



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 02:35 PM GMT

PDB ID : 3ZXU
Title : Crystal structure of the Ctf19-Mcm21 kinetochore heterodimer from yeast
Authors : Schmitzberger, F.; Harrison, S.C.
Deposited on : 2011-08-15
Resolution : 3.70 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
<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

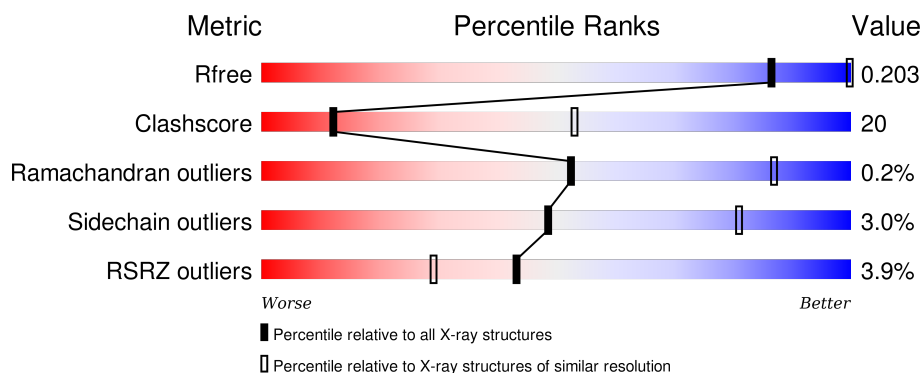
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.70 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	1101 (3.90-3.50)
Clashscore	102246	1224 (3.90-3.50)
Ramachandran outliers	100387	1172 (3.90-3.50)
Sidechain outliers	100360	1170 (3.90-3.50)
RSRZ outliers	91569	1108 (3.90-3.50)

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	296	<div> <div>43%</div> <div>26%</div> <div>•</div> <div>29%</div> </div>
1	C	296	<div> <div>43%</div> <div>25%</div> <div>•</div> <div>29%</div> </div>
2	B	270	<div> <div>50%</div> <div>23%</div> <div>•</div> <div>27%</div> </div>
2	D	270	<div> <div>48%</div> <div>25%</div> <div>27%</div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	CA	A	1294	-	-	-	X
3	CA	D	1270	-	-	-	X

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 13474 atoms, of which 6763 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 MCM21.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	211	Total	C	H	N	O	S	0	0	0
			3487	1127	1745	290	318	7			
1	C	211	Total	C	H	N	O	S	0	0	0
			3488	1127	1746	290	318	7			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	EXPRESSION TAG	UNP Q6CVQ9
A	-1	ASN	-	EXPRESSION TAG	UNP Q6CVQ9
A	0	ALA	-	EXPRESSION TAG	UNP Q6CVQ9
C	-2	SER	-	EXPRESSION TAG	UNP Q6CVQ9
C	-1	ASN	-	EXPRESSION TAG	UNP Q6CVQ9
C	0	ALA	-	EXPRESSION TAG	UNP Q6CVQ9

- Molecule 2 is a protein called CTF19.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	197	Total	C	H	N	O	S	0	0	0
			3216	1013	1632	265	299	7			
2	D	198	Total	C	H	N	O	S	0	0	0
			3230	1017	1638	267	301	7			

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Ca	0	0
			1	1		
3	D	1	Total	Ca	0	0
			1	1		
3	C	1	Total	Ca	0	0
			1	1		

