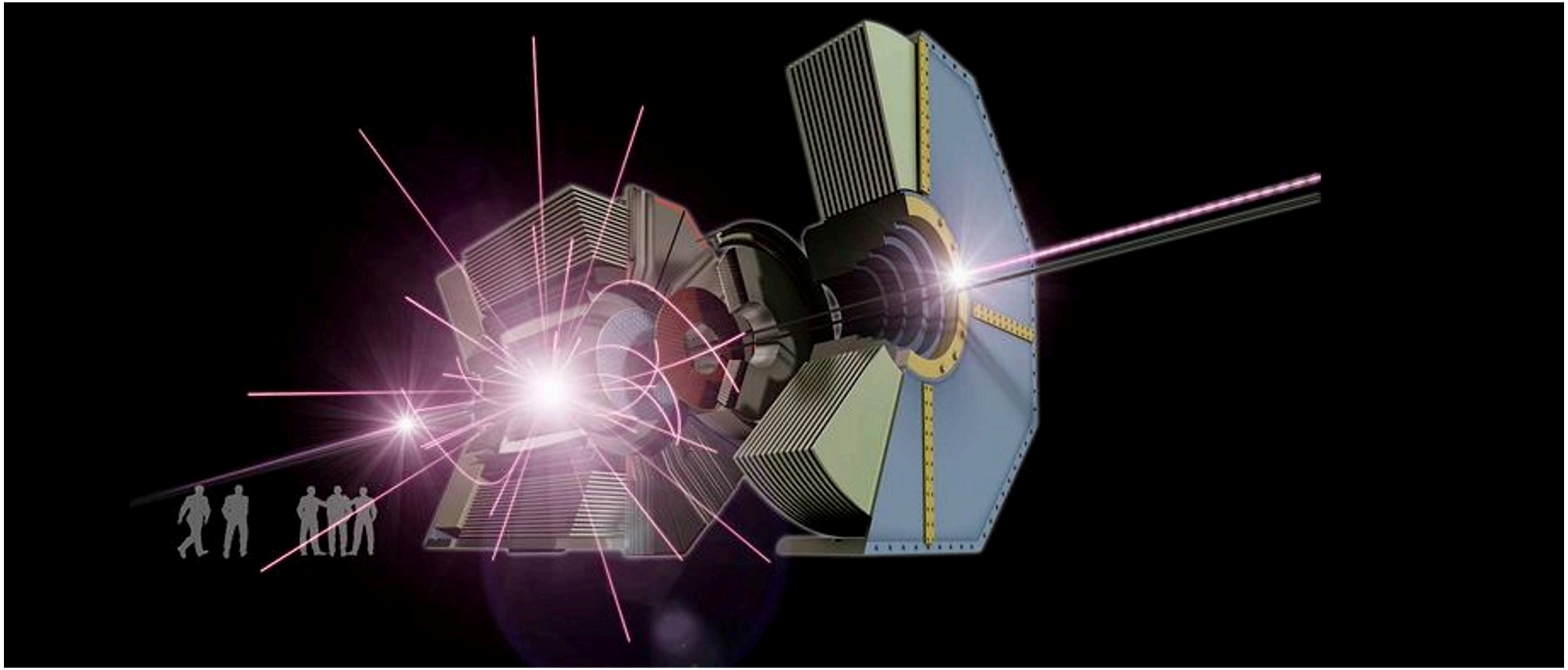
F. Le Diberder
on behalf of the
LAL-IPHC team

Belle II

@



The present proposal is :

for LAL-IPHC to join Belle-II as a long term commitment

It covers mostly **the initial period 2017-2018-2019** of the ramping up of the activities. We expect the team to enlarge and expand its responsibilities later (no commitment yet).

The proposal concerns **only Belle-II**, although it should be put in context, and thus other activities not belonging to the present Belle-II proposal will be mentioned.

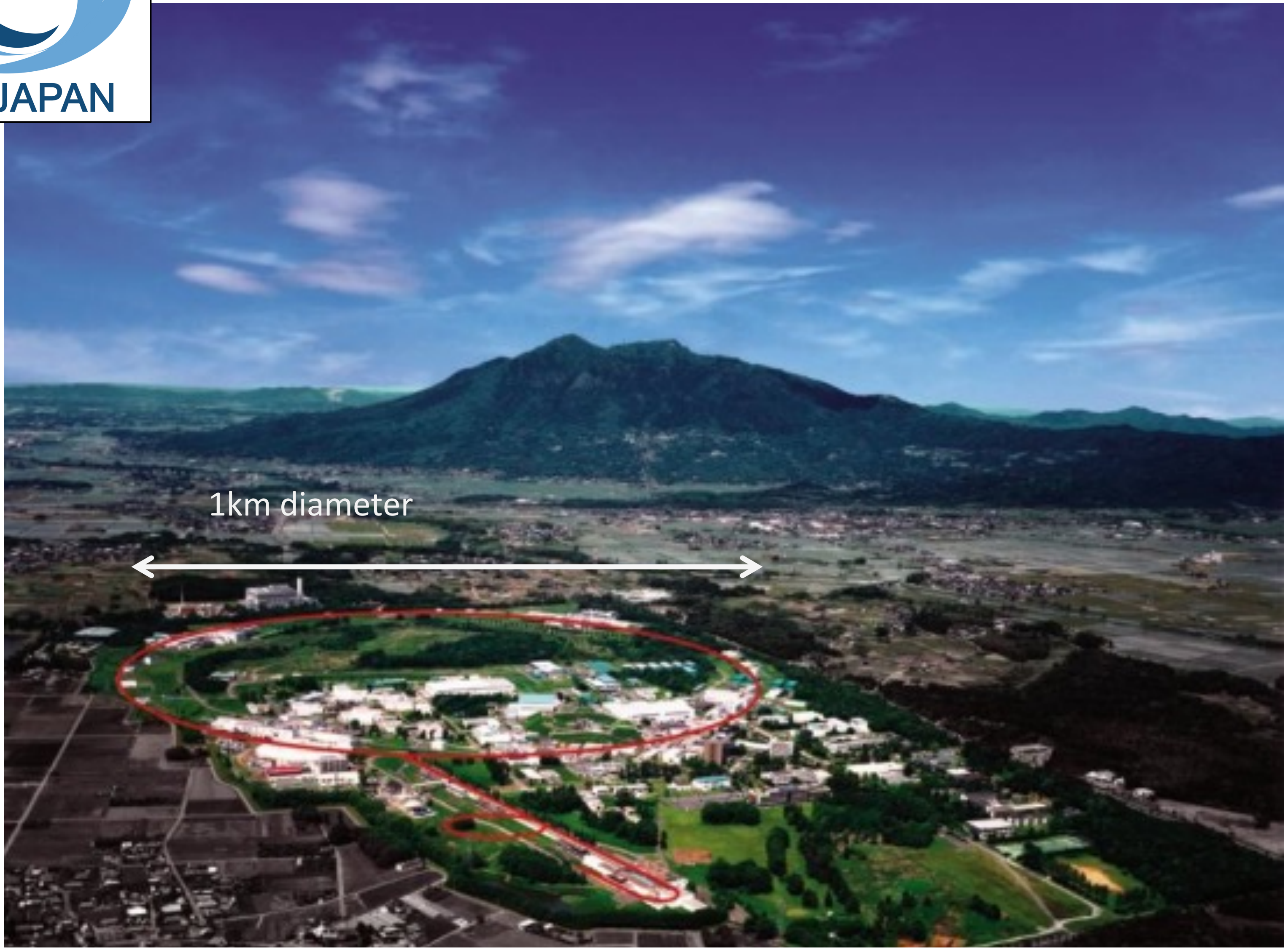
The understanding should be that the commitment of LAL-IPHC is meant for the full Belle-II project (far beyond 2019) and should represent quickly the main activity of the members of the team.

Scientific Council LAL : 22 May
Scientific Council IPHC : 8 June
Belle-II Institutional Board : 19 June

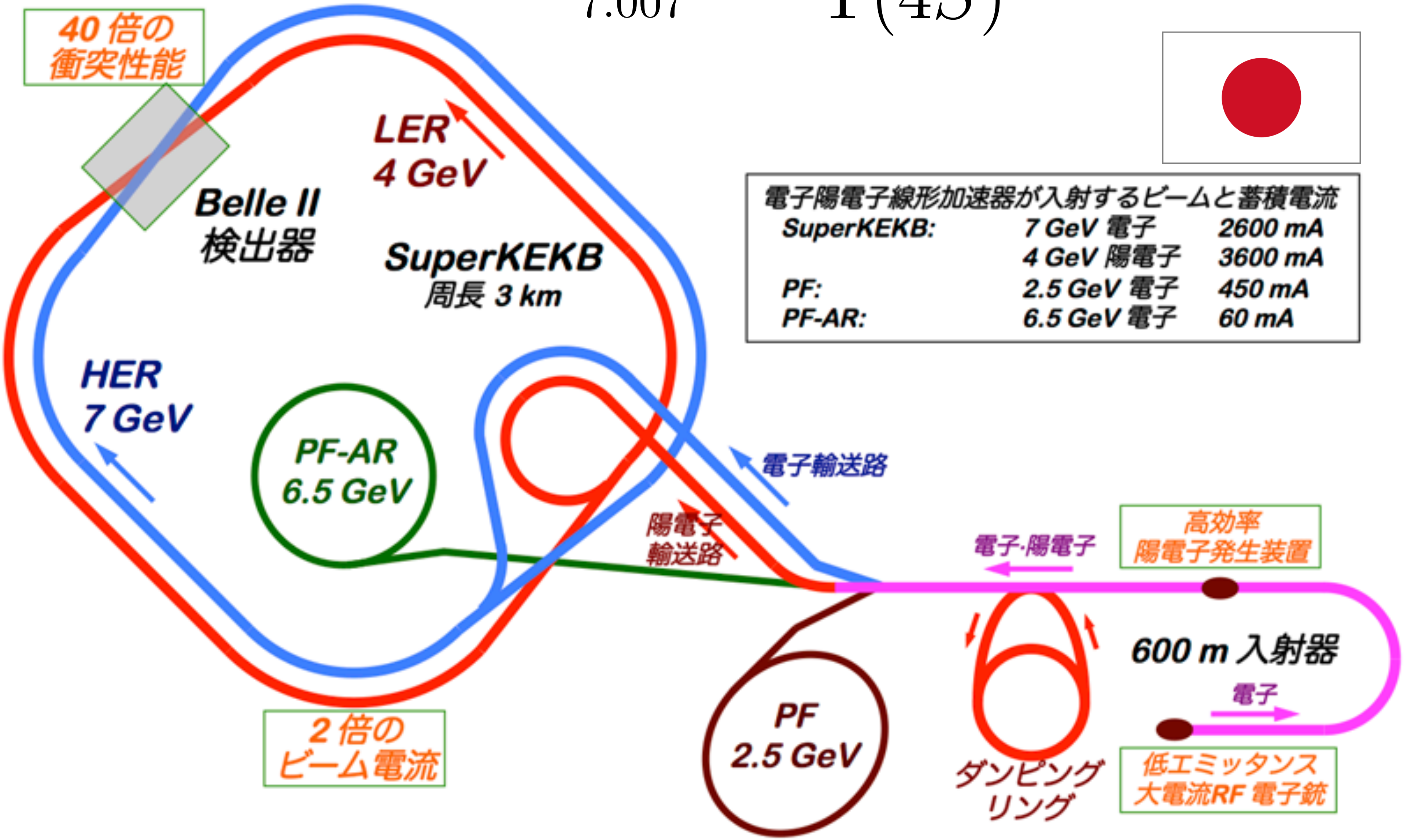
APPROVED enthusiastically

SuperKEKB

KEK-JAPAN


1km diameter

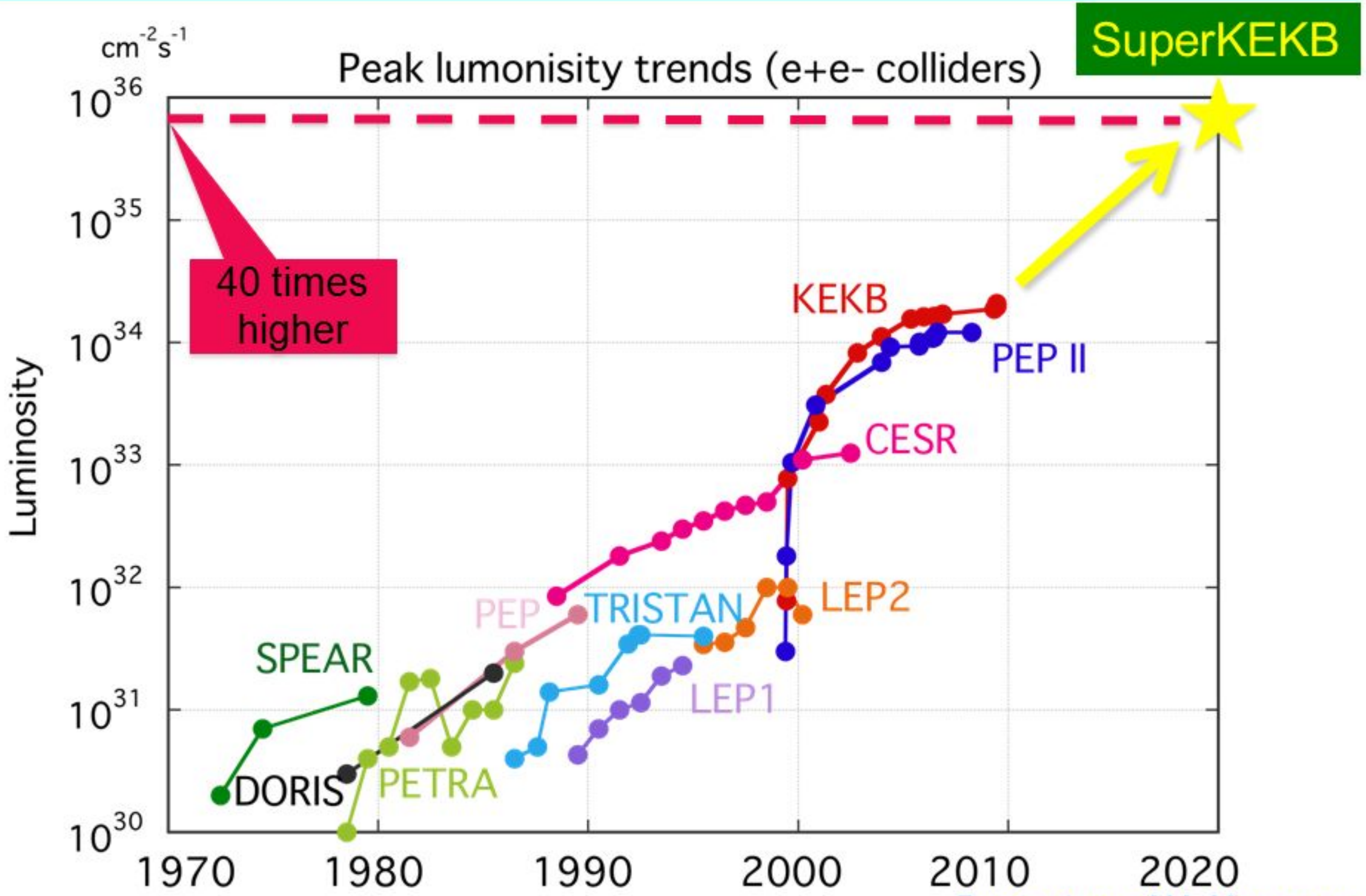
$$e^{-}(\underset{7.007}{7\mathrm{GeV}})\ \overset{83\ \mathrm{mrad}}{\underset{\Upsilon(4S)}{\longrightarrow\!\longleftarrow}}\ e^{+}(4\mathrm{GeV})$$


