

CLOSING-

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- Status Summary
 - What's next ?
- Comments & Discussions for each beam line / physics goals
 - HIHR
 - K1.1
 - K10
 - high-p

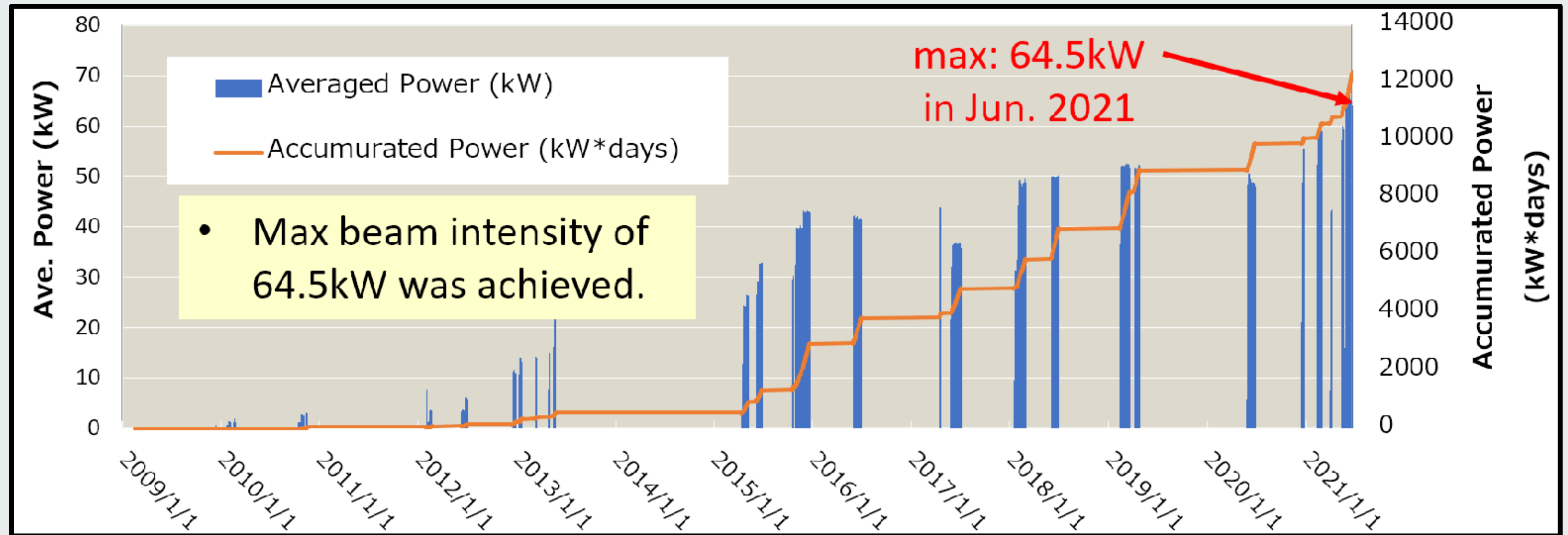
RECENT ACTIVITIES

- Workshops
 - K10 WS : June 7 - 9
 - HIHR & K1.1 WS : June 17 - 19
 - This WS : July 7 - 9
- Proposals
 - $S\pi K$ Project @ HIHR
 - Λp scattering @ K1.1
 - Ω Spectroscopy at K10

SX BEAM POWER

- Achieved 64.5 kW with New T1 target.
- PS replacement in a long shutdown in 2021 - 2022.

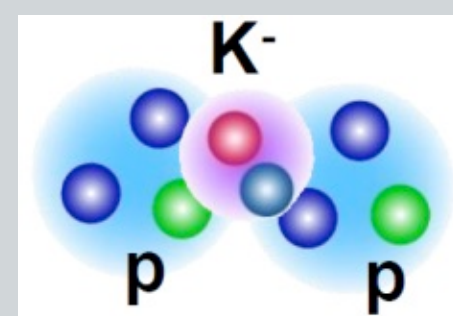
Max. 64.5 kW



Present Hadron Experimental Facility (HEF)

HD-EXT21

- $< 1.1 \text{ GeV}/c$
- $\sim 5 \times 10^5 \text{ K}^-/\text{spill}$
- **Kaon in nuclei**

