



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 24, 2017 – 07:45 AM EDT

PDB ID : 3GU0  
Title : Promiscuous Substrate Recognition in Folding and Assembly Activities of the Trigger Factor Chaperone  
Authors : Martinez-Hackert, E.; Hendrickson, W.A.  
Deposited on : unknown  
Resolution : 3.50 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20030345
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20030345

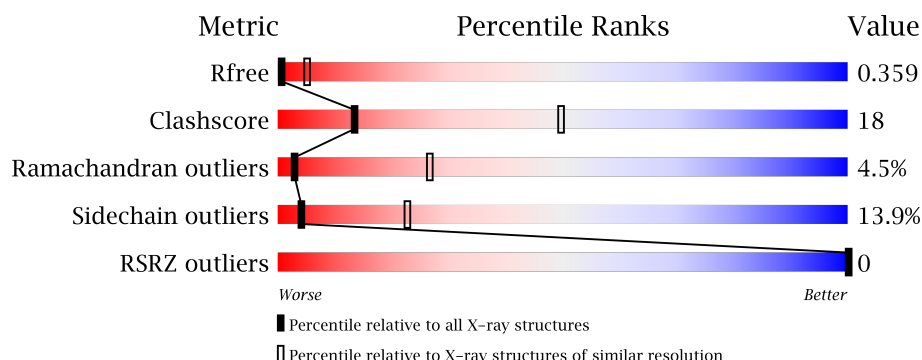
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.50 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))
$R_{free}$	100719	1195 (3.60-3.40)
Clashscore	112137	1322 (3.60-3.40)
Ramachandran outliers	110173	1283 (3.60-3.40)
Sidechain outliers	110143	1284 (3.60-3.40)
RSRZ outliers	101464	1226 (3.60-3.40)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	412	<div> <div style="width: 51%; background-color: green;"></div> <div style="width: 41%; background-color: yellow;"></div> <div style="width: 7%; background-color: orange;"></div> <div style="width: 1%; background-color: grey;"></div> </div> <div>51% 41% 7% .</div>

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 3368 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 Trigger factor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	406	Total	C	N	O	S	0	0	0
			3368	2122	569	671	6			

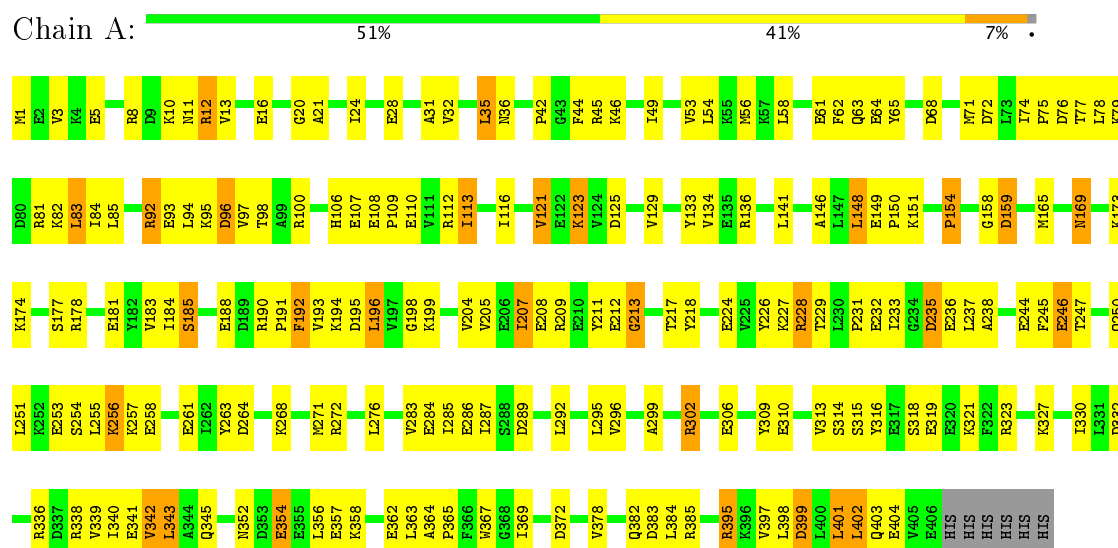
There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	406	GLU	-	EXPRESSION TAG	UNP Q9WZF8
A	407	HIS	-	EXPRESSION TAG	UNP Q9WZF8
A	408	HIS	-	EXPRESSION TAG	UNP Q9WZF8
A	409	HIS	-	EXPRESSION TAG	UNP Q9WZF8
A	410	HIS	-	EXPRESSION TAG	UNP Q9WZF8
A	411	HIS	-	EXPRESSION TAG	UNP Q9WZF8
A	412	HIS	-	EXPRESSION TAG	UNP Q9WZF8

