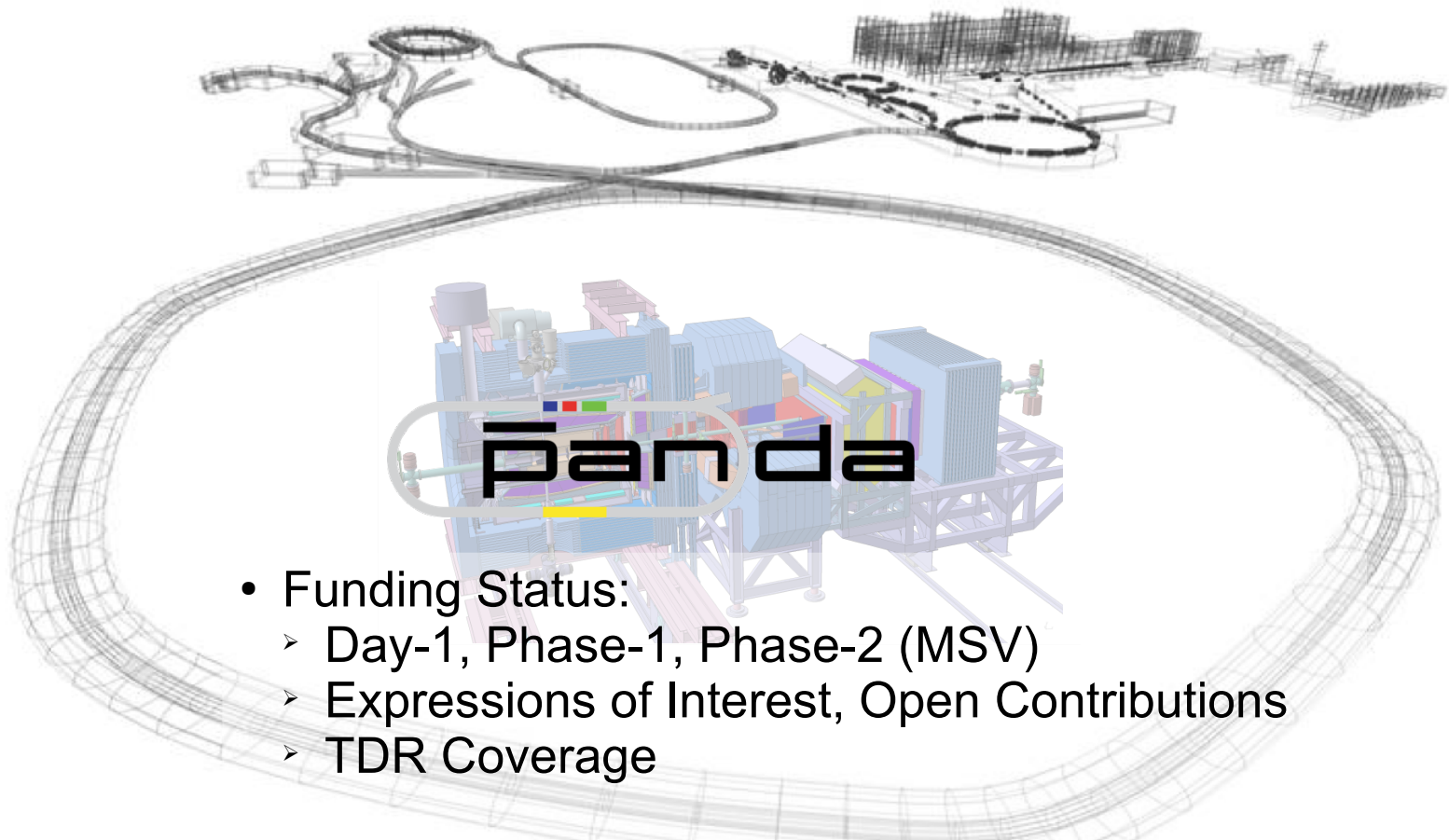


Report on the **panda** Resource Status

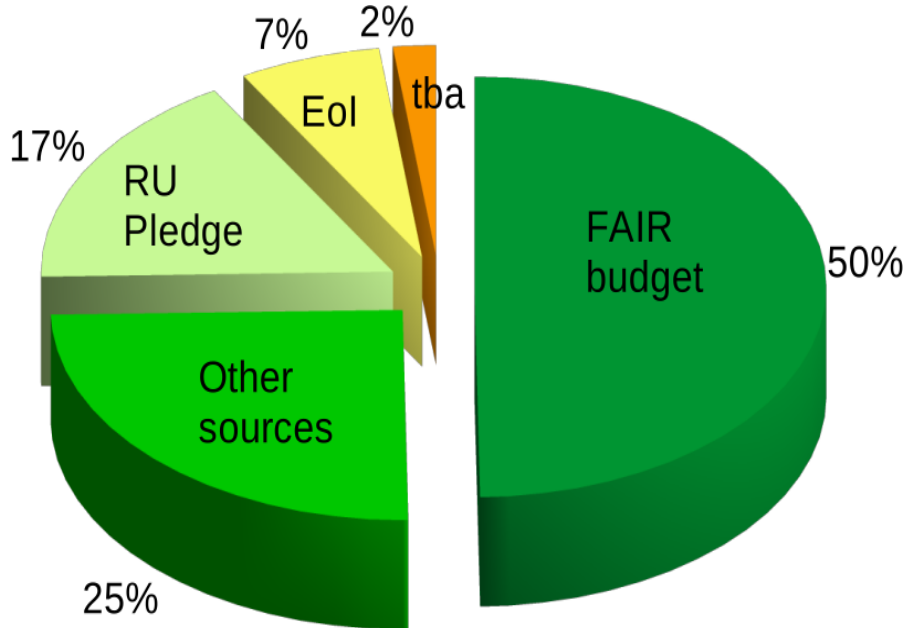


- Funding Status:
 - Day-1, Phase-1, Phase-2 (MSV)
 - Expressions of Interest, Open Contributions
 - TDR Coverage
- Construction-MoU / Construction Common Fund

PANDA Day-1 Setup – General Status

Day-1 Setup

48.461 M€ [2005] = 100%



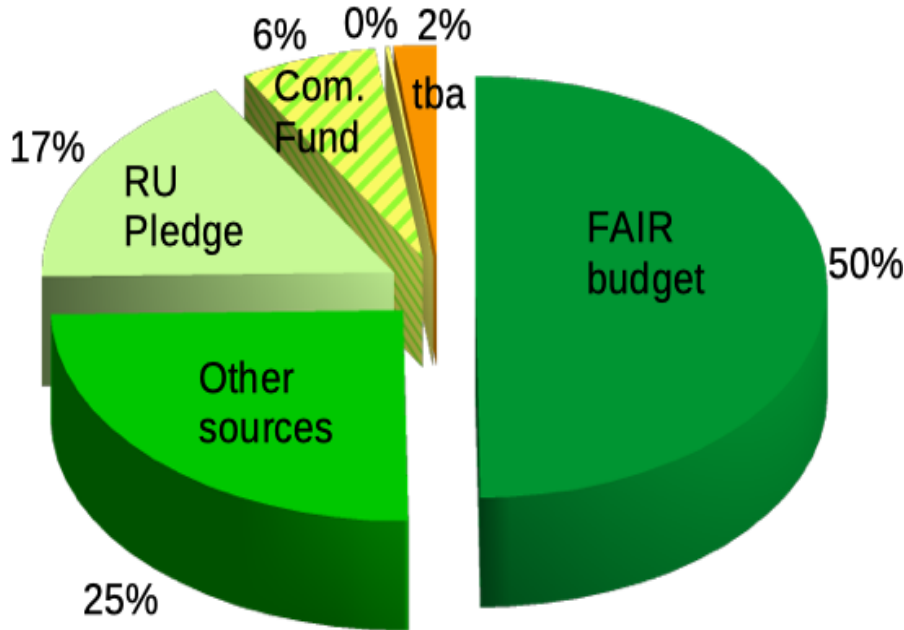
- Day-1 = Phase-1 setup, partially equipped:
 - Barrel-EMC : ~75% / ~12 'slices'
 - GEM : ~50% / 2 out of 3 planes
 - Fw.Tracking: FT 1-4 (+ LHCb-OT option)
 - New: MVD : Si-Strips only
- ~92% secured funding with “Russian Pledge” included
- Cost update for Common Infrastructure 3.1 M€ [2005] (= ~97% of “Eol”)
 - C-MoU with Construction Common Fund

- FAIR construction progressing, in particular South Area
 - funds yet pending for pLinac-, CR-, HESR-buildings
- PANDA subsystem construction progressing as well
 - Covid-19 pandemic interfering since 2 years

PANDA Day-1 Setup – General Status

Day-1 Setup

48.461 M€ [2005] = 100%

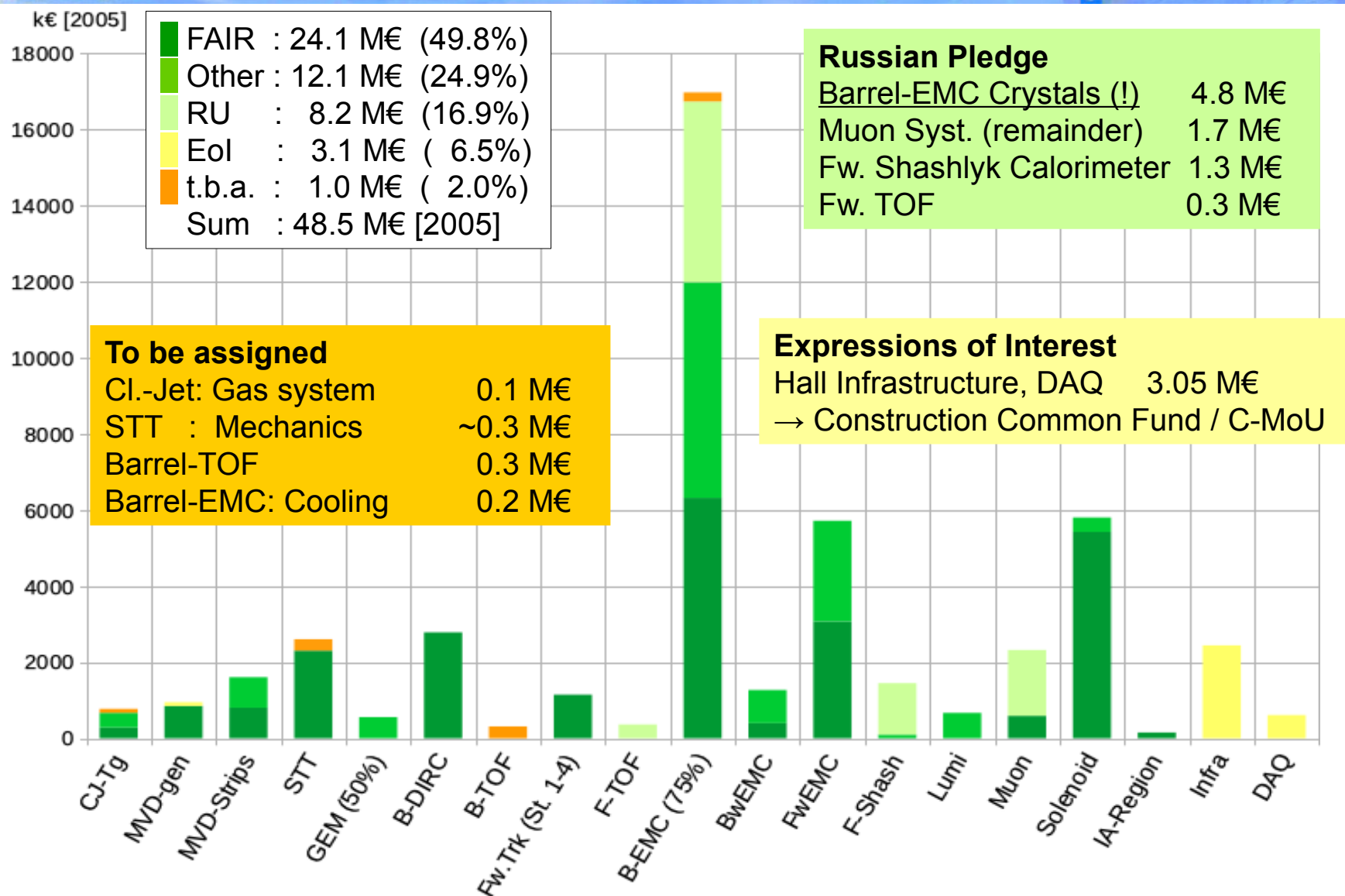


- Day-1 = Phase-1 setup, partially equipped:
 - Barrel-EMC : ~75% / ~12 'slices'
 - GEM : ~50% / 2 out of 3 planes
 - Fw.Tracking: FT 1-4 (+ LHCb-OT option)
 - New: MVD : Si-Strips only
- ~92% secured funding with “Russian Pledge” included
- Cost update for Common Infrastructure 3.1 M€ [2005] (= ~97% of “Eol”)
 - C-MoU with Construction Common Fund

