



Belle II



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WENLONG YUAN, EZIO TORASSA**

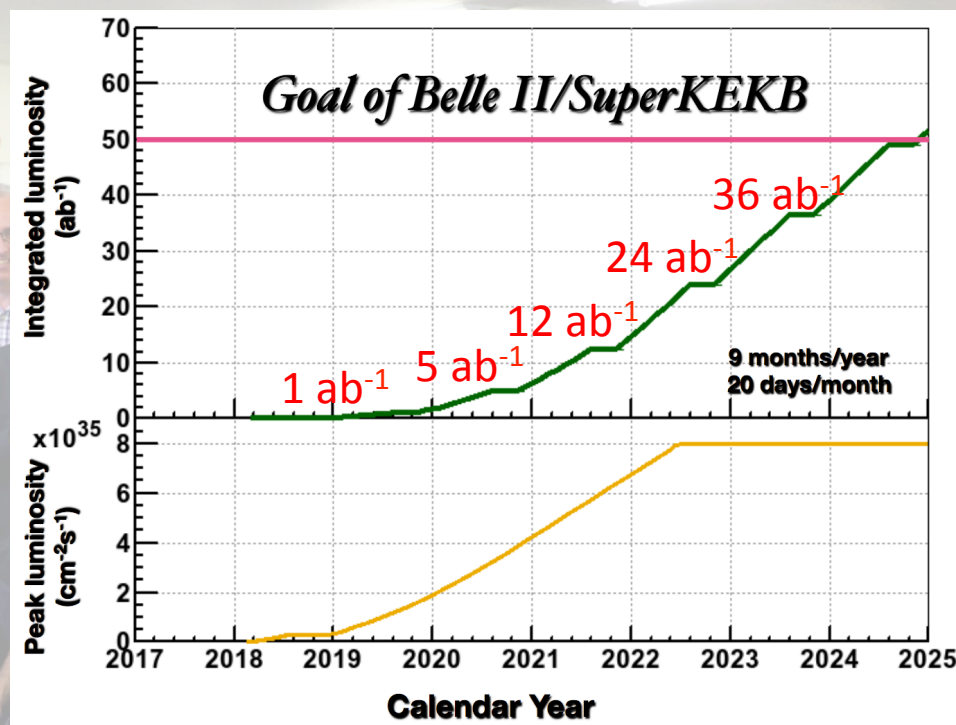
**CDS PRESENTAZIONE GR1
10 LUGLIO 2018**

SuperKEKB accelerator

First collisions: April 26th 2018 0:38am (GMT+09:00)

$$e^+e^- \rightarrow \Upsilon(4S), \Upsilon(nS) \rightarrow B \bar{B}$$

Integrated Luminosity
Phase 2
10/7/18 0.5 fb⁻¹



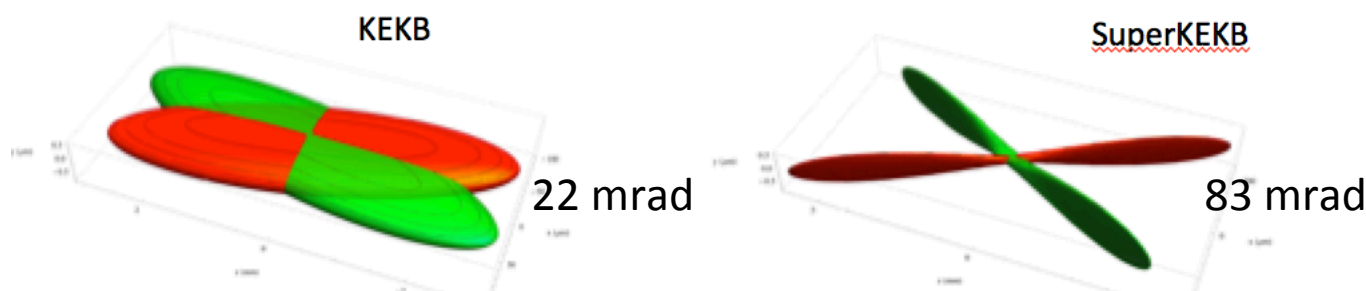
Expected integrated
luminosity Phase 3
(summer shutdown)

2019	1 ab ⁻¹
2020	5 ab ⁻¹
2021	12 ab ⁻¹
2022	24 ab ⁻¹
2023	36 ab ⁻¹

	KEKB	SuperKEKB	Units
Luminosity	2.1×10^{34}	8×10^{35}	cm⁻²s⁻¹
Integrated luminosity	1.04	50	ab⁻¹
BB pairs	~ 1	~ 50	billion

SuperKEKB accelerator

Large crossing angle and nano-beams !



