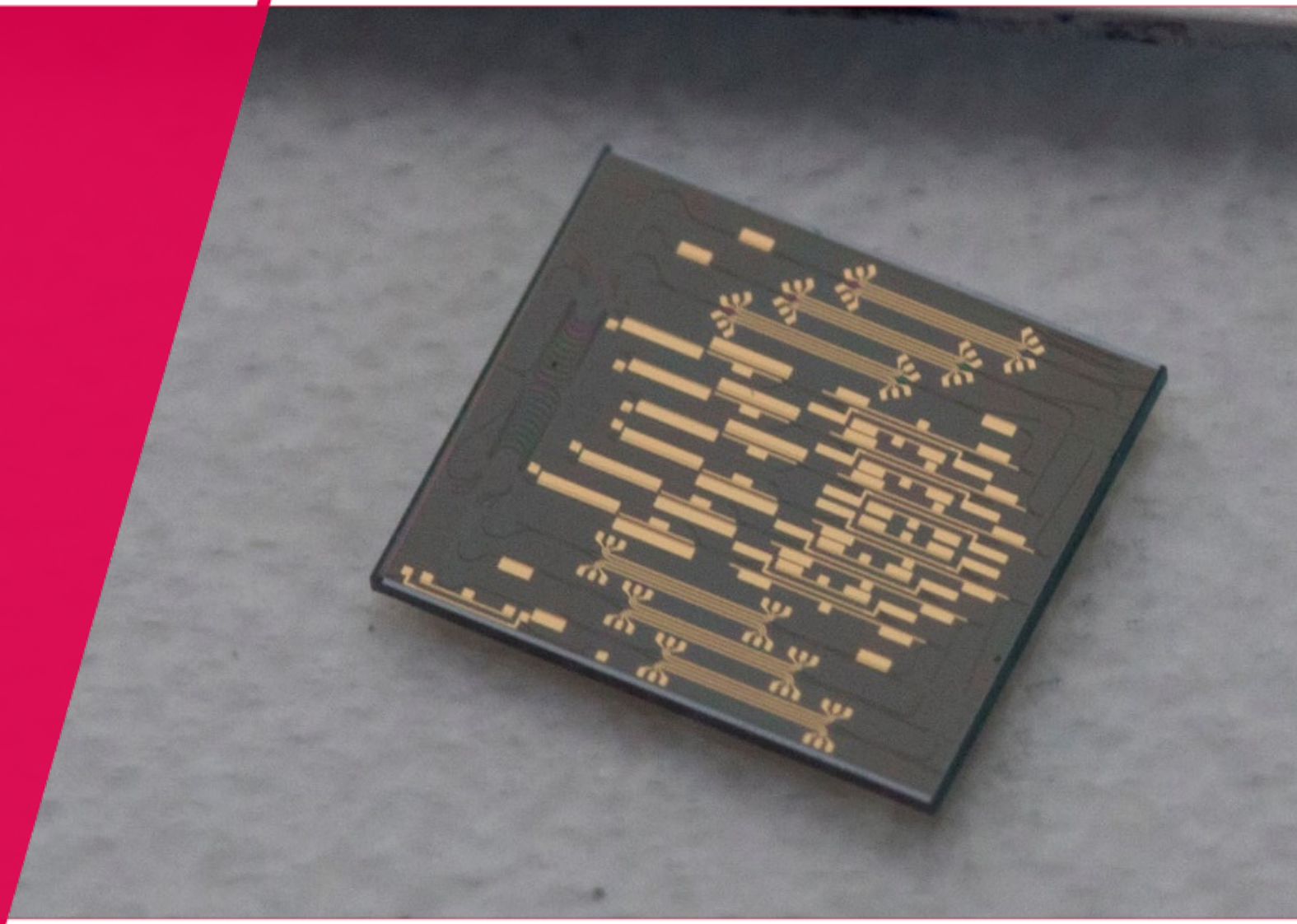
Technische Universiteit
Eindhoven
University of Technology

