

East Area Renovation Project

EDMS 1730967 (15 min)

Sebastien EVRARD (EN-EA) On behalf of the Project team



LS2
Days

7th & 8th November 2016

<http://indico.cern.ch/event/564604/>



Agenda

- Introduction
- Scope of the Renovation
- Planning
- Resources availability
- Logistics aspects
- Summary

Introduction

DG talk in June 2016



East Area renovation

Unique facility in Europe: provides hadron beams down to ~ 1 GeV \rightarrow used by a broad community:

- ❑ experiments: CLOUD (previously DIRAC, HARP); Beam-Line-for-School
- ❑ test beams: LHC, COMPASS, BabyMind, Linear Collider detectors, SHiP, AMS, PAMELA, ...
- ❑ irradiation facilities: IRRAD (detector components), CHARM (accelerator electronics irradiation)



EA renovation: ~ 20 MCHF \rightarrow installation in LS2

- ❑ very old equipment, lack of spares, manpower/time-consuming interventions, safety issues
 - \rightarrow new pulsed magnets, power converters, cooling and ventilation, electrical infrastructure
 - \rightarrow energy saving of ~ 600 kCHF/year
- ❑ increase beam energy up to 15 GeV (\rightarrow overlap with NA beams), better particle separation



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Decision making process

- **East area day 2012 → Concept & layout approved**

<https://indico.cern.ch/event/167761/>

- **LS1: DIRAC dismantling, CHARM and IRRAD installation**
- **LS2 days (September 2015)**

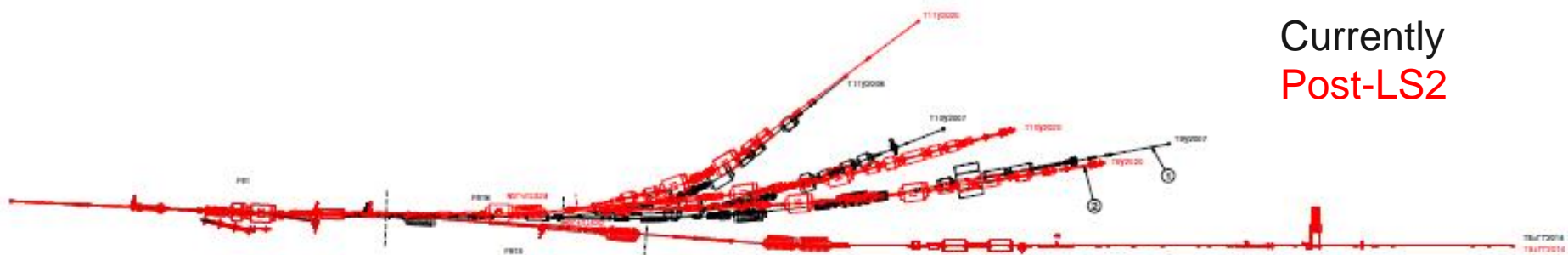
Strategy and plan for the next 5 years:

- It is challenging to conduct the consolidation of EA and NA in parallel →
Prioritisation of activities based on risk analysis
- Unique opportunity to include energy efficiency and equipment standardization solutions
- Focus now on East Area consolidation and complete it by the end of LS2.
- North Area: focus on urgent consolidation items and complete the main consolidation after LS2.
- **Chamonix (January 2016)**
- **Consolidation day (February 2016)**
- **Finance Committee (June 2016) → MTP approval**



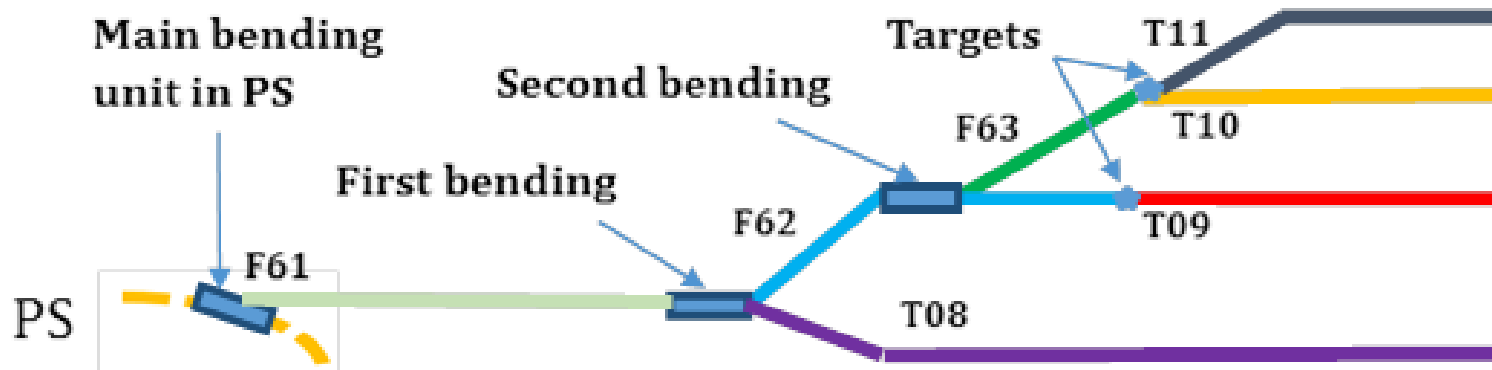
Beam line layout change

- to better cope with present physics requirements (higher top momenta, selectivity of particle type),
- to minimise dose rates to personnel, and allow faster repair times by improving equipment accessibility,
- to respect today's norms for radiation protection: a new ventilation system will fit the primary zone and the primary beam will be dumped cleanly just downstream of primary target.



