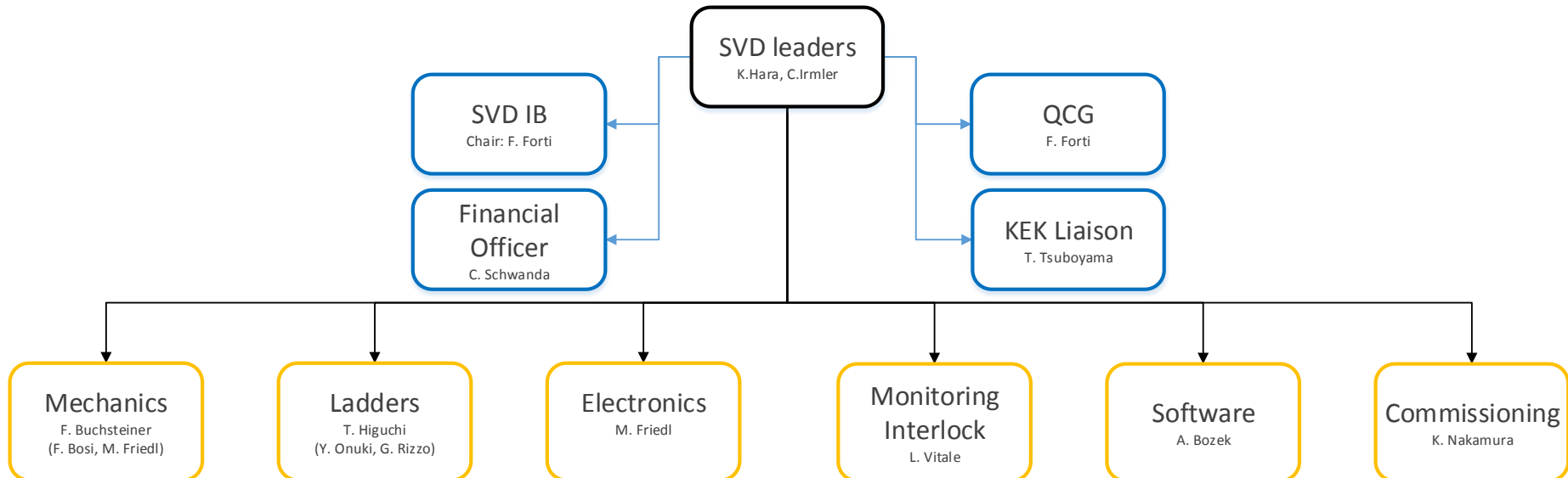# SVD session summary

Koji Hara (KEK)
Jan. 23, 2015

7th Belle II VXD Workshop and 18th International
Workshop on DEPFET Detectors and Applications

SVD Group Organization

SVD Group Organization

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                          ┌─────────────────┐
                          │  SVD leaders    │
                          │  K.Hara, C.Irmler│
                          └─────────────────┘
     ┌──────────────┐                              ┌──────────────┐
     │   SVD IB     │←──                         ──→│    QCG       │
     │ Chair: F. Forti│                             │  F. Forti    │
     └──────────────┘                              └──────────────┘
     ┌──────────────┐                              ┌──────────────┐
     │  Financial   │←──                         ──→│ KEK Liaison  │
     │  Officer     │                              │ T. Tsuboyama │
     │ C. Schwanda  │                              └──────────────┘
     └──────────────┘
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Mechanics	Ladders	Electronics	Monitoring Interlock	Software	Commissioning
F. Buchsteiner (F. Bosi, M. Friedl)	T. Higuchi (Y. Onuki, G. Rizzo)	M. Friedl	L. Vitale	A. Bozek	K. Nakamura

Remarks:
Names of deputies and advisors are written in brackets below the name of the sub-group coordinator.
Deputies and advisors of remaining sub-groups to be completed.

