



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 7, 2023 – 10:41 AM EST

PDB ID : 5TON
Title : Crystal structure of AAT H143L mutant
Authors : Mueser, T.C.; Dajnowicz, S.; Kovalevsky, A.
Deposited on : 2016-10-18
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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

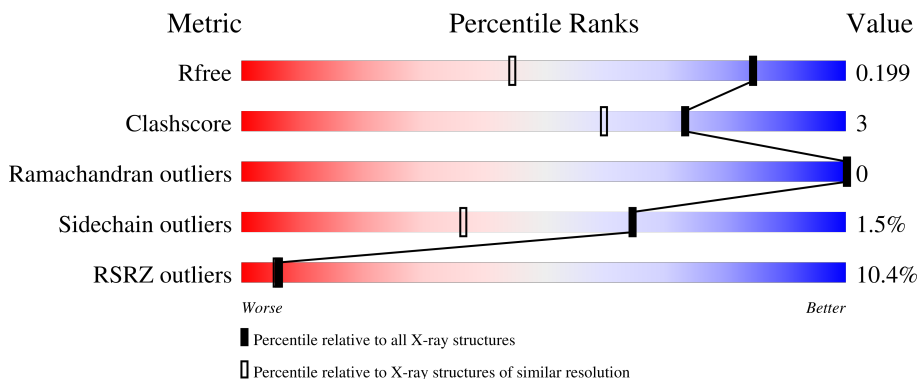
1 Overall quality at a glance

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))
R_{free}	130704	1714 (1.40-1.40)
Clashscore	141614	1812 (1.40-1.40)
Ramachandran outliers	138981	1763 (1.40-1.40)
Sidechain outliers	138945	1762 (1.40-1.40)
RSRZ outliers	127900	1674 (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 $\leq 5\%$. 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	414	 4% 94% 6%
1	B	414	 17% 87% 8% .

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 6996 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 Aspartate aminotransferase, cytoplasmic.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	P	S			
1	A	414	Total	C	N	O	P	S	0	6	0
			3342	2127	583	618	1	13			
1	B	396	Total	C	N	O	P	S	0	5	0
			3180	2023	553	588	1	15			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP P00503
A	63	ASN	ASP	conflict	UNP P00503
A	143	LEU	HIS	engineered mutation	UNP P00503
A	288	GLN	GLU	conflict	UNP P00503
A	376	GLN	GLU	conflict	UNP P00503
B	-1	GLY	-	expression tag	UNP P00503
B	63	ASN	ASP	conflict	UNP P00503
B	143	LEU	HIS	engineered mutation	UNP P00503
B	288	GLN	GLU	conflict	UNP P00503
B	376	GLN	GLU	conflict	UNP P00503

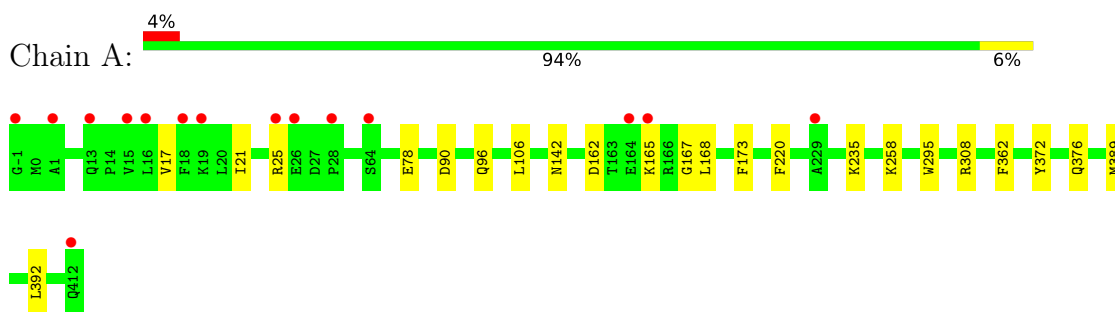
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	284	Total	O	0	0
			284	284		
2	B	190	Total	O	0	0
			190	190		

