Material Budget Studies of Belle II Silicon Tracker

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Outline

- Fully implemented PXD geometry in ILC Software
- Fully implemented SVD geometry in ILC Software – in 2 options:
  - *SVD "barrel-like forward region":* new option to be optimized
  - *SVD "slanted forward region":* baseline
- Material budget studies performed
  - Geantino (Geant4 neutral particle) used & simulated material passage (in terms of radiation lenghts)

ILC Software for Belle II – Scheme
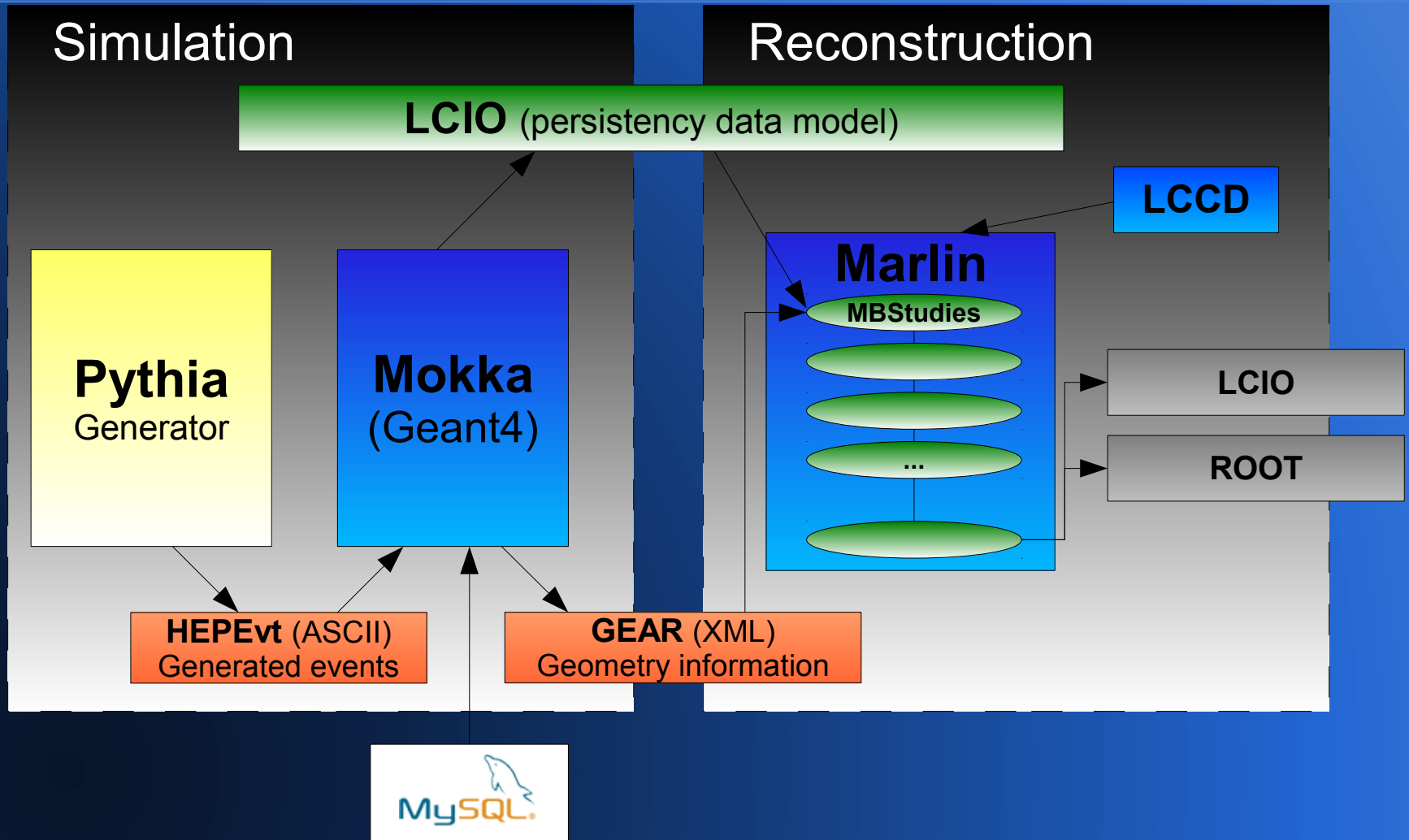
Mokka – Beam Pipe & PXD Geometry