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: Trigger factor



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	95.39 Å 114.49 Å 94.56 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 3.50 9.98 – 3.50	Depositor EDS
% Data completeness (in resolution range)	100.0 (10.00-3.50) 94.5 (9.98-3.50)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.00 (at 3.53 Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.244 , 0.358 0.243 , 0.359	Depositor DCC
$R_{free}$ test set	288 reflections (4.95%)	DCC
Wilson B-factor (Å <sup>2</sup> )	83.8	Xtriage
Anisotropy	0.194	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 65.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	3368	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	57.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.17% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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	0.49	0/3407	0.62	0/4570

There are no bond length outliers.

There are no bond angle outliers.

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	3368	0	3427	122	0
All	All	3368	0	3427	122	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 18.

All (122) 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:255:LEU:HA	1:A:258:GLU:HB2	1.29	1.07
1:A:84:ILE:HG22	1:A:85:LEU:HG	1.52	0.89
1:A:271:MET:HB3	1:A:402:LEU:HD11	1.57	0.86
1:A:395:ARG:O	1:A:399:ASP:HB2	1.76	0.85
1:A:97:VAL:HG12	1:A:97:VAL:O	1.79	0.82

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:32:VAL:O	1:A:36:ASN:HB2	1.81	0.80
1:A:338:ARG:O	1:A:342:VAL:HG23	1.83	0.78
1:A:53:VAL:O	1:A:56:MET:HB2	1.85	0.76
1:A:58:LEU:HB3	1:A:61:GLU:HB3	1.70	0.71
1:A:382:GLN:HA	1:A:385:ARG:HE	1.56	0.71
1:A:109:PRO:HG2	1:A:285:ILE:HD11	1.73	0.70
1:A:363:LEU:HB3	1:A:367:TRP:CZ3	2.28	0.69
1:A:338:ARG:HA	1:A:341:GLU:HB2	1.74	0.68
1:A:302:ARG:HD2	1:A:306:GLU:OE2	1.94	0.67
1:A:84:ILE:HG21	1:A:295:LEU:HD11	1.77	0.67
1:A:276:LEU:HB2	1:A:398:LEU:HD11	1.78	0.66
1:A:84:ILE:HG12	1:A:108:GLU:HA	1.79	0.65
1:A:83:LEU:HB3	1:A:107:GLU:HA	1.77	0.65
1:A:159:ASP:N	1:A:159:ASP:OD1	2.30	0.64
1:A:276:LEU:HB2	1:A:398:LEU:CD1	2.29	0.62
1:A:21:ALA:HA	1:A:24:ILE:HD12	1.81	0.62
1:A:35:LEU:HB3	1:A:54:LEU:HD21	1.81	0.62
1:A:174:LYS:NZ	1:A:177:SER:HB2	2.15	0.61
1:A:97:VAL:O	1:A:97:VAL:CG1	2.47	0.60
1:A:11:ASN:ND2	1:A:110:GLU:H	2.00	0.60
1:A:352:ASN:ND2	1:A:354:GLU:HB3	2.16	0.60
1:A:283:VAL:HG21	1:A:339:VAL:HG21	1.84	0.59
1:A:44:PHE:HB2	1:A:49:ILE:HG12	1.85	0.59
1:A:247:THR:H	1:A:250:GLN:HE21	1.51	0.58
1:A:11:ASN:ND2	1:A:286:GLU:O	2.35	0.58
1:A:16:GLU:OE2	1:A:100:ARG:HD2	2.02	0.58
1:A:10:LYS:HD2	1:A:286:GLU:HB3	1.87	0.57
1:A:76:ASP:HA	1:A:79:LYS:HE2	1.86	0.57
1:A:246:GLU:H	1:A:250:GLN:NE2	2.03	0.56
1:A:44:PHE:CB	1:A:49:ILE:HG12	2.35	0.56
1:A:289:ASP:HA	1:A:292:LEU:HD12	1.88	0.56
1:A:61:GLU:HG3	1:A:65:TYR:HE2	1.69	0.56
1:A:112:ARG:NH2	1:A:284:GLU:HG2	2.21	0.55
1:A:191:PRO:O	1:A:192:PHE:CD1	2.60	0.55
1:A:191:PRO:HA	1:A:194:LYS:HE2	1.88	0.54
1:A:204:VAL:HG12	1:A:205:VAL:N	2.21	0.54
1:A:318:SER:HB2	1:A:321:LYS:HG2	1.89	0.54
1:A:125:ASP:O	1:A:129:VAL:HG23	2.07	0.54
1:A:310:GLU:O	1:A:314:SER:HB2	2.08	0.53
1:A:12:ARG:HD2	1:A:106:HIS:CE1	2.43	0.53
1:A:174:LYS:HZ1	1:A:177:SER:HB2	1.71	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:83:LEU:HA	1:A:107:GLU:HA	1.91	0.53
