



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 01:34 PM UTC

PDB ID : 5TXE / pdb_00005txe
Title : AtxE2 Isopeptidase - S527A Variant with Astexin3-dC4 Bound
Authors : Chekan, J.R.; Nair, S.K.
Deposited on : 2016-11-16
Resolution : 2.20 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
Xtriage (Phenix)	:	2.0
EDS	:	3.0
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

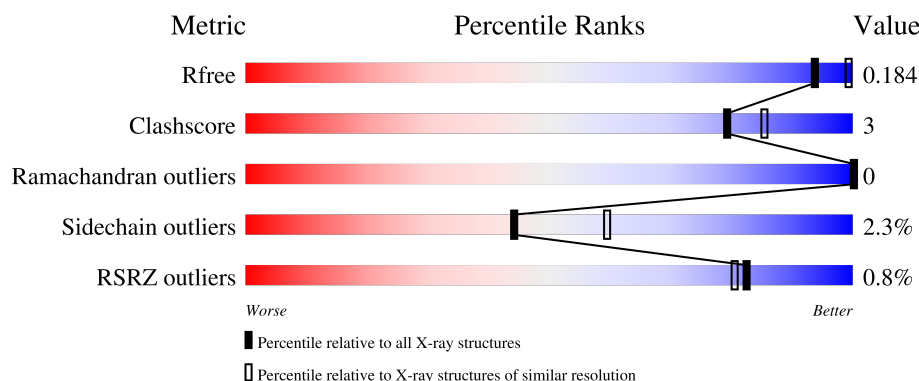
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	705	
1	B	705	
2	C	24	
2	D	24	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 11501 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 AtxE2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	652	Total	C	N	O	S	0	3	0
			5161	3248	935	963	15			
1	B	652	Total	C	N	O	S	0	4	0
			5171	3255	937	964	15			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	527	ALA	SER	engineered mutation	UNP E8RUP5
A	696	GLY	-	expression tag	UNP E8RUP5
A	697	SER	-	expression tag	UNP E8RUP5
A	698	ARG	-	expression tag	UNP E8RUP5
A	699	SER	-	expression tag	UNP E8RUP5
A	700	HIS	-	expression tag	UNP E8RUP5
A	701	HIS	-	expression tag	UNP E8RUP5
A	702	HIS	-	expression tag	UNP E8RUP5
A	703	HIS	-	expression tag	UNP E8RUP5
A	704	HIS	-	expression tag	UNP E8RUP5
A	705	HIS	-	expression tag	UNP E8RUP5
B	527	ALA	SER	engineered mutation	UNP E8RUP5
B	696	GLY	-	expression tag	UNP E8RUP5
B	697	SER	-	expression tag	UNP E8RUP5
B	698	ARG	-	expression tag	UNP E8RUP5
B	699	SER	-	expression tag	UNP E8RUP5
B	700	HIS	-	expression tag	UNP E8RUP5
B	701	HIS	-	expression tag	UNP E8RUP5
B	702	HIS	-	expression tag	UNP E8RUP5
B	703	HIS	-	expression tag	UNP E8RUP5
B	704	HIS	-	expression tag	UNP E8RUP5
B	705	HIS	-	expression tag	UNP E8RUP5

- Molecule 2 is a protein called Astexin3-dC4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	17	Total	C	N	O	S	0	0	0
			125	80	19	25	1			
2	D	18	Total	C	N	O	S	0	0	0
			134	85	21	27	1			

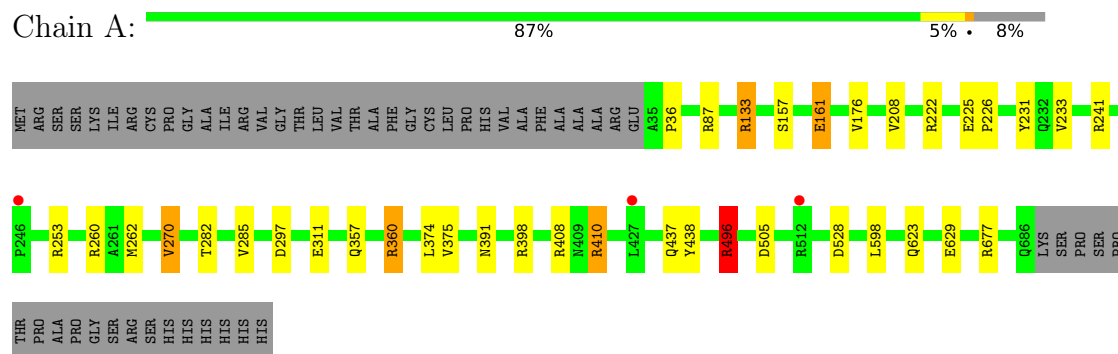
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	339	Total	O	0	0
			339	339		
3	C	10	Total	O	0	0
			10	10		
3	B	551	Total	O	0	0
			551	551		
3	D	10	Total	O	0	0
			10	10		

