J/psi

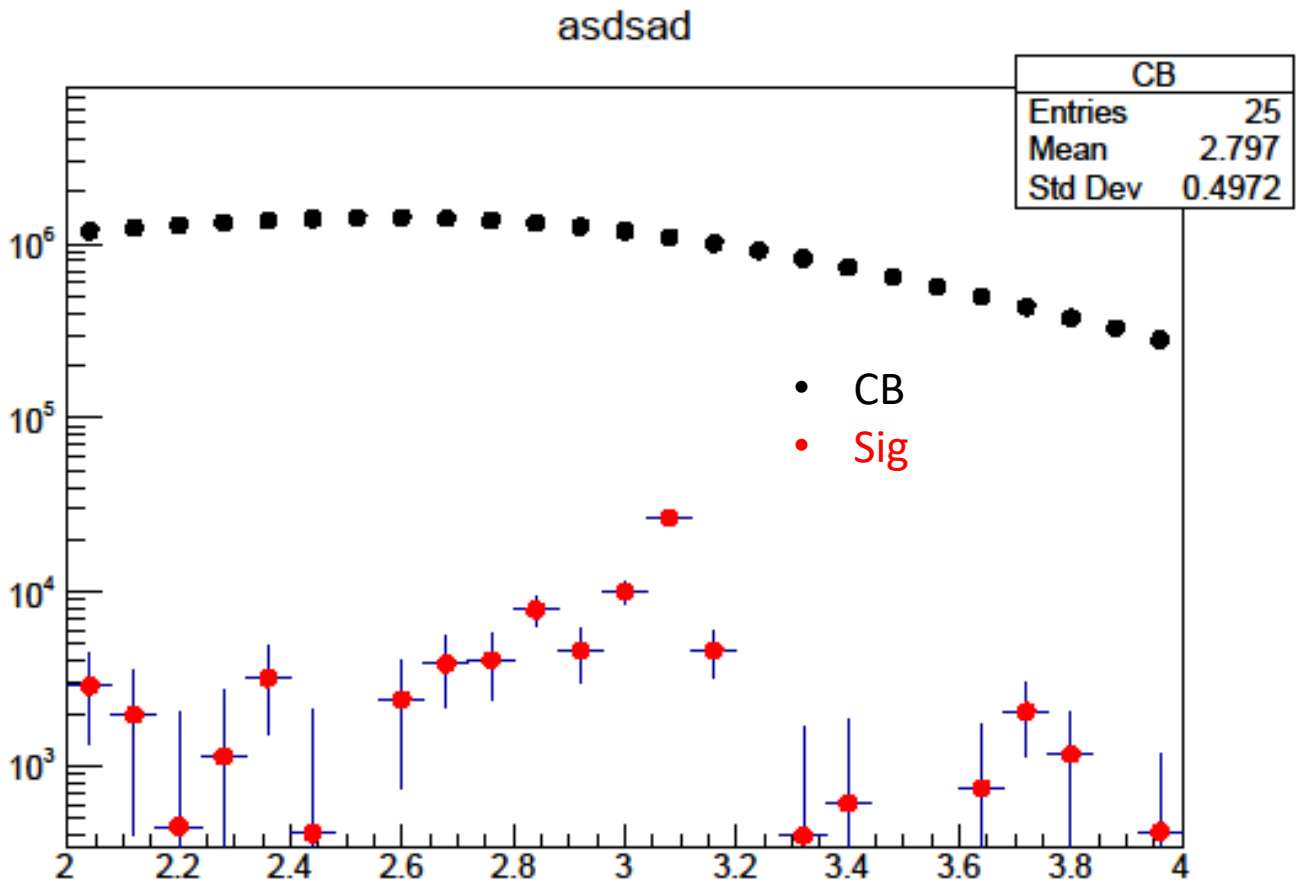
JB

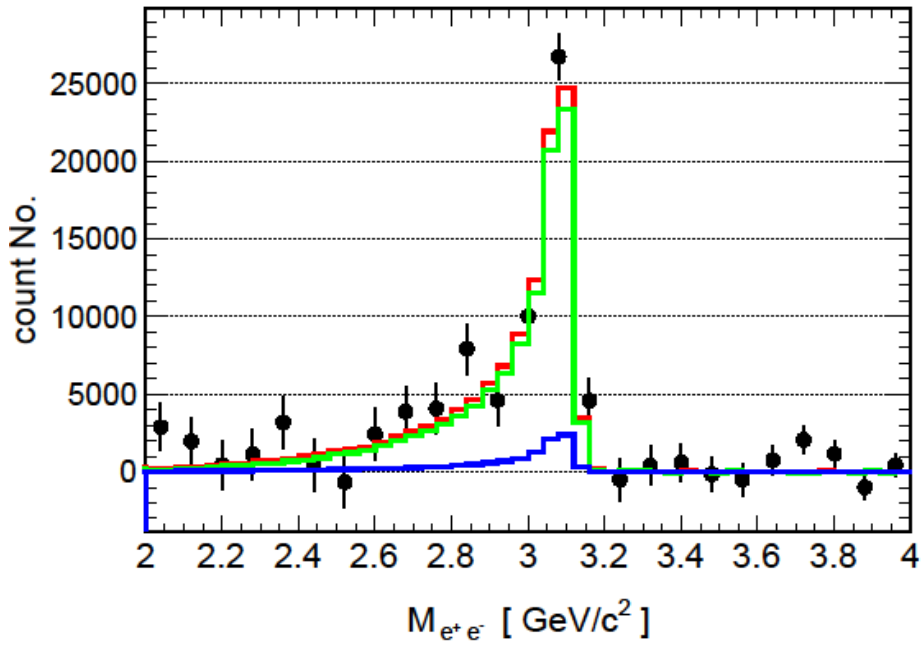
Menu

