



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 1, 2026 – 06:23 PM UTC

PDB ID : 2WT7 / pdb\_00002wt7  
Title : Crystal structure of the bZIP heterodimeric complex MafB:cFos bound to DNA  
Authors : Pogenberg, V.; Holton, S.; Wilmanns, M.  
Deposited on : 2009-09-11  
Resolution : 2.30 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](mailto: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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
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) : 2.49

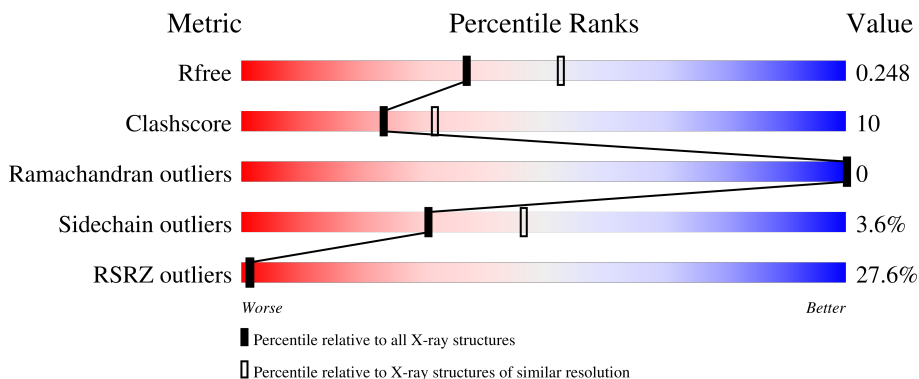
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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))
$R_{free}$	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	63	 19% 78% 22%
2	B	90	 43% 78% 20%
3	C	16	 88% 12%
4	D	16	 81% 19%

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 2156 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 PROTO-ONCOGENE PROTEIN C-FOS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	63	542	327	109	104	2	0	2	0

- Molecule 2 is a protein called TRANSCRIPTION FACTOR MAFB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	90	787	482	162	141	2	0	3	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	298	SER	CYS	engineered mutation	UNP P54841

- Molecule 3 is a DNA chain called MODIFIED T-MARE MOTIF.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	C	16	325	157	59	94	15	0	0	0

- Molecule 4 is a DNA chain called MODIFIED T-MARE MOTIF.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	D	16	325	157	59	94	15	0	0	0

- Molecule 5 is PHOSPHATE ION (CCD ID: PO4) (formula: O<sub>4</sub>P).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	1	Total	O P	0	0
			5	4 1		

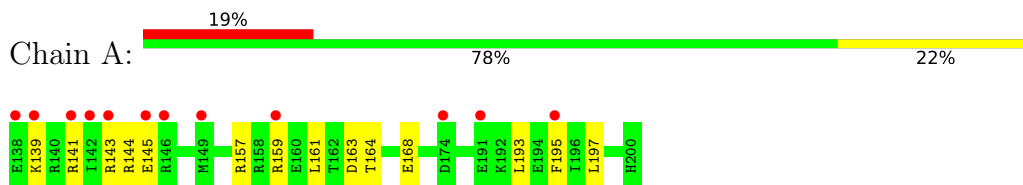
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	46	Total	O	0	0
			46	46		
6	B	49	Total	O	0	0
			49	49		
6	C	34	Total	O	0	0
			34	34		
6	D	43	Total	O	0	0
			43	43		

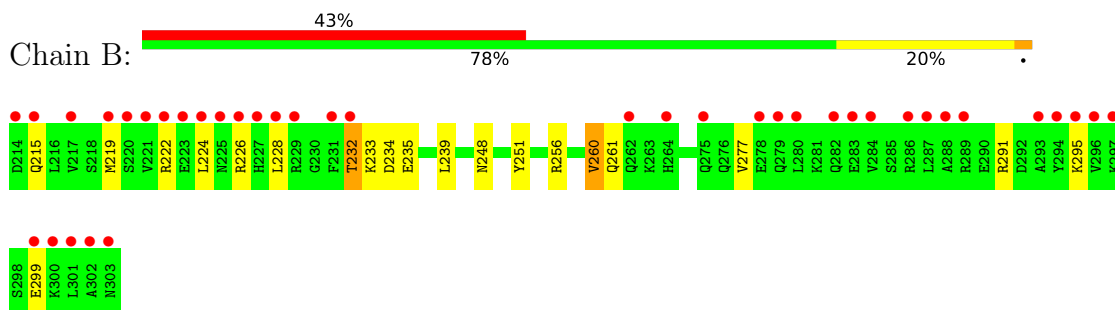
### 3 Residue-property plots [i](#)

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.

