



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 04:53 AM UTC

PDB ID : 2CB5 / pdb_00002cb5
Title : HUMAN BLEOMYCIN HYDROLASE, C73S/DELE455 MUTANT
Authors : O'Farrell, P.A.; Gonzalez, F.; Zheng, W.; Johnston, S.A.; Joshua-Tor, L.
Deposited on : 1999-03-02
Resolution : 1.85 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
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

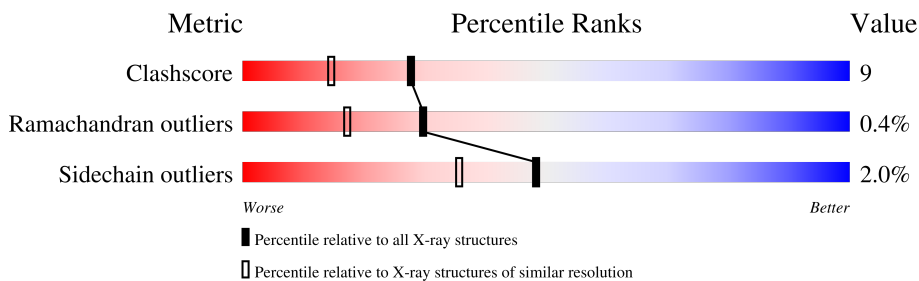
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.85 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	190562	3579 (1.86-1.86)
Ramachandran outliers	187476	3553 (1.86-1.86)
Sidechain outliers	187428	3553 (1.86-1.86)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	453	
1	B	453	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7953 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 PROTEIN (BLEOMYCIN HYDROLASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	453	3694	2354	629	684	27	73	7	0
1	B	453	3695	2354	628	686	27	68	8	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	73	SER	CYS	engineered mutation	UNP Q13867
A	280	HIS	TYR	SEE REMARK 999	UNP Q13867
B	73	SER	CYS	engineered mutation	UNP Q13867
B	280	HIS	TYR	SEE REMARK 999	UNP Q13867

- Molecule 2 is water.

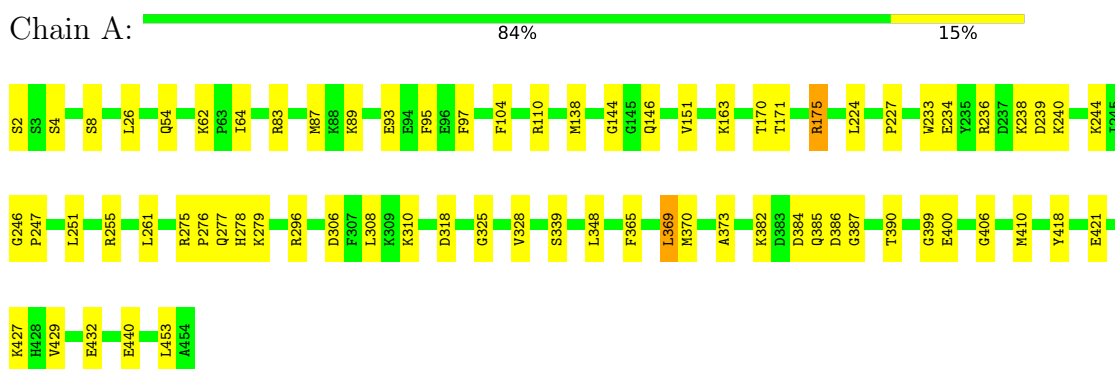
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	282	Total	O	0	0
			282	282		
2	B	282	Total	O	0	0
			282	282		

