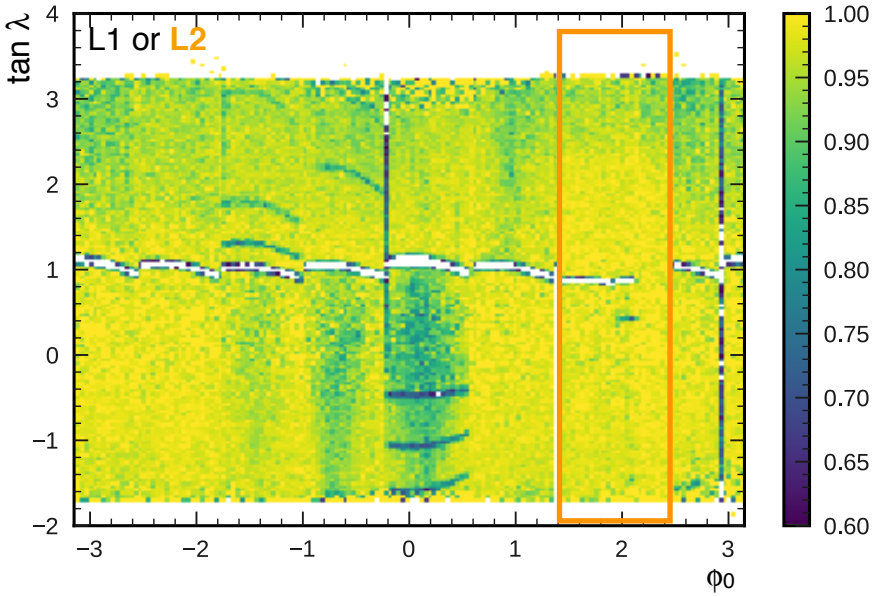
Issues of the Meeting

- Detector performance
  - reach next level in understanding to exploit full potential for physics
    - efficiency, reconstruction, alignment, resolution
- Readiness for coming autumn run period
  - establish sustainable operation scheme building on significantly improved online software
    - final goal: routine operation by CR shifter / PXD experts on-call
  - further optimise operation parameters $\Rightarrow$ improve overall availability and performance
  - establish routine operation with Gated Mode
- Radiation hardness
  - understand damage mechanisms during beam losses in May/June ($\rightarrow$beam test in Mainz)
  - increase robustness against bursts & future accidents $\Rightarrow$ establish fast emergency ramp down
- PXD21
  - good progress but some delays in ladder assembly and sensor production (not yet critical)
  - very strong push from KEK management for early start of 2021 shutdown (~February)
    - $\Rightarrow$ half shells have to be at KEK in a year from now
  - FWD: solve cable space issue and exploit options for improved shielding around bellows (CDC bkg)

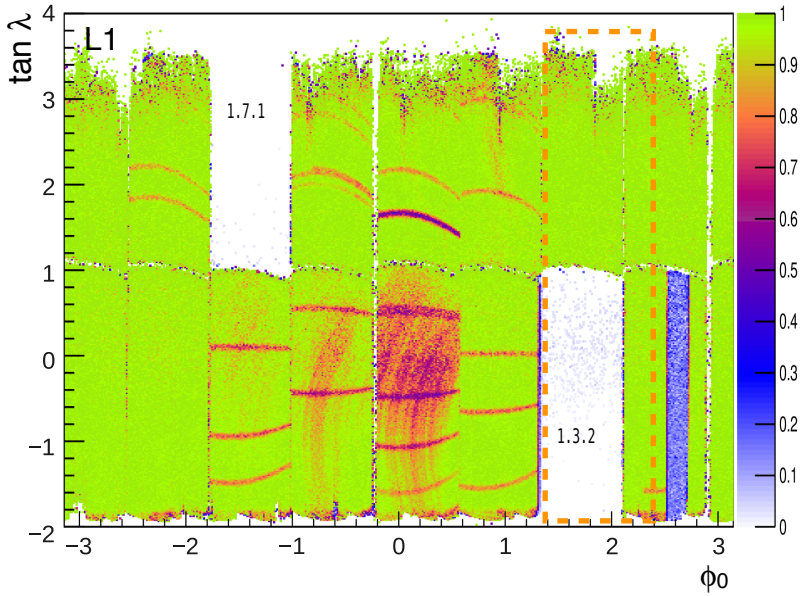
Evolution of PXD Status

May 21



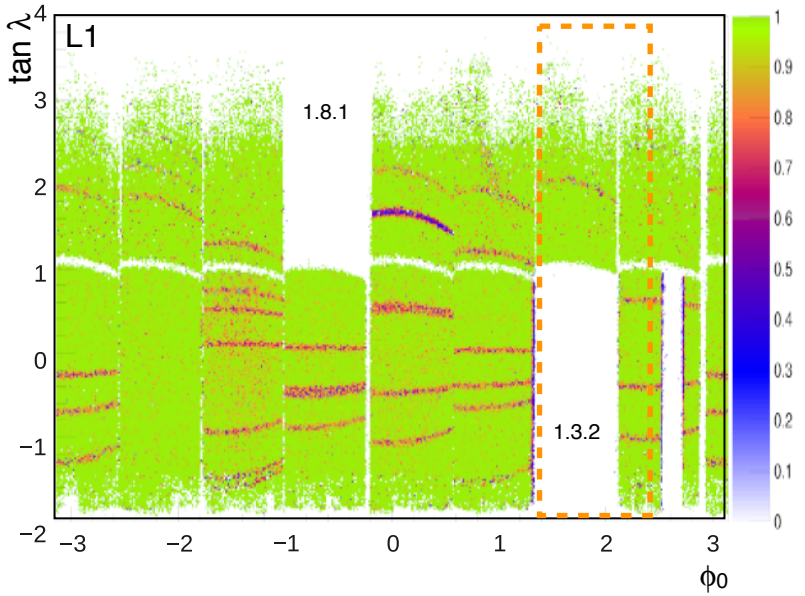
- Gaps between fwd & bwd modules and between half shells
- Several dead gates
- Few modules not yet at optimal working point
- Bad module 1.3.2 covered by module 2.4.2 in L2

After May 28



- 9 modules went into OVP
  - increased clear currents
- One module remained inoperable
  - 1.7.1 recovered only on Jun 7
- Many more dead gates
- Working point shifted further
- [Later lost one DHP link in 1.4.2]