Currently
Post-LS2

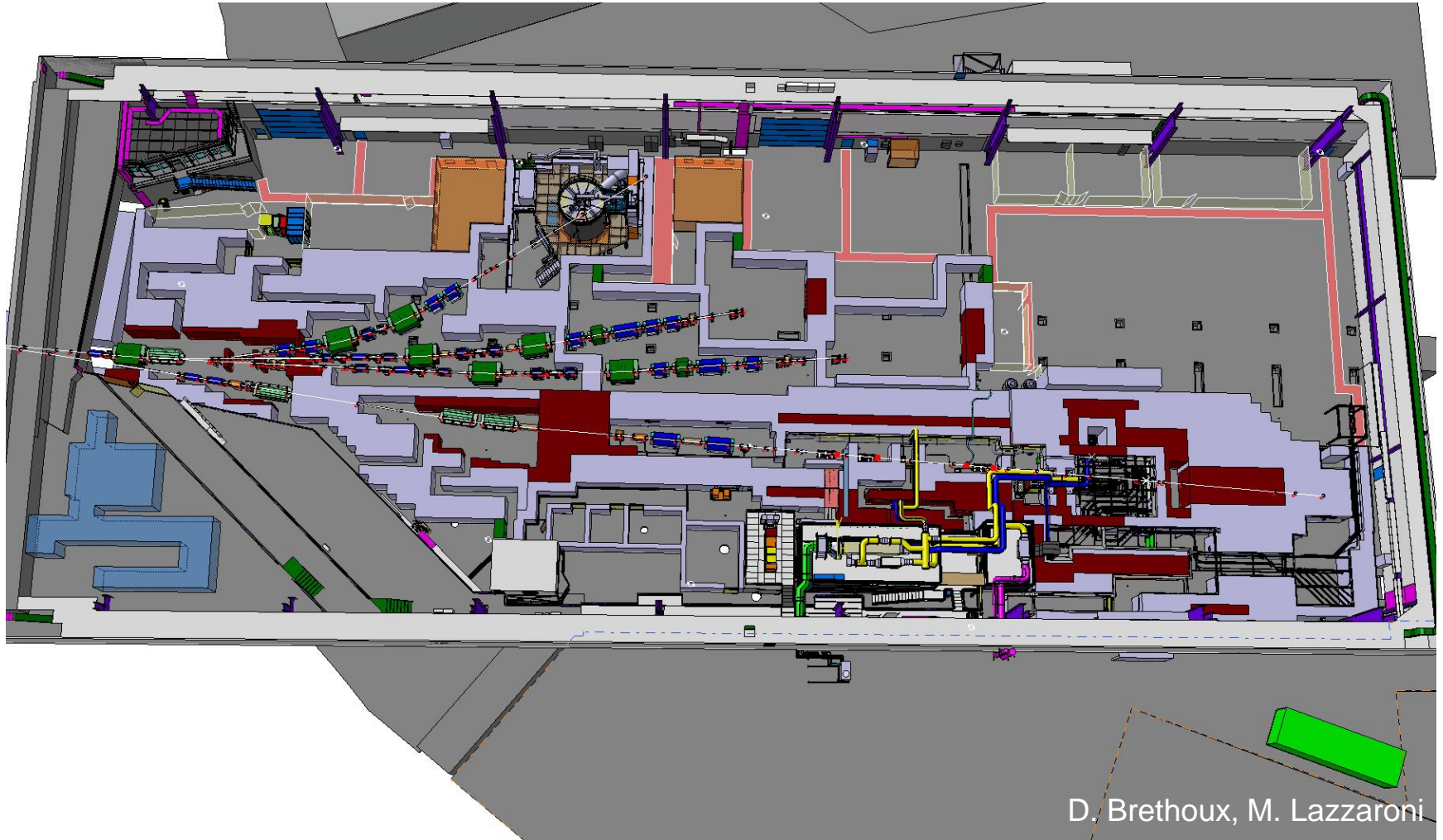
Beam line layout change



Primary Beam Parameter	Value
Proton beam momentum [GeV/c]	24
Maximum flux per PS spill	$5 \cdot 10^{11}$
Maximum # spills per super-cycle	6
Duration of super-cycle [s]	45.6
Maximum # protons per second	$6.7 \cdot 10^{10}$
Maximum number of days per year	200
Assumed efficiency	90%
Maximum number of super-cycles per year	340,000
Maximum number of protons per year	$1.0 \cdot 10^{18}$
Minimum spot size [mm RMS]	$\sim 5 \times 5$

Head	Material	Length (mm)	Diameter (mm)
1	Be W	200 3	10 + Al case
2	Al Be	100 3	10
3	Al	200	10
4	Air	-	-
5	Al	20	10