Version: 3.0   2014/12/08

SVD Parallel Session II: Mechanics

Florian Buchsteiner
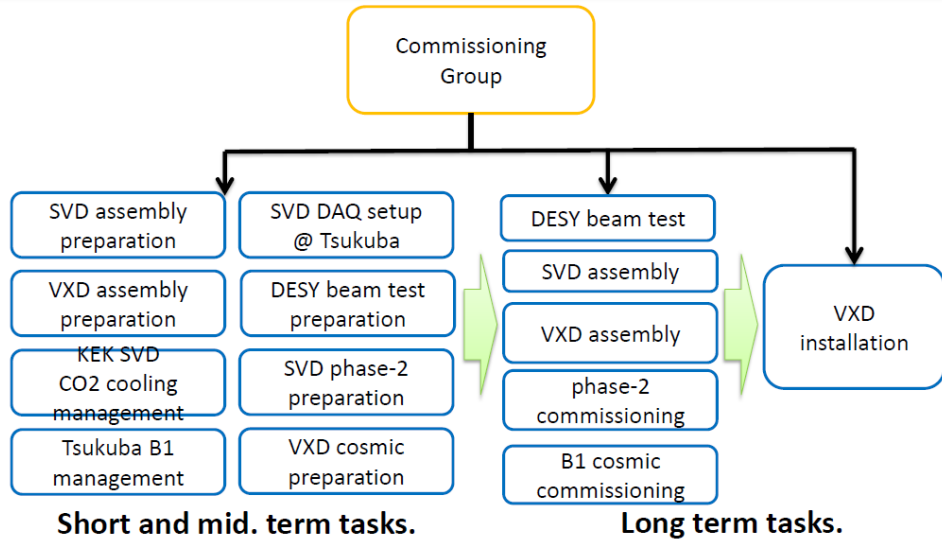
Seminar room T9, Faculty of Mathematics and Physics, Charles University in Prague (Prague, Czech Republic)

SVD Parallel Session III: Ladders 1

Takeo Higuchi
T9, Charles U. Prague   *12:30 - 13:00*

Charles University in Prague, Prague, Czech Republic

SVD Parallel Session III: Ladders 2

Takeo Higuchi

Seminar room T9, Building T, Prague, Czech Republic

Coffee Break

SVD Parallel Session IV: Electronics

Dr. Markus Friedl

Seminar room T9, Prague   *16:00 - 17:00*

SVD Parallel Session V: Software

Andrzej Bozek

SVD Parallel Session VI: PA task force discussion

Giuliana Rizzo

Seminar room T9, Building T, Faculty of Mathematics and Physics, Charles University in Prague, Prague, Czech Republic

SVD Parallel Session VI: Commissioning

Mr. Katsuro Nakamura
Seminar room T9, Prague   *10:00 - 10:30*

SVD Parallel Session VI: Monitoring and Interlocks

Lorenzo Vitale
Seminar room T9, Building T, Faculty of Mathematics and Physics, Charles University in Prague, Prague, Czech Republic

PXD Parallel Sessio
Background Simula

Christian Kiesling
Lecture hall T1, Buil
Mathematics and Ph
University in Prague,
Republic

- Parallel sessions organized by subgroup leaders
  + PA task force discussion

Work Package

Commissioning Group

SVD assembly preparation

VXD assembly preparation

KEK SVD CO2 cooling management

Tsukuba B1 management

SVD DAQ setup @ Tsukuba

DESY beam test preparation

SVD phase-2 preparation

VXD cosmic preparation

DESY beam test

SVD assembly

VXD assembly

phase-2 commissioning

B1 cosmic commissioning

VXD installation

Short and mid. term tasks.   **Long term tasks.**

2

How to Proceed

1. Let's define the Milestones for each sub-group
2. Extract global major milestones
3. Define dates for them

- Who?
  - SVD leaders together with sub-group coordinators.
  - Need input from sub-groups.

Work packages and people involved

- VXD radiation monitoring and Beam Abort (L.Vitale)
  - Sensors (LV, LB, LL)
  - RO Electronics (Elettra + LL LV)
  - Simulations (Gianluca Inguglia?)
  - Software EPICS (Simon Bacher?)
- SVD Temperature with NTC (L.Lanceri?)
  - Hardware and lab software (PC, LL)
  - Software EPICS (Simon Bacher?)
- SVD Temperature with FOS (L.Vitale)
  - Hardware, lab software + calibration (LV, LL, TS techn, + help from PXD)
  - Software EPICS (Simon Bacher?)
- VXD Humidity (L.Lanceri?)
  - Hardware and lab software (LL, LV)
  - Pipes (MPI, DESY, KEK)
  - Software EPICS (Simon Bacher?)
- Interlock with PLC (L.Lanceri?)
- BEAST2 (L.Vitale)

- Work package and people clarified
- Open issues
- Milestones
- Plan
- Discussion continue to B2GM

Keratherm

Y. Onuki

- How to attach Keratherm is one of the most serious missing pieces to be solved asap.
  - Higher priority than the how to attach CO2 cooling pipe.
  - We'll start ladder production. Where it should be in procedure and what implementation method.
  - Closest distance between bonding pad is 0.548mm.
  - Cut precision is unknown since very soft and sticky.
- So far, it is believed there are 2 timings to attach Keratherm.
  - During ladder assembly as same as attaching CO2 clips.
  - After ladder mount.

