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$(1,2)$-symmetric subgroups of SL$(4,\mathbb{C})$

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The topic is finite diagonal subgroups $A \subset$SL$(4,\mathbb{C})$ and their \hbox{A-Hilbert} schemes. As a dimension reducing assumption, I impose the additional $(1,2)$-symmetric condition. The case to bear in mind is $\frac{1}{r}(1,1,a,b)$ with $r=a+b+2$. The "junior end and all-even" conditions for the quotient $X=\mathbb{A}^4/A$ to have a crepant resolution are known from Sarah Davis's thesis [D].

Studying the A-Hilbert scheme A-Hilb$\mathbb{A}^4$ in the general $(1,2)$-symmetric case is interesting in its own right, and provides more detailed insight into case of the crepant resolution. The variety $Y=A$-Hilb$\mathbb{A}^4$ is toric, a union of affine pieces corresponding to monomomial ideals $I\subset k[\mathbb{A}^4]=k[x,y,z,t]$, and can be constructed by my 2009 computer algebra routine [M]. In very many cases Y is nonsingular, and is a resolution $Y\to X$ with exceptional divisors of discrepancy 0 or 1.

The calculation of A-Hilb$\mathbb{A}^4$ mirrors the classical construction of Nakamura [A] and Craw–Reid [CR], with some remarkable modifications.

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