3 Residue-property plots [i](#)

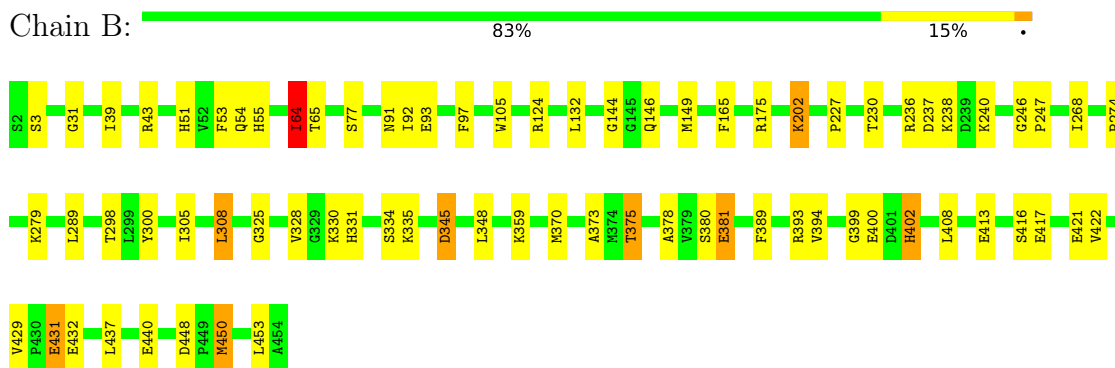
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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: PROTEIN (BLEOMYCIN HYDROLASE)



- Molecule 1: PROTEIN (BLEOMYCIN HYDROLASE)



4 Data and refinement statistics

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

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	179.51Å 179.51Å 164.15Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 1.85	Depositor
% Data completeness (in resolution range)	89.9 (30.00-1.85)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	8.20	Depositor
Refinement program	CNS 0.4	Depositor
R, R_{free}	0.182 , 0.210	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	7953	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

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	0.69	1/3819 (0.0%)	1.01	13/5159 (0.3%)
1	B	0.67	1/3819 (0.0%)	0.99	12/5160 (0.2%)
All	All	0.68	2/7638 (0.0%)	1.00	25/10319 (0.2%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	410	MET	SD-CE	-11.30	1.51	1.79
1	B	149	MET	SD-CE	-7.33	1.61	1.79

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	429	VAL	N-CA-C	9.30	117.15	107.76
1	A	440	GLU	N-CA-C	-7.69	99.96	109.65
1	B	97	PHE	N-CA-C	-6.90	101.23	110.55
1	A	97	PHE	N-CA-C	-6.88	101.26	110.55
1	B	440	GLU	N-CA-C	-6.73	99.45	109.42
1	A	387	GLY	N-CA-C	-6.65	97.41	113.18
1	B	279	LYS	N-CA-C	6.15	118.65	110.53
1	B	144	GLY	N-CA-C	6.11	119.05	112.33
1	B	175	ARG	N-CA-C	6.07	118.40	111.11
1	B	64	ILE	N-CA-C	-6.06	101.76	109.58
1	B	417	GLU	N-CA-C	6.05	119.13	111.69
1	A	54	GLN	N-CA-C	6.00	117.50	111.07
1	A	429	VAL	N-CA-C	6.00	113.82	107.76
1	A	328	VAL	N-CA-C	5.86	116.60	110.62
1	B	328	VAL	N-CA-C	5.75	117.18	110.62
1	A	339	SER	N-CA-C	-5.62	98.01	108.02
1	A	365	PHE	N-CA-C	5.60	119.20	112.93
1	A	8	SER	N-CA-C	5.51	117.29	111.28
1	A	418	TYR	N-CA-C	5.42	121.73	113.61
1	A	279	LYS	N-CA-C	5.30	117.53	110.53

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	165	PHE	CA-C-N	5.21	125.21	120.21
1	B	165	PHE	C-N-CA	5.21	125.21	120.21
1	B	394	VAL	N-CA-C	5.18	115.36	108.11
1	A	175	ARG	N-CA-C	5.09	117.23	111.02
1	A	410	MET	CG-SD-CE	-5.01	89.88	100.90

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	3694	0	3609	56	0
1	B	3695	0	3613	73	0
2	A	282	0	0	0	0
2	B	282	0	0	12	0
All	All	7953	0	7222	129	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 9.

