

三銃士



$3 \pm 1$

(So far)

$LAL + IPHC = 2$   
within one sigma : it should be fine to start



## Demande de Soutien Projet IN2P3

Belle-II / Le Diberder



(next critical steps ahead)

CS LAL : 22 May  
 CS IPHC : 8 June  
 CS IN2P3 : 22 June  
 Belle-II : June

Initial step is strongly supported by IN2P3 and LAL & IPHC Directors

### 8 Laboratoires participants et visas



Nom du Laboratoire	Nom du Directeur	Visa
LAL : Laboratoire de l'Accélérateur Linéaire	Achille STOCCHI	<i>Achille STOCCHI</i> Directeur du Laboratoire de l'Accélérateur Linéaire
IPHC : Institut Pluridisciplinaire Hubert Curien	Christelle ROY	La Directrice de l'IPHC <i>Christelle ROY</i>

Remarque : Les signatures et visa seront apposés sur la version PDF du document final. La version PDF seule sera envoyée ou déposée sous ATRIUM.

## The team

<b>Philip</b>	<b>Bambade</b>	<b>LAL</b>	<b>DR</b>
<b>Leonid</b>	<b>Burmistrov</b>	<b>LAL</b>	<b>IR</b>
<b>Daniel</b>	<b>Cuesta</b>	<b>IPHC</b>	<b>PhD</b>
<b>Emi</b>	<b>Kou</b>	<b>LAL</b>	<b>DR</b>
<b>Francois</b>	<b>Le Diberder</b>	<b>LAL</b>	<b>Pr</b>
<b>Mehdi</b>	<b>Moravie</b>	<b>IPHC</b>	<b>M2</b>
<b>Jerome</b>	<b>Baudot</b>	<b>IPHC</b>	<b>Pr</b>
<b>Isabelle</b>	<b>Ripp-Baudot</b>	<b>IPHC</b>	<b>DR</b>
<b>New</b>	<b>Physicist</b>	<b>IPHC</b>	<b>Postdoc</b>

# B2TiP



TOPICAL WORKSHOP

## MIAPP - B2TiP Workshop

15 - 17 November 2016, Garching

The MIAPP B2TiP Workshop will bring together experimentalists and theorists to define the physics programme for the first years of data taking of the Belle II detector at the upgraded SuperKEKB  $e^+e^-$  accelerator. This workshop is an important milestone towards the publication of the Belle II Physics Book.

**Workshop Topics:**

- WI 1: Scintillators & Luminosity & Storage
- WI 2: Radiation & Electromagnetic Phenomena
- WI 3:  $e^+e^-$  and  $Z \rightarrow e^+e^-$
- WI 4:  $e^+e^-$
- WI 5: Quantum Hadronic & Decay
- WI 6: Charm
- WI 7: Quarkonium(like)
- WI 8:  $e^+e^-$  New multiplicity & CP
- WI 9: New Physics

**Hosts:**  
Institute for Advanced Study (IAS)  
Ludwig-Maximilians-Universität München (LMU)  
Garching

**Organisers:**  
Christoph Becher  
Thomas Kuhn

**Local organization:**  
Susann Blumrich, Ina Fombberger  
Tina Jacobi, Thomas Kämpfer  
pat@miapp.de

[www.miapp.de/B2TiP](http://www.miapp.de/B2TiP)



