Full wwPDB X-ray Structure Validation Report (i)

Oct 17, 2021 – 07:40 AM EDT

PDB ID	:	1LW3
Title	:	Crystal Structure of Myotubularin-related protein 2 complexed with phosphate
Authors	:	Begley, M.J.; Taylor, G.S.; Kim, S.-A.; Veine, D.M.; Dixon, J.E.; Stuckey, J.A.
Deposited on	:	2002-05-30
Resolution	:	2.30 Å(reported)

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

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

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

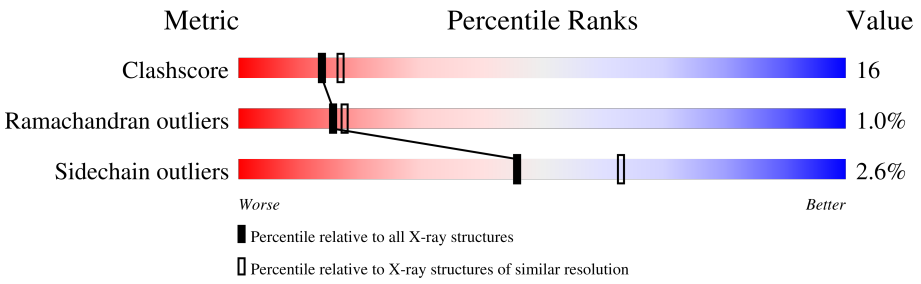
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 2.30 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	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)

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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	657	54% 23% • 22%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 4478 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.

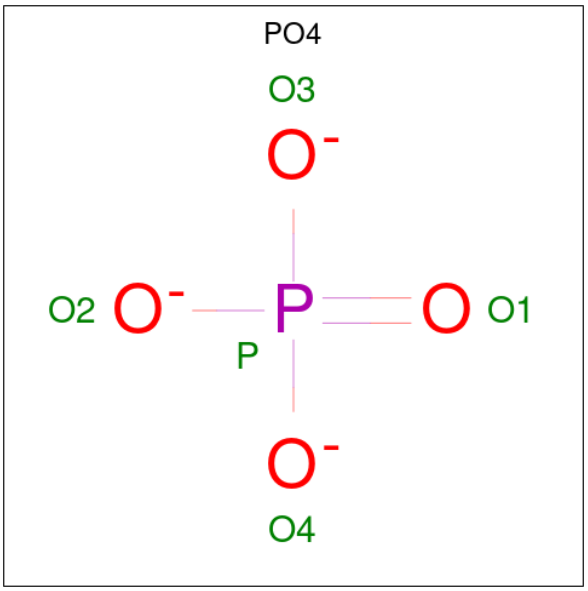
- Molecule 1 is a protein called Myotubularin-related protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	513	4189	2679	729	764	17	0	0	0

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	MET	-	cloning artifact	UNP Q13614
A	-1	ALA	-	cloning artifact	UNP Q13614
A	0	SER	-	cloning artifact	UNP Q13614
A	417	SER	CYS	engineered mutation	UNP Q13614
A	644	ALA	-	expression tag	UNP Q13614
A	645	ALA	-	expression tag	UNP Q13614
A	646	ALA	-	expression tag	UNP Q13614
A	647	LEU	-	expression tag	UNP Q13614
A	648	GLU	-	expression tag	UNP Q13614
A	649	HIS	-	expression tag	UNP Q13614
A	650	HIS	-	expression tag	UNP Q13614
A	651	HIS	-	expression tag	UNP Q13614
A	652	HIS	-	expression tag	UNP Q13614
A	653	HIS	-	expression tag	UNP Q13614
A	654	HIS	-	expression tag	UNP Q13614

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O P 5 4 1	0	0
2	A	1	Total O P 5 4 1	0	0
2	A	1	Total O P 5 4 1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	274	Total O 274 274	0	0

