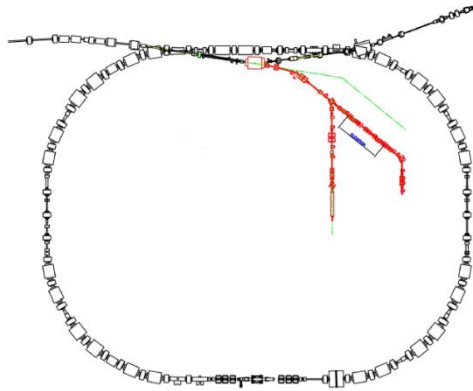


Extra Low ENergy Antiproton ring (ELENA) TE-EPC-CCS contribution to the project

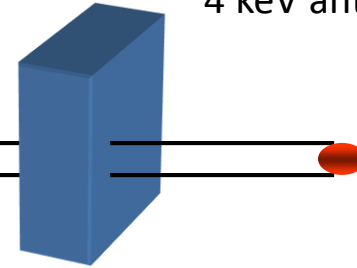
Section Meeting
Michal Dudek





5.3 MeV antiprotons
a shot every ~ 100 sec
to 1 experiment

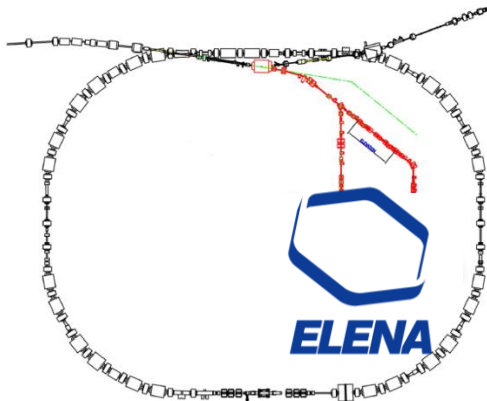
$\sim 3 \times 10^7$



~ 4 keV antiprotons/ ~ 100 sec

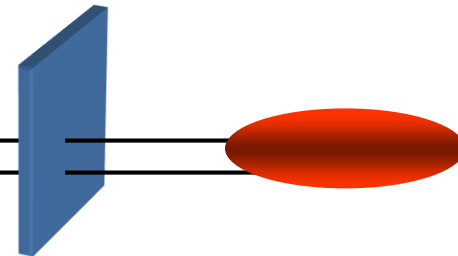
Present situation with AD alone:

- experiments slow antiprotons down by „degrader”
- very inefficient method, most ($>99\%$) antiprotons lost



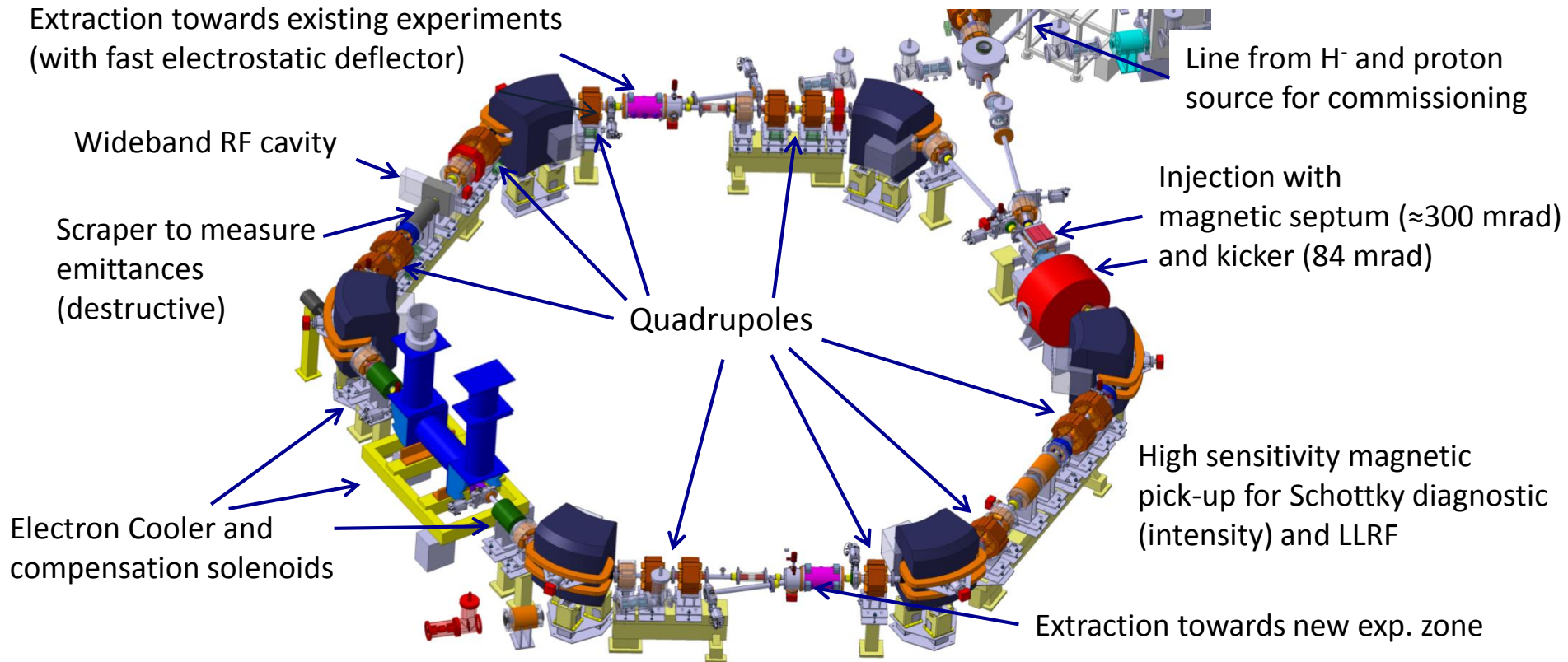
100 keV antiprotons
a shot every ~ 100 sec
shared by ~ 4 experiments

$\sim .45 \times 10^7$



Future situation with AD and ELENA decelerating to 100 keV:

- thinner „degrader” and increased trapping efficiency (some experiments use other means to decelerate the beam)
- intensity shared by four experiments allows longer periods with beam



- ❑ Deceleration of antiprotons from 5.3 MeV to 100 keV to improve efficiency of experiments
- ❑ Circumference of 30.4 m (1/6 the size of the AD)
 - ❑ Fits in available space in AD hall and allows installing all equipment without particular efforts

Total cost of the project equals to 26MCHF, from which CERN's contribution is 22.94MCHF. In order to facilitate the management of the project, one work package (WP) was created for each deliverables that has to be provided by groups around CERN. The ELENA WP 2.4 belongs to TE-EPC and it is splitted into 8 smaller sub-work packages.

Activity	Expenses total [CHF]
ELENA WP 2.4.1 – CANCUN Power Converters	300 000
ELENA WP 2.4.2 – Commercial Low Power Converters	195 000
ELENA WP 2.4.3 – APOLO Power Converters	253 000
ELENA WP 2.4.4 – HV Power Converters	352 000
ELENA WP 2.4.5 – Controls for HV Power Converters	98 000
ELENA WP 2.4.6 – Power Converter Control Electronics	305 000
ELENA WP 2.4.7 – High Precision Measurements (DCCTs)	55 000
ELENA WP 2.4.8 – Low Power Converters for Cooler	197 000

Total amount of money assigned to TE-EPC for ELENA project is **1 753 000CHF**.