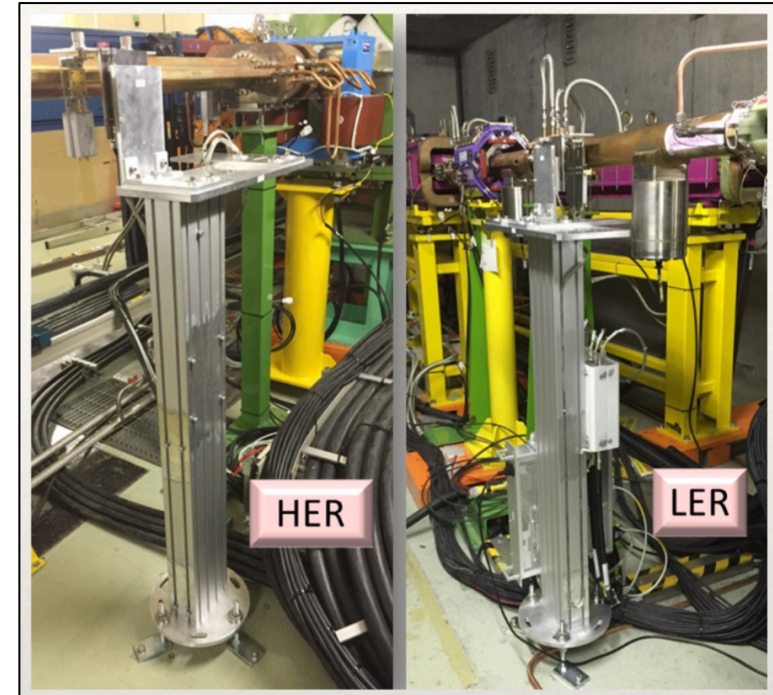
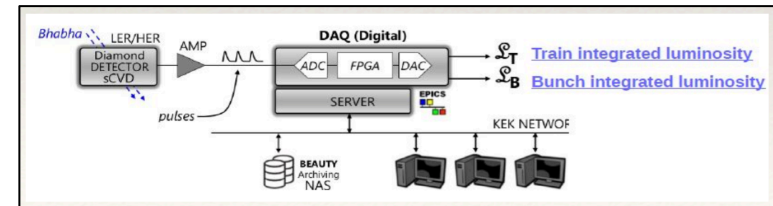
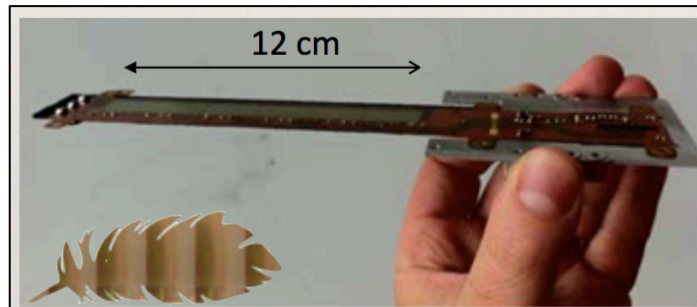
One of us is already playing  
a major role in



2014 → 2017 → 2019

2014 → 2018

And four of us already contribute to the Belle-II collaboration through Beast & SuperKeKB



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



A wide experience of  
International collaborations  
In laboratories all around the  
world



STANFORD LINEAR ACCELERATOR CENTER





Čerenkov  
Inner tracker

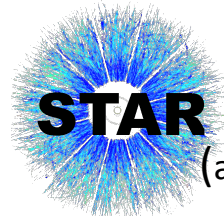
$$B \rightarrow \tau \nu_\tau$$



$$B_s \leftrightarrow \bar{B}_s$$

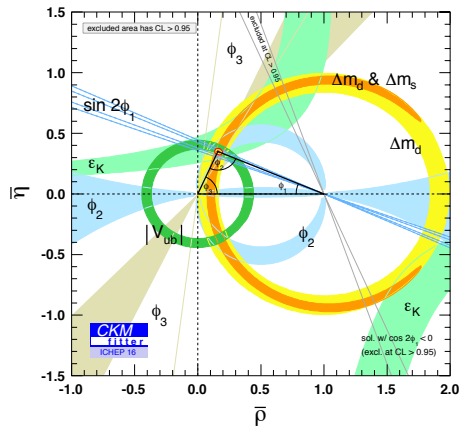
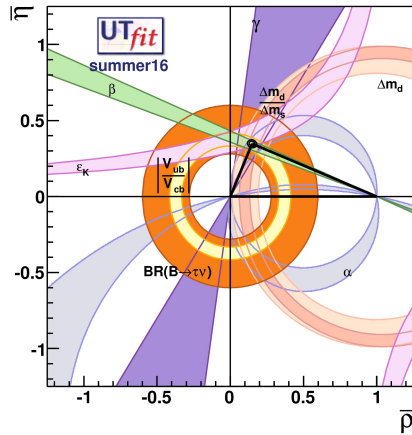


