



2021.Q3 Quarter Report and Points of attention

- Despite several progresses on all Phase-II projects, overall concerns on schedule:
 - ◆ Confirming trend of the last 3 quarters
 - ◆ Efficiency (measured as fraction of task/milestone completed from beginning of project)

All tasks and milestones (not only P2UG ones) - as tracked by ATLAS PMO

		2021.Q3		2021.Q2		2021.Q1		2020.Q4	
		Tasks completed	Milestones completed	Tasks completed	Milestones completed	Tasks completed	Milestones completed	Tasks completed	Milestones completed
1	TDAQ	72%	66%	77%	77%	80%	80%	76%	75%
2.1	ITk-Pixel	73%	71%	73%	72%	73%	72%	83%	85%
2.2	ITk-Strips	65%	51%	62%	60%	56%	57%	57%	58%
2.3	ITk-Common Mech.	66%	73%	82%	100%	59%	57%	76%	71%
2.4	ITk-Common Elec.	67%	71%	73%	77%	76%	77%	84%	82%
3	LAr	62%	60%	63%	65%	67%	73%	63%	75%
4	Tile	66%	64%	67%	60%	74%	68%	78%	74%
5	Muon	77%	71%	76%	60%	70%	58%	79%	61%
8	HGTD	71%	72%	87%	88%	N/A	N/A	N/A	N/A
ATLAS Average		69%	67%	73%	73%	62%	60%	75%	73%
ATLAS StdDev		5%	7%	8%	14%	8%	9%	10%	9%

P2UG Milestones only

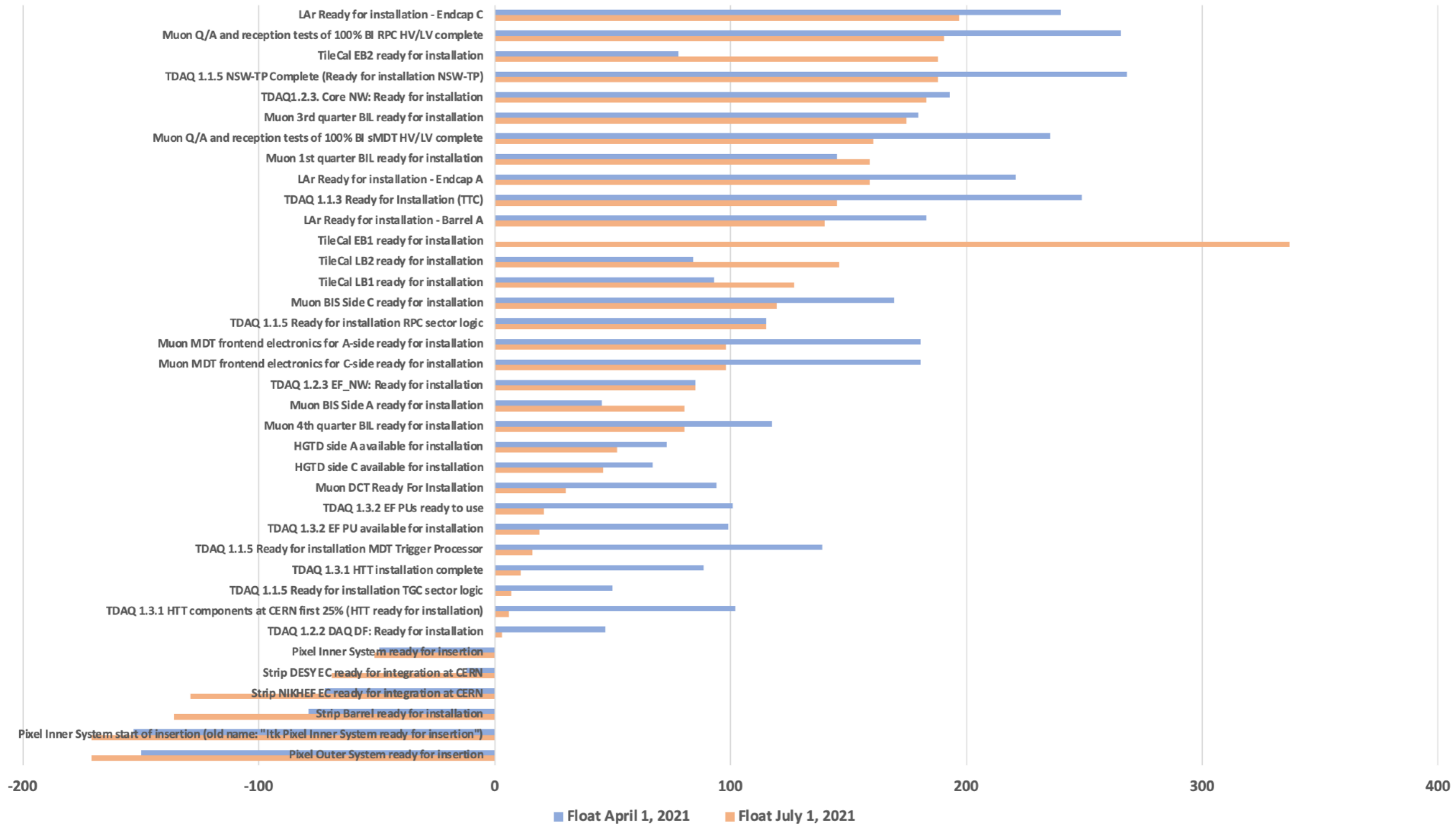
Project	Baseline Overall (until 2021-06-30)				Baseline Reporting Quarter (Apr-Jun 2021)			Expected milestones from previous report		
	No. P2UG Milestones	No. Expected	Completed	Completed (%)	No. Expected	Completed	Completed (%)	No. Expected	Completed	Completed (%)
1. TDAQ	163	23	13	56.5%	7	0	0%	6	1	16.7%
2.1 ITk-Pixel	339	38	21	55.3%	6	0	0%	0	0	N/A
2.2 ITk-Strips(*)	216	71	41	57.7%	7	0	0%	0	0	N/A
2.3 ITk-CM	30	8	7	87.5%	1	0	0%	0	0	N/A
2.4 ITk-CE	33	22	14	63.6%	4	0	0%	3	1	33.3%
2.5.1 ITk-PDB	4	3	2	66.7%	1	0	0%	0	0	N/A
3. LAr	86	35	23	65.7%	7	1	14.3%	0	0	N/A
4. Tile(*)	120	61	36	59%	2	0	0%	9	1	11.1%
5. Muons(*)	150	68	41	60.3%	10	1	0%	11	4	36.4%
8. HGTD	152	8	4	50%	3	1	33.3%	0	0	N/A

(*) re-baselined in Jun 2021

Readiness scheduled contingency (grouped by WBS)

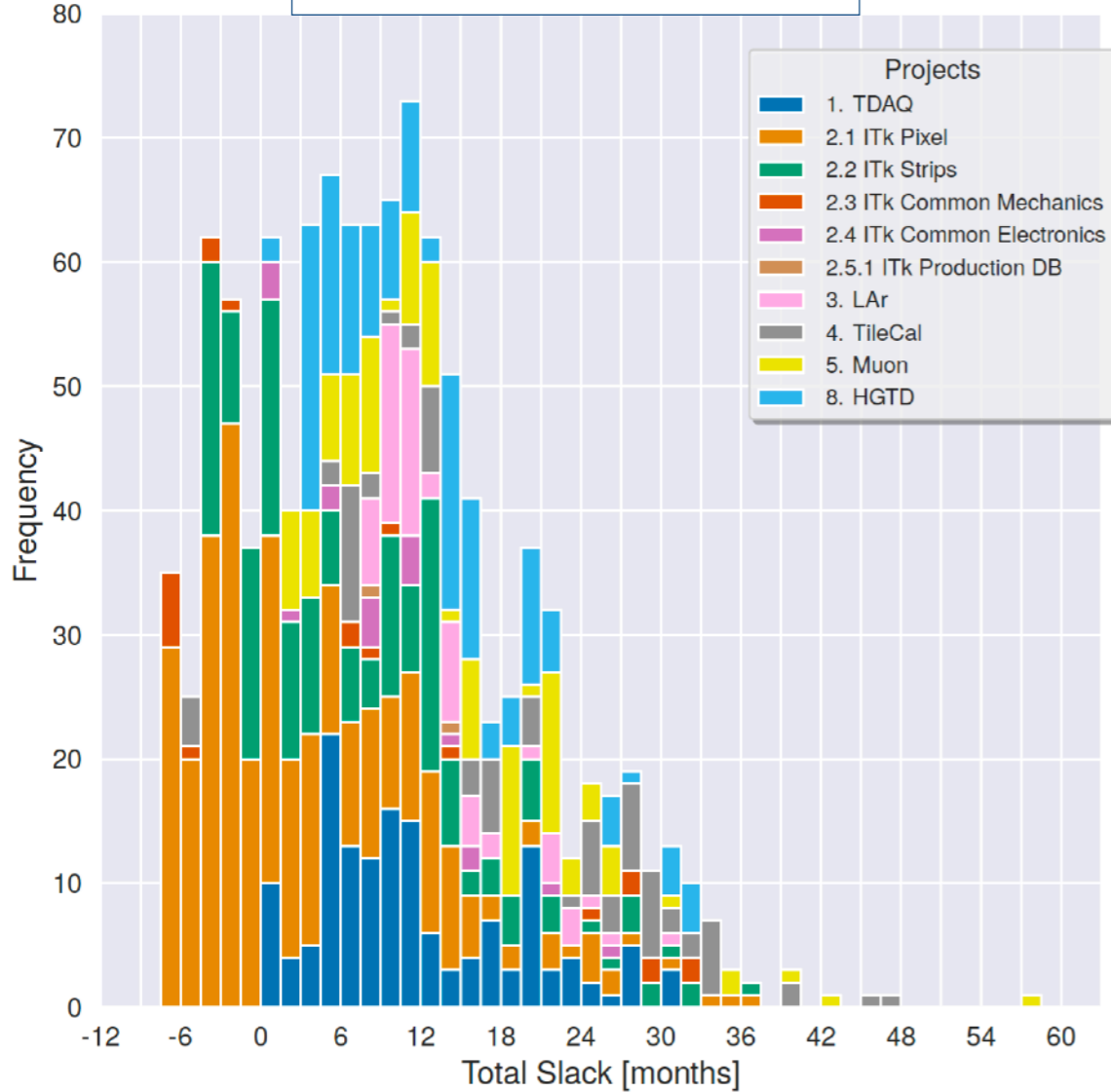
			2021.Q3	2021.Q2	2021.Q1	Δ [2021.Q3-Q2]
2.1	ITk-Pixel	(Inner/Outer Barrel readiness)	-170	-153	-153	-17
2.2	ITk-Strips	(Strip Barrel readiness)	-136	-79	-18	-57
3	LAr	EMB-A	140	183	154	-43
		EMB-C	232	294	294	-62
		EC-A	197	296	240	-99
		EC-C	159	221	221	-62
100% production completion vs. required date for installation on the calorimeter partitions						
4	Tile	LB-1	127	93	93	34
		LB-2	146	84	84	62
		EB-1	337	0	0	337
		EB-2	401	127	127	274
23 days float of installation + 104 wd internal production float (driven by PMT)						
5	Muon	5.1 sMDT Det.	417	411	307	6
		5.2 sMDT FE Elec.	98	181	243	-62
		5.3 RPC BIL Det. + FE	81	118	172	-37
		5.3 RPC BIS Det. + FE	81	46	100	35
		5.4 RPC Elec. RO + Trigger	30	94	95	-64
		5.5 TGC Det.	252	56	184	196
		5.6 TGC Elec.	285	285	233	0
		5.8 PS	161	236		
previous estimates not comparable. Now Calculated for each detector tech.						
8	HGTD	Side-A	52	73		-21
		Side-C	46	67		-21

