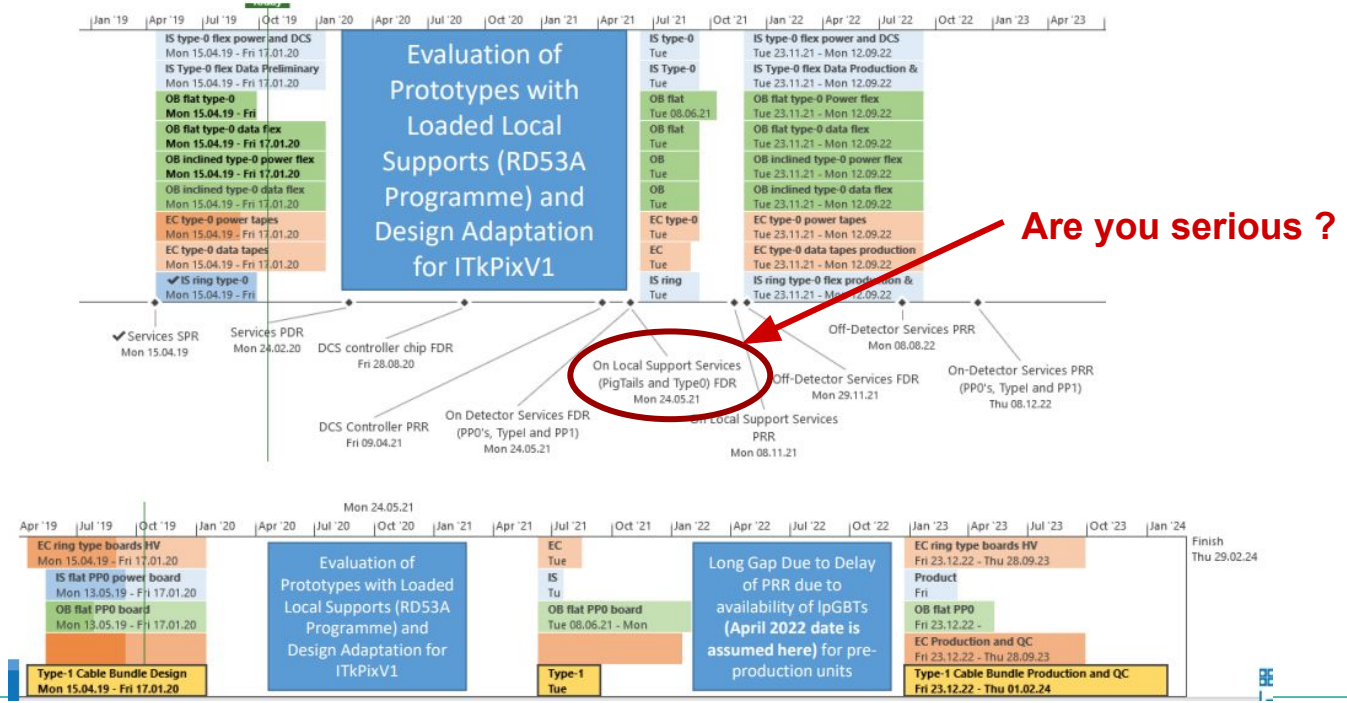
ATLAS Annual Review
ITk Pixel

Type 0 Services Schedule



Type 0 critical Items

- stable baseline for the number of required data links
  - evaluation of HGTD MinBias samples with new detector description (in production)
  - agreement with TDAQ on number of events per data stream
  - application of safety factor and maximum link occupancy
  - freeze number of links
- usage of command forwarding and, if yes, where in the detector?
  - evaluate potential savings in all sections of detector
  - decide in which regions the additional risk for the availability of the detector justify the choice to use command forwarding
- services concept in the outer barrel
  - find conceptual solution that based on the new data rate estimates fits in to the available envelope
  - work out details for that solution
- verification of available space in the subsystems
- interfaces to data transmission Type-1 cables

