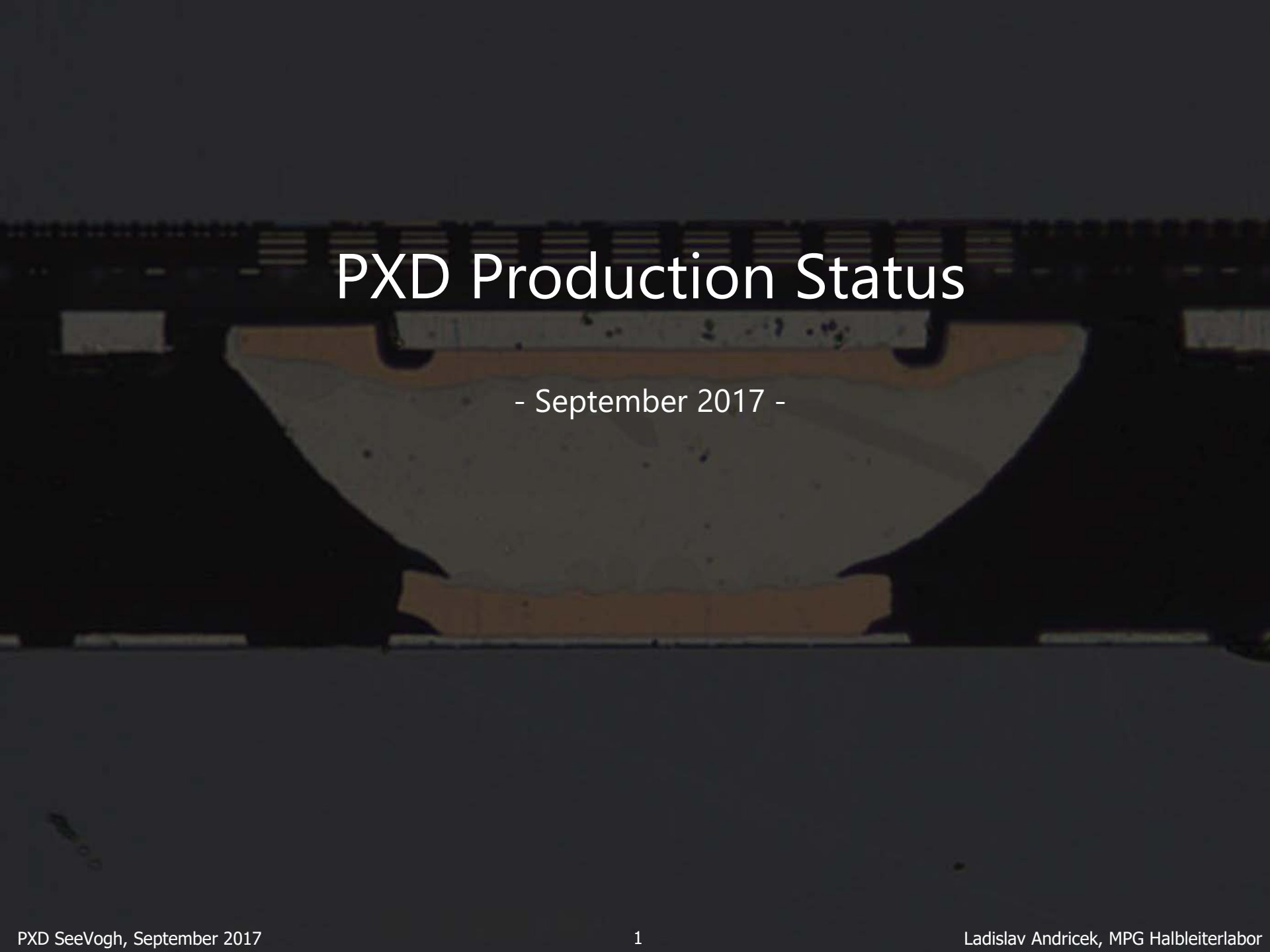


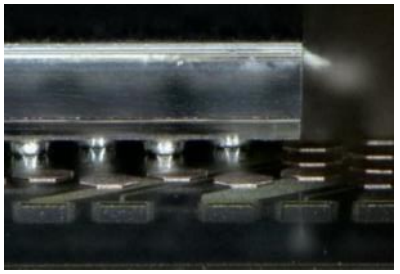
PXD Production Status

- September 2017 -

Module and Ladder Assembly – in a nutshell

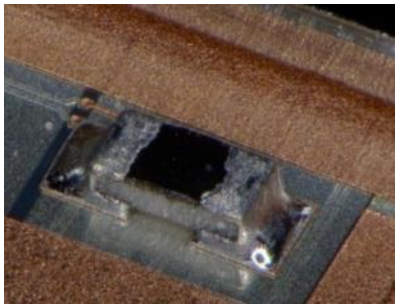
1. Flip Chip of ASICs (~240°C):

- ▷ Bumped ASICs have the solder balls (SAC305 and AgSn)
  - ↳ DHP bumping at TSMC, DCD bumping via Europractice
  - ↳ SWB bumping on chip level at IZM Berlin



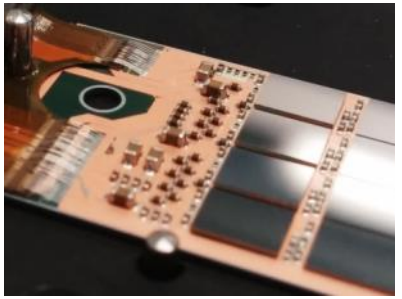
2. SMD placement (~200°C):

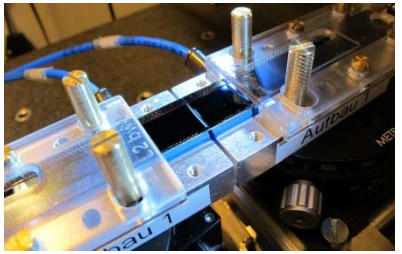
- ▷ Passive components (termination resistors, decoupling caps)
- ▷ Dispense solder paste/jetting of solder balls, pick, place and reflow
- ▷ First module tests on probe station possible at this stage already



3. Kapton attachment (~170°C), wire bonding and ladder gluing (RT):

- ▷ Solder paste printing on kapton, soldering
- ▷ Wire-bond, wedge-wedge, 32 µm Al bond wires
- ▷ → Module tests