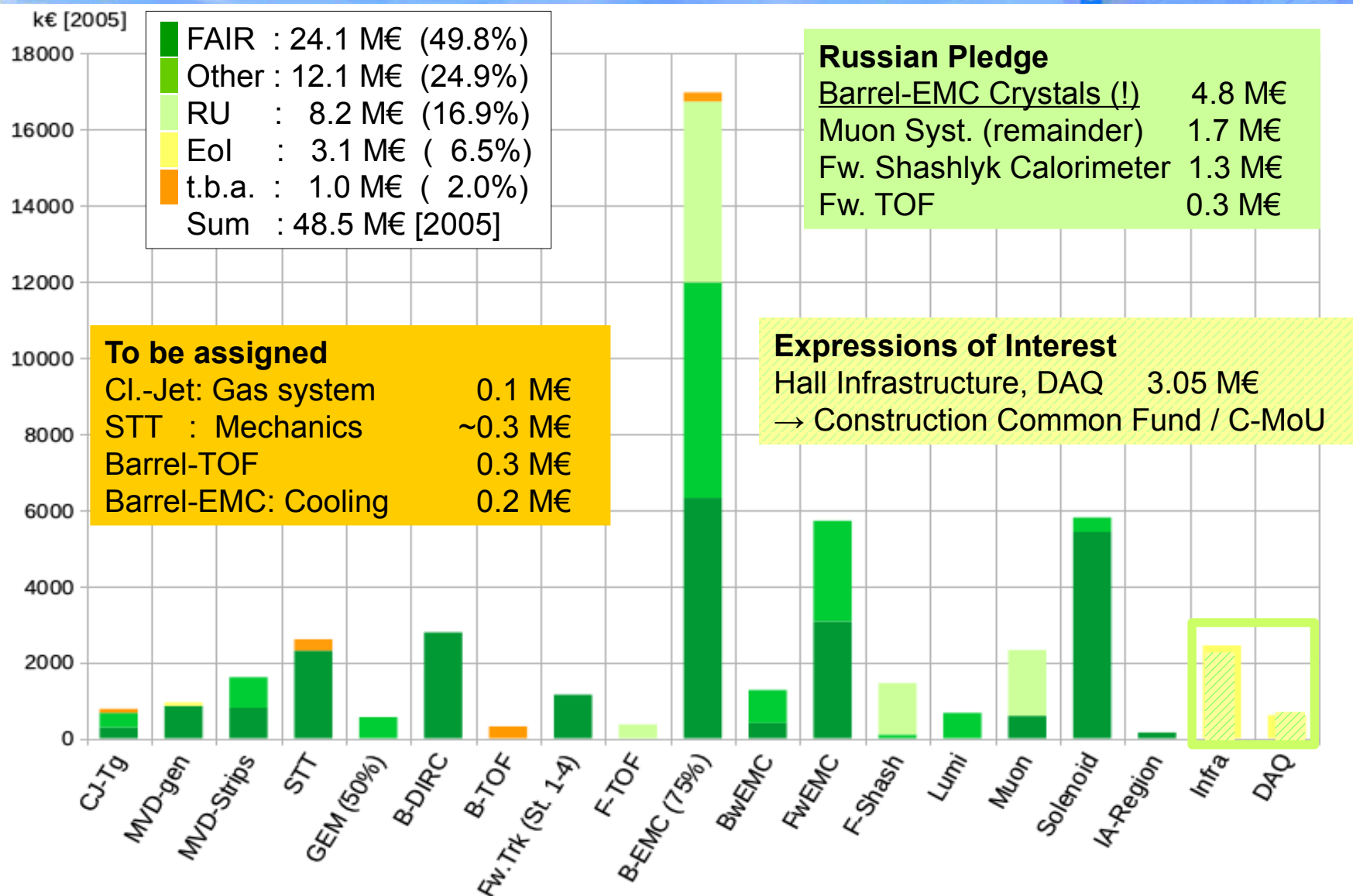
- FAIR construction progressing, in particular South Area
 - funds yet pending for pLinac-, CR-, HESR-buildings
- PANDA subsystem construction progressing as well
 - Covid-19 pandemic interfering since 2 years

- **EMC crystals**
 - 70 additional crystals secured by rearrangement within FAIR-CZ
 - Manufacturer Crytur (CZ) urgently asks for larger orders for profitable operation. Cost increase likely, amount depends on delay (+ energy cost)
- **German Universities** collaborative funding (“Verbundforschung”)
 - 2021-24 period started
- **In-kind contracts**
 - concluded with JU Krakow: FT 1-4, 1145 k€ [2005]
 - close to signature with U Uppsala: PWO Crystals for Barrel-EMC, 205 k€ [2005] (post-production)
- **Construction MoU & Common Infrastructure**
 - some progress → slides below

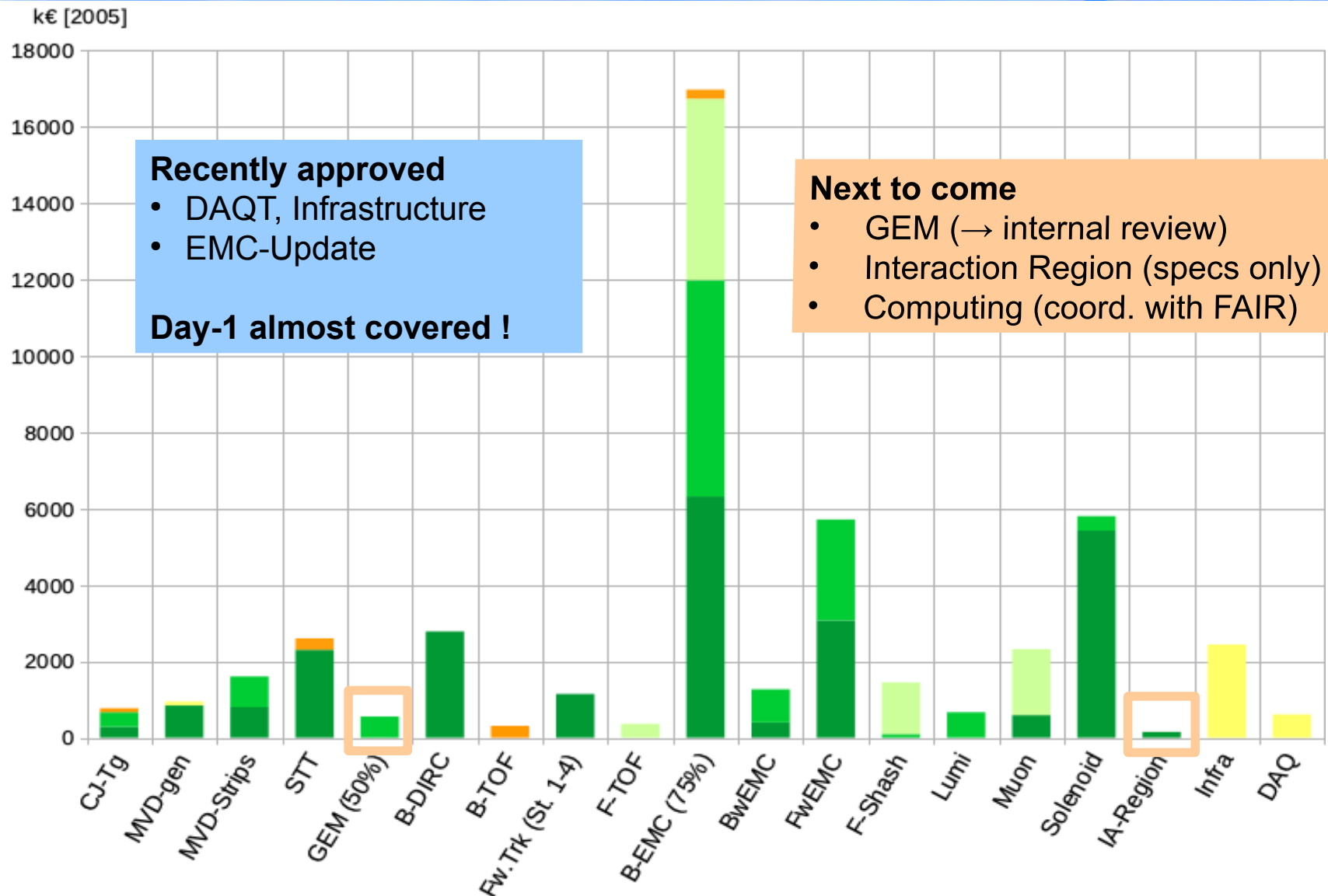
Day-1 Setup: Financial Status of Subsystems



Day-1 Setup: Financial Status of Subsystems



Day-1 Setup: TDR Coverage



Day-1 → Phase-1 → Phase-2

Phase-2:

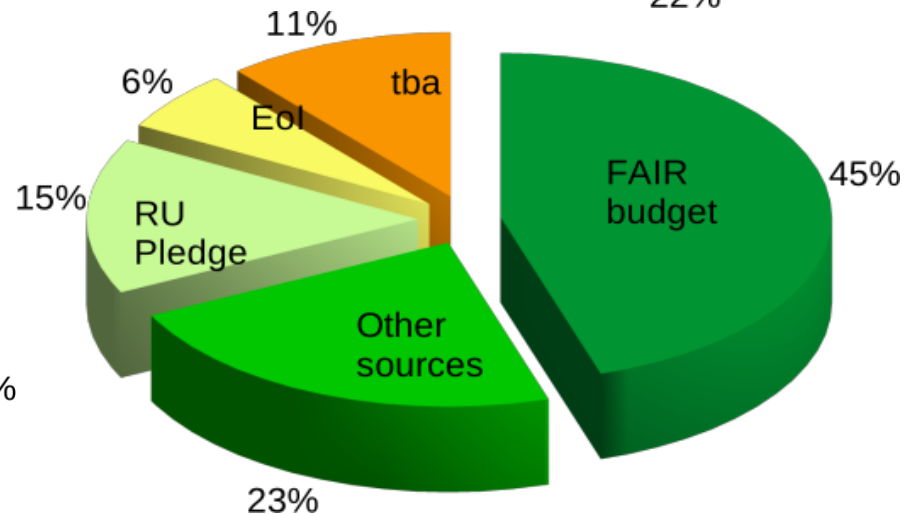
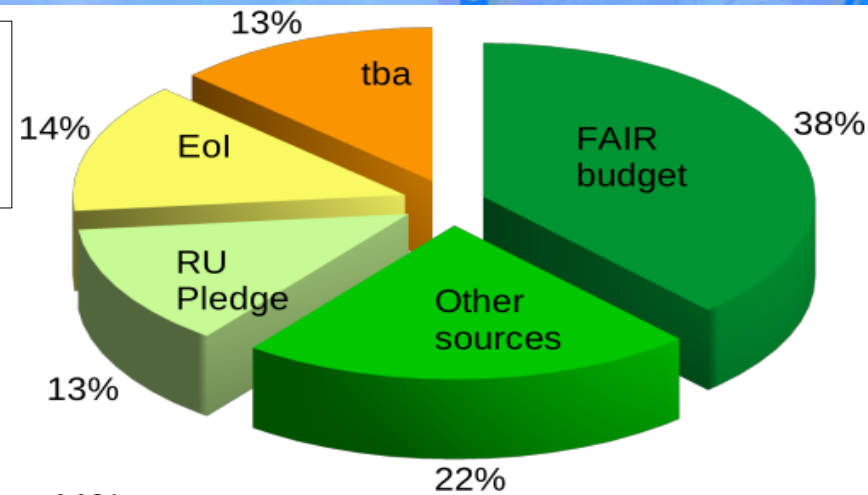
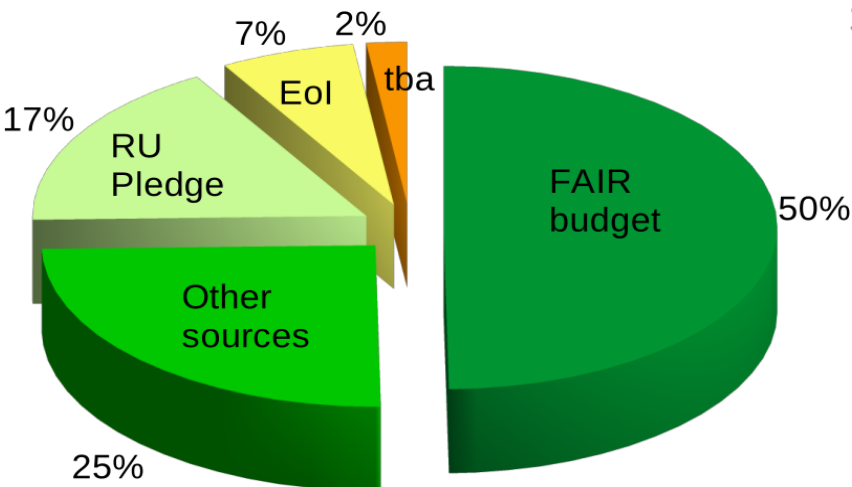
- 63.2 M€ [2005]
- 73% secured
- Full setup (w/ Pellets, FT 5+6, Fw. Cer's., Hyp. N)