All readiness milestones on Critical Path or Near Critical Path (DFCP < 200 days)

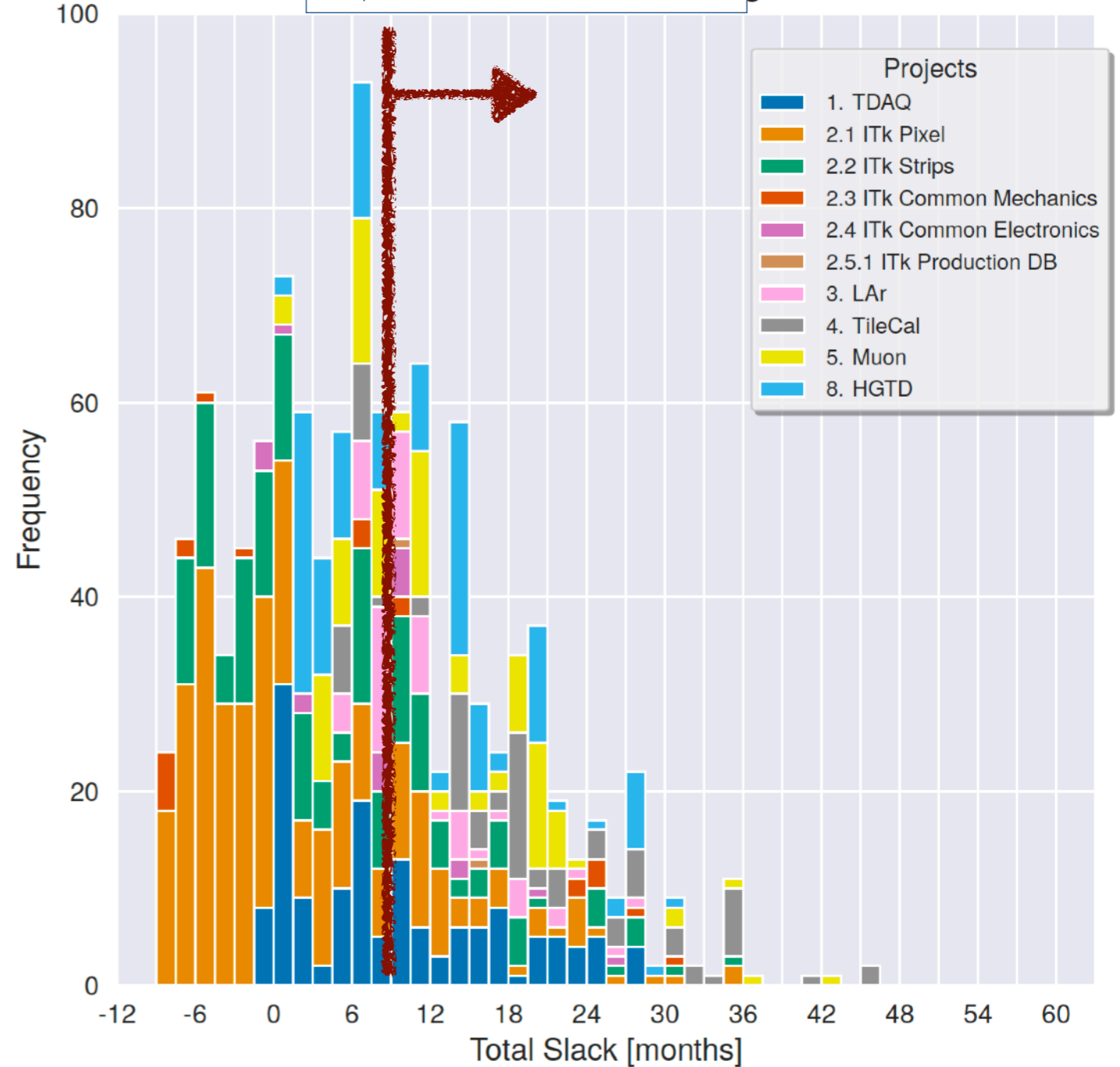


- DFCP for all P2UG milestones in a project

Jan-Mar 2021



Apr-Jun 2021

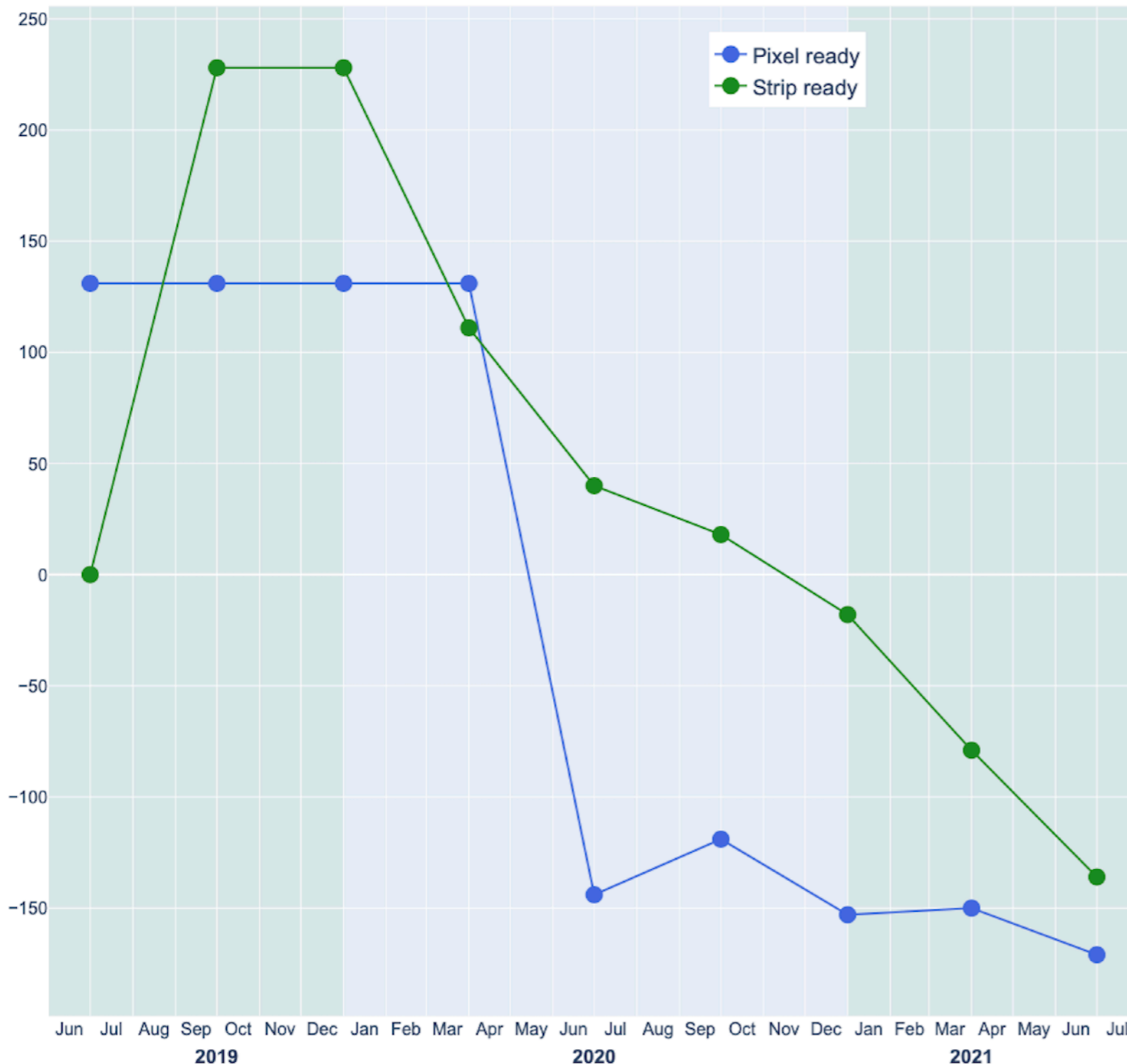


- ITk drives ATLAS schedule w/ negative floats in both the ITk Strip and Pixel projects - inconsistent with the LS3 schedule



