Introduction to the Heavy Flavour session : the lanscape

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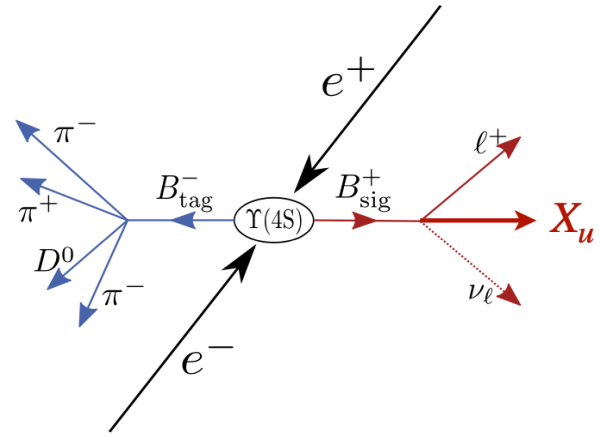
BFactories (Belle-II)



Beam energy const. + tag-side
→ kinematical constraints

Inclusive decays

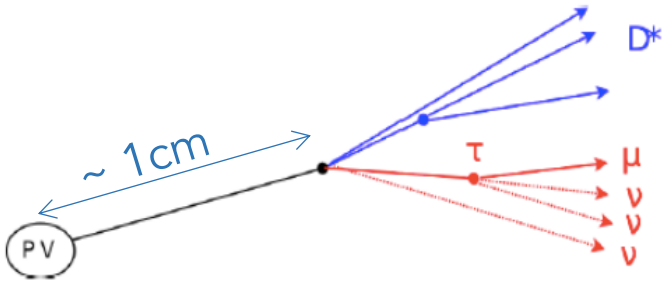
Access to absolute BR

BaBar & Belle ~ 1.1 ab^{-1}

Belle-II (ICHEP2020 schedule) :
10 ab^{-1} in 2025, 50 ab^{-1} in 2031

Belle-III ? (250 ab^{-1}) triggerless

LHCb



Very large boost→ flight distance reconstruction
→ kinematical constraints

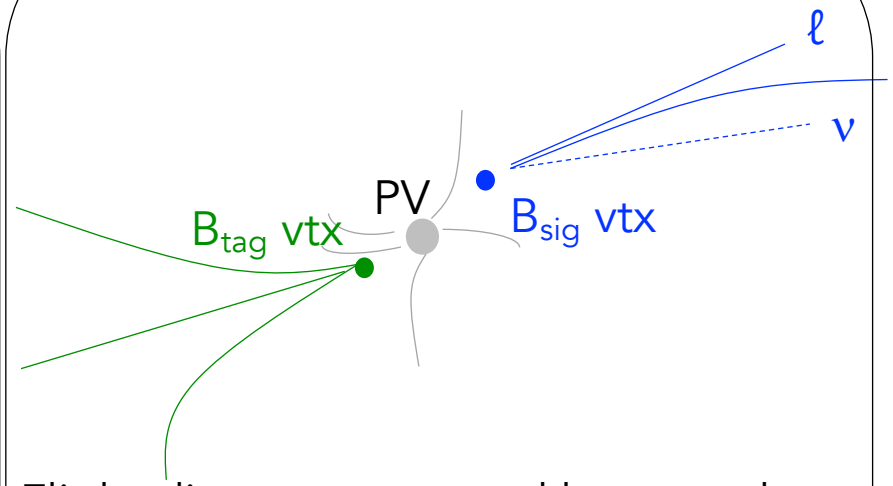
All b-hadrons species

No access to absolute BR

LHCb: 9fb^{-1} at hand

LHCb-Upgrade 1 (soft. trigger) :
at the end of Run3 (2024) : 23 fb^{-1}
at the end of 2020s : 50 fb^{-1}
LHCb-Upgrade 2 : 300 fb^{-1}

FCCee



Flight distance reco. and beam+other hemisphere
→ kinematical constraints

All b-hadrons species

Access to absolute BR

FCCee (from late 2030)

5 10^{12} Z^0

1.5 10^8 WW

triggerless

With 300 fb-1 of data at LHCb and Belle-II (III ?) a lot will be already known on Flavour Physics