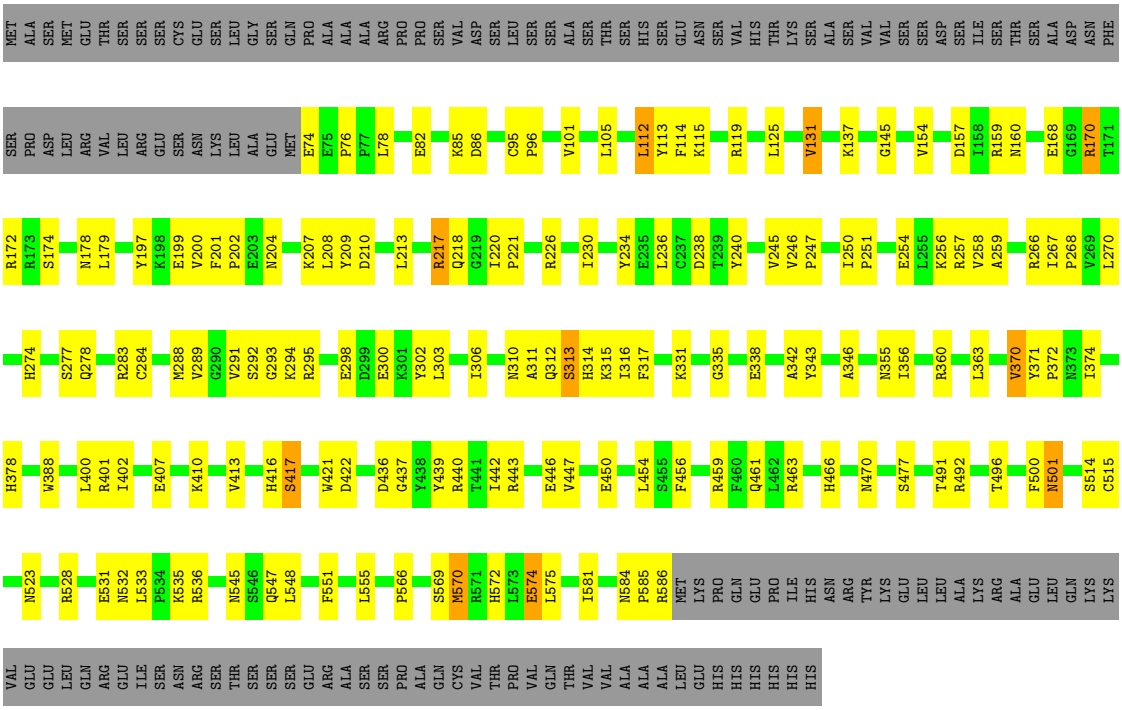
3 Residue-property plots (i)

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. 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. 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.

Note EDS was not executed.

• Molecule 1: Myotubularin-related protein 2

Chain A: 54% 23% • 22%



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	66.08Å 66.08Å 261.41Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.30	Depositor
% Data completeness (in resolution range)	89.2 (8.00-2.30)	Depositor
R_{merge}	0.02	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.209 , 0.273	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4478	wwPDB-VP
Average B, all atoms (Å^2)	45.0	wwPDB-VP

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: PO4

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	0.54	1/4300 (0.0%)	0.58	1/5829 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	417	SER	CB-OG	27.75	1.78	1.42

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	112	LEU	N-CA-C	-5.30	96.68	111.00

There are no chirality outliers.

There are no planarity outliers.

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	4189	0	4113	132	0
2	A	15	0	0	1	0
3	A	274	0	0	18	1
All	All	4478	0	4113	132	1

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 16.

