

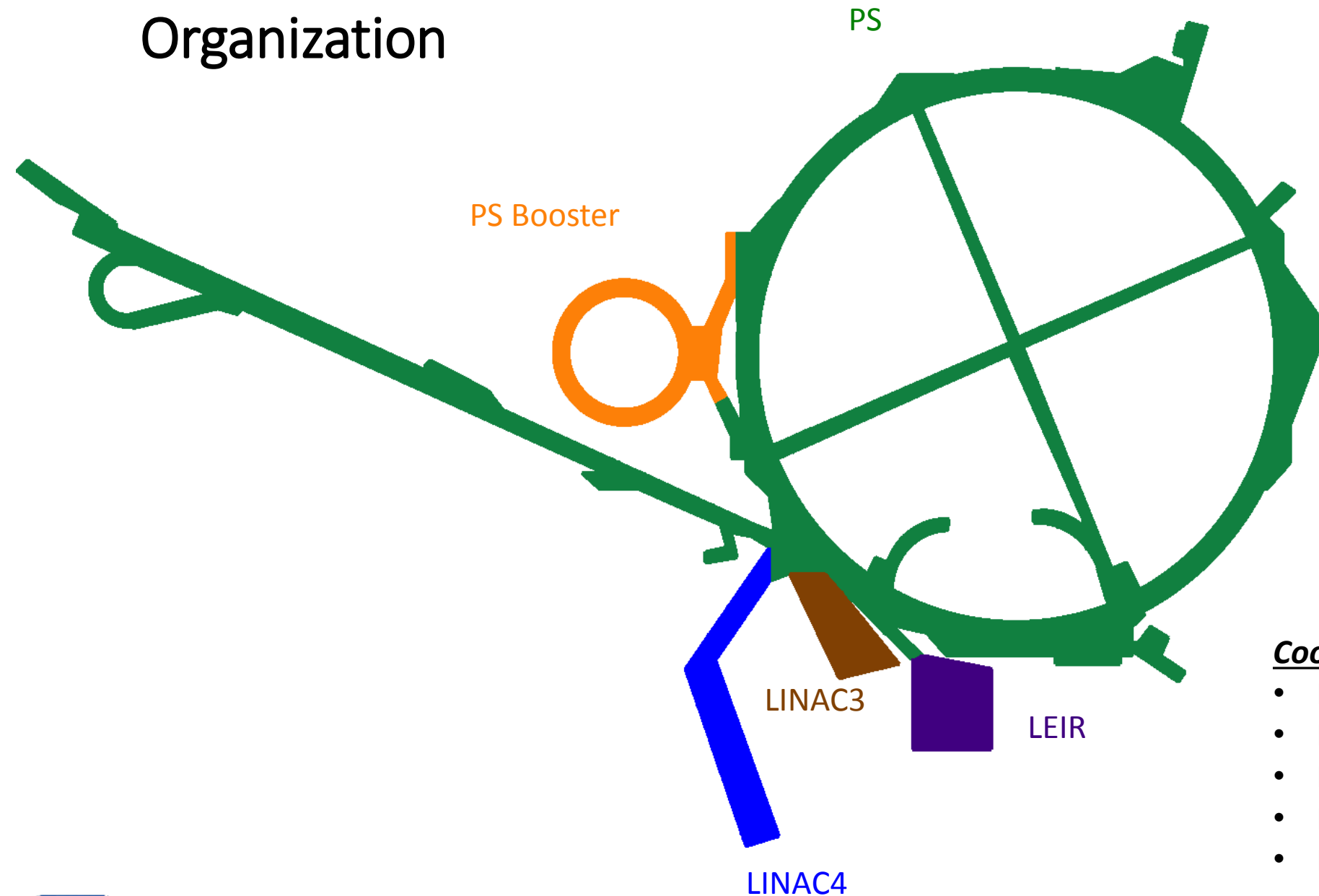
Picture-review of the PS Complex (L3/LEIR/L4/PSB/PS/TT2)

Fernando PEDROSA

on behalf of the injectors Facility Coordinators

LEIR, LINAC3, LINAC4, PS Booster, PS and TT2

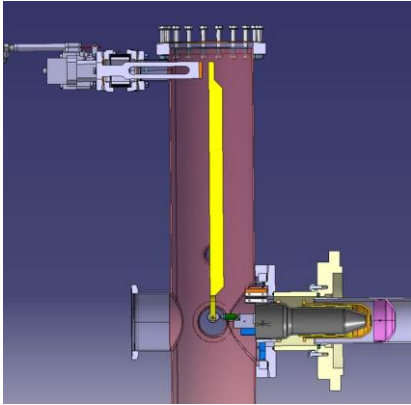
Organization



Coordination:

- LEIR – C. Wetton (BE-OP)
- LINAC3 – C. Mastrostefano (BE-ABP)
- LINAC4 – L. Timeo (BE-RF)
- PS Booster – D. Hay (EN-ACE)
- PS & TT2 – F. Pedrosa (EN-ACE)

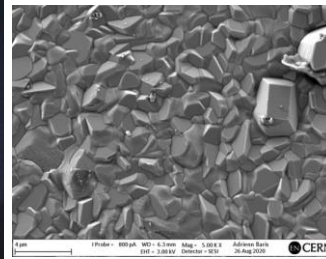
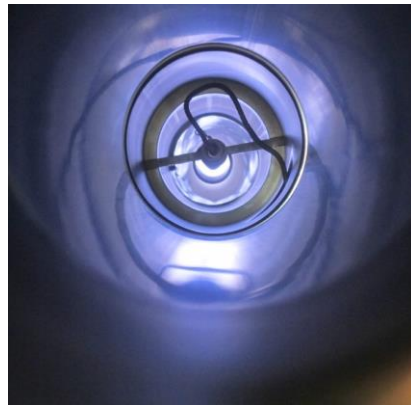
LINAC3 LS2 works in pictures



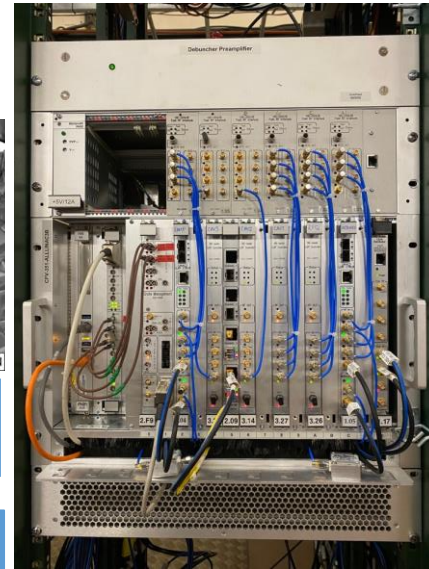
New source movable puller system



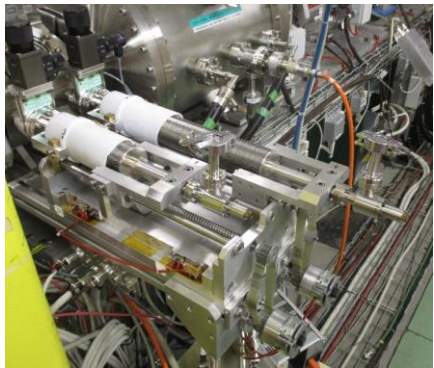
New source Al coated plasma chamber



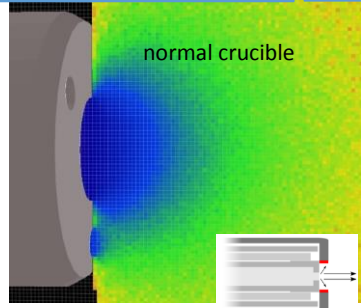
≈ 20 μm thick Al coating



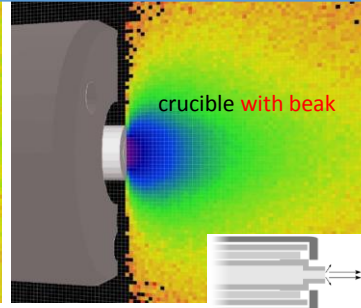
New Low Level RF system



New stripper foil tank & mechanics



normal crucible

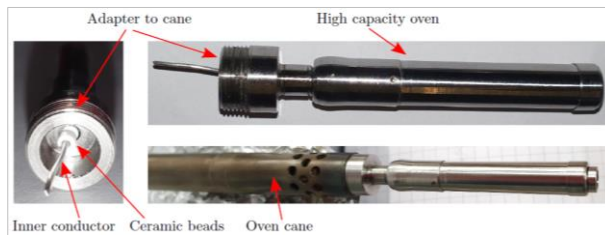


crucible with beak



New source crucible tip to prevent lead oxide blockage

New high-capacity oven (collaboration with Dubna)