➔For FCCee to play a significant role, the detector should be tailored to Flavour Physics

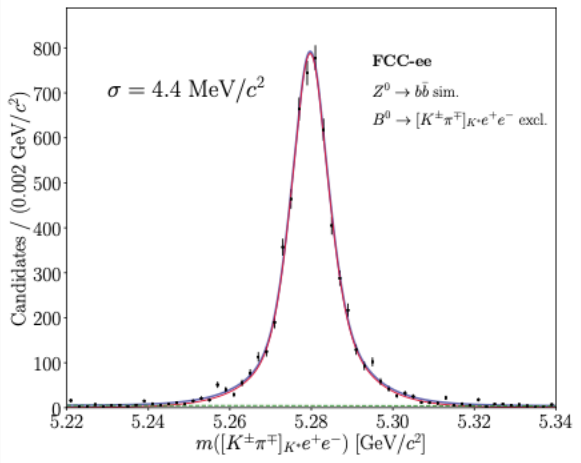
- ➔Powerful PID (Pi/K/p e and mu) over a large momentum range
- ➔neutral reconstruction (Pi0, γ)
- ➔excellent vertex reconstruction
- ➔excellent mass resolution
- ➔excellent jet flavour tagging
- ➔hermeticity (many-body decays, use of the other hemisphere on top of beam E constraints)
- ➔.. and a light detector (Bremstrahlung, conversions)

➔We should identify exemplary key channels, also from a physics point of view

All charged tracks modes with leptons (e/μ):

- (very) Rare modes with muons : LHCb will have done the most of the job
- (very) Rare modes with electrons :

Donal presentation:



IDEA detector, no brem emission

LHCb σ = 75 MeV/c^2

Belle σ = 5 MeV/c^2
[arXiv: 1904.02440]

to be implemented in order to study decays involving electrons
IDEA detector is expected to be light … (still)

σ (K*μμ) ~ 20 MeV for LHCb [arXiv:1112.3515]

This is a place where FCCee may play a very important role

Donal's presentation in Nov 2020 at CERN

Physics analyses involving Flavour tagging :

LHCb ~ 6% (now)
FCCee could reach 20%-25% ?

DsK ⊗ JPsi Phi

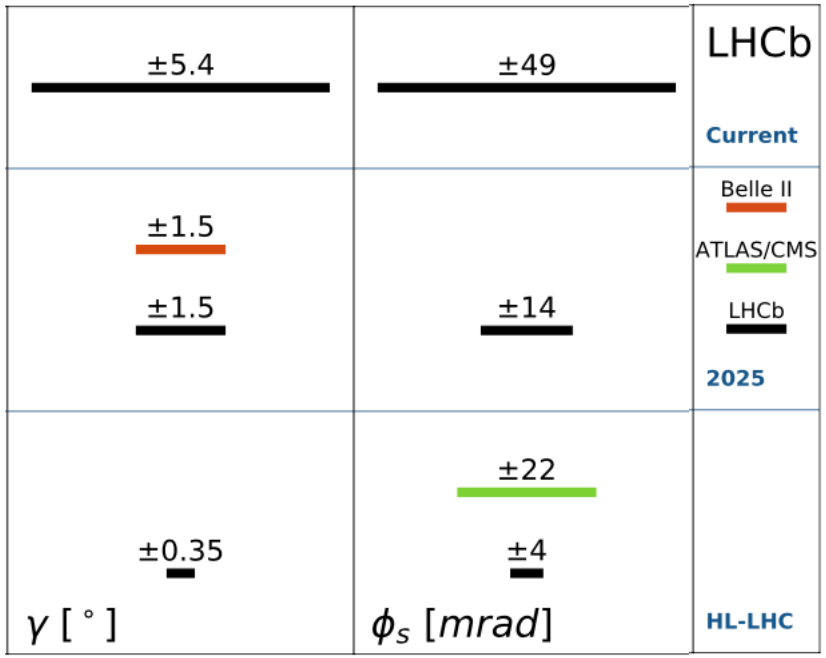
Bs

$\delta(\gamma) \lesssim 0.4° \ (stat.), \quad \delta(\beta_s) \lesssim 3.4° \times 10^{-2} (stat.)$ achievable