$$B \rightarrow DX$$

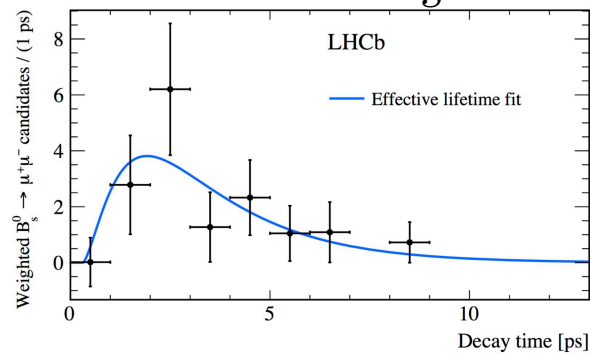


(and more...)

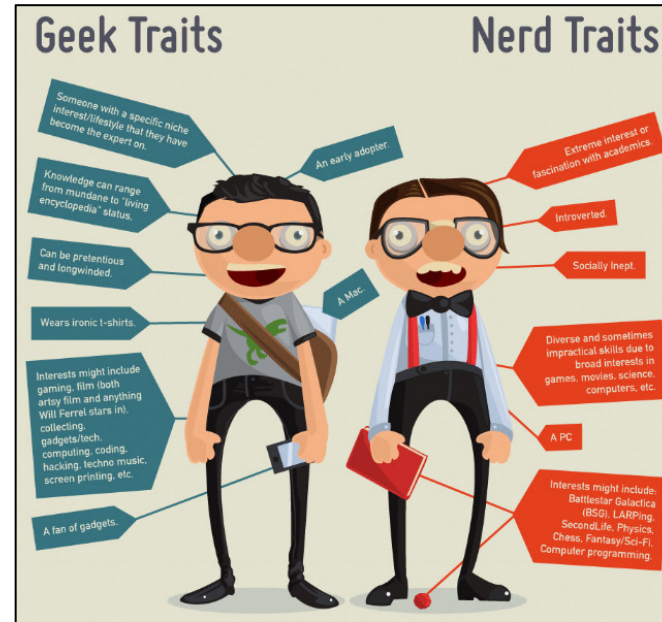




*s*Plot



# Statistics Geek&Nerd



since 2008

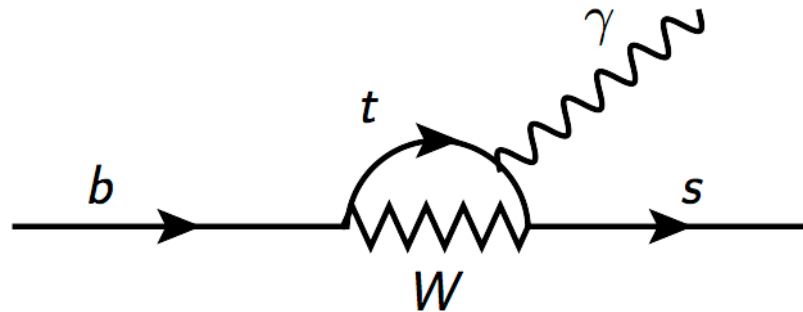




