Full wwPDB X-ray Structure Validation Report (i)

Jan 16, 2024 – 01:25 am GMT

PDB ID	:	6Z5V
Title	:	CRYSTAL STRUCTURE OF RAT PEROXISOMAL MULTIFUNCTIONAL ENZYME TYPE-1 (RPMFE1) COMPLEXED WITH 3-KETODECANOYL-COA IN CROTONASE FOLD AND OXIDISED NICOTINAMIDE ADENINE DINUCLEOTIDE IN HAD FOLD
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Deposited on	:	2020-05-27
Resolution	:	2.33 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

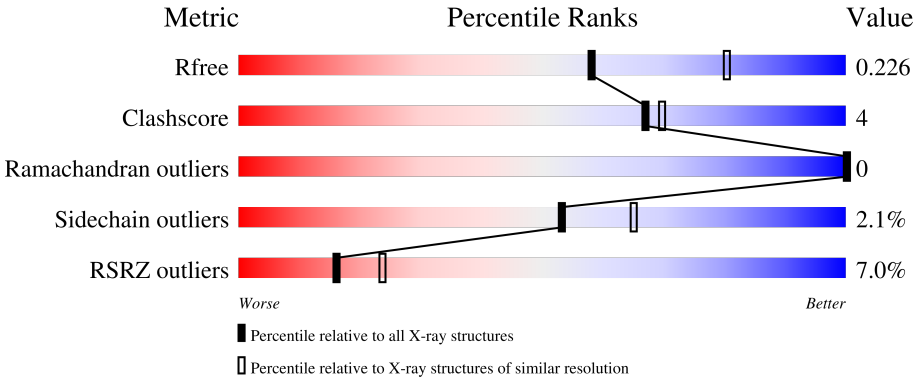
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.33 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2096 (2.36-2.32)
Clashscore	141614	2193 (2.36-2.32)
Ramachandran outliers	138981	2159 (2.36-2.32)
Sidechain outliers	138945	2160 (2.36-2.32)
RSRZ outliers	127900	2067 (2.36-2.32)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	AAA	742	6% 85% 11%
1	BBB	742	7% 86% 10%

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 11432 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Peroxisomal bifunctional enzyme.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	AAA	719	Total	C	N	O	S	0	3	0
			5549	3545	974	1007	23			
1	BBB	713	Total	C	N	O	S	0	0	0
			5482	3509	957	993	23			

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	-19	MET	-	initiating methionine	UNP P07896
AAA	-18	GLY	-	expression tag	UNP P07896
AAA	-17	SER	-	expression tag	UNP P07896
AAA	-16	SER	-	expression tag	UNP P07896
AAA	-15	HIS	-	expression tag	UNP P07896
AAA	-14	HIS	-	expression tag	UNP P07896
AAA	-13	HIS	-	expression tag	UNP P07896
AAA	-12	HIS	-	expression tag	UNP P07896
AAA	-11	HIS	-	expression tag	UNP P07896
AAA	-10	HIS	-	expression tag	UNP P07896
AAA	-9	SER	-	expression tag	UNP P07896
AAA	-8	SER	-	expression tag	UNP P07896
AAA	-7	GLY	-	expression tag	UNP P07896
AAA	-6	LEU	-	expression tag	UNP P07896
AAA	-5	VAL	-	expression tag	UNP P07896
AAA	-4	PRO	-	expression tag	UNP P07896
AAA	-3	ARG	-	expression tag	UNP P07896
AAA	-2	GLY	-	expression tag	UNP P07896
AAA	-1	SER	-	expression tag	UNP P07896
AAA	0	HIS	-	expression tag	UNP P07896
BBB	-19	MET	-	initiating methionine	UNP P07896
BBB	-18	GLY	-	expression tag	UNP P07896
BBB	-17	SER	-	expression tag	UNP P07896
BBB	-16	SER	-	expression tag	UNP P07896
BBB	-15	HIS	-	expression tag	UNP P07896

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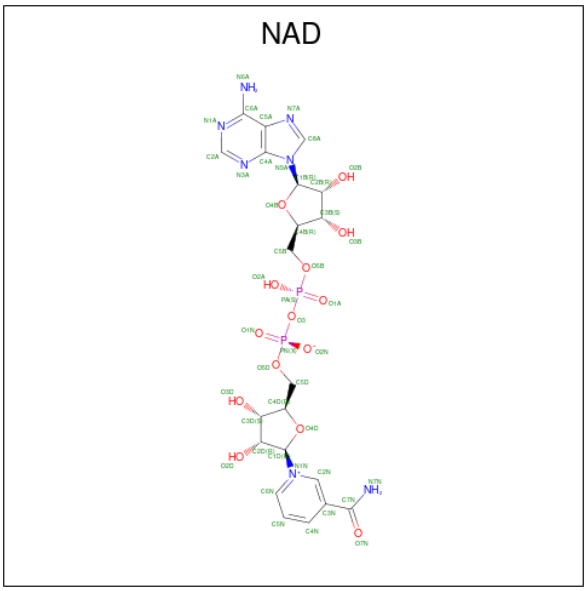
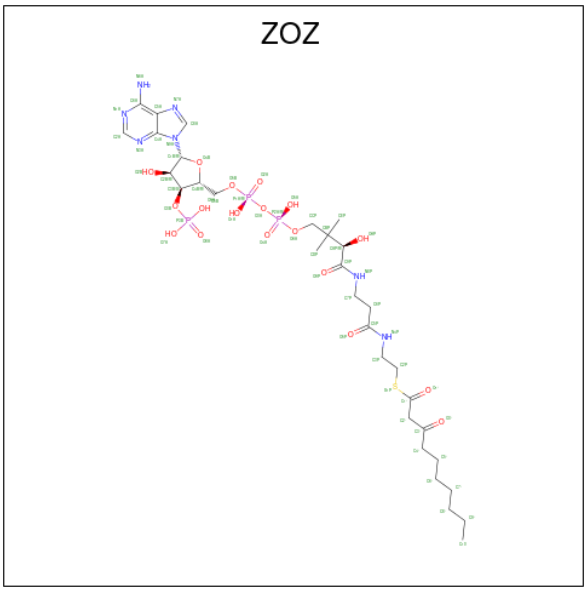
Chain	Residue	Modelled	Actual	Comment	Reference
BBB	-14	HIS	-	expression tag	UNP P07896
BBB	-13	HIS	-	expression tag	UNP P07896
BBB	-12	HIS	-	expression tag	UNP P07896
BBB	-11	HIS	-	expression tag	UNP P07896
BBB	-10	HIS	-	expression tag	UNP P07896
BBB	-9	SER	-	expression tag	UNP P07896
BBB	-8	SER	-	expression tag	UNP P07896
BBB	-7	GLY	-	expression tag	UNP P07896
BBB	-6	LEU	-	expression tag	UNP P07896
BBB	-5	VAL	-	expression tag	UNP P07896
BBB	-4	PRO	-	expression tag	UNP P07896
BBB	-3	ARG	-	expression tag	UNP P07896
BBB	-2	GLY	-	expression tag	UNP P07896
BBB	-1	SER	-	expression tag	UNP P07896
BBB	0	HIS	-	expression tag	UNP P07896

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$) (labeled as "Ligand of Interest" by depositor).



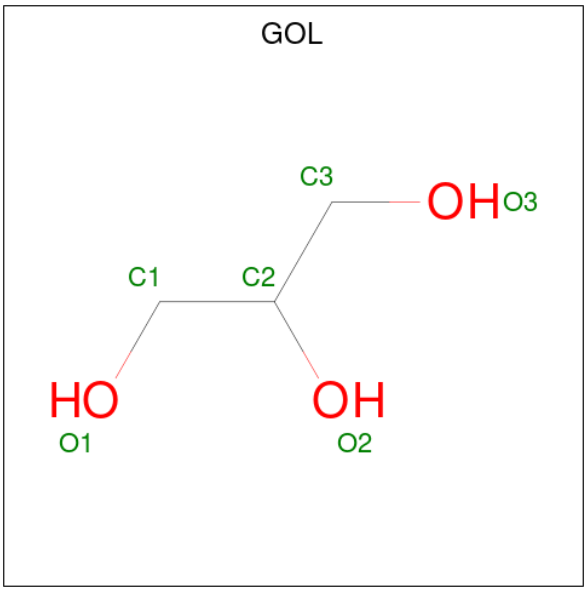
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	AAA	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	BBB	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 3 is 3-KETO-DECANOYL-COA (three-letter code: ZOZ) (formula: $C_{31}H_{52}N_7O_{18}P_3S$) (labeled as "Ligand of Interest" by depositor).



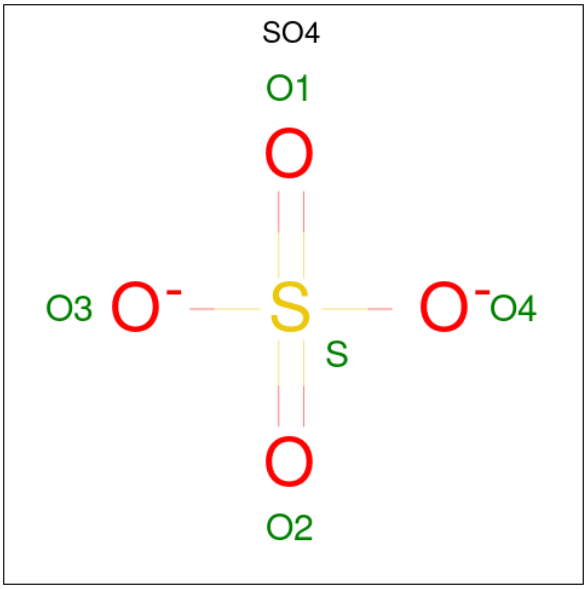
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	AAA	1	Total	C	N	O	P	S	0	0
			60	31	7	18	3	1		
3	BBB	1	Total	C	N	O	P	S	0	0
			60	31	7	18	3	1		

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	AAA	1	Total	C	O		0	0
			6	3	3			

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O_4S) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	AAA	1	Total O S 5 4 1	0	0
5	AAA	1	Total O S 5 4 1	0	0
5	BBB	1	Total O S 5 4 1	0	0
5	BBB	1	Total O S 5 4 1	0	0

- Molecule 6 is water.

