UK-IT Integration meeting

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5 April 2018

Introduction

- Welcome to LNF !
- This is the first of meetings aimed to optimize synergy for the outer pixel-endcap assembly
  - others will follow in the next years
- Scope of this meeting:
  - Overview of the various aspect of the assembly
  - Agreement on work sharing
- A lot of time is devoted to discussion

Next dates of interest

- October 2018: Memorandum of Understanding (MoU)
  - Planed to define cost and responsabilities for 2.1.7.1.x deliverables (info from Claudia Gemme)

- Discussion at the IB the 18th April during ATLAS Upgrade Week

- Face-to-face meeting the 19th April during ATLAS Upgrade Week:
  - aim to show to the community the outcomes of this meeting

WBS related to Integration

2.1.4.1	**On stave/ring cables (Type-0)**
2.1.4.2	**Patch Panel 0 (PP0)**
2.1.4.3.1	Cooling pipes in Type 1
2.1.4.3.2	High speed electrical data cables in Type 1
2.1.4.3.2.1	Twisted Pair data cables
2.1.4.3.2.2	Twinax data cables
2.1.4.3.3	Power and DCS cables in Type 1
2.1.4.3.4	Management of cables in Type 1
2.1.4.3	**Type 1 Services**
2.1.4.4.1	Shielding cage
2.1.4.4.2	Sealing of PP1
2.1.4.4	**Patch Panel 1 (PP1)**
2.1.4.5	**Optical drivers/receivers**
2.1.4.6	**Optical patch panel**
2.1.4.7	**Optical fibers**
2.1.4.8	**Type 2 Services**
2.1.4.9	**Patch Panel 2 (PP2)**
2.1.4.10	**Type 3 Services**
2.1.4	**Services**

WBS related to Integration

2.1.6.4.a	Laminates
2.1.6.4.b	EndRings
2.1.6.4.c	Tools/EoB
2.1.6.4	**Outer Endcap structures**
2.1.6	**Global Mechanics and installation tooling**

2.1.7.3.a	Tooling preparation for half cylinders
2.1.7.3.b	Assembly infrastructure
2.1.7.3.c	Transport to CERN
2.1.7.3	**Integration of endcap rings to cylinders**

WBS related to Integration

2.1.7.4.a	Reception test of endcaps at CERN
2.1.7.4.b	Tooling preparation for endcaps
2.1.7.4.c	Outer placement and integration
2.1.7.4.d	Placement of IST, transfer tool
2.1.7.4.e	Bridging rail system
2.1.7.4.f	Alignment equipment
2.1.7.4.g	Forces monitor
2.1.7.4.h	Traction system
2.1.7.4	**Integration of Endcaps to Barrel**

2.1.7.8.a	System setup (no cooling plant)
2.1.7.8.b	Consumables
2.1.7.8.c	Equipement for welding
2.1.7.8	**Endcap local support system testing**

2.1.7.10.a	Readout for the slice test if FELIX not available
2.1.7.10.b	Transportation from institutes
2.1.7.10	**DAQ for test setups**

5 April

09:00
Introduction — *TESTA, Marianna et al.*
Aula Salvini, INFN - Laboratori Nazionali di Frascati 09:00 - 09:20

EndCap design
Aula Salvini, INFN - Laboratori Nazionali di Frascati 09:20 - 11:00

10:00
11:00
Coffee break
Aula Salvini, INFN - Laboratori Nazionali di Frascati 11:00 - 11:30

DAQ
Aula Salvini, INFN - Laboratori Nazionali di Frascati 11:30 - 12:00

12:00
Discussion
Aula Salvini, INFN - Laboratori Nazionali di Frascati 12:00 - 12:30

14:00
Services
Aula Salvini, INFN - Laboratori Nazionali di Frascati 14:15 - 16:30

15:00
16:00
Coffee break
Aula Salvini, INFN - Laboratori Nazionali di Frascati 16:30 - 17:00

17:00
Integrations procedure and tooling
Aula Salvini, INFN - Laboratori Nazionali di Fra

