Implications wrap-up

Mat Charles (Sorbonne Université / LPNHE)
for the organising committee

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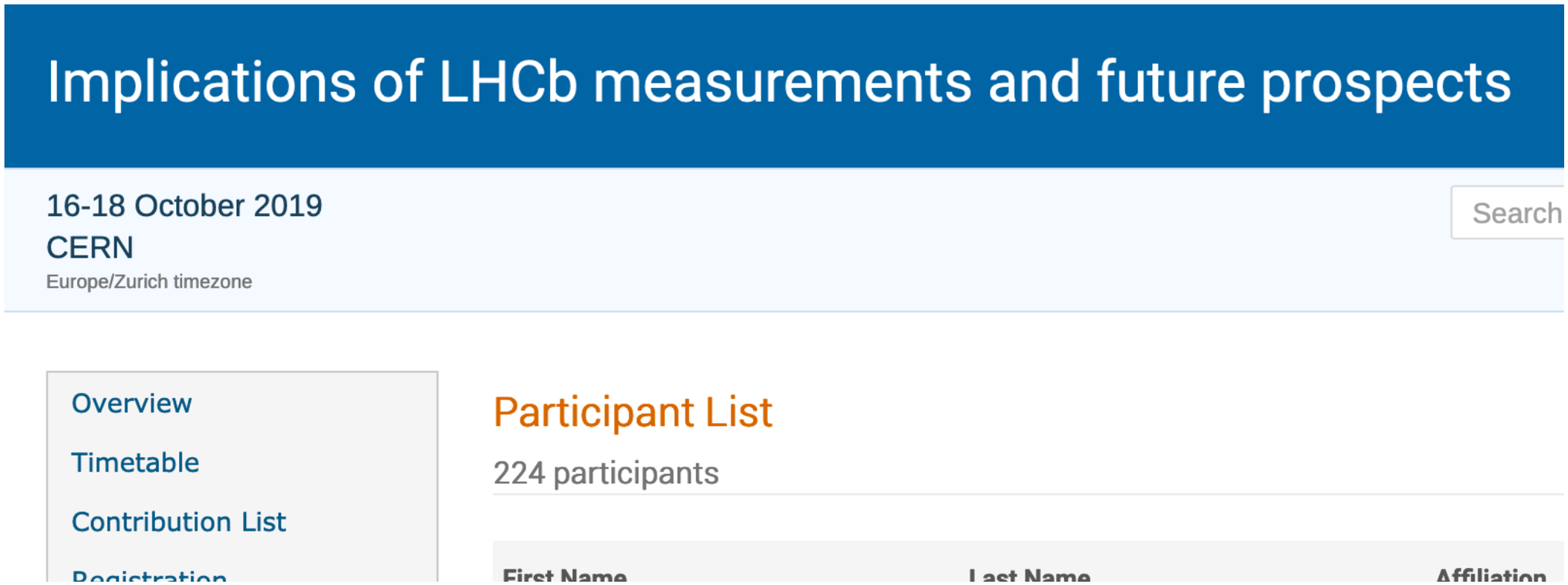
Some numbers



- 224 people registered
- 38 speakers
- Typically 15-30 people connected remotely
  - Somewhat fewer at 08:30

Thanks to

- LHCb Secretariat (Nathalie, Cindy, Amelie)
  - for handling CERN access, badges, hostel booking validation, welcome drink, booking shuttle, setting up pit visit, ...

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Starts 16 Oct 2019, 08:30
Ends 18 Oct 2019, 14:30
Europe/Zurich

Alexander Lenz
Chris Parkes
Danny van Dyk
Giovanni Passaleva
Guy Wilkinson
Johannes Albrecht
Jure Zupan
Matthew John Charles
Monica Pepe-Altarelli
S Fajfer
Yasmine Sara Amhis

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- Stream convenors (Matthew, Fabio, Jinlin, Nathan, Marzia, Peter, Carla, Ricci, Fady, Charlotte, Shanzhen, Feng-Kun, Patricia, Biplab, Tim)

- Mixing and CP violation in Beauty and Charm [Matthew Kirk, Fabio Ferrari, Jinlin Fu, Nathan Jurik, email all]
- Semileptonic decays, rare decays, and tests of lepton flavour universality [Marzia Bordone, Peter Stangl, Carla Marin Benito, Ricardo Vazquez Gomez, email all]
- Electroweak physics, heavy flavour production, implications for (n)PDFs, heavy ions, and exotica searches [Fady Bishara, Charlotte van Hulse, Shanzhen Chen, email all]
- QCD spectroscopy and exotic hadrons [Feng-Kun Guo, Patricia Magalhaes, Biplab Dey, Tim Evans, email all]

