Full wwPDB X-ray Structure Validation Report ⓘ

May 26, 2020 – 11:51 am BST

PDB ID	:	4BY2
Title	:	SAS-4 (dCPAP) TCP domain in complex with a Proline Rich Motif of Ana2 (dSTIL) of Drosophila Melanogaster
Authors	:	Cottee, M.A.; Muschalik, N.; Wong, Y.L.; Johnson, C.M.; Johnson, S.; Andreeva, A.; Oegema, K.; Lea, S.M.; Raff, J.W.; van Breugel, M.
Deposited on	:	2013-07-17
Resolution	:	2.57 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
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:

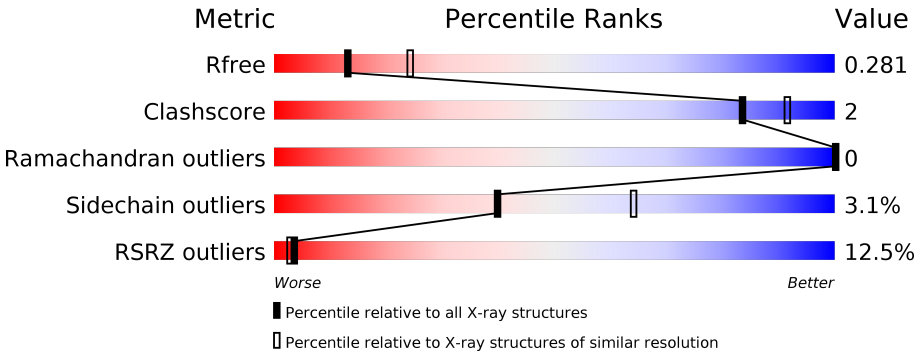
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.57 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}	130704	3676 (2.60-2.56)
Clashscore	141614	4049 (2.60-2.56)
Ramachandran outliers	138981	3979 (2.60-2.56)
Sidechain outliers	138945	3979 (2.60-2.56)
RSRZ outliers	127900	3614 (2.60-2.56)

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 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	252	8% 54% 7% 39%
1	B	252	4% 57% 5% 38%
1	C	252	11% 54% 8% 38%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3859 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.

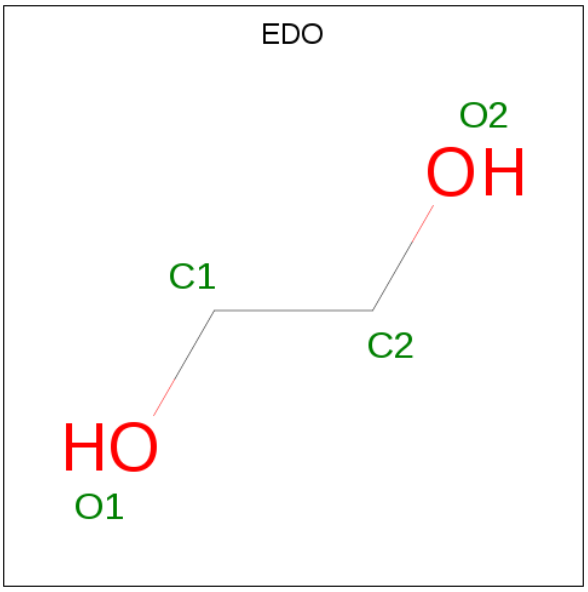
- Molecule 1 is a protein called ANASTRAL SPINDLE 2, SAS 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	154	Total	C	N	O	S	0	0	0
			1258	792	223	240	3			
1	B	155	Total	C	N	O	S	0	0	0
			1265	797	224	241	3			
1	C	155	Total	C	N	O	S	0	0	0
			1267	797	224	243	3			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP Q9XZ31
A	2	PRO	-	expression tag	UNP Q9XZ31
A	3	MET	-	expression tag	UNP Q9XZ31
A	4	GLY	-	expression tag	UNP Q9XZ31
B	1	GLY	-	expression tag	UNP Q9XZ31
B	2	PRO	-	expression tag	UNP Q9XZ31
B	3	MET	-	expression tag	UNP Q9XZ31
B	4	GLY	-	expression tag	UNP Q9XZ31
C	1	GLY	-	expression tag	UNP Q9XZ31
C	2	PRO	-	expression tag	UNP Q9XZ31
C	3	MET	-	expression tag	UNP Q9XZ31
C	4	GLY	-	expression tag	UNP Q9XZ31

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



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total C O 4 2 2	0	0

- Molecule 3 is water.

