



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 27, 2024 – 04:09 PM EST

PDB ID : 1A16  
Title : AMINOPEPTIDASE P FROM E. COLI WITH THE INHIBITOR PRO-LEU  
Authors : Wilce, M.C.; Bond, C.S.; Lilley, P.E.; Dixon, N.E.; Freeman, H.C.; Guss, J.M.  
Deposited on : 1997-12-22  
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 : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

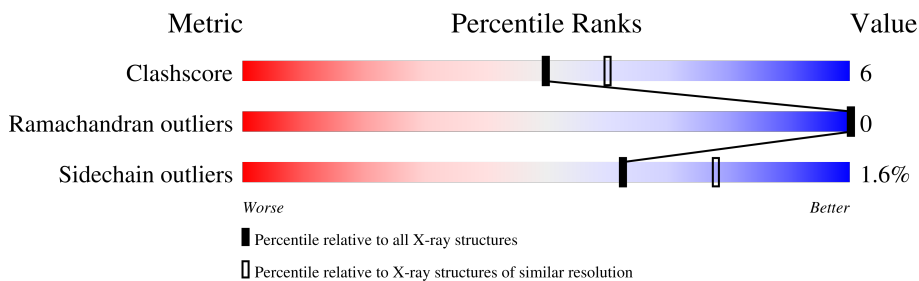
# 1 Overall quality at a glance

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	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	440	85% 13%

## 2 Entry composition [i](#)

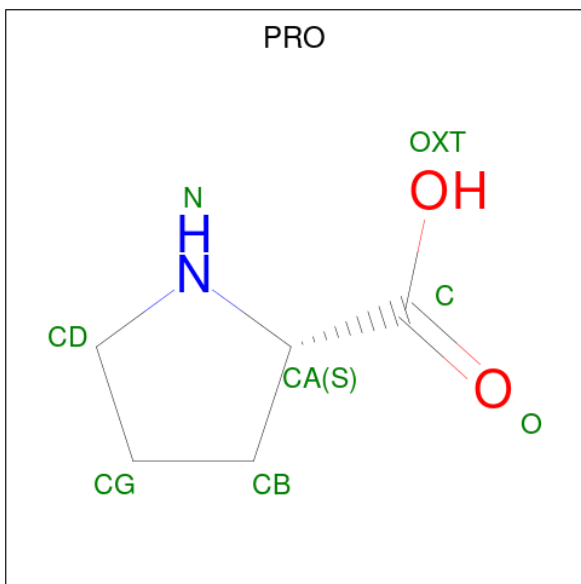
There are 5 unique types of molecules in this entry. The entry contains 3858 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 AMINOPEPTIDASE P.

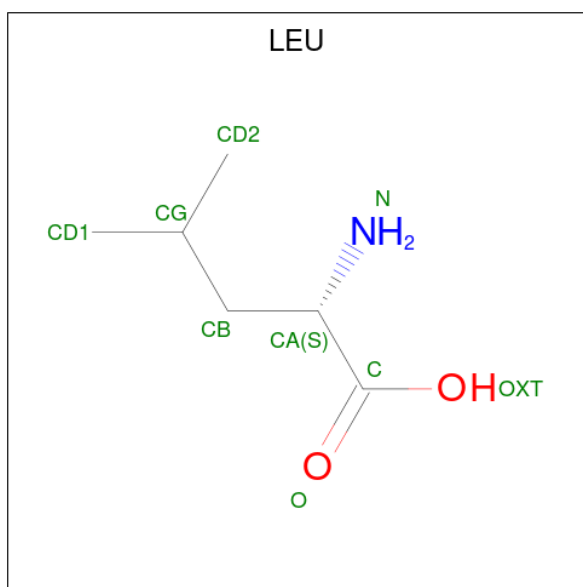
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	439	3494	2199	617	663	15	3	0	0

- Molecule 2 is PROLINE (three-letter code: PRO) (formula: C<sub>5</sub>H<sub>9</sub>NO<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	7	5	1	1	0	0

- Molecule 3 is LEUCINE (three-letter code: LEU) (formula: C<sub>6</sub>H<sub>13</sub>NO<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			9	6	1	2		

- Molecule 4 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Mn	0	0
			2	2		

- Molecule 5 is water.

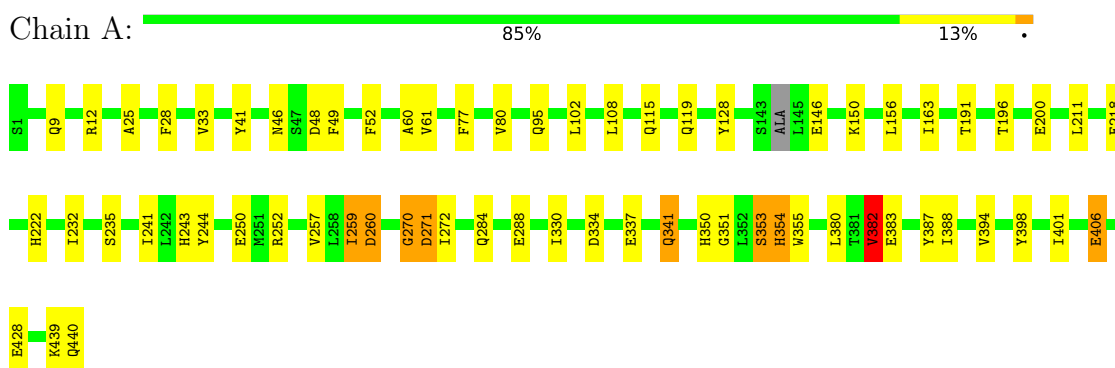
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	346	Total	O	0	0
			346	346		

