

Physics Motivation

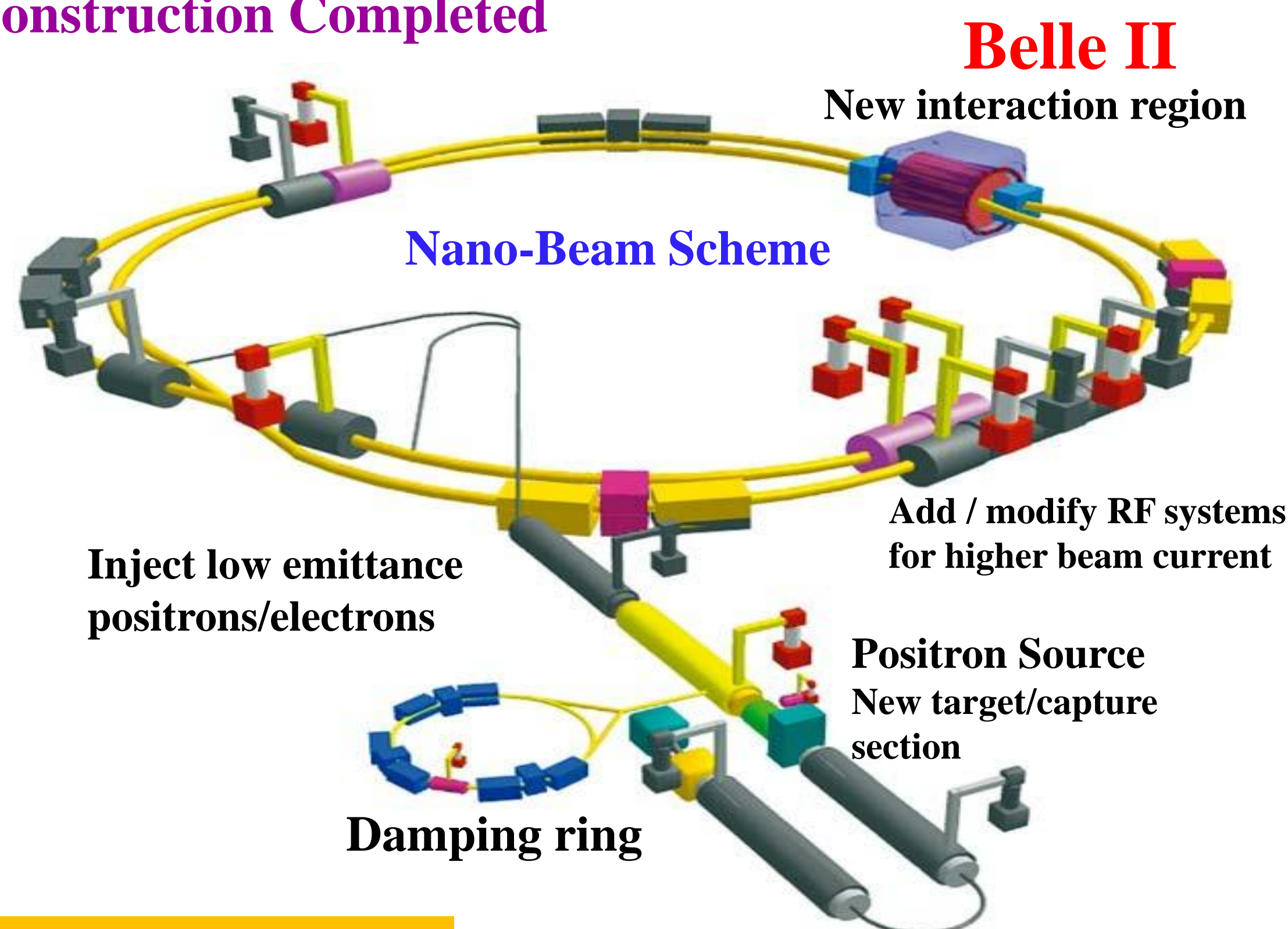
- First generation B factories using e^+e^- asymmetric colliders: Belle experiment at KEKB collider in KEK, BaBar experiment at PEP-II collider in SLAC
- L_{int} : 1.5 ab^{-1} at center of mass energy of $\Upsilon(4S)$.
- Major milestone achieved: experimental evidence of the CKM mechanism as a source of CP violation (CPV) in the Standard Model (SM), which confirms the structure of quark flavor sector.
- New Physics: flavor-changing neutral currents (FCNC), lepton favor violation (LFV), and new sources of CPV.
- ➔ High precision measurements require large statistics.
- Next generation B-factory experiment: Belle II @ SuperKEKB Major upgrade of Belle @ KEKB.
- ✓ Designed luminosity of SuperKEKB: $8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ 40 times higher than KEKB
- ✓ Expected L_{int} of Belle II is 50 ab^{-1} 50 times higher than Belle
- ✓ **Belle II will provide improved tracking and better particle identification as compared to Belle**
- ✓ **Search for NP beyond the SM**