After June 9

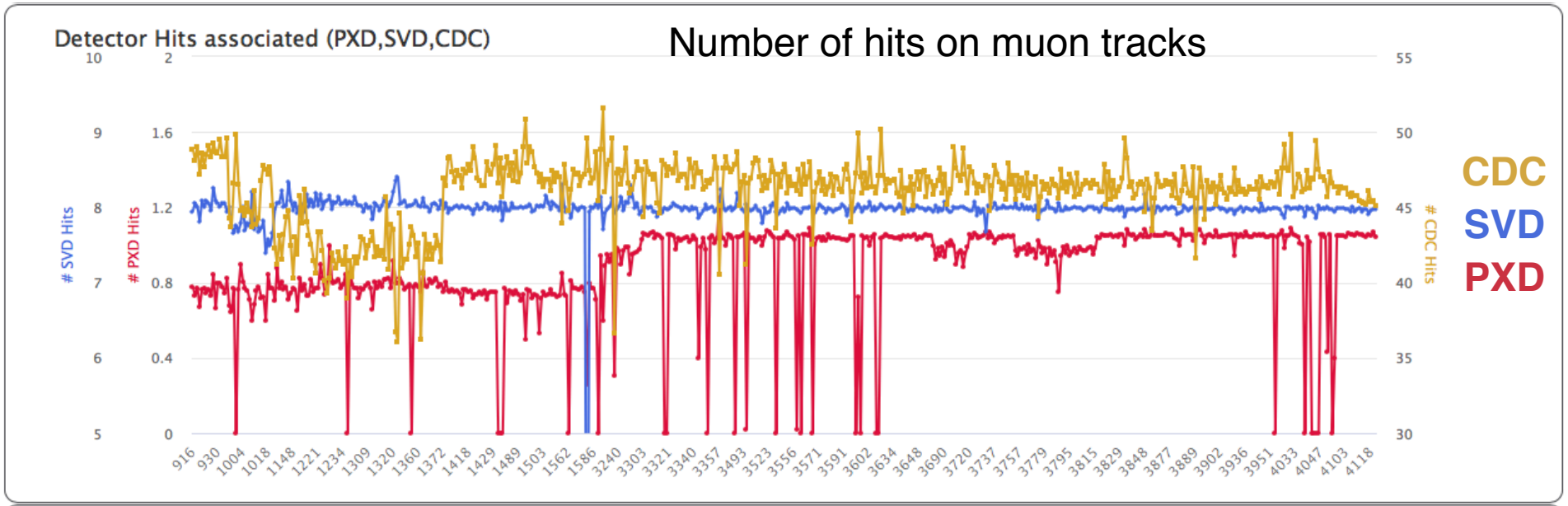


- LER lost ~150 mA within 40μs ⇒ damaged D02V1, QCSR quench and 3 rad accumulated dose
  - all modules triggered OVP
- Module 1.8.1 inoperable: current between clear and gate
- Many more dead gates (but a few were also recovered)

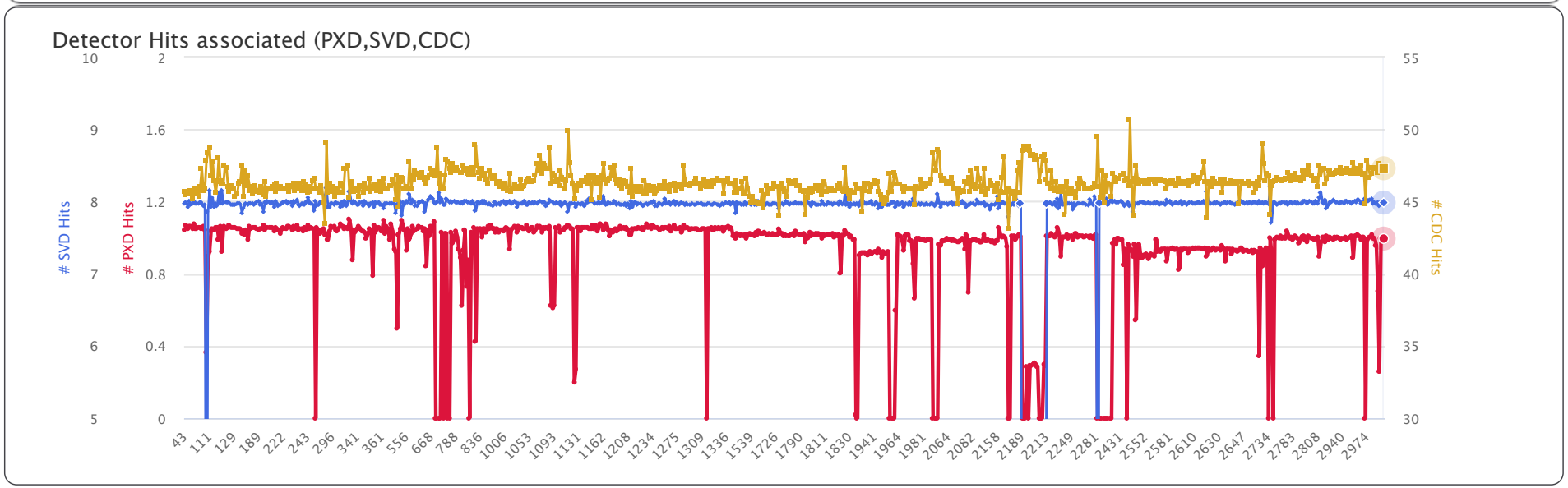
Evolution of PXD Performance in Phase 3.1

