



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 15, 2017 – 01:35 am GMT

PDB ID : 4AU3  
Title : Crystal Structure of a Hsp47-collagen complex  
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Deposited on : 2012-05-14  
Resolution : 2.78 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : trunk28620  
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) : recalc28949

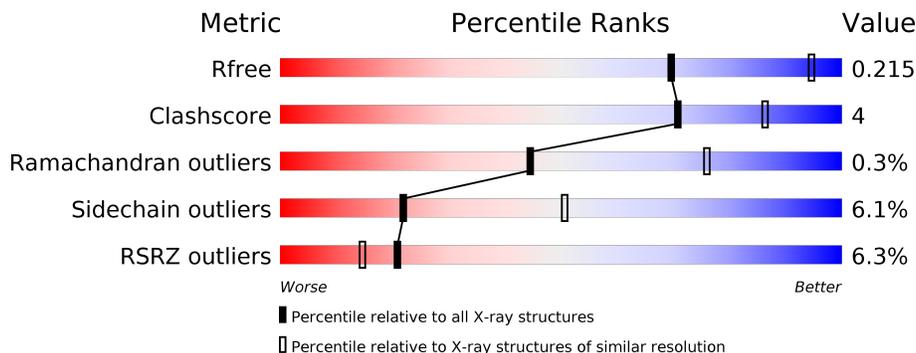
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.78 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	3276 (2.80-2.76)
Clashscore	112137	3771 (2.80-2.76)
Ramachandran outliers	110173	3707 (2.80-2.76)
Sidechain outliers	110143	3709 (2.80-2.76)
RSRZ outliers	101464	3307 (2.80-2.76)

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	392	 84% 9% • 6%
1	C	392	 14% 79% 15% • 6%
1	D	392	 3% 81% 11% • 5%
2	B	392	 6% 78% 12% • 7%
3	E	20	 70% 5% 25%
3	F	20	 80% 20%

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Mol	Chain	Length	Quality of chain
3	G	20	 70% 5% 25%
3	H	20	 80% 5% 15%
3	I	20	 70% 10% 20%
3	J	20	 65% 10% 25%

## 2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 12171 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 SERPIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47 ), MEMBER 1, (COLLAGEN BINDING PROTEIN 1).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	367	2886	1839	501	532	1	13	0	0	0
1	C	370	2911	1854	505	538	1	13	0	0	0
1	D	372	2926	1861	513	538	1	13	0	0	0

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	35	MSE	-	EXPRESSION TAG	UNP E2RHY7
A	419	LEU	-	EXPRESSION TAG	UNP E2RHY7
A	420	GLU	-	EXPRESSION TAG	UNP E2RHY7
A	421	HIS	-	EXPRESSION TAG	UNP E2RHY7
A	422	HIS	-	EXPRESSION TAG	UNP E2RHY7
A	423	HIS	-	EXPRESSION TAG	UNP E2RHY7
A	424	HIS	-	EXPRESSION TAG	UNP E2RHY7
A	425	HIS	-	EXPRESSION TAG	UNP E2RHY7
A	426	HIS	-	EXPRESSION TAG	UNP E2RHY7
C	35	MSE	-	EXPRESSION TAG	UNP E2RHY7
C	419	LEU	-	EXPRESSION TAG	UNP E2RHY7
C	420	GLU	-	EXPRESSION TAG	UNP E2RHY7
C	421	HIS	-	EXPRESSION TAG	UNP E2RHY7
C	422	HIS	-	EXPRESSION TAG	UNP E2RHY7
C	423	HIS	-	EXPRESSION TAG	UNP E2RHY7
C	424	HIS	-	EXPRESSION TAG	UNP E2RHY7
C	425	HIS	-	EXPRESSION TAG	UNP E2RHY7
C	426	HIS	-	EXPRESSION TAG	UNP E2RHY7
D	35	MSE	-	EXPRESSION TAG	UNP E2RHY7
D	419	LEU	-	EXPRESSION TAG	UNP E2RHY7
D	420	GLU	-	EXPRESSION TAG	UNP E2RHY7
D	421	HIS	-	EXPRESSION TAG	UNP E2RHY7