1:A:251:LEU:O	1:A:254:SER:OG	2.24	0.52
1:A:339:VAL:HG12	1:A:343:LEU:HD12	1.91	0.52
1:A:332:ASP:O	1:A:336:ARG:HG3	2.10	0.51
1:A:338:ARG:NH1	1:A:342:VAL:HG22	2.26	0.51
1:A:402:LEU:C	1:A:404:GLU:H	2.14	0.51
1:A:238:ALA:HB1	1:A:245:PHE:HB3	1.91	0.51
1:A:255:LEU:HG	1:A:258:GLU:OE2	2.11	0.50
1:A:296:VAL:HG21	1:A:327:LYS:HG3	1.92	0.50
1:A:208:GLU:HG2	1:A:217:THR:HG23	1.92	0.50
1:A:28:GLU:HG3	1:A:62:PHE:HE2	1.76	0.50
1:A:299:ALA:HA	1:A:302:ARG:NH2	2.27	0.50
1:A:8:ARG:NH1	1:A:107:GLU:OE1	2.44	0.50
1:A:83:LEU:CB	1:A:107:GLU:HA	2.42	0.49
1:A:149:GLU:H	1:A:227:LYS:HG3	1.77	0.49
1:A:133:TYR:HD1	1:A:136:ARG:NH2	2.11	0.49
1:A:211:TYR:O	1:A:213:GLY:N	2.45	0.49
1:A:209:ARG:NE	1:A:211:TYR:OH	2.33	0.49
1:A:207:ILE:CG2	1:A:218:TYR:HB2	2.43	0.49
1:A:382:GLN:O	1:A:384:LEU:N	2.45	0.49
1:A:113:ILE:HD12	1:A:113:ILE:H	1.78	0.48
1:A:74:ILE:HB	1:A:75:PRO:HD3	1.94	0.48
1:A:159:ASP:HA	1:A:228:ARG:HB3	1.95	0.48
1:A:185:SER:N	1:A:188:GLU:OE2	2.47	0.48
1:A:134:VAL:HG21	1:A:256:LYS:HA	1.96	0.48
1:A:148:LEU:HA	1:A:227:LYS:O	2.13	0.48
1:A:149:GLU:N	1:A:227:LYS:HZ2	2.12	0.47
1:A:109:PRO:CG	1:A:285:ILE:HD11	2.43	0.47
1:A:183:VAL:HG21	1:A:228:ARG:CZ	2.45	0.47
1:A:94:LEU:HD12	1:A:98:THR:O	2.14	0.47
1:A:108:GLU:OE2	1:A:338:ARG:HD3	2.15	0.47
1:A:364:ALA:N	1:A:365:PRO:HD2	2.30	0.47
1:A:296:VAL:HG22	1:A:330:ILE:HD12	1.96	0.47
1:A:336:ARG:O	1:A:340:ILE:HG12	2.14	0.47
1:A:96:ASP:N	1:A:96:ASP:OD2	2.43	0.47
1:A:63:GLN:HG3	1:A:94:LEU:HD23	1.97	0.46
1:A:72:ASP:O	1:A:75:PRO:HD2	2.15	0.46
1:A:285:ILE:HG12	1:A:286:GLU:N	2.30	0.46
1:A:83:LEU:HA	1:A:108:GLU:H	1.81	0.46
1:A:309:TYR:CZ	1:A:313:VAL:HG11	2.51	0.46
1:A:339:VAL:CG1	1:A:343:LEU:HD12	2.46	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:64:GLU:HG3	1:A:92:ARG:NH2	2.31	0.45
1:A:169:ASN:HD22	1:A:169:ASN:HA	1.57	0.45
1:A:196:LEU:HA	1:A:199:LYS:HG3	1.98	0.45
1:A:268:LYS:HB3	1:A:272:ARG:HH21	1.81	0.45
1:A:204:VAL:CG1	1:A:205:VAL:N	2.81	0.44
1:A:352:ASN:HD21	1:A:354:GLU:HB3	1.82	0.44
1:A:151:LYS:HD3	1:A:154:PRO:O	2.18	0.43
1:A:319:GLU:HG2	1:A:323:ARG:HH21	1.82	0.43
1:A:193:VAL:O	1:A:196:LEU:HB3	2.18	0.43
1:A:109:PRO:HG3	1:A:287:ILE:HD12	1.99	0.43
1:A:319:GLU:O	1:A:323:ARG:HG3	2.19	0.43
1:A:207:ILE:HG22	1:A:218:TYR:HB2	2.00	0.43
1:A:31:ALA:O	1:A:35:LEU:HB2	2.19	0.43
1:A:151:LYS:HZ3	1:A:154:PRO:HD2	1.82	0.43
1:A:146:ALA:HA	1:A:231:PRO:HD2	2.00	0.43
1:A:158:GLY:H	1:A:185:SER:HA	1.82	0.42
1:A:123:LYS:HD3	1:A:263:TYR:OH	2.19	0.42
1:A:235:ASP:N	1:A:235:ASP:OD1	2.52	0.42
1:A:183:VAL:HG21	1:A:228:ARG:NH2	2.34	0.42
1:A:150:PRO:HA	1:A:226:TYR:HA	2.02	0.42
1:A:382:GLN:C	1:A:384:LEU:N	2.73	0.42
1:A:82:LYS:HD2	1:A:82:LYS:N	2.35	0.41
1:A:158:GLY:HA2	1:A:184:ILE:O	2.21	0.41
1:A:397:VAL:O	1:A:401:LEU:HG	2.19	0.41
1:A:68:ASP:HA	1:A:71:MET:HB2	2.03	0.41
1:A:154:PRO:HB2	1:A:198:GLY:HA2	2.02	0.41
1:A:20:GLY:O	1:A:24:ILE:HG13	2.21	0.41
1:A:113:ILE:H	1:A:113:ILE:CD1	2.34	0.41
1:A:64:GLU:HG3	1:A:92:ARG:HH22	1.85	0.41
1:A:286:GLU:N	1:A:286:GLU:OE1	2.54	0.41
1:A:165:MET:O	1:A:178:ARG:N	2.51	0.41
1:A:194:LYS:CG	1:A:195:ASP:H	2.34	0.41
1:A:309:TYR:O	1:A:313:VAL:HG12	2.21	0.41
1:A:354:GLU:O	1:A:357:GLU:HB2	2.20	0.40
1:A:363:LEU:HB3	1:A:367:TRP:HZ3	1.80	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	404/412 (98%)	328 (81%)	58 (14%)	18 (4%)	3	27