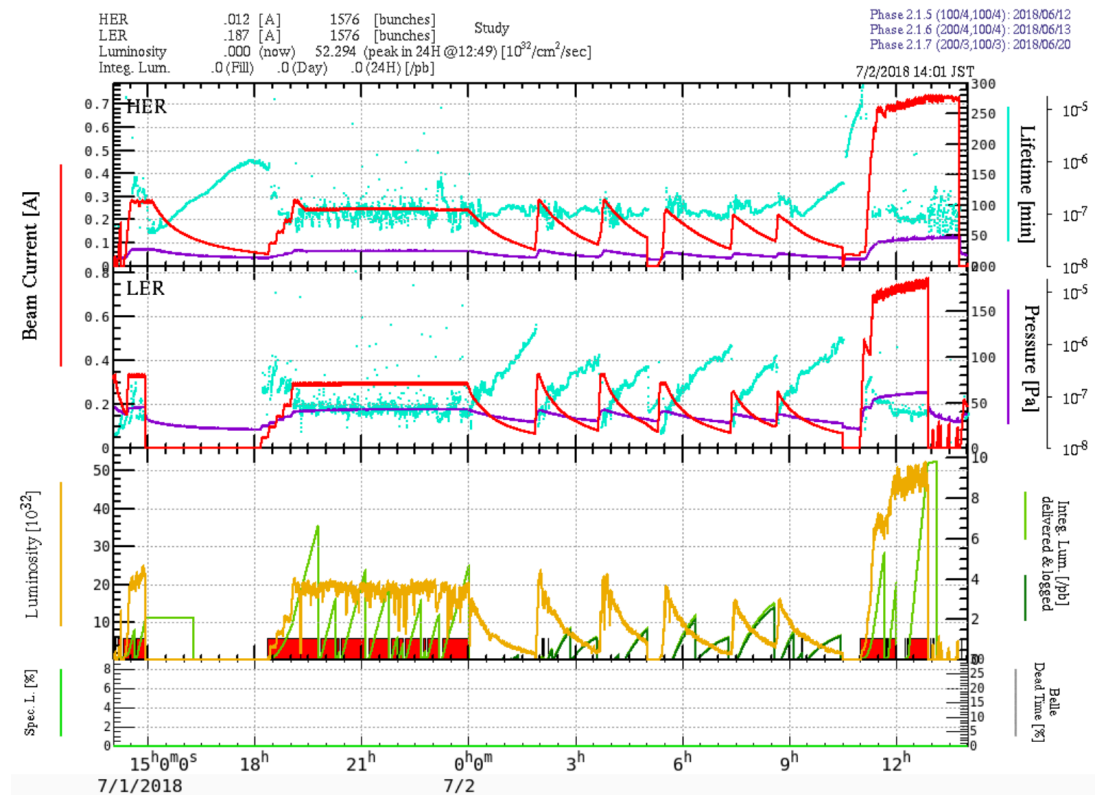
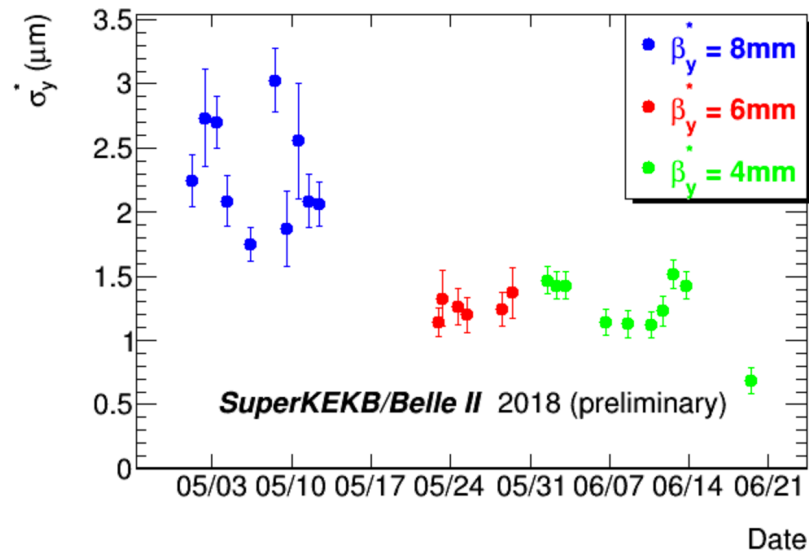
Parameter	KEKB Design	KEKB Achieved	SuperKEKB Design
Energy (GeV) (LER/HER)	3.5/8.0	3.5/8.0	4.0/7.0
β_y^* (mm)	10/10	5.9/5.9	0.27/0.30
β_x^* (mm)	330/330	1200/1200	32/25
ϵ_x (nm)	18/18	18/24	3.2/5.3
$\frac{\epsilon_y}{\epsilon_x}$ (%)	1	0.85/0.64	0.27/0.24
σ_y (μm)	1.9	0.94 $\xrightarrow{1/20}$	0.048/0.062
ξ_y	0.052	0.129/0.090	0.09/0.081
σ_z (mm)	4	6/7	6/5
I_{beam} (A)	2.6/1.1	1.64/1.19 $\xrightarrow{\times 2}$	3.6/2.6
N_{bunches}	5000	1584	2500
Luminosity ($10^{34} \text{cm}^{-2} \text{s}^{-1}$)	1.0	2.11 $\xrightarrow{\times 40}$	80