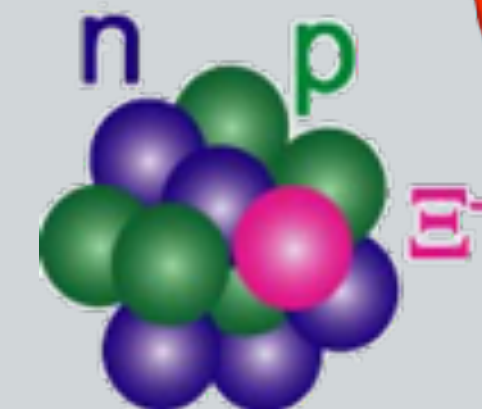


K1.8BR

K1.8

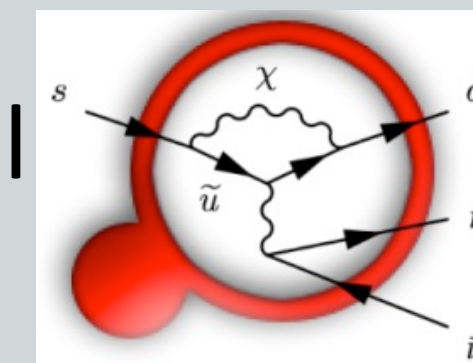
56 m

- $< 2.0 \text{ GeV}/c$
- $\sim 10^6 \text{ K}^-/\text{spill}$
- **S=-1 and S=-2 hypernuclei**



KL

- 16 deg extraction
- $\sim 2.1 \text{ GeV}/c \sim 10^7 \text{ K}_L^0/\text{spill}$
- **$K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$**



- Au Target
- $< 95 \text{ kW}$

T1 target

high-p

- *launched in 2020*
- 30 GeV proton $\sim 10^{10}$
- $< 31 \text{ GeV}/c$ unsepa. $\pi \sim 10^7$
- **Hadron physics**



- 30 GeV proton beam
- 65kW (7×10^{13} ppp, 5.2s)
- [as of 2021, June]

COMET

will start in 2023

- μ^- beam
- **μ -e conversion**

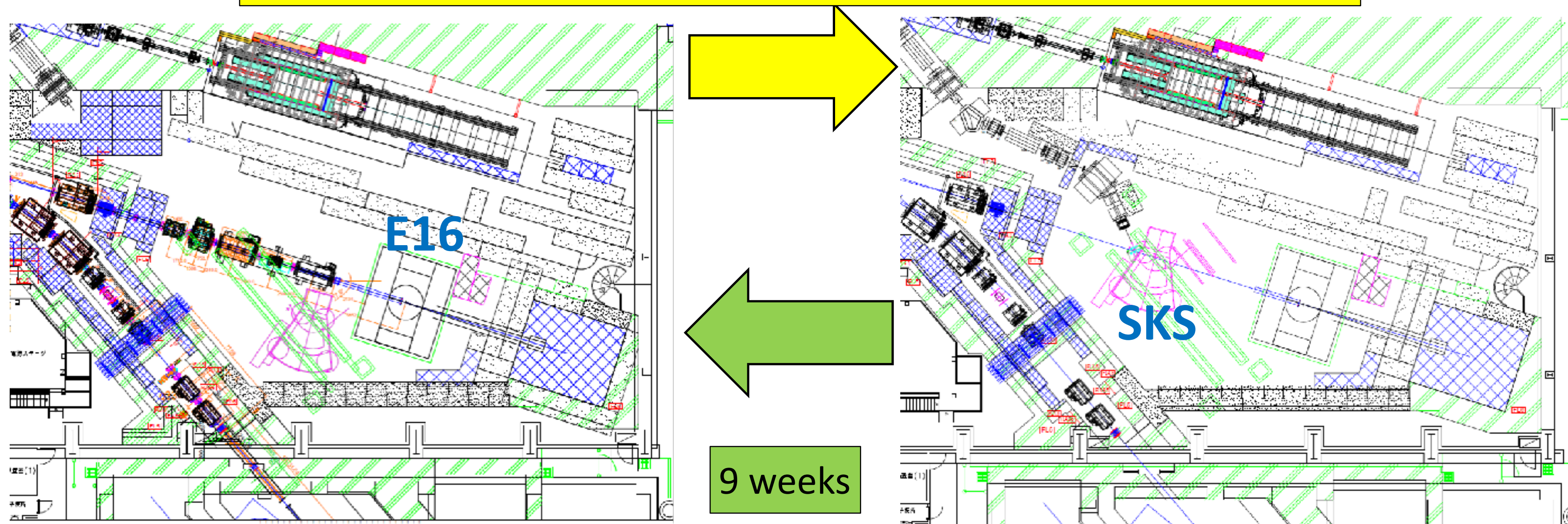
K1.1 in the current Hadron Hall

Space & time sharing operation with high-p has been planned.

high-p E16 mode (present)

K1.1+SKS mode

6 months (including construction of BL & cryogenic facility for SKS)
15 weeks (if BL and cryogenic facility are ready)



Operation of not only high-p/K1.1 but also A(K1.8/K1.8BR/KL) /C(COMET) lines during these change-over period is difficult in the Radiation Permission point.