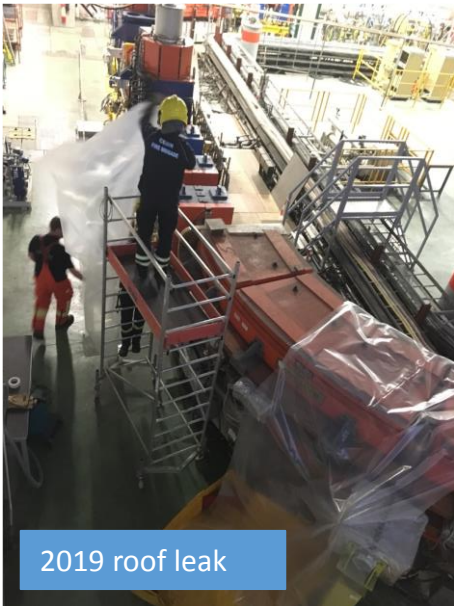
Replacement of the complete heating and ventilation system and asbestos removal



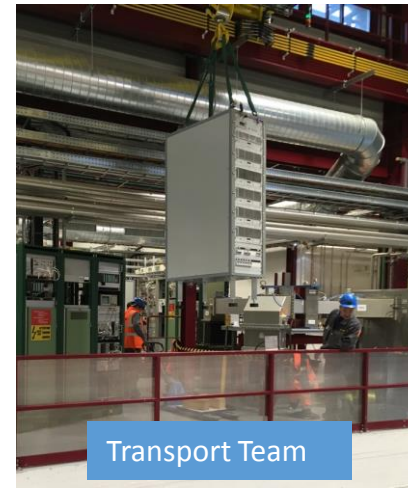
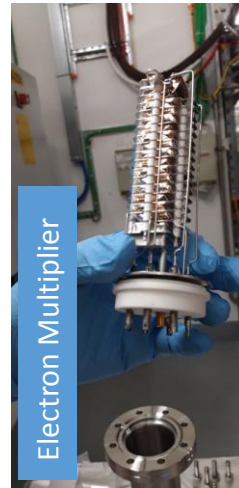
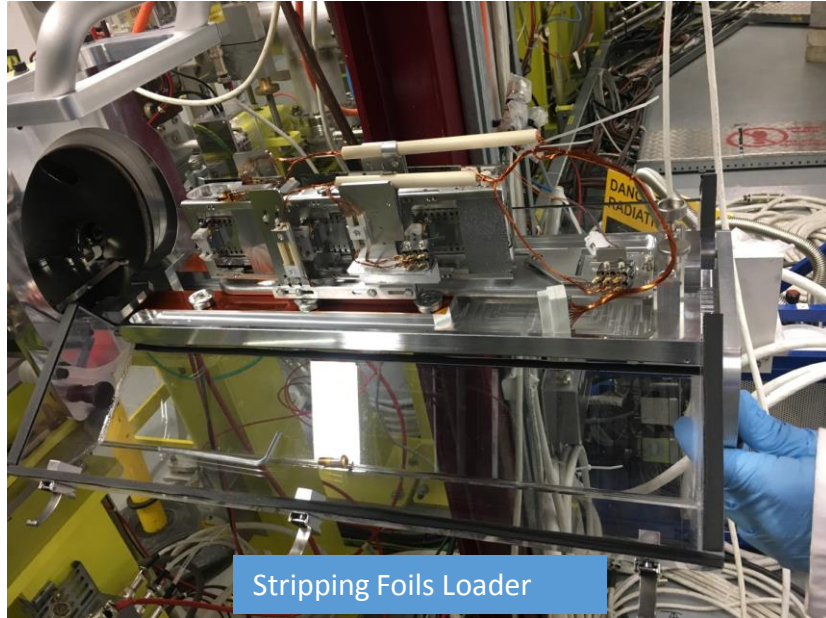
LEIR LS2 works in pictures



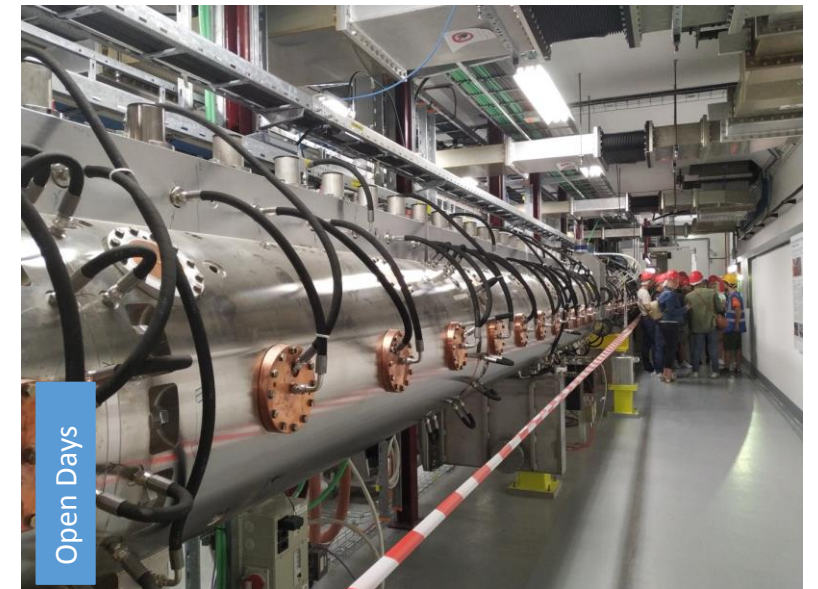
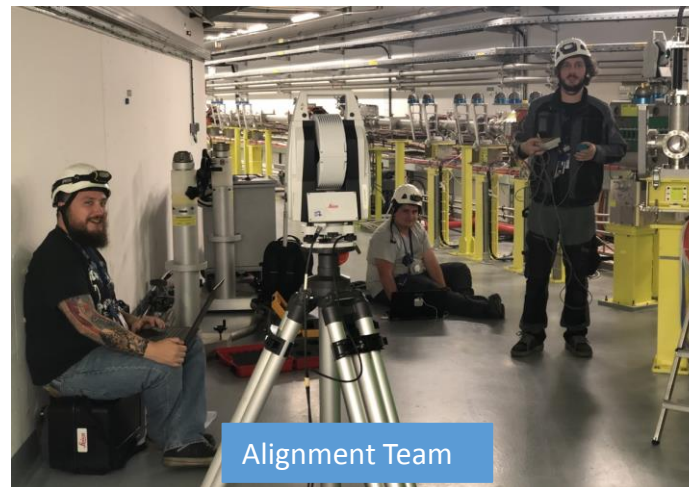
Magnet consolidation