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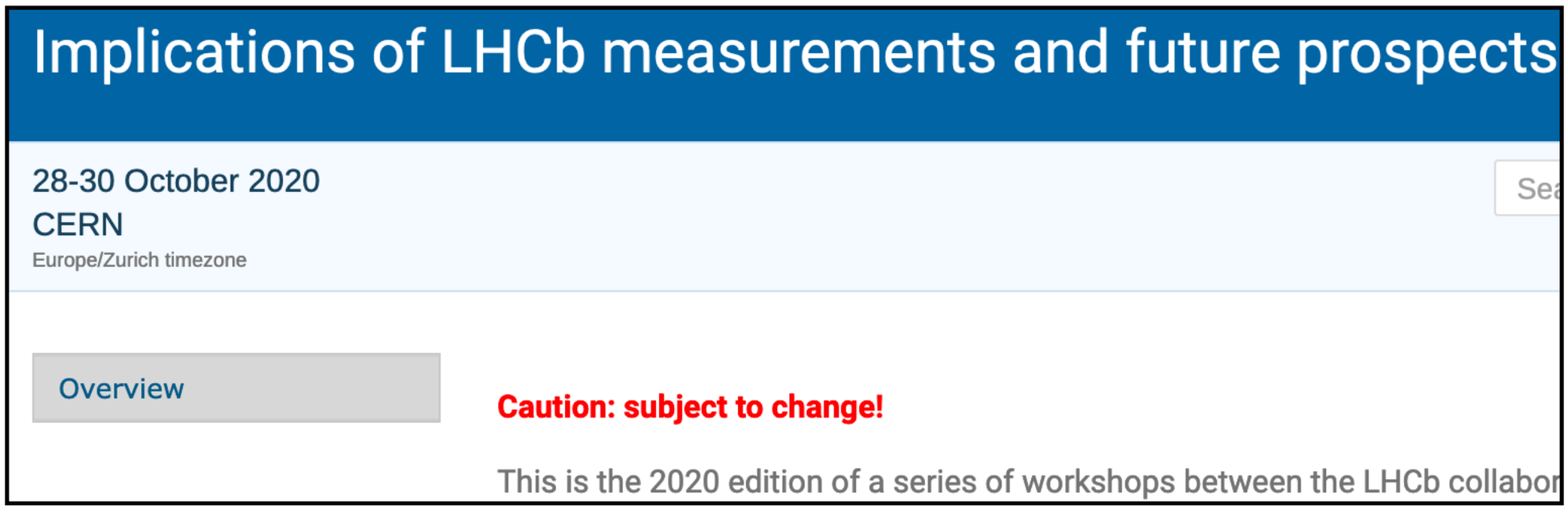
- Stream convenors (Matthew, Fabio, Jinlin, Nathan, Marzia, Peter, Carla, Ricci, Fady, Charlotte, Shanzhen, Feng-Kun, Patricia, Biplab, Tim)
- The speakers and everyone who contributed to the discussion (and put up with the clicker).