More detailed information concerning the budget can be found under the following address <https://issues.cern.ch/browse/EPCCCS-2032>



Navigator

- ELENA Hardware Baseline
 - Layouts and Integration
 - Schedule Documentation
 - Magnets
 - Injection / Ejection Systems
 - Vacuum System
 - Power Converter Systems**
 - LNA-PM-MG-0002 (v.2.1) ELENA Work Package 2.4. - Electronic Power Converters (Part1)
 - 1539773 (v.2.1) HV ELENA Master sheet
 - 1539774 (v.2.3) Power Converters: ELENA summary
 - LNA-R-ES-0003 (v.2.0) Commercial Low Power Converters for ELENA's Ring Powering
 - LNA-R-ES-0004 (v.1.0) Functional Specification for the Powering of the ELENA Ion Switch
 - LNA-R-ES-0002 (v.2.1) High Voltage Power Converters for ELENA Transfer Lines: Correctors, Quads and Bending Elements
 - LNA-R-ES-0005 (v.1.0) Functional Specification for Cancun Power Converters for ELENA
 - LNA-R-ES-0006 (v.1.0) Commercial Low Power Converters for ELENA's Electron Cooler Powering
 - LNA-R-ES-0007 (v.1.0) Cancun Power Converters for the ELENA Electron Cooler
 - LNA-R-ES-0008 (v.1.0) Low Energy Power Converters for the ELENA Electron Cooler - Phase 1
 - LNA-R-ES-0009 (v.1.0) High Voltage Power Converters for the ELENA Electron Cooler
 - LNA-R-ES-0010 (v.2.0) Functional Specification of the Control System for ELENA's High Voltage Power Converters
 - LNA-PM-MG-0009 (v.1.1) ELENA Work Package 2.4 Electronic Power Converters (Part 2)
 - LNA-R-HCP-0001 (v.1.0) Test Procedure and Acceptance Criteria for the ELENA Magnet Circuits
 - Radiofrequency System
 - Beam Instrumentation
 - Electron Cooler
 - Supports and Alignment
 - H+/H- Source
 - Transfer Lines
 - Infrastructure
 - General Services
 - Installation
 - Safety and Access
 - Controls
 - LNA-PM-ER-0001 (v.1.0) ELENA Design Report

CERN-0000097845 Public access
Power Converter Systems

ID	Title	Version	Status	Release Date	Author	Category
20	LNA-PM-MG-0002	ELENA Work Package 2.4. - EL...	Approval Ac	2016-04-19	Michal Dudek	Managemen...
20	LNA-PM-MG-0002	ELENA Work Package 2.4. - EL...	Obsolete	2015-10-02	Michal Dudek	Managemen...
20	LNA-PM-MG-0002	ELENA Work-Package Descri...	Cancelled	2014-09-05	John Alistair Ba	Managemen...
20	LNA-PM-MG-0002	ELENA Work Package 2.4. - EL...	Approval Ac	2015-09-02	Michal Dudek	Managemen...
20	LNA-PM-MG-0002	ELENA Work Package 2.4. - EL...	Released	2016-09-26	Michal Dudek	Managemen...
20	LNA-PM-MG-0002	ELENA Work Package 2.4. - EL...	Obsolete	2016-04-19	Michal Dudek	Managemen...
30	LNA-R-ES-0003 v	Commercial Low Power Conv...	Approval Rt	2015-06-29	Nicolas Kuczen	Engineering ...
30	LNA-R-ES-0003 v	Commercial Low Power Conv...	Approval Ac	2015-08-25	Nicolas Kuczen	Engineering ...
30	LNA-R-ES-0003 v	Commercial Low Power Conv...	Released	2016-10-28	Nicolas Kuczen	Engineering ...
30	LNA-R-ES-0003 v	Commercial Low Power Conv...	Obsolete	2015-09-25	Nicolas Kuczen	Engineering ...
40	LNA-R-ES-0004 v	Functional Specification for the...	Cancelled	2015-11-11	Christophe Mac	Engineering ...
40	LNA-R-ES-0004 v	Functional Specification for the...	Released	2016-02-18	Christophe Mac	Engineering ...
40	LNA-R-ES-0004 v	Functional Specification for the...	Approval Ac	2016-02-09	Christophe Mac	Engineering ...
40	LNA-R-ES-0004 v	Functional Specification for the...	Approval Rt	2015-12-03	Christophe Mac	Engineering ...
40	LNA-R-ES-0004 v	Functional Specification for the...	Approval Rt	2016-01-28	Christophe Mac	Engineering ...
50	LNA-R-ES-0002 v	High Voltage Power Converters...	Released	2016-02-16	JOSE MANUEL	Engineering ...
50	LNA-R-ES-0002 v	High Voltage Power Converters...	Obsolete	2015-09-25	JOSE MANUEL	Engineering ...
60	LNA-R-ES-0005 v	Functional Specification for Ca...	Released	2016-03-29	Serge Pittet	Engineering ...
60	LNA-R-ES-0005 v	Functional Specification for Ca...	Approval Ac	2016-02-09	Serge Pittet	Engineering ...
60	LNA-R-ES-0005 v	Functional Specification for Ca...	Approval Rt	2016-01-06	Serge Pittet	Engineering ...
70	LNA-R-ES-0006 v	Commercial Low Power Conv...	Approval Ac	2016-01-11	Nicolas Kuczen	Engineering ...



WBS

- ⊖ HIEGYFRT: High energy frontier
 - ⊖ ELENA: ELENA
 - ⊖ ADU: AD upgrade
 - ⊖ ADU-PRJ: AD Upgrade
 - ⊖ ELENA: EXTRA LOW ENERGY ANTIPROTON RING
 - ⊖ ELENA 1: PROJECT MANAGEMENT & MACHINE
 - ⊖ ELENA 2: MACHINE
 - ⊖ ELENA 2.1: MECHANICAL DESIGN & SUPPO
 - ⊖ ELENA 2.2: MAGNETS
 - ⊖ ELENA 2.3: RF & SCHOTTKY PICK-UP
 - ⊖ ELENA 2.4: POWER CONVERTERS
 - ⊖ ELENA 2.4.1: CANCUN Converters
 - ⊖ ELENA 2.4.2: COMMERCIAL LOW POWER
 - ⊖ ELENA 2.4.3: APOLO CONVERTERS
 - ⊖ ELENA 2.4.4: HV CONVERTERS
 - ⊖ ELENA 2.4.5: HV POWER CONVERTERS C
 - ⊖ ELENA 2.4.6: POWER CONVERTER CONTR
 - ⊖ ELENA 2.4.7: HIGH PRECISION MEASURE

- ⊖ ELENA 2.5: VACUUM SYSTEM
- ⊖ ELENA 2.6: ELECTRON COOLER
- ⊖ ELENA 2.7: BEAM INSTRUMENTATION
- ⊖ ELENA 2.8: AD KICKERS HV GENERATORS
- ⊖ ELENA 2.9: ELECTROMECHANICAL HARDWA
- ⊖ ELENA 2.10: BEAM TRANSFERS (OPTICS +
- ⊖ ELENA 2.12: CONTROLS
- ⊖ ELENA 2.13: B TRAIN
- ⊖ ELENA 2.14: INTERLOCK SYSTEM
- ⊖ ELENA 2.15: H SOURCE
- ⊖ ELENA 2.16: MAGNETIC MEASURES
- ⊖ ELENA 2.18: ELECTRONICS FOR KICKER, SI
- ⊖ ELENA 3: INFRASTRUCTURE
- ⊖ ELENA 4: GBAR EXPERIMENTAL AREA
- ⊖ HIEISOLDEP: HIE-ISOLDE

Search: Year: Future Org unit: TE-EPC-CCS Filter: [Reset] [Search]