Change-over time & cost will give considerable effects to the whole program of HEF

A lot of Programs at K1.1/high-p BLs

stage-1

stage-2

- high-p (30 GeV primary proton beam)
 - E16 (ϕ -meson mass in nuclei by e^+e^-) Run-1 (53.3 days) + Run-2 (106.7 days)
 - new proposal to measure K^+K^- decay mode [P88] 30 days
- high-p (secondary beams)
 - E50 (charmed baryon spectroscopy) ~200 days (~3 years)
 - E79 ($I=3$ dibaryon resonance) 15 days
 - Λp scattering at high momentum [LOI]
- J-PARC HI (heavy ion beam at high-p BL) [new proposal P87]
- K1.1
 - E63 (γ -ray spectroscopy of ${}^4_\Lambda\text{H}({}^3_\Lambda\text{H})$ and ${}^7_\Lambda\text{Li}$) 60 days
 - E18 (weak decay of Λ -nuclei)
 - E29 (ϕ -meson in nuclei) 80 days
 - new proposal for Λp scattering [P86] 30+30 days
 - γ -ray spectroscopy (mirror/med.-heavy Λ -nuclei) several months / 15 days
 - next exp. for Λp / Λd scattering
 - weak decay of ${}^4_\Lambda\text{H}$ via the (π^-, K^0) [revised P74]
 - β -decay [LOI]

To carry out these experimental program **efficiently** and **maximize outputs**, new K1.1 which can be **simultaneously operated** is necessary.

- Hadron Hall experiments are doing well at 65 kW with K1.8/BR, KL, and high-p/COMET
- In MLF, the g-2/EDM budget request will be submitted.

ARE WE READY ?

- Science Council of Japan : Master Plan 2020; selected as one of 31 large important projects.
- MEXT Roadmap 2020; selected as one of 15 important projects.
- Should be included in KEK-PIP in the next revision, for the KEK budget request in JFY2022.

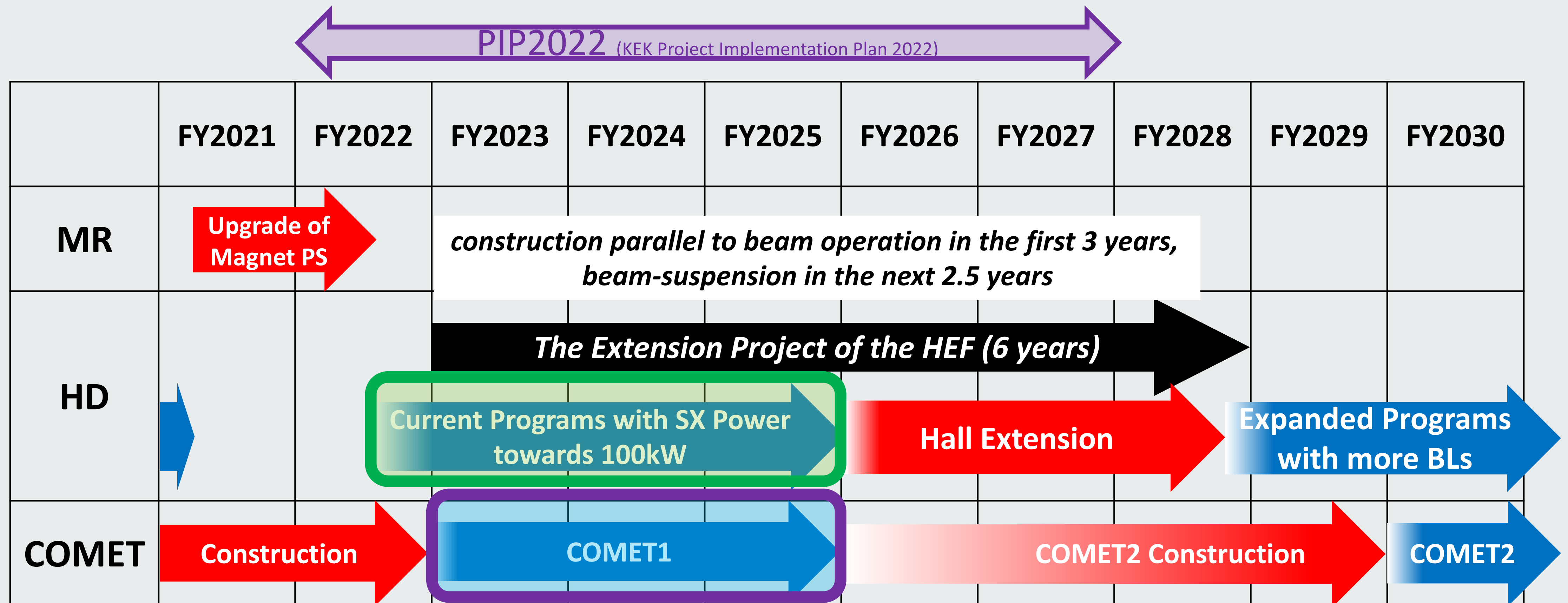
Yes we are !