SuperKEKB accelerator

July 2nd 2018 Luminosity record $5 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$
 (target end Phase 2 July 15th 2018 $1 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$)

β_y^* 8 mm -> 4 mm
 (target 0.3 mm)

$I_{\text{LER}} / I_{\text{HER}} = 0.7 / 0.7 \text{ A}$
 (target 3.6 / 2.6 A)



First physics results

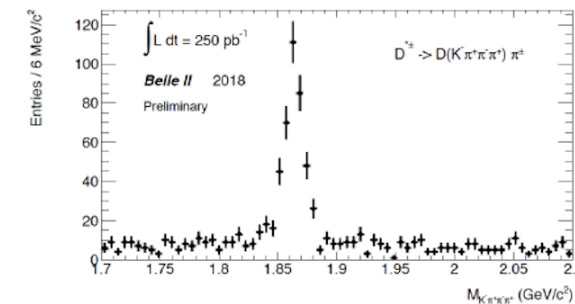
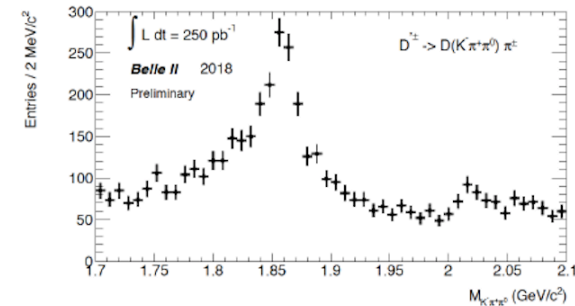
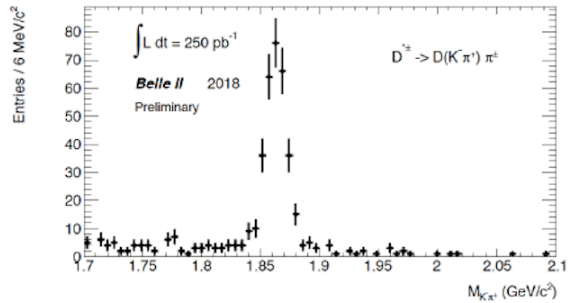
Reconstruction of $D^{*\pm}$, B^0 , $B^\pm$ with 250 pb $^{-1}$

$$e^+e^- \rightarrow c\bar{c}$$

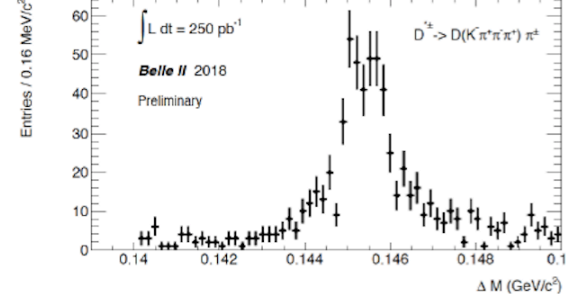
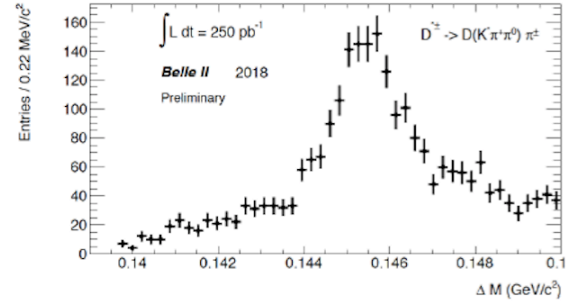
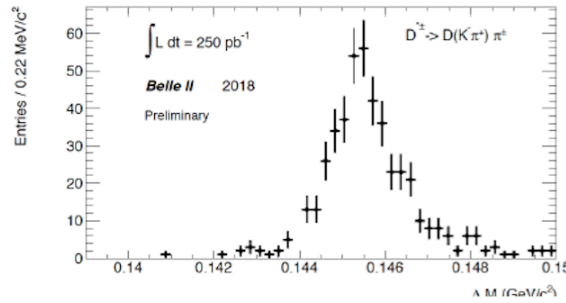
$$D^{*+} \rightarrow D^0\pi^+,$$