Workunits: 1- 28 of 28. Page size: 30

Workunits for future for WBS ELENA 2.4: POWER CONVERTERS

ID	Description	WBS	Holder	Start Date	Finish Date
133414	Power Converters Tested-SUBWP ELENA 2.4.1(CANCUN CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.1	S. Pittet (TE-EPC)	01-Sep-2015	18-Jul-2016
133415	Installation & Commissioning-SUBWP ELENA 2.4.1(CANCUN CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.1	S. Pittet (TE-EPC)	01-Jan-2016	31-Dec-2016
133424	CERN Development of Commercial Electronic K7 + Rack interfaces / Panels-SUBWP ELENA 2.4.2(COMMERCIAL LOW POWER CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.2	Y. Thurel (TE-EPC)	01-Sep-2014	01-Jul-2016
133428	CERN Commercial Converter Integration At CERN (DCCTS + Electronic + Power Source)-SUBWP ELENA 2.4.2(COMMERCIAL LOW POWER CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.2	Y. Thurel (TE-EPC)	01-Jul-2015	31-Aug-2016
133429	CERN Commercial Converter Racks Installation-SUBWP ELENA 2.4.2(COMMERCIAL LOW POWER CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.2	Y. Thurel (TE-EPC)	01-Oct-2015	31-Aug-2016
133430	CERN Commercial Converter Racks Commissioning At ELENA-SUBWP ELENA 2.4.2(COMMERCIAL LOW POWER CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.2	Y. Thurel (TE-EPC)	01-Nov-2015	31-Aug-2016
133438	Installation & Commissioning-SUBWP ELENA 2.4.3(APOLO CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.3	G. Le Godec (TE-EPC)	01-Jun-2015	29-Jul-2016
133662	Ion Switch design-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	01-Jan-2015	07-Apr-2016
133664	Laboratory testing-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	01-Jan-2015	01-Jul-2016
133660	Electron Cooler Gun Powering-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	01-Nov-2015	31-Mar-2017
133658	HV modules Reception Preseries-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	01-Nov-2015	02-Feb-2016
133663	Ion Switch production-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	01-Nov-2015	15-Sep-2016
133659	HV modules Reception Series-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	01-Mar-2016	18-Jul-2016
133665	Converters installed and commissioned-SUBWP ELENA 2.4.4(HV CONVERTERS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.4	J. De Paco Soto (TE-EPC)	02-May-2016	30-Jan-2017
133752	Lab testing-SUBWP ELENA 2.4.5(HV POWER CONVERTERS CONTROL)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.5	J. De Paco Soto (TE-EPC)	01-Jan-2015	04-Oct-2016
133753	Installation & Commissioning-SUBWP ELENA 2.4.5(HV POWER CONVERTERS CONTROL)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.5	J. De Paco Soto (TE-EPC)	01-Dec-2015	30-Jan-2017
133751	Reception tests-SUBWP ELENA 2.4.5(HV POWER CONVERTERS CONTROL)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.5	J. De Paco Soto (TE-EPC)	01-Mar-2016	04-Oct-2016
160948	Infrastructure - Ethernet Switches-SUBWP ELENA 2.4.6(POWER CONVERTER CONTROL ELECTRONICS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.6	B. Todd (TE-EPC)	01-Jan-2016	31-Dec-2016
160939	Research and Development - Materials-SUBWP ELENA 2.4.6(POWER CONVERTER CONTROL ELECTRONICS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.6	B. Todd (TE-EPC)	01-Jan-2016	31-Dec-2016
160944	FGC3 for CANCUN 50 Converters-SUBWP ELENA 2.4.6(POWER CONVERTER CONTROL ELECTRONICS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.6	B. Todd (TE-EPC)	01-Jan-2016	31-Dec-2016
160951	Infrastructure - FGC_Ether Address Dongles-SUBWP ELENA 2.4.6(POWER CONVERTER CONTROL ELECTRONICS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.6	B. Todd (TE-EPC)	01-Jan-2016	31-Dec-2016
160949	Infrastructure - Ethernet Pulse Injectors-SUBWP ELENA 2.4.6(POWER CONVERTER CONTROL ELECTRONICS)-WP ELENA 2.4(POWER CONVERTERS)	ELENA 2.4.6	B. Todd (TE-EPC)	01-Jan-2016	31-Dec-2016