- Focused review in IPNS in August, 2021

FOCUSED REVIEW AT IPNS

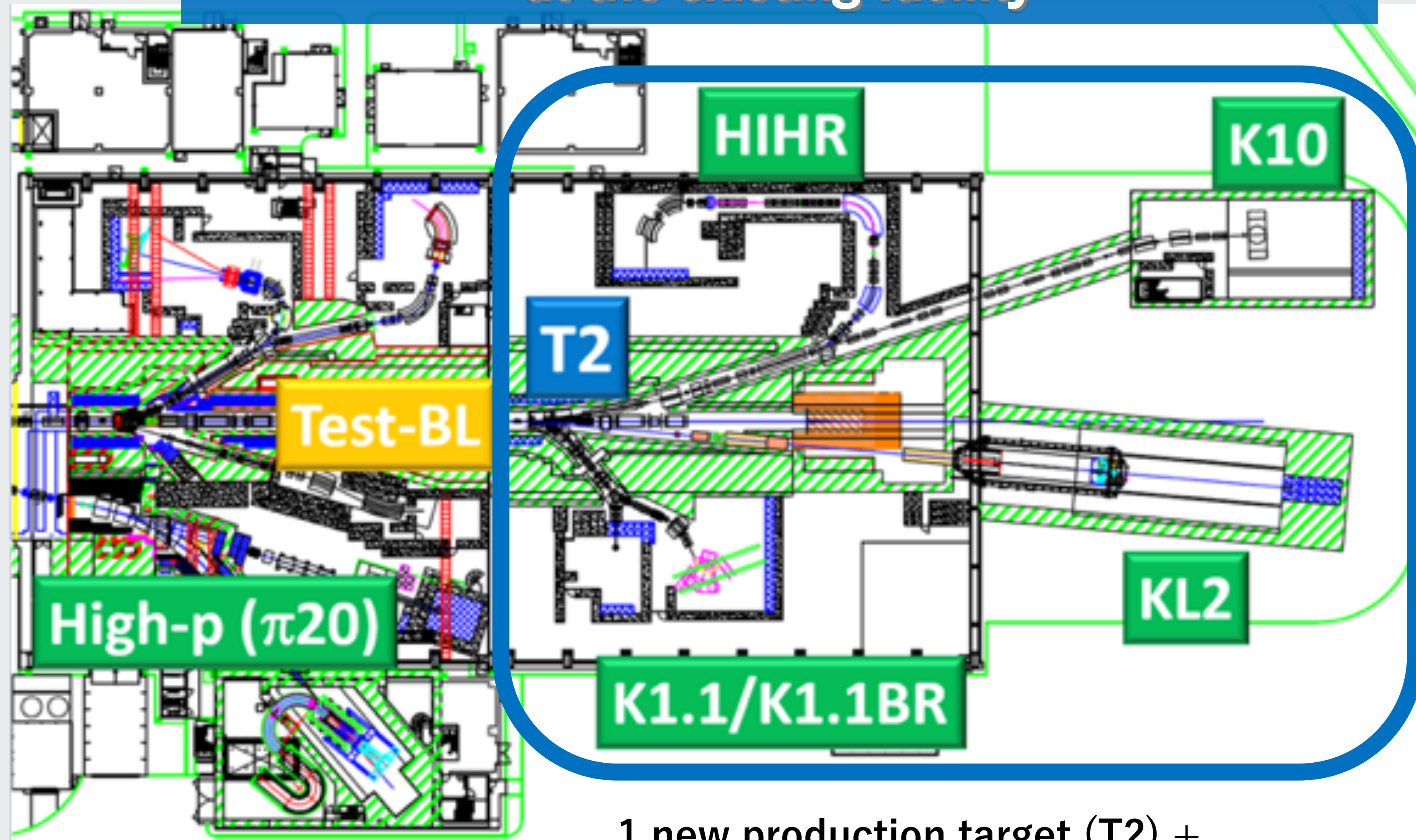
- Chair : T. Hatsuda
 - Monika Blanke, Marek Karliner, Matthew Moulson,
 - Josef Pochodzalla, A. Ohnishi, K. Miyabayashi
- 1st meeting in August 10, 11, 16