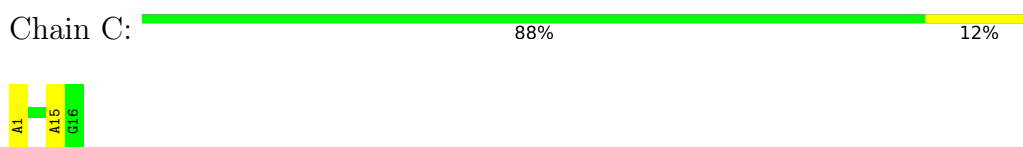
- Molecule 1: PROTO-ONCOGENE PROTEIN C-FOS



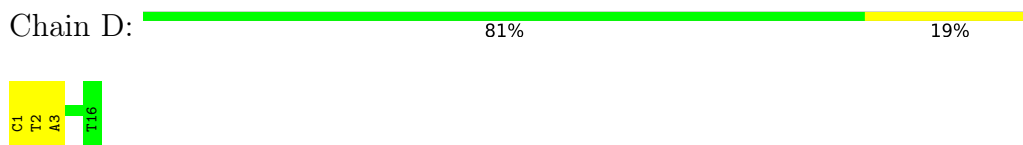
- Molecule 2: TRANSCRIPTION FACTOR MAFB



- Molecule 3: MODIFIED T-MARE MOTIF



- Molecule 4: MODIFIED T-MARE MOTIF



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 62	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	146.68Å 146.68Å 51.12Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	127.00 – 2.30 127.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.5 (127.00-2.30) 99.5 (127.00-2.30)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.07 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.4.0069	Depositor
R, $R_{free}$	0.228 , 0.256 0.229 , 0.248	Depositor DCC
$R_{free}$ test set	1415 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.1	Xtrriage
Anisotropy	0.089	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 53.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.035 for h,-h-k,-l	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	2156	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.91% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PO4

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	0.64	0/546	0.95	1/722 (0.1%)
2	B	0.57	0/800	0.82	0/1061
3	C	0.43	0/364	1.12	1/560 (0.2%)
4	D	0.41	0/364	1.16	0/560
All	All	0.54	0/2074	0.99	2/2903 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	139	LYS	N-CA-C	-5.55	106.46	113.18
3	C	1	DA	N9-C1'-C2'	5.21	121.31	113.50

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	542	0	563	10	0
2	B	787	0	822	24	0
3	C	325	0	183	1	0
4	D	325	0	183	3	0
5	C	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	46	0	0	1	0
6	B	49	0	0	1	0
6	C	34	0	0	0	0
6	D	43	0	0	0	0
All	All	2156	0	1751	37	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 10.

All (37) 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)
2:B:215[B]:GLN:HG3	2:B:219:MET:CE	1.59	1.31
2:B:215[B]:GLN:CG	2:B:219:MET:HE2	1.76	1.13
2:B:215[B]:GLN:HG3	2:B:219:MET:HE2	1.16	1.06
2:B:215[B]:GLN:HE21	2:B:219:MET:HG3	1.29	0.98
2:B:215[B]:GLN:HG3	2:B:219:MET:HE3	1.46	0.96
2:B:215[B]:GLN:CG	2:B:219:MET:CE	2.43	0.85
1:A:168[A]:GLU:HG3	6:A:2018:HOH:O	1.81	0.79
2:B:215[B]:GLN:NE2	2:B:219:MET:HG3	2.04	0.73
1:A:141:ARG:NH1	1:A:145:GLU:OE2	2.28	0.67
1:A:143:ARG:HG3	1:A:144:ARG:N	2.20	0.56
2:B:232:THR:CG2	2:B:233:LYS:N	2.69	0.54
2:B:215[B]:GLN:HE21	2:B:219:MET:CG	2.13	0.53
2:B:232:THR:HG23	6:B:2012:HOH:O	2.10	0.52
1:A:193:LEU:O	1:A:197:LEU:HD13	2.10	0.51
1:A:159[B]:ARG:NH2	1:A:163:ASP:OD2	2.43	0.51
2:B:215[B]:GLN:HG2	2:B:219:MET:HE2	1.81	0.51
2:B:232:THR:HB	2:B:235:GLU:CD	2.37	0.49
2:B:232:THR:HG22	2:B:235:GLU:H	1.78	0.49
1:A:195:PHE:N	1:A:195:PHE:CD1	2.81	0.47
1:A:157:ARG:O	1:A:161:LEU:HG	2.14	0.46
1:A:159[B]:ARG:HE	1:A:159[B]:ARG:HB3	1.46	0.46
1:A:141:ARG:O	1:A:145:GLU:HG3	2.16	0.46
2:B:256:ARG:O	2:B:260:VAL:HG13	2.16	0.45
2:B:295:LYS:O	2:B:299:GLU:HG2	2.17	0.45
1:A:195:PHE:N	1:A:195:PHE:HD1	2.16	0.44
2:B:232:THR:HB	2:B:235:GLU:OE1	2.17	0.44
4:D:1:DC:H2'	4:D:2:DT:C6	2.53	0.43
4:D:1:DC:H2''	4:D:2:DT:H5'	2.00	0.43
2:B:248:ASN:HA	2:B:251:TYR:CD2	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:228:LEU:HD21	2:B:239:LEU:HD22	2.01	0.42
2:B:291:ARG:O	2:B:295:LYS:HG3	2.20	0.42
2:B:222:ARG:HG2	2:B:226:ARG:NH2	2.34	0.41
2:B:232:THR:HG23	2:B:233:LYS:N	2.36	0.41
2:B:260:VAL:CG2	2:B:261[A]:GLN:HE21	2.34	0.41
3:C:15:DA:C2	4:D:3:DA:C2	3.08	0.41
2:B:232:THR:HG22	2:B:234:ASP:N	2.36	0.40