All (132) 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:A:417:SER:OG	1:A:417:SER:CB	1.78	1.32
1:A:74:GLU:HB2	1:A:115:LYS:HD3	1.36	1.04
1:A:461:GLN:HE22	1:A:466:HIS:HB2	1.27	0.98
1:A:461:GLN:NE2	1:A:466:HIS:HB2	1.81	0.96
1:A:105:LEU:HD11	1:A:112:LEU:HD11	1.54	0.90
1:A:274:HIS:HD2	1:A:277:SER:H	1.29	0.80
1:A:437:GLY:HA2	1:A:440:ARG:NH1	1.97	0.79
1:A:496:THR:HG22	1:A:555:LEU:HB3	1.68	0.76
1:A:251:PRO:HG2	1:A:254:GLU:HB2	1.67	0.74
1:A:442:ILE:O	1:A:446:GLU:HG3	1.90	0.71
1:A:288:MET:O	1:A:294:LYS:HE3	1.89	0.71
1:A:402:ILE:HG23	1:A:413:VAL:HG21	1.74	0.69
1:A:289:VAL:O	1:A:294:LYS:HG2	1.92	0.69
1:A:532:ASN:ND2	1:A:535:LYS:HB2	2.08	0.69
1:A:247:PRO:HB2	1:A:250:ILE:HG12	1.76	0.68
1:A:295:ARG:HD2	1:A:300:GLU:OE2	1.93	0.67
1:A:199:GLU:HG2	1:A:201:PHE:CE1	2.30	0.66
1:A:443:ARG:O	1:A:447:VAL:HG23	1.96	0.65
1:A:311:ALA:HB3	1:A:312:GLN:NE2	2.12	0.64
1:A:217:ARG:HH12	1:A:218:GLN:HG3	1.63	0.64
1:A:257:ARG:HD2	3:A:1282:HOH:O	1.99	0.62
1:A:355:ASN:HB2	3:A:1200:HOH:O	1.99	0.62
1:A:310:ASN:HB3	3:A:1205:HOH:O	1.98	0.62
1:A:437:GLY:HA2	1:A:440:ARG:HH11	1.64	0.60
1:A:101:VAL:HG22	1:A:119:ARG:NH2	2.17	0.60
1:A:292:SER:O	1:A:294:LYS:N	2.33	0.59
1:A:569:SER:HB3	1:A:572:HIS:HD2	1.67	0.58
1:A:76:PRO:HB3	1:A:113:TYR:CD2	2.39	0.58
1:A:400:LEU:HD11	1:A:566:PRO:O	2.04	0.58
1:A:303:LEU:HD12	1:A:343:TYR:CD2	2.39	0.58
1:A:236:LEU:HD11	1:A:259:ALA:HB2	1.86	0.57
1:A:312:GLN:O	1:A:314:HIS:N	2.37	0.57
1:A:570:MET:CE	1:A:570:MET:HA	2.35	0.57
1:A:199:GLU:HG3	1:A:200:VAL:N	2.20	0.55
1:A:208:LEU:HD21	1:A:446:GLU:HB2	1.88	0.55
1:A:230:ILE:HD11	1:A:256:LYS:HE3	1.89	0.55
1:A:313:SER:HA	3:A:1205:HOH:O	2.06	0.55
1:A:131:VAL:HG21	1:A:157:ASP:CG	2.26	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:257:ARG:CB	1:A:298:GLU:HG2	2.36	0.55
1:A:277:SER:O	1:A:278:GLN:HB2	2.06	0.55
1:A:257:ARG:HB2	1:A:298:GLU:HG2	1.91	0.53
1:A:584:ASN:C	1:A:586:ARG:H	2.11	0.53
1:A:217:ARG:HB3	1:A:217:ARG:HH11	1.74	0.53
1:A:378:HIS:HE1	3:A:1185:HOH:O	1.93	0.52
1:A:295:ARG:HG2	3:A:1174:HOH:O	2.09	0.52
1:A:266:ARG:NH2	1:A:456:PHE:O	2.38	0.51
1:A:531:GLU:O	1:A:536:ARG:HD3	2.10	0.51
1:A:137:LYS:NZ	3:A:1210:HOH:O	2.43	0.51
1:A:545:ASN:HA	1:A:548:LEU:HD21	1.92	0.51
1:A:422:ASP:HB2	2:A:655:PO4:P	2.51	0.51
1:A:258:VAL:HG12	1:A:267:ILE:HG22	1.93	0.51
1:A:268:PRO:HA	1:A:283:ARG:O	2.10	0.51
1:A:501:ASN:ND2	1:A:501:ASN:H	2.08	0.50
1:A:245:VAL:HB	1:A:270:LEU:HB3	1.93	0.50
1:A:331:LYS:HA	1:A:335:GLY:O	2.12	0.50
1:A:78:LEU:HD22	1:A:82:GLU:HG2	1.93	0.50
1:A:247:PRO:HB2	1:A:250:ILE:CG1	2.40	0.50
1:A:168:GLU:O	1:A:170:ARG:HD3	2.11	0.50
1:A:295:ARG:HB3	1:A:300:GLU:OE2	2.11	0.50
1:A:291:VAL:HG13	3:A:1355:HOH:O	2.12	0.50
1:A:114:PHE:HB3	1:A:125:LEU:HB3	1.95	0.49
1:A:450:GLU:HA	1:A:454:LEU:HD12	1.95	0.49
1:A:76:PRO:HB3	1:A:113:TYR:CG	2.47	0.49
1:A:274:HIS:CD2	1:A:277:SER:H	2.20	0.48
1:A:246:VAL:HG12	1:A:302:TYR:OH	2.13	0.48
1:A:131:VAL:HG21	1:A:157:ASP:OD1	2.13	0.48
