



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 03:02 PM GMT

PDB ID : 4BC5
Title : Crystal structure of human D-xylulokinase in complex with inhibitor 5- deoxy-5-fluoro-D-xylulose
Authors : Bunker, R.D.; Loomes, K.M.; Baker, E.N.
Deposited on : 2012-10-01
Resolution : 1.98 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
<http://wwpdb.org/validation/2016/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 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
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) : trunk26865

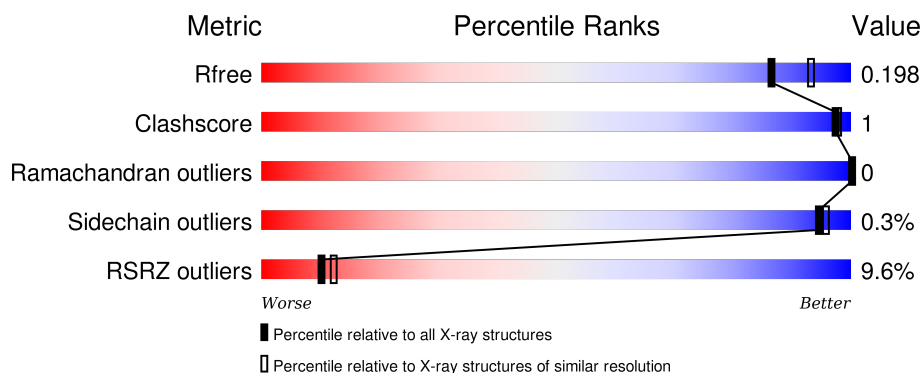
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.98 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}	91344	8664 (2.00-1.96)
Clashscore	102246	9905 (2.00-1.96)
Ramachandran outliers	100387	9792 (2.00-1.96)
Sidechain outliers	100360	9791 (2.00-1.96)
RSRZ outliers	91569	8679 (2.00-1.96)

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	538	<div> <div>10%</div> <div>94%</div> <div>• •</div> </div>
1	B	538	<div> <div>8%</div> <div>94%</div> <div>• •</div> </div>
1	C	538	<div> <div>10%</div> <div>94%</div> <div>• •</div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 24196 atoms, of which 11481 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.

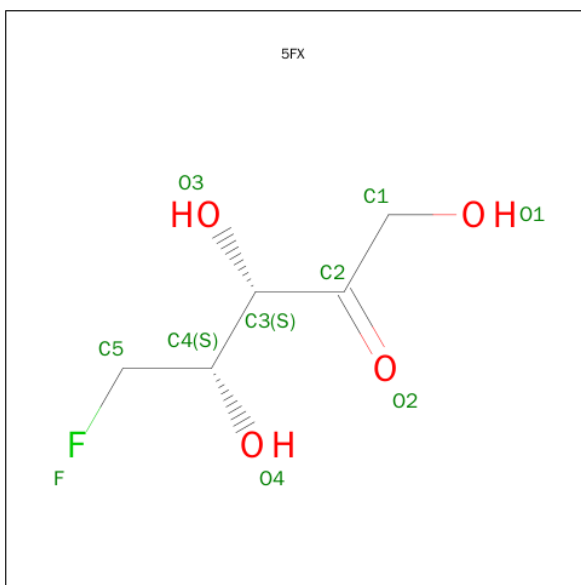
- Molecule 1 is a protein called XYLULOSE KINASE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	524	Total	C	H	N	O	S	0	2	0
			7770	2506	3806	679	753	26			
1	B	526	Total	C	H	N	O	S	0	4	0
			7846	2531	3839	687	763	26			
1	C	526	Total	C	H	N	O	S	0	0	0
			7774	2513	3803	679	754	25			

There are 6 discrepancies between the modelled and reference sequences:

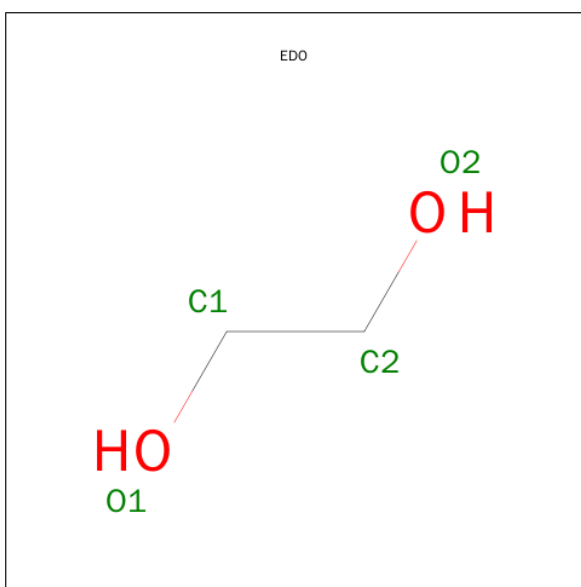
Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	EXPRESSION TAG	UNP O75191
A	0	ALA	-	EXPRESSION TAG	UNP O75191
B	-1	GLY	-	EXPRESSION TAG	UNP O75191
B	0	ALA	-	EXPRESSION TAG	UNP O75191
C	-1	GLY	-	EXPRESSION TAG	UNP O75191
C	0	ALA	-	EXPRESSION TAG	UNP O75191

- Molecule 2 is 5-DEOXY-5-FLUORO-D-XYLULOSE (three-letter code: 5FX) (formula: C₅H₉FO₄).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	F	H	O	0	0
			19	5	1	9	4		
2	B	1	Total	C	F	H	O	0	0
			19	5	1	9	4		
2	C	1	Total	C	F	H	O	0	0
			19	5	1	9	4		

- Molecule 3 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	C	1	Total	C	H	O	0	0
			10	2	6	2		

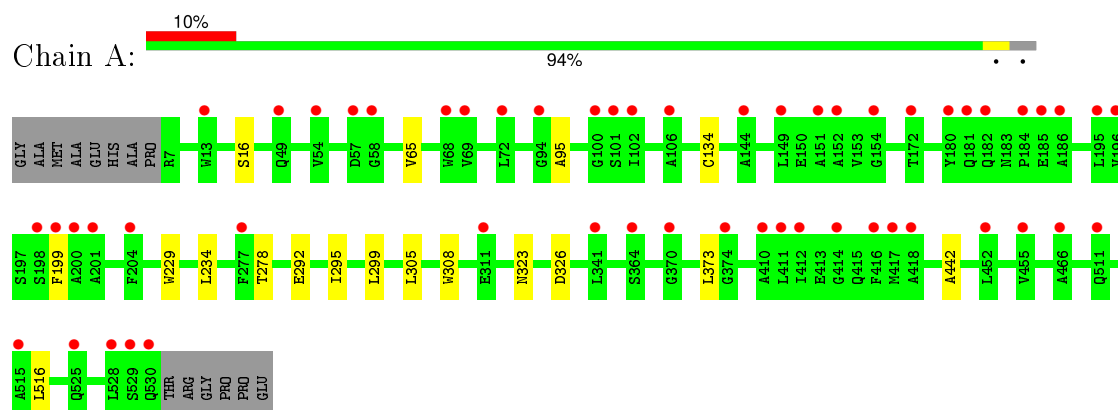
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	212	Total 212	O 212	0	0
4	B	253	Total 253	O 253	0	0
4	C	274	Total 274	O 274	0	0

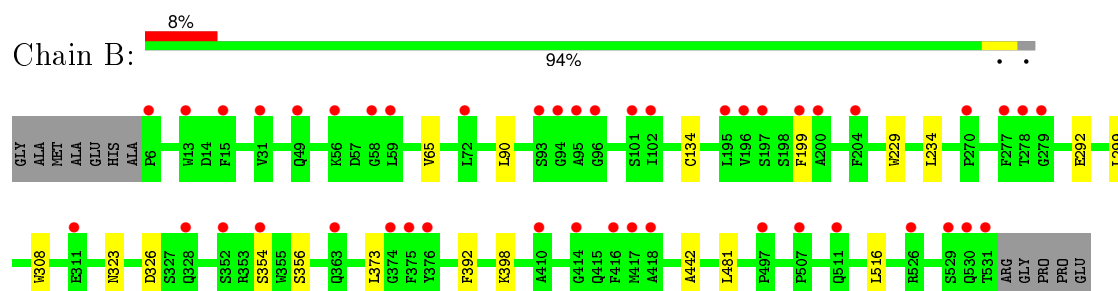
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