18:00
Shift is currently pressed. Changes will be applied to blocks after

6 April

09:00
Quality Control
Aula Salvini, INFN - Laboratori Nazionali di Frascati 09:00 - 09:30

System tests
Aula Salvini, INFN - Laboratori Nazionali di Frascati 09:30 - 10:15

10:00
Transport
Aula Salvini, INFN - Laboratori Nazionali di Frascati 10:15 - 11:00

11:00
Coffee Break
Aula Salvini, INFN - Laboratori Nazionali di Frascati 11:00 - 11:30

Discussion
Aula Salvini, INFN - Laboratori Nazionali di Frascati 11:30 - 13:00

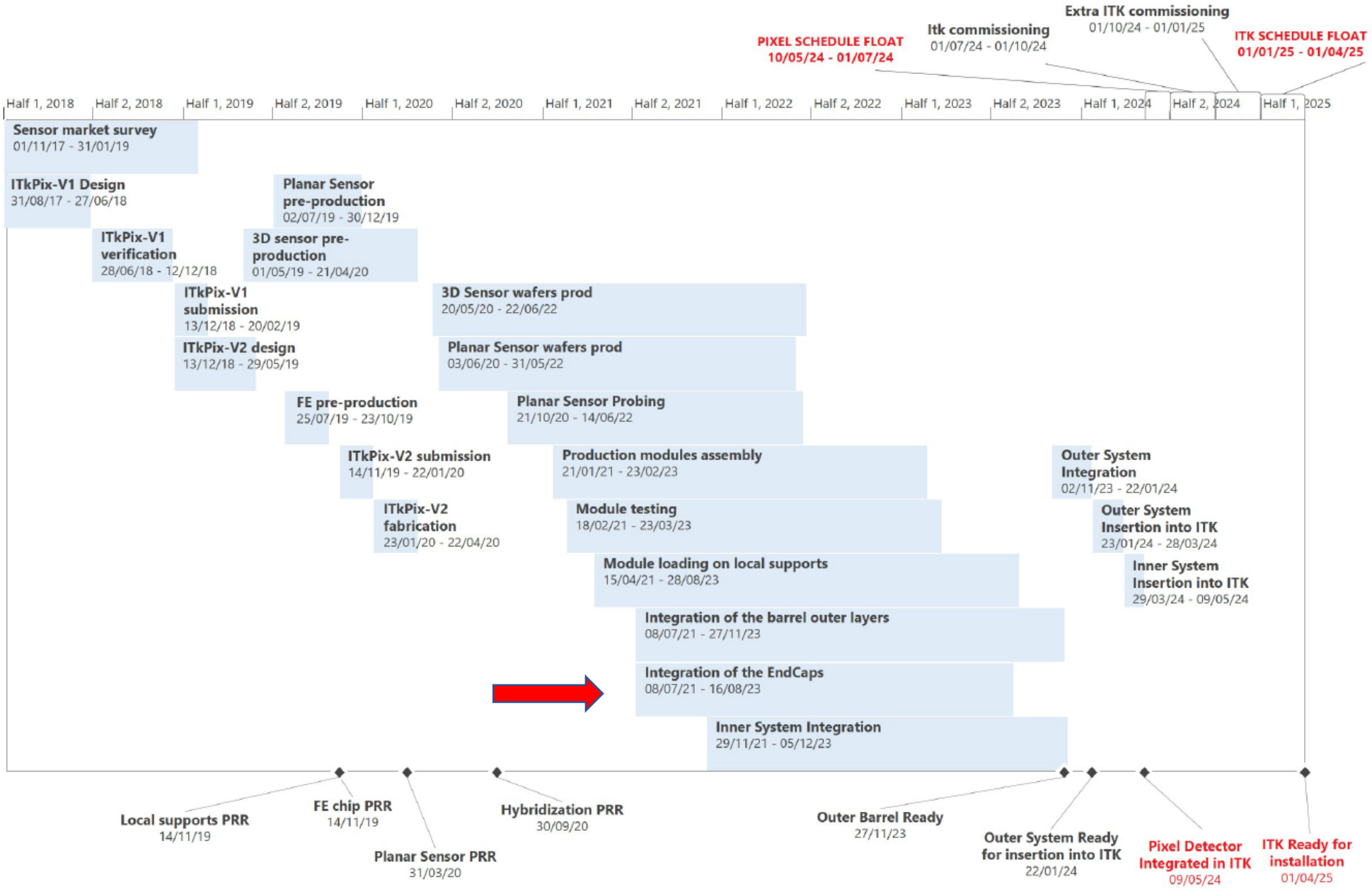
12:00

Lot of time for discussion