- Mokka model: *VTXBelleII_SVDBarrel(Slant)_PXD075um1600_NB*

  - *Beam pipe:* cylindrical onion-like structure

    - inner Au layer (10 μm) + inner Be wall (0.6 mm) + cooling gap (paraffin,0.5 mm) + outer Be wall (0.35 mm)

  - *PXD:* 2 layers of Si pixel detectors – DEPFETs

    - organized in wind-mill structure

    - active part: layers $\rightarrow$ ladders $\rightarrow$ Si sensors (75 μm)

    - passive part: Si rims (450 μm) + gap inbetween sensors , i.e. passive Si (550 μm) + Si support bridge (750 μm) + copper on Si sensors (1.5 μm) + 12 switchers (350 μm) + Au bumps (0.8 μm)

    - 1st layer rotated by 180 degrees, i.e. upside-down

PXD – side view
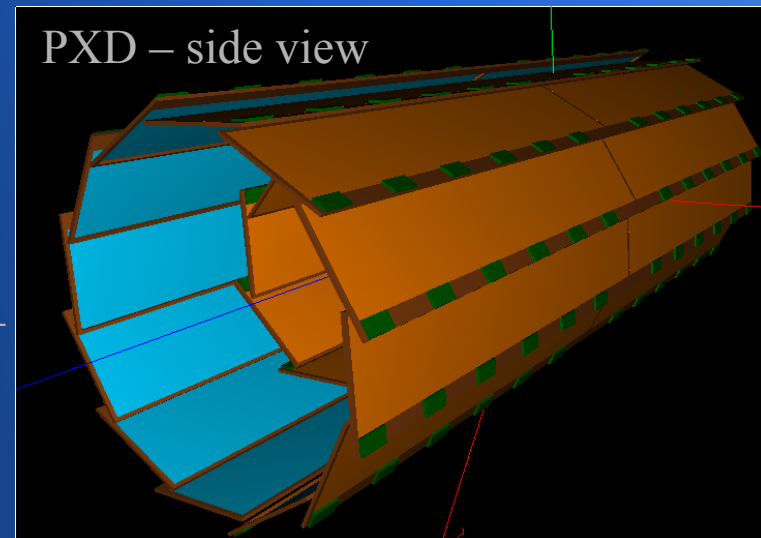
	R [mm]	*# ladders*	*support*
Pxl layer 1	14.00	8	yes
Pxl layer 2	22.00	12	yes

Mokka – SVD Barrel Geometry

- Mokka model: *VTXBelleII_SVDBarrel_PXD075um1600_NB – new option*
  - *SVD:* 4 layers of DSSDs
    - organized in wind-mill structure
    - active part: layers → ladders → Si sensors (320 μm)
    - passive part: Si rims + SCFR (sandwich of carbon fibers + rohacell) + rohacell on the top of the sensor
    - electronics: Flex circuits on the top (copper + kaptons), origami chip (nickel + golden pads, chips)
   - cooling: pipe (steel 316) + medium (CO_2)

SVD Barrel – side view

	R [mm]	# ladders	# sensors
SVD layer 1	38.00	8	2
SVD layer 2	65.00	8	3
SVD layer 3	115.00	14	5
SVD layer 4	140.00	17	6
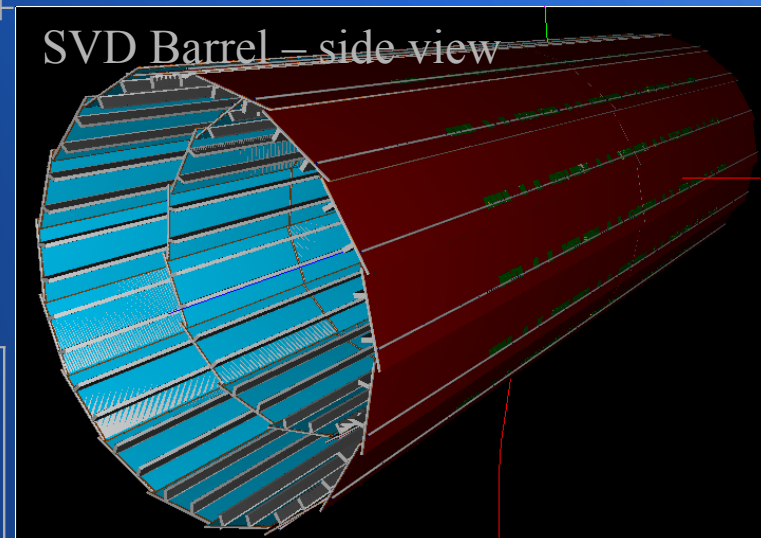
Mokka – SVD Slant Geometry