there will be an informal review on the status of the services end of November

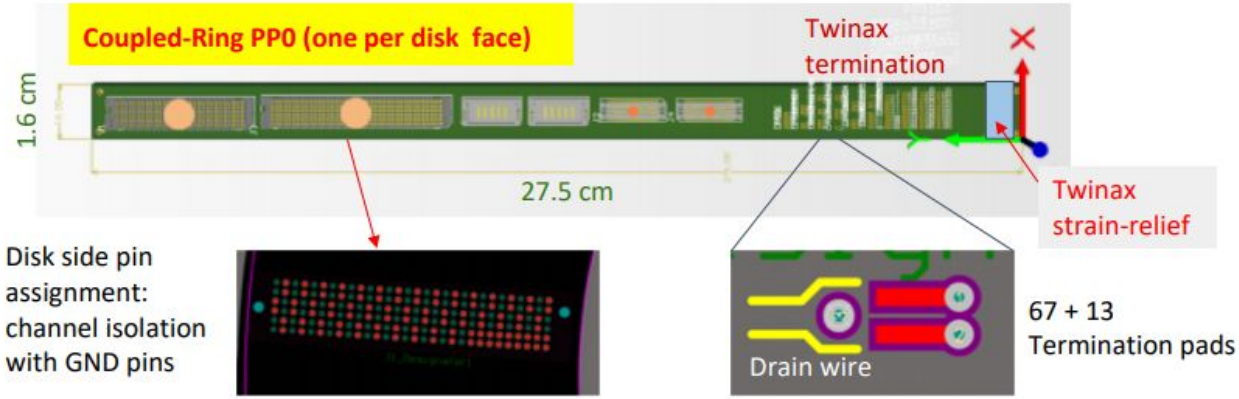
LpGBT & System Test

WBS 2.1.10: Data Transmission – Schedule: lpGBT availability

- Optoboard production impact on overall schedule by ~6 months due to delayed availability of lpGBT:
  - Engineering run 40,000 (all experiments) by 2021 Q4
  - Production run available only by 2022 Q3
- Main impact of delayed optobox availability is on the QC of loaded local supports and system tests at ~17 sites, each requires one optobox with ~30 lpGBT.
- ATLAS priority allocation from the 40,000 lpGBT engineering run can be a significant help to alleviate the problem to a large extent.

Twinaxes Termination (Inner)

WBS 2.1.10: Data Transmission – Twinax Termination (Inner)



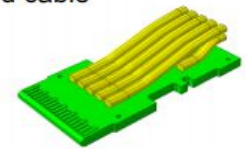
- Inner system PP0 aiming for direct solder termination due to space limitation
- PP0 is 20 layer PCB
- At least one vendor still on board (informally) with twinax termination

Are you serious ?

Twinaxes Termination (OB)

WBS 2.1.10: Data Transmission – Twinax Termination (Outer)

Same scheme as existing ALICE ECU5 connector Based cable



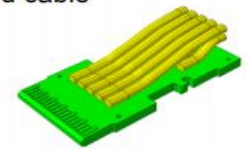
Barrel L2 @ 1MHz

- Outer Barrel and Endcap envisaging Samtec Firefly ECUE connector for more modular assembly process.
- Smaller bundle modularity (2x10) and standard connector termination should make better vendor availability than Inner system.
- Packing strategy to meet service volume constraint is still in progress.

Twinaxes Termination (OB)

WBS 2.1.10: Data Transmission – Twinax Termination (Outer)

