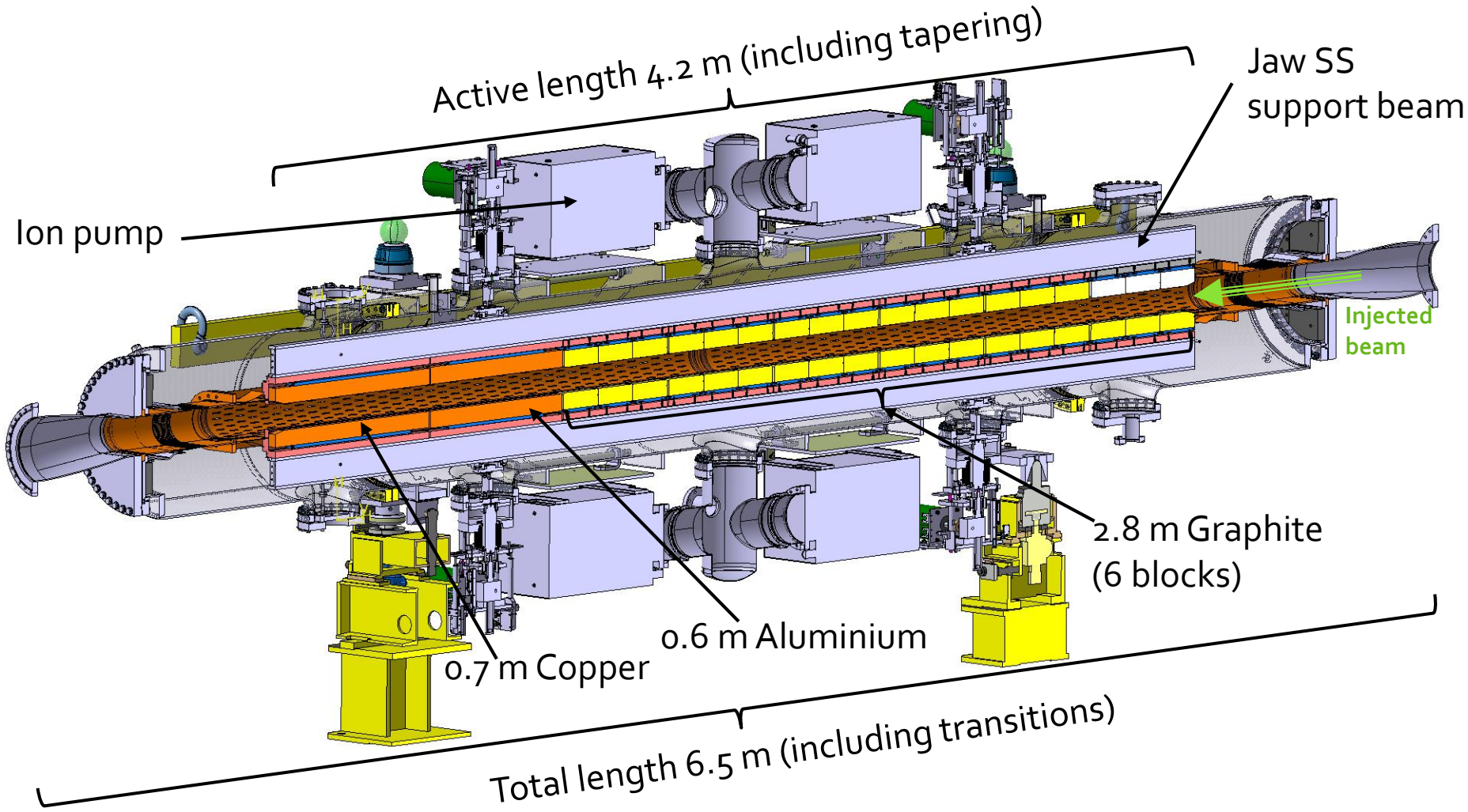
TDIS Design Overview

A. Perillo-Marcone (EN/STI)

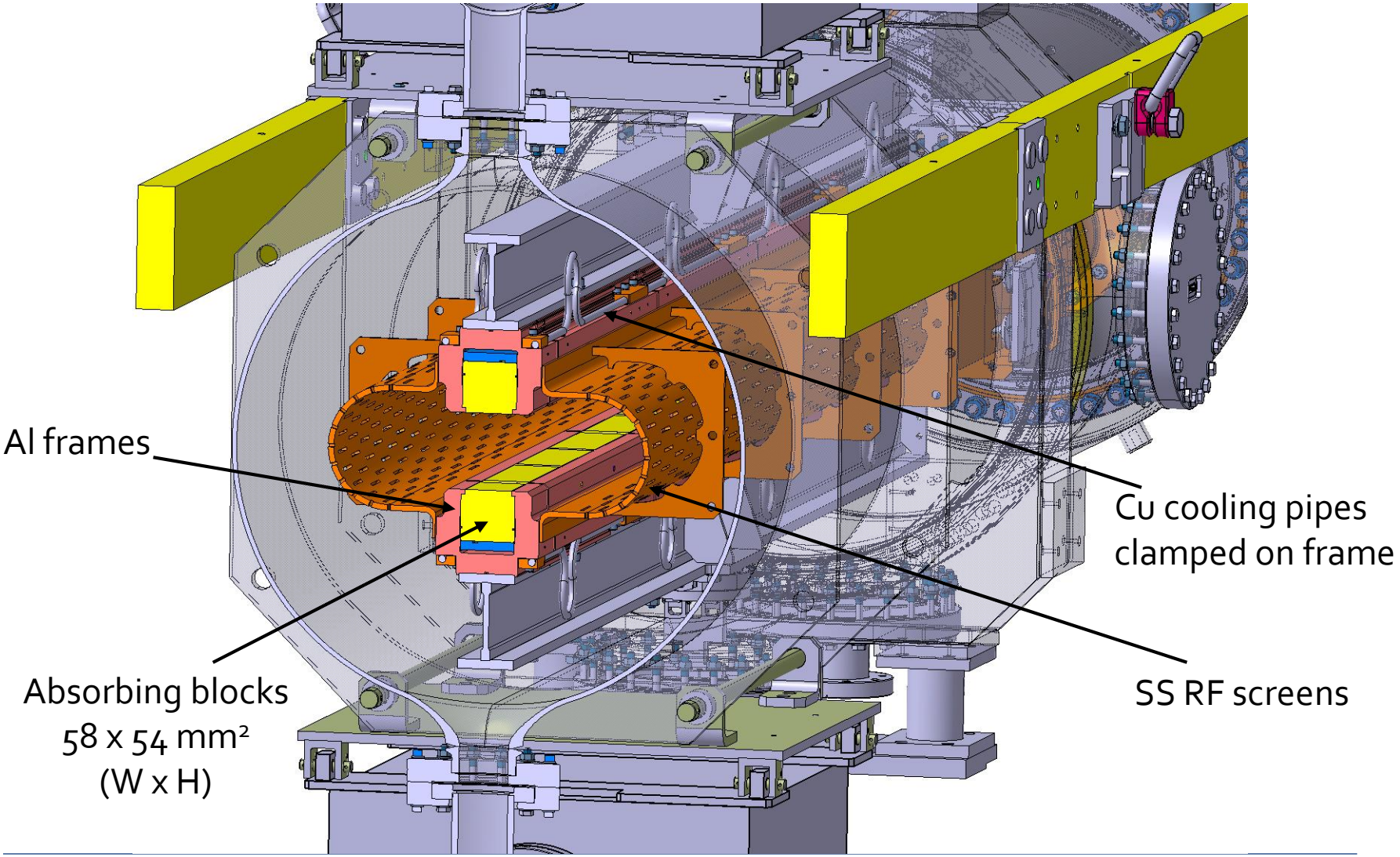
Presentation Outline

- Present device (TDI)
- Proposed design
- Absorbing materials
- Coating
- Cooling system
- Instrumentation
- Transport
- Spare policy
- Prototyping
- Schedule

Present device (TDI)