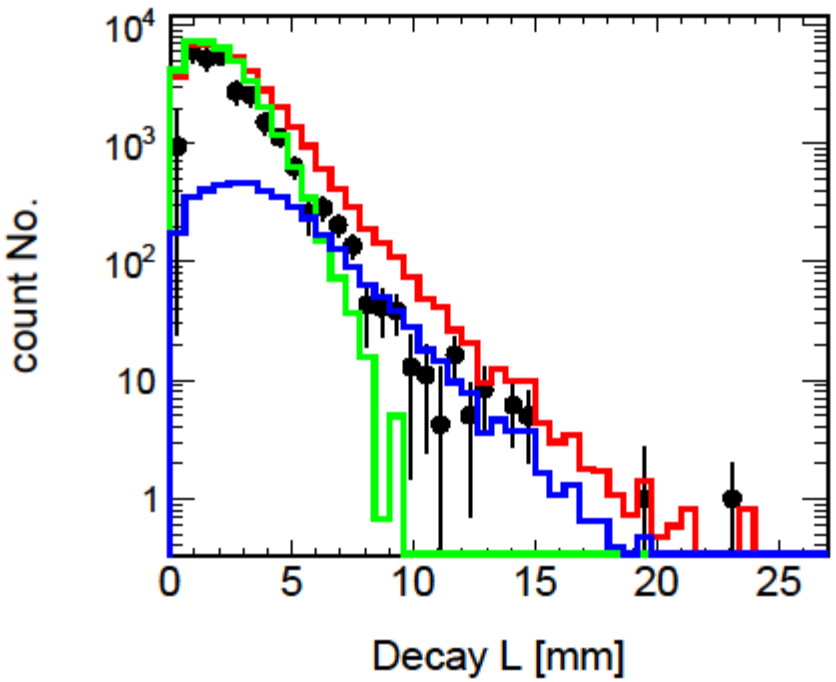
- Technical scope
- Physics scope

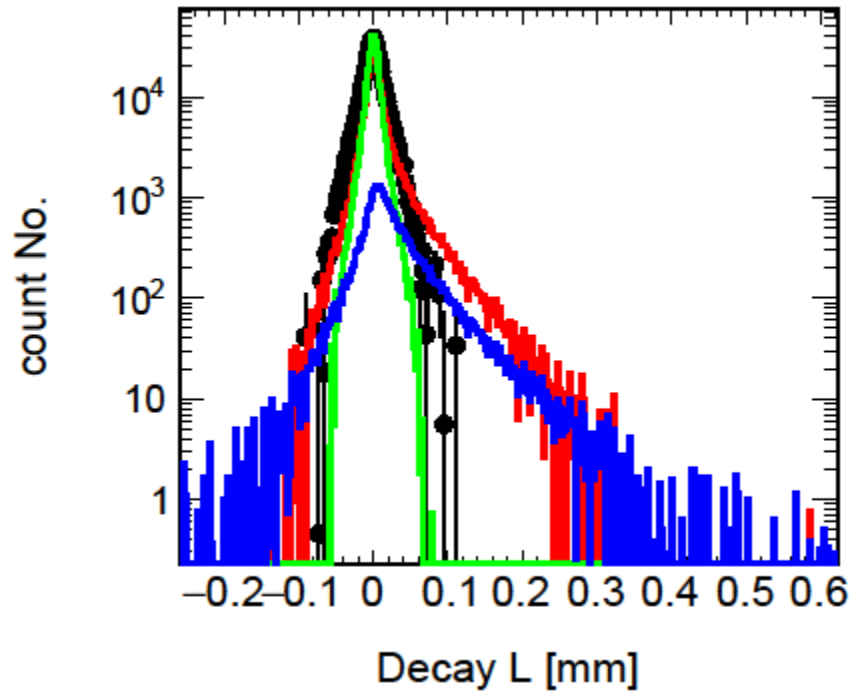
First Look

- LHC18 q+r (10% cent.)
- Number of events 80M
- N jpsi – 45928
- S/B ratio – 0.01 ☹
- N jpsi after NN 41000