Keratherm on APV on APV
How to put them: open issue
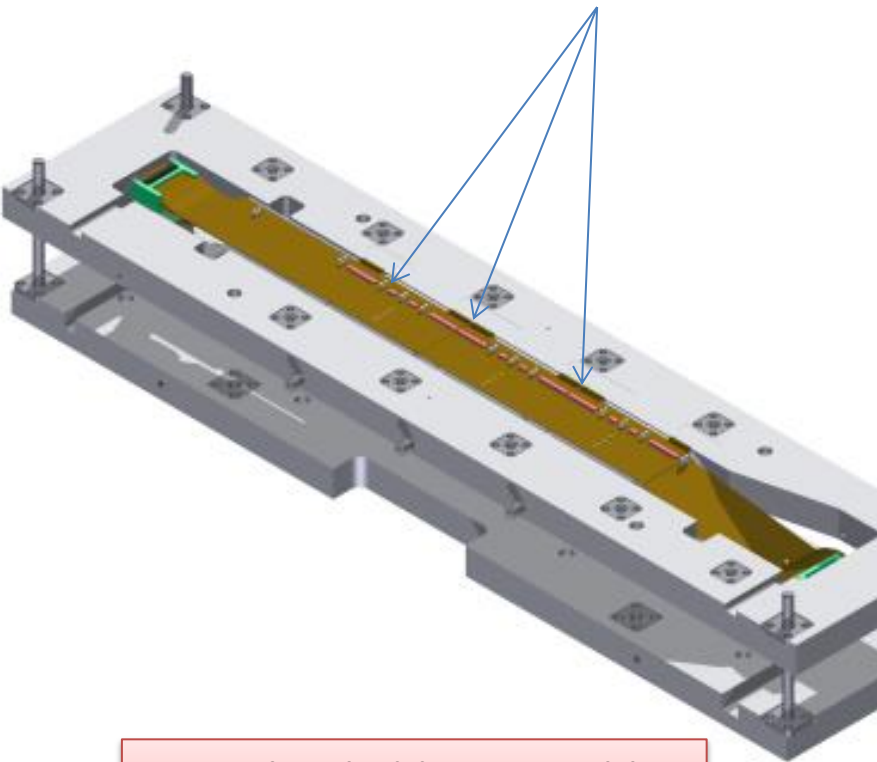
Any other ladder assembly processes not determined?

𝓑 Belle II ≡ SVD

Concerns (1) - Delay

2.5 Concerns and Recommendations

The committee appreciates the dedication of the SVD group to building and commissioning a state-of-the-art silicon tracker. The reviewers, however, unanimously found the status of the project presented during this review disquieting. The project has incurred a delay of approximately 16 months over the last 8 months. The causes for this delay have been identified and are being addressed. There is a remaining concern, however, that there may be still hidden issues. At this moment, no fully functional ladders that have undergone thorough testing are available, though ladder production is imminent.

- 6 months to get new FlexPA design
- Still not in production!
- Origami PA0 problem
- What else have we overseen?
- Fully functional ladder: **Need to build it as soon we have new working and tested Origami hybrids!**

PA0 and Origami

- **PA0 problems**
  - Cracks
  - Shorts between pads
  - Design to keep
    - bonding pad length
    - Available size of the bias hole
  - Shrinkage (likely by heat)
    - 0.1-0.2%
    - Not uniform??

- **Origami status**
  - Produced at Taiyo
  - Preserved as sheets before cutting and electrical test
  - Need to confirm Origami+z prebending method (performed by SVD group)
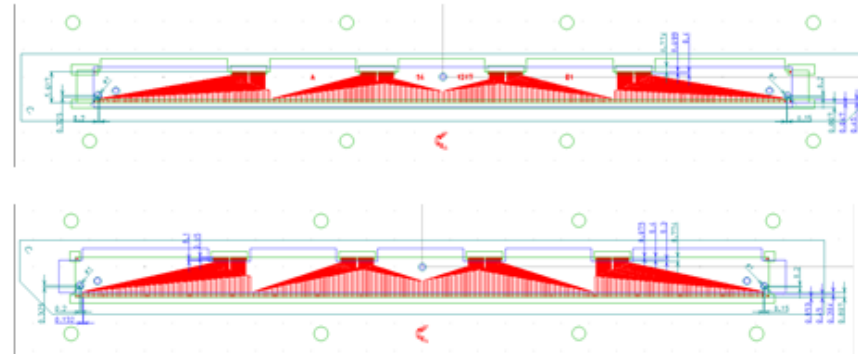   - Any modification necessary from the previous method?

