EN-STI LIU Activities during LS2

François-Xavier Nuiry, on behalf of the STI group

LS2 DAYS

29-30 SEPTEMBER 2015

http://indico.cern.ch/event/436424/

Outlines

1. **Activities other than LIU:**

HL-LHC, Collimators, n_TOF, AD target

2. **LIU**

SPS

PS

Booster

L4

3. **ISOLDE:** See Richard Catherall's talk

STI main activities beyond LIU

- **TDI:** Injection dumps for LHC machines (end of TI2 and TI8)

→Operations limited to never surpass 400ºC.

→Graphite R4550 to be used in new TDI, instead of hBN.

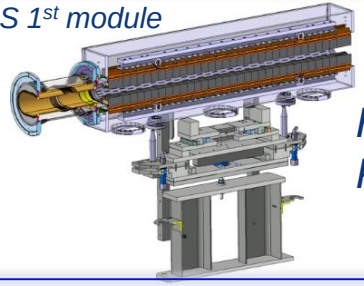
Consolidation project
Planning: YETS 2015

- **TDIS**

→Two TDIS, each one made up of 3 modules (Graphite-Graphite-Alu/Cu).

→Production of a total of 10 modules (6 installed, 4 spares).

TDIS 1st module



HL-LHC
Planning: LS2

- **Collimators**

→Collimation maintenance and spare policy (continuous activity managed by STI, collimation project).

→Recovery of collimator 5th axis for TCT's in pts 1 and 5. YETS 15/16. (STI involved, collimation project).

→Production and installation of 4 TCTW. EYETS 16/17. HL-LHC, collimation project.

→Control system consolidation (STI-ECE).

→Replacement of tertiary collimators (TCT) @ IP1,5,2,8.

→Replacement of 8 primary (TCP) and ~10 secondary (TCS) with BPM design, in pts 3 and 7.

→Passive Absorbers for the LHC warm cleaning insertions (Point 7).

Consolidation project
Planning:LS2

- **N-TOF target consolidation: Target replacement with a new one**

→Water cooling corrosion of the aluminum window.

→Risk of shutting down n_TOF physics for >1 year + potential contamination problem.

→Resources required: EN-MME, EN-CV, EN-MEF, EN-HE, DGS-RP

Consolidation project
Planning: LS2

STI main activities beyond LIU, for LS2

- AD target

AD-target area is feeding the AD machine with antiprotons

Consolidation project

- Risk analysis
  - If not carried out then an increase of interventions and/or a 50%-100% loss in physics program

- Budget

→Consolidation budget submitted
→Reference documents: AD-PM-MG-0001 + BCR:1312689
→Total budget (all groups involved): ~7.5 MCHF

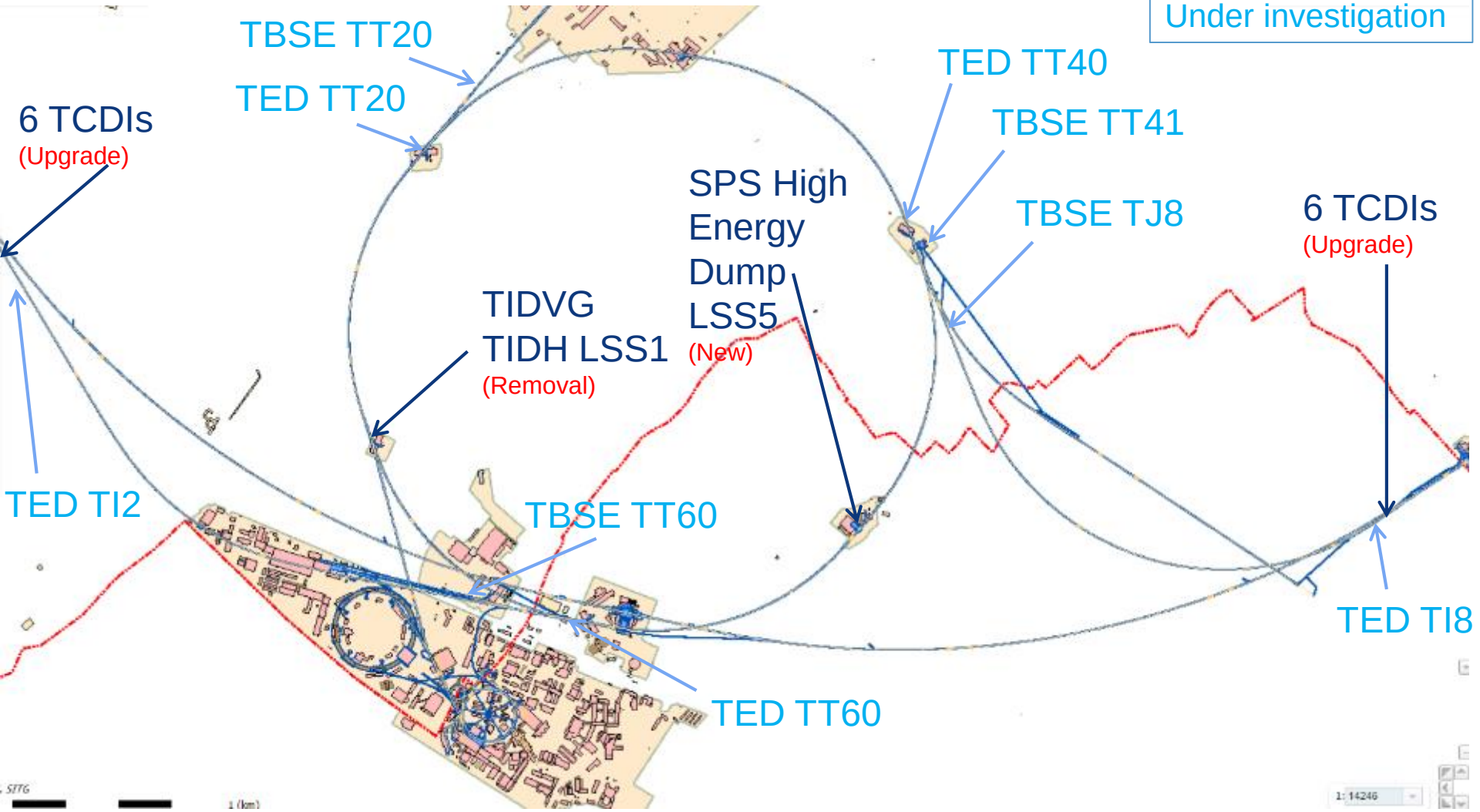
- Planning: LS2

Resources required:

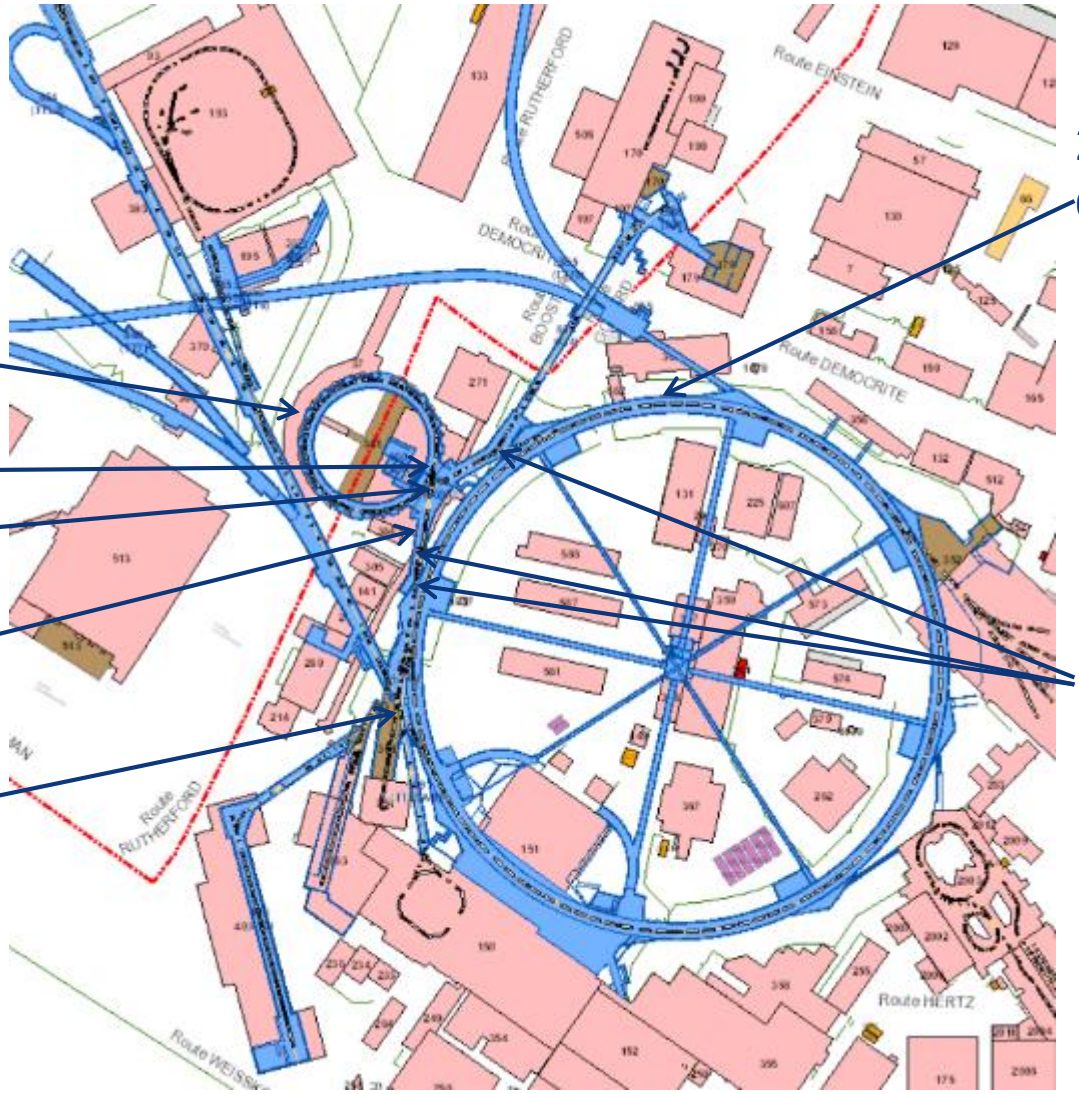
TE-MSC,
TE-VSC
TE-ABT,
EN-CV,
EN-HE,
EN-EL,
EN-MME,
EN-MEF,
GS-ASE,
DGS-RP,
DGS-SEE,
BE-BI.

Main STI objects (LIU related)

LS2 baseline
Under investigation



Main STI objects (LIU related)



PS Booster Absorber / Scraper (upgrade)

$H0H^-$ dump (New)

Head & tail dump (New)

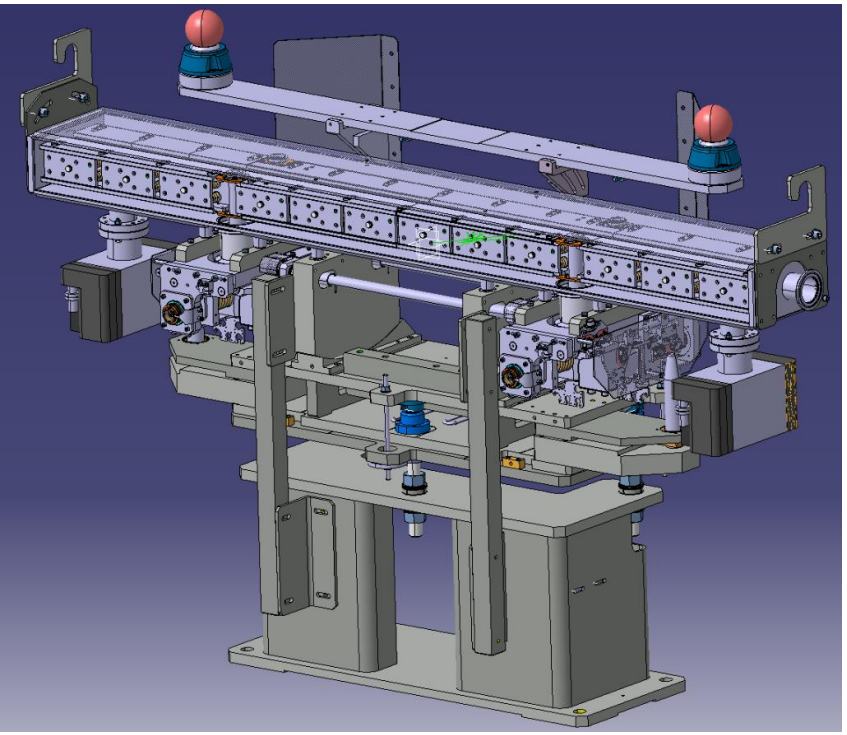
LBE Dump H^- (New)

