Plan for DESY VXD Integration Test

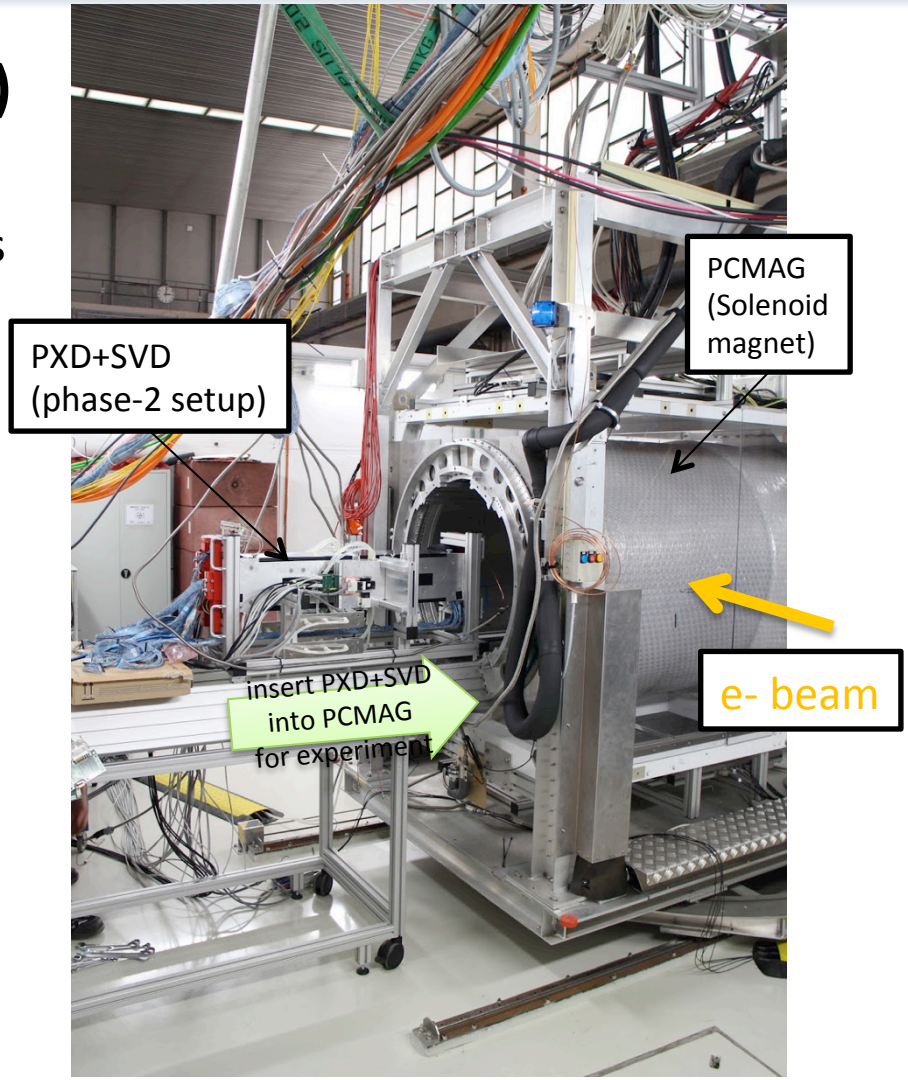
Katsuro Nakamura

Sep. 6, 2016

TRG/DAQ Workshop

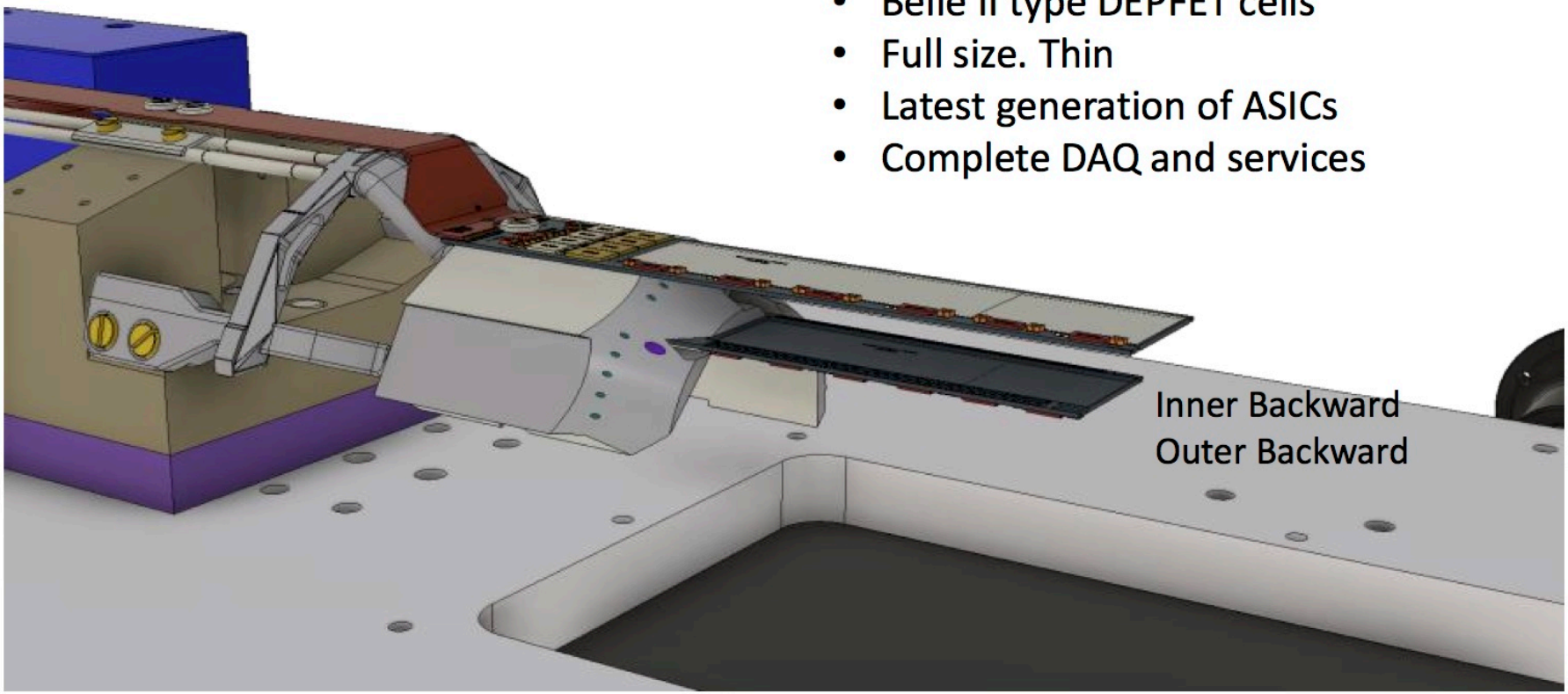
VXD Beam Test Campaign

- **Combined beam test (= BT) of VXD = PXD + SVD**
  - Geometrical setup is same as phase-2
- **e- beam with momentum of 2-5 GeV/c**
- **Full readout DAQ chain**
- **1T B-field in PCMAG**
- **Nominal trigger rate: ~500Hz**



PXD Test Beam Set Up

- Belle II type DEPFET cells
- Full size. Thin
- Latest generation of ASICs
- Complete DAQ and services



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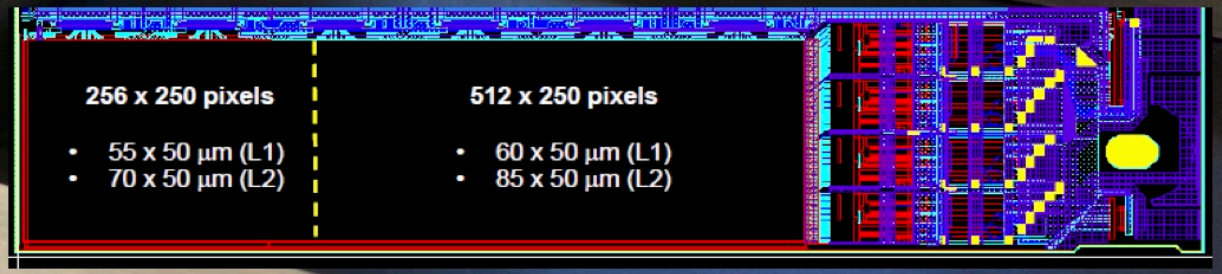
PXD on the SCB