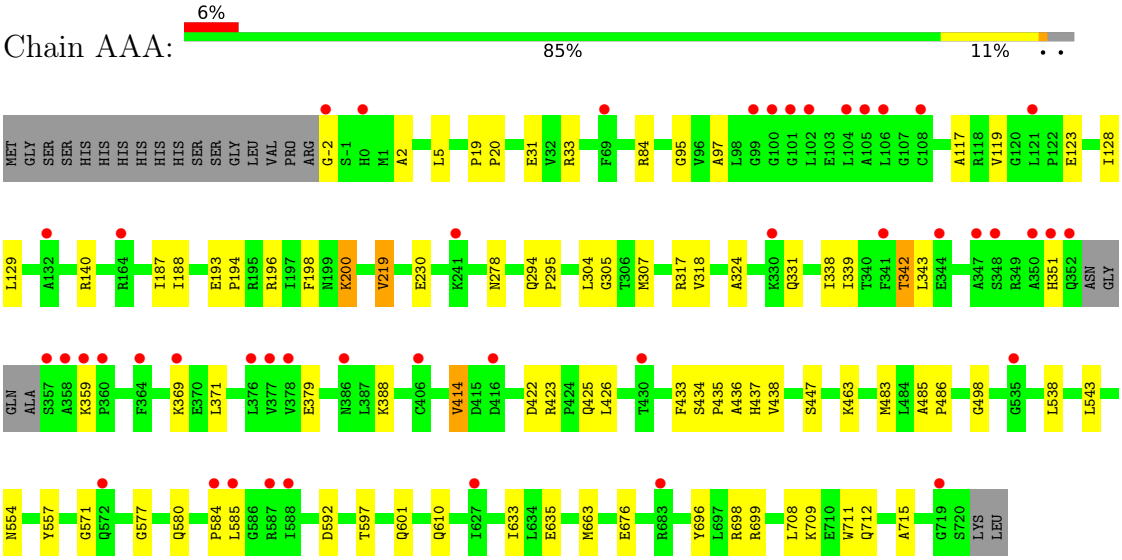
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	AAA	126	Total O 126 126	0	0
6	BBB	41	Total O 41 41	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

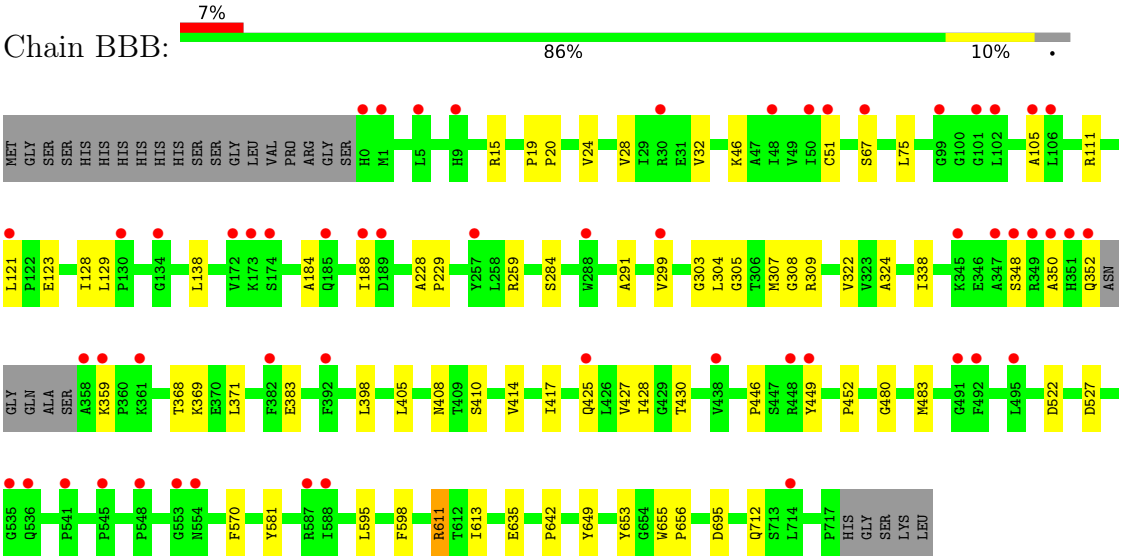
• Molecule 1: Peroxisomal bifunctional enzyme

Chain AAA:



• Molecule 1: Peroxisomal bifunctional enzyme

Chain BBB:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	65.31Å 126.30Å 224.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.15 – 2.33 29.13 – 2.33	Depositor EDS
% Data completeness (in resolution range)	99.0 (29.15-2.33) 99.2 (29.13-2.33)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.08 (at 2.34Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.203 , 0.226 0.203 , 0.226	Depositor DCC
R_{free} test set	4072 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å^2)	58.0	Xtriage
Anisotropy	0.069	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 40.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	11432	wwPDB-VP
Average B, all atoms (Å^2)	83.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.63% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZOZ, NAD, SO4, GOL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| > 5$	RMSZ	$\#\|Z\| > 5$
1	AAA	0.38	0/5676	0.70	2/7686 (0.0%)
1	BBB	0.30	0/5608	0.60	0/7597
All	All	0.34	0/11284	0.65	2/15283 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	AAA	200	LYS	CB-CA-C	5.95	122.30	110.40
1	AAA	84	ARG	CB-CA-C	-5.04	100.32	110.40

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	AAA	5549	0	5653	43	0
1	BBB	5482	0	5596	42	0
2	AAA	44	0	26	3	0
2	BBB	44	0	26	4	0
3	AAA	60	0	0	0	0
3	BBB	60	0	0	0	0
4	AAA	6	0	8	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	AAA	10	0	0	0	0
5	BBB	10	0	0	0	0
6	AAA	126	0	0	1	0
6	BBB	41	0	0	0	0
All	All	11432	0	11309	87	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (87) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:AAA:304:LEU:HD11	1:AAA:324:ALA:HB1	1.48	0.92
1:BBB:309:ARG:HD3	1:BBB:338:ILE:HD11	1.77	0.67
1:AAA:433:PHE:O	1:AAA:436:ALA:HA	1.97	0.65
1:BBB:304:LEU:HD11	1:BBB:324:ALA:HB1	1.79	0.65
1:BBB:635:GLU:OE2	1:BBB:695:ASP:HB2	1.97	0.64
1:AAA:538:LEU:O	1:AAA:543:LEU:HD13	1.97	0.64
1:AAA:294:GLN:HG2	1:AAA:295:PRO:HD2	1.82	0.62
1:AAA:597:THR:HG21	2:BBB:901:NAD:H3B	1.81	0.61
1:AAA:331:GLN:HG2	2:AAA:1001:NAD:O3B	2.01	0.61
1:AAA:339:ILE:O	1:AAA:343:LEU:HB2	2.01	0.60
1:BBB:307:MET:HG2	1:BBB:408:ASN:HD21	1.67	0.59
1:BBB:405:LEU:HB2	1:BBB:427:VAL:HG22	1.85	0.59
1:AAA:140:ARG:O	1:AAA:200:LYS:HE3	2.02	0.59
1:BBB:383:GLU:HB2	2:BBB:901:NAD:H3D	1.85	0.58
1:AAA:97:ALA:O	1:AAA:119:VAL:HA	2.05	0.56
1:AAA:699:ARG:NH2	1:AAA:715:ALA:O	2.40	0.55
1:AAA:708:LEU:HA	1:AAA:711:TRP:CE2	2.41	0.55
1:BBB:28:VAL:O	1:BBB:32:VAL:HG23	2.07	0.55
1:BBB:307:MET:HG2	1:BBB:408:ASN:ND2	2.22	0.54
1:AAA:635:GLU:HB3	1:AAA:696:TYR:HB2	1.90	0.54
1:BBB:15:ARG:HG3	1:BBB:51:CYS:SG	2.48	0.53
2:AAA:1001:NAD:O1N	2:AAA:1001:NAD:N7N	2.42	0.52
1:BBB:368:THR:HG22	1:BBB:368:THR:O	2.10	0.52
1:AAA:423:ARG:HG3	1:AAA:423:ARG:O	2.10	0.52
1:AAA:305:GLY:HA3	2:AAA:1001:NAD:O5B	2.10	0.51
1:AAA:193:GLU:HB3	1:AAA:194:PRO:HD3	1.93	0.50
1:BBB:655:TRP:CD1	1:BBB:656:PRO:HD2	2.47	0.50
1:BBB:369:LYS:C	1:BBB:371:LEU:H	2.13	0.50
1:BBB:642:PRO:HD3	1:BBB:712:GLN:HG2	1.93	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:BBB:414:VAL:HA	1:BBB:417:ILE:HD12	1.94	0.49
1:BBB:483:MET:HE2	1:BBB:649:TYR:CE1	2.48	0.49
1:AAA:129:LEU:C	1:AAA:129:LEU:HD12	2.34	0.49
1:AAA:2:ALA:HB3	1:AAA:31:GLU:HB3	1.95	0.47
1:BBB:228:ALA:HB3	1:BBB:229:PRO:HD3	1.96	0.47
1:AAA:307:MET:SD	1:AAA:434:SER:HB3	2.54	0.47
1:AAA:498:GLY:HA2	1:AAA:610:GLN:HE22	1.80	0.47
1:BBB:527:ASP:HB3	1:BBB:570:PHE:CD1	2.50	0.47
1:AAA:698[A]:ARG:HD2	6:AAA:1132:HOH:O	2.15	0.46
1:AAA:219:VAL:HG11	1:AAA:230:GLU:HA	1.96	0.46
1:BBB:522:ASP:HB3	1:BBB:581:TYR:OH	2.15	0.46
1:BBB:303:GLY:O	1:BBB:308:GLY:HA3	2.17	0.45
1:BBB:350:ALA:C	1:BBB:352:GLN:H	2.19	0.45
1:AAA:584:PRO:O	1:AAA:585:LEU:HB2	2.17	0.45
1:AAA:557:TYR:CE1	4:AAA:1003:GOL:H31	2.52	0.45
1:BBB:24:VAL:HG11	1:BBB:75:LEU:HD13	1.99	0.45
1:BBB:105:ALA:O	1:BBB:111:ARG:HD3	2.17	0.45
1:AAA:193:GLU:OE1	1:AAA:196:ARG:HD2	2.17	0.44
1:BBB:129:LEU:HD12	1:BBB:129:LEU:C	2.38	0.44
1:AAA:123:GLU:HB3	1:AAA:128:ILE:HG13	1.99	0.44
1:BBB:299:VAL:O	1:BBB:322:VAL:HA	2.18	0.44
1:BBB:123:GLU:HB3	1:BBB:128:ILE:HG13	1.99	0.44
1:AAA:19:PRO:HA	1:AAA:20:PRO:HA	1.78	0.43
1:AAA:435:PRO:HB2	1:AAA:438:VAL:HG22	2.00	0.43
1:AAA:437:HIS:H	1:AAA:437:HIS:CD2	2.36	0.43
1:AAA:485:ALA:N	1:AAA:486:PRO:HD2	2.33	0.43
1:AAA:423:ARG:HB2	1:AAA:426:LEU:HD12	2.01	0.43
1:AAA:187:ILE:HD12	1:AAA:187:ILE:C	2.39	0.43
1:AAA:-2:GLY:HA2	1:AAA:31:GLU:OE2	2.19	0.42
1:BBB:184:ALA:O	1:BBB:188:ILE:HB	2.18	0.42
1:BBB:305:GLY:O	1:BBB:309:ARG:HG3	2.19	0.42
1:BBB:408:ASN:HA	1:BBB:430:THR:O	2.19	0.42
1:BBB:428:ILE:HG13	1:BBB:446:PRO:HA	2.01	0.42
1:AAA:580:GLN:HB3	1:AAA:592:ASP:HB2	2.01	0.42
1:AAA:317:ARG:HG3	1:AAA:318:VAL:HG13	2.00	0.42
1:AAA:571:GLY:HA2	1:AAA:577:GLY:HA3	2.01	0.42
1:BBB:46:LYS:HB2	1:BBB:188:ILE:HD11	1.99	0.42
1:BBB:595:LEU:HA	1:BBB:598:PHE:HB3	2.00	0.42
1:AAA:95:GLY:O	1:AAA:117:ALA:HA	2.19	0.42
1:BBB:480:GLY:HA3	1:BBB:653:TYR:CE2	2.55	0.42
1:BBB:425:GLN:HA	1:BBB:449:TYR:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:AAA:663:MET:HA	1:AAA:663:MET:HE2	2.03	0.41
1:BBB:371:LEU:HD12	1:BBB:371:LEU:HA	1.94	0.41
1:BBB:408:ASN:O	2:BBB:901:NAD:H1D	2.20	0.41
1:BBB:121:LEU:HD12	1:BBB:138:LEU:HD22	2.03	0.41
1:BBB:655:TRP:CG	1:BBB:656:PRO:HD2	2.55	0.41
2:BBB:901:NAD:N7N	2:BBB:901:NAD:O1N	2.53	0.41
1:AAA:425:GLN:HG2	1:AAA:426:LEU:HG	2.03	0.41
1:AAA:414:VAL:HG23	1:AAA:447:SER:HB3	2.01	0.41
1:AAA:483:MET:HG3	1:AAA:633:ILE:CD1	2.51	0.41
1:BBB:19:PRO:HA	1:BBB:20:PRO:HA	1.81	0.41
1:BBB:369:LYS:HG2	1:BBB:398:LEU:HD22	2.03	0.40
1:AAA:379:GLU:OE2	1:AAA:388:LYS:NZ	2.54	0.40
1:AAA:712:GLN:NE2	1:AAA:712:GLN:HA	2.36	0.40
1:BBB:611:ARG:NH2	1:BBB:613:ILE:HG12	2.36	0.40
1:AAA:338:ILE:O	1:AAA:342:THR:OG1	2.32	0.40
1:BBB:291:ALA:HB2	1:BBB:452:PRO:HB3	2.04	0.40
1:BBB:405:LEU:O	1:BBB:427:VAL:HA	2.22	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	AAA	718/742 (97%)	688 (96%)	30 (4%)	0	100	100
1	BBB	709/742 (96%)	686 (97%)	23 (3%)	0	100	100
All	All	1427/1484 (96%)	1374 (96%)	53 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	AAA	593/609 (97%)	575 (97%)	18 (3%)	41 50
1	BBB	586/609 (96%)	579 (99%)	7 (1%)	71 82
All	All	1179/1218 (97%)	1154 (98%)	25 (2%)	53 65

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	5	LEU
1	AAA	33	ARG
1	AAA	188	ILE
1	AAA	198	PHE
1	AAA	219	VAL
1	AAA	278	ASN
1	AAA	342	THR
1	AAA	351	HIS
1	AAA	359	LYS
1	AAA	369	LYS
1	AAA	371	LEU
1	AAA	414	VAL
1	AAA	422	ASP
1	AAA	463	LYS
1	AAA	554	ASN
1	AAA	601	GLN
1	AAA	676	GLU
1	AAA	709	LYS
1	BBB	67	SER
1	BBB	259	ARG
1	BBB	284	SER
1	BBB	348	SER
1	BBB	359	LYS
1	BBB	410	SER
1	BBB	611	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are

no such sidechains identified.