Future Layout



D. Brethoux, M. Lazzaroni

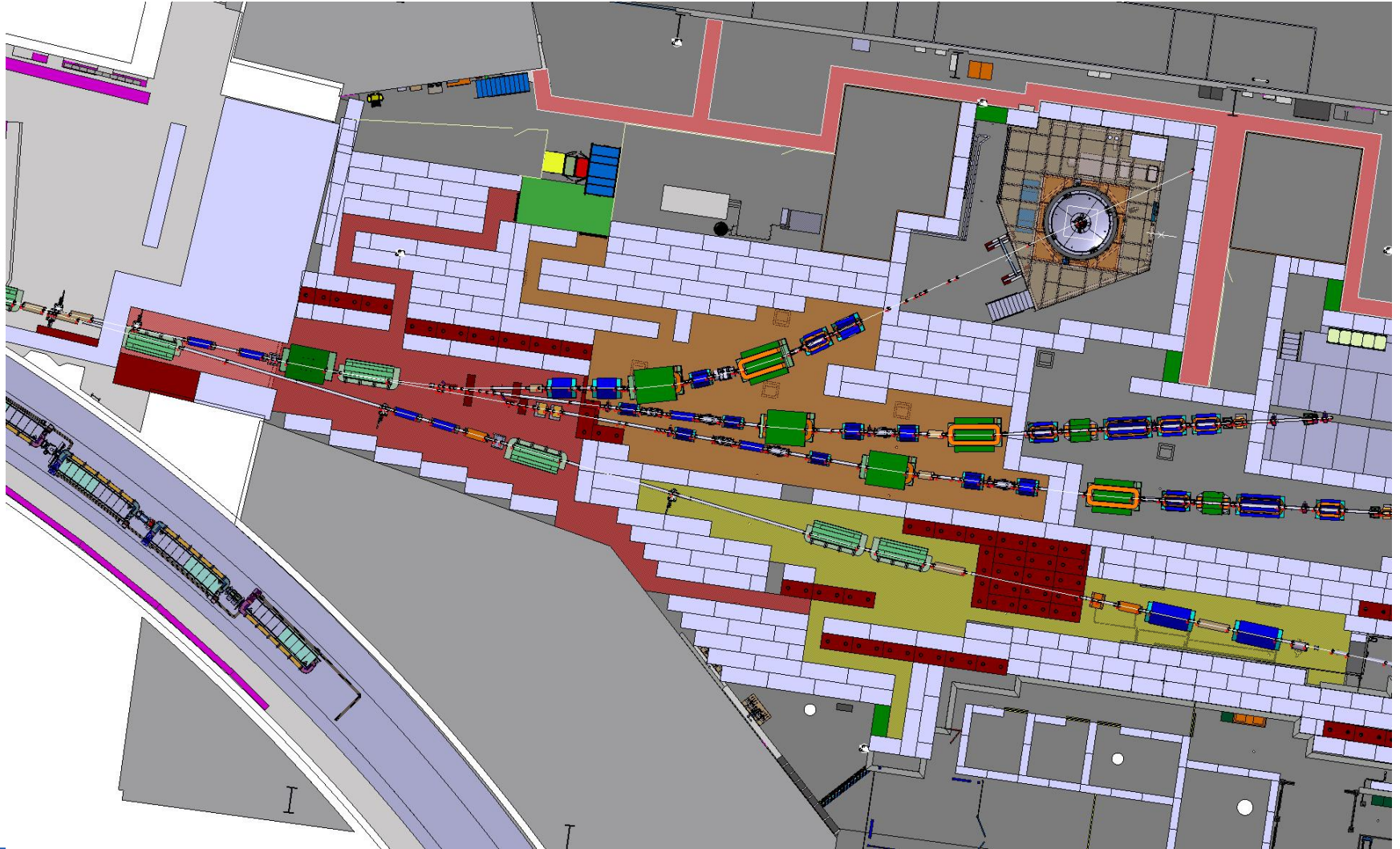


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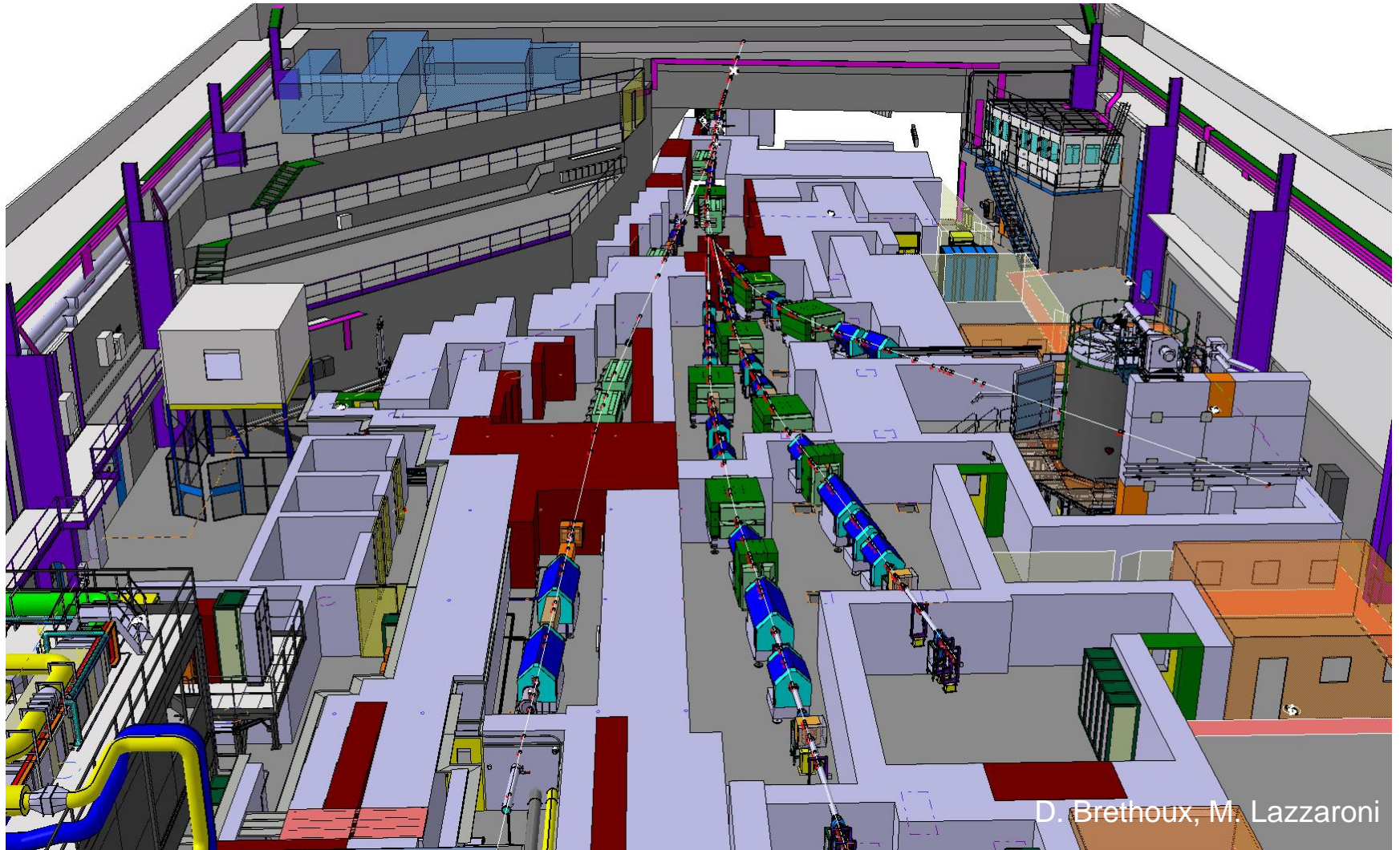
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Future Layout



