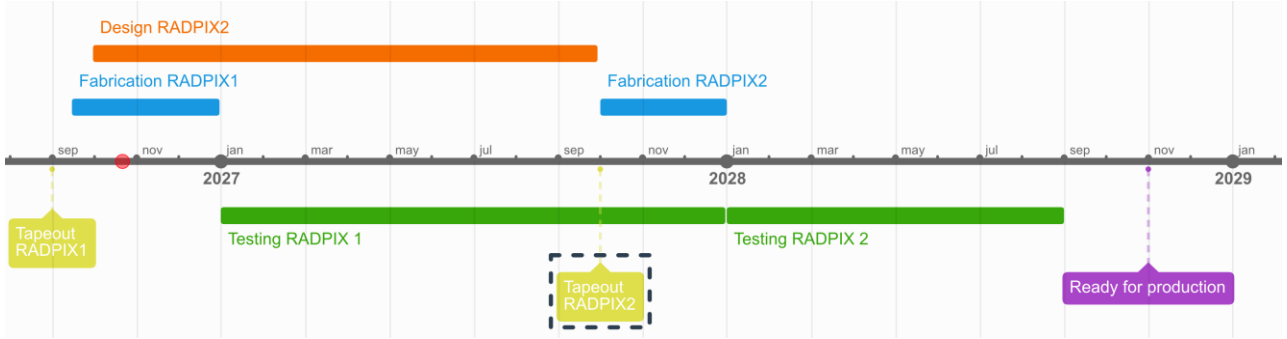
RadPix1: Test preparation

Eva Vilella
University of Liverpool
(on behalf of the RadPix collaboration)

Questions (for slide preparation):
- Should add author names explicitly? But tests involve more than design team, and testing only groups have not contributed yet

RadPix R&D plan

See “RADPIX” presentation at 2026 CEPC Workshop, F. Guilloux (here)



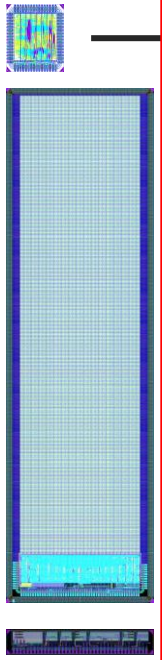
- **Q3 2026:** RadPix1 + SLDO + BIG tape out as part of DRD3 community submission
- **Q4 2026:** Anticipated wafer delivery
- **Q1-Q3 2027:** Active test campaigns
- **Q4 2027:** RadPix2 tape out (see RadPix design presentation by S. Benhammadi on Wednesday)

BIG: Bunch ID Grouping test chip, ~ 100 MHz/cm^2 for 6 e-links max.

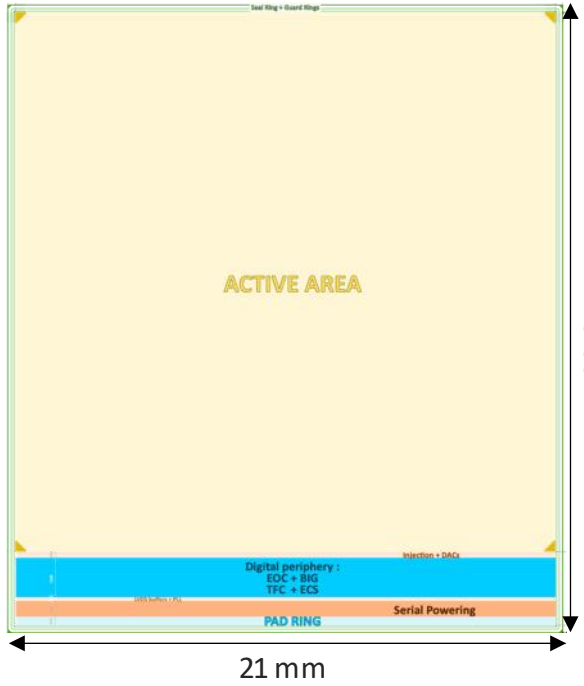
RadPix1:

- 256 x 64 pixels (¼ final sensor size)
- 4 pixel flavours
- 80 µm pixel pitch
- 99% hit efficiency within 25 ns
- 150 mW/cm^2
- I2C slow control
- Time Fast Control (TFC) @320 MHz
- 1 hit = 32 bit
- Compatibility with LHCb data out protocol @1.28 Gbs