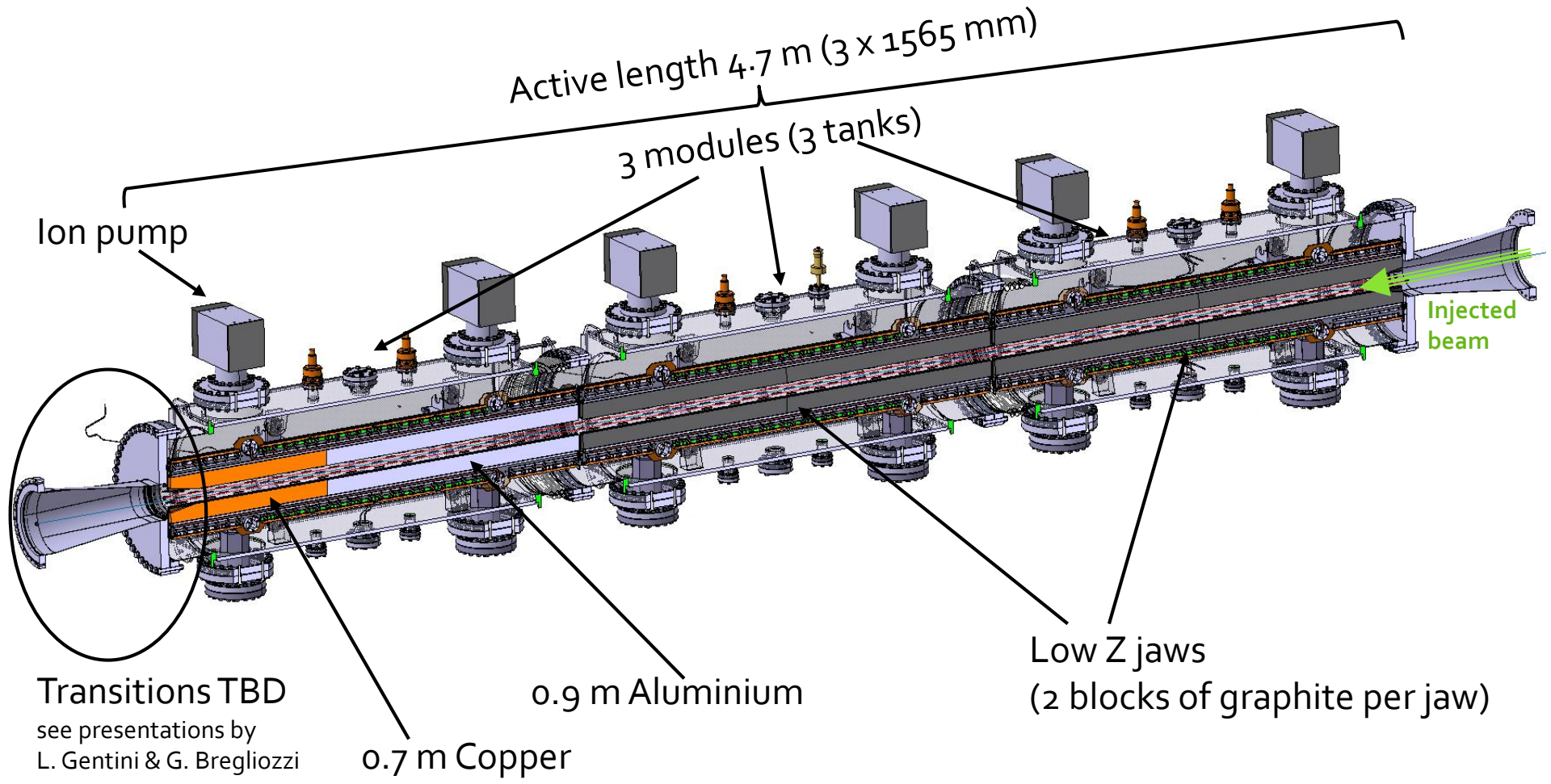
Present TDI


Al frames
Absorbing blocks
58 x 54 mm²
(W x H)
Cu cooling pipes
clamped on frame
SS RF screens

Present device (main issues)

- Mechanism
  - Jaw design prone to "large" geometrical defects
  - Unpractical alignment possibilities (difficult to achieve accuracy)
  - Flexible jaws and jaw supports (unstable/unreliable alignment)
  - Jaw position – lack of robust mechanical reference
- Impedance
  - No electrical contact jaw/screen
  - Large volumes
- Tank
  - Too large (not adapted to TDI) –> Inefficient
  - Large flanges
  - Limited access for assembly

