



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 02:34 AM UTC

PDB ID : 5FH9 / pdb_00005fh9
Title : Crystal structure of NFeoB from Escherichia coli BL21 in the apo state.
Authors : Hagelueken, G.
Deposited on : 2015-12-21
Resolution : 3.16 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 types of validation reports are described at

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

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

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (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

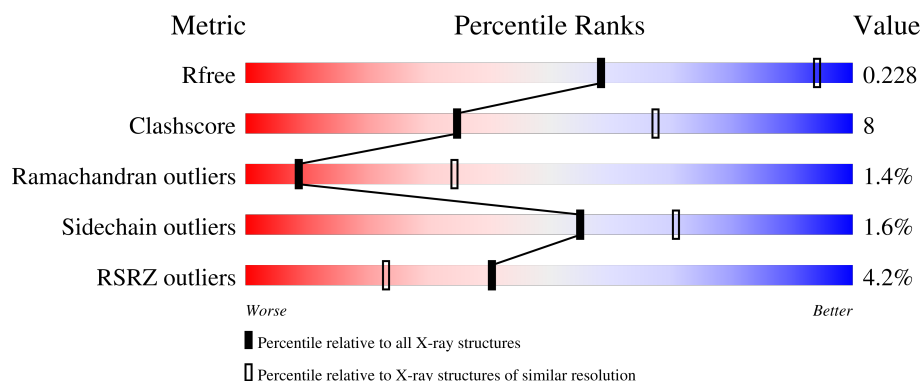
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.16 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	2361 (3.20-3.12)
Clashscore	190562	2486 (3.20-3.12)
Ramachandran outliers	187476	2405 (3.20-3.12)
Sidechain outliers	187428	2404 (3.20-3.12)
RSRZ outliers	180081	2361 (3.20-3.12)

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 ≥ 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	274	80% 15% .
1	B	274	7% 78% 14% 6%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 4010 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.

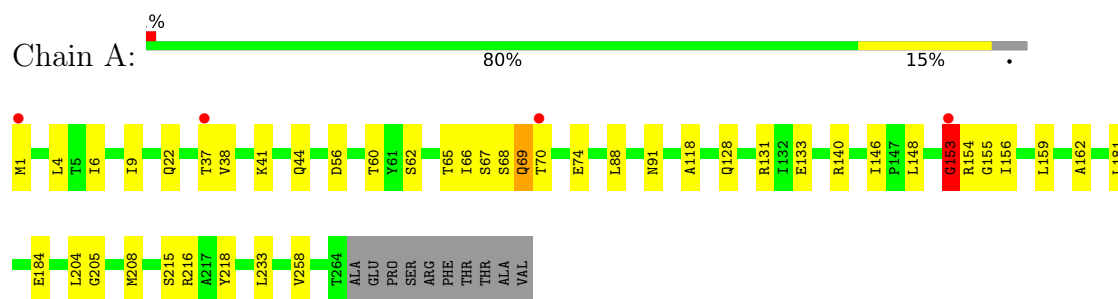
- Molecule 1 is a protein called Ferrous iron transport protein B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	264	Total	C	N	O	S	0	0	0
			2031	1272	357	392	10			
1	B	257	Total	C	N	O	S	0	0	0
			1979	1242	348	379	10			

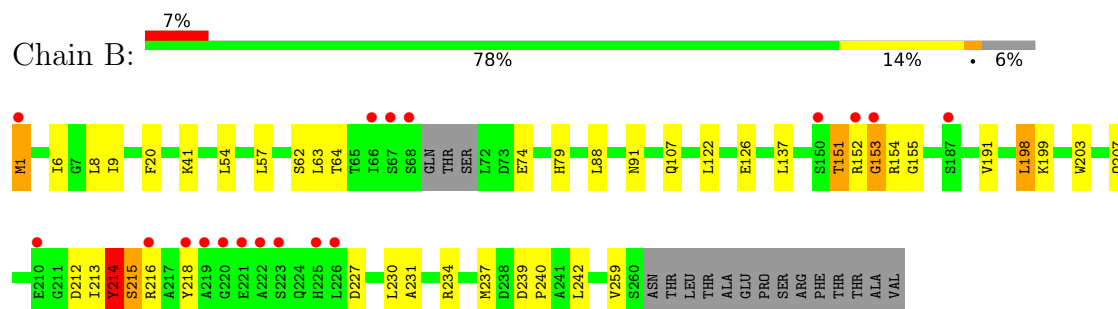
3 Residue-property plots [i](#)