- ▷ Dispense adhesive, align two modules, join two modules to ladder
- ▷ → ladder tests





Process qualification batches and pilot run

- Assembly of many(!) mechanical dummies, EMCMs, and ladders .....

- 28 B- and C-grade modules with different chip sets assembled
  - One electrically functional L1 ladder
  - One electrically functional L2 ladder
  - Most of the rest of the modules for Photon Factory

- Phase2 modules – pilot run
  - Sensors from pre-production batch PXD9-7
    - set1: W38-IB, W37-IF, W37-OB1, W37-OF1
    - set2: W40-IB, W40-IF, W38-OB1, W40-OF1
  - **Final ASICs DCDB4.2, DHPT1.2b, SWB2.1** (IZM bumps)
  - All ASICs tested (KIT, Bonn, KIT)
  - Start of module assembly delayed due to late arrival of diced DCDB4.2

  - Transport to IZM Berlin by UPS (set1 and set2 together)
  - Procedure: FC set1 → send back to HLL → SMD → test with probe card → FC set2

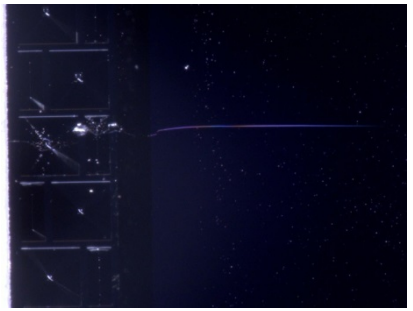
- Did not go that well ....