For any issue,
don’t hesitate to contact us

Backup with timelines

Overall Schedule

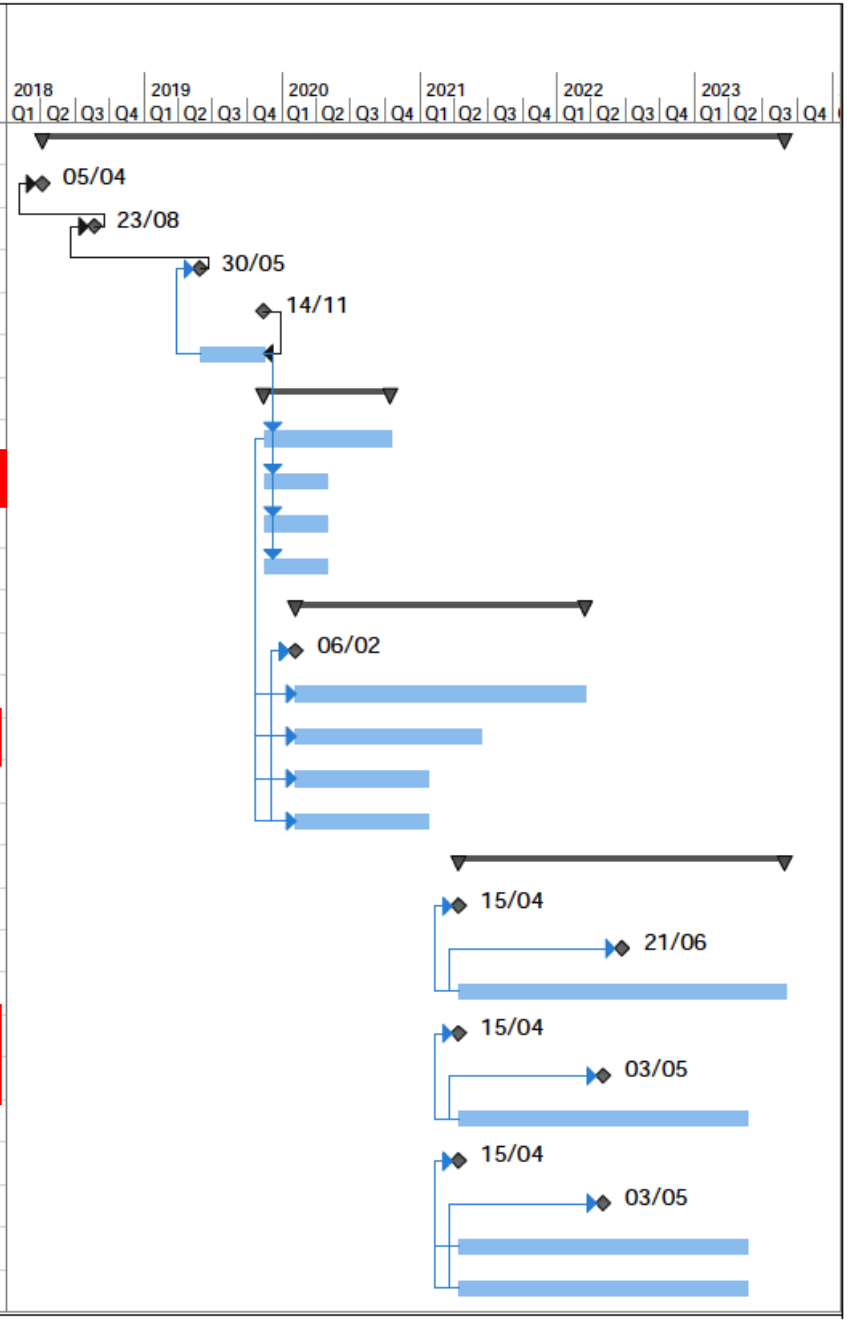


Services Schedule

- Q2 2017- middle 2020:
  preparation of the Type-0 and Type-I services (including cables, fibres, patch panels, tubes)
  - First half of 2019: pre-production and qualification
  - Q3 2019: final production starting
  - Q2 2020: Pre-production of the VTRX++ (components for electrical-optical conversion of data) followed rapidly by bulk production
- Middle of 2020: Orders will be placed for the GBT transmitters, complete one year later.