1:A:101:VAL:HG22	1:A:119:ARG:CZ	2.43	0.48
1:A:250:ILE:HG23	1:A:254:GLU:HG2	1.96	0.48
1:A:569:SER:HB3	1:A:572:HIS:CD2	2.47	0.48
1:A:338:GLU:HB3	1:A:343:TYR:CD1	2.49	0.48
1:A:360:ARG:NH1	3:A:1101:HOH:O	2.46	0.48
1:A:257:ARG:HD3	3:A:1382:HOH:O	2.14	0.48
1:A:356:ILE:HB	1:A:477:SER:CB	2.44	0.47
1:A:410:LYS:HE2	3:A:1289:HOH:O	2.14	0.47
1:A:470:ASN:HB2	3:A:1296:HOH:O	2.14	0.47
1:A:204:ASN:ND2	1:A:207:LYS:HG2	2.29	0.47
1:A:210:ASP:HB3	1:A:213:LEU:HB2	1.96	0.47
1:A:220:ILE:HG23	1:A:221:PRO:HA	1.96	0.47
1:A:514:SER:O	1:A:515:CYS:HB2	2.14	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:547:GLN:HG3	3:A:1363:HOH:O	2.14	0.47
1:A:157:ASP:HB3	1:A:159:ARG:HG2	1.96	0.47
1:A:199:GLU:HG2	1:A:201:PHE:CZ	2.49	0.46
1:A:316:ILE:O	1:A:346:ALA:HA	2.16	0.46
1:A:584:ASN:HB3	3:A:1306:HOH:O	2.16	0.46
1:A:295:ARG:HD3	1:A:342:ALA:HB2	1.96	0.46
1:A:306:ILE:HG22	1:A:316:ILE:HD11	1.97	0.46
1:A:360:ARG:NH1	3:A:1269:HOH:O	2.48	0.46
1:A:157:ASP:OD2	1:A:159:ARG:NH2	2.49	0.46
1:A:463:ARG:HG3	3:A:1005:HOH:O	2.15	0.46
1:A:209:TYR:CD1	1:A:447:VAL:HG13	2.51	0.45
1:A:317:PHE:O	1:A:413:VAL:HA	2.16	0.45
1:A:137:LYS:HD3	1:A:172:ARG:NH2	2.32	0.45
1:A:256:LYS:NZ	3:A:1371:HOH:O	2.50	0.45
1:A:492:ARG:HD2	1:A:574:GLU:OE1	2.17	0.45
1:A:168:GLU:CD	1:A:168:GLU:H	2.21	0.44
1:A:209:TYR:HD1	1:A:447:VAL:HG13	1.82	0.44
1:A:174:SER:O	1:A:178:ASN:ND2	2.50	0.44
1:A:112:LEU:HD13	1:A:179:LEU:HD21	1.99	0.44
1:A:459:ARG:NH1	1:A:523:ASN:HB3	2.32	0.44
1:A:436:ASP:HB3	1:A:439:TYR:CD1	2.53	0.43
1:A:217:ARG:NH1	1:A:218:GLN:HG3	2.33	0.43
1:A:343:TYR:CD1	1:A:343:TYR:N	2.87	0.43
1:A:277:SER:O	1:A:278:GLN:CB	2.66	0.43
1:A:85:LYS:O	1:A:86:ASP:HB2	2.19	0.43
1:A:268:PRO:HA	1:A:284:CYS:HB3	2.00	0.43
1:A:437:GLY:CA	1:A:440:ARG:NH1	2.75	0.43
1:A:442:ILE:HG12	1:A:500:PHE:HB3	2.00	0.43
1:A:338:GLU:OE1	1:A:416:HIS:HE1	2.01	0.42
1:A:95:CYS:HA	1:A:96:PRO:HD3	1.93	0.42
1:A:311:ALA:C	1:A:313:SER:H	2.22	0.42
1:A:461:GLN:HB3	1:A:523:ASN:OD1	2.20	0.42
1:A:197:TYR:CZ	1:A:199:GLU:HB3	2.55	0.42
1:A:208:LEU:HD12	1:A:443:ARG:HH21	1.83	0.42
1:A:168:GLU:O	1:A:170:ARG:NH1	2.47	0.42
1:A:501:ASN:H	1:A:501:ASN:HD22	1.67	0.42
1:A:528:ARG:CG	1:A:533:LEU:HD12	2.50	0.41
1:A:154:VAL:HA	1:A:160:ASN:OD1	2.19	0.41
1:A:370:VAL:HG22	1:A:581:ILE:HG12	2.02	0.41
1:A:501:ASN:HD21	1:A:551:PHE:HA	1.84	0.41
1:A:234:TYR:HB3	1:A:238:ASP:HA	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:226:ARG:HH11	1:A:226:ARG:HG2	1.86	0.41
1:A:371:TYR:CD1	1:A:372:PRO:HA	2.56	0.41
1:A:569:SER:CB	1:A:572:HIS:HD2	2.31	0.41
1:A:356:ILE:HB	1:A:477:SER:HB2	2.03	0.41
1:A:528:ARG:HG2	1:A:533:LEU:CD1	2.51	0.40
1:A:295:ARG:HD3	1:A:342:ALA:CB	2.52	0.40
1:A:374:ILE:HD11	1:A:581:ILE:HD13	2.03	0.40
1:A:363:LEU:HB2	1:A:388:TRP:CZ3	2.56	0.40
1:A:416:HIS:HD2	1:A:417:SER:O	2.04	0.40
1:A:585:PRO:HA	3:A:1364:HOH:O	2.21	0.40
1:A:105:LEU:HD11	1:A:112:LEU:CD1	2.37	0.40
1:A:407:GLU:O	1:A:410:LYS:HD3	2.22	0.40