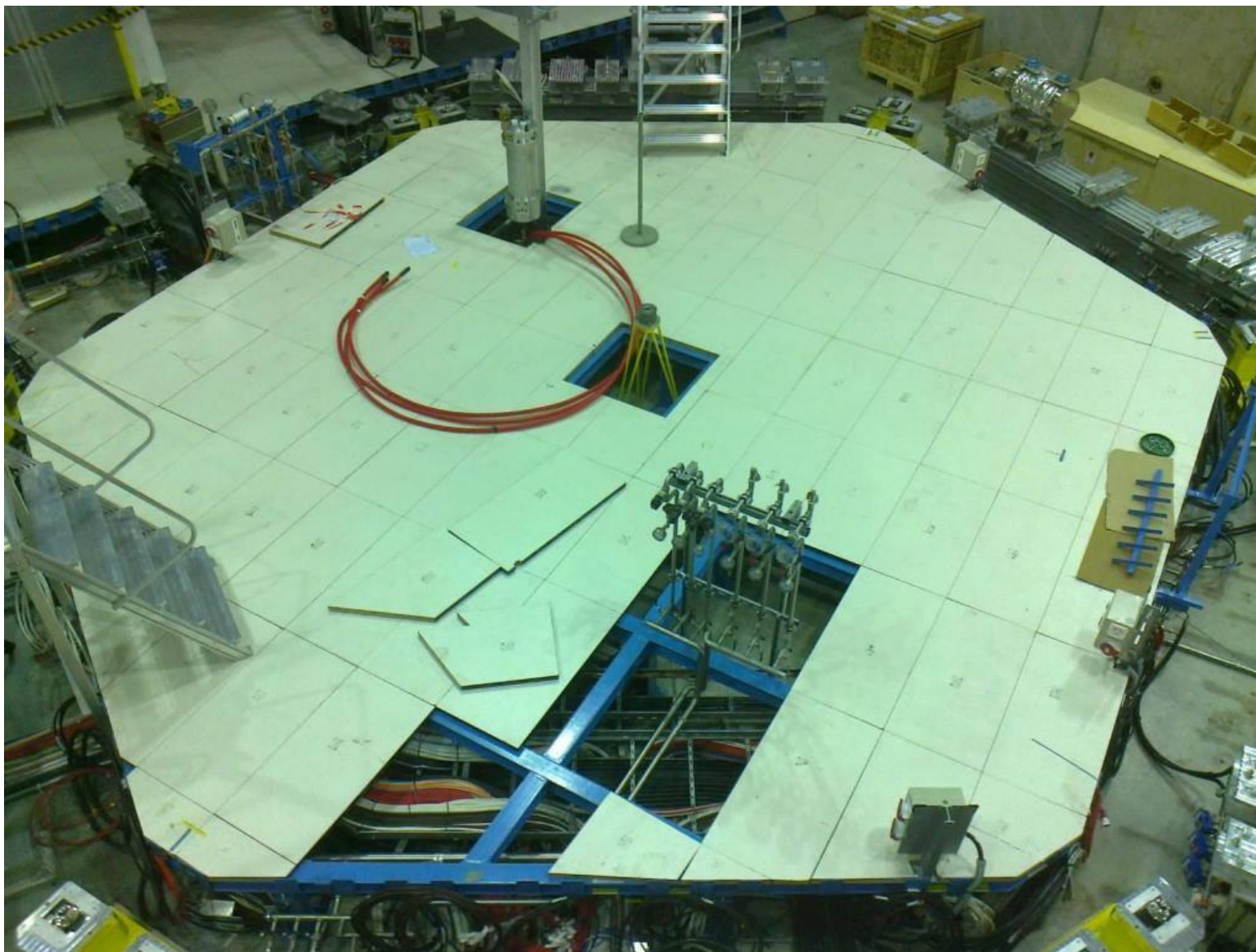
Budget -- cet.cern.ch

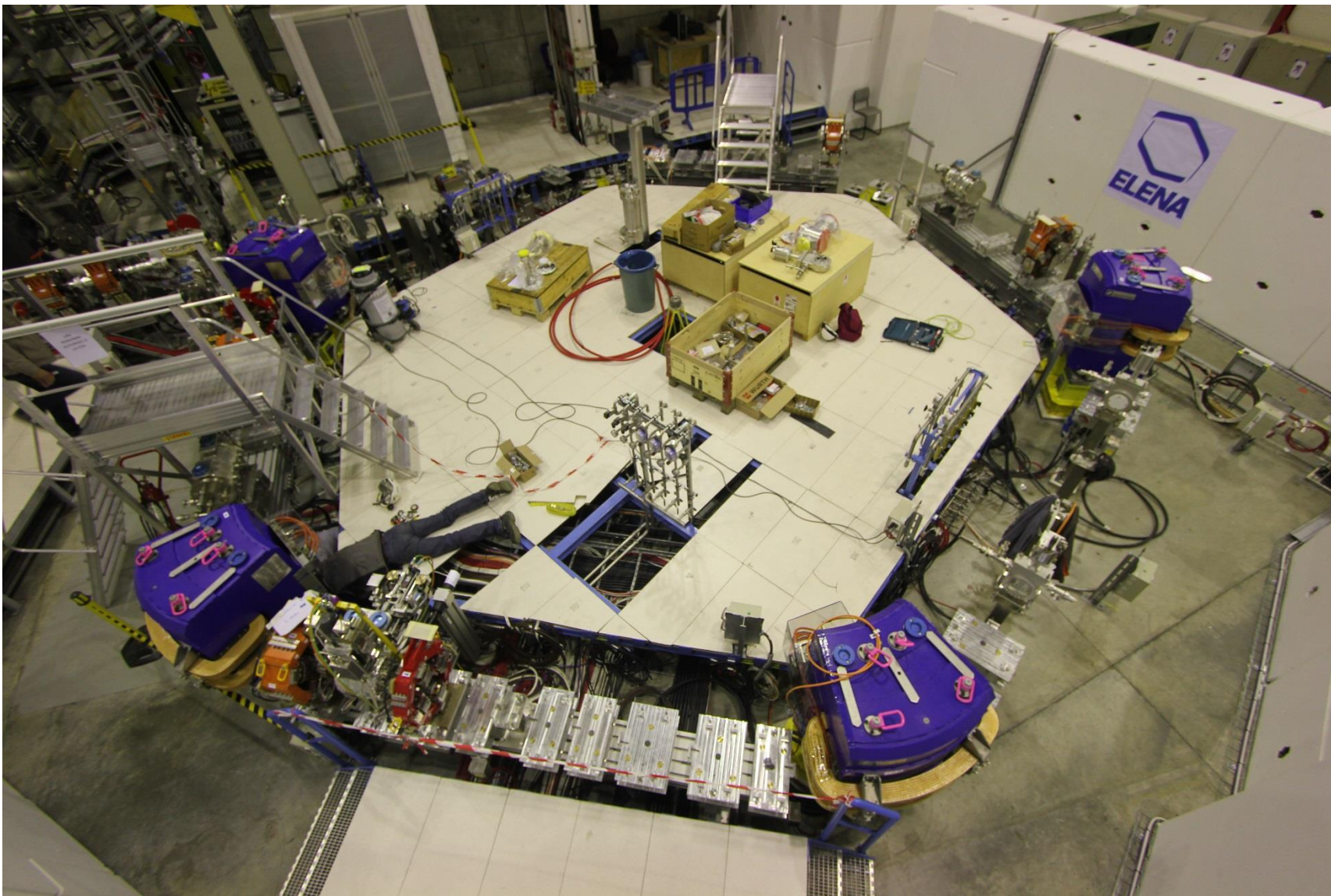


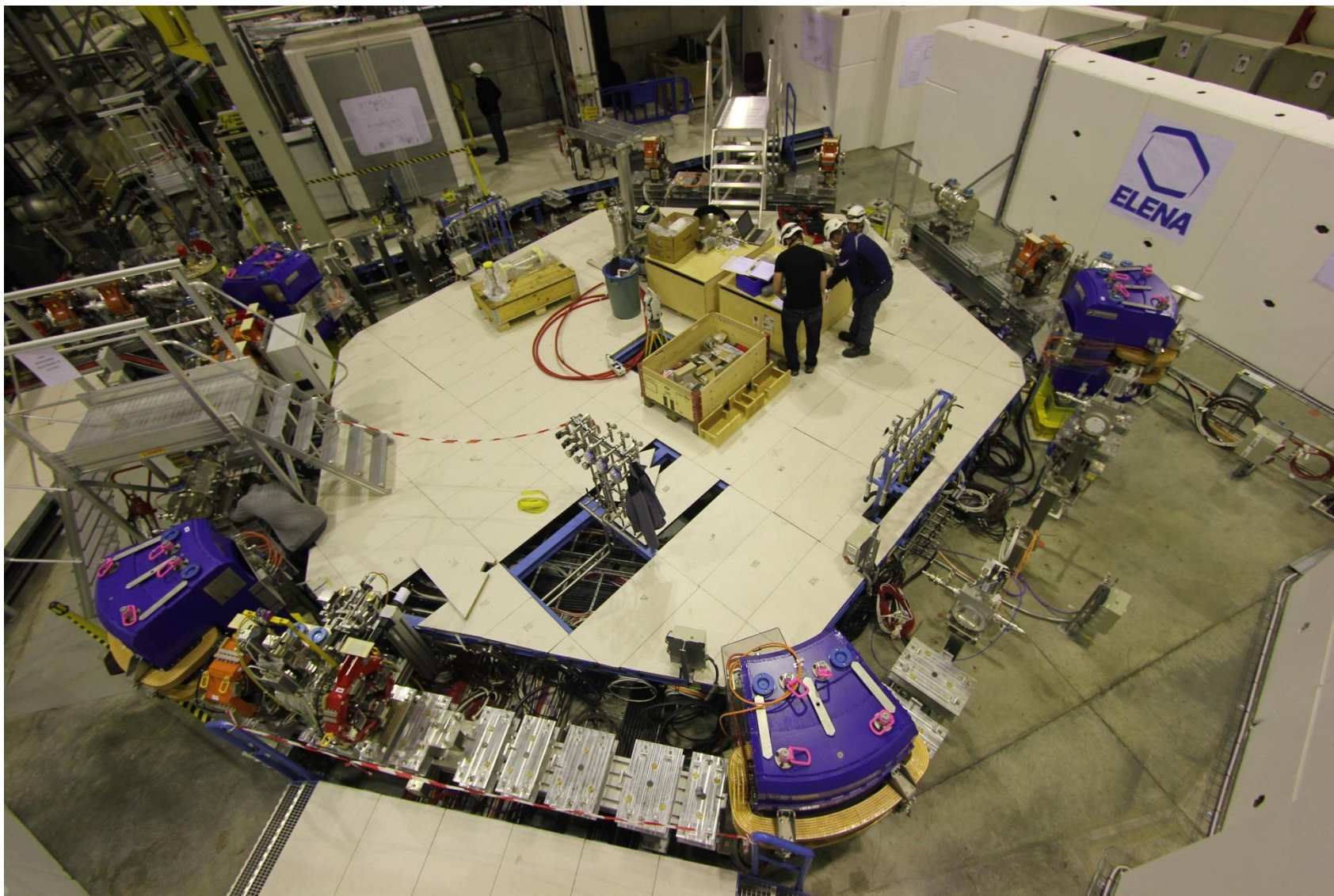
ELENA - ADELN-C (1602-1603)									
99293	OL6310966	864-TIRAGE CABLES TIMING AU 864 & 866 (1602-1603)	GROS Guillaume	Y213AGA116 24.05.2016	25.02.2016	286.20	286.20		91
99293	OL6383782	193-EPL_FGC3 AD ELENA - ADELN-CC9 (1605-1606)	BURDELSKI Pawel Andrzej	Y213AFA527 08.08.2016	11.05.2016	56.00	56.00		91
99293	OV6291464	193-ETHERNET PC TO EPI - ELENA - ADELN-C (1602-1603)	BURDELSKI Pawel Andrzej	C213AFA508 16.09.2016	12.02.2016	6,201.72	6,201.72		91
99293	OV6310965	864-TIRAGE CABLES TIMING AU 864 & 866 (1602-1603)	GROS Guillaume	C213AGA116 03.06.2016	25.02.2016	334.13	334.13		91
99293	OV6383784	193-EPL_FGC3 AD ELENA - ADELN-CC9 (1605-1606)	BURDELSKI Pawel Andrzej	C213AFA527 05.08.2016	11.05.2016	874.14	874.14		91
99293	TTID_TID0780373	FGC3 / RegFGC3 2016: COMBO (#7)		6556646 21.10.2016	21.10.2016	1,975.00	1,975.00		
99293	TTID_TID0780375	FGC3 / RegFGC3 2016: CUTE (#9)		6556648 27.10.2016	27.10.2016	56,700.00	56,700.00		
99293	TTID_TID0780426	FGC3 / RegFGC3 2016: various (6556713 27.10.2016	27.10.2016	63,600.00	63,600.00		
99293	TTID_TID0780560	FGC3 / RegFGC3 2016: supp. ele		6564768 01.11.2016	01.11.2016	59,025.00	59,025.00		
Subtotal for 99293:						224,276.96	228,107.94	3,830.98	11,283.00
99294	CA6169374	1200A DCCTs for ELENA	HUDSON Gregory	6169374 19.02.2016	01.00.2016	9,031.74	9,031.74		91
99294	CA6414858	70 13A DCCTs for the CUTE Converters	HUDSON Gregory	6414858 20.10.2016	15.06.2016	16,472.60	16,472.60		91
99294	CA6508791	VHP202 Resistors	CERQUEIRA BASTOS Miguel	6508791 17.11.2016	13.09.2016	1,017.00	1,465.21	448.21	72
99294	CL6389882	Goupilles cylindriques,INOX,A1 / A2	PINGET Bernard Maurice	6389882 28.06.2016	13.05.2016	117.98	117.98		91
99294	CL6508801	resistor S102 for CUTE proto	CERQUEIRA BASTOS Miguel	6508801 16.09.2016	12.09.2016	229.66	229.66		91
99294	FD15914	TRANSPORT DE MARCHANDISES		18.03.2016	18.03.2016	197.04	197.04		91
99294	MAGA 1605	Magasins 05-16		27.05.2016	27.05.2016	21.50	21.50		
Subtotal for 99294:						27,087.52	27,535.73	448.21	
Grand total:						743,078.33	761,431.27	18,352.94	11,283.00
Rows returned: 296									

