



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 12, 2017 – 10:08 pm GMT

PDB ID : 1BEX  
Title : STRUCTURE OF RUTHENIUM-MODIFIED PSEUDOMONAS AERUGINOSA AZURIN  
Authors : Faham, S.; Day, M.W.; Rees, D.C.  
Deposited on : 1998-05-18  
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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity	:	4.02b-467
Mogul	:	1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

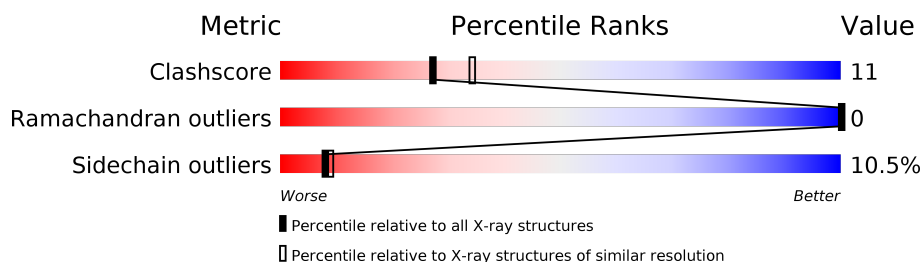
# 1 Overall quality at a glance

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))
Clashscore	112137	4751 (2.30-2.30)
Ramachandran outliers	110173	4705 (2.30-2.30)
Sidechain outliers	110143	4704 (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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	128	
1	B	128	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 2104 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.

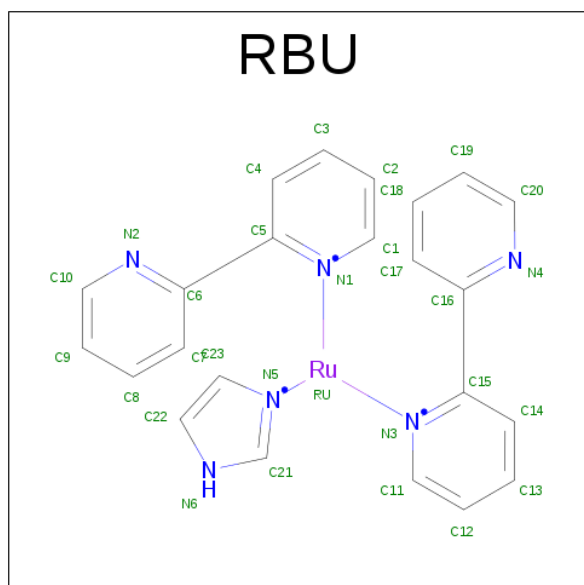
- Molecule 1 is a protein called AZURIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	128	Total	C	N	O	S	0	0	0
			974	607	164	194	9			
1	B	128	Total	C	N	O	S	0	0	0
			974	607	164	194	9			

- Molecule 2 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	2	Total	Cu	0	0
			2	2		
2	A	2	Total	Cu	0	0
			2	2		

- Molecule 3 is RUTHEMIUM BIS(2,2'-BIPYRIDINE)-2-IMIDAZOLE (three-letter code: RBU) (formula: C<sub>23</sub>H<sub>20</sub>N<sub>6</sub>Ru).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	Ru	0	0
			30	23	6	1		
3	B	1	Total	C	N	Ru	0	0
			30	23	6	1		

- Molecule 4 is water.

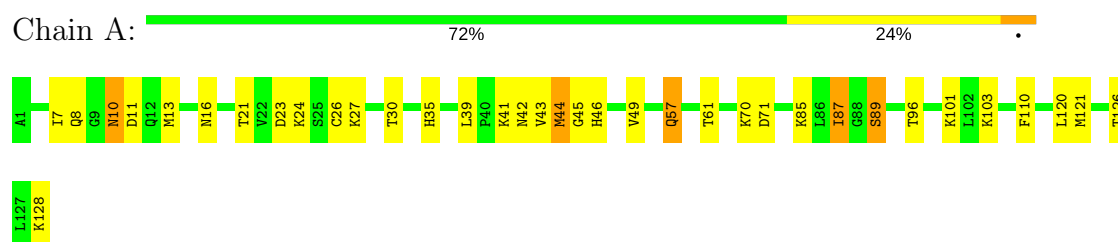
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	51	Total	O	0	0
			51	51		
4	B	41	Total	O	0	0
			41	41		

