Full wwPDB X-ray Structure Validation Report ⓘ

Dec 9, 2024 – 12:09 PM JST

PDB ID	:	9IX8
Title	:	Crystallization and structural characterization of phosphopentomutase from the hyperthermophilic archaeon Thermococcus kodakarensis
Authors	:	Naz, Z.; Lubkowski, T.J.; Saleem, M.; Rahman, M.; Wlodawer, A.; Rashid, N.
Deposited on	:	2024-07-26
Resolution	:	2.39 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:

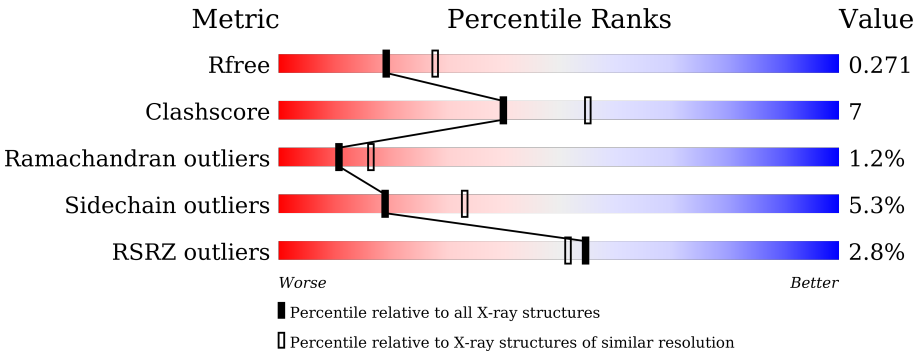
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.21
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.40

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 2.39 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}	164625	4642 (2.40-2.40)
Clashscore	180529	5218 (2.40-2.40)
Ramachandran outliers	177936	5158 (2.40-2.40)
Sidechain outliers	177891	5159 (2.40-2.40)
RSRZ outliers	164620	4642 (2.40-2.40)

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 <=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	449	5% 82% 15%
1	B	449	4% 75% 22%
1	C	449	% 84% 14%
1	D	449	% 84% 14%

2 Entry composition

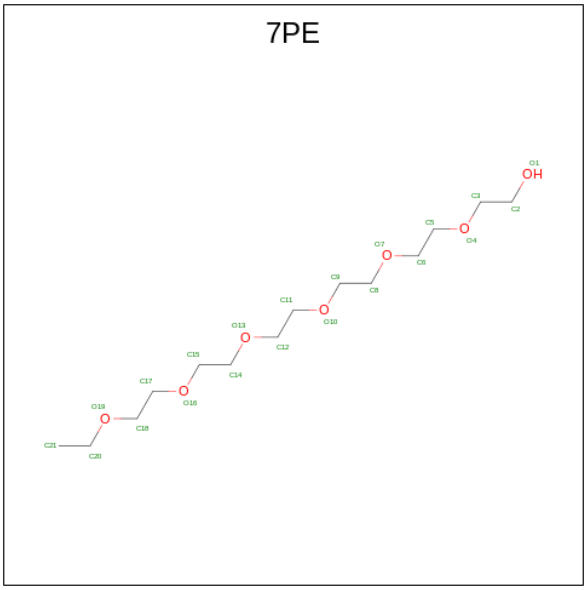
There are 4 unique types of molecules in this entry. The entry contains 14297 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Phosphopentomutase.

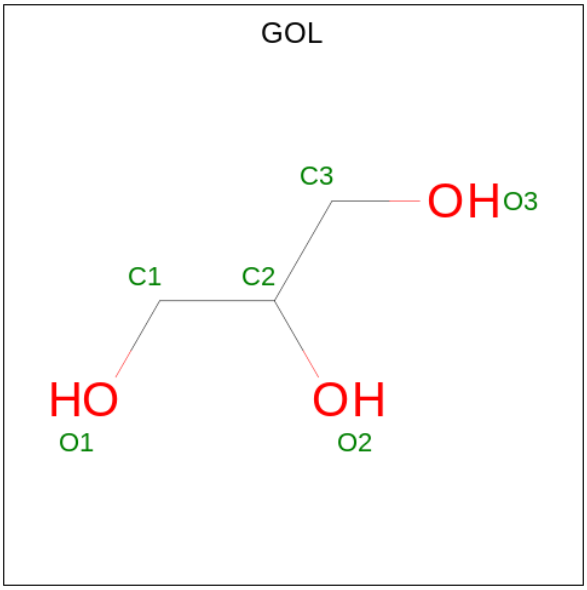
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	445	Total	C	N	O	S	0	0	0
			3444	2198	593	643	10			
1	B	445	Total	C	N	O	S	0	1	0
			3449	2203	593	643	10			
1	C	446	Total	C	N	O	S	0	1	0
			3461	2208	597	646	10			
1	D	447	Total	C	N	O	S	0	2	0
			3472	2217	596	647	12			

- Molecule 2 is 2-(2-(2-(2-(2-(2-ETHOXYETHOXY)ETHOXY)ETHOXY)ETHOXY)ETHOXY)ETHANOL (three-letter code: 7PE) (formula: $C_{14}H_{30}O_7$).



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

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



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

- Molecule 4 is water.