All (129) 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:89:LYS:HD3	1:A:261:LEU:HD11	1.31	1.12
1:B:54:GLN:NE2	1:B:381:GLU:H	1.50	1.08
1:B:92:ILE:HA	1:B:238:LYS:HE3	1.38	1.01
1:B:93:GLU:HB2	1:B:238:LYS:HD2	1.38	1.00
1:B:431:GLU:H	1:B:431:GLU:CD	1.68	1.00
1:B:238:LYS:HE2	1:B:238:LYS:N	1.82	0.93
1:B:54:GLN:HE21	1:B:381:GLU:H	1.19	0.90
1:B:370:MET:SD	2:B:702:HOH:O	2.29	0.88
1:B:237:ASP:C	1:B:238:LYS:HE2	1.99	0.88
1:B:64:ILE:HD13	1:B:65:THR:N	1.89	0.87
1:A:93:GLU:HG2	1:A:238:LYS:HG2	1.56	0.87

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:453:LEU:HD21	2:B:702:HOH:O	1.78	0.81
1:A:89:LYS:CD	1:A:261:LEU:HD11	2.11	0.80
1:A:370:MET:CE	1:A:453:LEU:HD21	2.12	0.79
1:B:93:GLU:CB	1:B:238:LYS:HD2	2.12	0.78
1:B:236[B]:ARG:HH11	1:B:236[B]:ARG:HG3	1.47	0.78
1:B:54:GLN:HG3	1:B:55:HIS:CD2	2.20	0.77
1:B:93:GLU:HB2	1:B:238:LYS:CD	2.15	0.76
1:A:64:ILE:HD12	1:A:406:GLY:HA3	1.70	0.71
1:B:54:GLN:NE2	1:B:381:GLU:N	2.34	0.70
1:A:64:ILE:CD1	1:A:406:GLY:HA3	2.19	0.70
1:B:93:GLU:N	1:B:238:LYS:HD2	2.05	0.70
1:A:370:MET:HE3	1:A:453:LEU:HD21	1.72	0.70
1:B:54:GLN:HE21	1:B:381:GLU:N	1.89	0.70
1:B:54:GLN:HG2	1:B:380:SER:HA	1.75	0.69
1:B:431:GLU:CD	1:B:431:GLU:N	2.49	0.69
1:B:64:ILE:HG21	1:B:400:GLU:HB2	1.73	0.69
1:B:124:ARG:HG2	1:B:124:ARG:HH11	1.59	0.67
1:B:450:MET:HB3	2:B:706:HOH:O	1.95	0.67
1:B:51:HIS:HD2	2:B:512:HOH:O	1.79	0.65
1:B:453:LEU:HD11	2:B:702:HOH:O	1.97	0.64
1:A:163:LYS:HD2	1:A:233:TRP:HE1	1.62	0.63
1:A:370:MET:HE2	1:A:453:LEU:HD21	1.80	0.63
1:A:370:MET:HB2	1:A:453:LEU:HD21	1.81	0.63
1:B:334[A]:SER:OG	1:B:402:HIS:HD2	1.82	0.61
1:A:83:ARG:O	1:A:87:MET:HG3	2.00	0.61
1:A:251:LEU:HD11	1:A:255:ARG:HD2	1.83	0.61
1:A:236[B]:ARG:HH11	1:A:236[B]:ARG:HG3	1.67	0.60
1:B:370:MET:HB2	1:B:453:LEU:HD21	1.84	0.60
1:A:104:PHE:CD1	1:A:227:PRO:HG2	2.36	0.60
1:B:236[B]:ARG:HG3	1:B:236[B]:ARG:NH1	2.11	0.60
1:B:92:ILE:CA	1:B:238:LYS:HE3	2.25	0.60
1:A:306[B]:ASP:OD2	1:A:310:LYS:HE2	2.02	0.59
1:A:325:GLY:HA3	1:A:370:MET:HE3	1.83	0.59
1:A:64:ILE:HD13	1:A:399:GLY:C	2.27	0.58
1:B:402:HIS:NE2	1:B:408:LEU:HD21	2.19	0.58
1:A:2:SER:C	1:A:4:SER:H	2.11	0.58
1:A:369:LEU:HD22	1:A:370:MET:O	2.04	0.57
1:B:375:THR:HG23	2:B:529:HOH:O	2.04	0.57
1:A:373:ALA:HB2	1:A:453:LEU:HD13	1.87	0.57
1:A:175:ARG:HH11	1:A:175:ARG:HG3	1.70	0.56
1:A:370:MET:HE2	1:A:453:LEU:CG	2.36	0.56

