



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 18, 2023 – 08:08 PM JST

PDB ID : 8I4N
Title : Crystal structure of 6-phosphogluconate dehydrogenase from *Corynebacterium glutamicum*
Authors : Yu, H.; Kim, K.-J.
Deposited on : 2023-01-20
Resolution : 2.41 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
Xtriage (Phenix) : 1.13
EDS : 2.34
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) : 2.34

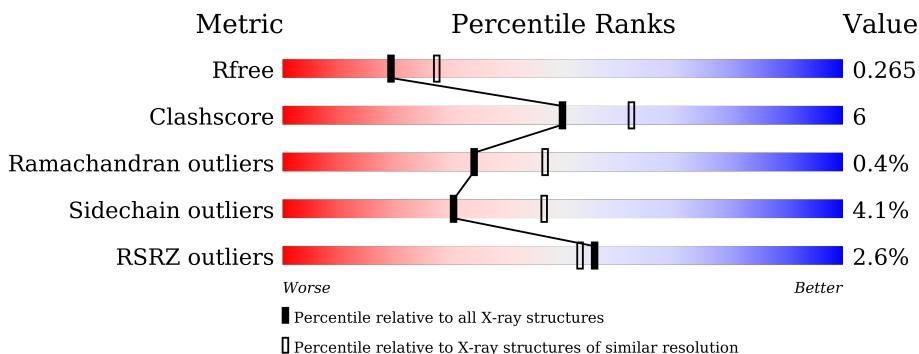
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.41 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	4647 (2.44-2.40)
Clashscore	141614	5161 (2.44-2.40)
Ramachandran outliers	138981	5073 (2.44-2.40)
Sidechain outliers	138945	5074 (2.44-2.40)
RSRZ outliers	127900	4543 (2.44-2.40)

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 $\leq 5\%$. 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	492	 3% 84% 13% ..
1	B	492	 2% 82% 14% ..

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7302 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 6-phosphogluconate dehydrogenase, decarboxylating.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	481	Total 3621	C 2271	N 628	O 713	S 9	0	0	0
1	B	480	Total 3617	C 2269	N 627	O 712	S 9	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	485	LEU	-	expression tag	UNP Q8NQI2
A	486	GLU	-	expression tag	UNP Q8NQI2
A	487	HIS	-	expression tag	UNP Q8NQI2
A	488	HIS	-	expression tag	UNP Q8NQI2
A	489	HIS	-	expression tag	UNP Q8NQI2
A	490	HIS	-	expression tag	UNP Q8NQI2
A	491	HIS	-	expression tag	UNP Q8NQI2
A	492	HIS	-	expression tag	UNP Q8NQI2
B	485	LEU	-	expression tag	UNP Q8NQI2
B	486	GLU	-	expression tag	UNP Q8NQI2
B	487	HIS	-	expression tag	UNP Q8NQI2
B	488	HIS	-	expression tag	UNP Q8NQI2
B	489	HIS	-	expression tag	UNP Q8NQI2
B	490	HIS	-	expression tag	UNP Q8NQI2
B	491	HIS	-	expression tag	UNP Q8NQI2
B	492	HIS	-	expression tag	UNP Q8NQI2