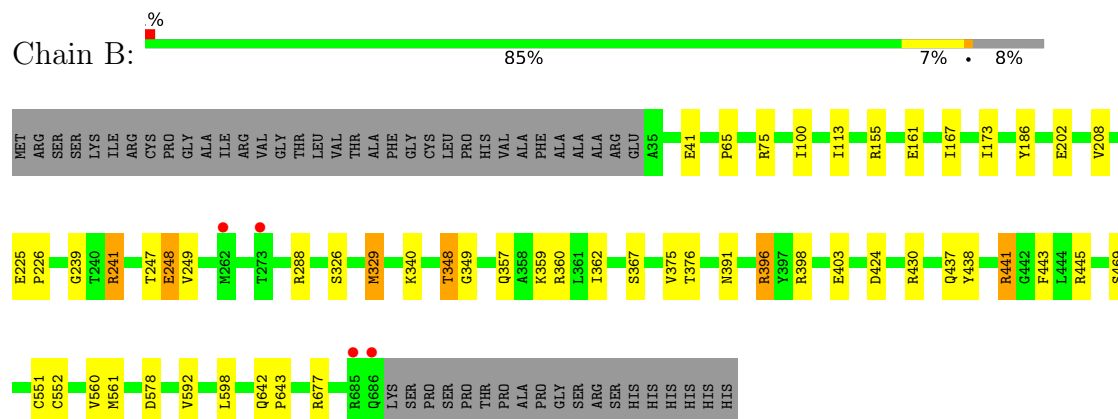
3 Residue-property plots [i](#)

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.

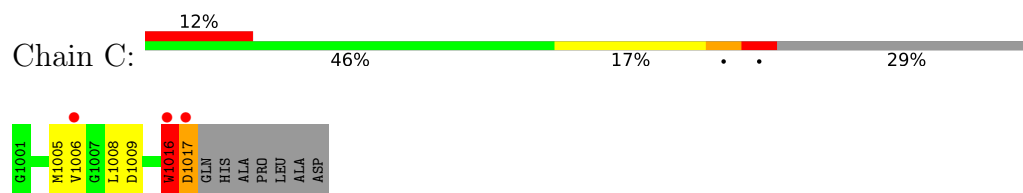
• Molecule 1: AtxE2



• Molecule 1: AtxE2

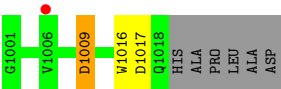


• Molecule 2: Astexin3-dC4



• Molecule 2: Astexin3-dC4





4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	151.25Å 202.85Å 110.40Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.82 – 2.20 29.82 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.8 (29.82-2.20) 99.8 (29.82-2.20)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.87 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.8.0073	Depositor
R, R_{free}	0.154 , 0.198 (Not available) , 0.184	Depositor DCC
R_{free} test set	4255 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	29.8	Xtriage
Anisotropy	0.272	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 34.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	11501	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.05% 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

5.1 Standard geometry

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	1.10	2/5297 (0.0%)	1.02	5/7224 (0.1%)
1	B	1.20	9/5304 (0.2%)	1.06	11/7233 (0.2%)
2	C	1.27	0/129	1.48	5/176 (2.8%)
2	D	1.25	0/138	0.97	0/188
All	All	1.15	11/10868 (0.1%)	1.05	21/14821 (0.1%)

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
2	C	0	1

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	241	ARG	CD-NE	-7.73	1.35	1.46
1	B	247	THR	CA-C	-6.38	1.45	1.52
1	B	430	ARG	C-O	-5.71	1.17	1.24
1	B	248	GLU	CA-C	5.44	1.60	1.52
1	B	247	THR	C-O	-5.43	1.17	1.24
1	B	239	GLY	C-O	-5.38	1.16	1.23
1	A	36	PRO	CA-C	5.36	1.55	1.52
1	B	445	ARG	CD-NE	-5.35	1.38	1.46
1	B	592	VAL	C-O	-5.30	1.18	1.24
1	B	396	ARG	CA-C	5.20	1.60	1.52
1	A	496	ARG	CD-NE	-5.02	1.39	1.46