Phase-1:

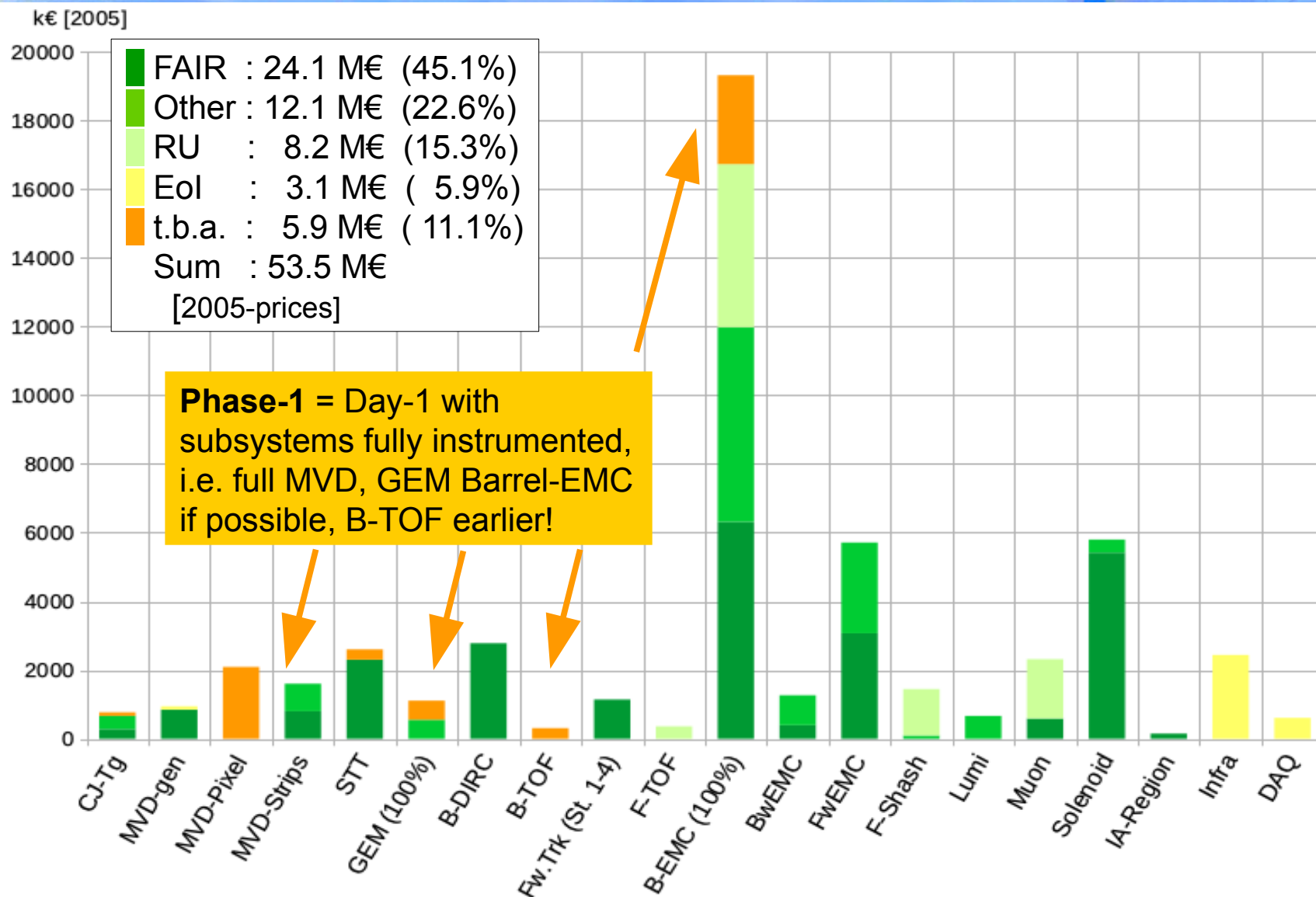
- 53.5 M€ [2005]
- 83% secured
- complete B-EMC, GEM, MVD

Day-1:

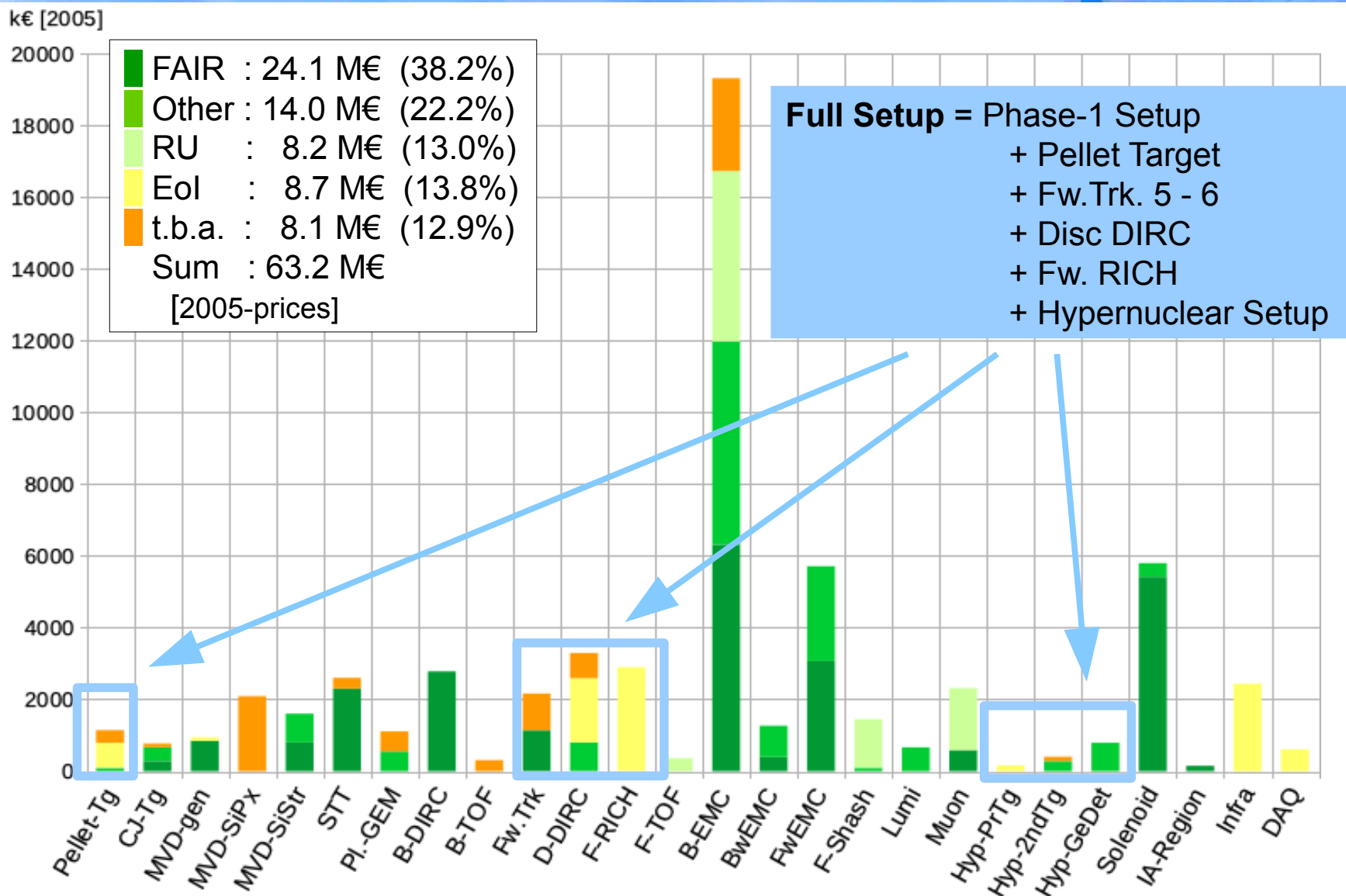
- 48.5 M€ [2005]
- 92% secured
- 75% B-EMC, 50% GEM, MVD-Strips



Phase-1: Financial Status of Subsystems



Phase-2 / MSV: Financial Status of Subsystems



- DAQT-TDR & Infrastructure report recently approved by FAIR (DCS-TDR already in 2020)
 - Basis for update of common infrastructure cost estimate now at 3.05 M€ [2005] / 5.12 M€ [2024] in total
- PANDA - C-MoU draft approved by Collaboration Board and ECE-ECSG
 - established concepts and procedures by closely following CBM-C-MoU (in execution since mid 2020)
 - likewise included: Construction Common Fund for Common Infrastructure
- Current planning foresees PANDA hall in 2024
 - procurement e.g. for support structures needs to start well in advance
 - C-MoU with Construction Common Fund as prerequisite needed

- Document about the distribution of responsibilities for the construction of PANDA. Oversimplified:
*“Institute X builds & installs subsystem Y
and funding agency F_x agrees by providing funds”*
in-kind model as underlying principle
- includes Construction Common Fund for Common Infrastructure
- Parties: FAIR/GSI (host lab), PANDA Institutions, Funding Agencies
- Strong commitment
→ legally not binding (except General Conditions – Annex 8)

Construction → to be distincted from Maintenance & Operations!

