**1. Introduction**

- ATLAS is a multi-purpose detector in the LHC ring.
- First observation of the associated production of a Z boson with prompt and non-prompt J/ψ mesons.

**Z (ee and ψψ) boson selection**

- $p_T$ (trigger lepton)>25 GeV
- $p_T$ (sub-leading lepton)>15 GeV
- $|y|$ from Z<0.5
- $|y|$=91.1876 GeV×10 GeV

**J/ψ (ψψ) selection**

- 2.9<p_T<3.6 GeV
- 8.5<p_T<100 GeV
- $p_T$>4.0 GeV, $|y|<2.5$
- $p_T$>3.5 GeV for $|y|>1.3$ OR $p_T$<2.5 GeV for 1.3<|$y$|<2.5
- Z and J/ψ vertex separation in z-axis to be less than 10 mm

**2. Signal extraction**

- Unbinned two dimensional fit in J/ψ mass and pseudo-proper time to separate prompt and non-prompt signal component from combinatorial background.
- DPS contribution estimated using J/ψ from W+2j.
- Probability that a J/ψ is produced from a hard scatter in an event which also contains a Z is $P_{J/ψ} = 0.798 ± 0.008$.
- DPS contribution estimated using J/ψ cross-section and $\sigma_{J/ψ}$ from W+2J ATLAS measurement.
- Also use J/ψ observable to set an upper limit on $\sigma_{J/ψ}$ of 5.3 (3.7) mb at 68 (95)% confidence level.

**3. Z bosons produced in association with a J/ψ meson**

- Z boson candidate mass distributions associated to prompt and non-prompt J/ψ determined from weights derived from mass – pseudo-proper time fit.
- Weighed distributions are fitted with signal + multijet templates.
- Background contribution (primarily from multijet processes) was found to be negligible.

**4. Double Parton Scattering (DPS)**

- Probability that a J/ψ is produced from a hard scatter in an event which also contains a Z is $P_{J/ψ} = 0.798 ± 0.008$.
- DPS contribution estimated using J/ψ cross-section and $\sigma_{J/ψ}$ from W+2J ATLAS measurement.
- Also use J/ψ observable to set an upper limit on $\sigma_{J/ψ}$ of 5.3 (3.7) mb at 68 (95)% confidence level.

**5. Cross section measurements and comparison to theory**

- Measurement of the production cross-section ratios of prompt and non-prompt J/ψ mesons in association with a Z boson relative to inclusive Z production.
- Total integrated cross-section – measured in the defined fiducial volume.
- Inclusive – corrected for detector acceptance effects on the J/ψ reconstruction.
- Corrected cross-section after the subtraction of the DPS contribution.
- Comparison of measured single parton scattering rates to theoretical predictions.
- Production of a J/ψ in association with a Z boson occurs approximately twice per million Z bosons.

**6. Differential production cross-section ratios**

- Normalised production cross-section of J/ψ in association with a Z boson as a function of $p_T$ of prompt (top) and non-prompt (bottom) J/ψ.
- Overlaid contribution from estimated DPS.
- Theoretical prediction at NLO accuracy from DPS.

**7. Z → ℓ+ℓ−J/ψ decay**

- Check for potential contamination from the $Z → \ell+\ell−J/ψ$ decay.
- µ and µµ invariant mass distributions in the J/ψ and Z mass region.
- Peak in µµ found to be consistent from non-J/ψ µµ pairs.

**8. Summary**

- The production of prompt and non-prompt J/ψ mesons in association of Z bosons was observed with the background-only hypothesis being excluded at more than 5σ significance, using 20.3 fb$^{-1}$ of pp collisions at 8 TeV.
- Both DPS and SPS contributions present in data.
- Fiducial, inclusive and DPS-subtracted cross-section ratios of the production of Z+J/ψ normalised to the inclusive Z cross-section.
- Production rates in data greater than predicted by NLO theoretical predictions.
- DPS rates measured to be (29±9)% for prompt and (8±2)% for non-prompt J/ψ production, using azimuthal angle between Z boson and J/ψ.