Timeline with the current programs



- We would like to start the project from FY2023
 - 4 years operation before beam suspension (except for COMET)
 - 3 years operation for COMET (Beamline completion in FY2022)

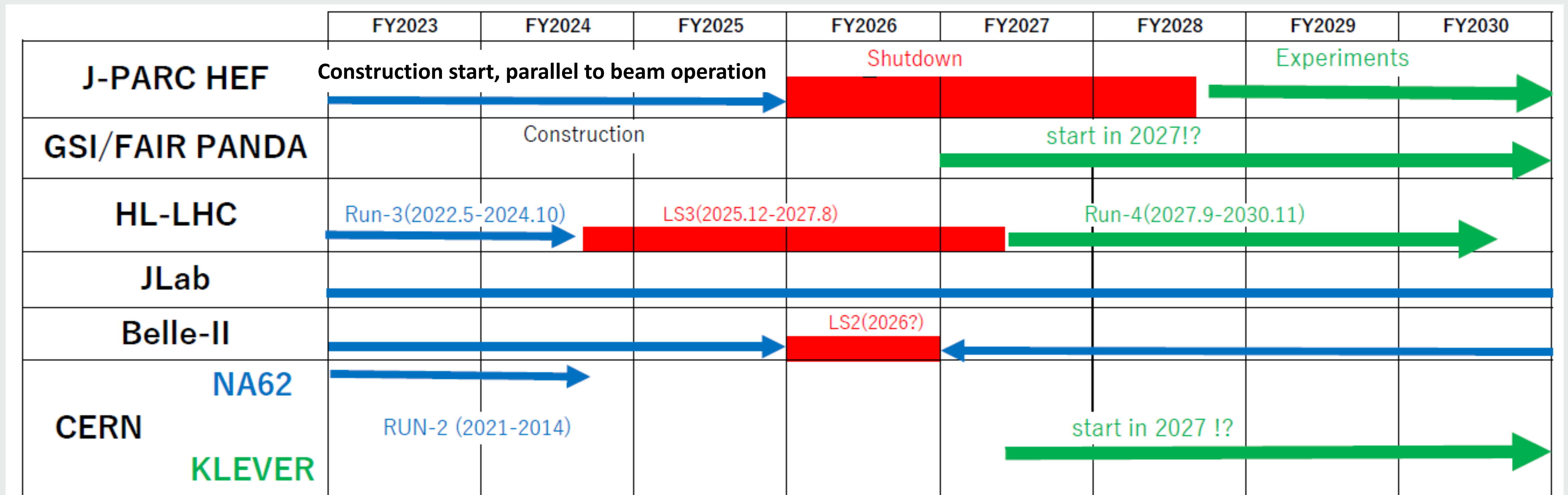
**Open new physics that cannot be implemented
at the existing facility**



1 new production target (T2) +
2 modified beamlines (High-p ($\pi 20$), Test-BL)
4 new beamlines (HIHR, K1.1/K1.1BR, KL2, K10)

Urgency of the Project

Super J/ ψ Factory ?



Around after 2027, FAIR-PANDA, HL-LHC, and KLEVER will start their operations
→ To keep leading position in the field, early realization of the project is needed