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	445	ARG	NE-CZ-NH2	-10.46	109.78	119.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	348	THR	N-CA-C	-9.08	98.54	110.53
1	B	445	ARG	CD-NE-CZ	8.00	135.60	124.40
2	C	1016	TRP	CB-CA-C	7.71	123.79	110.45
1	A	391	ASN	CA-C-N	-6.92	113.57	120.21
1	A	391	ASN	C-N-CA	-6.92	113.57	120.21
1	B	445	ARG	NE-CZ-NH1	6.74	128.24	121.50
2	C	1016	TRP	CA-C-O	-6.55	113.57	121.89
1	B	391	ASN	CA-C-N	-6.51	112.82	120.11
1	B	391	ASN	C-N-CA	-6.51	112.82	120.11
1	B	441	ARG	CG-CD-NE	-6.31	98.11	112.00
2	C	1016	TRP	CA-C-N	6.29	133.02	121.70
2	C	1016	TRP	C-N-CA	6.29	133.02	121.70
2	C	1016	TRP	O-C-N	-6.14	115.71	122.84
1	B	247	THR	CA-C-O	-6.09	114.63	120.90
1	A	133	ARG	CG-CD-NE	5.83	124.81	112.00
1	A	222	ARG	CB-CG-CD	5.63	124.24	111.30
1	B	241	ARG	NE-CZ-NH2	-5.46	114.28	119.20
1	B	249	VAL	N-CA-C	5.45	115.65	110.42
1	A	408	ARG	N-CA-C	-5.41	100.36	109.07
1	B	113	ILE	CB-CA-C	-5.05	104.44	109.89

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	C	1016	TRP	Peptide

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	5161	0	5068	18	0
1	B	5171	0	5080	29	1
2	C	125	0	112	6	0
2	D	134	0	120	6	0
3	A	339	0	0	2	0
3	B	551	0	0	12	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	10	0	0	0	0
3	D	10	0	0	0	0
All	All	11501	0	10380	56	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 3.

All (56) 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)
2:C:1016:TRP:CD1	2:C:1017:ASP:HA	1.68	1.27
1:B:348:THR:C	3:B:802:HOH:O	1.91	1.12
2:D:1016:TRP:CD1	2:D:1017:ASP:H	1.71	1.07
2:D:1016:TRP:CD1	2:D:1017:ASP:N	2.22	1.07
2:C:1016:TRP:CD1	2:C:1017:ASP:CA	2.55	0.88
1:B:348:THR:CB	3:B:802:HOH:O	2.26	0.83
2:D:1016:TRP:CG	2:D:1017:ASP:H	1.96	0.82
1:B:202[B]:GLU:OE2	3:B:801:HOH:O	2.00	0.79
1:A:410:ARG:NH1	1:A:505:ASP:OD1	2.20	0.75
1:B:41:GLU:HG3	3:B:1067:HOH:O	1.89	0.71
1:A:157:SER:OG	3:A:801:HOH:O	2.09	0.69
2:D:1016:TRP:CG	2:D:1017:ASP:N	2.61	0.64
1:A:270:VAL:HG13	1:A:282:THR:HB	1.80	0.64
1:B:326:SER:O	1:B:441:ARG:NH2	2.31	0.59
1:B:398:ARG:NH1	1:B:424:ASP:OD2	2.36	0.58
1:B:362:ILE:HD13	1:B:376:THR:HG22	1.87	0.57
1:B:155:ARG:NH2	3:B:810:HOH:O	2.38	0.56
1:B:41:GLU:CG	3:B:1067:HOH:O	2.50	0.56
1:B:560:VAL:HG12	1:B:561:MET:HE2	1.88	0.55
2:C:1016:TRP:NE1	2:C:1017:ASP:HA	2.16	0.55
1:A:133:ARG:NH1	1:A:176:VAL:O	2.40	0.55
1:A:437:GLN:HB3	1:A:438:TYR:HB3	1.88	0.55
1:A:496:ARG:HH22	1:A:528:ASP:CG	2.16	0.54
1:A:629:GLU:OE2	1:A:677:ARG:HD2	2.07	0.54
2:D:1016:TRP:HD1	2:D:1017:ASP:N	2.01	0.54
2:D:1009:ASP:OD1	2:D:1016:TRP:HB2	2.08	0.53
1:B:349:GLY:N	3:B:802:HOH:O	2.25	0.52
1:B:437:GLN:HB3	1:B:438:TYR:HB3	1.92	0.51
1:B:357:GLN:OE1	1:B:360:ARG:NH1	2.40	0.51
2:C:1009:ASP:OD1	2:C:1016:TRP:HB2	2.12	0.49
1:B:359:LYS:NZ	3:B:816:HOH:O	2.46	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:157:SER:OG	1:A:161:GLU:HG2	2.14	0.47
1:A:225:GLU:OE1	1:A:226:PRO:HA	2.15	0.47
1:B:225:GLU:OE1	1:B:226:PRO:HA	2.15	0.47
1:A:231:TYR:OH	1:A:253:ARG:NH1	2.47	0.46
1:A:677:ARG:CZ	1:B:208:VAL:HG21	2.46	0.46
1:B:173[A]:ILE:HD12	1:B:186:TYR:CD2	2.52	0.44
1:A:233:VAL:O	1:A:241:ARG:HA	2.17	0.44
1:A:157:SER:CB	1:A:161:GLU:HG2	2.48	0.44
2:C:1006:VAL:HG12	2:C:1017:ASP:HB2	2.01	0.43
1:B:75:ARG:NH2	3:B:831:HOH:O	2.52	0.43
1:B:167:ILE:HG22	1:B:173[B]:ILE:HD11	2.01	0.43
1:B:100:ILE:HD11	3:B:1206:HOH:O	2.19	0.42
1:A:357:GLN:OE1	1:A:360:ARG:NH1	2.48	0.42
1:A:208:VAL:HG21	1:B:677:ARG:CZ	2.50	0.42
1:A:133:ARG:HA	1:A:133:ARG:HD3	1.84	0.42
1:B:248:GLU:HA	3:B:873:HOH:O	2.19	0.41
1:A:87:ARG:NH2	3:A:829:HOH:O	2.53	0.41
1:A:623:GLN:HE22	1:B:578:ASP:HA	1.84	0.41
1:B:642:GLN:HA	1:B:643:PRO:HD3	1.95	0.41
1:B:367:SER:O	1:B:443:PHE:HA	2.21	0.41
2:C:1016:TRP:HD1	2:C:1017:ASP:CA	2.24	0.40
1:B:438:TYR:HB2	1:B:469:SER:HB2	2.03	0.40
1:B:288:ARG:HD3	3:B:1163:HOH:O	2.22	0.40
1:B:551:CYS:HA	1:B:552:CYS:HA	1.88	0.40
1:B:329:MET:HE3	1:B:329:MET:HB3	1.90	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)
1:B:403:GLU:OE2	1:B:403:GLU:OE2[6_565]	2.18	0.02