- Preamble
- Art. 1 Parties to CMoU (→ *Institutes, Host Lab, Funding Agencies*)
- Art. 2 Purpose of CMoU (→ *Construction of PANDA, in-kind*)
- Art. 3 Duration and Extension (→ *2022 - 2026*)
- Art. 4 The PANDA Experiment and Collaboration (→ *An. 1,3,5*)
- Art. 5 Program of Work, Sharing of Responsibilities (→ *An. 4, 6, 7*)
- Art. 6 Common Infrastructure and Construction Common Fund (→ *An. 7*)
→ *i.a. FAIR ownership of CCF-items*
- Art. 7 Obligations of Host Lab and Institutes (→ *An. 8 - Gen. Conditions*)
- Art. 8 Relationship PANDA Collaboration – FAIR (→ *An. 3 - Gov. Rules*)
- Art. 9 Rights and Benefits of the Institutes (→ *An. 8 - Gen. Conditions*)
- Art. 10 Administrative and Financial Provisions (German GmbH rules apply)
- Art. 11 Amendments
- Art. 12 Disputes
- Art. 13 Annexes
- Art. 14 Final Provisions (→ *An. 8 - Gen. Conditions legally binding*)

- Annex 1 – Institutions
- Annex 2 – Funding Agencies
- Annex 3 – Governance Rules
- Annex 4a – Responsibilities and Work Packages
- Annex 4b – Costs (→ *RRB*)
- Annex 5 – TDR Status
- Annex 6 – Construction Schedule
- Annex 7 – Construction Common Fund Procedures
- Annex 8 – General Conditions for Experiments at FAIR
- Annex 9 – The Panda Day-1, Phase-1 and Phase-2 setup

- Common infrastructure: PANDA specific, but not subsystem-specific equipment within experimental building, as described in DCS-TDR, DAQT-TDR and Infrastructure Report
- Technical Coordination team oversees planning, procurement and installation and coordinates with subsystem teams and host lab
- Costs **~3.05 M€ [2005] / ~5.1 M€ [2024]**
 - distribution between work packages
 - distribution between institutes according to the **number of PhD-holders**
- PANDA: 17 countries, 61 institutions, 396 members, 233 PhD-holders (emeriti exempt) → ~4400 € / y / PhD for 5 year construction period
- Annual or down-payments possible
In-kind instead of cash possible if needs and costs match

Annex 7 – Costs vs. Work Packages (1)

PANDA Construction Common Fund – Work Packages

Costs / k€

Technical Report for the: PANDA Detector
Infrastructure and Installation

TDR (nominal)	2005	2024 (esc.)
------------------	------	----------------

1.4.1.18.1

Supports

(AntiProton Annihilation)
Strong Interaction Stud

November 19



Common (Installation, Surveying, Certification)

Detector Platforms

Inner Detector Supports

Movement Systems

Installation Platforms

Subtotal

673	445	746
235	155	260
271	179	300
225	149	249
185	122	205
1589	1050	1761

1.4.1.18.2

Supplies

Cable Ducts

Electrical Supplies

Cooling

Gas Supplies

Subtotal

61	40	68
161	106	178
1086	718	1204
327	216	362
1635	1081	1812

Annex 7 – Costs vs. Work Packages (2)

PANDA Construction Common Fund – Work Packages

Costs / k€

TDR
(nominal) 2005 2024
(esc.)

Technical Design Report for the:
PANDA Detector Control System

(AntiProton Annihilations at Darmstadt)
Strong Interaction Studies

PANDA Collaboration

September 2000

1.4.1.18.3

Controls

Workstations, Servers

Electrical & Environmental Monitoring

Storage servers

Network infrastructure

Fault Tolerant Monitoring (FTLMC)

Control Room Equipment

Subtotal

58	39	66
108	73	123
80	54	91
110	75	125
20	14	23
83	55	92
459	310	520

Technical Design Report for the:
PANDA Data Acquisition Filter

(AntiProton Annihilations at Darmstadt)
Strong Interaction Studies with Antiprotons

PANDA Collaboration

August 12, 2000

1.4.1.19

DAQT

Data Concentrators

Computing Infrastructure

Network

Subtotal

345	228	382
255	169	283
320	212	356
920	609	1021

Total

4603	3050	5115
------	------	------

Subsystem (TDR)	Actual estimate		≤ RRB #10	
	k€ [2024]	k€ [2005]	k€ [2005]	
Supports (Infra)	1761	1050	2400	-56%
Supplies (Infra)	1812	1081	760	+42%
Controls (DCS)	520	310	400	-23%
DAQT (DAQT)	1021	609	980	-38%
Sum Common Fund	5115	3050	4540	-33%

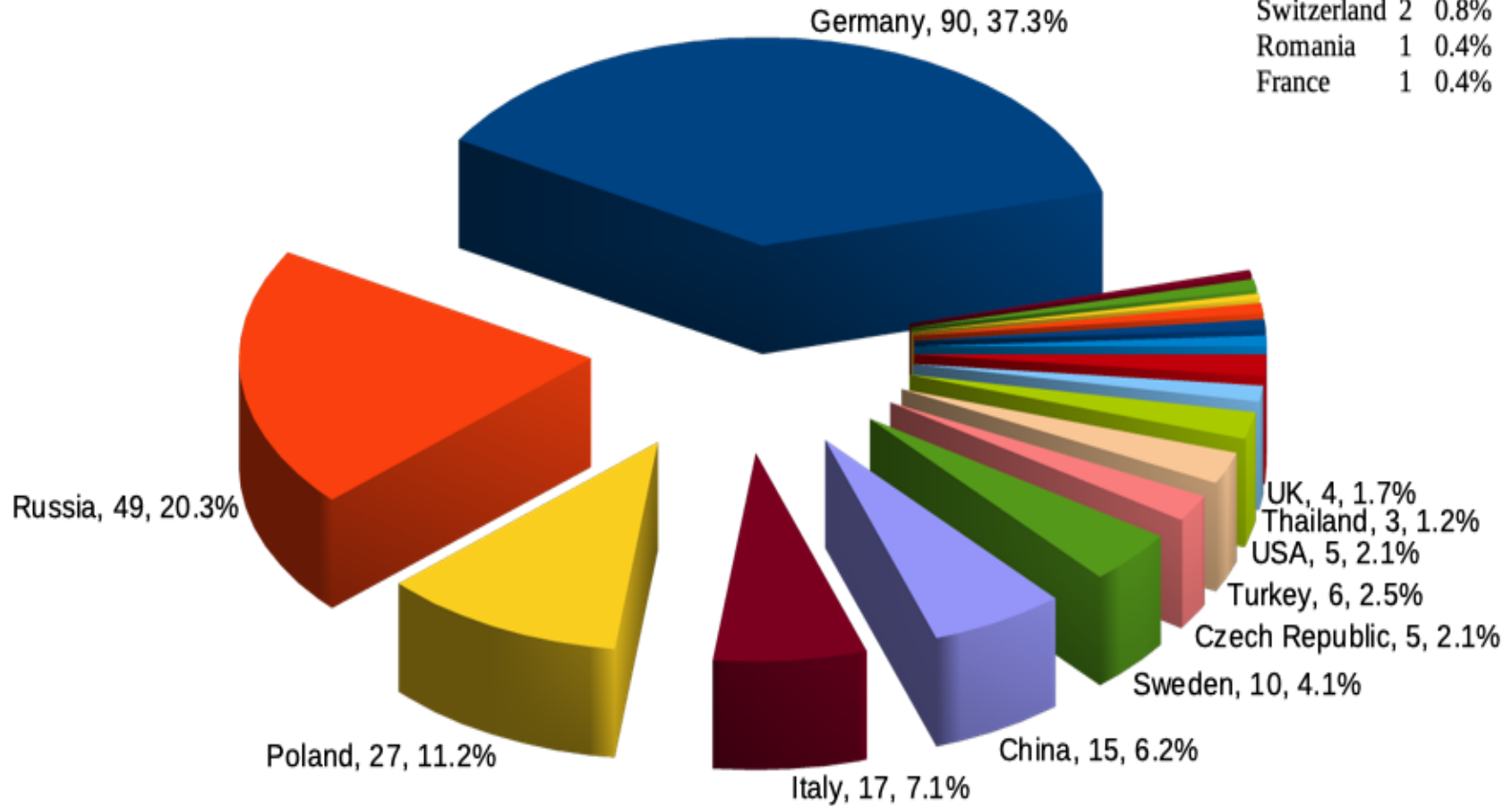
- ECE recommendation: Infrastructure report “living document”, to be updated for schedule and funding boundary conditions
- possible risk of under-estimated manpower for installation
- member count 'risk', actually 233 PhD-holders (w/o emeriti etc.)
→ ~4.4 k€ [2024] / y / PhD for assumed 5y construction period