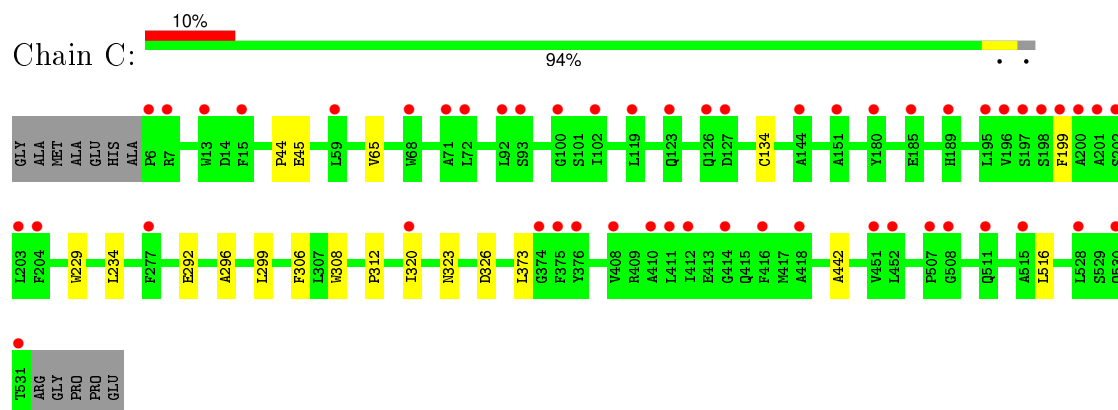
• Molecule 1: XYLULOSE KINASE



• Molecule 1: XYLULOSE KINASE



• Molecule 1: XYLULOSE KINASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α , β , γ	102.11Å 102.11Å 159.10Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	28.98 – 1.98 28.98 – 1.98	Depositor EDS
% Data completeness (in resolution range)	99.0 (28.98-1.98) 99.0 (28.98-1.98)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.43 (at 1.98Å)	Xtriage
Refinement program	BUSTER 2.11.1	Depositor
R, R_{free}	0.172 , 0.192 0.179 , 0.198	Depositor DCC
R_{free} test set	6406 reflections (5.27%)	DCC
Wilson B-factor (Å ²)	37.3	Xtriage
Anisotropy	0.272	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 51.9	EDS
Estimated twinning fraction	0.005 for -h,-k,l 0.034 for h,-h-k,-l 0.018 for -k,-h,-l	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 127897 reflections	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	24196	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 18.73% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: 5FX, EDO

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	0.50	0/4069	0.64	0/5534
1	B	0.50	0/4124	0.64	0/5605
1	C	0.53	0/4065	0.64	0/5529
All	All	0.51	0/12258	0.64	0/16668

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

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	3964	3806	3801	8	0
1	B	4007	3839	3844	11	0
1	C	3971	3803	3824	10	0
2	A	10	9	9	0	0
2	B	10	9	9	0	0
2	C	10	9	9	0	0
3	C	4	6	6	0	0
4	A	212	0	0	0	0
4	B	253	0	0	0	0
4	C	274	0	0	0	0
All	All	12715	11481	11502	27	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 1.