- **Electrical test of PA0**
  - 4 probe measurement possible for PA0 alone and PA0 glued on Origami
  - Test condition to suppress probe traces

- **Practice whole procedure**

PA0 from Taiyo → Electrical test @ Daiei → PA0 + Origami gluing @ Taiyo → Electrical test @ Daiei → assembly@REPIC → test by APVDAQ@KEK

Understood, considered in design

Mainly by heating of reflow soldering → Discussion continues

Test production and evaluation in Feb. Discussing mass reproduction plan

PA0 latest Design by Taiyo

- Released for review by SVD group on Jan. 19
  - Followed our request on the pad lengths and bias hole positions
- dxf files on PATaskForce twiki page

6

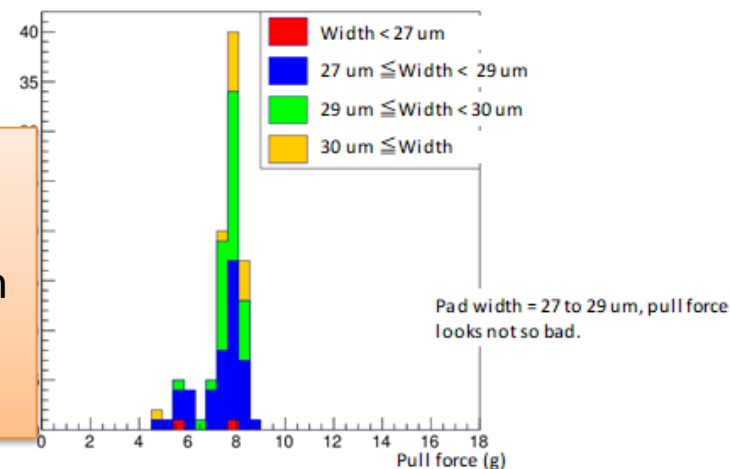# PA-Flex bonding test results in Pisa

- 4 PF/PB from 2nd preproduction, with regions with small pads, bonded to CMS half moon
- Bonding efficiency 100% but in regions with pads < 30 um some bonds had to be redone a 2nd time
- Poor alignment can make bonding very difficult also with pad = 30 um!
- See full set of pictures in
  - https://drive.google.com/folderview?id=0BzYaX1UJ403HZWhNQTAwTUduVXc&usp=drive_web
- NO pull force done (done in other sites with good results)
- Previous bonding experience on PA from 1st preproduction confirmed from this tests.
- Our conclusion: bonding on pads >= 30 um, can be painful but ok.

G. Rizzo   VXD Workshop –Jan. 23 2015

Wrapping condition
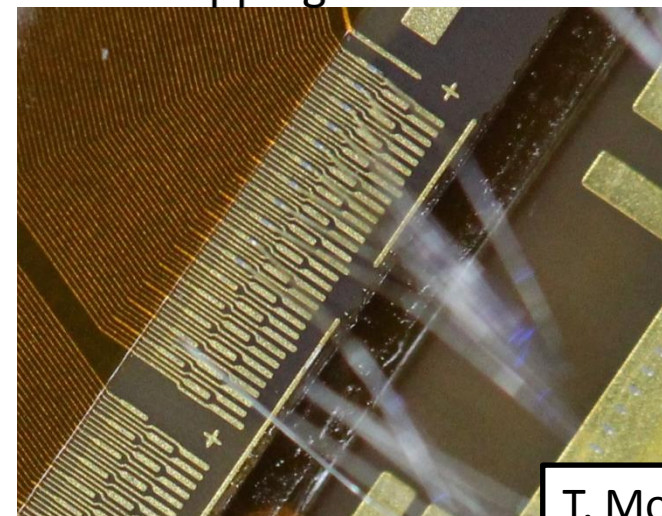
T. Morii

Pad width V.S. pull force of PA2

	Width < 27 um
	27 um ≦ Width < 29 um
	29 um ≦ Width < 30 um
	30 um ≦ Width

Pad width = 27 to 29 um, pull force looks not so bad.