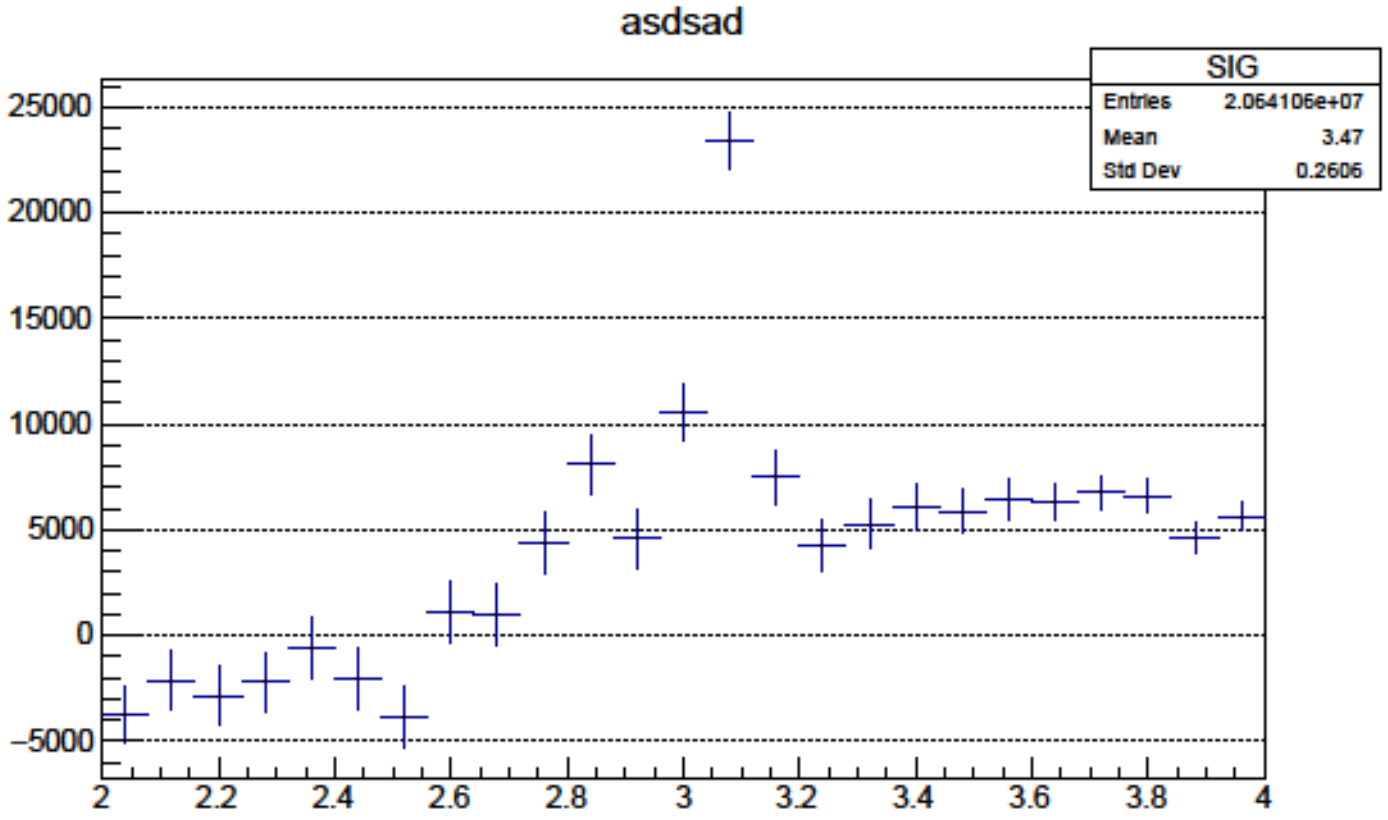



count No.
25000
20000
15000
10000
5000
0
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
$M_{e^+e^-}$ [GeV/c^2]


count No.
10^4
10^3
10^2
10
1
0
5
10
15
20
25
Decay L [mm]


count No.
10^4
10^3
10^2
10
1
–0.2
–0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
Decay L [mm]

After NN


asdsad
SIG
Entries 2.064106e+07
Mean 3.47
Std Dev 0.2606
25000
20000
15000
10000
5000
0
−5000
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4

Physics Scope

- J/psi polarisation as a prob of the QGP?
- What can affect it ? (J/psi spin 1, has a “memory” of the Λ_b Σ_b polarisation)

- Electromagnetic form factors (EMFF`s) contain information abut hadron charge and current distributions.
- For J = ½ one can get 2 types such as: **G_E, G_M**

Assuming one photon exchange:
- neutral baryons

$$\sigma_{Born}(q^2) = \frac{4\pi\alpha^2\beta}{3q^2}\left[\left|G_M(q^2)\right|^2 + \frac{1}{2\tau}\left|G_E(q^2)\right|^2\right]$$

$$\alpha = \frac{1}{137} \qquad \beta = \sqrt{1-\frac{1}{\tau}} \qquad \tau = \frac{q^2}{4m_B^2}$$

Effective form factor →

$$\left|G(q^2)\right|^2 = \frac{2\tau\left|G_M(q^2)\right|^2 + \left|G_E(q^2)\right|^2}{2\tau+1}$$

$$R = \frac{G_E}{G_M}$$

In the time like region the EMFF`s are complex:

- $\boldsymbol{G_E(q^2) = \left|G_E(q^2)\right| * e^{i\Phi_E}}$
- $\boldsymbol{G_M(q^2) = \left|G_M(q^2)\right| * e^{i\Phi_M}}$