Future Layout



D. Brethoux, M. Lazzaroni



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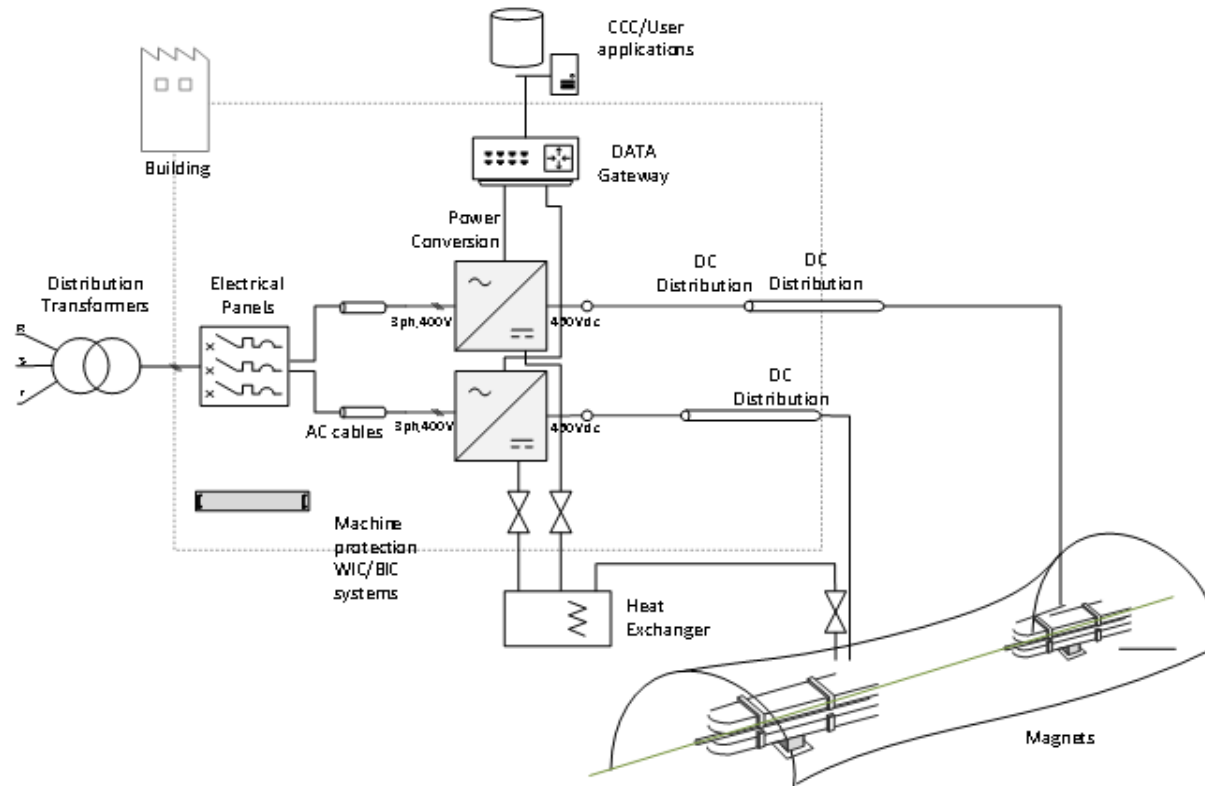
Future Layout



New magnet powering scheme

- The new cycled powering mode implies to
 - Replace massive magnet yokes by laminated ones to allow magnet pulsing
 - Replace old power converters by new generation of Sirius power converters (with energy recovery) in a modular way. After each pulse, energy will be recuperated on capacitors for reuse.
- Due to small duty cycle (few percent) the annual power consumption can be reduced from 11 to 0.6 GWh.
- This renovation will be also a unique opportunity to
 - Redo magnet cabling, without TB boxes,
 - Reduce number of different magnet types, only use reliable (refurbished) magnets and make sure that there are enough spares
 - Upgrade the magnet interlock system to new TE/MPE system standards.

New magnet powering scheme

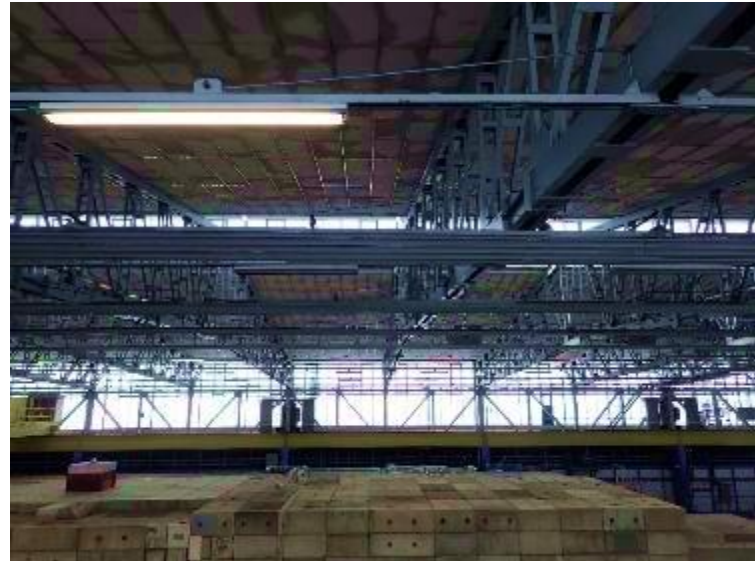


K. Papastergiou

- A total number of 60 power converters will be employed to feed 61 magnets.
- 15 magnet families are needed for the new layout and 25 massive magnet yokes must be exchanged by laminated ones