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:236[B]:ARG:HD3	1:B:240:LYS:O	2.05	0.56
1:B:77[B]:SER:HB3	1:B:375:THR:HG22	1.88	0.56
1:A:369:LEU:CD2	1:A:370:MET:O	2.54	0.55
1:A:251:LEU:C	1:A:251:LEU:HD13	2.32	0.55
1:A:370:MET:CE	1:A:453:LEU:HD11	2.37	0.55
1:B:64:ILE:HD13	1:B:64:ILE:C	2.32	0.55
1:B:413:GLU:HG3	2:B:580:HOH:O	2.06	0.55
1:B:300:TYR:CD2	1:B:450:MET:SD	3.00	0.54
1:A:348:LEU:O	1:A:348:LEU:HD23	2.07	0.54
1:A:432:GLU:H	1:A:432:GLU:CD	2.14	0.54
1:A:369:LEU:HD22	1:A:369:LEU:C	2.33	0.54
1:A:110:ARG:NH2	1:A:144:GLY:O	2.41	0.53
1:B:450:MET:O	1:B:450:MET:HG3	2.09	0.53
1:B:373:ALA:HB2	1:B:453:LEU:HD13	1.91	0.53
1:B:325:GLY:HA3	2:B:702:HOH:O	2.07	0.53
1:B:236[B]:ARG:NH1	2:B:531:HOH:O	2.41	0.52
1:B:230[A]:THR:HG22	2:B:723:HOH:O	2.08	0.52
1:A:64:ILE:HD13	1:A:400:GLU:HA	1.91	0.52
1:B:105:TRP:CZ2	1:B:227:PRO:HG3	2.45	0.52
1:B:202:LYS:HB2	1:B:202:LYS:NZ	2.25	0.52
1:A:64:ILE:HG21	1:A:400:GLU:HB2	1.92	0.52
1:B:93:GLU:CA	1:B:238:LYS:HD2	2.39	0.52
1:B:305:ILE:HG12	1:B:416:SER:HA	1.92	0.51
1:A:370:MET:HE2	1:A:453:LEU:CD2	2.40	0.51
1:A:62:LYS:HE2	1:A:93:GLU:O	2.11	0.51
1:A:277:GLN:HG2	1:A:278:HIS:CD2	2.46	0.51
1:A:163:LYS:HD2	1:A:233:TRP:NE1	2.26	0.50
1:B:91:ASN:O	1:B:238:LYS:HG2	2.12	0.50
1:A:26:LEU:C	1:A:26:LEU:HD23	2.37	0.50
1:B:93:GLU:H	1:B:238:LYS:CE	2.24	0.50
1:A:251:LEU:CD1	1:A:255:ARG:HD2	2.42	0.49
1:B:64:ILE:CD1	1:B:65:THR:O	2.60	0.49
1:A:325:GLY:HA3	1:A:370:MET:CE	2.43	0.49
1:A:87:MET:HG2	1:A:95:PHE:HB3	1.94	0.48
1:A:26:LEU:HD23	1:A:26:LEU:O	2.14	0.48
1:B:93:GLU:N	1:B:238:LYS:CD	2.75	0.48
1:A:239:ASP:O	1:A:240:LYS:HB2	2.14	0.47
1:B:345:ASP:HB3	1:B:348:LEU:HB3	1.97	0.47
1:B:64:ILE:HD13	1:B:65:THR:O	2.15	0.47
1:B:448:ASP:OD1	1:B:450:MET:HG2	2.15	0.47
1:B:64:ILE:HD12	1:B:399:GLY:CA	2.45	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:348:LEU:HD23	1:A:348:LEU:C	2.42	0.45
1:B:268:ILE:HD12	1:B:437:LEU:HD21	1.98	0.45
1:A:93:GLU:HG2	1:A:238:LYS:CG	2.39	0.45
1:A:138:MET:HE3	1:A:138:MET:HB2	1.80	0.45
1:B:432:GLU:H	1:B:432:GLU:HG3	1.43	0.45
1:B:202:LYS:HB2	1:B:202:LYS:HZ2	1.81	0.44
1:B:335:LYS:HG3	2:B:573:HOH:O	2.17	0.44
1:A:246:GLY:HA2	1:A:247:PRO:C	2.43	0.44
1:A:171:THR:CG2	1:A:224:LEU:HD22	2.47	0.44
1:A:64:ILE:HD13	1:A:400:GLU:CA	2.48	0.44
