Norwegian contributions to ITk Pixels

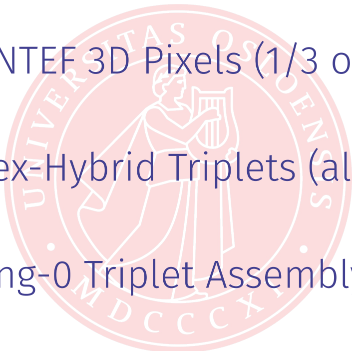
O. M. Røhne[1]

[1]University of Oslo [2]University of Bergen

ITk Visit to Norway — 2024-06-25

Outline

1. Funding and Project Structure
2. SINTEF 3D Pixels (1/3 of the Innermost layer)
3. Flex-Hybrid Triplets (all three designs)
4. Ring-0 Triplet Assembly and Testing



NorLHC I/II WP2

Project structure and funding

NorLHC / WP2 - 2018-22

In-kind:

- Local infrastructures at the University groups in Bergen and Oslo
- Module prototyping, testing and validateion
- Sensor qualification and pre-production

Common:

- Pixel ASIC
- Hybridization/flip-chip

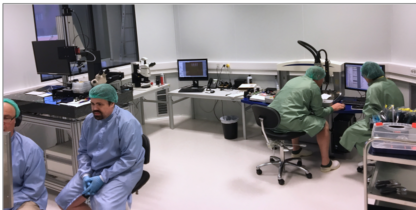
NorLHC-II / WP2 - 2023-27

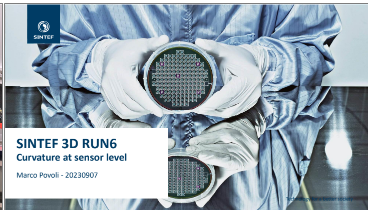
In-kind:

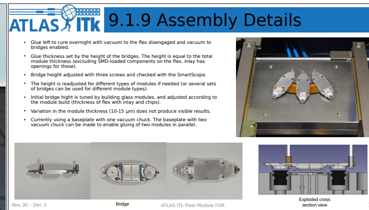
- Sensor production
- Flex-PCB production
- Site qualifications
- Module assembly (Oslo)
- Module testing (Bergen)

Common:

- On-detector services
- Common items







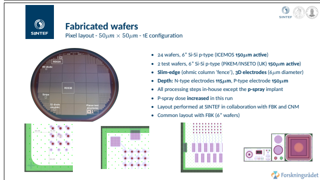
SINTEF 3D Pixel Sensors

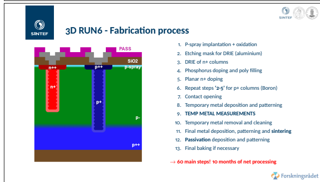
Recent history of 3D technology at SINTEF

YEAR	Project	Wafer type	Active thickness [μm]	Electrode diameter [μm]	Remarks
2006	Run-1	4" SOI	230	15	N-type, low mechanical yield
2008	Run-2	4" SOI	230	15	50% yield (roughly)
2010	Run-3	4" SOI	230	15	Low yield (2 out of 24 wafer ok)
2018	Run-4*	6" Si-Si	50 & 100	4	Very good yield (FE-I4 layout)
2019	Run-5*	6" Si-Si	150	6	OK yield (RD53 A/B with active edge)
2021	**Run-6***	**6" Si-Si**	**150**	**6**	**Completed Feb. 2021. ATLAS pre-production. (RD53 A/B with common layout with FBK, slim-edge termination)**

*funded by Norwegian ATLAS R&D

Forskningsrådet

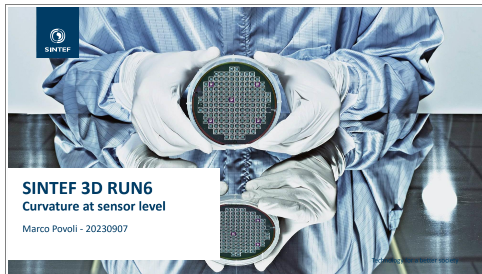


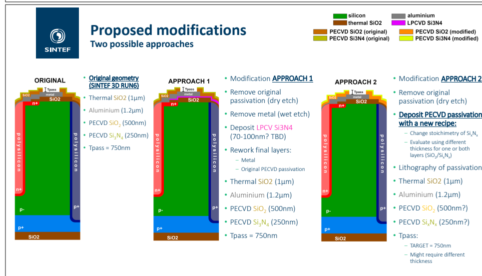


M. Povoli et al. TREDI 2022

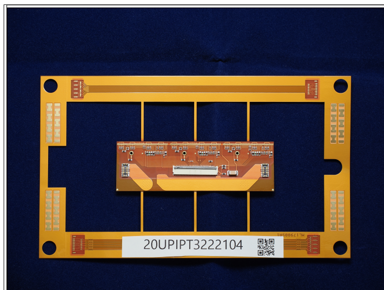
Production Runs

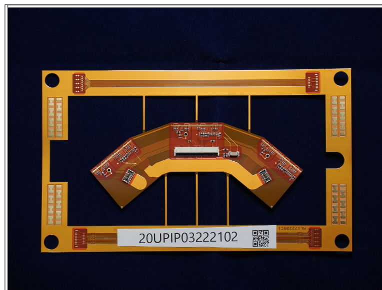
- First wafers from Run-6 was delivered to ATLAS beginning of 2022. Up to 70 % good die per wafer.
- Residual stress imbalance has caused some doubts and delays in downstream processing, successful mitigation under way.
- Runs 7 & 8 are currently in progress, ETA end 2024

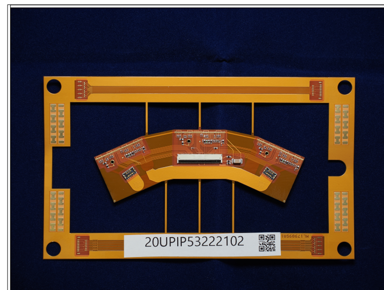


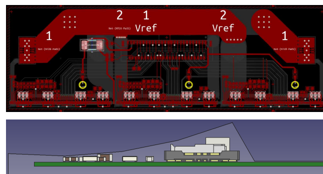


Triplet Flex-Hybrid Design and Manufacture

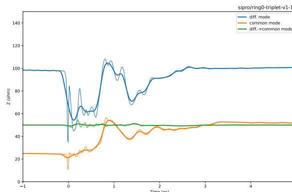




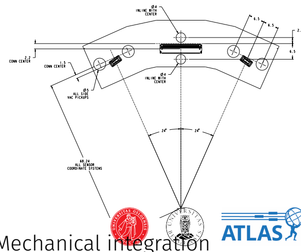




Detector envelope



Signal integrity



Mechanical integration

Precision Assembly

Triplet Assembly

Pick and place (Zevac Onyx32)

- Survey the triplet face-down in jig with cut-outs (inlay)
- Glue application by stamping at each chip location
- Bare modules picked and surveyed using custom tool (bridge)
- Each module held in place below bridge during glue cure