LEIR Dump (New)

2 PS Internal dumps (upgrade)

3 PS Booster beam stoppers (upgrade?)

TCDI collimators (SPS)



- SPS/LHC Transfer lines collimators (TI2 and TI8)
- 12 collimators and 2 spares
- 2.3m long, > 500kg

PROVISIONAL SCHEDULE:

Resources required:

EN-MME: Design for manufacturing, prototyping

TE VSC: Vacuum design, new vacuum layout (TI2-TI8), vacuum tests

EN HE: Transport / tooling for integration

EN MEF: CAD Integration / survey (2 steps for each collimator)

DGS RP: RP simulations and support

GS IS: Material procurement

Other actors:

EN EL: new cables for 3 TCDIs + MQIF.87000 and MQID.87100 quads

FP PI: Procurement

Dumps dismantling from LS1 (SPS)

→TIDVG

- Target Internal Dump Vertical
- Graphite, 4.3 m long, > ~20 Ton

→TIDH

- Target Internal Dump Horizontal
- Aluminium, similar size

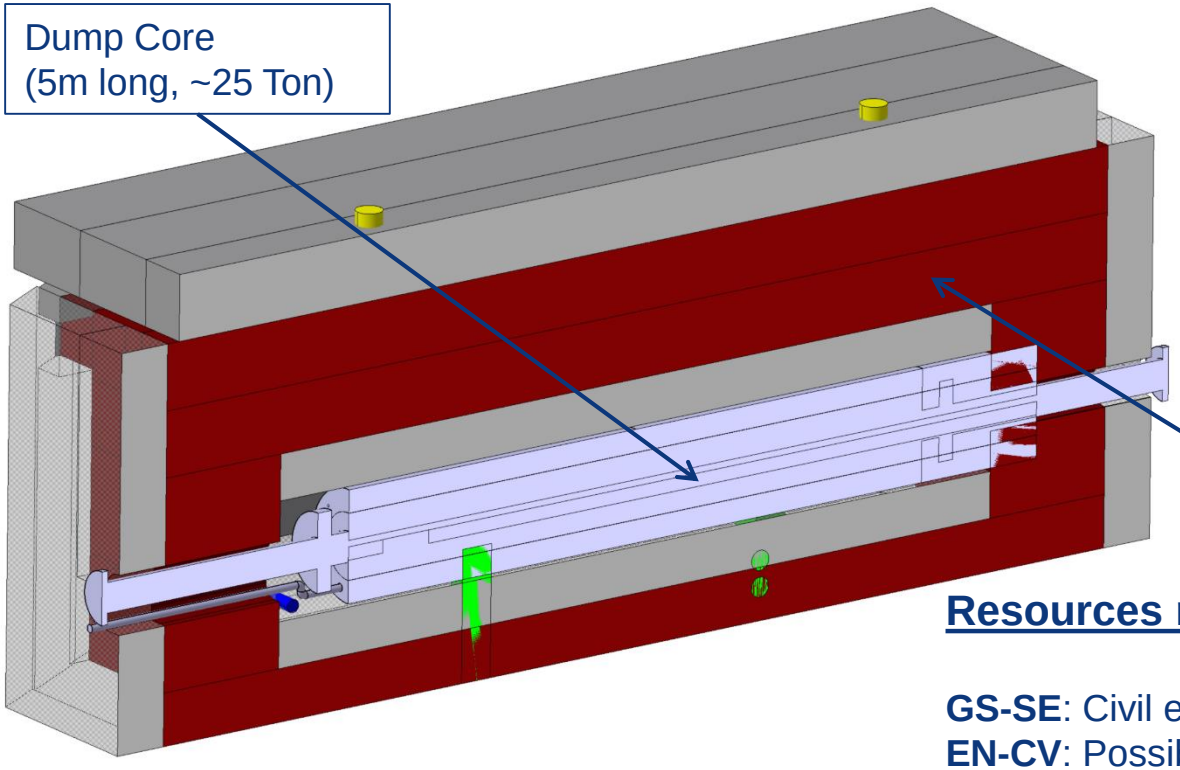
PROVISIONAL SCHEDULE:

- Late in LS2 (Radiation cooldown)

Resources required:

DGS-RP: ALARA, radioactive waste/storage, calculations
EN-HE: Handling, tooling
TE-VSC: Vacuum chambers, connections
GS IS: Radioactive storage (bunker)

SPS high energy dump @ LSS5



- Internal dump in LSS5 (SPS)
- Replace TIDVG, TIDH
- 1 dump and 1 spare

PROVISIONAL SCHEDULE:

Installation and commissioning → End of LS2

Resources required:

GS-SE: Civil engineering works in LSS5
EN-CV: Possibly dedicated water cooling ~300 kW
EN-HE: Handling, tooling, crane
DGS-RP: Calculations, validation, installation
EN-MME: Design, subcontracting
EN-MEF: Survey, procurement external shielding blocks
TE-VSC: Design, procurement, installation, connections
EN-EL: Cabling, installation
GS IS: Material procurement
FP-PI: Procurement

TEDs and TBSEs (Simulations)

TED TT40

TED TT60

- TED: SPS Dump-Stopper, 5 objects (+ spares).
  ~4.5m long, ~22 Tons
- TBSE: Beam stopper, 4 objects (+ spares).
  ~4m long, ~ 1.5 Tons