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

9 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
5	SO4	BBB	904	-	4,4,4	0.38	0	6,6,6	0.06	0
4	GOL	AAA	1003	-	5,5,5	0.11	0	5,5,5	0.42	0
2	NAD	BBB	901	-	42,48,48	0.72	1 (2%)	50,73,73	0.94	4 (8%)
5	SO4	BBB	903	-	4,4,4	0.38	0	6,6,6	0.05	0
3	ZOZ	AAA	1002	-	53,62,62	0.58	0	65,89,89	0.85	3 (4%)
5	SO4	AAA	1005	-	4,4,4	0.38	0	6,6,6	0.06	0
3	ZOZ	BBB	902	-	53,62,62	0.55	0	65,89,89	0.84	3 (4%)
2	NAD	AAA	1001	-	42,48,48	0.79	1 (2%)	50,73,73	0.76	2 (4%)
5	SO4	AAA	1004	-	4,4,4	0.31	0	6,6,6	0.10	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GOL	AAA	1003	-	-	1/4/4/4	-
2	NAD	BBB	901	-	-	6/26/62/62	0/5/5/5
3	ZOZ	AAA	1002	-	-	14/57/78/78	0/3/3/3
3	ZOZ	BBB	902	-	-	11/57/78/78	0/3/3/3
2	NAD	AAA	1001	-	-	6/26/62/62	0/5/5/5

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	AAA	1001	NAD	C2N-N1N	3.29	1.39	1.35
2	BBB	901	NAD	C2N-N1N	2.78	1.38	1.35

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	BBB	902	ZOZ	C3'-C2'-C1'	3.53	119.55	112.52
2	BBB	901	NAD	C3N-C2N-N1N	-3.49	117.01	120.43
3	AAA	1002	ZOZ	C3'-C2'-C1'	3.38	119.24	112.52
2	BBB	901	NAD	C6N-N1N-C2N	-3.12	119.13	121.97
2	AAA	1001	NAD	C6N-N1N-C2N	-3.04	119.20	121.97
2	BBB	901	NAD	C5A-C6A-N6A	2.27	123.80	120.35
3	BBB	902	ZOZ	C5A-C6A-N6A	2.23	123.74	120.35
3	AAA	1002	ZOZ	O6A-CCP-CBP	-2.18	107.03	110.55
3	AAA	1002	ZOZ	C5A-C6A-N6A	2.18	123.67	120.35
2	AAA	1001	NAD	C5A-C6A-N6A	2.13	123.59	120.35
2	BBB	901	NAD	O4B-C1B-C2B	-2.12	103.82	106.93
3	BBB	902	ZOZ	O6A-CCP-CBP	-2.10	107.18	110.55

There are no chirality outliers.

All (38) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	AAA	1001	NAD	O4D-C1D-N1N-C2N
2	AAA	1001	NAD	O4D-C1D-N1N-C6N
2	AAA	1001	NAD	C2D-C1D-N1N-C2N
2	AAA	1001	NAD	C2D-C1D-N1N-C6N
2	BBB	901	NAD	C5B-O5B-PA-O1A
2	BBB	901	NAD	O4D-C1D-N1N-C2N
3	AAA	1002	ZOZ	C6P-C5P-N4P-C3P
3	AAA	1002	ZOZ	CAP-CBP-CCP-O6A
3	AAA	1002	ZOZ	CCP-O6A-P2A-O4A

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Mol	Chain	Res	Type	Atoms
3	AAA	1002	ZOZ	P1A-O3A-P2A-O6A
3	AAA	1002	ZOZ	O5P-C5P-N4P-C3P
2	BBB	901	NAD	O4B-C4B-C5B-O5B
3	BBB	902	ZOZ	O4B-C4B-C5B-O5B
2	BBB	901	NAD	C3B-C4B-C5B-O5B
3	AAA	1002	ZOZ	CDP-CBP-CCP-O6A
3	AAA	1002	ZOZ	CEP-CBP-CCP-O6A
3	AAA	1002	ZOZ	C5'-C6'-C7'-C8'
3	AAA	1002	ZOZ	C4'-C5'-C6'-C7'
3	BBB	902	ZOZ	C3'-C4'-C5'-C6'
3	BBB	902	ZOZ	C6'-C7'-C8'-C9'
2	AAA	1001	NAD	O4B-C4B-C5B-O5B
3	BBB	902	ZOZ	C5'-C6'-C7'-C8'
4	AAA	1003	GOL	O1-C1-C2-C3
3	BBB	902	ZOZ	C4'-C5'-C6'-C7'
3	BBB	902	ZOZ	C3B-O3B-P3B-O8A
2	BBB	901	NAD	C5B-O5B-PA-O3
3	AAA	1002	ZOZ	CCP-O6A-P2A-O3A
3	AAA	1002	ZOZ	P2A-O3A-P1A-O1A
3	BBB	902	ZOZ	C1'-C2'-C3'-O3'
2	BBB	901	NAD	PA-O3-PN-O2N
3	AAA	1002	ZOZ	C3'-C4'-C5'-C6'
3	BBB	902	ZOZ	C3P-C2P-S1P-C1'
3	BBB	902	ZOZ	O1'-C1'-S1P-C2P
2	AAA	1001	NAD	C3B-C4B-C5B-O5B
3	BBB	902	ZOZ	C1'-C2'-C3'-C4'
3	AAA	1002	ZOZ	P2A-O3A-P1A-O2A
3	AAA	1002	ZOZ	CCP-O6A-P2A-O5A
3	BBB	902	ZOZ	CEP-CBP-CCP-O6A

There are no ring outliers.

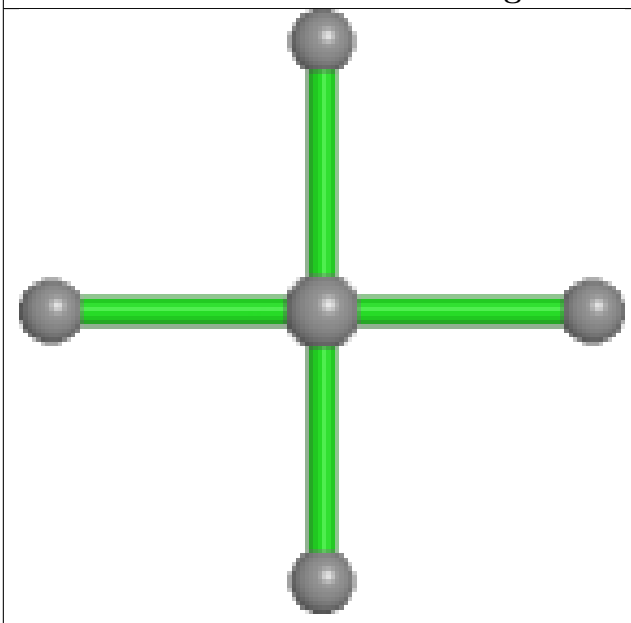
3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	AAA	1003	GOL	1	0
2	BBB	901	NAD	4	0
2	AAA	1001	NAD	3	0

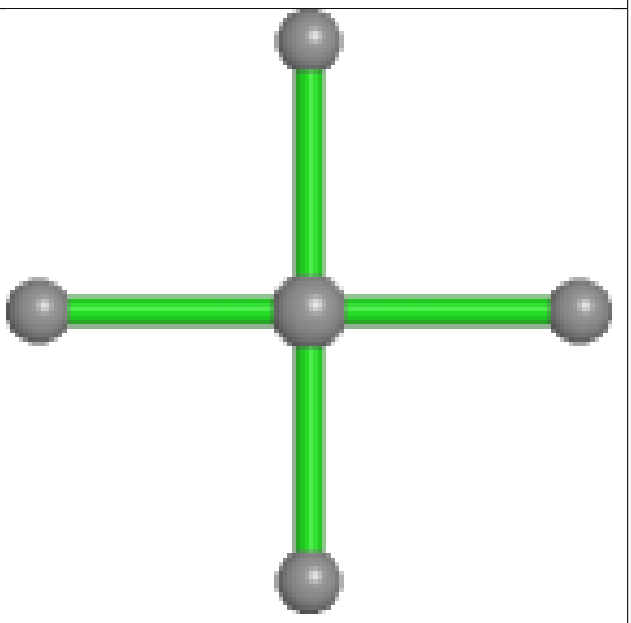
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is