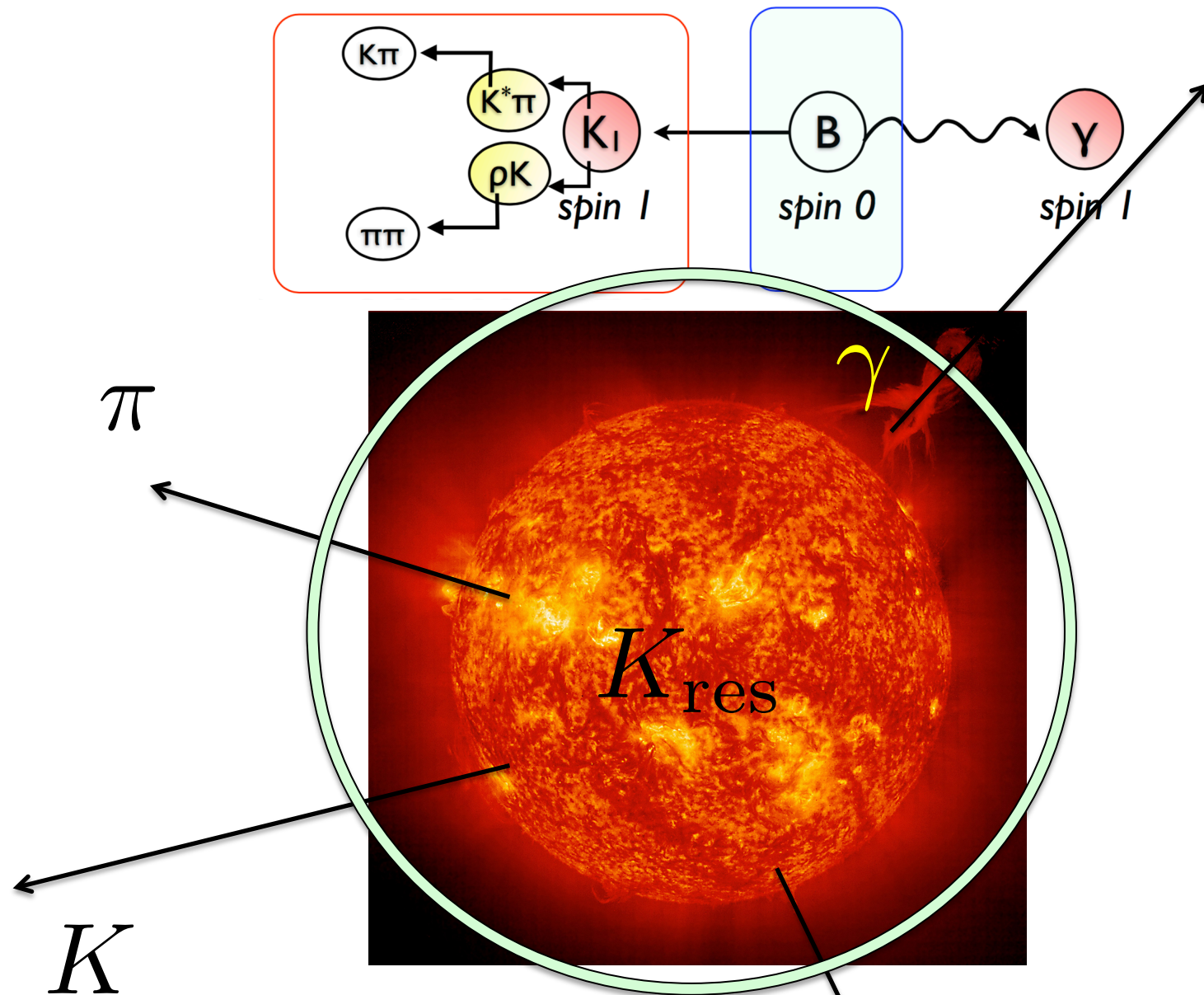
# Main motivation : BSM



⇒ A common analysis goal



$$B \rightarrow K \pi \pi \gamma \leftarrow \text{polarized} \quad (\text{in SM})$$