Progress TU/e

Progress Meeting OpenPICs
04/04/2018



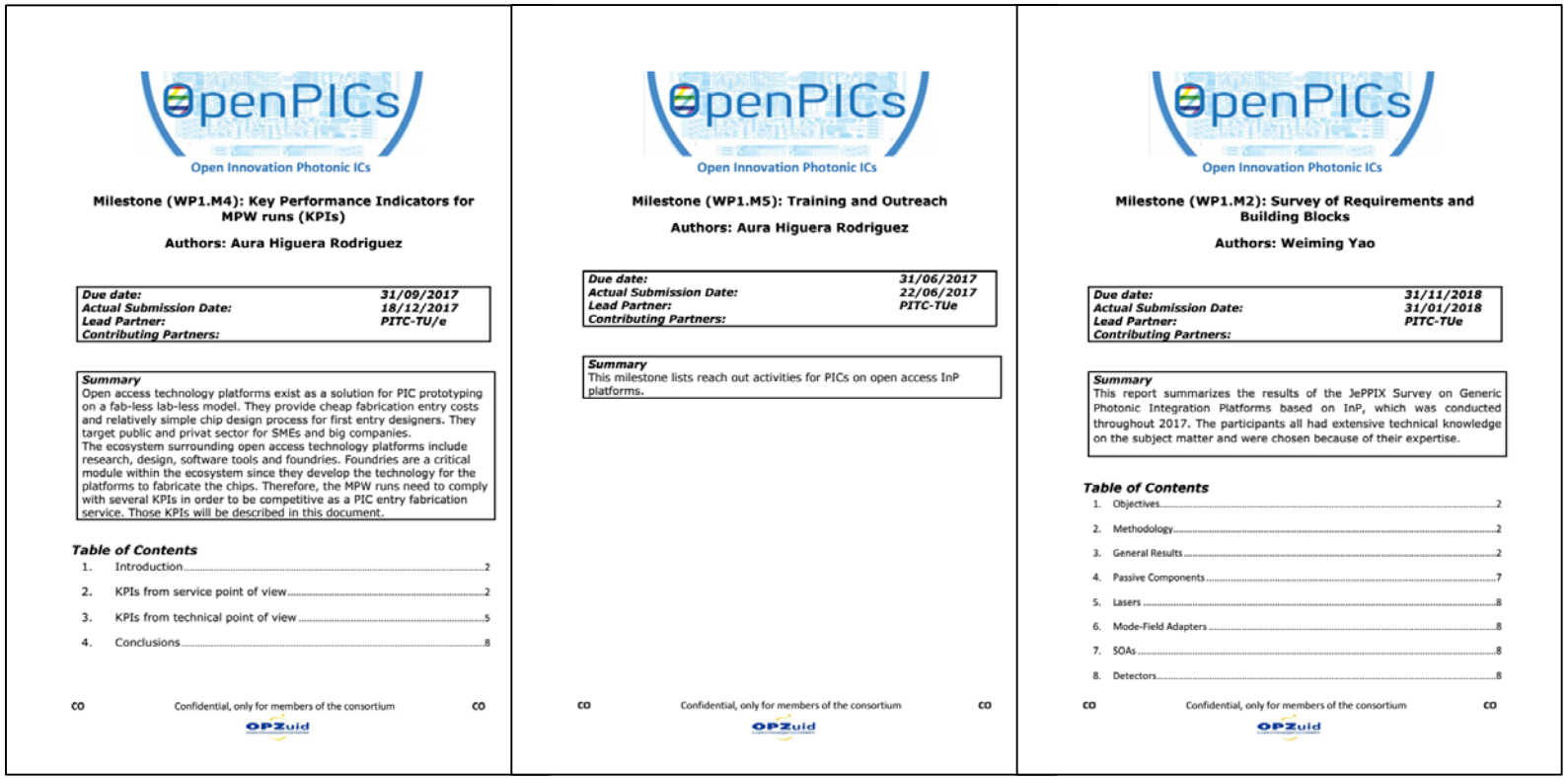
Where innovation starts

Photonic Integration Technology Centre

JePPIX

Work Package 1

WP1.M1	Demonstrator definitions – linking products to building blocks	Aura	Mar-17
WP1.M2	Survey of requirements and building blocks	Weiming	Nov-18
WP1.M3	Platform roadmap	Aura	Sep-18
WP1.M4	Key performance Indicators for MPWs	Aura	Sep-17
WP1.M5	Training and Outreach	Aura	Jun-17



OpenPICs
Open Innovation Photonic ICs

Milestone (WP1.M4): Key Performance Indicators for MPW runs (KPIs)

Authors: Aura Higuera Rodriguez

Due date:	*31/09/2017*
Actual Submission Date:	*18/12/2017*
Lead Partner:	*PITC-TU/e*
Contributing Partners:	

Summary

Open access technology platforms exist as a solution for PIC prototyping on a fab-less lab-less model. They provide cheap fabrication entry costs and relatively simple chip design process for first entry designers. They target public and privat sector for SMEs and big companies.
The ecosystem surrounding open access technology platforms include research, design, software tools and foundries. Foundries are a critical module within the ecosystem since they develop the technology for the platforms to fabricate the chips. Therefore, the MPW runs need to comply with several KPIs in order to be competitive as a PIC entry fabrication service. Those KPIs will be described in this document.

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OpenPICs
Open Innovation Photonic ICs

Milestone (WP1.M5): Training and Outreach

Authors: Aura Higuera Rodriguez

Due date:	*31/06/2017*
Actual Submission Date:	*22/06/2017*
Lead Partner:	*PITC-TUe*
Contributing Partners:	

Summary

This milestone lists reach out activities for PICs on open access InP platforms.