https://mirabelle.belle2.org

Experiment 7



Experiment 8



Evolution of PXD Performance in Phase 3.1

https://mirabelle.belle2.org

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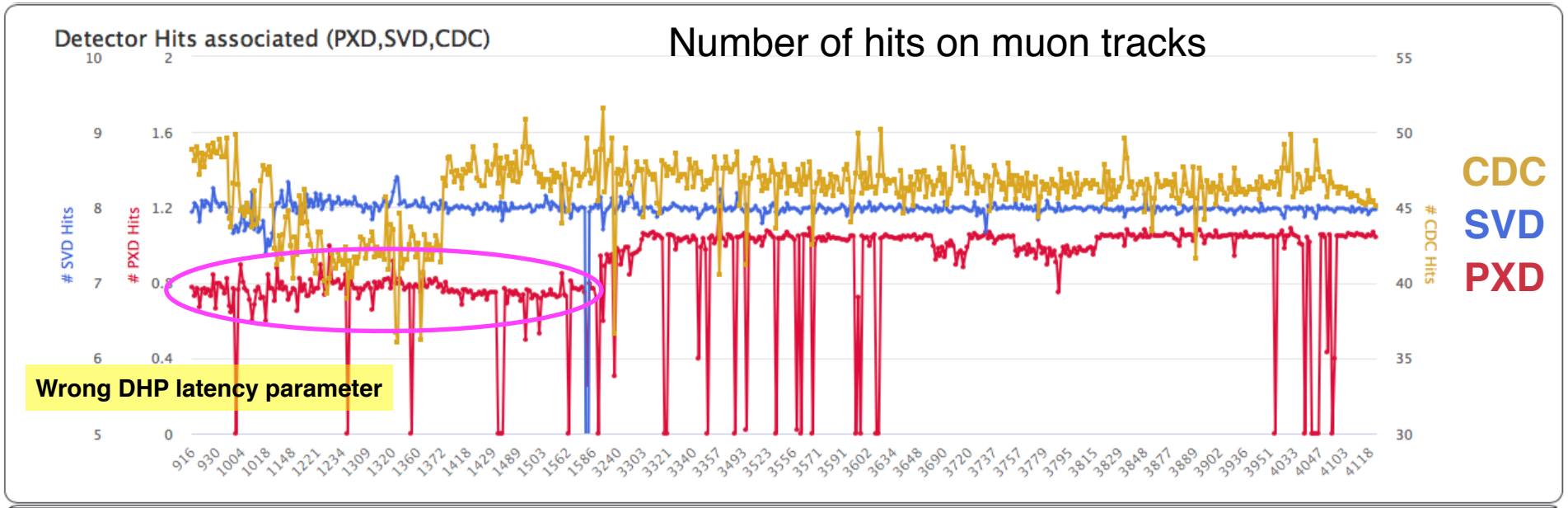
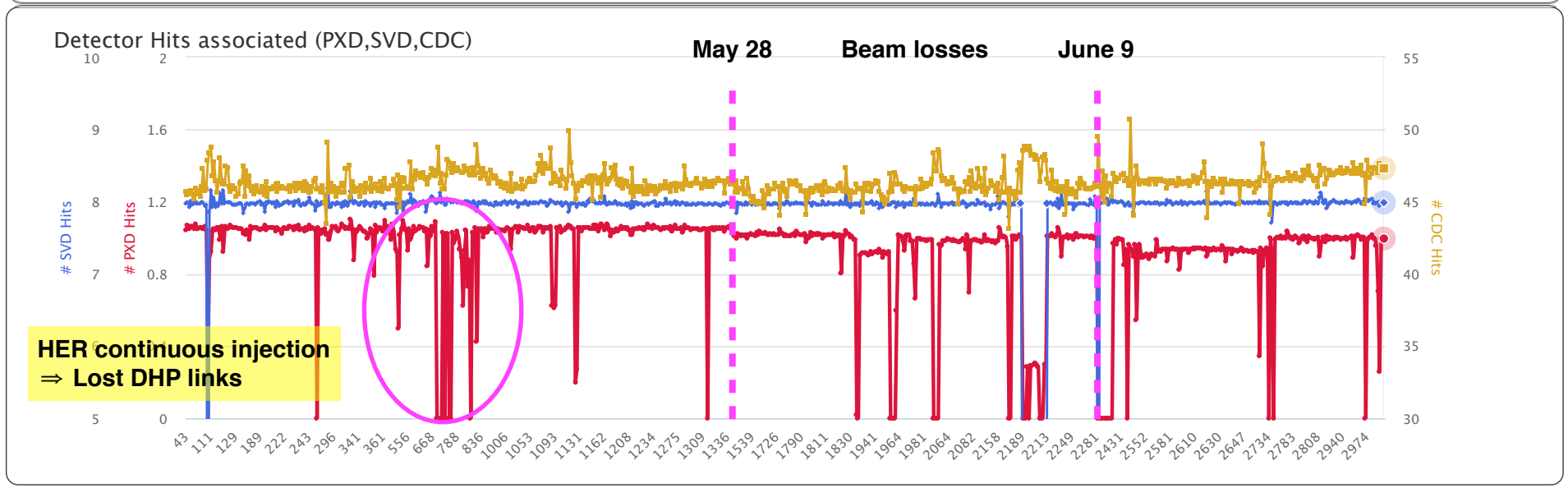
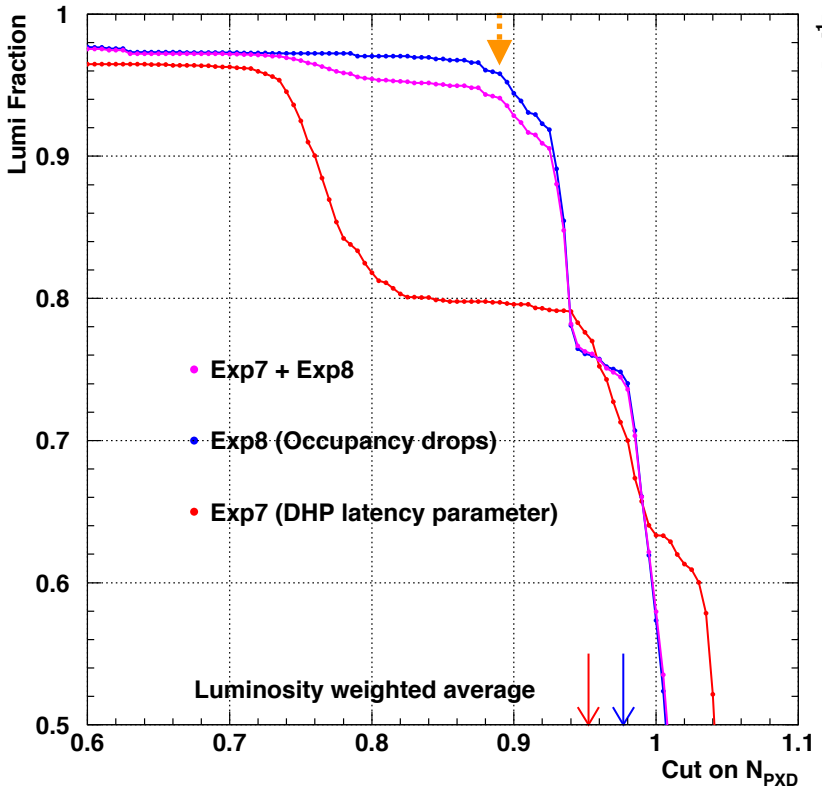
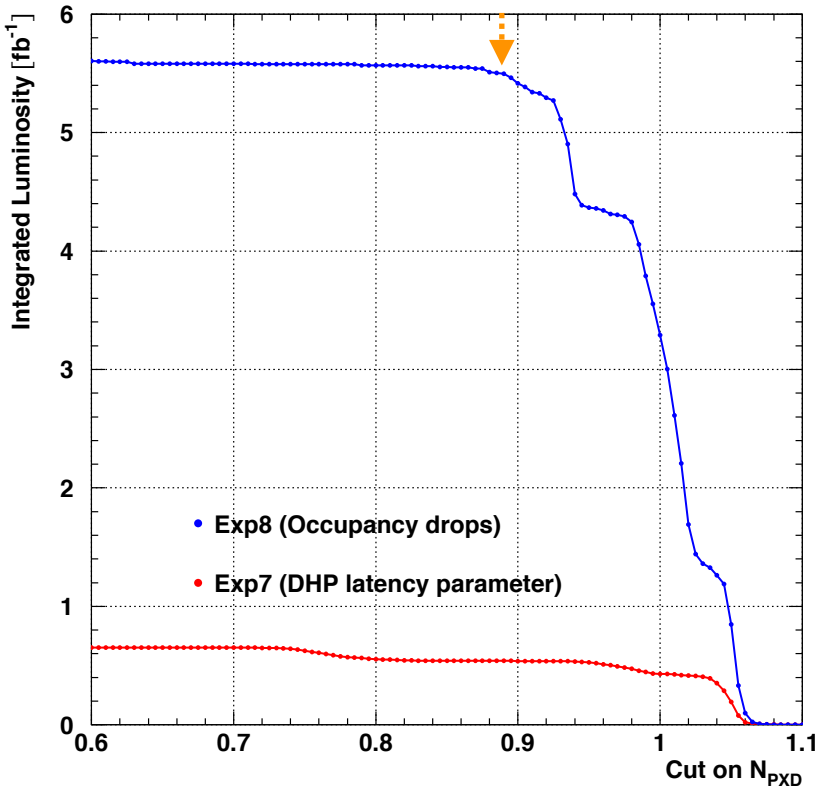