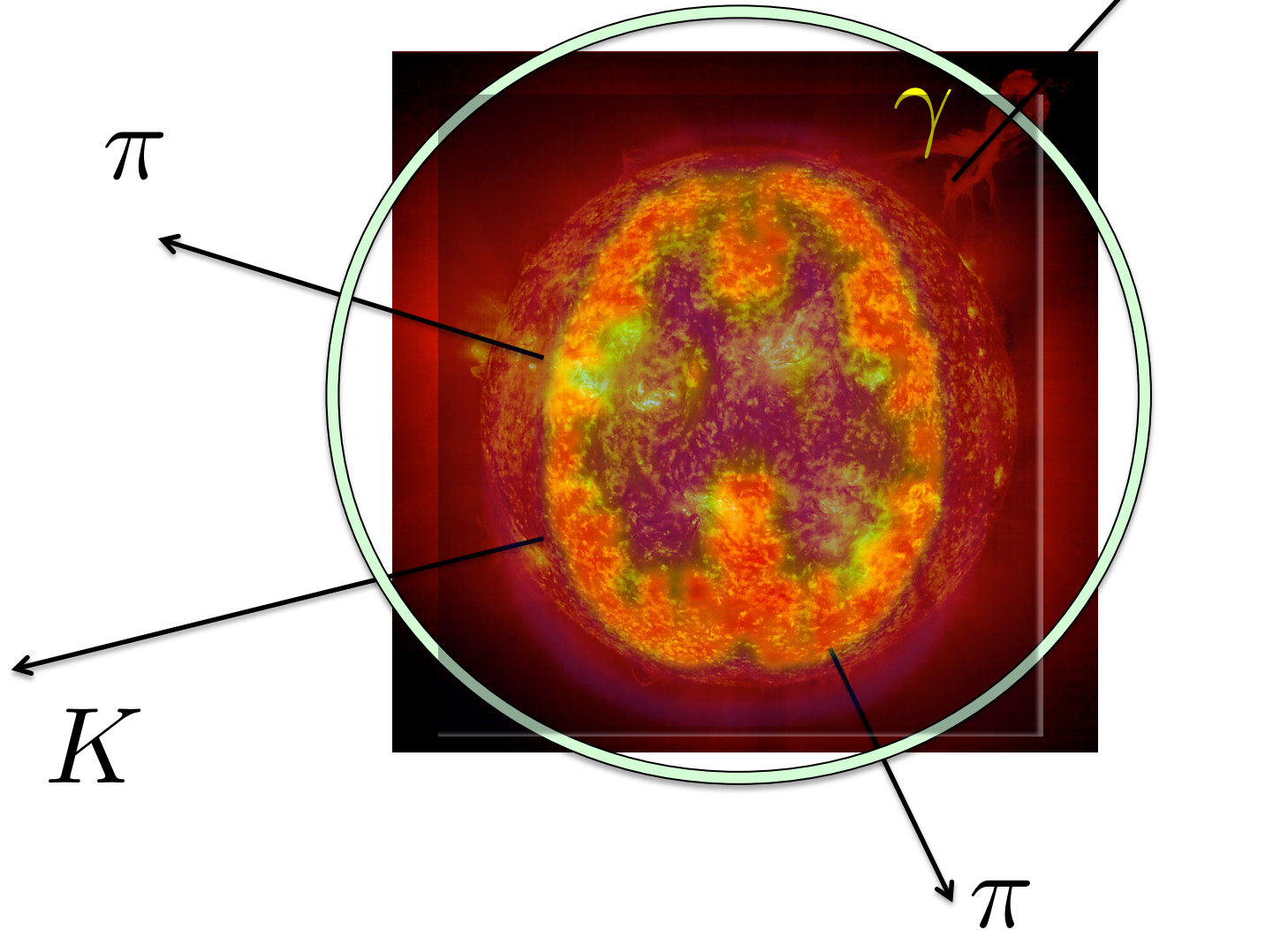
*polarized*  $\rightarrow K \pi \pi \leftarrow B \rightarrow \gamma \leftarrow$  *polarized*

Gronau, Grossman, Pirjol, Ryd (2001)