Local support schedule

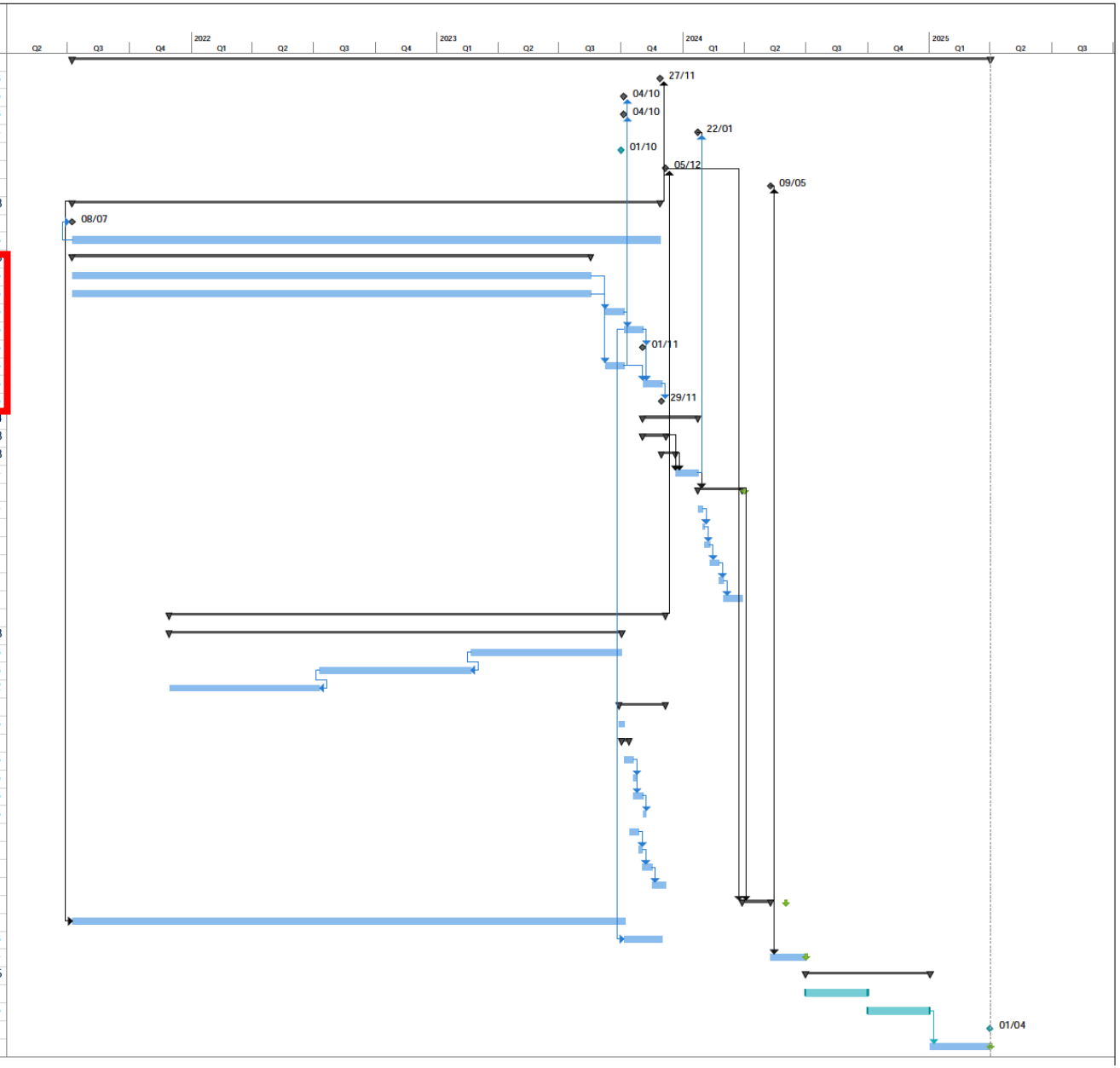
WBS	Task Name	Duration	Start	Finish
2.1.5	Local Supports	1408 days	Thu 05/04/18	Mon 28/08/23
	Spec review	0 days	Thu 05/04/18	Thu 05/04/18
	PDR	0 days	Thu 23/08/18	Thu 23/08/18
	FDR	0 days	Thu 30/05/19	Thu 30/05/19
	Local supports PRR	0 days	Thu 14/11/19	Thu 14/11/19
	Loaded Local Supports pre-production	6 mons	Thu 30/05/19	Thu 14/11/19
2.1.5.1	Local Support cooling line	240 days	Thu 14/11/19	Wed 14/10/20
2.1.5.1.1	Outer Barrel Local Support Cooling Line	12 mons	Thu 14/11/19	Wed 14/10/20
2.1.5.1.2	Outer Encap Local Support Cooling Line	6 mons	Thu 14/11/19	Wed 29/04/20
2.1.5.1.3	Inner Barrel Local Support Cooling Line	6 mons	Thu 14/11/19	Wed 29/04/20
2.1.5.1.4	Inner Encap Local Support Cooling Line	6 mons	Thu 14/11/19	Wed 29/04/20
2.1.5.2	Local support Mechanical Structure	550 days	Thu 06/02/20	Wed 16/03/22
	First Mechanics from each subsystem de	0 days	Thu 06/02/20	Thu 06/02/20
2.1.5.2.1	Outer Barrel mechanical structure	550 days	Thu 06/02/20	Wed 16/03/22
2.1.5.2.2	Outer Endcap mechanical structure	350 days	Thu 06/02/20	Wed 09/06/21