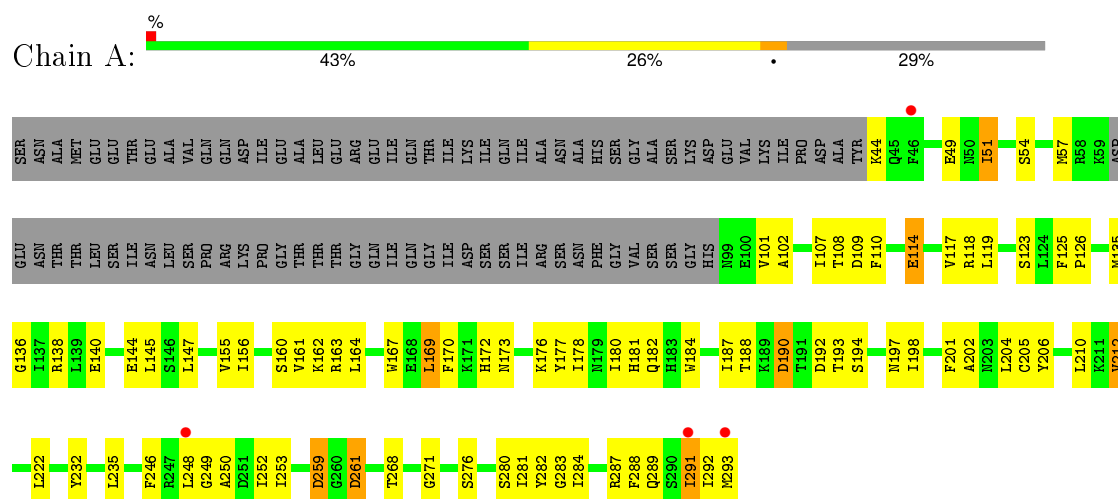
- Molecule 4 is water.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	13	Total	O		0	0
			13	13			
4	B	6	Total	O		0	0
			6	6			
4	C	18	Total	O		0	0
			18	18			
4	D	11	Total	H	O	0	0
			13	2	11		

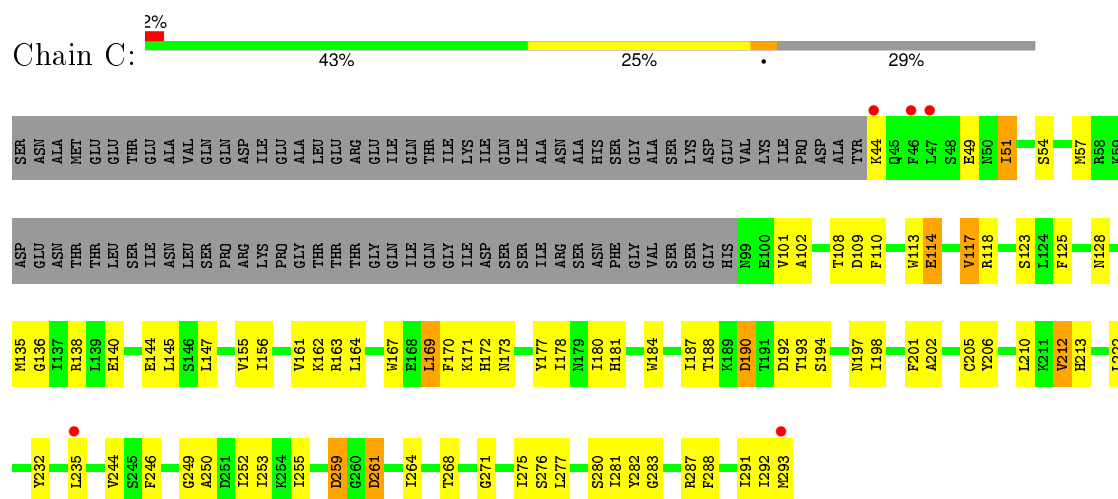
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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 ($\text{RSRZ} > 2$). 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.

