



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 5, 2026 – 11:59 AM EDT

PDB ID : 1H2R / pdb_00001h2r
Title : THREE-DIMENSIONAL STRUCTURE OF NI-FE HYDROGENASE FROM
DESULFIVIBRIO VULGARIS MIYAZAKI F IN THE REDUCED FORM AT
1.4 Å RESOLUTION
Authors : Higuchi, Y.; Ogata, H.
Deposited on : 1999-06-14
Resolution : 1.40 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

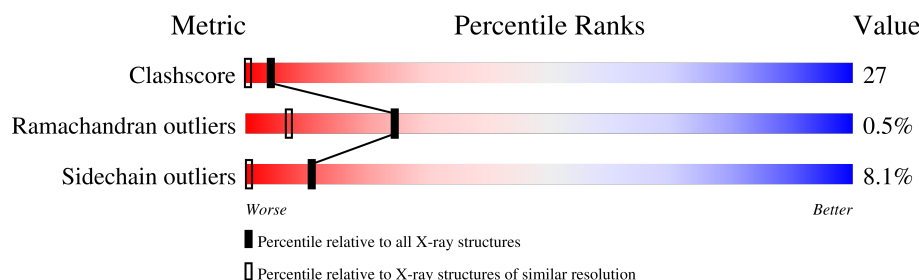
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.40 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))
Clashscore	190562	2660 (1.40-1.40)
Ramachandran outliers	187476	2611 (1.40-1.40)
Sidechain outliers	187428	2610 (1.40-1.40)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	S	267	
2	L	534	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	F3S	S	1003	-	-	X	-

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 6803 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.

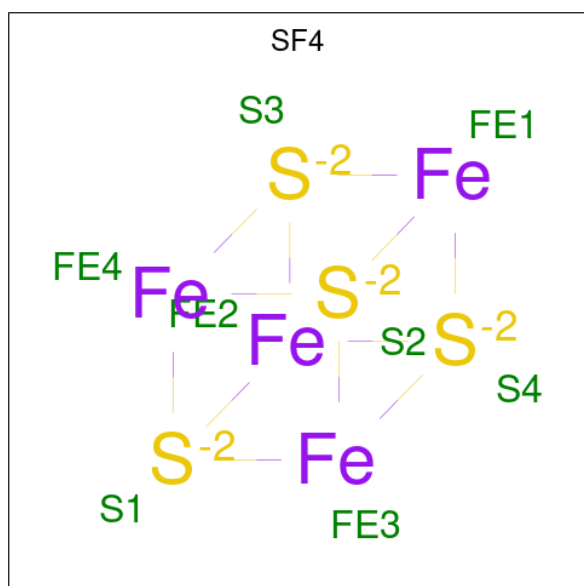
- Molecule 1 is a protein called PROTEIN (PERIPLASMIC [NIFE] HYDROGENASE SMALL SUBUNIT).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	S	267	2019	1282	342	378	17	0	0	0

- Molecule 2 is a protein called PROTEIN (PERIPLASMIC [NIFE] HYDROGENASE LARGE SUBUNIT).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	L	534	4175	2671	725	764	15	0	0	0

- Molecule 3 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe₄S₄).



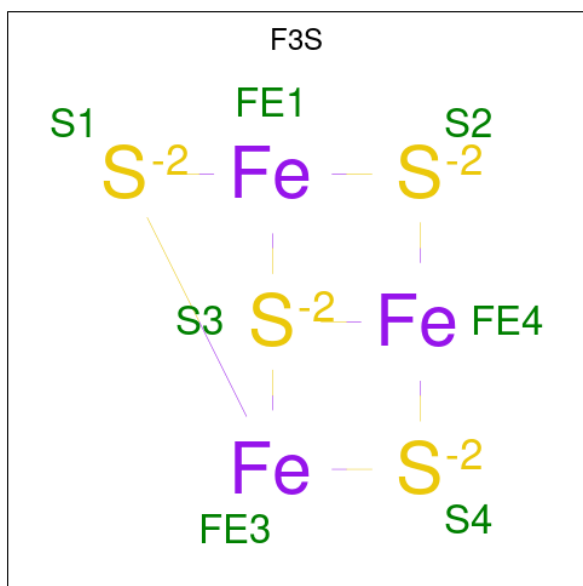
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
3	S	1	8	4	4	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	S	1	Total	Fe	S	0	0
			8	4	4		

- Molecule 4 is FE3-S4 CLUSTER (CCD ID: F3S) (formula: Fe_3S_4).

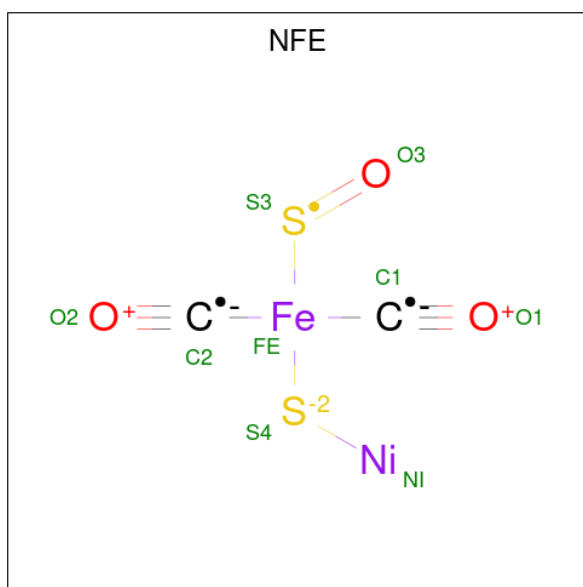


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	S	1	Total	Fe	S	0	0
			7	3	4		

- Molecule 5 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	L	1	Total	Mg	0	0
			1	1		

- Molecule 6 is NI-FE ACTIVE CENTER (CCD ID: NFE) (formula: $\text{C}_2\text{FeNiO}_3\text{S}_2$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
6	L	1	Total	C	Fe	Ni	O	S	0	0
			8	2	1	1	3	1		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	S	193	Total	O	0	0
			193	193		
7	L	384	Total	O	0	0
			384	384		

4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	100.44Å 126.86Å 66.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	6.00 – 1.40	Depositor
% Data completeness (in resolution range)	86.0 (6.00-1.40)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	0.04	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.218 , 0.254	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6803	wwPDB-VP
Average B, all atoms (Å ²)	20.0	wwPDB-VP

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: SF4, MG, NFE, F3S

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	S	0.63	0/2075	1.06	12/2830 (0.4%)
2	L	0.61	0/4286	1.03	24/5830 (0.4%)
All	All	0.62	0/6361	1.04	36/8660 (0.4%)

There are no bond length outliers.