2.1.5.2.3	Inner Barrel mechanical structure	250 days	Thu 06/02/20	Wed 20/01/21
2.1.5.2.4	Inner Endcap mechanical structure	250 days	Thu 06/02/20	Wed 20/01/21
2.1.5.3	Module loading on local supports	618 days	Thu 15/04/21	Mon 28/08/23
2.1.5.3.1(	First OB Loaded local support delivered	0 days	Thu 15/04/21	Thu 15/04/21
2.1.5.3.1	50% OB Loaded local support delivered	0 days	Tue 21/06/22	Tue 21/06/22
2.1.5.3.1	Outer Barrel Module Loading	618 days	Thu 15/04/21	Mon 28/08/23
2.1.5.3.1	First EndCap Loaded local support delive	0 days	Thu 15/04/21	Thu 15/04/21
2.1.5.3.1	50% EndCap Loaded local support delive	0 days	Tue 03/05/22	Tue 03/05/22
2.1.5.3.2	Outer Endcap Module Loading	546 days	Thu 15/04/21	Thu 18/05/23
2.1.5.3.1	First Inner Loaded local support delivere	0 days	Thu 15/04/21	Thu 15/04/21
2.1.5.3.1	50% Inner Loaded local support delivere	0 days	Tue 03/05/22	Tue 03/05/22
2.1.5.3.3	Inner Barrel Module Loading	546 days	Thu 15/04/21	Thu 18/05/23
2.1.5.3.4	Inner Endcap Module Loading	546 days	Thu 15/04/21	Thu 18/05/23



Integration schedule

Endcap: Start Q3 2021 (first loaded half-ring available) - Delivered at CERN October 2023