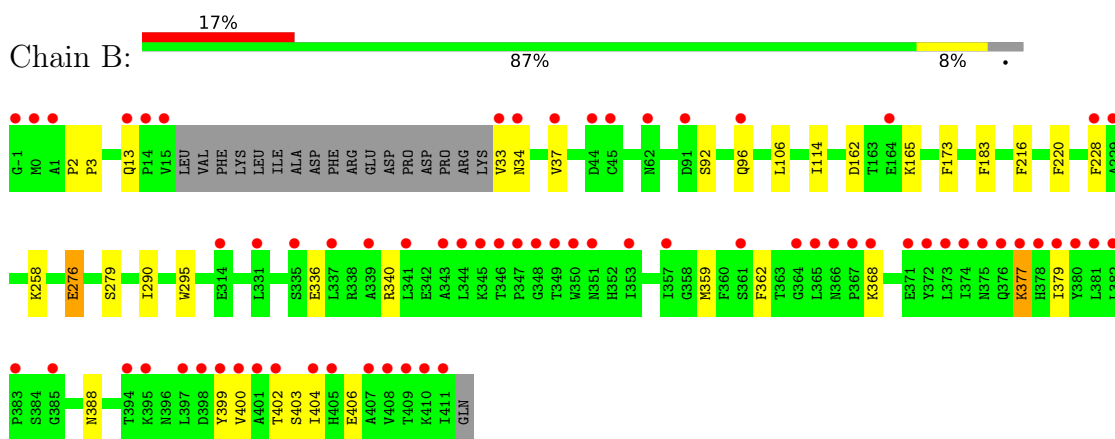
3 Residue-property plots [i](#)

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: Aspartate aminotransferase, cytoplasmic



- Molecule 1: Aspartate aminotransferase, cytoplasmic



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	55.29Å 124.01Å 129.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.34 – 1.40 35.34 – 1.40	Depositor EDS
% Data completeness (in resolution range)	99.9 (35.34-1.40) 99.9 (35.34-1.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.13 (at 1.40Å)	Xtrriage
Refinement program	PHENIX (1.10.1_2155)	Depositor
R, R_{free}	0.184 , 0.198 0.185 , 0.199	Depositor DCC
R_{free} test set	8739 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	10.7	Xtrriage
Anisotropy	0.161	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 45.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.012 for -h,l,k	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6996	wwPDB-VP
Average B, all atoms (Å ²)	16.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.26% 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: LLP

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	0.34	0/3404	0.55	0/4623
1	B	0.34	0/3233	0.56	1/4389 (0.0%)
All	All	0.34	0/6637	0.55	1/9012 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	377	LYS	CD-CE-NZ	-6.94	95.73	111.70

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	3342	0	3279	14	0
1	B	3180	0	3120	29	0
2	A	284	0	0	5	0
2	B	190	0	0	3	0
All	All	6996	0	6399	42	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 3.

All (42) 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:165:LYS:NZ	1:A:168:LEU:O	1.85	1.08
1:B:377:LYS:NZ	1:B:379:ILE:HG13	1.98	0.78
1:A:162:ASP:HB3	1:A:165:LYS:HG2	1.68	0.74
1:B:33:VAL:N	2:B:503:HOH:O	2.23	0.71
1:B:34:ASN:O	2:B:501:HOH:O	2.08	0.70
1:B:377:LYS:CE	1:B:379:ILE:HG13	2.23	0.69
1:B:377:LYS:HZ1	1:B:379:ILE:HG13	1.58	0.68
1:B:377:LYS:O	1:B:377:LYS:HG2	1.94	0.68
1:A:78:GLU:OE1	2:A:501:HOH:O	2.14	0.64
1:B:377:LYS:HD2	1:B:403:SER:HB3	1.79	0.63
1:A:142[B]:ASN:ND2	2:A:503:HOH:O	2.32	0.62
1:B:340:ARG:HH11	1:B:340:ARG:HG2	1.67	0.59
1:B:228:PHE:HE1	1:B:359:MET:HG2	1.68	0.58
1:A:389:MET:HE3	1:A:392:LEU:HD12	1.85	0.57
1:B:379:ILE:HD11	1:B:400:VAL:HG22	1.86	0.56
1:B:13:GLN:O	2:B:502:HOH:O	2.18	0.55
1:A:21:ILE:O	1:A:25:ARG:HG3	2.05	0.55
1:B:92:SER:O	1:B:96:GLN:HG3	2.05	0.55
1:A:165:LYS:HE3	2:A:740:HOH:O	2.08	0.54
1:B:228:PHE:CE1	1:B:359:MET:HG2	2.44	0.53
1:B:377:LYS:HE3	1:B:379:ILE:HG13	1.91	0.53
1:B:377:LYS:NZ	1:B:399:TYR:CE2	2.79	0.51
1:B:402:THR:O	1:B:406:GLU:HG3	2.11	0.50
1:B:377:LYS:HE3	1:B:379:ILE:CD1	2.42	0.50
1:B:377:LYS:HD2	1:B:403:SER:CB	2.42	0.49
1:A:235:LYS:NZ	2:A:505:HOH:O	2.46	0.47
1:B:162:ASP:CG	1:B:165:LYS:HG2	2.36	0.46
1:A:106:LEU:HD11	1:B:106:LEU:HD11	1.98	0.45
1:A:106:LEU:HD23	1:A:295:TRP:CE2	2.51	0.45
1:B:379:ILE:HD13	1:B:379:ILE:HG21	1.73	0.45
1:B:37:VAL:HG13	1:B:388:ASN:ND2	2.32	0.44
1:B:183:PHE:HA	1:B:216:PHE:O	2.18	0.44
1:B:400:VAL:O	1:B:404:ILE:HG12	2.18	0.43
1:B:336:GLU:OE1	1:B:340:ARG:NH2	2.52	0.43
1:A:165:LYS:HE2	1:A:167:GLY:C	2.39	0.43
1:B:106:LEU:HD23	1:B:295:TRP:CE2	2.54	0.43
1:B:276:GLU:OE1	1:B:279:SER:OG	2.29	0.42
1:B:114:ILE:HD12	1:B:290:ILE:HG22	2.00	0.42
1:A:372:TYR:CD1	1:A:376:GLN:HG3	2.54	0.42
1:A:96:GLN:HG2	2:A:514:HOH:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:17:VAL:O	1:A:21:ILE:HG12	2.20	0.41
1:B:2:PRO:HA	1:B:3:PRO:HD3	1.89	0.41