All (1) 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)
3:A:1286:HOH:O	3:A:1286:HOH:O[8_775]	1.97	0.23

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	511/657 (78%)	470 (92%)	36 (7%)	5 (1%)	15 17

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	313	SER
1	A	293	GLY
1	A	315	LYS
1	A	202	PRO

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Mol	Chain	Res	Type
1	A	145	GLY

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	456/584 (78%)	444 (97%)	12 (3%)	46 63

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	131	VAL
1	A	170	ARG
1	A	217	ARG
1	A	240	TYR
1	A	370	VAL
1	A	401	ARG
1	A	421	TRP
1	A	491	THR
1	A	501	ASN
1	A	570	MET
1	A	574	GLU
1	A	575	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	189	ASN
1	A	204	ASN
1	A	274	HIS
1	A	312	GLN
1	A	416	HIS
1	A	461	GLN
1	A	501	ASN
1	A	532	ASN

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Mol	Chain	Res	Type
1	A	572	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

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	PO4	A	655	-	4,4,4	1.71	0	6,6,6	0.42	0
2	PO4	A	656	-	4,4,4	1.68	0	6,6,6	0.44	0
2	PO4	A	657	-	4,4,4	1.79	1 (25%)	6,6,6	0.44	0

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	657	PO4	P-O2	-2.10	1.48	1.54

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	655	PO4	1	0

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)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.