Implications 2020

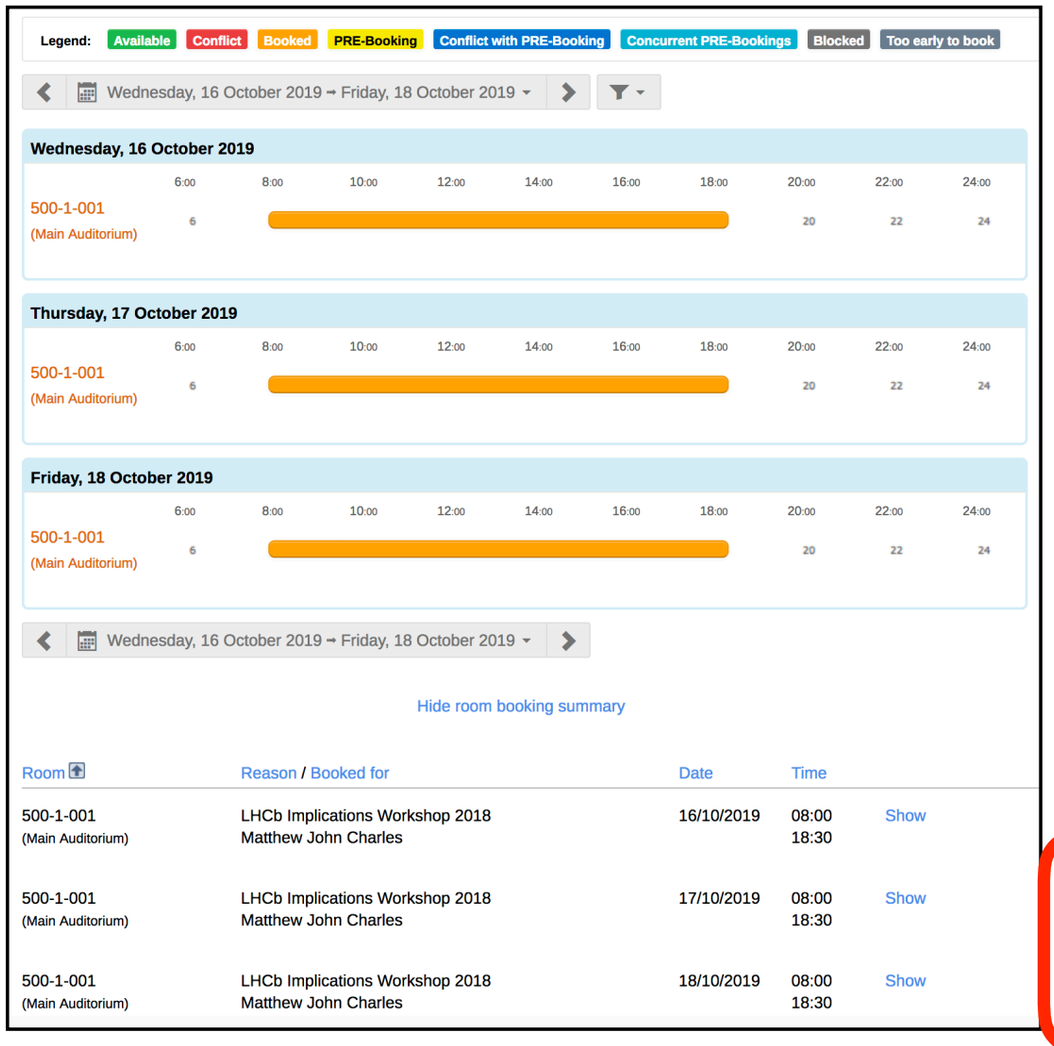


- Wed 28 - Fri 30 October 2020 (and maybe something on Tue 27 October, being discussed)
- Save the dates! [https://indico.cern.ch/e/Implications2020]

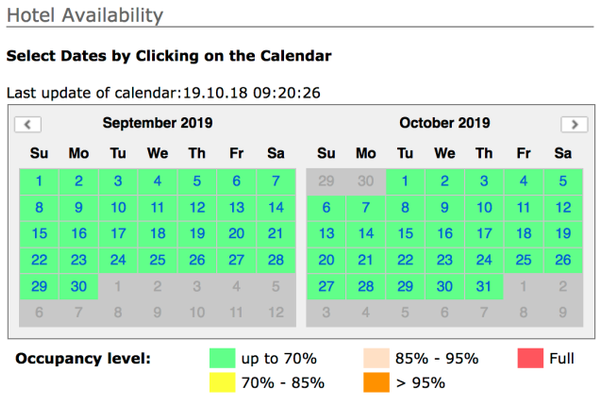
- Survey to come soon (call for feedback, fresh ideas). Please send us your thoughts!