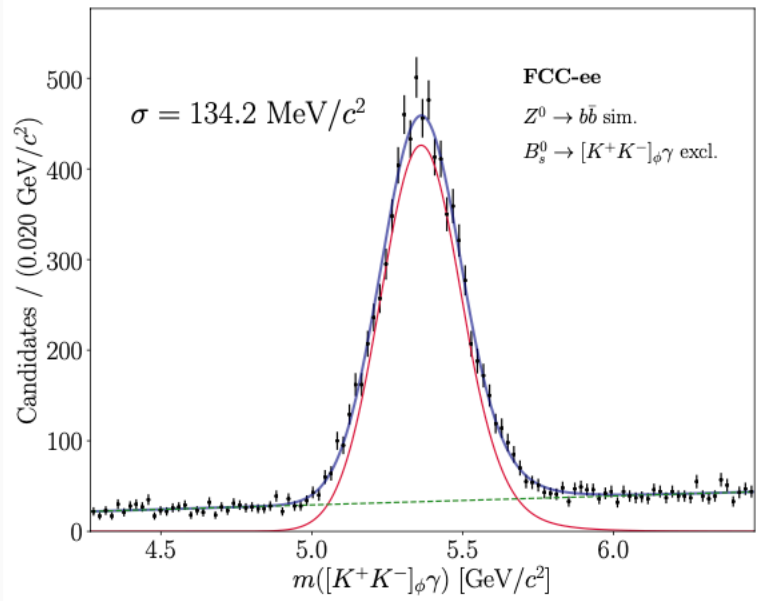
.6 mrad

Roy Aleksan

arXiv:1808.08865



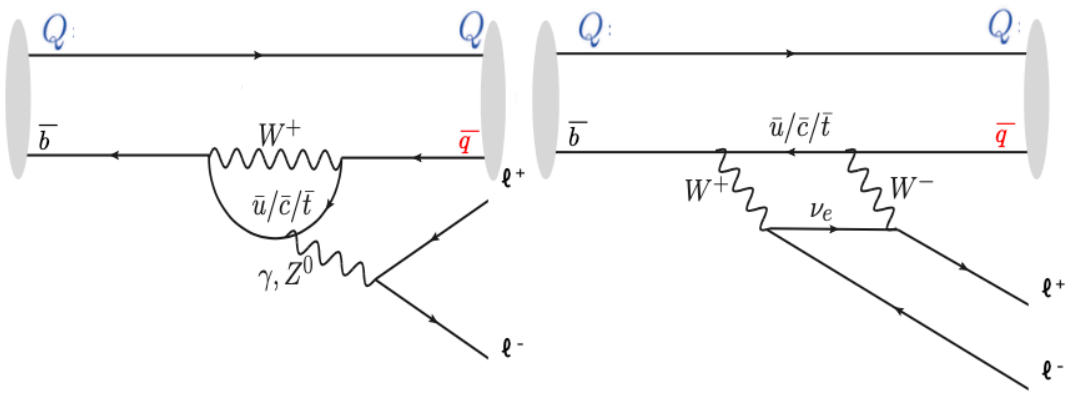
$B_s \rightarrow \phi\gamma$



LHCb : 100 MeV

Once tagging taken into account similar effective power ?

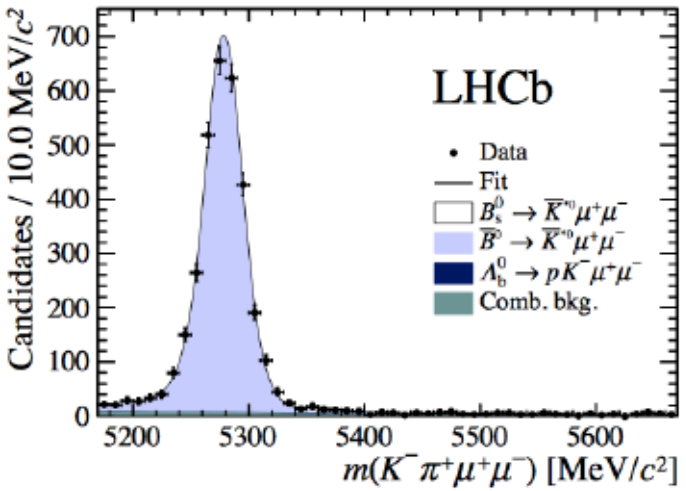
A unique access to b→ dll transitions ?