40 倍の
衝突性能
LER
4 GeV
Belle II
検出器
SuperKEKB
周長 3 km
HER
7 GeV
PF-AR
6.5 GeV
電子輸送路
陽電子
輸送路
電子·陽電子
高効率
陽電子発生装置
600 m 入射器
電子
PF
2.5 GeV
ダンピング
リング
低エミッタンス
大電流RF 電子銃
2 倍の
ビーム電流

電子陽電子線形加速器が入射するビームと蓄積電流

SuperKEKB:	7 GeV 電子	2600 mA
	4 GeV 陽電子	3600 mA
PF:	2.5 GeV 電子	450 mA
PF-AR:	6.5 GeV 電子	60 mA

Luminosity trend



By courtesy of M. Masuzawa

How to increase the luminosity?

Lorentz factor

Beam current

Beam-beam parameter

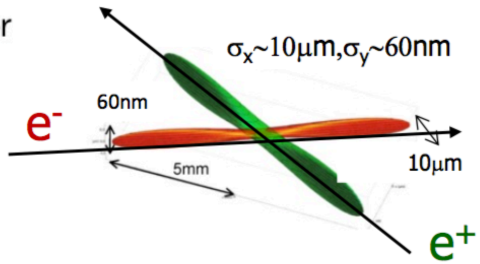
$$L = \frac{\gamma_{e\pm}}{2er_e}\left(1+\frac{\sigma_y^*}{\sigma_x^*}\right)\left(\frac{I_{e\pm}\xi_y^{e\pm}}{\beta_y^*}\right)\left(\frac{R_L}{R_{\xi_y}}\right)$$

Lumi. reduction factor
(crossing angle)&
Tune shift reduction factor
(hour glass effect)
0.8 - 1
(short bunch)

Classical electron radius

Beam size ratio@IP
1 - 2 % (flat beam)

Vertical beta function@IP



(1) Smaller β_y^*

(2) Increase beam currents

(3) Increase ξ_y

← **"Nano-Beam" scheme**

Collision with very small spot-size beams

cf. Pantaleo Raimondi (SuperB)

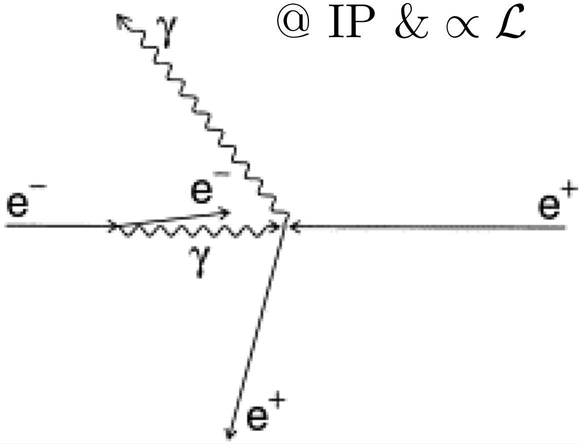
Machine Design Parameters

parameters		KEKB		SuperKEKB		units
		LER	HER	LER	HER	
Beam energy	E_b	3.5	8	4	7.007	GeV
Half crossing angle	φ	11		41.5		mrad
# of Bunches	N	1584		2500		
Horizontal emittance	ε_x	18	24	3.2	4.6	nm
Emittance ratio	κ	0.88	0.66	0.27	0.28	%
Beta functions at IP	β_x^*/β_y^*	1200/5.9		32/0.27	25/0.30	mm
Beam currents	I_b	1.64	1.19	3.6	2.6	A
beam-beam param.	ξ_y	0.129	0.090	0.088	0.081	
Bunch Length	σ_z	6.0	6.0	6.0	5.0	mm
Horizontal Beam Size	σ_x^*	150	150	10	11	um
Vertical Beam Size	σ_y^*	0.94		0.048	0.062	um
Luminosity	**L**	**2.1×10^{34}**		**8×10^{35}**		**cm^{-2}s^{-1}**

Major source of background

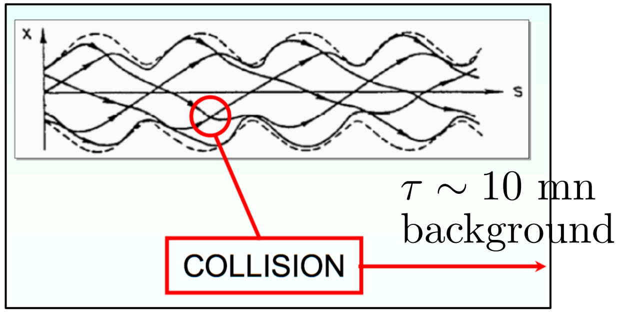
radiative BhaBha′s

@ IP & $\propto \mathcal{L}$



Touschek scattering ⟵ nanobeam

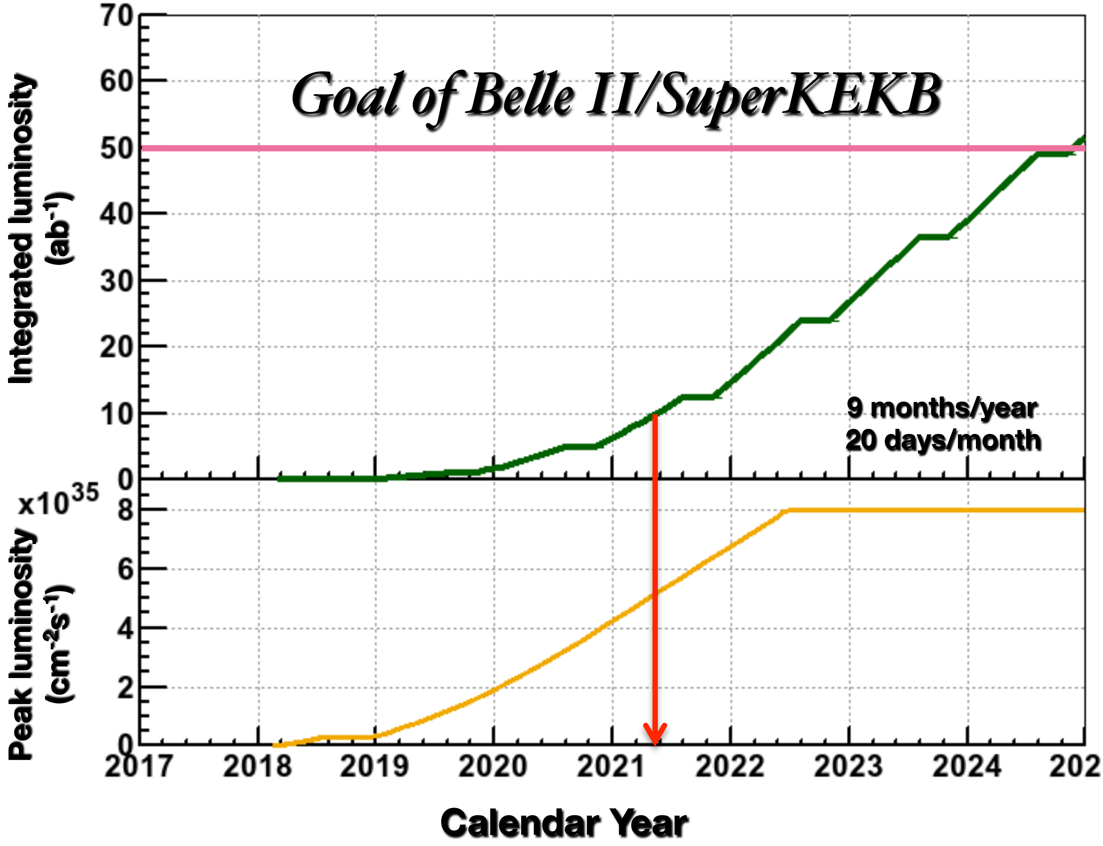
- Intra-bunch scattering, Rate $\propto$ (beam size)$^{-1}$,$(E_{beam})^{-3}$
- Most dangerous background at SuperKEKB,
  since beam size is x20 smaller (“Nano-beam scheme”)



$\tau \sim 10$ mn

background

SuperKEKB luminosity projection



$(\pm \text{syst})$

Program length

$\geq \ 10 \text{ years}$

Assume nominal
9 month running
per year $\Longrightarrow$ ¥

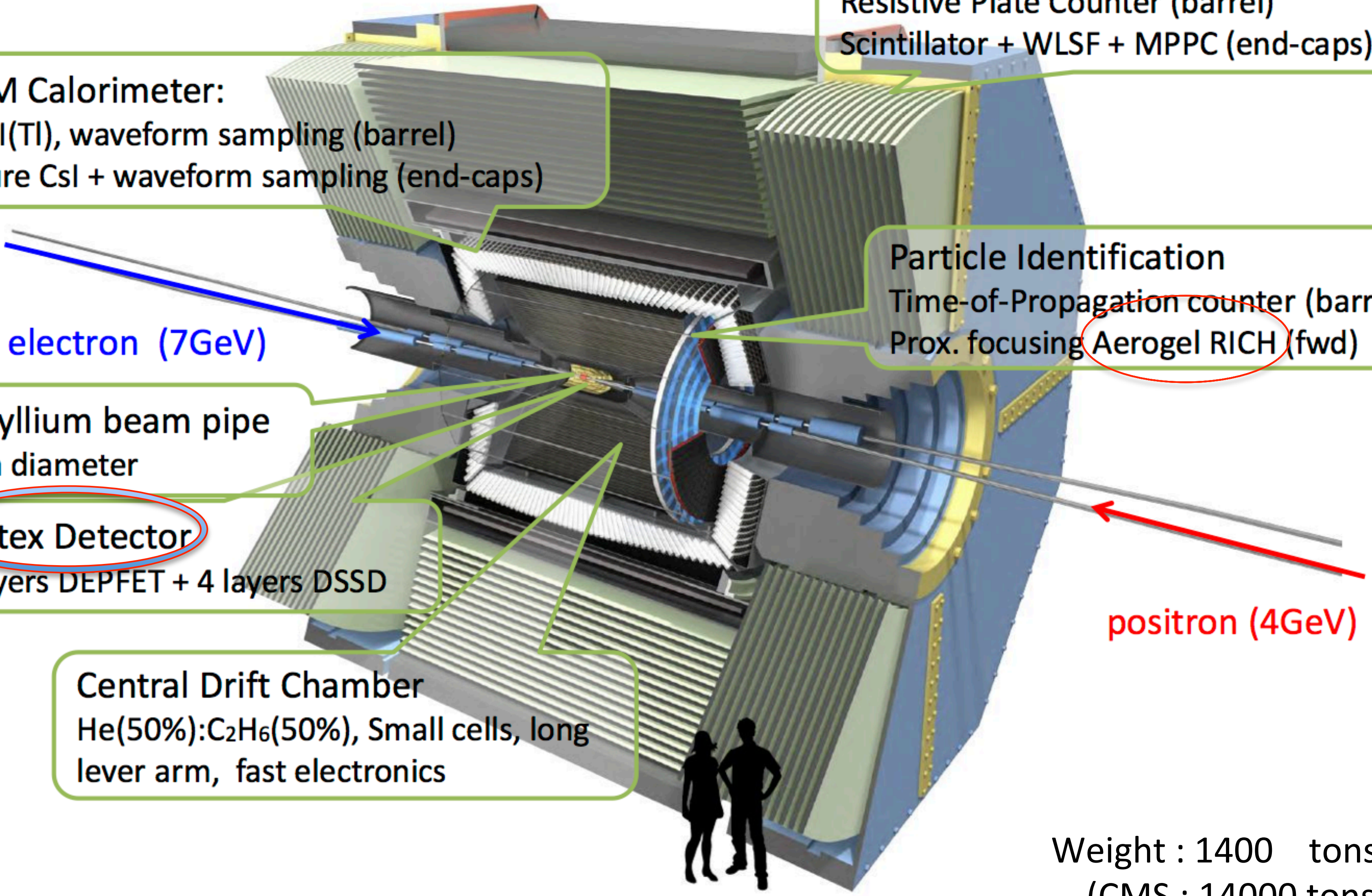
The starting date of nominal data taking is now firm : end 2018
The learning curve assumptions are conservative, not "aggressive"

Excellent team of Machine Physicists

MITSUBISHI

Belle II

Belle II Detector



KL and muon detector:
Resistive Plate Counter (barrel)
Scintillator + WLSF + MPPC (end-caps)

EM Calorimeter:
CsI(Tl), waveform sampling (barrel)
Pure CsI + waveform sampling (end-caps)

electron (7GeV)