$$D^0 \rightarrow K^-\pi^+, K^-\pi^+\pi^0, K^-\pi^+\pi^-\pi^+$$

$M(D^{*\pm})$

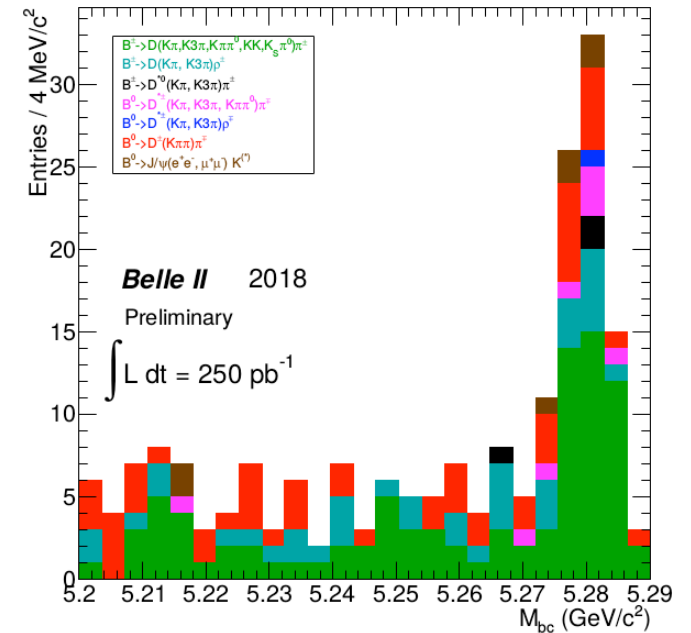


$M(D^{*\pm}) - M(D^0)$

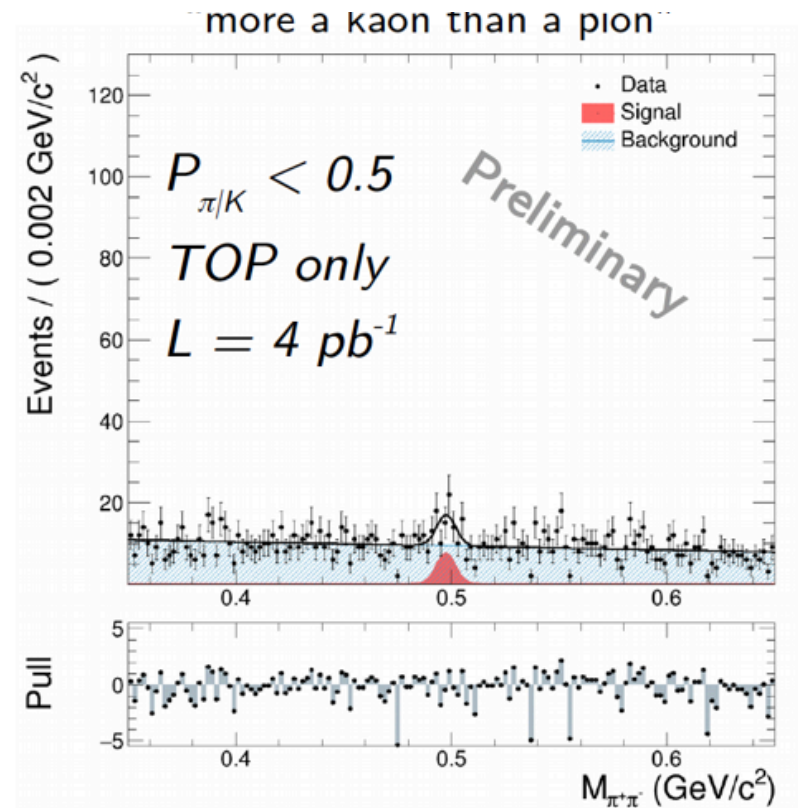
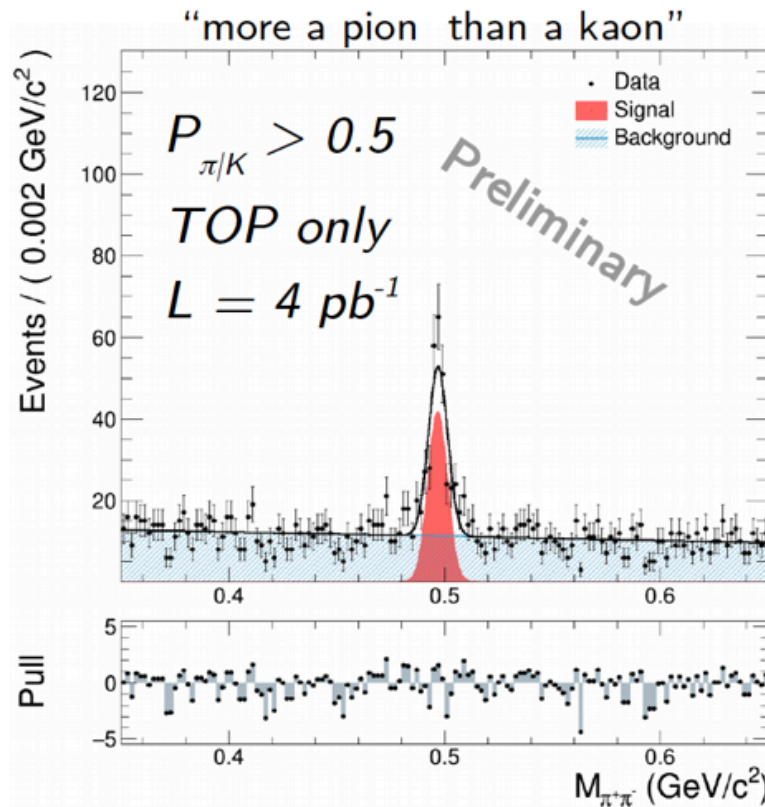