All (27) 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:295:ILE:HD11	1:A:305:LEU:HD11	1.81	0.63
1:A:65:VAL:HB	1:A:134:CYS:SG	2.55	0.46
1:B:65:VAL:HB	1:B:134:CYS:SG	2.56	0.45
1:A:95:ALA:HA	1:A:278:THR:O	2.17	0.45
1:C:373:LEU:HD21	1:C:516:LEU:HD11	1.99	0.45
1:B:354:SER:HB2	1:C:44:PRO:HG2	1.98	0.45
1:A:373:LEU:HD21	1:A:516:LEU:HD11	1.99	0.45
1:C:229:TRP:HB3	1:C:234:LEU:HD11	2.00	0.44
1:C:299:LEU:HD13	1:C:442:ALA:HB3	2.01	0.43
1:C:65:VAL:HB	1:C:134:CYS:SG	2.59	0.43
1:B:373:LEU:HD21	1:B:516:LEU:HD11	2.00	0.43
1:C:323:ASN:HB3	1:C:326:ASP:O	2.19	0.42
1:B:90:LEU:HB3	1:B:481:LEU:HD21	2.02	0.42
1:B:229:TRP:HB3	1:B:234:LEU:HD11	2.02	0.42
1:A:299:LEU:HD13	1:A:442:ALA:HB3	2.03	0.41
1:B:356:SER:HB2	1:C:45:GLU:OE2	2.20	0.41
1:B:392:PHE:CE2	1:B:398:LYS:HG2	2.56	0.41
1:B:90:LEU:CB	1:B:481:LEU:HD21	2.51	0.41
1:A:323:ASN:HB3	1:A:326:ASP:O	2.21	0.41
1:A:229:TRP:HB3	1:A:234:LEU:HD11	2.03	0.41
1:C:292:GLU:HA	1:C:308:TRP:CD1	2.56	0.41
1:C:312:PRO:HB3	1:C:320:ILE:HG21	2.03	0.41
1:B:292:GLU:HA	1:B:308:TRP:CD1	2.56	0.40
1:B:299:LEU:HD13	1:B:442:ALA:HB3	2.02	0.40
1:C:296:ALA:HB3	1:C:306:PHE:HB2	2.03	0.40
1:A:292:GLU:HA	1:A:308:TRP:CD1	2.56	0.40
1:B:323:ASN:HB3	1:B:326:ASP:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	524/538 (97%)	516 (98%)	8 (2%)	0	100	100
1	B	528/538 (98%)	522 (99%)	6 (1%)	0	100	100
1	C	524/538 (97%)	517 (99%)	7 (1%)	0	100	100
All	All	1576/1614 (98%)	1555 (99%)	21 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	419/440 (95%)	417 (100%)	2 (0%)	92	93
1	B	428/440 (97%)	427 (100%)	1 (0%)	95	96
1	C	419/440 (95%)	418 (100%)	1 (0%)	95	96
All	All	1266/1320 (96%)	1262 (100%)	4 (0%)	94	96

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	SER
1	A	199	PHE
1	B	199	PHE
1	C	199	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

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	5FX	A	1531	-	8,9,9	1.53	1 (12%)	4,11,11	1.11	0
2	5FX	B	1532	-	8,9,9	1.01	1 (12%)	4,11,11	0.88	0
2	5FX	C	1532	-	8,9,9	0.86	1 (12%)	4,11,11	1.01	0
3	EDO	C	1533	-	3,3,3	0.72	0	2,2,2	0.40	0

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	5FX	A	1531	-	-	0/10/12/12	0/0/0/0
2	5FX	B	1532	-	-	0/10/12/12	0/0/0/0
2	5FX	C	1532	-	-	0/10/12/12	0/0/0/0
3	EDO	C	1533	-	-	0/1/1/1	0/0/0/0

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	1532	5FX	C1-C2	2.39	1.57	1.50
2	B	1532	5FX	C4-C3	2.77	1.56	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1531	5FX	C4-C3	3.76	1.57	1.53

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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, 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	524/538 (97%)	0.55	54 (10%) 9 10	34, 51, 75, 91	0
1	B	526/538 (97%)	0.39	45 (8%) 13 15	32, 45, 65, 112	0
1	C	526/538 (97%)	0.40	52 (9%) 9 11	30, 44, 66, 103	0
All	All	1576/1614 (97%)	0.45	151 (9%) 10 12	30, 46, 70, 112	0

All (151) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	531	THR	7.0
1	A	528	LEU	6.6
1	B	6	PRO	5.4
1	A	529	SER	4.8
1	C	6	PRO	4.7
1	C	200	ALA	4.5
1	C	196	VAL	4.5
1	C	412	ILE	4.5
1	C	531	THR	4.4
1	A	416	PHE	4.4
1	C	416	PHE	4.2
1	C	180	TYR	4.2
1	A	410	ALA	4.2
1	C	204	PHE	4.2
1	C	199	PHE	3.9
1	C	411	LEU	3.8
1	B	196	VAL	3.7
1	A	414	GLY	3.7
1	A	411	LEU	3.7
1	A	311	GLU	3.6
1	C	59	LEU	3.6
1	A	199	PHE	3.6
1	A	182	GLN	3.6