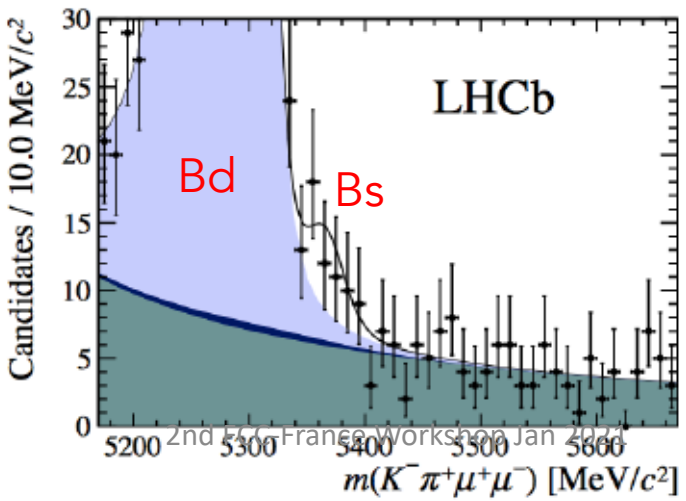


q=d

The equivalent of B0-> K*ll is B0-> ρ ll … . Background , not self-tagging.

$$\mathcal{B}(B_s^0 \to \overline{K}^* \mu^+ \mu^-) = (3.0 \pm 1.0(\text{stat}) \pm 0.2(\text{syst}) \pm 0.3(\text{ext})) \times 10^{-8}$$