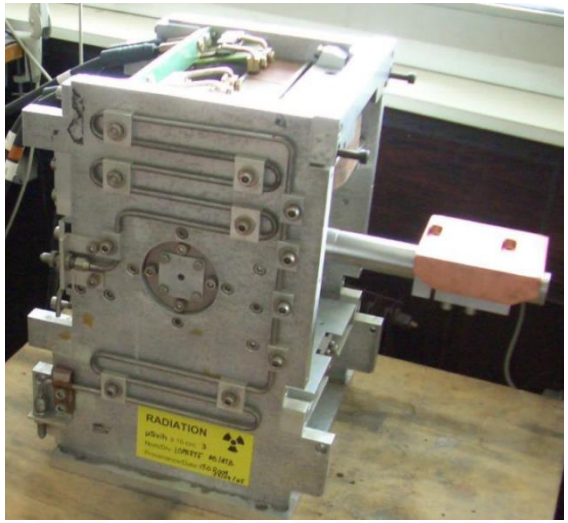
TBSE TT20

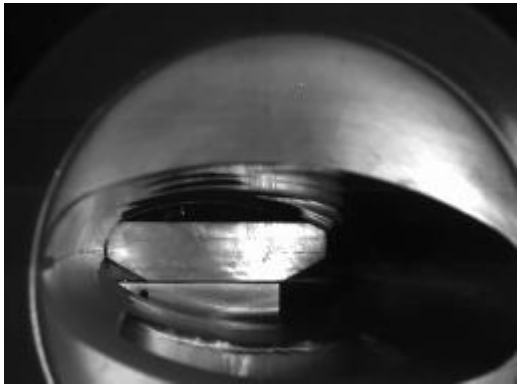
TBSE TT41

Resources required in case of replacement:

EN-MME: Design, manufacturing
EN-HE: Handling, tooling
DGS-RP: Calculations, validation, survey
TE-VSC: Modification of vacuum chambers
FP-PI: Procurement

PS internal dump





- Two new PS internal dumps
- New positions: SS47, SS75 ?
- 2 dumps and 2 spares
- ~ 15kg, enters in the beam in <0.3s
- ~400.000 cycles per year
- Steel and concrete shielding blocs
- PROVISIONAL SCHEDULE:

Removal	LBE Beam tests	Dumps installation	
1/01/2019	5/08/2019	1/11/2019	15/06/2020

New shielding for the dumps: part of the Consolidation Project

Resources required:

EN-MME: Design for fabrication

EN MEF: CAD Integration / shielding / survey

EN HE: Transport / tooling for integration

TE VSC: Vacuum design checks, chambers, tests

EN CV: Cooling

EN EL: New cables

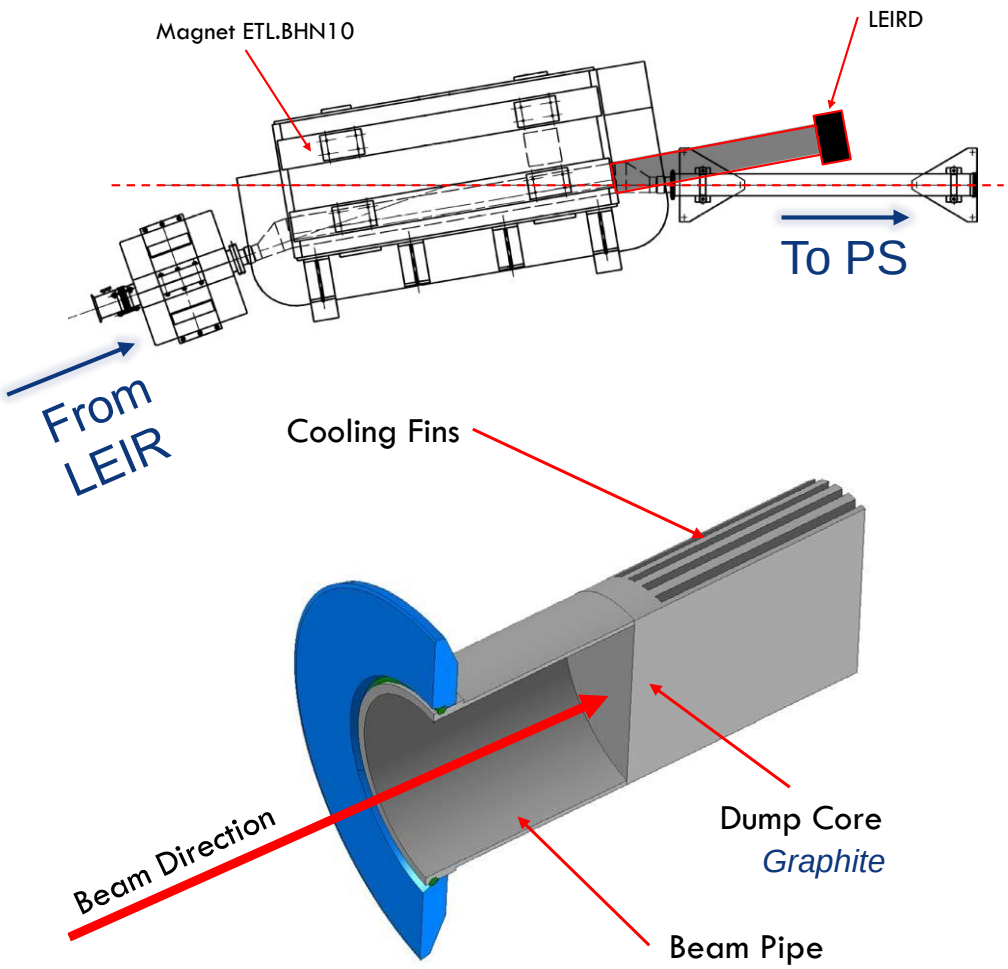
DGS RP: RP simulations / Radioactive waste

Other actors:

BE ABP: ECR

FP PI: Procurement

LIU-ION LEIR dump



- Location : Next to ETL.BHN.10 Magnet (between LEIR and PS)
- 1 dump and 1 spare
- Al cylinder ~ ϕ70mm x 20mm
- Shielding may be required (TBD)
- PROVISIONAL SCHEDULE

  YETS 2017-2018

Resources required:

EN-MME: Design for fabrication

EN MEF: CAD Integration / shielding / survey

EN HE: Transport. Dismantling of shielding

TE VSC: Vacuum chamber modification

TE-MSC: Magnet dismantling and reassembly

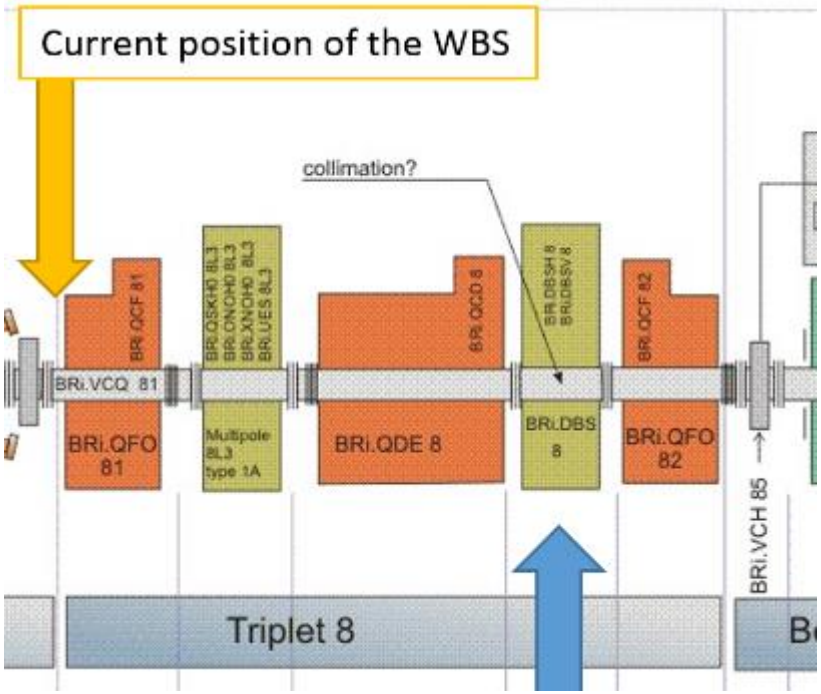
DGS-RP: Shielding calculation

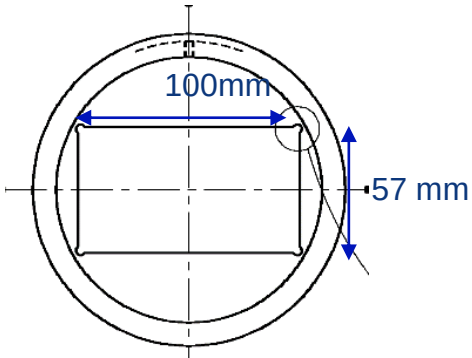
Other actors:

BE ABP: ECR

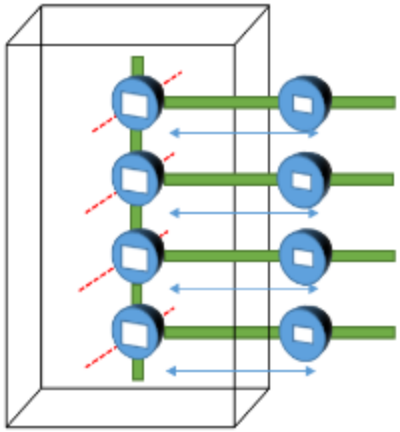
FP PI: Procurement

PS booster absorber / scraper





BRr.WBS8L2



- Replacement of the Windows Beam Scope BRr.WBS8L2
- **RP / Fluka simulation to be launched**
- Maintenance scenario to be studied (ALARA)
- 4 independent axis (1 per ring)
- 1 absorber and 1 spare / modular design
- 520mm long, ~ 300kg (estimates)
- Shielding: should be studied.

PROVISIONAL SCHEDULE:

Resources required:

EN-MME: Design for fabrication

EN MEF: CAD Integration / survey

EN HE: Transport / tooling for integration

TE VSC: Vacuum design, and vacuum tests

EN EL: New cables

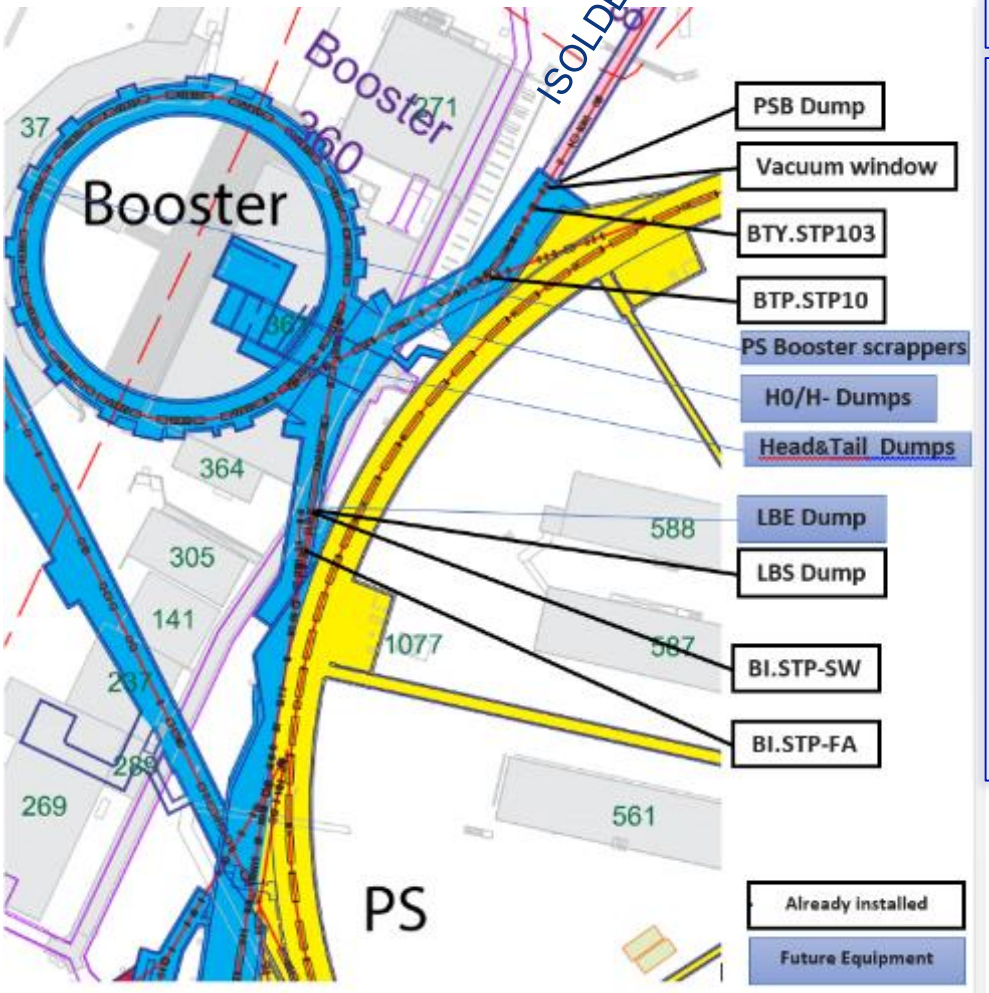
DGS RP: RP simulations / Radioactive waste