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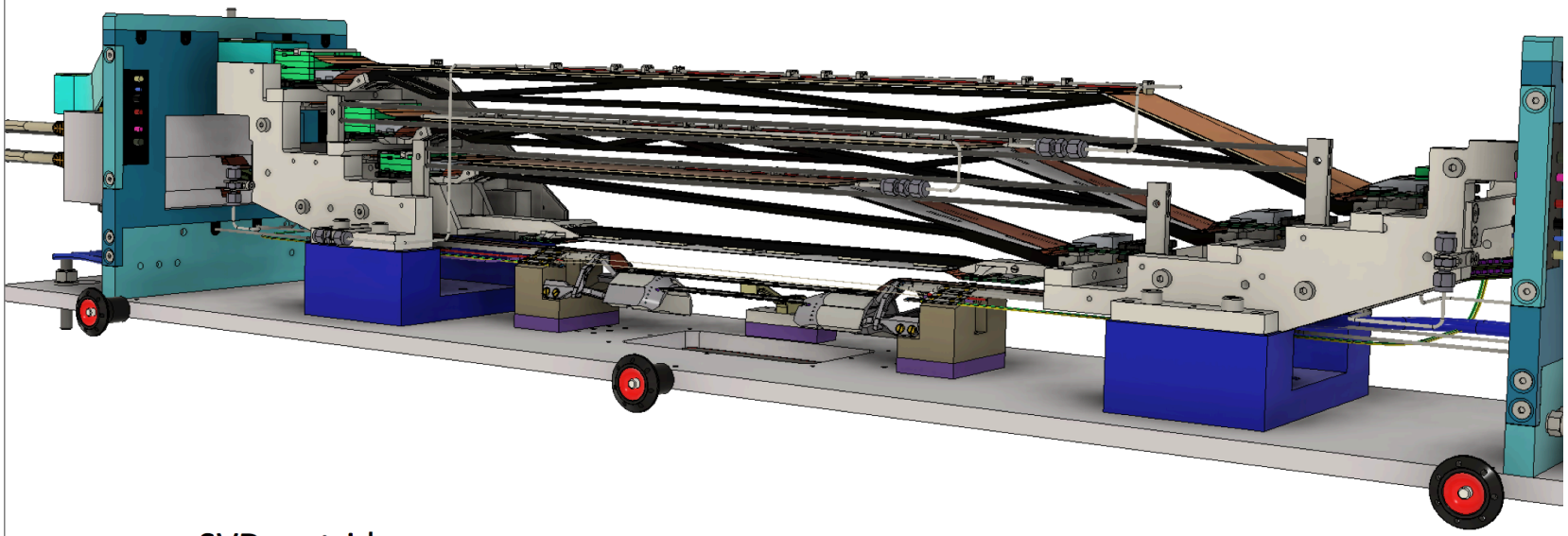
SVD setup in DESY BT campaign (1)

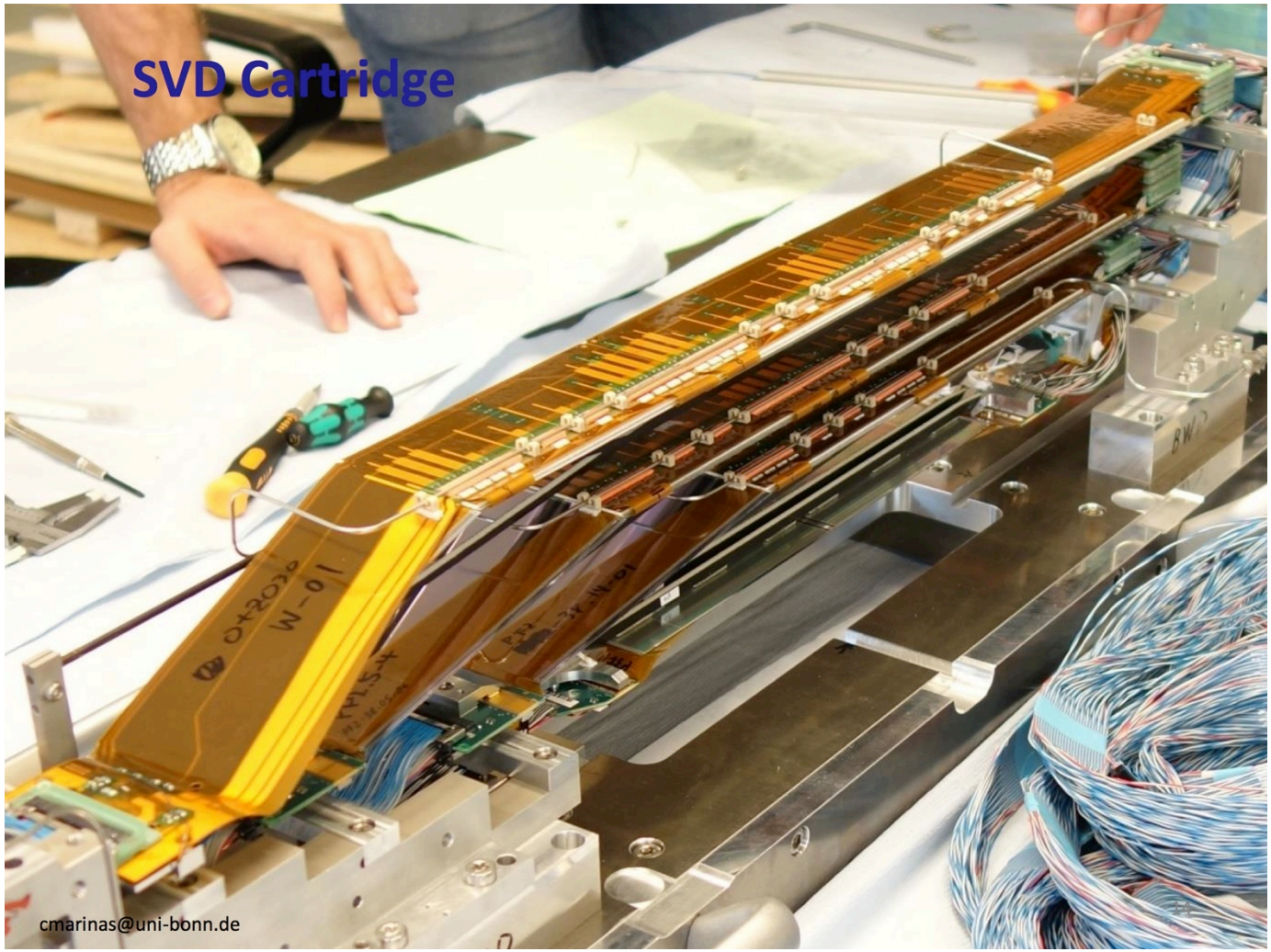
Same setup as phase-2

- One SVD ladder in each layer
- Total 4 SVD ladders



SVD cartridge

SVD setup in DESY BT campaign (2)



VXD Assembly

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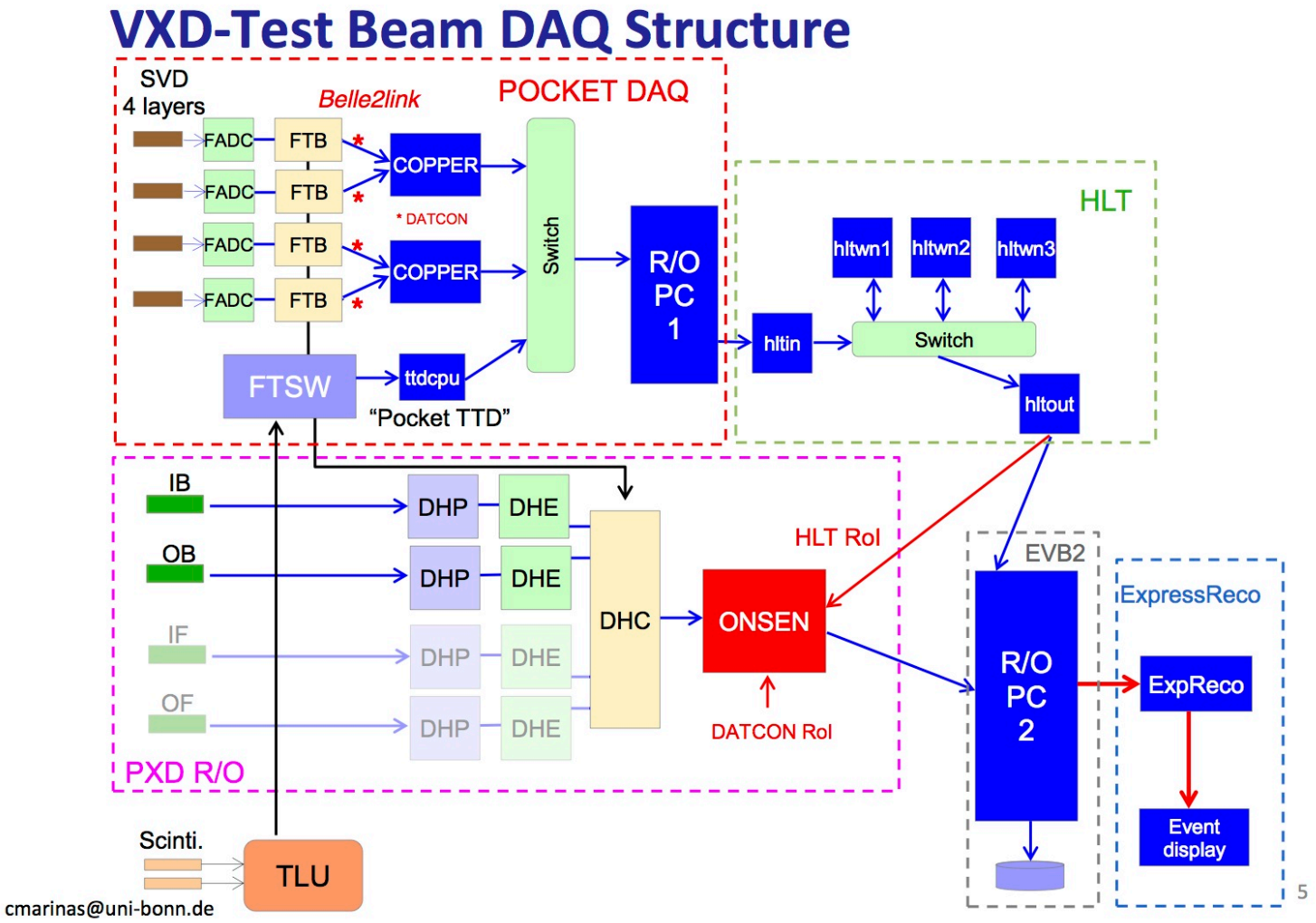
DAQ setup in DESY BT campaign