PA-Flex bonding pad minimum width settled to be 30μm
Sign-off the full specification to start production soon in Jan.
Delivery in Mar-May
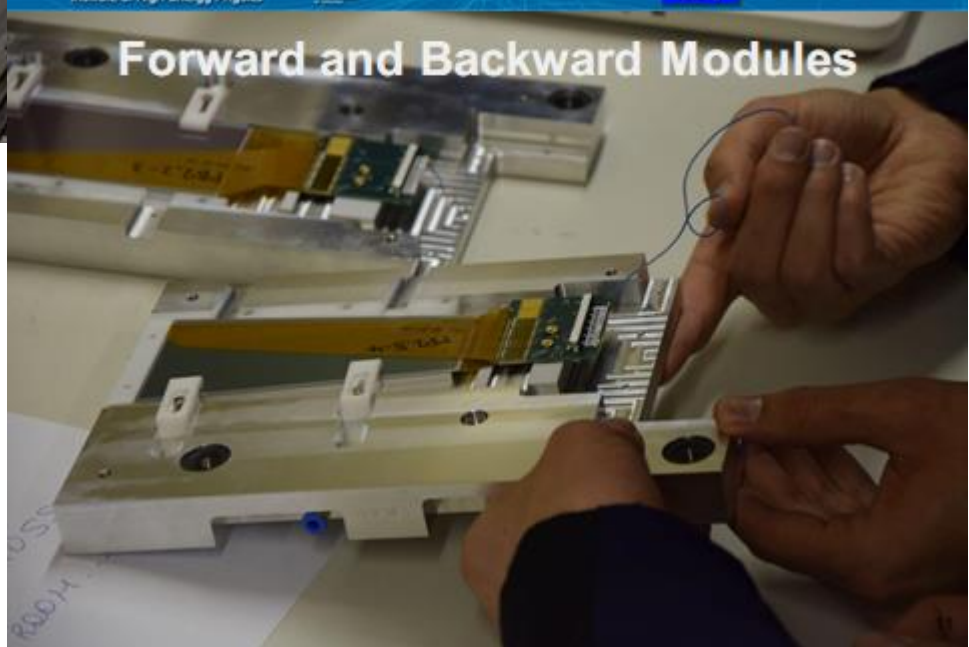
FW Module results