Particle Identification
Time-of-Propagation counter (barrel)
Prox. focusing Aerogel RICH (fwd)

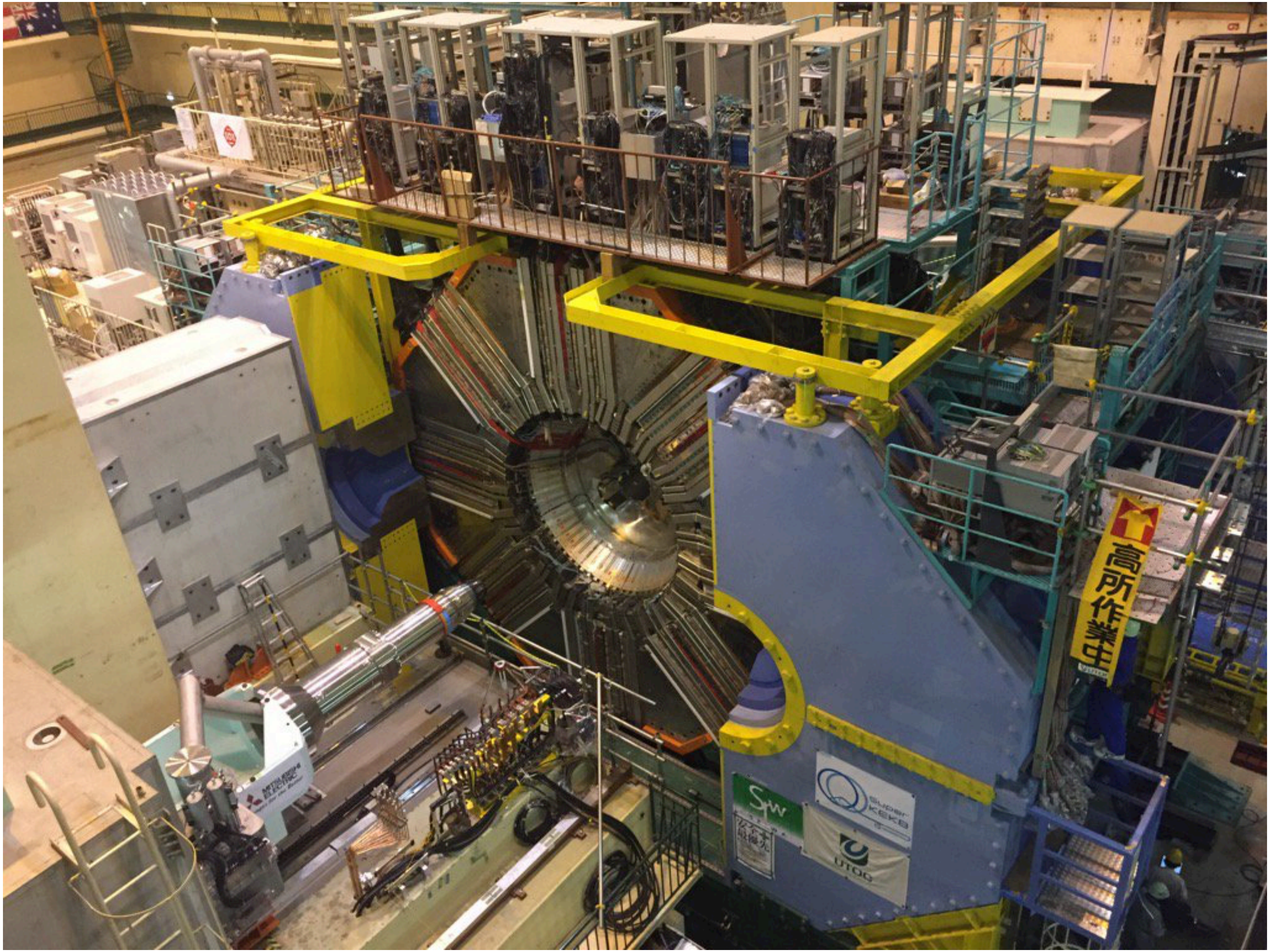
Beryllium beam pipe
2cm diameter

Vertex Detector
2 layers DEPFET + 4 layers DSSD

positron (4GeV)

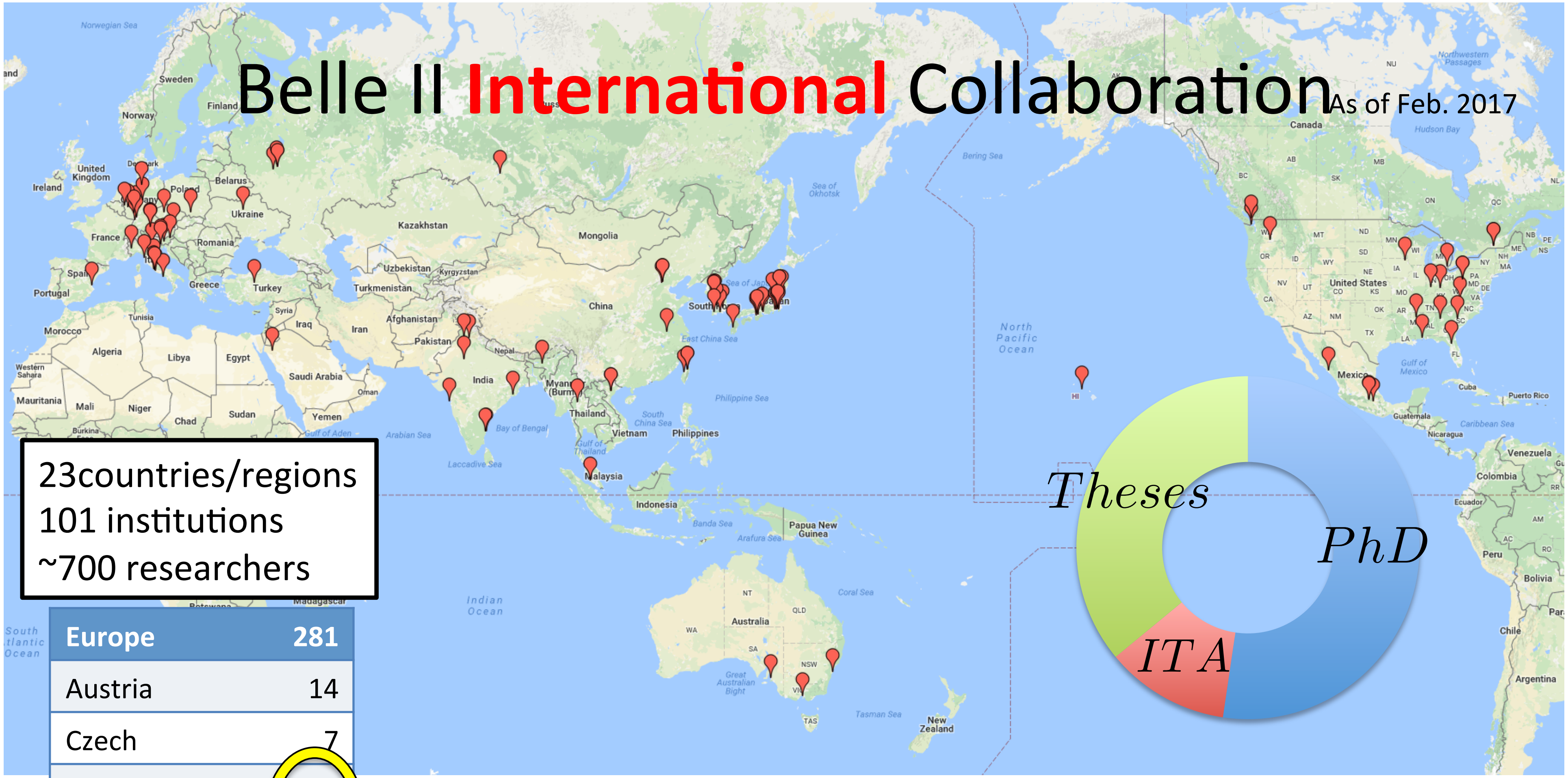
Central Drift Chamber
He(50%):C_2H_6(50%), Small cells, long lever arm, fast electronics

Weight : 1400 tons
(CMS : 14000 tons)


Super KEKB
MITSUBISHI ELECTRIC
高所作業中

Belle II **International** Collaboration

As of Feb. 2017

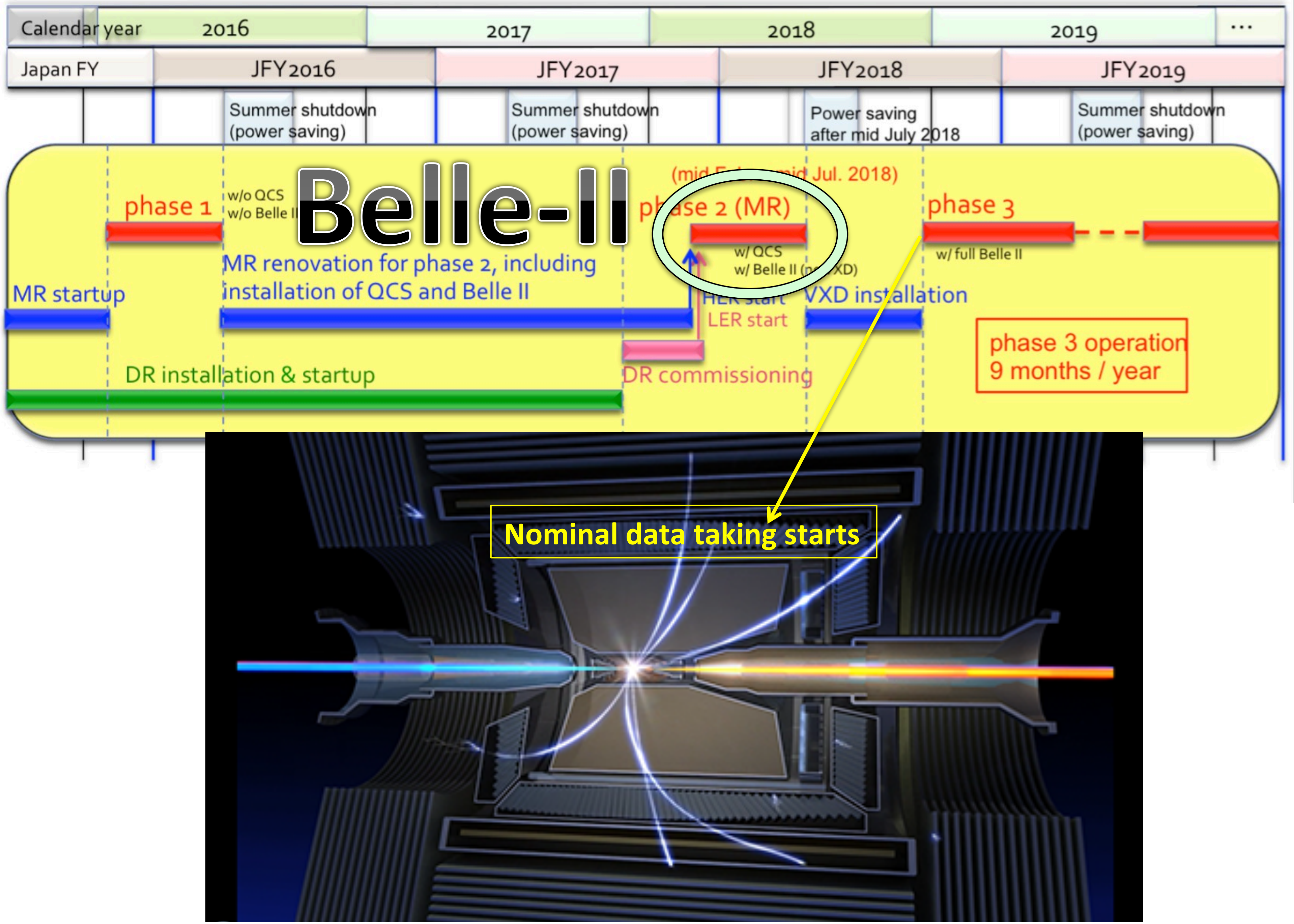

Theses
PhD
ITA
Norwegian Sea
Sweden
Norway
Finland
Denmark
United Kingdom
Ireland
Poland
Belarus
Ukraine
France
Romania
Spain
Portugal
Greece
Turkey
Tunisia
Morocco
Algeria
Libya
Egypt
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Saudi Arabia
Yemen
Oman
Iraq
Iran
Kazakhstan
Uzbekistan
Kyrgyzstan
Turkmenistan
Afghanistan
Pakistan
Nepal
India
Mongolia
China
South Korea
Japan
Sea of Okhotsk
East China Sea
Philippine Sea
Thailand
Vietnam
Philippines
South China Sea
Malaysia
Indonesia
Papua New Guinea
Arabian Sea
Bay of Bengal
Laccadive Sea
Indian Ocean
Australia
Coral Sea
Tasman Sea
New Zealand
Bering Sea
North Pacific Ocean
Canada
Hudson Bay
United States
Mexico
Gulf of Mexico
Cuba
Puerto Rico
Caribbean Sea
Venezuela
Colombia
Ecuador
Peru
Bolivia
Chile
Argentina
South Atlantic Ocean

23countries/regions
101 institutions
~700 researchers

Europe	**281**
Austria	14
Czech	7
Germany	106
Italy	74
Poland	10
Russia	46
Slovenia	17
Spain	4
Ukraine	3

Asia			**337**
Saudi Arabia	3	Korea	42
Australia	36	Malaysia	5
China	27	Vietnam	2
India	39	Taiwan	21
Japan	159	Thailand	2
		Turkey	1

America	**117**
Canada	23
Mexico	11
USA	83



Belle-II

Calendar year	2016	2017	2018	2019	…
Japan FY	JFY2016	JFY2017	JFY2018	JFY2019	

Summer shutdown (power saving)

Summer shutdown (power saving)

Power saving after mid July 2018

Summer shutdown (power saving)

phase 1

w/o QCS
w/o Belle II

MR startup

MR renovation for phase 2, including installation of QCS and Belle II

DR installation & startup

(mid Feb. – mid Jul. 2018)
phase 2 (MR)

w/ QCS
w/ Belle II (no VXD)