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	L	304	LYS	N-CA-C	-9.16	102.23	113.41
2	L	56	THR	N-CA-C	9.16	123.16	112.72
1	S	252	CYS	N-CA-C	7.14	121.44	112.87
2	L	529	ASP	N-CA-C	-6.69	99.77	110.14
2	L	351	HIS	N-CA-C	-6.68	101.35	109.83
1	S	85	ILE	N-CA-C	6.61	119.31	111.05
2	L	246	CYS	N-CA-C	6.37	119.60	108.52
2	L	85	THR	N-CA-C	6.17	123.93	110.80
2	L	199	TYR	N-CA-C	6.14	121.05	113.50
2	L	30	VAL	N-CA-C	-6.01	99.04	108.23
2	L	130	HIS	N-CA-C	6.00	119.78	112.23
1	S	5	ARG	N-CA-C	5.99	123.55	110.80
1	S	262	THR	CB-CA-C	5.98	116.99	108.68
1	S	231	CYS	N-CA-C	5.95	120.98	113.25
2	L	270	ASP	N-CA-C	5.93	117.82	111.36
2	L	548	ALA	N-CA-C	-5.88	104.87	111.28
2	L	288	THR	N-CA-C	-5.85	106.10	113.18
2	L	480	GLY	N-CA-C	5.82	119.09	110.60
1	S	191	CYS	N-CA-C	5.79	117.11	109.93
2	L	294	ASP	N-CA-C	5.72	120.30	112.68
2	L	379	MET	N-CA-C	-5.62	103.56	110.65
2	L	547	ILE	N-CA-C	5.61	118.10	111.09

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	L	80	THR	N-CA-C	-5.58	105.20	111.28
1	S	43	ASP	N-CA-C	5.58	120.08	113.28
2	L	503	THR	N-CA-C	-5.55	105.23	111.28
2	L	200	LEU	N-CA-C	5.50	118.21	110.23
2	L	550	GLY	N-CA-C	5.48	119.31	112.73
2	L	230	GLY	N-CA-C	5.43	124.40	115.34
1	S	39	THR	N-CA-C	5.37	116.94	111.14
1	S	145	ILE	N-CA-C	-5.29	101.91	108.89
2	L	374	LYS	N-CA-C	-5.20	103.82	110.53
1	S	133	VAL	N-CA-C	5.16	115.78	110.36
1	S	239	THR	N-CA-C	5.09	121.64	110.80
1	S	257	PHE	N-CA-C	5.08	118.26	111.75
2	L	351	HIS	CA-C-N	5.07	125.35	119.47
2	L	351	HIS	C-N-CA	5.07	125.35	119.47

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	S	2019	0	1949	132	3
2	L	4175	0	4120	218	1
3	S	16	0	0	1	0
4	S	7	0	0	2	0
5	L	1	0	0	0	0
6	L	8	0	0	1	0
7	L	384	0	0	145	3
7	S	193	0	0	67	1
All	All	6803	0	6069	337	4

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 27.

All (337) 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:S:241:TRP:CD1	1:S:242:PRO:HD2	2.04	0.93
2:L:541:HIS:HB2	7:L:3408:HOH:O	1.68	0.93
1:S:116:THR:HB	7:S:3039:HOH:O	1.68	0.91
3:S:1001:SF4:S4	2:L:79:ARG:HG3	2.11	0.90
2:L:102:VAL:HG11	2:L:463:TRP:HB3	1.52	0.90
1:S:26:ARG:HH21	2:L:233:ASN:HD21	1.22	0.88
1:S:152:PRO:HG2	7:S:3019:HOH:O	1.72	0.87
1:S:134:ASN:HD21	1:S:144:ALA:H	1.20	0.85
1:S:228:MET:SD	7:S:3518:HOH:O	2.33	0.85
1:S:238:GLN:HE21	2:L:224:ARG:HH21	1.24	0.84
2:L:515:VAL:HG11	7:L:3386:HOH:O	1.78	0.82
2:L:227:ALA:HB3	7:L:3102:HOH:O	1.81	0.81
2:L:205:ASN:HB3	7:L:3410:HOH:O	1.81	0.80
1:S:126:ASN:HD21	1:S:130:ALA:H	1.30	0.80
1:S:114:CYS:SG	7:S:3034:HOH:O	2.40	0.80
1:S:145:ILE:HG23	7:S:3133:HOH:O	1.82	0.79
2:L:244:VAL:HG11	7:L:3235:HOH:O	1.83	0.79
2:L:53:SER:HA	7:L:3564:HOH:O	1.83	0.79
2:L:236:THR:HB	7:L:3023:HOH:O	1.81	0.78
1:S:144:ALA:HB2	7:S:3391:HOH:O	1.82	0.78
2:L:551:VAL:HG23	7:L:3153:HOH:O	1.82	0.78
2:L:236:THR:HA	7:L:3300:HOH:O	1.85	0.77
1:S:241:TRP:HB3	7:S:3011:HOH:O	1.85	0.77
1:S:2:MET:HA	7:S:3186:HOH:O	1.84	0.76
1:S:187:VAL:HA	7:S:3211:HOH:O	1.85	0.76
2:L:108:ALA:HB1	7:L:3274:HOH:O	1.86	0.76
2:L:402:VAL:O	2:L:406:THR:HG23	1.85	0.75
2:L:336:GLU:HB3	7:L:3540:HOH:O	1.85	0.75
1:S:203:ALA:HB1	7:S:3374:HOH:O	1.85	0.74
2:L:389:ALA:HB3	7:L:3163:HOH:O	1.85	0.74
1:S:127:PRO:HB2	7:L:3494:HOH:O	1.87	0.74
2:L:349:ALA:HB1	7:L:3540:HOH:O	1.88	0.74
2:L:71:ARG:HG2	7:L:3086:HOH:O	1.87	0.74
1:S:93:THR:HG22	7:S:3482:HOH:O	1.85	0.74
7:S:3457:HOH:O	2:L:231:ALA:HA	1.87	0.73
2:L:226:MET:SD	7:L:3328:HOH:O	2.45	0.73
2:L:36:HIS:HB2	7:L:3058:HOH:O	1.87	0.73
2:L:504:TRP:HE3	7:L:3360:HOH:O	1.70	0.73
2:L:527:VAL:HG22	2:L:529:ASP:O	1.87	0.73
2:L:56:THR:HA	7:L:3295:HOH:O	1.86	0.73
2:L:33:ILE:HG21	7:L:3084:HOH:O	1.87	0.73
2:L:376:PRO:HD2	7:L:3141:HOH:O	1.89	0.73