Other actors:

BE OP / ABP: Specifications

FP PI: Procurement

PS booster beam stoppers and injection dumps



- Injection dumps:

$H0H^-$: under production.

Head &Tails : under production.

- Beam stoppers in BI and BTP:

Thermo-mechanical simulation are needed.

BI.STP-FA
Graphite cylinder

BI.STP-SW
Aluminium cylinder

BTP.STP10
2 Alum. cylinders

Resources required in case of replacement:

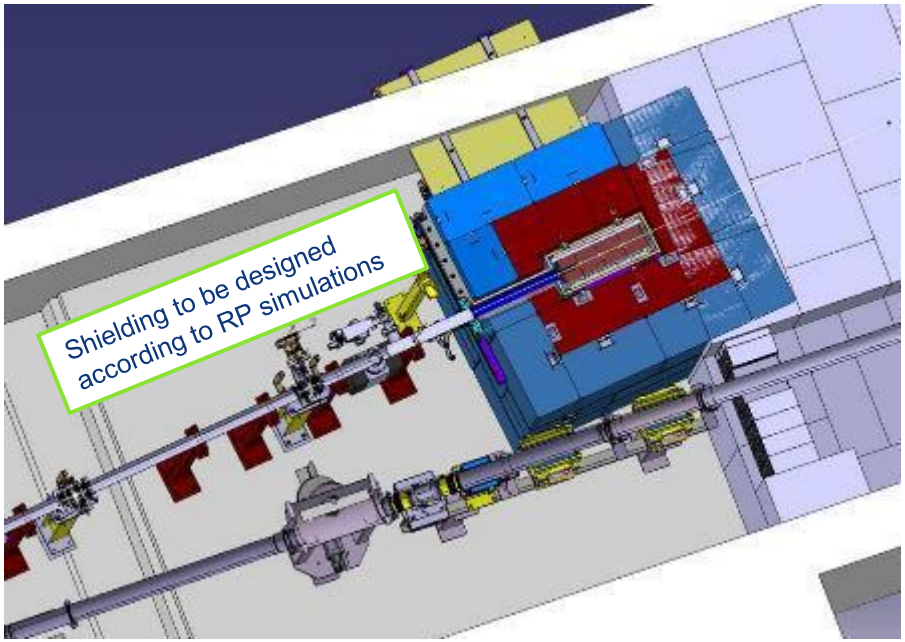
EN-MME : Design
EN-MEF: Integration
EN-HE: Dismantling
TE-VSC: Vacuum
DGS-RP: EIS Equipment

SCHEDULE:

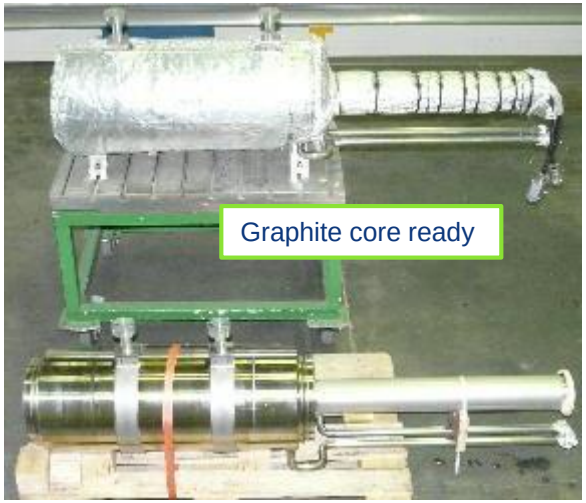
Installation baseline: LS2.

Equipment readiness: End 2016.

LBE dump (H- / 160MeV) (L4)