HER start
LER start

DR commissioning

VXD installation

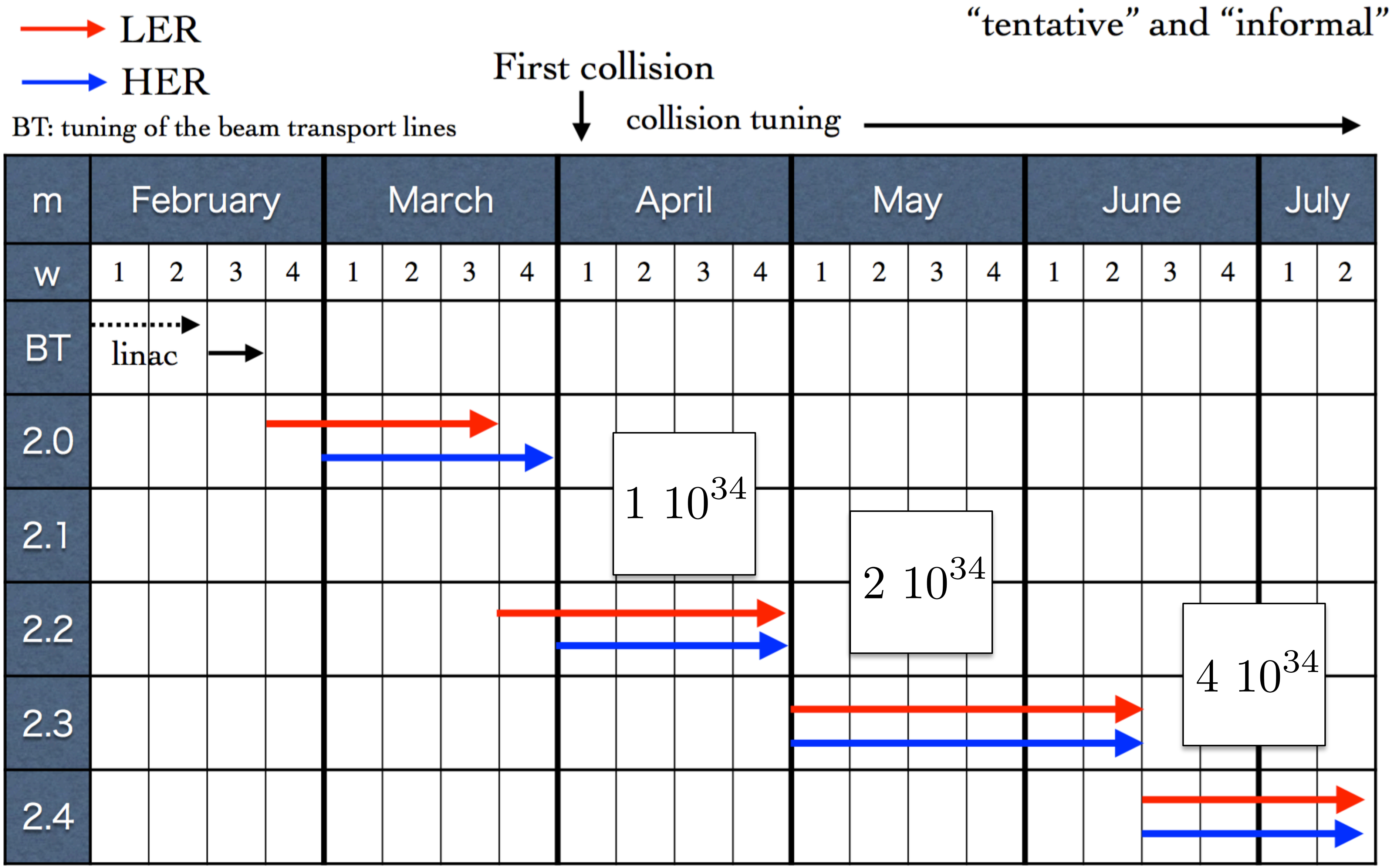
phase 3

w/ full Belle II

phase 3 operation
9 months / year

Nominal data taking starts

Phase II


LER
HER
BT: tuning of the beam transport lines
First collision
collision tuning
“tentative” and “informal”
m
February
March
April
May
June
July
w
1
2
3
4
1
2
3
4
1
2
3
4
1
2
3
4
1
2
3
4
1
2
BT
linac
2.0
2.1
2.2
2.3
2.4
1 10^34
2 10^34
4 10^34

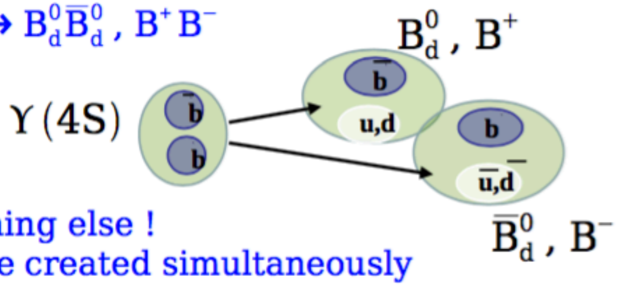
Belle II, a flavour-factory, a rich physics program ...

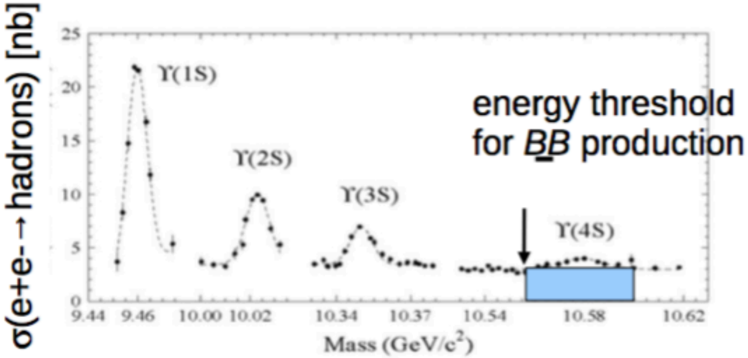
- We plan to collect 50 ab^{-1} of e^+e^- collisions at (or close to) the $\Upsilon(4S)$ resonance, so that we have:

  - **a (Super) B-factory (~1.1×10^9 $B\bar{B}$ pairs per ab^{-1})**

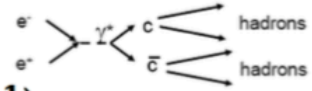
''on resonance'' production

$e^+e^- \to \Upsilon(4S) \to B_d^0\bar{B}_d^0,\ B^+B^-$



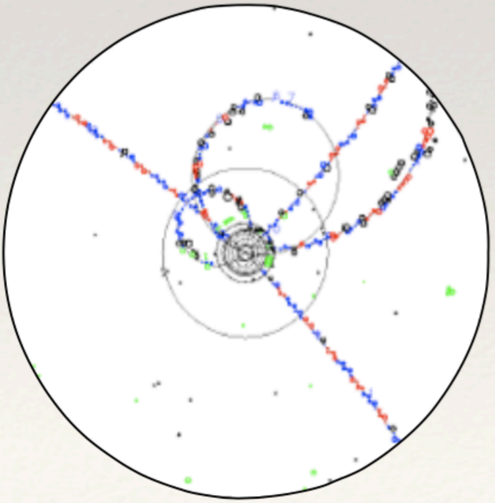


- 2 B's and nothing else !
- 2 B mesons are created simultaneously in a L=1 coherent state



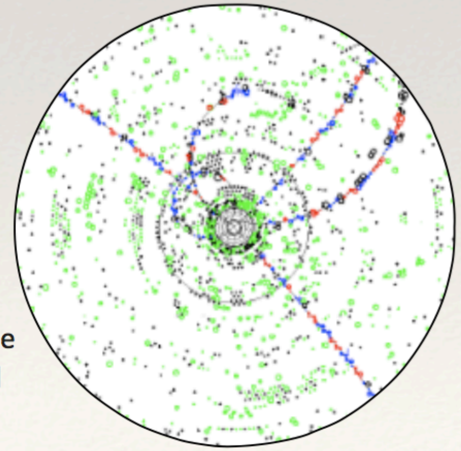
  - **a (Super) charm factory (~1.3×10^9 $c\bar{c}$ pairs per ab^{-1})**
  - **a (Super) τ factory (~1.3×10^9 $\tau^+\tau^-$ pairs per ab^{-1})**
  - with Initial State Radiation, effectively scan the range [0.5 – 10] GeV and measure the $e^+e^- \to$ light hadrons cross section very precisely
  - exploit the clean e^+e^- environment to probe the existence of exotic hadrons, dark photons/Higgs, light Dark Matter particles, ...

Entrance Fees ?



transverse view of the
detector with signal
[Belle]

SuperKEKB Commissioning Detector
BEAST II
獣
Belle II Collaboration

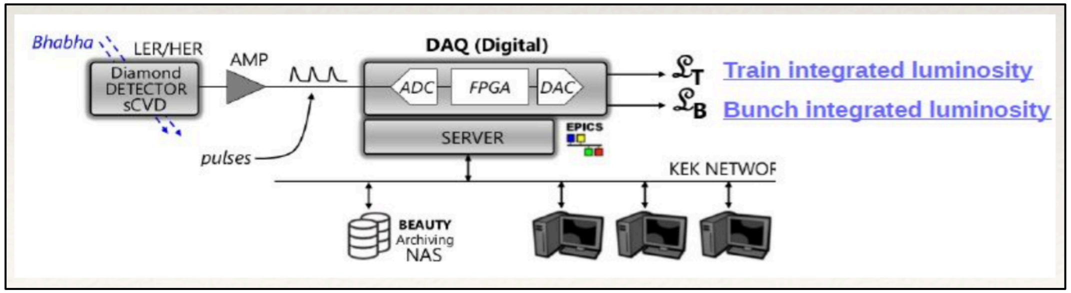


transverse view of the
detector with signal
[Belle II]

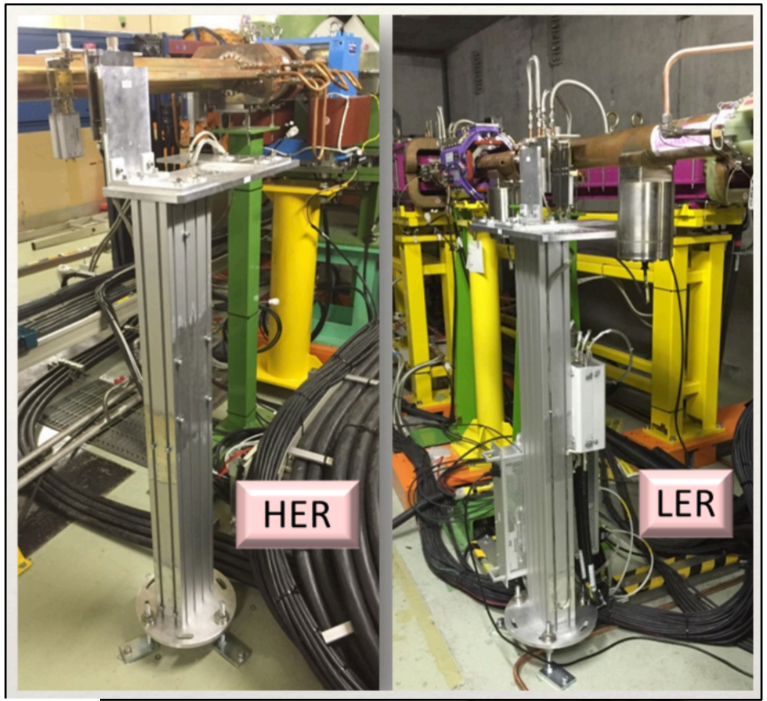
- High luminosity of the collider produces also huge amount of parasite particles:
    - dominate occupancy in inner tracker,
    - damage detectors.

➛ the success of Belle II physics program relies on the control of the beam induced background.

Fast Luminosity measurement Double purpose : Feed-back & (top-up) Monitoring

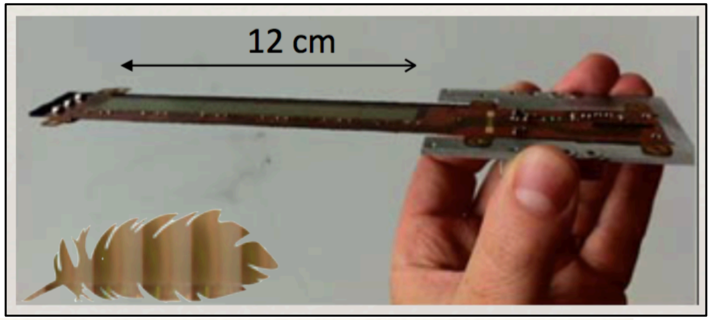

Bhabha
LER/HER
Diamond
DETECTOR
sCVD
AMP
pulses
DAQ (Digital)
ADC
FPGA
DAC
SERVER
EPICS
$\mathcal{L}_T$ Train integrated luminosity
$\mathcal{L}_B$ Bunch integrated luminosity
KEK NETWOF
BEAUTY
Archiving
NAS

LABORATOIRE
DE L'ACCÉLÉRATEUR
LINÉAIRE



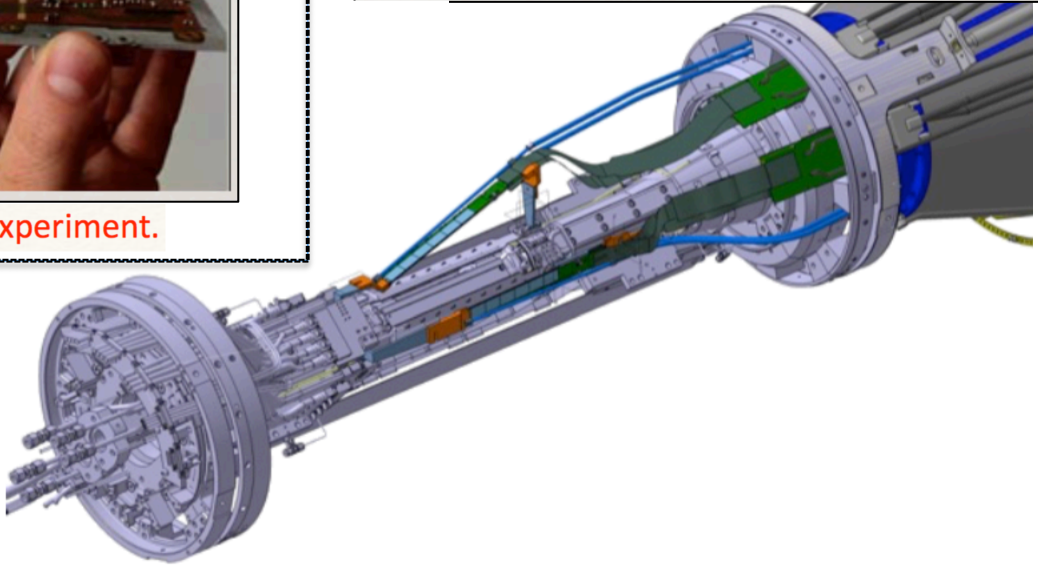
Plume detector : CMOS sensors (16M pixels)