$$\begin{aligned} B^\pm &\rightarrow D(K\pi, K3\pi, K\pi\pi^0, KK, K_S\pi^0)\pi^\pm \\ B^\pm &\rightarrow D(K\pi, K3\pi)\rho^\pm \\ B^\pm &\rightarrow D^{*0}(K\pi, K3\pi)\pi^\pm \\ B^0 &\rightarrow D^{*+}(K\pi, K3\pi, K\pi\pi^0)\pi^\mp \\ B^0 &\rightarrow D^{*+}(K\pi, K3\pi)\rho^\mp \\ B^0 &\rightarrow D^{*+}(K\pi\pi)\pi^\mp \\ B^0 &\rightarrow J/\psi(e^+e^-, \mu^+\mu^-) K^{(*)} \end{aligned}$$

$M(B^0, B^\pm)$



TOP performance



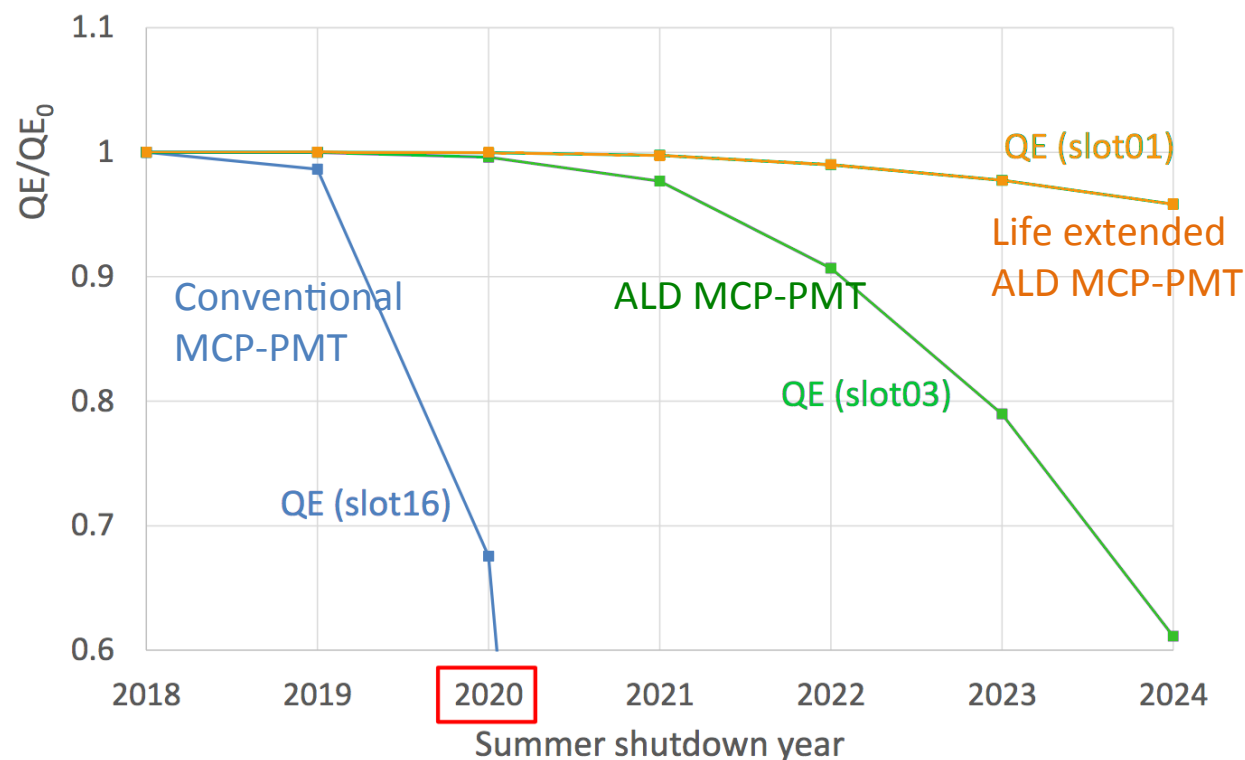
PID selection (probability to be a pion vs kaon) works for the K_S^0 invariant mass