Promised more results with Run2...

Implications 2019



- 16-18 October 2019
- Save the date!
- Still a few hostel rooms left...



- More results with Run2 data (we promise)

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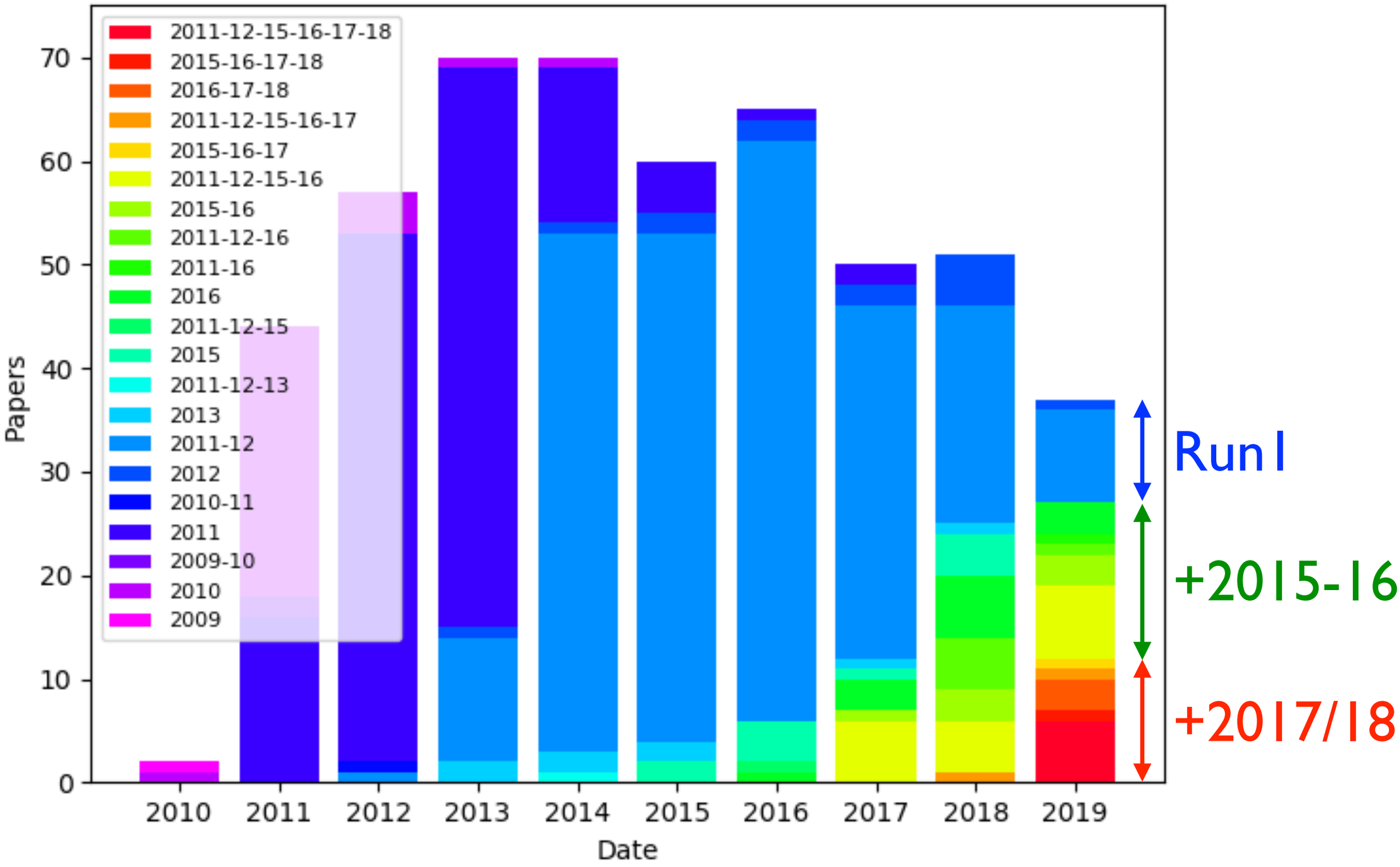
slides from 2018 wrap-up