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Chain	Residue	Modelled	Actual	Comment	Reference
D	422	HIS	-	EXPRESSION TAG	UNP E2RHY7
D	423	HIS	-	EXPRESSION TAG	UNP E2RHY7
D	424	HIS	-	EXPRESSION TAG	UNP E2RHY7
D	425	HIS	-	EXPRESSION TAG	UNP E2RHY7
D	426	HIS	-	EXPRESSION TAG	UNP E2RHY7

- Molecule 2 is a protein called SERPYIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47 ), MEMBER 1, (COLLAGEN BINDING PROTEIN 1).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	S				Se
2	B	364	2856	1817	498	527	1	13	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	35	MSE	-	EXPRESSION TAG	UNP E2RHY7
B	419	LEU	-	EXPRESSION TAG	UNP E2RHY7
B	420	GLU	-	EXPRESSION TAG	UNP E2RHY7
B	421	HIS	-	EXPRESSION TAG	UNP E2RHY7
B	422	HIS	-	EXPRESSION TAG	UNP E2RHY7
B	423	HIS	-	EXPRESSION TAG	UNP E2RHY7
B	424	HIS	-	EXPRESSION TAG	UNP E2RHY7
B	425	HIS	-	EXPRESSION TAG	UNP E2RHY7
B	426	HIS	-	EXPRESSION TAG	UNP E2RHY7

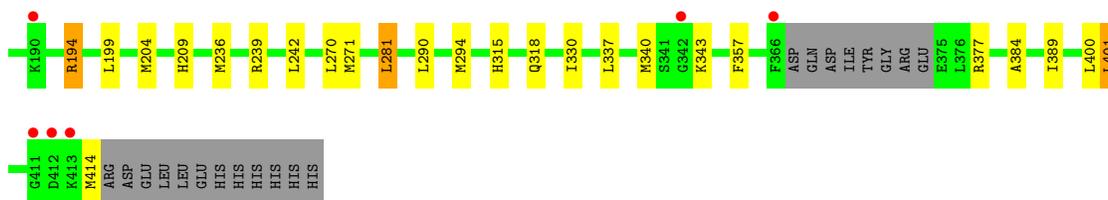
- Molecule 3 is a protein called 18ER COLLAGEN MODEL PEPTIDE 15-R8.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	E	15	94	61	18	15	0	0	0
3	F	16	101	66	19	16	0	0	0
3	G	15	94	61	18	15	0	0	0
3	H	17	108	71	20	17	0	0	0
3	I	16	101	66	19	16	0	0	0
3	J	15	94	61	18	15	0	0	0

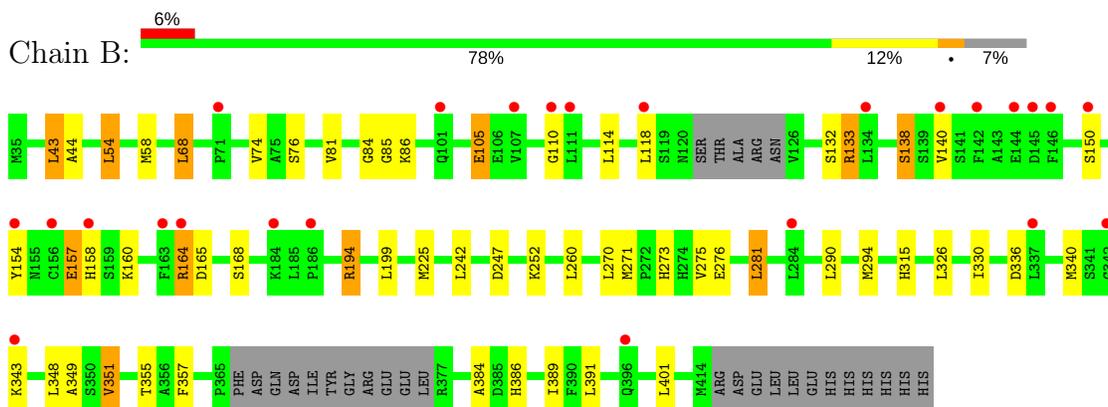
There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	0	ACE	-	EXPRESSION TAG	UNP Q96A83
E	19	NH2	-	EXPRESSION TAG	UNP Q96A83
F	0	ACE	-	EXPRESSION TAG	UNP Q96A83
F	19	NH2	-	EXPRESSION TAG	UNP Q96A83
G	0	ACE	-	EXPRESSION TAG	UNP Q96A83
G	19	NH2	-	EXPRESSION TAG	UNP Q96A83
H	0	ACE	-	EXPRESSION TAG	UNP Q96A83
H	19	NH2	-	EXPRESSION TAG	UNP Q96A83
I	0	ACE	-	EXPRESSION TAG	UNP Q96A83
I	19	NH2	-	EXPRESSION TAG	UNP Q96A83
J	0	ACE	-	EXPRESSION TAG	UNP Q96A83
J	19	NH2	-	EXPRESSION TAG	UNP Q96A83