OpenPICs
Open Innovation Photonic ICs

Milestone (WP1.M2): Survey of Requirements and Building Blocks

Authors: Weiming Yao

Due date:	*31/11/2018*
Actual Submission Date:	*31/01/2018*
Lead Partner:	*PITC-TUe*
Contributing Partners:	

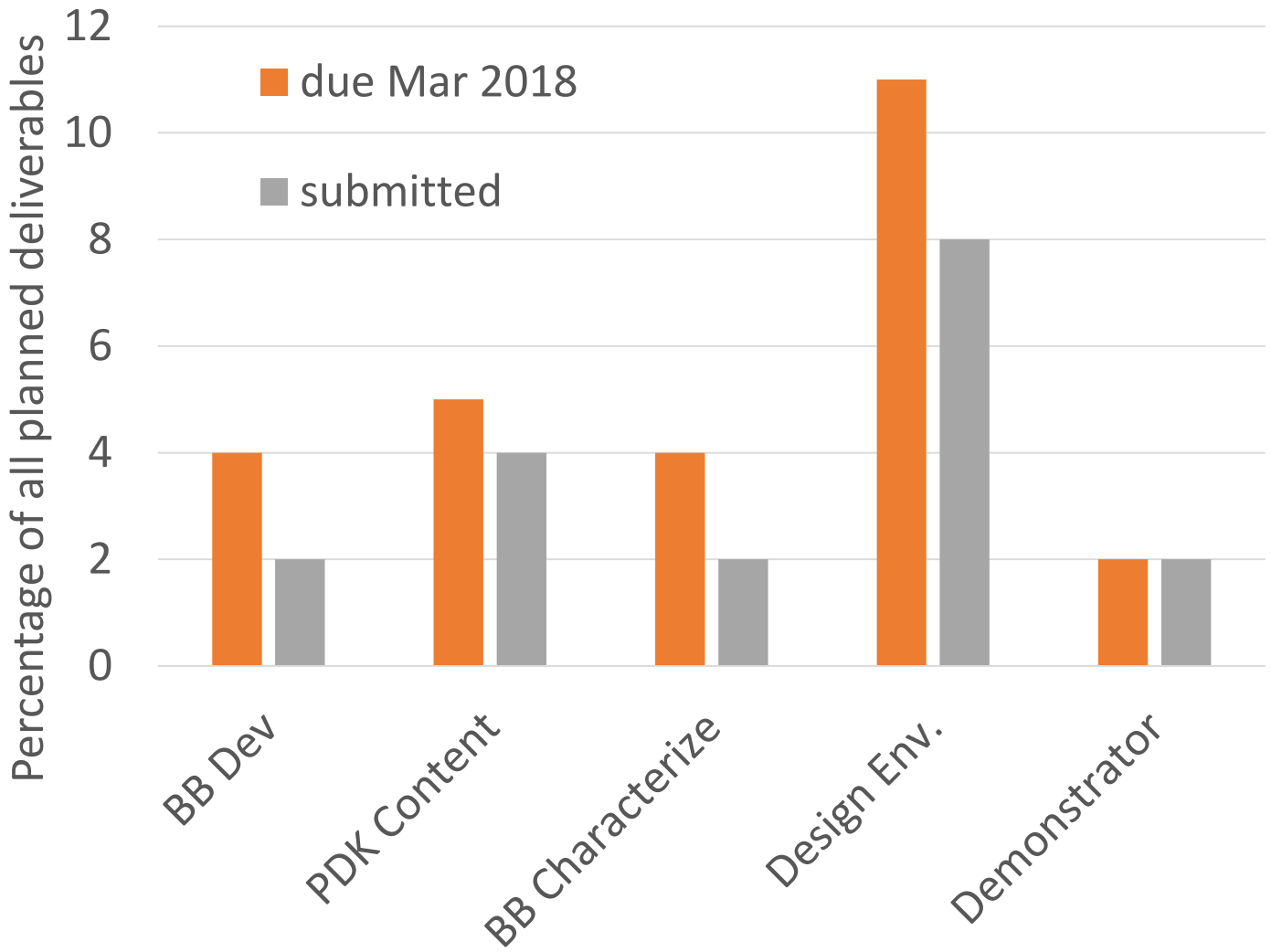
Summary

This report summarizes the results of the JePPIX Survey on Generic Photonic Integration Platforms based on InP, which was conducted throughout 2017. The participants all had extensive technical knowledge on the subject matter and were chosen because of their expertise.

Table of Contents

- JePPIX Survey 2017
- KPIs in JePPIX Roadmap
- JePPIX Training Eindhoven 2017
- JePPIX Training Beijing 2018

Work Package 3



Building Block Design
Bright, Tue

PDK Content
Smart, TUe

BB Characterization
Smart, TU/e

Design Environment
- Phoenix
- Bright
- (TUe)