- Mokka model: *VTXBelleII_SVDSlant_PXD075um1600_NB – baseline*
  - *SVD:* 4 layers of DSSDs
    - organized in wind-mill structure
    - active part: layers → ladders → Si sensors (320 μm)
    - passive part: Si rims + SCFR (sandwich of carbon fibers + rohacell) + rohacell on the top of the sensor
    - electronics: Flex circuits on the top (copper + kaptons), origami chip (nickel + golden pads, chips)
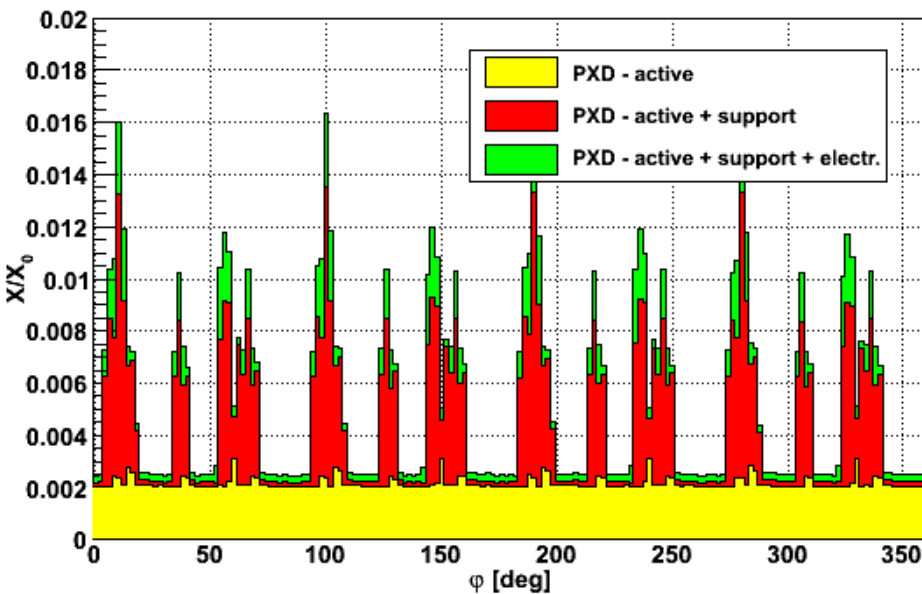   - cooling: pipe (steel 316) + medium (CO_2)

