



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 21, 2024 – 04:06 AM EDT

PDB ID : 1S9R  
Title : CRYSTAL STRUCTURE OF ARGININE DEIMINASE COVALENTLY LINKED WITH A REACTION INTERMEDIATE  
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Deposited on : 2004-02-05  
Resolution : 1.60 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 : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 1.20.1  
EDS : **FAILED**  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

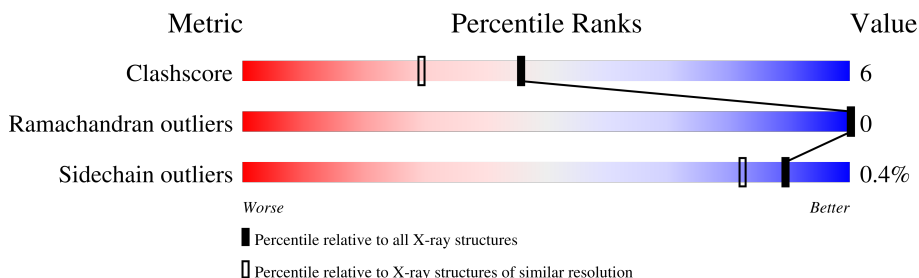
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.60 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	180529	4682 (1.60-1.60)
Ramachandran outliers	177936	4583 (1.60-1.60)
Sidechain outliers	177891	4582 (1.60-1.60)

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.

Note EDS failed to run properly.

Mol	Chain	Length	Quality of chain
1	A	410	
1	B	410	

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	TRS	A	952	-	X	-	-
3	TRS	B	953	-	X	-	-

## 2 Entry composition [i](#)

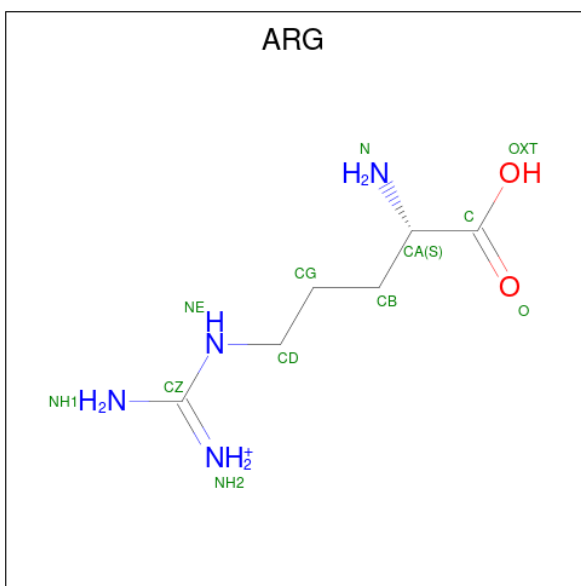
There are 5 unique types of molecules in this entry. The entry contains 7528 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Arginine deiminase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	409	Total 3270	C 2096	N 545	O 617	S 12	0	0	0
1	B	409	Total 3270	C 2096	N 545	O 617	S 12	0	0	0

- Molecule 2 is ARGININE (three-letter code: ARG) (formula: C<sub>6</sub>H<sub>15</sub>N<sub>4</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	Total 11	C 6	N 3	O 2	0	0
2	B	1	Total 11	C 6	N 3	O 2	0	0

- Molecule 3 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: C<sub>4</sub>H<sub>12</sub>NO<sub>3</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	8	4	1	3	0	0
3	B	1	8	4	1	3	0	0

- Molecule 4 is UNKNOWN ATOM OR ION (three-letter code: UNX) (formula: X).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	X		
4	A	4	4	4	0	0
4	B	5	5	5	0	0

- Molecule 5 is water.