SuperKEKB

$$e^+ (4 \text{ GeV}) + e^- (7 \text{ GeV}) \rightarrow B\bar{B} \text{ at } \sqrt{s} = 10.58 \text{ GeV } (\Upsilon(4S))$$

Designed luminosity = $8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$

Construction Completed

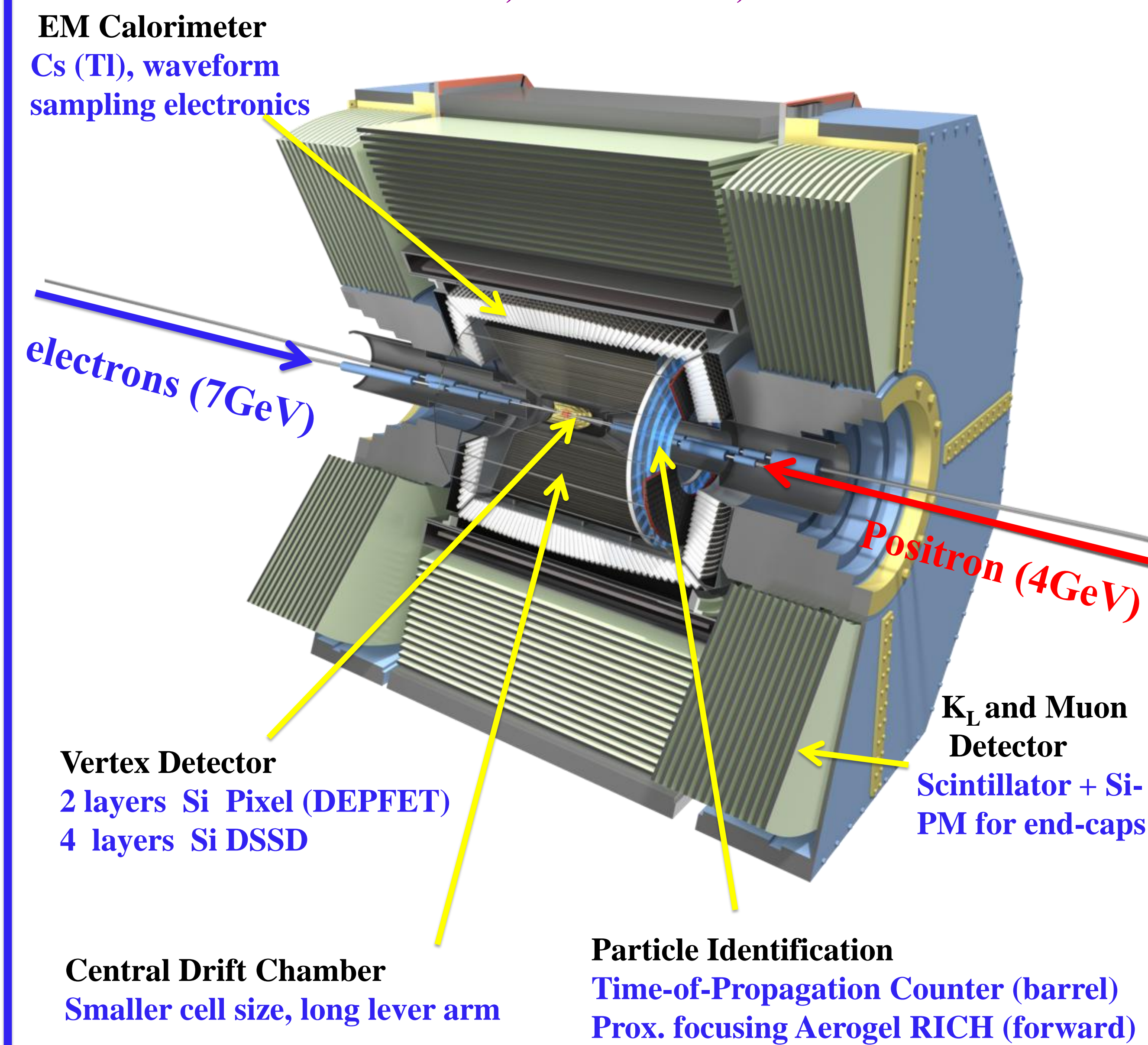


KEKB to SuperKEKB

S. No.	Parameters	KEKB	SuperKEKB