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:S:245:ALA:HB2	7:S:3457:HOH:O	1.88	0.72
2:L:244:VAL:HB	7:L:3485:HOH:O	1.87	0.72
1:S:132:GLY:HA2	7:S:3294:HOH:O	1.89	0.71
2:L:86:TYR:N	7:L:3088:HOH:O	2.23	0.71
1:S:120:VAL:HG12	7:S:3034:HOH:O	1.89	0.71
1:S:2:MET:SD	1:S:3:GLY:N	2.64	0.71
1:S:111:TYR:CD1	7:S:3019:HOH:O	2.43	0.71
1:S:74:VAL:HG23	7:S:3320:HOH:O	1.91	0.71
1:S:242:PRO:HG3	2:L:232:LYS:HE2	1.72	0.70
1:S:191:CYS:HB2	7:S:3338:HOH:O	1.89	0.70
1:S:147:ILE:HG13	7:S:3174:HOH:O	1.91	0.70
2:L:343:TRP:HD1	7:L:3173:HOH:O	1.74	0.70
2:L:500:VAL:HG21	2:L:549:CYS:HB3	1.73	0.69
1:S:44:TYR:HB2	7:S:3233:HOH:O	1.93	0.69
2:L:299:PHE:H	2:L:476:ASN:ND2	1.90	0.69
1:S:2:MET:SD	1:S:3:GLY:O	2.51	0.69
2:L:430:ARG:HA	7:L:3103:HOH:O	1.92	0.69
2:L:488:ILE:HD11	7:L:3382:HOH:O	1.93	0.69
1:S:1:LEU:HB3	2:L:187:THR:OG1	1.93	0.69
1:S:187:VAL:HG13	1:S:224:GLY:HA2	1.75	0.69
2:L:506:LEU:HD13	2:L:518:VAL:HG21	1.74	0.69
2:L:100:VAL:HG23	7:L:3316:HOH:O	1.93	0.68
2:L:538:ARG:HA	7:L:3408:HOH:O	1.92	0.68
2:L:30:VAL:HG23	7:L:3215:HOH:O	1.91	0.68
1:S:13:HIS:HD2	7:S:3065:HOH:O	1.75	0.68
2:L:241:VAL:HG22	7:L:3557:HOH:O	1.92	0.68
2:L:244:VAL:HG13	7:L:3274:HOH:O	1.93	0.68
2:L:505:THR:O	2:L:518:VAL:HG23	1.94	0.68
1:S:113:THR:HA	1:S:116:THR:HG22	1.76	0.67
2:L:102:VAL:CG1	2:L:463:TRP:HB3	2.22	0.67
1:S:241:TRP:HE3	7:S:3011:HOH:O	1.77	0.67
2:L:236:THR:HG22	2:L:238:PHE:HD2	1.60	0.67
2:L:246:CYS:SG	7:L:3485:HOH:O	2.52	0.67
2:L:132:HIS:HA	7:L:3373:HOH:O	1.94	0.67
4:S:1003:F3S:S3	7:S:3184:HOH:O	2.51	0.67
2:L:90:LEU:HA	7:L:3169:HOH:O	1.95	0.67
2:L:335:ILE:HD11	2:L:499:VAL:HG11	1.75	0.67
2:L:373:MET:HE2	7:L:3153:HOH:O	1.94	0.67
2:L:235:HIS:HB3	7:L:3117:HOH:O	1.96	0.66
1:S:18:THR:HA	7:S:3051:HOH:O	1.95	0.66
1:S:151:PRO:HB2	7:S:3566:HOH:O	1.95	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:S:1:LEU:HD21	1:S:59:ALA:O	1.95	0.66
1:S:252:CYS:SG	7:S:3237:HOH:O	2.54	0.66
1:S:242:PRO:HD3	2:L:232:LYS:HD2	1.77	0.66
2:L:350:ARG:N	7:L:3540:HOH:O	2.29	0.66
2:L:230:GLY:O	2:L:236:THR:HG23	1.94	0.65
1:S:41:SER:HB3	7:S:3422:HOH:O	1.95	0.65
2:L:27:VAL:HG13	2:L:39:ILE:HB	1.78	0.65
2:L:537:LEU:HG	7:L:3181:HOH:O	1.96	0.65
2:L:459:ILE:HD13	7:L:3414:HOH:O	1.95	0.65
2:L:76:PHE:HB3	7:L:3132:HOH:O	1.98	0.64
1:S:21:SER:O	1:S:24:VAL:HG22	1.96	0.64
2:L:518:VAL:O	2:L:522:LEU:HD23	1.97	0.64
2:L:529:ASP:C	7:L:3426:HOH:O	2.41	0.64
1:S:77:GLY:HA3	7:S:3027:HOH:O	1.99	0.62
1:S:230:ASN:HD22	1:S:230:ASN:H	1.46	0.62
1:S:253:SER:HB2	7:S:3029:HOH:O	1.99	0.62
1:S:187:VAL:CG1	1:S:224:GLY:HA2	2.30	0.62
1:S:78:ILE:HD12	7:S:3466:HOH:O	1.99	0.61
1:S:241:TRP:CZ3	1:S:243:VAL:HG22	2.35	0.61
2:L:39:ILE:HD13	7:L:3564:HOH:O	1.99	0.61
2:L:53:SER:HB2	7:L:3055:HOH:O	2.01	0.61
1:S:236:PHE:HB3	7:L:3158:HOH:O	2.00	0.60
2:L:29:PRO:HG2	7:L:3242:HOH:O	2.00	0.60
1:S:150:CYS:SG	2:L:79:ARG:HD2	2.41	0.60
1:S:241:TRP:HD1	1:S:242:PRO:HD2	1.58	0.60
1:S:241:TRP:NE1	4:S:1003:F3S:S1	2.71	0.59
2:L:238:PHE:HB2	7:L:3485:HOH:O	2.02	0.59
2:L:504:TRP:HA	7:L:3141:HOH:O	2.01	0.59
1:S:28:PHE:CE2	1:S:29:GLU:HG3	2.36	0.59
1:S:171:PRO:O	1:S:173:LEU:HD13	2.01	0.59
1:S:187:VAL:HG22	7:S:3338:HOH:O	2.02	0.59
2:L:167:LEU:HD13	7:L:3434:HOH:O	2.02	0.59
1:S:237:ASN:HD21	2:L:233:ASN:H	1.50	0.59