Demonstrators
Effect, Technobis

Building Block Design
Bright, Tue

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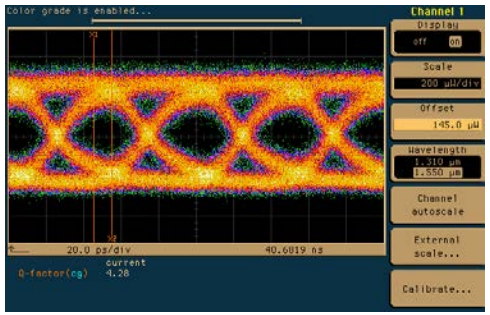
MPW run #					SP18	SP19	SP20	SP21	SP22	SP23	SP24	SP25	SP26	SP27	SP28	SP29
Month					9 10 11	12 1 2	3 4	5 6	7 8	9 10	11 12	1 2	3	4 5 6	7 8	9 10	11 12	1 2	3 4	5 6	7 8
ID	Title	Responsible	Contrib. partner	Due Times	2016	2017					2018			2019		
WP 3.1	*BB Design*															
WP3.1.M0	Technology and Design Concept	Weiming, Ronald		Dec-17		postponed from Bright										
WP3.1.R0	Analysis and Design	Weiming, Ronald		Dec-17					postponed from Bright							
WP3.1.M1	Mask Design Tape-out I	Weiming, Ronald		Jun-17												
WP3.1.R1	BB Results I	Weiming, Ronald		Mar-18												
WP3.1.M2	Mask Design Tape-out II	Weiming, Ronald		Sep-18												
WP3.1.R2	BB Results II	Weiming, Ronald		Jun-19												

- High-speed modulator — 30 GHz EO bandwidth, moderate eye diagram 20 Gb/s
- RF Lines — 67+ GHz bandwidth, BCB spacing layer
- Spot-size converter — await information from Smart
- Low linewidth laser — Bright Photonics
- Precision filter — Bright Photonics

WP3.1. M1

20 Gb/s



PDK Content
Smart, TUe

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MPW run #					SP18	SP19	SP20	SP21	SP22	SP23	SP24	SP25	SP26	SP27	SP28	SP29
Month					9 10 11	12 1 2	3 4	5 6	7 8	9 10	11 12 1 2	3	4 5 6 7 8	9 10 11 12	1 2	3 4 5 6 7 8
ID	Title	Responsible	Contrib. partner	Due Times	2016	2017				2018				2019		
WP 3.2	*PDK Content*															
WP3.2.M0	State of the PDK	Rui		Dec-16												
WP3.2.M1	Definition of basic BB figure of merits	Rui		Mar-17												
WP3.2.M2	Definition of composite BB FoM	Weiming		Mar-17												
WP3.2.R0	Definition of measurement procedures	Weiming		Jun-17												
WP3.2.R1	PDK upgrade with new advanced BB	Rui		Mar-18												
WP3.2.R2	Compact Models	Rui		Jun-18												

- State of the PDK
- Listing of Figure of merits
- Composite BB Figure of Merits
- Test cell measurement procedures

Smart PDK release 2017
used to design BB test cells
used to design CBB test cell
deliverable describing those

- Introduction of advanced BBs

Interface definition based on GDS or JSON

BB Characterization
Smart, TU/e

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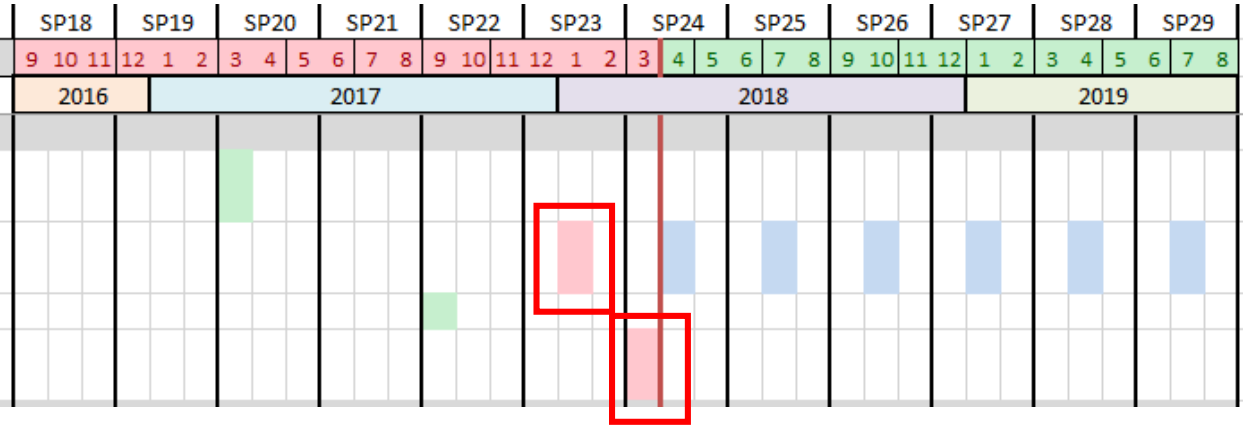
MPW run #				
Month				
ID	Title	Responsible	Contrib. partner	Due Times
WP 3.3	*BB Characterization*			
WP3.3.R0	Design of Standard MPW BB test cell	Weiming		Mar-17
WP3.3.M0	Report on standard MPW BB cell results	Rui		Every MPW
WP3.3.R1	Design of composite BB test cell	Weiming		Sep-17
WP3.3.M1	Report on composite test cell results	Weiming		Mar-18



- Design of BB test cell — compatible with automated test layout
- Composite BB test cell — list of advanced BBs from TU/e (SP22)
- Automation work — automated test setup -> May 2018