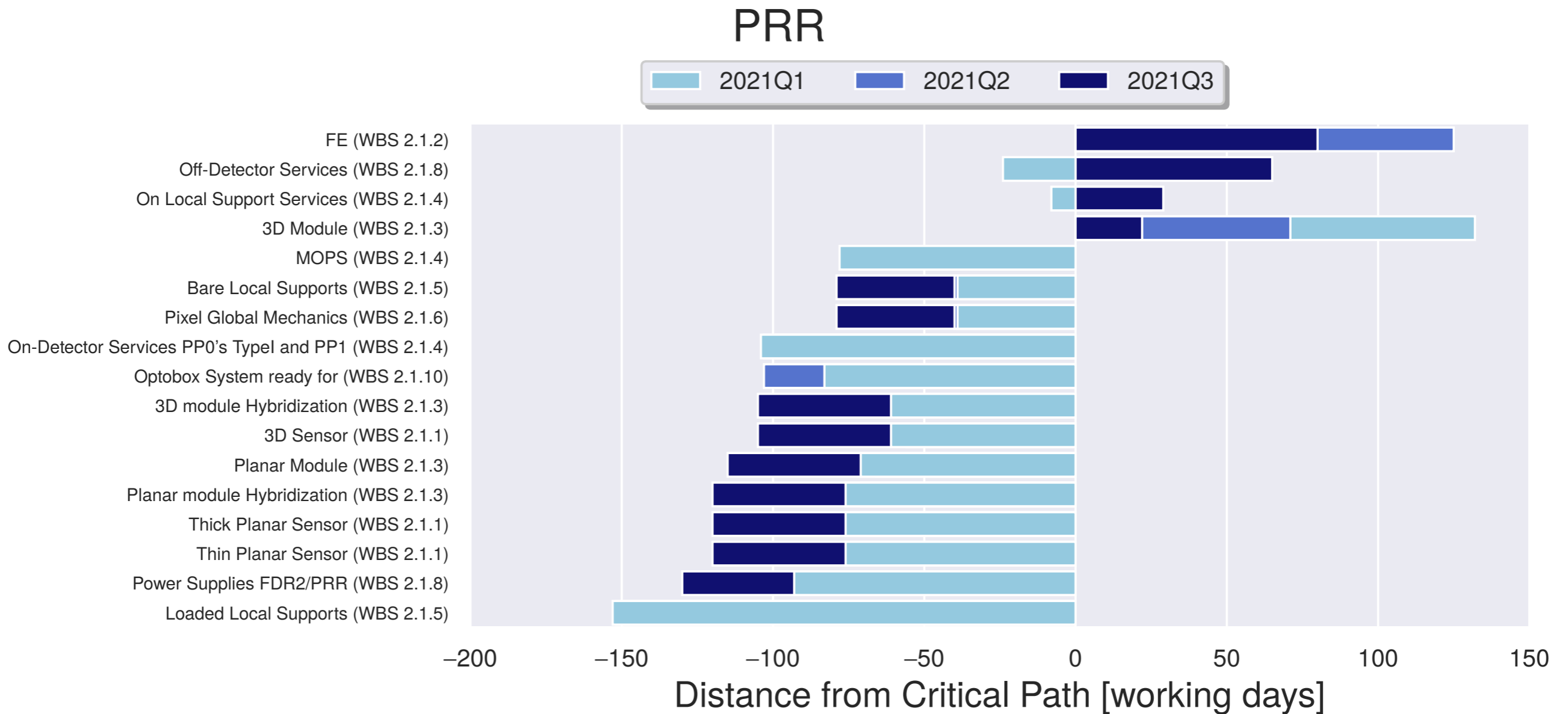
- Required date: Oct 2nd 2026
- ITk Ready date: Jun 2027.
- ITk-Strip high concern as much as Pixel

- ITk drives ATLAS schedule w/ negative floats in both the ITk Strip and Pixel projects - inconsistent with the LS3 schedule

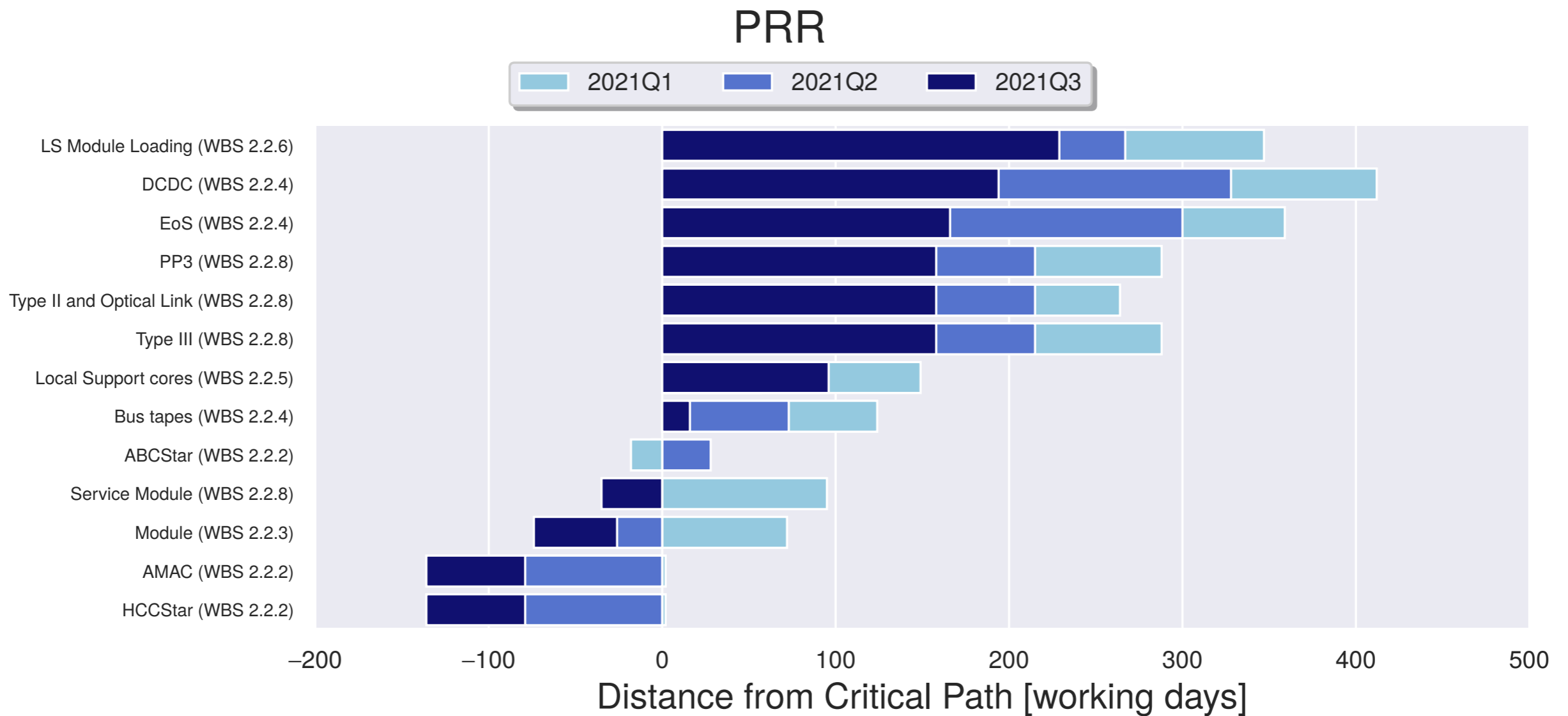


- Total 8 months negative float.
- Pixel: -170 wd
- Strip: -136 wd
- Strip situation becoming as critical as Pixel

