



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 13, 2018 – 11:14 pm GMT

PDB ID : 1PY2
Title : Structure of a 60 nM Small Molecule Bound to a Hot Spot on IL-2
Authors : Thanos, C.D.; Randal, M.; Wells, J.A.
Deposited on : 2003-07-07
Resolution : 2.80 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 ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : trunk31020
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk31020

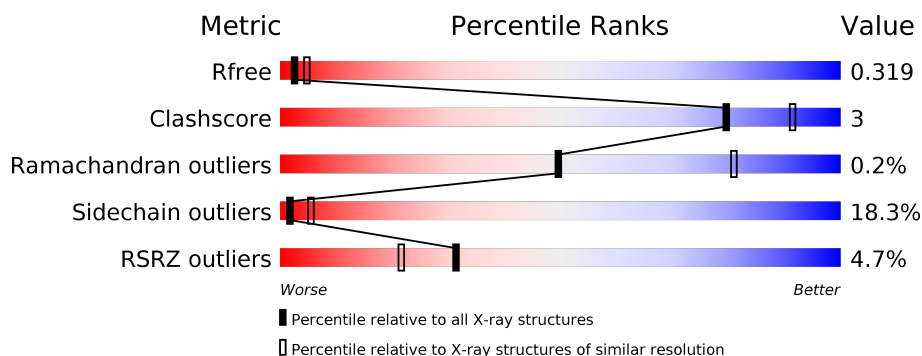
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	111664	2792 (2.80-2.80)
Clashscore	122126	3209 (2.80-2.80)
Ramachandran outliers	120053	3158 (2.80-2.80)
Sidechain outliers	120020	3160 (2.80-2.80)
RSRZ outliers	108989	2726 (2.80-2.80)

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 ≥ 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	132	 4% 64% 20% 5% 11%
1	B	132	 2% 58% 23% • • 12%
1	C	132	 4% 60% 21% 6% 13%
1	D	132	 8% 67% 20% • 9%

2 Entry composition [i](#)

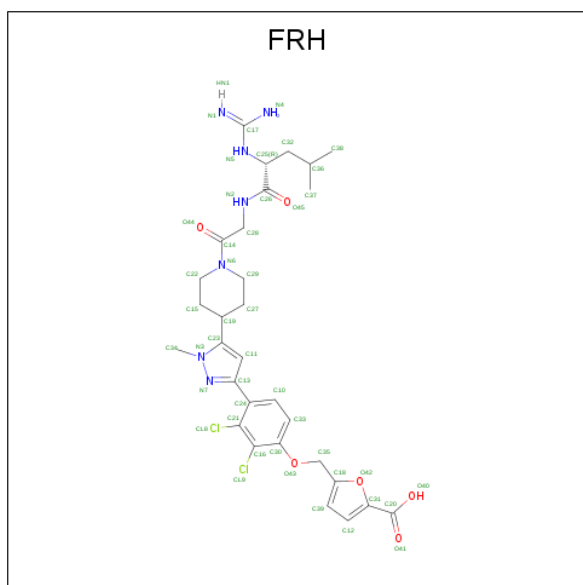
There are 3 unique types of molecules in this entry. The entry contains 4015 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Interleukin-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	117	Total	C	N	O	S	50	0	0
			959	623	152	177	7			
1	B	116	Total	C	N	O	S	54	0	0
			951	616	154	174	7			
1	C	115	Total	C	N	O	S	48	0	0
			944	610	152	175	7			
1	D	120	Total	C	N	O	S	24	0	0
			978	631	158	182	7			