See backup slide for further references

several  
 $K_{res}$

One needs a TEP camera to see inside  
 $\geq 3$  body final state needed





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

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



R. Dalitz

If observed it implies



$\gamma$  polarization

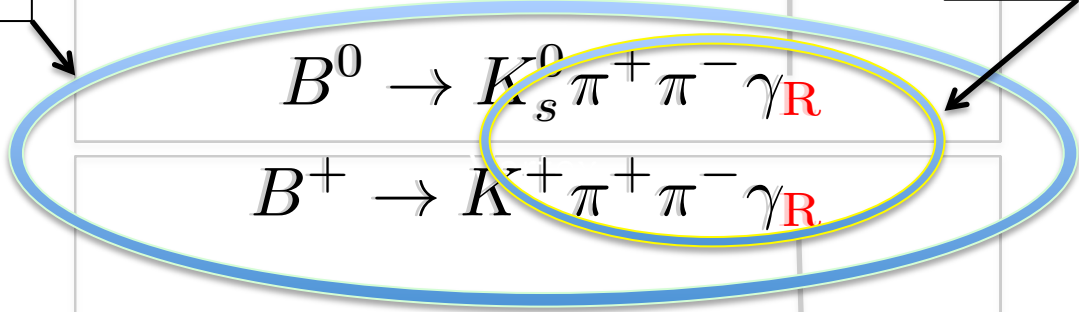


Common theoretical  
description

E. Kou

Vertexing

Common experimental  
aspects



PID



$$E = \begin{pmatrix} 0.034 & -0.133 & -0.021 & -0.067 & 0.007 \\ \hline & 0.040 & 0.260 & 0.630 & -0.320 \\ & & 0.019 & 0.395 & -0.470 \\ & & & 0.680 & -0.405 \\ & & & & 0.180 \end{pmatrix}$$

Preliminary result!

- ← Photon polarization
- ← K1(1270)/K1(1270) separation
- ← (Kπ)<sub>s-wave</sub> contributions
- ← K1 mixing angle c.f. (60±10)°
- ← Damping factor c.f. (4±0.5)

E. Kou

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

### Matrix Element Method

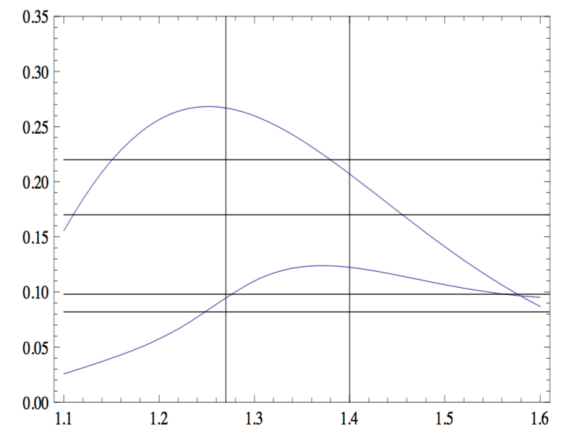
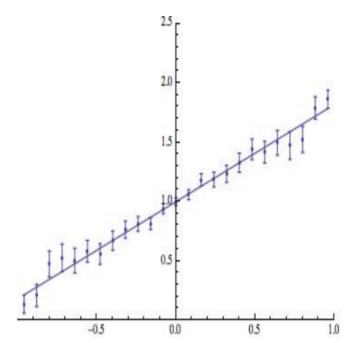
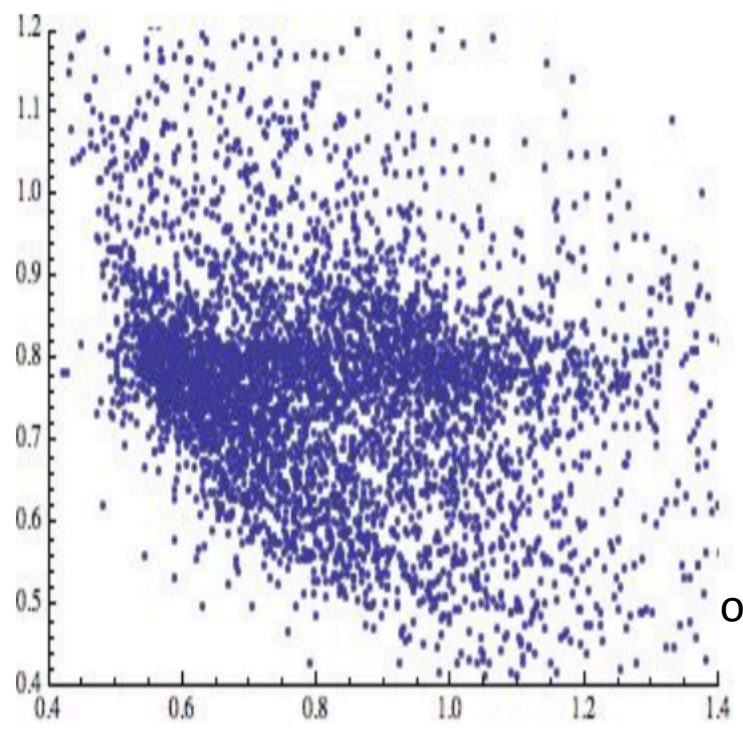