WBS	Task Name	Duration	Start	Finish
2.1.7	Integration and system test	974 days?	Thu 08/07/21	Tue 01/04/25
	Outer Barrel Ready	0 days	Mon 27/11/23	Mon 27/11/23
	EndCap C delivered at CERN	0 days	Wed 04/10/23	Wed 04/10/23
	EndCap A delivered at CERN	0 days	Wed 04/10/23	Wed 04/10/23
	Outer System Ready for insertion into ITK	0 days	Mon 22/01/24	Mon 22/01/24
	12 Inner System Quadrants delivered at CEI	0 days	Sun 01/10/23	Sun 01/10/23
	Inner System Assembled at CERN ready for	0 days	Tue 05/12/23	Tue 05/12/23
	Pixel Detector Integrated in ITK	0 days	Thu 09/05/24	Thu 09/05/24
2.1.7.2	Integration of the barrel outer layers	623 days	Thu 08/07/21	Mon 27/11/23
	Assembly line completed	0 days	Thu 08/07/21	Thu 08/07/21
	L2-L3-L4 longeron + typel services Integr	623 days	Thu 08/07/21	Mon 27/11/23
2.1.7.3	Integration of the Endcaps	550 days	Thu 08/07/21	Wed 16/08/23
	End Cap C Integration	550 days	Thu 08/07/21	Wed 16/08/23
	End Cap A integration	550 days	Thu 08/07/21	Wed 16/08/23
	Endcap C shipment to CERN	20 days	Thu 07/09/23	Wed 04/10/23
	Endcap C acceptance test	20 days	Thu 05/10/23	Wed 01/11/23
	EndCap C ready for integration	0 days	Wed 01/11/23	Wed 01/11/23
	Endcap A shipment to CERN	20 days	Thu 07/09/23	Wed 04/10/23
	Endcap A acceptance test	20 days	Thu 02/11/23	Wed 29/11/23
	EndCap A ready for integration	0 days	Wed 29/11/23	Wed 29/11/23
2.1.7.4	Outer System Integration	58 days	Thu 02/11/23	Mon 22/01/24
	End Cap A&C integration with IST	25 days	Thu 02/11/23	Wed 06/12/23
	OB Shell Layer Integration with the End	15 days	Thu 30/11/23	Wed 20/12/23
	Outer System cold cycling and testing	23 days	Thu 21/12/23	Mon 22/01/24
	Outer System Insertion into ITK	48 days	Tue 23/01/24	Thu 28/03/24
	Detector transfer into the insertion tool	5 days	Tue 23/01/24	Mon 29/01/24
	Alignement to the PST	3 days	Tue 30/01/24	Thu 01/02/24
	Outer System Insertion	5 days	Fri 02/02/24	Thu 08/02/24
	Reception Test (Outer Barrel in STRIPS)	10 days	Fri 09/02/24	Thu 22/02/24
	Pipe welding	5 days	Fri 23/02/24	Thu 29/02/24
	PP1 dress-up	20 days	Fri 01/03/24	Thu 28/03/24
2.1.7.1	Inner System Integration	527 days	Mon 29/11/21	Tue 05/12/23
	In USA	480 days	Mon 29/11/21	Mon 02/10/23
	4 Quadrants for Barrel Assembly	8 mons	Mon 20/02/23	Mon 02/10/23
	4 Quadrants for EndCap A Assembly	8 mons	Mon 11/07/22	Mon 20/02/23
	4 Quadrants for EndCap C Assembly	8 mons	Mon 29/11/21	Mon 11/07/22
	In SR1	49 days	Thu 28/09/23	Tue 05/12/23
	Assembly Line Setup	5 days	Thu 28/09/23	Wed 04/10/23
	12 Quadrants reception test	9 days	Mon 02/10/23	Thu 12/10/23
	Barrel 4 quadrants integration	10 days	Thu 05/10/23	Wed 18/10/23
	Reception test (on Assembled barrel)	3 days	Thu 19/10/23	Mon 23/10/23
	Inner End Cap A four quadrants integr	10 days	Thu 19/10/23	Wed 01/11/23
	Reception test (on Inner EndCap A)	3 days	Thu 02/11/23	Mon 06/11/23
	Inner EndCap C four quadrants integra	10 days	Fri 13/10/23	Thu 26/10/23
	Reception test (Inner EndCap C)	3 days	Fri 27/10/23	Tue 31/10/23
	Inner System Integration	10 days	Wed 01/11/23	Tue 14/11/23
	Inner System Cold Test	15 days	Wed 15/11/23	Tue 05/12/23
	Inner System Insertion into ITK	30 days	Fri 29/03/24	Thu 09/05/24
2.1.7.6	Barrel local support system testing	586 days	Thu 08/07/21	Thu 05/10/23
2.1.7.7	EndCap Local Support System Testing	40 days	Thu 05/10/23	Wed 29/11/23
	PIXEL SCHEDULE FLOAT	37 days	Fri 10/05/24	Mon 01/07/24
2.1.7.8	12.5% or slice system test in SR1	133 days	Mon 01/07/24	Wed 01/01/25
	Itk commissioning	67 days	Mon 01/07/24	Tue 01/10/24
	Extra ITK commissioning	67 days	Tue 01/10/24	Wed 01/01/25
	ITK Ready for installation	0 days	Tue 01/04/25	Tue 01/04/25
	ITK SCHEDULE FLOAT	65 days	Wed 01/01/25	Tue 01/04/25