π efficiency (or Kaon fake rate) is still 10% worst in Phase 2 data than MC.

The time calibration can be improved

TOP upgrade

BG x 1



Conventional MCP-PMTs to be replaced: **224 (+ 35 spares)**

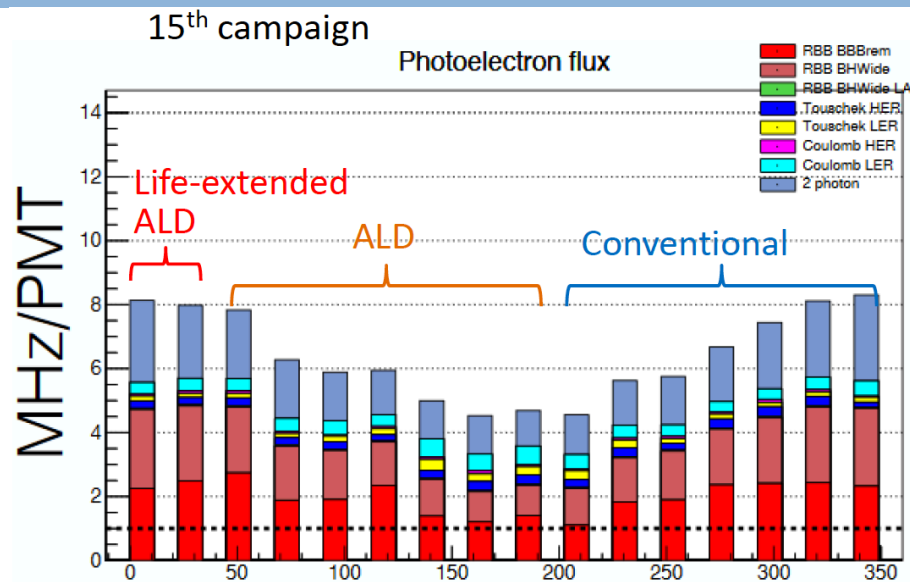
Available MCP-PMTs for replacements: **84**

Available MCP-PMTs with ongoing orders: **189** (**18 from INFN**, 70 from KEK, 17 from Nagoya)