Promised more results with Run2...



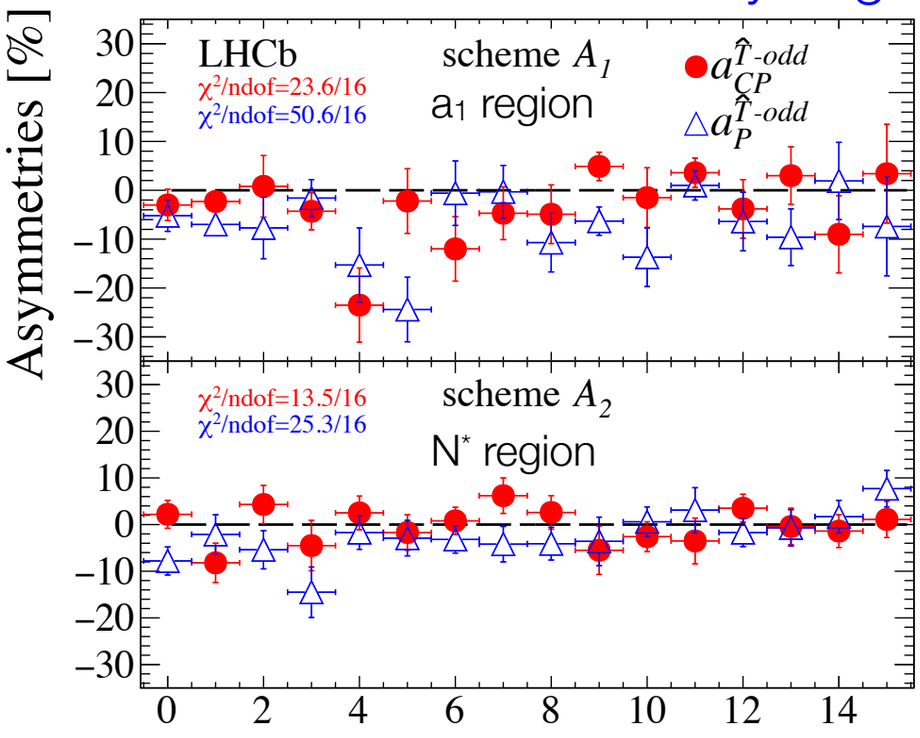
Multibody CPV searches with Run2

Search for CPV in $\Lambda_b^0 \to p\pi^-\pi^+\pi^-$

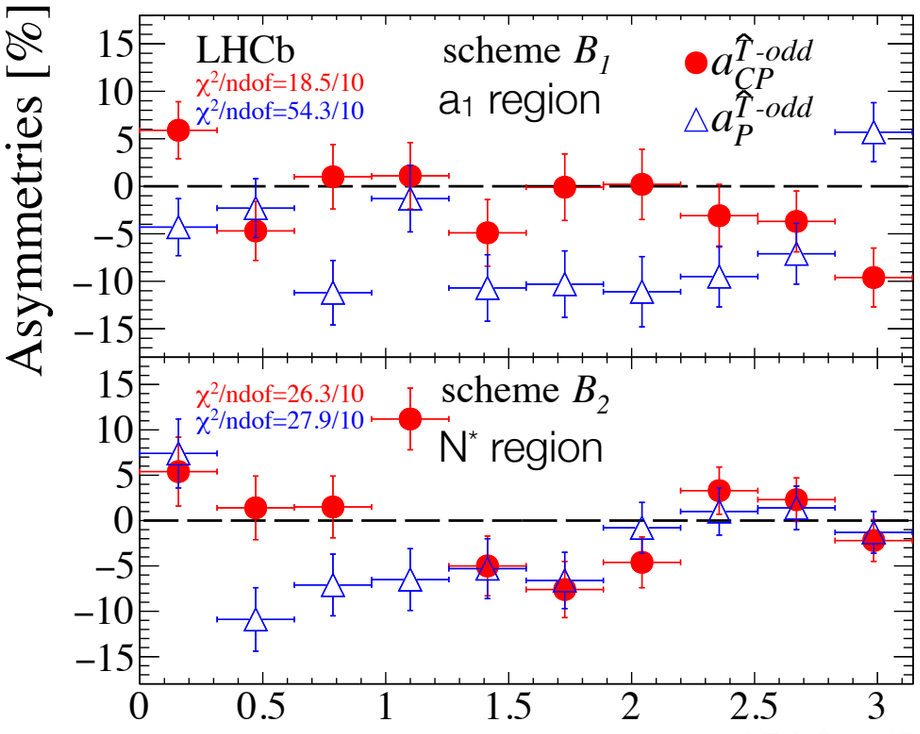
LHCb-PAPER-2019-028

- Update wrt the previous result

Scheme A: based on helicity angles



Scheme B: on **Φ** angle intervals



- Integrated measurements:

$$a_{CP}^{\hat{T}-odd} = (-0.70 \pm 0.70 \pm 0.17)\ \%$$ Stat. unc.

$$a_{P}^{\hat{T}-odd} = (3.98 \pm 0.70 \pm 0.17)\ \%$$ Syst. unc.

- CPV at the level of 2.9σ, no CPV integrated in phase space
- First observation of P violation in b-baryon decay at the level of 5.5σ

CPV search with amplitude analysis

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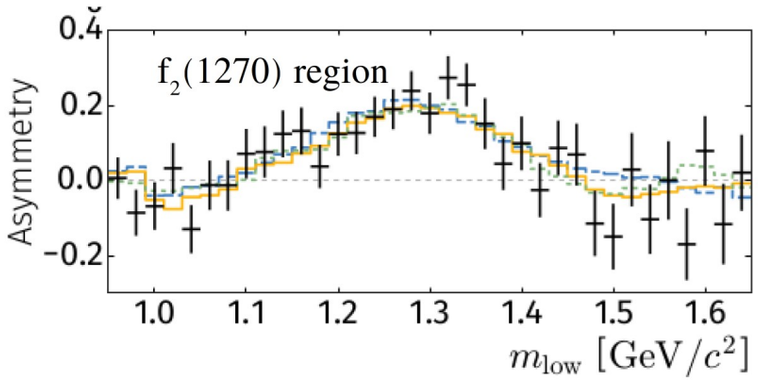
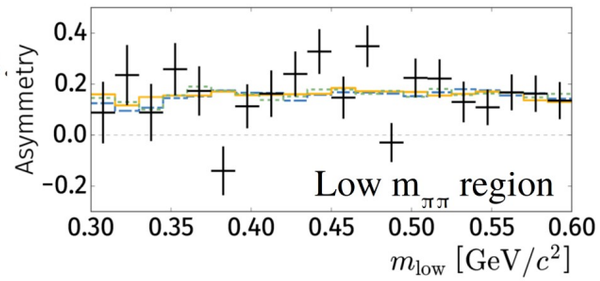
$B^+ \to \pi^+\pi^-\pi^+$: results with $3fb^{-1}$