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	653/705 (93%)	640 (98%)	13 (2%)	0	100	100
1	B	654/705 (93%)	640 (98%)	14 (2%)	0	100	100
2	C	15/24 (62%)	12 (80%)	3 (20%)	0	100	100
2	D	16/24 (67%)	12 (75%)	4 (25%)	0	100	100
All	All	1338/1458 (92%)	1304 (98%)	34 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	548/587 (93%)	533 (97%)	15 (3%)	39	53
1	B	549/587 (94%)	541 (98%)	8 (2%)	57	73
2	C	14/19 (74%)	11 (79%)	3 (21%)	1	1
2	D	15/19 (79%)	14 (93%)	1 (7%)	15	17
All	All	1126/1212 (93%)	1099 (98%)	27 (2%)	44	58

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	161	GLU
1	A	260	ARG
1	A	262	MET
1	A	270	VAL
1	A	285	VAL
1	A	297[A]	ASP
1	A	297[B]	ASP
1	A	311	GLU
1	A	360	ARG
1	A	374	LEU

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Mol	Chain	Res	Type
1	A	375	VAL
1	A	398	ARG
1	A	410	ARG
1	A	496	ARG
1	A	598	LEU
2	C	1005	MET
2	C	1008	LEU
2	C	1017	ASP
1	B	65	PRO
1	B	161	GLU
1	B	241	ARG
1	B	329	MET
1	B	340	LYS
1	B	375	VAL
1	B	396	ARG
1	B	598	LEU
2	D	1009	ASP

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	146	GLN
1	A	623	GLN
2	C	1014	GLN
1	B	146	GLN
1	B	314	ASN
1	B	492	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](#)

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	652/705 (92%)	-0.26	3 (0%) 87 85	19, 35, 68, 107	3 (0%)
1	B	652/705 (92%)	-0.61	4 (0%) 85 83	10, 25, 52, 101	4 (0%)
2	C	17/24 (70%)	0.78	3 (17%) 4 3	38, 47, 71, 75	0
2	D	18/24 (75%)	0.30	1 (5%) 30 27	33, 42, 62, 66	0
All	All	1339/1458 (91%)	-0.41	11 (0%) 82 80	10, 30, 65, 107	7 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	1016	TRP	3.1
1	B	685	ARG	3.0
1	A	427	LEU	2.5
1	A	246	PRO	2.3
1	A	512	ARG	2.3
2	D	1006	VAL	2.2
2	C	1017	ASP	2.1
1	B	262	MET	2.1
1	B	686	GLN	2.1
2	C	1006	VAL	2.1
1	B	273	THR	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.