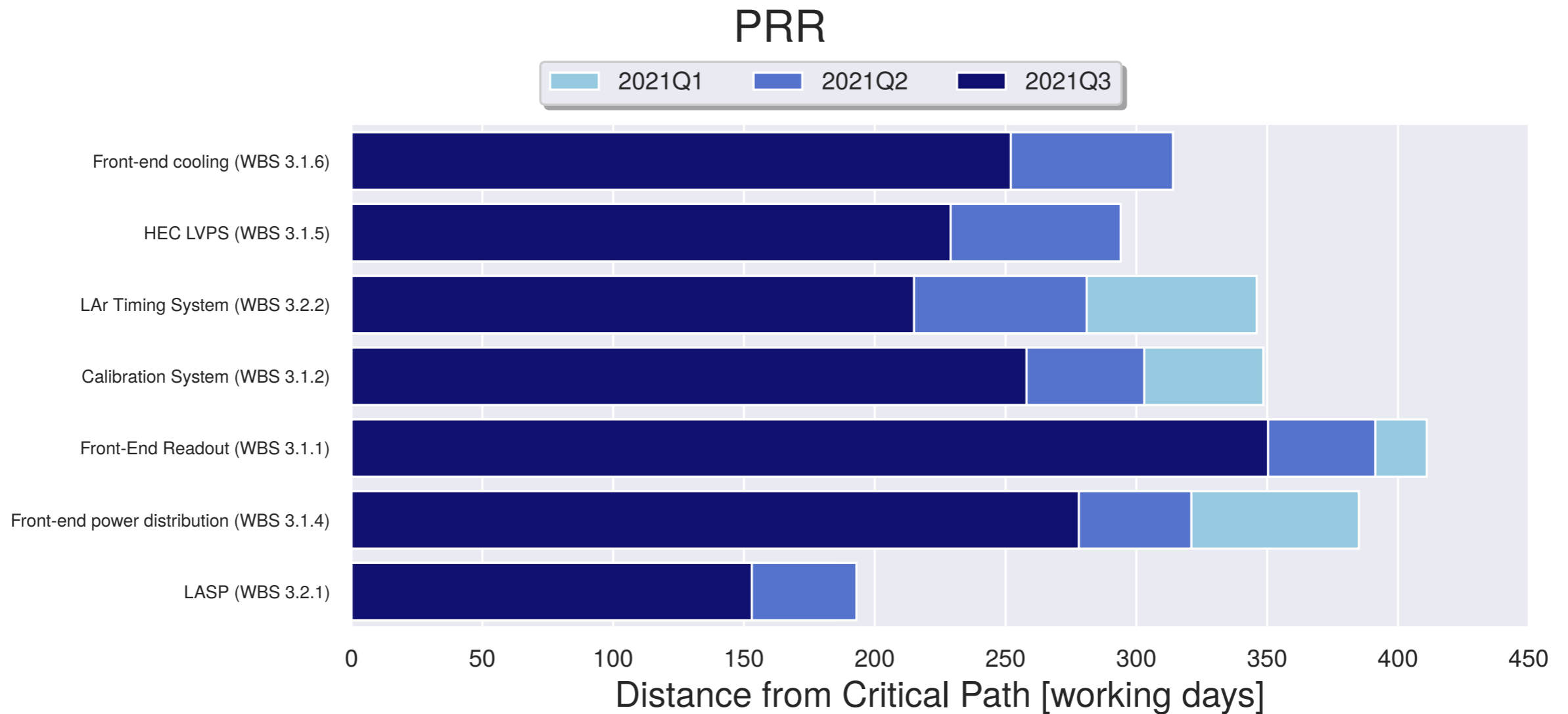
- On the short time scale going through the pre-productions in 2021-2022 and arrive to PRR is of the utmost priority
- PRR dates needs to be monitored closely



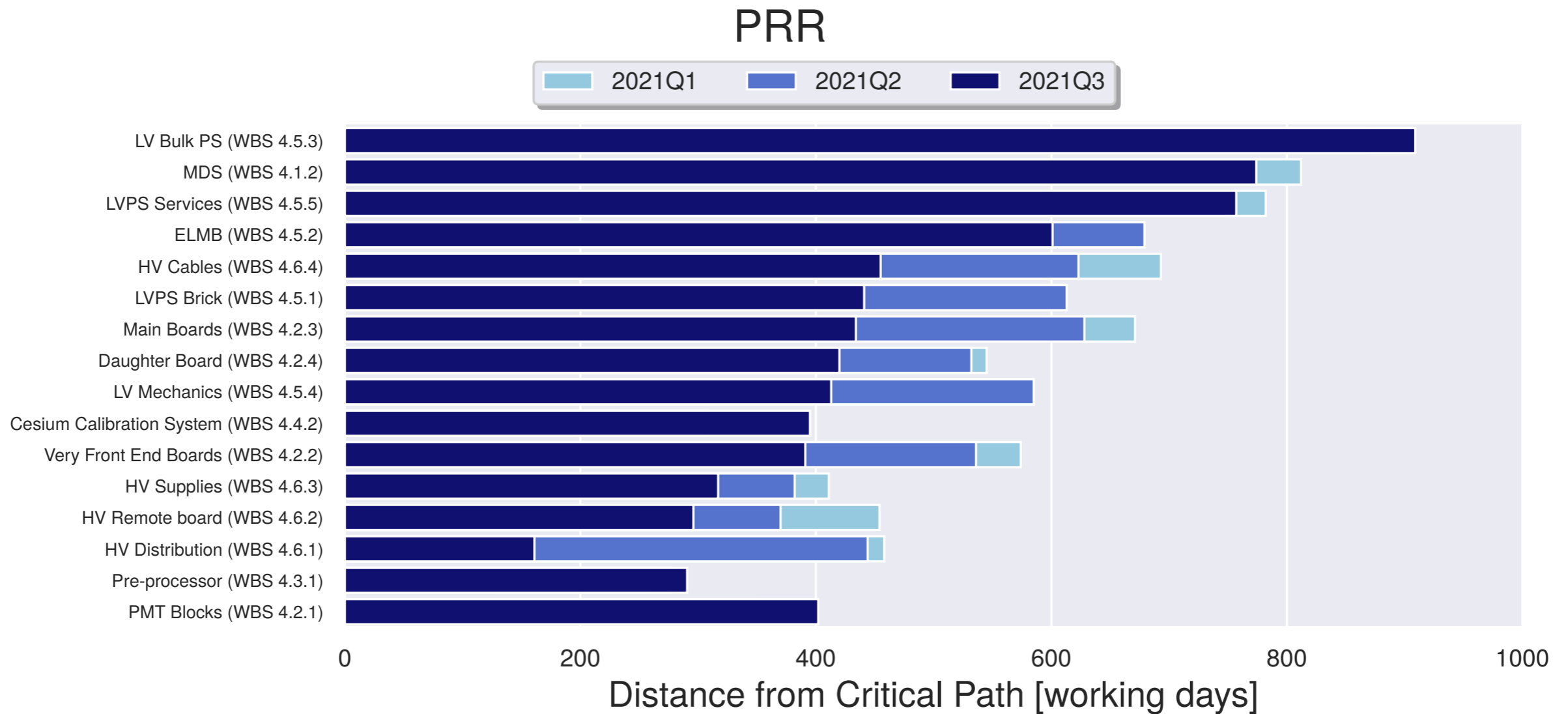
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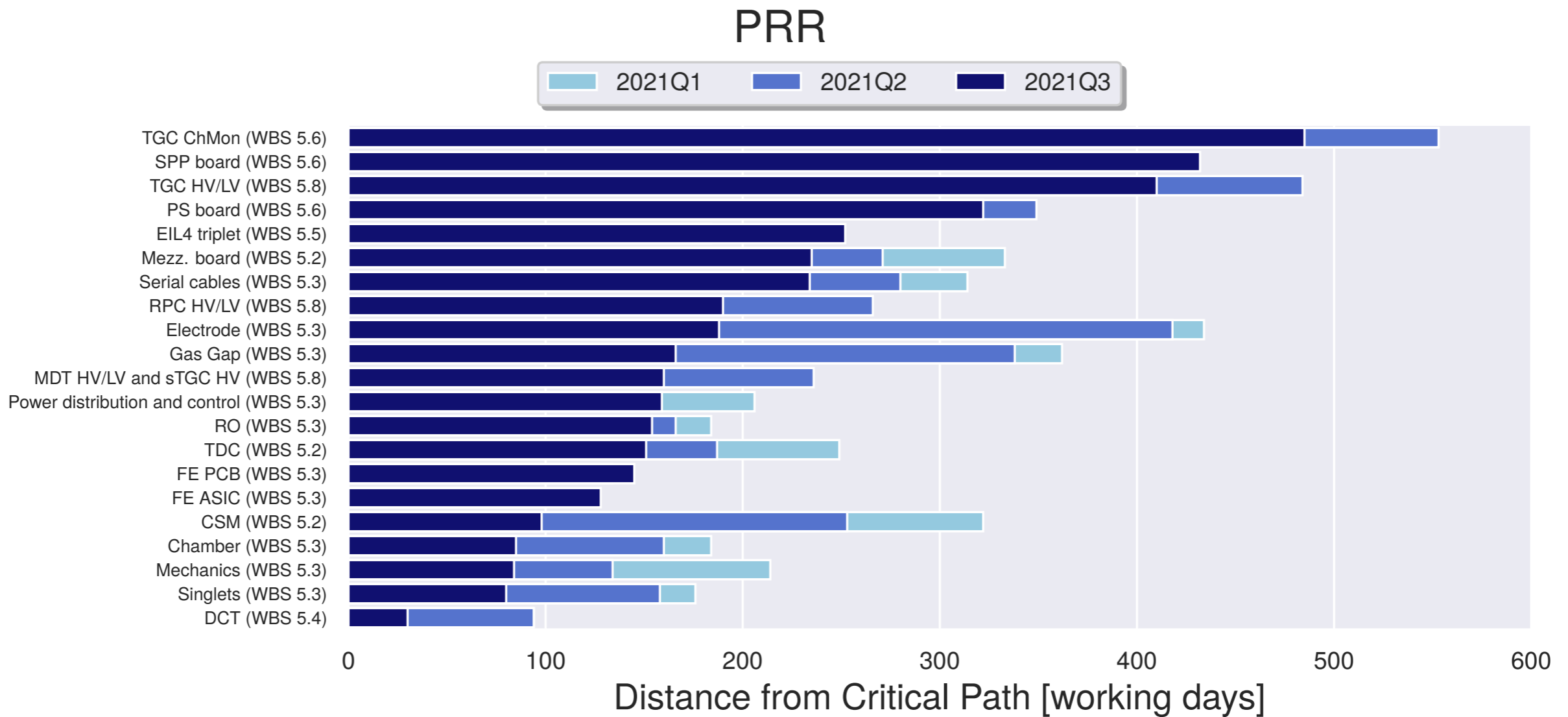
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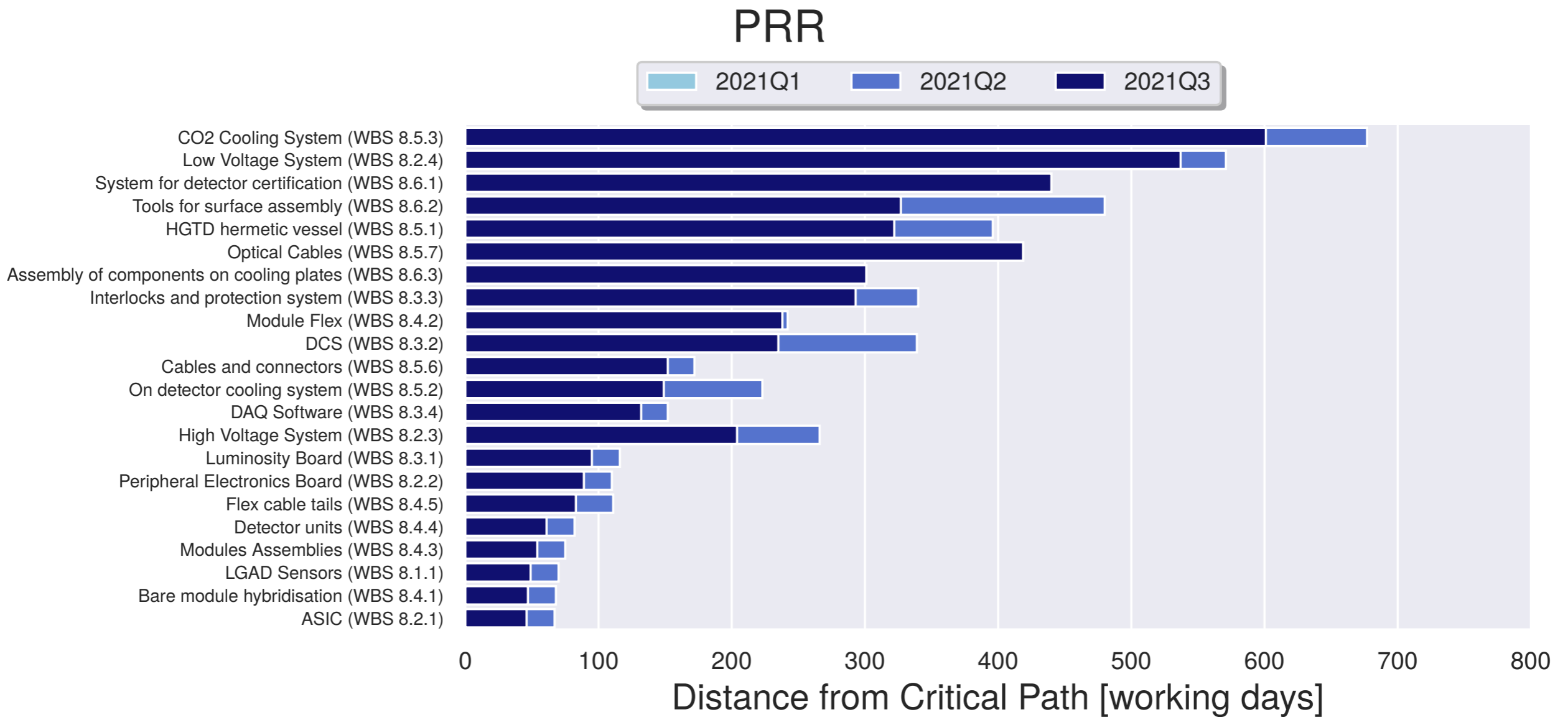
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Points of major attention