- Report on BB testing — joint effort with Smart
- Testing of cBB — SP22 delayed

BB Test Cell Results

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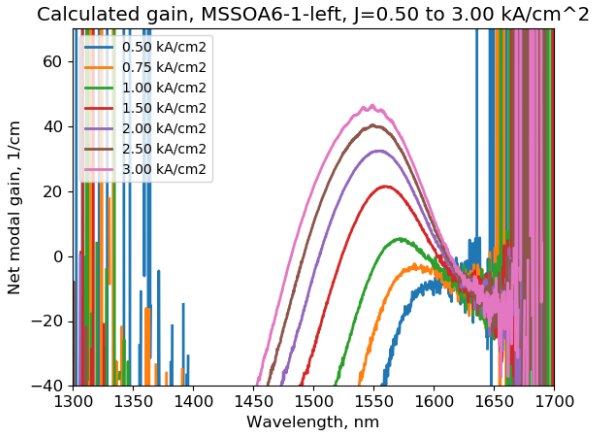
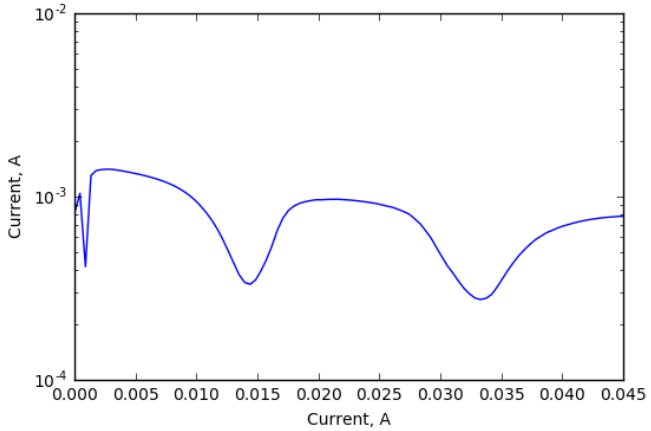
SP 20 spectral gain



SP 20 shallow WG Ring resonator with source-detector



SP19 Metal Resistance

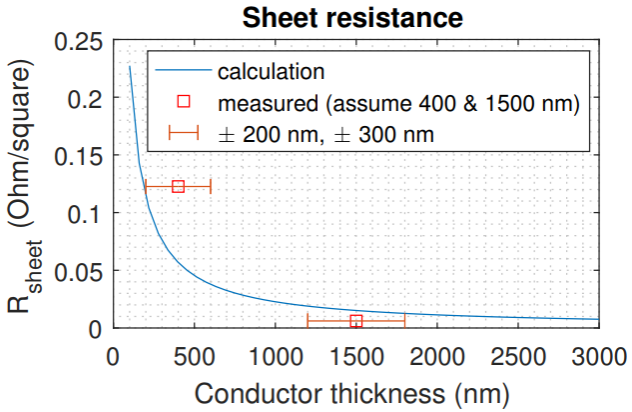


Figure 6. Comparison of extracted values and calculation. We introduce uncertainties in the thickness because the precise value in SP19 is unknown. Left data point represents evaporated+sputtered metal and right data point with plating.

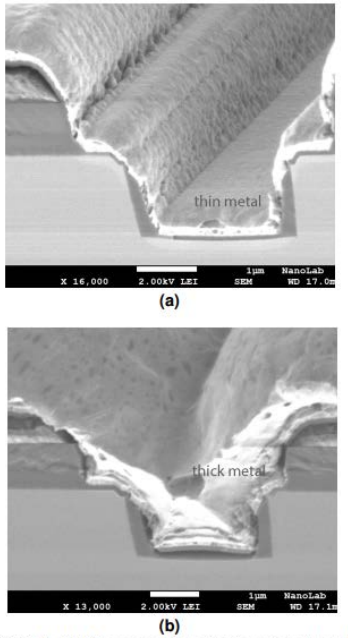


Figure 3. SEM cross section of (a) sputtered metal over deep trench and (b) with electro-plating in SP19 samples.

- Report in WP3.3.M0
- Re-design test cell for next run
- Faster testing with automated die testing

Work Package 4

← Layerstack fixed, wafer growth to start in mid- April)