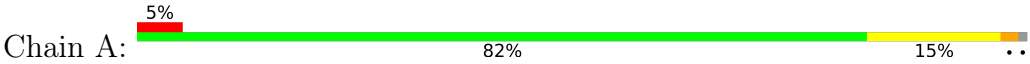
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	107	Total O 107 107	0	0
4	B	91	Total O 91 91	0	0
4	C	105	Total O 109 109	0	4
4	D	116	Total O 116 116	0	0

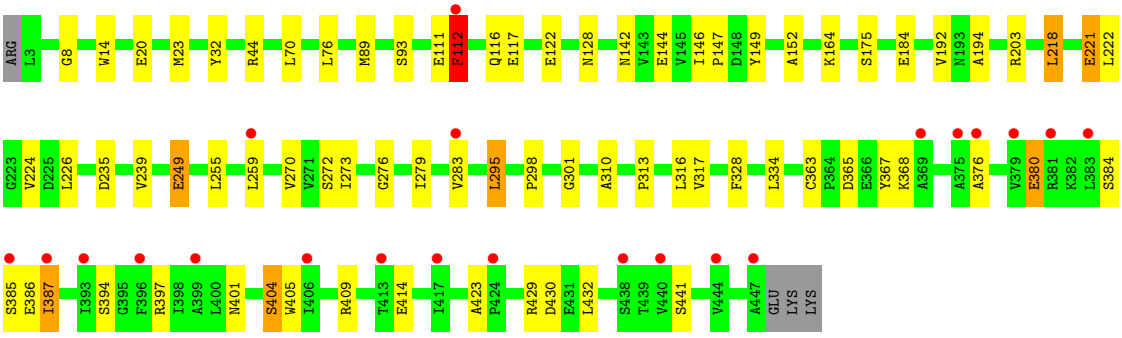
3 Residue-property plots (i)

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: Phosphopentomutase

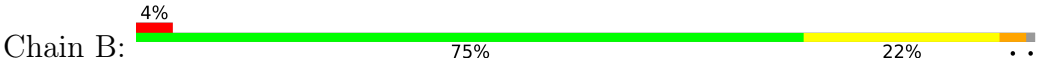
Chain A:

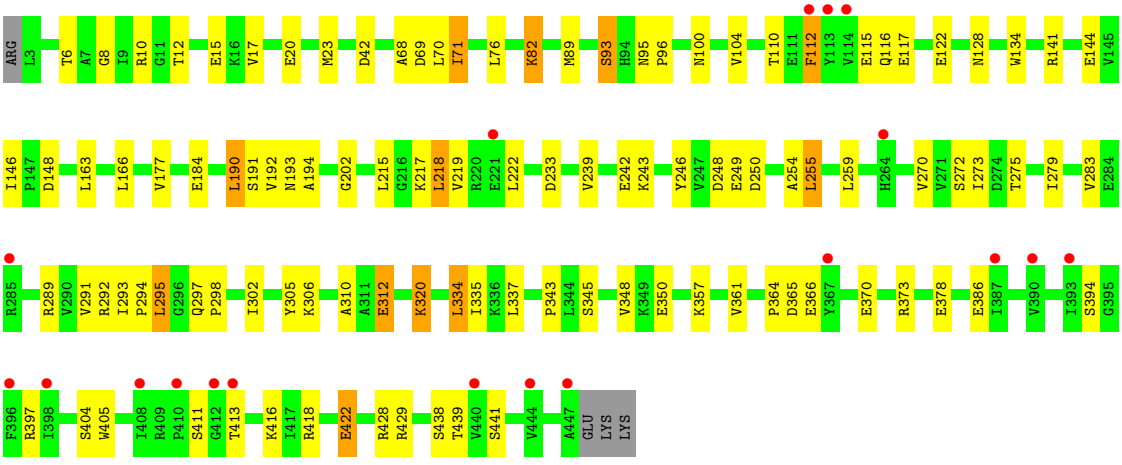




• Molecule 1: Phosphopentomutase

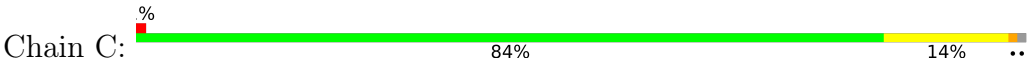
Chain B:

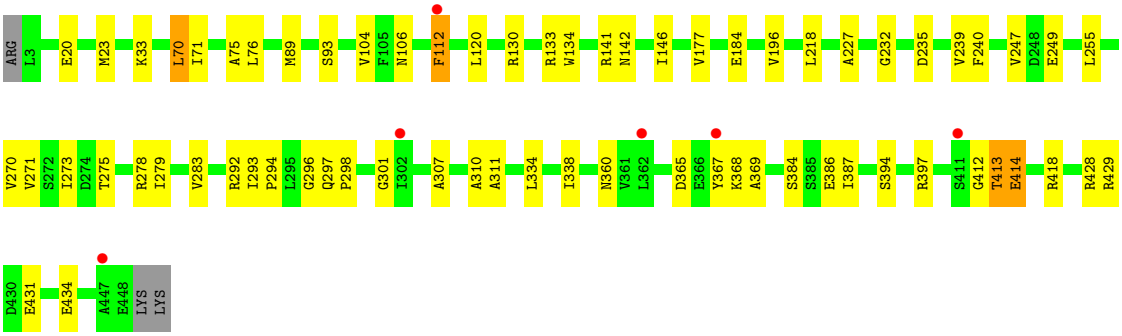




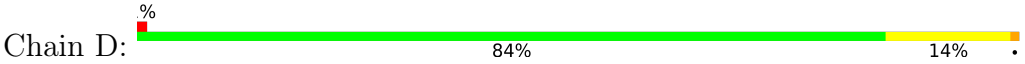
• Molecule 1: Phosphopentomutase

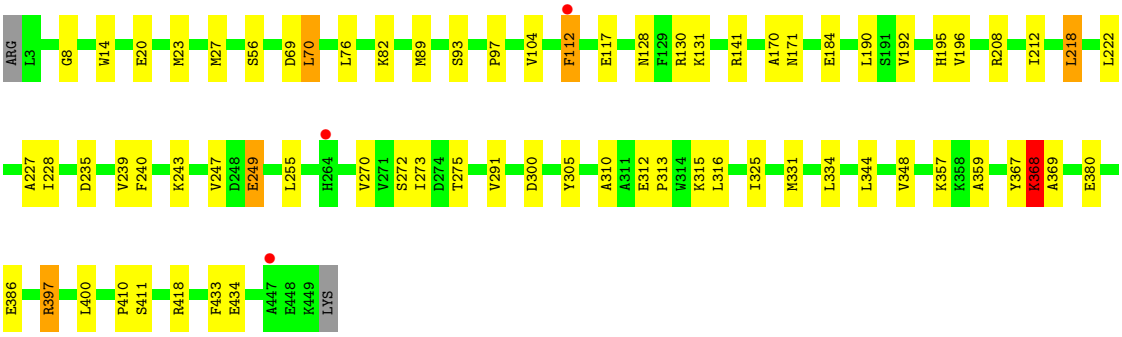
Chain C:





• Molecule 1: Phosphopentomutase





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	79.77Å 97.58Å 128.15Å 90.00° 94.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.39 50.00 – 2.39	Depositor EDS
% Data completeness (in resolution range)	99.0 (50.00-2.39) 99.0 (50.00-2.39)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.52 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.201 , 0.274 0.207 , 0.271	Depositor DCC
R_{free} test set	2311 reflections (3.00%)	wwPDB-VP
Wilson B-factor (Å^2)	44.0	Xtriage
Anisotropy	0.175	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 33.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14297	wwPDB-VP
Average B, all atoms (Å^2)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 68.03 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.6712e-06. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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: 7PE, 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	A	0.76	0/3513	0.92	2/4761 (0.0%)
1	B	0.76	0/3521	0.92	2/4772 (0.0%)
1	C	0.79	0/3533	0.96	3/4787 (0.1%)
1	D	0.78	1/3547 (0.0%)	0.95	0/4804
All	All	0.77	1/14114 (0.0%)	0.94	7/19124 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	56	SER	CA-CB	-5.50	1.44	1.52

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	130	ARG	NE-CZ-NH2	-7.04	116.78	120.30
1	C	130	ARG	NE-CZ-NH1	6.18	123.39	120.30
1	B	141	ARG	NE-CZ-NH2	-6.08	117.26	120.30
1	C	278	ARG	CB-CA-C	5.75	121.89	110.40
1	B	116	GLN	CB-CA-C	5.45	121.30	110.40
1	A	44	ARG	NE-CZ-NH2	-5.23	117.69	120.30
1	A	235	ASP	CB-CA-C	5.08	120.56	110.40

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	82	LYS	Peptide

5.2 Too-close contacts (i)

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	3444	0	3491	45	0
1	B	3449	0	3502	63	0
1	C	3461	0	3510	50	0
1	D	3472	0	3528	44	0
2	A	21	0	30	2	0
2	B	21	0	30	3	0
3	D	6	0	8	0	0
4	A	107	0	0	3	0
4	B	91	0	0	1	0
4	C	109	0	0	5	0
4	D	116	0	0	0	0
All	All	14297	0	14099	183	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 7.

