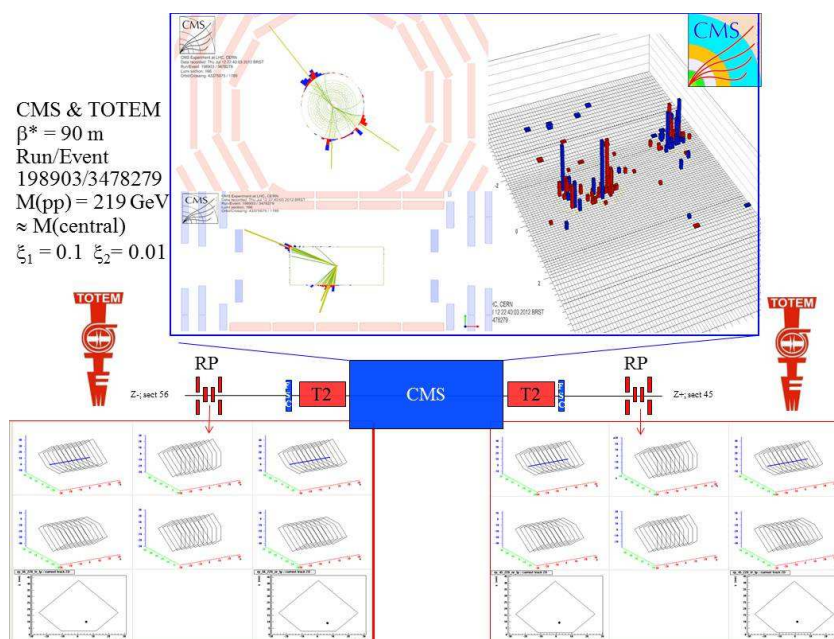


Search for invisible objects in CT-PPS

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Low x 2017, Bari, June 2017

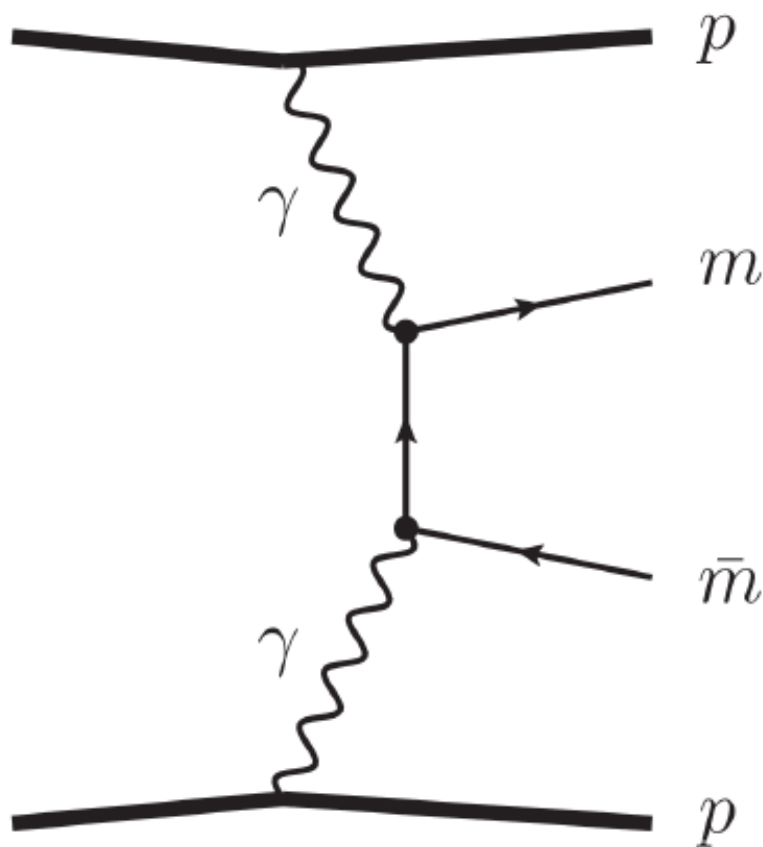


- Invisible objects in CMS and the advantage of CT-PPS
- Backgrounds
- Detector improvement needed

This talk is more to open discussions and benefits from discussions/collaborations with Rafal Staszewski, Simone Giani, Ken Osterberg, Valery Khoze...