Experiment 8



PXD Run Quality

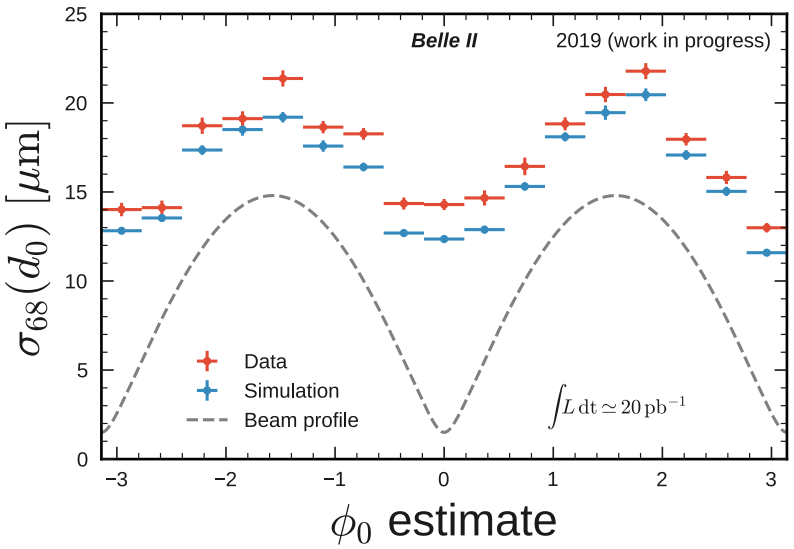


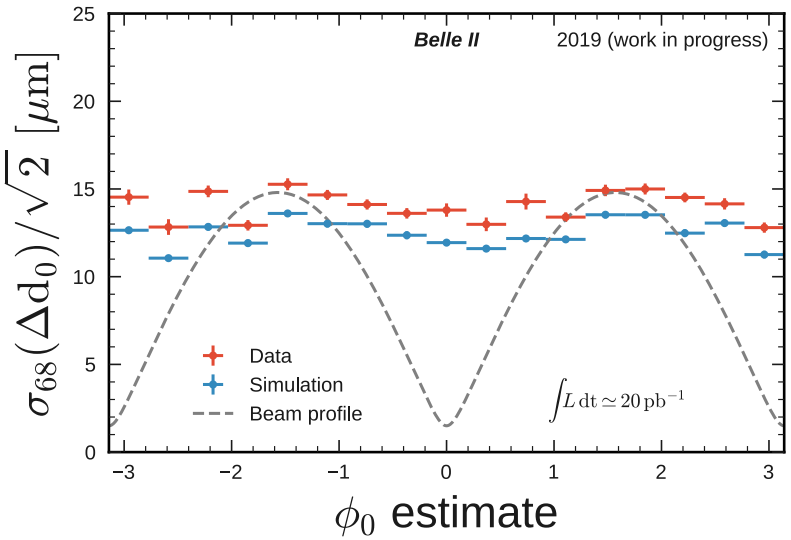


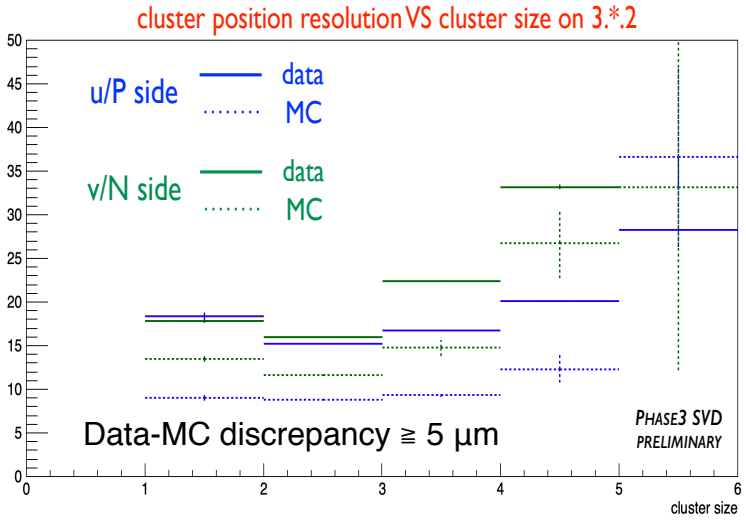
Cut on NPXD	Experiment 7+8		Additional loss due to cut on NPXD	
	Lost Lumi	Fraction	Lost Lumi	Fraction
0	335,0	5,2 %	0,0	0,0 %
0,5	408,3	6,4 %	73,3	1,1 %
0,7	431,1	6,7 %	96,1	1,5 %
0,89	489,6	7,6 %	154,6	2,4 %
0,9	568,9	8,9 %	233,9	3,6 %

- Cut $N_{PXD} > 0.89$ leads to an additional loss of luminosity of 2.4% (relative + ~50%)
- Not a disaster but leaves room for improvement …

Transverse Impact Parameter Resolution







LER: ε_x = 2.1 nm, β^*_x = 200 mm

HER: ε_x = 4.6 nm, β^*_x = 100 mm

Predicted horizontal beam spot size:

$$\widetilde{\sigma}_x = \frac{\sqrt{\varepsilon_x^{\mathrm{LER}} \cdot \beta_x^{\star\mathrm{LER}} + \varepsilon_x^{\mathrm{HER}} \cdot \beta_x^{\star\mathrm{HER}}}}{2}$$

$\widetilde{\sigma}_x = 14.8 \pm 0.5\,\mu\mathrm{m}$ (used for MC)

Measured ϕ_0 dependence:

$$\sigma_{d_0} = \sqrt{\sigma_i^2 + (\widetilde{\sigma}_x \sin\phi_0)^2 + (\widetilde{\sigma}_y \cos\phi_0)^2}$$

For 2-track (t– and t+) event,

$\Delta d_0 \equiv d_0(t-) + d_0(t+)$

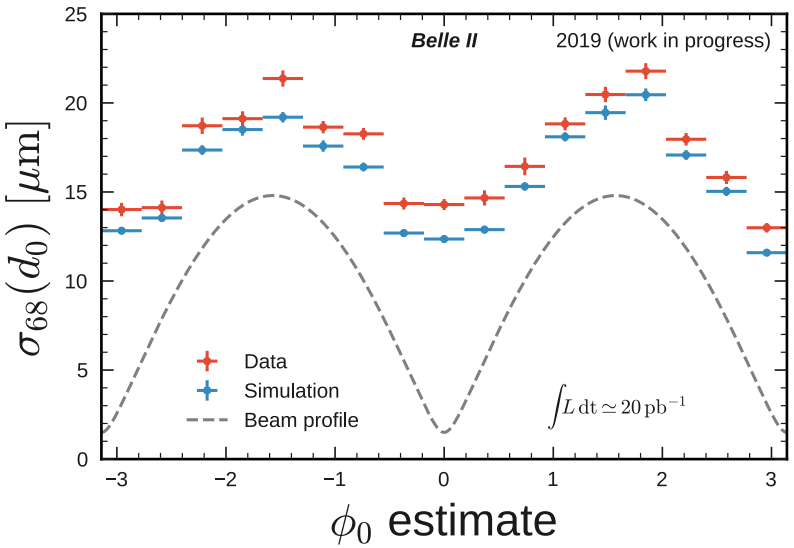
Width of $\Delta d_0/\sqrt{2}$ distribution used as estimate of **intrinsic** d_0 resolution σ_i