All (183) 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:69:ASP:HB2	2:B:501:7PE:H52	1.65	0.78
1:B:242:GLU:OE1	1:B:343:PRO:HB3	1.85	0.76
1:A:368:LYS:NZ	1:A:414:GLU:O	2.19	0.76
1:B:76:LEU:HD22	1:B:89:MET:HB2	1.68	0.76
1:D:270:VAL:O	1:D:310:ALA:HA	1.88	0.74
1:B:259[A]:LEU:CD1	1:B:337:LEU:HD13	2.18	0.73
1:C:112:PHE:HE2	1:C:120:LEU:HD11	1.53	0.73
1:D:104:VAL:HB	1:D:112:PHE:HD2	1.54	0.72
1:C:112:PHE:CE2	1:C:120:LEU:HD11	2.26	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:227:ALA:HB3	1:D:240:PHE:HB2	1.74	0.69
1:C:76:LEU:HD22	1:C:89:MET:HB2	1.78	0.66
1:B:270:VAL:O	1:B:310:ALA:HA	1.95	0.65
1:A:112:PHE:O	1:A:112:PHE:HD1	1.80	0.64
1:D:112:PHE:CE1	1:D:117:GLU:OE1	2.51	0.64
1:B:95:ASN:HB3	1:B:96:PRO:HD2	1.80	0.64
1:A:149:TYR:HH	1:A:328:PHE:HD2	1.46	0.62
1:D:27[A]:MET:HE3	1:D:131:LYS:HE2	1.80	0.62
1:A:386:GLU:O	1:A:401:ASN:ND2	2.23	0.62
1:A:20:GLU:HG3	1:C:23:MET:CE	2.30	0.61
1:A:270:VAL:O	1:A:310:ALA:HA	2.00	0.61
1:C:104:VAL:HG11	1:C:112:PHE:CE2	2.35	0.61
1:B:259[A]:LEU:HD11	1:B:337:LEU:HD13	1.83	0.61
1:C:270:VAL:O	1:C:310:ALA:HA	2.01	0.60
1:C:273:ILE:HD11	4:C:556:HOH:O	2.02	0.59
1:B:259[A]:LEU:HD13	1:B:337:LEU:HD13	1.84	0.59
1:B:163:LEU:HD12	1:B:335:ILE:HG23	1.85	0.59
1:A:111:GLU:OE2	1:A:112:PHE:CZ	2.56	0.58
2:B:501:7PE:C15	1:C:142:ASN:HB3	2.33	0.58
1:B:190:LEU:HG	1:B:222:LEU:HD13	1.85	0.58
1:B:279:ILE:O	1:B:283:VAL:HG23	2.04	0.58
1:B:275:THR:O	1:B:292:ARG:NH2	2.37	0.57
1:B:112:PHE:HD1	1:B:112:PHE:O	1.87	0.57
1:B:242:GLU:OE1	1:B:343:PRO:CB	2.52	0.57
1:C:239:VAL:HG22	1:C:247:VAL:HB	1.85	0.57
1:B:215:LEU:O	1:B:219:VAL:HG23	2.05	0.57
1:B:259[A]:LEU:HD11	1:B:337:LEU:CD1	2.36	0.56
1:C:386:GLU:OE2	1:C:428:ARG:NH2	2.39	0.56
1:D:104:VAL:H	1:D:112:PHE:HE2	1.53	0.56
1:D:76:LEU:HG	1:D:76:LEU:O	2.05	0.56
1:B:386:GLU:OE2	1:B:428:ARG:NH2	2.39	0.56
1:D:112:PHE:O	1:D:112:PHE:HD1	1.90	0.55
1:A:409:ARG:NH2	4:A:602:HOH:O	2.37	0.55
1:A:270:VAL:HG11	1:A:301:GLY:HA3	1.89	0.55
2:B:501:7PE:H151	1:C:142:ASN:HB3	1.88	0.55
1:D:8:GLY:HA2	1:D:112:PHE:CZ	2.42	0.55
1:A:432:LEU:HA	4:A:651:HOH:O	2.06	0.55
1:A:20:GLU:HG3	1:C:23:MET:HE1	1.89	0.54
1:B:250:ASP:O	1:B:254:ALA:N	2.36	0.54
1:A:20:GLU:HA	1:C:23:MET:HE1	1.89	0.54
1:A:144:GLU:OE2	1:D:141:ARG:HD2	2.07	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:272:SER:HB2	1:B:295:LEU:HD13	1.90	0.53
1:B:68:ALA:O	1:B:71:ILE:HD13	2.09	0.53
1:A:249:GLU:HG3	1:A:313:PRO:HB3	1.90	0.53
1:A:218:LEU:HD21	1:B:218:LEU:HD21	1.91	0.53
1:B:357:LYS:HB2	1:B:429:ARG:HD3	1.91	0.53
1:D:344:LEU:O	1:D:348:VAL:HG13	2.09	0.52
1:A:32:TYR:CE1	1:A:116:GLN:HG3	2.45	0.52
1:B:23:MET:HE1	1:D:20:GLU:HA	1.91	0.52
1:C:412:GLY:O	1:C:413:THR:HG23	2.10	0.52
1:D:386:GLU:O	1:D:400:LEU:HA	2.09	0.52
1:C:33:LYS:NZ	1:C:106:ASN:OD1	2.41	0.52
1:B:144:GLU:OE2	1:C:141:ARG:HD2	2.10	0.51
1:A:384:SER:HA	1:A:387:ILE:HG12	1.92	0.51
1:D:249:GLU:HG3	1:D:313:PRO:HB3	1.91	0.51
1:A:112:PHE:CD1	1:A:117:GLU:OE1	2.64	0.51
1:B:93:SER:HA	1:B:233:ASP:OD1	2.10	0.51
1:D:76:LEU:HD22	1:D:89:MET:HB2	1.93	0.51
1:A:23:MET:HE1	1:C:20:GLU:HA	1.92	0.51
1:B:104:VAL:HB	1:B:112:PHE:CD2	2.46	0.51
1:D:228:ILE:HD13	1:D:331:MET:HB2	1.93	0.51
1:D:70:LEU:HD21	1:D:196:VAL:HG11	1.93	0.50
1:B:110:THR:HB	1:B:297:GLN:HE22	1.76	0.50
1:C:227:ALA:HB3	1:C:240:PHE:HB2	1.93	0.50
1:B:8:GLY:HA2	1:B:112:PHE:HZ	1.77	0.50
1:B:259[A]:LEU:HD21	1:B:337:LEU:HD11	1.94	0.50
1:C:71:ILE:HG12	1:C:75:ALA:HB3	1.92	0.50
1:C:296:GLY:C	1:C:298:PRO:HD3	2.31	0.49
1:B:273:ILE:HD13	1:B:394:SER:HB3	1.94	0.49
1:A:363:CYS:SG	1:A:367:TYR:O	2.71	0.49
1:B:134:TRP:CZ3	1:D:97:PRO:HB2	2.48	0.49
1:C:146:ILE:HG23	1:C:177:VAL:HG22	1.93	0.49
1:A:384:SER:HA	1:A:387:ILE:CG1	2.43	0.49
1:D:8:GLY:HA2	1:D:112:PHE:HZ	1.77	0.49
1:B:8:GLY:HA2	1:B:112:PHE:CZ	2.47	0.48
1:A:272:SER:HB2	1:A:295:LEU:HD13	1.96	0.48
1:B:246:TYR:CE2	1:B:248:ASP:HA	2.48	0.48
1:A:112:PHE:O	1:A:112:PHE:CD1	2.63	0.48
1:B:364:PRO:C	1:B:366:GLU:H	2.16	0.48
1:A:23:MET:CE	1:C:20:GLU:HG3	2.44	0.48
1:B:293:ILE:HB	1:B:294:PRO:HD2	1.96	0.48
1:D:112:PHE:O	1:D:112:PHE:CD1	2.65	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:297:GLN:N	1:C:298:PRO:HD3	2.29	0.48
1:D:190:LEU:C	1:D:190:LEU:HD23	2.34	0.48
1:A:218:LEU:HD23	1:A:222:LEU:HD11	1.95	0.47