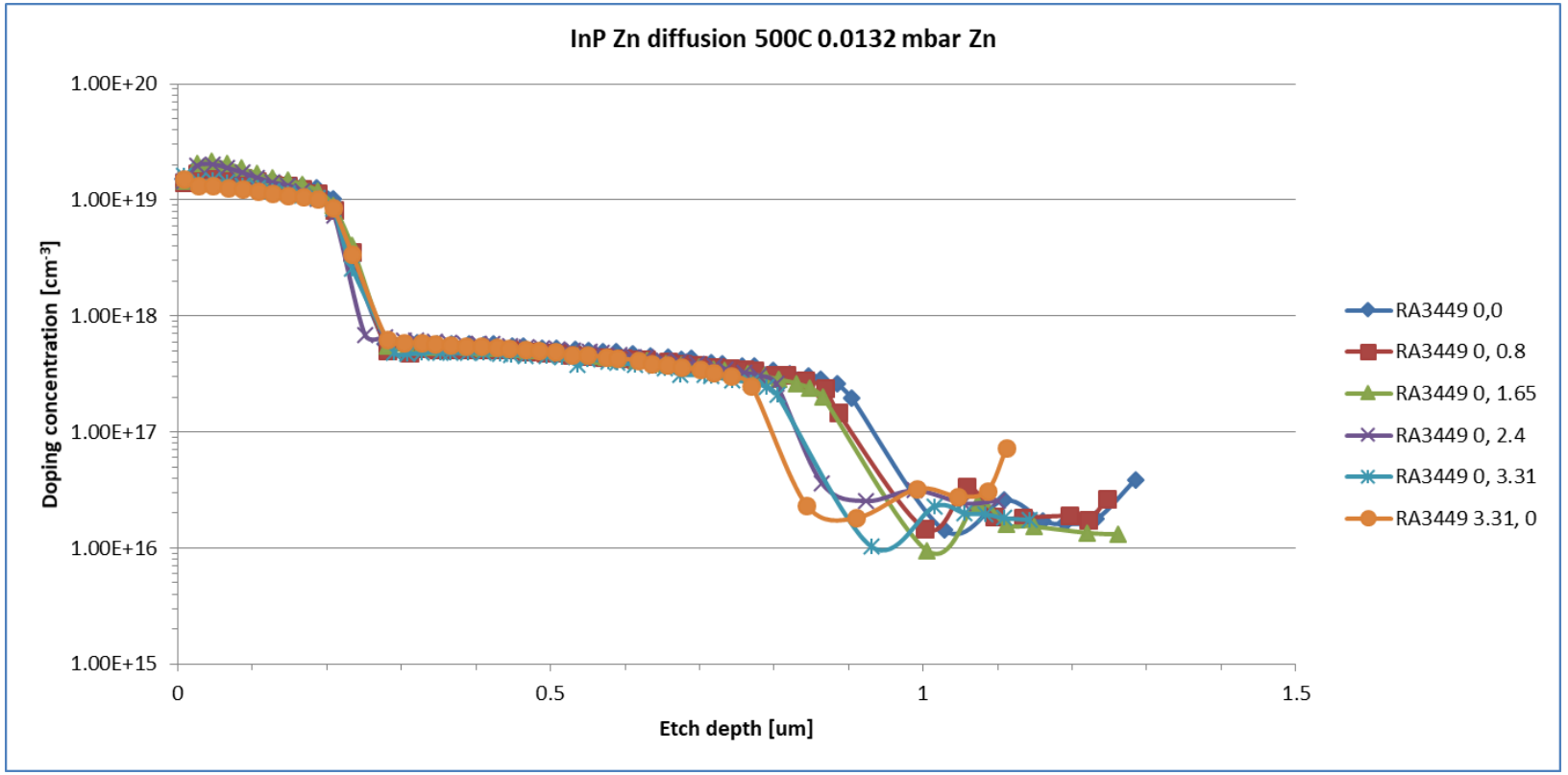
← Serious issues with reproducibility

Work Package 4

← In idle, waiting for MPW layout from SMART to continue…

← Demonstrated earlier. Report to be written.

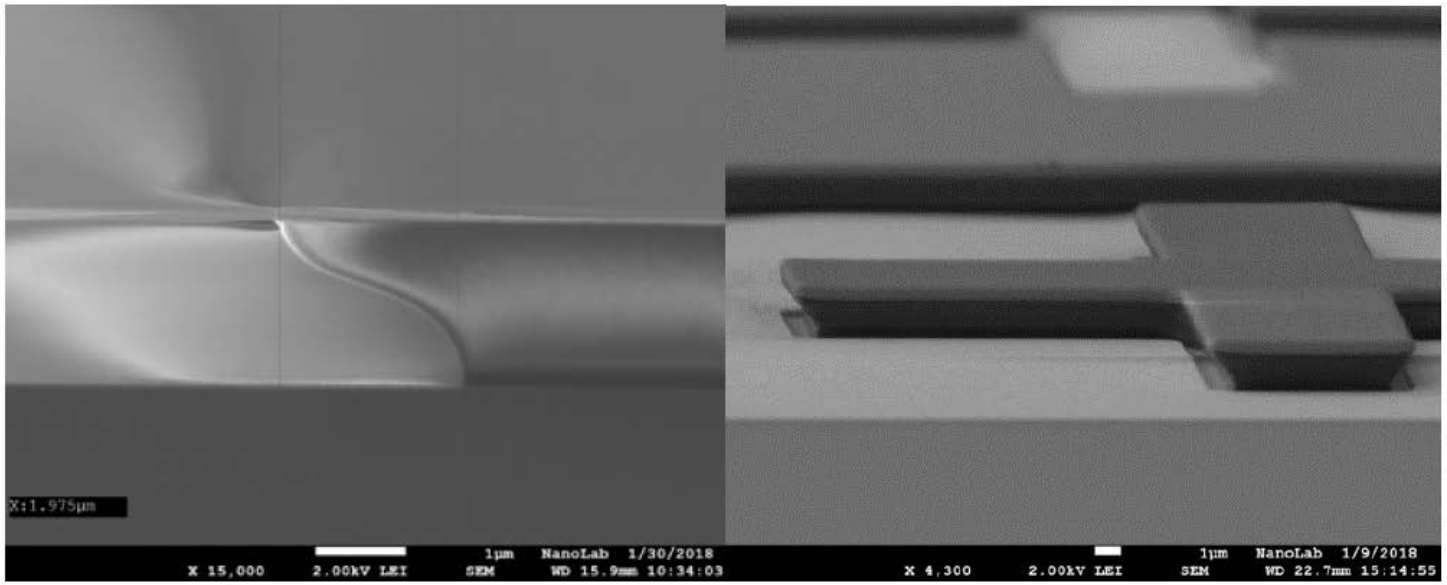
Highlights: Zn diffusion uniformity (3”)