PANDA PhD holders

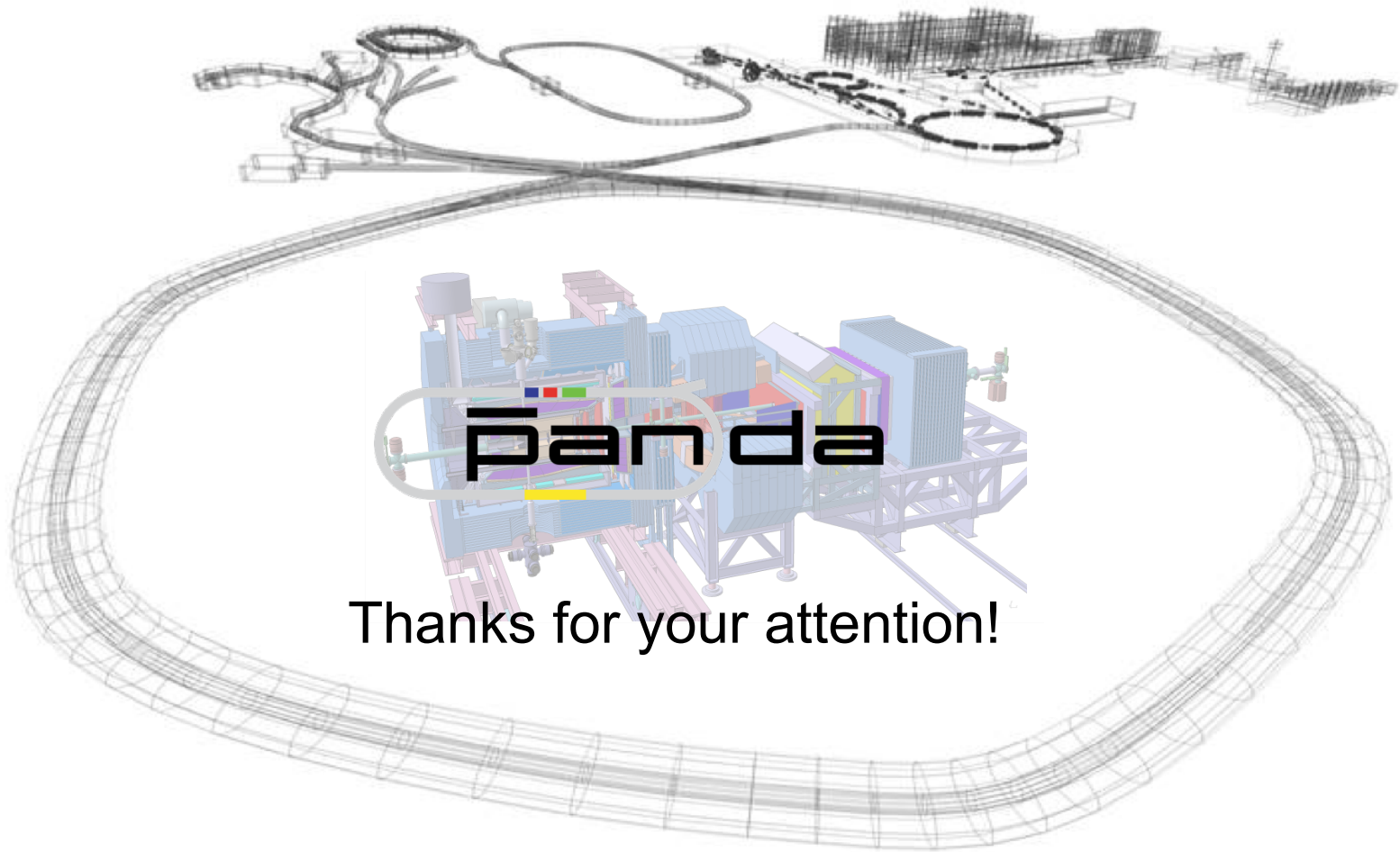


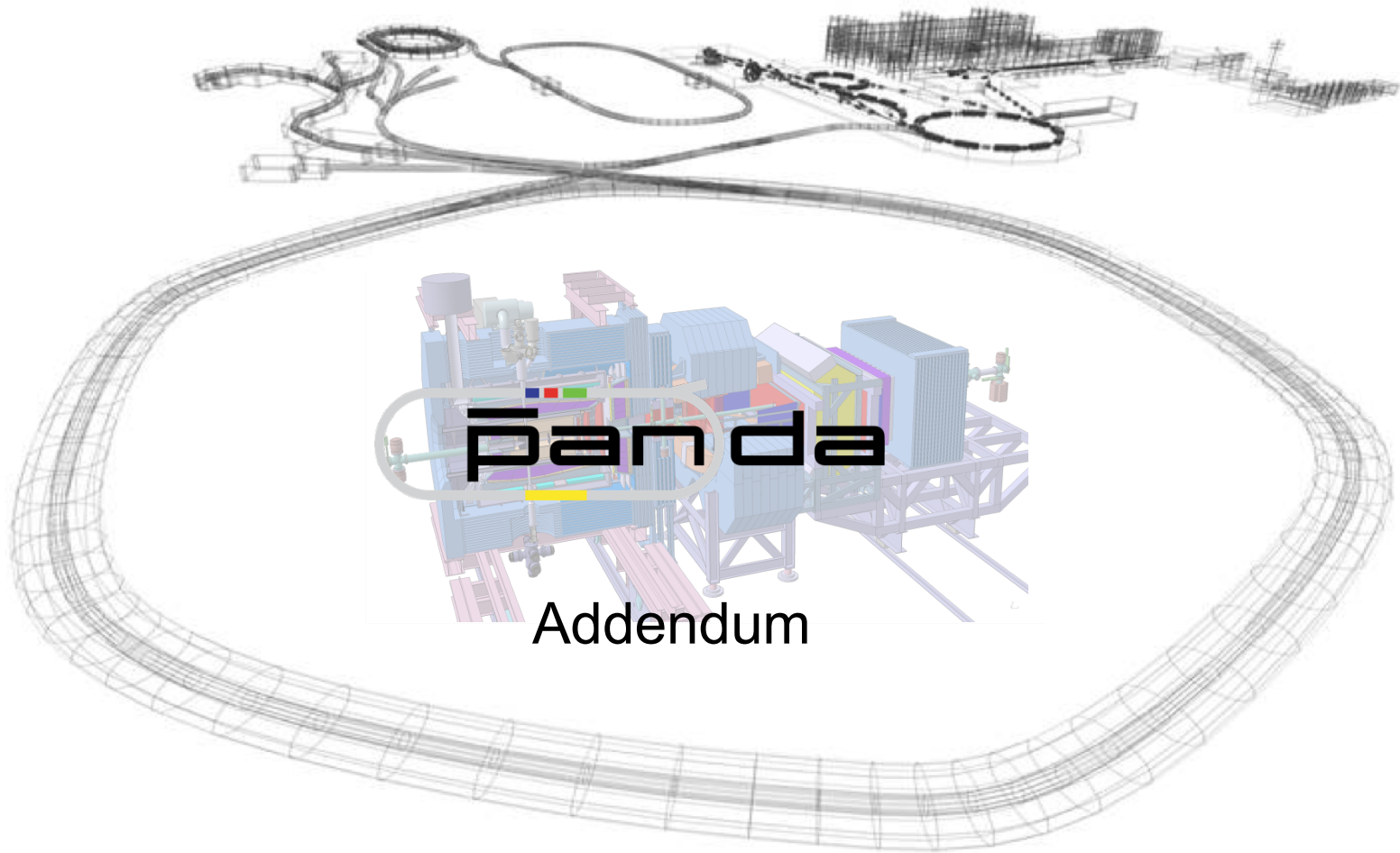
PANDA PhD holders
241 in total, distributed over 17 countries
(incl. emeriti, retirees, honoraries)

India	2	0.8%
Netherlands	2	0.8%
Belarus	2	0.8%
Switzerland	2	0.8%
Romania	1	0.4%
France	1	0.4%



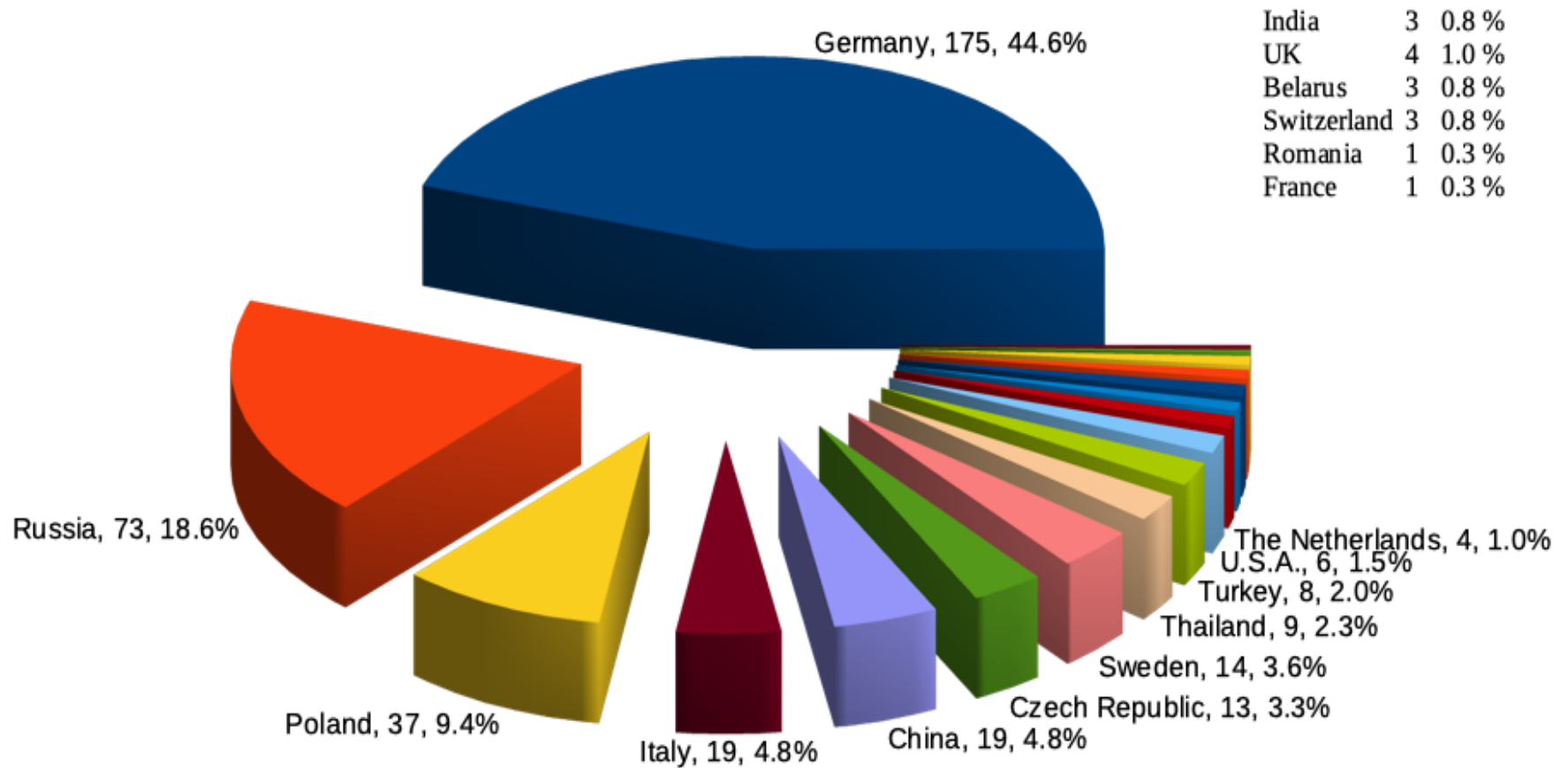
- PANDA : Excellent science
 - from Day-1 onwards
 - for all physics subgroups
- Construction progress continues
 - Subsystems advancing reasonably well (*caveat: Covid-19*)
 - TDR for Day-1 and Phase-1 almost complete
 - Day-1 funding consolidated (*++caveat: persisting funding issues*)
 - C-MoU put forward to further ensure timely construction