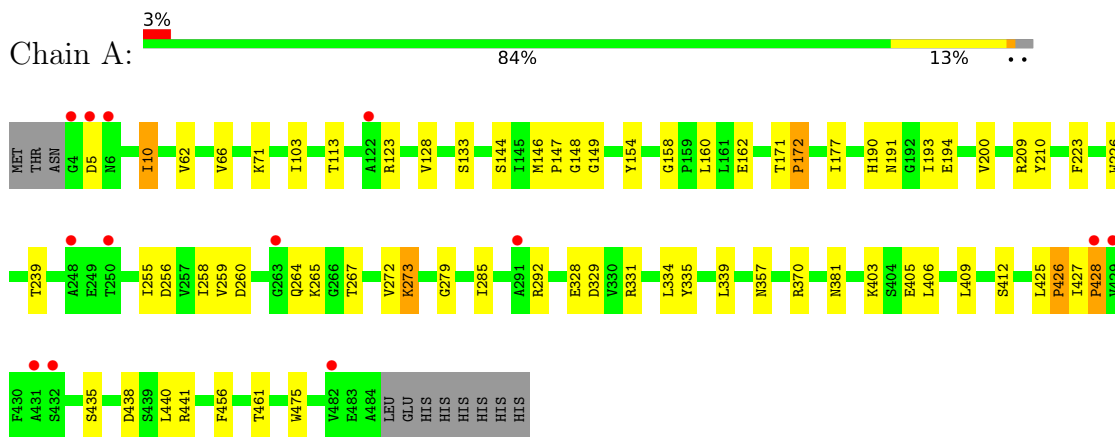
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	35	Total 35	O 35	0	0
2	B	29	Total 29	O 29	0	0

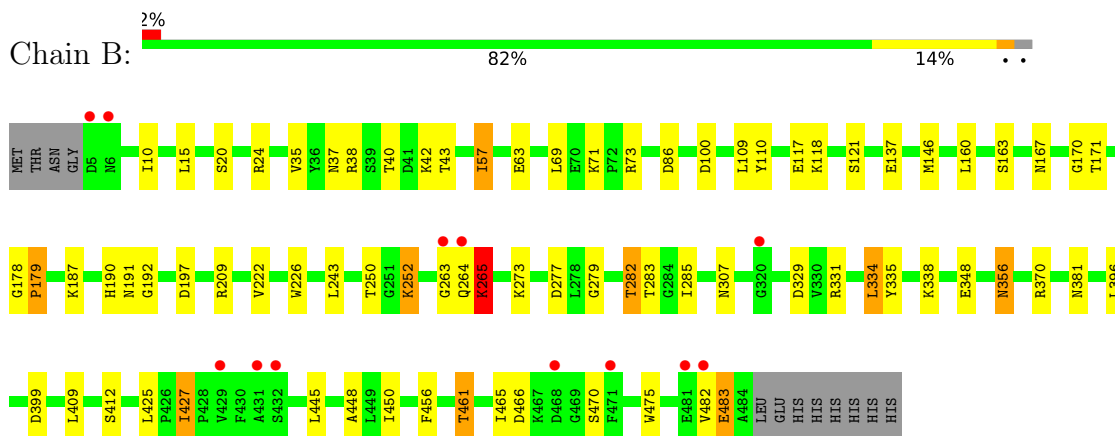
3 Residue-property plots [i](#)

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: 6-phosphogluconate dehydrogenase, decarboxylating



- Molecule 1: 6-phosphogluconate dehydrogenase, decarboxylating



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	63.90Å 120.30Å 152.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.99 – 2.41 33.96 – 2.41	Depositor EDS
% Data completeness (in resolution range)	94.5 (33.99-2.41) 94.6 (33.96-2.41)	Depositor EDS
R_{merge}	0.97	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.52 (at 2.42Å)	Xtrriage
Refinement program	REFMAC 7.1.000	Depositor
R, R_{free}	0.200 , 0.267 0.210 , 0.265	Depositor DCC
R_{free} test set	2167 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	34.2	Xtrriage
Anisotropy	0.082	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 30.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	7302	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.38% 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

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	0.91	9/3685 (0.2%)	0.91	4/5001 (0.1%)
1	B	0.93	12/3681 (0.3%)	0.90	3/4996 (0.1%)
All	All	0.92	21/7366 (0.3%)	0.91	7/9997 (0.1%)