Serial powering chip: 7 SLDO matching RadPix1 power domains



RadPix2



RadPix2:

- 256 x 256 pixels (~ 4 cm^2 active area)
  - Pixel selection
  - TFC optimisation
- PLL (from CMS HGCROC design)
- Radiation hardness → digital periphery
- ECS protocol (“slow” control)
  - Up/down links to lpGBT
  - AC coupled signals (serial powering)
  - Daisy chain up link for 5 sensors
- BIG and SLDO optimisation and integration to full-size chip

DRD3 submission and fabrication

- Engineering run with 15 wafers
- 33 complete reticles per wafer
- There are a few dicing conflicts

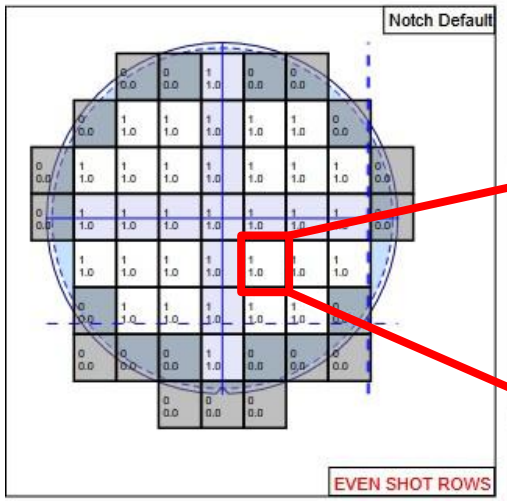
waferMap Version 2.2.3			
Product	Y1E1	Description	
Fab	9	Scanner	ASML 5500/800
Wafer Dia.	200 mm	Edge Clr.	3.0 mm
Notch	Default	WL Parallel Ref.	Default

	X	Y
Die Size with Scribe (mm)	24.168	26.62938
Shift (mm)	0.0	0.6

DPW & Shots	
Die Per Wafer	33.0
DPW on Yielding Shots	33.0
EFR Die (- corner)	3
Shots	54
Inner Shots	33
Partial Shots	0
Wafer Coverage Shots	54
Si Area Unused (mm^2)	1292.05
Si Area Unused (%)	4.11

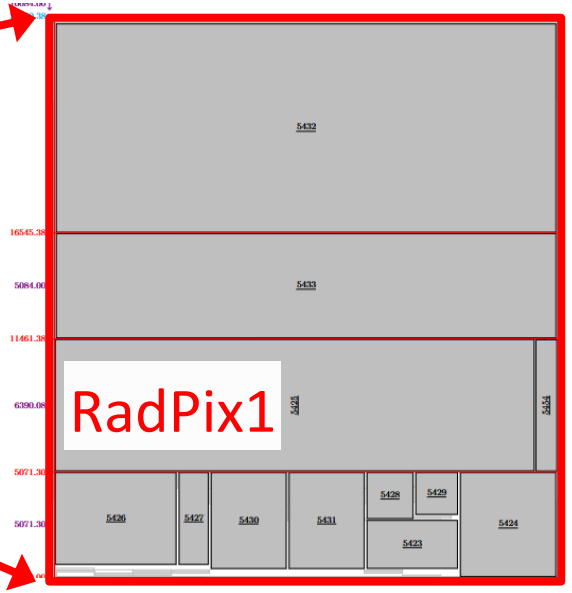
Reticle	
Die Per Reticle	1
Reticle Field Eff. (%)	77.3532
Lens Diameter (mm)	41.2300
Die Rotated	false
Forced DPR	true
Die Area (mm^2)	643.5789
Reticle Area (mm^2)	643.5789

	X	Y
Die Per Reticle	1	1
Step Size (mm)	24.168	26.62938
Step Maximum (mm)	26.0	32.0
Die Count +1: Die Size (mm)	13.0	16.0
Die Count +1: Delta (mm)	11.168	10.62938
Die Count +1: Eff. (%)	83.2168	92.9538



Dicing proposal

Wafer type	Wafer number	RadPix1 + SLDO	RadPix1	SLDO
CZ 100-1100 Ω·cm	2	0	66	66
CZ 2k Ω·cm	10 + 1 backup	20 (unthinned) 60 (100 µm) 60 (150 µm) 60 (200 µm)	10 (unthinned) 30 (100 µm) 30 (150 µm) 30 (200 µm)	10 (unthinned) 30 (100 µm) 30 (150 µm) 30 (200 µm)
Epi	2	40	20	20