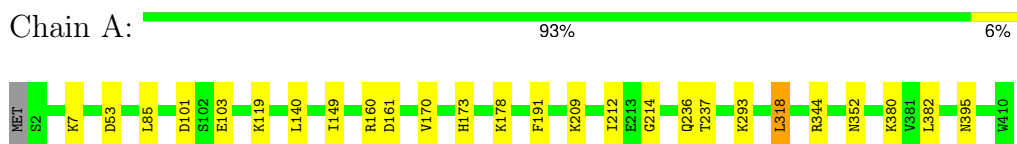
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	513	513	513	0	0
5	B	428	428	428	0	0

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

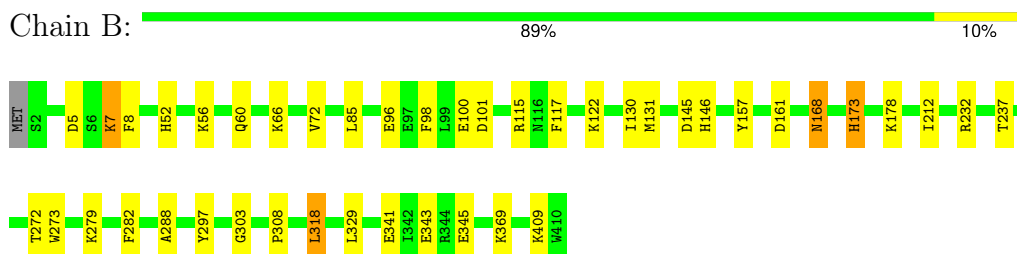
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density.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

Note EDS failed to run properly.

- Molecule 1: Arginine deiminase



- Molecule 1: Arginine deiminase



## 4 Data and refinement statistics

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	76.83Å 76.36Å 82.85Å 90.00° 107.96° 90.00°	Depositor
Resolution (Å)	19.46 – 1.60	Depositor
% Data completeness (in resolution range)	89.0 (19.46-1.60)	Depositor
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.88 (at 1.60Å)	Xtrriage
Refinement program	CNS 1.0	Depositor
R, $R_{free}$	0.168 , 0.202	Depositor
Wilson B-factor (Å <sup>2</sup> )	11.6	Xtrriage
Anisotropy	0.620	Xtrriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	7528	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	17.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.69% 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: UNX, TRS

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	0.76	0/3341	0.87	3/4527 (0.1%)
1	B	0.71	0/3341	0.86	4/4527 (0.1%)
All	All	0.73	0/6682	0.87	7/9054 (0.1%)

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	B	0	1

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	318	LEU	CA-CB-CG	-6.01	101.48	115.30
1	B	318	LEU	CA-CB-CG	-5.90	101.73	115.30
1	B	232	ARG	NE-CZ-NH2	-5.37	117.61	120.30
1	B	173	HIS	N-CA-C	5.28	125.26	111.00
1	A	173	HIS	N-CA-C	5.23	125.13	111.00
1	B	161	ASP	N-CA-C	5.14	124.88	111.00
1	A	161	ASP	N-CA-C	5.01	124.54	111.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	157	TYR	Sidechain

## 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	3270	0	3265	23	0
1	B	3270	0	3265	39	0
2	A	11	0	10	1	0
2	B	11	0	10	1	0
3	A	8	0	9	3	0
3	B	8	0	9	3	0
4	A	4	0	0	0	0
4	B	5	0	0	0	0
5	A	513	0	0	16	0
5	B	428	0	0	15	0
All	All	7528	0	6568	66	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 6.