Work breakdown structures

2.1.4	Services	
	2.1.4.1	On stave/ring cables (Type-0)
	2.1.4.2	Patch Panel 0 (PP0)
	2.1.4.3	Type-I Services
	2.1.4.4	Patch Panel 1 (PP1)
	2.1.4.5	Optical drivers/receivers
	2.1.4.6	Optical patch panel
	2.1.4.7	Optical fibres
	2.1.4.8	Type-II Services
	2.1.4.9	Patch Panel 2 (PP2)
	2.1.4.10	Type-III Services
2.1.5	Local Supports	
	2.1.5.1	Local Support cooling line
	2.1.5.2	Local support Mechanical Structure
	2.1.5.3	Module loading on local supports
2.1.6	Global Mechanics and installation tooling	
	2.1.6.1	Inner layers Support Tube (IST) – Insertion system
	2.1.6.2	Outer Barrel mechanical structure – Support points
	2.1.6.3	Inner Barrel mechanical structure and insertion tooling
	2.1.6.4	Outer End-cap structures
2.1.7	Integration and system test	
	2.1.7.1	Integration of Inner Replaceable Layers
	2.1.7.2	Integration of Barrel Outer Layers
	2.1.7.3	Integration of End-cap rings to Cylinders
	2.1.7.4	Integration of End-caps to Barrel
	2.1.7.5	Integration of Inner Layers to End-caps and Outer Layers
	2.1.7.6	Barrel local support system testing
	2.1.7.7	Inner local support system testing
	2.1.7.8	End-cap local support system testing
	2.1.7.9	12.5% or slice system test in SR1
	2.1.7.10	DAQ for test setups

Table 19.2: Main review dates for the ITk Pixel Detector

Major Pixel reviews associated with production				
WBS	What	PDR	FDR	PRR
2.1.1	Planar Sensor	Q1 18	Q1 19	Q2 20
	3D sensor	Q1 18	Q4 18	Q2 20
2.1.2	FE chip	Q1 18	Q4 18	Q4 19
	Data concentrator	Q4 18	Q4 19	Q4 20
	PSPP chip	Q2 18	Q4 18	Q4 19
	DCS controller chip	Q2 18	Q1 19	Q3 20
2.1.3	Module Assembly	Q1 18	Q3 19	Q4 20
	Modules flex	Q1 18	Q4 18	Q4 20
2.1.4	Services	Q1 18	Q4 18	Q2 19
2.1.5	Local Support	Q3 18	Q2 19	Q4 19
2.1.6	Global Mechanics	Q3 18	Q2 19	Q2 20
2.1.7	Integration	Q3 19	Q3 20	