



6th Belle II PXD/SVD Workshop and

- 17th Intl. Workshop on DEPFET Detectors and Applications
- News from recent Meetings (Seeon, B2GM)
- New group in PXD project: Mainz (Prof. C. Sfienti)
- Recent developments and issues
- Next steps
- Spare / upgrade PXD
- Schedule
- Outlook





Half-yearly international Meeting on DEPFET sensors and applications (16th in the row: May 25-28)

URL: https://indico.mpp.mpg.de/conferenceOtherViews.py?confId=2809&view=standard

Main stream PXD @ Belle II but also:

sensors for high energy (mainly vertex detector for ILD), for astrophysics and photon science (KEK-PF)

Test experiment planned using 2nd grade Belle II sensors + ASICs + DHH-and PS-systems (BMBF), DAQ and mechanics by KEK

BMBF positive Addendum to DEPFET-MoU now agreed between DEPFET Coll and KEK-PF, passed legal check by MPG lawyer, ready to sign





Some topics relevant for PXD:

- New beam pipe design: bigger aperture for HER : 3.2 -> 5 mm smaller aperture for LER: 5.8 -> 5 mm consequence: strong decrease of synchrotron occupancy in PXD (HER: occ. < 0.06 %, LER much smaller) BUT: "new" background seen on the "other side" (-x) most likely backscatters (-> BEAST 2 setup)
- Background increased for TOP (after correct lepton transport through Belle with B field on): Proposal to lower Belle's B-field (from 1.5 to 1.0 T)

-> Factor 2 higher QED bg in PXD -> unacceptable

Problem can be solved in principle with rad-hard MCP-PMTs

July B2GM: Decision on AIM





C. Kiesling, 6th Belle II PXD/SVD Workshop and 17th Intl. Worshopp on DEPFET Detectors and Applications, Pisa, Oct. 1-3, 2014

July B2GM: Decision on Slow Control





- NSM2: network shared memory v2. KEK proprietary communication protocol
- @Belle II: Split NSM2/EPICS system.
- CSS as common GUI
 - Including alarm UI, data archiving.

CSS (GUI) decided for Belle II, NSM2 (Run Ctrl) and EPICS (Slow Contr.)



- Prof. Concettina Sfienti's group interested to join DEPFET-Collaboration and Belle II
- Interest in Hadron Physics (strange particles)
- HW/SW activities planned in the Slow Control sector
- 2 meetings so far (Mainz and Munich) to establish work packages
- Presentation of the group during PXD-IB tomorrow
- Application for DEPFET membership during this meeting (PXD IB session)



PXD - Components







Recent Developments (I)



- Technology development for the PXD9 metallization now finalized (early May 2014, EMCM V1-3)
- Verification: EMCM Version 4 tests (fully equipped) ongoing (see Lab Test par. session)





Recent Developments (II)



 Prototype ASICs (DHPT, DCDpl, SwitcherG) working, some known bugs -> next submission



- Detailed investigation of DCD features (fine tuning), preparations for Gated Mode Test
- DHPT Debugging ongoing (Design Review in October 27/28, see ASIC par. session)



Recent Developments (III)



 SMD mounting procedure @Valencia under development (see Module Ass. par. session):

Passive components (termination resistors, decoupling caps)

- Dispense solder paste/jetting of solder balls, pick, place and reflow at ~200 °C (done AFTER Flip chipping of ASICs)
- For EMCMs at Finetech, Berlin.

Process is being installed at IFIC/NTC Valencia

(see session on module production)



DEPFET

Recent Developments (IV): Sensors



	0	1	2	3	4	5	sum
Chip1	10	9	2	2	1	6	30
Chip2	16	7	1	0	0	6	30
Chip3	16	4	3	2	0	5	30
Chip4	11	4	5	3	1	6	30
Chip5	12	4	4	2	2	6	30
Chip6	15	4	2	2	1	6	30

0 - no severe defects
1 - single pixel
2 -single rows and columns
3 - whole modul affected?
4 - whole module killed
5 - to be clarified
(see Rainer's session)





Recent Developments (V)



- Optimization of Kapton cable ongoing (Bonn / MPI / LMU)
- Two test productions: Taiyo and Kaupke
- Some design changes proposed



D1 D0 TDI TDO D3 RST TRG -CK GCK TCK TMS D2 3x Sense **Proposed changes** impact on metal

design of sensor (done)





Final design of passive elements on the Kapton cable missing so far



FWD and BWD sides different geometry (shown here is the FWD side)