All (66) 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:B:101:ASP:HB3	5:B:1315:HOH:O	1.83	0.79
1:B:178:LYS:HE2	5:B:1300:HOH:O	1.84	0.77
1:A:85:LEU:HB2	5:A:1440:HOH:O	1.85	0.76
1:A:101:ASP:HB3	5:A:1379:HOH:O	1.83	0.76
1:B:7:LYS:HD2	1:B:7:LYS:C	2.11	0.71
1:B:409:LYS:HG3	1:B:409:LYS:O	1.92	0.70
5:A:1469:HOH:O	1:B:343:GLU:HG2	1.98	0.63
1:B:5:ASP:OD2	1:B:7:LYS:HE3	2.01	0.60
1:B:96:GLU:O	1:B:100:GLU:HG3	2.01	0.60
1:A:293:LYS:HD3	5:A:1409:HOH:O	2.02	0.59
2:A:950:ARG:CZ	5:A:963:HOH:O	2.53	0.57
1:B:7:LYS:HD2	1:B:8:PHE:N	2.20	0.56
1:B:279:LYS:HZ1	1:B:409:LYS:HE3	1.70	0.56
1:A:212:ILE:HB	1:A:237:THR:HG21	1.89	0.54
1:B:85:LEU:HD12	1:B:85:LEU:C	2.27	0.54
1:B:145:ASP:OD2	1:B:146:HIS:HD2	1.90	0.54
1:B:212:ILE:HB	1:B:237:THR:HG21	1.89	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:297:TYR:CZ	1:B:308:PRO:HB3	2.43	0.54
1:B:269:HIS:HB2	5:B:962:HOH:O	2.07	0.53
1:A:344:ARG:HB3	3:A:952:TRS:N	2.25	0.52
1:A:178:LYS:HE2	5:A:1405:HOH:O	2.10	0.52
2:B:951:ARG:CZ	5:B:962:HOH:O	2.58	0.50
1:B:146:HIS:HE1	5:B:1177:HOH:O	1.94	0.50
3:B:953:TRS:H21	5:B:987:HOH:O	2.10	0.50
1:A:7:LYS:NZ	5:A:1387:HOH:O	2.30	0.49
1:B:101:ASP:CB	5:B:1315:HOH:O	2.53	0.48
1:B:168:ASN:H	1:B:168:ASN:HD22	1.59	0.48
1:A:85:LEU:CB	5:A:1440:HOH:O	2.53	0.48
1:B:60:GLN:HG3	5:B:1364:HOH:O	2.14	0.47
1:A:236:GLN:HG2	5:A:1129:HOH:O	2.15	0.46
1:B:409:LYS:HG2	5:B:1111:HOH:O	2.15	0.46
1:B:282:PHE:HB2	1:B:329:LEU:HD23	1.96	0.46
1:B:56:LYS:HD2	5:B:1274:HOH:O	2.14	0.46
1:B:178:LYS:NZ	5:B:1315:HOH:O	2.48	0.46
3:A:952:TRS:H21	5:A:1067:HOH:O	2.15	0.46
1:B:115:ARG:NH2	5:B:1338:HOH:O	2.47	0.45
1:A:103:GLU:OE1	5:A:1405:HOH:O	2.21	0.45
1:A:344:ARG:HB3	3:A:952:TRS:HN2	1.80	0.45
1:B:272:THR:HG23	5:B:962:HOH:O	2.16	0.45
1:A:160:ARG:O	1:A:214:GLY:HA3	2.17	0.44
1:A:293:LYS:CD	5:A:1409:HOH:O	2.61	0.44
1:B:318:LEU:O	1:B:318:LEU:HG	2.16	0.44
1:B:345:GLU:HG2	3:B:953:TRS:N	2.33	0.44
1:B:341:GLU:OE1	1:B:369:LYS:HE2	2.18	0.44
1:A:352:ASN:HB3	1:A:395:ASN:HB3	2.00	0.43
1:B:98:PHE:HB2	1:B:131:MET:HE3	2.00	0.43
1:A:380:LYS:NZ	5:A:1022:HOH:O	2.49	0.43
1:A:380:LYS:HE2	1:A:382:LEU:HD21	1.99	0.43
1:B:52:HIS:CD2	5:B:1278:HOH:O	2.70	0.43
1:A:85:LEU:HG	5:A:1183:HOH:O	2.18	0.43
1:A:318:LEU:O	1:A:318:LEU:HG	2.13	0.43
1:B:66:LYS:HZ2	1:B:72:VAL:HB	1.84	0.43
1:B:303:GLY:HA3	5:B:1233:HOH:O	2.19	0.42
1:B:168:ASN:HD22	1:B:168:ASN:N	2.18	0.42
1:A:293:LYS:HG2	5:A:1351:HOH:O	2.20	0.42
1:A:53:ASP:HB3	5:A:1054:HOH:O	2.18	0.42
1:A:170:VAL:HG11	1:A:191:PHE:CZ	2.54	0.42
1:A:140:LEU:HD12	1:A:149:ILE:HG13	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:122:LYS:HA	1:B:122:LYS:HD3	1.89	0.41
1:B:117:PHE:HE2	1:B:130:ILE:HG12	1.86	0.41
1:A:119:LYS:HB2	1:A:119:LYS:HE3	1.92	0.41
1:B:173:HIS:HB3	1:B:212:ILE:O	2.20	0.41
1:B:245:ILE:HG23	1:B:251:CYS:SG	2.61	0.41
1:B:273:TRP:CE3	1:B:288:ALA:HB2	2.56	0.41
1:B:56:LYS:HD3	1:B:56:LYS:HA	1.82	0.40
1:B:345:GLU:HG2	3:B:953:TRS:HN1	1.87	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	407/410 (99%)	397 (98%)	10 (2%)	0	100	100
1	B	407/410 (99%)	396 (97%)	11 (3%)	0	100	100
All	All	814/820 (99%)	793 (97%)	21 (3%)	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	361/362 (100%)	360 (100%)	1 (0%)	91	85