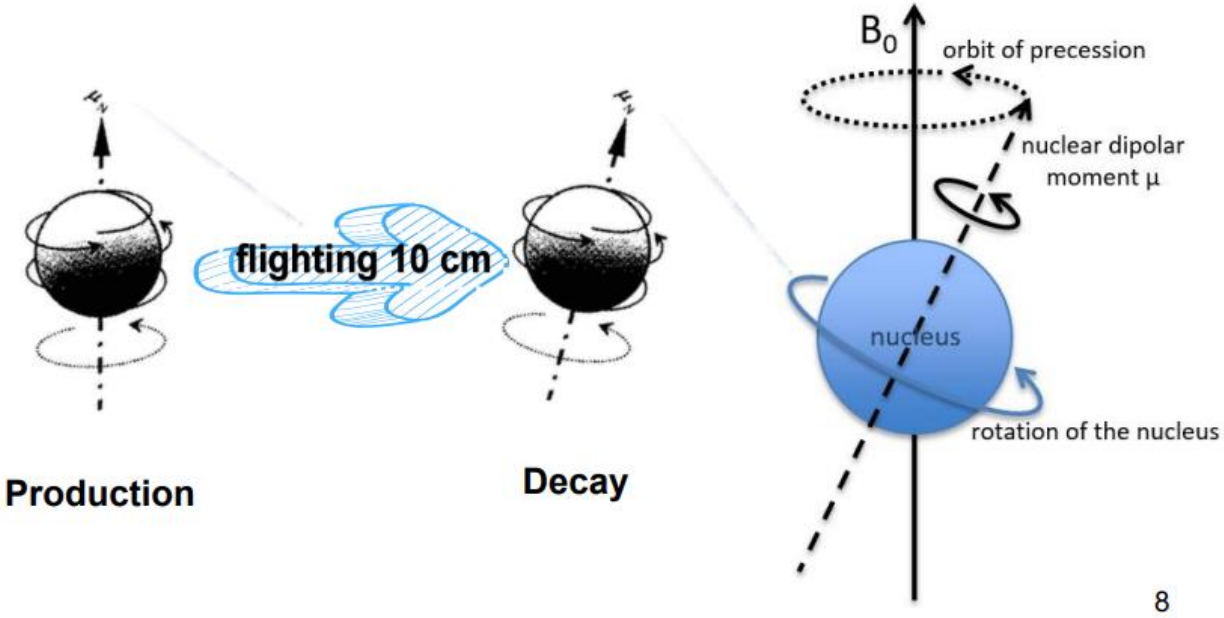
Have a relative phase:

- $\boldsymbol{\Delta\Phi = \Phi_M - \Phi_E}$

True for Λ_0 (uds quark hyperon)

But that’s not all

- Detector magnetic field (1T in the central barrel)
- Local magnetic field in the collision point



permeability, *μ*

The change of spin direction

$$\begin{pmatrix} \hat{s}_1'^x \\ \hat{s}_1'^y \\ \hat{s}_1'^z \end{pmatrix} = \begin{pmatrix} 1 & -\omega t \hat{B}'_z & \omega t \hat{B}'_y \\ \omega t \hat{B}'_z & 1 & -\omega t \hat{B}'_x \\ -\omega t \hat{B}'_y & \omega t \hat{B}'_x & 1 \end{pmatrix} \begin{pmatrix} \hat{s}_1^x \\ \hat{s}_1^y \\ \hat{s}_1^z \end{pmatrix}$$

$$\omega = -\frac{2\mu_\Lambda B}{\hbar}$$

precession angle is about 0.017 rad

- B=1.0T
- s_1 is the spin direction of Λ
- t = 2×10^{-10}s
- $\mu_\Lambda = -0.613 \pm 0.04\mu_N$

Done for Lambda

System	Magnetic Field in Tesla
Human brain	10^{-12}
Earth's magnetic field	10^{-5}
Refrigerator magnet	10^{-3}
Loudspeaker magnet	1
Strongest field in lab	10^{3}
Neutron star	10^{6}
Heavy-ion collisions	***10^{15} - 10^{16}***

Distorting "unwanted" effect or a sign of QGP ?
The answer can be a study of polarisation at low pT….