



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:58 AM UTC

PDB ID : 2P9G / pdb_00002p9g
Title : Crystal structure of serine bound G336V,G337V double mutant of E.coli phosphoglycerate dehydrogenase
Authors : Dey, S.; Sacchettini, J.C.
Deposited on : 2007-03-25
Resolution : 2.80 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)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

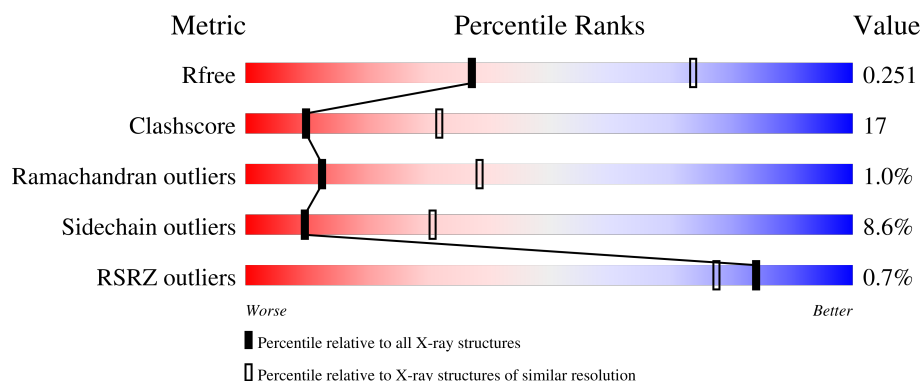
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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 $\leq 5\%$. 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	A	410	% 64% 31% ..
1	B	410	% 64% 29% 5% ..

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6281 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.

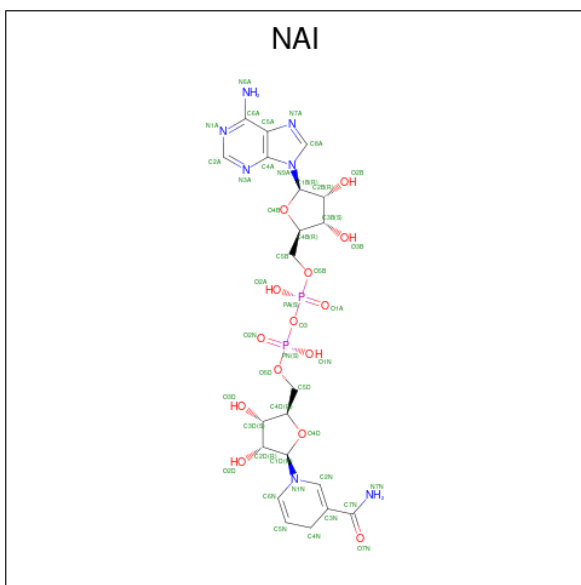
- Molecule 1 is a protein called D-3-phosphoglycerate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	404	Total	C	N	O	S	0	0	0
			3065	1944	532	581	8			
1	B	404	Total	C	N	O	S	0	0	0
			3065	1944	532	581	8			

There are 12 discrepancies between the modelled and reference sequences:

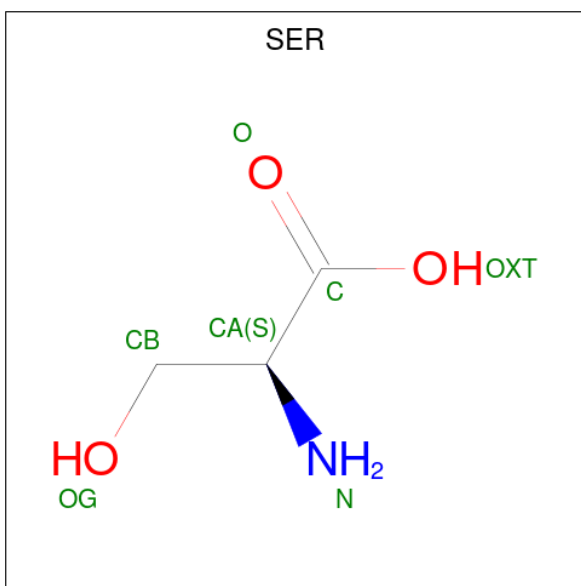
Chain	Residue	Modelled	Actual	Comment	Reference
A	81	ALA	CYS	engineered mutation	UNP P0A9T0
A	83	ALA	CYS	engineered mutation	UNP P0A9T0
A	250	ALA	CYS	engineered mutation	UNP P0A9T0
A	282	ALA	CYS	engineered mutation	UNP P0A9T0
A	336	VAL	GLY	engineered mutation	UNP P0A9T0
A	337	VAL	GLY	engineered mutation	UNP P0A9T0
B	81	ALA	CYS	engineered mutation	UNP P0A9T0
B	83	ALA	CYS	engineered mutation	UNP P0A9T0
B	250	ALA	CYS	engineered mutation	UNP P0A9T0
B	282	ALA	CYS	engineered mutation	UNP P0A9T0
B	336	VAL	GLY	engineered mutation	UNP P0A9T0
B	337	VAL	GLY	engineered mutation	UNP P0A9T0

- Molecule 2 is 1,4-DIHYDRONICOTINAMIDE ADENINE DINUCLEOTIDE (CCD ID: NAI) (formula: C₂₁H₂₉N₇O₁₄P₂).



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

- Molecule 3 is SERINE (CCD ID: SER) (formula: $\text{C}_3\text{H}_7\text{NO}_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			7	3	1	3		
3	A	1	Total	C	N	O	0	0
			7	3	1	3		

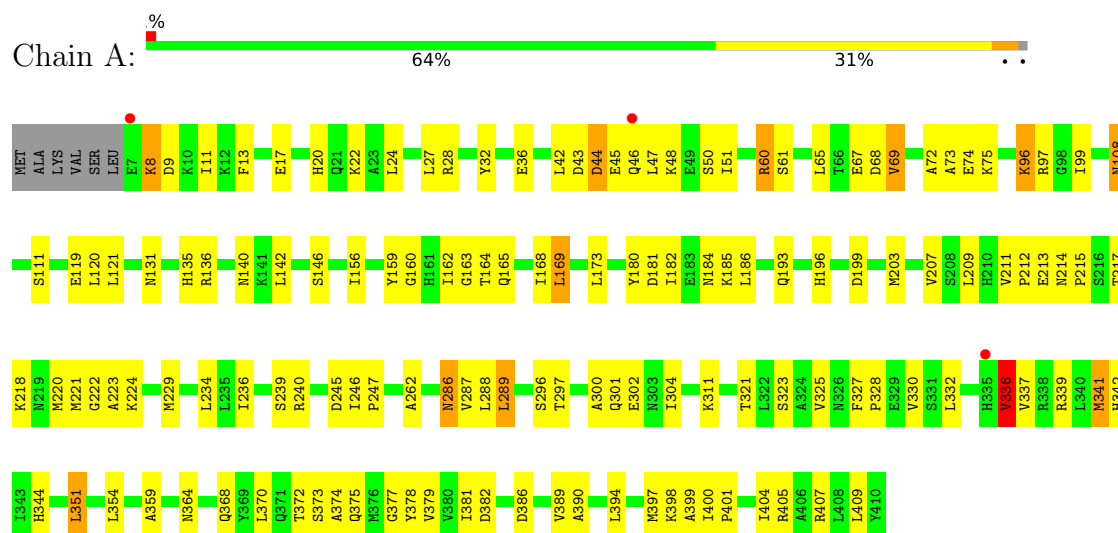
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	29	Total 29	O 29	0	0
4	B	20	Total 20	O 20	0	0

