

CRUISE REPORT



R/V Aranda

Cruise 1/2020

Combine1/2020 Leg 1
21st – 24th January, 2020

Cruise 1/2019, Combine1, Leg 1

21st – 24th January, 2020

Chief scientist: Harri T. Kankaanpää

INTRODUCTION

This cruise was focused to monitoring of hydrography, nutrients and oil contamination in the Gulf of Finland as part of the national EU MSFD programme and HELCOM/MONAS Combine programme (Combine 1). Additionally, water and sediment samples for monitoring of harmful substances were collected. Altogether 18 stations including one hydrophone logger retrieval site were surveyed in the Gulf of Finland and the Baltic Proper close to the western entrance to the Gulf of Finland (Figure 1, Table 1). At every station CTD (salinity, temperature, fluorescence, O₂ concentration profile and pressure), pH, ammonia/ammonium concentration and nutrient concentrations were measured using rosette-bottled samples. In addition to the CTD/rosette profile, these parameters were also measured from near-bottom water samples (1 m above the seafloor). Total sulfide (hydrogen sulfide) concentration was analysed at sites with oxygen concentrations below the limit of hypoxia. Oil contamination was examined using subsurface water from one metre depth at selected stations. Additional water samples for quality assurance measurements were taken at stations JML and JONTKA.

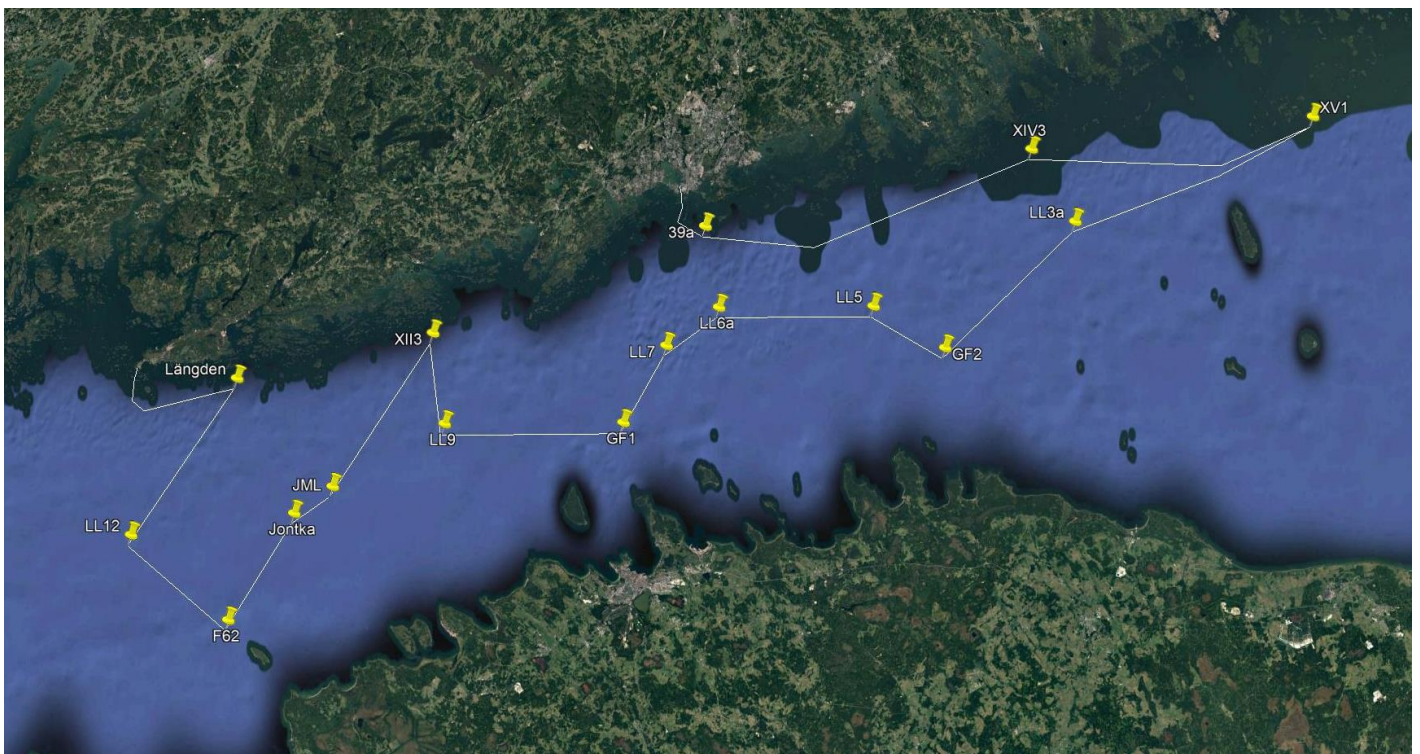


Fig. 1. Location of research stations and the approximate route of R/V Aranda along the course of the Combine1 leg (Helsinki – Hanko) within the Gulf of Finland and its western entrance during January 21 – 24, 2020.