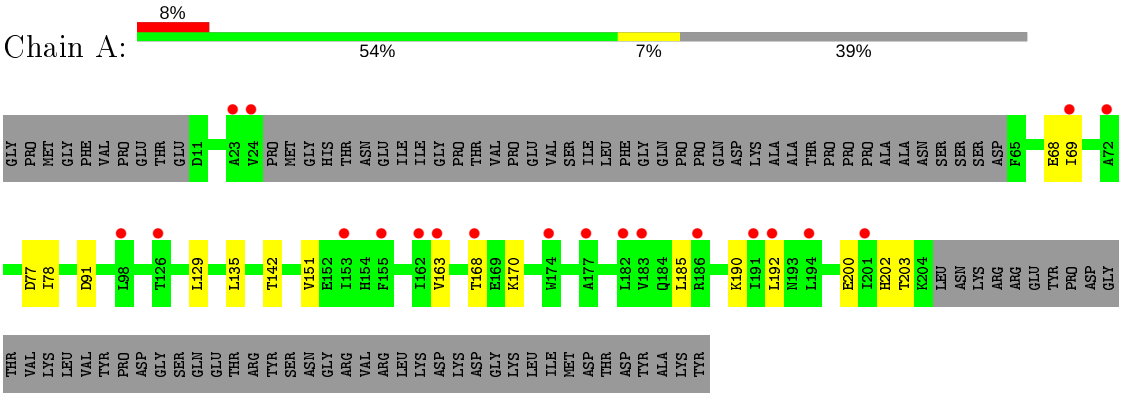
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	20	Total O 20 20	0	0
3	B	28	Total O 28 28	0	0
3	C	17	Total O 17 17	0	0

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 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.

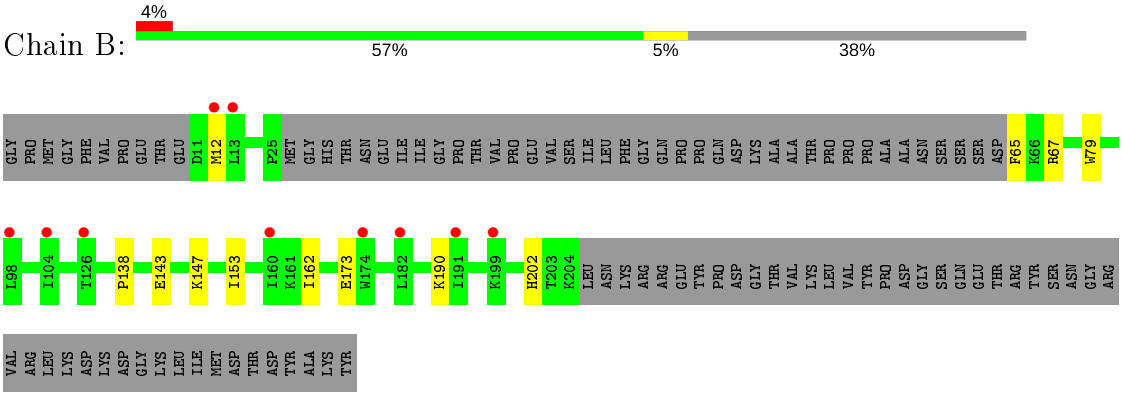
• Molecule 1: ANASTRAL SPINDLE 2, SAS 4

Chain A:



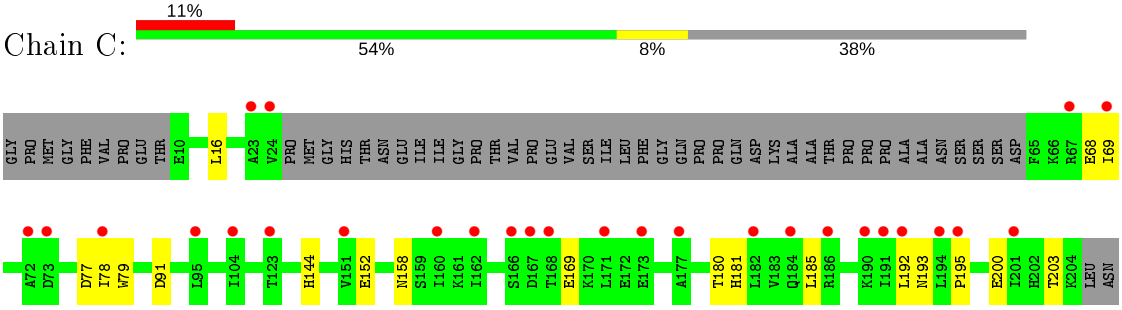
• Molecule 1: ANASTRAL SPINDLE 2, SAS 4

Chain B:



• Molecule 1: ANASTRAL SPINDLE 2, SAS 4

Chain C:



LYS
ARG
ARG
GLU
TYR
PRO
ASP
GLY
THR
VAL
LYS
LEU
VAL
TYR
PRO
ASP
GLY
SER
GLN
GLU
THR
ARG
TYR
SER
ASN
GLY
ARG
VAL
ARG
LEU
LYS
ASP
LYS
ASP
GLY
LYS
LEU
ILE
MET
ASP
THR
ASP
TYR
ALA
LYS
TYR

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	58.64Å 69.91Å 69.98Å 86.96° 88.64° 67.69°	Depositor
Resolution (Å)	64.60 – 2.57 64.60 – 2.57	Depositor EDS
% Data completeness (in resolution range)	97.6 (64.60-2.57) 97.6 (64.60-2.57)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.95 (at 2.58Å)	Xtriage
Refinement program	BUSTER 2.11.4	Depositor
R, R_{free}	0.245 , 0.263 0.260 , 0.281	Depositor DCC
R_{free} test set	1611 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	53.7	Xtriage
Anisotropy	0.791	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 46.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.027 for h,h-k,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	3859	wwPDB-VP
Average B, all atoms (Å^2)	70.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.14% of the height of the origin peak. No significant pseudotranslation is detected.*

[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

Bond lengths and bond angles in the following residue types are not validated in this section: 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	0.38	0/1286	0.57	0/1738
1	B	0.35	0/1294	0.54	0/1750
1	C	0.37	0/1295	0.55	0/1750
All	All	0.37	0/3875	0.56	0/5238

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	1258	0	1230	7	0
1	B	1265	0	1237	5	0
1	C	1267	0	1236	7	0
2	B	4	0	6	0	0
3	A	20	0	0	0	0
3	B	28	0	0	0	0
3	C	17	0	0	0	0
All	All	3859	0	3709	18	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 2.

All (18) 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:68:GLU:HG3	1:A:78:ILE:HG12	1.82	0.60
1:C:192:LEU:HB3	1:C:200:GLU:HB2	1.84	0.60
1:C:68:GLU:HG3	1:C:78:ILE:HG12	1.84	0.58
1:B:143:GLU:HG2	1:B:153:ILE:HG12	1.90	0.53
1:B:67:ARG:HB2	1:B:79:TRP:HB2	1.92	0.52
1:C:180:THR:HB	1:C:195:PRO:HD3	1.93	0.50
1:A:151:VAL:HB	1:A:163:VAL:HG13	1.93	0.49
1:A:170:LYS:HA	1:A:185:LEU:HA	1.97	0.47
1:C:144:HIS:HB2	1:C:152:GLU:HB3	1.97	0.46
1:B:190:LYS:HB2	1:B:202:HIS:HB2	1.98	0.45
1:C:181:HIS:HB3	1:C:193:ASN:HB2	1.98	0.44
1:A:69:ILE:HG23	1:A:77:ASP:HB2	2.01	0.42
1:A:135:LEU:O	1:A:142:THR:HA	2.20	0.42
1:B:138:PRO:HA	1:C:16:LEU:HB2	2.00	0.42
1:A:192:LEU:HB3	1:A:200:GLU:HB2	2.03	0.41
1:A:190:LYS:HB2	1:A:202:HIS:HB2	2.01	0.41
1:C:69:ILE:HG23	1:C:77:ASP:HB2	2.02	0.41
1:B:162:ILE:HB	1:B:173:GLU:HB2	2.02	0.41