- LINAC 4 measurement line dump
- Dimensions and weight: optimisation to be done



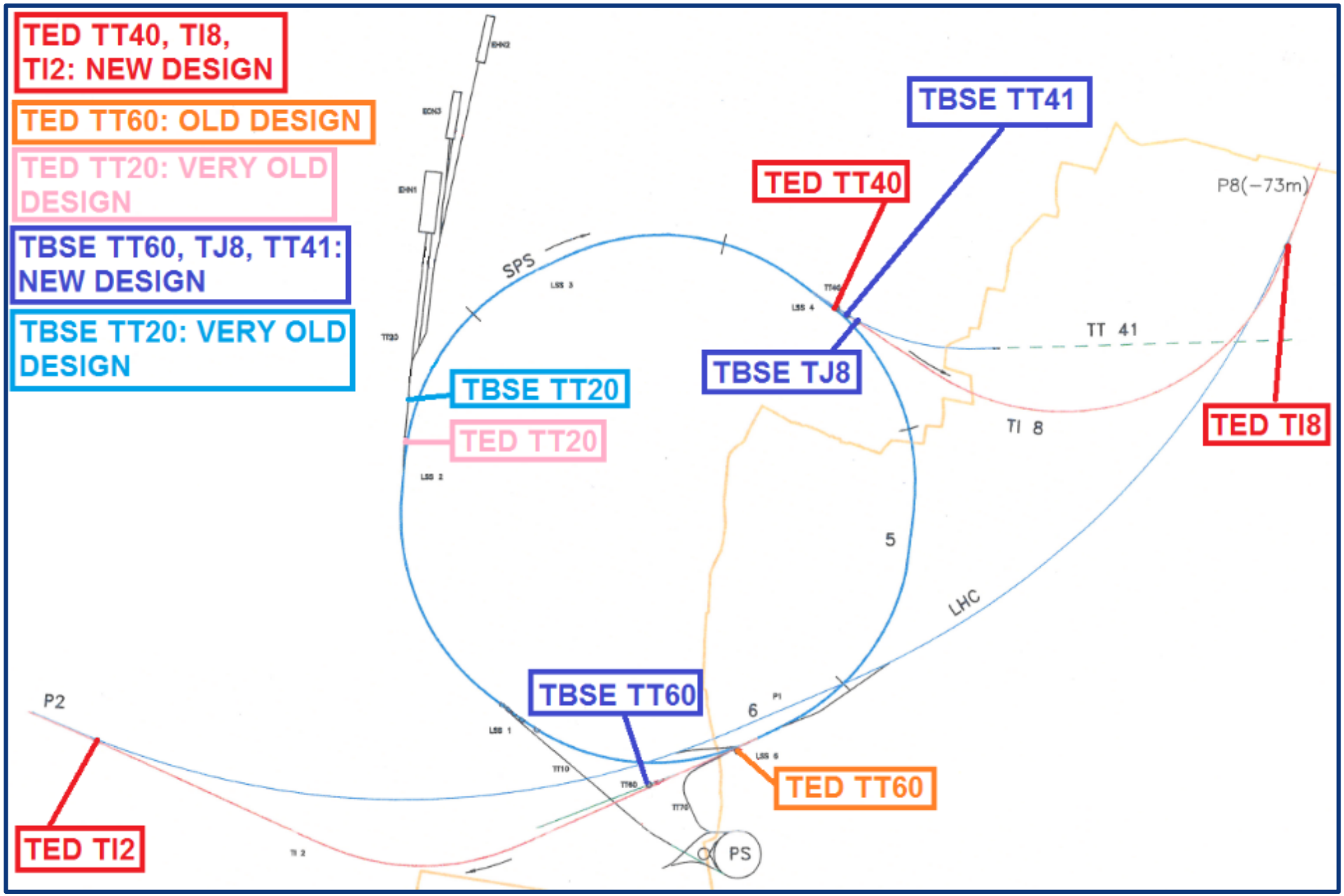
Resources required:

DGS RP : Shielding optimisation
EN MME: Detail drawings, subcontracting
GS SE: Validation, possible civil engineering modifications
EN HE: New crane, dismantling of the line & installation
TE VSC: Modification of the line & connection
EN MEF: Integration, Survey, Re-alignment of the line
EN EL: Cabling
EN CV: Water cooling of the dump

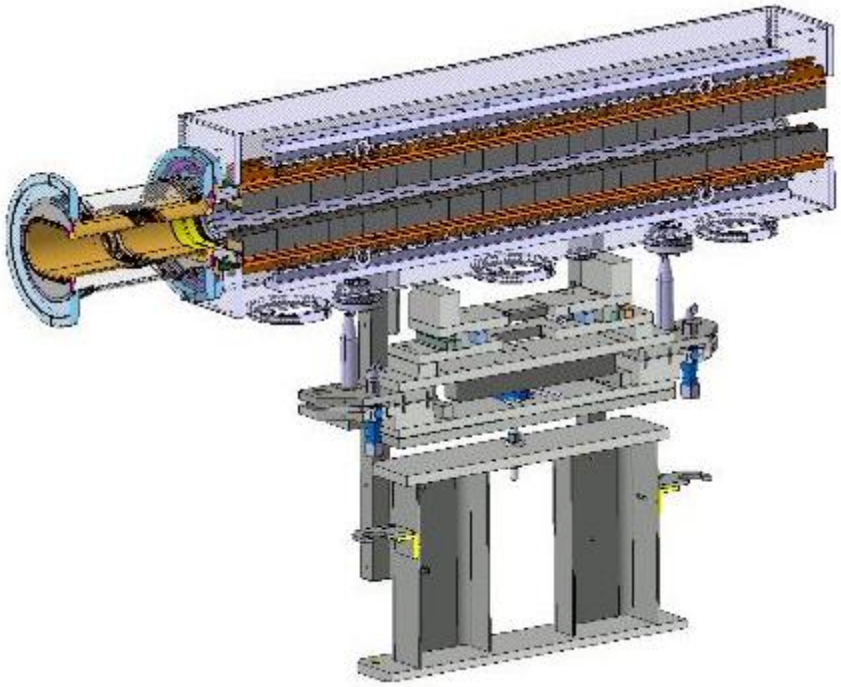
- Baseline: connection during the ***LS2***

- Emergency connection to PS complex in case of major failure in the Accelerator Complex. To be ready by the ***end of 2016.***