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	417/414 (101%)	412 (99%)	5 (1%)	0	100	100
1	B	396/414 (96%)	387 (98%)	9 (2%)	0	100	100
All	All	813/828 (98%)	799 (98%)	14 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	358/352 (102%)	353 (99%)	5 (1%)	67	40
1	B	340/352 (97%)	335 (98%)	5 (2%)	65	37
All	All	698/704 (99%)	688 (99%)	10 (1%)	65	40

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	90	ASP
1	A	173	PHE
1	A	220	PHE
1	A	308	ARG
1	A	362	PHE
1	B	173	PHE
1	B	220	PHE
1	B	276	GLU
1	B	362	PHE
1	B	368	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	375	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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
1	LLP	B	258	1	23,24,25	2.55	7 (30%)	25,32,34	1.48	4 (16%)
1	LLP	A	258	1	23,24,25	2.51	6 (26%)	25,32,34	1.47	3 (12%)

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
1	LLP	B	258	1	-	7/16/17/19	0/1/1/1
1	LLP	A	258	1	-	6/16/17/19	0/1/1/1

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	258	LLP	C4-C4'	8.05	1.61	1.46
1	A	258	LLP	C4-C4'	8.03	1.61	1.46
1	B	258	LLP	C4'-NZ	5.01	1.44	1.27
1	A	258	LLP	C4'-NZ	4.96	1.43	1.27
1	B	258	LLP	C4-C5	-3.97	1.37	1.42
1	A	258	LLP	C4-C5	-3.69	1.37	1.42
1	B	258	LLP	C2'-C2	3.57	1.56	1.50
1	A	258	LLP	C2'-C2	3.26	1.55	1.50
1	A	258	LLP	C6-N1	2.38	1.39	1.34
1	B	258	LLP	C6-N1	2.36	1.39	1.34
1	B	258	LLP	C5'-C5	2.13	1.56	1.50
1	B	258	LLP	P-OP3	-2.08	1.46	1.54
1	A	258	LLP	C5'-C5	2.04	1.56	1.50

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	258	LLP	C4-C4'-NZ	-4.85	102.06	124.31
1	B	258	LLP	C4-C4'-NZ	-4.07	105.62	124.31
1	B	258	LLP	C5-C6-N1	-2.72	119.28	123.82
1	B	258	LLP	OP4-C5'-C5	2.72	114.53	109.35
1	A	258	LLP	C5-C6-N1	-2.27	120.04	123.82
1	B	258	LLP	C5'-C5-C6	-2.10	115.91	119.37
1	A	258	LLP	C5'-C5-C6	-2.00	116.08	119.37