Same scheme as existing ALICE ECU5 connector Based cable



Barrel L2 @ 1MHz

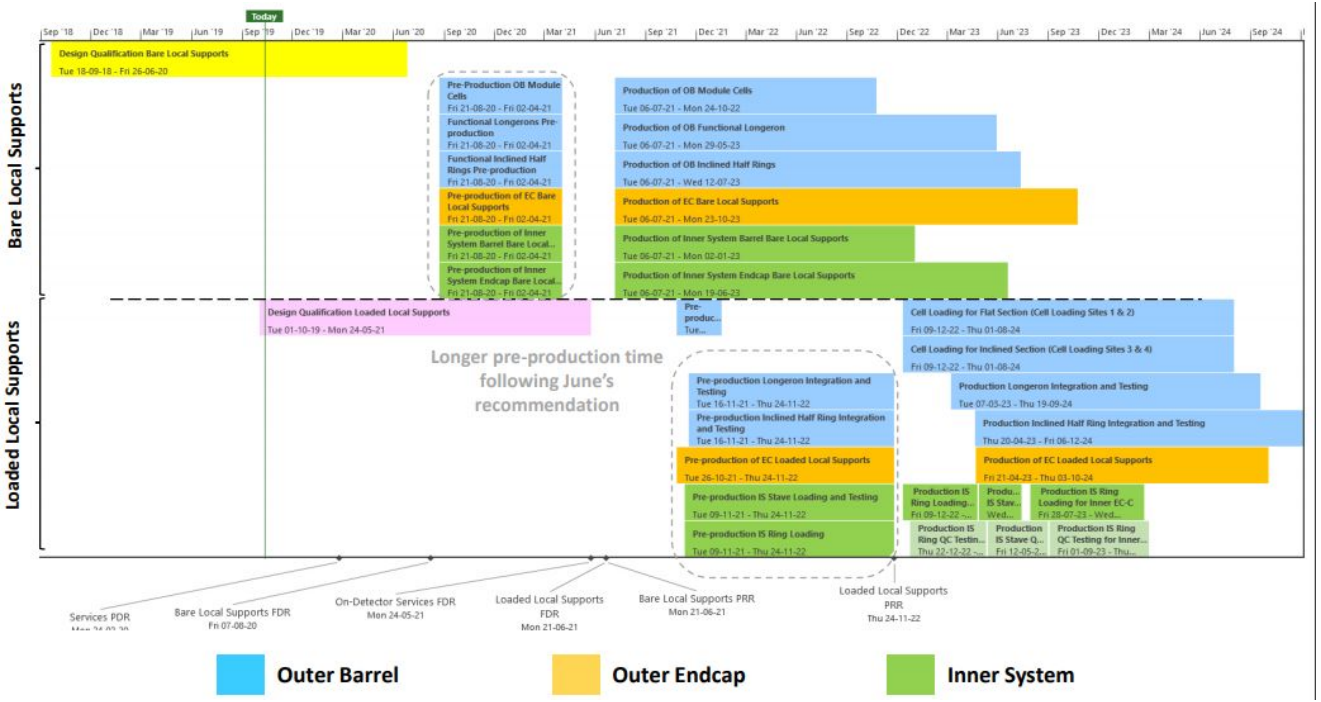
- Outer Barrel and Endcap envisaging Samtec Firefly ECUE connector for more modular assembly process.
- Smaller bundle modularity (2x10) and standard connector termination should make better vendor availability than Inner system.
- Packing strategy to meet service volume constraint is still in progress.

Services: Decisions & Risks

WBS 2.1.10: Data Transmission – Key Decision Points & Risks

- We need a stable baseline
  - We have made reasonable assumptions, but key bandwidth numbers could change
  - The process includes a new estimate of the bandwidth, then the modularity will be set
  - Once the modularity (number of down and uplinks for each subsystem) and bundle configuration settled, the overall mapping and the location of the optoboxes can be fixed
- Risk to schedule due to lpGBT and VTRx delivery
  - Due to assumption that the system tests and loca support QC will be performed with the actual opto system in readout chain. Can trade schedule risk with extra costs to develop alternative readout schemes building optobox with non-production components.
- Risk twinax fire certification
  - Proceed with qualification certification tests and prepare for derogation process as backup.
- Risk of twinax termination fabrication complications
  - Investigate smaller bundle solutions.
- Risk of space allocation for cable routing
  - Alternative Distributed PP0 design for Outer barrel. Cable bundle/ribbon procedures.
- Risk of space allocation to Optoboxes
  - Ensure all identified potential locations remain avaiable

OB Integration Schedule



OB Mock-up

WBS 2.1.7: Integration – Focus for Next Year

- Integration PDR together with Global Mechanics PDR in Q3/2020 (+ 6 months after passing Global Mechanics SPR', Q1/2020)
  - Detailed definition of integration procedures
  - Support points during integration
  - Handling of services during integration
  - Testing procedure and cooling needs during QC
- Preparation of **mock-ups for routing of services** (Q3/2020 to Q2/2021)
  - Inner system: at SLAC
    - Integration of loaded local support into quarter-shell prototype (at SLAC)
    - Shipment test of quarter shell
  - Outer Barrel : at CERN
    - Slice test with longeron and half-ring
  - Outer Endcaps: in Frascati & Liverpool
    - Assembly of loaded half-ring in half-cylinder section (in Liverpool)
    - PP1 prototype check of assembly (in Frascati)
- Verification of testing procedure with loaded local supports - Installation of electrical test infrastructure for one integration site of each sub-system for a single loaded local support with RD53A
- Finalization of planning for SR1 (target end of 2019)
- Development and verification of welding procedure close to Pixel electronics

Schedule delay: 10 months

- "Internal" causes:
  - The hybridization process for the RD53A modules that we use to qualify the design of the services and the local supports is taking about >3 mons longer.
  - In parallel to this (and not in cascade) the Services PDR also suffers an analogous delay (> 3.5 mons). The reason is the time required to prove that the services properly fit in the available gaps (as requested by the FDR review board). The proving process was slowed down by several changes in the services baseline and by the time to re-building an accurate services 3D models a/o mockups
- The impact to the detector delivery date of the above concurrent variances costs ~4mons delay in the detector delivery date (January 2026 w.r.t. August 2026 in July's baseline)