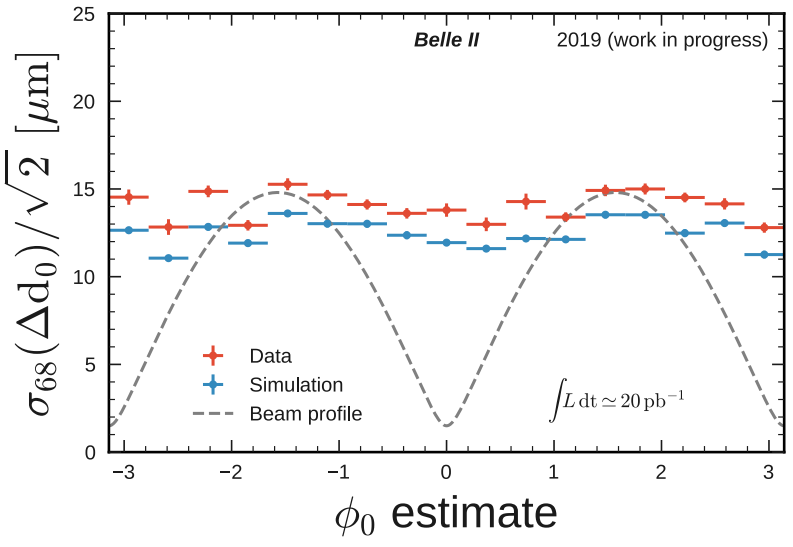
Data: $\sigma_i = 14.1 \pm 0.1\,\mu\mathrm{m}$

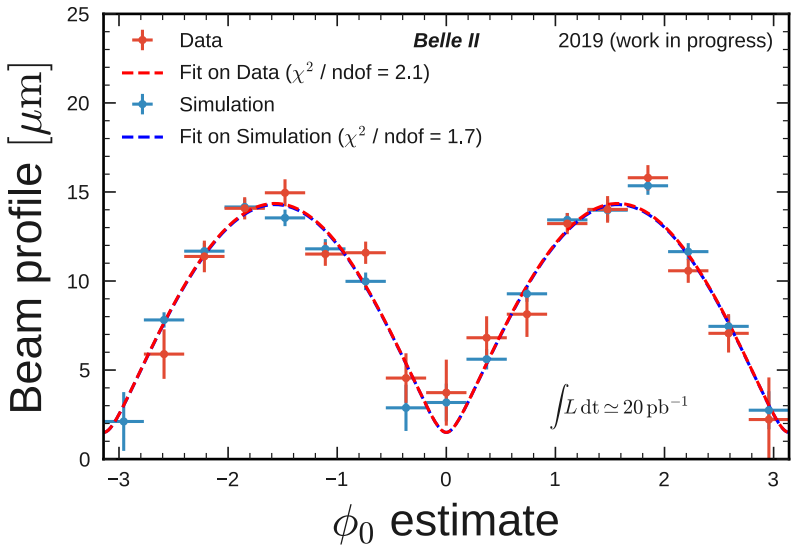
Simulation: $\sigma_i = 12.5 \pm 0.1\,\mu\mathrm{m}$

Difference affected by too optimistic MC expectation for SVD cluster position resolution.

Transverse Impact Parameter Resolution







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Simulation: $\sigma_i = 12.5 \pm 0.1\,\mu\mathrm{m}$

Difference affected by too optimistic MC expectation for SVD cluster position resolution.

Quadratically subtract σ_i from σ_{d0} and fit beam profile separately for data and MC with fixed $\widetilde{\sigma}_y = 1.5\,\mu\mathrm{m}$ determined from vertical beam scan.

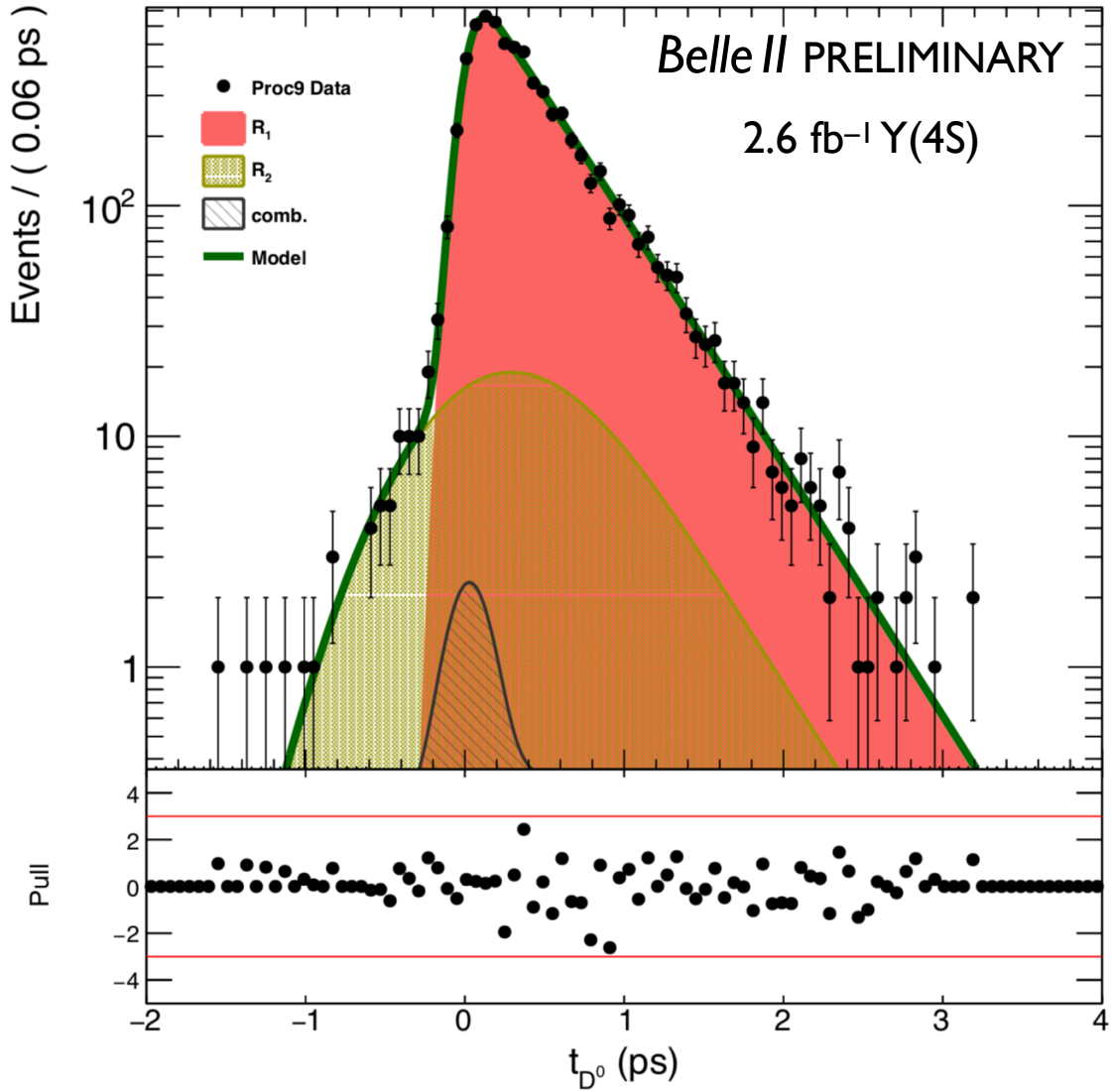
Data: $\widetilde{\sigma}_x = 14.4 \pm 0.9\,\mu\mathrm{m}$

