Run plan update
&
beam background study preparation

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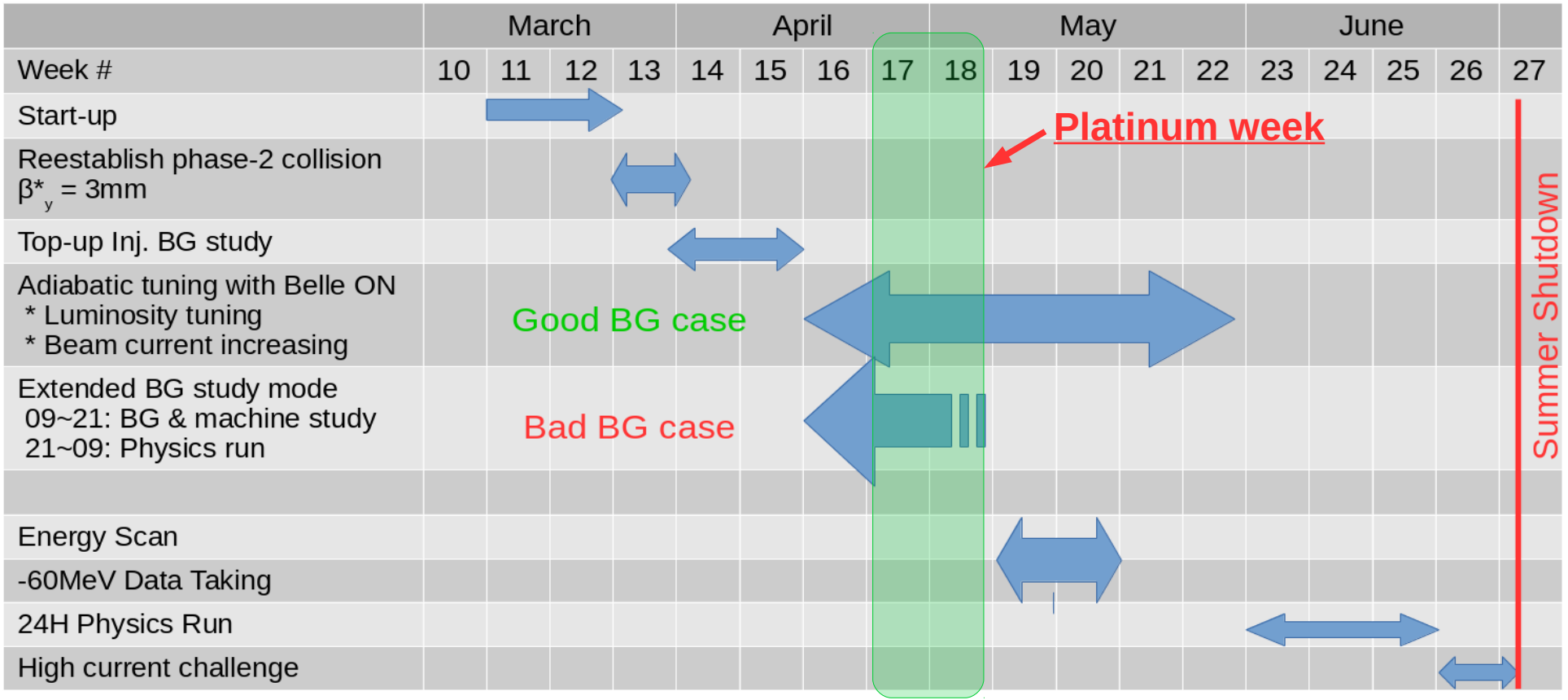
Run plan update(1)
Timeline: 2019.03 ~ 2019.06



No major update from 31st B2GM

Run plan update(2)

- Beam operation in platinum week(04.27 ~ 05.06)
  - CONTINUE beam operation for physics run.
  - DOES NOT perform risky study & tuning during platinum week due to lack of human resource for responding emergency.
  - Off-resonance operation during platinum week WOULD NOT BE realistic.
    - REMEMBER that we DOES NOT HAVE knowledge of energy scan operation after machine upgrade.
    - We HAVE TO discuss off-resonance & energy scan operation schedule for preparation.