All (18) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	196	LEU
1	A	233	ILE
1	A	46	LYS
1	A	212	GLU
1	A	383	ASP
1	A	121	VAL
1	A	154	PRO
1	A	5	GLU
1	A	12	ARG
1	A	256	LYS
1	A	315	SER
1	A	244	GLU
1	A	253	GLU
1	A	42	PRO
1	A	192	PHE
1	A	343	LEU
1	A	403	GLN
1	A	213	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	374/380 (98%)	322 (86%)	52 (14%)	4 23

All (52) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	3	VAL
1	A	13	VAL
1	A	35	LEU
1	A	45	ARG
1	A	77	THR
1	A	78	LEU
1	A	81	ARG
1	A	83	LEU
1	A	92	ARG
1	A	93	GLU
1	A	95	LYS
1	A	96	ASP
1	A	113	ILE
1	A	116	ILE
1	A	121	VAL
1	A	123	LYS
1	A	141	LEU
1	A	148	LEU
1	A	159	ASP
1	A	169	ASN
1	A	173	LYS
1	A	181	GLU
1	A	185	SER
1	A	190	ARG
1	A	207	ILE
1	A	224	GLU
1	A	228	ARG
1	A	229	THR
1	A	232	GLU
1	A	235	ASP
1	A	236	GLU
1	A	237	LEU
1	A	246	GLU
1	A	257	LYS
1	A	261	GLU
1	A	264	ASP
1	A	302	ARG

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Mol	Chain	Res	Type
1	A	316	TYR
1	A	342	VAL
1	A	345	GLN
1	A	354	GLU
1	A	356	LEU
1	A	358	LYS
1	A	362	GLU
1	A	369	ILE
1	A	372	ASP
1	A	378	VAL
1	A	395	ARG
1	A	399	ASP
1	A	401	LEU
1	A	402	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	11	ASN
1	A	26	GLN
1	A	37	GLN
1	A	169	ASN
1	A	250	GLN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	406/412 (98%)	-0.36	0 100 100	34, 59, 72, 82	0

There are no RSRZ outliers to report.

### 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 carbohydrates 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.