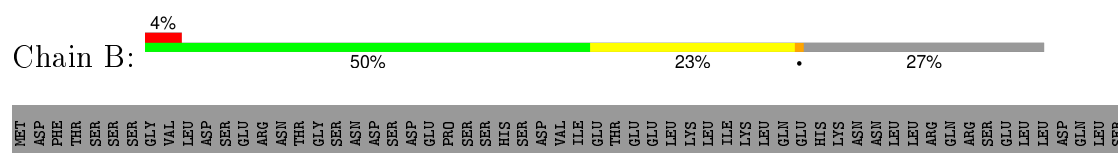
• Molecule 1: MCM21

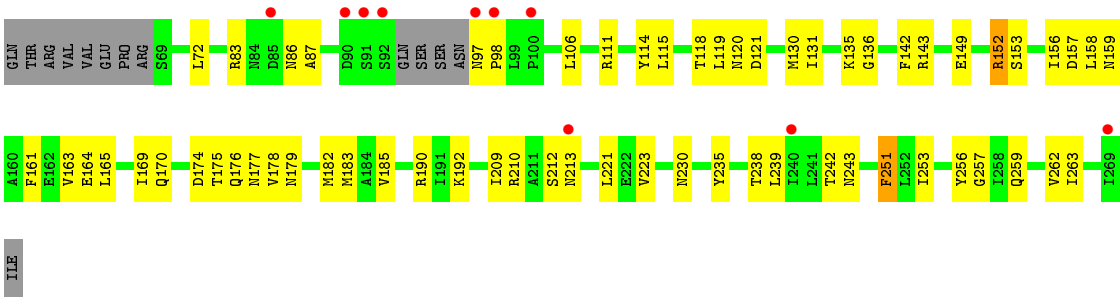


• Molecule 1: MCM21

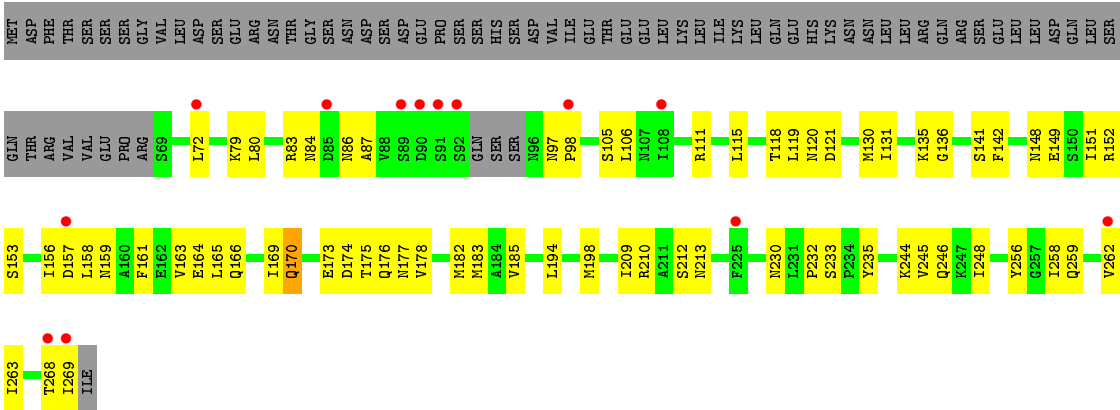


• Molecule 2: CTF19





• Molecule 2: CTF19



4 Data and refinement statistics

Property	Value	Source
Space group	P 62 2 2	Depositor
Cell constants a, b, c, α , β , γ	239.04Å 239.04Å 179.49Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	47.49 – 3.70 47.53 – 3.70	Depositor EDS
% Data completeness (in resolution range)	96.7 (47.49-3.70) 96.6 (47.53-3.70)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.45 (at 3.67Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.183 , 0.209 0.181 , 0.203	Depositor DCC
R_{free} test set	2215 reflections (7.53%)	DCC
Wilson B-factor (Å ²)	158.3	Xtriage
Anisotropy	0.290	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 231.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Outliers	2 of 31670 reflections (0.006%)	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	13474	wwPDB-VP
Average B, all atoms (Å ²)	168.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.02% 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: CA

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	0.52	0/1779	0.77	0/2396
1	C	0.53	0/1779	0.79	1/2396 (0.0%)
2	B	0.48	0/1607	0.79	1/2176 (0.0%)
2	D	0.48	0/1615	0.78	0/2187
All	All	0.50	0/6780	0.78	2/9155 (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	3
1	C	0	4
2	B	0	1
2	D	0	1
All	All	0	9

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	C	117	VAL	CG1-CB-CG2	5.48	119.67	110.90
2	B	190	ARG	NE-CZ-NH1	5.13	122.87	120.30

There are no chirality outliers.

