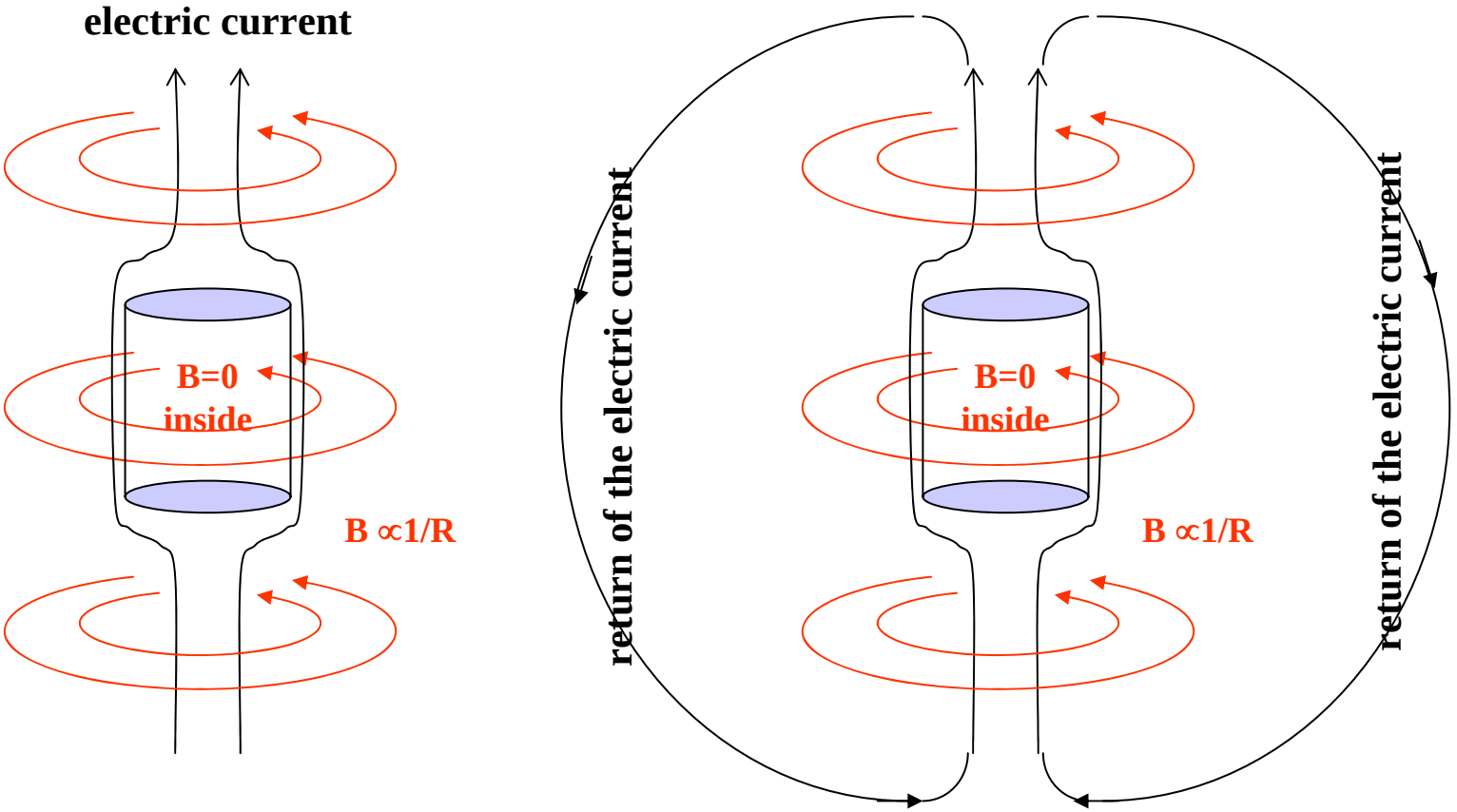


NASA 'Habitat'

H_2O shelter included in the project



TransHab



- the solenoidal configuration is not adequate and must be adopted a **toroidal configuration** where the field diminishes at the increasing of the radius;
- the outer part of the system must be **deployed or assembled** in space.