- Diffusion front variation ~ 140nm (single diffusion)
- Causes might include:
  - Lower temperature in wafer center (faster diffusion)
  - Non-uniformity in layers thicknesses

*low PH_3

Highlights: MaN process for stepper



Picture 1a/b: SEM images of undercut profile of 2 microns for Ma-N 1420.

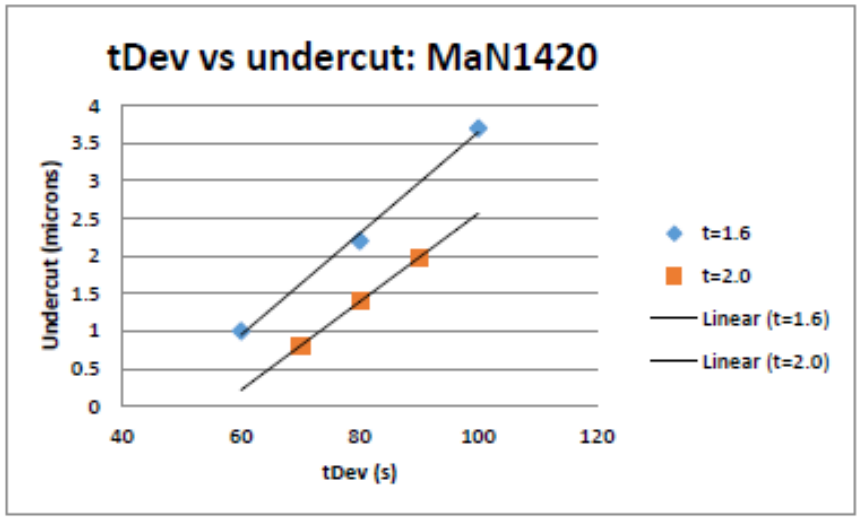


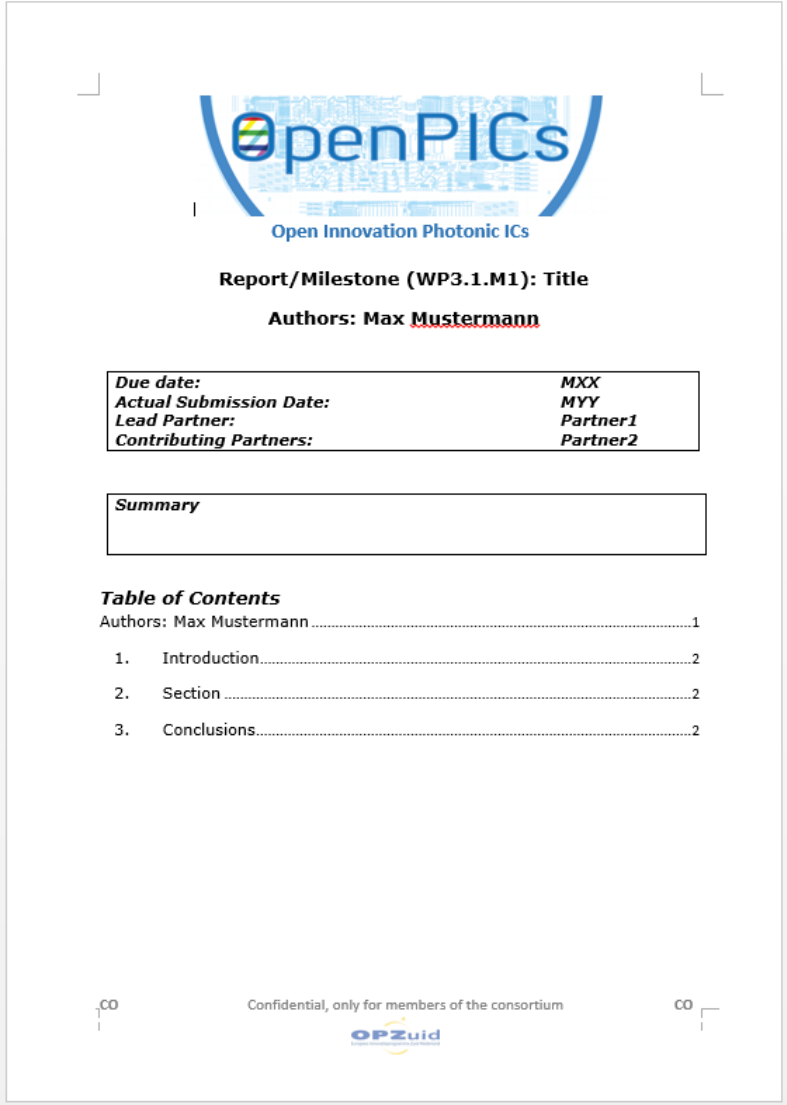
Figure 7: Effect of different development times on undercut pattern.