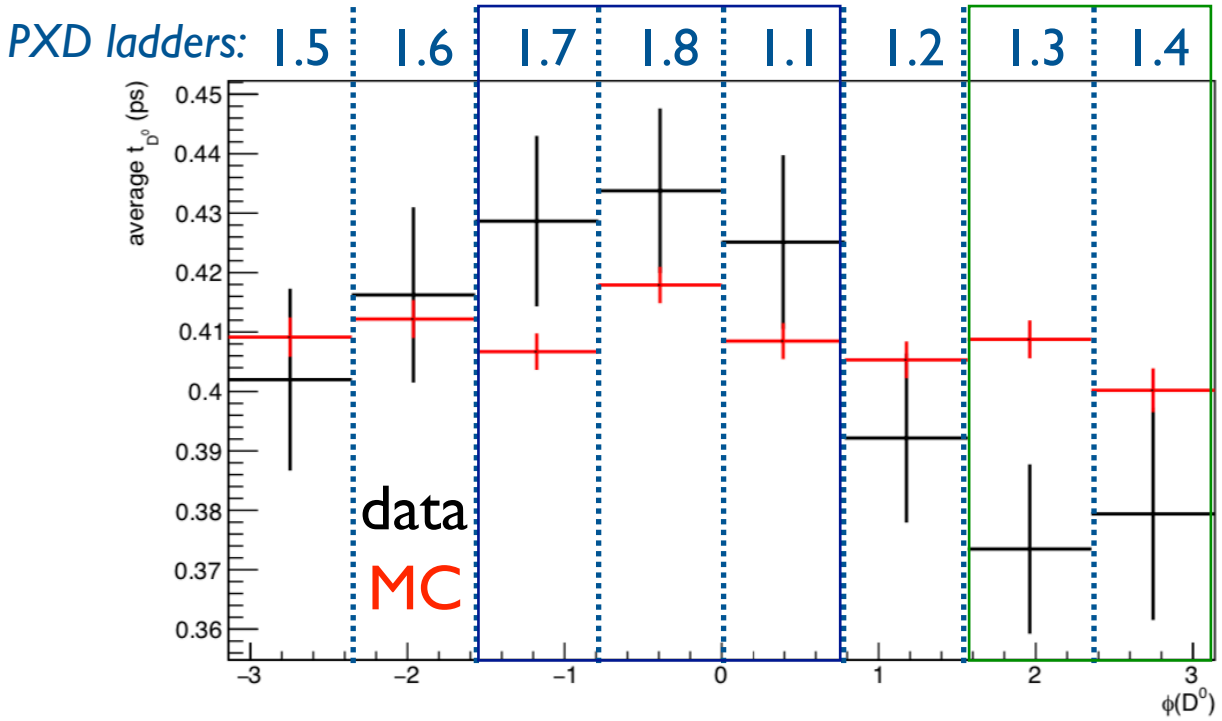
Simulation: $\widetilde{\sigma}_x = 14.3 \pm 0.6\,\mu\mathrm{m}$

Excellent agreement between data and MC and with the prediction based on machine parameters.

VXD Performance for Physics

Gaetano de Marino, Giulia Casarosa



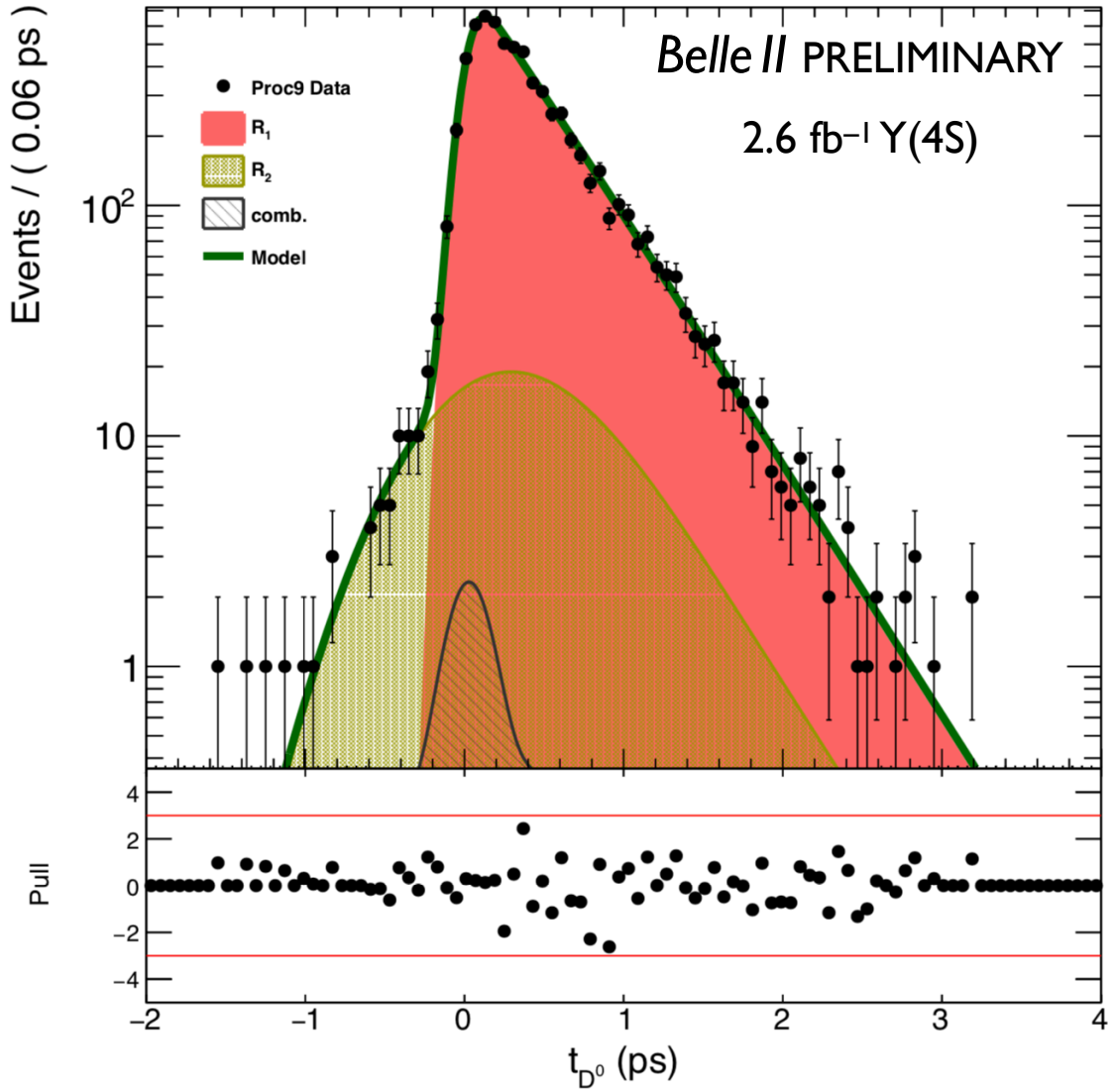


(a) Average proper time for each of the eight bins in which th range for the azimuthal angle ϕ of the D^0 is divided.