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Technological criteria

- **C**ryogen **F**ree **S**uperconducting **M**agnet -→ ***cryocoolers***

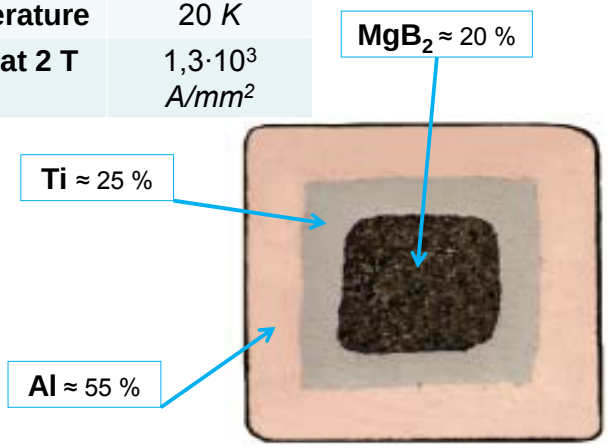
-'ideal cable' for space applications (Turin university + Alenia)

thin MgB2 cable produced by the in-situ method in a titanium sheath stabilized outside in aluminum:

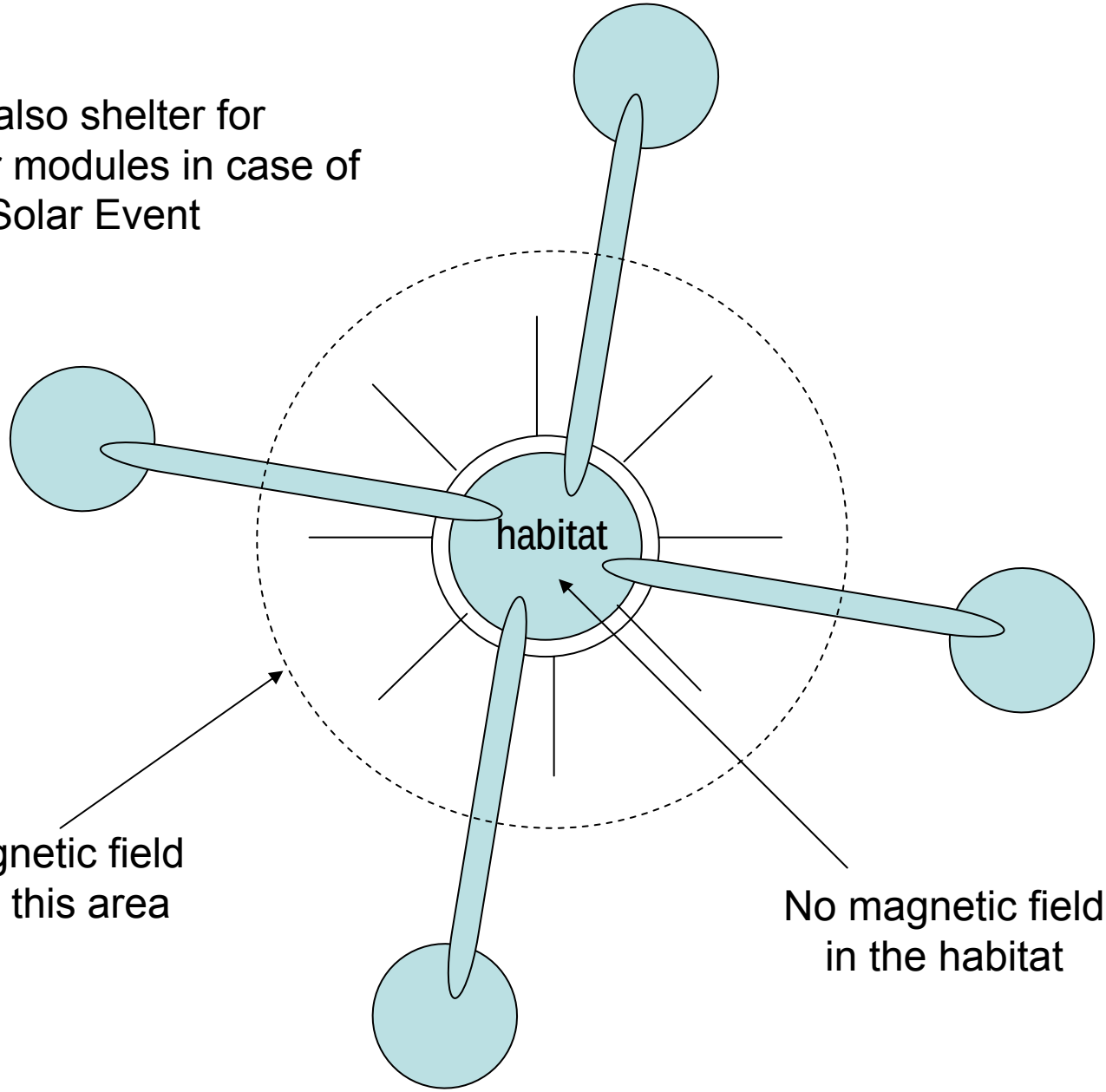
- Medium operating temperature (20k)
- Low density (3 g/cm3)
- Small section: cables less suffering current and temperature instability, and distributing current in the surrounding cables in case of bad functioning.