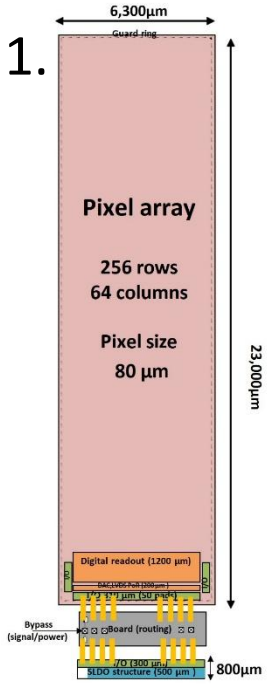


Questions (for slide preparation):
- Should add BIG to the table above?

MARS testbench

- RadPix evaluation programme will use MARS DAQ
- Currently, finishing chip carrier board design
- Carrier board has two different chip footprints:
  1. RadPix1 and SLDO as two separate chips
  2. RadPix1 and SLDO on the same silicon piece

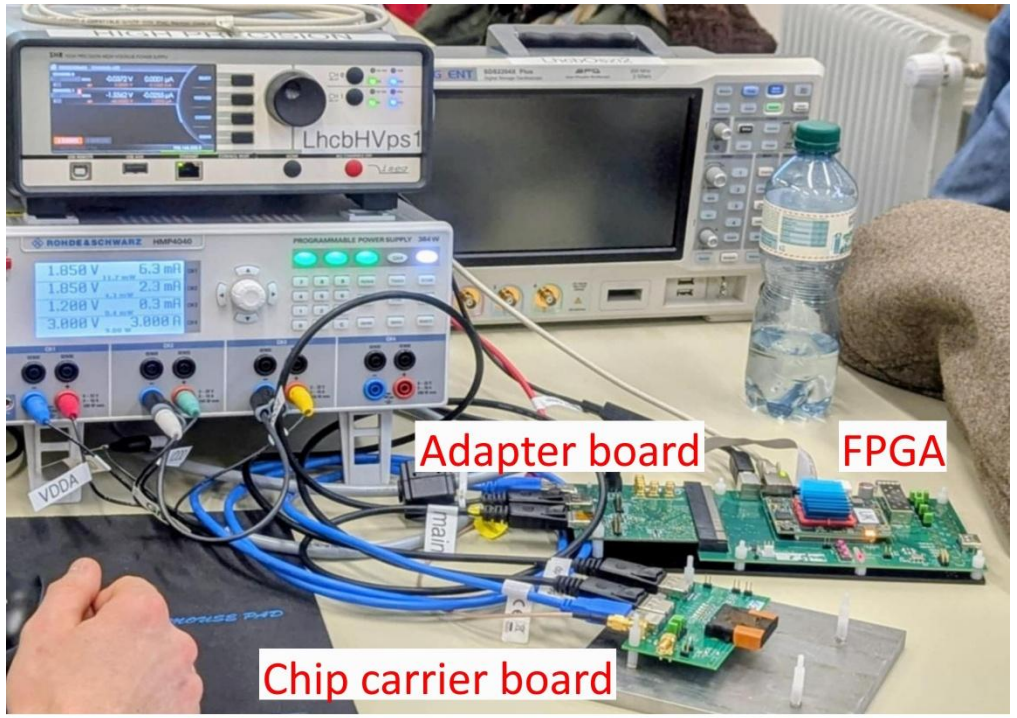
1.



2.

New drawing

Request Sam a PCB screenshot



Generic test plan in seven steps: overview

Adapted from “xxx” presentation at xxx, E. Niel ()

1 Reception and functionality

- Glueing and wire-bonding on carrier board
- DAQ debugging
- Power-up, slow and fast control, PLL, e-links
- Wafer probing

2 Lab characterisation

- I-Vs, C-Vs
- DAC, TDAC
- S-curves, noise, pixel masking
- Timing, power consumption

3 Irradiation (NIEL and TID)

- NIEL: Ljubljana or Mainz, with unirradiated samples
- TID (X-ray): CERN, Glasgow or RAL

4 Test beams (DESY)

- Hit efficiency
- In-time efficiency
- Spatial resolution
- Before and after irradiation to relevant fluence