SVD Slant – side view

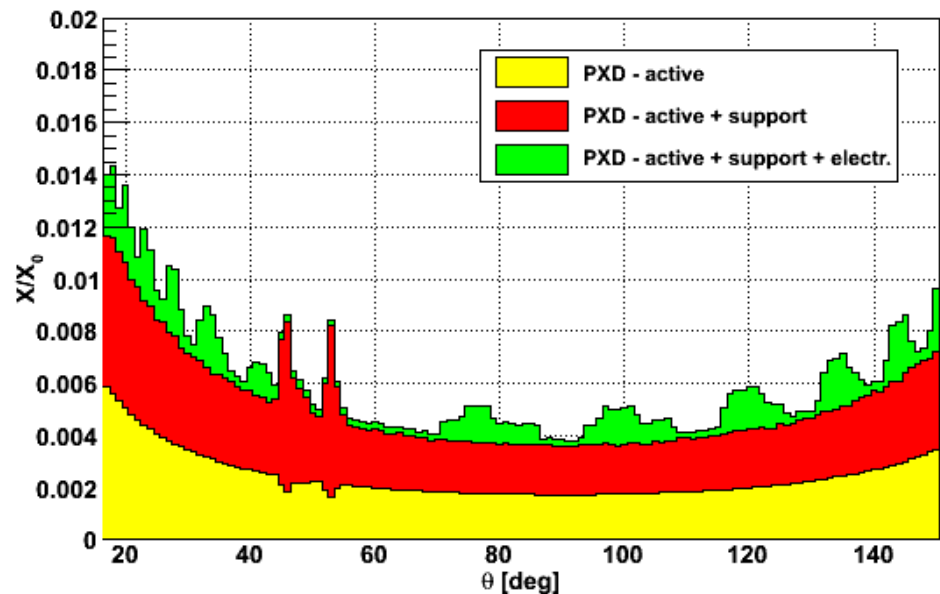|	R [mm]	# ladders	# sensors	theta [deg]
SVD layer 1	38.00	8	2	0.0
SVD layer 2	80.00	10	3	11.9
SVD layer 3	115.00	14	4	17.2
SVD layer 4	140.00	17	5	21.1
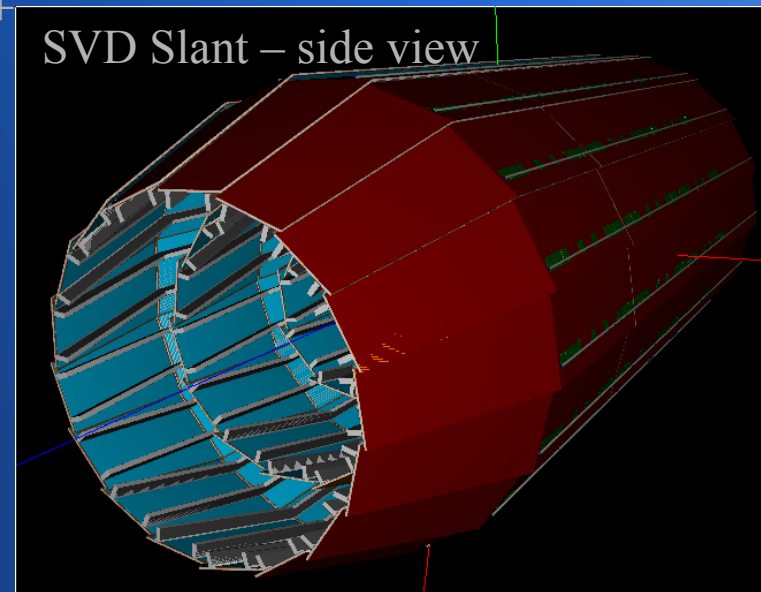
PXD - Material Budget Studies

- Material budget studies of PXD:
  - in φ angle (left) x in θ angle (right)

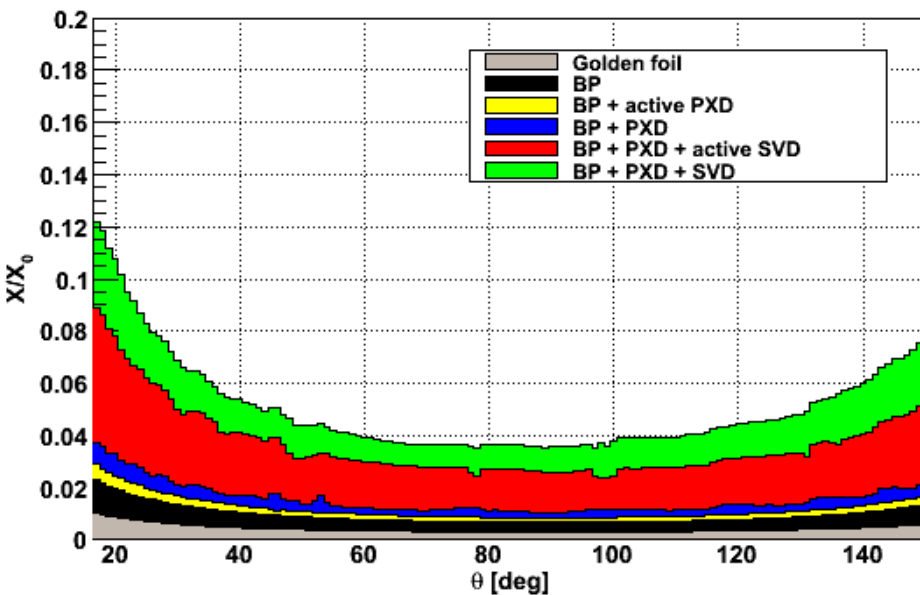Material budget studies: Belle II - SVD Barrel, PXD 75μm

- PXD - active
- PXD - active + support
- PXD - active + support + electr.

Beam pipe + PXD + SVD - MB Studies

- Material budget studies of beam pipe + PXD + SVD:
  - **Barrel-like** SVD (left) **x Slanted** SVD (right) in forward region - in θ angle