Characteristic	Value
Averaged density	2,96 g/cm^3
Diameter of the cable	200 μm
Section of MgB2	$6{,}28 \cdot 10^{-3}$ mm^2
Operation temperature	20 K
Critical current at 2 T	$1{,}3 \cdot 10^3$ A/mm^2

Ideal cable

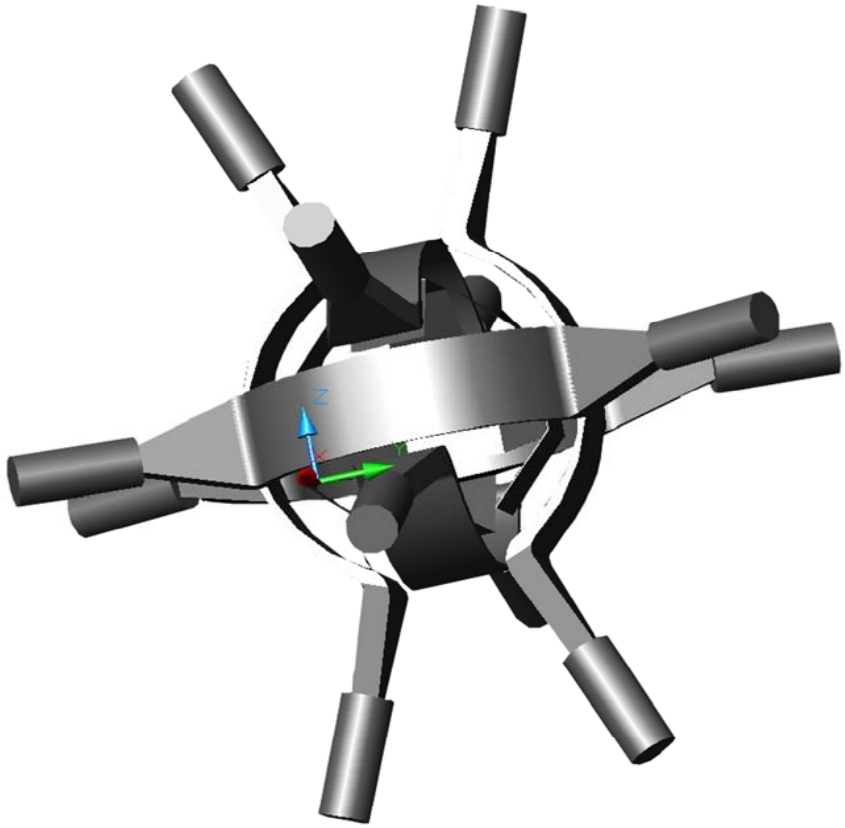


Habitat, also shelter for
the other modules in case of
Intense Solar Event



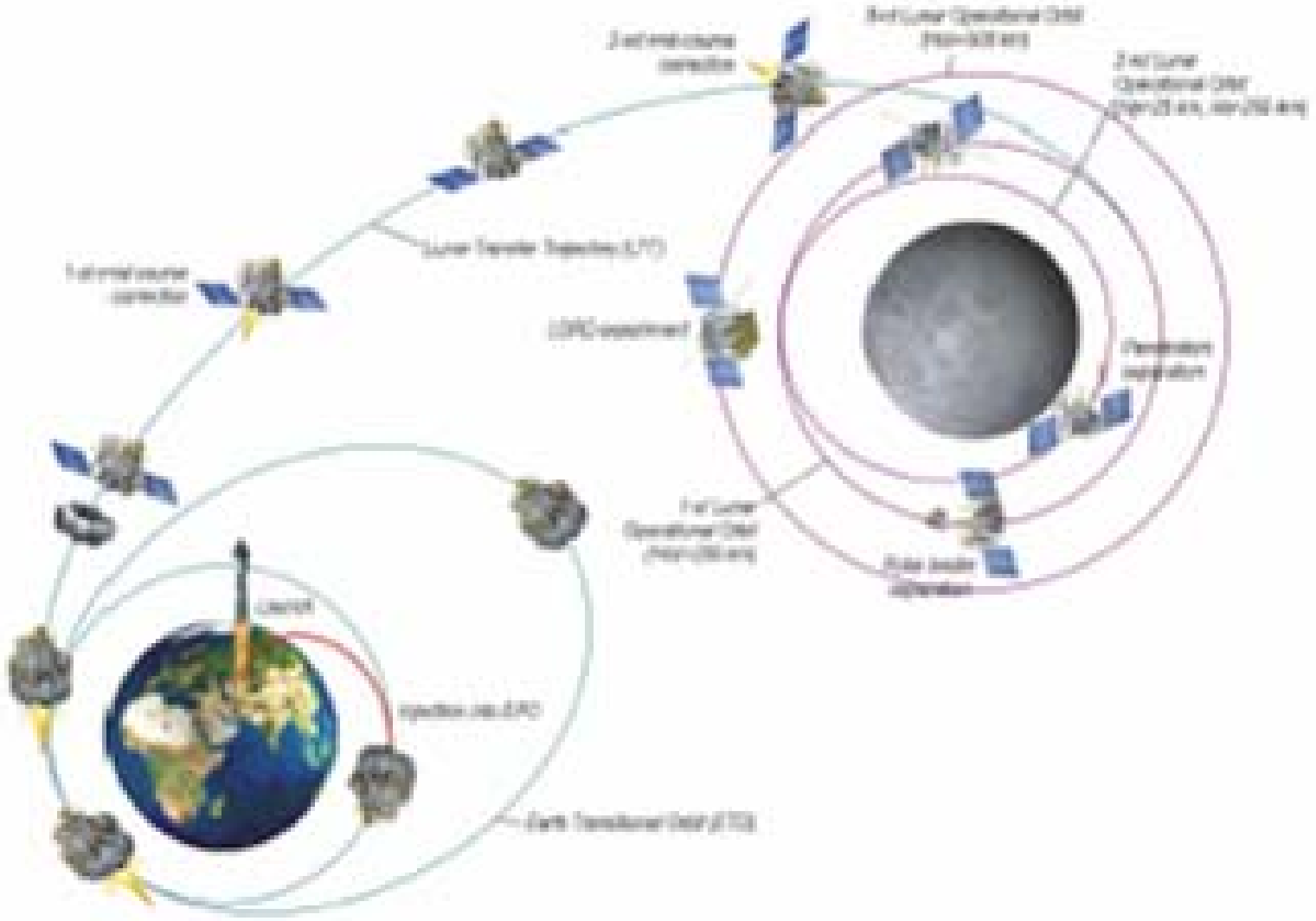
No magnetic field
beyond this area

No magnetic field
in the habitat



System	M (kg)	P (W)
Scintillator counter system (trigger + ToF)	1.0	2.0
Silicon detector System (Si + F.E.E.)	0.5	1.0
Readout and digitisation system	0.5	1.0
Mechanics and Cables	1.0	-
On Board Data Handling	< 2.4	<15
Total	< 5.4	<19

BARTINI instrument (SPHERA)
for measuring the arrival direction of SCR



LUNA-GLOB mission profile