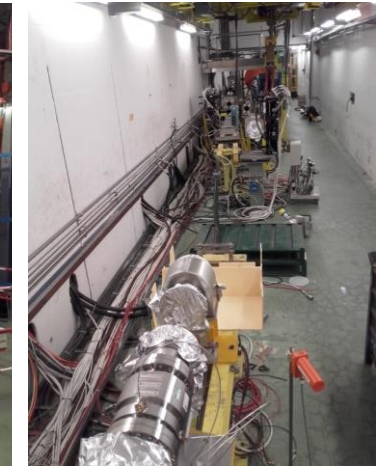
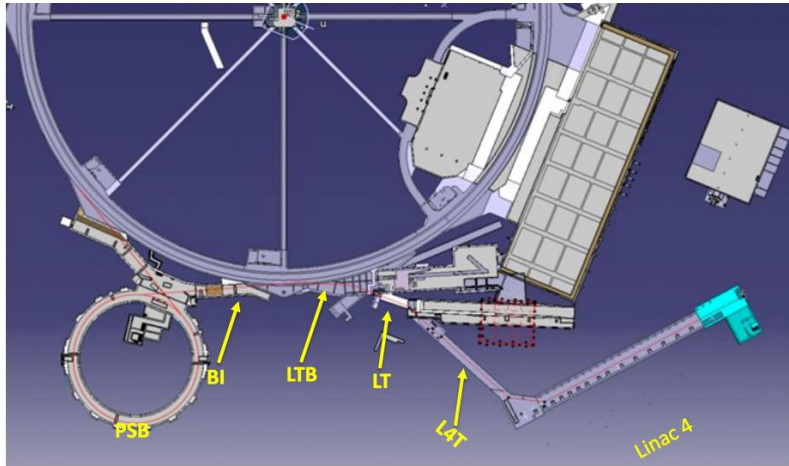
LINAC4 LS2 works in pictures



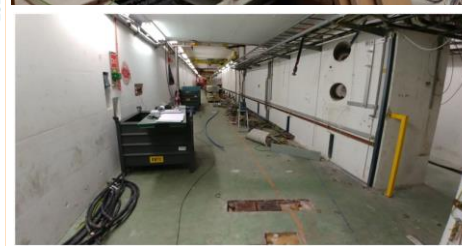
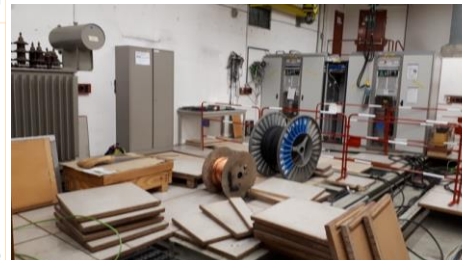
- 1 social media event
- 2 dedicated 3MeV runs
- 3 DSO tests
- 281 Impact documents



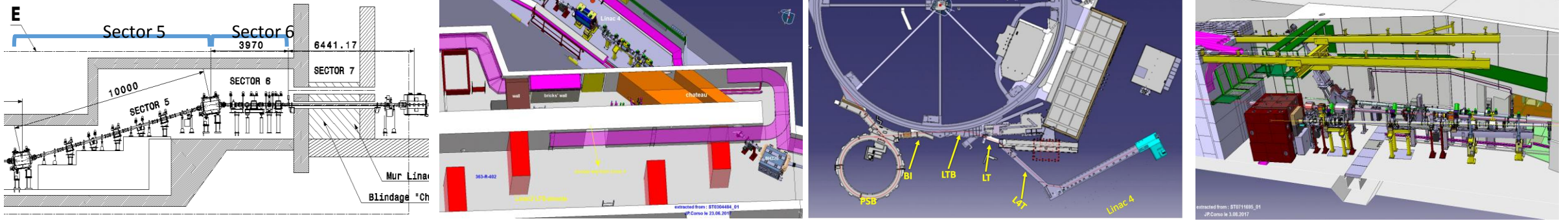
LINAC4 connection in pictures (LIU)



Dismantling before installation (e.g. LINAC2, Beam Emittance measurement line, ...)



LINAC4 connection in pictures

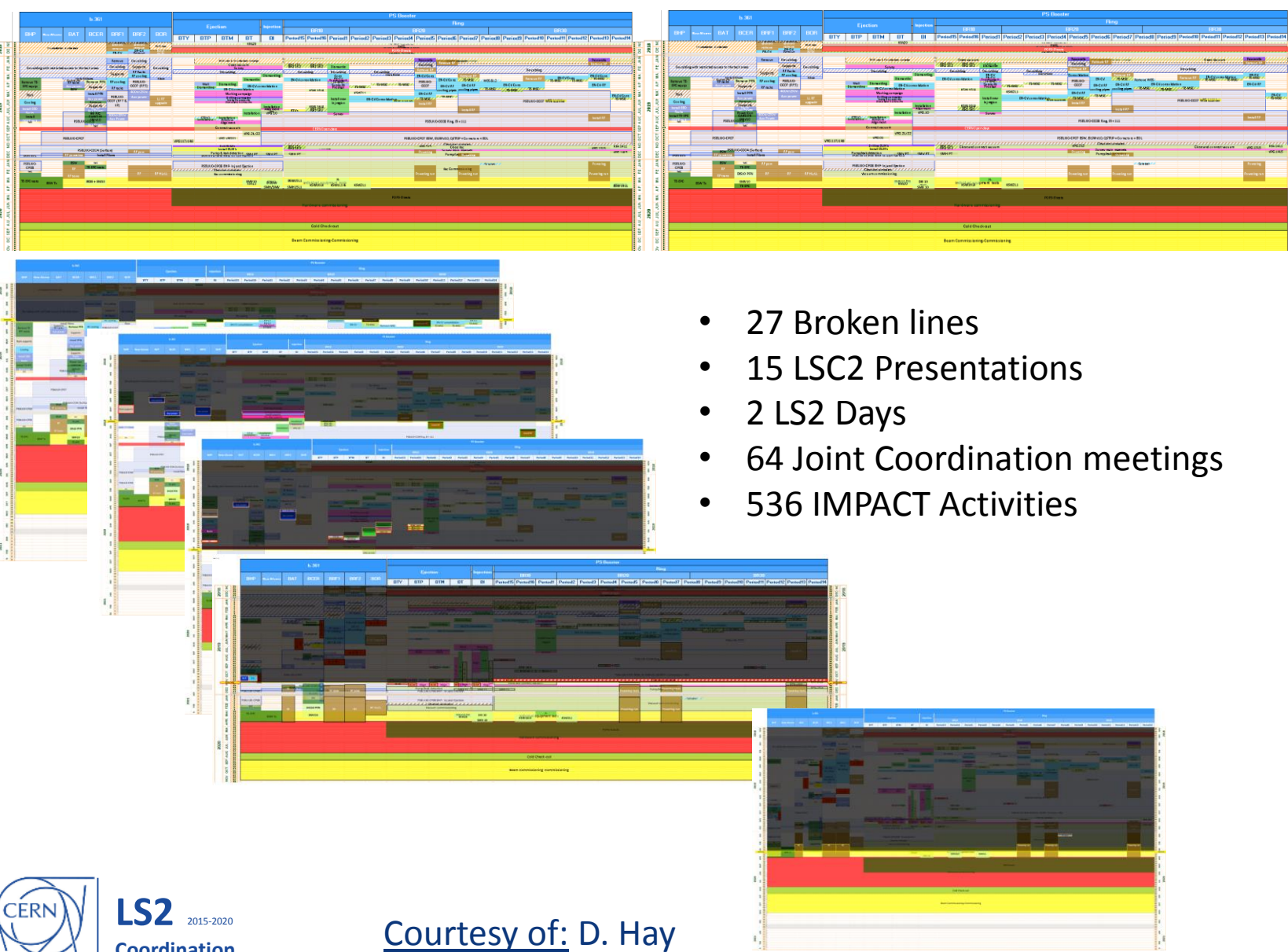


Connection of the Linac4 to the LT.BHZ20 and Reconfiguration of the Beam Emittance measurement Line (LBE) in the PS Switch Yard

