wwPDB X-ray Structure Validation Summary Report (i)

Jan 12, 2026 – 10:14 AM EST

PDB ID	:	9Q78 / pdb_00009q78
Title	:	Crystal structure of T. cruzi EIF4E6 in complex with EIF4G5 peptide
Authors	:	Penteado, R.F.; Guimaraes, B.G.
Deposited on	:	2025-08-22
Resolution	:	2.10 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

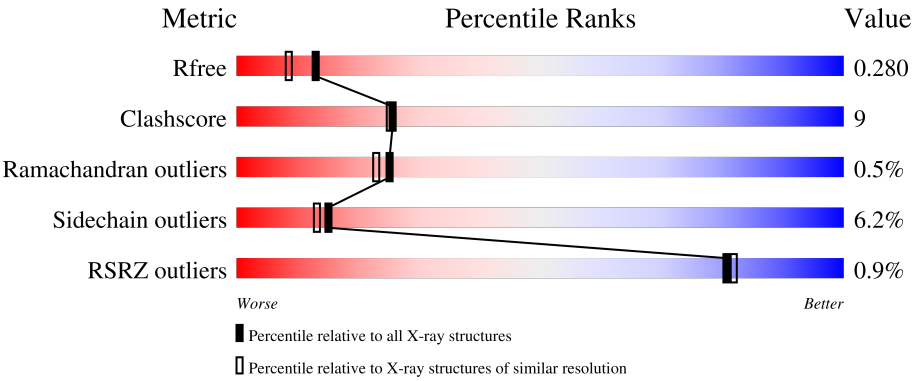
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.47

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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}	164625	6234 (2.10-2.10)
Clashscore	180529	6893 (2.10-2.10)
Ramachandran outliers	177936	6839 (2.10-2.10)
Sidechain outliers	177891	6840 (2.10-2.10)
RSRZ outliers	164620	6234 (2.10-2.10)

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 <=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	186	61% 23% • 13%
1	C	186	% 68% 17% •• 14%
1	E	186	2% 64% 20% • 14%
1	G	186	% 60% 23% • 13%
2	B	49	2% 65% 14% 20%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
2	D	49	2% 55% 22% 18%
2	F	49	69% 8% 18%
2	H	49	63% 14% 22%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 6832 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 Putative Eukaryotic translation initiation factor 4E type 6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	160	Total	C	N	O	S	16	3	0
			1324	858	224	238	4			
1	A	161	Total	C	N	O	S	31	5	0
			1353	877	231	241	4			
1	G	161	Total	C	N	O	S	41	2	0
			1319	859	222	234	4			
1	E	160	Total	C	N	O	S	25	3	0
			1325	861	225	235	4			

- Molecule 2 is a protein called Eukaryotic translation initiation factor 4 gamma 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	40	Total	C	N	O	S	7	0	0
			325	209	55	59	2			
2	B	39	Total	C	N	O	S	12	1	0
			318	206	52	58	2			
2	H	38	Total	C	N	O	S	3	0	0
			306	198	51	55	2			
2	F	40	Total	C	N	O	S	4	1	0
			328	211	55	60	2			

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	70	MET	-	initiating methionine	UNP A0A2V2VHI6
D	113	HIS	-	expression tag	UNP A0A2V2VHI6
D	114	HIS	-	expression tag	UNP A0A2V2VHI6
D	115	HIS	-	expression tag	UNP A0A2V2VHI6
D	116	HIS	-	expression tag	UNP A0A2V2VHI6
D	117	HIS	-	expression tag	UNP A0A2V2VHI6
D	118	HIS	-	expression tag	UNP A0A2V2VHI6
B	70	MET	-	initiating methionine	UNP A0A2V2VHI6