Run plan update(3)

- Remarks
  - HAVE TO confirm function of reassembled & new installed devices.
  - HAVE TO perform vacuum scrabbling(20~100Ah).
  - Beam background situation MAY be changed due to reassemblage of final focus system.
    - QCS cryostat alignment error is reported(a few hundred micrometers / preliminary).
  - QC1* BPM cables are damaged after QCS insertion works.
    - Fast collision feedback WOULD be limited, however, it was not used in Phase-2 operation.
    - Slow orbit measurement is possible, but measurement accuracy WOULD be degreaded.
  - Start up operation schedule in March(~3weeks) DOES NOT contain buffer for trouble shooting.
    - MAY BE delayed due to troubles if occurred.

Run plan update(4)

Baseline(conservative) machine parameter target until next summer

Conservative	#1 (~2019.06)	
Ring	LER	HER
ε_x[nm]	2.0	4.6
$\varepsilon_y/\varepsilon_x$[%]	8.0	8.0
β^*_y[mm]	3	3
σ_z[mm]	6	6
I[A]	1.2	1.0
Number of Bunches	1576	
Bunch Current[mA]	0.761	0.635
σ^*_y[nm]	693	1051
ξ_y	0.0262	0.0272
L[$cm^{-2}\,s^{-1}$]	1.06 x 10^{34}	

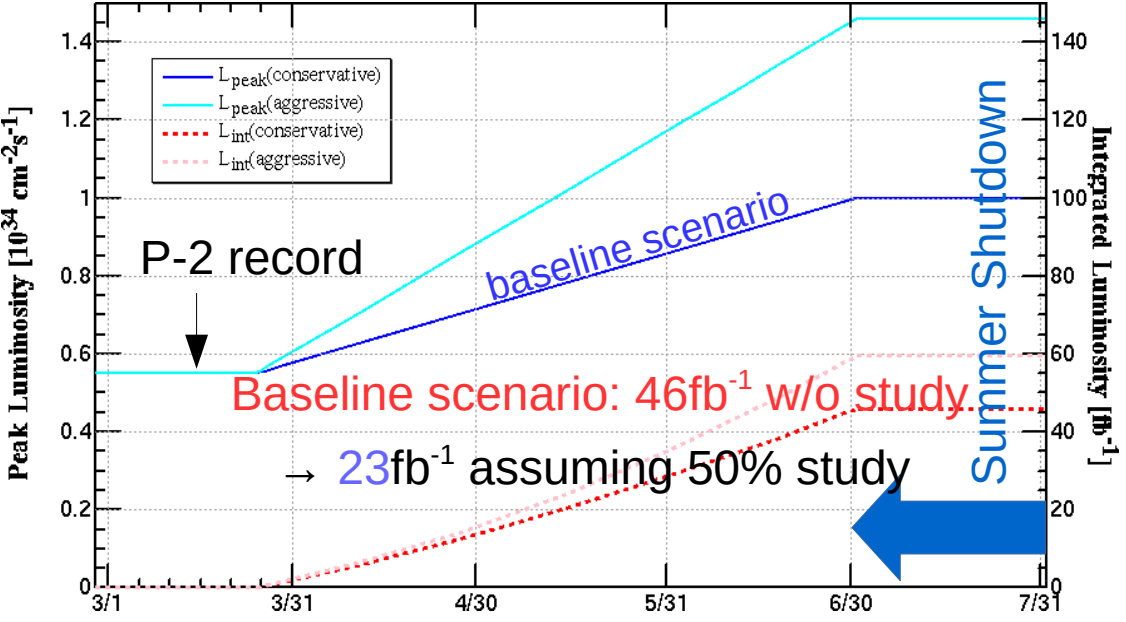
- β^*_y = 3mm collision is confirmed in Phase-2.
- Maximum stored beam currents are...
  0.858 / 0.788 A (LER/HER) in Phase-2
  1.010 / 0.879 A in Phase-1 w/o IP
- 1576 bunch operation is confirmed in Phase-2.
- Minimum colliding σ^*_y is 333 nm(ultra low bunch current).
- Maximum ξ_{y-} achieved in Phase-2 is 0.021.
- Maximum L_{peak} achieved in Phase-2 is 0.555 x 10^{34} $cm^{-2}s^{-1}$.