within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

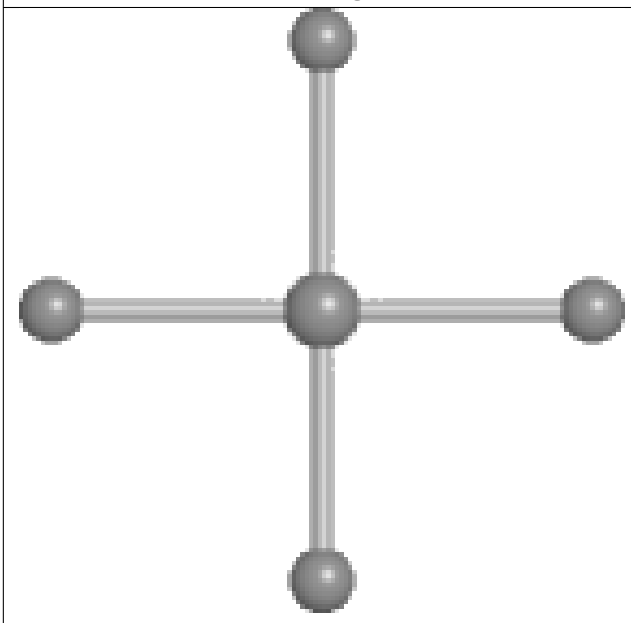
Ligand SO4 BBB 904



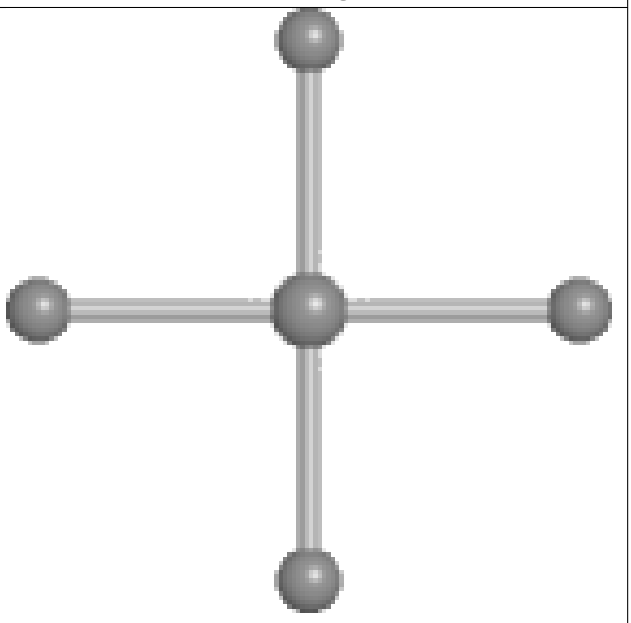
Bond lengths



Bond angles

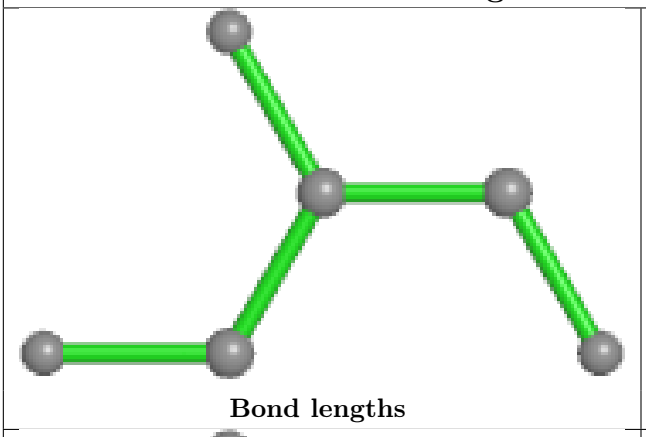


Torsions

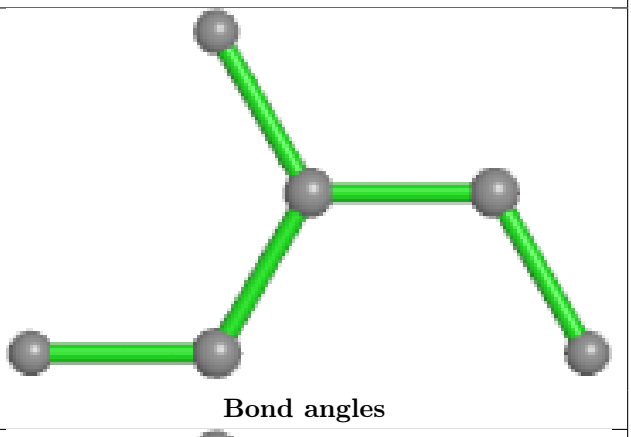


Rings

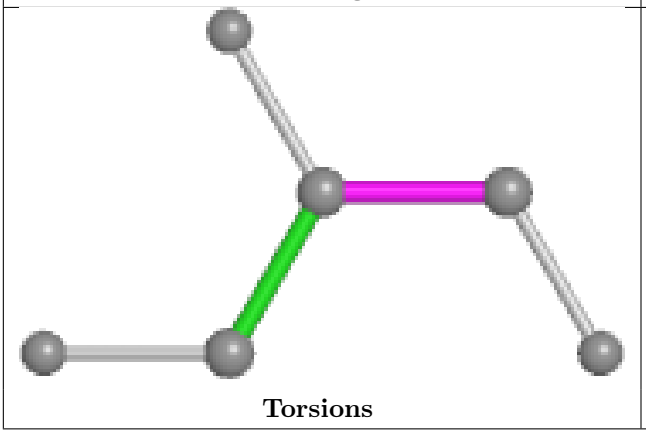
Ligand GOL AAA 1003



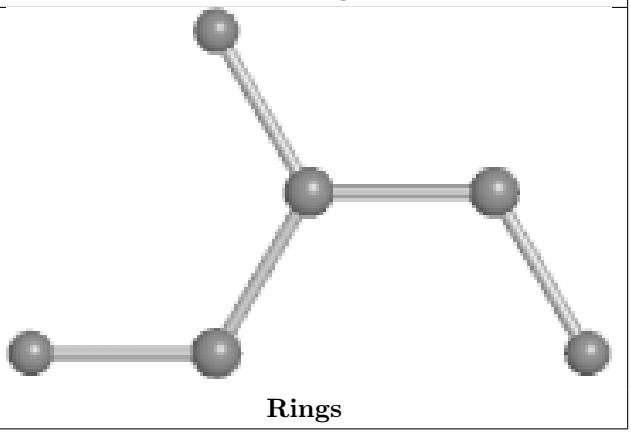
Bond lengths



Bond angles

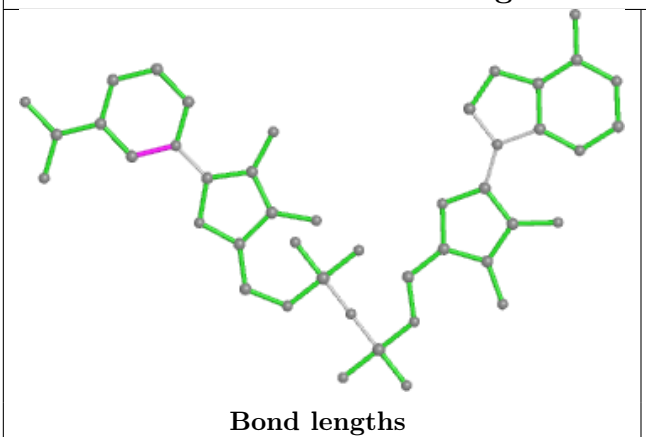


Torsions

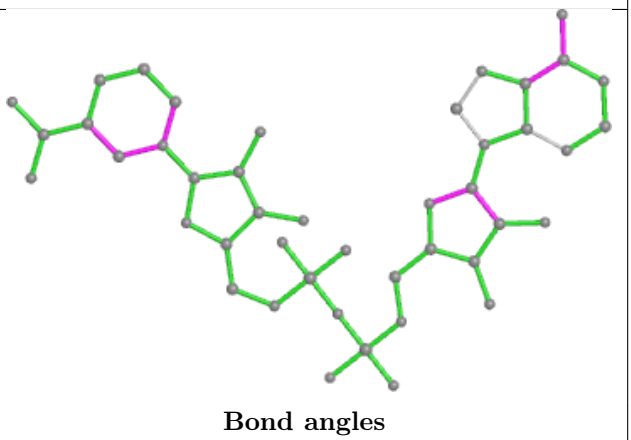


Rings

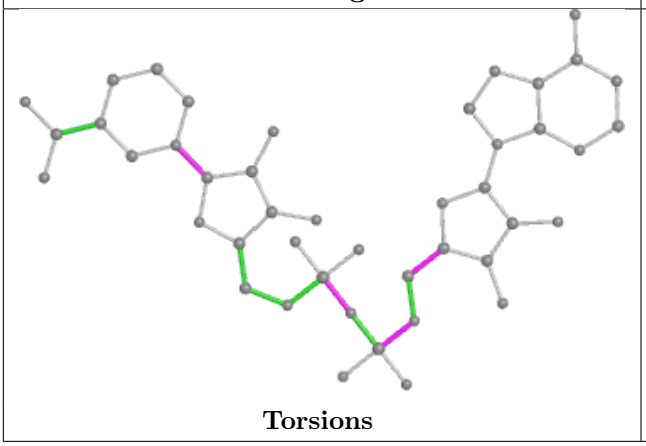
Ligand NAD BBB 901



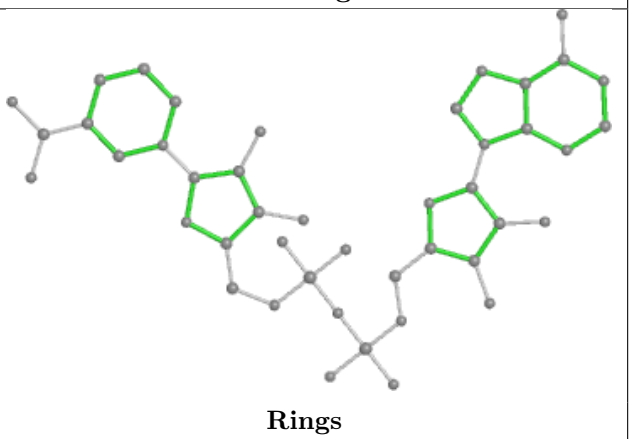
