Diffractive B meson production through the channel $J/\psi \rightarrow \mu^+\mu^-$

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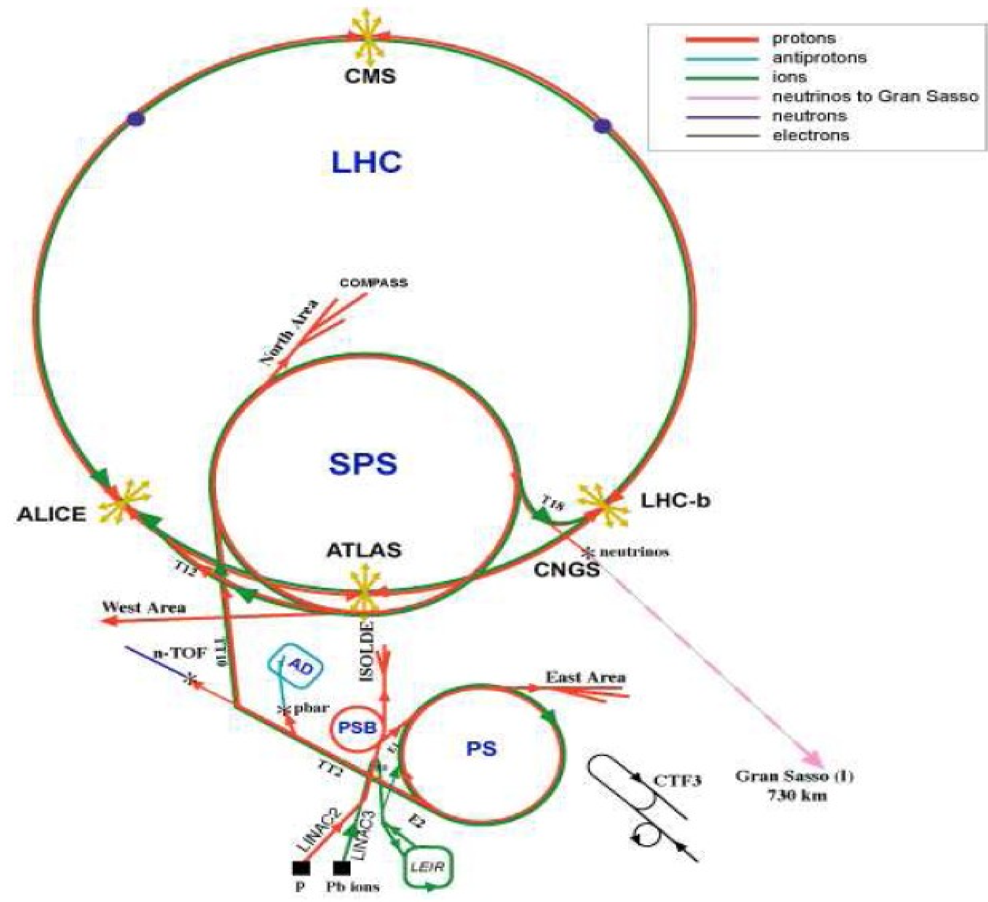
INTRODUCTION