1.	Beam Energy (GeV)	3.5/8.0	4.0/7.0
2.	Crossing angle (mrad)	22	83
3.	Vertical beta functions at IP (mm)	5.9/5.9	0.27/0.30
4.	Beam currents (A)	1.6/1.2	3.6/2.6
5.	Luminosity ($\text{cm}^{-2}\text{s}^{-1}$)	2.1×10^{34}	8×10^{35}

Belle II Detector

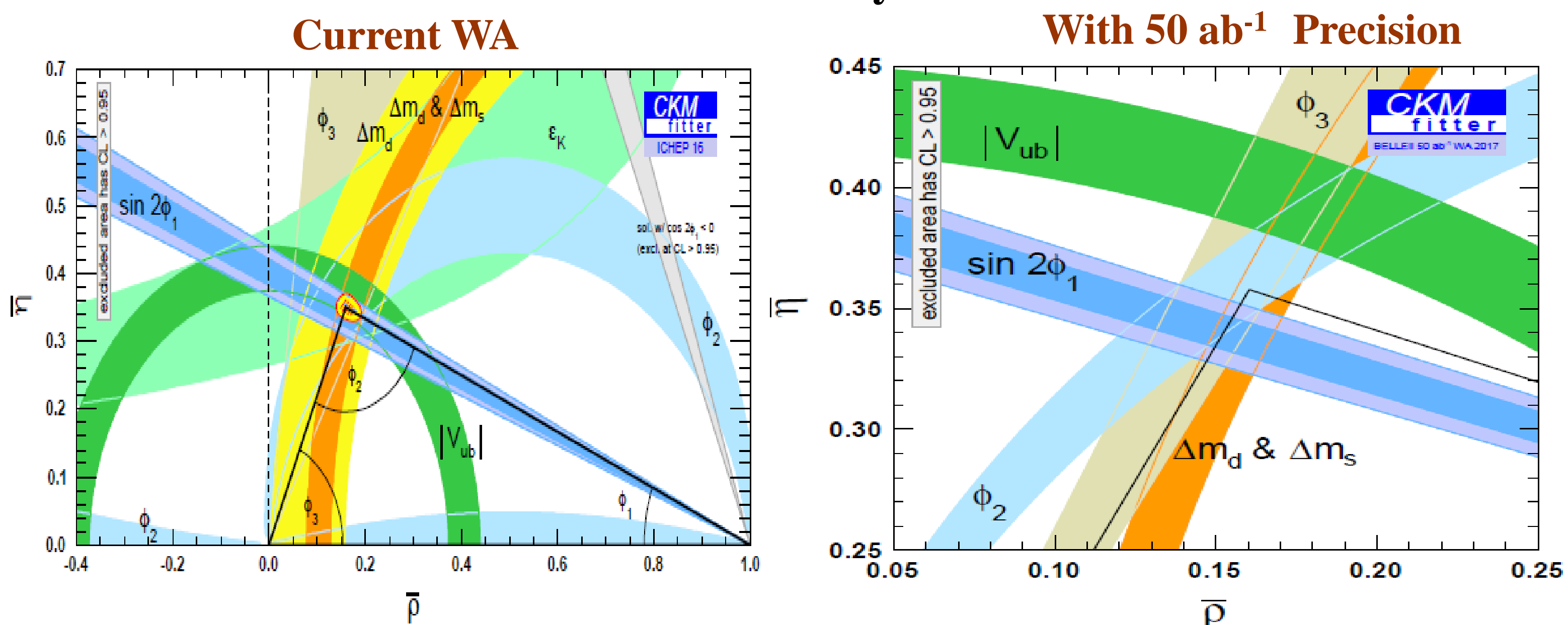
750 Collaborators, 101 Institutes, 23 Countries