- Molecule 2 is 5-[2,3-DICHLORO-4-(5-{1-[2-(2-GUANIDINO-4-METHYL-PENTANOYLAMINO)-ACETYL]-PIPERIDIN-4-YL}-1-METHYL-1H-PYRAZOL-3-YL)-PHE NOXYMETHYL]-FURAN-2-CARBOXYLIC ACID (three-letter code: FRH) (formula: C₃₀H₃₇Cl₂N₇O₆).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Cl	N	O	0	0
			45	30	2	7	6		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	Cl	N	O	0	0
			45	30	2	7	6		
2	C	1	Total	C	Cl	N	O	0	0
			45	30	2	7	6		
2	D	1	Total	C	Cl	N	O	0	0
			45	30	2	7	6		

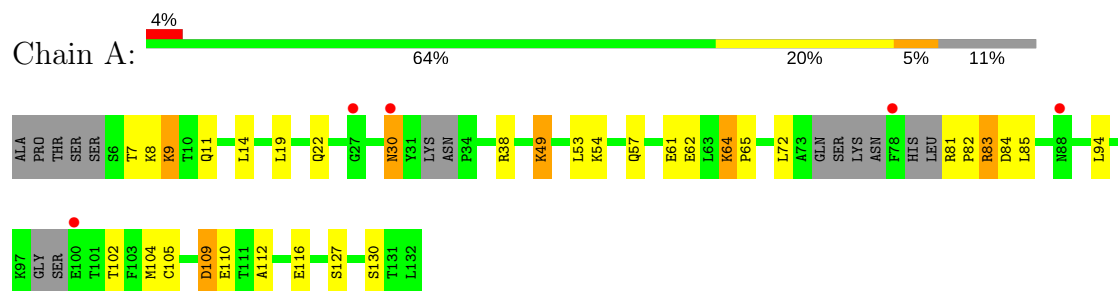
- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	2	Total	Zn	0	0
			2	2		
3	C	1	Total	Zn	0	0
			1	1		

3 Residue-property plots [i](#)

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.