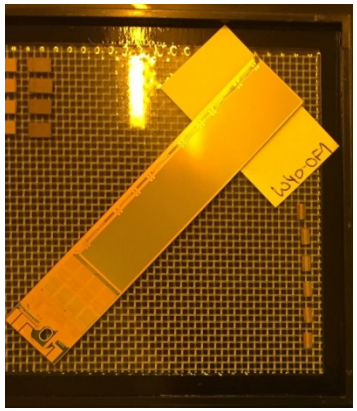
Pilot run (Phase2 modules) results

- Set 1
  - W37-IB
    - EOS okay, but one SWB wrongly placed
    - Rework at IZM was successful **(the first reworked module..)**
  - W37-OB1, W37-OF1, W37-IF all okay after some initial confusion
  - Modules have now kapton attached and are on the test stands at MPP, BN, and GOE

- Set2
  - After first probe card testing of set1 FC was done on set2
  - At incoming inspection at IZM **two sensors were found broken** (W40-OF1, W40-IB)
    - Most likely happened in transport (UPS …)
    - W38-OB1 has a still not identified short between DHP_CORE and DHP_IO
      - First of ~30 modules which has this kind of problem, no conclusion ..
    - Only 1/4 modules (W40-IF) functional

- Consequences
  - don't use UPS but personal transport
  - Initially it was planned to send larger batches, now decided to be more careful and don't put all "eggs in one basket"
    - → **smaller production batches!**





Production strategy and status

- Start with smaller batches of L1 modules, then larger batches of L2, **50% contingency**
  - P3-1: Layer 1 - 4+4 modules
  - P3-2: Layer 1 - 4+4 modules
  - P3-3: Layer 1 – 4+4 modules
  - P3-4: Layer 2 – 6+6 modules
  - P3-5: Layer 2 – 12+12 modules
- Status as of today:
  - All L1 modules P3-1, -2, -3: 24/24 modules good on probe station
    - P3-1 had a few b-grade modules to allow for some learning curve
  - P3-4: first L2 batch done with FC
  - P3-5: about to start → next week
- **Here, for BPAC, I need a summary from Pablo's work on the probe station**

