SI Table ---:

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| Complex | Global heavy atom RMSD | Co-factor loop RMSD | Substrate RMSD |
| 4FVT (ternary complex) – Xtal vs 4BVG ( native intermediate) Xtal  | 0.5 Å | 4.0 Å | NAD part (0.8 Å)peptide(0.3 Å) |
| 4FVT (ternary complex) – Xtalvs4FVT (ternary complex) – MD averaged |  1.1Å | 2.2Å | NAD part (0.4Å)Peptide part(1 Å) |
| 4BVG (native intermediate) Xtalvs4BVG (native intermediate) MD averaged | 1.6Å | 1.8Å | NAD (0.5Å)Peptide part( 2.6 Å) |
| 3GLS (apo Sirt3) – Xtalvs3GLS (apo Sirt3) – MD averaged |  1.1Å | 0.79Å | Not applicable |
| Sirt3/ADPR complex/NAM modelled from 4FVT (**MD average**)vsSirt3/ADPR complex/NAM modelled from 4FVT but with loop replaced from 4BVG (**MD average**) | 2.2 Å | 5.9Å |  NAD (0.4Å)Peptide part( 0.9Å)NAM (6.7 Å) |
| 4FVT (ternary complex) – XtalvsSirt3/ADPR complex/NAM modelled from 4FVT (MD average) | 1.9Å | 3.9Å | NAD part (0.62Å)peptide part( 0.5Å) |
| 4FVT (ternary complex) – Xtal vsSirt3/ADPR complex/NAM modelled from 4FVT but with loop replaced form 4BVG (MD average) | 1.1Å | 3.7Å | NAD part (0.3Å)peptide part(0.7 Å) |
| 4BVG (native intermediate) XtalvsSirt3/ADPR complex/NAM modelled from 4FVT (MD average) | 2.0Å | 6.3Å | NAD part (0.65.Å)peptide part( 0.55Å) |
| Sirt3/INT/NAM modelled from 4FVT but with loop replaced from 4BVG (**MD average**)vsSirt3/ternary complex/modelled from 4FVT but with loop replaced from 4BVG (**MD average**) | 1.64Å | 2.19Å | ADPR part (2.6.Å)NAM part (1.42.Å) |
| 4BVG (native intermediate) XtalvsSirt3/ADPR complex/NAM modelled from 4FVT but with loop replaced form 4BVG (MD average) | 1.0Å | 1.4Å | NAD part (0.4.Å)peptide part( 0.8Å) |
| 4FVT (ternary complex) Xtal vs Sirt3/ternary complex/with 4BVG loop ( native intermediate loop) MD averaged | 1.6Å | 4.0 Å | NAD part (2.4Å)peptide part( 0.44Å) |
| 4BVG (Intermediate complex) Xtal vs Sirt3/ternary complex/modelled with 4BVG loop ( native intermediate loop) MD averaged | 1.63Å | 1.62Å | NAD part (2.84Å)Peptide part( 0.68Å)  |
| 4FVT (ternary complex) Xtal vs Sirt3/product complex/with 4FVT loop (native ternary loop) MD averaged | 1.57Å | 3.04 Å | NAD part (2.0Å)Peptide part( 0.93Å) |
| 4FVT (ternary complex) Xtal vs Sirt3/product complex /with 4BVG loop (native intermediate loop) MD averaged | 1.82Å | 3.68Å | NAD part (2.43Å)Peptide part( 0.43Å) |
| 4BVG (intermediate complex) Xtal vs Sirt3/product complex /with 4FVT loop (native ternary loop) MD averaged | 1.81Å | 4.37Å | NAD part (2.54Å)Peptide part(1.06 Å) |
| 4BVG (intermediate complex) Xtal vs Sirt3/product complex /with 4BVG loop (native intermediate loop) MD averaged | 1.72Å | 2.14Å | NAD part (1.73Å)Peptide part(0.34 Å) |

*\*Note: Only the matching atoms were considered for RMSD calculation.*