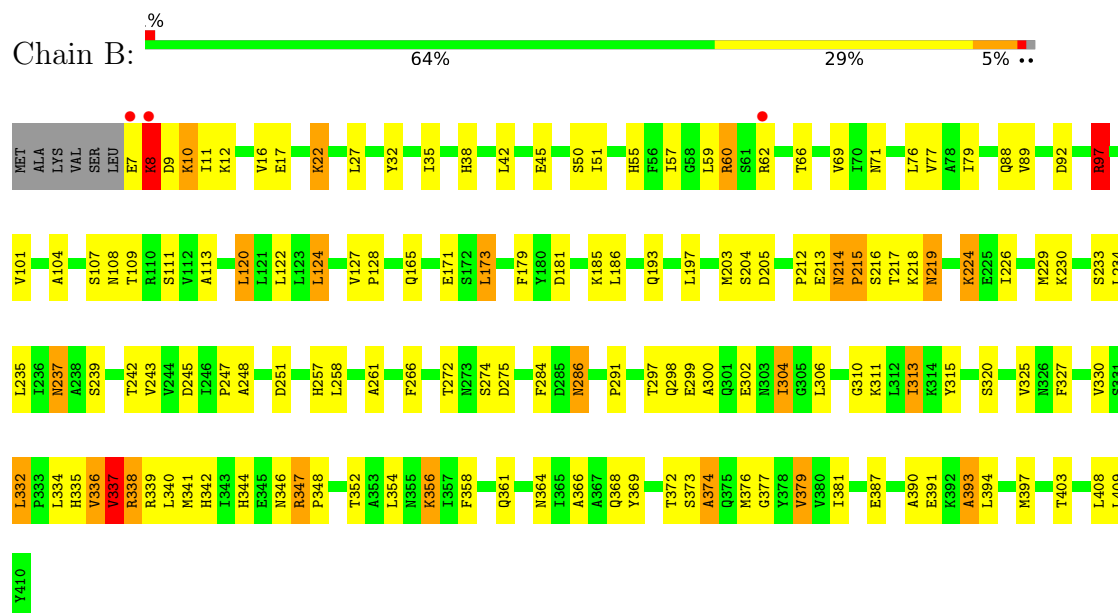
3 Residue-property plots [i](#)

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: D-3-phosphoglycerate dehydrogenase



• Molecule 1: D-3-phosphoglycerate dehydrogenase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	144.07Å 132.24Å 52.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.00 – 2.80 35.00 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.2 (35.00-2.80) 99.2 (35.00-2.80)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.07 (at 2.81Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.197 , 0.250 0.191 , 0.251	Depositor DCC
R_{free} test set	1287 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	52.4	Xtriage
Anisotropy	0.686	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 48.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6281	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.92% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NAI

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	A	1.06	3/3118 (0.1%)	1.20	15/4227 (0.4%)
1	B	1.06	7/3118 (0.2%)	1.27	20/4227 (0.5%)
All	All	1.06	10/6236 (0.2%)	1.24	35/8454 (0.4%)

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	377	GLY	N-CA	7.83	1.55	1.46
1	B	304	ILE	CA-CB	-6.42	1.46	1.54
1	B	291	PRO	N-CA	-6.05	1.42	1.47
1	B	313	ILE	CA-CB	-5.71	1.47	1.54
1	B	113	ALA	CA-CB	-5.71	1.44	1.53
1	B	218	LYS	CD-CE	5.56	1.69	1.52
1	A	390	ALA	CA-CB	-5.19	1.45	1.53
1	A	296	SER	CA-C	-5.13	1.48	1.53
1	B	393	ALA	CA-CB	-5.11	1.45	1.53
1	B	261	ALA	CA-CB	-5.08	1.45	1.53

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	377	GLY	CA-C-O	-9.54	111.51	120.57
1	B	336	VAL	N-CA-C	8.17	118.05	106.53
1	A	377	GLY	O-C-N	7.72	130.74	123.48
1	B	379	VAL	N-CA-C	7.50	118.24	108.35
1	B	338	ARG	CB-CA-C	-7.47	95.91	110.10
1	B	337	VAL	CA-C-N	6.87	134.07	121.70
1	B	337	VAL	C-N-CA	6.87	134.07	121.70
1	B	387	GLU	N-CA-C	6.83	118.72	111.28
1	B	205	ASP	N-CA-C	-6.68	105.25	113.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	168	ILE	CB-CA-C	-6.55	103.63	111.81
1	B	10	LYS	N-CA-C	-6.46	106.36	114.56
1	A	186	LEU	CA-C-N	6.36	126.69	119.83
1	A	186	LEU	C-N-CA	6.36	126.69	119.83
1	A	69	VAL	CB-CA-C	-6.34	101.98	112.26
1	B	92	ASP	N-CA-C	-6.11	104.53	111.07
1	B	11	ILE	CB-CA-C	6.06	118.17	111.08
1	B	77	VAL	CB-CA-C	-5.65	106.07	111.44
1	A	136	ARG	N-CA-C	-5.53	105.14	112.94
1	B	237	ASN	N-CA-C	5.53	117.86	108.02
1	A	99	ILE	N-CA-C	5.49	113.47	107.60
1	A	404	ILE	CB-CA-C	-5.38	106.13	111.30
1	B	97	ARG	N-CA-C	-5.30	106.66	113.02
1	B	381	ILE	CB-CA-C	-5.30	102.34	110.50
1	A	399	ALA	CA-C-N	-5.29	118.78	122.59
1	A	399	ALA	C-N-CA	-5.29	118.78	122.59
1	B	104	ALA	CA-C-N	5.26	126.41	119.84
1	B	104	ALA	C-N-CA	5.26	126.41	119.84
1	A	246	ILE	CA-C-N	-5.24	113.51	119.28
1	A	246	ILE	C-N-CA	-5.24	113.51	119.28
1	A	196	HIS	N-CA-C	5.18	117.17	108.73
1	B	335	HIS	CA-C-N	-5.16	116.68	122.93
1	B	335	HIS	C-N-CA	-5.16	116.68	122.93
1	B	361	GLN	N-CA-C	-5.15	105.34	113.02
1	B	35	ILE	CB-CA-C	-5.07	103.22	110.12
1	A	73	ALA	N-CA-C	5.06	116.89	107.99

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	A	3065	0	3112	104	0
1	B	3065	0	3112	118	0
2	A	44	0	27	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	44	0	27	2	0
3	A	14	0	8	5	0
4	A	29	0	0	2	0
4	B	20	0	0	0	0
All	All	6281	0	6286	218	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 17.