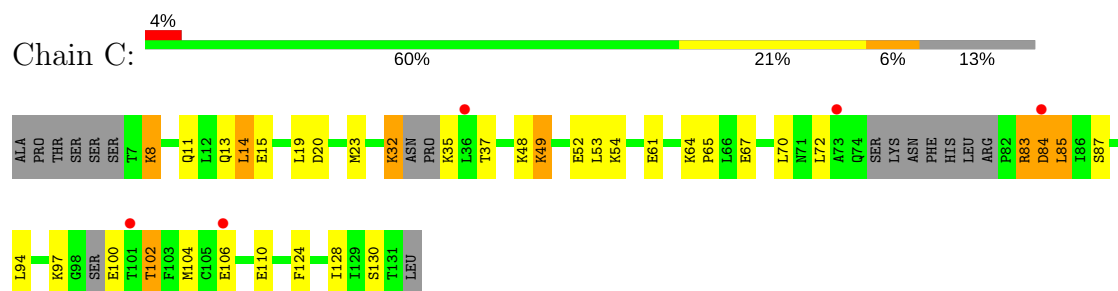
• Molecule 1: Interleukin-2



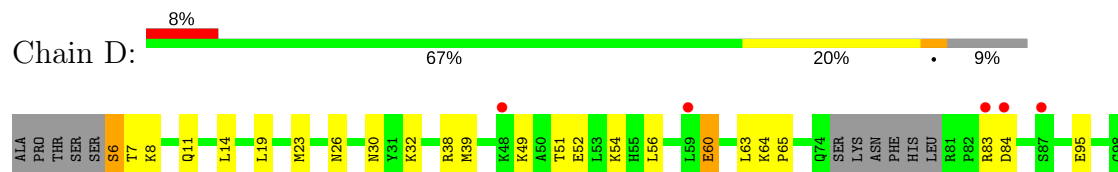
• Molecule 1: Interleukin-2

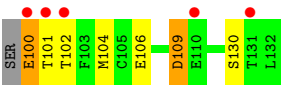


• Molecule 1: Interleukin-2



• Molecule 1: Interleukin-2





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	59.98Å 52.45Å 89.47Å 90.00° 106.34° 90.00°	Depositor
Resolution (Å)	15.00 – 2.80 19.90 – 2.80	Depositor EDS
% Data completeness (in resolution range)	98.4 (15.00-2.80) 98.4 (19.90-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.19 (at 2.79Å)	Xtriage
Refinement program	REFMAC 5.1.19	Depositor
R, R_{free}	0.271 , 0.320 0.267 , 0.319	Depositor DCC
R_{free} test set	644 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å ²)	57.5	Xtriage
Anisotropy	0.183	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 37.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	4015	wwPDB-VP
Average B, all atoms (Å ²)	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.99% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, FRH

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	2.16	10/971 (1.0%)	1.38	16/1306 (1.2%)
1	B	2.90	11/964 (1.1%)	1.38	17/1299 (1.3%)
1	C	1.89	13/955 (1.4%)	1.09	15/1283 (1.2%)
1	D	1.67	7/991 (0.7%)	1.42	11/1336 (0.8%)
All	All	2.20	41/3881 (1.1%)	1.33	59/5224 (1.1%)

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	1
1	B	0	1
All	All	0	2

The worst 5 of 41 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	32	LYS	CB-CG	75.71	3.56	1.52
1	A	49	LYS	CB-CG	42.04	2.66	1.52
1	C	83	ARG	CB-CG	39.77	2.60	1.52
1	D	102	THR	CB-OG1	29.05	2.01	1.43
1	B	64	LYS	CB-CG	26.30	2.23	1.52

The worst 5 of 59 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	100	GLU	CA-CB-CG	-24.01	60.58	113.40
1	D	8	LYS	CD-CE-NZ	-23.80	56.95	111.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	32	LYS	CA-CB-CG	-22.94	62.94	113.40
1	A	8	LYS	CA-CB-CG	-19.00	71.60	113.40
1	B	7	THR	N-CA-CB	16.98	142.57	110.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	30	ASN	Sidechain
1	B	30	ASN	Sidechain

5.2 Too-close contacts

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	959	0	988	3	2
1	B	951	0	987	12	4
1	C	944	0	979	4	2
1	D	978	0	1008	2	4
2	A	45	0	35	0	0
2	B	45	0	35	5	0
2	C	45	0	35	0	0
2	D	45	0	35	1	0
3	B	2	0	0	0	0
3	C	1	0	0	0	0
All	All	4015	0	4102	22	6

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 3.

The worst 5 of 22 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:B:33:ASN:HB2	1:B:34:PRO:HD3	1.56	0.88
1:B:33:ASN:CB	1:B:34:PRO:HD3	2.21	0.70

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:33:ASN:HB2	1:B:34:PRO:CD	2.24	0.67
1:C:83:ARG:O	1:C:84:ASP:HB2	1.96	0.65
1:D:64:LYS:HB2	1:D:65:PRO:HD3	1.87	0.57

The worst 5 of 6 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:72:LEU:CD2	1:D:100:GLU:OE2[2_646]	1.07	1.13
1:B:52:GLU:OE1	1:C:102:THR:OG1[2_656]	1.41	0.79
1:B:52:GLU:CD	1:C:102:THR:OG1[2_656]	2.01	0.19
1:A:72:LEU:CD2	1:D:100:GLU:CD[2_646]	2.11	0.09
1:B:8:LYS:NZ	1:D:26:ASN:OD1[1_655]	2.16	0.04

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	108/132 (82%)	107 (99%)	1 (1%)	0	100	100
1	B	110/132 (83%)	107 (97%)	2 (2%)	1 (1%)	19	50
1	C	107/132 (81%)	105 (98%)	2 (2%)	0	100	100
1	D	114/132 (86%)	113 (99%)	1 (1%)	0	100	100
All	All	439/528 (83%)	432 (98%)	6 (1%)	1 (0%)	49	81