Proposed Design for TDIS



Absorbing Materials

- Low Z jaws
  - **Baseline: Graphite R7550 (SGL)**
  - Back-up: 3D CfC

  To be noted:
    - Graphite option is better in terms of impedance and outgassing
    - 3D CfC has a higher strength (performance under beam impact to be tested)
    - HRMT-28 will test both materials in 2017 under LIU-BCMS-like beam impact

- High Z jaws
  - **Baseline: 90 cm Al + 67 cm CuCrZr**
  - Back-up: 78 cm Ti6Al4V + 78 cm CuCrZr (still to be studied)

  To be noted:
    - Al expected to undergo plastic deformation in case of high-intensity beam impacts
    - Ti6Al4V has a high strength but loads and T expected to be higher (to be checked).
    - Ti6Al4V is a bad thermal conductor, although probably not critical in this application (to be checked)

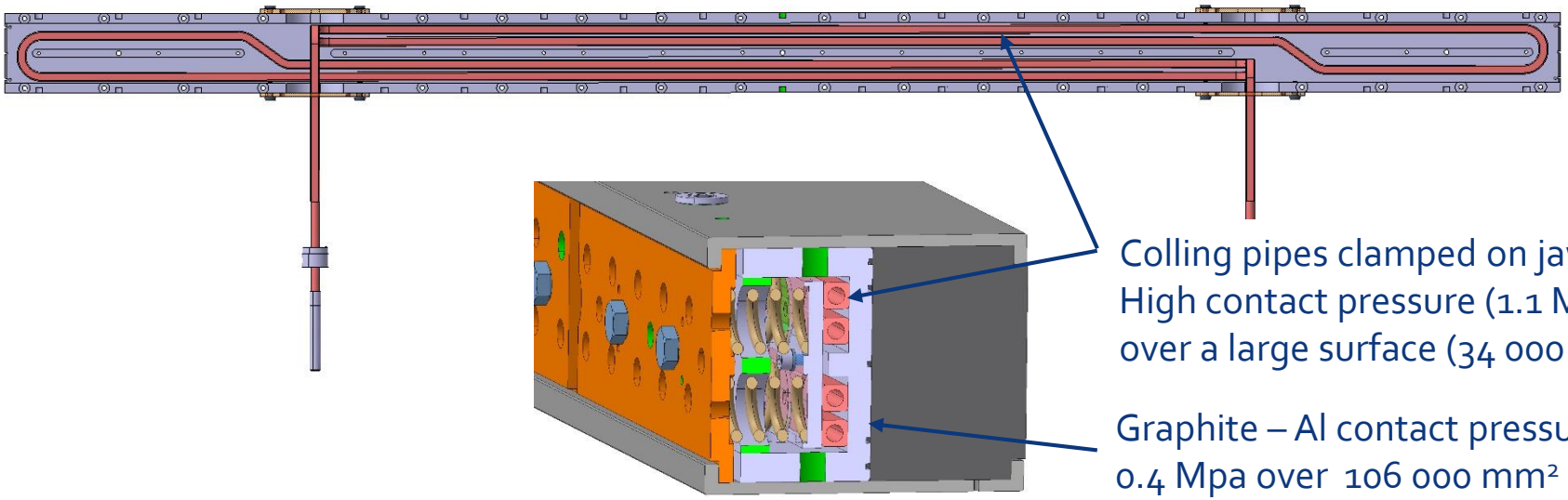
Coating

- Cu coating on graphite significantly improves impedance (see N. Biancacci's presentation)
- High risk of damage in case of grazing impact (to be assessed in 2017 with HRMT-35)
- Non-coated graphite expected to be good enough in terms of impedance

Baseline: NO COATING ON GRAPHITE

Ti coating on Al absorbing block necessary to avoid SEY (see G. Skripka's presentation)