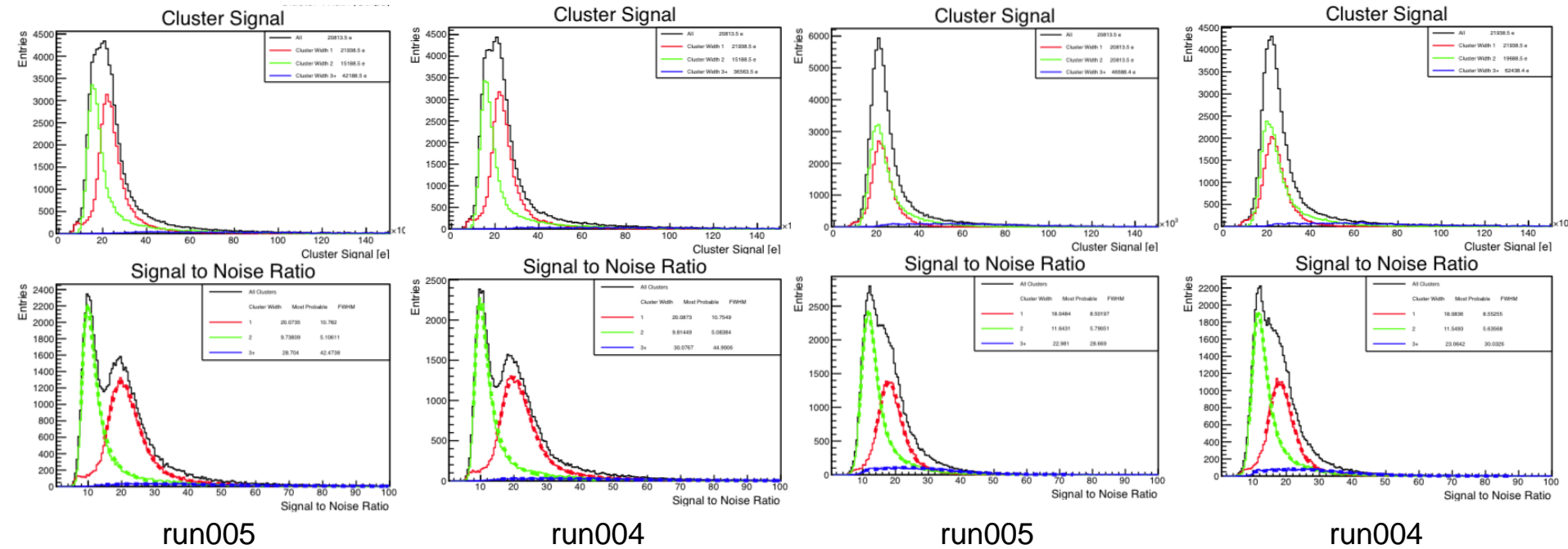## n-side   p-side

run005   run004   run005   run004
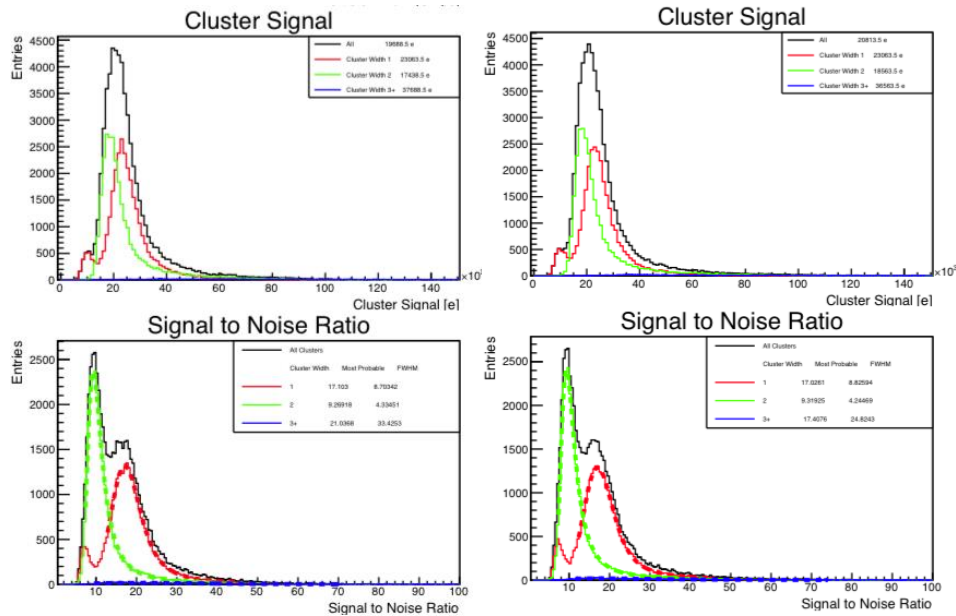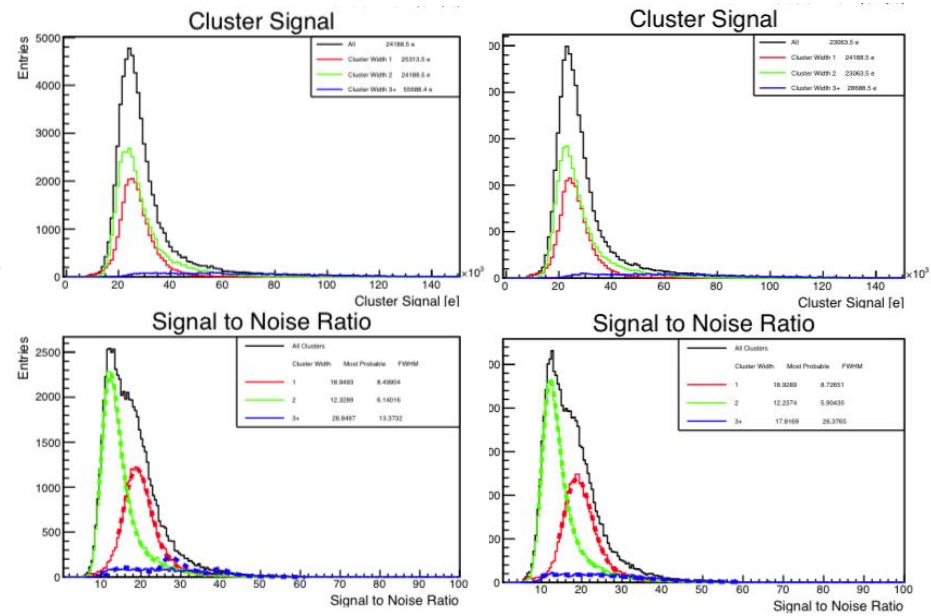
No significant differences between runs in spite of shifting the beam spot