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	113	HIS	-	expression tag	UNP A0A2V2VHI6
B	114	HIS	-	expression tag	UNP A0A2V2VHI6
B	115	HIS	-	expression tag	UNP A0A2V2VHI6
B	116	HIS	-	expression tag	UNP A0A2V2VHI6
B	117	HIS	-	expression tag	UNP A0A2V2VHI6
B	118	HIS	-	expression tag	UNP A0A2V2VHI6
H	70	MET	-	initiating methionine	UNP A0A2V2VHI6
H	113	HIS	-	expression tag	UNP A0A2V2VHI6
H	114	HIS	-	expression tag	UNP A0A2V2VHI6
H	115	HIS	-	expression tag	UNP A0A2V2VHI6
H	116	HIS	-	expression tag	UNP A0A2V2VHI6
H	117	HIS	-	expression tag	UNP A0A2V2VHI6
H	118	HIS	-	expression tag	UNP A0A2V2VHI6
F	70	MET	-	initiating methionine	UNP A0A2V2VHI6
F	113	HIS	-	expression tag	UNP A0A2V2VHI6
F	114	HIS	-	expression tag	UNP A0A2V2VHI6
F	115	HIS	-	expression tag	UNP A0A2V2VHI6
F	116	HIS	-	expression tag	UNP A0A2V2VHI6
F	117	HIS	-	expression tag	UNP A0A2V2VHI6
F	118	HIS	-	expression tag	UNP A0A2V2VHI6

- Molecule 3 is water.

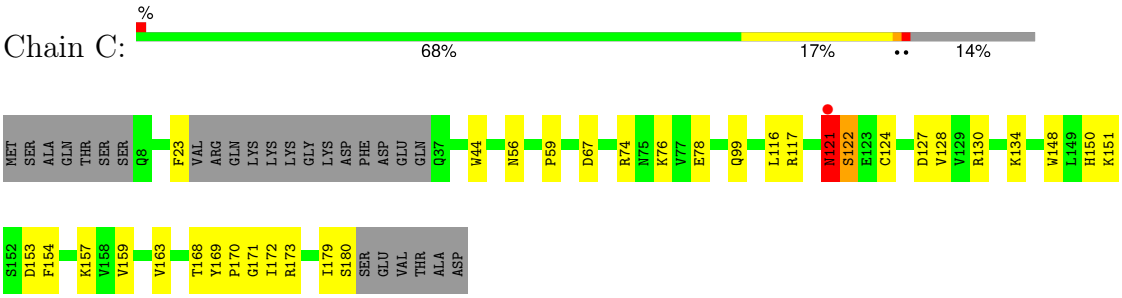
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	C	42	Total O 42 42	0	0
3	D	17	Total O 17 17	0	0
3	A	54	Total O 54 54	0	0
3	B	16	Total O 16 16	0	0
3	G	48	Total O 48 48	0	0
3	H	10	Total O 10 10	0	0
3	E	35	Total O 35 35	0	0
3	F	12	Total O 12 12	0	0

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.

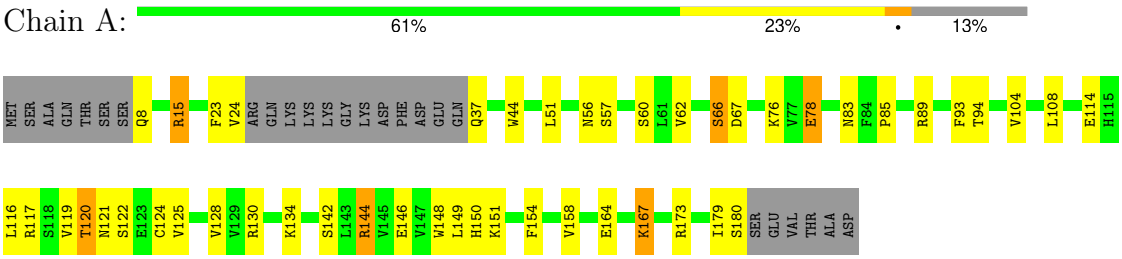
• Molecule 1: Putative Eukaryotic translation initiation factor 4E type 6

Chain C:



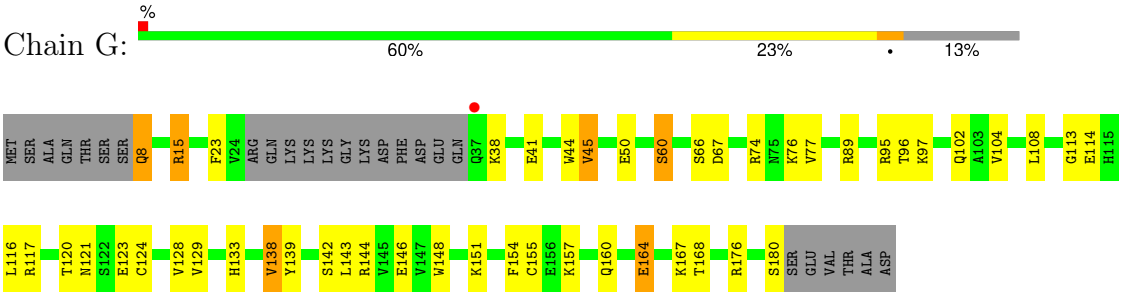
• Molecule 1: Putative Eukaryotic translation initiation factor 4E type 6