Necessary additional order: **35 (+35 spares)**

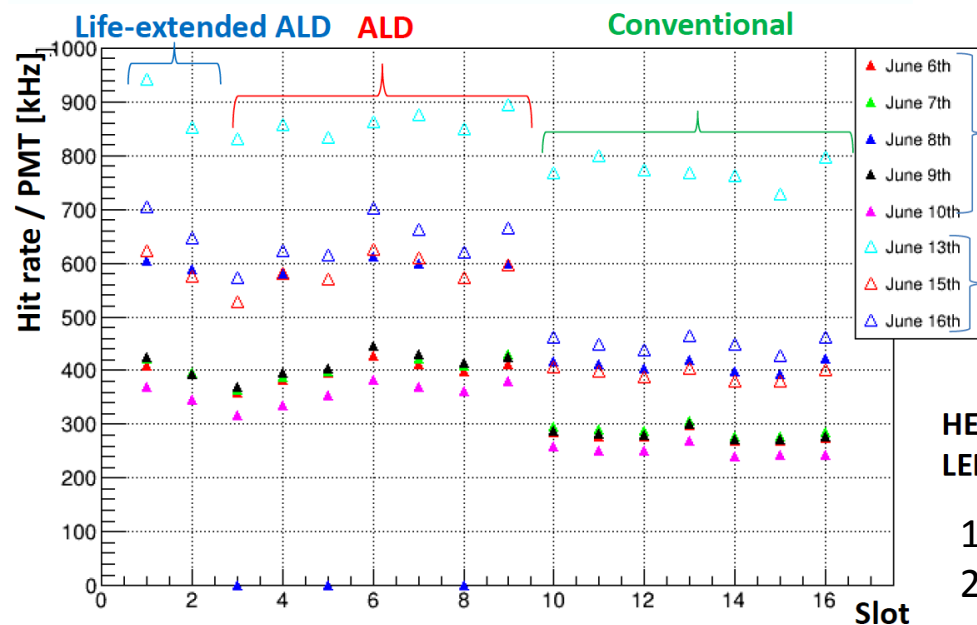
MCP-PMT replacement: Summer 2020

Beam background



Expected rate with $L = 8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$

4 – 8 MHz / PMT



Measured rate with $L \sim 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$