Production Modules

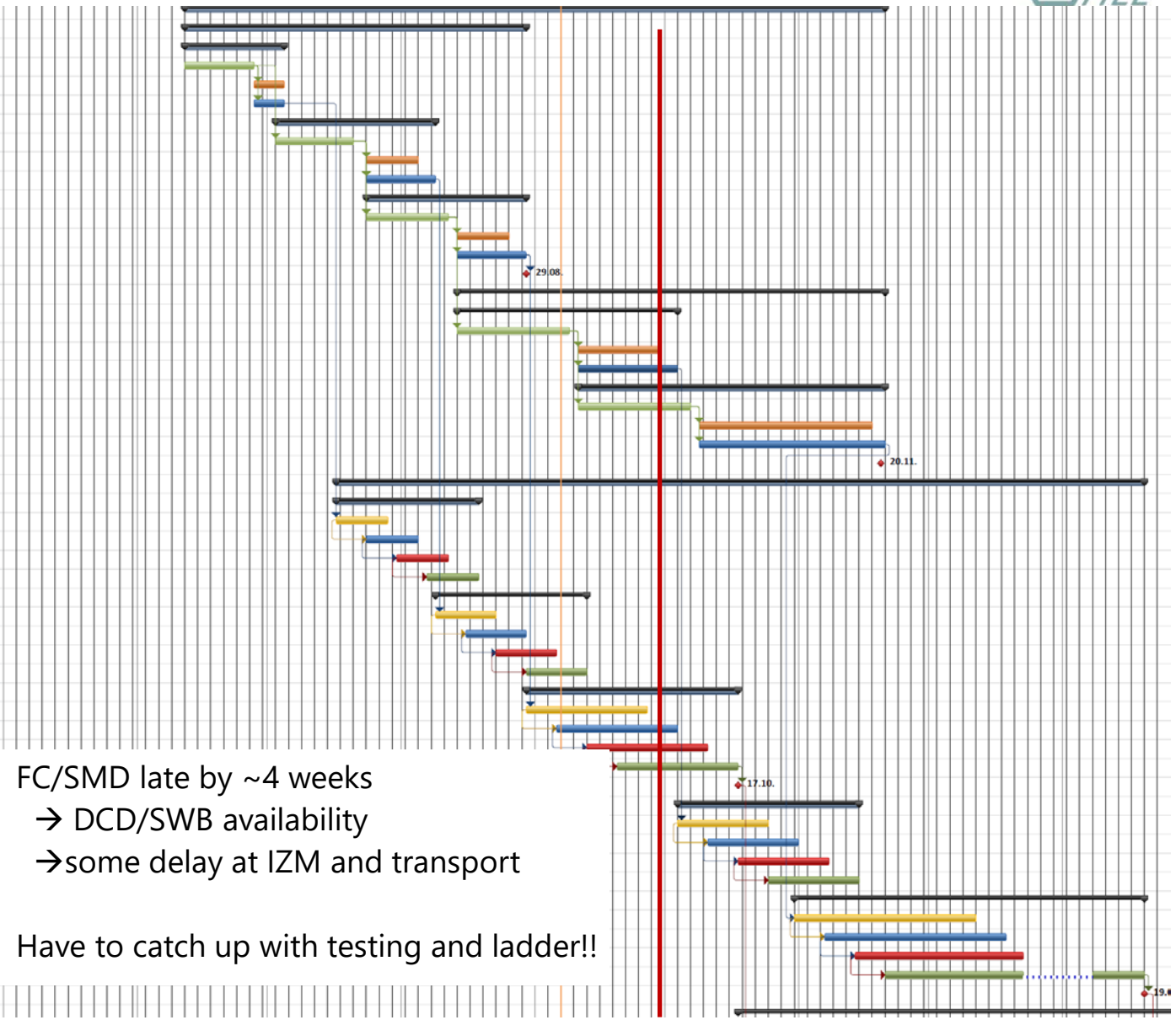
IB	Batch		IF	Batch		OB	Batch		OF	Batch	
W32	P3-3	G100	W32	P3-3	G100				W32-1		G99.5
						W32-2		G100	W32-2		G100
						W33-1		G99.5	W33-1		G100
									W33-2		G100
W41	P3-3	G100	W41	P3-3	G99.5				W41-1		G99.5
W42	P3-3	G100	W42	P3-3	G99.3	W42-1		G99.5	W42-1		M100
						W42-2		G100	W42-2		M100
W43	P3-2	G100	W43	P3-2	G100	W43-2		M99.9	W43-1		G100
W44	P3-2	G100	**W44**	P3-1	G100	W44-1		G99	W44-1		G100
						W44-2		G100	W44-2		G100
W45	P3-2	G100	**W45**	P3-1	G100				W45-1		G99.5
						W45-2		G100	W45-2		G100
W46	P3-1	G99.5	**W46**	P3-1	G99.5	W46-1		G99.5	W46-1		G100
						W46-2		G100	W46-2		G99.9
W47	P3-1	G99.5	**W47**	P3-1	G99.5				W47-1		G98.1
W01	P3-1	G94.4				W01-1		G100	W01-1		G99.6
W02	P3-1	M99	W02	P3-2	G99				W02-1		G99
W03	P3-2	G100	W03	P3-2	G99	W03-1		G99			
									W03-2		G99.4
W04		M99.5	W04		G99	W04-1		M99	W04-1		G99.3
W05		G98.4	W05	P3-2	G99.3	W05-1		G99	W05-1		G99.5
									W05-2		G99.3
W06		M99.5	W06		G98.8	W06-1	P3-4	G99	W06-1		G98.9
									W06-2		G97.9
			W08	P3-3	G99.5	W08-1	P3-4	G99			
						W08-2	P3-4	G99	W08-2	P3-4	G99.5
W09	P3-3	G100	W09		G99	W09-1	P3-4	G99	W09-1	P3-4	G99
						W09-2		M99.5	W09-2	P3-4	G99.5
			W10		G99	W10-1		G98.4	W10-1		G98.4
									W10-2		G98.4
W11		M98.7	W11		G99.3				W11-1	P3-4	G99
									W11-2	P3-4	G99
						W12-1	P3-4	G99.5	W12-1	P3-4	G99
						W12-2	P3-4	G99	W12-2		M98.9
W13		G99	W13		G99.5				W13-1		G97.9
						W13-2		G98.4			

Kapton issue

- Here I would summarize the results from the kapton production (Miriam's and Markus') results
  - Comparison prototype – production
  - Number of available kaptons
- Tests at Bonn with production kaptons – need data from Leo
- Some nice pictures of modules with kaptons …