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	33	ASN

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	111/125 (89%)	94 (85%)	17 (15%)	3	9
1	B	110/125 (88%)	89 (81%)	21 (19%)	1	5
1	C	109/125 (87%)	86 (79%)	23 (21%)	1	3
1	D	113/125 (90%)	93 (82%)	20 (18%)	2	6
All	All	443/500 (89%)	362 (82%)	81 (18%)	2	5

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

Mol	Chain	Res	Type
1	B	127	SER
1	C	23	MET
1	D	60	GLU
1	B	132	LEU
1	C	14	LEU

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

Mol	Chain	Res	Type
1	B	22	GLN
1	D	71	ASN
1	C	90	ASN
1	A	126	GLN
1	D	22	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](#)

Of 7 ligands modelled in this entry, 3 are monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	FRH	A	201	-	42,48,48	2.12	7 (16%)	54,68,68	1.87	9 (16%)
2	FRH	B	301	-	42,48,48	2.13	7 (16%)	54,68,68	1.87	6 (11%)
2	FRH	C	401	-	42,48,48	2.16	7 (16%)	54,68,68	1.95	7 (12%)
2	FRH	D	501	-	42,48,48	2.15	7 (16%)	54,68,68	1.85	8 (14%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FRH	A	201	-	-	0/31/48/48	0/4/4/4
2	FRH	B	301	-	-	0/31/48/48	0/4/4/4
2	FRH	C	401	-	-	0/31/48/48	0/4/4/4
2	FRH	D	501	-	-	0/31/48/48	0/4/4/4

The worst 5 of 28 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	401	FRH	C11-C23	-7.14	1.26	1.38
2	A	201	FRH	C39-C18	-7.09	1.26	1.39
2	B	301	FRH	C39-C18	-7.08	1.26	1.39
2	C	401	FRH	C11-C13	-7.07	1.27	1.40
2	D	501	FRH	C39-C18	-7.03	1.26	1.39

The worst 5 of 30 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	FRH	C15-C22-N6	-3.22	106.06	110.81
2	C	401	FRH	C27-C29-N6	-3.18	106.11	110.81
2	C	401	FRH	C15-C22-N6	-3.11	106.22	110.81
2	D	501	FRH	O43-C30-C33	-2.60	118.38	124.00
2	D	501	FRH	C27-C29-N6	-2.52	107.09	110.81

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	301	FRH	5	0
2	D	501	FRH	1	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	C	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	C	84:ASP	C	85:LEU	N	1.06
1	C	83:ARG	C	84:ASP	N	1.00

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, 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	117/132 (88%)	0.20	5 (4%) 35 25	29, 54, 86, 96	16 (13%)
1	B	116/132 (87%)	0.16	2 (1%) 70 63	34, 54, 83, 91	15 (12%)
1	C	115/132 (87%)	0.28	5 (4%) 35 25	28, 56, 89, 110	13 (11%)
1	D	120/132 (90%)	0.45	10 (8%) 11 6	37, 56, 78, 84	8 (6%)
All	All	468/528 (88%)	0.27	22 (4%) 31 21	28, 55, 84, 110	52 (11%)

The worst 5 of 22 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	102	THR	5.2
1	C	101	THR	4.4
1	D	100	GLU	4.3
1	A	30	ASN	4.1
1	D	110	GLU	4.0

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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	ZN	B	801	1/1	0.40	0.35	155,155,155,155	0
2	FRH	C	401	45/45	0.68	0.36	49,115,147,155	0
3	ZN	B	601	1/1	0.84	0.36	116,116,116,116	0
3	ZN	C	701	1/1	0.85	0.42	137,137,137,137	0
2	FRH	A	201	45/45	0.88	0.26	35,55,106,127	0
2	FRH	D	501	45/45	0.88	0.24	43,63,116,137	0
2	FRH	B	301	45/45	0.88	0.24	35,56,96,110	0

6.5 Other polymers [i](#)

There are no such residues in this entry.