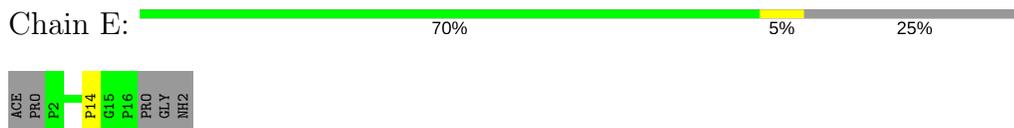




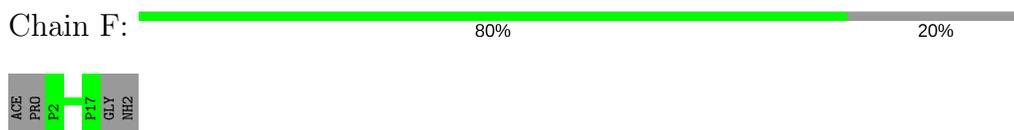
- Molecule 2: SERPYIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47 ), MEMBER 1, (COLLAGEN BINDING PROTEIN 1)



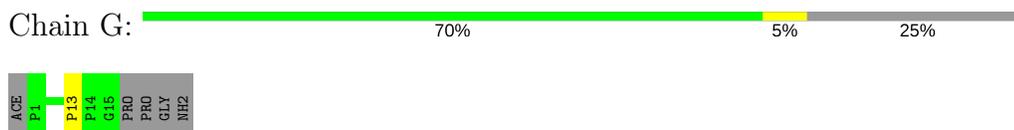
- Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8



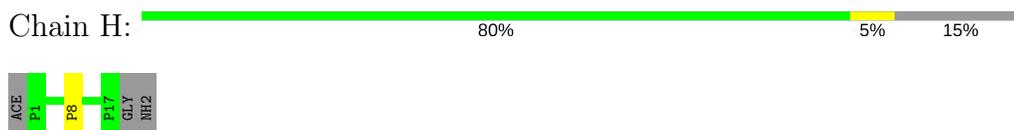
- Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8



- Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8



- Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8



- Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8

Chain I:  70% 10% 20%



- Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8

Chain J:  65% 10% 25%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	101.26Å 101.26Å 366.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	91.74 – 2.78 91.75 – 2.68	Depositor EDS
% Data completeness (in resolution range)	98.7 (91.74-2.78) 97.8 (91.75-2.68)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.31 (at 2.69Å)	Xtrriage
Refinement program	BUSTER 2.10.0	Depositor
R, $R_{free}$	0.203 , 0.234 0.216 , 0.215	Depositor DCC
$R_{free}$ test set	1332 reflections (2.80%)	DCC
Wilson B-factor (Å <sup>2</sup> )	62.8	Xtrriage
Anisotropy	0.131	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 54.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	12171	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	77.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.18% 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	0.54	0/2932	0.73	0/3932
1	C	0.50	0/2957	0.72	0/3966
1	D	0.49	0/2973	0.73	1/3988 (0.0%)
2	B	0.49	0/2901	0.73	0/3889
3	E	0.44	0/102	0.43	0/143
3	F	0.45	0/110	0.48	0/155
3	G	0.52	0/102	0.44	0/143
3	H	0.55	0/118	0.44	0/167
3	I	0.44	0/110	0.48	0/155
3	J	0.54	0/102	0.46	0/143
All	All	0.51	0/12407	0.72	1/16681 (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	D	164	ARG	C-N-CA	5.16	134.60	121.70

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	2886	0	2919	15	0
1	C	2911	0	2942	30	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2926	0	2965	22	0
2	B	2856	0	2883	31	0
3	E	94	0	91	1	0
3	F	101	0	98	0	0
3	G	94	0	93	1	0
3	H	108	0	107	1	0
3	I	101	0	100	2	0
3	J	94	0	93	2	0
All	All	12171	0	12291	99	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 4.