1:S:113:THR:HA	1:S:116:THR:CG2	2.33	0.59
2:L:233:ASN:HB2	7:L:3323:HOH:O	2.02	0.59
2:L:299:PHE:H	2:L:476:ASN:HD22	1.50	0.59
1:S:10:VAL:HG22	7:S:3556:HOH:O	2.03	0.59
1:S:152:PRO:HD2	7:S:3566:HOH:O	2.01	0.58
1:S:236:PHE:HE1	7:S:3026:HOH:O	1.85	0.58
2:L:79:ARG:HD3	2:L:235:HIS:CE1	2.37	0.58
2:L:30:VAL:N	7:L:3215:HOH:O	2.36	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:L:236:THR:CG2	2:L:238:PHE:CD2	2.86	0.58
1:S:93:THR:O	1:S:97:ILE:HG22	2.03	0.58
2:L:497:GLN:HB3	7:L:3066:HOH:O	2.03	0.58
1:S:147:ILE:O	7:S:3019:HOH:O	2.16	0.58
1:S:231:CYS:HB3	1:S:241:TRP:CD1	2.38	0.58
1:S:187:VAL:HB	7:S:3067:HOH:O	2.03	0.58
1:S:1:LEU:HG	1:S:62:GLN:OE1	2.02	0.58
2:L:334:GLN:O	2:L:378:TYR:O	2.22	0.58
2:L:55:SER:HB3	7:L:3444:HOH:O	2.03	0.58
2:L:406:THR:HG22	2:L:432:ILE:HG21	1.84	0.58
2:L:96:VAL:HB	7:L:3557:HOH:O	2.03	0.58
2:L:406:THR:HG22	2:L:432:ILE:HD13	1.86	0.58
1:S:11:TYR:HD1	7:S:3064:HOH:O	1.87	0.57
2:L:445:LEU:HD21	7:L:3271:HOH:O	2.04	0.57
1:S:238:GLN:NE2	2:L:224:ARG:HH21	1.98	0.57
2:L:236:THR:HG21	2:L:238:PHE:CE2	2.38	0.57
1:S:128:THR:HG23	7:L:3494:HOH:O	2.03	0.57
1:S:204:PRO:HD2	1:S:210:GLU:CG	2.34	0.57
2:L:142:ALA:N	7:L:3410:HOH:O	2.36	0.57
2:L:224:ARG:HG3	7:L:3102:HOH:O	2.05	0.57
2:L:337:GLU:N	7:L:3540:HOH:O	2.36	0.57
1:S:108:VAL:HG23	7:S:3320:HOH:O	2.04	0.57
1:S:226:VAL:HG12	1:S:226:VAL:O	2.03	0.56
2:L:132:HIS:CE1	7:L:3408:HOH:O	2.57	0.56
2:L:233:ASN:HA	7:L:3353:HOH:O	2.05	0.56
2:L:236:THR:CG2	2:L:238:PHE:HD2	2.17	0.56
2:L:499:VAL:HG23	7:L:3104:HOH:O	2.05	0.56
1:S:85:ILE:HA	7:S:3482:HOH:O	2.04	0.56
2:L:133:ALA:HA	7:L:3543:HOH:O	2.05	0.56
1:S:134:ASN:ND2	1:S:144:ALA:H	1.99	0.56
2:L:83:VAL:HG11	7:L:3380:HOH:O	2.05	0.56
2:L:504:TRP:HB3	7:L:3360:HOH:O	2.05	0.56
2:L:239:THR:HG21	7:L:3169:HOH:O	2.06	0.55
1:S:5:ARG:NH1	1:S:5:ARG:HB3	2.21	0.55
2:L:219:GLN:HB3	7:L:3416:HOH:O	2.05	0.55
2:L:401:LYS:HD3	7:L:3082:HOH:O	2.06	0.55
1:S:117:PHE:N	7:S:3294:HOH:O	2.40	0.55
2:L:343:TRP:HZ3	7:L:3295:HOH:O	1.88	0.55
2:L:541:HIS:HB3	7:L:3052:HOH:O	2.06	0.55
2:L:55:SER:HA	7:L:3062:HOH:O	2.07	0.55
2:L:232:LYS:HG3	7:L:3232:HOH:O	2.06	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:L:142:ALA:HB2	7:L:3410:HOH:O	2.06	0.55
1:S:237:ASN:HB2	7:L:3102:HOH:O	2.07	0.54
1:S:204:PRO:HD2	1:S:210:GLU:HG3	1.88	0.54
2:L:125:ILE:HG12	7:L:3510:HOH:O	2.06	0.54
1:S:204:PRO:CD	1:S:210:GLU:HG3	2.37	0.54
2:L:66:LYS:HD3	7:L:3464:HOH:O	2.08	0.54
2:L:269:VAL:HG13	7:L:3219:HOH:O	2.06	0.54
2:L:327:ILE:HD11	2:L:396:SER:HB2	1.90	0.54
2:L:385:THR:HA	7:L:3163:HOH:O	2.07	0.54
2:L:230:GLY:O	2:L:231:ALA:HB3	2.08	0.54
1:S:229:ASN:N	7:S:3040:HOH:O	2.40	0.54
1:S:250:ILE:HD11	7:L:3240:HOH:O	2.08	0.53
1:S:121:GLN:NE2	7:S:3034:HOH:O	2.40	0.53
1:S:229:ASN:HD22	1:S:230:ASN:H	1.57	0.53
1:S:120:VAL:N	7:S:3034:HOH:O	2.41	0.53
2:L:274:ILE:HD11	7:L:3219:HOH:O	2.09	0.53
2:L:352:PRO:HB3	7:L:3104:HOH:O	2.09	0.53
2:L:31:THR:HG23	7:L:3242:HOH:O	2.08	0.53
2:L:143:LEU:HD13	2:L:174:LEU:HD13	1.91	0.53
2:L:114:LEU:HG	7:L:3385:HOH:O	2.08	0.53
7:S:3252:HOH:O	2:L:184:GLY:HA3	2.09	0.52
2:L:37:LEU:HD12	7:L:3084:HOH:O	2.09	0.52
2:L:401:LYS:O	2:L:405:VAL:HG12	2.08	0.52
2:L:551:VAL:HG21	7:L:3444:HOH:O	2.09	0.52