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	150/252 (60%)	147 (98%)	3 (2%)	0	100	100
1	B	151/252 (60%)	150 (99%)	1 (1%)	0	100	100
1	C	151/252 (60%)	148 (98%)	3 (2%)	0	100	100
All	All	452/756 (60%)	445 (98%)	7 (2%)	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	137/221 (62%)	133 (97%)	4 (3%)	42	66
1	B	138/221 (62%)	135 (98%)	3 (2%)	52	74
1	C	138/221 (62%)	132 (96%)	6 (4%)	29	52
All	All	413/663 (62%)	400 (97%)	13 (3%)	40	64

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	91	ASP
1	A	129	LEU
1	A	168	THR
1	A	203	THR
1	B	12	MET
1	B	65	PHE
1	B	147	LYS
1	C	79	TRP
1	C	91	ASP
1	C	158	ASN
1	C	169	GLU
1	C	185	LEU
1	C	203	THR

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 (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)

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	$\#\|Z\| > 2$
2	EDO	B	1205	-	3,3,3	0.55	0	2,2,2	0.36	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	EDO	B	1205	-	-	0/1/1/1	-

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

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	154/252 (61%)	1.03	20 (12%) 3 2	44, 72, 98, 121	0
1	B	155/252 (61%)	0.83	10 (6%) 18 16	40, 65, 88, 109	0
1	C	155/252 (61%)	1.17	28 (18%) 1 1	41, 71, 102, 127	0
All	All	464/756 (61%)	1.01	58 (12%) 3 3	40, 69, 99, 127	0

All (58) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	24	VAL	6.2
1	A	23	ALA	4.8
1	A	186	ARG	4.5
1	C	168	THR	4.4
1	C	192	LEU	4.1
1	A	72	ALA	4.0
1	A	191	ILE	4.0
1	C	72	ALA	3.7
1	C	177	ALA	3.7
1	C	186	ARG	3.5
1	A	69	ILE	3.2
1	C	151	VAL	3.2
1	B	191	ILE	3.2
1	C	182	LEU	3.1
1	C	166	SER	3.1
1	C	23	ALA	3.1
1	C	73	ASP	3.0
1	C	69	ILE	2.9
1	C	171	LEU	2.7
1	C	162	ILE	2.7
1	B	12	MET	2.7
1	A	192	LEU	2.6
1	A	183	VAL	2.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	126	THR	2.5
1	B	13	LEU	2.5
1	B	104	ILE	2.5
1	A	174	TRP	2.5
1	A	24	VAL	2.4
1	A	182	LEU	2.4
1	C	190	LYS	2.4
1	A	162	ILE	2.3
1	C	195	PRO	2.3
1	A	163	VAL	2.3
1	C	201	ILE	2.3
1	B	199	LYS	2.3
1	B	160	ILE	2.3
1	B	182	LEU	2.2
1	A	177	ALA	2.2
1	A	168	THR	2.2
1	B	98	LEU	2.2
1	B	126	THR	2.2
1	C	160	ILE	2.2
1	C	194	LEU	2.2
1	C	123	THR	2.1
1	A	153	ILE	2.1
1	A	201	ILE	2.1
1	C	104	ILE	2.1
1	C	191	ILE	2.1
1	A	98	LEU	2.1
1	C	95	LEU	2.1
1	C	167	ASP	2.1
1	C	173	GLU	2.1
1	C	184	GLN	2.1
1	C	67	ARG	2.1
1	A	194	LEU	2.1
1	C	78	ILE	2.0
1	A	155	PHE	2.0
1	B	174	TRP	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. The B-factors column lists the minimum, median, 95^{th} 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(Å^2)	Q<0.9
2	EDO	B	1205	4/4	0.94	0.24	59,59,59,59	0

6.5 Other polymers (i)

There are no such residues in this entry.