Infrastructure renovation

- Building 157 and its heating/ventilation will be upgraded according to the IPP proposal.
- This includes improvement of thermal insulation, wall & roof cladding (asbestos) and window exchange.
- Cooling circuits for primary and secondary beams & zones will be separated.



Other beam related equipment

- Replace collimators by NA standard ones (XCHV) with remotely controlled motorisation
- Update beam instrumentation, in particular with threshold counters
- Install beam loss monitors along primary beams
- Redo the vacuum system like in North Area with standard VSC controls
- Add converters and absorbers
- Consolidate beam stoppers
- Modify shielding, PPS & alarms according to new layout

Master Schedule

SHUTDOWN/ TS	PROTON PHYSICS	2016	2017	2018	2019	2020	2021																		
COMMISSIONING	IONS	J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D																		
Group	Activity																								
TE-EPC	Procure Power Converter																								
TE-MSC	Prepare new yokes																								
TE-MSC	Remove magnets																								
TE-MSC	Modify magnets																								
TE-MSC	Re-install magnets																								
EN-EL	Renovate AC&DC distribution																								
EN-CV	Renovate cooling systems																								
SMB-SE	Building																								
TE-EPC	Install new power converters																								
EN-EA	Change beam line layout + vacuum beam pipe																								
EN-ACE	Survey																								
All	Commission new facility																								

Tender + FC ↓

SMB-CE intervention during operation

Commissioning after injectors & LHC, driven by Power Converters

Time line



WP analysis

- First iteration completed
- Goal: Reach the same level of preparation (study/design) in each group

Integration

- In progress
- Goal: review WP's transversally, freeze final layout

CSR

- Early December '16
- Goal: Fine tune resources (budget & manpower) and schedule, identify risks → Project baseline

WBS and PLAN tool

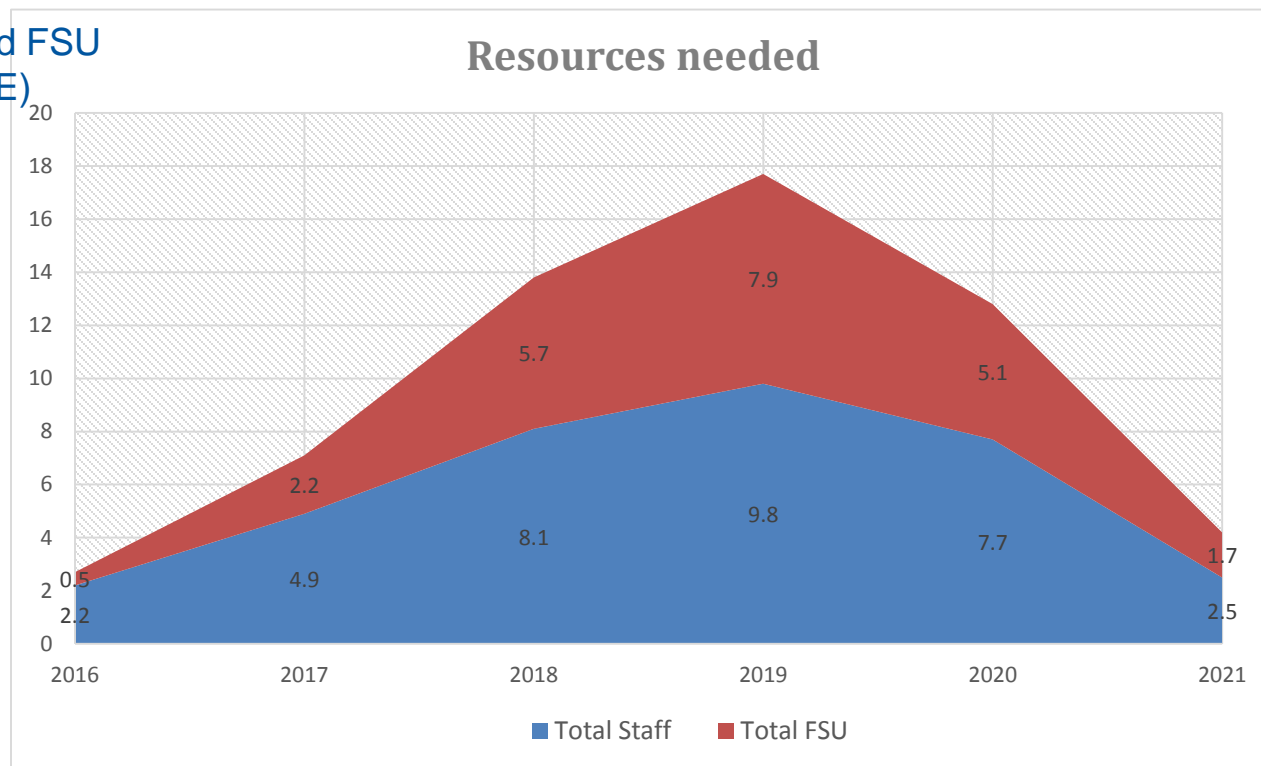
- Extensive WBS available in EDMS 1730966
- Approved activities created in Plan tool