Not readable MS Project plan …

Module Assembly	116 Tage	Mo 12.06.17
L1-BWD, L1-FWD, 24 modules (+50%)	57 Tage	Mo 12.06.17
Batch P3-1 (4+4)	17 Tage	Mo 12.06.17
Flip Chip	2,4 Wochen	Mo 12.06.17
SMD	1 Woche	Mi 28.06.17
Test	1 Woche	Mi 28.06.17
Batch P3-2 (4+4)	27 Tage	Mo 03.07.17
Flip Chip	2,8 Wochen	Mo 03.07.17
SMD	2 Wochen	Mo 24.07.17
Test	2,4 Wochen	Mo 24.07.17
Batch P3-3 (4+4)	27 Tage	Mo 24.07.17
Flip Chip	3 Wochen	Mo 24.07.17
SMD	2 Wochen	Mo 14.08.17
Test	2,4 Wochen	Mo 14.08.17
L1 Modules finished	0 Tage	Di 29.08.17
L2-BWD, L2-FWD, 36 modules (+50%)	71 Tage	Mo 14.08.17
Batch P3-4 (6+6)	37 Tage	Mo 14.08.17
Flip Chip	4 Wochen	Mo 14.08.17
SMD	15 Tage	Mo 11.09.17
Test	3,4 Wochen	Mo 11.09.17
Batch P3-5 (12+12)	51 Tage	Mo 11.09.17
Flip Chip	4 Wochen	Mo 11.09.17
SMD	6 Wochen	Mo 09.10.17
Test	6,2 Wochen	Mo 09.10.17
L2 Modules finished	0 Tage	Mo 20.11.17
Ladder Assembly	135 Tage	Mo 17.07.17
Batch P3-1 L1 (4+4)	25 Tage	Mo 17.07.17
Kapton Soldering	10 Tage	Mo 17.07.17
Module Test	10 Tage	Mo 24.07.17
Ladder Assembly	10 Tage	Mo 31.07.17
Ladder Test	10 Tage	Mo 07.08.17
Batch P3-2 L1 (4+4)	25 Tage	Mi 09.08.17
Kapton Soldering	10 Tage	Mi 09.08.17
Module Test	10 Tage	Mi 16.08.17
Ladder Assembly	10 Tage	Mi 23.08.17
Ladder Test	10 Tage	Mi 30.08.17
Batch P3-3 L1 (4+4)	35 Tage	Mi 30.08.17
Kapton Soldering	20 Tage	Mi 30.08.17
Module Test	20 Tage	Mi 06.09.17
Ladder Assembly	20 Tage	Mi 13.09.17
Ladder Test	20 Tage	Mi 20.09.17
L1 ladders ready for shipment to DESY	0 Tage	Di 17.10.17
Batch P3-4 L2 (6+6)	30 Tage	Mi 04.10.17
Kapton Soldering	15 Tage	Mi 04.10.17
Module Test	15 Tage	Mi 11.10.17
Ladder Assembly	15 Tage	Mi 18.10.17
Ladder Test	15 Tage	Mi 25.10.17
Batch P3-5 L2 (12+12)	59 Tage	Di 31.10.17
Kapton Soldering	30 Tage	Di 31.10.17
Module Test	30 Tage	Di 07.11.17
Ladder Assembly	29 Tage	Di 14.11.17
Ladder Test	34 Tage	Di 21.11.17
L2 ladders ready for shipment to DESY	0 Tage	Fr 19.01.18
Half Shell Assembly	108 Tage	Mi 18.10.17



FC/SMD late by ~4 weeks
→ DCD/SWB availability
→some delay at IZM and transport

Have to catch up with testing and ladder!!

BPAC Agenda

Oct 17
PXD Session (slightly rearranged, but covering all suggested topics)
Session 1:
- Overview (organization, issues, schedule) 10+10 — C. Niebuhr
- Module production (sensors, ASICs, SMD, Kapton) 30+20 — L. Andricek
- Lab tests including gated mode performance 30+20 — C. Koffmane

Session 2:
- Ladder assembly and ladder mount 20+20 — NN
- Half shell assembly, commissioning at DESY 20+20 — NN
- Services (PS, cables, PPs, dock boxes) 20+20 — S. Rummel (tbc)

Session 3:
- Readout overview 15+10 — S. Lange
- DHH System 15+10 — I. Konorov
- ONSEN und DATCON 20+10 — NN
- Integration test plan before phase3 15+15 — NN

Session 4:
- PXD test beam performance 30+10 — NN