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

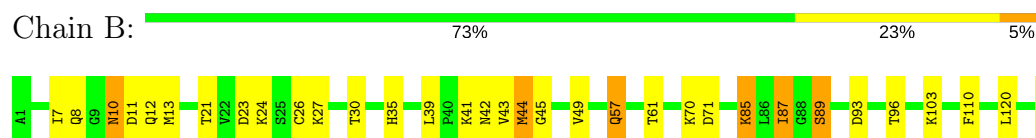
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are 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.

Note EDS was not executed.

#### • Molecule 1: AZURIN



#### • Molecule 1: AZURIN



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	100.60 Å   35.40 Å   74.70 Å 90.00°   106.50°   90.00°	Depositor
Resolution (Å)	20.00 – 2.30	Depositor
% Data completeness (in resolution range)	84.4 (20.00-2.30)	Depositor
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR 3.843	Depositor
R, $R_{free}$	0.209 , 0.289	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2104	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	12.0	wwPDB-VP

## 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: RBU, CU

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	0.56	0/991	0.78	0/1335
1	B	0.58	0/991	0.77	1/1335 (0.1%)
All	All	0.57	0/1982	0.78	1/2670 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	125	LEU	CA-CB-CG	5.91	128.88	115.30

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	974	0	952	21	0
1	B	974	0	952	23	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	30	0	20	1	0
3	B	30	0	20	0	0
4	A	51	0	0	2	0
4	B	41	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	2104	0	1944	45	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 11.

All (45) 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:24:LYS:HB2	1:A:128:LYS:OXT	1.81	0.80
1:B:24:LYS:HB2	1:B:128:LYS:OXT	1.84	0.78
1:B:85:LYS:NZ	4:B:577:HOH:O	2.13	0.76
1:B:30:THR:HG1	1:B:96:THR:HG1	1.36	0.73
1:A:42:ASN:ND2	1:A:43:VAL:HG23	2.09	0.68
1:B:42:ASN:ND2	1:B:43:VAL:HG23	2.09	0.67
1:A:30:THR:HG1	1:A:96:THR:HG1	1.40	0.65
1:A:10:ASN:C	1:A:10:ASN:HD22	2.03	0.61
1:B:8:GLN:HG3	4:B:581:HOH:O	1.99	0.61
1:B:10:ASN:C	1:B:10:ASN:HD22	2.01	0.61
1:A:10:ASN:C	1:A:10:ASN:ND2	2.55	0.60
1:A:13:MET:HE1	1:A:120:LEU:HD12	1.84	0.59
1:A:13:MET:CE	1:A:120:LEU:HD12	2.33	0.58
1:B:10:ASN:C	1:B:10:ASN:ND2	2.57	0.56
1:B:126:THR:HG23	4:B:582:HOH:O	2.05	0.55
1:A:49:VAL:O	1:A:110:PHE:HA	2.08	0.54
1:A:126:THR:HG23	4:A:510:HOH:O	2.07	0.53
1:B:49:VAL:O	1:B:110:PHE:HA	2.09	0.53
1:B:70:LYS:O	1:B:71:ASP:HB2	2.10	0.52
1:A:70:LYS:O	1:A:71:ASP:HB2	2.12	0.50
1:A:57:GLN:OE1	1:A:57:GLN:HA	2.11	0.50
1:A:39:LEU:HD12	1:A:44:MET:HG3	1.92	0.50
1:B:42:ASN:HD21	1:B:43:VAL:HG23	1.77	0.50
1:A:23:ASP:HB3	1:A:26:CYS:SG	2.53	0.49
1:A:11:ASP:OD1	1:A:35:HIS:HE1	1.96	0.48
1:B:13:MET:CE	1:B:120:LEU:HD12	2.44	0.48
1:A:35:HIS:CG	1:A:89:SER:HA	2.49	0.48
1:B:57:GLN:O	1:B:61:THR:HG23	2.14	0.47
1:A:45:GLY:HA2	1:A:87:ILE:O	2.13	0.47
1:B:57:GLN:OE1	1:B:57:GLN:HA	2.12	0.47
1:A:42:ASN:HD21	1:A:43:VAL:HG23	1.76	0.47
1:B:11:ASP:OD1	1:B:35:HIS:HE1	1.99	0.46
1:B:39:LEU:HD12	1:B:44:MET:HG3	1.98	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:87:ILE:CD1	1:B:93:ASP:HB2	2.46	0.45
1:B:23:ASP:HB3	1:B:26:CYS:SG	2.57	0.45
1:B:45:GLY:HA2	1:B:87:ILE:O	2.17	0.45
1:B:87:ILE:HD11	1:B:93:ASP:HB2	1.99	0.45
1:B:10:ASN:ND2	1:B:12:GLN:H	2.14	0.44
1:A:57:GLN:O	1:A:61:THR:HG23	2.17	0.44
1:B:35:HIS:CG	1:B:89:SER:HA	2.52	0.44
1:A:35:HIS:HB3	1:A:89:SER:HA	1.99	0.43
3:A:130:RBU:H23	4:A:540:HOH:O	2.19	0.43
1:A:46:HIS:CE1	1:A:121:MET:SD	3.14	0.41
1:B:35:HIS:HB3	1:B:89:SER:HA	2.01	0.41
1:A:8:GLN:HG3	1:A:16:ASN:ND2	2.36	0.41