Points of attention:

- Sensors:

- ◆ Planar sensors

- ❖ Plan for orders developed based on responses to Invitation to Tender
 - ❖ First round of discussion with planar sensor vendors complete
 - ❖ CERN negotiating on cost and schedule (how to discuss higher rate as suggested by the Schedule TF?)

- ◆ 3D pre-production

- ❖ CNM problems with first pre-production batch, now being reprocessed, report on problems at end of July2ndbatch being processed for delivery in October
 - ❖ FBK sensors in transit to CERN
 - ❖ Sintef sensors expected in October

- FE ASICs:

- ◆ List of changes agreed with RD53 and in ATLAS: no major changes

- ◆ Space constraints requires removal of SEU counter in CROCV1 to implement ToT fix implementation in ITkPixV2. This was foreseen in design of CROCV1 and can easily be done by "if" statements in design

- ◆ RD53 schedule for RTL is 2 months to finish bug-fixes and then work on wish list design, finish end of September

- ◆ Verification framework: RD53 are developing a new verification framework

- ❖ Framework will be ready in October to start verification

- ◆ RD53 submission target March '22

- ◆ Driven by verification, need to define the list of critical features to be tested

- ◆ ITkPixV1 FE-testing

- ❖ Single chip V1 modules with Sintef sensors delivered and tested
 - ❖ Modules will be tested and then go for irradiation in Sept

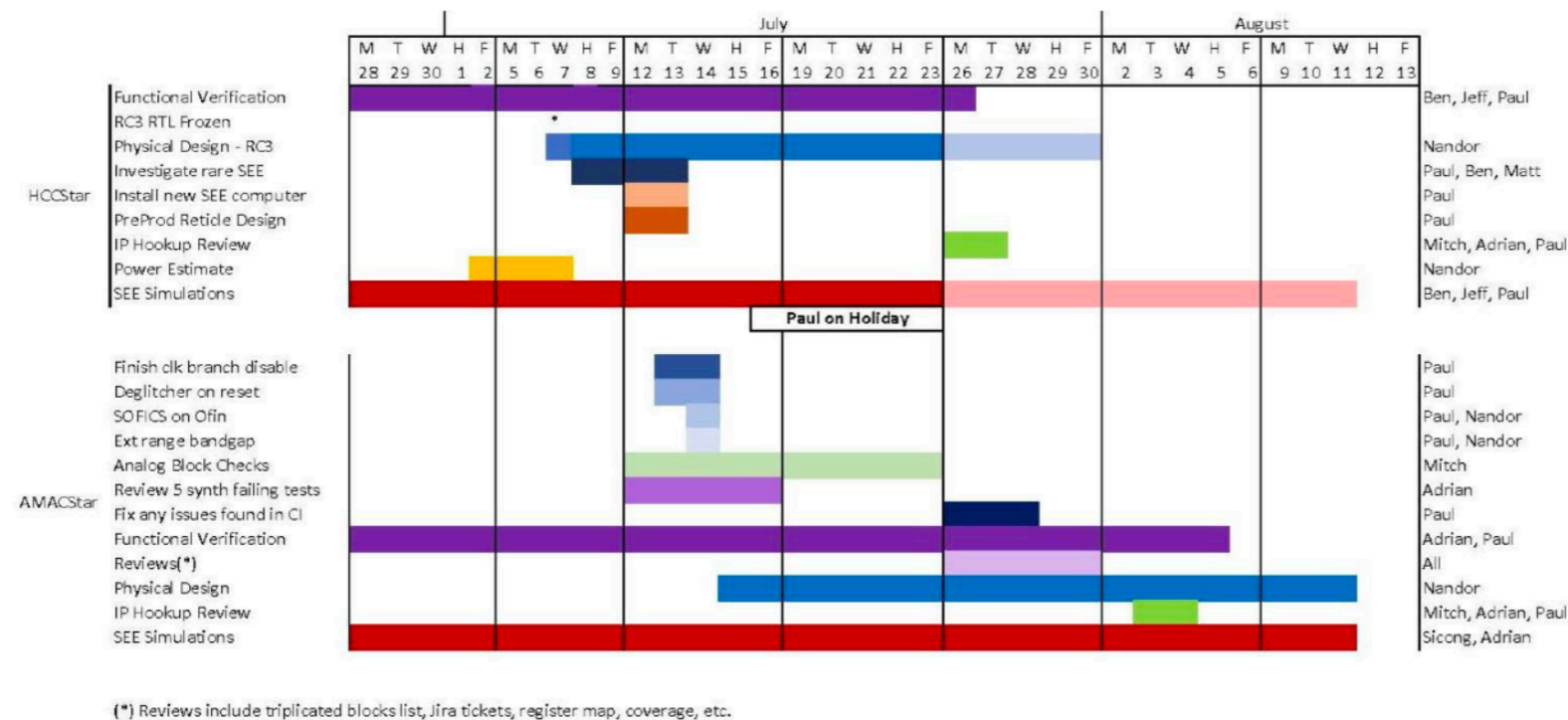
- RD53a Module Production:
 - ◆ Slow ramp-up (some recently improved rates)
 - ◆ Initially problems w/ wire-bond map now fixed
 - ◆ Electrical problems with chips
 - ❖ Shorting of VDDA and VDDD or VDDD and ground
 - ❖ Visual inspection shows chipping on edges of sensors and/or ASICs
 - ➔ Progressing moderately well for Module FDR but rate needs to speed up to supply to Local Supports needs

- Site qualification for module assembly
 - ◆ 12 sites now qualified for assembly (+Siegen/Bonn and Oxford)
 - ◆ 6 sites (MPI & Paris newly qualified) qualified for Phase-II testing, more working towards qualification (MPI & Paris newly qualified)
 - ➔ organization and documentation to be closely followed