Bond lengths



Bond angles

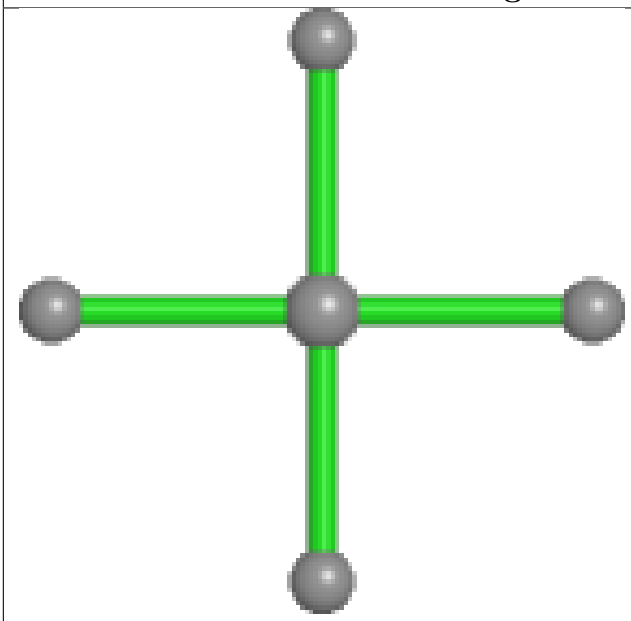


Torsions

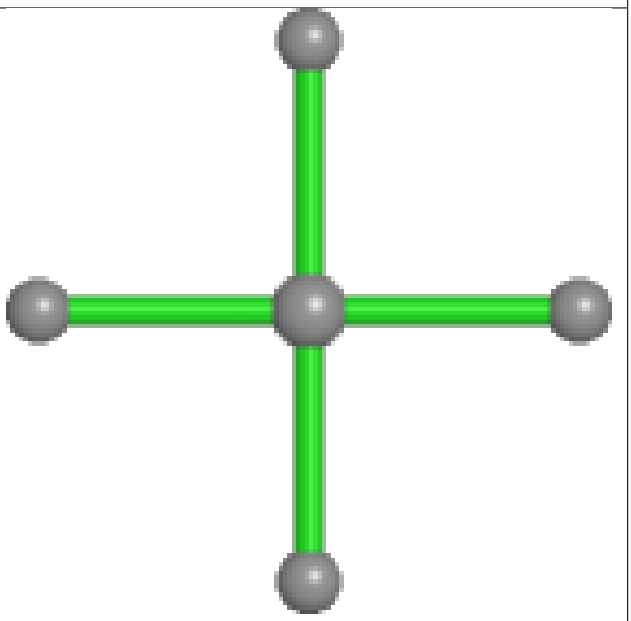


Rings

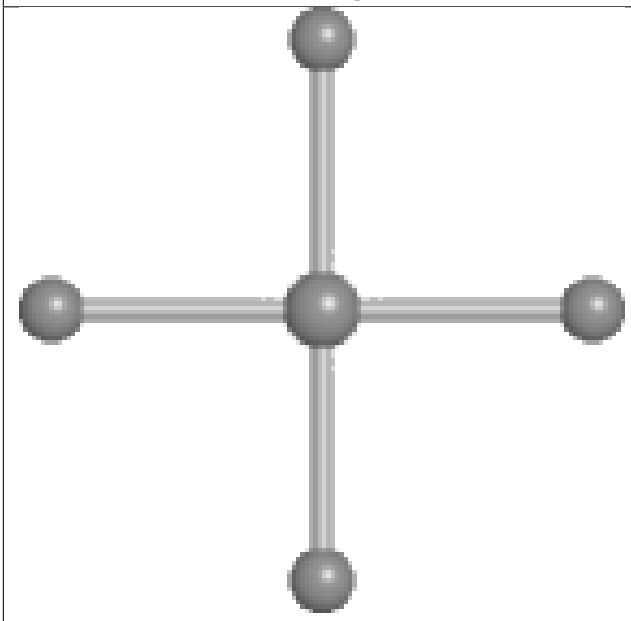
Ligand SO4 BBB 903



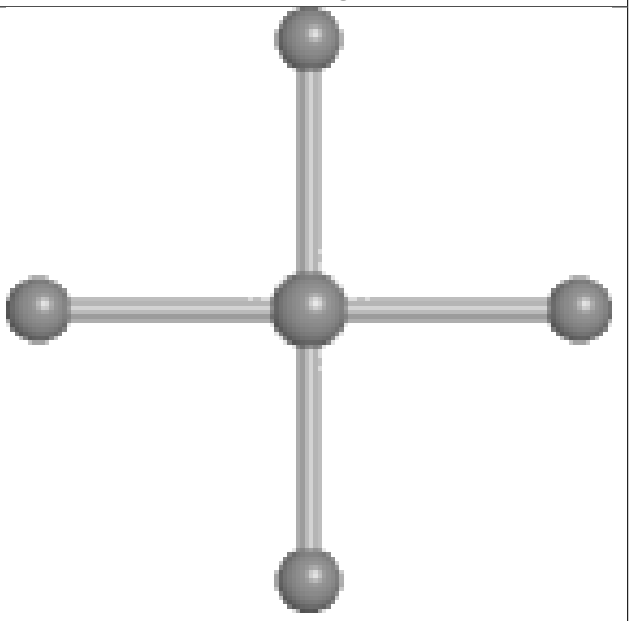
Bond lengths



Bond angles

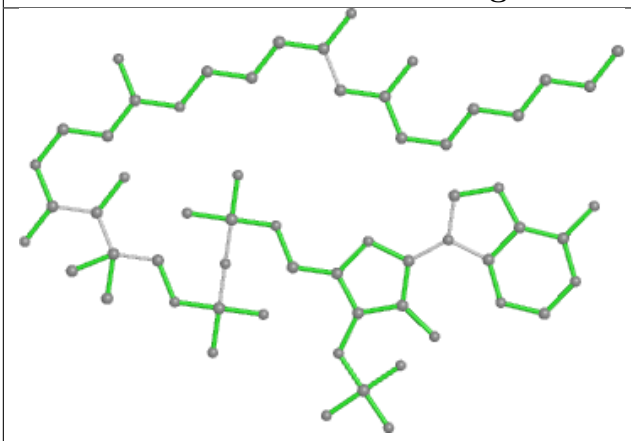


Torsions

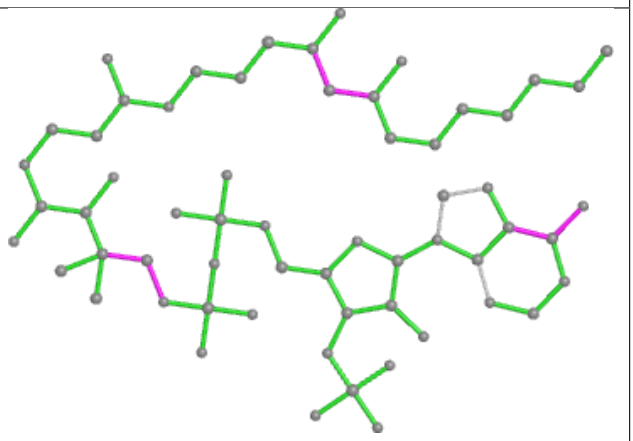


Rings

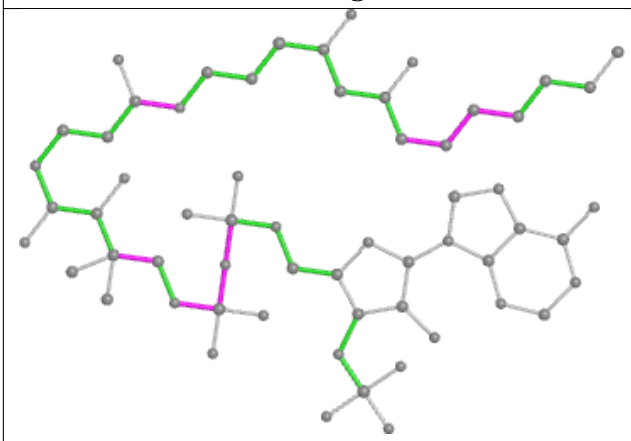
Ligand ZOZ AAA 1002



Bond lengths



Bond angles



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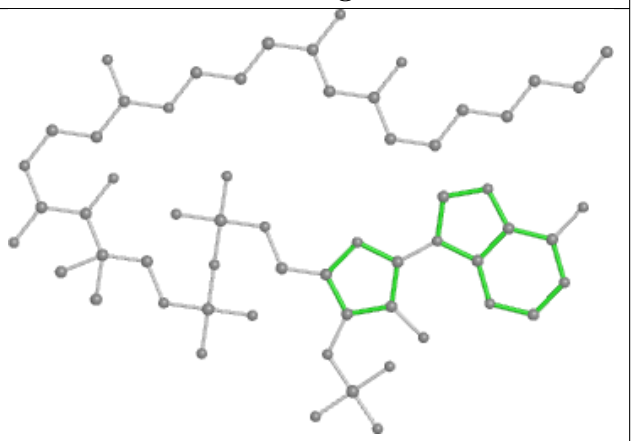
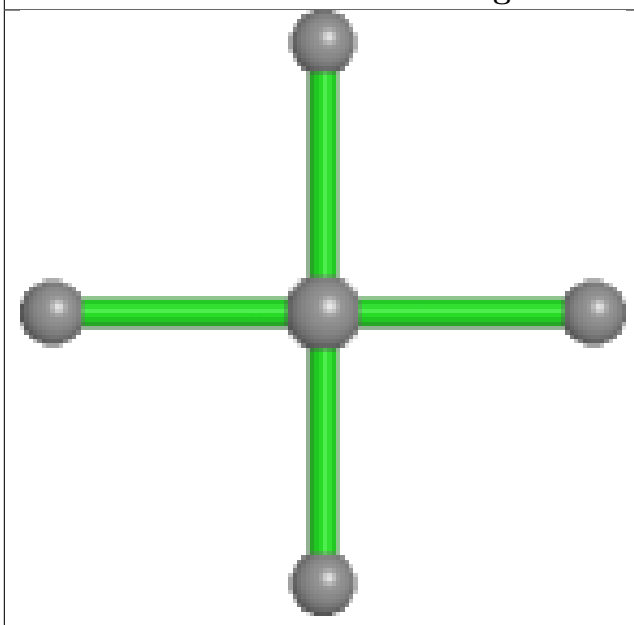
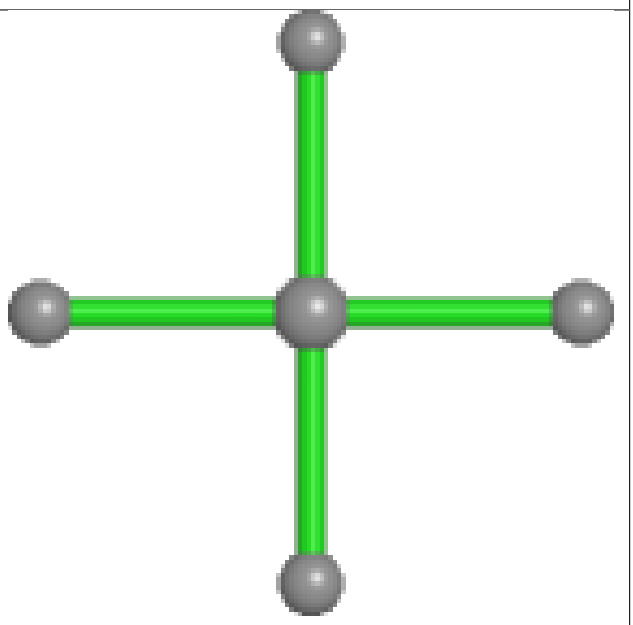