All (218) 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:B:224:LYS:HD3	1:B:224:LYS:H	1.12	1.08
1:A:22:LYS:HE3	1:A:302:GLU:OE1	1.53	1.06
1:B:214:ASN:C	1:B:214:ASN:HD22	1.66	1.03
1:B:297:THR:HG23	1:B:300:ALA:H	1.27	0.98
1:B:336:VAL:O	1:B:336:VAL:HG13	1.70	0.92
1:B:339:ARG:HG2	1:B:409:LEU:HD12	1.56	0.88
1:A:287:VAL:HG12	1:A:289:LEU:HD13	1.55	0.87
1:B:272:THR:HG22	1:B:275:ASP:OD2	1.76	0.84
1:B:286:ASN:HD22	1:B:286:ASN:H	1.26	0.84
1:A:8:LYS:HA	1:A:11:ILE:HD12	1.60	0.83
1:A:286:ASN:HD22	1:A:286:ASN:H	1.25	0.83
1:B:17:GLU:OE1	1:B:60:ARG:HB2	1.80	0.82
1:B:124:LEU:HD13	1:B:234:LEU:CD1	2.09	0.82
1:B:124:LEU:HD13	1:B:234:LEU:HD11	1.68	0.76
1:B:66:THR:OG1	1:B:69:VAL:HG23	1.85	0.76
1:A:22:LYS:CE	1:A:302:GLU:OE1	2.33	0.74
1:B:224:LYS:H	1:B:224:LYS:CD	1.90	0.73
1:A:43:ASP:C	1:A:45:GLU:H	1.97	0.73
1:A:339:ARG:HG2	1:A:409:LEU:HD12	1.71	0.73
1:B:224:LYS:HD3	1:B:224:LYS:N	1.96	0.72
1:B:340:LEU:HD22	1:B:397:MET:HE2	1.72	0.71
1:A:160:GLY:O	1:A:164:THR:HG23	1.92	0.70
1:A:211:VAL:HG21	1:A:220:MET:HE1	1.72	0.70
1:A:20:HIS:HD2	1:A:22:LYS:H	1.39	0.69
1:A:386:ASP:OD1	1:A:389:VAL:HG23	1.95	0.67
1:A:327:PHE:CD1	1:A:328:PRO:HD2	2.29	0.67
1:A:119:GLU:HG2	1:A:288:LEU:HD13	1.77	0.67
1:A:321:THR:HG23	1:A:378:TYR:CE2	2.30	0.67
1:B:62:ARG:HH12	1:B:272:THR:HA	1.61	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:69:VAL:HG12	1:A:69:VAL:O	1.96	0.66
1:A:43:ASP:O	1:A:45:GLU:N	2.28	0.66
1:A:48:LYS:NZ	1:A:68:ASP:OD2	2.21	0.65
1:B:336:VAL:O	1:B:336:VAL:CG1	2.42	0.65
1:B:342:HIS:HD2	1:B:344:HIS:ND1	1.95	0.65
1:B:124:LEU:HD13	1:B:234:LEU:HD12	1.78	0.65
1:B:111:SER:OG	1:B:297:THR:HG21	1.96	0.65
1:B:214:ASN:C	1:B:214:ASN:ND2	2.42	0.65
1:A:185:LYS:H	1:A:193:GLN:HE22	1.43	0.65
1:B:17:GLU:CD	1:B:60:ARG:HB2	2.22	0.64
1:A:17:GLU:CD	1:A:60:ARG:HB2	2.22	0.64
1:A:213:GLU:HB2	1:A:240:ARG:HG3	1.79	0.64
1:B:373:SER:O	1:B:374:ALA:C	2.41	0.64
1:B:12:LYS:NZ	1:B:50:SER:O	2.30	0.64
1:B:27:LEU:HD23	1:B:313:ILE:HD11	1.81	0.62
1:A:342:HIS:HD2	1:A:344:HIS:ND1	1.97	0.62
1:B:286:ASN:HD22	1:B:286:ASN:N	1.94	0.62
1:A:211:VAL:HB	1:A:212:PRO:HD2	1.81	0.61
1:B:214:ASN:ND2	1:B:216:SER:H	1.98	0.61
1:B:107:SER:HB2	1:B:304:ILE:HG13	1.81	0.61
1:A:131:ASN:O	1:A:135:HIS:HD2	1.84	0.60
1:B:213:GLU:OE2	1:B:242:THR:CG2	2.49	0.60
1:A:344:HIS:NE2	3:A:451:SER:O	2.34	0.60
1:A:287:VAL:CG1	1:A:289:LEU:HD13	2.29	0.60
1:A:341:MET:HE3	1:A:407:ARG:NH1	2.16	0.60
1:B:245:ASP:OD2	1:B:247:PRO:HD2	2.02	0.60
1:A:364:ASN:OD1	3:A:551:SER:N	2.35	0.59
1:B:336:VAL:O	1:B:337:VAL:C	2.46	0.58
1:B:237:ASN:ND2	1:B:239:SER:H	2.00	0.58
1:B:340:LEU:HD22	1:B:397:MET:CE	2.32	0.58
1:A:217:THR:HG22	1:A:220:MET:HE2	1.84	0.58
1:B:272:THR:HG23	1:B:274:SER:H	1.69	0.58
1:A:239:SER:OG	1:A:240:ARG:N	2.35	0.57
1:B:390:ALA:O	1:B:391:GLU:C	2.46	0.57
1:A:311:LYS:HE2	1:A:323:SER:OG	2.04	0.57
1:B:16:VAL:O	1:B:17:GLU:HB2	2.04	0.57
1:B:181:ASP:OD1	1:B:185:LYS:HE3	2.04	0.57
1:A:69:VAL:O	1:A:69:VAL:CG1	2.53	0.57
1:B:120:LEU:O	1:B:124:LEU:HB2	2.05	0.57
1:B:8:LYS:O	1:B:10:LYS:N	2.33	0.56
1:B:286:ASN:H	1:B:286:ASN:ND2	2.01	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:199:ASP:O	1:A:203:MET:HE3	2.05	0.56