Cooling system



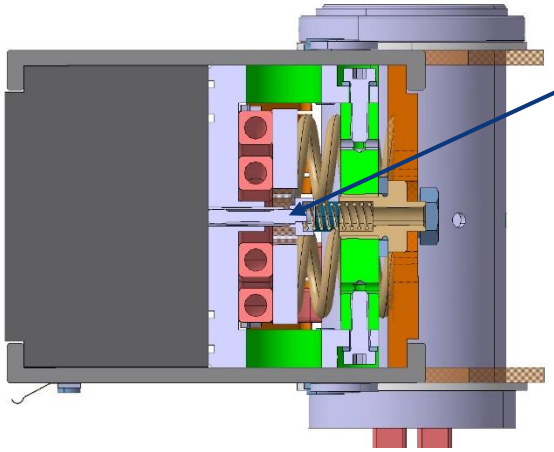
Colling pipes clamped on jaw
High contact pressure (1.1 Mpa)
over a large surface (34 000 mm²)

Graphite – Al contact pressure
0.4 Mpa over 106 000 mm²

Material for cooling pipes

- Baseline –> CuNi 90/10 (good erosion/corrosion resistance)
- Alternatives:
  - Cu (10 x higher thermal conductivity, low erosion/corrosion resistance)
  - Ni (1.5 x higher thermal conductivity, good erosion/corrosion resistance)

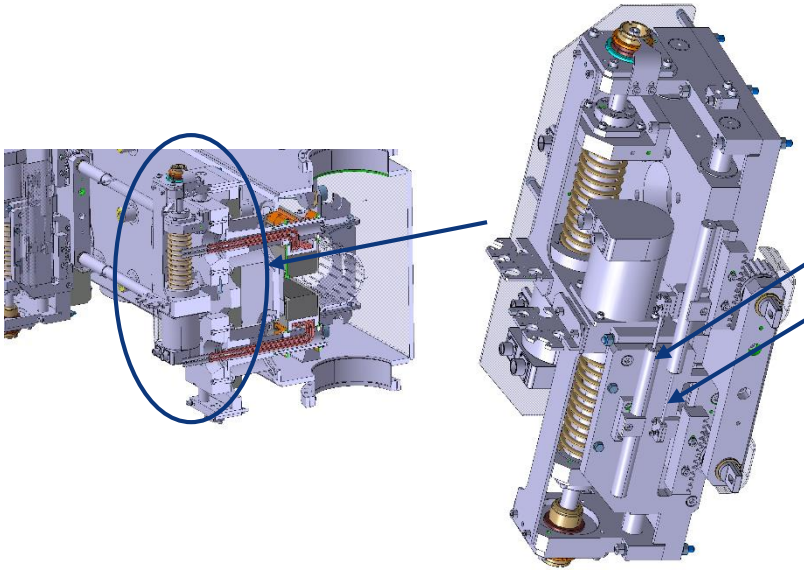
Instrumentation



3 x PT100 per jaw at contact with absorbing block.
2 x PT100 on each RF screen

Total 8 x PT100 per module (i.e. 24 x PT100 per TDIS)

How to avoid EM coupling?



3 x LVDT par assembly (2 x assemblies per jaw)

- 2 x LVDT per jaw (upstream / downstream)
- 2 x LVDT per module for gap measurement

No interferometers in baseline

Total 6 x LVDT per module (i.e. 18 x LVDT per TDIS)