Rings

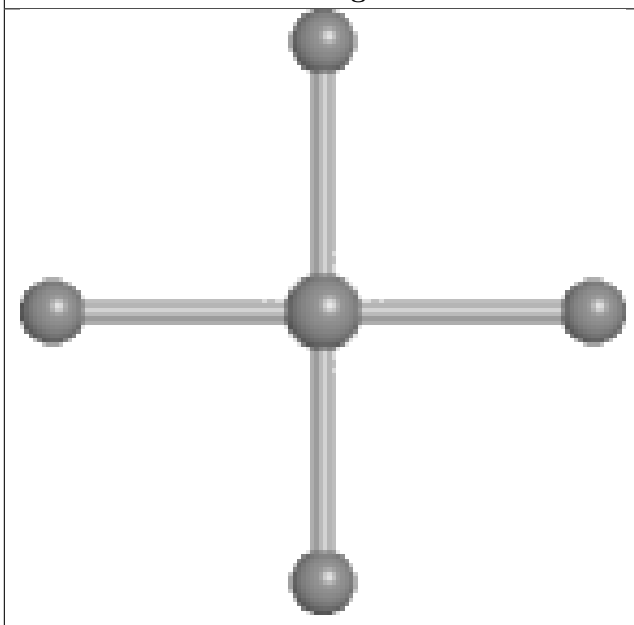
Ligand SO4 AAA 1005



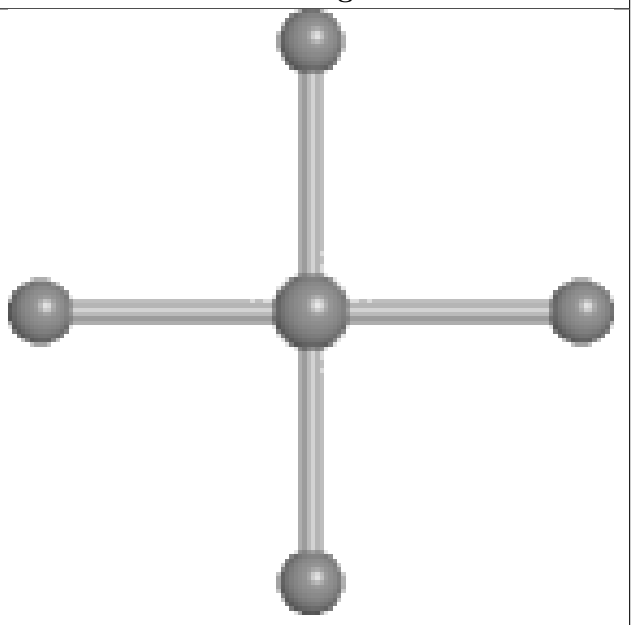
Bond lengths



Bond angles

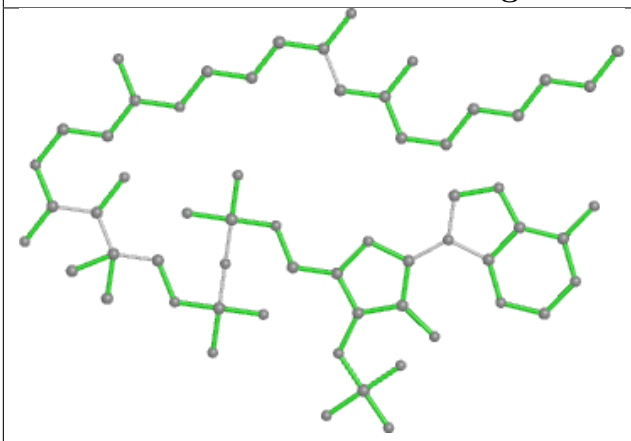


Torsions

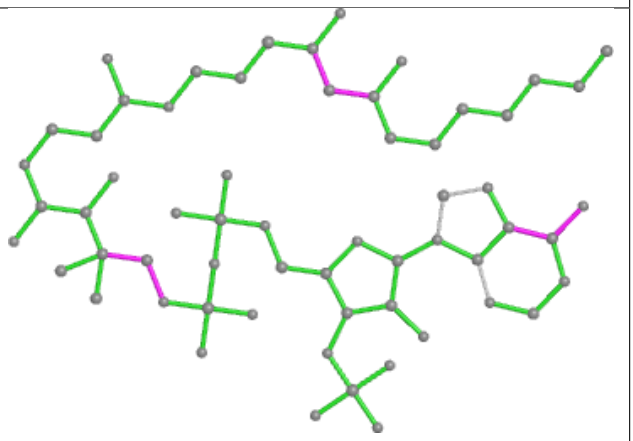


Rings

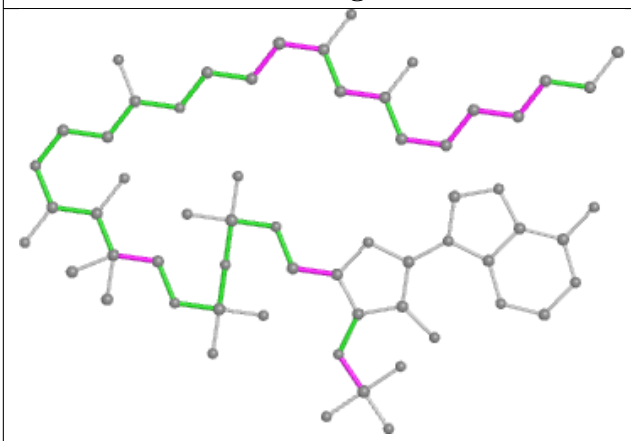
Ligand ZOZ BBB 902



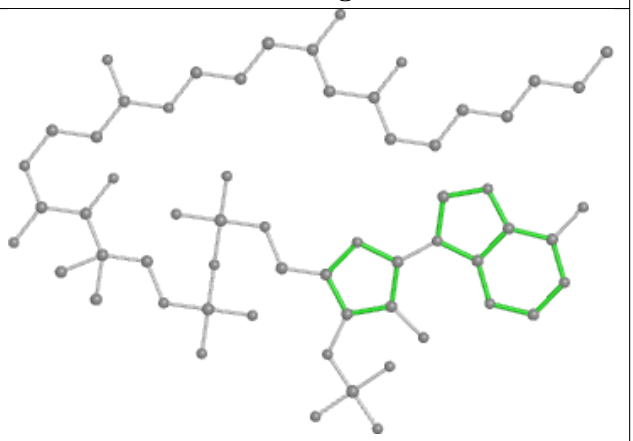
Bond lengths



Bond angles

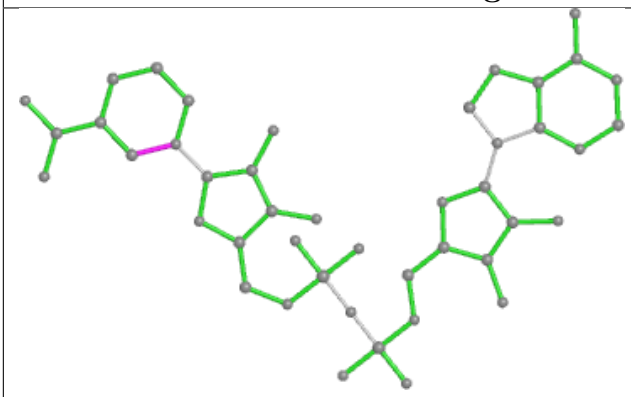


Torsions

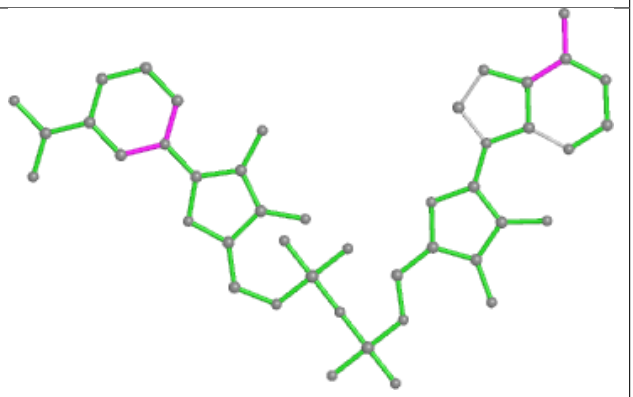


Rings

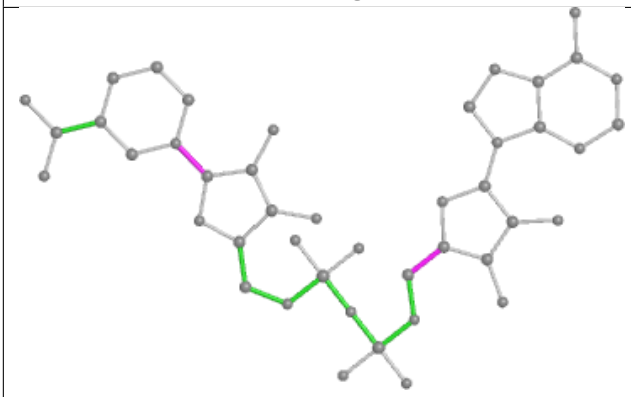
Ligand NAD AAA 1001



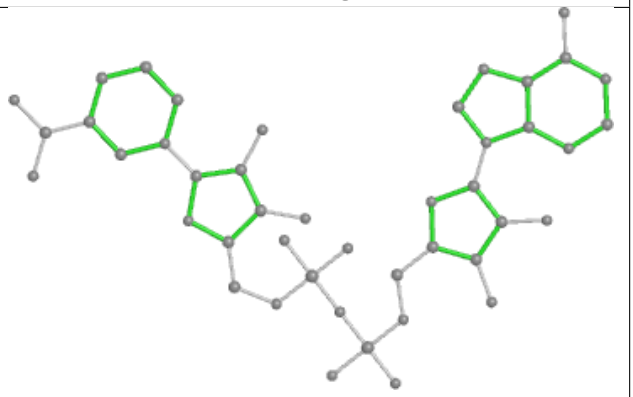
Bond lengths



Bond angles

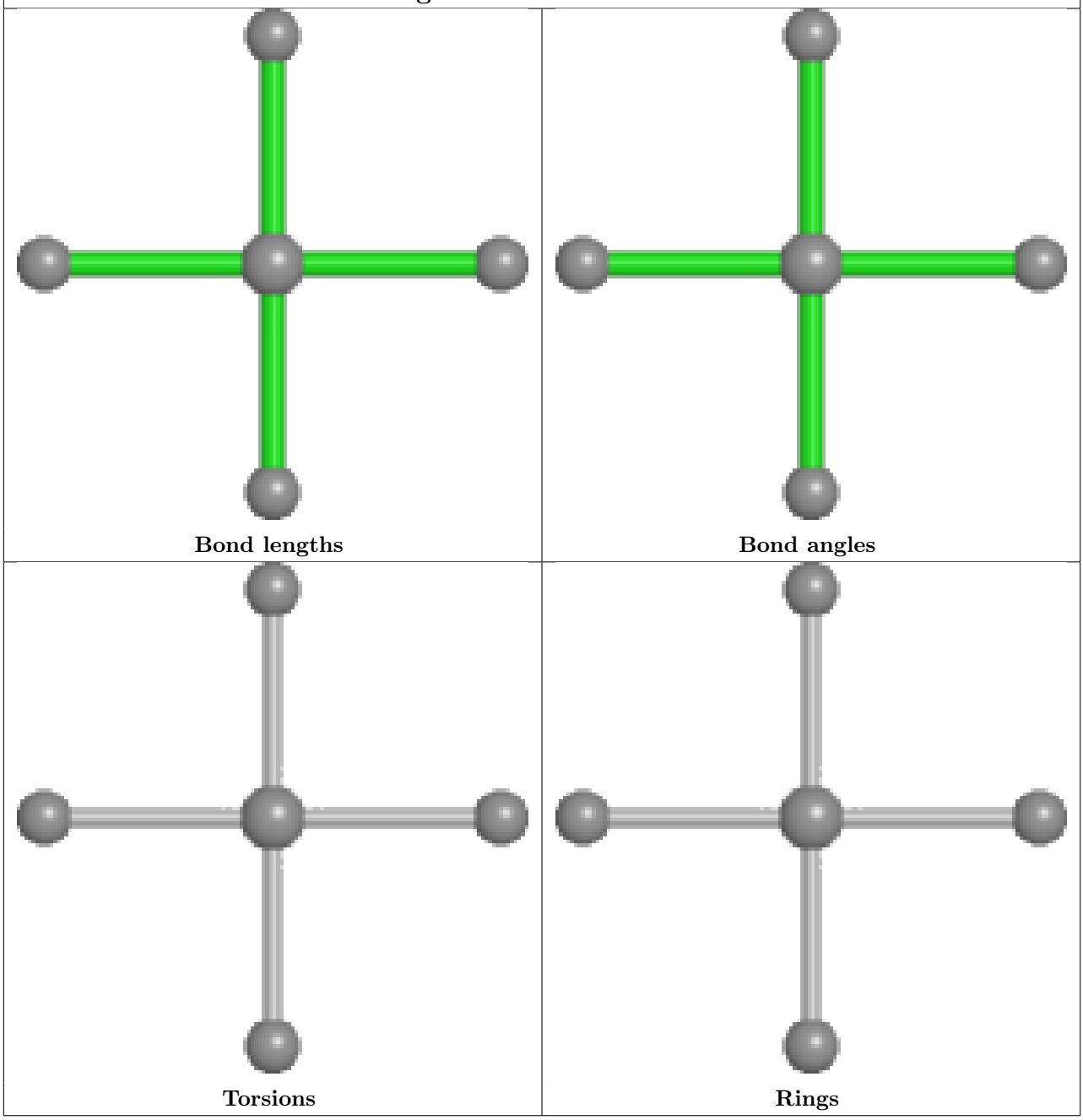


Torsions



Rings

Ligand SO4 AAA 1004



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	AAA	719/742 (96%)	0.31	45 (6%)	20	28	31, 63, 134, 267	0
1	BBB	713/742 (96%)	0.46	55 (7%)	13	20	48, 91, 148, 227	0
All	All	1432/1484 (96%)	0.39	100 (6%)	16	24	31, 78, 144, 267	0

All (100) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	BBB	347	ALA	6.9
1	BBB	351	HIS	6.4
1	BBB	348	SER	6.3
1	AAA	357	SER	5.7
1	AAA	351	HIS	5.2
1	AAA	104	LEU	4.2
1	AAA	105	ALA	4.1
1	AAA	69	PHE	4.0
1	AAA	341	PHE	3.9
1	BBB	349	ARG	3.9
1	AAA	102	LEU	3.8
1	BBB	350	ALA	3.7
1	AAA	378	VAL	3.7
1	BBB	438	VAL	3.7
1	BBB	545	PRO	3.7
1	BBB	554	ASN	3.6
1	BBB	588	ILE	3.5
1	BBB	102	LEU	3.5
1	AAA	587	ARG	3.5
1	BBB	30	ARG	3.4
1	BBB	359	LYS	3.3
1	AAA	0	HIS	3.3
1	AAA	588	ILE	3.3
1	BBB	553	GLY	3.2