History of DESY VXD BT campaign

- **Jan. 2014: 1st DESY BT campaign**
  - PXD: sensor in pilot production
  - SVD: prototype DSSD module
  - Conceptual confirmation of VXD-DAQ was achieved.
- **Apr. 2016: 2nd DESY BT campaign**
  - PXD: Final DEPFET sensors with prototype ASICs. Only BWD sensors were installed.
  - SVD: Final ladders (but class-B = lower grade)
  - We encountered several issues on VXD-DAQ. We decided to have another campaign to tackle them.
- **Dec. 2016 (+ Jan. 2017?): 3rd DESY BT campaign**
  - PXD: Final sensors with final ASICs
  - SVD: Final ladders (but class-B)
  - + BEAST sensors
  - compatible setup as phase-2 VXD

We deeply appreciate large contributions of DAQ group for great successes in the previous BT campaigns!

Hit maps for selected events

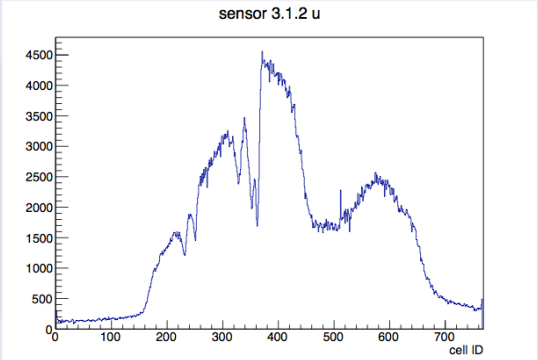
SVD hit maps (ϕ-direction = p-side)

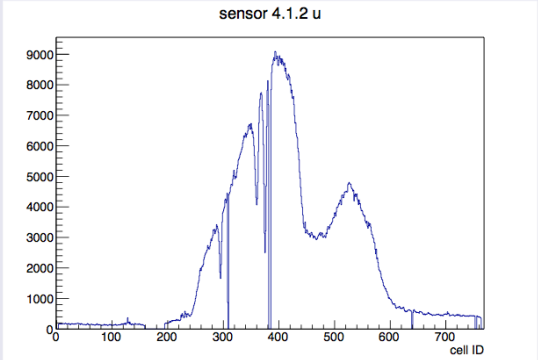
from T. Luck slides, Jun 21 B2GM

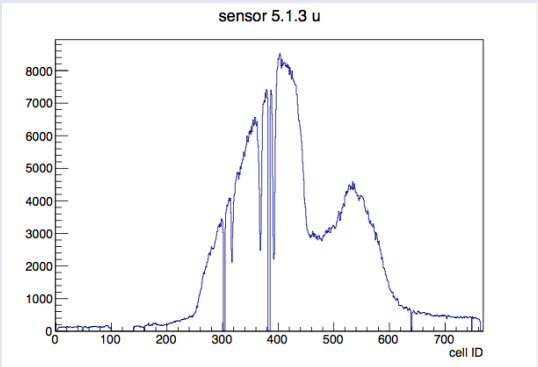
selected hits u-direction

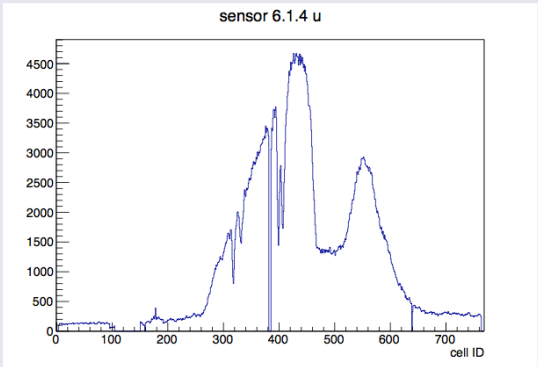
Note:

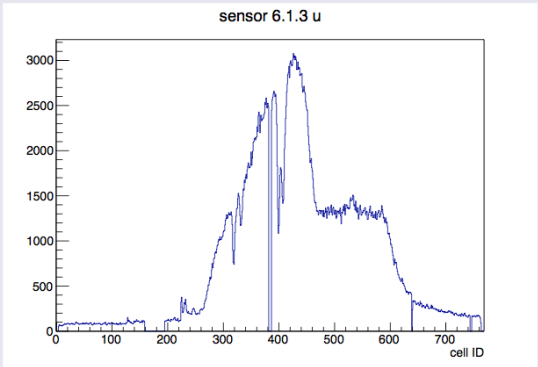
- some features are induced by selection











Hit maps for selected events

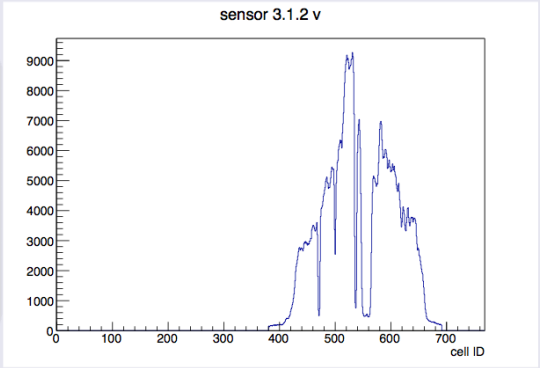
SVD hit maps (z-direction = n-side)

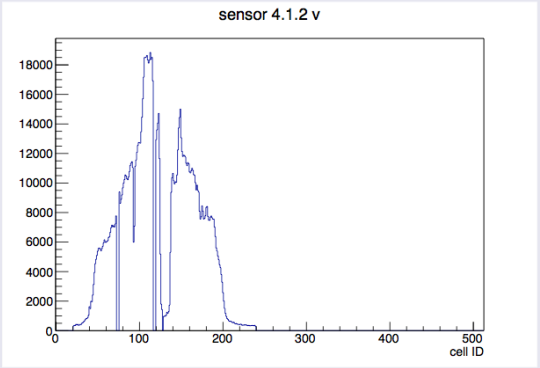
from T. Luck slides, Jun 21 B2GM

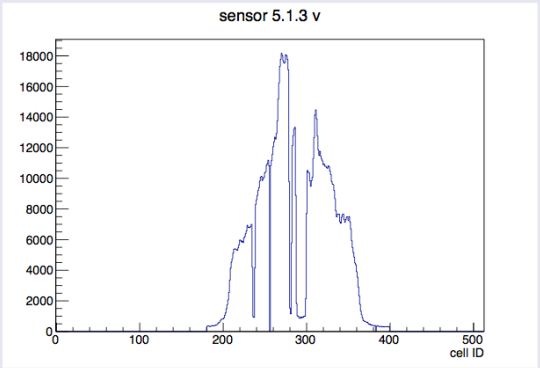
selected hits v-direction

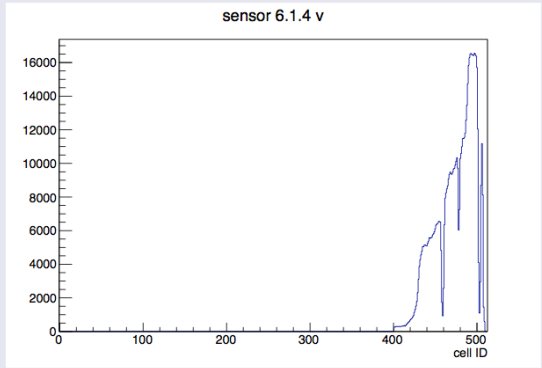
Note:

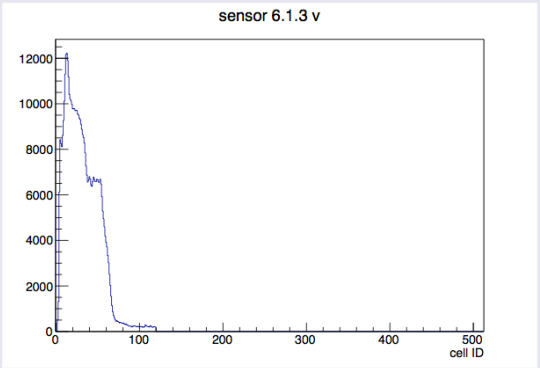
- some features are induced by selection





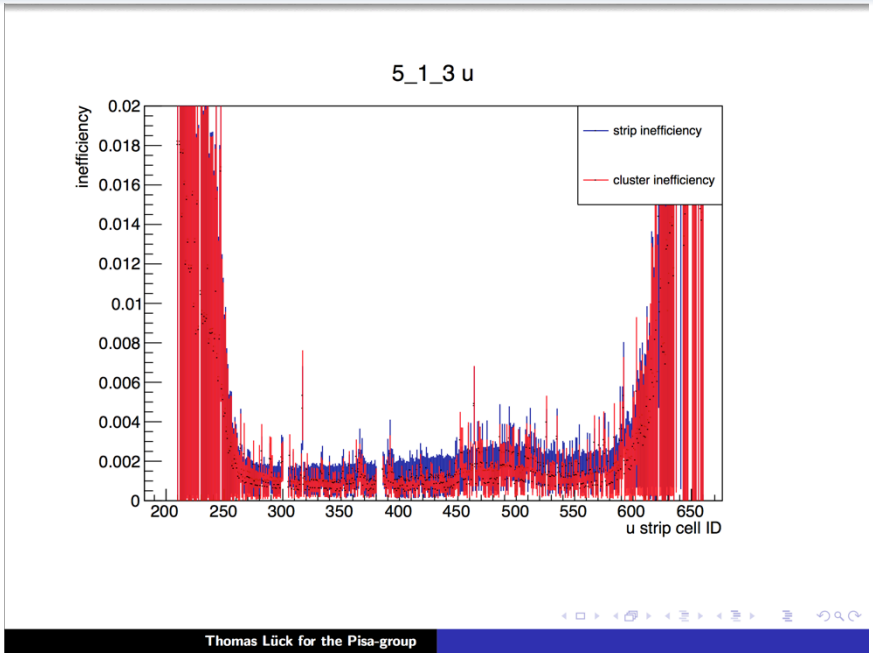


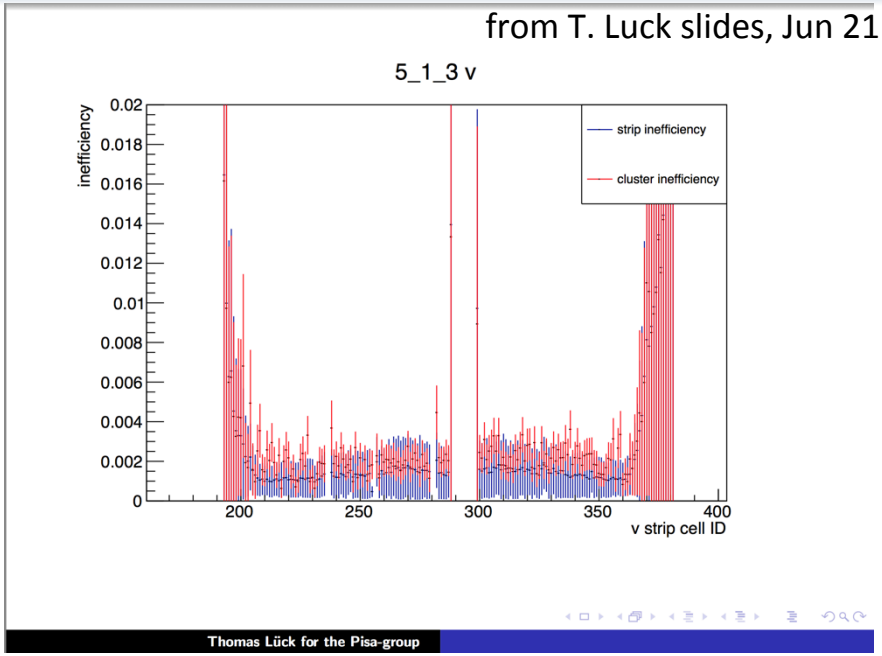




SVD hit/cluster inefficiency (1 - efficiency)

from T. Luck slides, Jun 21 B2GM



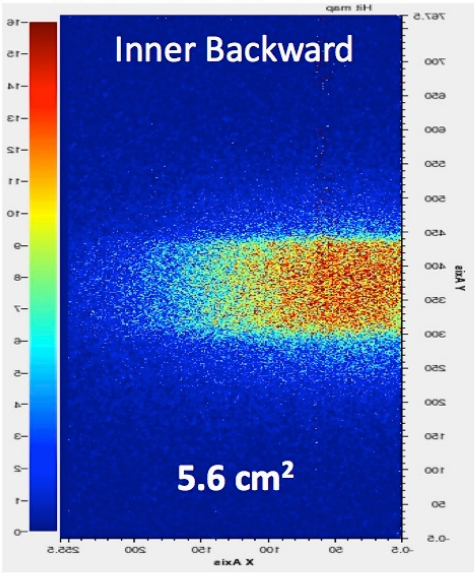


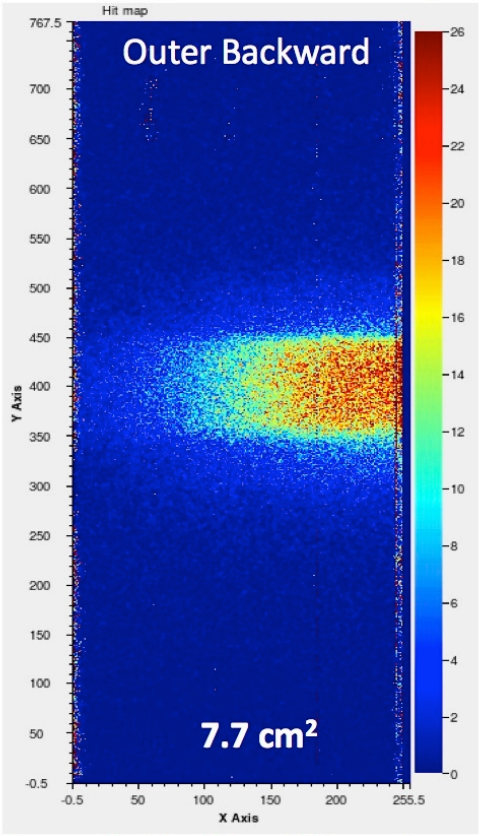
- **very high efficiency, > 99%**
- **some inefficiencies by known defects, new defects and selection**

PXD Hit Maps

PXD Hit Maps

Threshold = 5 (~ 1200 electrons)

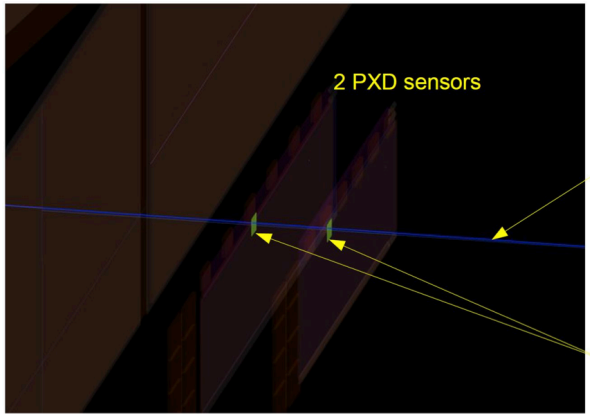




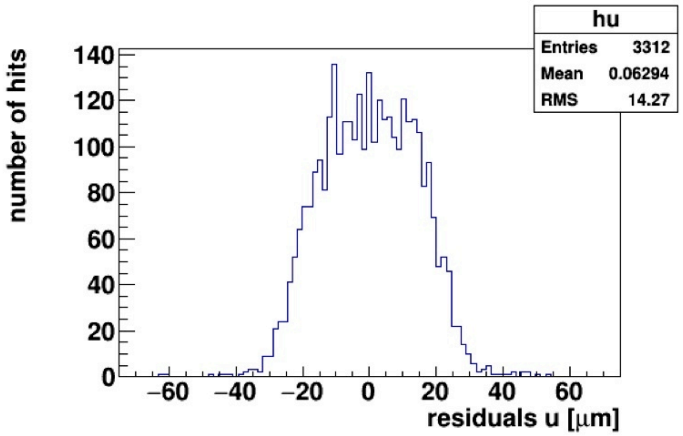
Trigger on 4 scintillators
Collimated beam
No magnetic field