1:B:219:ASN:HD22	1:B:219:ASN:N	2.04	0.56
1:A:159:TYR:CE1	1:A:164:THR:HG22	2.41	0.56
1:B:171:GLU:C	1:B:173:LEU:H	2.13	0.56
1:A:214:ASN:HB2	1:A:215:PRO:HD2	1.88	0.55
1:A:213:GLU:O	1:A:214:ASN:HB3	2.06	0.55
1:B:8:LYS:C	1:B:10:LYS:H	2.15	0.55
1:A:341:MET:CE	1:A:407:ARG:NH1	2.70	0.55
1:B:203:MET:HG3	1:B:204:SER:N	2.22	0.54
1:B:7:GLU:N	1:B:32:TYR:CZ	2.75	0.54
1:B:297:THR:CG2	1:B:300:ALA:H	2.11	0.54
1:B:79:ILE:HB	1:B:101:VAL:HG22	1.87	0.54
1:B:12:LYS:H	1:B:55:HIS:HD2	1.54	0.54
1:A:336:VAL:HG13	1:A:337:VAL:O	2.08	0.54
1:A:207:VAL:CG2	1:A:229:MET:HE3	2.37	0.54
1:A:217:THR:HG22	1:A:220:MET:CE	2.37	0.54
1:A:321:THR:HG23	1:A:378:TYR:HE2	1.72	0.53
1:A:20:HIS:CD2	1:A:22:LYS:H	2.24	0.53
1:A:400:ILE:O	1:A:401:PRO:C	2.49	0.53
1:B:124:LEU:CD1	1:B:234:LEU:HD11	2.37	0.52
1:A:286:ASN:HD22	1:A:286:ASN:N	1.97	0.52
1:A:13:PHE:CE1	1:A:32:TYR:HB3	2.44	0.52
1:B:369:TYR:O	1:B:379:VAL:HG23	2.09	0.52
1:B:213:GLU:OE2	1:B:242:THR:HG23	2.08	0.52
1:B:393:ALA:O	1:B:394:LEU:C	2.49	0.52
1:A:370:LEU:HD12	1:A:378:TYR:O	2.10	0.51
1:A:397:MET:O	1:A:400:ILE:HG13	2.10	0.51
1:B:394:LEU:HA	1:B:397:MET:HG3	1.92	0.51
1:B:257:HIS:C	1:B:258:LEU:HD23	2.36	0.51
1:B:394:LEU:O	1:B:397:MET:N	2.44	0.50
1:B:127:VAL:N	1:B:128:PRO:CD	2.74	0.50
1:A:212:PRO:O	1:A:217:THR:HG21	2.11	0.50
1:A:286:ASN:H	1:A:286:ASN:ND2	2.03	0.50
3:A:451:SER:N	1:B:364:ASN:OD1	2.44	0.50
1:B:297:THR:HG22	1:B:300:ALA:HB3	1.94	0.50
1:A:222:GLY:O	1:A:223:ALA:C	2.54	0.50
1:B:229:MET:HE1	1:B:235:LEU:HB2	1.94	0.49
1:B:108:ASN:OD1	2:B:550:NAI:H5N	2.12	0.49
1:A:43:ASP:OD2	1:A:43:ASP:N	2.43	0.49
1:A:119:GLU:HG2	1:A:288:LEU:CD1	2.42	0.49
1:A:209:LEU:HD11	1:A:221:MET:HG3	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:43:ASP:C	1:A:45:GLU:N	2.61	0.49
1:A:300:ALA:O	1:A:301:GLN:C	2.55	0.49
1:A:180:TYR:CD2	1:A:180:TYR:C	2.91	0.49
1:B:315:TYR:HD2	1:B:320:SER:O	1.96	0.48
1:A:339:ARG:HB2	1:A:382:ASP:OD1	2.13	0.48
1:B:185:LYS:H	1:B:193:GLN:HE22	1.60	0.48
1:A:341:MET:HE3	1:A:407:ARG:HH11	1.79	0.48
1:B:297:THR:HG22	1:B:300:ALA:CB	2.43	0.48
1:A:405:ARG:HD3	4:A:522:HOH:O	2.13	0.48
1:A:17:GLU:OE1	1:A:60:ARG:HB2	2.12	0.48
1:A:22:LYS:HD2	1:A:302:GLU:CG	2.44	0.48
1:B:226:ILE:O	1:B:229:MET:HB2	2.14	0.47
1:B:340:LEU:HG	1:B:408:LEU:HD12	1.96	0.47
1:A:22:LYS:HD2	1:A:302:GLU:HG3	1.96	0.47
1:A:236:ILE:HG23	1:A:262:ALA:HB3	1.97	0.47
1:B:97:ARG:HE	1:B:97:ARG:HB3	1.66	0.47
1:B:339:ARG:CG	1:B:409:LEU:HD12	2.38	0.47
1:A:8:LYS:HE3	1:A:32:TYR:CZ	2.49	0.47
1:A:359:ALA:HB2	1:B:352:THR:OG1	2.14	0.47
1:B:230:LYS:HB3	1:B:233:SER:HB3	1.97	0.46
1:A:48:LYS:HA	1:A:51:ILE:HG22	1.97	0.46
1:A:44:ASP:HB3	4:A:538:HOH:O	2.16	0.46
1:B:258:LEU:HD23	1:B:258:LEU:N	2.28	0.46
1:A:108:ASN:HD21	1:A:304:ILE:HD11	1.80	0.46
1:B:88:GLN:HG2	1:B:89:VAL:HG23	1.97	0.46
1:B:214:ASN:HB2	1:B:215:PRO:HD2	1.97	0.45
1:B:8:LYS:C	1:B:10:LYS:N	2.74	0.45
1:A:108:ASN:HD22	1:A:108:ASN:N	2.14	0.45
1:B:213:GLU:OE2	1:B:242:THR:HG21	2.14	0.45
1:A:212:PRO:HD3	2:A:450:NAI:H52A	1.98	0.45
1:B:224:LYS:CD	1:B:224:LYS:N	2.69	0.45
1:A:332:LEU:HB3	1:A:339:ARG:NH2	2.32	0.45
1:A:336:VAL:CG1	1:A:337:VAL:O	2.65	0.45
1:A:96:LYS:HE2	1:A:375:GLN:NE2	2.31	0.45