5 Single Event Effects

- Single Event Upset
- Single Event Latch-up
- Single Event Burnout

6 System level

- SLDO serial chain
- Multi-chip system on flex
- lpGBT slice

7 Rate capability

- Injection, X-ray flux
- Efficiency vs rate

Generic test plan in seven steps: RadPix1

Adapted from “xxx” presentation at xxx, E. Niel ()

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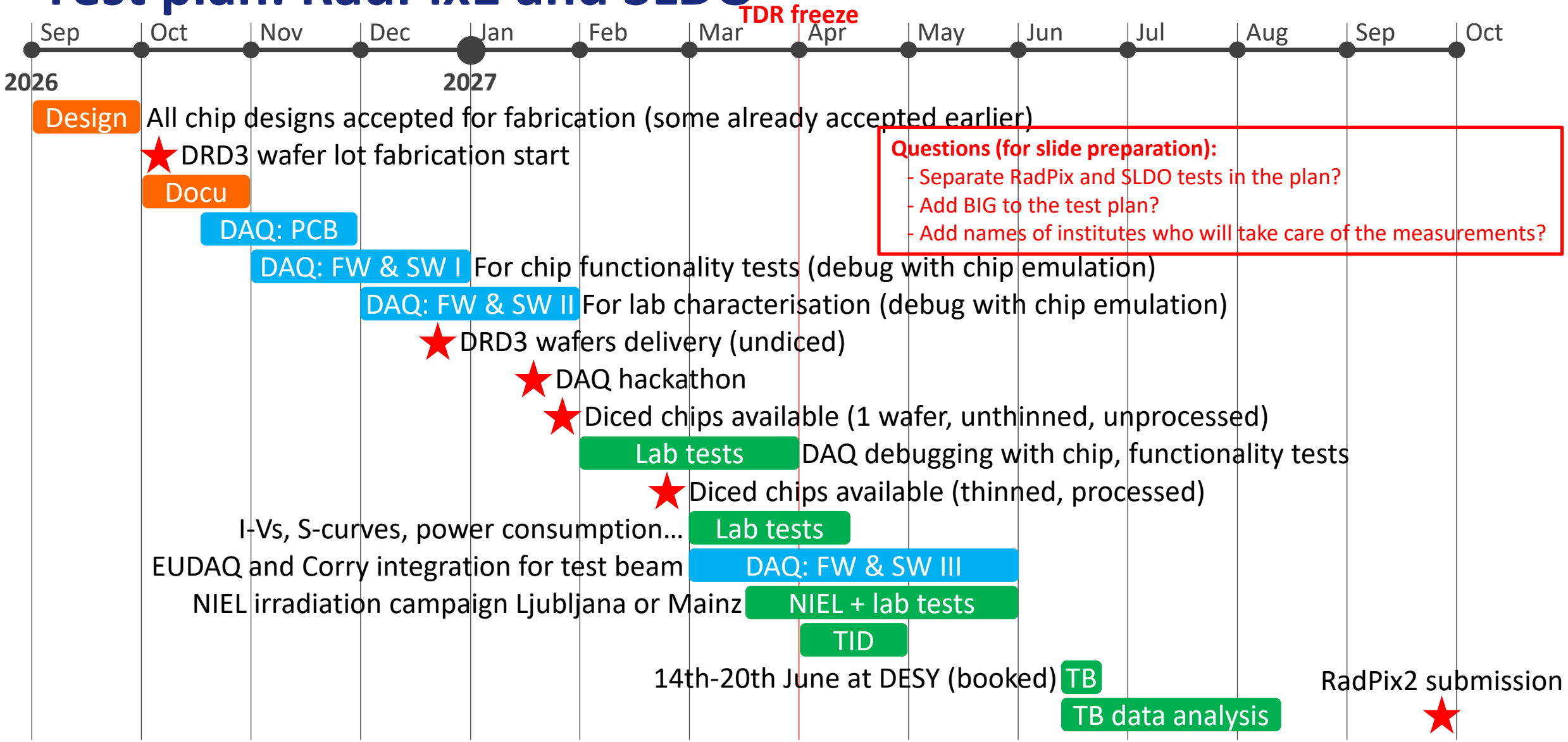
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- Multi-chip system on flex
- lpGBT slice

7 Rate capability

- Injection, X-ray flux
- Efficiency vs rate

Plan to do with RadPix1

Test plan: RadPix1 and SLDO



Backup slides