Phase 2.1.2

0.4 – 0.8 MHz / PMT

Phase 2.1.3

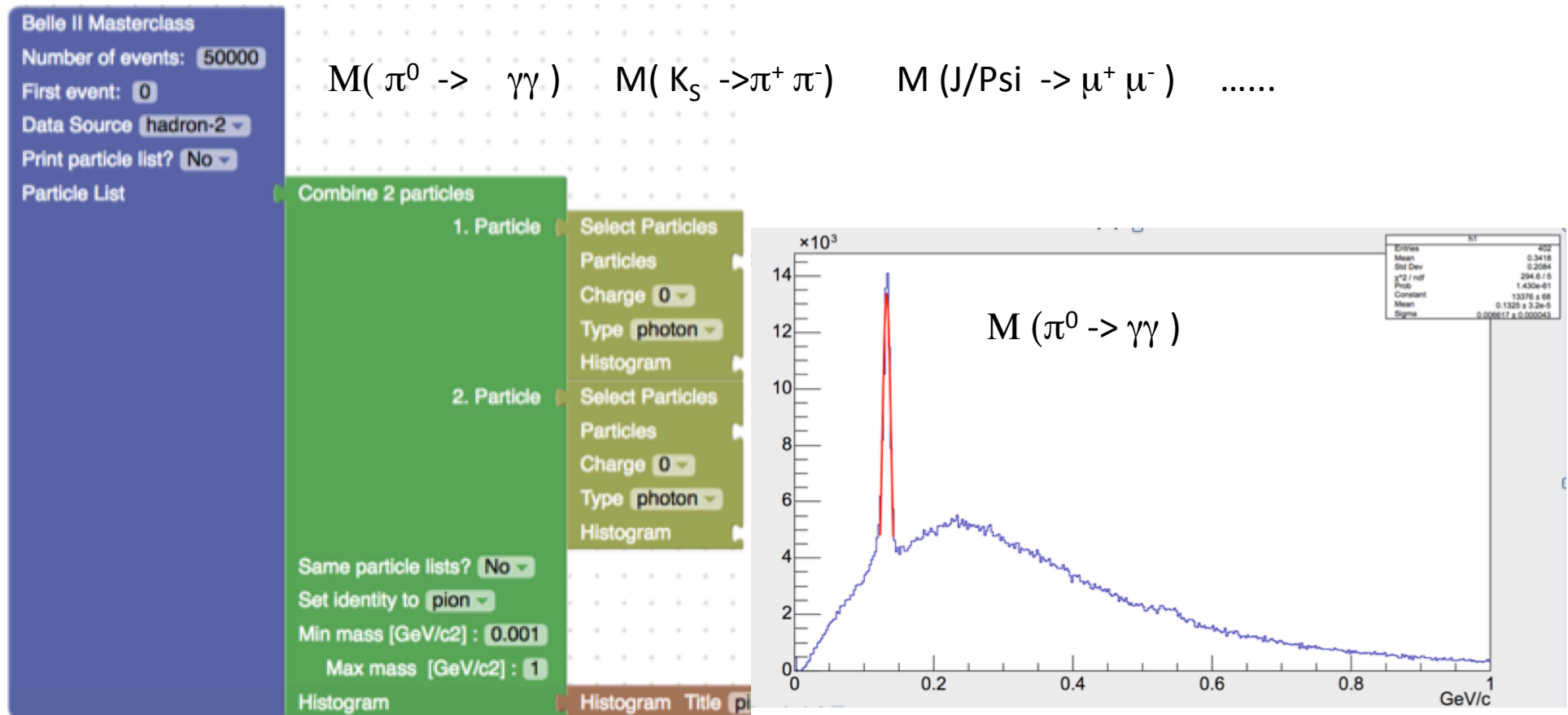
HER = 250 mA

LER = 250 mA

- 1) background does not scale linearly with the lumin.
- 2) background optimization still to be done

Outreach

Il 16 Marzo 2018 è stata realizzata a Padova la prima Masterclass dell'esperimento Belle II utilizzando un visore 3D con eventi simulati di Belle II ed un software di programmazione divulgativo (Blockly) che ha permesso di ricostruire masse invarianti con dati reali di Belle. Ad Ottobre sarà realizzata a Mainz la prima Masterclass con dati reali di Belle II.



Responsabilità

2018

2019

Stefano Lacaprara Contact person fisica PD
T0 calibration

Contact person fisica PD
Resp. Gruppo fisica TDCPV(*)

Alessandro Mordà data production liaison for TDCPV
chair data production liason

Mario Posocco Membro comm. pari opportunità

Membro comm. pari opport.

Roberto Stroili Contact person computing PD

Contact person computing PD
Responsabile attività TOP Italia(**)

Ezio Torassa Responsabile attività TOP Italia

Membro Executive Board

Bold: nuove responsabilità

(*) decisione 11/7 (**) decisione a Settembre

Anagrafica

Padova 2018

Alessandro Mordà	100%
Wenlong Yuan	100%
Mario Posocco	0%
Paolo Sartori	100%
Stefano Lacaprara	30%
Roberto Stroili	90%
Ezio Torassa	40%

TOT Ric. **4.6 FTE**

Fabio Montecassiano	20%
Flavio DalCorso	20%

TOT 5.0 FTE

TOT STAFF 2.0 FTE

Padova 2019

Alessandro Mordà	
Wenlong Yuan	
Mario Posocco	0%
Paolo Sartori	0%
Stefano Lacaprara	70%
Roberto Stroili	100%
Ezio Torassa	80%
Franco Simonetto	20%

2.7 FTE

Fabio Montecassiano	20%
Flavio DalCorso	20%

3.1 FTE

3.1 FTE

Progetti europei

Jennifer 1 terminerà il 31 Marzo 2019

Research and Innovation Staff Exchange (RISE) Call: H2020-MSCA-RISE-2014

2.3 M€ (1.3 M€ Belle II, 1 M€ T2K/HyperK)

0.774 M€ INFN

Belle II Padova secondments effettuati: 8 mesi 10 giorni

Belle II Padova secondments da effettuare: 1 mese 16 giorni

Approvato Jennifer 2

Research and Innovation Staff Exchange (RISE) Call: H2020-MSCA-RISE-2018

2.4 M€ (1 M€ Belle II, 1 M€ T2k/HyperK, 0.15 M€ new photo det, 0.25 M€ computing)

agreement da firmare entro metà Settembre 2018

La data di inizio è da stabilire, l'obiettivo è il 1 Aprile 2019

Richieste 2019

Richieste alla sezione per il 2019

Servizio progettazione ed officina Elettronica 0 m.u.
 Servizio officina Meccanica 0 m.u.
 Servizio progettazione Meccanica 0 m.u.
 Servizio calcolo 0 m.u.

Richieste all'INFN per il 2019

Sede	Capitolo	Descrizione	Richiesta (keuro)	SJ (keuro)
PD	consumo	Metabolismo (1.5 k€ * FTE)	4.5	
PD	missioni	Metabolismo ([6 k€ + 1 k€] * FTE)	21.5	
PD	missioni	Turni TOP 6 m.u. fase 3 (PD + TO)	36	
PD	missioni	Membro executive board	5	
PD	missioni	Test ALD-MCP-PMT a Nagoya / KEK	6	
PD	apparati	24 life-extended ALD MCP-PMT	122	

Missioni per turni centrali fase 2: fondi presso sede del coordinatore nazionale Belle II

(LNF)