1:A:351:LEU:HB2	3:A:451:SER:HB3	1.98	0.45
1:A:111:SER:HG	1:A:297:THR:HG1	1.57	0.45
1:B:214:ASN:ND2	1:B:214:ASN:O	2.43	0.45
1:A:223:ALA:O	1:A:224:LYS:C	2.60	0.45
1:A:368:GLN:OE1	1:A:381:ILE:HD12	2.16	0.45
1:B:212:PRO:O	1:B:217:THR:HG21	2.16	0.45
1:B:243:VAL:O	1:B:243:VAL:HG12	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:24:LEU:HD12	1:A:24:LEU:N	2.33	0.44
1:A:245:ASP:OD1	1:A:247:PRO:HD2	2.17	0.44
1:B:219:ASN:HD22	1:B:219:ASN:H	1.64	0.44
1:B:372:THR:HG22	1:B:377:GLY:CA	2.48	0.44
1:B:57:ILE:O	1:B:57:ILE:HG23	2.18	0.44
1:A:121:LEU:HD11	1:A:173:LEU:HD21	2.00	0.44
1:A:156:ILE:HD13	1:A:163:GLY:O	2.18	0.44
1:B:22:LYS:HA	1:B:22:LYS:HD3	1.47	0.44
1:A:185:LYS:N	1:A:193:GLN:HE22	2.14	0.44
1:B:22:LYS:CG	1:B:302:GLU:HG3	2.48	0.44
1:B:51:ILE:HD12	1:B:57:ILE:HD12	1.99	0.44
1:B:214:ASN:HD22	1:B:216:SER:H	1.65	0.44
1:A:169:LEU:HA	1:A:169:LEU:HD12	1.62	0.43
1:B:111:SER:OG	1:B:297:THR:CG2	2.65	0.43
1:B:179:PHE:CZ	1:B:193:GLN:HB2	2.53	0.43
1:A:159:TYR:CD1	1:A:164:THR:HG22	2.54	0.43
1:A:341:MET:CE	1:A:407:ARG:HH11	2.29	0.43
1:B:298:GLN:O	1:B:299:GLU:C	2.61	0.43
1:A:97:ARG:HE	1:A:97:ARG:HB3	1.59	0.43
1:A:364:ASN:HB2	1:B:348:PRO:HG3	2.00	0.43
1:B:22:LYS:HG2	1:B:302:GLU:HG3	1.99	0.43
1:A:120:LEU:HD12	1:A:120:LEU:C	2.44	0.43
1:A:321:THR:CG2	1:A:378:TYR:CE2	3.00	0.43
1:B:181:ASP:OD2	2:B:550:NAI:H1B	2.18	0.42
3:A:551:SER:HB2	1:B:347:ARG:O	2.19	0.42
1:B:203:MET:CG	1:B:204:SER:N	2.82	0.42
1:B:332:LEU:HB3	1:B:339:ARG:NH2	2.34	0.42
1:B:356:LYS:C	1:B:358:PHE:N	2.77	0.42
1:A:373:SER:O	1:A:374:ALA:C	2.61	0.42
1:B:122:LEU:N	1:B:122:LEU:CD1	2.83	0.42
1:A:8:LYS:H	1:A:8:LYS:HG2	1.57	0.42
1:A:65:LEU:HD12	1:A:65:LEU:HA	1.72	0.42
1:B:214:ASN:ND2	1:B:216:SER:N	2.66	0.42
1:A:181:ASP:OD1	1:A:182:ILE:N	2.53	0.42
1:A:336:VAL:O	1:A:336:VAL:HG12	2.19	0.42
1:B:297:THR:CG2	1:B:300:ALA:CB	2.97	0.42
1:B:248:ALA:O	1:B:251:ASP:HB2	2.20	0.42
1:B:284:PHE:HB3	1:B:286:ASN:ND2	2.33	0.42
1:B:336:VAL:HG11	1:B:366:ALA:CB	2.49	0.42
1:B:342:HIS:CD2	1:B:344:HIS:ND1	2.83	0.42
1:B:76:LEU:HD12	1:B:76:LEU:HA	1.80	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:247:PRO:O	1:B:248:ALA:C	2.60	0.41
1:B:310:GLY:O	1:B:311:LYS:C	2.63	0.41
1:A:368:GLN:NE2	1:B:368:GLN:HE21	2.17	0.41
1:B:354:LEU:HD11	1:B:397:MET:SD	2.59	0.41
1:A:185:LYS:H	1:A:193:GLN:NE2	2.15	0.41
1:A:42:LEU:HA	1:A:42:LEU:HD12	1.75	0.41
1:A:24:LEU:HD23	1:A:28:ARG:HH22	1.85	0.41
1:A:43:ASP:CG	1:A:46:GLN:H	2.28	0.41
1:B:266:PHE:CD1	1:B:266:PHE:N	2.89	0.41
1:B:372:THR:HG22	1:B:377:GLY:HA3	2.02	0.41
1:A:69:VAL:O	1:A:72:ALA:HB3	2.21	0.41
1:A:394:LEU:O	1:A:398:LYS:HG3	2.20	0.41
1:B:7:GLU:N	1:B:7:GLU:CD	2.79	0.41
1:B:342:HIS:CE1	1:B:403:THR:OG1	2.74	0.41
1:B:38:HIS:ND1	1:B:42:LEU:HD21	2.36	0.41
1:B:214:ASN:O	1:B:215:PRO:C	2.64	0.41
1:A:370:LEU:CD1	1:A:379:VAL:HB	2.51	0.40
1:B:27:LEU:HD23	1:B:27:LEU:HA	1.76	0.40
1:A:24:LEU:HD23	1:A:28:ARG:NH2	2.37	0.40
1:A:224:LYS:HA	1:A:224:LYS:HE3	2.03	0.40
1:B:71:ASN:HA	1:B:97:ARG:HH11	1.85	0.40
1:B:341:MET:HA	1:B:379:VAL:O	2.20	0.40
1:A:372:THR:HG23	1:B:366:ALA:O	2.21	0.40
1:B:346:ASN:OD1	1:B:346:ASN:C	2.63	0.40
1:B:306:LEU:HD23	1:B:306:LEU:HA	1.76	0.40