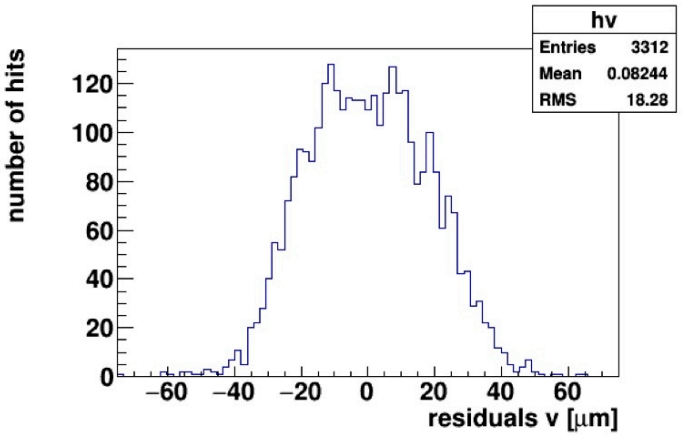
Both detectors fully functional

PXD Residual Distributions



From R.Itoh in DAQ session



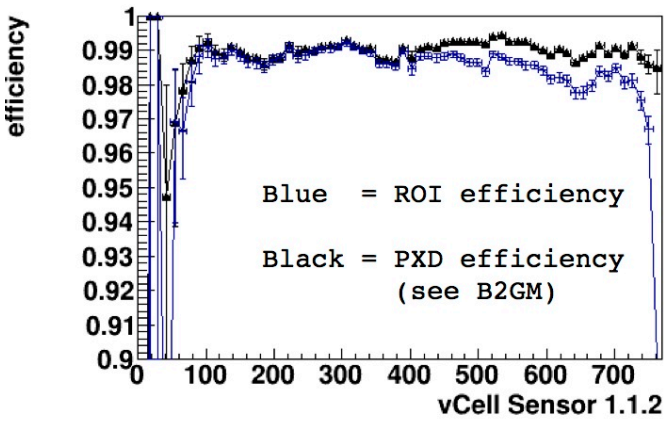


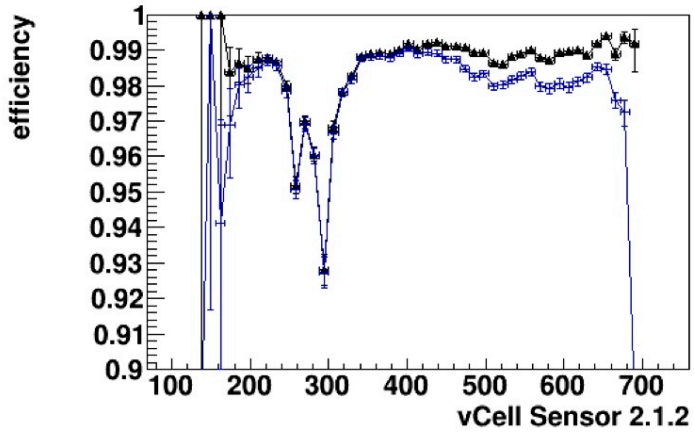
Residuals for perpendicular incident MIPS:

- 14 μm (50 μm pitch)
- 18 μm (60 μm pitch)

Cluster size ~1 – binary resolution

PXD ROI efficiency





- Offline ROI: Distance cut (<1mm) around extrapolated intersection
- Data sample: run329 (all subruns)
  - ~2h long run
  - 5GeV e- beam in 1T field
- PXDTriggerShifter not active (Module removed from path)
- Quality cuts on SVD tracks:
  - Only single track events
  - p-value > 0.01
  - p>3GeV && p<8GeV

(plots from Benjamin)

from Spruck-san's slides
https://indico.mpp.mpg.de/event/4412/contribution/0/material/slides/0.pdf

Issues on 2nd VXD BT Campaign ~ PXD ~

- **Only half ladder (only BWD) was tested.**
  - Full ladder will be prepared by the next BT campaign.
- **Some Links between DHP-DHE were unstable**
  - Optical links for final experiment will improve the stability.
- **Event number mismatch between DHEs**
  - Above broken links caused an “extra” event in DHE which caused this event number mismatch.
- **DHP or matrix coordinate mapping (DHE-ONSEN)**
  - Fixed, clustering in the DHC
- **Large trigger veto (100usec or 300usec) was applied for PXD-DAQ**
  - Under investigation. This must be reduced into ~600nsec.

Issues on 2nd VXD BT Campaign ~ SVD ~

- **Short study time for attack to the SVD noise issue**
  - Most likely, the biggest noise source seems a water chiller beside PCMAG.
  - We have to study how this affects our data qualities.
- **An issue on trigger veto in SVD FADC system for the trigger-timing scan run.**
  - FPGA firmware issue. Can be fixed easily and soon.
- **SVD internal event number mismatch**
  - Due to an issue in process of trigger number decoding from FTSW signals (in FADC-Ctrl)
  - APV-emulator firmware is necessary to check correctness of event order. This will be developed and tested at the next BT campaign.
- **Data format in FTB-DATCON**
  - must be revised by the next BT campaign.
- **Further development is necessary for SVD slow control**
  - will be improved by the next BT campaign.

Issues on 2nd VXD BT Campaign ~ VXD ~

- **Event number shift between PXD data and SVD data on ONSEN**
  - Most likely, due to an issue in process of trigger number decoding from FTSW signals (in DHC).
  - This is to be confirmed.
- **ROI feature of DATCON-ONSEN is not working properly yet**
  - Further development seems necessary.
  - Need to be solved in the next BT campaign
- **Data taking with high rate triggers**
  - So far, we haven't confirm the feasibility for such high rate DAQ.
- **Acceptance of sensors**
  - Hit efficiencies on sensors are measured. We should also check the acceptance of fiducial regions in sensors.

Plan for 3rd DESY BT campaign

- **Requirement:**
  - VXD DAQ must be well debugged before the the BT campaign with well coordinated schedule.
    - Event-mixing problem must be completely solved.
    - FTB-DATCON-ONSEN line must be established.
  - Integration test for BEAST sensors in VXD volume (FANGS, CLAWS, and PLUME)
    - check proximities between detectors and grounding interference.

- **Proposal:**
  - Permanent VXD DAQ setup at DESY
    - even after the next BT campaign
  - Improve BonnDAQ so that it can send dummy PXD hit information to ONSEN.
  - Step-by-step increasing complexity with each data link check
  - Dry integration of BEAST sensors on PXD and SVD
  - Final BT in Dec. 5 – Dec. 23

