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Interactive comment on "Source apportionment of highly time resolved trace elements during a firework episode from a rural freeway site in Switzerland" *by* Pragati Rai et al.

Anonymous Referee #1

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This paper examines data previously reported by Furger et al (2017) applying PMF source apportionment techniques to a subset of the reported data to provide insight into the chemical composition of different sources. It focuses on firework / burning sources associated with local celebrations (which are a common influence on air quality for short periods in many countries) and to a lesser extent on suspended dust from road and surface sources. The article is generally well written and the approach is methodologically robust. However, the data used is somewhat limited and the authors have not taken advantage of the aerosol mass spectrometer data which was available. I have many suggested edits and some points which require consideration by the authors. Major Comments – Pg 5, line 16 – the authors reduce the data set from 24 to

14 based on manufacturer supplied MDLs to produce 'better' source apportionment results. Firstly, even though the measurements are below the detection limit, they could contain 'valuable' information on variability, especially during firework periods as some of the excluded elements are potential firework components (e.g. Cd). They have been excluded based on % below MDL at a rather arbitrary value e.g. Bi at 93% was included while Cd at 87% was not. It would be worth including this data and downweighting rather that excluding it or at least performing sensitivity test. A further 4 elements are excluded based on data quality but no detail on what constitutes data quality is given. Pg 8 Line 4 and later – The CBPF is an important analysis which is used to justify the identification of sources and the charts should not be shunted to the appendix. Further, the reliance on 90th percentile to identify the sources is flawed when considered on its own, especially when the distribution of measurements is heavily skewed (as it is with Cl). A range of CBPFs should be presented (at least in the supplementary) to support the interpretation. The authors should also consider the use of the min bin statistic to ensure that individual points are not skewing the interpretation. Finally, the conclusion that the two dust sources are from different sources (based on these plots) when their direction is broadly similar is rather weak. Pg 8 Line 9 and later – KNO_3 is quoted as comprising 74% of fireworks. In which case NO_3 could be a useful tracer for unburnt firework material - it was measured but is not reported. A recognition of this point, even to say that there was no correlation would help. The same is true of the other mass concentrations and m/z measured by the ACSM – were these examined or even considered for inclusion in the PMF or data analysis? Line 29 and later – The use of SoFi to separate highly correlated sources such as the two firework sources is the reason for this paper. The consideration of Cl displacement is interesting and has evidence to support it, why does it therefore come after 2 purely speculative thoughts about possible alternative sources. Promote this point and consider the speculations as alternatives. One of these - the separation of bonfires from fireworks may have been helped by considering the ACSM data. General Comment- The authors use the term 'trace' elements. I would not consider S or Fe trace elements in ambient PM. I suggest

the authors just refer to them as elements

Pg 1 Line 13 - Source Finder software, please quote version number, supplier and country Line 19 - The abstract is partly written in the present tense – ‘experiences’ should read ‘experienced’, ‘concentrations are similar’ should read ‘concentrations were similar’ Pg 2 Line 29 – clarify that you are talking about off line sampling systems Line 33 – the sampler don’t specifically need those analysis techniques, they require techniques with high precision and low detection limits – such as these methods Pg 3 Line 28 – delete XACT manufacturer already provided line 4 Line 30 – with should read at Line 31 onwards – be consistent with how you name equipment – model, make, supplier, country Line 31 – quote filter manufacturer Pg 4 Line 2 – TEOM and FDMS in full then in brackets or just the abbreviation, not a mixture Line 20 – can values be applied to individual data points; this implies that individual points can be used for a-value constraining. Is this true? Certain sections in a time series can but individual points cannot be separated out in this way. Line 28 – this is not the first use of sofi in the manuscript - the reference, version number and supplier should go there Pg 5 Line 1 – ‘PMF’ rather than ‘model’ Line 4 – ‘identify’ rather than ‘find’ Line 4 – this only helps to identify the high concentration peaks and whether then influence the mean will depend on the distribution of data (see Cl results in fig 4) Line 22 – Bi a major component of fireworks – a reference, some evidence would be good here and even justify the exclusion of other elements Pg 6 Line 1 - need a description on xij Line 16 – listed s1-s4 but only s2 and s3 relate to this point Pg 7 Line 18 – how do you know it is coarse Cl, you have two measures of Cl one is non-refractory Cl- in PM1 and one is Cl in PM10? Pg 8 Line 6 – are these elements really the main components of fireworks by mass, surely you need a reference here to justify this. Line 7 – chlorate and perchlorate (line 11) will also be detected as Cl in XRF Line 16 – the sentence starting ‘A pronounced. . .) should really come at te start of the para Line 29 – this consideration of Cl displacement is interesting and at has evidence to support it, why does it therefore come after 2 purely speculative thoughts. Promote this point and consider the speculations as alternatives. Pg 11 – line 6 – there is no fig S12

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