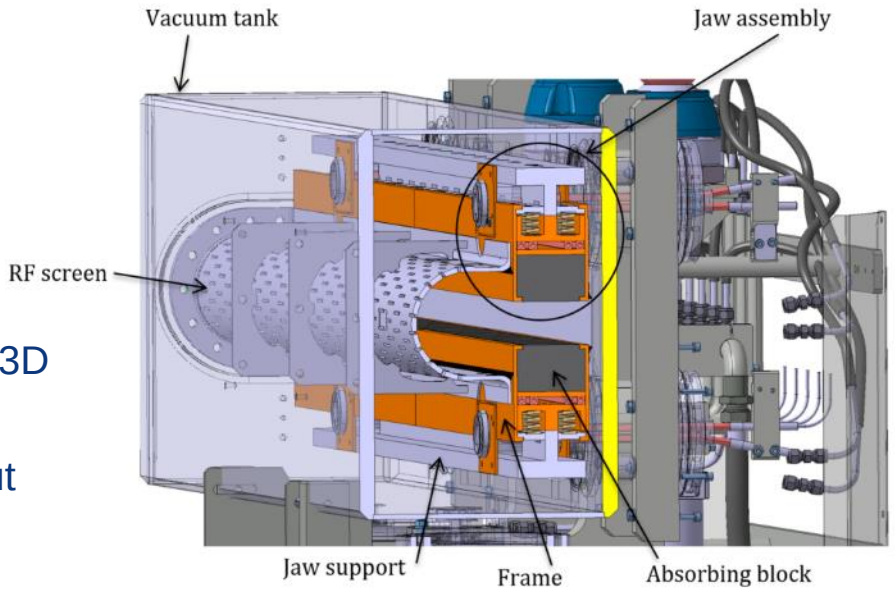

CERN
LS2 DAYS
29-30 SEPTEMBER 2015


TED TT40, TI8, TI2: NEW DESIGN
TED TT60: OLD DESIGN
TED TT20: VERY OLD DESIGN
TBSE TT60, TJ8, TT41: NEW DESIGN
TBSE TT20: VERY OLD DESIGN
TBSE TT41
TED TT40
TBSE TJ8
TBSE TT20
TED TT20
TED TI8
TBSE TT60
TED TT60
TED TI2
SPS
LHC
P8(−73m)
TT 41
TI 8
P2
PS
5
6

TDIS – LS2



- Two TDIS
- Each TDIS made up of 3 modules
- A total of 10 modules (6 installed, 4 spares)
- Prototyping of sub-assemblies may be required
- Project Schedule overview:
  - Detailed design CERN (2015-2016)
  - Prototyping and tests at CERN (2016-2017)
  - Procurement and Manufacture (2016-2018)
  - Assembly (2018-2019)
  - Installation and commissioning (2019)
- Contract scenario:
  - Parts to be ordered separately
  - Assembly and testing done at CERN (no turnkey contracts)
- Suppliers to be consulted:
  - Raw materials with or without machining (graphite, 3D CfC, Glidcop, 3D forged 316LN)
  - Machining, welding, brazing
  - Off-the-shelf components (Interferometers, bake-out jackets, vacuum equipment, mechanical components…)



New LHC Collimators – LS2

- 6 different types of collimators for the LHC
- Main design principles identically for all types
- Quantities not yet defined

Not exhaustive

- Subcontractor key qualification criteria:

-Proven experience in scientific instrument production
-Capacity to produce precise mechanical assemblies
-Electron beam welding and Vacuum brazing
-Familiar with ultra high vacuum requirements
-Company able to test all functionalities of the equipment
…

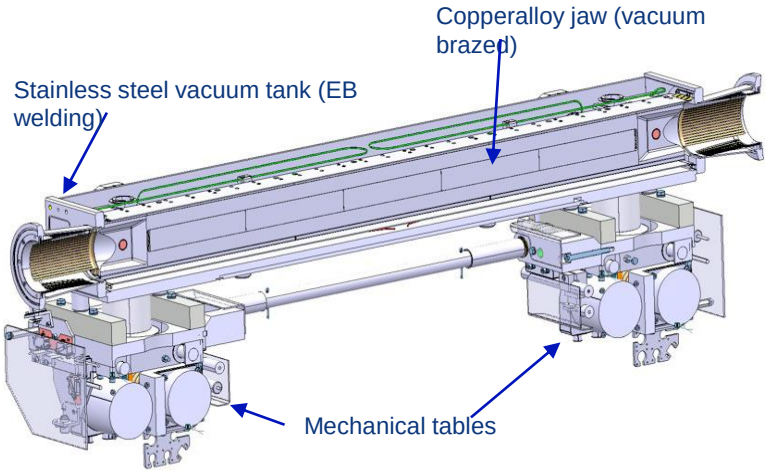
- Project Schedule overview:

-Collimator design at CERN (2015/16)
-Prototyping and tests at CERN (2016/17)
-Production follow up (start in 2017/18)
-Reception at CERN and cabling/controls (2019)
-Installation and commissioning (2019)

- Contract scenario:

-Turn key contract for the collimator core assembly: Tank, Jaws, Tables, part of the supporting structure. Quality controls (functional tests, vacuum leak tests and metrology) shall be included in the contract.

-Tender open to several companies.



Collimator few characteristics:

- *1.5m long, about 1m high*
- *Weight close to 500kg*
- *Equipped with 1.2m long jaws with a flatness of 0,02mm*
- *Working around 10^{-10}mbar*
- *Electron beam welded tank*
- *Vacuum brazing of cooling circuit to Glidcop© support structure*

Collimation

- Collimation maintenance and spare policy (continuous activity managed by STI, collimation project).

→2 spares for TCSP collimators for point 6, with BPM. Presently produced by CINEL. (time scale: 2016).
→4 TCTW collimators (for BBLR compensation) for installation, with BPM and wire. Presently produced by CINEL. (time scale: 2016).
→1 TCPP for testing, with BPM. Presently produced by CINEL. (time scale: 2016).
→Spare policy for mechanical components.
→Consolidated Mechanical Design.
→Primary collimator spares (TCP).
→Spares for other collimator types.

- Recovery of collimator 5th axis for TCT's in point 1 and point 5. YETS 15/16. (managed by STI, collimation project).

→To be discussed if need of adding few motors also in Points 2 and 8.

- Control system consolidation (STI-ECE). LS2. Consolidation project.

- Replacement of tertiary collimators (TCT) @ the four interaction points: (IP1,5,2,8). LS2. Consolidation project.

→More robust TCT for lower Beta8 in run II and III (16 collimators), possibly layout modification.

- Replacement of primary (TCP) and secondary (TCS) collimators with BPM design, in points 3 and 7. LS2. Consolidation project.

→8 TCP replaced by 8 TCPP.
→~10 TCS replaces by 10 TCSP.

- Passive Absorbers for the LHC warm cleaning insertions (Point 7). LS2. Consolidation Project.

- Train for remote collimator survey (STI-ECE?). Consolidation Project. Timeline??

- R and D ongoing activities (STI NOT INVOLVED?):

→TCTPM (M for Metal) (EN-MME?). For points 2 and 8.
→TCLA (ABT + MME ?). For point 6.
→TCLD (TE-CRG, EN-MME) Point 2 and 6?

} STI participation to be clarified