1:A:64:ILE:HD13	1:A:400:GLU:N	2.33	0.44
1:B:330:LYS:O	1:B:331:HIS:C	2.61	0.44
1:A:318:ASP:OD2	1:A:427:LYS:HE3	2.17	0.43
1:B:124:ARG:HG2	1:B:124:ARG:NH1	2.29	0.43
1:B:238:LYS:HE2	1:B:238:LYS:CA	2.46	0.43
1:A:370:MET:HE1	1:A:421:GLU:OE1	2.19	0.43
1:B:238:LYS:N	1:B:238:LYS:CE	2.69	0.42
1:B:274:PRO:HG3	1:B:359:LYS:HB3	2.01	0.42
1:B:289:LEU:O	1:B:298:THR:CG2	2.68	0.42
1:A:64:ILE:CD1	1:A:399:GLY:C	2.93	0.42
1:B:31:GLY:HA2	1:B:39:ILE:HD13	2.02	0.41
1:B:124:ARG:HH11	1:B:124:ARG:CG	2.30	0.41
1:B:450:MET:CE	2:B:707:HOH:O	2.68	0.41
1:B:93:GLU:H	1:B:238:LYS:HD2	1.82	0.41
1:A:275:ARG:HA	1:A:276:PRO:HD3	1.89	0.41
1:A:2:SER:C	1:A:4:SER:N	2.76	0.41
1:A:146:GLN:OE1	1:A:421:GLU:OE2	2.38	0.41
1:B:246:GLY:HA2	1:B:247:PRO:C	2.45	0.41
1:B:77[A]:SER:HB2	1:B:375:THR:HG22	2.02	0.41
1:B:381:GLU:HA	1:B:389:PHE:HA	2.02	0.41
1:B:308:LEU:HD13	1:B:422:VAL:HG22	2.01	0.41
1:A:151:VAL:HG11	1:A:296:ARG:CZ	2.51	0.40
1:B:146:GLN:OE1	1:B:421:GLU:OE2	2.39	0.40
1:B:378:ALA:HB3	1:B:393:ARG:HB3	2.02	0.40
1:B:53:PHE:CD1	1:B:53:PHE:N	2.89	0.40
1:A:382:LYS:HG2	1:A:390:THR:HG23	2.02	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	458/453 (101%)	446 (97%)	9 (2%)	3 (1%)	18	8
1	B	459/453 (101%)	449 (98%)	9 (2%)	1 (0%)	43	31
All	All	917/906 (101%)	895 (98%)	18 (2%)	4 (0%)	30	17

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	385	GLN
1	A	386	ASP
1	A	384	ASP
1	B	3	SER

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	412/405 (102%)	407 (99%)	5 (1%)	63	55
1	B	413/405 (102%)	402 (97%)	11 (3%)	39	24
All	All	825/810 (102%)	809 (98%)	16 (2%)	48	38

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	170	THR
1	A	234	GLU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	244	LYS
1	A	308	LEU
1	A	369	LEU
1	B	43	ARG
1	B	64	ILE
1	B	132	LEU
1	B	202	LYS
1	B	308	LEU
1	B	345	ASP
1	B	375	THR
1	B	381	GLU
1	B	402	HIS
1	B	431	GLU
1	B	450	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	59	GLN
1	A	91	ASN
1	A	226	ASN
1	A	241	ASN
1	A	342	ASN
1	B	23	GLN
1	B	51	HIS
1	B	54	GLN
1	B	55	HIS
1	B	91	ASN
1	B	226	ASN
1	B	241	ASN
1	B	402	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 oligosaccharides 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

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.