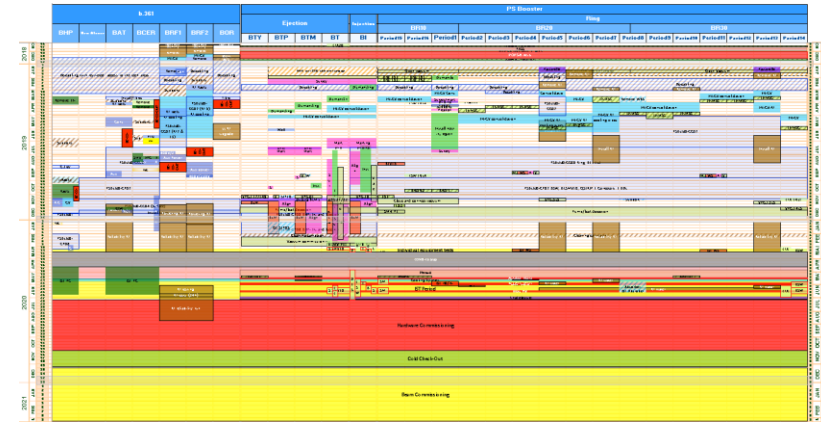


LT.BHZ20

PSB LS2 works in pictures (evolution)

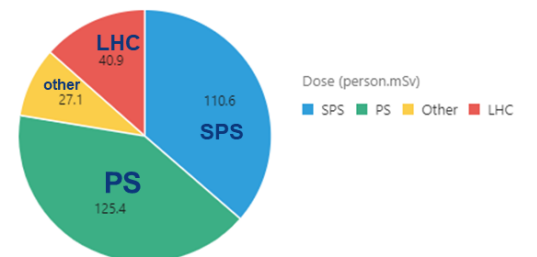


- 27 Broken lines
- 15 LSC2 Presentations
- 2 LS2 Days
- 64 Joint Coordination meetings
- 536 IMPACT Activities

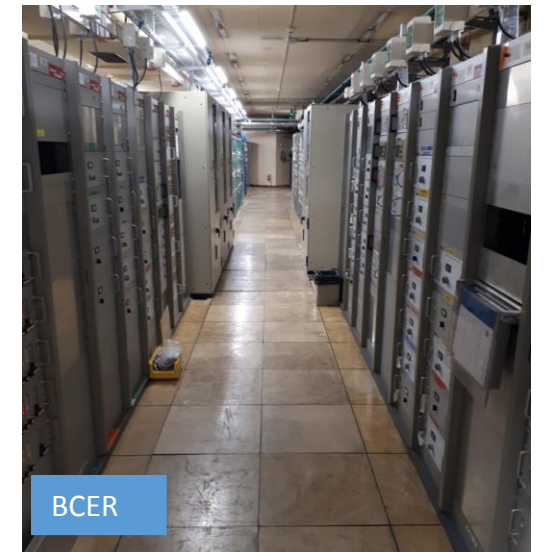
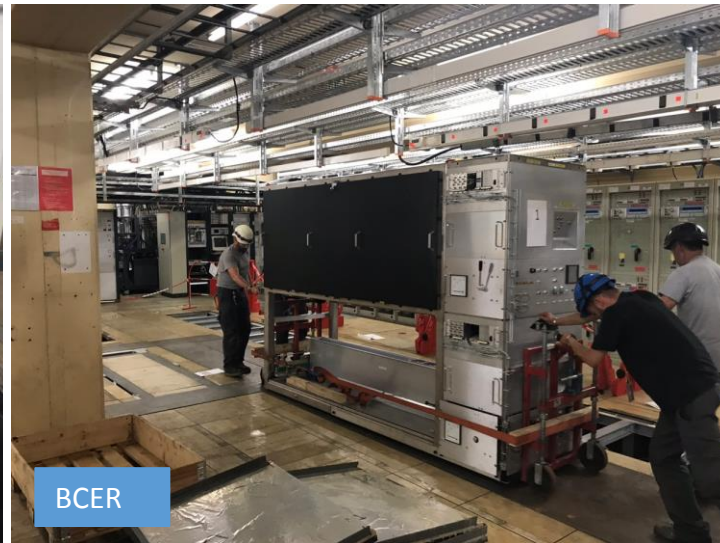
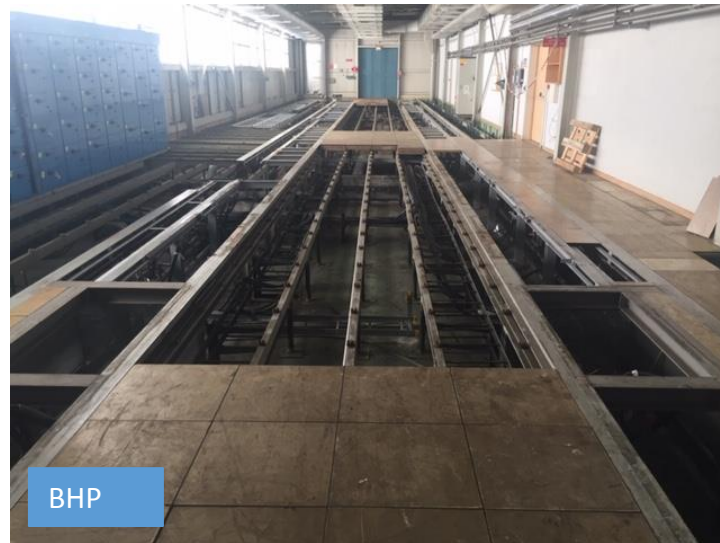


Facility	ALARA Committee	INDICO Site	Intervention	Collective dose (person.mSv)		Max. ind. dose (mSv)		DMR	Comments
				Estimated	Actual	Estimated	Actual		
PS	21-Sep-18	INDICO 724929	Renovation of PS main required units	33.5	25.4	1.5	1.5	DMR 724929	Finished
PSB	15-Oct-18	INDICO 724929	Disassembling of the PSB injection region and the BE and BT transfer beam	5.9	5.4	0.4	0.4	DMR 724929	Finished
PS	02-Nov-18	INDICO 724929	PS Line Voltage distribution system refurbishment	24.3	11.7	1.2	0.9	DMR 724929	Finished
SPS	09-Nov-18	INDICO 724929	Fire safety system SPS - part 1: Installation portable escape fire (WFS1)	1.8	1.3	0.7	0.6	DMR 724929	Finished
			Fire safety system SPS - part 1: Fire detection (WFS)	6.7	6.6	0.8	0.8	DMR 724929	Finished
			Fire safety system SPS - part 1: Dry risers (WFS)	7.3	5.1	0.9	0.8	DMR 724929	Finished
SPS	22-Nov-18	INDICO 724929	Fire safety system SPS - part 1: Sprinklers (WFS)	7.6	1.4	1.2	0.3	DMR 724929	Finished
			SPS safety lighting infrastructure installation	18.0	9.9	1.4	1.1	DMR 724929	Finished
AD target	25-Jan-19	INDICO 724929	AD target area disassembling	8.0	6.9	0.9	0.7	DMR 724929	Finished
ISOLDE	11-Jan-19	waited	ISOLDE HPS front end exchange	9.0	0.5	1.6	0.6	DMR 724929	Finished
SPS	08-Feb-19	INDICO 726273	SPS dump removal	9.1	4.9	0.7	0.8	DMR 726273	Finished
FA target	01-Mar-19	INDICO 801786	East area target area renovation - F&E PS facility	1.5	1.0	0.1	0.1	DMR 726273	Finished
SPS	08-Mar-19	INDICO 801939	SPS electrostatic septum magnet exchange	4.4	3.0	0.5	0.4	DMR 726273	Finished
n_TOT	09-Apr-19	INDICO 818516	n_TOT target exchange	10.2	3.3	1.0	0.5	DMR 726273	Finished
PS	23-Jul-19	INDICO 818516	PS asbestos clearing	8.3	4.8	1.4	0.8	DMR 726273	Finished
SPS	20-Sep-19	INDICO 818929	Fire safety system SPS - part 2: Fire detection (WFS2)	10.3	3.8	1.0	0.9	DMR 726273	Finished
BDF target	11-Oct-19	INDICO 853278	Fire safety system SPS - part 2: Dry risers (WFS)	0.8	0.8	0.15	0.1	DMR 726273	Finished
			Fire safety system SPS - part 2: Sprinklers (WFS)	15.2	4.2	1.6	0.8	DMR 726273	Finished
SPS	05-Dec-19	INDICO 867679	Beam Dump Facility test target removal	0.5	0.2	0.09	0.05	DMR 726273	Finished
SPS	15-Jan-20	INDICO 867679	Part 1 (De-cabling, PPS, GEM, Fire Safety)	5.2	4.9	0.7	0.7	DMR 726273	Finished
SPS	15-Jan-20	INDICO 877420	Part 2 (ES, Wires and MS/MSM cabling)	12.7	9.1	1.0	1.0	DMR 726273	Finished
SPS target	11-Jan-21	INDICO 877420	LSC2 beamline reinstallation	8.1	4.3	0.6	0.4	DMR 726273	Finished
SPS target	11-Jan-21	INDICO 877420	TCC crane refurbishment					DMR 726273	Finished