SuperKEKB Commissioning Detector
BEAST II
獣
Belle II Collaboration



BEAST II: Beam Exorcism for A STable BELLE II experiment.

iPHC
Institut Pluridisciplinaire
Hubert CURIEN
STRASBOURG



B2TiP

TOPICAL WORKSHOP

MIAPP - B2TiP Workshop

15 - 17 November 2016, Garching

$2014 \rightarrow 2017 \rightarrow 2019$

One of us is already playing
a major role in Belle II

- Collaboration wide review to commence ASAP - near end of June.
- Managed by new publication council (see IB meeting)
- Intend to use plots, results from book at summer conferences
- Post as a public report on docs.belle2.org by early July

E. Kou & P. Urquijo
(Belle-II Analysis Coordinator)

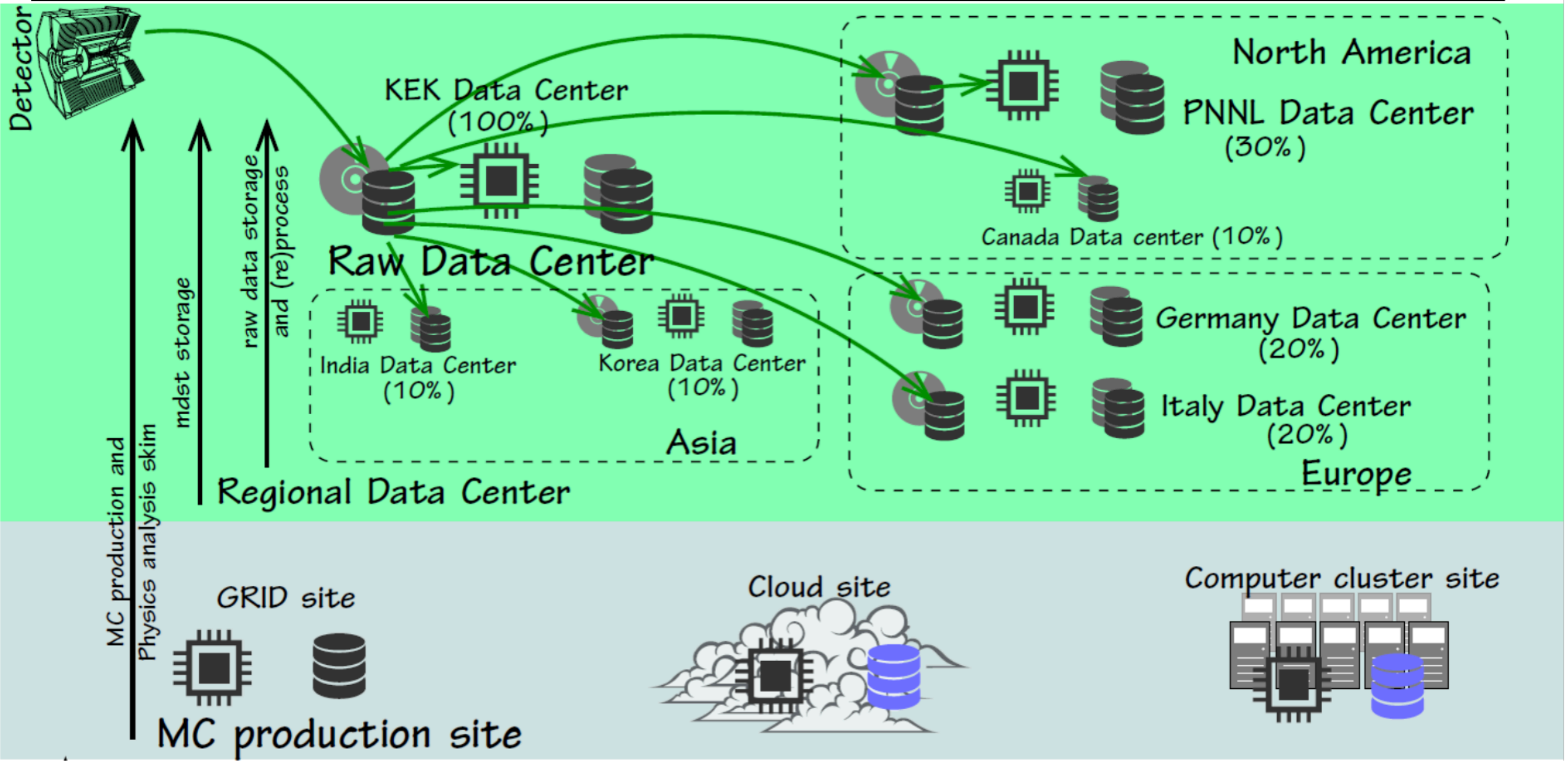
Belle-II relies on DIRAC

Computing Model

>10 PB of raw data per year

→ Distributed computing model

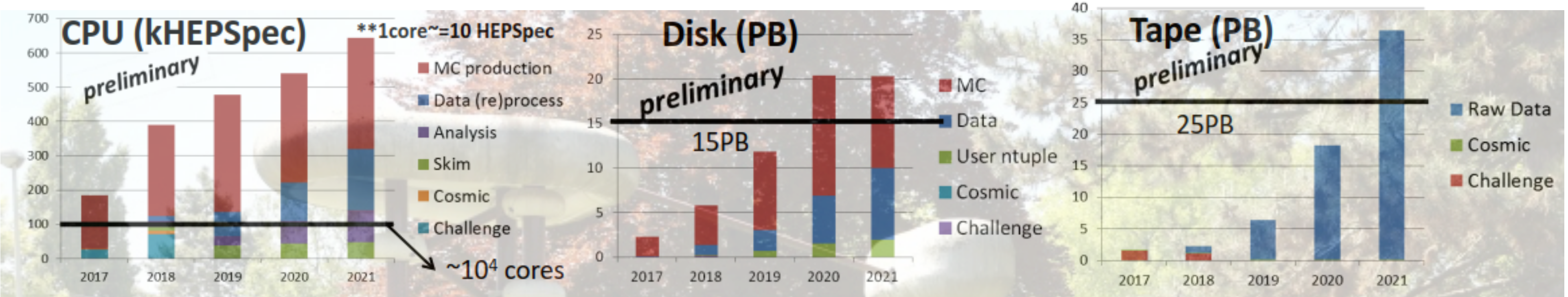
Share per fraction of PhDs



Detector
KEK Data Center
(100%)
Raw Data Center
North America
PNNL Data Center
(30%)
Canada Data center (10%)
India Data Center
(10%)
Korea Data Center
(10%)
Asia
Germany Data Center
(20%)
Italy Data Center
(20%)
Europe
raw data storage
and (re)process
mdst storage
Regional Data Center
MC production and
Physics analysis skim
GRID site
MC production site
Cloud site
Computer cluster site

Computing resources

Belle II Computing : resource estimate (up to 2021 ~20 ab^{-1})

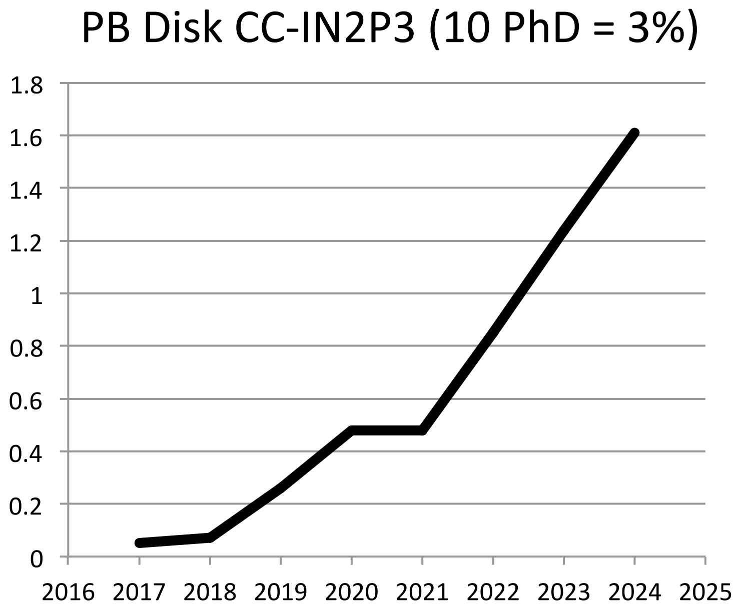


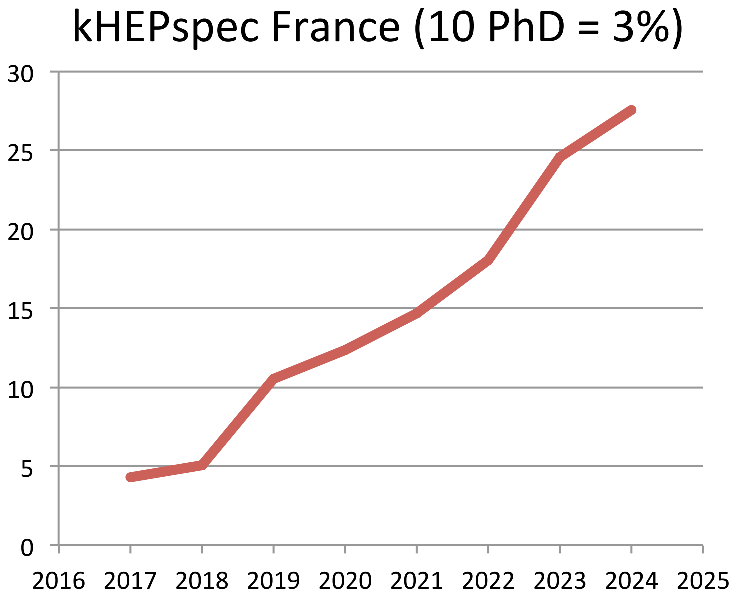
Basically, each collabortion country is expected to provide the computing resources proportional to a fraction of the number of Ph.D researchers in Belle II

Assuming 10 PhD researchers in French Belle II group, ~3% contribution is expected.

An already long history
of collaboration France-Japan
notably for computing/software

The computing ressources requested
are small… because the group
is meant to remain rather small : ~10 PhD


PB Disk CC-IN2P3 (10 PhD = 3%)


kHEPspec France (10 PhD = 3%)

France = CC-IN2P3 + IPHC + LAL (best effort)

M&O = 3 k€ / PhD
for 9 months operation
(i.e nominal year)

LAL-IPHC Project

The LAL – IPHC initial team, as of now

Philip	Bambade	LAL	DR
Sviatoslav	Bilokin	IPHC	Postdoc
Leonid (*)	Burmistrov	LAL	IR
Daniel	Cuesta	IPHC	PhD
Emi	Kou	LAL	DR
Francois	Le Diberder	LAL	Pr
Jerome	Baudot	IPHC	Pr
Isabelle	Ripp-Baudot	IPHC	DR

(*) long stays foreseen

$b\&c$ tagging

Čerenkov & PID
Fast simulation

$B \rightarrow \tau\nu_\tau$

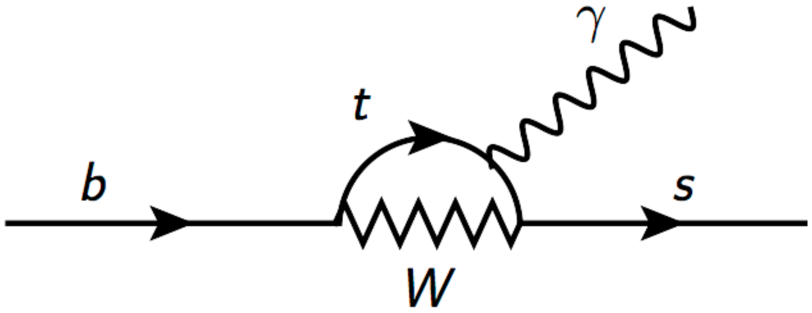
$B_s \leftrightarrow \bar{B}_s$

א

**Members of the team
are experienced in B Physics**

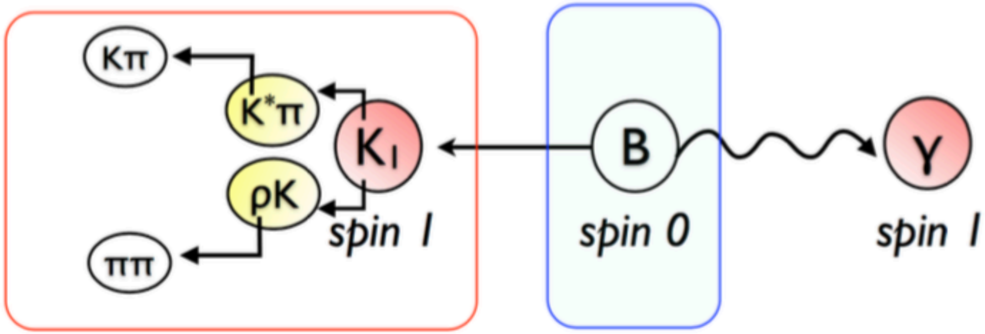
$B \rightarrow DX$

Main motivation : BSM



$$B \to K\pi\pi\gamma_{\leftarrow polarized}$$ (in SM)