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	63/63 (100%)	63 (100%)	0	0	100	100
2	B	91/90 (101%)	90 (99%)	1 (1%)	0	100	100
All	All	154/153 (101%)	153 (99%)	1 (1%)	0	100	100

There are no Ramachandran outliers to report.

#### 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	57/55 (104%)	56 (98%)	1 (2%)	51	70

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	87/84 (104%)	83 (95%)	4 (5%)	24	36
All	All	144/139 (104%)	139 (96%)	5 (4%)	31	48

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	164	THR
2	B	224	LEU
2	B	232	THR
2	B	260	VAL
2	B	277	VAL

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

### 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](#)

1 ligand is 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
5	PO4	C	1017	-	4,4,4	0.95	0	6,6,6	0.73	0

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 [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	63/63 (100%)	1.03	12 (19%) 3 4	16, 44, 82, 105	2 (3%)
2	B	90/90 (100%)	1.54	39 (43%) 0 0	18, 57, 107, 116	3 (3%)
3	C	16/16 (100%)	-0.61	0 100 100	27, 37, 45, 56	0
4	D	16/16 (100%)	-0.55	0 100 100	28, 35, 46, 47	0
All	All	185/185 (100%)	1.00	51 (27%) 1 1	16, 44, 99, 116	5 (2%)

All (51) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	143	ARG	4.1
2	B	264[A]	HIS	4.1
2	B	299	GLU	4.0
2	B	301	LEU	3.9
2	B	226	ARG	3.9
2	B	302	ALA	3.9
1	A	138	GLU	3.7
1	A	149	MET	3.7
1	A	145	GLU	3.5
2	B	262	GLN	3.5
2	B	293	ALA	3.4
2	B	224	LEU	3.3
2	B	223	GLU	3.3
2	B	232	THR	3.2
2	B	295	LYS	3.2
2	B	279	GLN	3.1
2	B	289	ARG	3.1
2	B	275	GLN	3.1
2	B	303	ASN	3.1
2	B	294	TYR	3.0
2	B	296	VAL	2.9

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Mol	Chain	Res	Type	RSRZ
2	B	227	HIS	2.9
2	B	221	VAL	2.9
2	B	284	VAL	2.8
1	A	142	ILE	2.8
2	B	297	LYS	2.8
1	A	139	LYS	2.8
2	B	278	GLU	2.7
1	A	195	PHE	2.7
2	B	225	ASN	2.7
2	B	300	LYS	2.7
1	A	146	ARG	2.7
2	B	219	MET	2.6
1	A	174	ASP	2.6
2	B	228	LEU	2.5
2	B	214	ASP	2.5
1	A	191	GLU	2.5
2	B	286	ARG	2.4
2	B	229	ARG	2.4
2	B	282	GLN	2.4
2	B	280	LEU	2.4
2	B	288	ALA	2.4
2	B	287	LEU	2.4
2	B	222	ARG	2.3
2	B	231	PHE	2.3
2	B	215[A]	GLN	2.2
1	A	159[A]	ARG	2.2
1	A	141	ARG	2.2
2	B	217	VAL	2.1
2	B	220	SER	2.1
2	B	283	GLU	2.1

## 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 oligosaccharides 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
5	PO4	C	1017	5/5	0.99	0.07	40,41,43,44	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.