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	126/128 (98%)	120 (95%)	6 (5%)	0	100	100
1	B	126/128 (98%)	120 (95%)	6 (5%)	0	100	100
All	All	252/256 (98%)	240 (95%)	12 (5%)	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	110/110 (100%)	98 (89%)	12 (11%)	7	8
1	B	110/110 (100%)	99 (90%)	11 (10%)	9	10
All	All	220/220 (100%)	197 (90%)	23 (10%)	8	9

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	ILE
1	A	10	ASN
1	A	21	THR
1	A	27	LYS
1	A	41	LYS
1	A	44	MET
1	A	57	GLN
1	A	85	LYS
1	A	87	ILE
1	A	89	SER
1	A	101	LYS
1	A	103	LYS
1	B	7	ILE
1	B	10	ASN
1	B	21	THR
1	B	27	LYS
1	B	41	LYS
1	B	44	MET
1	B	57	GLN
1	B	85	LYS
1	B	87	ILE
1	B	89	SER
1	B	103	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	8	GLN
1	A	10	ASN
1	A	32	ASN
1	A	42	ASN
1	B	8	GLN

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Mol	Chain	Res	Type
1	B	10	ASN
1	B	14	GLN
1	B	32	ASN
1	B	42	ASN

### 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 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 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	$\# Z  > 2$
3	RBU	A	130	1	27,34,34	5.60	13 (48%)	29,46,46	3.89	18 (62%)
3	RBU	B	130	1	27,34,34	5.66	13 (48%)	29,46,46	3.81	17 (58%)

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
3	RBU	A	130	1	-	0/4/49/49	0/5/5/5
3	RBU	B	130	1	-	0/4/49/49	0/5/5/5