COMMENTS & DISCUSSIONS

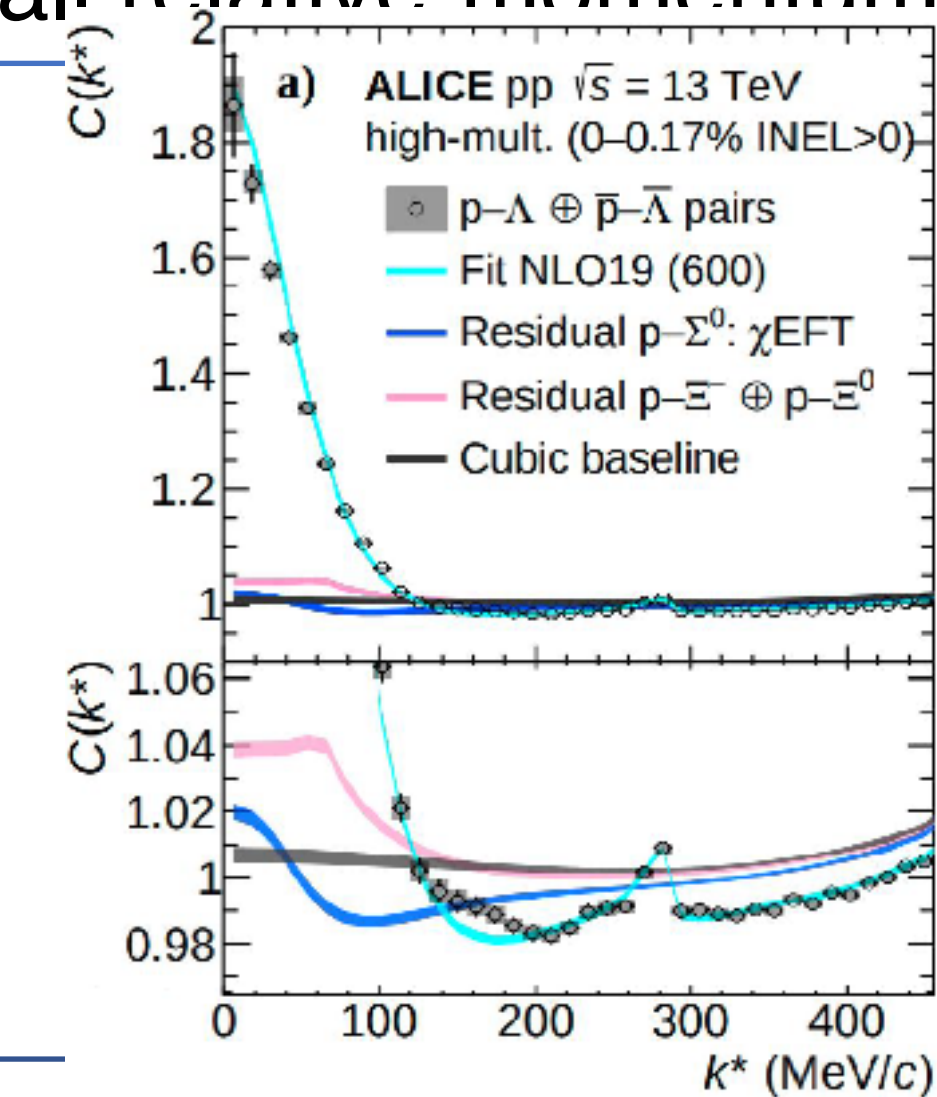
STRANGENESS NUCLEAR PHYSICS

- Hyperon Puzzle
 - HAL-QCD, Ch-EFT ; in short range
 - 3-Body-Force : S, T, p dependence
 - in Heavy Nuclei ?
 - Single-particle Energy, B_{Λ}^s , in Heavy Systems ; Unique probe.
 - HIHR ; $\Delta E = 400$ keV enough ?
- How about K1.1 ?
- Multi-Strangeness with S-2S
 - $S = -2$, $\Xi N - \Lambda\Lambda$

Femtoscscopy from HIC

- ✓ High statistics
- ✓ Correlations for many baryon pairs and baryon-meson pairs
 - Big advantage in baryon pairs with multi strangeness which are difficult to study the direct scattering experiment
- ✓ Sensitive for small relative-momentum region (S-wave region)
- Spin averaged information is obtained.
- No differential information