1:S:117:PHE:CD2	1:S:255:PRO:HA	2.45	0.52
2:L:77:THR:HG22	7:L:3569:HOH:O	2.08	0.52
2:L:481:GLY:HA3	7:L:3164:HOH:O	2.09	0.52
2:L:288:THR:HG23	2:L:419:ALA:HA	1.92	0.52
2:L:459:ILE:HG21	7:L:3414:HOH:O	2.09	0.51
2:L:304:LYS:HD2	7:L:3496:HOH:O	2.10	0.51
2:L:457:ASN:HA	7:L:3468:HOH:O	2.10	0.51
2:L:70:PRO:HB2	2:L:465:MET:HE1	1.92	0.51
1:S:26:ARG:HE	2:L:233:ASN:ND2	2.08	0.51
2:L:28:ASP:HA	7:L:3215:HOH:O	2.09	0.51
2:L:504:TRP:CE3	7:L:3360:HOH:O	2.55	0.51
1:S:133:VAL:HG11	7:S:3310:HOH:O	2.10	0.51
2:L:39:ILE:HD12	7:L:3324:HOH:O	2.10	0.51
1:S:187:VAL:HG13	1:S:224:GLY:CA	2.40	0.50
2:L:139:VAL:HA	7:L:3341:HOH:O	2.10	0.50
2:L:332:LYS:O	2:L:335:ILE:HG22	2.12	0.50
2:L:227:ALA:HB2	7:L:3208:HOH:O	2.12	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:L:405:VAL:HG11	2:L:436:VAL:CG1	2.41	0.50
2:L:56:THR:HG22	7:L:3165:HOH:O	2.11	0.50
2:L:212:TYR:HB2	7:L:3136:HOH:O	2.11	0.50
2:L:451:ASN:HB3	7:L:3377:HOH:O	2.11	0.49
2:L:297:ILE:HG23	2:L:383:MET:CE	2.42	0.49
2:L:395:TYR:CE1	2:L:406:THR:OG1	2.66	0.49
2:L:410:LEU:HG	7:L:3180:HOH:O	2.12	0.49
2:L:96:VAL:HG11	7:L:3336:HOH:O	2.12	0.48
1:S:2:MET:HE2	7:S:3422:HOH:O	2.13	0.48
1:S:118:GLY:N	7:S:3294:HOH:O	2.41	0.48
2:L:27:VAL:CG1	2:L:39:ILE:HB	2.43	0.48
2:L:238:PHE:HE1	7:L:3235:HOH:O	1.96	0.48
2:L:233:ASN:C	2:L:233:ASN:HD22	2.21	0.48
7:S:3253:HOH:O	2:L:372:TRP:NE1	2.47	0.47
1:S:18:THR:HG23	7:S:3051:HOH:O	2.15	0.47
1:S:247:HIS:HB2	7:L:3499:HOH:O	2.13	0.47
2:L:100:VAL:HG12	2:L:102:VAL:HG22	1.96	0.47
1:S:85:ILE:HG13	2:L:361:TYR:CE2	2.50	0.47
2:L:79:ARG:NH2	7:L:3117:HOH:O	2.46	0.47
2:L:85:THR:HG21	7:L:3190:HOH:O	2.14	0.47
2:L:20:SER:HB3	2:L:45:ASN:C	2.40	0.47
2:L:112:ARG:N	7:L:3235:HOH:O	2.47	0.47
2:L:231:ALA:HB3	7:L:3300:HOH:O	2.14	0.47
2:L:448:TYR:HD2	7:L:3377:HOH:O	1.97	0.47
1:S:42:LEU:N	7:S:3252:HOH:O	2.48	0.47
2:L:232:LYS:HD3	7:L:3300:HOH:O	2.15	0.47
1:S:111:TYR:HA	7:S:3019:HOH:O	2.13	0.47
2:L:223:ALA:HA	2:L:226:MET:HE3	1.95	0.47
2:L:236:THR:HG21	2:L:238:PHE:CD2	2.50	0.47
2:L:406:THR:O	2:L:410:LEU:HD13	2.15	0.47
1:S:6:ARG:NH2	7:S:3303:HOH:O	2.48	0.47
1:S:36:ILE:HG21	7:L:3342:HOH:O	2.15	0.46
2:L:433:GLU:HB3	7:L:3103:HOH:O	2.15	0.46
2:L:78:GLN:HB2	7:L:3214:HOH:O	2.15	0.46
7:S:3252:HOH:O	2:L:184:GLY:CA	2.62	0.46
2:L:297:ILE:HG21	7:L:3047:HOH:O	2.14	0.46
2:L:527:VAL:O	2:L:527:VAL:HG13	2.16	0.46
2:L:529:ASP:OD1	2:L:532:ARG:HD3	2.16	0.46
1:S:241:TRP:CD1	1:S:242:PRO:CD	2.90	0.46
1:S:241:TRP:CE3	7:S:3011:HOH:O	2.56	0.46
7:S:3096:HOH:O	2:L:227:ALA:HB1	2.16	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:S:97:ILE:HD13	1:S:98:CYS:N	2.31	0.45
2:L:403:LYS:HE3	2:L:403:LYS:HB2	1.79	0.45
7:S:3311:HOH:O	2:L:31:THR:HB	2.15	0.45
2:L:74:GLN:NE2	7:L:3568:HOH:O	2.48	0.45
1:S:187:VAL:HB	7:S:3040:HOH:O	2.15	0.45
2:L:434:THR:HA	7:L:3166:HOH:O	2.16	0.45
2:L:93:THR:HA	7:L:3557:HOH:O	2.17	0.45
2:L:515:VAL:HG23	2:L:520:ALA:HB2	1.99	0.45
1:S:118:GLY:HA2	7:S:3027:HOH:O	2.16	0.45
2:L:364:LEU:HD11	7:L:3165:HOH:O	2.16	0.45
1:S:1:LEU:HD12	1:S:2:MET:N	2.31	0.45
1:S:138:LYS:HG3	1:S:139:HIS:N	2.32	0.45
2:L:115:VAL:HG21	7:L:3123:HOH:O	2.17	0.45
2:L:399:HIS:HD2	2:L:402:VAL:H	1.64	0.45
1:S:132:GLY:CA	7:S:3294:HOH:O	2.55	0.44
1:S:112:GLY:N	7:S:3019:HOH:O	2.50	0.44