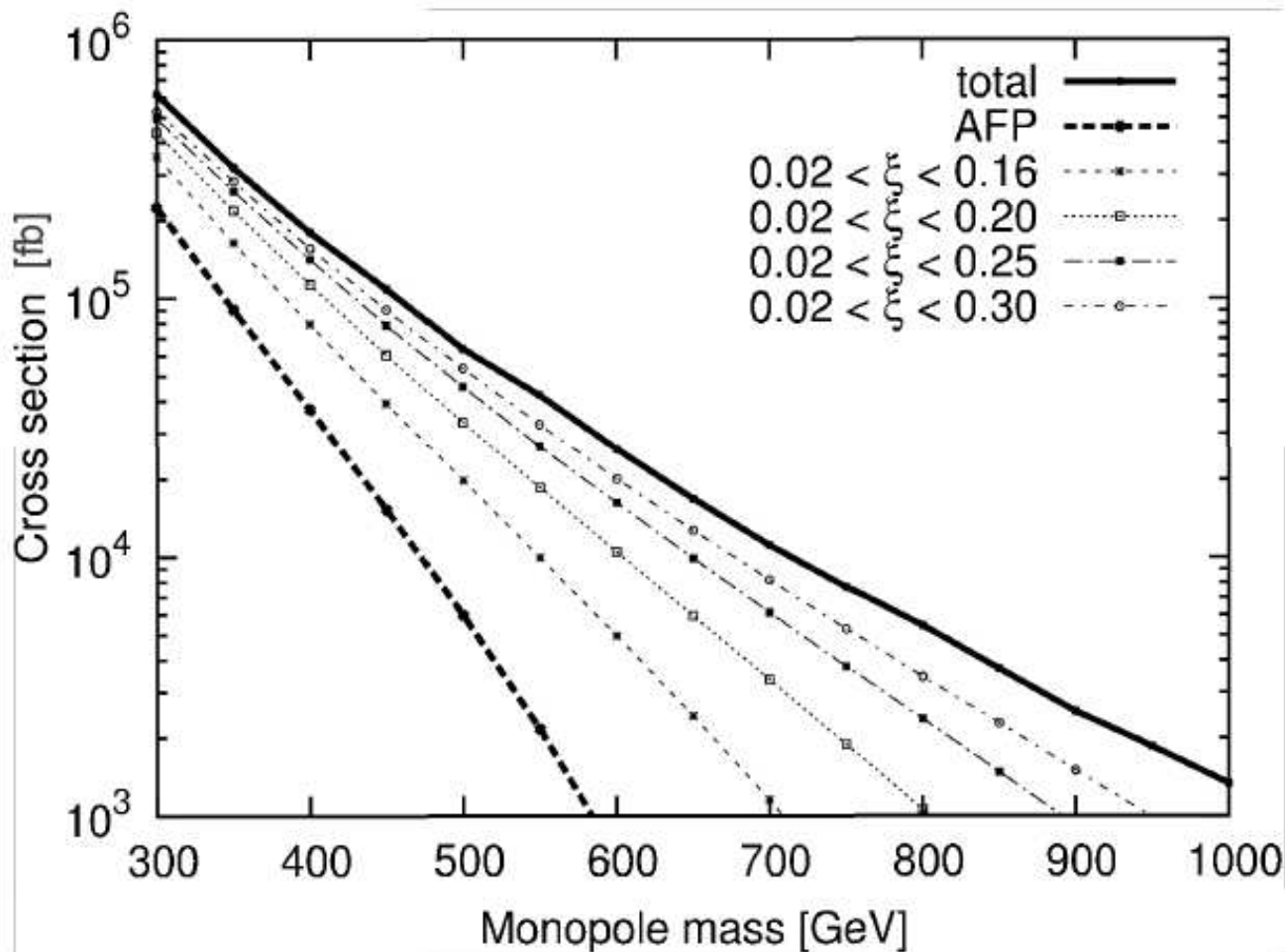
Invisible objects in CMS

- Production of pairs of magnetic monopoles
- Production of pairs of dark matter particles
- **Signature:** nothing in ATLAS/CMS, 2 protons of high mass in CT-PPS, AFP....
- **A few issues:** Trigger rate, background? (we do not see anything in CMS/ATLAS and any quasi-elastic event is a background)



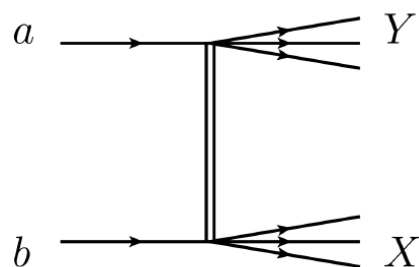
Monopole production cross section (from Rafal)

- Order of magnitude for monopole production in the AFP acceptance (Rafal)
- Check the importance of going beyond the EPA approximation for high mass object production