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	258	LLP	C5'-OP4-P-OP1
1	B	258	LLP	C5'-OP4-P-OP1
1	B	258	LLP	C5'-OP4-P-OP3
1	B	258	LLP	C4-C4'-NZ-CE
1	B	258	LLP	CG-CD-CE-NZ
1	A	258	LLP	CA-CB-CG-CD
1	B	258	LLP	CA-CB-CG-CD

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Mol	Chain	Res	Type	Atoms
1	A	258	LLP	C3-C4-C4'-NZ
1	B	258	LLP	C3-C4-C4'-NZ
1	A	258	LLP	C5-C4-C4'-NZ
1	A	258	LLP	CD-CE-NZ-C4'
1	A	258	LLP	C5'-OP4-P-OP3
1	B	258	LLP	C5-C4-C4'-NZ

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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, 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	413/414 (99%)	0.08	15 (3%) 42 42	5, 11, 27, 47	0
1	B	395/414 (95%)	0.82	69 (17%) 1 1	6, 15, 45, 61	6 (1%)
All	All	808/828 (97%)	0.44	84 (10%) 6 6	5, 12, 37, 61	6 (0%)

All (84) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	-1	GLY	16.1
1	B	411	ILE	12.3
1	B	379	ILE	11.5
1	A	18	PHE	10.0
1	B	0	MET	9.3
1	B	373	LEU	7.2
1	B	33	VAL	7.1
1	B	409	THR	6.7
1	B	1	ALA	6.6
1	B	375	ASN	6.5
1	B	372	TYR	6.2
1	B	377	LYS	6.0
1	B	399	TYR	6.0
1	B	404	ILE	6.0
1	B	398	ASP	5.8
1	B	368	LYS	5.6
1	B	380	TYR	5.4
1	B	347	PRO	5.2
1	A	-1	GLY	5.2
1	B	15	VAL	4.9
1	A	16	LEU	4.8
1	B	37	VAL	4.8
1	B	397	LEU	4.8
1	B	345	LYS	4.7

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Mol	Chain	Res	Type	RSRZ
1	A	412	GLN	4.6
1	B	343	ALA	4.6
1	B	365	LEU	4.6
1	B	394	THR	4.5
1	B	401	ALA	4.5
1	B	14	PRO	4.4
1	B	378	HIS	4.4
1	B	402	THR	4.2
1	A	26	GLU	4.2
1	B	339	ALA	4.2
1	B	400	VAL	4.1
1	B	34	ASN	4.0
1	B	13	GLN	4.0
1	B	344	LEU	3.7
1	B	408	VAL	3.6
1	B	348	GLY	3.6
1	B	371	GLU	3.5
1	B	45	CYS	3.4
1	B	349	THR	3.3
1	B	337	LEU	3.3
1	A	1	ALA	3.2
1	B	228	PHE	3.2
1	B	341	LEU	3.2
1	B	376	GLN	3.2
1	A	15	VAL	3.1
1	B	350	TRP	3.0
1	A	13	GLN	2.9
1	B	96	GLN	2.9
1	A	25	ARG	2.8
1	B	44	ASP	2.8
1	A	164	GLU	2.8
1	B	410	LYS	2.8
1	B	346	THR	2.7
1	A	165	LYS	2.7
1	B	395	LYS	2.6
1	B	366	ASN	2.6
1	B	229	ALA	2.5
1	B	382	LEU	2.5
1	B	385	GLY	2.5
1	B	331	LEU	2.5
1	B	407	ALA	2.5
1	B	91	ASP	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	367	PRO	2.4
1	B	364	GLY	2.4
1	B	383	PRO	2.4
1	B	335	SER	2.3
1	B	361	SER	2.3
1	A	229	ALA	2.3
1	B	353	ILE	2.3
1	B	405	HIS	2.2
1	B	381	LEU	2.2
1	B	374	ILE	2.2
1	B	357	ILE	2.2
1	B	62	ASN	2.1
1	A	19	LYS	2.1
1	B	314	GLU	2.1
1	B	164	GLU	2.1
1	A	64	SER	2.1
1	B	351	ASN	2.0
1	A	28	PRO	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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(Å ²)	Q<0.9
1	LLP	B	258	24/25	0.97	0.11	7,12,18,24	0
1	LLP	A	258	24/25	0.98	0.11	5,11,16,19	0

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.