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Mol	Chain	Res	Type	RSRZ
1	AAA	359	LYS	3.2
1	BBB	0	HIS	3.2
1	AAA	376	LEU	3.2
1	BBB	106	LEU	3.2
1	BBB	587	ARG	3.2
1	AAA	-2	GLY	3.1
1	AAA	101	GLY	3.1
1	BBB	173	LYS	3.1
1	AAA	352	GLN	3.1
1	BBB	189	ASP	3.0
1	AAA	386	ASN	3.0
1	AAA	683	ARG	3.0
1	BBB	358	ALA	3.0
1	AAA	416	ASP	2.9
1	AAA	106	LEU	2.9
1	BBB	714	LEU	2.9
1	BBB	541	PRO	2.9
1	AAA	241	LYS	2.8
1	AAA	330	LYS	2.8
1	BBB	130	PRO	2.8
1	BBB	134	GLY	2.8
1	AAA	430	THR	2.8
1	BBB	105	ALA	2.7
1	BBB	536	GLN	2.7
1	AAA	99	GLY	2.7
1	BBB	448	ARG	2.7
1	AAA	100	GLY	2.7
1	AAA	358	ALA	2.6
1	AAA	585	LEU	2.6
1	BBB	67	SER	2.6
1	BBB	51	CYS	2.6
1	BBB	352	GLN	2.6
1	AAA	535	GLY	2.6
1	BBB	50	ILE	2.6
1	BBB	185	GLN	2.5
1	BBB	101	GLY	2.5
1	BBB	535	GLY	2.5
1	AAA	132	ALA	2.4
1	AAA	377	VAL	2.4
1	BBB	361	LYS	2.4
1	BBB	188	ILE	2.4
1	BBB	9	HIS	2.4

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Mol	Chain	Res	Type	RSRZ
1	BBB	99	GLY	2.4
1	AAA	369	LYS	2.3
1	BBB	172	VAL	2.3
1	BBB	345	LYS	2.3
1	AAA	348	SER	2.3
1	BBB	121	LEU	2.3
1	BBB	257	TYR	2.3
1	AAA	360	PRO	2.3
1	AAA	584	PRO	2.3
1	BBB	299	VAL	2.2
1	BBB	288	TRP	2.2
1	AAA	347	ALA	2.2
1	BBB	5	LEU	2.2
1	BBB	495	LEU	2.2
1	AAA	364	PHE	2.2
1	BBB	174	SER	2.2
1	AAA	719	GLY	2.2
1	AAA	406	CYS	2.2
1	AAA	121	LEU	2.2
1	AAA	344	GLU	2.2
1	BBB	548	PRO	2.2
1	BBB	392	PHE	2.1
1	BBB	382	PHE	2.1
1	BBB	492	PHE	2.1
1	BBB	1	MET	2.1
1	AAA	108	CYS	2.1
1	AAA	572	GLN	2.1
1	AAA	164	ARG	2.1
1	AAA	627	ILE	2.1
1	BBB	48	ILE	2.1
1	BBB	491	GLY	2.0
1	AAA	350	ALA	2.0
1	BBB	449	TYR	2.0
1	BBB	425	GLN	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

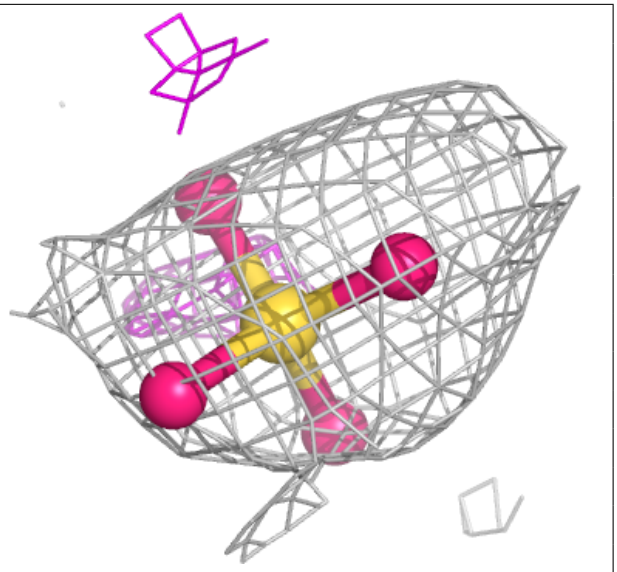
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

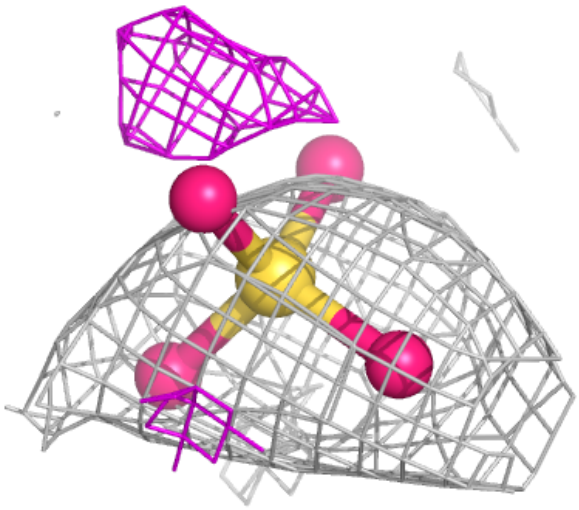
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	SO4	AAA	1005	5/5	0.60	0.31	145,150,153,154	0
2	NAD	BBB	901	44/44	0.76	0.25	150,169,184,188	0
5	SO4	BBB	903	5/5	0.78	0.20	120,131,133,137	0
5	SO4	BBB	904	5/5	0.83	0.23	150,153,156,158	0
3	ZOZ	AAA	1002	60/60	0.84	0.17	44,68,99,100	0
2	NAD	AAA	1001	44/44	0.89	0.16	89,94,106,107	0
4	GOL	AAA	1003	6/6	0.91	0.19	64,74,75,77	0
3	ZOZ	BBB	902	60/60	0.91	0.15	61,74,81,84	0
5	SO4	AAA	1004	5/5	0.95	0.16	58,67,73,78	0

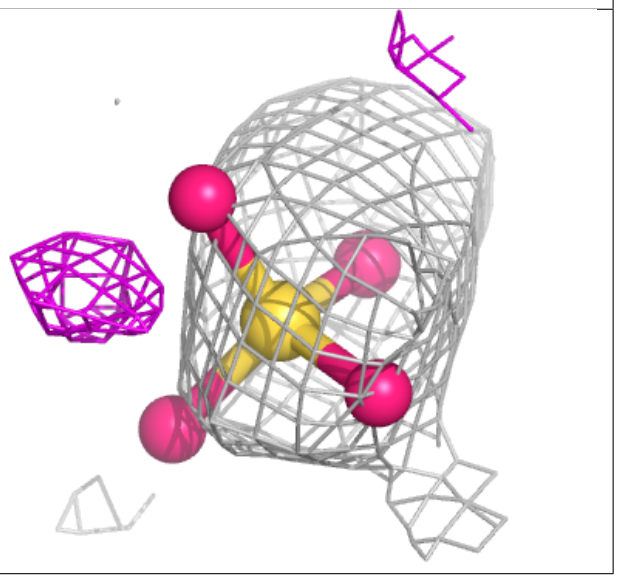
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around SO4 AAA 1005:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

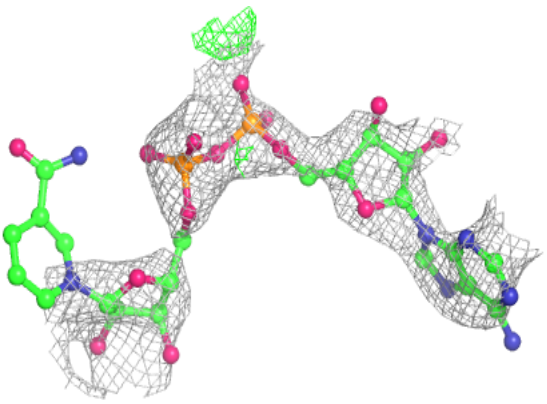


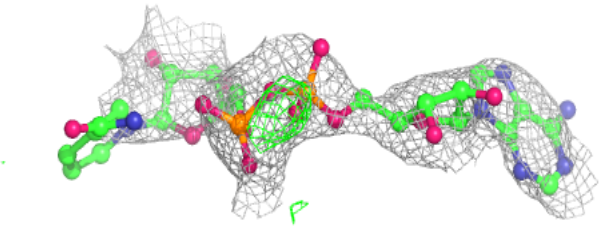


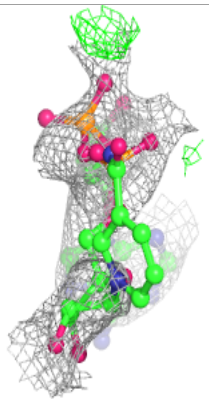


Electron density around NAD BBB 901:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

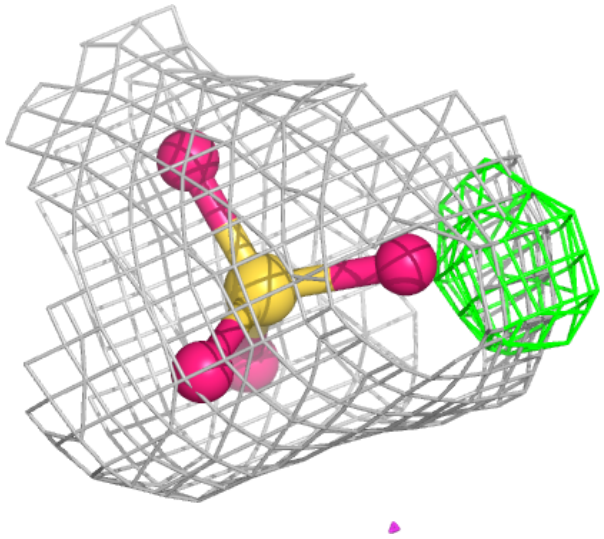


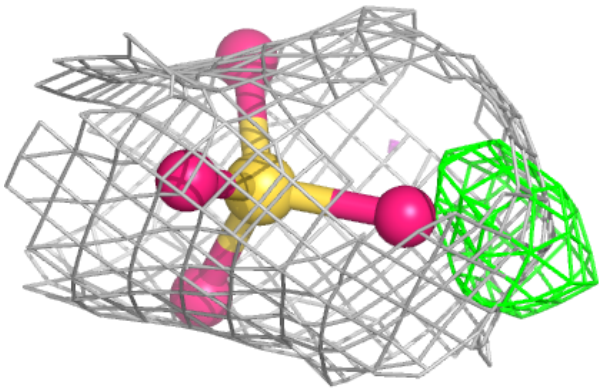


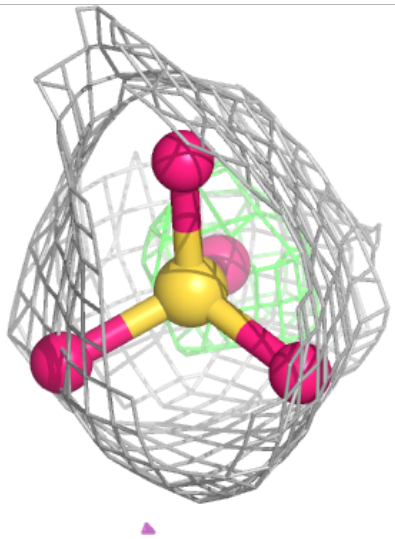


Electron density around SO4 BBB 903:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