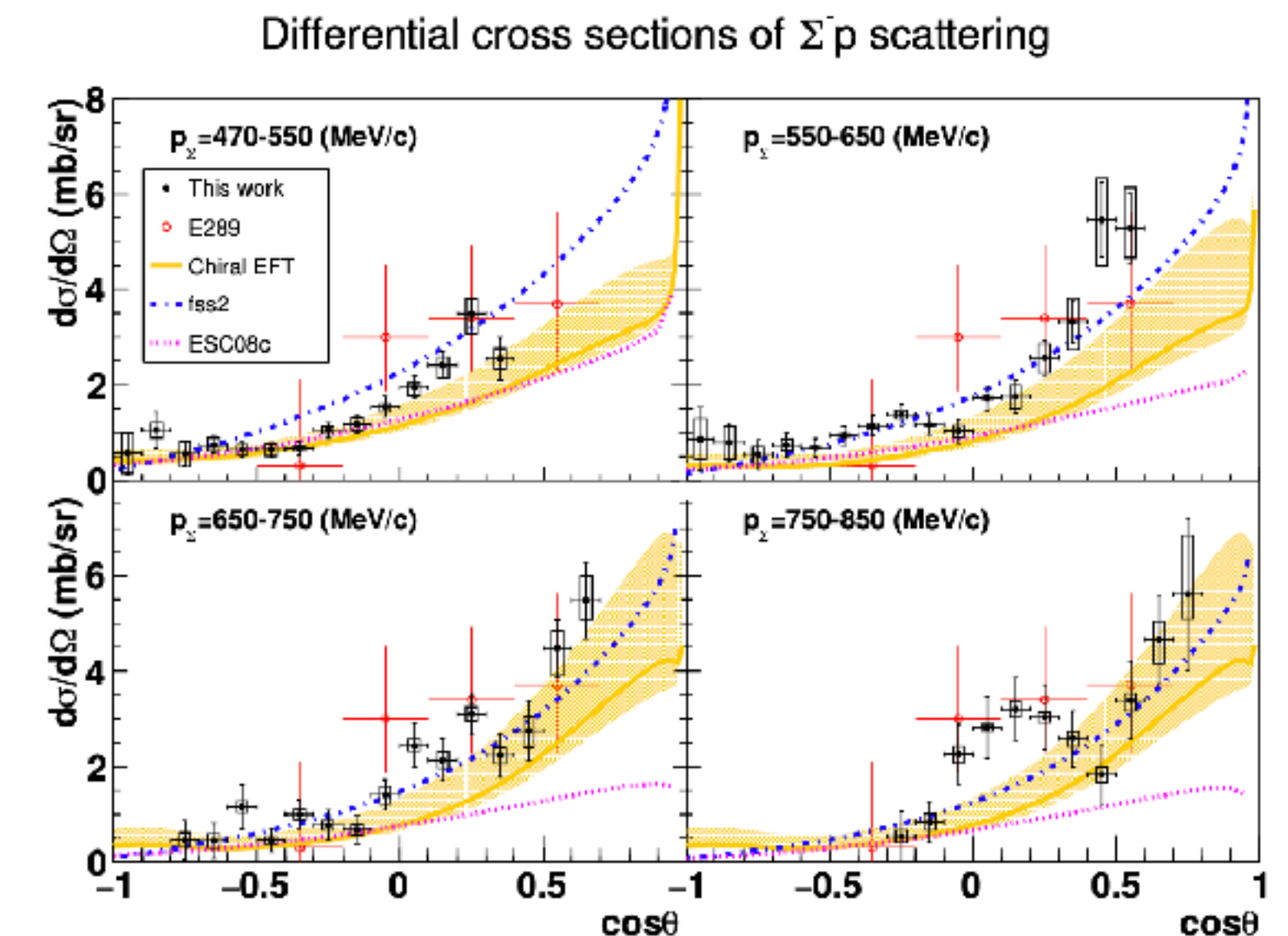
Small relative-momentum region



Yp scattering experiment at J-PARC

- ✓ Experimental condition is controllable
 - ▣ Beam momentum → Interaction at short range should be studied by higher energy hyperon beam up to ~ 1.5 GeV/c
 - ▣ Beam spin, scattered hyperon's spin
- ✓ Differential information can be obtained.
 - ▣ Differential cross section.
 - ▣ Spin observables
 - Measurement of these multi observables can be connected to phase shift analysis
- ✓ Higher waves can be studied.
- Statistics is smaller than femtoscopy in many cases.
- Low energy scattering is experimentally difficult.
- YY scattering is impossible.