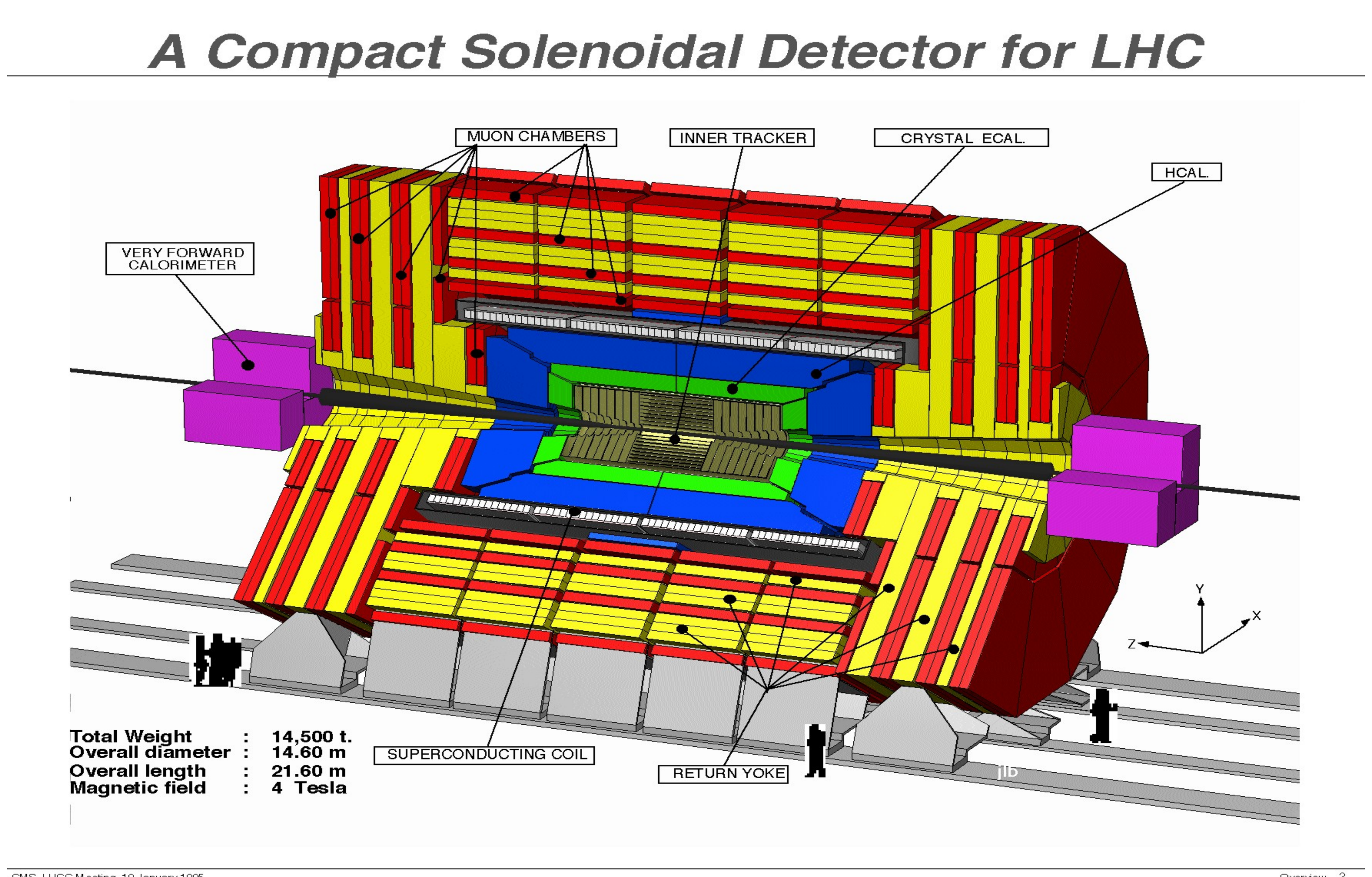
In the Standard Model framework we have a number of important problems to be solved. Among these problems we have the soft and hard diffractive processes as important components of the Strong Interactions. We expect that in the Large Hadron Collider (LHC) era we will be able to clarify these topics. It will collide protons beam's at energy of 14 TeV and start operation in 2007. In the first year is expected an integrated luminosity of 10 fb-1. This will use the PS/SPS complex to pre-accelerate protons which will be injected into it. LHC will have four experiments: ALICE, ATLAS, CMS/TOTEM and LHCb.



CMS

The Compact Muon Solenoid (CMS) experiment is a large particle physics detector that measures 21 metres long and 5.9 m inner diameter, weigh approximately 12500 tonnes and 4T superconducting solenoid.