There are no symmetry-related clashes.

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	A	402/410 (98%)	370 (92%)	29 (7%)	3 (1%)	18 47

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	402/410 (98%)	373 (93%)	24 (6%)	5 (1%)	10	34
All	All	804/820 (98%)	743 (92%)	53 (7%)	8 (1%)	12	38

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	44	ASP
1	A	336	VAL
1	B	8	LYS
1	B	9	ASP
1	B	337	VAL
1	B	374	ALA
1	A	47	LEU
1	B	215	PRO

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	A	324/329 (98%)	295 (91%)	29 (9%)	9	28
1	B	324/329 (98%)	297 (92%)	27 (8%)	10	32
All	All	648/658 (98%)	592 (91%)	56 (9%)	10	31

All (56) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	LYS
1	A	9	ASP
1	A	27	LEU
1	A	36	GLU
1	A	50	SER
1	A	60	ARG
1	A	61	SER
1	A	67	GLU

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Mol	Chain	Res	Type
1	A	74	GLU
1	A	75	LYS
1	A	96	LYS
1	A	108	ASN
1	A	140	ASN
1	A	142	LEU
1	A	146	SER
1	A	162	ILE
1	A	165	GLN
1	A	169	LEU
1	A	184	ASN
1	A	218	LYS
1	A	234	LEU
1	A	286	ASN
1	A	289	LEU
1	A	325	VAL
1	A	330	VAL
1	A	336	VAL
1	A	341	MET
1	A	351	LEU
1	A	354	LEU
1	B	8	LYS
1	B	22	LYS
1	B	45	GLU
1	B	59	LEU
1	B	60	ARG
1	B	97	ARG
1	B	109	THR
1	B	120	LEU
1	B	124	LEU
1	B	165	GLN
1	B	173	LEU
1	B	186	LEU
1	B	197	LEU
1	B	214	ASN
1	B	219	ASN
1	B	224	LYS
1	B	286	ASN
1	B	325	VAL
1	B	327	PHE
1	B	330	VAL
1	B	332	LEU

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Mol	Chain	Res	Type
1	B	334	LEU
1	B	337	VAL
1	B	338	ARG
1	B	347	ARG
1	B	356	LYS
1	B	376	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (30) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	20	HIS
1	A	34	ASN
1	A	55	HIS
1	A	87	ASN
1	A	108	ASN
1	A	135	HIS
1	A	161	HIS
1	A	165	GLN
1	A	193	GLN
1	A	237	ASN
1	A	257	HIS
1	A	273	ASN
1	A	286	ASN
1	A	303	ASN
1	A	342	HIS
1	B	34	ASN
1	B	55	HIS
1	B	135	HIS
1	B	193	GLN
1	B	214	ASN
1	B	219	ASN
1	B	237	ASN
1	B	286	ASN
1	B	301	GLN
1	B	303	ASN
1	B	318	ASN
1	B	342	HIS
1	B	355	ASN
1	B	364	ASN
1	B	368	GLN

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 ⓘ

4 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$
3	SER	A	451	-	4,6,6	1.57	1 (25%)	2,7,7	2.98	1 (50%)
2	NAI	A	450	-	47,48,48	1.72	7 (14%)	64,73,73	2.07	16 (25%)
2	NAI	B	550	-	47,48,48	1.76	8 (17%)	64,73,73	1.67	12 (18%)
3	SER	A	551	-	4,6,6	1.27	1 (25%)	2,7,7	2.98	1 (50%)

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
3	SER	A	451	-	-	1/6/6/6	-
2	NAI	A	450	-	-	11/29/72/72	0/5/5/5
2	NAI	B	550	-	-	9/29/72/72	0/5/5/5
3	SER	A	551	-	-	1/6/6/6	-

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	550	NAI	O7N-C7N	6.71	1.40	1.24
2	A	450	NAI	O7N-C7N	6.70	1.40	1.24
2	B	550	NAI	C4N-C3N	-4.66	1.41	1.50
2	A	450	NAI	C4N-C3N	-4.34	1.41	1.50
2	B	550	NAI	C4N-C5N	-3.37	1.40	1.49
2	A	450	NAI	C2A-N3A	3.34	1.39	1.33
2	A	450	NAI	C4N-C5N	-3.23	1.40	1.49
2	B	550	NAI	C2A-N1A	3.21	1.39	1.33
2	A	450	NAI	C2A-N1A	3.20	1.39	1.33
3	A	451	SER	OXT-C	-3.07	1.20	1.30
2	A	450	NAI	C6N-C5N	3.05	1.42	1.33
2	B	550	NAI	C2A-N3A	2.80	1.38	1.33
2	B	550	NAI	C8A-N7A	2.73	1.36	1.31
2	B	550	NAI	C6N-C5N	2.71	1.41	1.33
3	A	551	SER	OXT-C	-2.52	1.22	1.30
2	B	550	NAI	C5A-N7A	-2.18	1.35	1.39
2	A	450	NAI	C5A-N7A	-2.13	1.35	1.39

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	450	NAI	C5A-C4A-N3A	-6.42	117.87	126.72
2	A	450	NAI	O4D-C1D-N1N	6.31	120.11	108.08
2	B	550	NAI	O4D-C1D-N1N	5.48	118.53	108.08
2	B	550	NAI	N3A-C2A-N1A	-5.13	120.81	128.58
2	A	450	NAI	N3A-C2A-N1A	-4.90	121.17	128.58
3	A	551	SER	OXT-C-O	-4.21	114.53	124.08
2	B	550	NAI	N9A-C8A-N7A	-4.03	108.22	113.94
2	A	450	NAI	C2A-N3A-C4A	4.01	121.62	111.83
3	A	451	SER	OXT-C-O	-3.93	115.16	124.08
2	A	450	NAI	N3A-C4A-N9A	3.78	133.59	127.17
2	A	450	NAI	C5A-N7A-C8A	3.55	109.03	103.45
2	A	450	NAI	O4B-C1B-C2B	-3.49	99.14	106.62
2	A	450	NAI	C6A-C5A-C4A	3.35	121.75	117.18
2	A	450	NAI	O7N-C7N-C3N	-3.31	114.66	120.90
2	A	450	NAI	C4A-C5A-N7A	-3.25	106.87	110.58
2	A	450	NAI	C1D-N1N-C2N	-2.96	116.25	121.14
2	A	450	NAI	N9A-C8A-N7A	-2.93	109.78	113.94
2	A	450	NAI	C3N-C7N-N7N	2.91	122.84	117.67
2	B	550	NAI	C4A-N9A-C8A	2.76	108.63	105.74
2	B	550	NAI	C5A-N7A-C8A	2.54	107.44	103.45
2	A	450	NAI	O2A-PA-O3	2.52	114.09	107.27

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	450	NAI	C5A-C4A-N9A	2.49	108.52	105.81
2	B	550	NAI	C5A-C4A-N3A	-2.34	123.49	126.72
2	A	450	NAI	O3-PA-O1A	-2.27	103.88	110.70
2	B	550	NAI	C2B-C1B-N9A	-2.27	107.67	113.30
2	B	550	NAI	O2A-PA-O3	2.25	113.34	107.27
2	B	550	NAI	C2A-N3A-C4A	2.22	117.26	111.83
2	B	550	NAI	O2B-C2B-C1B	-2.13	102.78	110.10
2	B	550	NAI	C3N-C2N-N1N	-2.02	120.24	123.20
2	B	550	NAI	C2D-C1D-N1N	-2.01	108.35	113.31

There are no chirality outliers.