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: Ferrous iron transport protein B



• Molecule 1: Ferrous iron transport protein B



4 Data and refinement statistics

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, α , β , γ	166.68Å 166.68Å 65.58Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.12 – 3.16 48.12 – 3.16	Depositor EDS
% Data completeness (in resolution range)	99.6 (48.12-3.16) 99.6 (48.12-3.16)	Depositor EDS
R_{merge}	0.23	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.36 (at 3.19Å)	Xtriage
Refinement program	PHENIX (1.10.1_2155: ???)	Depositor
R, R_{free}	0.208 , 0.228 0.208 , 0.228	Depositor DCC
R_{free} test set	903 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	71.3	Xtriage
Anisotropy	0.039	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 61.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	0.065 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	4010	wwPDB-VP
Average B, all atoms (Å ²)	76.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.08% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

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	0.19	0/2058	0.46	2/2796 (0.1%)
1	B	0.18	0/2005	0.45	0/2721
All	All	0.18	0/4063	0.45	2/5517 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	153	GLY	CA-C-N	5.74	132.04	121.70
1	A	153	GLY	C-N-CA	5.74	132.04	121.70

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	2031	0	2070	32	0
1	B	1979	0	2018	35	0
All	All	4010	0	4088	61	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 8.

All (61) 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:153:GLY:HA2	1:B:155:GLY:H	1.47	0.78
1:A:68:SER:OG	1:A:69:GLN:N	2.21	0.72
1:A:4:LEU:HD11	1:A:88:LEU:HD21	1.72	0.70
1:A:38:VAL:HG23	1:B:1:MET:HE1	1.73	0.70
1:B:79:HIS:ND1	1:B:218:TYR:OH	2.27	0.67
1:B:64:THR:HG23	1:B:107:GLN:HE22	1.60	0.65
1:A:131:ARG:NH1	1:A:133:GLU:OE2	2.30	0.65
1:A:215:SER:O	1:A:218:TYR:N	2.24	0.64
1:B:215:SER:O	1:B:218:TYR:N	2.29	0.64
1:B:214:TYR:O	1:B:216:ARG:N	2.30	0.64
1:A:37:THR:OG1	1:B:1:MET:SD	2.51	0.64
1:B:9:ILE:HB	1:B:57:LEU:HD12	1.81	0.61
1:A:65:THR:OG1	1:A:67:SER:O	2.18	0.60
1:A:153:GLY:HA2	1:A:155:GLY:H	1.65	0.60
1:B:64:THR:HG22	1:B:207:GLN:HE22	1.67	0.58
1:A:22:GLN:HB3	1:A:156:ILE:HD11	1.87	0.56
1:B:237:MET:HE2	1:B:240:PRO:HA	1.87	0.56
1:B:212:ASP:OD1	1:B:213:ILE:N	2.39	0.56
1:B:64:THR:HG22	1:B:207:GLN:NE2	2.21	0.55
1:A:205:GLY:HA2	1:A:208:MET:HE2	1.88	0.55
1:B:212:ASP:OD1	1:B:214:TYR:N	2.40	0.54
1:B:8:LEU:HB2	1:B:54:LEU:HD11	1.89	0.53
1:A:146:ILE:HD11	1:A:162:ALA:CB	2.39	0.53
1:B:227:ASP:O	1:B:231:ALA:N	2.35	0.52
1:A:128:GLN:NE2	1:B:198:LEU:HD11	2.25	0.52
1:A:153:GLY:HA2	1:A:154:ARG:HB3	1.92	0.51
1:B:6:ILE:HA	1:B:88:LEU:O	2.11	0.51
1:B:151:THR:O	1:B:153:GLY:N	2.42	0.51
1:A:140:ARG:NH2	1:A:258:VAL:HG11	2.25	0.51
1:A:146:ILE:HD13	1:A:159:LEU:HA	1.93	0.50
1:A:6:ILE:HA	1:A:88:LEU:O	2.13	0.49
1:B:231:ALA:HA	1:B:234:ARG:HH21	1.77	0.49
1:B:20:PHE:CE2	1:B:41:LYS:HD2	2.48	0.48
1:B:239:ASP:HB3	1:B:242:LEU:HB3	1.96	0.48
1:A:6:ILE:HG12	1:A:88:LEU:HG	1.96	0.48
1:B:62:SER:O	1:B:74:GLU:HG3	2.15	0.47
1:B:214:TYR:CZ	1:B:218:TYR:HE1	2.32	0.46
1:A:128:GLN:OE1	1:B:198:LEU:HD11	2.14	0.46
1:A:128:GLN:HE22	1:B:198:LEU:HD11	1.80	0.46
1:B:198:LEU:HD13	1:B:199:LYS:N	2.31	0.46
1:A:128:GLN:CD	1:B:198:LEU:HD11	2.42	0.45
1:B:230:LEU:O	1:B:234:ARG:HG3	2.16	0.45