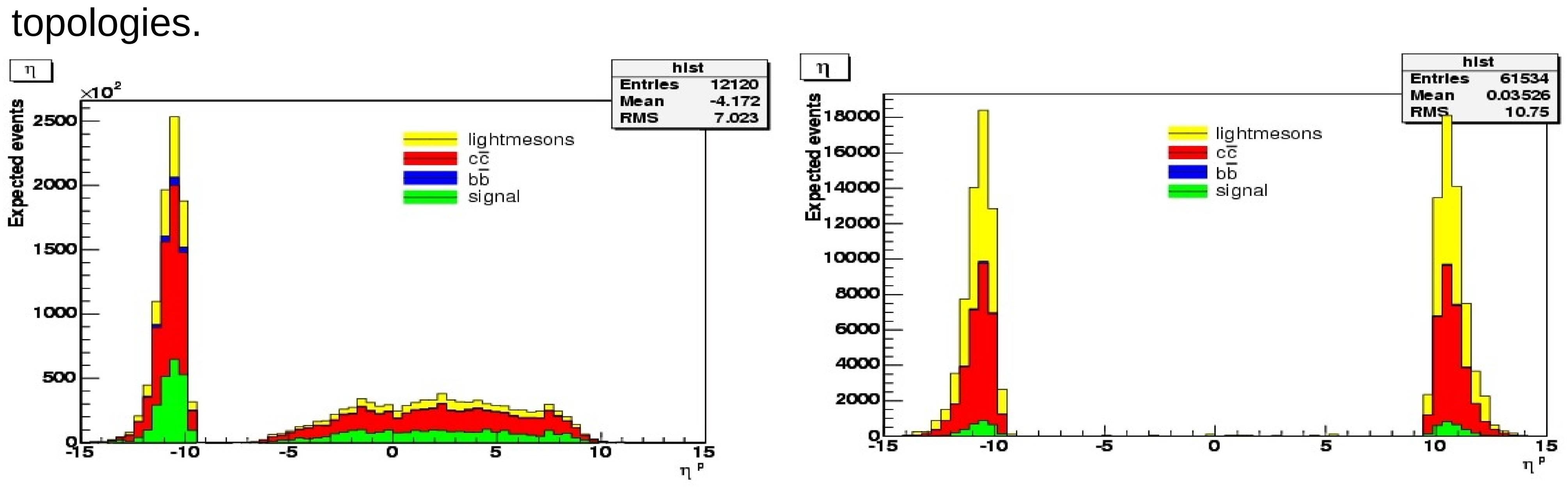
1. a highly performant **muon system**
2. the best possible **electromagnetic calorimeter**
3. a high quality **central tracking**
4. a hermetic **hadron calorimeter**



CMS detector is divided in 4 major subsystems. 1. The tracking sub-system that includes a silicon vertex detector. 2. The electromagnetic calorimeter (**ECAL**) made of lead tungstate crystals. 3. The hadron calorimeter (**HCAL**) made of brass and scintillator and 4. The muon sub-system.

Generation and Simulation

The event generator used in this study was DPEMC 2.3, which is an inclusive and exclusive Monte Carlo based on POMWIG and HERWIG. DPEMC uses a model where the processes are factorized into a dissociation of a pomerom (IP). We are interested in diffractive events, with single dffraction (SD) and double pomeron exchange (DPE) topologies.