Dose by complex in person · mSv



PSB LS2 works in pictures - surface



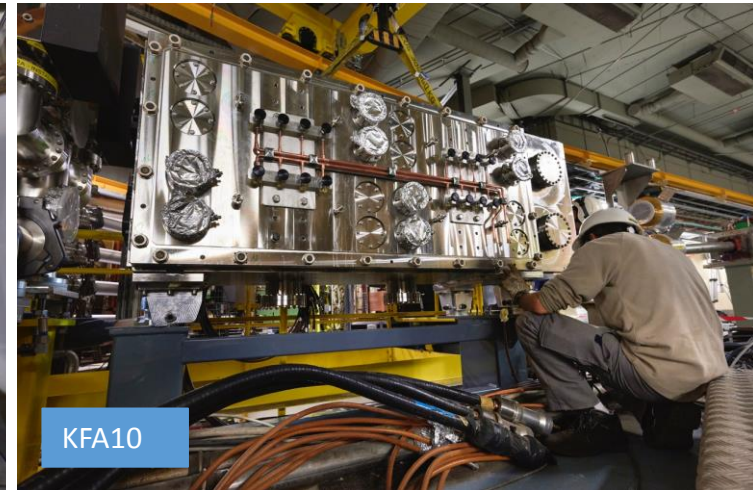
PSB LS2 works in pictures



Dismantled lines



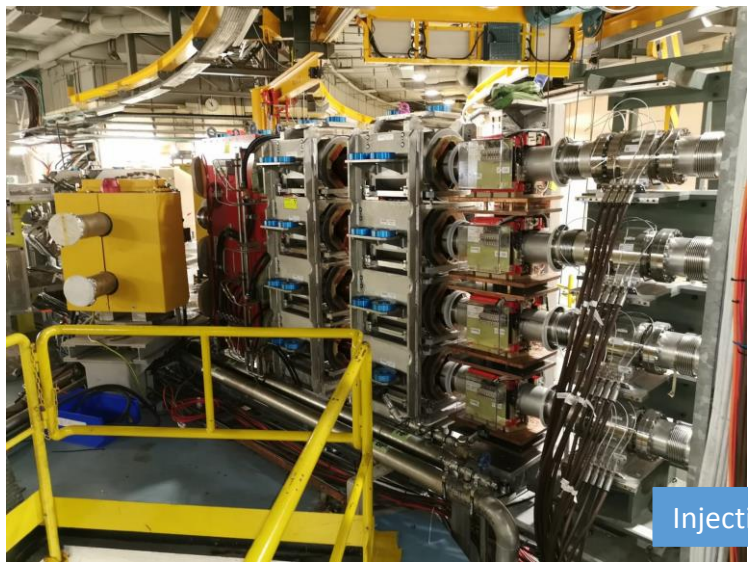
Beam stoppers



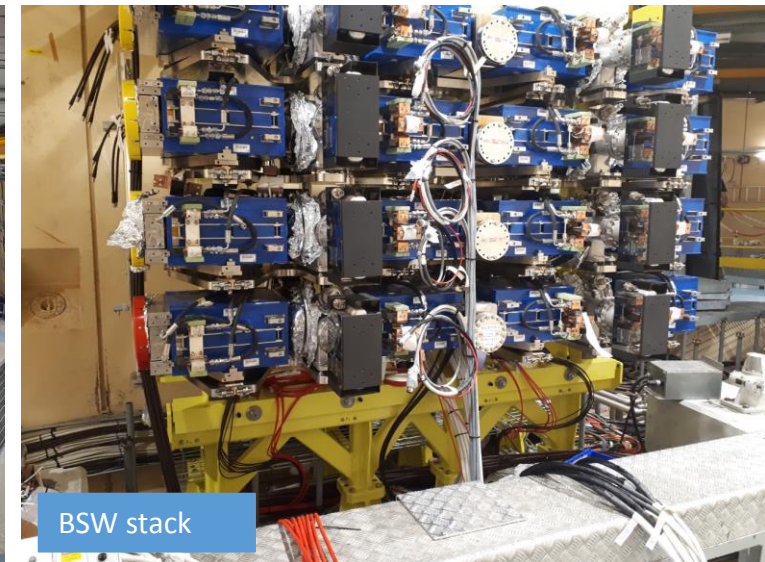
KFA10



BSW transformers



Injection Line

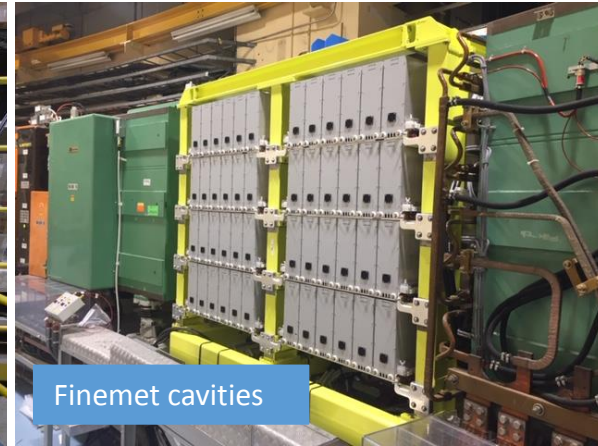


BSW stack

PSB LS2 works in pictures



15L1 magnet



Finemet cavities



BHZ1



Cooling pipes



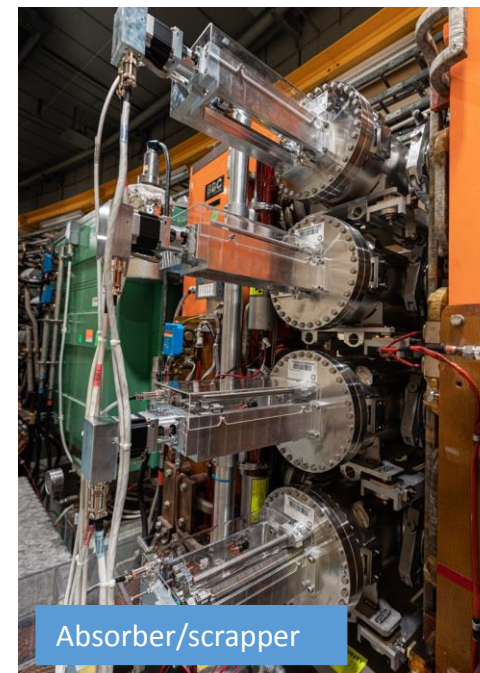
Dismantling



Cabling



Wire Scanners

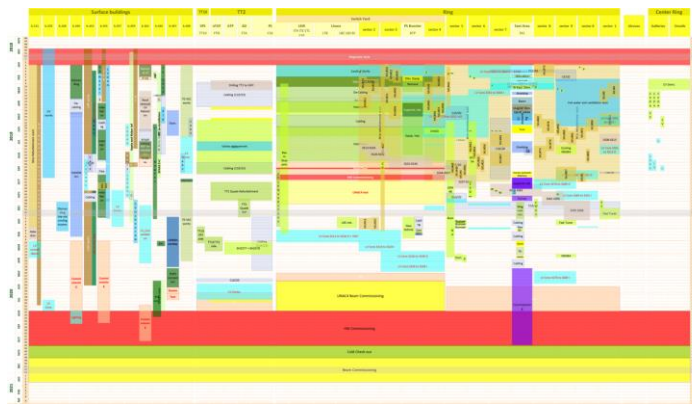
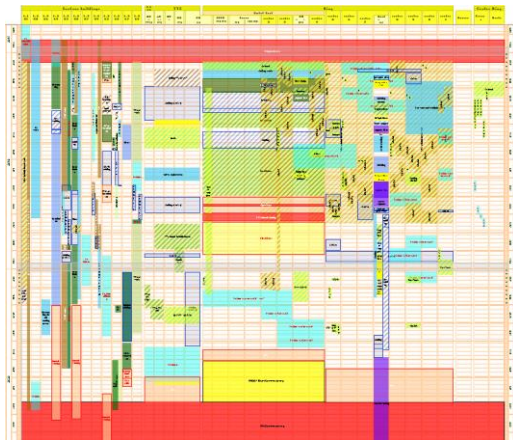
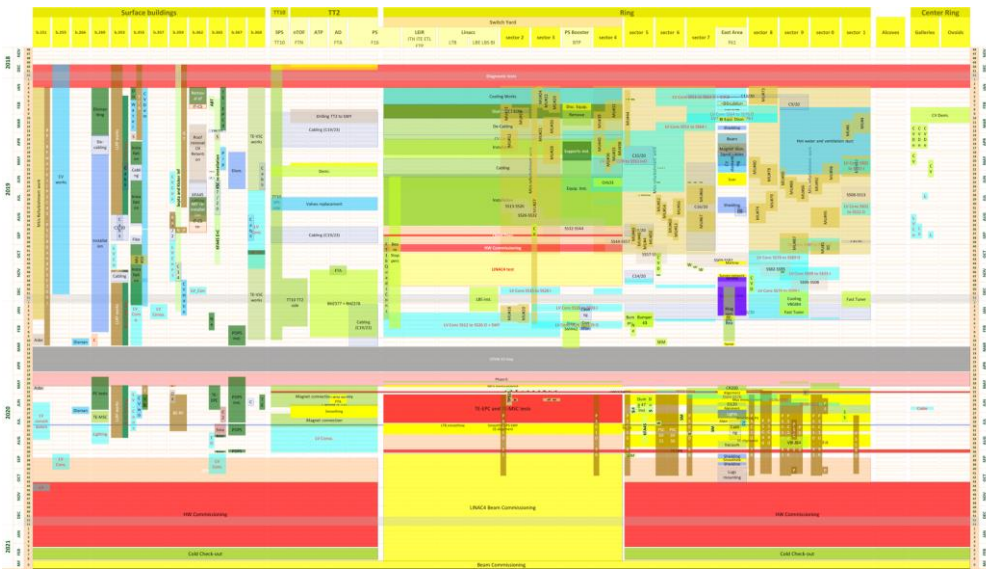


Absorber/scrapper

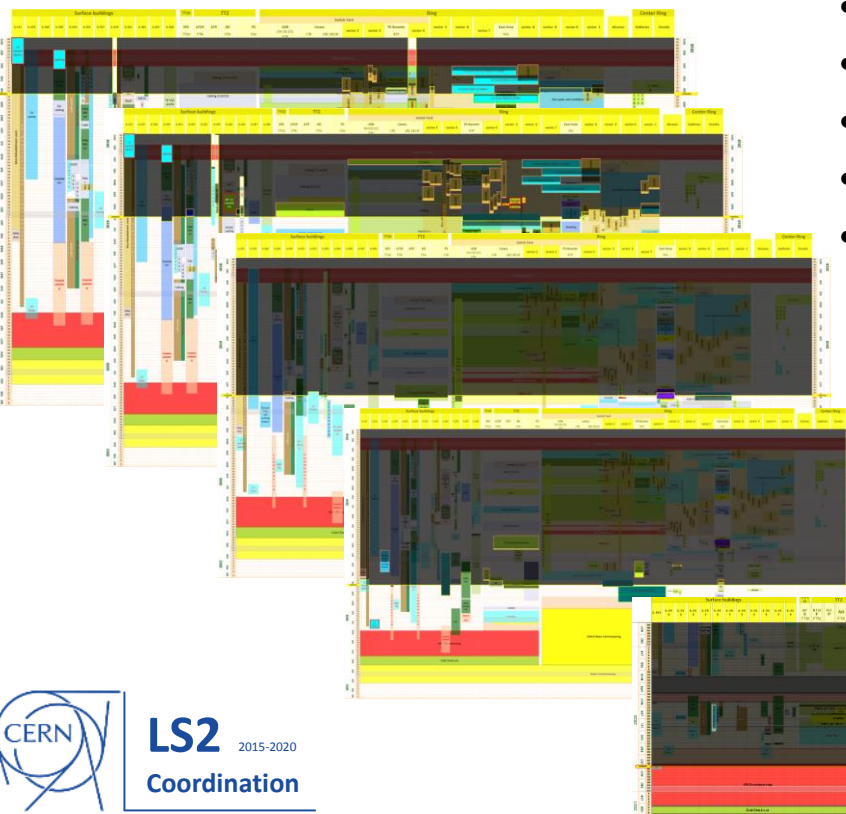


BTV15

PS&TT2 LS2 works in pictures



- 33 Broken lines
- 18 LSC2 Presentations
- 2 LS2 Days
- 70 Joint Coordination meetings
- 1583 IMPACT activities



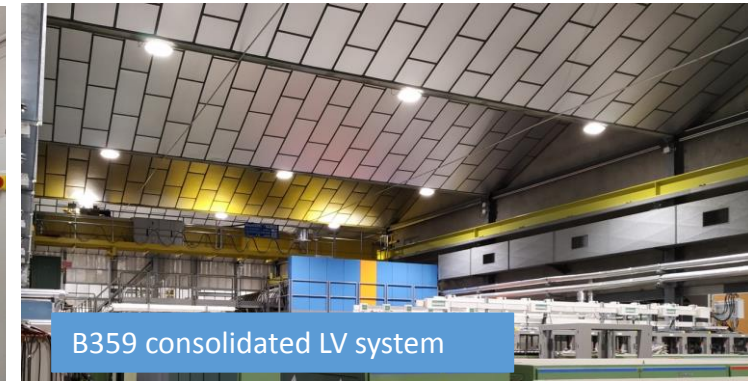
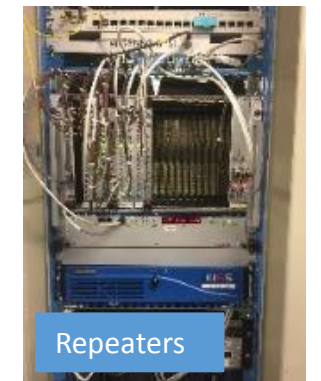
Facility	AUMA Committee	INDICO Site	Intervention	Collective dose (mSv/worker)		Max. ind. dose (mSv)		DIMA	Comments
				Planned	Actual	Planned	Actual		
PS	21 Sep-19	INDICO 276529	Renovation of PS main support coils	33.5	25.4	1.3	1.6	DIMP 2772576	Finished
PSB	31 Oct-19	INDICO 276702	Disassembly of the PSB injection region and the B1 and B7 transfer lines	5.9	5.4	0.4	0.4	DIMP 2772576	Finished
PS	03 Nov-19	INDICO 282904	PS main Voltage distribution system refurbishment	25.2	13.2	2.2	0.9	DIMP 2805048	Finished
SPS	09 Nov-18	INDICO 272426	Fire safety system SPS - part 1: Installation porte coupe feu (WPF)	1.8	1.1	0.7	0.8	DIMP 2808228	Finished
SPS	22 Nov-18	INDICO 272524	Fire safety system SPS - part 1: Fire detection (WPF)	6.7	0.6	0.8	0.2	DIMP 2808228	Finished
SPS	25 Jan-19	INDICO 270965	Fire safety system SPS - part 3: Dry Vests (WPF)	7.8	5.1	0.8	0.8	DIMP 2729223	Finished