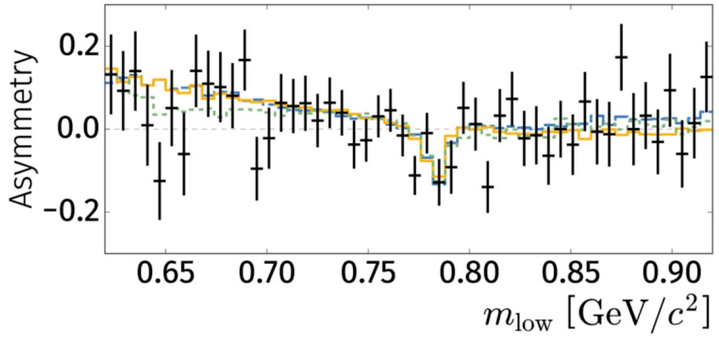
ARXIV:1909.05212

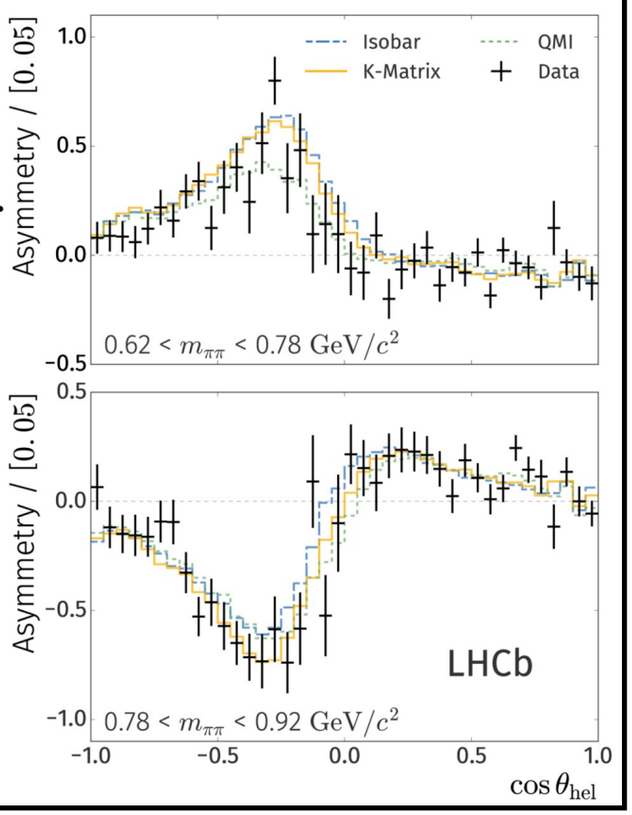
- Significant CPV at low $m(\pi^+\pi^-)$ where only S-wave contributes.
  - Constant until ~ $2m_K$, and then changes sign.
- Large (~40%) CPV in the region where $f_2(1270)$ is dominant.





- Interference between S- and P- waves is significant beyond 25σ.
  - Right: A_{CP} as a function of the helicity below (top) and above (bottom) the (ρ-ω) pole
  - Below: integrated A_{CP} vs mass → no integrated A_{CP}.



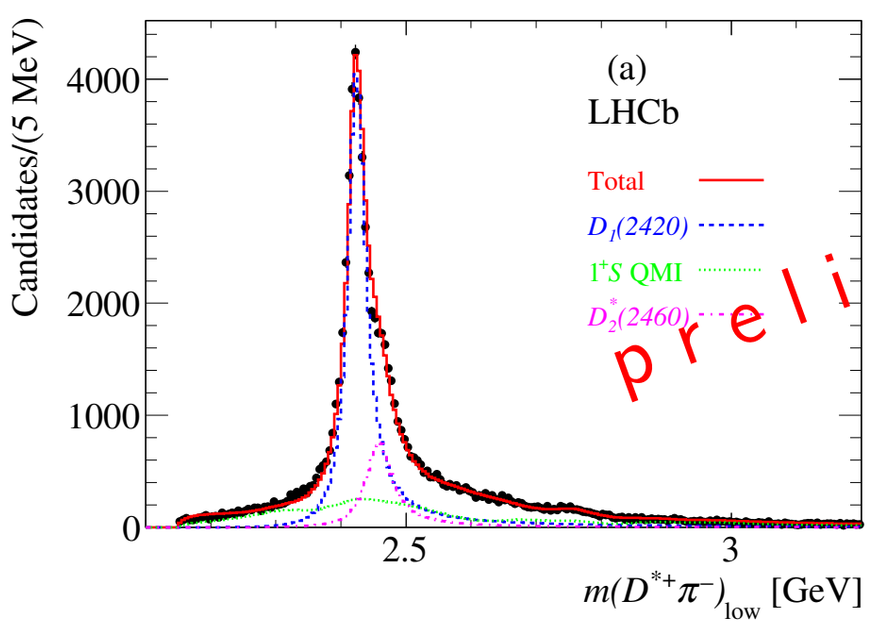


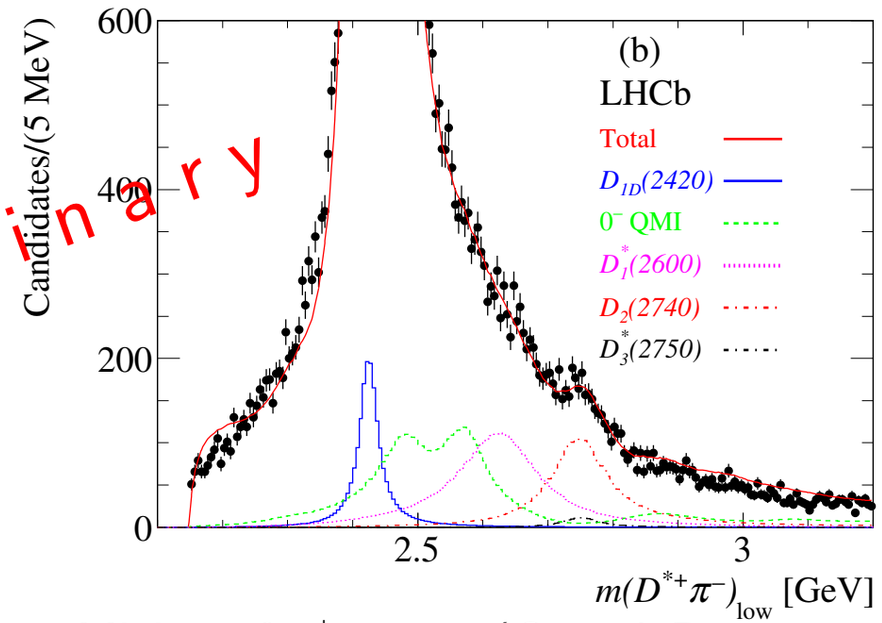
Amplitude analysis with Run2

Open-charm spectroscopy in $\mathrm{B}^- \to \mathrm{D}^{*+}\pi^-\pi^-$ Preliminary!