1:A:20:GLU:HG3	1:C:23:MET:HE3	1.96	0.47
1:A:221:GLU:OE2	1:B:217:LYS:HD3	2.15	0.47
1:A:279:ILE:O	1:A:283:VAL:HG23	2.14	0.47
1:B:17:VAL:HG21	1:B:100:ASN:O	2.15	0.47
1:A:142:ASN:HB3	2:A:501:7PE:H82	1.96	0.47
1:B:104:VAL:HB	1:B:112:PHE:HD2	1.78	0.47
1:C:271:VAL:HA	1:C:311:ALA:O	2.15	0.47
1:C:232:GLY:HA3	4:C:506:HOH:O	2.15	0.46
1:D:316:LEU:HD12	1:D:316:LEU:N	2.30	0.46
1:C:273:ILE:O	1:C:397:ARG:HD2	2.15	0.46
1:C:279:ILE:O	1:C:283:VAL:HG23	2.15	0.46
1:D:112:PHE:CD1	1:D:117:GLU:OE1	2.69	0.46
1:C:270:VAL:HG11	1:C:301:GLY:HA3	1.97	0.46
1:C:384:SER:HA	1:C:387:ILE:HD12	1.97	0.46
1:B:166:LEU:HD21	1:B:215:LEU:HD22	1.98	0.45
1:C:76:LEU:O	1:C:76:LEU:HG	2.15	0.45
1:D:368:LYS:CD	1:D:410:PRO:HB2	2.46	0.45
1:A:164:LYS:HB3	1:A:224:VAL:HA	1.98	0.45
1:C:367:TYR:O	1:C:369:ALA:N	2.50	0.45
1:A:152:ALA:O	4:A:601:HOH:O	2.21	0.45
1:A:23:MET:HE3	1:C:20:GLU:HG3	1.99	0.45
1:A:276:GLY:HA2	1:A:405:TRP:CZ2	2.52	0.45
1:B:438:SER:HA	1:B:441:SER:HB2	1.98	0.45
1:C:273:ILE:CD1	4:C:556:HOH:O	2.64	0.45
1:C:273:ILE:CD1	1:C:394:SER:O	2.64	0.45
1:D:190:LEU:HD13	1:D:222:LEU:HD13	1.98	0.45
1:B:20:GLU:HA	1:D:23[A]:MET:HE1	1.98	0.45
1:A:273:ILE:HD13	1:A:394:SER:HB3	1.98	0.44
1:A:376:ALA:O	1:A:380:GLU:HB2	2.17	0.44
1:C:104:VAL:CG1	1:C:112:PHE:CE2	3.00	0.44
1:B:112:PHE:CD1	1:B:117:GLU:OE1	2.70	0.44
1:C:218:LEU:HD22	1:D:218:LEU:HD22	1.98	0.44
1:A:273:ILE:O	1:A:397:ARG:HD2	2.17	0.44
1:A:298:PRO:HB2	1:A:317:VAL:HG21	1.98	0.44
1:B:293:ILE:HB	1:B:294:PRO:CD	2.48	0.44
1:B:112:PHE:CD1	1:B:112:PHE:N	2.83	0.44
1:B:146:ILE:HG23	1:B:177:VAL:HG22	1.98	0.44
1:A:76:LEU:HD22	1:A:89:MET:HB2	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:404:SER:OG	1:A:423:ALA:HA	2.18	0.43
1:B:345:SER:HA	1:B:348:VAL:HG22	2.00	0.43
1:D:357:LYS:HE2	1:D:433:PHE:CE2	2.53	0.43
1:A:404:SER:OG	1:A:423:ALA:CB	2.66	0.43
1:D:368:LYS:HD2	1:D:410:PRO:HB2	1.98	0.43
1:C:292:ARG:NE	1:C:397:ARG:NH1	2.66	0.43
1:B:191:SER:HB2	1:B:194:ALA:CB	2.49	0.43
1:D:272:SER:OG	1:D:275:THR:HG23	2.18	0.43
1:D:239:VAL:HG22	1:D:247:VAL:HB	1.99	0.43
1:C:23:MET:HE2	4:C:576:HOH:O	2.19	0.43
1:B:378:GLU:OE1	1:B:439:THR:HG23	2.19	0.43
1:A:175:SER:HB3	1:A:194:ALA:O	2.19	0.42
1:B:23:MET:CE	1:D:20:GLU:HG3	2.49	0.42
1:B:255:LEU:HD12	1:B:255:LEU:HA	1.95	0.42
1:D:315:LYS:HD3	1:D:325:ILE:HD13	2.01	0.42
2:A:501:7PE:H181	1:D:69:ASP:HB2	2.00	0.42
1:C:106:ASN:OD1	1:C:112:PHE:CE1	2.72	0.42
1:C:334:LEU:O	1:C:338:ILE:HG13	2.19	0.42
1:A:365:ASP:HA	1:A:368:LYS:CE	2.49	0.42
1:D:315:LYS:HB3	1:D:325:ILE:HG21	2.01	0.42
1:B:20:GLU:HG3	1:D:23[A]:MET:CE	2.50	0.42
1:D:170:ALA:O	1:D:171:ASN:HB2	2.20	0.42
1:B:42:ASP:OD1	1:B:42:ASP:C	2.58	0.42
1:B:272:SER:OG	1:B:275:THR:HG23	2.20	0.42
1:D:195:HIS:O	1:D:195:HIS:CG	2.73	0.42
1:A:316:LEU:N	1:A:316:LEU:HD12	2.35	0.42
1:B:370:GLU:HA	1:B:373:ARG:NH1	2.35	0.42
1:D:208:ARG:O	1:D:212:ILE:HG12	2.19	0.42
1:B:411:SER:OG	1:B:418:ARG:NH1	2.53	0.41
1:C:218:LEU:HD13	1:D:218:LEU:CD1	2.50	0.41
1:C:293:ILE:HB	1:C:294:PRO:HD2	2.01	0.41
1:A:8:GLY:HA2	1:A:112:PHE:CZ	2.55	0.41
1:B:148:ASP:CG	1:C:141:ARG:HH22	2.24	0.41
1:C:70:LEU:HD21	1:C:196:VAL:HG11	2.03	0.41
1:C:413:THR:O	1:C:414:GLU:HB2	2.20	0.41
1:D:367:TYR:O	1:D:369:ALA:N	2.53	0.41
1:D:291:VAL:HG11	1:D:305:TYR:CZ	2.56	0.41
1:C:270:VAL:HG23	1:C:307:ALA:HB2	2.02	0.41
1:C:397:ARG:NH2	4:C:501:HOH:O	2.47	0.41
1:B:298:PRO:HG3	1:B:312:GLU:HG2	2.02	0.41
1:C:360:ASN:OD1	1:C:418:ARG:HG3	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:273:ILE:O	1:D:397:ARG:HD2	2.19	0.41
1:B:291:VAL:HG11	1:B:305:TYR:CZ	2.56	0.41
1:B:320:LYS:HB2	4:B:629:HOH:O	2.21	0.41
1:B:334:LEU:HD23	1:B:334:LEU:HA	1.90	0.41
1:D:27[A]:MET:CE	1:D:131:LYS:HE2	2.49	0.41
1:C:133:ARG:O	1:C:134:TRP:C	2.60	0.41
1:A:146:ILE:HB	1:A:147:PRO:HD3	2.03	0.40
1:B:193:ASN:OD1	1:B:202:GLY:HA3	2.22	0.40
1:B:397:ARG:NH1	1:B:405:TRP:CE3	2.90	0.40
1:B:404:SER:HA	1:B:422:GLU:O	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	A	443/449 (99%)	407 (92%)	28 (6%)	8 (2%)	7	9
1	B	444/449 (99%)	412 (93%)	27 (6%)	5 (1%)	12	18
1	C	445/449 (99%)	419 (94%)	22 (5%)	4 (1%)	14	22
1	D	447/449 (100%)	423 (95%)	20 (4%)	4 (1%)	14	22
All	All	1779/1796 (99%)	1661 (93%)	97 (6%)	21 (1%)	11	16