- Number of FELIX: in progress
 - ◆ First discussions with Hucheng Chen have been held
 - ◆ Being developed further using updates from sub-systems and of termination boards, all inputs by end of July (L. Franconi)
 - ◆ Expected to complete by early Sep

- Type-1 data cable
 - ◆ 80000 feet delivery soon, but late –shortage of material
 - ◆ First 5000 feet delivered to SLAC
 - ◆ Planning mini-FDR (about Dec) ahead of services FDR (Feb-22) to ensure procurement
 - ➔ worrisome delays require close monitor. 2nd vendor prototype to be followed-up

- Sign-off for submission further delayed now mid/end August
 - ◆ among still additional fixes required on AMAC



- HCCStar design is finally nearing completion
 - ◆ Release Candidate 3 (RC 3) is the final version (a RC4 to address a supposedly rare SEE has not been considered necessary)
 - ◆ PnR of V2 (reroute, no RTL change) completed
 - ◆ Ready to generate stream file (tape out)
 - ◆ In parallel: Spectre simulation of 640MHz clock on going
 - ◆ Specified statistics of SEE simulations achieved by this weekend
 - ◆ Double-check IP connections
 - ◆ Logfiles and time analysis delivered for internal review (ATLAS and CHIPS)
- Now AMACStar drives final schedule
- Target meeting w/ CHIPS, ATLAS and USATLAS mgmt. to discuss and decide submission in the week of August 16th
- ➔ We're in any case reconsidering the possibility of a CERN driven 65nm design targeting the use in the regions of the detector more challenging cf. radiation (e.g. innermost two barrel layers) → September

- **Schedule: 2.5 month delay to Strip delivery in last quarter from modules activity (-137 WD float)**
 - ◆ Site qualification ramp up (net slide)
 - ◆ EC module assembly jig production delays:
 - ❖ Distribution of 4 (of 6) to all the sites making the module type has already happened - but one has sever issues that may require to be redone
 - ❖ Of the remaining two, (i) anodization company made an error and did not plug bushing holes but repairs attempts were unsuccessful and they will need to be remade; (ii) Lagging set was ready for anodization but their preferred firm stopped responding

- **Module site qualification**
 - ◆ Significant progress in the last 2-3 weeks (within 1 week of schedule now)
 - ◆ Most sites have site ramping up well but some still lagging behind
 - ◆ **Remaining concern: entering the holiday season and starting steps that are more technical involved**

- **LS Cores (Stave) FDR Follow-up + Integration FDR: Met with RO to follow-up on remaining 5 actions**
 - ◆ Drawing w/ tolerance complete
 - ◆ Creep results promising at stave end wi/o support @ $z=0$ (<30 nm/hour) - but continuing to study until PRR
 - ◆ Metrology results shown: Locking points within requirements
 - ◆ **Global flatness has been difficult to assess**
 - ◆ Target outcome of meeting:
 - ❖ Close LS Core (Stave) FDR Follow-up
 - ❖ Approval to begin PPA staves
 - ❖ **Link locking brackets, insertion trials, barrel dressing and stave global flatness to Integration FDR 1.5b in September**

- Bus Tapes: some issues for the barrel tapes
 - ◆ SS from CERN: all received and pass QC
 - ◆ LS/SS for Alta-flex sub 1: under-etched resulting in impedance of signal traces below specification
- Sensor production sensors: first delivery by end of July
 - ◆ Barrel: tests for KEK underway at HPK.
 - ◆ EC: delivery to CERN delayed to mid-August.
 - ❖ Ramping up testing procedures for all 6 types
 - ◆ Next month's delivery at end of August on schedule
- Readiness of ABCStar PRR progressing to keep production slots at GF
 - ◆ Excellent agreement between probing sites (~99.5%)
 - ◆ Rare SEE issue for fast commands seen (corrected in HCCStar)
 - ◆ Test beam completed on irradiated R0 and SS module
 - ◆ Flagged a possible issue of effort available for testing and analysis - to be followed up
- Petal EoS PRR Follow-up being closed
- Services progressing
 - ◆ Type 2 cables under test at CERN; type 1 completed at firms and under test
 - ◆ Both cables should pass CPR requirements as is.
 - ◆ Repaired type 3 cables (for system tests) meet specification, but do not meet updated CPR (fire safety) requirements

Points of attention:

- ADC:
 - ◆ COLUTA v4 on track for Sep 1st MPW run with I2C fixes (SEE mitigation)
 - MPW was rejected in June because of foundry's overbooking

- Power distribution:
 - ◆ new GaN controller from CERN group might be an option for FEC LV PS
 - ◆ still looking for a an LDO LV regulator for the FEB2 boards (CMS's HGCal LDO might be an option)

- LASP: Lumi-dependent energy reconstruction
 - ◆ inst. lumi dependent (average for $O(1 \text{ min})$) signal degradation of up to 30% expected in FCal1 and EMEC IV
 - ◆ Started to look into off-detector FW algos for dealing with this
 - ◆ Needs local LAr lumi measurement as well

Status and next steps:

- Light BCP this (Q2) quarter:
 - ◆ matching TC schedule and Tile installation schedule, Cs hydraulics.
- Full BCP next (Q3) quarter:
 - ◆ Cs electronics/Laser calibration: design options studies are concluded for the final system design
 - ◆ Low Voltage : adjustment of the design and radiation qualification of new active components
 - ◆ PreProcessor: synchronise schedules of three sub-packages
 - ◆ Daughter Board: final design (v6) completed
 - ◆ High Voltage: system redesign + Covid
- Pending reviews:
 - ◆ PRR mechanics: cooling hoses material (waiting for TC approval)
 - ◆ PRR High Voltage Active Dividers follow up (RETF-2020 induced radiation tests)
 - ◆ FDR Low Voltage Bricks follow up (components availability for radiations tests)
 - ◆ PRR Main Board/FENICS (integration tests with DBv6 and RETF-2020 tests)

Points of attention:

- **Component availability** is a growing concern because of the lead-time for several COTS (up to 50 weeks for components currently not available)
- **Delays in the production** (mostly but not only due to Covid)
 - ◆ Fenics boards 1st preproduction batch was expected in April, now not earlier than begin-August → shift the PRR to February 2022, start of production to May 2022
 - ◆ Main Board 2nd preproduction batch assembly: delayed by couple months → shift the PRR to begin 2022
- **RETF-2020**: single lot procurements are required and to test exactly the same batches that will be used for the pre-production: concerns about availability of facilities, extra cost and person-power

Points of attention:

- sMDT production:
 - ◆ ongoing smoothly: Starting chamber 15 in Munich and ch. 4 in UM (out of 96 total), drift tube yield at MSU drastically improved recently
- MDT electronics:
 - ◆ ASD: defining acceptance cuts before starting mass QA/QC at company
 - ◆ Full integration test with Chamber+TDC+ASD+CSM done with CR and beam, next step with beam under radiation at GIF++
 - ◆ Irradiation tests: TDC + LDOs done, CSM SEE test first half of August
 - ◆ TDC FDR on August 5 (on critical path)
- RPC detector and FE:
 - ◆ FE ASIC PDR follow-up: study of pre-prototype and validation of project completed, wrapping up documentation. To be sent to RO within this week.
 - ◆ Mechanics tests done and pre-prototypes ready. PDR to be scheduled now for September..
 - ◆ Prototypes of gas-gaps (for first set of prototypes) are of bad quality, they show bad I-V curves, possibly a bad bakelite batch, need to be understood better.
- TGC electronics FDR done yesterday (passed)
- Power System:
 - ◆ it is taking more than expected to make the complete requirement document for the tender. Current plan is SPR2 in September.

Points of attention:

- Schedule:

- ◆ Float reduced by 21 days due mainly to late submission of ALTIROC
- ◆ 71% tasks completed, 72% milestones done
- ◆ LV SPR (15.07) probably passed w/ recommendations (no report yet)
- ◆ Plan to rebaseline: re-assess ALTIROC schedule, optimization of delivery of components, assembly at CERN, AAR recommendations, technical fixes (arrangement of parallel tasks, review follow-ups etc.)