2:L:441:VAL:HG23	7:L:3207:HOH:O	2.16	0.44
2:L:459:ILE:HG23	7:L:3512:HOH:O	2.18	0.44
2:L:232:LYS:N	7:L:3300:HOH:O	2.51	0.44
1:S:1:LEU:HD22	1:S:43:ASP:HB3	1.99	0.44
1:S:242:PRO:HG3	2:L:232:LYS:CE	2.43	0.44
2:L:388:LEU:HD22	2:L:392:LEU:HG	1.99	0.44
2:L:386:GLY:HA2	7:L:3536:HOH:O	2.17	0.44
1:S:133:VAL:HG11	7:S:3391:HOH:O	2.17	0.44
7:S:3253:HOH:O	2:L:372:TRP:CD1	2.70	0.44
2:L:96:VAL:O	2:L:100:VAL:HB	2.18	0.44
2:L:297:ILE:O	2:L:297:ILE:HG13	2.17	0.44
1:S:156:ASN:HD21	1:S:230:ASN:HD21	1.65	0.44
2:L:78:GLN:HG3	2:L:85:THR:O	2.17	0.44
1:S:240:ASN:CG	7:S:3457:HOH:O	2.60	0.43
2:L:128:PHE:HB2	7:L:3277:HOH:O	2.18	0.43
1:S:26:ARG:NH2	2:L:233:ASN:HD21	2.02	0.43
1:S:94:MET:HE1	2:L:57:LEU:HG	2.00	0.43
2:L:112:ARG:NE	7:L:3274:HOH:O	2.51	0.43
1:S:210:GLU:HB2	1:S:215:TRP:CG	2.54	0.43
1:S:111:TYR:CE1	1:S:157:LEU:HB2	2.54	0.43
1:S:157:LEU:HA	7:S:3174:HOH:O	2.18	0.43
1:S:196:HIS:HD2	1:S:201:GLU:OE1	2.02	0.43
1:S:232:PRO:HG3	1:S:241:TRP:CZ2	2.54	0.43
2:L:23:GLY:O	2:L:43:VAL:HG13	2.19	0.43
2:L:395:TYR:HE1	2:L:406:THR:OG1	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:S:52:ALA:HA	7:L:3242:HOH:O	2.19	0.43
2:L:274:ILE:HD12	7:L:3321:HOH:O	2.17	0.43
2:L:387:PRO:HA	7:L:3098:HOH:O	2.18	0.43
2:L:27:VAL:O	7:L:3215:HOH:O	2.21	0.42
1:S:13:HIS:CE1	7:S:3051:HOH:O	2.72	0.42
1:S:13:HIS:HE1	1:S:21:SER:OG	2.02	0.42
2:L:137:VAL:HG13	2:L:205:ASN:HD22	1.84	0.42
2:L:37:LEU:HA	7:L:3062:HOH:O	2.19	0.42
2:L:132:HIS:HD2	7:L:3551:HOH:O	2.02	0.42
1:S:94:MET:HA	1:S:97:ILE:HG23	2.00	0.42
1:S:116:THR:HG23	1:S:117:PHE:CD2	2.54	0.42
2:L:233:ASN:HB3	7:L:3208:HOH:O	2.19	0.42
2:L:320:PHE:HE2	2:L:328:LYS:HD3	1.84	0.42
1:S:19:GLY:HA3	7:L:3264:HOH:O	2.18	0.42
2:L:502:SER:OG	6:L:1004:NFE:O3	2.34	0.42
1:S:73:VAL:HG12	7:S:3007:HOH:O	2.20	0.42
1:S:2:MET:HE3	7:S:3196:HOH:O	2.19	0.42
2:L:448:TYR:HA	7:L:3377:HOH:O	2.19	0.42
2:L:161:LYS:HE3	2:L:161:LYS:HB2	1.86	0.41
2:L:234:PRO:HB2	7:L:3264:HOH:O	2.20	0.41
1:S:91:ASN:HD22	1:S:91:ASN:HA	1.74	0.41
2:L:113:ASN:HD21	2:L:303:PRO:HD2	1.85	0.41
2:L:320:PHE:CE2	2:L:328:LYS:HD3	2.55	0.41
2:L:485:TRP:CD1	7:L:3104:HOH:O	2.74	0.41
2:L:170:VAL:HB	7:L:3140:HOH:O	2.20	0.41
2:L:236:THR:HG22	2:L:238:PHE:CD2	2.45	0.41
2:L:288:THR:CG2	2:L:419:ALA:HA	2.50	0.41
2:L:392:LEU:HB2	7:L:3146:HOH:O	2.19	0.41
1:S:6:ARG:HA	1:S:7:PRO:HD3	1.83	0.41
1:S:85:ILE:HA	1:S:85:ILE:HD12	1.88	0.41
1:S:226:VAL:O	1:S:226:VAL:CG1	2.69	0.41
1:S:230:ASN:HD22	1:S:230:ASN:N	2.11	0.41
1:S:239:THR:HG22	7:L:3102:HOH:O	2.21	0.41
2:L:125:ILE:HA	7:L:3521:HOH:O	2.21	0.41
2:L:233:ASN:ND2	2:L:233:ASN:C	2.79	0.41
2:L:247:TYR:HA	7:L:3414:HOH:O	2.20	0.41
2:L:545:PRO:HG2	7:L:3084:HOH:O	2.19	0.41
2:L:37:LEU:CD2	7:L:3564:HOH:O	2.69	0.41
2:L:184:GLY:HA3	2:L:185:PRO:HD3	1.97	0.41
2:L:335:ILE:HB	7:L:3037:HOH:O	2.20	0.41
1:S:222:CYS:HA	1:S:248:PRO:HB2	2.02	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:L:37:LEU:HD22	7:L:3564:HOH:O	2.20	0.40
2:L:297:ILE:HG23	2:L:383:MET:HE3	2.02	0.40
1:S:239:THR:OG1	2:L:254:ARG:NH2	2.55	0.40
2:L:388:LEU:HG	2:L:426:ARG:HA	2.03	0.40
2:L:480:GLY:N	7:L:3536:HOH:O	2.54	0.40
1:S:5:ARG:HB3	1:S:5:ARG:HH11	1.87	0.40
2:L:79:ARG:NH1	7:L:3240:HOH:O	2.54	0.40
2:L:96:VAL:HG22	7:L:3382:HOH:O	2.22	0.40