	Level 1	Responsible	Group	Plan ID
EAR 1	Management	S. Evrard, M. Lazzaroni	EN-EA	11254
EAR 2	Magnets	R. Lopez	TE-MSD	10945, 10946, 11255, 11256
EAR 3	Power Converters	K. Papastergiou	TE-EPC	11258
EAR 4	Beam instrumentation	J. Tan	BE-BI	11259
EAR 5	Beam Intercepting Devices	M. Calviani	EN-STI	10026, 10011, 10009, 11182
EAR 6	Vacuum System	V. de Jesus	EN-EA	
EAR 7	Networks	L. Borakiewicz	IT-CS	
EAR 8	Controls	K. Sigerud	BE-CO	
EAR 9	Electrical Systems	S. Bertolasi	EN-EL	11260, 11261, 11262
EAR 10	Cooling and Ventilation	S. Moccia	EN-CV	
EAR 11	Installation, Transport and handling	C. Bertone	EN-HE	
EAR 12	Civil Engineering	S. Mcilwraith	SMB-SE	
EAR 13	Radiation Protection	R. Froeschl	HSE-RP	
EAR 14	Machine Interlocks	R. Mompò	TE-MPE	10812
EAR 15	Alarms	S. Grau	BE-ICS	10771, 10745
EAR 16	Personnel Protection System	P. Ninin	BE-ICS	
EAR 17	Survey	D. Missiaen	EN-ACE	
EAR 18	Commissioning and Operation	S. Evrard	EN-EA	
EAR 19	Safety	E. Harrouch	EN-EA	
EAR 20	Shielding	M. Lazzaroni	EN-EA	
EAR 21	Collimation	A. Ebn Rhamoun	EN-EA	10814
EAR 22	Dismantling	M. Lazzaroni	EN-EA	11253, 11252

Resources needed – Personnel

- First iteration
- Fine tuning in CSR

Staff and FSU
(FTE)



	2016	2017	2018	2019	2020	2021	Total
Total Staff	2.2	4.9	8.1	9.8	7.7	2.5	35.2
Total FSU	0.5	2.2	5.7	7.9	5.1	1.7	23.1
Missing staff	To be analysed in the CSR						

Resources needed – Initial Budget



- CtC Project
- Further discussion in CSR
- identified activities beyond original scope
 - B251 building renovation
 - B157 Asbestos disposal

Budget profile (kCHF)						
2016	2017	2018	2019	2020	2021	Total
277	3,931	7,399	6,294	5,423	513	23,837

Logistics aspects

- The renovation implies to dismantle all the beam lines (except T8) and associated services → many co-activities.
- Storage needs for concrete and cast iron blocks, magnets, access control equipment.
- Major civil engineering works for B.157, B. 251 and synergy with B.156
- Cloud experiment protection during CE works in 2018
- Cloud run in 2019 and 2020 without beam (under study)
- Waste management
 - Activated waste
 - Asbestos
- Work in controlled areas.