Foreseen capacitors fit into the space between Heavy Metal and CFRP cones of the



Next Steps



- Start a pilot run with PXD9 2-3 wafers + 3-4 EMCMs (final metallization + thinning)
- Submit "final" ASICs this year (back by spring 2015)
- Submit "final" Kapton design this year (back early 2015)
- Do thorough tests with final assembly (+ gated mode) (flip chip under control, SMD to be certified)
- Prepare beam test (at DESY) with 2 sensors (ladders) together with final SVD ladders for the fall of 2015
- While all this is ongoing, continue metallization of the PXD9 production (-> discussion)







Coated carbon tubes glued into SCB, painted with silver conductive film: $R \sim 2.5 \Omega$ (8 tubes in total)

Ohmic connection between FWD and BWD SCBs via air cooling tubes (Al-coated Carbon fiber)

VXD Mechanics: PXD Integration



Mounting tool for PXD connection to the beam pipe





VXD Mechanics: PXD Integration



Mounting tool for PXD connection to the beam pipe

Maybe support PXD only on a single arm (better access)

Maybe rotate mounting direction from top to 60° (better optical control) VXD assembly table + preparation of thinned dummies for thermal test @ DESY





- Plan: complete spare / upgrade by the summer of 2019 (~ 5 years from now)
- Need 2 years of production of sensors + < 2.5 years for construction, optional development of new ASICs, and commissioning
 - -> continue production of new sensors when the present production is finished
 - -> invest and manpower needed during the coming funding period, (German universities: 2015-18)
- Development of ASICs (+DAQ H/W) should wait for significant experience in beam operation (start development in 2017)





- Estimated cost: 1.7 M€ sensors (MPI will cover 1.1 M€)
 -> further funding needed
- German HEP Strategy Meeting on May 14-15 in Bad Honnef (Belle case presented by Norbert Wermes):

For ASIC development need additional 0.8 M€ (dominated by engineering power), leading to a total budget request of 1.4 M€

BMBF: look for some support within Belle II (or DEPFET Coll. ?)

 Spare proposed to Belle II EB (letter of support expected by Belle II management)

Plan "C4" (top: present baseline)



2014			2015		2016	2017		
	JFY2014 (H		FY2014 (H26)	JFY2015	(H27)	JFY2016 (H28)	JFY2017 (H29)	
	1 2	3 4 5 6 7	8 9 10 11 12 1 2	3 4 5 6 7 8 9 10	0 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	
Original Schedule								
SuperKEKB/Belle II (overall)		Construction	Startup with high Phase 1 power No QCS condition No Sole ing	s noid	Phase 2 w/ QCS w/ Solenoid w/o VXD	Summer Phase 3 Shutdown Physics Run	Shutdown to add TOP (7 months assumed here)	
Main Ring		Construction					(add RF stations)	
IR		Construction	IR for p	hase 1 * QCS ins	tall IR for phase	2		
Belle II		Construction	Beast p	hase 1 * Belle II rol	l in (no VXD) Beast phase	2 VXD install Partial TOP	add TOP Full Belle I	
Damping Ring		Construction		DR				
(MR high power startup)			RF conditioning					
(Dhase 1 to Dhase 2)			Magnet power on	ID discountly	Beam Te	st @ DFSY		
(Phase I to Phase 2)				R disassembly				
				QCS install				
				QCS fi	eld mensurement			
			operation but	dget	IR assembly	IDDelle (
		•	cut in JFY20	14				
Plan C4					Phase	e 1 (option)		
SuperKEKB/Belle II (overall)		Construction		Startup with high power condition ing	hase 1 o QCS o Solenoid	•	Phase 2 w/ QCS Summer Phase 3 w/ Solenoid Shutdown Physics Run w/ o VXD	
Main Ring		Construction					w/ Full TOP	
IR		Construction		IR	for phase 1	* QCS install	IR for phase 2	
Belle II		Construction		Beast phase 1		* Belle II (no yxp. Full TC	TOP Beast phase 2 VXD install Full Belle II	
Damping Ring		Construction			DR			
(MR high power startup)				RF conditioning				
				Magnet power on				
(Phase 1 to Phase 2)						R disassembly		
Plan C4						QCS install QCS field measurem	Physics Run with full TOP starts in 2017 autumn.	
							Belle II roll in only once.	
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					VXD and Plan C4			

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- Critical milestones for DEPFET matrix production achieved
- R&D program ongoing or partly completed, enter now the phase of constructing the PXD (Sensors, ASICs, Kapton)
- PXD mechanics under control, assembly scheme started, first ideas on integration with beampipe (and SVD)
- Construction of CO2 Cooling started (ordering of parts)
- "DESY" Beam test with final sensors in fall of 2015
- Slow Control scheme (CSS & EPICS) for VXD (Belle II) emerging, strong impact by new Mainz group expected
- Plans become more concrete for "backup" PXD





Backup





	Class 0/1	Class 2-5	Sum	PXD	
inner	36	20	56	16	
outer	70	43	113	24	
Sum	106	63	169	40	