### 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. 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. 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: AMINOPEPTIDASE P



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	177.30Å 177.30Å 96.50Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.30	Depositor
% Data completeness (in resolution range)	91.9 (50.00-2.30)	Depositor
$R_{merge}$	0.05	Depositor
$R_{sym}$	0.05	Depositor
Refinement program	X-PLOR 3.8	Depositor
R, $R_{free}$	0.184 , 0.226	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	3858	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	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: MN

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	1.00	27/3565 (0.8%)	0.94	23/4825 (0.5%)

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	2

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	383	GLU	CD-OE1	21.27	1.49	1.25
1	A	406	GLU	CD-OE2	16.13	1.43	1.25
1	A	354	HIS	CA-C	13.41	1.87	1.52
1	A	383	GLU	CA-CB	-13.28	1.24	1.53
1	A	353	SER	C-N	12.63	1.63	1.34
1	A	383	GLU	C-O	-11.42	1.01	1.23
1	A	406	GLU	CD-OE1	11.37	1.38	1.25
1	A	383	GLU	CB-CG	10.07	1.71	1.52
1	A	354	HIS	CG-CD2	-10.02	1.18	1.35
1	A	383	GLU	C-N	9.60	1.52	1.34
1	A	354	HIS	CB-CG	9.38	1.67	1.50
1	A	271	ASP	N-CA	-8.96	1.28	1.46
1	A	406	GLU	CG-CD	-8.43	1.39	1.51
1	A	354	HIS	CA-CB	7.93	1.71	1.53
1	A	383	GLU	CD-OE2	-7.51	1.17	1.25
1	A	260	ASP	C-O	7.26	1.37	1.23
1	A	383	GLU	N-CA	7.17	1.60	1.46
1	A	271	ASP	CG-OD1	6.99	1.41	1.25

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	383	GLU	CG-CD	-6.88	1.41	1.51
1	A	260	ASP	CA-CB	-6.66	1.39	1.53
1	A	354	HIS	C-N	6.46	1.49	1.34
1	A	260	ASP	N-CA	-6.34	1.33	1.46
1	A	271	ASP	C-N	-6.29	1.19	1.34
1	A	260	ASP	CG-OD1	5.98	1.39	1.25
1	A	354	HIS	CD2-NE2	5.72	1.53	1.42
1	A	259	ILE	C-N	5.29	1.46	1.34
1	A	271	ASP	CB-CG	5.22	1.62	1.51

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	354	HIS	O-C-N	15.08	146.83	122.70
1	A	383	GLU	OE1-CD-OE2	-14.59	105.79	123.30
1	A	270	GLY	O-C-N	-14.55	99.42	122.70
1	A	383	GLU	CG-CD-OE2	11.37	141.05	118.30
1	A	260	ASP	CB-CG-OD2	10.65	127.88	118.30
1	A	270	GLY	CA-C-N	10.46	140.21	117.20
1	A	271	ASP	CB-CG-OD2	9.60	126.94	118.30
1	A	353	SER	C-N-CA	-9.26	98.55	121.70
1	A	260	ASP	CB-CA-C	8.06	126.52	110.40
1	A	271	ASP	CB-CA-C	7.99	126.37	110.40
1	A	354	HIS	N-CA-C	-7.68	90.25	111.00
1	A	354	HIS	CA-C-N	-7.55	100.60	117.20
1	A	406	GLU	OE1-CD-OE2	-6.99	114.91	123.30
1	A	353	SER	CA-C-N	-6.99	101.83	117.20
1	A	260	ASP	OD1-CG-OD2	-6.95	110.09	123.30
1	A	271	ASP	CB-CG-OD1	-6.22	112.70	118.30
1	A	383	GLU	CA-CB-CG	5.94	126.46	113.40
1	A	259	ILE	O-C-N	-5.50	113.89	122.70
1	A	259	ILE	C-N-CA	5.48	135.40	121.70
1	A	382	VAL	C-N-CA	-5.41	108.19	121.70
1	A	353	SER	O-C-N	5.37	131.29	122.70
1	A	271	ASP	N-CA-CB	5.32	120.18	110.60
1	A	260	ASP	CA-C-N	5.18	128.60	117.20

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	353	SER	Mainchain

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Mol	Chain	Res	Type	Group
1	A	382	VAL	Mainchain