SPS	25 Jan-19	INDICO 270965	Fire safety system SPS - part 3: Sprinklers (WPF)	7.6	1.4	1.2	0.3	DIMP 2808228	Finished
AD target	11 Jan-19	INDICO 270965	AD target area dismantling	8.0	6.9	0.9	0.7	DIMP 2808228	Finished
ISOLDE	11 Jan-19	INDICO 270965	ISOLDE HPS front end exchange	9.0	0.0	3.6	0.0	DIMP 2808228	Finished
ISOLDE	11 Jan-19	INDICO 270965	ISOLDE GFS front end exchange	7.2	6.0	3.5	1.1	DIMP 2808228	Finished
SPS	08 Feb-19	INDICO 276273	SPS dump removal	9.1	4.9	0.7	0.3	DIMP 2782211	Finished
SA target	05 Mar-19	INDICO 803286	Gas area target area renovation - FCS PS Facility	1.5	1.0	0.1	0.1	DIMP 2812529	Finished
SA target	05 Mar-19	INDICO 803286	Gas area target area renovation - Primary Area	5.3	3.3	0.32	0.38	DIMP 2812529	Finished
SPS	08 Mar-19	INDICO 803498	SPS electrostatic septum magnet exchange	4.4	3.0	0.5	0.4	DIMP 2808228	Finished
PS	03 Jun-19	INDICO 276529	PS target area change	10.2	1.3	1.6	0.6	DIMP 2782211	Finished
PS	23 Jul-19	INDICO 836819	PS injection upgrade	8.3	4.8	1.4	0.9	DIMP 2782211	Finished
SPS	23 Jul-19	INDICO 836819	Fire safety system SPS - part 2: Fire detection (WPF)	10.3	2.8	1.0	0.5	DIMP 2808228	Finished
SPS	20 Sep-19	INDICO 848028	Fire safety system SPS - part 2: Dry Vests (WPF)	0.8	0.8	0.35	0.31	DIMP 2778229	Finished
SPS	20 Sep-19	INDICO 848028	Fire safety system SPS - part 2: Sprinklers (WPF)	10.3	4.2	1.6	0.8	DIMP 2808228	Finished
RFQ target	11 Oct-19	INDICO 855279	Beam Dump Facility wet target removal	0.5	0.0	0.09	0.05	DIMP 2805048	Finished
SPS	05 Dec-19	INDICO 867093	Part 1 (Dry ceiling, PPS, OMA, Fire Safety)	5.2	4.9	0.7	0.7	DIMP 2806000	Finished
SPS	10 Jan-20	INDICO 877438	Part 2 (DS, Glass and M200MSE ceiling)	12.7	5.1	1.0	1.0	DIMP 2805048	Finished
SPS target	11 Jan-21	INDICO 877438	DSX beamline reinstallation	8.1	0.0	0.6	0.0	DIMP 2808228	Finished
SPS target	11 Jan-21	INDICO 877438	TCC2 crane refurbishment	8.1	0.0	0.6	0.0	DIMP 2808228	Finished