TDIS Design - Transport

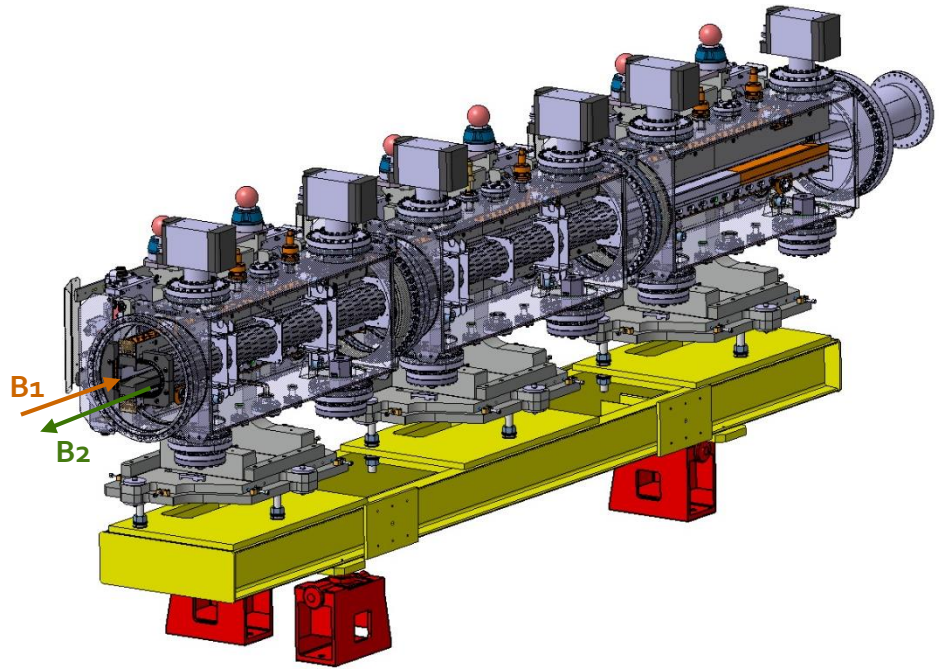
Studies to be performed:

- Tooling for transport on lorry.
- Max length of TDIS?
- Tooling for lowering in shaft (PM25 / PM-85) – cameras, contact sensors, protection?
- Tooling for transport in tunnel

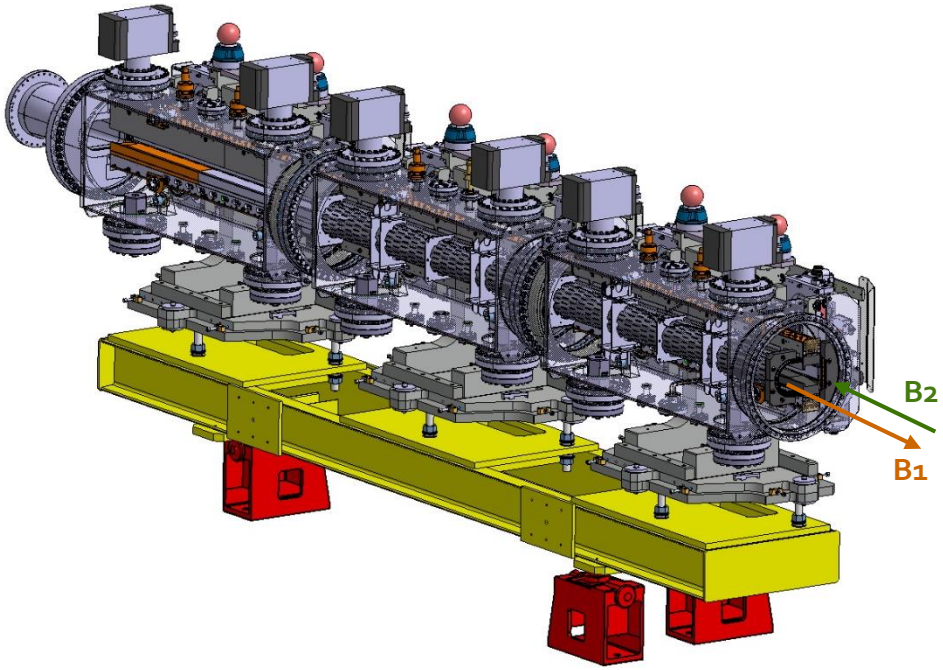
Present TDI

Spare policy

- One dedicated spare for each point
- Spares not exchangeable
- Modules exchangeable but before assembly