Demonstrator/Milestones
Actions
Any Other Business

Reports

- Form of documenting partner effort
- Output of project
- Technical Content in form of gathered data, insight
- →increases usefulness
- Reuse encouraged

→ Tutorial, templates…



OpenPICs

Open Innovation Photonic ICs

Report/Milestone (WP3.1.M1): Title

Authors: Max Mustermann

Due date:	***MXX***
Actual Submission Date:	***MYY***
Lead Partner:	***Partner1***
Contributing Partners:	***Partner2***

Summary

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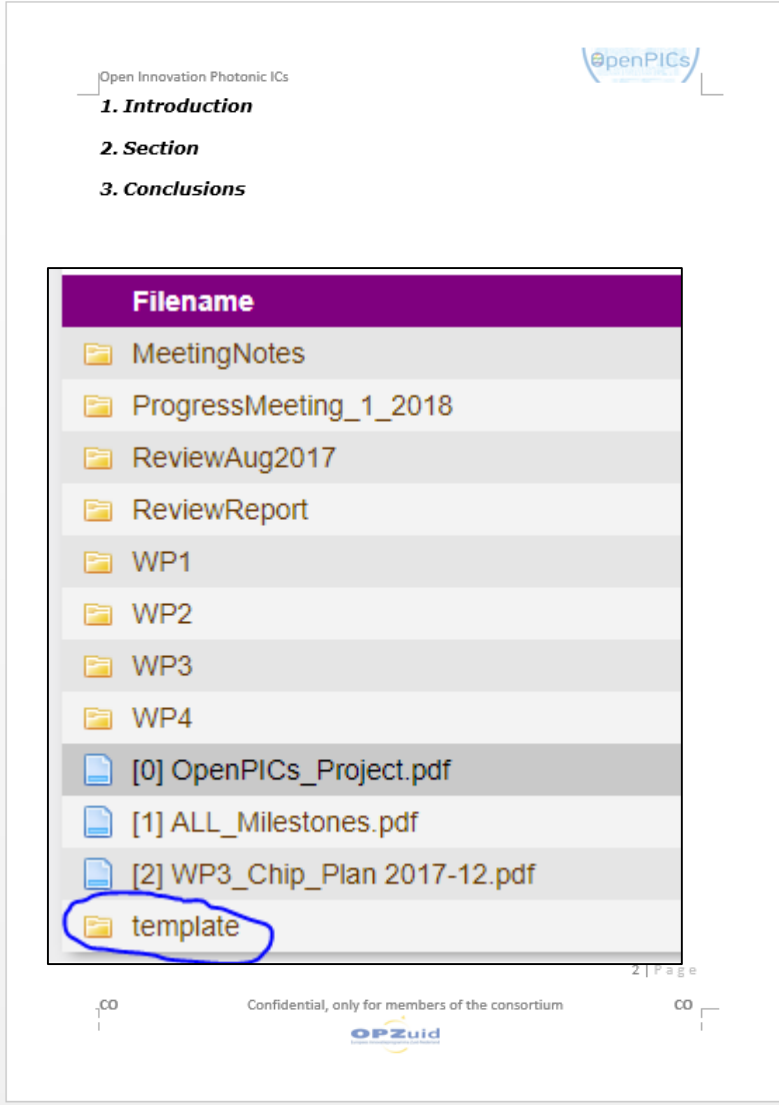

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Demonstrators
Effect, Technobis

MPW run #					SP18			SP19			SP20			SP21			SP22			SP23			SP24			SP25			SP26			SP27			SP28			SP29		
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ID	Title	Responsible	Contrib. partner	Due Times	2016			2017													2018												2019							
WP 3.5	*Demonstrator Design*																																						
WP3.5.R0	400G Transmitter concept	Saeed		Mar-17																																			
WP3.5.R1	Fiber sensing chip concept	Pim		Mar-17																																			
WP3.5.M0	400 G Transmitter Design	Saeed		Sep-18																																			
WP3.5.M1	Fiber Sensing Chip Design	Ronald		Sep-18																																			
WP3.5.M2	Results of 400G Transmitter	Saeed		Jun-19																																			
WP3.5.M3	Results of fiber sensing chip	Pim		Jun-19																																			

Demonstrator Design ready in September!

Fiber Sensor Chip
Technobis+Bright

400 G Transmitter
Effect

Actions/AOB

- Effect Demonstrator – decision on which run, what BBs (Saeed coordinates)
- Technobis Demonstrator – which run, SSC, tolerances, linewidth (Ronald coordinates)
- SSC more data needed
- Input for Phoenix requested from all partners
  - Way to define DRC
  - Way to define BB, PDK
  - Smart performs evaluation with example PDK
  - Version control

- Next Meeting Location