## 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	3494	0	3422	40	0
2	A	7	0	7	2	0
3	A	9	0	11	0	0
4	A	2	0	0	0	0
5	A	346	0	0	0	0
All	All	3858	0	3440	40	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 (40) 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:354:HIS:CA	1:A:354:HIS:C	1.87	1.42
1:A:46:ASN:HD22	1:A:49:PHE:H	1.21	0.88
1:A:354:HIS:C	1:A:354:HIS:N	2.38	0.77
1:A:250:GLU:HB3	1:A:252:ARG:HH21	1.55	0.71
1:A:350:HIS:HE1	1:A:387:TYR:OH	1.80	0.65
1:A:354:HIS:CA	1:A:355:TRP:N	2.60	0.65
1:A:354:HIS:N	1:A:354:HIS:O	2.35	0.60
1:A:284:GLN:O	1:A:288:GLU:HG3	2.03	0.58
1:A:241:ILE:HB	1:A:244:TYR:HB2	1.89	0.54
1:A:146:GLU:OE1	1:A:150:LYS:HE2	2.10	0.52
1:A:243:HIS:CD2	2:A:441:PRO:HD2	2.46	0.51
1:A:77:PHE:HA	1:A:108:LEU:O	2.11	0.51
1:A:46:ASN:ND2	1:A:49:PHE:H	2.01	0.49
1:A:211:LEU:HD13	1:A:259:ILE:HD11	1.96	0.48
1:A:350:HIS:HD2	1:A:351:GLY:O	1.97	0.48
1:A:60:ALA:HA	1:A:77:PHE:O	2.14	0.48
1:A:191:THR:HG22	1:A:272:ILE:HD12	1.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:270:GLY:O	1:A:271:ASP:HB2	2.15	0.47
1:A:337:GLU:O	1:A:341:GLN:HG2	2.15	0.46
1:A:128:TYR:HA	1:A:163:ILE:O	2.15	0.46
1:A:334:ASP:HB3	1:A:337:GLU:HB2	1.99	0.45
1:A:28:PHE:CD2	1:A:61:VAL:HG22	2.52	0.45
1:A:80:VAL:HG23	1:A:95:GLN:HE22	1.82	0.45
1:A:388:ILE:HG21	1:A:394:VAL:HG21	1.99	0.45
1:A:115:GLN:O	1:A:119:GLN:NE2	2.48	0.44
1:A:330:ILE:HG23	1:A:394:VAL:HG11	1.98	0.44
1:A:398:TYR:HA	1:A:401:ILE:HD12	2.00	0.44
1:A:33:VAL:HG12	1:A:41:TYR:HD2	1.83	0.44
1:A:218:GLU:OE2	1:A:222:HIS:HE1	2.01	0.44
1:A:243:HIS:NE2	2:A:441:PRO:HD2	2.34	0.43
1:A:232:ILE:HB	1:A:260:ASP:HB3	2.00	0.43
1:A:46:ASN:HD21	1:A:48:ASP:HB2	1.82	0.43
1:A:439:LYS:O	1:A:440:GLN:HB2	2.19	0.43
1:A:354:HIS:C	1:A:354:HIS:CB	2.84	0.42
1:A:196:THR:O	1:A:200:GLU:HG3	2.19	0.42
1:A:382:VAL:O	1:A:406:GLU:HA	2.20	0.41
1:A:12:ARG:NH1	1:A:52:PHE:O	2.53	0.41
1:A:350:HIS:CE1	1:A:387:TYR:OH	2.68	0.41
1:A:235:SER:HA	1:A:257:VAL:HA	2.03	0.41
1:A:25:ALA:HA	1:A:128:TYR:HB2	2.03	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	435/440 (99%)	425 (98%)	10 (2%)	0	<a href="#">100</a> <a href="#">100</a>

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	371/371 (100%)	365 (98%)	6 (2%)	62 78

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	GLN
1	A	102	LEU
1	A	156	LEU
1	A	341	GLN
1	A	380	LEU
1	A	428	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	9	GLN
1	A	46	ASN
1	A	56	ASN
1	A	95	GLN
1	A	116	GLN
1	A	131	GLN
1	A	195	HIS
1	A	222	HIS
1	A	341	GLN
1	A	350	HIS
1	A	368	GLN

### 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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 2 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	LEU	A	442	2	7,8,8	1.06	1 (14%)	9,10,10	2.03	3 (33%)
2	PRO	A	441	3	5,7,8	0.54	0	7,8,10	1.00	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
3	LEU	A	442	2	-	3/8/8/8	-
2	PRO	A	441	3	-	0/0/9/11	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	442	LEU	OXT-C	-2.16	1.23	1.30

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	442	LEU	OXT-C-CA	3.49	125.28	113.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	442	LEU	OXT-C-O	-3.42	116.32	124.09
3	A	442	LEU	CB-CA-N	3.06	117.14	110.32

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	442	LEU	O-C-CA-N
3	A	442	LEU	OXT-C-CA-N
3	A	442	LEU	C-CA-CB-CG

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	441	PRO	2	0

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	353:SER	C	354:HIS	N	1.63
1	A	271:ASP	C	272:ILE	N	1.19

## 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.