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:9:ILE:O	1:B:91:ASN:HA	2.17	0.45
1:A:184:GLU:HG3	1:A:233:LEU:HG	1.98	0.44
1:B:203:TRP:O	1:B:207:GLN:HG2	2.17	0.44
1:A:181:LEU:HD23	1:A:233:LEU:HD13	1.99	0.43
1:A:118:ALA:HB1	1:A:148:LEU:HD11	2.01	0.43
1:A:69:GLN:OE1	1:A:70:THR:HG23	2.19	0.42
1:B:122:LEU:O	1:B:126:GLU:HG2	2.19	0.42
1:A:60:THR:OG1	1:A:74:GLU:HG2	2.19	0.42
1:A:41:LYS:HE2	1:A:56:ASP:OD2	2.19	0.42
1:B:63:LEU:N	1:B:107:GLN:OE1	2.48	0.42
1:A:9:ILE:O	1:A:91:ASN:HA	2.19	0.42
1:A:69:GLN:HB3	1:A:70:THR:H	1.63	0.42
1:A:60:THR:OG1	1:A:62:SER:O	2.36	0.41
1:A:204:LEU:HD22	1:A:215:SER:HB2	2.01	0.41
1:A:4:LEU:HD11	1:A:88:LEU:CD2	2.45	0.41
1:B:137:LEU:HB2	1:B:259:VAL:HG11	2.02	0.41
1:B:153:GLY:CA	1:B:154:ARG:HB3	2.51	0.41
1:A:1:MET:HE2	1:A:1:MET:HB3	1.85	0.40
1:B:153:GLY:HA2	1:B:155:GLY:N	2.24	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	262/274 (96%)	251 (96%)	8 (3%)	3 (1%)	11	39
1	B	253/274 (92%)	243 (96%)	6 (2%)	4 (2%)	7	32
All	All	515/548 (94%)	494 (96%)	14 (3%)	7 (1%)	9	34

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	215	SER
1	A	153	GLY
1	A	69	GLN
1	A	216	ARG
1	B	152	ARG
1	B	214	TYR
1	B	153	GLY

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	222/230 (96%)	220 (99%)	2 (1%)	70	77
1	B	215/230 (94%)	210 (98%)	5 (2%)	44	66
All	All	437/460 (95%)	430 (98%)	7 (2%)	55	71

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	44	GLN
1	A	66	ILE
1	B	1	MET
1	B	151	THR
1	B	191	VAL
1	B	198	LEU
1	B	214	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	91	ASN
1	A	176	HIS
1	A	243	HIS
1	B	11	ASN
1	B	44	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	51	GLN
1	B	176	HIS

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](#)

There are no ligands in this entry.

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

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, 95th 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	264/274 (96%)	-0.00	4 (1%)	72 52	40, 61, 105, 136	0
1	B	257/274 (93%)	0.39	18 (7%)	22 13	52, 77, 145, 167	0
All	All	521/548 (95%)	0.19	22 (4%)	40 23	40, 69, 126, 167	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	153	GLY	4.1
1	B	1	MET	4.1
1	B	219	ALA	3.9
1	A	70	THR	3.7
1	B	223	SER	3.2
1	B	218	TYR	3.0
1	A	1	MET	3.0
1	B	226	LEU	3.0
1	B	222	ALA	2.9
1	B	153	GLY	2.9
1	B	66	ILE	2.8
1	B	210	GLU	2.8
1	B	216	ARG	2.7
1	B	221	GLU	2.6
1	B	68	SER	2.5
1	B	225	HIS	2.3
1	A	37	THR	2.3
1	B	187	SER	2.3
1	B	220	GLY	2.3
1	B	67	SER	2.3
1	B	150	SER	2.3
1	B	152	ARG	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.