- ALTIROC:

- ◆ ALTIROC2 submission delayed (also by IMEC)
- ◆ → expected 20 wafers back by end of August
- ◆ first testing batch by end of October
- ◆ ALTIROC3 design partly in parallel with ALTIROC2 testing, but test results required before review and submission
- ◆ ALTIROC3 production starting mid March 2023

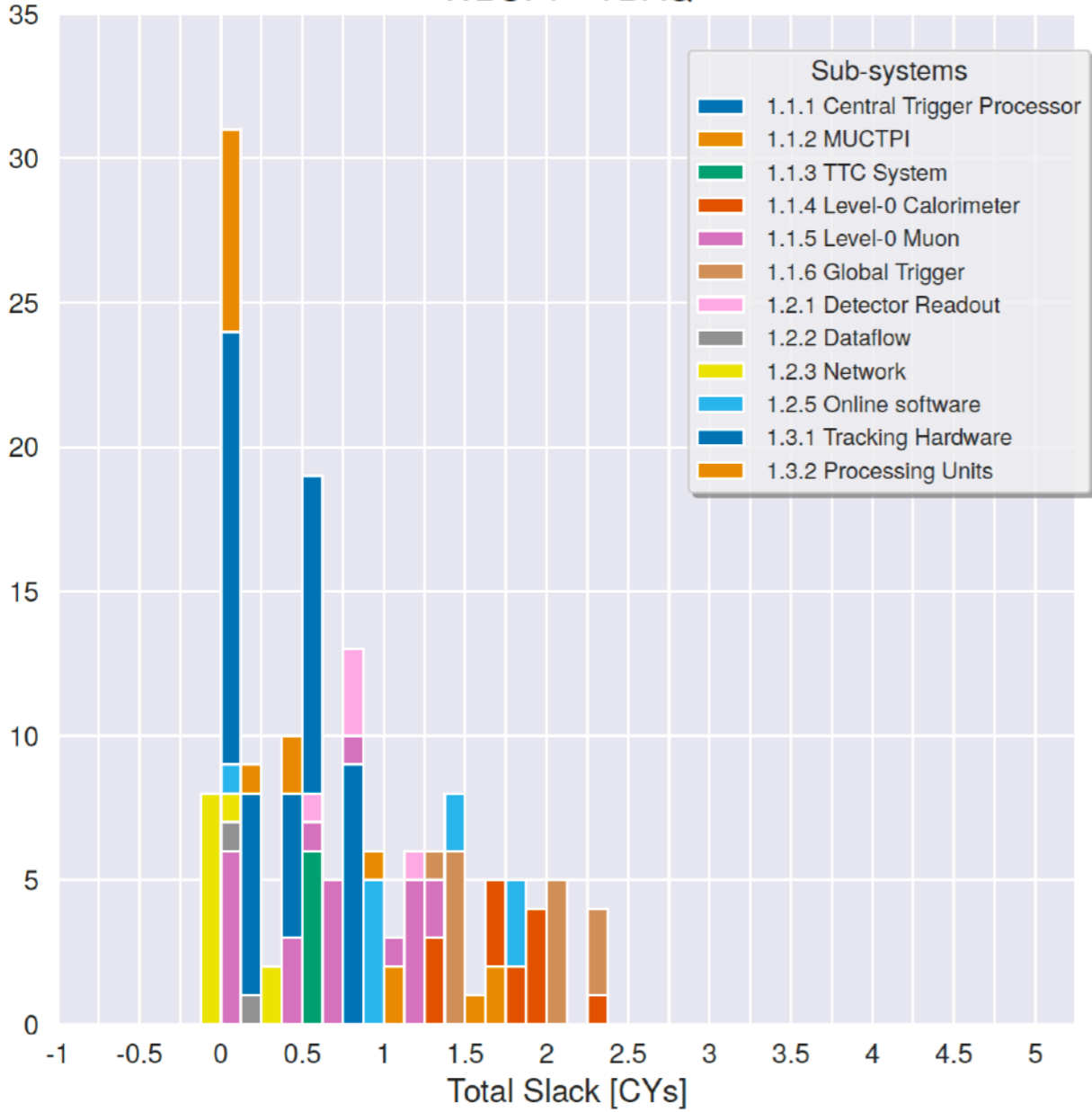
- Sensors:

- ◆ Full-size sensors already available in quantities by several vendors - w/ and w/o carbon diffusion
- ◆ The main issue to iron out are destructive breakdowns of sensors observed at high bias voltages (> 600V approx.) , required by some sensors at end-of-life after being highly irradiated (> 1.5×10^{15} n/cm²)
- ◆ Testbeam @ DESY confirms previous observations: indication that failures are induced by high-electric field breakdown in the bulk: 13 V/μm
- ◆ Carbon infused sensors show better survival performance (2 vendors survived at operational voltage after maximum irradiation)
- ◆ Analysis to be completed and resolved prior to the FDR planned for April 2022