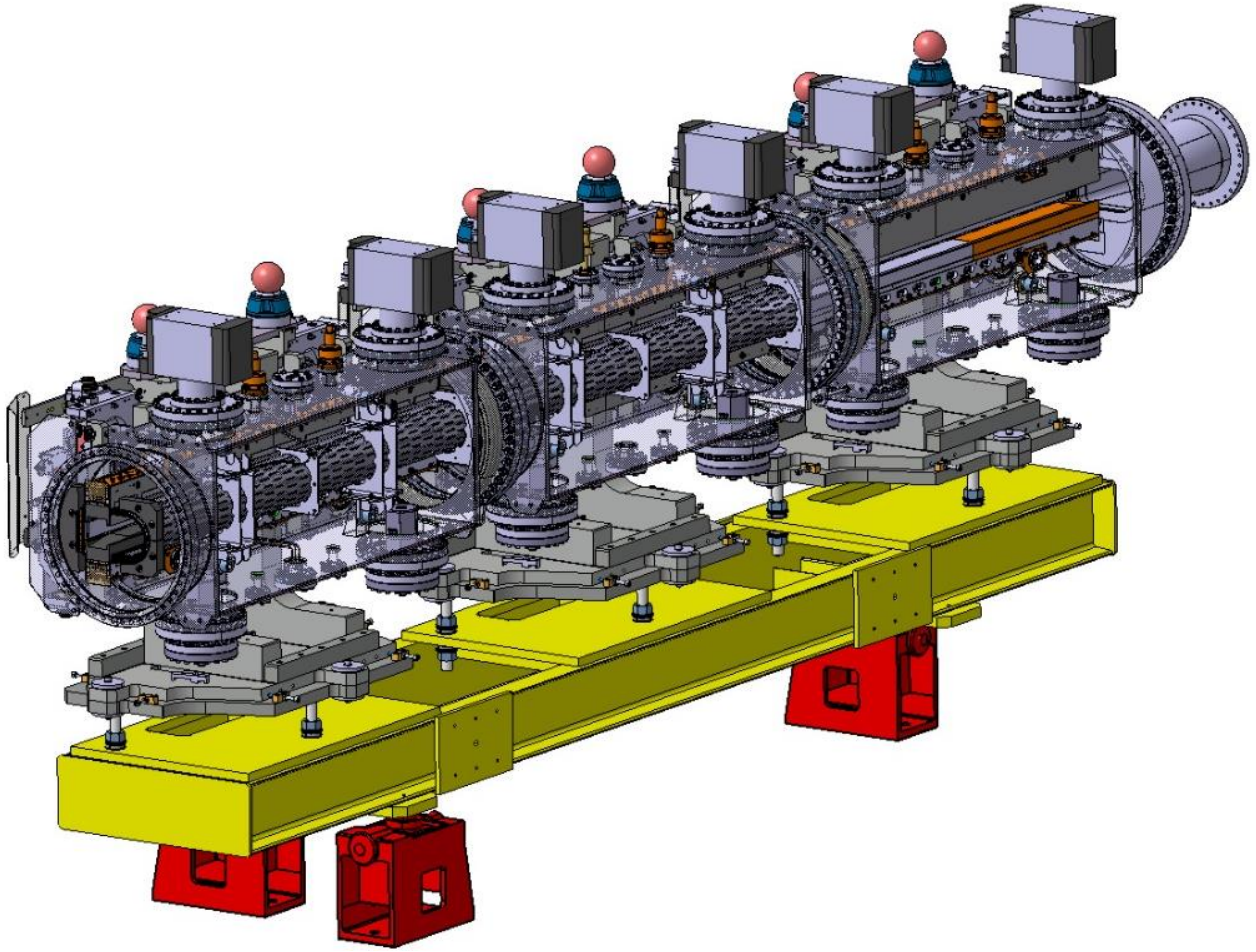
Configuration for P2



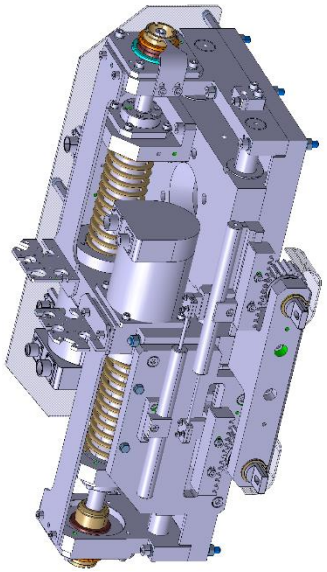
Configuration for P8

Prototyping

A full TDIS to be produced in 2017 to be assembled and tested in 2018

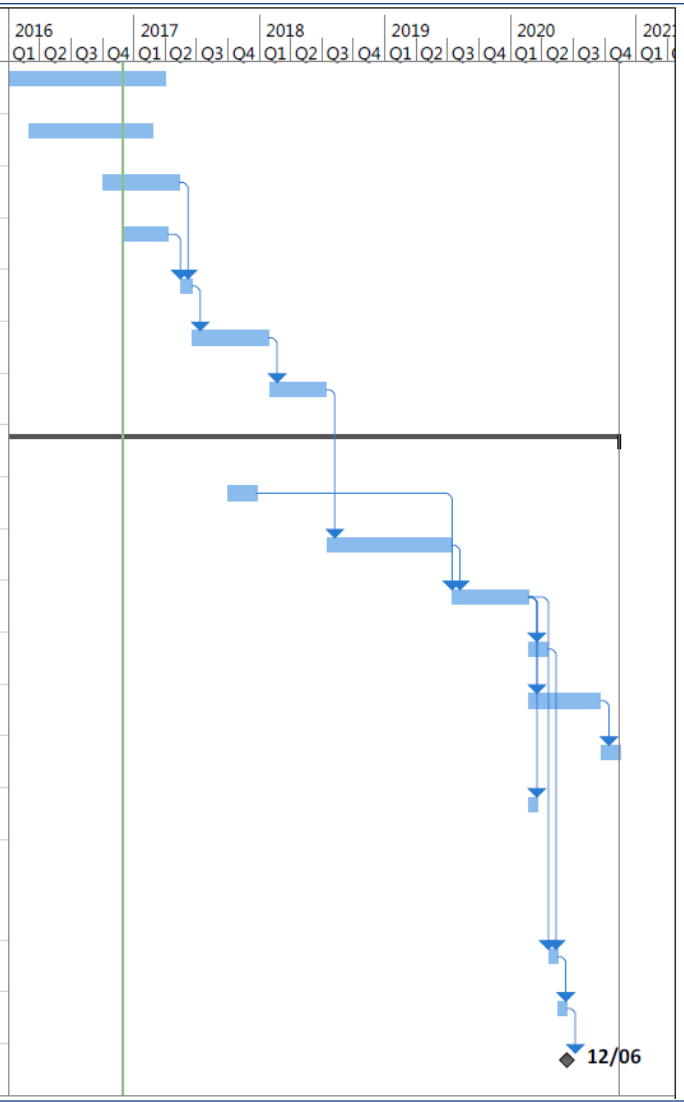


One additional motorisation assembly to be submitted to several cycles



Schedule

Task Name	Duration	Start	Finish
Conceptual Design	87 wks	Mon 06/07/15	Fri 31/03/17
Detailed design (3D)	50 wks	Mon 29/02/16	Fri 24/02/17
Detailed Design (2D drawings)	30 wks	Mon 03/10/16	Fri 12/05/17
Tanks - Market Survey + IT	16 wks	Mon 05/12/16	Fri 07/04/17
Invitation do tender	5 wks	Mon 15/05/17	Fri 16/06/17
Prototyping manufacture (1 full TDIS)	30 wks	Mon 19/06/17	Fri 26/01/18
Prototyping assembly and tests	24 wks	Mon 29/01/18	Fri 13/07/18
Procurement and Manufacture	**67.5 mons**	**Mon 06/07/15**	**Fri 13/11/20**
Procurement low Z blocks	12 wks	Mon 02/10/17	Fri 22/12/17
Manufacture parts (final production)	50 wks	Mon 16/07/18	Fri 12/07/19
Assembly 2 TDIS	30 wks	Mon 15/07/19	Fri 21/02/20
Bake-out 2 TDIS	8 wks	Mon 24/02/20	Fri 17/04/20
Assembly 2 spare TDIS	30 wks	Mon 24/02/20	Fri 18/09/20
Bake-out 2 spare TDIS	8 wks	Mon 21/09/20	Fri 13/11/20
Dismantling old TDI	4 wks	Mon 24/02/20	Fri 20/03/20
Modification position sector valve in tunnel	2 wks	Mon 06/07/15	Fri 17/07/15
Installation	4 wks	Mon 20/04/20	Fri 15/05/20
Commissioning tests	4 wks	Mon 18/05/20	Fri 12/06/20
Ready for opeartion	0 mons	Fri 12/06/20	Fri 12/06/20



THANK YOU!