The worst 5 of 99 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:C:230:TYR:HE1	1:C:413:LYS:HB3	1.47	0.77
1:D:43:LEU:HD23	1:D:110:GLY:HA3	1.68	0.74
1:C:58:MSE:HE1	1:C:315:HIS:HB3	1.70	0.73
1:A:72:VAL:HG21	1:A:118:LEU:HD21	1.71	0.73
1:A:58:MSE:HE1	1:A:315:HIS:HB3	1.76	0.68

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	361/392 (92%)	350 (97%)	10 (3%)	1 (0%)	44 76
1	C	364/392 (93%)	346 (95%)	16 (4%)	2 (0%)	32 65
1	D	368/392 (94%)	349 (95%)	17 (5%)	2 (0%)	32 65

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	358/392 (91%)	348 (97%)	10 (3%)	0	100	100
3	E	13/20 (65%)	13 (100%)	0	0	100	100
3	F	14/20 (70%)	14 (100%)	0	0	100	100
3	G	13/20 (65%)	13 (100%)	0	0	100	100
3	H	15/20 (75%)	15 (100%)	0	0	100	100
3	I	14/20 (70%)	14 (100%)	0	0	100	100
3	J	13/20 (65%)	13 (100%)	0	0	100	100
All	All	1533/1688 (91%)	1475 (96%)	53 (4%)	5 (0%)	44	76

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	165	ASP
1	A	366	PHE
1	C	138	SER
1	C	87	ALA
1	D	377	ARG

### 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	313/324 (97%)	298 (95%)	15 (5%)	30	62
1	C	316/324 (98%)	299 (95%)	17 (5%)	26	56
1	D	317/324 (98%)	292 (92%)	25 (8%)	14	36
2	B	309/325 (95%)	285 (92%)	24 (8%)	15	37
3	E	10/12 (83%)	10 (100%)	0	100	100
3	F	11/12 (92%)	11 (100%)	0	100	100
3	G	10/12 (83%)	10 (100%)	0	100	100
3	H	12/12 (100%)	12 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	I	11/12 (92%)	11 (100%)	0	100	100
3	J	10/12 (83%)	10 (100%)	0	100	100
All	All	1319/1369 (96%)	1238 (94%)	81 (6%)	22	50

5 of 81 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	351	VAL
1	C	175	GLU
1	D	281	LEU
2	B	391	LEU
1	C	97	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	174	ASN
1	D	62	GLN
1	D	262	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 carbohydrates 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 [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	354/392 (90%)	0.04	3 (0%) 86 83	35, 55, 89, 130	0
1	C	357/392 (91%)	0.66	55 (15%) 2 1	33, 82, 153, 179	0
1	D	359/392 (91%)	0.27	12 (3%) 47 40	41, 79, 139, 166	0
2	B	351/392 (89%)	0.48	25 (7%) 17 11	42, 82, 127, 178	0
3	E	15/20 (75%)	0.17	0 100 100	47, 60, 89, 98	0
3	F	16/20 (80%)	0.18	0 100 100	49, 60, 91, 95	0
3	G	15/20 (75%)	0.11	0 100 100	39, 51, 86, 97	0
3	H	17/20 (85%)	-0.08	0 100 100	37, 46, 75, 83	0
3	I	16/20 (80%)	-0.03	0 100 100	41, 51, 86, 94	0
3	J	15/20 (75%)	0.00	0 100 100	33, 48, 78, 98	0
All	All	1515/1688 (89%)	0.34	95 (6%) 21 15	33, 70, 138, 179	0

The worst 5 of 95 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	413	LYS	8.8
2	B	342	GLY	8.0
1	A	366	PHE	7.6
2	B	343	LYS	6.6
1	C	348	LEU	6.1

### 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 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.