All (21) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	387	ILE
1	C	368	LYS
1	C	414	GLU
1	D	368	LYS
1	A	93	SER

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Mol	Chain	Res	Type
1	B	93	SER
1	B	306	LYS
1	A	226	LEU
1	B	15	GLU
1	C	93	SER
1	D	93	SER
1	A	203	ARG
1	C	413	THR
1	D	14	TRP
1	D	359	ALA
1	A	112	PHE
1	A	429	ARG
1	A	441	SER
1	A	14	TRP
1	B	350	GLU
1	B	365	ASP

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	364/368 (99%)	346 (95%)	18 (5%)	21	36
1	B	365/368 (99%)	337 (92%)	28 (8%)	10	17
1	C	366/368 (100%)	355 (97%)	11 (3%)	36	57
1	D	368/368 (100%)	347 (94%)	21 (6%)	17	29
All	All	1463/1472 (99%)	1385 (95%)	78 (5%)	19	33

All (78) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	70	LEU
1	A	112	PHE
1	A	122	GLU
1	A	128	ASN
1	A	184	GLU

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Mol	Chain	Res	Type
1	A	192	VAL
1	A	218	LEU
1	A	221	GLU
1	A	239	VAL
1	A	249	GLU
1	A	255	LEU
1	A	259	LEU
1	A	295	LEU
1	A	334	LEU
1	A	380	GLU
1	A	385	SER
1	A	404	SER
1	A	430	ASP
1	B	6	THR
1	B	10	ARG
1	B	12	THR
1	B	70	LEU
1	B	71	ILE
1	B	82	LYS
1	B	112	PHE
1	B	115	GLU
1	B	122	GLU
1	B	128	ASN
1	B	184	GLU
1	B	190	LEU
1	B	192	VAL
1	B	218	LEU
1	B	239	VAL
1	B	243	LYS
1	B	249	GLU
1	B	255	LEU
1	B	289	ARG
1	B	295	LEU
1	B	302	ILE
1	B	312	GLU
1	B	320	LYS
1	B	334	LEU
1	B	361	VAL
1	B	413	THR
1	B	416	LYS
1	B	422	GLU
1	C	70	LEU

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Mol	Chain	Res	Type
1	C	112	PHE
1	C	184	GLU
1	C	235	ASP
1	C	249	GLU
1	C	255	LEU
1	C	275	THR
1	C	365	ASP
1	C	429	ARG
1	C	431	GLU
1	C	434	GLU
1	D	70	LEU
1	D	82	LYS
1	D	112	PHE
1	D	128	ASN
1	D	130	ARG
1	D	184	GLU
1	D	192	VAL
1	D	218	LEU
1	D	235	ASP
1	D	243	LYS
1	D	249	GLU
1	D	255	LEU
1	D	300	ASP
1	D	312	GLU
1	D	334	LEU
1	D	368	LYS
1	D	380	GLU
1	D	397	ARG
1	D	411	SER
1	D	418	ARG
1	D	434	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	106	ASN
1	A	116	GLN
1	A	299	HIS
1	B	297	GLN
1	B	341	ASN
1	D	52	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