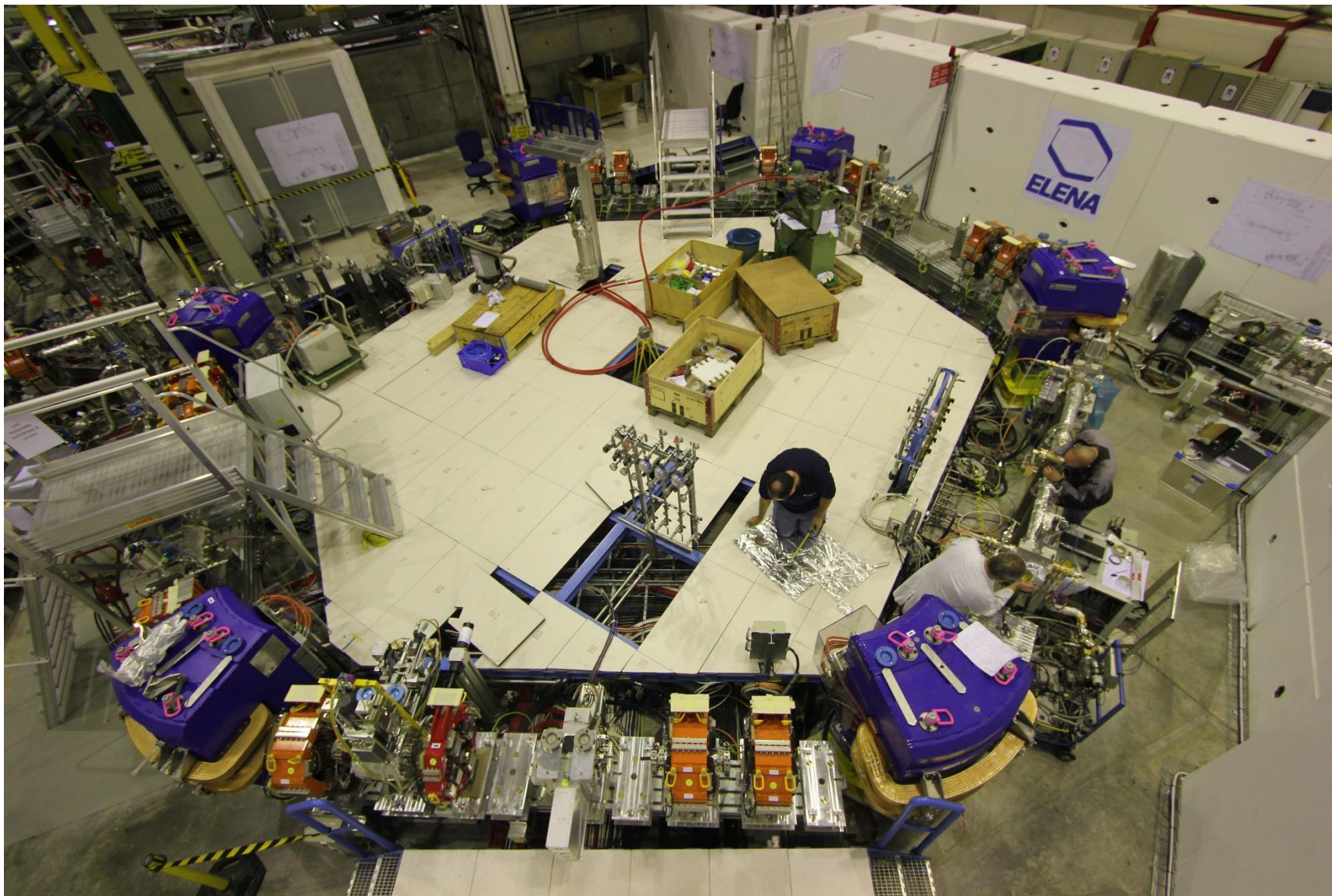
Budget Code Breakdown:									
Budget Code	Charged to Budget Code (CHF)	Annual Commitment (CHF)	Annual Open Commitment (CHF)	Payment Budget (CHF)	Pipeline (CHF)	Commitments incl. Pipeline (CHF)	Balance (Including Pipeline) (CHF)	Balance (Excluding Pipeline) (CHF)	Percentage Budget Used (Including Pipeline)
68250	32,074.95	40,276.76	8,201.81	87,000.00	0.00	40,276.76	46,723.24	46,723.24	46.30
99250	1,036.15	4,080.15	3,044.00	65,000.00	0.00	4,080.15	60,919.85	60,919.85	6.28
99287	18,038.29	19,516.57	1,478.28	89,000.00	0.00	19,516.57	69,483.43	69,483.43	21.93
99288	149,190.65	149,742.68	552.03	145,000.00	0.00	149,742.68	-4,742.68	-4,742.68	103.27
99291	272,523.30	272,523.29	-0.01	328,000.00	0.00	272,523.29	55,476.71	55,476.71	83.09
99292	18,850.51	19,648.15	797.64	87,000.00	0.00	19,648.15	67,351.85	67,351.85	22.58
99293	224,276.96	228,107.94	3,830.98	234,000.00	11,283.00	239,390.94	-5,390.94	5,892.06	102.30
99294	27,087.52	27,535.73	448.21	19,000.00	0.00	27,535.73	-8,535.73	-8,535.73	144.92
Grand Total:	743,078.33	761,431.27	18,352.94	1,054,000.00	11,283.00	772,714.27	281,285.73	292,568.73	73.31