➔ Improved tracking and better particle identification with Belle II

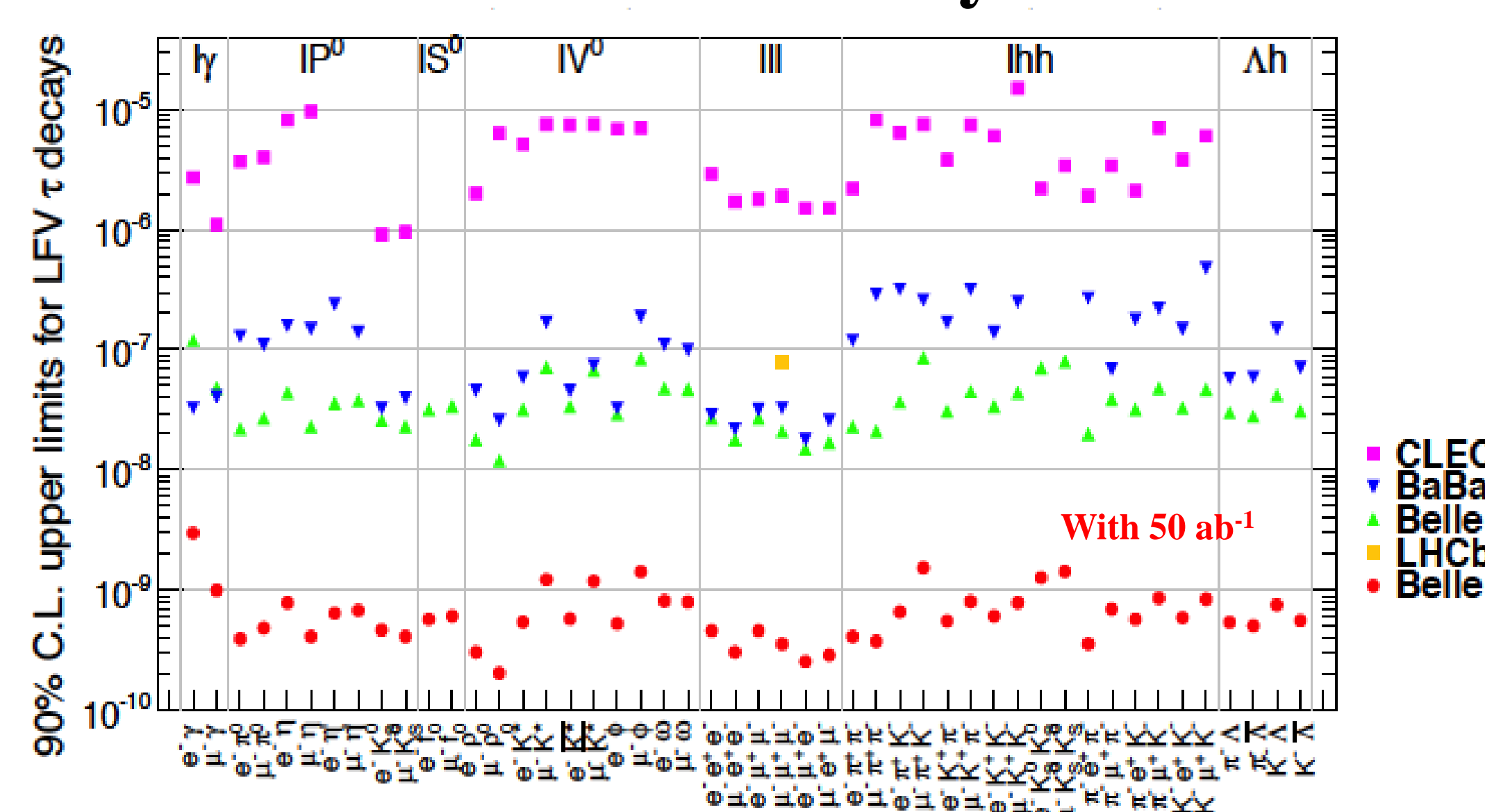
Physics at Belle II

Precision Test of the CKM Unitarity



New Physics also includes rare B decays, charm physics, dark sector and spectroscopy.