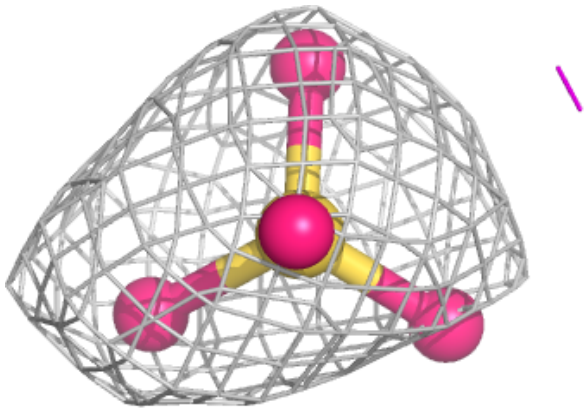


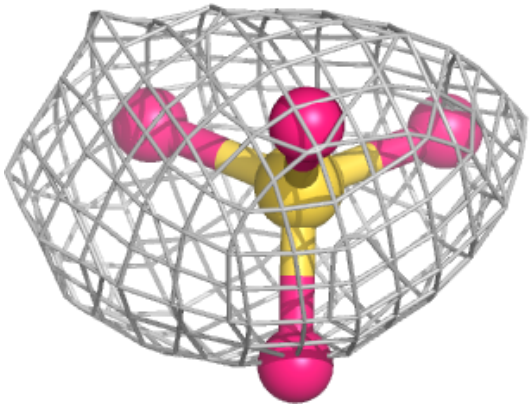


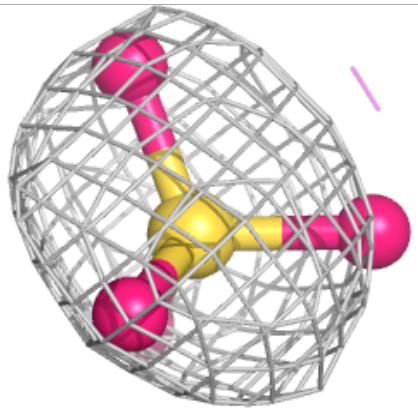


Electron density around SO4 BBB 904:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

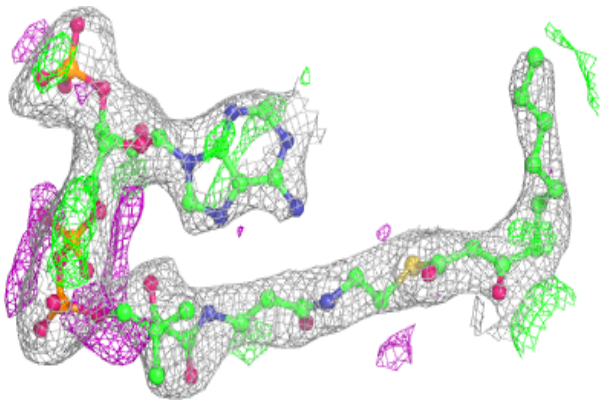


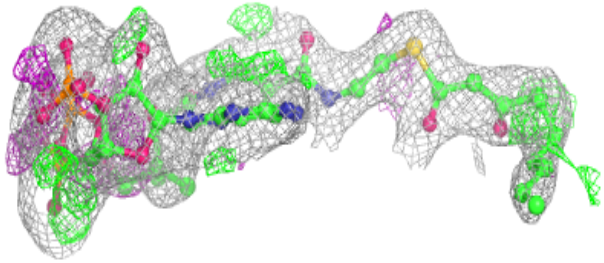


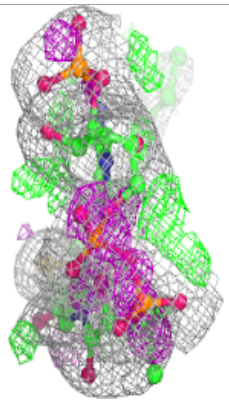


Electron density around ZOZ AAA 1002:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

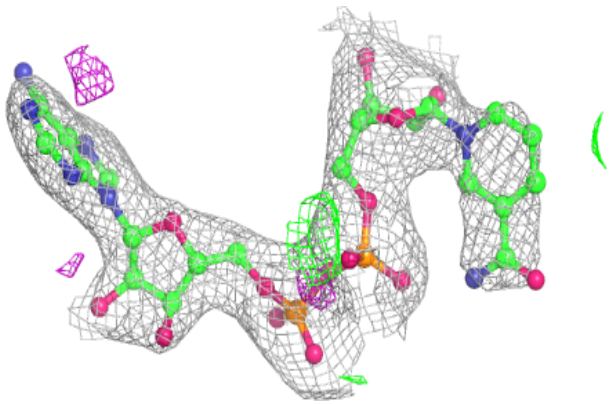


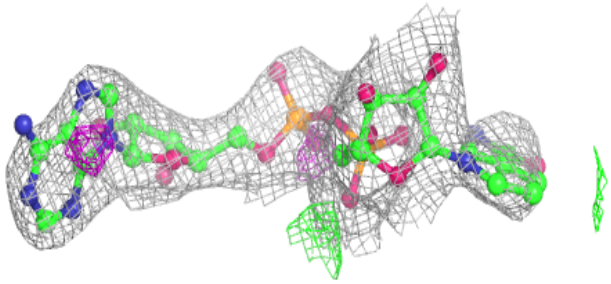


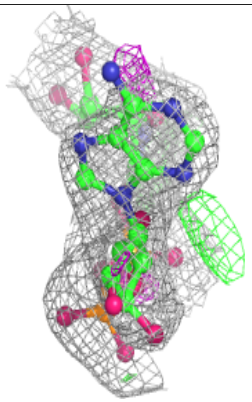


Electron density around NAD AAA 1001:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

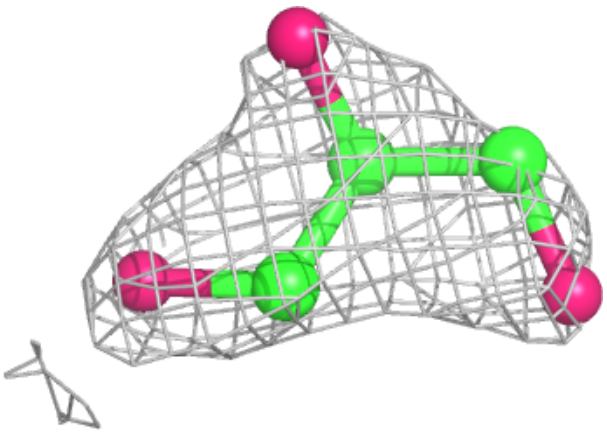


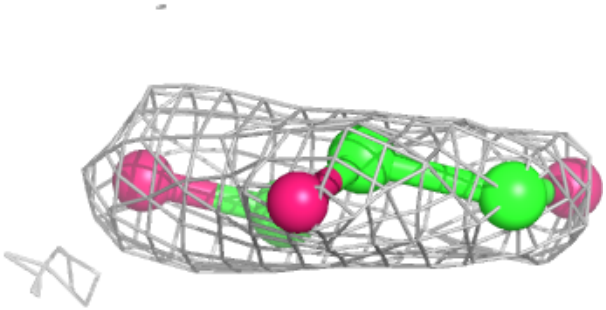


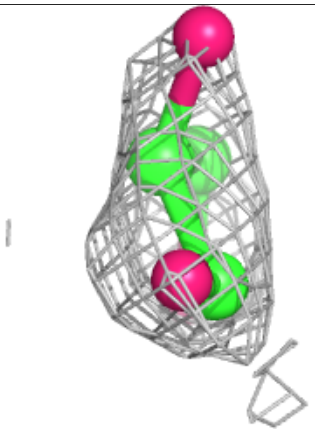


Electron density around GOL AAA 1003:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

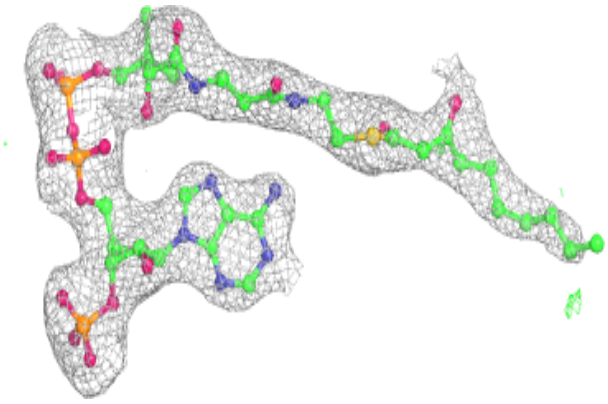


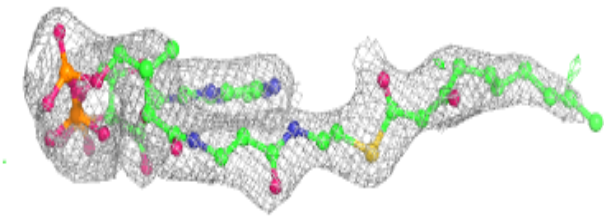




Electron density around ZOZ BBB 902:

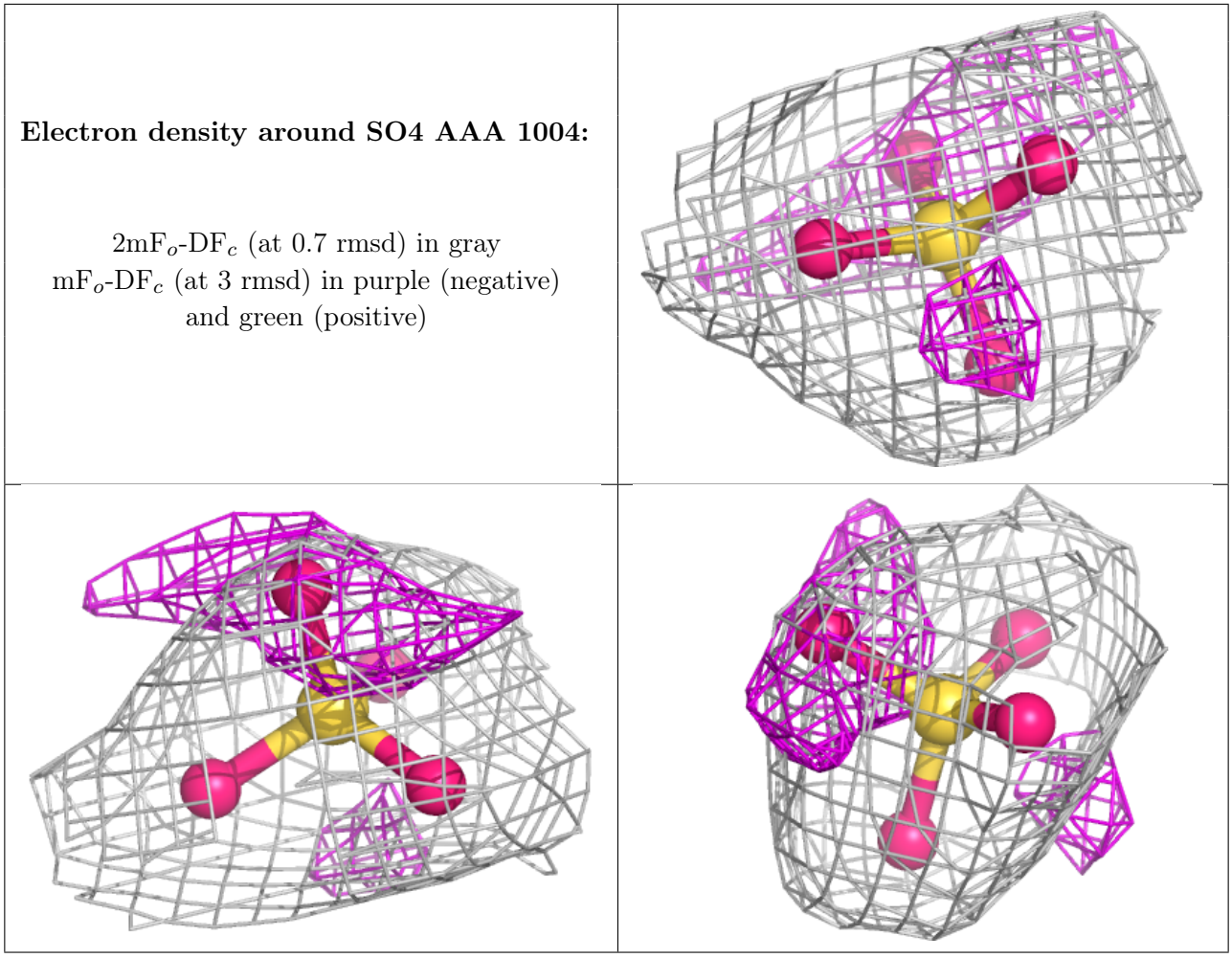
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)





Electron density around SO4 AAA 1004:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers

There are no such residues in this entry.