Schedule 2016

DESY Testbeam Schedule 2016 - Version 8 - 27/04/2016

Ralf Diener, Norbert Meyners, Marcel Stanitzki - DESY Test Beam Coordinators

	Week		TB21		TB22		TB24/1		TB24	
			DATURA	none	DURANTA	none	Telescope in PCMAG	PCMAG	none	
4-Jan-16	1		Shutdown							
11-Jan-16	2									
18-Jan-16	3									
25-Jan-16	4									
1-Feb-16	5									
8-Feb-16	6									
15-Feb-16	7									
22-Feb-16	8									
29-Feb-16	9									
7-Mar-16	10		Startup		Startup		Startup		Startup	
14-Mar-16	11		CMS-Pixel-Phase1		Mu3e					
21-Mar-16	12		Goettingen-CMOS		ATLAS-Pixel-AMSH35					
28-Mar-16	13		ATLAS-Pixel-MPP							
4-Apr-16	14		CMS-Pixel-Phase1				Belle-II			
11-Apr-16	15		PLUME							
18-Apr-16	16		PLUME							
25-Apr-16	17		CMS-Pixel-Phase1							
2-May-16	18					CALICE-AHCAL			SiPM	
9-May-16	19		ATLAS-DMicromegas			CALICE-AHCAL			SiPM	
16-May-16	20									
23-May-16	21		ATLAS-Strip-Glue		ATLAS-ITK-Strip					
30-May-16	22		ATLAS-Strip-Glue		ATLAS-ITK-Strip					
6-Jun-16	23		CMS-Phase2-EPI						CMS-Pixel-Phase1	
13-Jun-16	24		CMS-Phase2-EPI							
20-Jun-16	25					CALICE-AHCAL				
27-Jun-16	26									
4-Jul-16	27		CMS-Pixel-PII-KA							
11-Jul-16	28		CMS-Pixel-PII-KA							
18-Jul-16	29									
25-Jul-16	30				ATLAS-Strip-Glue					
1-Aug-16	31		Summer Students		ATLAS-Strip-Glue					
8-Aug-16	32									
15-Aug-16	33									
22-Aug-16	34		FCAL							
29-Aug-16	35								CBM-TRD	
5-Sep-16	36									
12-Sep-16	37									
19-Sep-16	38									
26-Sep-16	39									
3-Oct-16	40									
10-Oct-16	41									
17-Oct-16	42		CMS-Phase2-EPI							
24-Oct-16	43		CMS-Phase2-EPI		HEP for Teachers					
31-Oct-16	44									
7-Nov-16	45				Mu3e					
14-Nov-16	46									
21-Nov-16	47									
28-Nov-16	48									
5-Dec-16	49									
12-Dec-16	50						Belle-II			
19-Dec-16	51	Beam till 23/12 0800								
26-Dec-16	52									

Announced

VXD Dry Tests

Phase 2 Dry Integration

Dec. 5 – 23 is assigned for VXD beam test.

Preparation schedule of 3rd DESY BT campaign (still not clear yet)

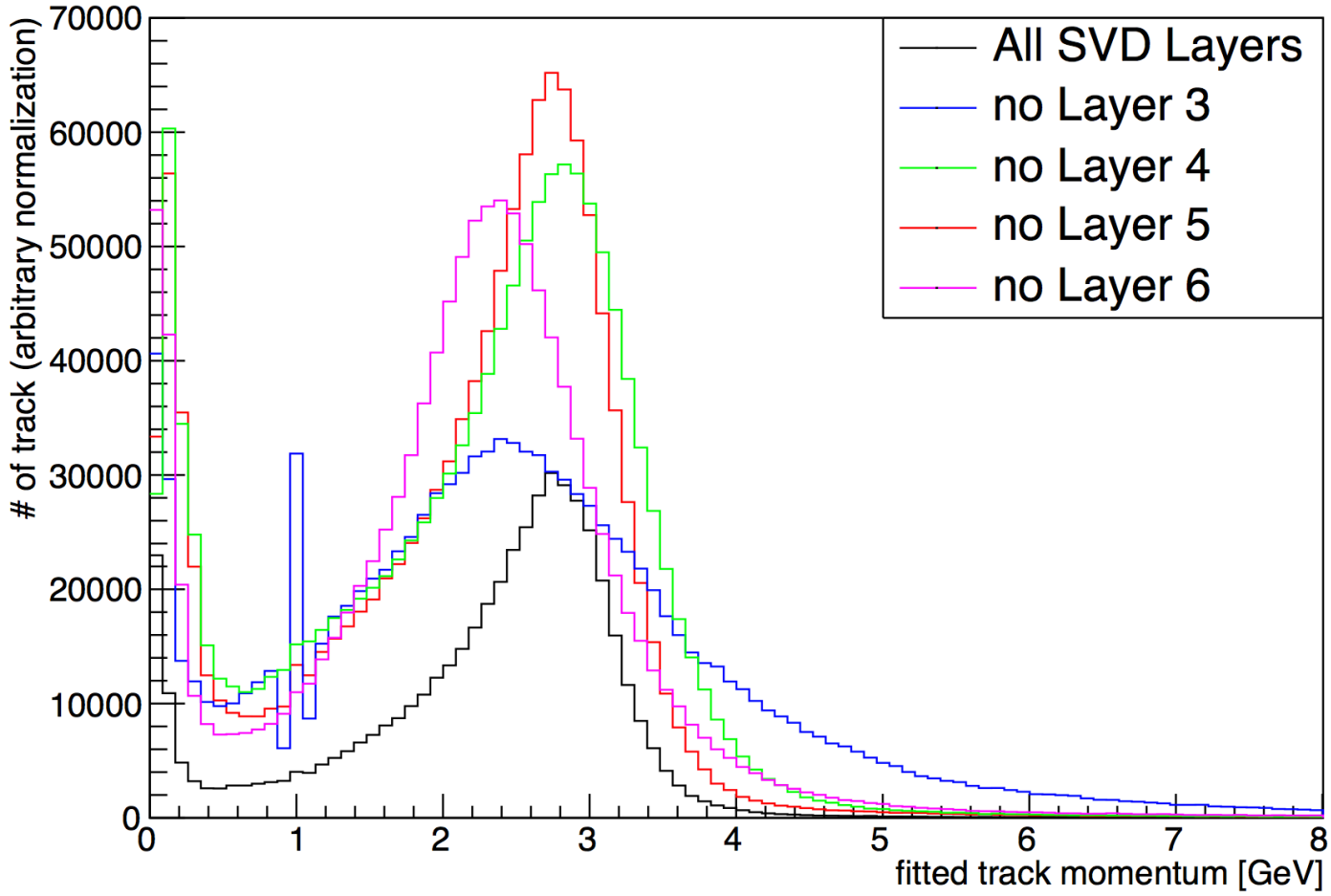
- **We should have core weeks in which all the experts can work together.**
  - We need to determine when and how long.
- **Before the BT, Two or three DAQ members will come to DESY in early Nov. for about a week.**
  - This must be before B2TIP meeting at MIAPP (Munich) Nov. 15-17
  - They will rebuild PocketDAQ setup and perform dry runs with VXD modules.
- **Before the start of BT, we must confirm whole chains of VXD-DAQ work properly.**
- **From Dec. 5: 3rd DESY BT campaign**

- **We have to clarify:**
  - Travel funding from Japan to Europe
  - Detailed schedule of core weeks and preparation
- **These scheduling issues will be dedicatedly discussed on the coming VXD workshop (Sep. 14-16). After the workshop, the detailed preparation schedule must be clear and circulated to all relevant members immediately.**