9

Old Wedge results

n-side   p-side
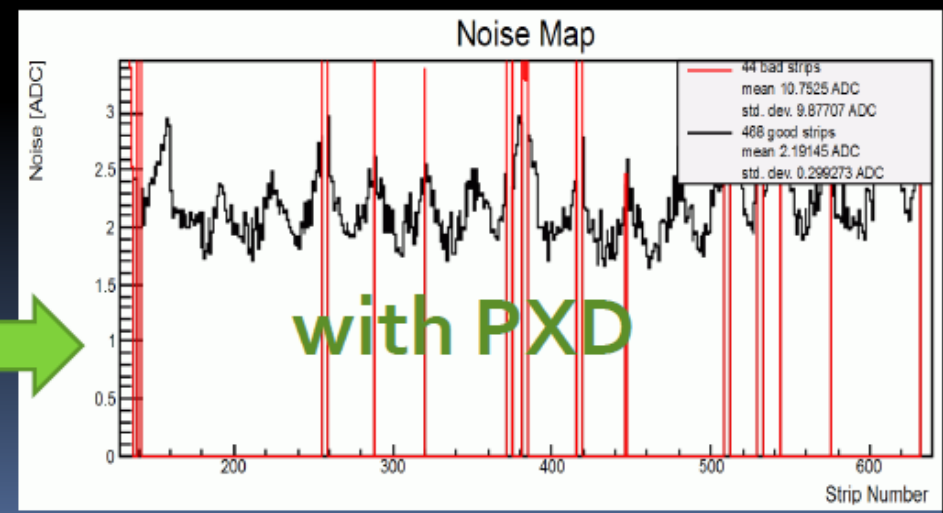

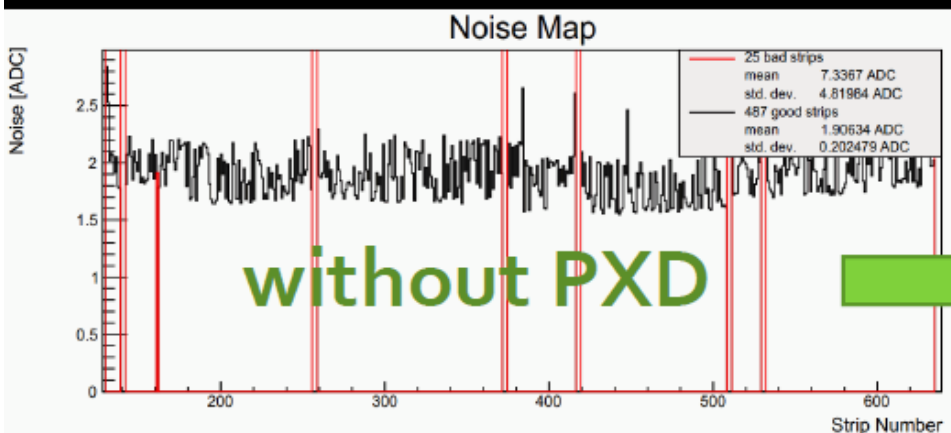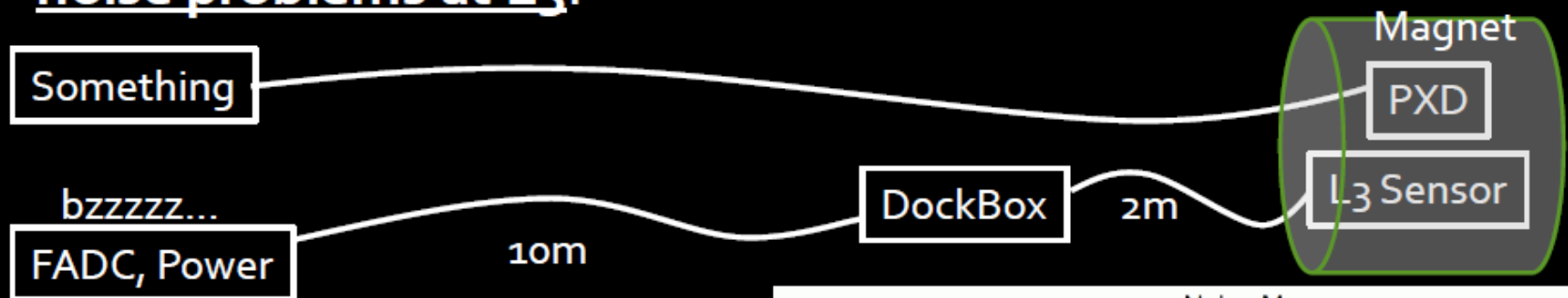run005   run004   run005   run004