Chain A:



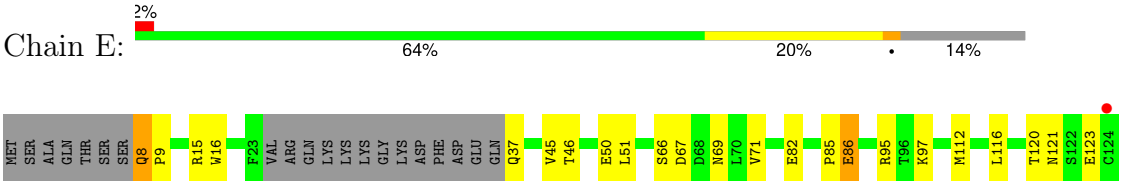
• Molecule 1: Putative Eukaryotic translation initiation factor 4E type 6

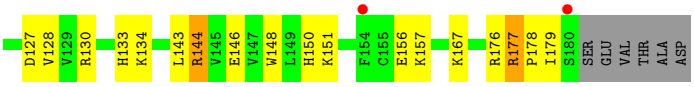
Chain G:



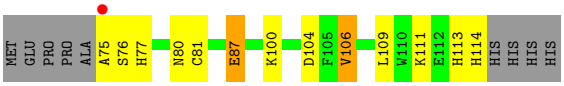
• Molecule 1: Putative Eukaryotic translation initiation factor 4E type 6

Chain E:

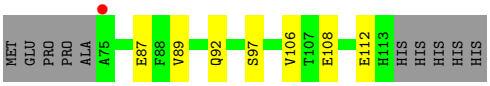




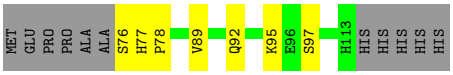
• Molecule 2: Eukaryotic translation initiation factor 4 gamma 5



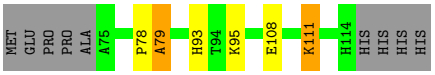
• Molecule 2: Eukaryotic translation initiation factor 4 gamma 5



• Molecule 2: Eukaryotic translation initiation factor 4 gamma 5



• Molecule 2: Eukaryotic translation initiation factor 4 gamma 5



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	39.89Å 112.69Å 100.02Å 90.00° 97.96° 90.00°	Depositor
Resolution (Å)	49.58 – 2.10 49.58 – 2.10	Depositor EDS
% Data completeness (in resolution range)	73.9 (49.58-2.10) 73.8 (49.58-2.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.06 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0430	Depositor
R, R_{free}	0.201 , 0.270 0.215 , 0.280	Depositor DCC
R_{free} test set	1932 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å^2)	14.6	Xtriage
Anisotropy	1.337	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 34.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	6832	wwPDB-VP
Average B, all atoms (Å^2)	17.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 47.77 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.4572e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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	0.73	2/1398 (0.1%)	0.82	0/1904
1	C	0.69	0/1367	0.86	0/1862
1	E	0.71	0/1371	0.87	1/1867 (0.1%)
1	G	0.73	0/1362	0.93	2/1857 (0.1%)
2	B	0.72	0/332	0.88	0/451
2	D	0.70	0/336	0.90	0/456
2	F	0.65	0/342	0.84	0/465
2	H	0.64	0/316	0.88	0/429
All	All	0.71	2/6824 (0.0%)	0.87	3/9291 (0.0%)

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
1	A	0	4
1	C	0	3
1	E	0	3
1	G	0	1
All	All	0	11

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	180	SER	CB-OG	10.21	1.62	1.42
1	A	85	PRO	C-O	8.00	1.32	1.23

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	G	8	GLN	CA-CB-CG	-8.62	96.87	114.10
1	G	157	LYS	CA-CB-CG	6.63	127.37	114.10

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	E	82	GLU	CB-CA-C	-5.08	102.04	110.68

There are no chirality outliers.