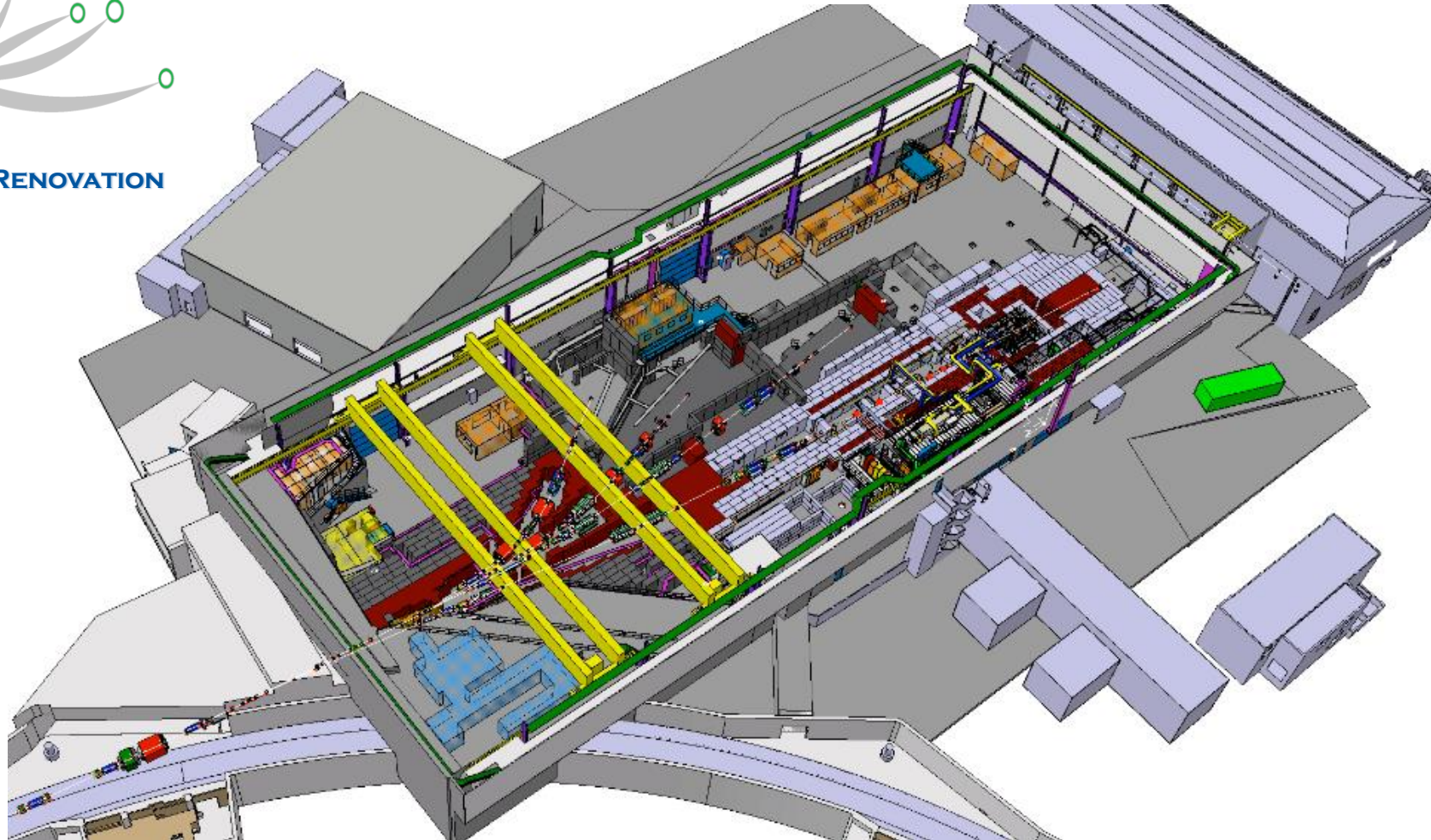
Summary

- The East Area Renovation project is a CtC project.
- Beam line layout change – New magnet powering scheme – infrastructure renovation: a lot of activities involving all infrastructure, equipment and support groups in LS2.
- Anticipation of many activities during EYETS, YETS and 2018 Run to relieve LS2 period. However, LS2 will be very challenging, especially in terms of manpower.
- First important milestone: CSR in early December'16.
- Missing resources to be discussed in detail at the CSR.

Thanks for your attention!



EAST AREA RENOVATION



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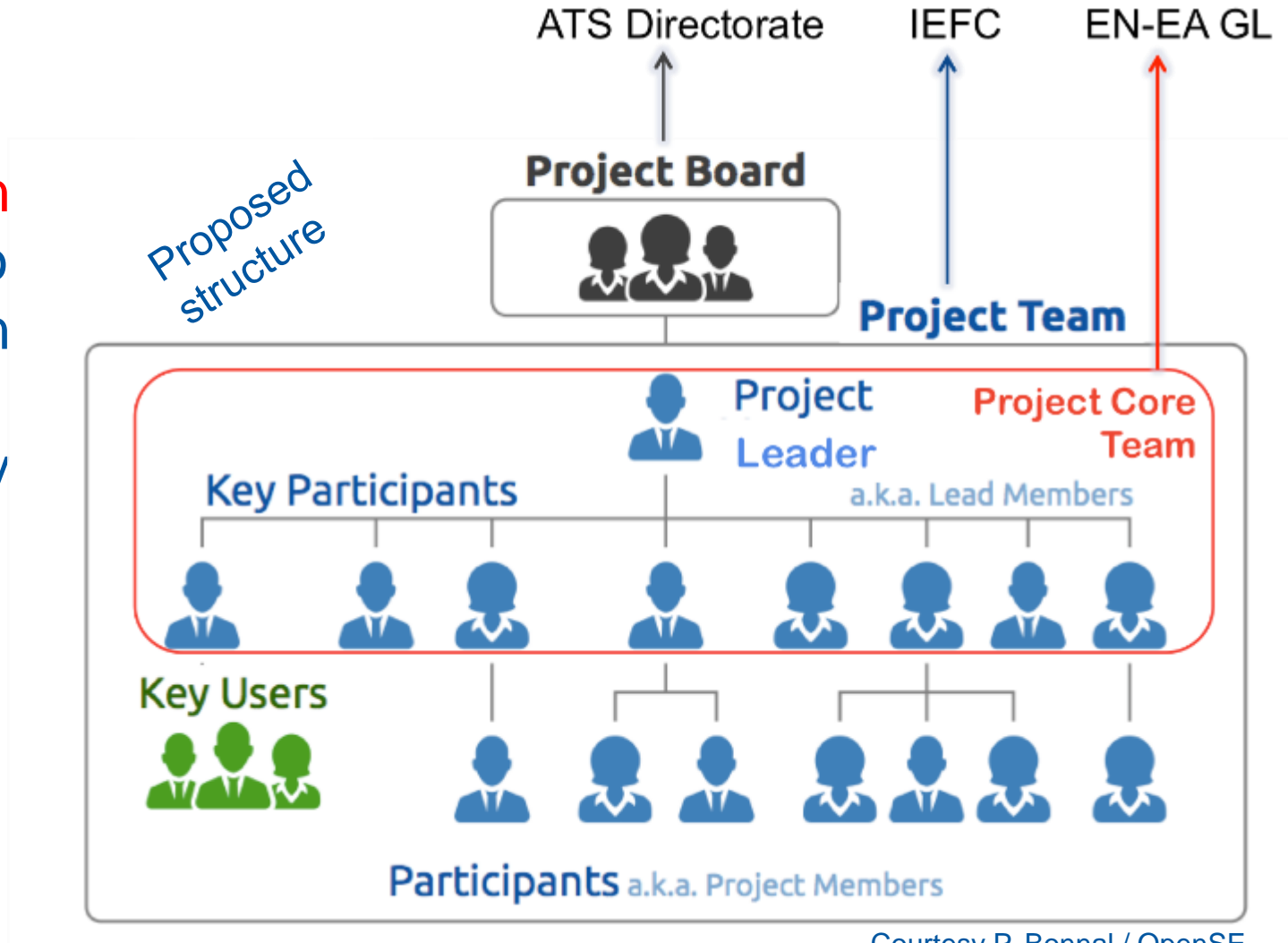
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Backup slides



Project management

- The East Area **Renovation** is a Cost to Completion (CtC) project fully driven by the EN-EA Group.