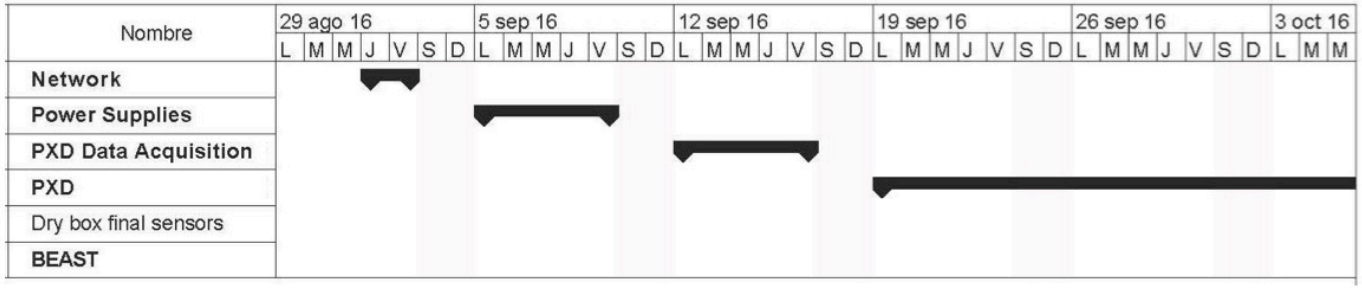
backup

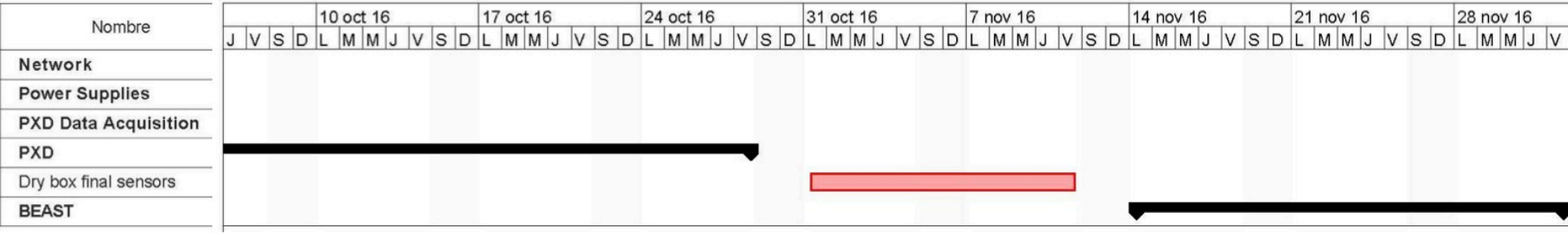
Measured momentum distribution in SVD

from T. Luck slides, Jun 21 B2GM



Schedule 2016





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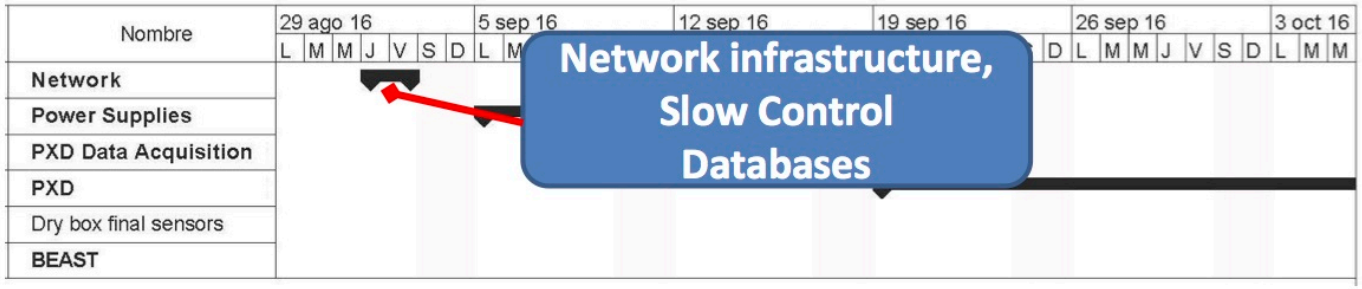
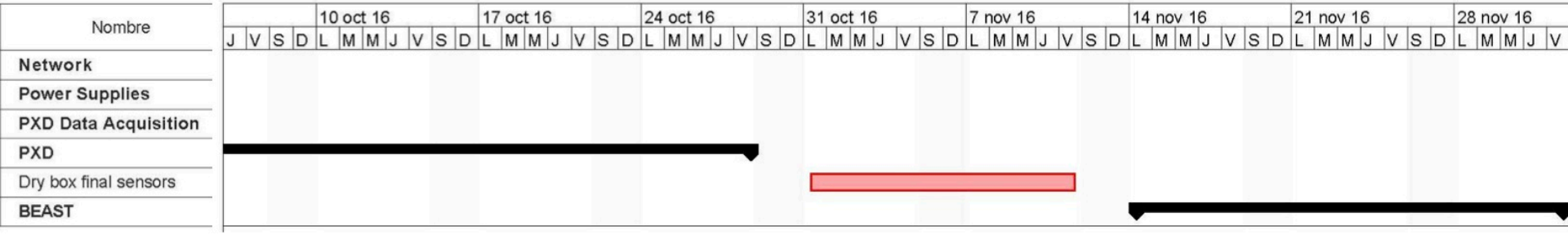
Schedule 2016





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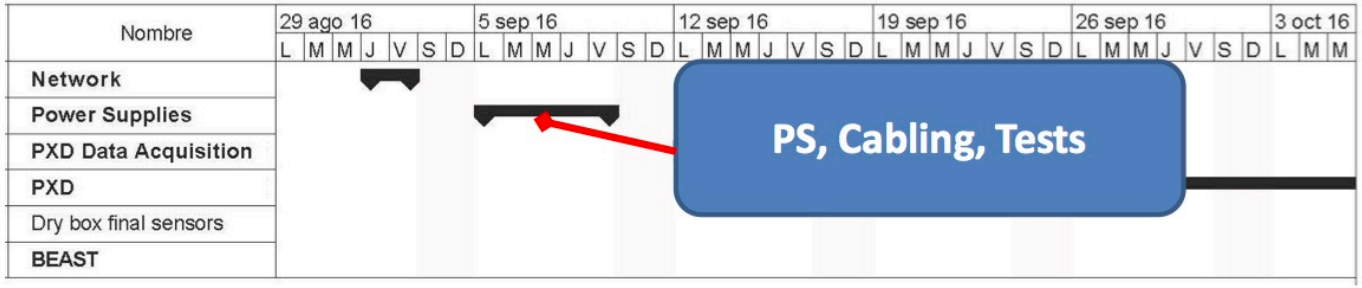

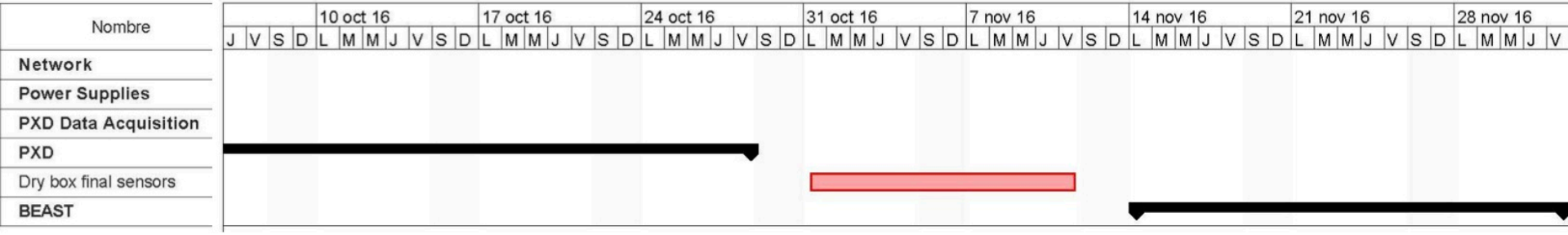

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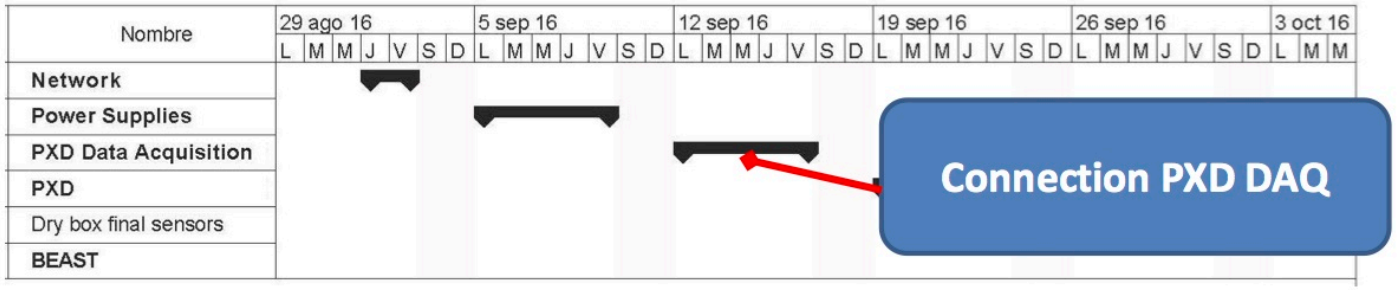

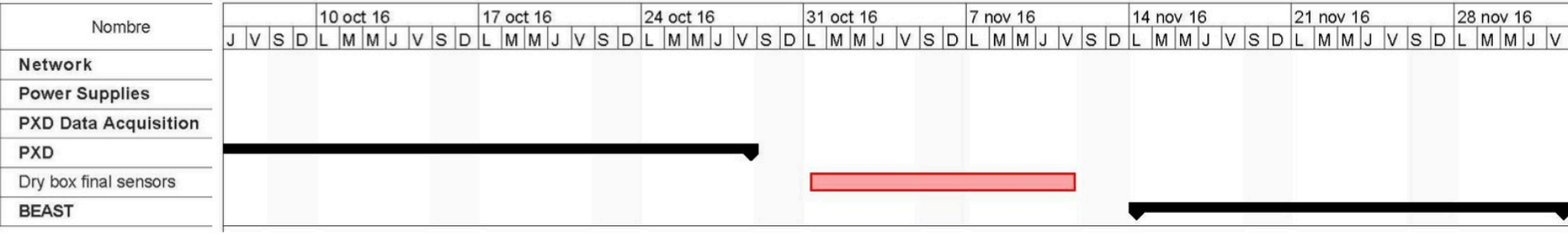

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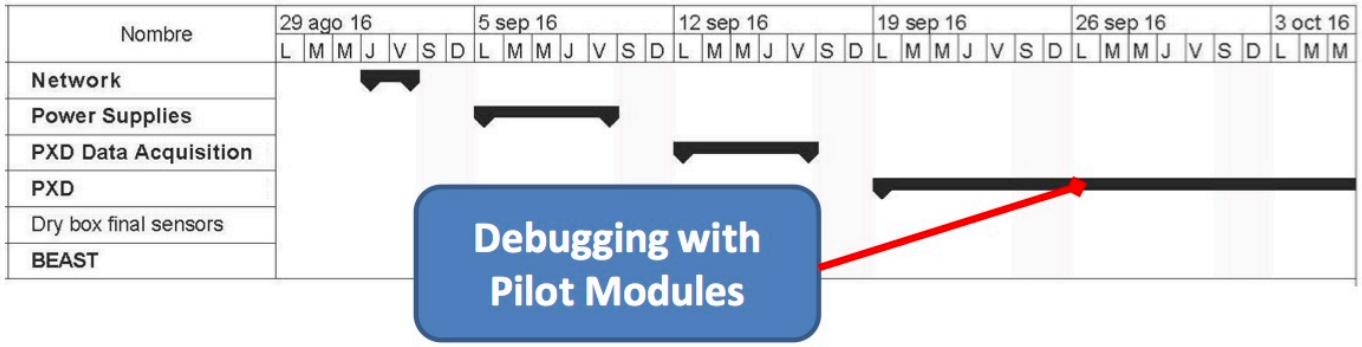

