# Spark with triple GEMs

| Source /cause of the spark | Where it likely happens | Impact on GEM | GEM HV | Rate with beam current | Could HV trip limit avoid it | Could it be mitigated? |
|---|---|---|---|---|---|---|
| Large ionization | More likely 3rd GEM | **Limited** (if good quality GEM foil) | Increase the spark probability | Increase the spark probability | No impact | yes with<br>• lower beam current<br>• Lower HV |
| Impurities / dust etc .. | Any GEM foil with the impurity | Any foil with the impurity | Yes, but will happen at any operating HV | Yes, but will eventually happen anyway | No, it could actually make it worse | Yes, clean gas but not a big concern with BB GEMs |
| GEM foil defect | Any GEM foil with the defect | Any foil with the impurity | Yes, but will happen at any operating HV | Yes, but will eventually happen anyway | No, it could actually make it worse | This is what we need to worry about the most |
| Humidity | Any GEM foil with the defect | Limited if good monitoring | Hi HV will make things worse | Yes, but will eventually happen anyway | Yes, early shot down of HV can avoid any consequence | • monitoring of GEM current<br>• Should not be big concern with BB GEMs |

Other causes that I don't have on the tabke are:

- bad combination HV / gas mixture,
- Operating the chambers during beam tuning or other ltype of condition where the beam can hit the GEMs
- Bad HV divider …