Intermediate energy region



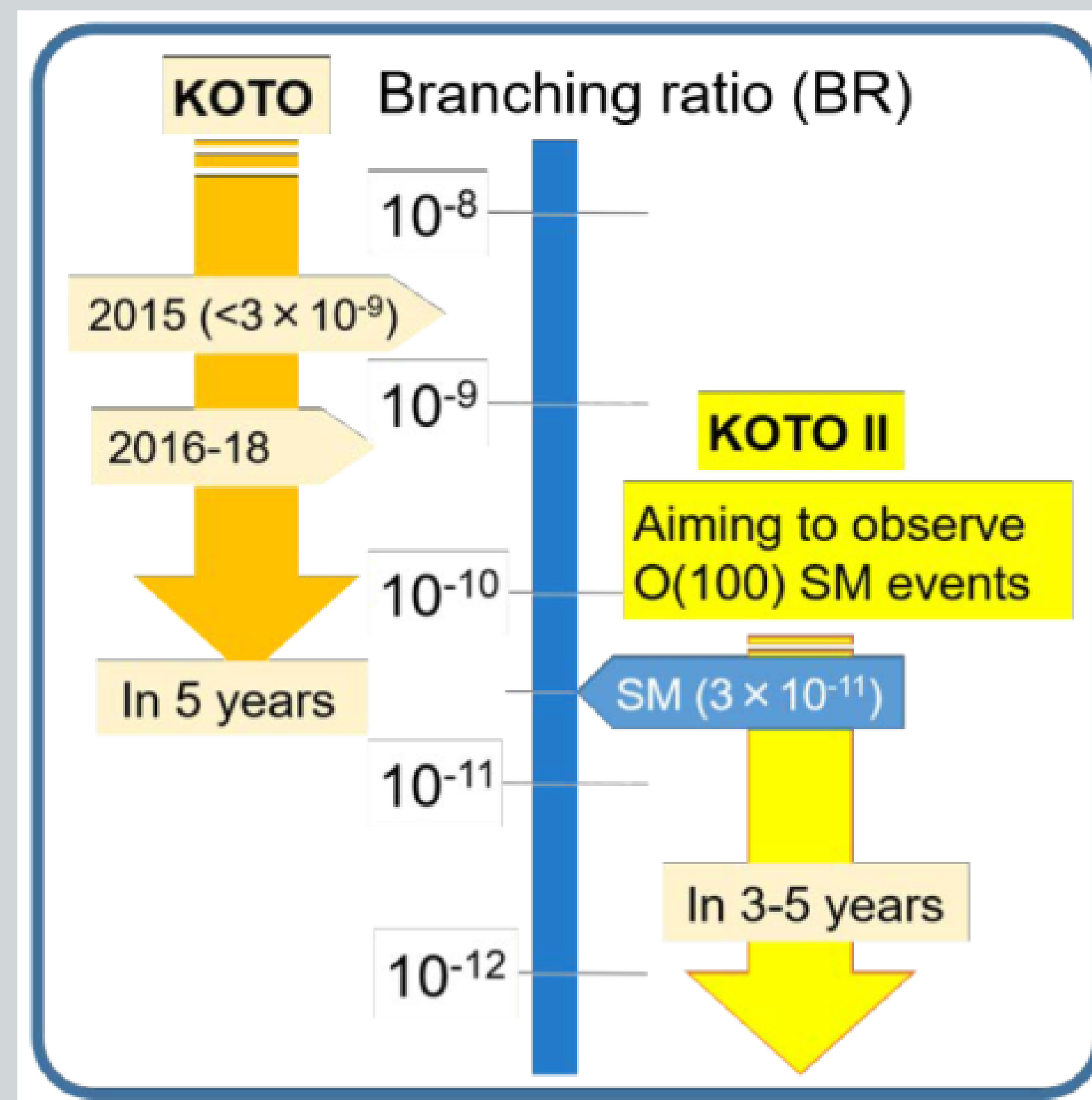
HADRON PHYSICS

- Hadron Spectroscopy
 - Ξ^* , Ω^*
 - Charmed baryons
- (High-p beam line)
 - φ in nuclei
- Technical Feasibility of K10
Trigger & DAQ

- KL2 beam line & KOTO2

- KL intensity

- Goal



Discussion on KOTO2

- T1/T2 beam loss
 - KOTO2 requests 100-kW beam at T2.
 - Share of beam loss between T1 and T2
 - T1-target design with variable beam loss is good idea?
 - Shield at the target should be designed to accept possible loss.
 - 150-kW beam to hadron experimental facility is desirable.
- Length of KL2 beamline
 - A 43-m-long beamline is a current design in the KOTO2 sensitivity studies.
 - Shorter is better to gain acceptance of beam and to reduce decay-loss of KL.
 - KOTO2 considers 43 m is feasible.
 - Any conflicts between KL2 and other beamlines?
- Additional iron shield behind dump
 - 7-m thick additional iron shield is required instead of part of concrete shield behind the main dump body to reduce punch-through muon rate.
 - Design of the dump area including the additional shield is required.