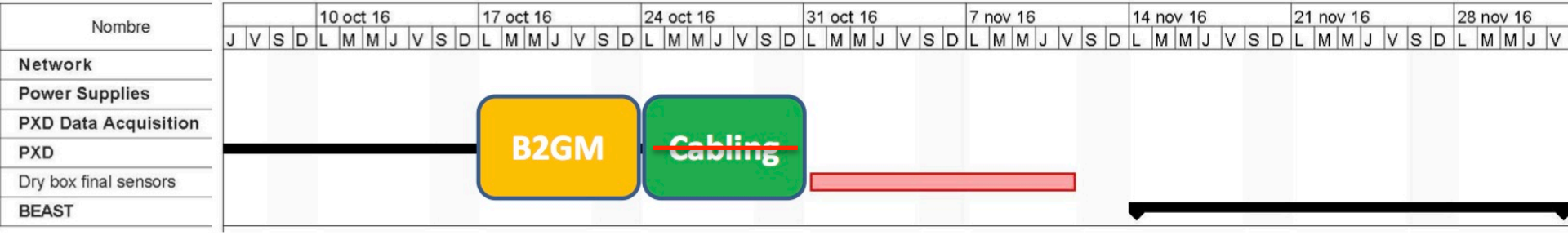

In the latest schedule,
cabling work on KEK
is moved to Dec.

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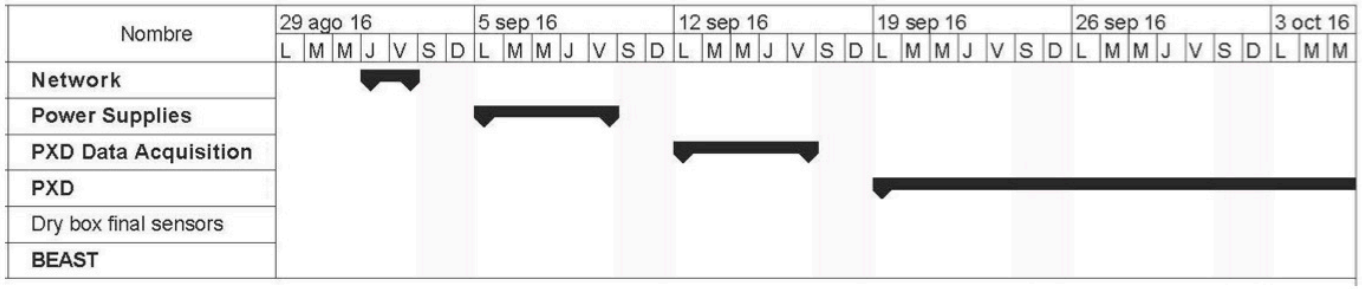
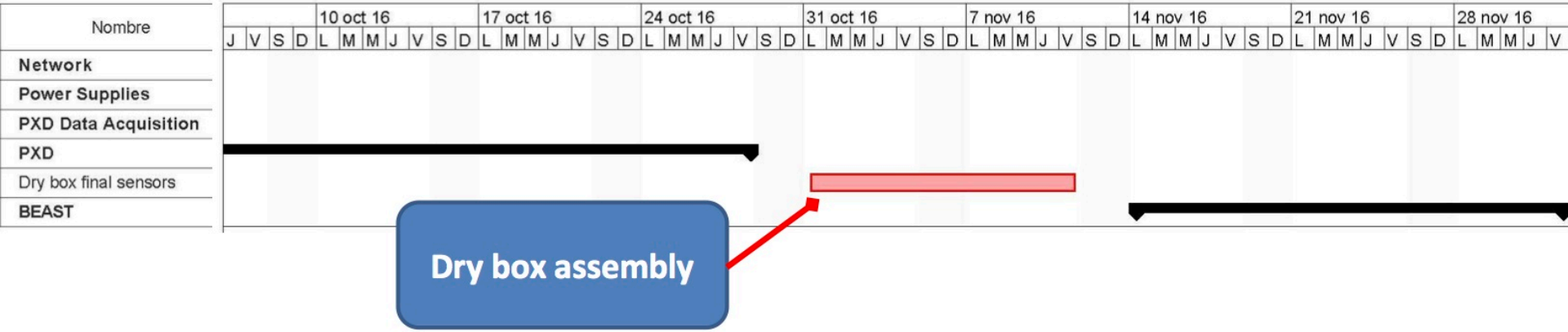
Schedule 2016





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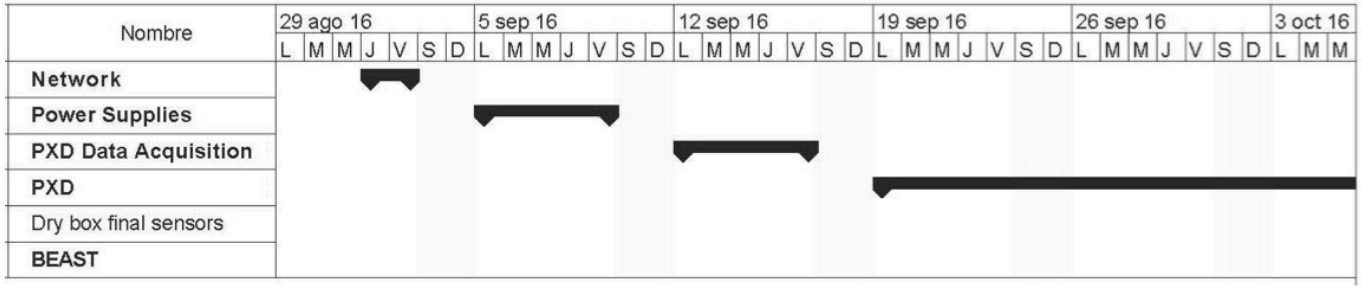
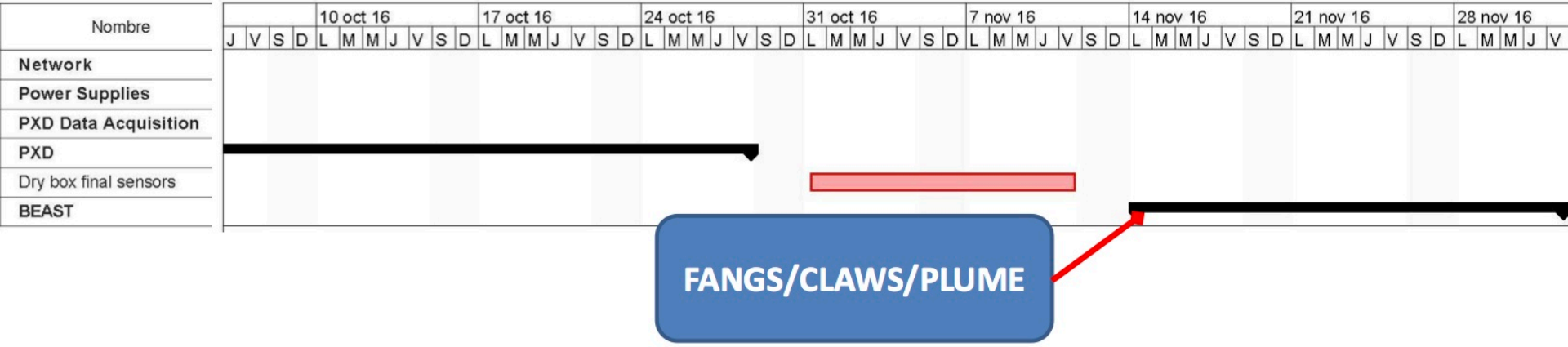
Schedule 2016





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