- Indication for remaining inconsistencies in alignment/reconstruction/run-vertex determination

VXD Performance for Physics

Gaetano de Marino, Giulia Casarosa

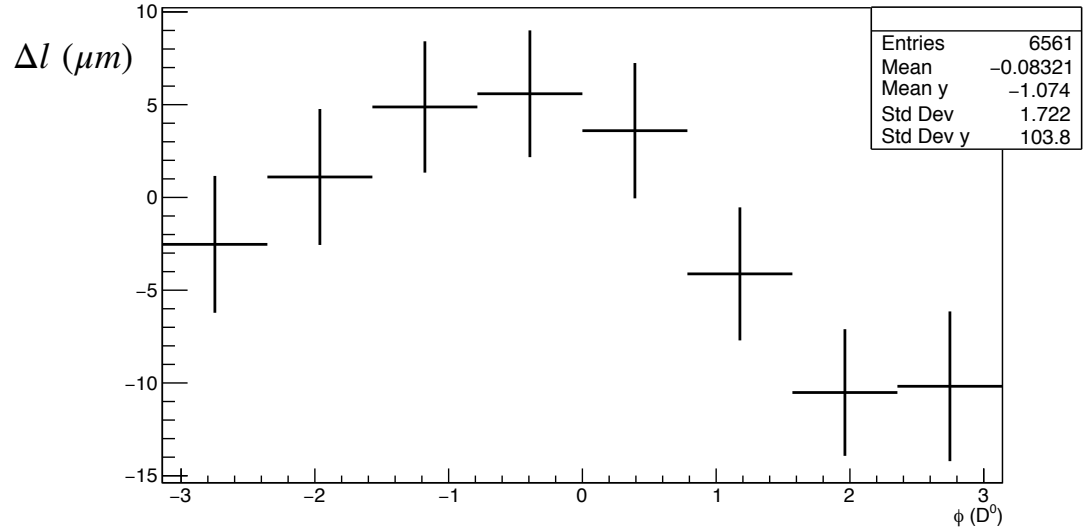


assuming that the lifetime can be estimated as the average of the proper time distribution

$$l = \beta\gamma ct \rightarrow < l > = \beta\gamma c\tau$$

then we can compare the average flight length $< l >$ with the one that we expect for D^0 candidates with the nominal lifetime:

$$\Delta l \simeq l - \beta\gamma c\tau_{PDG} = \beta\gamma c(\tau - \tau_{PDG})$$



- Indication for remaining inconsistencies in alignment/reconstruction/run-vertex determination

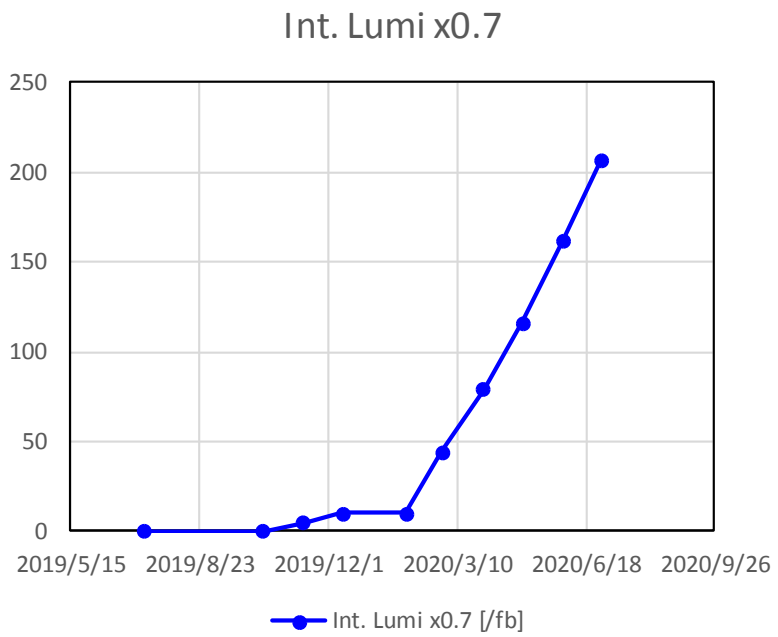
PXD Expert Shifts & Shifter Training Plans for Fall Run

- PXD operation scheme similar as in spring run
- At least one PXD expert on site (not permanently at KEK)
- Remote shifts mainly from Europe
  - following SuperKEKB operation plan highest priority to fill owl shifts and weekends
  - request to all PXD groups to fill new list **PXD_SHIFTS** in B2MMS ⇒ to be interfaced to ShifTool for registry and quota accounting
- Shift training
  - new people should sign up for shift training
  - require at least one shadow shift before taking first shift

Operation Plan

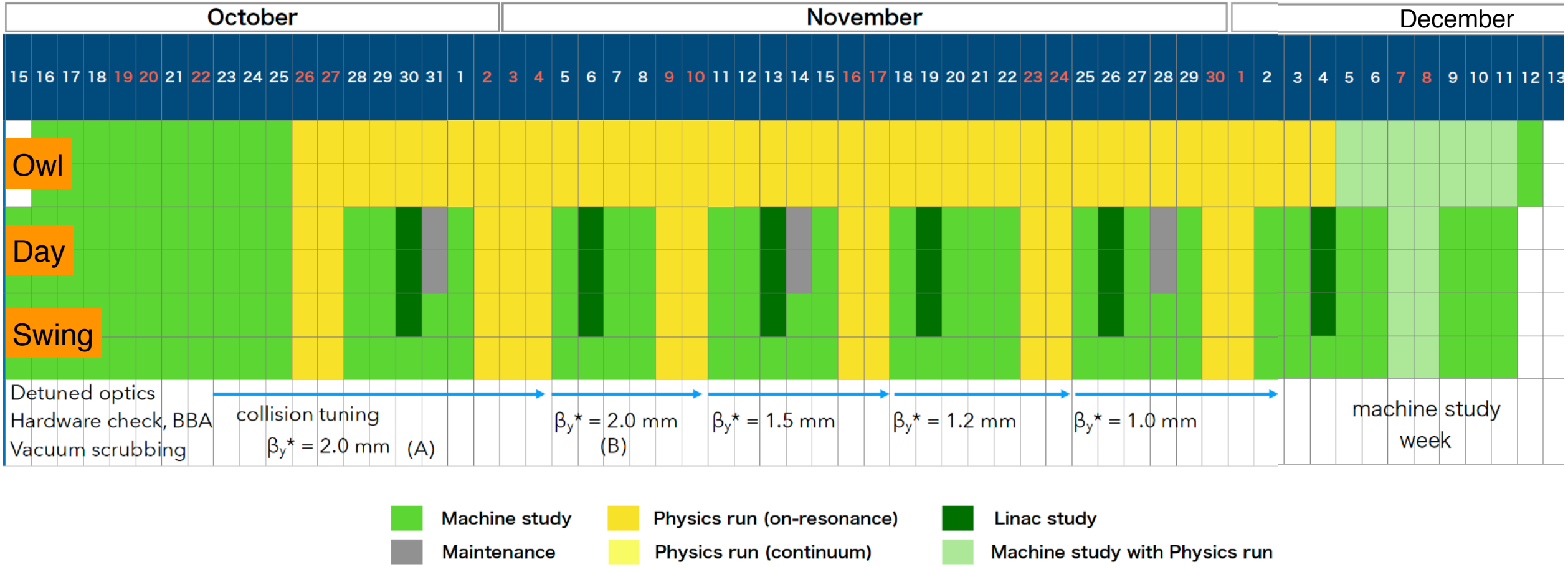
- Commissioning meeting at 6/Aug
- 2019 Autumn: Mainly focus on machine developments for increasing luminosity and reducing beam background.
  - Need vacuum scrubbing runs, especially around Oct., of course.
- 2020 Jan to Jun runs: Luminosity production run with target luminosity of 200/fb.