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	428	PRO	N-CA	12.59	1.68	1.47
1	A	172	PRO	N-CA	12.57	1.68	1.47
1	A	426	PRO	N-CA	12.22	1.68	1.47
1	B	179	PRO	N-CA	12.22	1.68	1.47
1	B	57	ILE	C-N	8.64	1.50	1.34
1	B	445	LEU	C-N	8.58	1.50	1.34
1	B	146	MET	C-N	8.26	1.50	1.34
1	B	427	ILE	C-N	8.24	1.50	1.34
1	B	71	LYS	C-N	8.23	1.49	1.34
1	B	252	LYS	C-N	8.23	1.49	1.34
1	A	71	LYS	C-N	8.22	1.49	1.34
1	A	146	MET	C-N	8.21	1.49	1.34
1	B	399	ASP	C-N	8.21	1.49	1.34
1	A	149	GLY	C-N	8.21	1.49	1.34
1	B	171	THR	C-N	7.99	1.49	1.34
1	B	425	LEU	C-N	7.84	1.49	1.34
1	B	348	GLU	CD-OE2	-5.76	1.19	1.25
1	A	171	THR	C-N	5.53	1.44	1.34
1	A	427	ILE	C-N	5.36	1.44	1.34
1	B	178	GLY	C-N	5.16	1.44	1.34
1	A	425	LEU	C-N	5.10	1.44	1.34

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	179	PRO	CA-N-CD	-7.65	100.78	111.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	172	PRO	CA-N-CD	-7.08	101.58	111.50
1	A	428	PRO	CA-N-CD	-6.93	101.79	111.50
1	A	113	THR	CA-CB-OG1	-6.53	95.29	109.00
1	B	277	ASP	CB-CA-C	6.50	123.40	110.40
1	A	426	PRO	CA-N-CD	-5.51	103.79	111.50
1	B	399	ASP	CB-CA-C	-5.44	99.52	110.40

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	3621	0	3545	43	0
1	B	3617	0	3542	45	0
2	A	35	0	0	1	0
2	B	29	0	0	0	0
All	All	7302	0	7087	83	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 6.