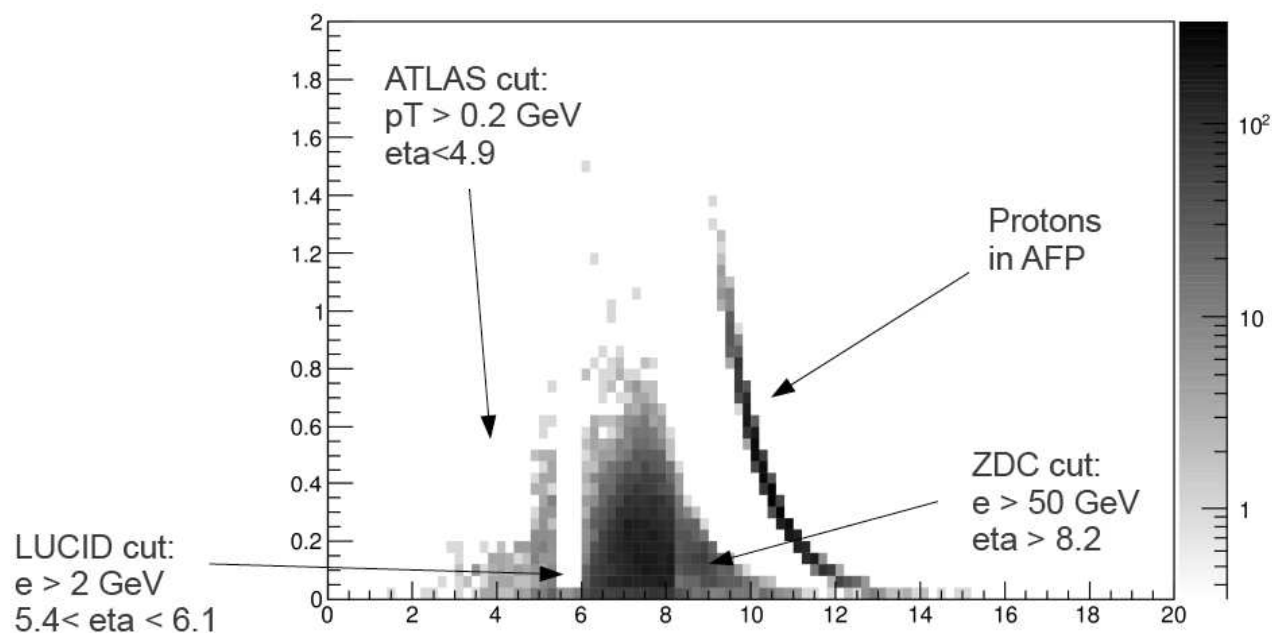


Background studies (from Rafal)

- Main background due to double diffractive events: large cross section and not perfectly known
- Recent paper by Khoze, Martin, Ryskin on the large background
- Second background: pile up, if one wants to perform measurements at high luminosity
- Veto on particles produced in very forward detectors (results from Rafal): ZDC...

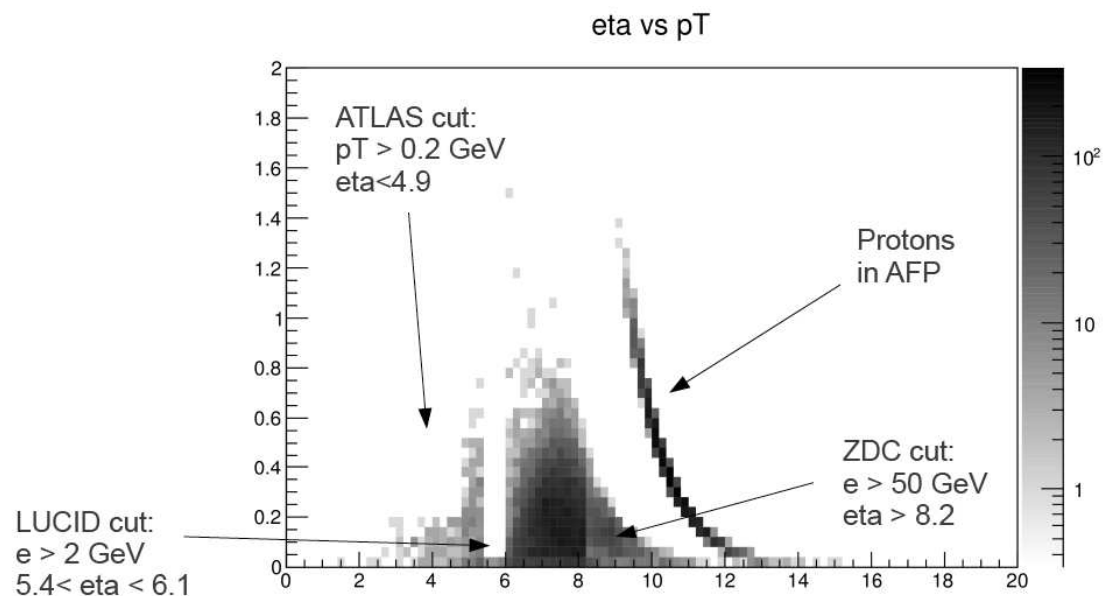


eta vs pT



How to see invisible events? Some ideas...

- The vertex where dark matter particles, monopoles are produced is not known
- We assume that the two protons originate from that vertex and we measure the time of flight of produced particles
- We now assume that we measure the time-of-flight of all particles produced in the very forward region (ZDC...) and we can get that information at trigger level; this means that we know from which vertex these particles are originating
- We need to request that there is incompatibility between the two proton vertex (found using time detectors) and the vertex found using particles in very forward region
- This requires few upgrades: timing measurements in forward detectors, possibility of triggering on high mass proton pairs



Conclusion

- Looking for invisible objects in AFP/CT-PPS
- Large background originating from pile up and quasi-elastic events
- This search would require an upgrade of the detector installing timing detectors in ZDC
- We need also to be able to trigger on intact protons in the final state (high level trigger)
- Background studies in progress: Cristian et al.
- Additional recent studies: [arXiv:1611.09320](https://arxiv.org/abs/1611.09320)