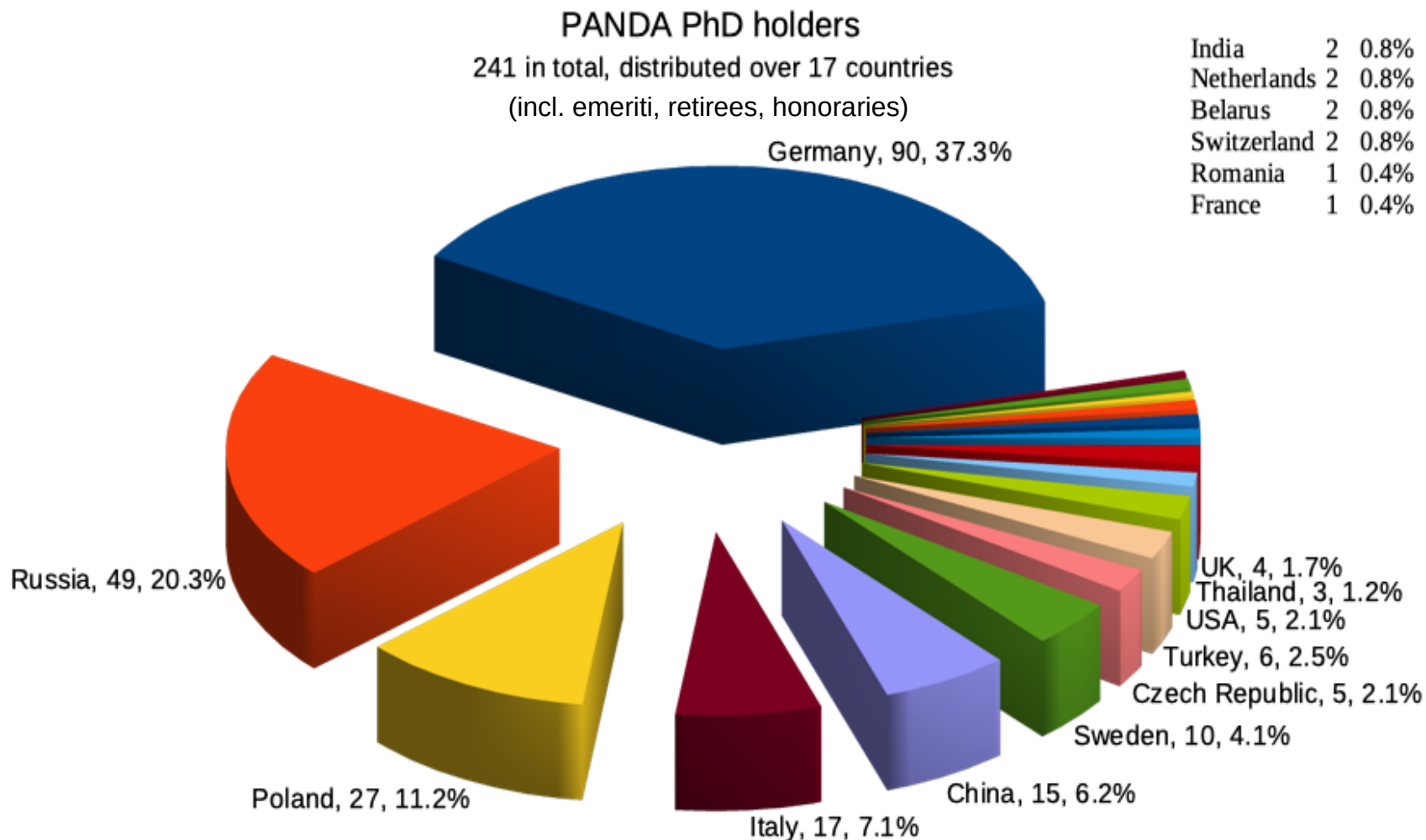


Member Distribution

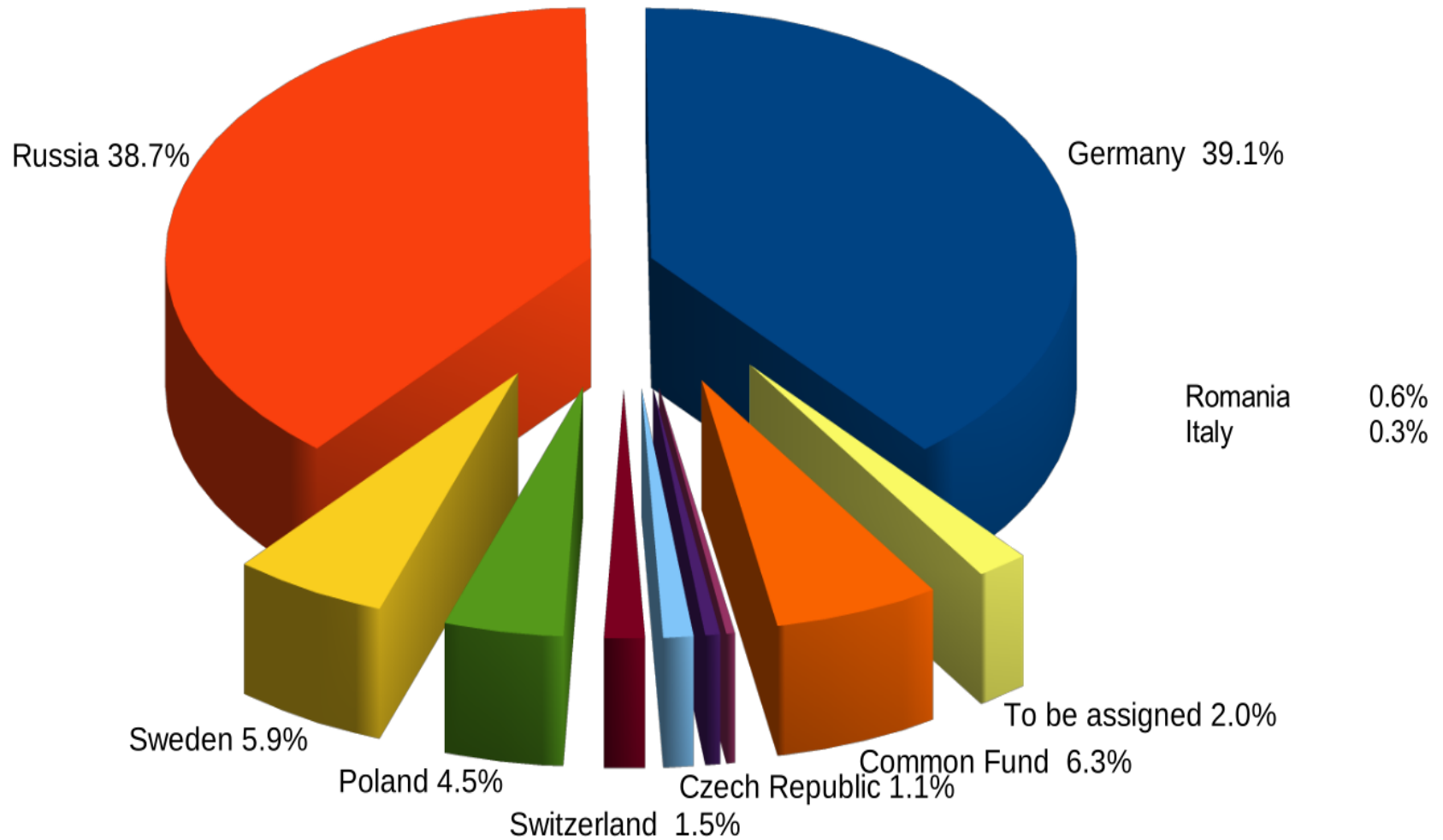
PANDA members
394 in total, distributed over 17 countries



PhD-holder Distribution

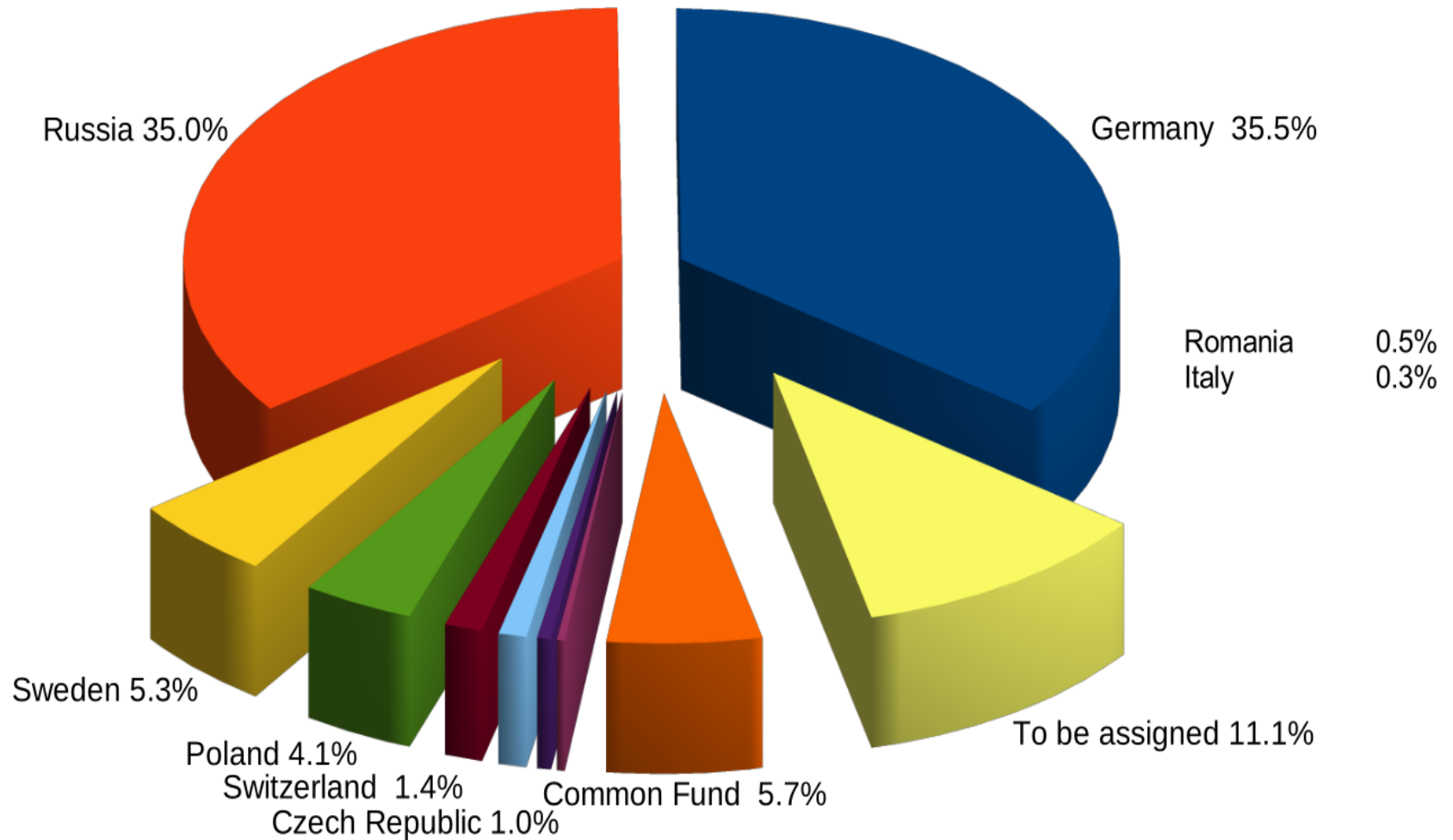


Countries & Funding: Day-1 Setup



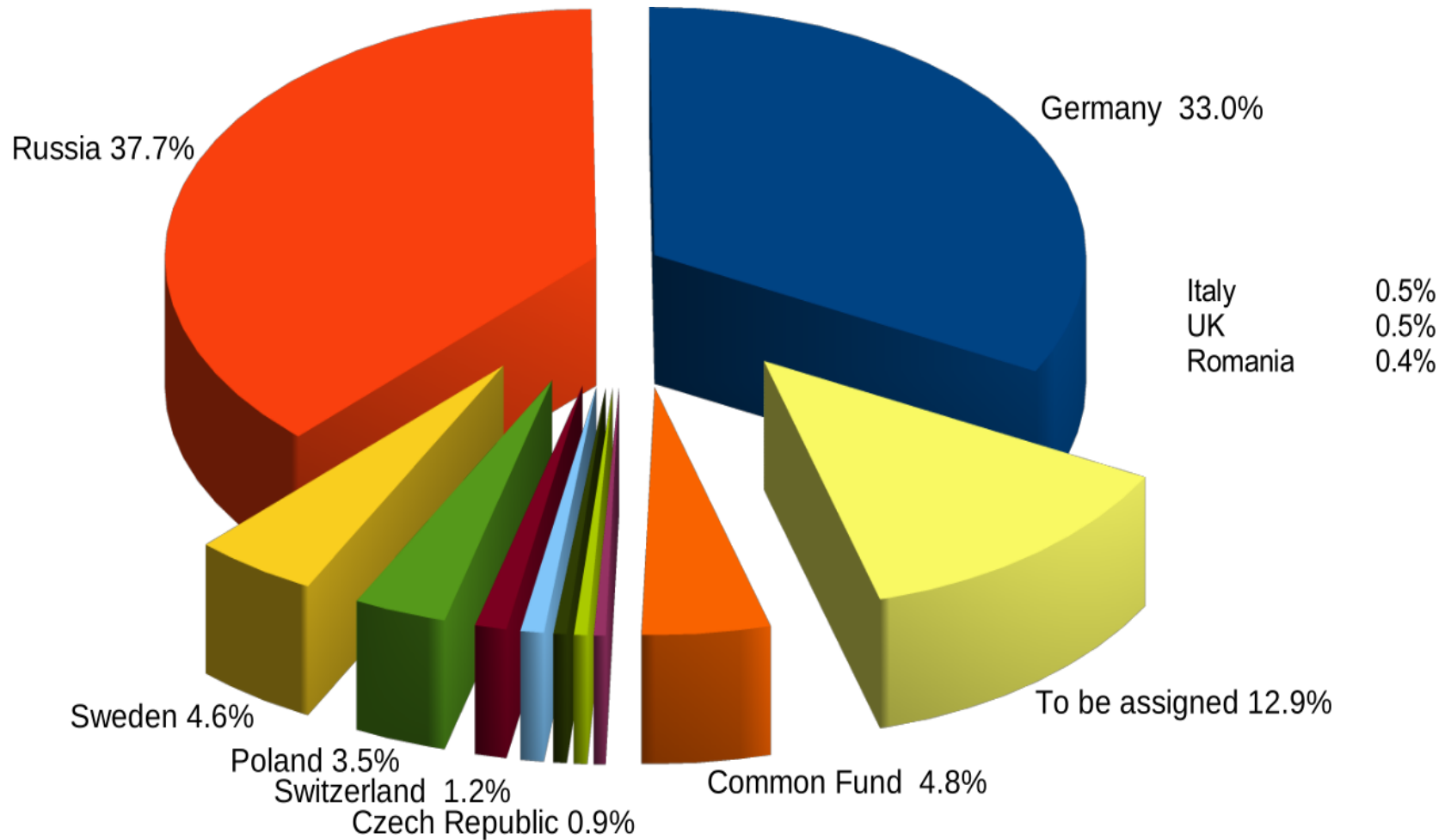
Day-1 setup, 48.5 M€ [2005]

Countries & Funding: Phase-1 / Start Setup



Phase-1 / Start setup, 53.5 M€ [2005]

Countries & Funding: Phase-2 / Full Setup



Phase-2 / Full (MSV) setup, 63.2 M€ [2005]