All (83) 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:428:PRO:N	1:A:428:PRO:CA	1.68	1.44
1:A:426:PRO:N	1:A:426:PRO:CA	1.68	1.35
1:B:179:PRO:N	1:B:179:PRO:CA	1.68	1.32
1:A:172:PRO:CA	1:A:172:PRO:N	1.68	1.28
1:B:334:LEU:HD12	1:B:334:LEU:O	1.85	0.77
1:B:250:THR:HG23	1:B:252:LYS:H	1.51	0.74
1:B:63:GLU:OE2	1:B:63:GLU:HA	1.91	0.69
1:B:334:LEU:HD12	1:B:334:LEU:C	2.14	0.68
1:A:123:ARG:HG2	1:A:123:ARG:O	1.94	0.68
1:A:172:PRO:N	1:A:172:PRO:C	2.46	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:426:PRO:N	1:A:426:PRO:C	2.48	0.66
1:A:370:ARG:HH11	1:A:381:ASN:HD21	1.46	0.61
1:B:179:PRO:N	1:B:179:PRO:C	2.50	0.61
1:B:15:LEU:HD12	1:B:43:THR:HA	1.83	0.60
1:A:62:VAL:O	1:A:66:VAL:HG23	2.04	0.58
1:A:209:ARG:NH2	1:A:256:ASP:OD2	2.37	0.57
1:B:37:ASN:HD22	1:B:42:LYS:HB2	1.69	0.56
1:B:335:TYR:CD1	1:B:409:LEU:HD11	2.40	0.56
1:B:10:ILE:HB	1:B:160:LEU:HD23	1.88	0.56
1:B:73:ARG:HB2	1:B:100:ASP:CG	2.25	0.56
1:A:133:SER:OG	1:A:144:SER:HB3	2.07	0.55
1:A:264:GLN:HE22	1:B:279:GLY:HA2	1.72	0.55
1:B:15:LEU:HD11	1:B:35:VAL:HB	1.89	0.54
1:A:255:ILE:HA	1:A:258:ILE:HD12	1.91	0.53
1:A:123:ARG:HG2	1:A:123:ARG:HH21	1.75	0.52
1:B:370:ARG:HH11	1:B:381:ASN:HD21	1.56	0.51
1:A:226:TRP:CD2	1:A:331:ARG:HG3	2.47	0.50
1:B:356:ASN:N	1:B:356:ASN:ND2	2.60	0.50
1:B:73:ARG:NH1	1:B:100:ASP:OD2	2.44	0.49
1:A:264:GLN:O	1:A:264:GLN:HG2	2.12	0.49
1:A:200:VAL:HB	1:A:334:LEU:CD1	2.43	0.49
1:A:273:LYS:HG2	1:B:273:LYS:HG2	1.94	0.49
1:A:456:PHE:HA	1:A:475:TRP:CD1	2.48	0.49
1:A:223:PHE:HD2	1:A:239:THR:HG22	1.78	0.48
1:A:128:VAL:HA	1:A:148:GLY:O	2.13	0.48
1:A:259:VAL:HG23	1:A:259:VAL:O	2.14	0.48
1:A:223:PHE:CD2	1:A:239:THR:HG22	2.49	0.48
1:B:40:THR:HG22	1:B:40:THR:O	2.13	0.48
1:B:37:ASN:ND2	1:B:42:LYS:HB2	2.29	0.48
1:B:69:LEU:HB2	1:B:73:ARG:HD3	1.96	0.47
1:A:428:PRO:N	1:A:428:PRO:C	2.61	0.47
1:B:482:VAL:HG23	1:B:482:VAL:O	2.14	0.46
1:A:5:ASP:OD1	1:A:5:ASP:N	2.43	0.46
1:B:187:LYS:HE2	1:B:191:ASN:HD21	1.81	0.46
1:A:403:LYS:HE3	1:B:307:ASN:O	2.15	0.46
1:B:263:GLY:HA3	1:B:265:LYS:HD3	1.98	0.46
1:A:10:ILE:HB	1:A:160:LEU:HD13	1.98	0.45
1:A:191:ASN:HD22	1:A:267:THR:HG21	1.81	0.45
1:B:167:ASN:HD21	1:B:170:GLY:HA2	1.81	0.45
1:A:154:TYR:CE1	1:A:158:GLY:HA2	2.51	0.45
1:A:193:ILE:HG22	1:A:193:ILE:O	2.17	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:335:TYR:CD1	1:A:409:LEU:HD11	2.51	0.45
1:B:456:PHE:HA	1:B:475:TRP:CD1	2.51	0.45
1:B:192:GLY:O	1:B:285:ILE:HG12	2.17	0.45
1:A:339:LEU:HD23	1:A:406:LEU:HD21	1.99	0.44
1:A:279:GLY:HA2	1:B:264:GLN:NE2	2.32	0.44
1:A:405:GLU:O	1:A:409:LEU:HG	2.17	0.44
1:A:209:ARG:HD3	1:A:210:TYR:CZ	2.53	0.44
1:B:57:ILE:HG22	1:B:57:ILE:O	2.17	0.44
1:B:335:TYR:HD1	1:B:409:LEU:HD11	1.82	0.44
1:A:329:ASP:HA	1:A:412:SER:HB3	2.00	0.43
1:A:441:ARG:NH2	2:A:502:HOH:O	2.52	0.43
1:B:226:TRP:CD2	1:B:331:ARG:HG3	2.53	0.43
1:B:483:GLU:H	1:B:483:GLU:HG3	1.52	0.43
1:B:282:THR:HG23	1:B:285:ILE:HB	2.01	0.42
1:B:329:ASP:HA	1:B:412:SER:HB3	2.02	0.42
1:B:396:LEU:HD23	1:B:396:LEU:HA	1.91	0.42
1:B:282:THR:CG2	1:B:282:THR:O	2.68	0.42
1:A:272:VAL:CG2	1:A:285:ILE:HG22	2.50	0.42
1:B:243:LEU:HD23	1:B:243:LEU:HA	1.91	0.41
1:B:20:SER:O	1:B:24:ARG:HG3	2.20	0.41
1:A:158:GLY:O	1:A:162:GLU:HG3	2.20	0.41
1:A:147:PRO:HD2	1:A:177:ILE:HG12	2.02	0.41
1:A:260:ASP:HB3	1:B:448:ALA:HB2	2.01	0.41
1:B:252:LYS:HE2	1:B:252:LYS:HB3	1.86	0.41
1:B:461:THR:HG21	1:B:470:SER:HB3	2.01	0.41
1:A:328:GLU:HA	1:A:328:GLU:OE1	2.20	0.41
1:B:118:LYS:N	1:B:118:LYS:HD3	2.34	0.41
1:B:482:VAL:O	1:B:482:VAL:CG2	2.69	0.41
1:A:438:ASP:HA	1:A:441:ARG:HG2	2.02	0.41
1:A:103:ILE:HA	1:A:128:VAL:O	2.22	0.40
1:B:109:LEU:HD12	1:B:109:LEU:HA	1.85	0.40
1:B:265:LYS:HB2	1:B:265:LYS:HE2	1.59	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	479/492 (97%)	454 (95%)	22 (5%)	3 (1%)	25	35
1	B	478/492 (97%)	456 (95%)	21 (4%)	1 (0%)	47	61
All	All	957/984 (97%)	910 (95%)	43 (4%)	4 (0%)	34	47