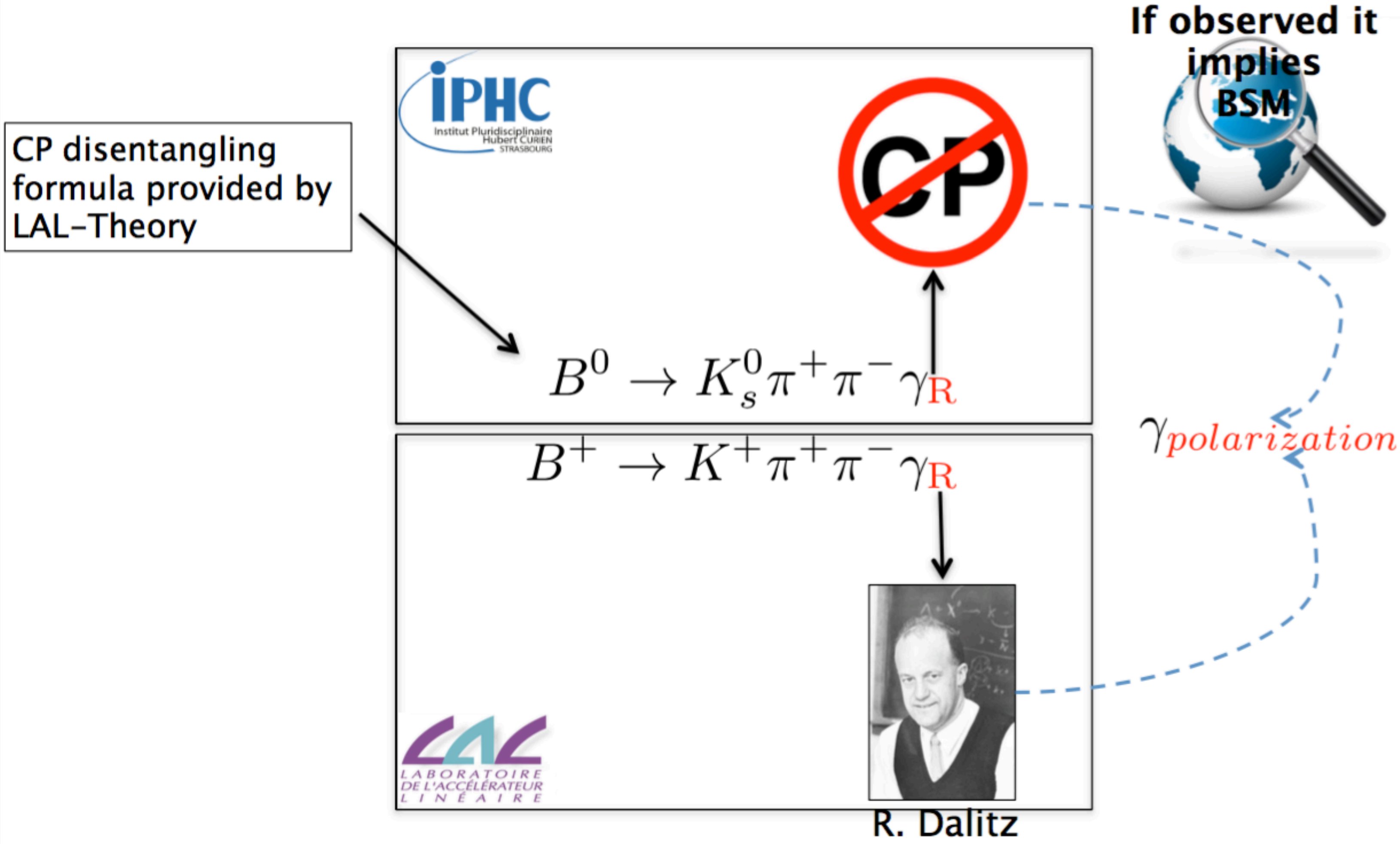
polarized→ $K\pi\pi \leftarrow B \rightarrow \gamma$ ←*polarized*


Kπ
K*π
K₁
ρK
ππ
spin 1
B
spin 0
γ
spin 1

≥ 3 body final state needed

$$\boxed{\mathcal{W}^{\gamma}(s_{13}, s_{23}, \cos\theta, \phi)_s \equiv a^{\gamma} + (-2a^{\gamma} + a_2^{\gamma}\cos 2\phi + a_3^{\gamma}\sin 2\phi)\sin^2\theta + b^{\gamma}\cos\theta}$$

$a_i^{\gamma}/b_i^{\gamma}$: 3 Dalitz variable function


IPHC
Institut Pluridisciplinaire Hubert CURIEN STRASBOURG
CP
LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

CP disentangling formula provided by LAL-Theory

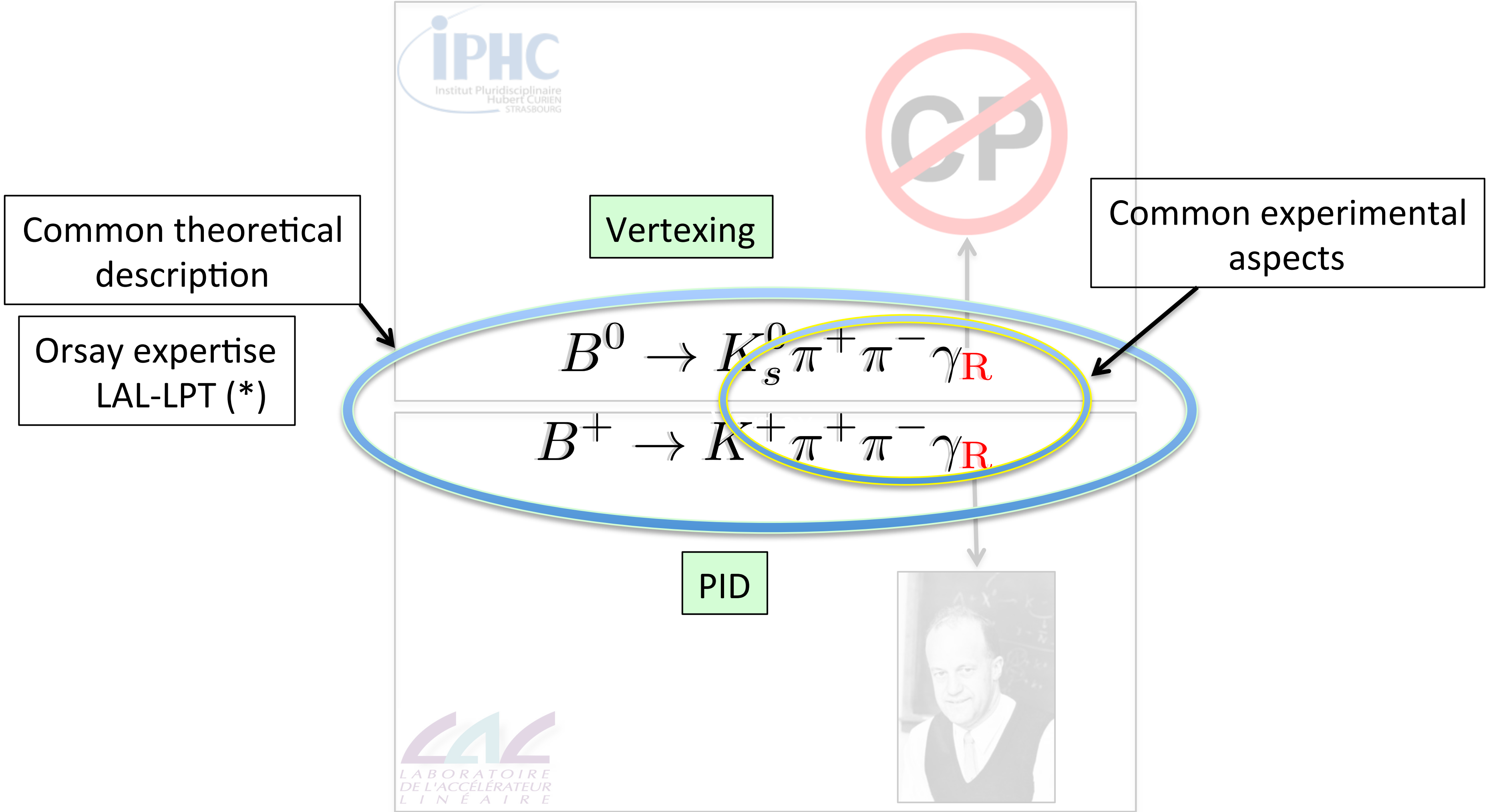
$$B^0 \to K_s^0\pi^+\pi^-\gamma_{\mathrm{R}}$$

$$B^+ \to K^+\pi^+\pi^-\gamma_{\mathrm{R}}$$

If observed it implies BSM

$$\gamma_{polarization}$$

R. Dalitz


IPHC
Institut Pluridisciplinaire Hubert CURIEN STRASBOURG
CP
LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

Common theoretical description

Orsay expertise LAL-LPT (*)

Vertexing

$$B^0 \to K_s^0 \pi^+ \pi^- \gamma_R$$

$$B^+ \to K^+ \pi^+ \pi^- \gamma_R$$

PID

Common experimental aspects

(*) D. Becirevic, E. Kou, A. Le Yaouanc, A. Tayduganov

Bells and Whistles

	# for (*) $2\ \mathrm{ab}^{-1}$
$B^0 \to K_s^0 \pi^+ \pi^- \gamma_{\mathrm{R}}$	1200
$B^+ \to K^+ \pi^+ \pi^- \gamma_{\mathrm{R}}$	7000
$B^0 \to K^+ \pi^- \pi^0 \gamma_{\mathrm{R}}$	1700
$B^+ \to K_s^0 \pi^+ \pi^0 \gamma_{\mathrm{R}}$	1600

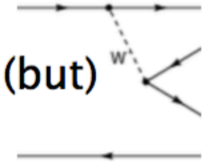
(*) $\langle \epsilon_{\mathrm{sel}} \rangle_{\mathrm{BFactory}}$

and the same, but with $\gamma \to J/\Psi$

(laboratory to probe/constrain theory)

$\mathrm{Br} \times 40$

(but)



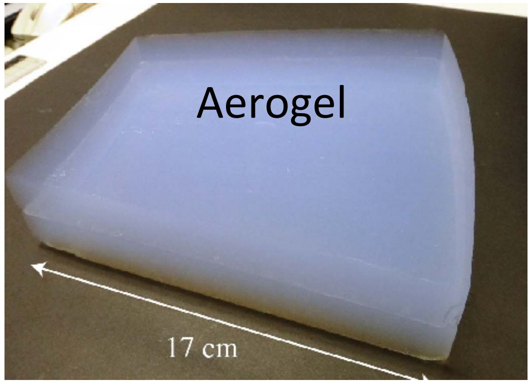
$K\pi\pi$

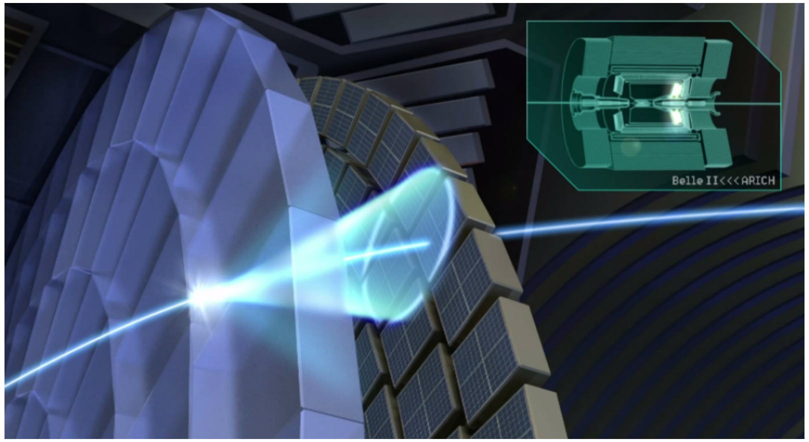
A.Tayduganov, EK, Le Yaouanc, 1604.07708

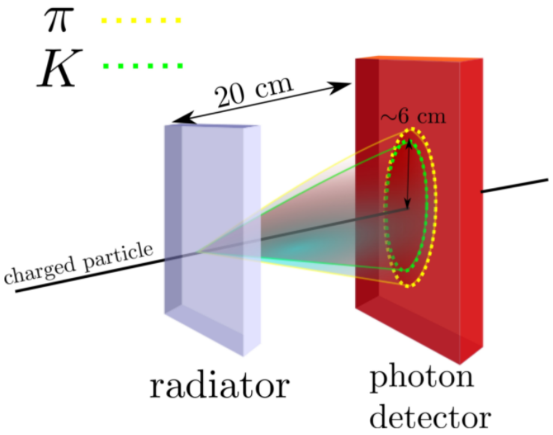
- Theoretical new idea to COPY the Dalitz plot from J/psi -> γ to remove the hadronic uncertainties
- New idea for statistic tricks needed (if succeeded, this has more application, more LAL contribution to fit package?!)!

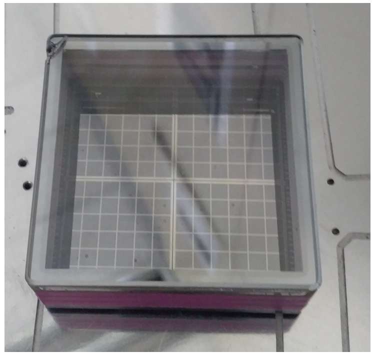
ARICH

- **A**erogel **R**ing **I**maging **CH**erenkov (ARICH)
- ARICH detector located in forward endcap.
- Target performance : K/pi separation at $> 4\sigma$ C.L. @ $0.5 < p < 4$ GeV/c.