Day-1: Scorecard



PANDA		TDR / Specs	Cost [k€ 2005]	% Funding (Sec / RUS / EoI / TBA)				Construction	Construction complete	Test/ Commissioning
Day-1	Cluster Jet Target		771,00						10/2025	
	Micro Vertex Detector (MVD) - Str		2.550,00						01/2025	
	Straw Tube Tracker (STT) (1)		2.603,00						09/2025	
	Planar GEM Tracker - 50%		555,00						03/2025	
	Barrel DIRC		2.782,00						10/2024	
	Barrel Time of Flight (TOF)		310,00						10/2024	
	Forward Tracking (w/o FT 5/6) (1)		1.145,00						08/2025	
	Forward TOF (2)		362,00						12/2024	
	Barrel EMC System		8.258,00						12/2025	
	Barrel EMC Crystals - 75% (2)		8.712,00						12/2025	
	Backward Endcap EMC		1.267,00						06/2025	
	Forward Endcap EMC		5.714,00						12/2023	
	Forward Shashlyk Calorimeter (2)		1.447,00						12/2025	
	Luminosity Detector		666,00						03/2025	
	Muon Detectors (2)		2.318,00						06/2024	
	Solenoid		5.800,00						04/2024	
	Interaction Region		151,00						12/2024	
	Infrastructure		2.441,00						06/2024	
	DAQ Hardware (3)		609,00						06/2025	
		99% value weighted	48.461,00	75%	17%	7%	2%	44% value weighted		1% value weighted
Changes since RRB #10		+7%	-7.7%	+5.6%	+1.3%	-7.1%	-2.0%	+5%		

(1) if synergies between STT and Fw. Tracking realised

(2) if German-Russian Roadmap realised

(3) DAQ computing via operation funds

2022-02-04

Status experiment funding

Experiment/Project	Start of operation	Remarks	Prices, K Euro							
			2005 prices					2022 prices		
			Total cost	Secured amount	Russian Pledge	Eol	To be assigned	Russian Pledge	Eol	To be assigned
Pellet Target	Phase 2		1144	93	0	700	351		1115	559
Cluster Jet Target	Day-1		771	668	0	0	103		0	164
Micro Vertex Detector (MVD)										
general	Day-1		946	849	0	97	0		155	0
Silicon Pixel Vertex Detectors	Phase-1		2091	0	0	0	2091		0	3331
Silicon Strip Vertex Detectors	Day-1		1604	1604	0	0	0		0	0
Target Spectrometer Tracking										
Straw Tube Tracker (STT)	Day-1		2603	2303	0	0	300		0	466
Planar GEM Trackers – Day-1	Day-1	Stations 1-2	555	555	0	0	0		0	0
Planar GEM Trackers – Completion	Phase-1	Station 3	555	0	0	0	555			861
Barrel DIRC	Day-1		2782	2782	0	0	0		0	0
Barrel Time of Flight (SciTil)	Day-1		310	0	0	0	310		0	494
Forward Tracking – Day-1	Day-1	Stations 1-4	1145	1145	0	0	0		0	0
Forward Tracking – Completion	Phase 2	Stations 5-6	1021	0	0	0	1021			1585
Forward Cherenkov Detectors										
Endcap Disc DIRC	Phase 2		3293	805	0	1788	700		2848	1115
Forward RICH	Phase 2		2900	0	0	2900	0		4620	0
Forward TOF	Day-1		362	0	362	0	0	577	0	0
Target Spectrometer EMC										
Barrel EMC – Day-1	Day-1	75% coverage	16970	11982	4750	0	238	7372	195	369
Barrel EMC – Completion	Phase-1		2348	0	0	0	2348			3644
Backward Endcap EMC	Day-1		1267	1267	0	0	0		0	0
Forward Endcap EMC	Day-1		5714	5714	0	0	0		0	0
Forward Shashlyk Calorimeter	Day-1		1447	95	1352	0	0	2098	0	0
Luminosity Detector	Day-1		666	666	0	0	0		0	0
Muon System	Day-1		2318	591	1727	0	0	2680	0	0
Hypernuclear Setup										
Primary Target	Phase 2		163	0	0	163	0		260	0
Secondary Active Target	Phase 2		403	281	0	0	122		0	194
Germanium Detector	Phase 2		793	793	0	0	0		0	0
Solenoid	Day-1		5800	5800	0	0	0		0	0
Interaction Region	Day-1		151	151	0	0	0		0	0
Infrastructure	Day-1		2441	0	0	2441	0		3889	0
DAQ	Day-1		609	0	0	609	0		970	0
Phase-2 (Full setup)			63172	38144	8191	8698	8139	12712	13499	12632
Phase-1			53455	36172	8191	3147	5945	12712	4884	9227
Day-1			48461	36172	8191	3147	951	12712	4884	1476

This calculation uses an escalation factor of 1.593 between 2005 prices and 2022 prices.

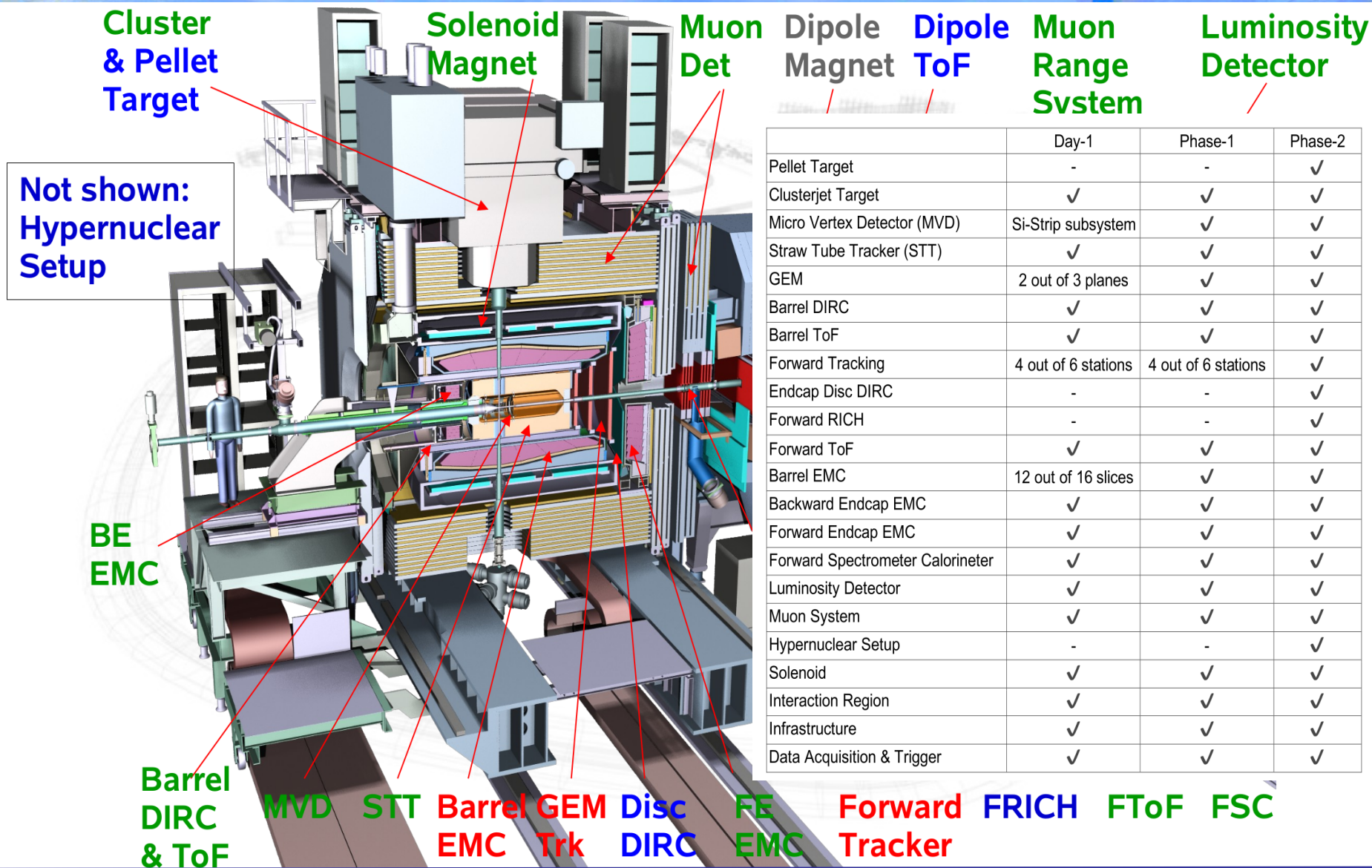
Status Experiment Funding

Subproject (TDR date)	2005 prices, k Euro								Start of operation foreseen
	Total cost	Diff. to RRB #10	Secured amount	Diff. to RRB #10	Eol / RU Pl.	Diff. to RRB #10	To be assigned	Diff. to RRB #10	
Pellet Target (exp. 2022)	1144	0	93	0	700	0	351	0	Phase 2
Cluster Jet Target (2013)	771	0	668	0	0	0	103	0	Day-1
Micro Vertex Detector (2013)									
general	946	0	849	0	97	0	0	0	Day-1
Silicon Pixel Vertex Detectors	2091	0	0	0	0	-2091	2091	2091	Phase-1
Silicon Strip Vertex Detectors	1604	0	1604	0	0	0	0	0	Day-1
Target Spectrometer Tracking									
Straw Tube Tracker (2013)	2603	0	2303	0	0	0	300	0	Day-1
Planar GEM Trackers – Day-1 (exp. 2022)	555	0	555	0	0	0	0	0	Day-1
Planar GEM Trackers – completion	555	0	0	0	0	0	555	0	Phase 1
Barrel DIRC (2017)	2782	0	2782	0	0	0	0	0	Day-1
Barrel Time of Flight (2018)	310	0	0	0	0	0	310	0	Day-1
Forward Tracking (2018) – Day-1	1145	0	1145	0	0	0	0	0	Day-1
Forward Tracking (2018) – completion	1021	0	0	0	0	0	1021	0	Phase 2
Forward Cherenkov Detectors									
Endcap Disc DIRC (2019)	3293	0	805	0	1788	0	700	0	Phase 2
Forward RICH (exp. 2022)	2900	0	0	0	2900	0	0	0	Phase 2
Forward TOF (2018)	362	0	0	0	362	0	0	0	Day-1
Target Spectrometer EMC (2008)									
Barrel EMC – Day-1	16970	335	11982	335	4750	0	238	0	Day-1
Barrel EMC – completion	2348	0	0	0	0	0	2348	0	Phase 1
Backward Endcap EMC	1267	0	1267	0	0	0	0	0	Day-1
Forward Endcap EMC	5714	0	5714	0	0	0	0	0	Day-1
Forward Shashlyk Calorimeter (2016)	1447	0	95	0	1352	0	0	0	Day-1
Luminosity Detector (2019)	666	0	666	0	0	0	0	0	Day-1
Muon System (2014)	2318	0	591	0	1727	0	0	0	Day-1
Hypernuclear Setup (exp. 2022)									
Primary Target	163	0	0	0	163	0	0	0	Phase 2
Secondary Active Target	403	0	281	0	0	0	122	0	Phase 2
Germanium Detector	793	0	793	0	0	0	0	0	Phase 2
Solenoid (2009)	5800	0	5800	0	0	0	0	0	Day-1
Interaction Region	151	0	151	0	0	0	0	0	Day-1
Infrastructure (exp. 2021)	2441	-1565	0	0	2441	-1565	0	0	Day-1
DAQ (exp. 2021)	609	-741	0	-370	609	-371	0	0	Day-1
Computing (exp. 2021)	0	0	0	0	0	0	0	0	Day-1
Sum	63172	-1971	38144	-35	16889	-4027	8139	2091	