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	194	GLU
1	A	265	LYS
1	A	273	LYS
1	B	265	LYS

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	368/379 (97%)	361 (98%)	7 (2%)	57	74
1	B	368/379 (97%)	345 (94%)	23 (6%)	18	27
All	All	736/758 (97%)	706 (96%)	30 (4%)	30	47

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	ILE
1	A	190	HIS
1	A	292	ARG
1	A	357	ASN
1	A	435	SER
1	A	440	LEU
1	A	461	THR
1	B	38	ARG

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Mol	Chain	Res	Type
1	B	86	ASP
1	B	110	TYR
1	B	117	GLU
1	B	121	SER
1	B	137	GLU
1	B	163	SER
1	B	190	HIS
1	B	197	ASP
1	B	209	ARG
1	B	222	VAL
1	B	265	LYS
1	B	282	THR
1	B	283	THR
1	B	334	LEU
1	B	338	LYS
1	B	356	ASN
1	B	427	ILE
1	B	450	ILE
1	B	461	THR
1	B	465	ILE
1	B	466	ASP
1	B	483	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	126	HIS
1	A	167	ASN
1	A	184	HIS
1	A	191	ASN
1	A	307	ASN
1	A	381	ASN
1	B	29	ASN
1	B	37	ASN
1	B	167	ASN
1	B	184	HIS
1	B	191	ASN
1	B	206	HIS
1	B	300	GLN
1	B	381	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 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	481/492 (97%)	-0.16	13 (2%) 54 52	25, 40, 63, 103	0
1	B	480/492 (97%)	-0.10	12 (2%) 57 54	23, 39, 69, 117	0
All	All	961/984 (97%)	-0.13	25 (2%) 56 53	23, 40, 66, 117	0

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	4	GLY	4.1
1	A	6	ASN	4.1
1	B	5	ASP	3.9
1	A	5	ASP	3.7
1	A	263	GLY	3.6
1	A	122	ALA	3.2
1	B	429	VAL	3.1
1	B	431	ALA	2.9
1	B	6	ASN	2.8
1	B	432	SER	2.8
1	A	250	THR	2.8
1	A	428	PRO	2.7
1	A	432	SER	2.7
1	A	248	ALA	2.6
1	A	291	ALA	2.5
1	B	482	VAL	2.5
1	A	429	VAL	2.5
1	B	468	ASP	2.5
1	A	431	ALA	2.3
1	B	471	PHE	2.3
1	B	320	GLY	2.3
1	B	264	GLN	2.2
1	B	481	GLU	2.2
1	B	263	GLY	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	482	VAL	2.1

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.