No significant differences between runs in spite of shifting the beam spot
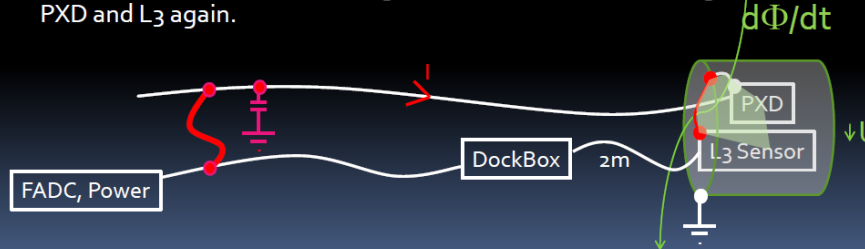
DESY Noise Problems – Symptoms

- The PXD was installed then and connected to its power supplies etc => since then the SVD software showed **severe noise problems at L3**.

DESY Noise Problems – Educated Guess

- So... if we would have grounded the L3 directly inside the magnet housing without including the 2m wires outside the magnet housing to the Dock box into our current loop, the problem **should have virtually disappeared**.

  Groundings or connections on any other **additional point**(s) now are **bad** because then we have a low impedance voltage divider of the voltage generated in the big loop between the impedance of the grounding lines and those of the external cabling. This causes to rise the voltage between PXD and L3 again.

FADC, Power   DockBox   2m   PXD   L3 Sensor   dΦ/dt
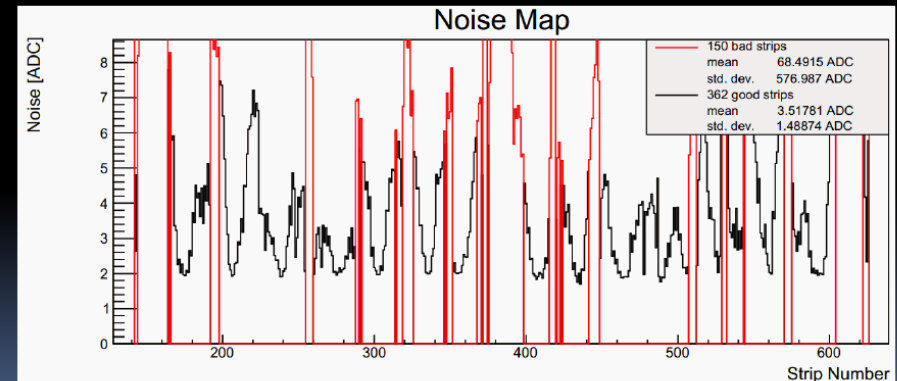
DESY Noise Problems – Investigation

- Based on these educated guess, so if such a **loop really was the cause of the noise**, it should be possible to **reproduce** the DESY-noise by applying some material close to the L3-sensor which has alternating voltage respect to the sensor.

- If such a loop with a voltage between the PXD and SVD was **not the cause**, it should be **unlikely** that such an **investigation brings comparable results**.

  So Hao and myself built and examined some **electrical mockup** last week.

  We intended to build a setup which causes SVD **noise behavior as close as possible** to those at the DESY beam test.

  The plan was to **inject some noise** (different shapes, amplitudes, …) in different ways (capacitive, inductive, combinations of them) with different injectors into the L3, until the software shows similar noise behavior as at the DESY beam test, to conclude what can have caused the problems.

DESY Noise Problems – Investigation

- The very first attempt was: A simple **metal sheet**, insulated by a sheet of paper, connected to a **frequency generator**, and placed near the L3. Frequency: 1.5 MHz, amplitude 20 Volts.

- Result: Noise behavior similar to DESY, but much worse.
- So we just lowered the amplitude to 5 volts – and we had **very similar noise** compared to the DESY beam test situation!

Noise Map

150 bad strips	
mean	68.4915 ADC
std. dev.	576.987 ADC
362 good strips	
mean	3.51781 ADC
std. dev.	1.48874 ADC

Noise [ADC]   Strip Number

Noise and grounding investigated
→ reproduced and succeeded to suppress in lab → test with real PXD

Thank you organizers for the great workshop

Let's continue discussion in B2GM…