Aerogel
17 cm


Belle II<<<ARICH

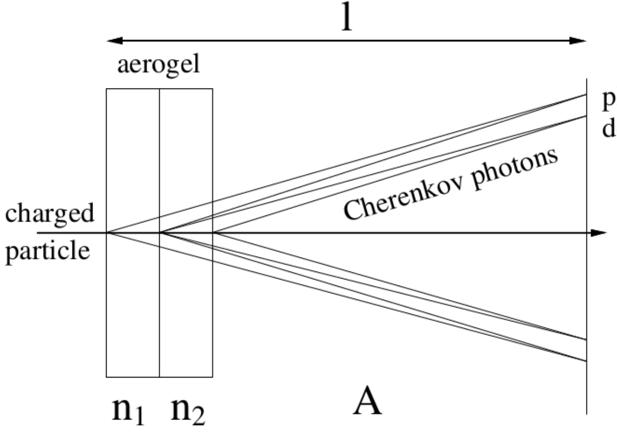

π
K
20 cm
~6 cm
charged particle
radiator
photon detector



Hybrid Avalanche Photo Detector (HAPD)

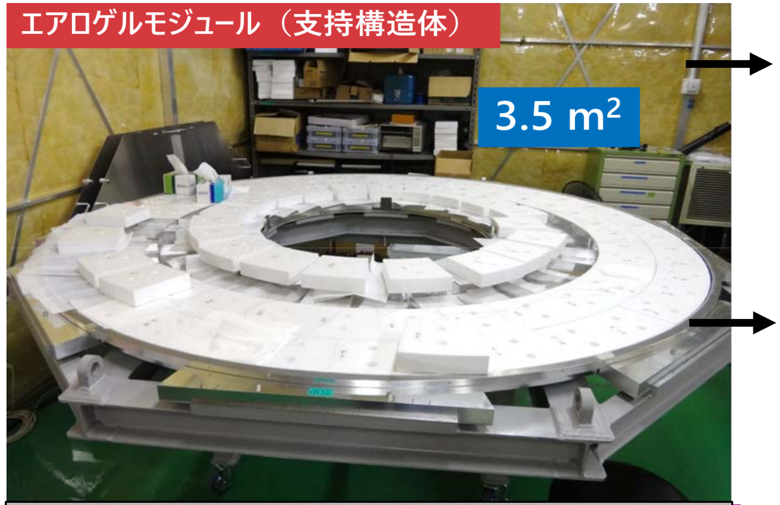
- Placed 2 m from I.P.
- rin = 56 cm, rout = 114 cm
- 3.5 m2 coverage surface
- 6 sectors
- 2 x 124 = 248 aerogel tiles
- 420 HAPD modules with
- 60480 readout channels
- 18 planar mirror plates

Focusing configuration n1 < n2


l
aerogel
photon detector
charged particle
Cherenkov photons
n_1
n_2
A

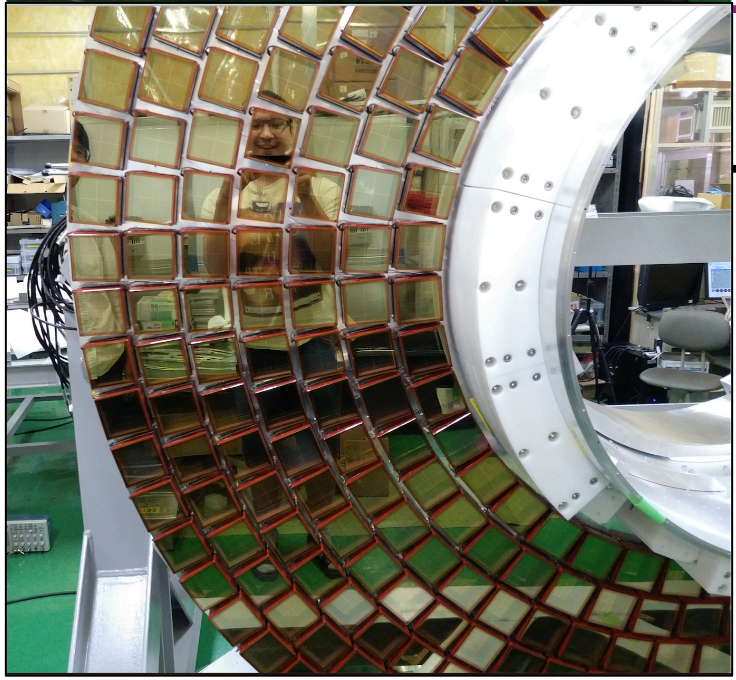
Work within ARICH team

Aerogel assembly



- Hardware
  - Installation → Short term contribution
  - Calibration
  - Alignment
- Data quality monitor (DQM).

→ Long term commitment



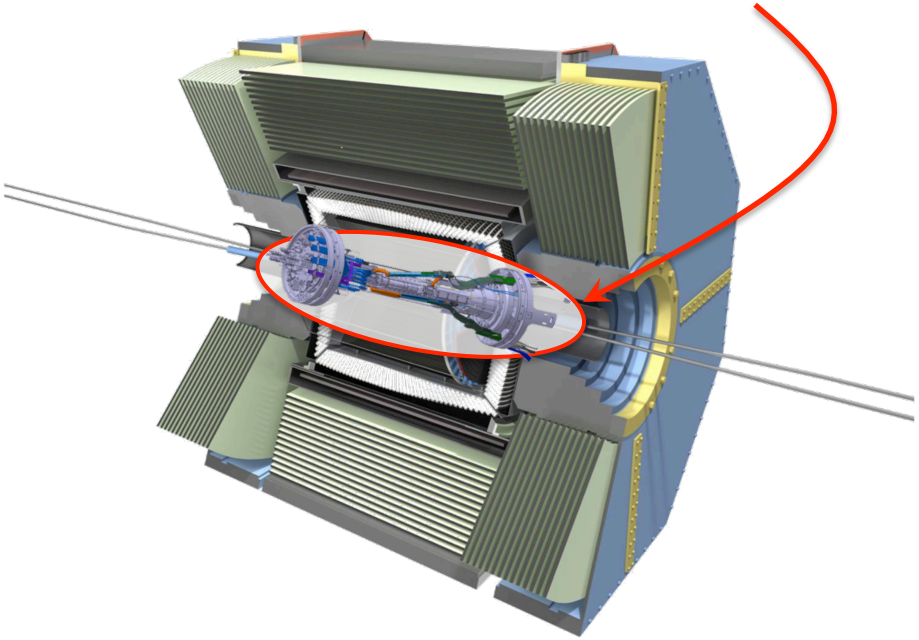
HAPDs assembly

- Simulation
  - Tests of new software release → Short term contribution
  - Tuning and Adjustment
  - Adding modules for background
  - Alignment
  - ARICH software → Long term commitment

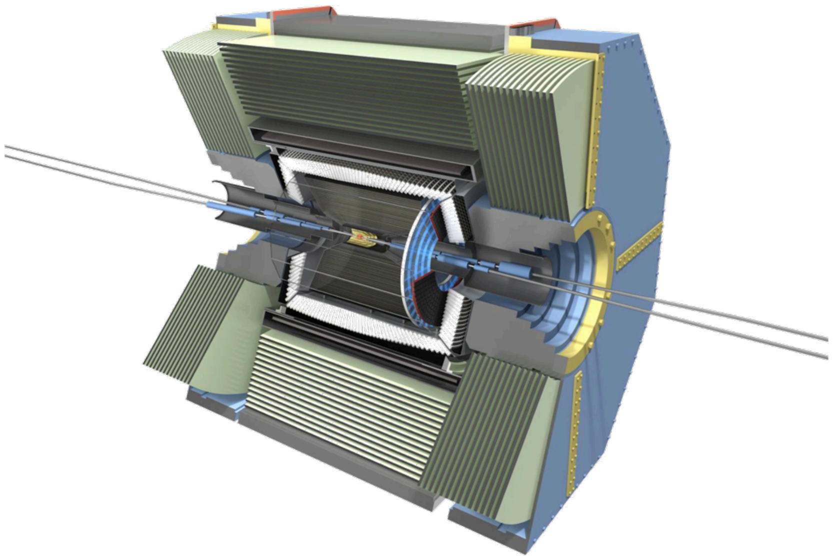
(But where is Leonid?)

Beam induced background

- Phase 2 = Belle II + BEAST II



- Phase ≥ 3 = Belle II data taking



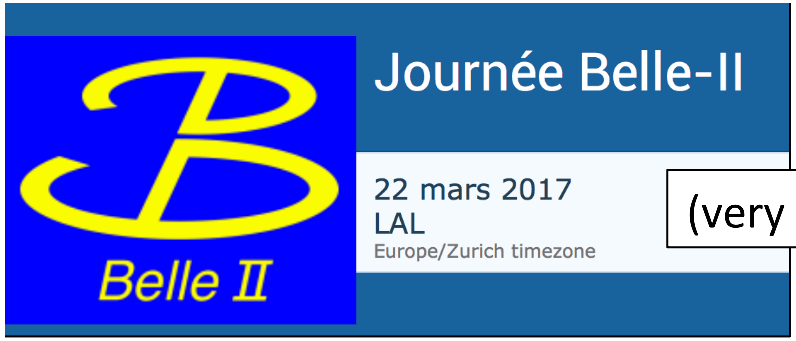
- Specific beam transport simulations
- Specific set of measurements (BEAST)

current commitment

- Simulation tuning to reproduce reality
- Bkg in Belle II-det. understood through BEAST

potential
commitment

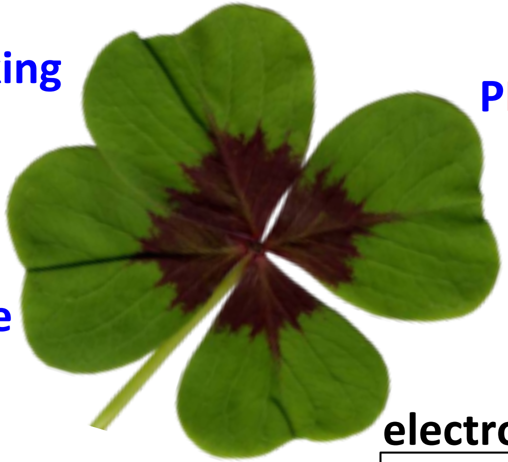
- Prediction of bkg level
- Bkg monitoring
  with BELLE II-det.


Journée Belle-II

22 mars 2017
LAL
Europe/Zurich timezone

(very friendly & open detailed discussions)

23^{rd} morning was added for further exchanges on software needs



commissioning

tracking

PID

computing

physics

software

electronics

DAQ upgrade ?

instrumentation

SVT upgrade ?

Conclusion

France very much welcome

Summary of intended contributions
(beside data analysis, and MDI follow-up)

At this stage Belle-II is gathering all its strenghts to assemble Detector&Software, which is a very exciting time in a collaboration lifetime.

France is **very much welcome**, and very much friendly expected to be a full-fledge member of the collaboration (kindergarten atmosphere).

For Belle-II, our acted commitments so far are :

LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE — ARICH

IPHC Institut Pluridisciplinaire Hubert CURIEN STRASBOURG — Tracking software (K_s^0)

The synergy between both labs is genuine for analysis aspects but it turned out to be strong for all aspects.

Other commitments are indiscussion, keeping in mind to avoid dispersion and over-commitments (re-inforcement would help a lot).

Request to IN2P3 Scientific Council:
positive recommandation for

- The initiative : IN2P3 joins Belle-II (long term)
- The initial phase (2017-2019)
- The growth up to ~ 12 FTE

For the initial phase, the funding request are

- Travel missions for collaboration meetings (3/year)
- Long Stay of

L. B. : 1-2 months 2017 : 1-2 years 2018-2019
F. LD. : CNRS “delegation + MAD” (2 years) 2018-2020

Answer to referees questions

Wilson coefficients

$C_7'(\gamma_R)$ $C_7(\gamma_L)$

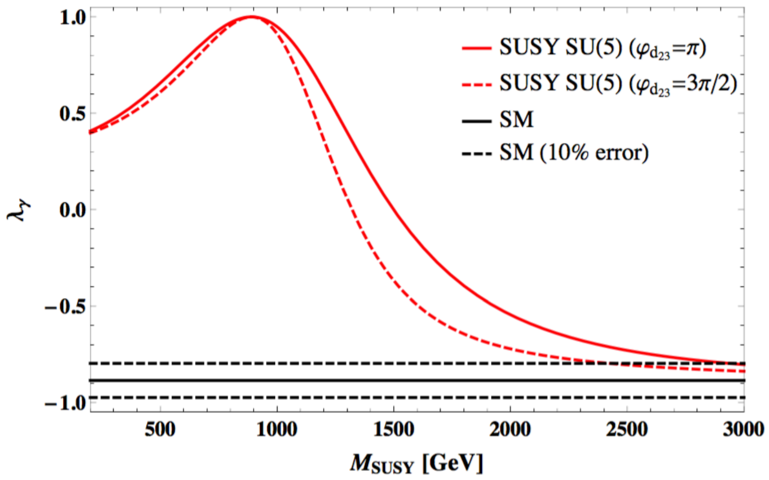
Large pQCD corrections

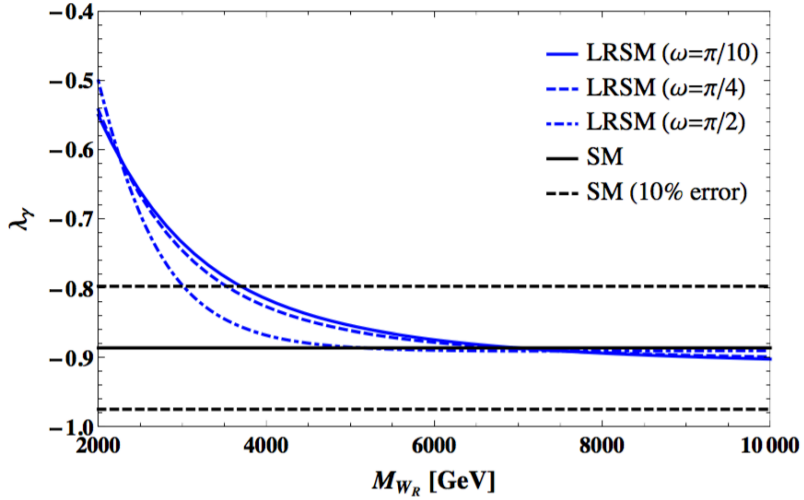
- **State of the art (Theory)**

$$\lambda_\gamma = \frac{\mid C_7' \mid^2 - \mid C_7 \mid^2}{\mid C_7' \mid^2 + \mid C_7 \mid^2} \simeq -1 + 2 \mid \frac{C_7'}{C_7} \mid^2 = -1 + 2\left(\frac{m_s}{m_b}\right)^2 \mid \delta \mid^2 \simeq -1 + 10^{-3} \mid \delta \mid^2$$