All (22) torsion outliers are listed below:

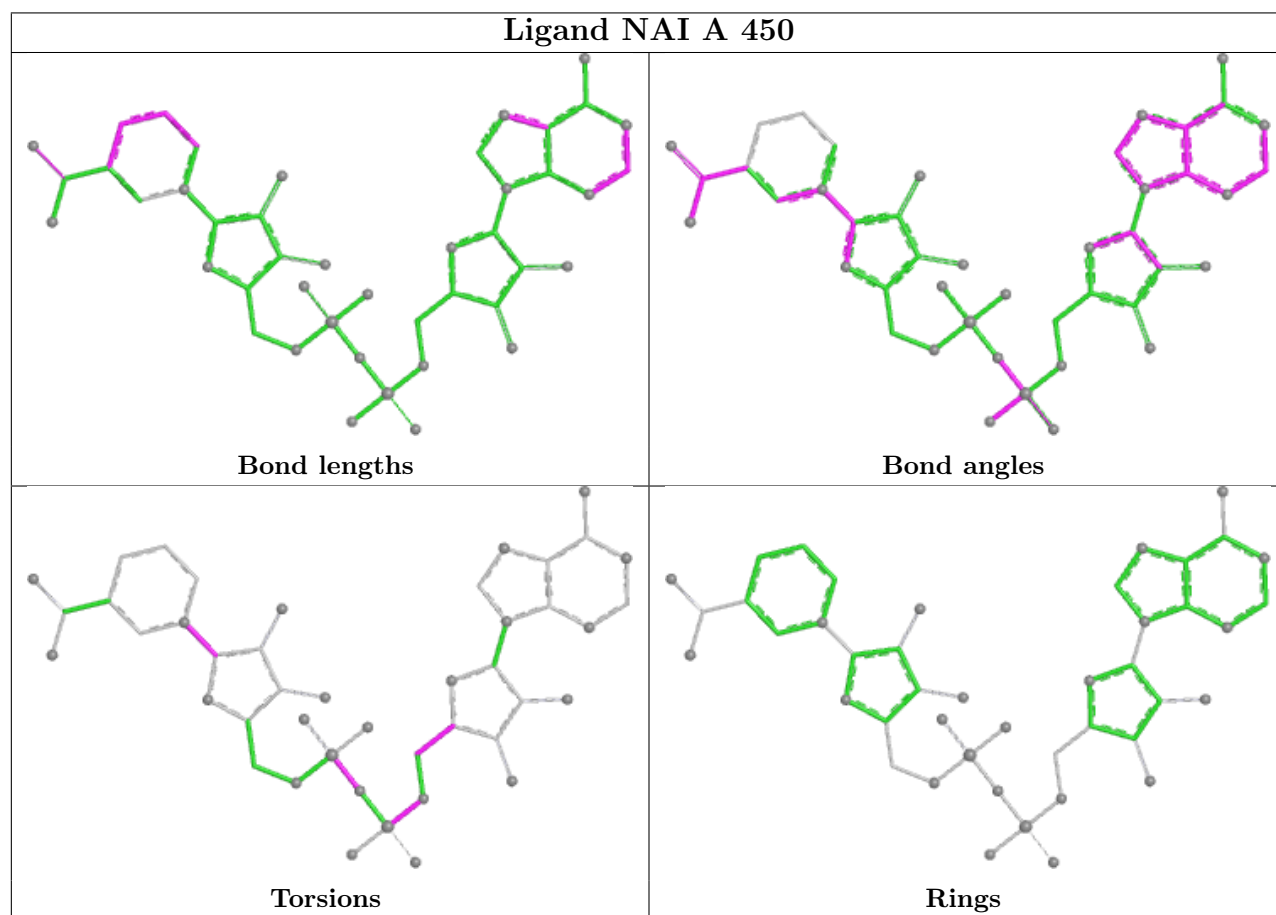
Mol	Chain	Res	Type	Atoms
2	A	450	NAI	C5B-O5B-PA-O1A
2	A	450	NAI	C5B-O5B-PA-O2A
2	A	450	NAI	C5B-O5B-PA-O3
2	B	550	NAI	C2N-C3N-C7N-N7N
2	A	450	NAI	O4B-C4B-C5B-O5B
2	A	450	NAI	C3B-C4B-C5B-O5B
2	B	550	NAI	C2D-C1D-N1N-C6N
2	B	550	NAI	O4D-C1D-N1N-C6N
2	B	550	NAI	C2D-C1D-N1N-C2N
2	B	550	NAI	C5B-O5B-PA-O1A
2	B	550	NAI	O4D-C1D-N1N-C2N
3	A	551	SER	C-CA-CB-OG
2	A	450	NAI	O4D-C1D-N1N-C2N
3	A	451	SER	O-C-CA-N
2	A	450	NAI	O4D-C1D-N1N-C6N
2	A	450	NAI	PA-O3-PN-O2N
2	A	450	NAI	C2D-C1D-N1N-C2N
2	B	550	NAI	C2B-C1B-N9A-C8A
2	B	550	NAI	PN-O3-PA-O1A
2	B	550	NAI	PN-O3-PA-O2A
2	A	450	NAI	C2D-C1D-N1N-C6N
2	A	450	NAI	PA-O3-PN-O1N