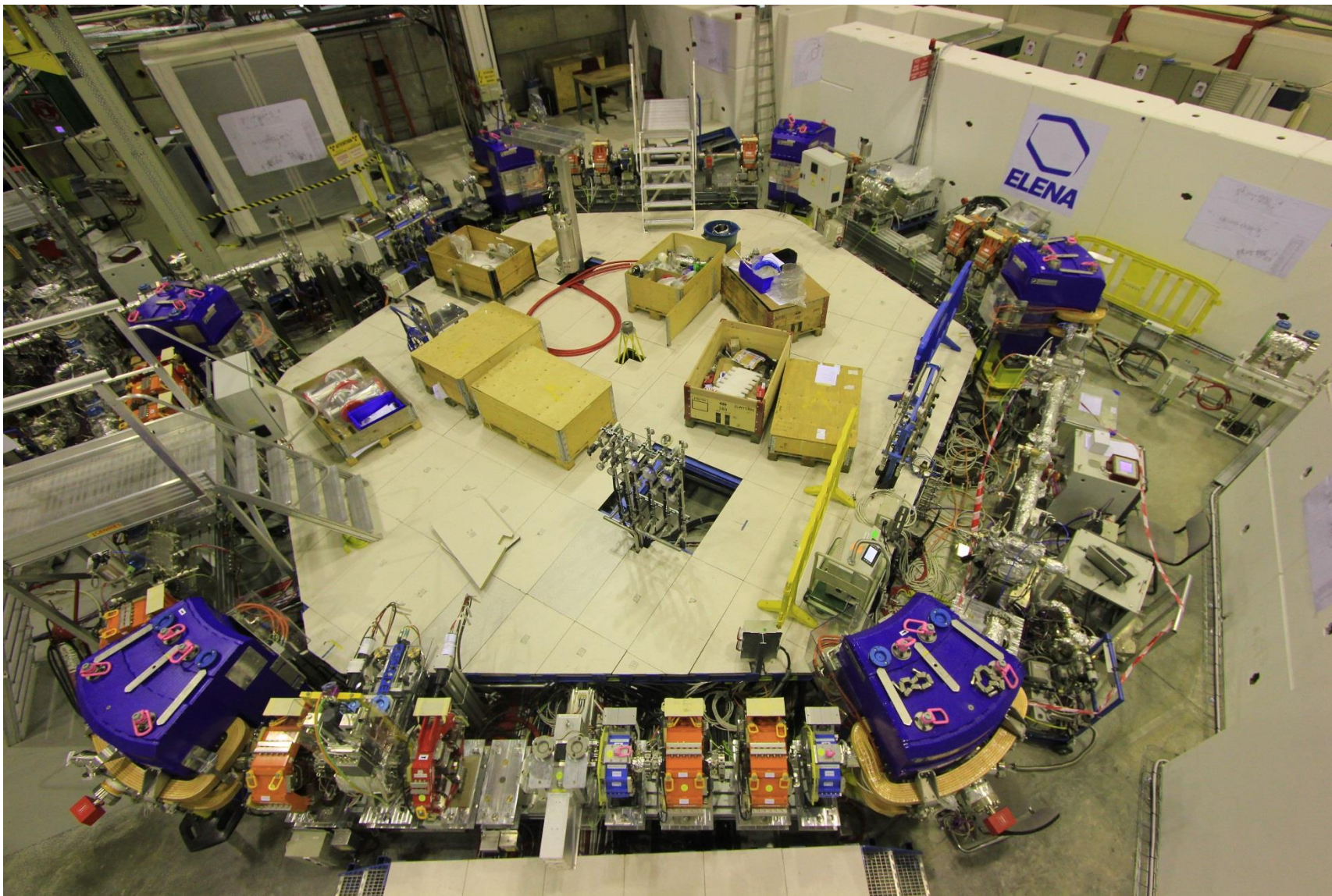
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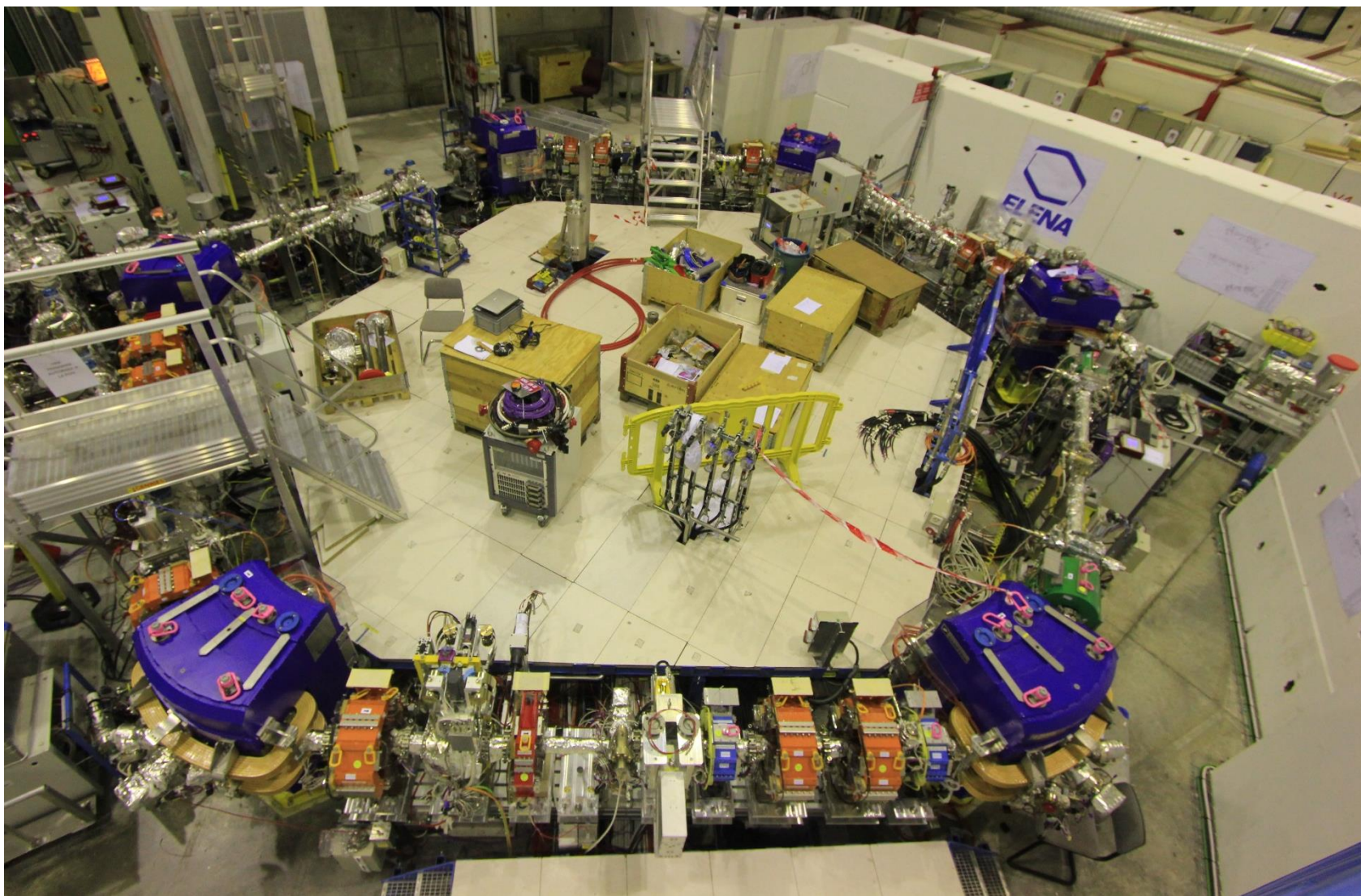