5 of 11 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	144[A]	ARG	Sidechain
1	A	15	ARG	Sidechain
1	C	130	ARG	Sidechain
1	C	153	ASP	Peptide
1	C	173	ARG	Sidechain

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	1353	0	1337	33	0
1	C	1324	0	1310	24	0
1	E	1325	0	1322	17	0
1	G	1319	0	1309	31	0
2	B	318	0	306	3	0
2	D	325	0	308	8	0
2	F	328	0	313	4	0
2	H	306	0	292	3	0
3	A	54	0	0	8	0
3	B	16	0	0	0	0
3	C	42	0	0	9	0
3	D	17	0	0	0	0
3	E	35	0	0	2	0
3	F	12	0	0	0	0
3	G	48	0	0	9	0
3	H	10	0	0	0	0
All	All	6832	0	6497	120	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.

The worst 5 of 120 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:66:SER:HB3	3:A:201:HOH:O	1.66	0.93
1:A:93:PHE:HB3	3:A:237:HOH:O	1.71	0.90
1:G:102:GLN:OE1	3:G:201:HOH:O	2.00	0.79
1:A:66:SER:CB	3:A:201:HOH:O	2.27	0.77
3:C:233:HOH:O	1:A:56:ASN:HB3	1.86	0.75

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	162/186 (87%)	149 (92%)	13 (8%)	0	100 100
1	C	159/186 (86%)	148 (93%)	9 (6%)	2 (1%)	10 6
1	E	159/186 (86%)	149 (94%)	10 (6%)	0	100 100
1	G	159/186 (86%)	150 (94%)	8 (5%)	1 (1%)	22 19
2	B	38/49 (78%)	38 (100%)	0	0	100 100
2	D	38/49 (78%)	35 (92%)	3 (8%)	0	100 100
2	F	39/49 (80%)	35 (90%)	3 (8%)	1 (3%)	4 1
2	H	36/49 (74%)	36 (100%)	0	0	100 100
All	All	790/940 (84%)	740 (94%)	46 (6%)	4 (0%)	25 23

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	F	79	ALA
1	C	121	ASN
1	C	122	SER
1	G	60	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	152/169 (90%)	143 (94%)	9 (6%)	16	14
1	C	149/169 (88%)	144 (97%)	5 (3%)	32	35
1	E	149/169 (88%)	136 (91%)	13 (9%)	8	6
1	G	147/169 (87%)	139 (95%)	8 (5%)	18	17
2	B	36/44 (82%)	32 (89%)	4 (11%)	5	3
2	D	36/44 (82%)	33 (92%)	3 (8%)	9	6
2	F	37/44 (84%)	36 (97%)	1 (3%)	40	44
2	H	34/44 (77%)	32 (94%)	2 (6%)	16	14
All	All	740/852 (87%)	695 (94%)	45 (6%)	15	13

5 of 45 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	164	GLU
1	E	116	LEU
2	H	95	LYS
1	E	37	GLN
1	E	151	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	121	ASN
1	G	75	ASN
1	E	121	ASN
2	D	92	GLN
1	C	121	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 (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, 95^{th} 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	161/186 (86%)	-0.22	0 100 100	5, 14, 30, 40	15 (9%)
1	C	160/186 (86%)	-0.19	1 (0%) 85 86	6, 13, 34, 52	7 (4%)
1	E	160/186 (86%)	-0.21	3 (1%) 66 67	3, 12, 31, 42	11 (6%)
1	G	161/186 (86%)	-0.25	1 (0%) 85 86	5, 12, 31, 46	13 (8%)
2	B	39/49 (79%)	-0.06	1 (2%) 57 59	8, 14, 42, 57	4 (10%)
2	D	40/49 (81%)	-0.01	1 (2%) 58 60	5, 13, 32, 39	2 (5%)
2	F	40/49 (81%)	-0.16	0 100 100	8, 15, 35, 42	2 (5%)
2	H	38/49 (77%)	-0.26	0 100 100	6, 13, 33, 37	1 (2%)
All	All	799/940 (85%)	-0.20	7 (0%) 81 82	3, 13, 34, 57	55 (6%)

The worst 5 of 7 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	75	ALA	3.5
1	E	154	PHE	2.7
1	G	37	GLN	2.6
2	D	75	ALA	2.5
1	E	124	CYS	2.4

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

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

6.3 Carbohydrates

There are no oligosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.