In Meyrin, near Geneva, the largest building site Europe has ever seen has started

The Proton Synchrotron: 60 years and counting <https://videos.cern.ch/record/2702431>

PS&TT2 LS2 works in pictures - surface



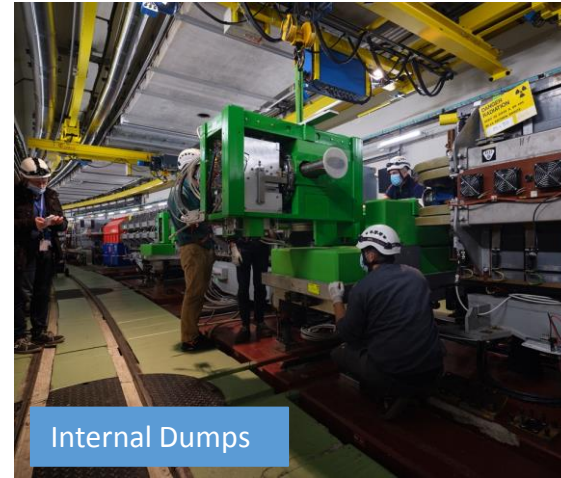
PS&TT2 LS2 works in pictures (enhancements)



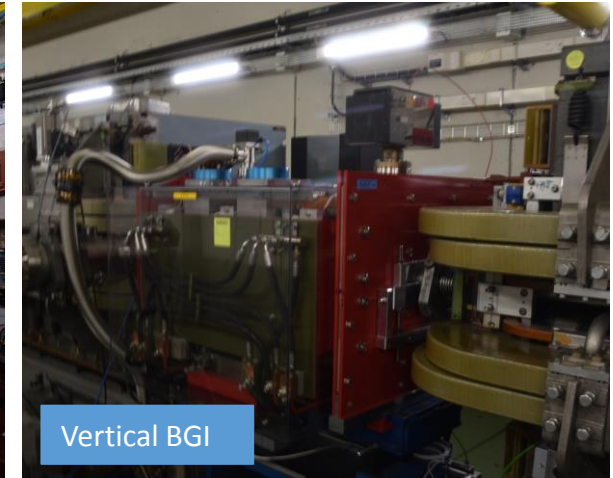
Booster to PS Line



SMH42



Internal Dumps



Vertical BGI



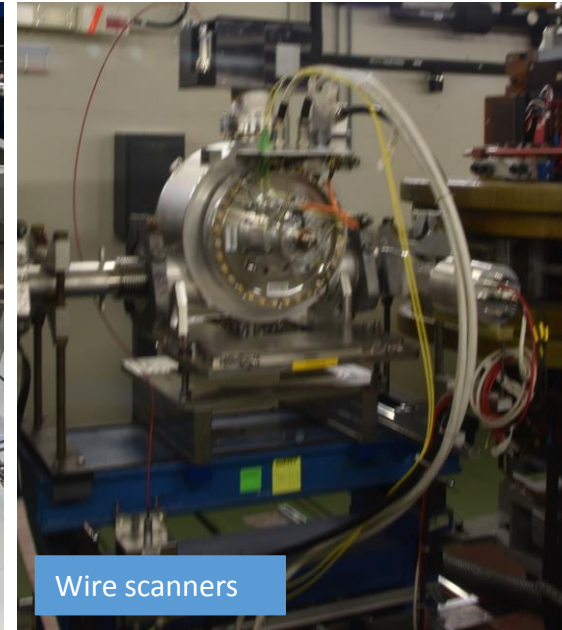
KFA45



Piping



10Mhz amplifiers



Wire scanners



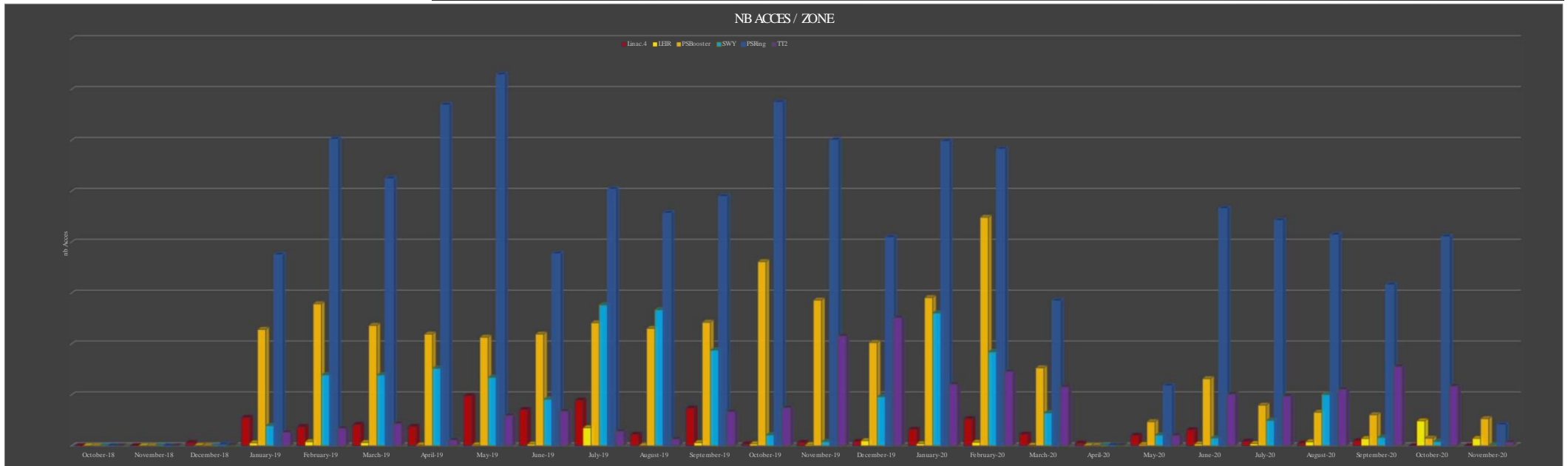
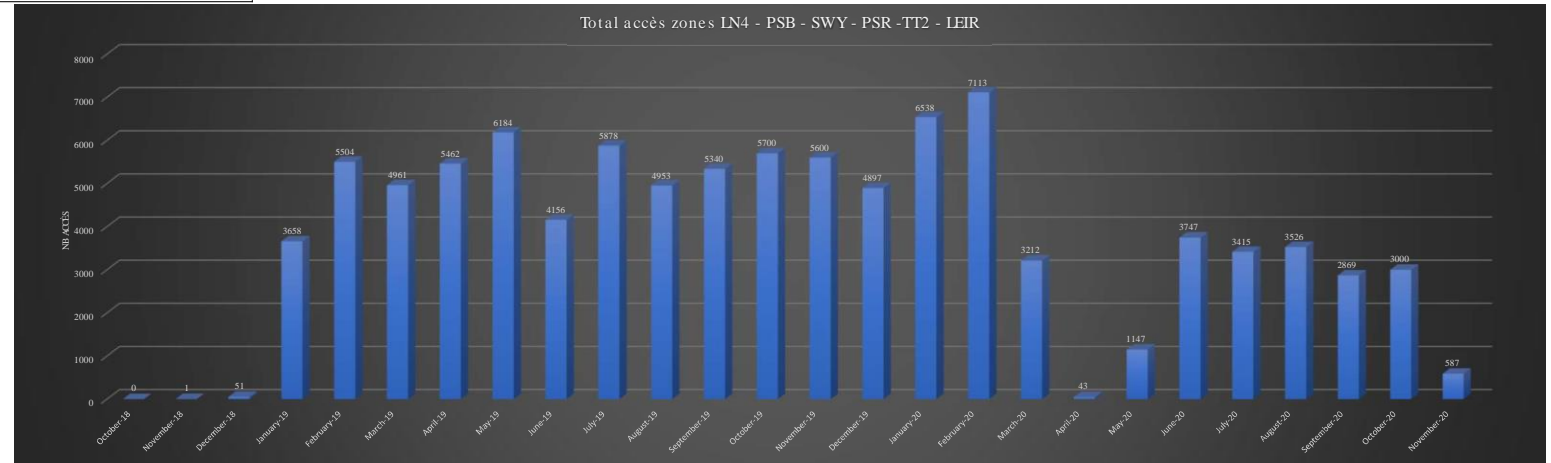
Longitudinal damper

PS&TT2 LS2 works in pictures (consolidation)



Work Done by

	Linac.4	LEIR	PSBooster	SWY	PSRing	TT2	Total accès zones LN4 - PSB - SWY - PSR -TT2 - LEIR
October-18	0	0	0	0	0	0	0
November-18	0	0	0	0	0	0	0
December-18	30	3	0	0	12	6	51
January-19	279	29	1144	198	1876	132	3658
February-19	188	41	1395	696	3013	171	5504
March-19	208	32	1183	696	2624	218	4961
April-19	190	9	1098	761	3348	56	5462
May-19	491	10	1068	672	3646	297	6184
June-19	356	17	1098	457	1888	340	4156
July-19	447	178	1209	1383	2520	141	5878
August-19	112	1	1154	1335	2286	65	4953
September-19	370	31	1214	940	2450	335	5340
October-19	18	19	1810	106	3374	373	5700
November-19	33	12	1432	40	3004	1079	5600
December-19	42	51	1015	482	2048	1259	4897
January-20	161	22	1457	1305	2990	603	6538
February-20	266	35	2245	923	2915	729	7113
March-20	113	6	767	323	1425	578	3212
April-20	25	1	5	2	5	5	43
May-20	102	13	237	105	589	101	1147
June-20	156	18	660	75	2331	507	3747
July-20	44	22	399	249	2213	488	3415
August-20	25	40	330	503	2073	555	3526
September-20	50	72	305	82	1581	779	2869
October-20	0	245	75	41	2054	585	3000
November-20	0	73	267	7	206	34	587
Total:							97541



Conclusions



Official PSB machine transfer from EN-ACE to BE-OP



Official PS machine transfer from EN-ACE to BE-OP

An intense story driven by LIU and consolidation works, with some surprises and a big poisoned apple "COVID-19" that tried to put us a sleep, but a successful story.

The success of this story was only possible thanks to the deep involvement of all the teams that worked in the PS Complex during LS2 and their strong commitment!



Additional information



ENGINEERING
DEPARTMENT

- LS2 committee meetings: <https://indico.cern.ch/category/7728/>
- PS Complex joint coordination meetings: <https://indico.cern.ch/category/7157/>