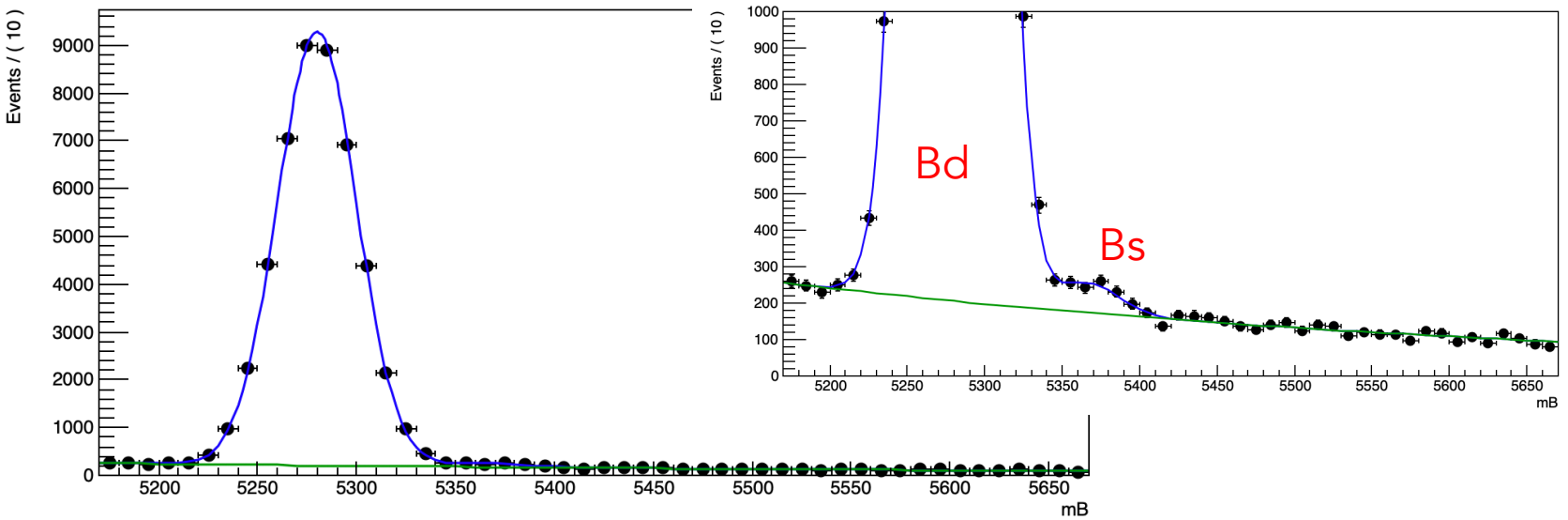




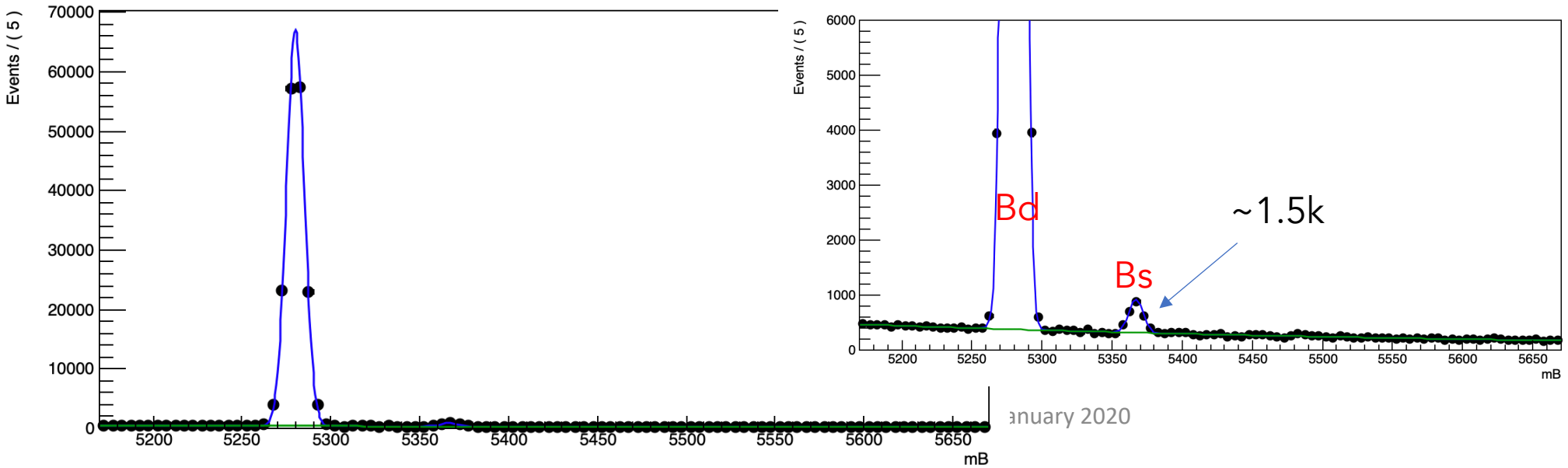
2011-2016

arXiv:1804.07167

Idealized and simplified LHCb situation with 50 fb^{-1}



Idealized and simplified FCCee situation



150 10^9 B_s
BR ~ 10^{-8}
➔ 1.5k B_s ?

Let's go !

	Introduction to the Heavy-Flavor/QCD session (15'+5')	*Marie-Hélène Schune*
	Video only	16:15 - 16:35
	First steps with flavour physics studies at FCC-ee using FCCSW (15'+5')	*Donal Hill*
	Video only	16:35 - 16:55
17:00	**First look at Bc--> tau nu @ FCC-ee (15+5')**	*Yasmine Amhis*
	Video only	16:55 - 17:15
	Flavour physics case studies (with related activities in Clermont) (15'+5')	*Stephane Monteil*
	Video only	17:15 - 17:35
	Study of Bs -> Ds K at FCC-ee and constraints on detector (15'+5')	*Roy Aleksan*
	Video only	17:35 - 17:55
18:00	**Perspectives for high-precision αS(m2Z) determinations at FCC-ee (15'+5')**	*Bogdan MALAESCU*
	Video only	17:55 - 18:15