3 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	$\#\|Z\| > 2$
2	7PE	B	501	-	20,20,20	0.36	0	19,19,19	0.35	0
3	GOL	D	501	-	5,5,5	0.26	0	5,5,5	0.42	0
2	7PE	A	501	-	20,20,20	0.39	0	19,19,19	0.31	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
2	7PE	B	501	-	-	11/18/18/18	-
3	GOL	D	501	-	-	4/4/4/4	-
2	7PE	A	501	-	-	11/18/18/18	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	501	7PE	O10-C11-C12-O13
2	B	501	7PE	O4-C5-C6-O7
2	A	501	7PE	C2-C3-O4-C5
2	A	501	7PE	O13-C14-C15-O16
2	B	501	7PE	O13-C14-C15-O16
2	B	501	7PE	O16-C17-C18-O19
2	B	501	7PE	O7-C8-C9-O10
2	B	501	7PE	C15-C14-O13-C12
2	A	501	7PE	O4-C5-C6-O7
2	B	501	7PE	C21-C20-O19-C18
3	D	501	GOL	O1-C1-C2-C3
3	D	501	GOL	C1-C2-C3-O3
2	A	501	7PE	O16-C17-C18-O19
2	A	501	7PE	O1-C2-C3-O4
2	A	501	7PE	O7-C8-C9-O10
3	D	501	GOL	O2-C2-C3-O3
2	A	501	7PE	C5-C6-O7-C8
2	B	501	7PE	C18-C17-O16-C15
2	A	501	7PE	C8-C9-O10-C11
2	A	501	7PE	C15-C14-O13-C12
2	A	501	7PE	C9-C8-O7-C6
2	A	501	7PE	C17-C18-O19-C20
2	B	501	7PE	C11-C12-O13-C14
2	B	501	7PE	C2-C3-O4-C5
2	B	501	7PE	C6-C5-O4-C3
3	D	501	GOL	O1-C1-C2-O2

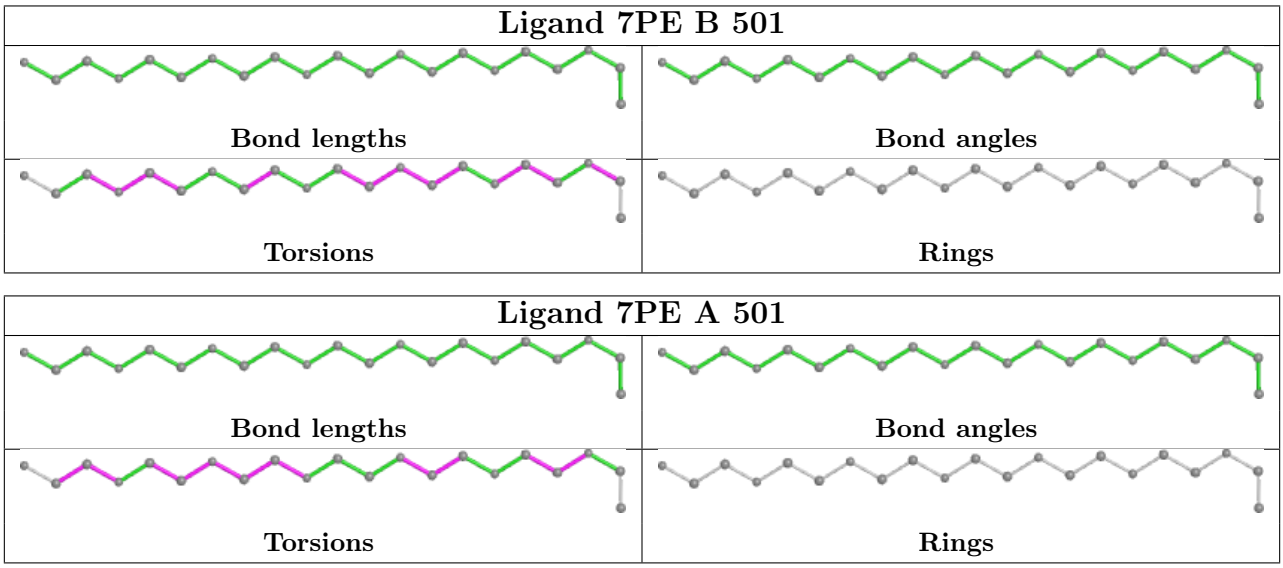
There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	501	7PE	3	0
2	A	501	7PE	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 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.



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	A	445/449 (99%)	0.20	22 (4%)	36	33	24, 52, 111, 148	0
1	B	445/449 (99%)	0.24	19 (4%)	40	38	23, 52, 104, 138	1 (0%)
1	C	446/449 (99%)	-0.14	6 (1%)	74	71	21, 41, 90, 129	1 (0%)
1	D	447/449 (99%)	-0.13	3 (0%)	84	81	20, 41, 92, 126	2 (0%)
All	All	1783/1796 (99%)	0.04	50 (2%)	55	51	20, 45, 103, 148	4 (0%)

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	112	PHE	5.5
1	D	112	PHE	3.9
1	A	375	ALA	3.7
1	B	447	ALA	3.5
1	A	447	ALA	3.4
1	B	367	TYR	3.4
1	B	112	PHE	3.4
1	A	383	LEU	3.3
1	B	221	GLU	3.3
1	D	264	HIS	3.1
1	A	396	PHE	3.1
1	A	112	PHE	3.1
1	B	264	HIS	3.0
1	A	440	VAL	2.9
1	B	413	THR	2.9
1	A	444	VAL	2.8
1	C	302	ILE	2.8
1	A	369	ALA	2.8
1	A	393	ILE	2.8
1	C	447	ALA	2.8
1	A	406	ILE	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	385	SER	2.6
1	B	113	TYR	2.6
1	A	376	ALA	2.6
1	B	412	GLY	2.5
1	C	367	TYR	2.5
1	B	408	ILE	2.5
1	D	447	ALA	2.5
1	A	417	ILE	2.4
1	A	438	SER	2.4
1	C	362	LEU	2.4
1	A	424	PRO	2.4
1	A	387	ILE	2.4
1	B	393	ILE	2.4
1	B	398	ILE	2.4
1	B	440	VAL	2.4
1	B	285	ARG	2.3
1	A	413	THR	2.3
1	B	410	PRO	2.3
1	B	444	VAL	2.2
1	A	381	ARG	2.2
1	B	114	VAL	2.2
1	B	390	VAL	2.2
1	C	411	SER	2.1
1	A	399	ALA	2.1
1	B	387	ILE	2.1
1	B	396	PHE	2.1
1	A	283	VAL	2.0
1	A	379	VAL	2.0
1	A	259	LEU	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)