- Pictures for PSB:
 - Formal hand-over between the LS2 coordination team and the accelerator's operation team for the PS Booster <https://cds.cern.ch/record/2722744?ln=en>
 - Various view of the PSB with upgrade complete <https://cds.cern.ch/record/2721991?ln=en>
 - Installation of the PSB absorber/scraper in the PS Booster <https://cds.cern.ch/record/2720709?ln=en>
 - Installation of a new magnet PSB 15l1 <https://cds.cern.ch/record/2702644?ln=en>
 - KFA10 installation in the PS Booster <https://cds.cern.ch/record/2702295?ln=en>
 - CERN Injectors Complex Beam Stopper <https://cds.cern.ch/record/2696542?ln=en>
 - PSB BHZ1l main dipole magnet - removal operation <https://cds.cern.ch/record/2655334?ln=en>
 - Search · CDS Videos · CERN <https://videos.cern.ch/search?page=1&size=21&q=booster&years=2019--2020>
 - Timelapse Footage upgrade of the Transfer Line in the PSB <https://videos.cern.ch/record/2745911>
 - LS2 new PSB injection sector 1L1 <https://videos.cern.ch/record/2677454>
 - LS2-LIU-PSB Finemet RF Systems <https://cds.cern.ch/record/2677529?ln=en>
 - PSB BHZ1l main dipole magnet <https://cds.cern.ch/record/2655334?ln=en>
 - PSB Finemet structure with installed cavities <https://cds.cern.ch/record/2686535?ln=en>
 - PSB magnet <https://cds.cern.ch/record/2712896?ln=en>
- Pictures for PS:
 - Formal hand-over between the LS2 coordination team and the accelerator's operation team for the PS <https://cds.cern.ch/record/2742645?ln=en>
 - Pictures on the SMH42 installation <https://cds.cern.ch/record/2721664?ln=en>
 - Internal Dumps installation <https://cds.cern.ch/record/2719678?ln=en>
 - Survey Operators in tunnel PS <https://cds.cern.ch/record/2719677?ln=en>
 - New Kicker magnet installation in PS 2020 <https://cds.cern.ch/record/2708037?ln=en>
 - New PS internal dump in Preveessin <https://cds.cern.ch/record/2708078?ln=en>
 - Machine Installation of the PS Ralentisseur <https://cds.cern.ch/record/2707952?ln=en>
 - Radiation Resistant lighting <https://cds.cern.ch/record/2697403?ln=en>
 - CERN Injectors Complex Beam Stopper <https://cds.cern.ch/record/2696542?ln=en>
 - Radiation Resistant lighting <https://cds.cern.ch/record/2689084?ln=en>
 - PS Complex beam stopper in Prévessin <https://cds.cern.ch/record/2679615?ln=en>
 - PS Magnets consolidation during LS2 <https://cds.cern.ch/record/2657869?ln=en>