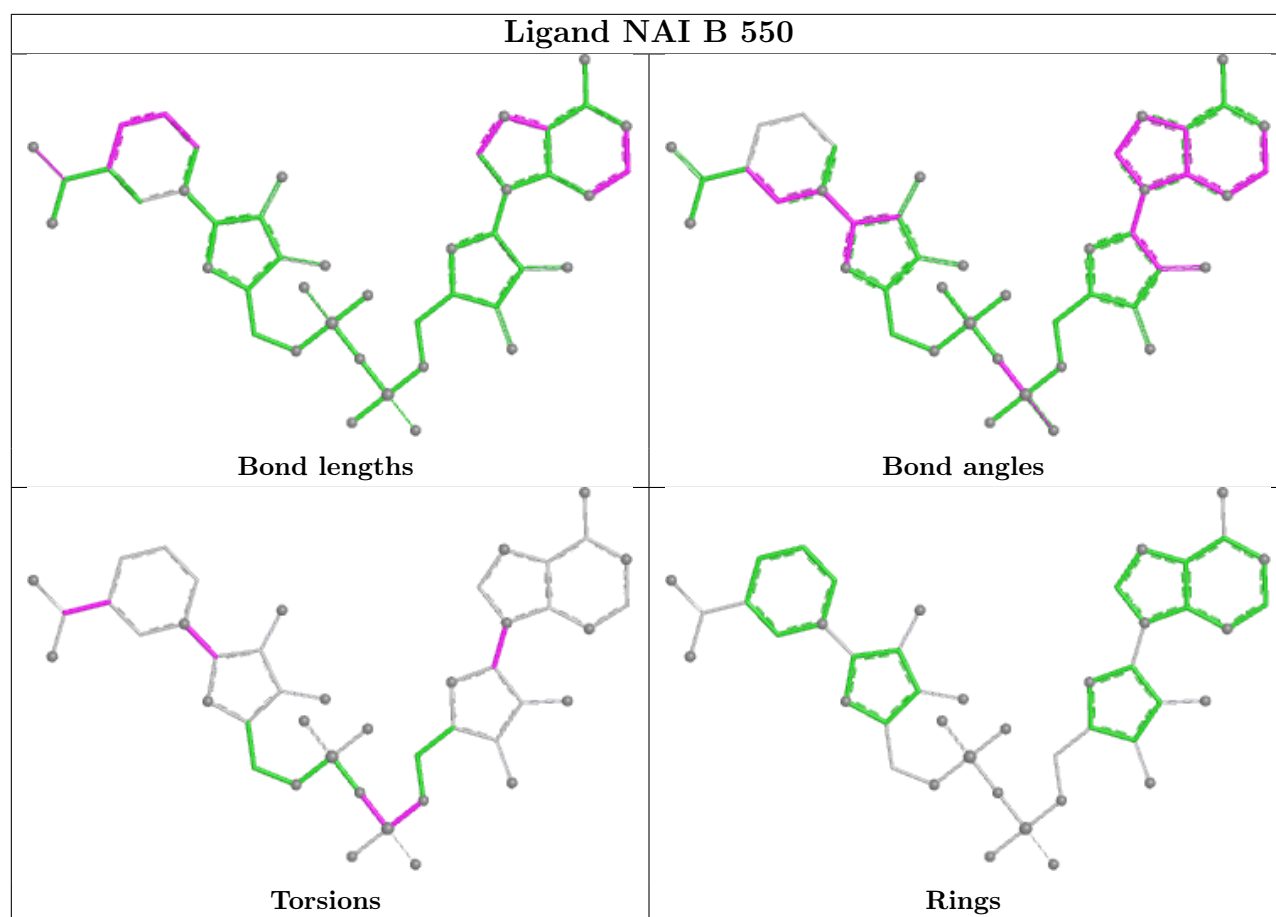
There are no ring outliers.

4 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	451	SER	3	0
2	A	450	NAI	1	0
2	B	550	NAI	2	0
3	A	551	SER	2	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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	A	404/410 (98%)	-0.43	3 (0%)	84 77	19, 41, 66, 82	9 (2%)
1	B	404/410 (98%)	-0.38	3 (0%)	84 77	22, 43, 68, 81	2 (0%)
All	All	808/820 (98%)	-0.41	6 (0%)	84 77	19, 42, 68, 82	11 (1%)

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	62	ARG	3.9
1	A	46	GLN	3.2
1	A	7	GLU	2.8
1	B	7	GLU	2.1
1	A	335	HIS	2.0
1	B	8	LYS	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

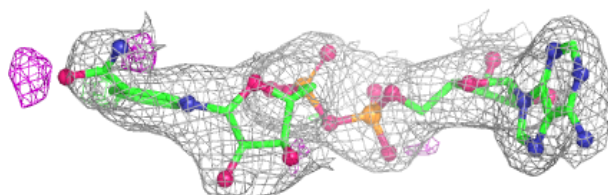
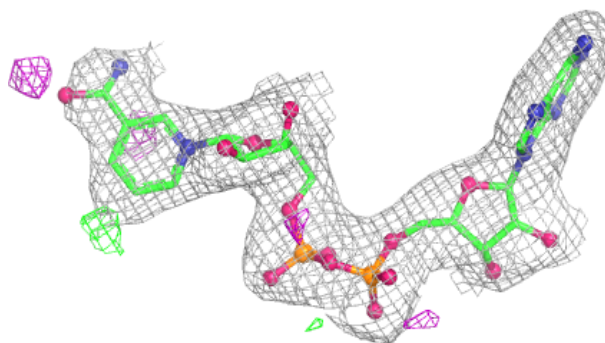
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	SER	A	551	7/7	0.86	0.15	37,40,52,57	0
3	SER	A	451	7/7	0.90	0.14	7,25,37,39	0
2	NAI	A	450	44/44	0.96	0.07	29,42,51,61	0
2	NAI	B	550	44/44	0.96	0.07	23,47,62,65	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.

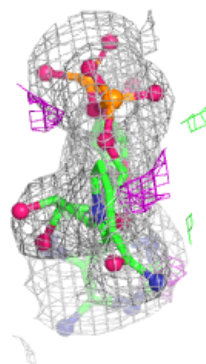
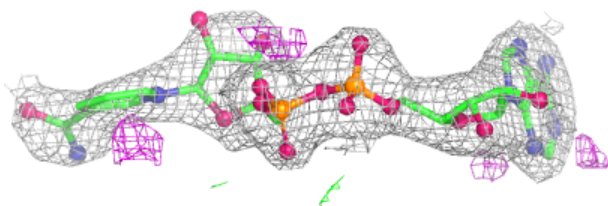
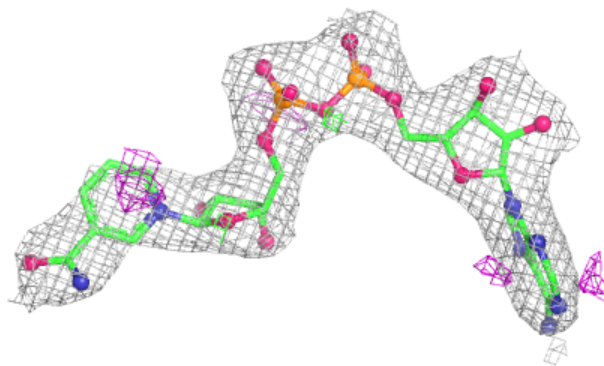
Electron density around NAI A 450:

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 NAI B 550:

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



6.5 Other polymers [i](#)

There are no such residues in this entry.