Run plan update(5)

Integral luminosity estimation until next summer

Assumptions of estimation:

- L_{peak} increases linearly during beam operation from Phase-2 record up-to baseline target performance.
- Efficiency $<L_{log}> / L_{peak}$ ~ 70%
- Belle works 24H during beam operation.(98days for 2019 spring run)
- Belle CAN take data with high beam current operation.(No BG limit)



Worst case scenario(bad BG case)

- No BG improvements from Phase-2.
- Log-able L_{peak} is limited by BG.
- $L_{peak\ limit}$ ~ 0.2 x 10^{34} $cm^{-2}s^{-1}$ (Ex. 2018.07.01 morning)

→ L_{int} in 2019 Spring ~ 11.8 fb^{-1} w/o study

→ 5.9 fb^{-1} assuming 50% study

We HAVE TO improve BG L_{peak} limit ASAP in order to achieve 10fb^{-1} with study margin.

Beam background study preparation(1)

- Study plan was proposed in MDI meeting.
  - Detail plan WOULD be discussed on MDI meeting.
- Beam collimator updates from Phase-2 to Phase-3:
  - Relocate D06H4 to D06H1.
    - LER phase-2 collimator configuration CAN NOT BE reproducible due to absent D06H4.
  - Replace damaged collimator head of D02V2 & D01V1.
  - Improve D01H4 collimator head cooling(Add booster pump for cooling water).
  - Install new collimators.
    - HER: D01H3(on going)
    - LER: D02H1, D02H2, D03H1 and D06V4(this February)

Beam background study preparation(2)

- Preparation of tuning knob(1)
  - Emittance control knob(ECK)
    - ECK based on global dispersion(iSize)
    - ECK based on arc localized dispersion(YaECK)
      - IP & source point dispersion IS NOT CHANGED in 1st order perturbation level(NOT confirmed by measurement).
      - Tuning range is SMALLER than “iSize” due to dispersion free constraints.
      - New skew quadrupole corrector(QKSF) WOULD extend tuning range, however, factor 2 improvement WOULD BE difficult due to matching constraints.

Beam background study preparation(3)

- Preparation of tuning knob(2)
  - Tilt knob at source point
    - REQUIRED in MDI meeting.
    - CAN prepare, however, development IS NOT STARTED at this moment.
      - It CAN NOT BE guaranteed whether tuning range is sufficient.
    - LER source tilt knob MIGHT change coupling/dispersion at injection point.
      - LER injection tuning/background WOULD be interfered.
    - HER source tilt knob MIGHT change coupling/dispersion at OHO straight section(wiggler & ARES cavity).
    - Source tilt knob MIGHT interfere with tuning range of “YaECK” due to parameter conflict.

Backup

Rough plan after 2019.10

- 2019.10
  - Start-up + Reestablish collision: 2~3weeks
- 2019.11
  - Adiabatic tuning
  - β*y = 2 mm collision trial?
- 2019.12 ~ 2020.01
  - Adiabatic tuning
  - Winter Shutdown: 2.5~3weeks (+ extra operation interrupt due to power receiving line maintenance?)
  - Restart collision: 1.5~2weeks
- 2020.02 ~ 2020.06
  - Adiabatic tuning
  - Adiabatic β*y squeezing trial down to 1.x mm & collision trial
- 2020.07 ~ 2020.12 or 2012.01
  - Extended summer shutdown for Belle II detector works.