Non-pQCD $\delta_{K^*\gamma} \simeq 0.8(2)$

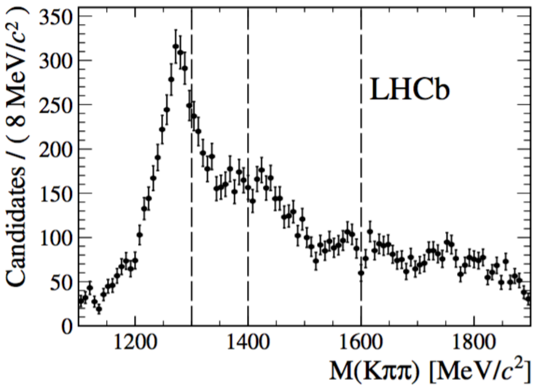
(guts feeling) $\lambda_\gamma(\mathrm{SM}) = -1$ at most at a few percents level





Answers to questions from referees

Beyond 2019



- **State of the art (Experiment)**

LHCb (2014) $\lambda_\gamma \neq 0 \ (5.2\sigma)$

Towards the measurement of λ_γ

(as of now R&D level)

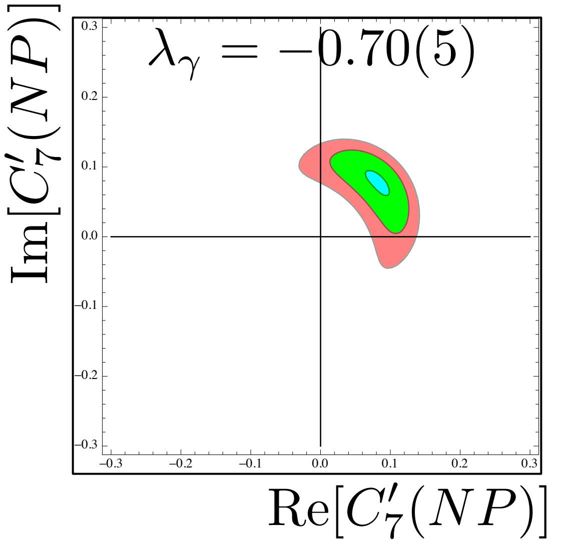
LHCb (2016) PhD (G. Veneziano)

Belle-I (ongoing analysis K. Trabelsi KEK)

Very challenging : **middle term** analysis project

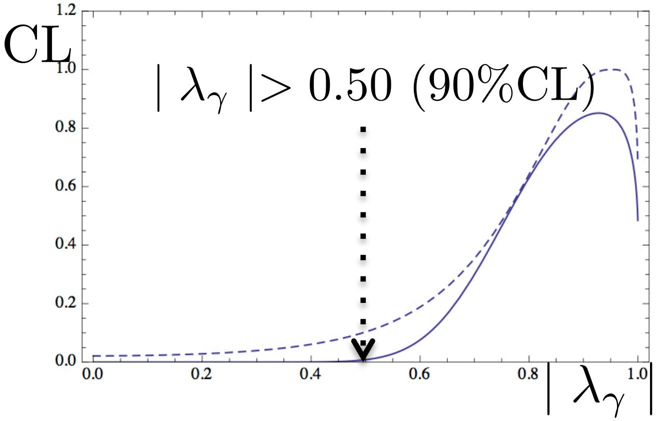
(because of background(s) and theory)

$\Longrightarrow$ joint LHCb-Belle mini workshop fall 2017



present experimental status

$$A_{\rm T}^{(2)} = -0.23 \pm 0.23 \pm 0.05$$
$$A_{\rm T}^{\rm Im} = +0.14 \pm 0.22 \pm 0.05$$
$$S_{K_s\pi^0\gamma} = -0.16 \pm 0.22$$
$$\mathrm{Br}_{B\to X_s\gamma} = (3.43 \pm 0.22)\ 10^{-4}$$
$$\mathcal{A}^{\Delta} = -0.98 \pm 0.54$$



$\mid \lambda_\gamma \mid > 0.75$ (if next LHCb = SM)

LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

5 dimensional kinematical variables

1 night on laptop?! ---→

Statistics tricks play ground!

5 parameter fit

- Fast fitting time -> many theoretical checks possible
- This trick can be applied to many other places (LAL contribution to fit package)

$$E = \left(\begin{array}{c|cccc} 0.034 & -0.133 & -0.021 & -0.067 & 0.007 \\ \hline & 0.040 & 0.260 & 0.630 & -0.320 \\ & & 0.019 & 0.395 & -0.470 \\ & & & 0.680 & -0.405 \\ & & & & 0.180 \end{array}\right)$$

← Photon polarization

← K1(1270)/K1(1270) separation

← $(K\pi)_{\text{s-wave}}$ contributions

← K1 mixing angle c.f. (60±10)°

← Damping factor c.f. (4±0.5)

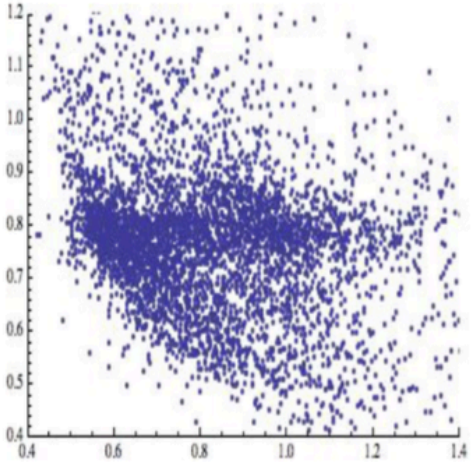
Preliminary result!

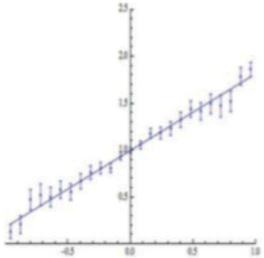
At ~3% level sensitivity to all 5 parameters (5k events)!

E. Kou & F. Le Diberder on-going

Matrix Element Method

$$\sim 2\ \mathrm{ab}^{-1} \simeq 2020$$





Some tricks are similar to the ones used for the measurement of the tau polarization at LEP

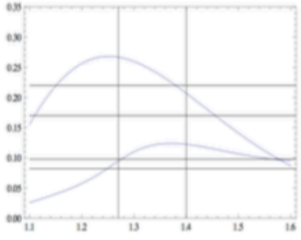
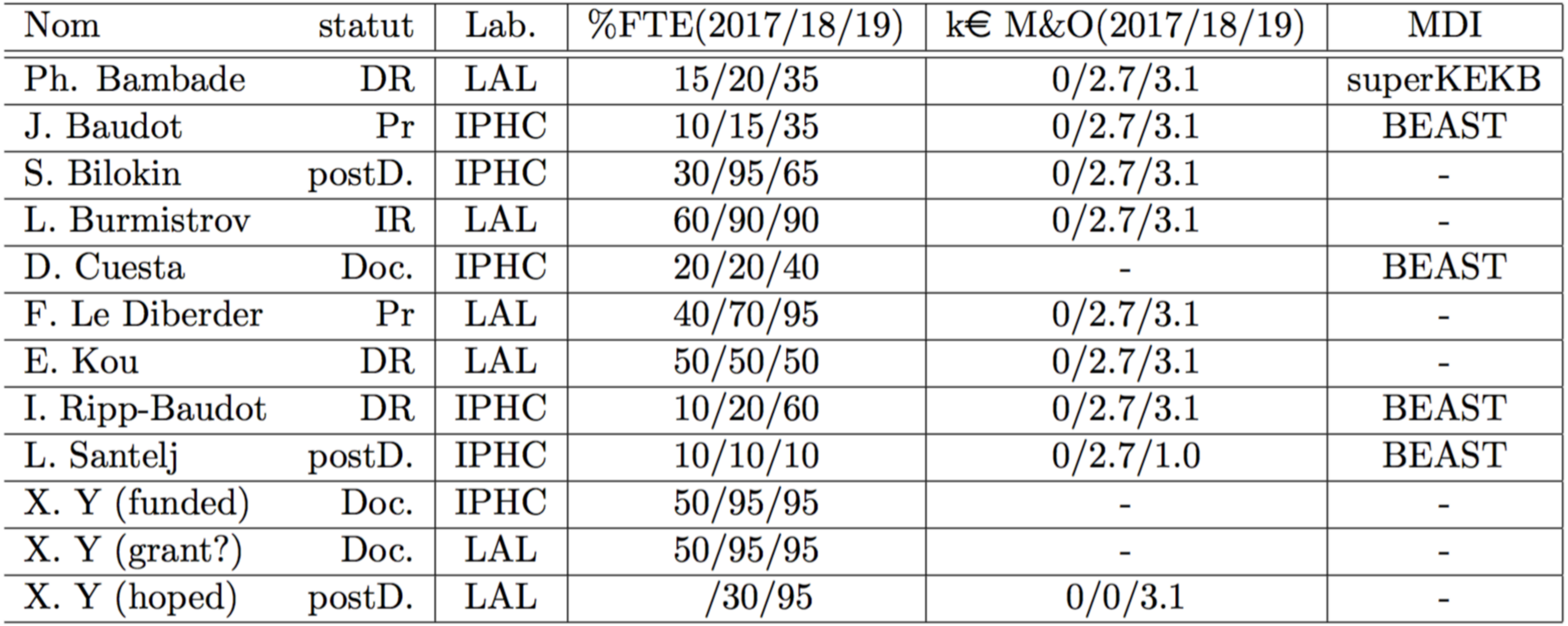


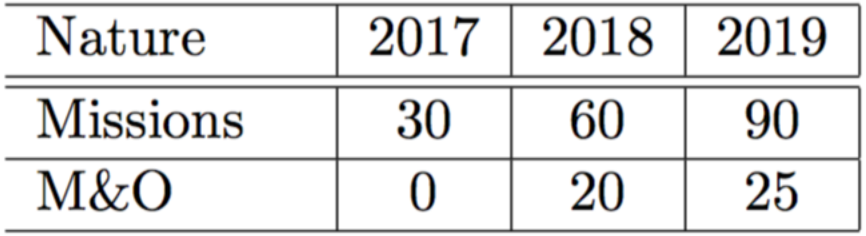
Figure 23: The widths Γ as a unction of s (GeV^2).

$$\begin{bmatrix} v_0^{\text{fit}} & \Gamma_{\text{cst}}^{\text{data}} & \Gamma_{(s)}^{\text{data}} \\ \Gamma_{\text{cst}}^{\text{theory}} & 0.782 & 0.829 \\ \Gamma_{(s)}^{\text{theory}} & 0.773 & 0.834 \\ \delta v_0 & -0.009 & -0.005 \\ \langle \delta v_0 \rangle & -0.003 & +0.006 \\ \sigma_{\delta v_0} & 0.010 & 0.010 \end{bmatrix}$$

Numbers and costs



Nom	statut	Lab.	%FTE(2017/18/19)	k€ M&O(2017/18/19)	MDI
Ph. Bambade	DR	LAL	15/20/35	0/2.7/3.1	superKEKB
J. Baudot	Pr	IPHC	10/15/35	0/2.7/3.1	BEAST
S. Bilokin	postD.	IPHC	30/95/65	0/2.7/3.1	-
L. Burmistrov	IR	LAL	60/90/90	0/2.7/3.1	-
D. Cuesta	Doc.	IPHC	20/20/40	-	BEAST
F. Le Diberder	Pr	LAL	40/70/95	0/2.7/3.1	-
E. Kou	DR	LAL	50/50/50	0/2.7/3.1	-
I. Ripp-Baudot	DR	IPHC	10/20/60	0/2.7/3.1	BEAST
L. Santelj	postD.	IPHC	10/10/10	0/2.7/1.0	BEAST
X. Y (funded)	Doc.	IPHC	50/95/95	-	-
X. Y (grant?)	Doc.	LAL	50/95/95	-	-
X. Y (hoped)	postD.	LAL	/30/95	0/0/3.1	-



Nature	2017	2018	2019
Missions	30	60	90
M&O	0	20	25

k€

Typical stays and related cost : KEK = 7 days * 3 = 6k€ + IPHC-LAL = 1 day * 2 = 1k€

- No double counting with MDI.
- **Long stay not accounted for** (1-2 months 2017, then full year 2018-2019)

Belle-II versus LHCb : why Belle-II ?

Institution level reason:

1) IN2P3-HEP is strongly present in LHC, in fact only in LHC => diversification
2) Develop collaboration with Japan
3) Funding needs are limited : small group, M&O very low

Physics reason:

1) Two extremely different experiments
   LHCb strengths : huge statistics, boost, all B's produced, detector tuned
   Belle-II strengths : large statistics, boost, very clean events, new detector
   exquisite tagging and π^0 , backgounds much smaller, and of different nature
2) If New Physics is observed in any of the two experiment
   => confirmation by the other is essential (would be delighted to simply confirm)

Sociological reason:

1) (non-aggressive) competition is a plus for the scientific life of an Institute (ATLASCMS)
2) Longstanding ties with KEK (and Japan) for most members of the LAL-IPHC team
3) 3) Belle-II group is not meant to grow large : no threat on LHCb
4) LAL-LHCb welcome the initiative

Remarks : cf. strong European presence in Belle-II (France is a late comer)

Beyond Initial period (2017-2019)

The goal is to expand the group from ~ 4 FTE (2019) to ~ 12 FTE (permanent staff) and to attrack other laboratories in France.

The present proposal to the CS-IN2P3 concerns only the initial phase because of that:

We are a small team, with no concrete proposition to future detector realization, yet.

The detector being assembled, the Belle-II collaboration is not diverting efforts to possible upgrades. Only for DAQ, an upgrade appears necessary in the middle term, but even here, the **kick-off** workshop on the subject will be held only in Fall 2017.

Would "significant" propositions from us materialize, the implication of the Institute would imply an explicit formulation to, and approval by the Scientific Council(s).

Remark : Considering the future size of the group (<- not "large") the term "significant" Is to be understood "considering the size of the group".