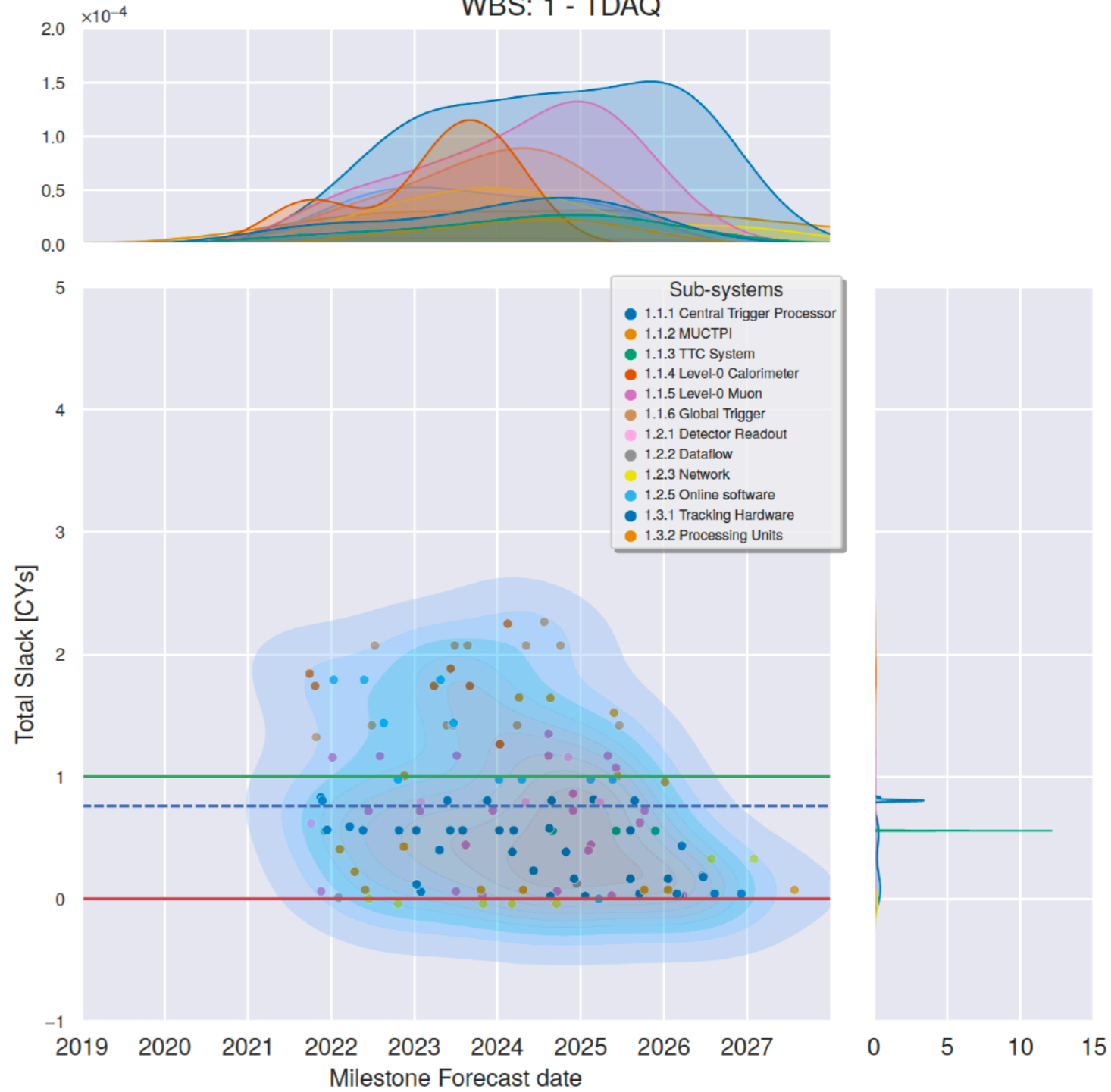


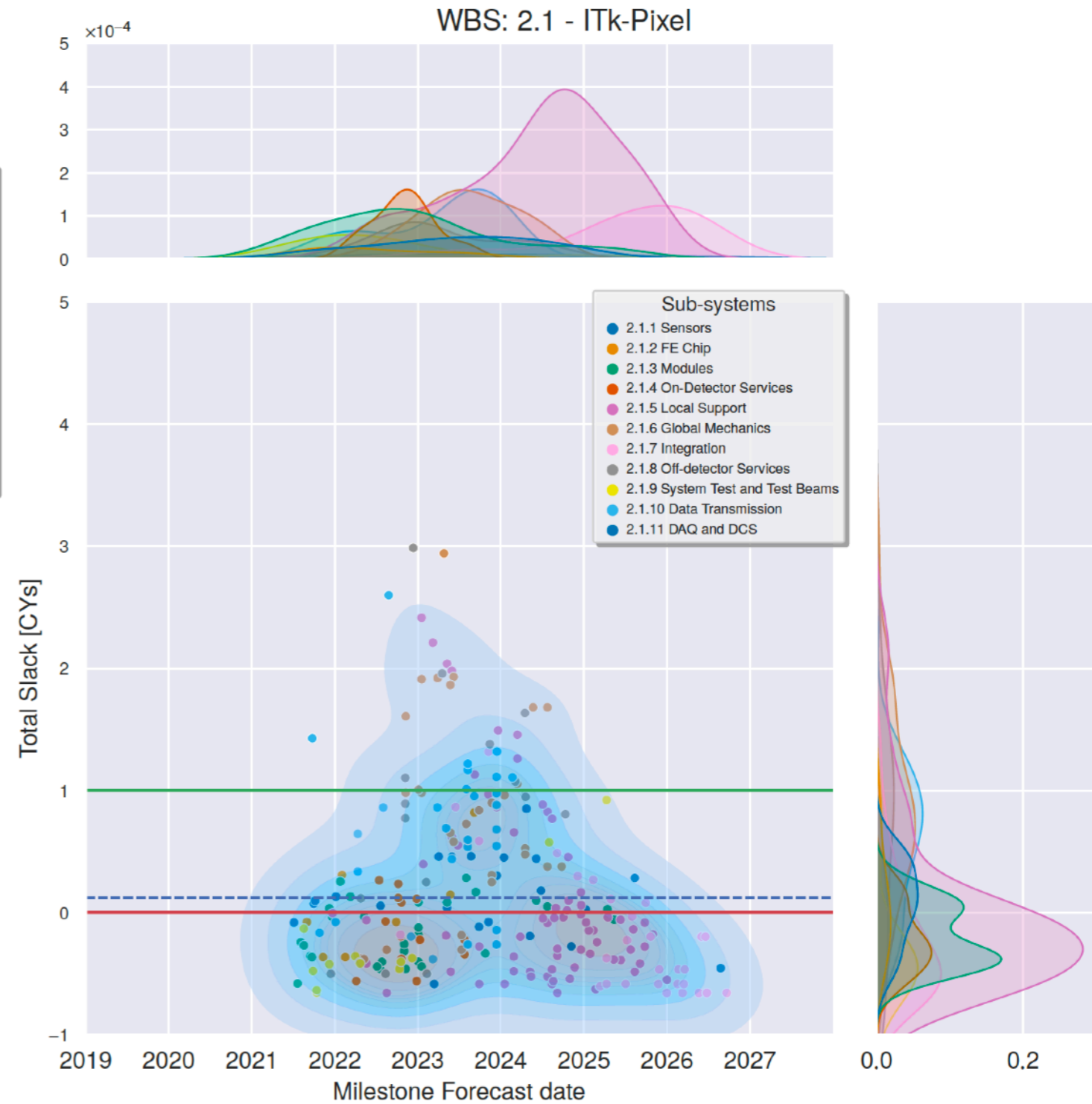
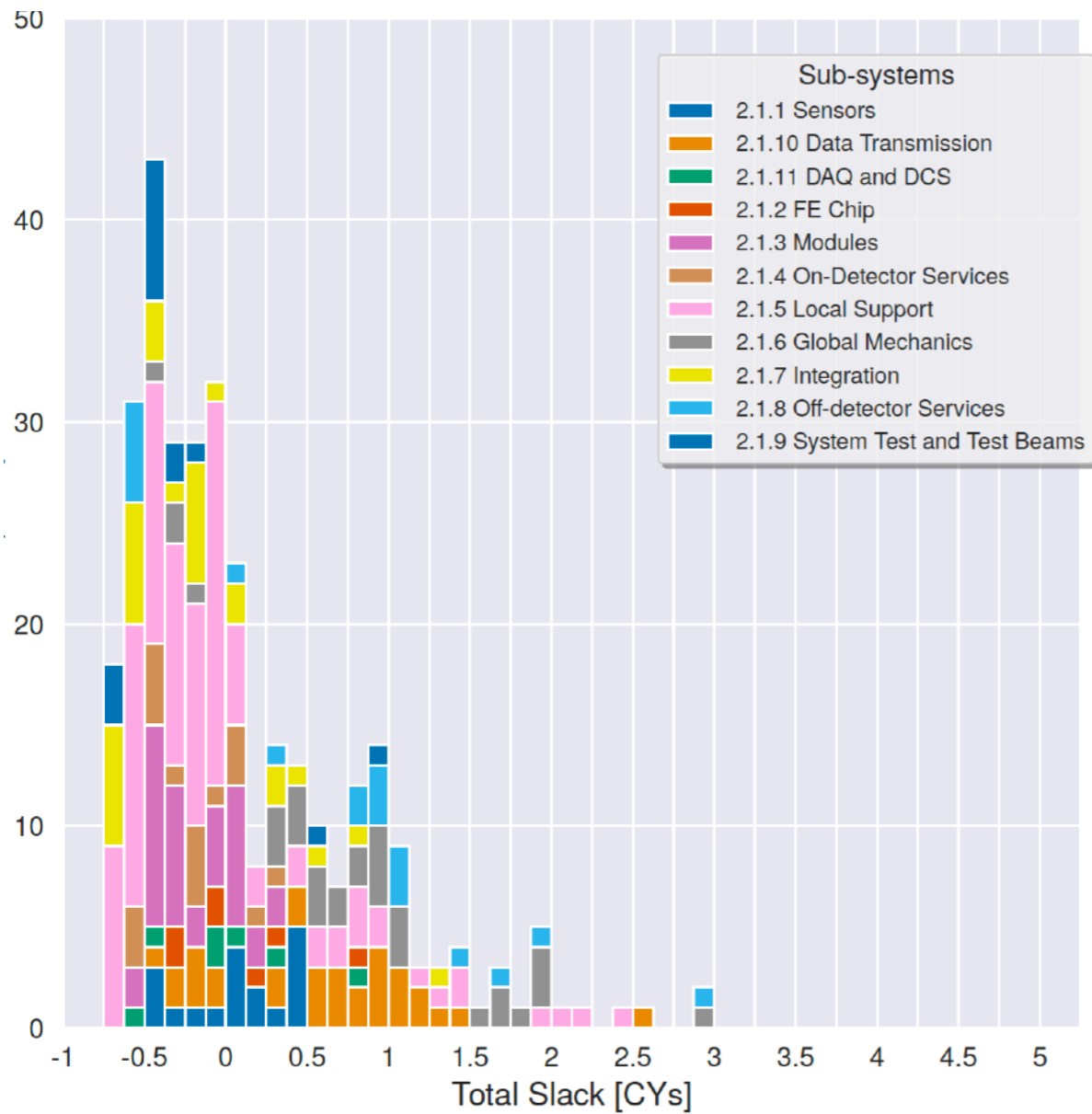
Additional Slides

WBS: 1 - TDAQ

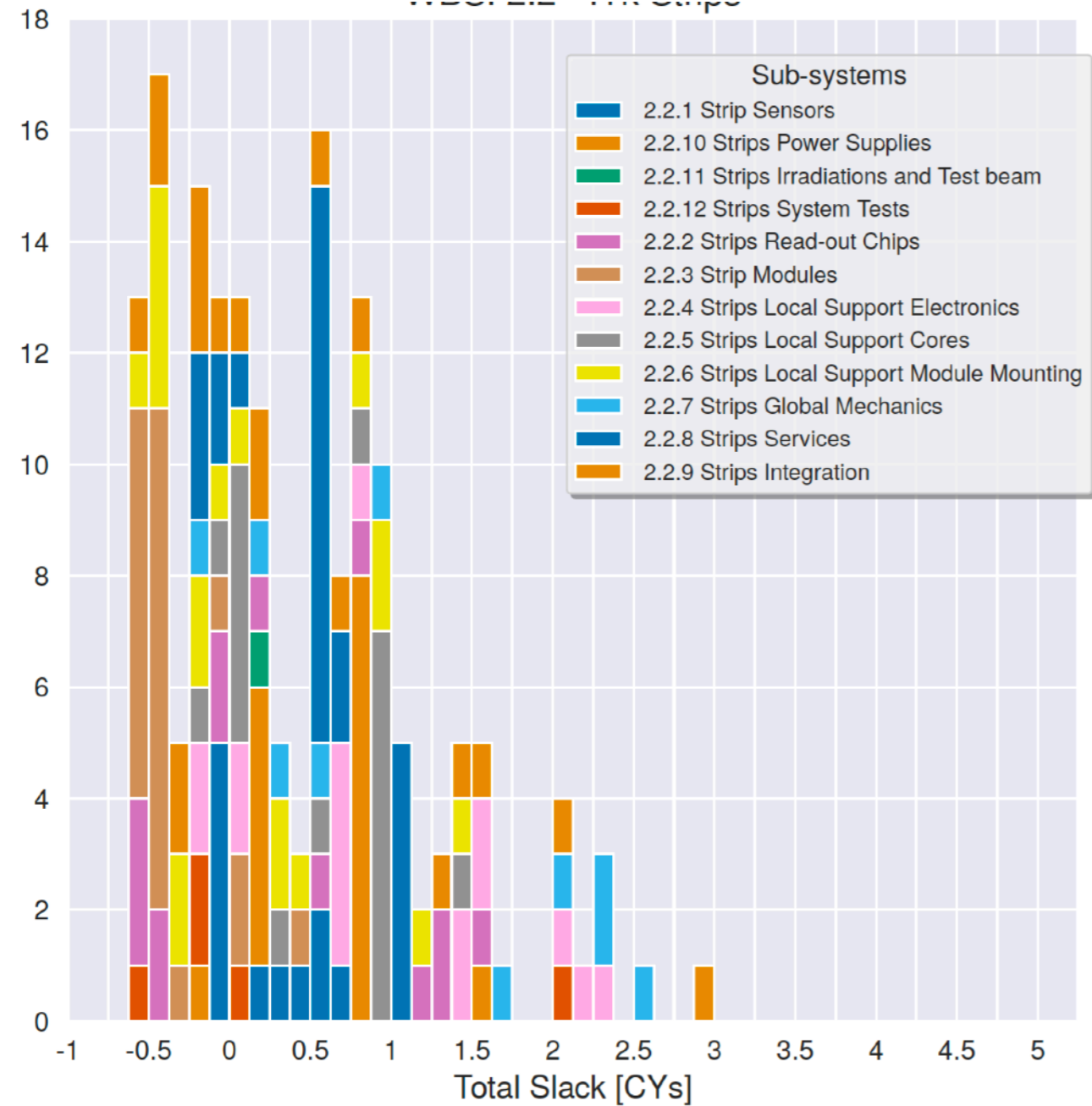


WBS: 1 - TDAQ





WBS: 2.2 - ITk-Strips



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