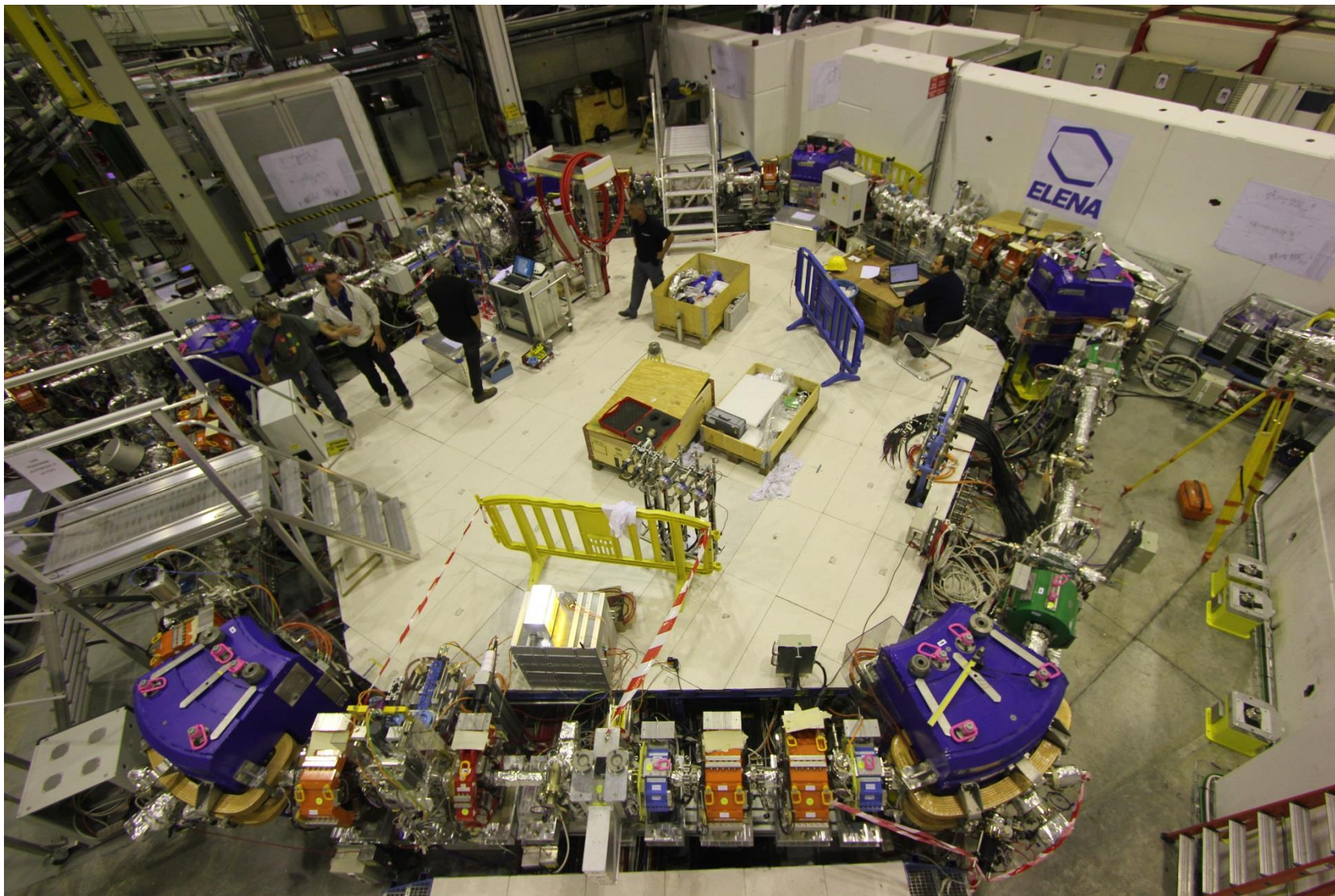












Timelapse

<https://cds.cern.ch/record/2220715>







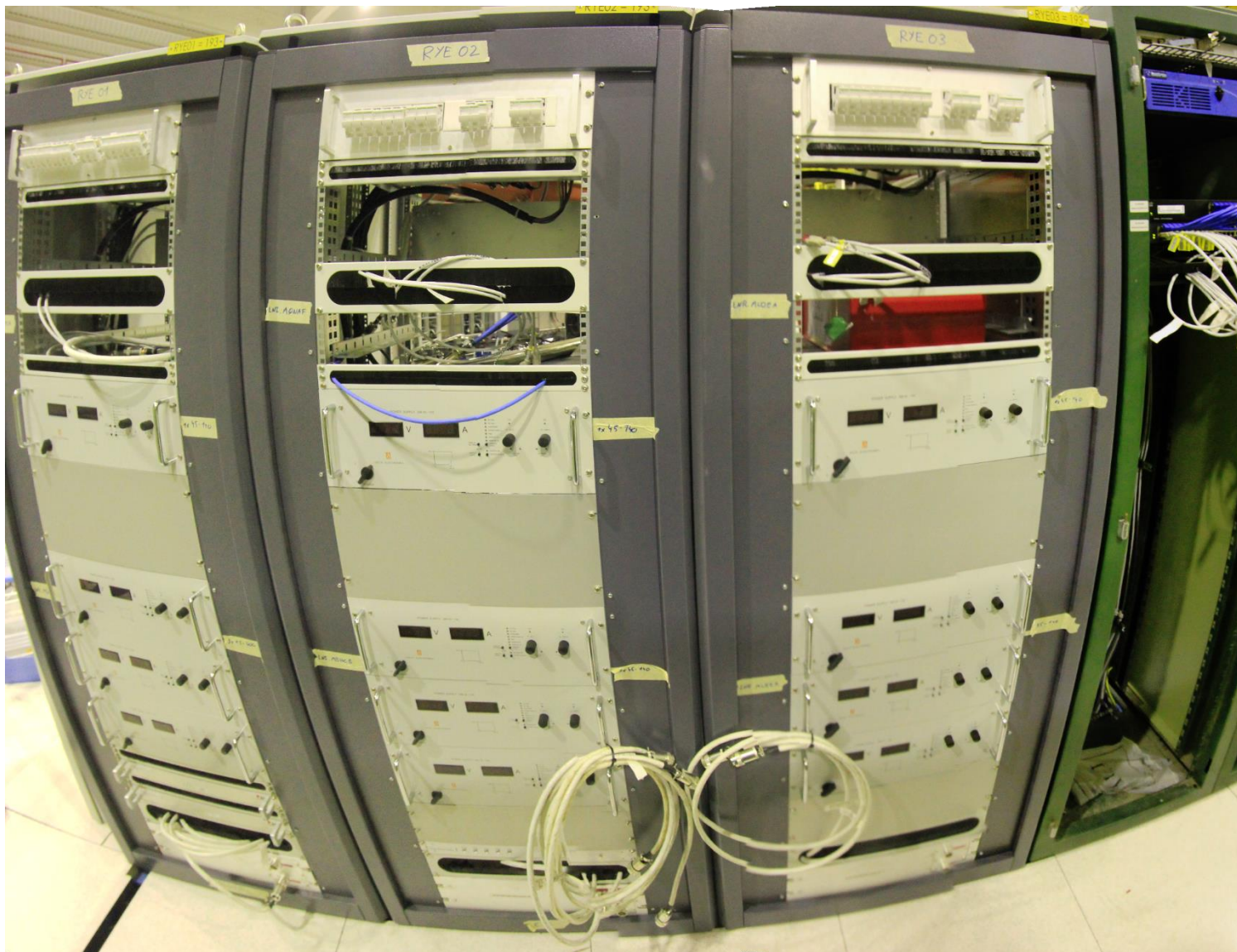


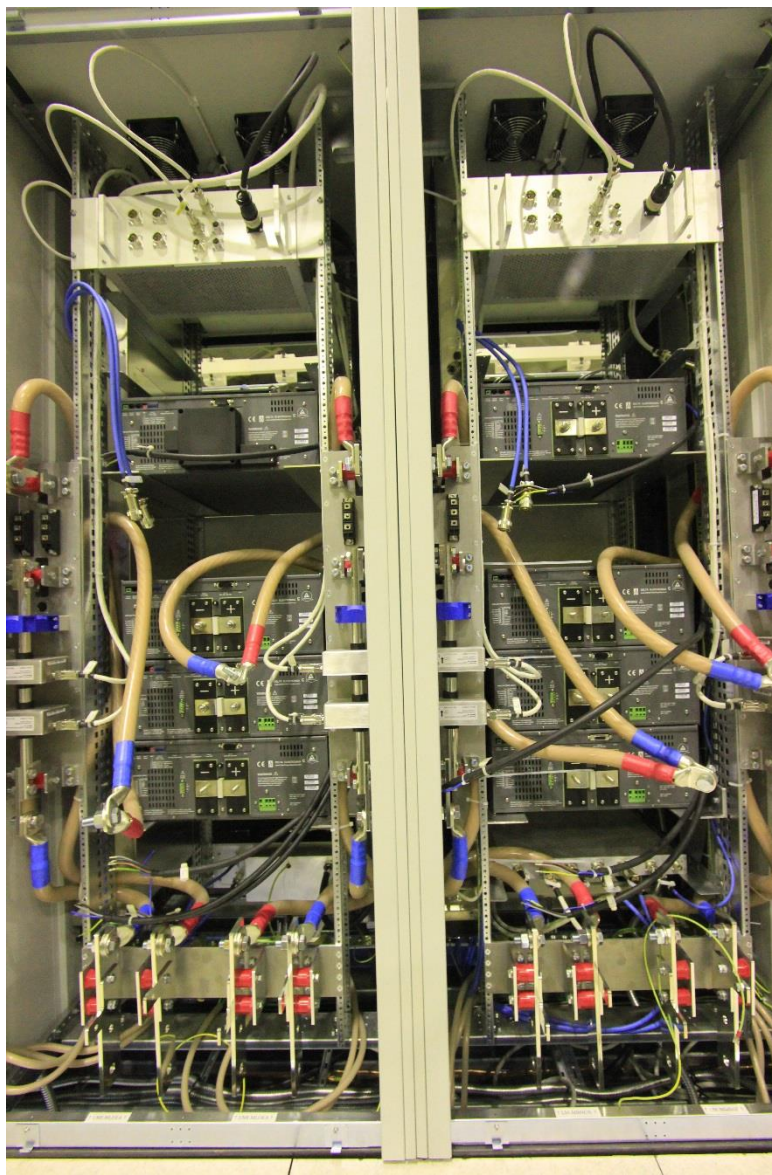








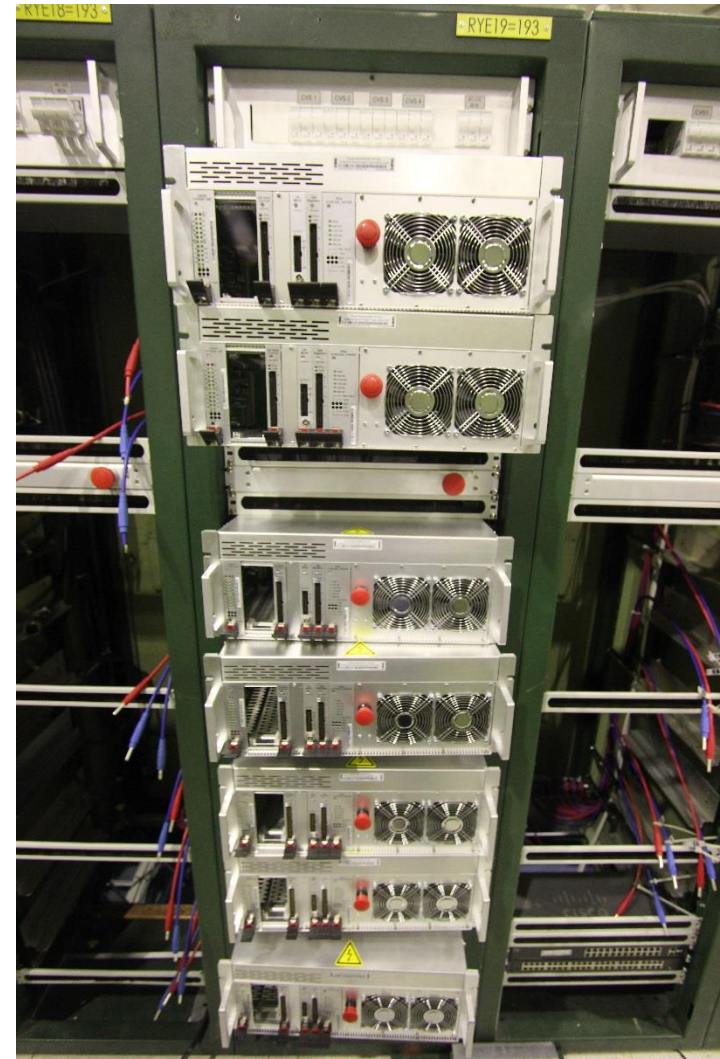
















Power converters on time ✓

Powering tests successful ✓

Magnetic tests successful ✓

Electron cooler in progress ⌚





Commissioning of electrical circuits



		C - must be consulted				X - executes work				I - must be informed			D - takes decision			d - mutually takes decision			
Power converter name	OP Naming	Nominal current [A]	Safety clearance	Power converter individual system test (DC cables disconnected)	Magnet DC cables connection	Magnet cooling & water leaks checks	Nominal R	Measured R	Resistance to ground at 1kV checks	ELOA checks	W/C <-> magnets tests	W/C <-> power converters tests	Power converters DC cables connection and loop tuning, 10% Inom	Magnets connected to correct power converters 10% Inom	Loop tuning, 100% Inom	Magnet polarity test 50% Inom	Overnight run Inom (heat distribution test) + abs_err	Performance tests (min, 50% Inom, Inom)	Released for ELENA OP