Fit results with the final model: [LHCb-PAPER-2019-027, in preparation]

- Quasi-model-independent for $J^P = 0^-$ and 1^+ S-wave (> 1 state)
- Breit-Wigner amplitudes for the rest





State	J^P	M (MeV)	Γ (MeV)
$D_1(2420)$	1^+	$2424.8 \pm 0.1 \pm 0.6$	$33.6 \pm 0.3 \pm 2.8$
$D_1(2430)$	1^+	$2411 \pm 3 \pm 10$	$309 \pm 9 \pm 41$
$D_0(2550)$	0^-	$2518 \pm 2 \pm 10$	$199 \pm 5 \pm 20$
$D_1^*(2600)$	1^-	$2641.9 \pm 1.8 \pm 4.5$	$149 \pm 4 \pm 20$
$D_2(2740)$	2^-	$2751 \pm 3 \pm 12$	$102 \pm 6 \pm 27$
$D_3^*(2750)$	3^-	$2753 \pm 4 \pm 6$	$66 \pm 10 \pm 14$

Mixing of 1^+ states (S- and D-wave amplitudes):

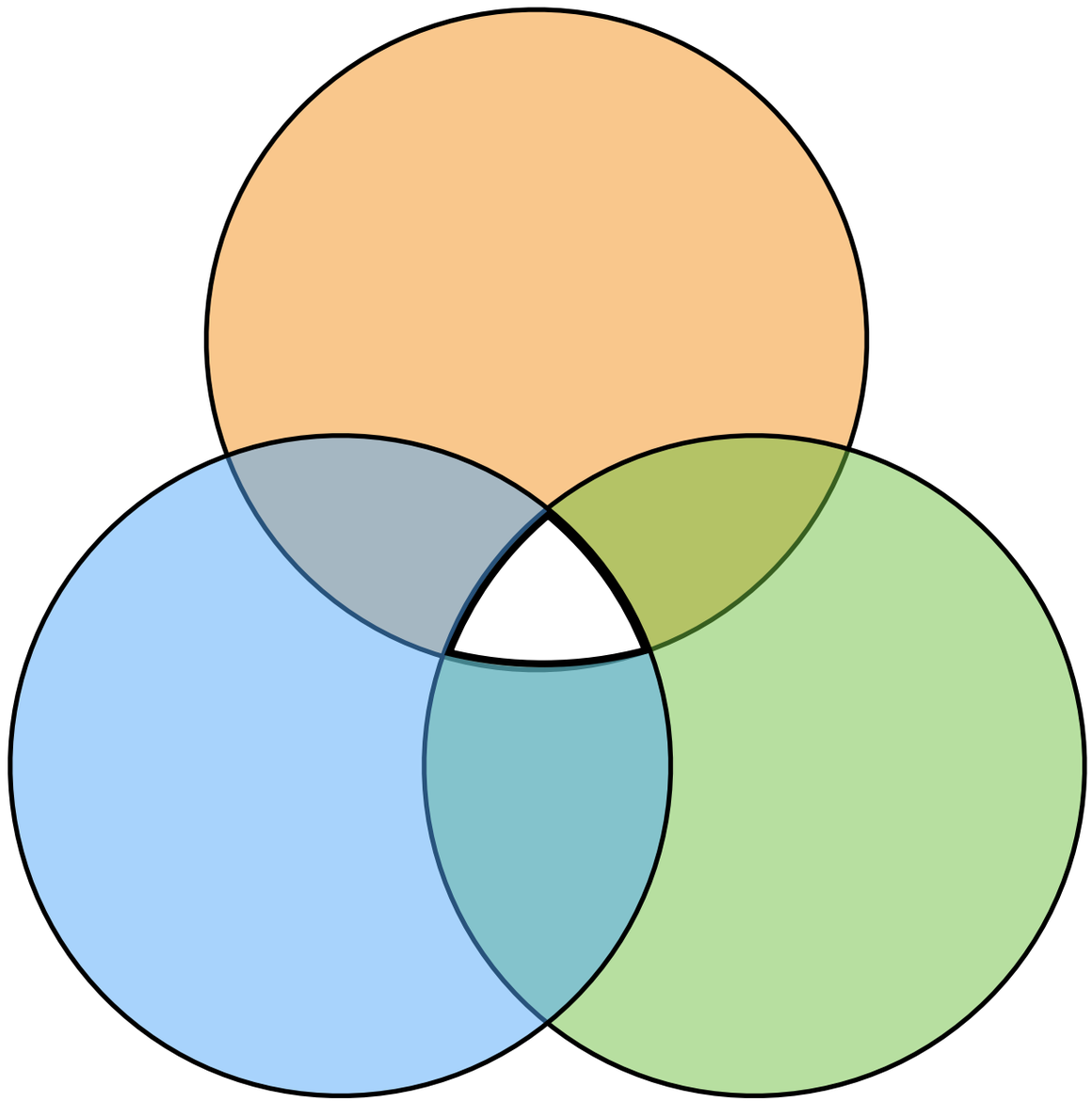
$$A^{D_1'} = A^{1S}\cos\omega - A^{1D}\sin\omega e^{i\psi}$$
$$A^{D_1} = A^{1S}\sin\omega + A^{1D}\cos\omega e^{i\psi}$$

$\omega = -0.063 \pm 0.019 \pm 0.021$

$\psi = -0.29 \pm 0.09 \pm 0.08$

Anton's slides

CPV searches in multibody decays with amplitude analysis with Run2



CPV searches in multibody decays with amplitude analysis with Run2

... soon*.