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	130	RBU	C4-C5	-15.87	1.38	1.53
3	A	130	RBU	C14-C15	-15.76	1.38	1.53
3	B	130	RBU	C14-C15	-15.25	1.39	1.53
3	A	130	RBU	C4-C5	-15.04	1.39	1.53
3	B	130	RBU	C11-N3	-9.93	1.36	1.49
3	B	130	RBU	C1-N1	-9.44	1.36	1.49
3	A	130	RBU	C11-N3	-9.25	1.37	1.49
3	A	130	RBU	C1-N1	-8.73	1.37	1.49
3	A	130	RBU	C15-N3	-7.21	1.36	1.49
3	A	130	RBU	C5-N1	-6.79	1.37	1.49
3	B	130	RBU	C15-N3	-6.65	1.37	1.49
3	B	130	RBU	C5-N1	-5.86	1.39	1.49
3	B	130	RBU	C13-C14	-5.53	1.38	1.53
3	A	130	RBU	C3-C4	-5.43	1.38	1.53
3	B	130	RBU	C3-C4	-5.36	1.39	1.53
3	A	130	RBU	C13-C14	-5.28	1.39	1.53
3	A	130	RBU	C11-C12	-3.64	1.37	1.51
3	B	130	RBU	C1-C2	-3.38	1.38	1.51
3	B	130	RBU	C11-C12	-3.37	1.38	1.51
3	A	130	RBU	C13-C12	-3.33	1.38	1.51
3	A	130	RBU	C1-C2	-3.22	1.39	1.51
3	A	130	RBU	C3-C2	-3.17	1.38	1.51
3	B	130	RBU	C13-C12	-3.14	1.38	1.51
3	B	130	RBU	C3-C2	-3.03	1.39	1.51
3	A	130	RBU	C6-N2	2.25	1.37	1.34
3	B	130	RBU	C6-N2	2.73	1.38	1.34

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	130	RBU	C19-C20-N4	-2.25	119.70	123.43
3	A	130	RBU	C9-C10-N2	-2.10	119.94	123.43
3	B	130	RBU	C9-C10-N2	-2.04	120.05	123.43
3	A	130	RBU	C6-C5-N1	2.26	116.87	112.90
3	B	130	RBU	C16-C15-N3	2.35	117.04	112.90
3	B	130	RBU	C6-C5-N1	2.45	117.21	112.90
3	A	130	RBU	C16-C15-N3	2.60	117.47	112.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	130	RB	C10-N2-C6	2.94	120.52	117.29
3	B	130	RB	C20-N4-C16	2.96	120.55	117.29
3	A	130	RB	C10-N2-C6	3.19	120.79	117.29
3	B	130	RB	C3-C4-C5	3.63	118.77	111.49
3	A	130	RB	C13-C14-C15	3.66	118.85	111.49
3	B	130	RB	C13-C14-C15	3.68	118.89	111.49
3	A	130	RB	C20-N4-C16	3.93	121.61	117.29
3	A	130	RB	C3-C4-C5	3.95	119.42	111.49
3	B	130	RB	C12-C13-C14	4.29	120.29	111.42
3	A	130	RB	C14-C15-N3	4.31	119.39	110.55
3	A	130	RB	C2-C3-C4	4.36	120.44	111.42
3	B	130	RB	C2-C3-C4	4.54	120.81	111.42
3	A	130	RB	C4-C5-N1	4.69	120.18	110.55
3	A	130	RB	C11-C12-C13	4.73	118.77	111.43
3	A	130	RB	C12-C13-C14	4.75	121.24	111.42
3	B	130	RB	C4-C5-N1	4.76	120.32	110.55
3	B	130	RB	C14-C15-N3	4.78	120.37	110.55
3	A	130	RB	C1-C2-C3	5.03	119.24	111.43
3	B	130	RB	C1-C2-C3	5.13	119.38	111.43
3	B	130	RB	C11-C12-C13	5.34	119.71	111.43
3	A	130	RB	C1-N1-C5	6.98	120.43	110.96
3	B	130	RB	C1-N1-C5	7.10	120.60	110.96
3	B	130	RB	C11-N3-C15	7.22	120.75	110.96
3	B	130	RB	C12-C11-N3	7.35	120.00	112.16
3	A	130	RB	C12-C11-N3	7.43	120.08	112.16
3	B	130	RB	C2-C1-N1	7.46	120.11	112.16
3	A	130	RB	C2-C1-N1	7.64	120.30	112.16
3	A	130	RB	C11-N3-C15	7.90	121.67	110.96

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	130	RB	1	0

## 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

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.