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	361/362 (100%)	359 (99%)	2 (1%)	84	74
All	All	722/724 (100%)	719 (100%)	3 (0%)	89	82

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	209	LYS
1	B	7	LYS
1	B	168	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	12	HIS
1	A	116	ASN
1	B	146	HIS
1	B	168	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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 13 ligands modelled in this entry, 9 are unknown - leaving 4 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
2	ARG	B	951	1	9,10,11	1.70	1 (11%)	8,11,13	0.84	0
2	ARG	A	950	1	9,10,11	0.91	0	8,11,13	1.67	2 (25%)
3	TRS	A	952	-	7,7,7	5.33	5 (71%)	9,9,9	2.70	6 (66%)
3	TRS	B	953	-	7,7,7	4.28	3 (42%)	9,9,9	3.15	6 (66%)

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	ARG	B	951	1	-	2/9/10/11	-
2	ARG	A	950	1	-	1/9/10/11	-
3	TRS	A	952	-	-	3/9/9/9	-
3	TRS	B	953	-	-	5/9/9/9	-

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	952	TRS	O2-C2	-9.60	1.11	1.42
3	B	953	TRS	O2-C2	-9.10	1.13	1.42
3	A	952	TRS	C3-C	-7.80	1.32	1.53
3	A	952	TRS	O3-C3	-5.86	1.23	1.42
3	B	953	TRS	C3-C	-5.69	1.37	1.53
2	B	951	ARG	CZ-NE	-4.59	1.33	1.45
3	B	953	TRS	O3-C3	-2.69	1.33	1.42
3	A	952	TRS	C-N	-2.26	1.42	1.49
3	A	952	TRS	O1-C1	-2.21	1.35	1.42

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	953	TRS	C2-C-C1	-5.03	97.25	110.66
3	B	953	TRS	C3-C-C2	-4.88	97.65	110.66
3	A	952	TRS	O2-C2-C	-4.40	98.62	110.88
2	A	950	ARG	NH1-CZ-NE	4.04	118.59	113.66
3	B	953	TRS	C1-C-N	3.77	117.79	108.17

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	952	TRS	C2-C-C1	-3.71	100.79	110.66
3	B	953	TRS	C2-C-N	3.22	116.39	108.17
3	A	952	TRS	C3-C-C1	3.18	119.13	110.66
3	A	952	TRS	C2-C-N	2.93	115.63	108.17
3	B	953	TRS	C3-C-C1	2.85	118.26	110.66
3	A	952	TRS	C3-C-C2	-2.67	103.54	110.66
3	B	953	TRS	O3-C3-C	-2.66	103.46	110.88
2	A	950	ARG	CZ-NE-CD	2.25	124.01	113.39
3	A	952	TRS	O1-C1-C	-2.10	105.02	110.88

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	952	TRS	C1-C-C2-O2
3	A	952	TRS	C3-C-C2-O2
3	A	952	TRS	N-C-C2-O2
3	B	953	TRS	N-C-C1-O1
3	B	953	TRS	C3-C-C2-O2
3	B	953	TRS	C3-C-C1-O1
3	B	953	TRS	C1-C-C2-O2
3	B	953	TRS	N-C-C2-O2
2	A	950	ARG	O-C-CA-N
2	B	951	ARG	O-C-CA-N
2	B	951	ARG	OXT-C-CA-N

There are no ring outliers.

4 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	951	ARG	1	0
2	A	950	ARG	1	0
3	A	952	TRS	3	0
3	B	953	TRS	3	0

## 5.7 Other polymers [i](#)

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 failed to run properly - this section is therefore empty.

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

EDS failed to run properly - this section is therefore empty.

### 6.3 Carbohydrates

EDS failed to run properly - this section is therefore empty.

### 6.4 Ligands

EDS failed to run properly - this section is therefore empty.

### 6.5 Other polymers

EDS failed to run properly - this section is therefore empty.