All (4) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:S:218:TYR:OH	2:L:487:ARG:NH1[2_664]	1.95	0.25
7:S:3054:HOH:O	7:L:3179:HOH:O[2_664]	2.11	0.09
1:S:263:PRO:O	7:L:3056:HOH:O[2_664]	2.13	0.07
1:S:266:GLN:NE2	7:L:3275:HOH:O[2_664]	2.14	0.06

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	S	265/267 (99%)	253 (96%)	10 (4%)	2 (1%)	16	3
2	L	532/534 (100%)	510 (96%)	20 (4%)	2 (0%)	30	10
All	All	797/801 (100%)	763 (96%)	30 (4%)	4 (0%)	24	7

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	S	5	ARG
1	S	4	PRO

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Mol	Chain	Res	Type
2	L	187	THR
2	L	378	TYR

5.3.2 Protein sidechains ⓘ

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	S	213/213 (100%)	189 (89%)	24 (11%)	5	0
2	L	438/438 (100%)	409 (93%)	29 (7%)	15	1
All	All	651/651 (100%)	598 (92%)	53 (8%)	11	0

All (53) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	S	2	MET
1	S	5	ARG
1	S	25	LEU
1	S	29	GLU
1	S	35	LEU
1	S	37	LEU
1	S	61	GLU
1	S	85	ILE
1	S	91	ASN
1	S	95	LEU
1	S	97	ILE
1	S	173	LEU
1	S	176	LEU
1	S	177	ASN
1	S	187	VAL
1	S	210	GLU
1	S	212	ARG
1	S	215	TRP
1	S	230	ASN
1	S	242	PRO
1	S	243	VAL

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Mol	Chain	Res	Type
1	S	255	PRO
1	S	262	THR
1	S	267	ASN
2	L	27	VAL
2	L	37	LEU
2	L	43	VAL
2	L	57	LEU
2	L	61	LEU
2	L	65	LEU
2	L	79	ARG
2	L	100	VAL
2	L	132	HIS
2	L	143	LEU
2	L	162	THR
2	L	174	LEU
2	L	200	LEU
2	L	213	LEU
2	L	220	VAL
2	L	232	LYS
2	L	233	ASN
2	L	250	LEU
2	L	254	ARG
2	L	261	LEU
2	L	277	LEU
2	L	278	LEU
2	L	318	VAL
2	L	364	LEU
2	L	388	LEU
2	L	418	GLU
2	L	445	LEU
2	L	457	ASN
2	L	500	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (32) such sidechains are listed below:

Mol	Chain	Res	Type
1	S	13	HIS
1	S	45	HIS
1	S	91	ASN
1	S	126	ASN
1	S	134	ASN
1	S	139	HIS

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Mol	Chain	Res	Type
1	S	190	GLN
1	S	196	HIS
1	S	229	ASN
1	S	230	ASN
1	S	237	ASN
1	S	238	GLN
1	S	266	GLN
1	S	267	ASN
2	L	36	HIS
2	L	45	ASN
2	L	50	ASN
2	L	75	HIS
2	L	78	GLN
2	L	107	ASN
2	L	113	ASN
2	L	122	HIS
2	L	127	HIS
2	L	132	HIS
2	L	188	ASN
2	L	205	ASN
2	L	233	ASN
2	L	235	HIS
2	L	390	GLN
2	L	451	ASN
2	L	457	ASN
2	L	476	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 5 ligands modelled in this entry, 1 is monoatomic - leaving 4 for Mogul analysis.

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
4	F3S	S	1003	1	0,9,9	-	-	-		
3	SF4	S	1002	1	0,12,12	-	-	-		
3	SF4	S	1001	1	0,12,12	-	-	-		
6	NFE	L	1004	2	2,6,8	4.69	2 (100%)	-		

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	F3S	S	1003	1	-	-	0/3/3/3
3	SF4	S	1002	1	-	-	0/6/5/5
3	SF4	S	1001	1	-	-	0/6/5/5

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	L	1004	NFE	O1-C1	4.89	1.22	1.16
6	L	1004	NFE	O2-C2	4.48	1.22	1.16

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 4 short contacts:

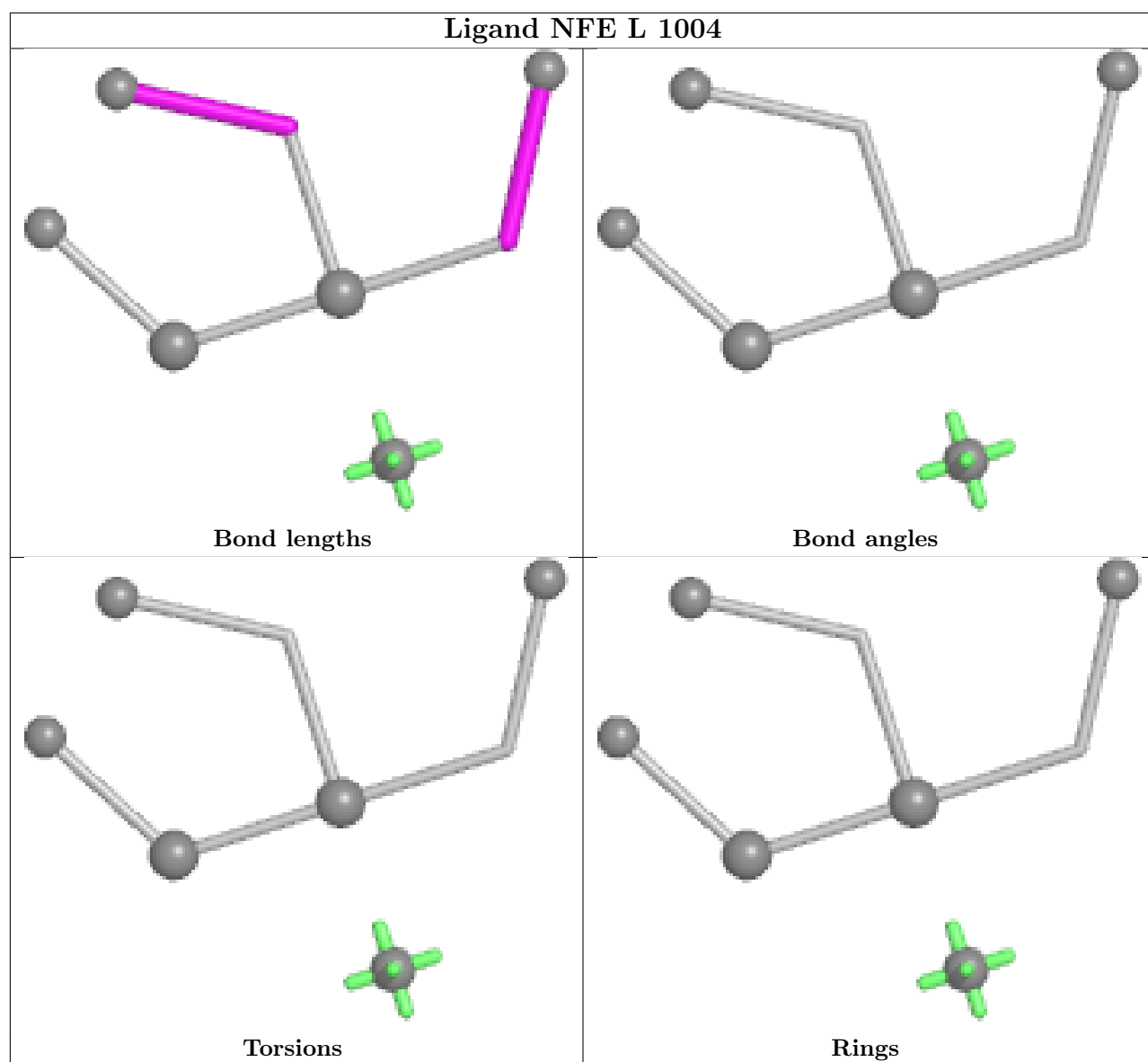
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	S	1003	F3S	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	S	1001	SF4	1	0
6	L	1004	NFE	1	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 than 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.



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

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.