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Mol	Chain	Res	Type	RSRZ
1	C	511	GLN	3.6
1	B	497	PRO	3.6
1	A	72	LEU	3.6
1	A	184	PRO	3.5
1	B	200	ALA	3.5
1	A	69	VAL	3.5
1	A	511	GLN	3.5
1	B	530	GLN	3.4
1	A	412	ILE	3.4
1	B	195	LEU	3.4
1	B	199	PHE	3.4
1	A	195	LEU	3.4
1	B	374	GLY	3.4
1	C	203	LEU	3.3
1	B	414	GLY	3.2
1	C	72	LEU	3.2
1	A	374	GLY	3.2
1	C	126	GLN	3.1
1	B	102	ILE	3.1
1	C	414	GLY	3.1
1	C	451	VAL	3.0
1	A	152	ALA	3.0
1	A	100	GLY	3.0
1	A	154	GLY	3.0
1	B	507	PRO	3.0
1	A	201	ALA	3.0
1	A	200	ALA	3.0
1	B	277	PHE	2.9
1	B	416	PHE	2.9
1	C	375	PHE	2.9
1	B	15	PHE	2.9
1	B	56	LYS	2.9
1	A	106	ALA	2.8
1	C	410	ALA	2.8
1	C	13	TRP	2.8
1	C	68	TRP	2.8
1	B	94	GLY	2.8
1	A	102	ILE	2.8
1	C	374	GLY	2.8
1	A	68	TRP	2.8
1	C	195	LEU	2.7
1	A	185	GLU	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	58	GLY	2.7
1	B	197	SER	2.7
1	B	511	GLN	2.7
1	C	144	ALA	2.7
1	A	144	ALA	2.7
1	C	15	PHE	2.7
1	C	408	VAL	2.7
1	A	58	GLY	2.7
1	B	417	MET	2.7
1	C	418	ALA	2.7
1	A	277	PHE	2.7
1	B	376	TYR	2.6
1	C	189	HIS	2.6
1	B	59	LEU	2.6
1	C	93	SER	2.6
1	C	151	ALA	2.6
1	C	507	PRO	2.6
1	A	204	PHE	2.6
1	C	277	PHE	2.6
1	C	197	SER	2.6
1	B	410	ALA	2.5
1	C	198	SER	2.5
1	B	270	PRO	2.5
1	B	95	ALA	2.5
1	C	515	ALA	2.5
1	C	452	LEU	2.5
1	A	370	GLY	2.5
1	A	54	VAL	2.5
1	A	364	SER	2.5
1	B	526	ARG	2.4
1	C	7	ARG	2.4
1	A	466	ALA	2.4
1	C	530	GLN	2.4
1	A	151	ALA	2.4
1	C	185	GLU	2.4
1	A	525	GLN	2.4
1	B	529	SER	2.4
1	C	376	TYR	2.3
1	C	201	ALA	2.3
1	A	530	GLN	2.3
1	C	123	GLN	2.3
1	A	13	TRP	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	452	LEU	2.3
1	C	71	ALA	2.3
1	C	127	ASP	2.3
1	C	528	LEU	2.3
1	A	186	ALA	2.3
1	A	455	VAL	2.3
1	B	375	PHE	2.3
1	B	418	ALA	2.3
1	A	180	TYR	2.3
1	B	204	PHE	2.2
1	A	94	GLY	2.2
1	A	196	VAL	2.2
1	B	93	SER	2.2
1	B	31	VAL	2.2
1	B	101	SER	2.2
1	C	102	ILE	2.2
1	A	172	THR	2.2
1	A	341	LEU	2.2
1	B	278	THR	2.2
1	B	279	GLY	2.1
1	B	49	GLN	2.1
1	A	181	GLN	2.1
1	A	417	MET	2.1
1	B	72	LEU	2.1
1	C	92	LEU	2.1
1	C	119	LEU	2.1
1	A	101	SER	2.1
1	C	202	SER	2.1
1	B	354	SER	2.1
1	B	311	GLU	2.1
1	C	508	GLY	2.1
1	C	320	ILE	2.1
1	B	13	TRP	2.1
1	A	49	GLN	2.1
1	A	515	ALA	2.1
1	B	363	GLN	2.1
1	C	100	GLY	2.1
1	A	57	ASP	2.0
1	A	198	SER	2.0
1	A	418	ALA	2.0
1	B	352	SER	2.0
1	A	149	LEU	2.0

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Mol	Chain	Res	Type	RSRZ
1	B	328	GLN	2.0
1	B	96	GLY	2.0

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(\AA^2)	Q<0.9
3	EDO	C	1533	4/4	0.95	0.12	1.09	43,47,48,48	0
2	5FX	B	1532	10/10	0.98	0.10	-0.79	33,35,38,39	0
2	5FX	C	1532	10/10	0.97	0.08	-1.33	33,38,43,44	0
2	5FX	A	1531	10/10	0.98	0.05	-1.88	32,34,37,37	0

6.5 Other polymers [i](#)

There are no such residues in this entry.