Figure 23: The widths  $\Gamma$  as a function of  $s$  (GeV<sup>2</sup>).

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

$v_0^{\text{fit}}$	$\Gamma_{\text{cst}}^{\text{data}}$	$\Gamma_{(s)}^{\text{data}}$
$\Gamma_{\text{cst}}^{\text{theory}}$	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

Bells and Whistles



$$B^0 \rightarrow K_s^0 \pi^+ \pi^- \gamma_{\mathbf{R}}$$

$$B^+ \rightarrow K^+ \pi^+ \pi^- \gamma_{\mathbf{R}}$$

$$B^0 \rightarrow K^+ \pi^- \pi^0 \gamma_{\mathbf{R}}$$

$$B^+ \rightarrow K_s^0 \pi^+ \pi^0 \gamma_{\mathbf{R}}$$

$$B^0 \rightarrow K_s^0 \pi^+ \pi^- \gamma_{\mathbf{R}}$$

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

A long and winding road to unravel BSM



Parton level, no detector effect, no background...



Obviously a small team



Strongly wishing to expand

and willing to contribute very significantly to the Belle-II Collaboration



## Backup slide for Further References

Determining the photon polarization of the  $b \rightarrow s \gamma$  using the  $B \rightarrow K_1(1270) \gamma \rightarrow (K \pi \pi) \gamma$  decay

E. Kou (Orsay, IPN), A. Le Yaouanc (Orsay, LPT), A. Tayduganov (Orsay, IPN

& Orsay, LPT). Nov 2010. 26 pp.

Published in Phys.Rev. D83 (2011) 094007 / LPT-ORSAY-10-91, LAL-10-209 / e-Print: arXiv:1011.6593 [hep-ph]

Future prospects for the determination of the Wilson coefficient  $C_7^{\gamma}$

Damir Becirevic (Orsay, LPT), Emi Kou (Orsay, LAL), Alain Le Yaouanc

(Orsay, LPT), Andrey Tayduganov (Orsay, LAL & Orsay, LPT). Jun 2012. 34pp.

Published in JHEP 1208 (2012) 090 / LPT-ORSAY-12-38, LAL-12-146 / e-Print: arXiv:1206.1502 [hep-ph]

The strong decays of  $K_1$  resonances

A. Tayduganov (Orsay, IPN & Orsay, LPT), E. Kou (Orsay, IPN), A. Le

Yaouanc (Orsay, LPT). Nov 2011. 57 pp.

Published in Phys.Rev. D85 (2012) 074011 / LPT-ORSAY-11-100, LAL-11-307 / e-Print: arXiv:1111.6307 [hep-ph]

Angular analysis of  $B \rightarrow J/\psi K_1$  : towards a model independent

determination of the photon polarization with  $B \rightarrow K_1 \gamma$

E. Kou (Orsay, LAL), A. Le Yaouanc (Orsay, LPT), A. Tayduganov (Marseille,

CPPM). Apr 26, 2016. 6 pp.

Published in Phys.Lett. B763 (2016) 66-71 / LAL-16-010, LPT-ORSAY-16-29 / e-Print: arXiv:1604.07708 [hep-ph] | PDF