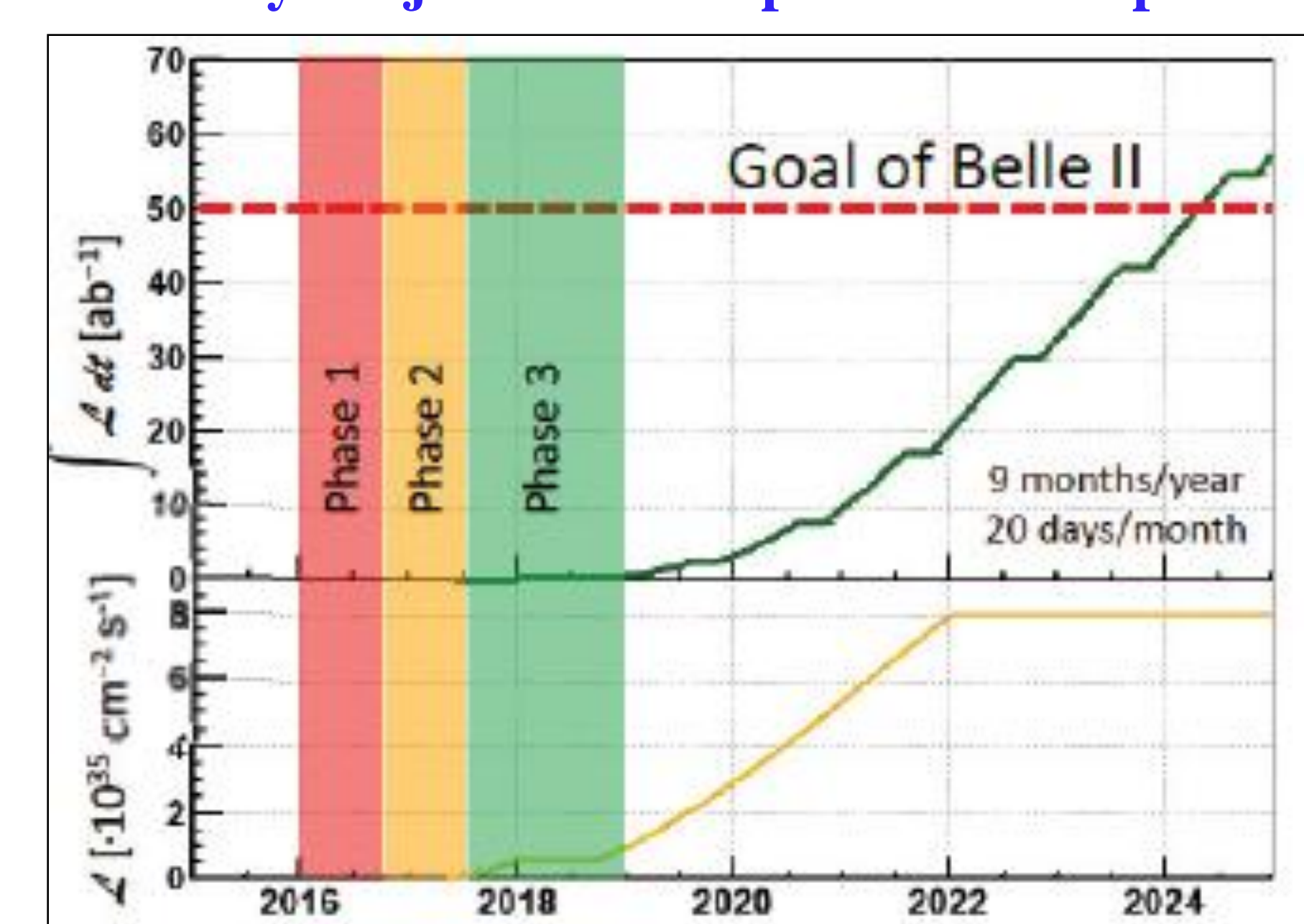
LFV in τ decays



Status and Schedule

- **Phase 1 (2016)**: Simple commissioning detector "BEAST" was used to measure and understand the background levels.
- **Phase 2 (2018)**: First data taking (without vertex detector).
- **Phase 3 (2018-2024)**: Full physics will start using complete detector system

Luminosity Projection and Operation of SuperKEKB



Summary

- At the SuperKEKB, e^+ and e^- collisions will reach the unprecedented instantaneous luminosity of $8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$.
- The upgraded Belle II detector will face the higher level of backgrounds with improved tracking and particle identification.
- The detector commissioning has started in 2016 (phase 1) and the full dataset of 50 ab^{-1} will be collected between the years 2018 to 2024.
- The physics program will include the new sources of CP violation, rare B decays, LFV, charm physics, dark sector and spectroscopy.

References

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- T. Aushev et al., "Physics at Super B Factory", KEK Report 2009-12, BELLE2-REPORT-2016-002, arXiv:1002.5012 [hepex].
- Bennet, "Belle II Physics Prospects, Status and Schedule" Journal of Physics Conference Series 770 (2016) 012044.

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