* for certain values of soon

Results with Run2

- ... and updates on certain awaited measurements in progress.

Soon: more results with Run3

- We are, right now, building the Run3 trigger

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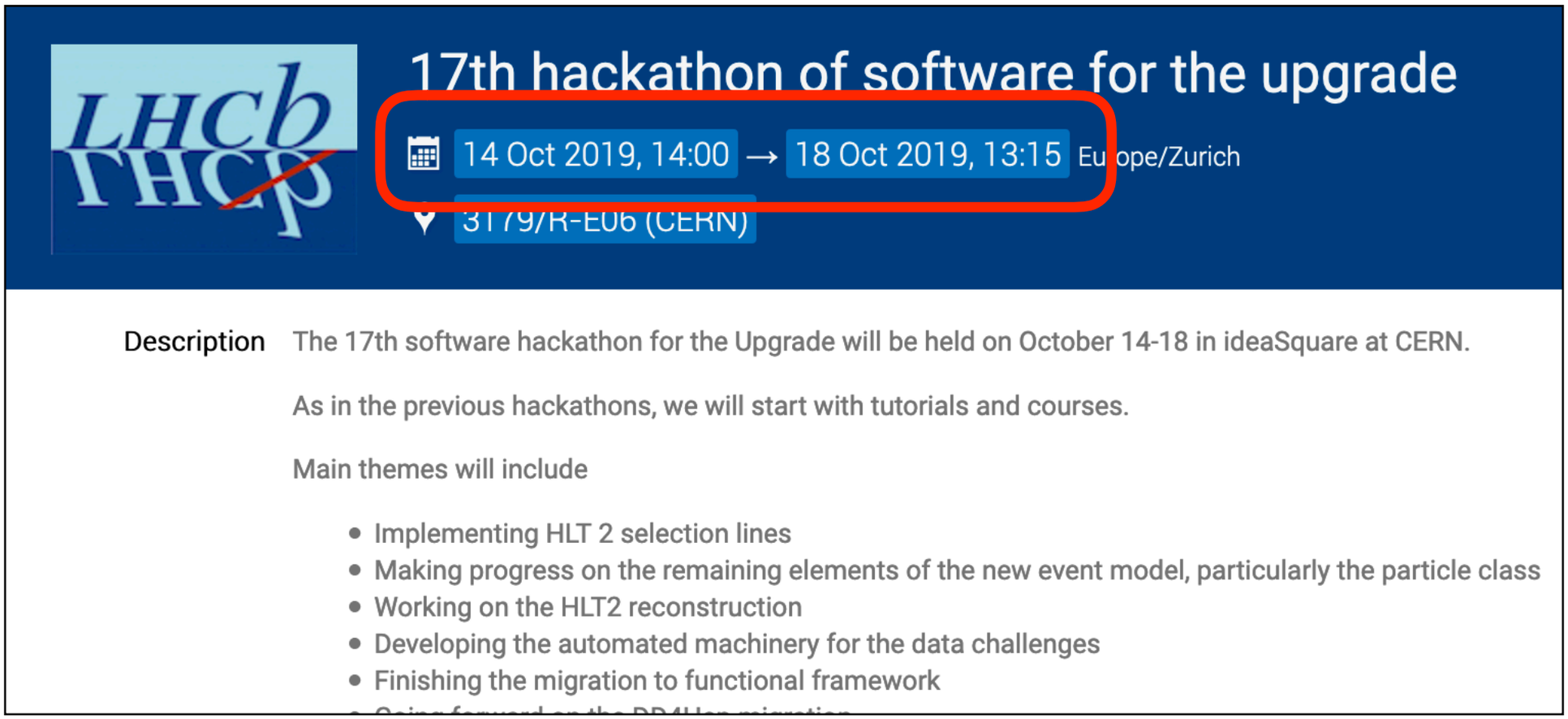

Soon: more results with Run3

- We are, right now, building the Run3 trigger
- In Run 3, we're doing two key things:
- Improving the trigger efficiency for hadronic decays
- Increasing the instantaneous luminosity
  - (plus several essential hardware upgrades to enable these)
  - Both are great news...
  - ... but it means a new, hard limit to our physics programme: how many bytes we can write out.
  - Solution: be smart* and selective.
  - Danger: if we don't select it, it's gone forever.
  - Corollary: if you have a new, clever idea, please get in touch, make sure we're going to select the events needed.

* for certain values of smart

See you next year!