RPADG.193.LNR.RBH.0640	LNR.BHZ	326	OKAY	OKAY	B=2737441A / R=2737440A B=2737442A / R=2737441A B=2737443A / R=2737442A B=2737444A / R=2737443A B=2737445A / R=2737444A B=2737446A / R=2737445A B=2737447A / R=2737446A	OKAY OKAY OKAY OKAY OKAY OKAY	322,5 mΩ	346 mΩ	12,5 MΩ	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY -- N on top	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY
RPAAN.193.LNR.RQF.0205	LNR.QFND	37	OKAY	OKAY	B=2737449A / R=2737448A B=2737450A / R=2737449A B=2737451A / R=2737450A B=2737452A / R=2737451A B=2737454A / R=2737453A B=2737455A / R=2737454A	OKAY OKAY OKAY OKAY OKAY OKAY	555,2 mΩ	627,5 mΩ	313,0 GΩ	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY -- S on top right	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	OKAY OKAY OKAY OKAY OKAY OKAY	
RPAAN.193.LNR.RQD.0210	LNR.QDND	37	OKAY	OKAY	B=2737456A / R=2737455A B=2737457A / R=2737456A B=2737459A / R=2737458A	OKAY OKAY OKAY	555,2 mΩ	627,5 mΩ	253,0 GΩ	OKAY OKAY OKAY	OKAY OKAY OKAY	OKAY OKAY OKAY	OKAY OKAY OKAY	OKAY OKAY OKAY	OKAY -- N on top right	OKAY OKAY OKAY	OKAY OKAY OKAY	OKAY OKAY OKAY	