5 of 9 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	145	LEU	Peptide
1	A	163	ARG	Peptide
1	A	57	MET	Peptide
2	B	230	ASN	Peptide
1	C	57	MET	Peptide

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	1742	1745	1741	81	1
1	C	1742	1746	1741	76	1
2	B	1584	1632	1631	65	1
2	D	1592	1638	1637	75	3
3	A	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	13	0	0	3	0
4	B	6	0	0	0	0
4	C	18	0	0	1	0
4	D	11	2	0	0	0
All	All	6711	6763	6750	265	4

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 20.

The worst 5 of 265 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:54:SER:OG	2:B:149:GLU:OE1	1.89	0.91
2:D:198:MET:SD	2:D:258:ILE:CD1	2.59	0.89
2:D:198:MET:SD	2:D:258:ILE:HD13	2.20	0.81
2:B:72:LEU:HD21	2:B:106:LEU:HD12	1.63	0.80
1:A:49:GLU:O	1:A:118:ARG:NH2	2.15	0.79

All (4) 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)
2:D:173:GLU:OE2	2:D:176:GLN:NE2[11_655]	2.03	0.17
1:A:235:LEU:O	2:D:256:TYR:OH[4_665]	2.05	0.15
2:B:256:TYR:OH	1:C:235:LEU:O[7_554]	2.08	0.12
2:D:173:GLU:OE2	2:D:176:GLN:HE21[11_655]	1.59	0.01

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	207/296 (70%)	185 (89%)	21 (10%)	1 (0%)	34	77
1	C	207/296 (70%)	184 (89%)	22 (11%)	1 (0%)	34	77
2	B	193/270 (72%)	173 (90%)	20 (10%)	0	100	100
2	D	194/270 (72%)	173 (89%)	21 (11%)	0	100	100
All	All	801/1132 (71%)	715 (89%)	84 (10%)	2 (0%)	52	87

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	291	ILE
1	C	51	ILE

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	197/269 (73%)	189 (96%)	8 (4%)	37	75

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	197/269 (73%)	189 (96%)	8 (4%)	37	75
2	B	183/254 (72%)	180 (98%)	3 (2%)	70	90
2	D	184/254 (72%)	180 (98%)	4 (2%)	60	86
All	All	761/1046 (73%)	738 (97%)	23 (3%)	48	81

5 of 23 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	251	PHE
1	C	164	LEU
2	D	170	GLN
1	C	114	GLU
1	C	169	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	172	HIS
1	A	289	GLN
2	B	213	ASN
1	C	172	HIS
2	D	166	GLN

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

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

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

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, 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	211/296 (71%)	0.34	4 (1%) 70 55	156, 219, 316, 410	0
1	C	211/296 (71%)	0.35	5 (2%) 62 46	158, 216, 304, 417	0
2	B	197/270 (72%)	0.38	10 (5%) 32 21	173, 230, 360, 432	0
2	D	198/270 (73%)	0.57	13 (6%) 22 12	168, 225, 355, 436	0
All	All	817/1132 (72%)	0.41	32 (3%) 43 29	156, 221, 339, 436	0

The worst 5 of 32 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	92	SER	7.0
2	D	269	ILE	6.2
2	D	72	LEU	4.7
1	C	293	MET	4.0
2	D	91	SER	3.8

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	CA	A	1294	1/1	0.93	0.48	2.00	184,184,184,184	0
3	CA	D	1270	1/1	0.98	0.58	1.98	217,217,217,217	0
3	CA	C	1294	1/1	0.81	0.20	-1.47	199,199,199,199	0

6.5 Other polymers [i](#)

There are no such residues in this entry.