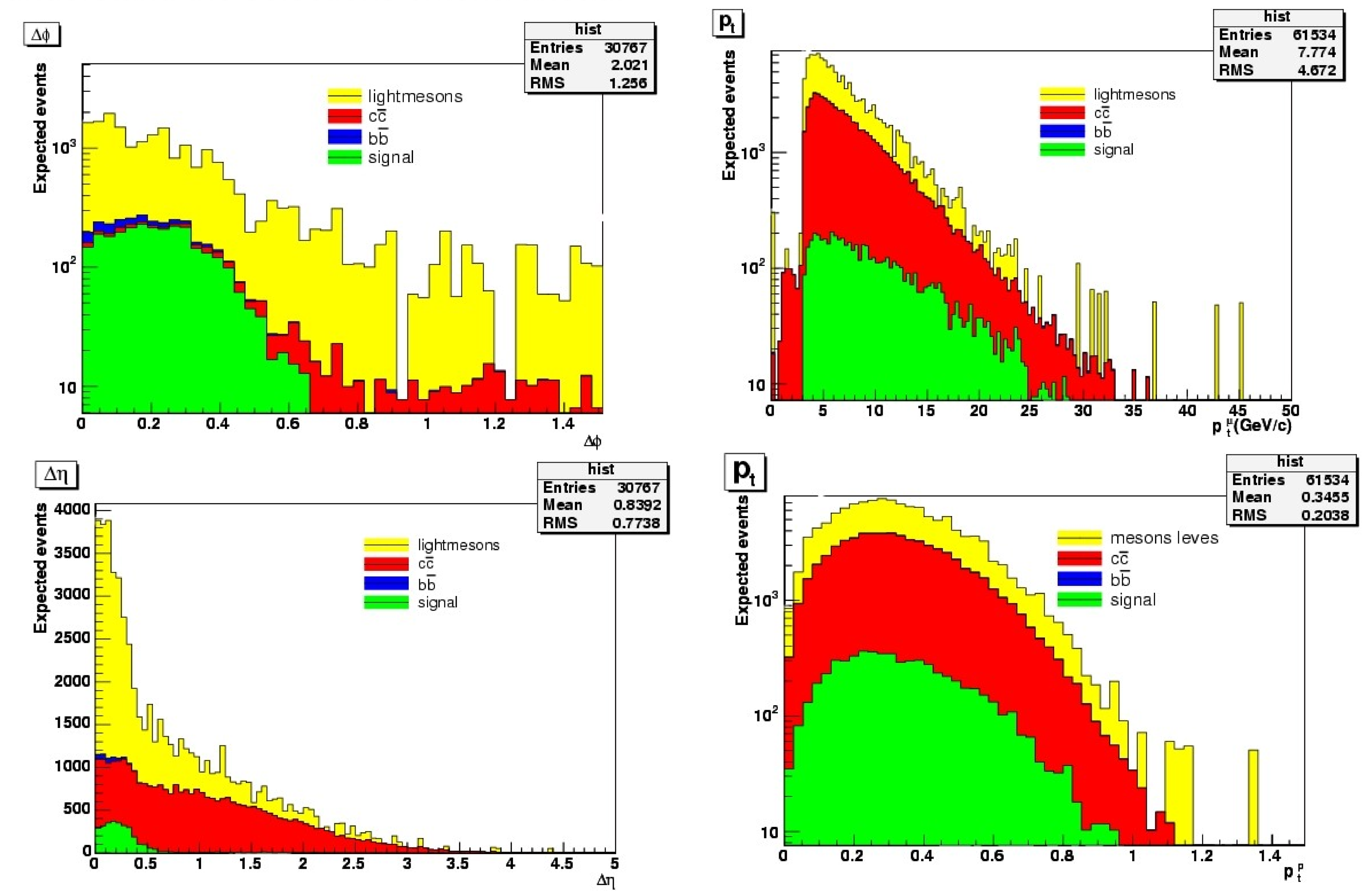


Data for this analysis was generated in four separate samples ($J/\psi \rightarrow \mu\mu$ and three backgrounds). We further separate our samples according to the diffractive production mechanism (SD and DPE).

After the generation, we processed the events through detector simulation and reconstruction. For this study we decided to use **FAMOS** (version 1_3_1), which is a fast CMS detector simulation package, instead of to do full detector simulation available in **OSCAR** and reconstruction in **ORCA**, which takes so long time to process events.

ANALYSE AND SELECTION CRITERIA

With the distribution of the simulate data showing below helps us to stablish and understand the selections criteria ahead.



Selection criterias:

- Dimuon charge equal zero.
- Transverse momentum of protons, p^p_t 0.85 Gev/c.
- Difference between pseudo-rapidity of dimuon, η^μ 0.8.
- Transverse momentum of muons, p^μ_t 2.75 GeV/c and p^μ_t 22 GeV/c.
- Difference between azimutal angles of dimuon, ϕ^μ 0.635.
- Invariant Mass of dimuon, 2.69 $M_{\mu+\mu}$ 3.49 GeV/c^2.

	Signal	Lightmeson	$b\bar{b}$	$c\bar{c}$
DPE	208.65	114	2.66	326.86
SD	16830.4	870.25	175.8	25.01

Conclusion

We study diffractive $B \rightarrow J/\psi$ production through it's decay into $\mu^+\mu^-$. Both Single Diffraction and Double Pomeron Exchange topologies were studied and we found the follwing cross section for them.

$$DPE \Rightarrow \sigma_{DPE} = 12.650 \pm 0.001 \text{ pb}$$

$$SD \Rightarrow \sigma_{SD} = 510.01 \pm 0.23 \text{ pb}$$

We nd good results for J/ψ mass with the dimuon candidates that we select:

$$DPE \Rightarrow M\mu+ \mu = 3.074 \pm 0.144 \text{ Gev/c2}.$$

$$SD \Rightarrow M\mu+ \mu = 3.093 \pm 0.061 \text{ Gev/c2}$$

The next steps will be to run these analysis for full detector simulation using OSCAR and ORCA and implement in analyse other techniques to select dimuon present in TDR_v1.

1 Affolder, T. et al., CDF Collab., Phys. Rev. Lett. 87, 241802 (2001).

2 AAbachi, S., et al., D0 Collab., Phys. Lett. B370, 239-248 (1996).

3 Janot, P. et. al., http://cmsdoc.cern.ch/famos.

4 Acoste, D. et al. CMS Computing TDR, CERN-LHCC-2005-023 (2005).