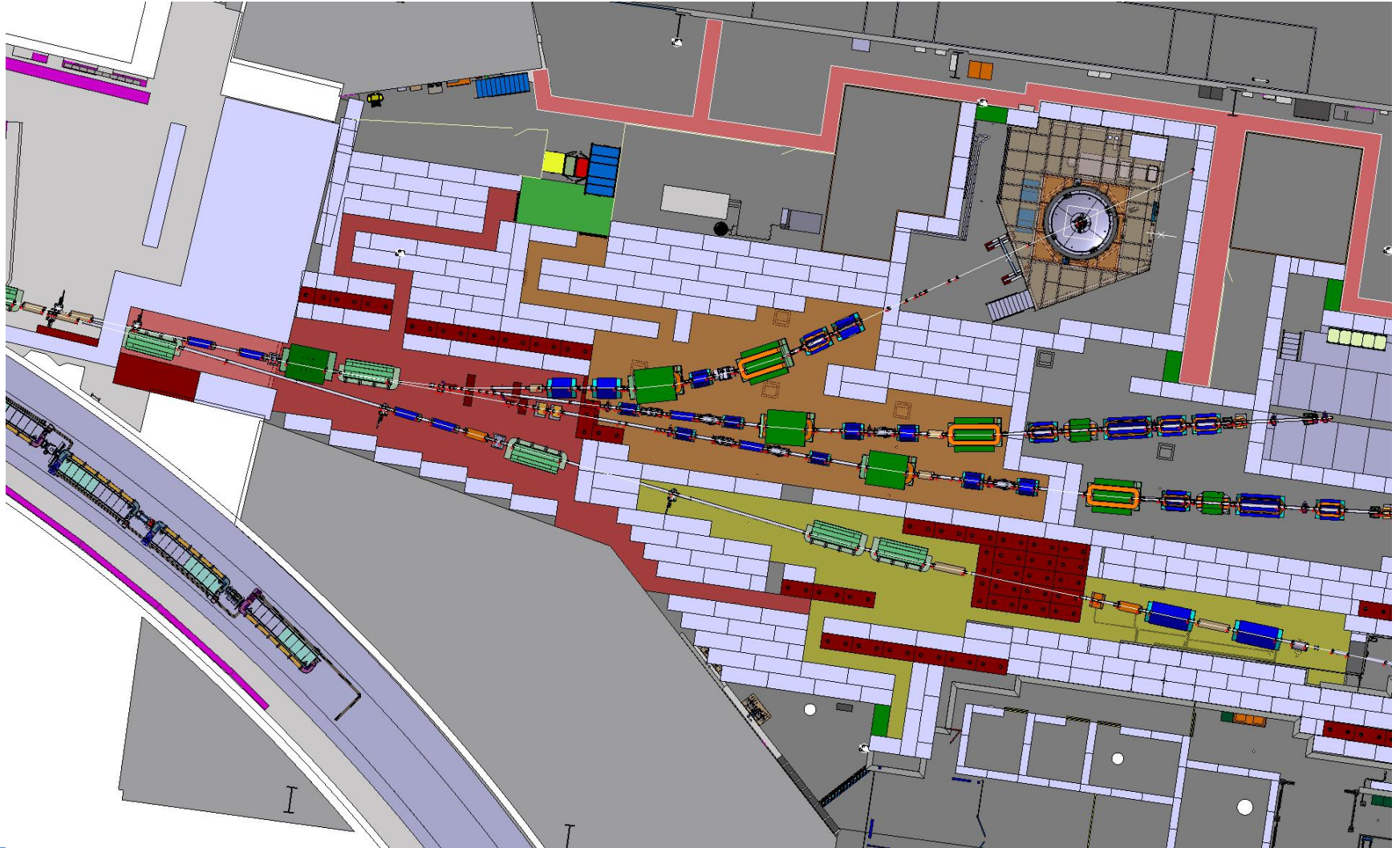
Courtesy P. Bonnal / OpenSE

Project team

Group	Group leader	Representative (s)
BE-BI	R. Jones	J. Tan, Ph. Carriere
BE-CO	E. Hatziangeli	K. Sigerud, M. Gourber-Pace
BE-ICS	P. Sollander	P. Ninin
EN-ACE	K. Foraz	D. Mergelkuhl
EN-CV	M. Nonis	W. Van Den Broucke
EN-DHO	R. Losito	R. Folch
EN-EA	M. Brugger	Project core team (see 2.4)
EN-EL	N. Bellegarde	J-C. Guillaume, Bertolasi
EN-STI	S. Gilardoni	M. Calviani, E. Grenier-Boley
EP		H. Wilkens, A. Onnela, S. Mathot, A. Desmarest
HSE-RP	D. Forkel-Wirth	R. Froeschl
HSE-SEE	E. Cennini	A. Henriques
IT-CS	T. Cass	M. Da Costa
SMB-SE	L. Scibile	S. Mcilwraith, C. Gasnier
TE-EPC	J-P. Burnet	K. Papastergiou
TE-MPE	A. Siemko	R. Mompo, J. Uythoven
TE-MSc	L. Bottura	R. Lopez
TE-VSC	P. Chiggiato	P. Gomes

membership based on the feedback before/during/after the kick-off meeting

New Sectorization



Organizational tools

- **EDMS:** <https://edms.cern.ch/project/CERN-0000169544>
- **Indico:** <https://indico.cern.ch/category/8407/>
- **E-groups:**
 - East-area-renovation-project-team@cern.ch : members of the Project team.
 - East-area-renovation-core-team-project@cern.ch: members of the Project core team.
- **SharePoint:** <https://espace.cern.ch/East-Area-Renovation-Project>
- **dfs:**
<https://dfsweb.web.cern.ch/dfsweb/Services/DFS/DFSBrowser.aspx/Workspaces/e/EastAreaRenovation/>