- Squeeze the beta* from 2 mm (achieved) to less than 1 mm (ex. 0.8mm) within two month.
  - Day and Swing shift will be used for machine tuning and background study
  - Owl shift and weekends will be used for the luminosity runs (with reduced beam currents and /or relaxed beta*_y)

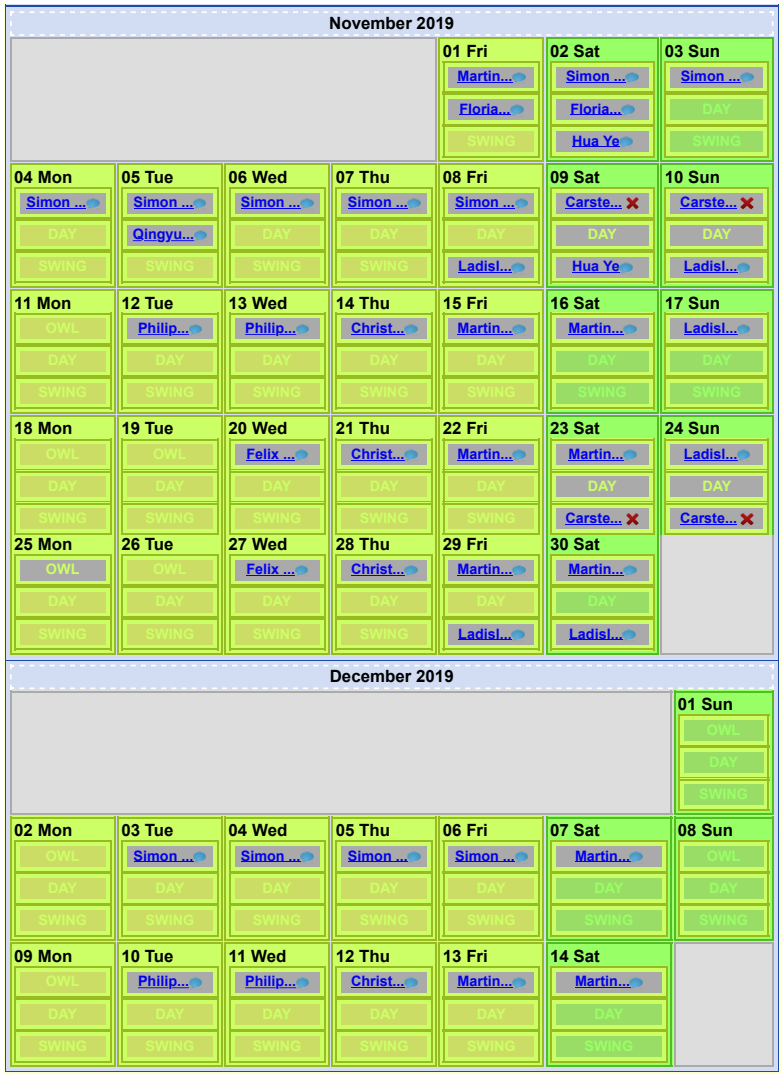


Phase 3.2 Run Schedule

Y. Ohnishi



PXD Shifts



- New list PXD_SHIFTS in B2MMS
  - to be interfaced to ShifTool for booking and quota accounting

- Please start booking shifts NOW
- Order of priority for remote shifts:
  - weekend → owl → swing

Further shift trainings will be scheduled in the near future: please register!

Agenda

Monday, September 23, 2019	
09:00	Overview - Carsten Niebuhr (DESY)
09:15	**Data/Background Analyses** - Christian Wessel (University of Bonn) (until 10:30)
09:15	PXD and Tracking - Christian Wessel (University of Bonn)
09:35	Updates on PXD offline calibration - Qingyuan LIU (DESY)
10:00	PXD efficiency in the phase 3 data - Navid Rad (DESY)
10:30	--- Break ---
11:00	**Operation at KEK** - Hua Ye (DESY) Bjoern Spruck (Mainz) Simon Reiter (Giessen) (until 12:40)
11:00	Summary Phase3 - Bjoern Spruck
11:20	Module & Calibration Summary - Hua Ye
11:40	DHH status - Dmytro Levit
12:05	ONSEN status - Simon Reiter
12:10	DATCON status & plans - Bruno Deschamps
12:15	Fast Emergency Shutdown - Michael Ritzert
12:40	--- Lunch ---
14:00	**Operation at KEK** - Hua Ye (DESY) Bjoern Spruck (Mainz) Simon Reiter (Giessen) (until 15:30)
14:00	IBBelle status - Hans-Günther Moser
15:30	--- Break ---
16:00	**IB** - Jochen Dingfelder (Bonn) (until 17:00)

Tuesday, September 24, 2019	
09:00	**Gated Mode Operation at KEK and DESY** - Felix J. Mueller (DESY) (until 10:30)
09:00	Summary of recent Gated Mode tests at DESY - Felix Müller (DESY)
09:45	PXD Response to Gated Mode - Robert Karl (DESY) Slides
10:30	--- Break ---
11:00	**PXD21** - Laci Andricek (HLL) (until 12:30)
11:00	Sensor and Module Situation Overview - Laci Andricek (MPG Halbleiterlabor)
11:30	Ladder Assembly - Hans-Guenther Moser (MPP Munich)
12:00	Other Components - jigs, kaptons, tools - Hans-Guenther Moser (MPP Munich)
12:30	--- Lunch ---
14:00	**Improvements/Ongoing Studies** - Botho Paschen (Bonn) (until 15:30)
14:00	Radiation Burst Tolerance Studies at MaMi - Matthias Hoek (Uni Mainz)
15:30	--- Break ---
16:00	**Preps for PXD21 Installation and Contingency** - Carsten Niebuhr (DESY) (until 18:00)

Workshop Dinner „La Panetteria“ 18:30