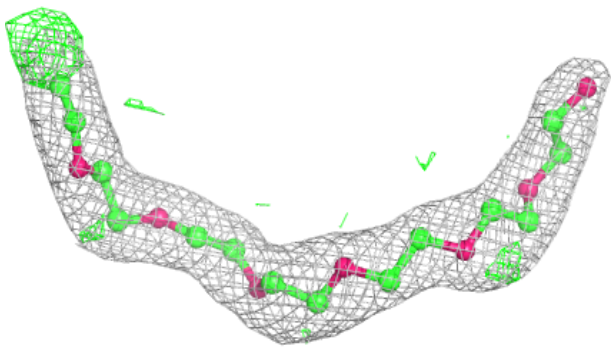
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

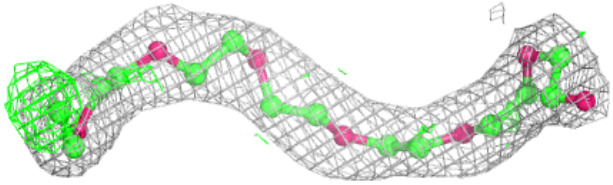
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	GOL	D	501	6/6	0.79	0.14	43,62,70,70	0
2	7PE	B	501	21/21	0.89	0.13	41,48,53,56	0
2	7PE	A	501	21/21	0.91	0.13	47,55,59,61	0

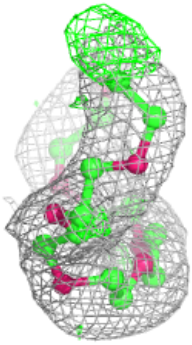
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around 7PE B 501:

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

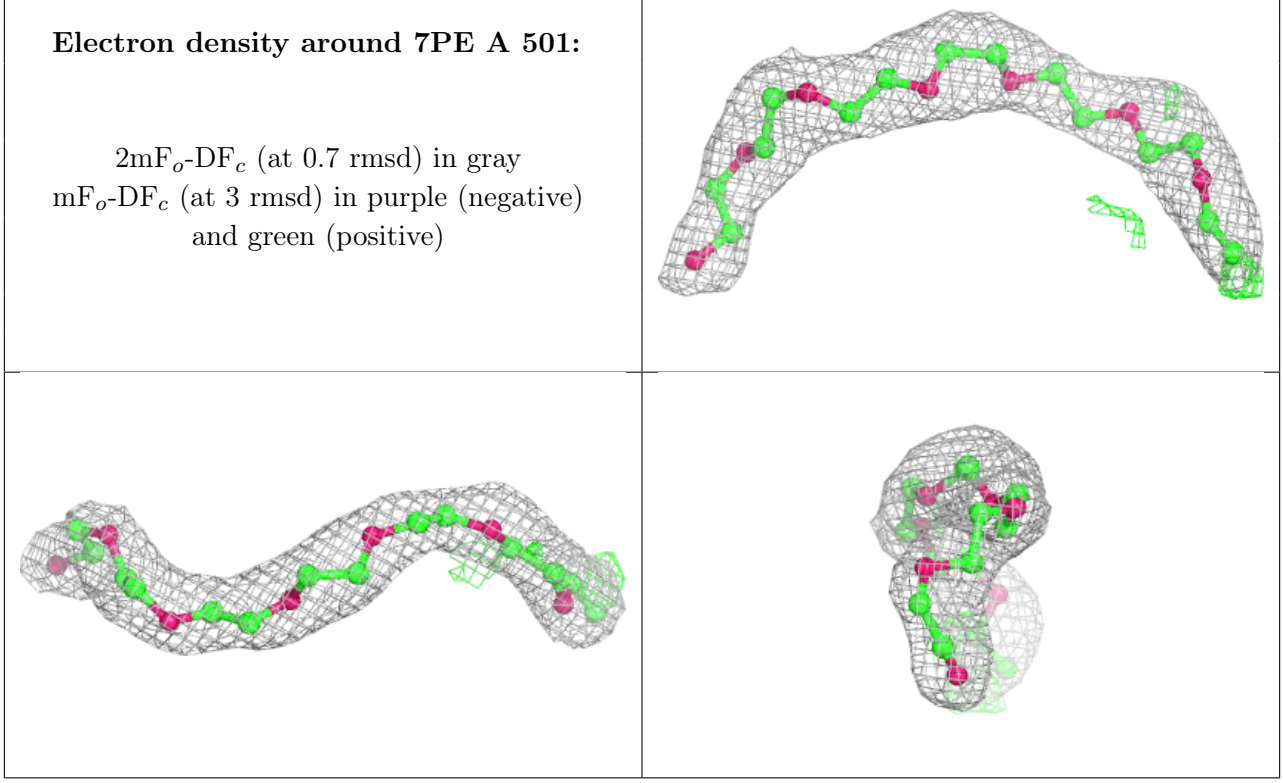






Electron density around 7PE A 501:

$2mF_o$-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.