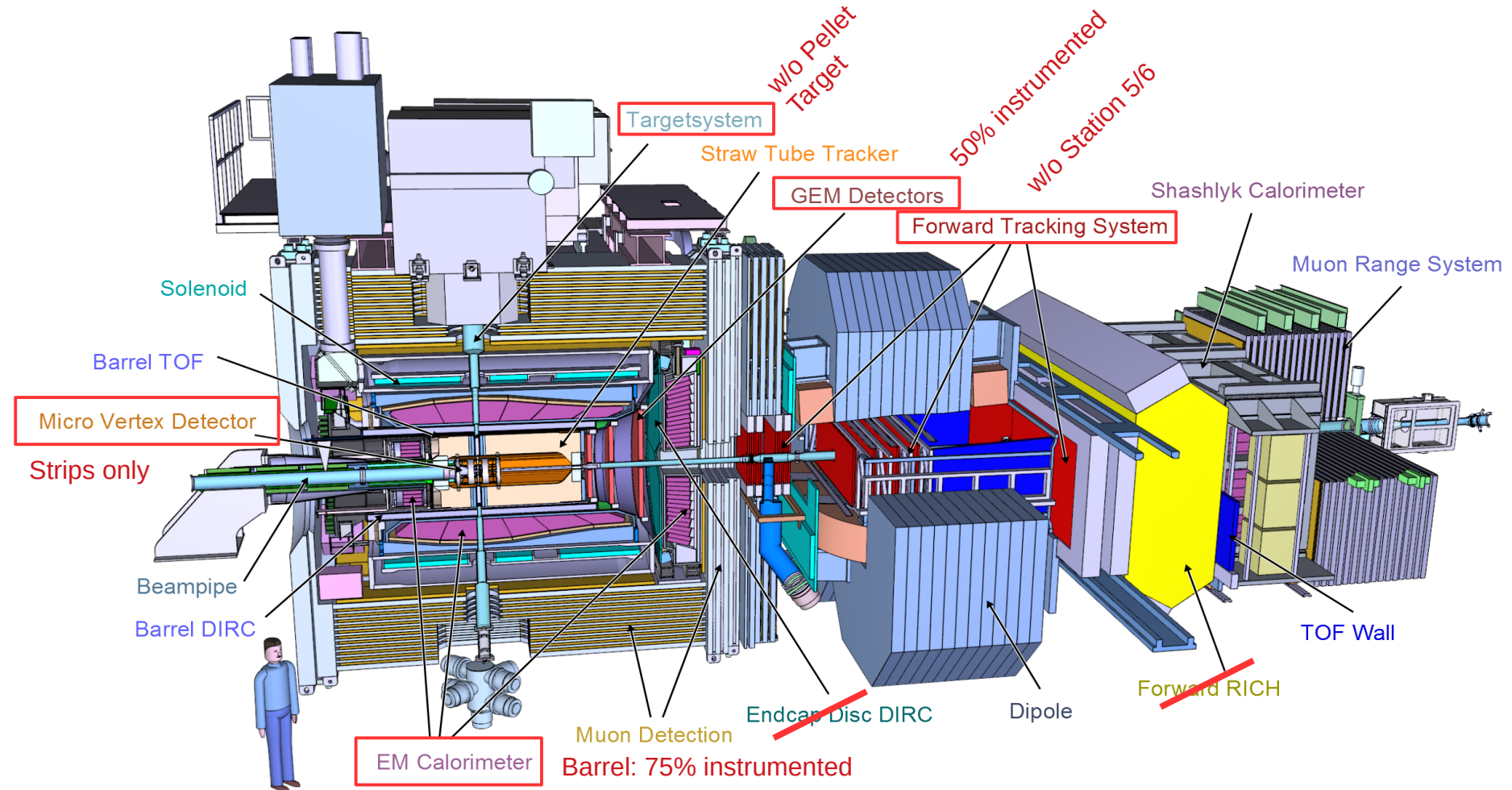
This calculation uses an escalation factor of 1.593 between 2005 prices and 2022 prices.

A grey background indicates a staged instrumentation approach for Day-1

Annex 9 – Day-1-Setup (& Phase-1/2)

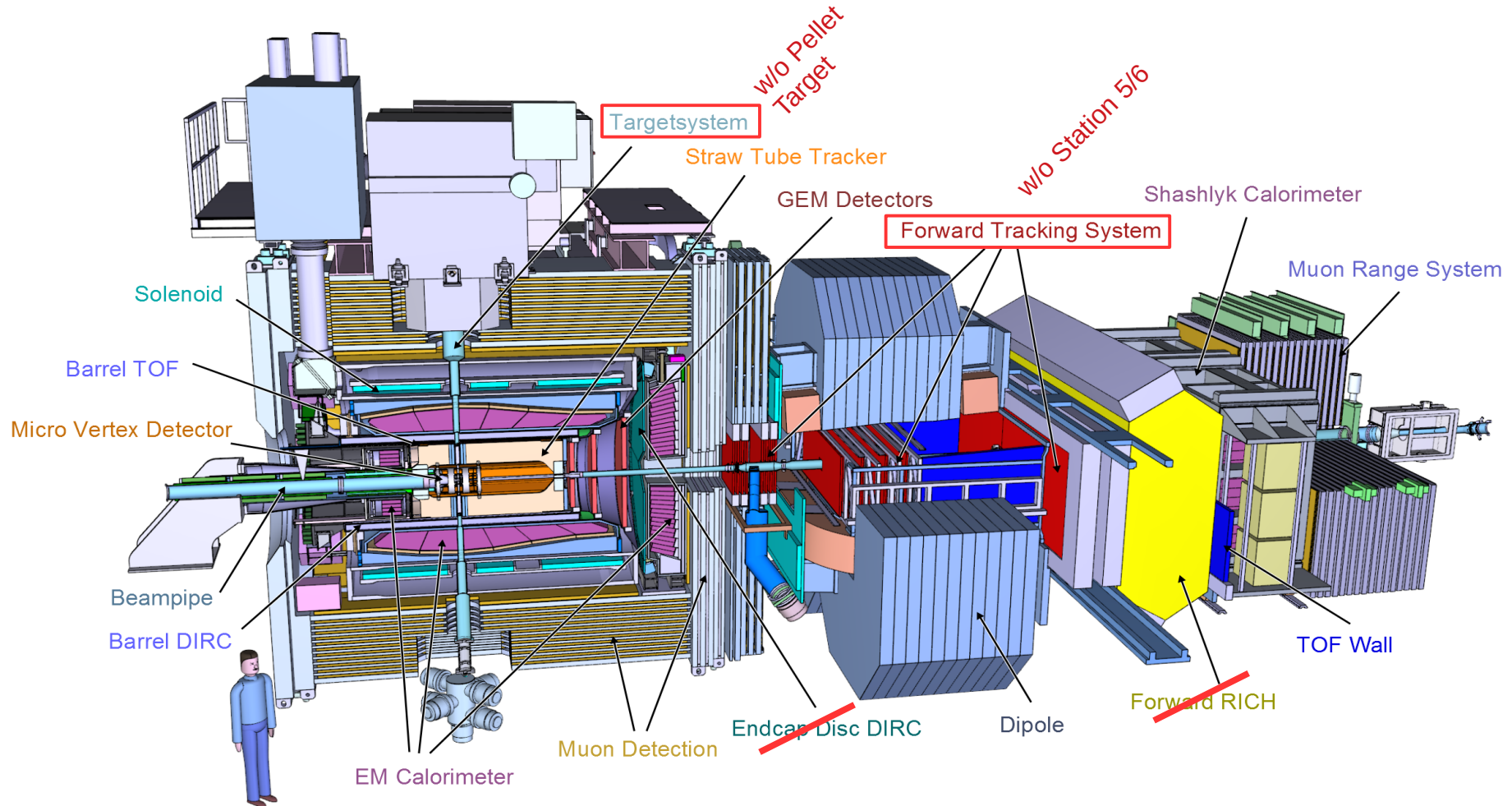


Day-1 Scenario: 48.5 M€ [2005]

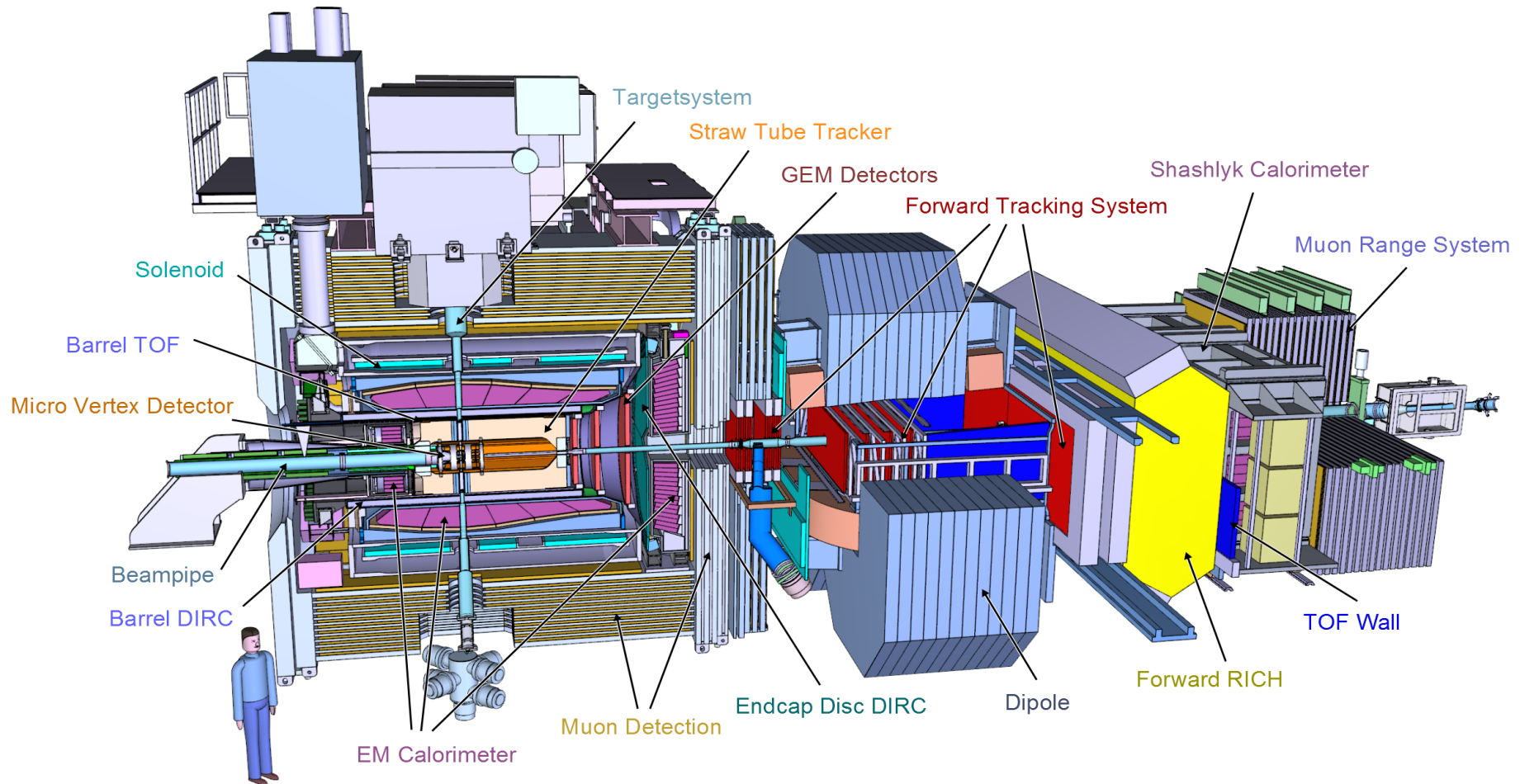


- MVD w/o Pixels, 75% of Barrel-EMC and 50% of GEM instrumented
- Includes "Russian Pledge" on EMC-crystals, Fw. TOF, Fw Shashlyk, Muon System

Phase-1 / Start Setup: 53.5 M€ [2005]



Not included: Pellet Target, Disc DIRC, Fw. RICH, Hyper-N. Setup, Fw.Trk Stations 5/6.



Included (but not depicted): Pellet Target and Hypernuclear Setup