OBSERVATION STATIONS AND MEASUREMENTS

Total number of stations during the cruise was 18. The various activities are listed in Table 1.

Index	Station	CTD	Hydrography pH, O ₂ , H ₂ S, SAL, NH ₃ /NH ₄ ⁺	Nutrients	Oil	Water harmful substances	Sediment harmful substances	Other
0001	39A	X	X	X				
0002	XIV3	X	X	X				
0003	XV1	X	X	X	X	X	X	
0004	LL3a	X	X	X		X		
0005	GF2	X	X	X				
0006	LL5	X	X	X				
0007	LL6a	X	X	X				
0008	LL7	X	X	X	X	X		
0009	GF1	X	X	X				
0010	LL9	X	X	X				
0011	XII3	X	X	X				
0012	JML	X	X	X			X	
0013	JML_LAATU	X	X	X				
0014	JONTKA	X	X	X				
0015	JONTKA_LAATU	X	X	X				Hydrophone retrieval, 1 m ³ surface water sample
0016	F62	X	X	X				
0017	LL12	X	X	X	X	X		
0018	LANGDEN	X	X	X				

Table 1. List of stations, monitoring activities and additional operations.

SUMMARY OF PHYSICAL AND CHEMICAL STATUS

The chemical status of the Gulf of Finland had improved considerably compared to the conditions during January 2019. Stratification of the water column was exceptionally weak along the entire research area. This was reflected in all water quality parameters (salinity, temperature, nutrients and oxygen). Near-bottom salinity was overall lower than during winter 2017 and 2019 (Fig. 1). The upper oxygenated section of the water column had been effectively mixed (CTD profiles in Appendix 1) with deeper (typically hypoxic or anoxic) water layers. As a consequence, the oxygen conditions in the Gulf of Finland were remarkably good (Fig. 2) compared to average conditions that have prevailed over the past decades. No hydrogen sulphide was detected in the water column. As a result of mixing of the deep, phosphate-rich water layer to the entire water column, surface phosphate concentrations (Fig. 3) were high compared to respective concentrations during 1990 – 2019. At one station a record-high surface water concentration was encountered. Accordingly, phosphate concentrations in deep water were low.

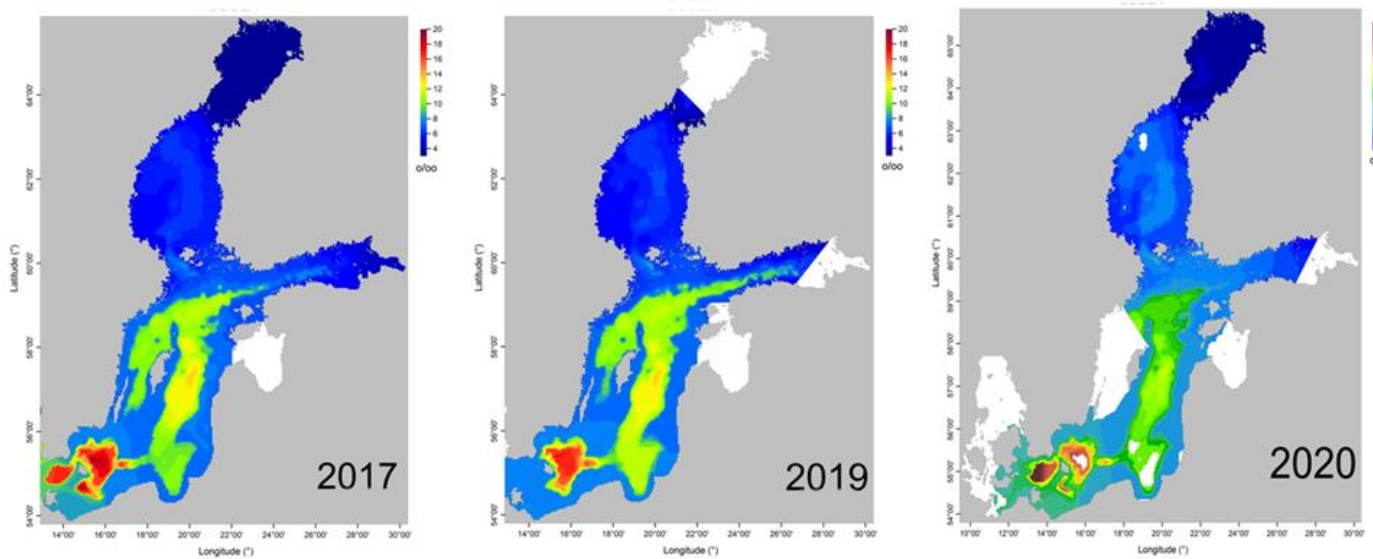


Fig. 1. Interpolated salinity values (PSU) at 1 m above seafloor in 2017, 2019 and 2020. No data from 2018 available due to the refurbishment of r/v Aranda.

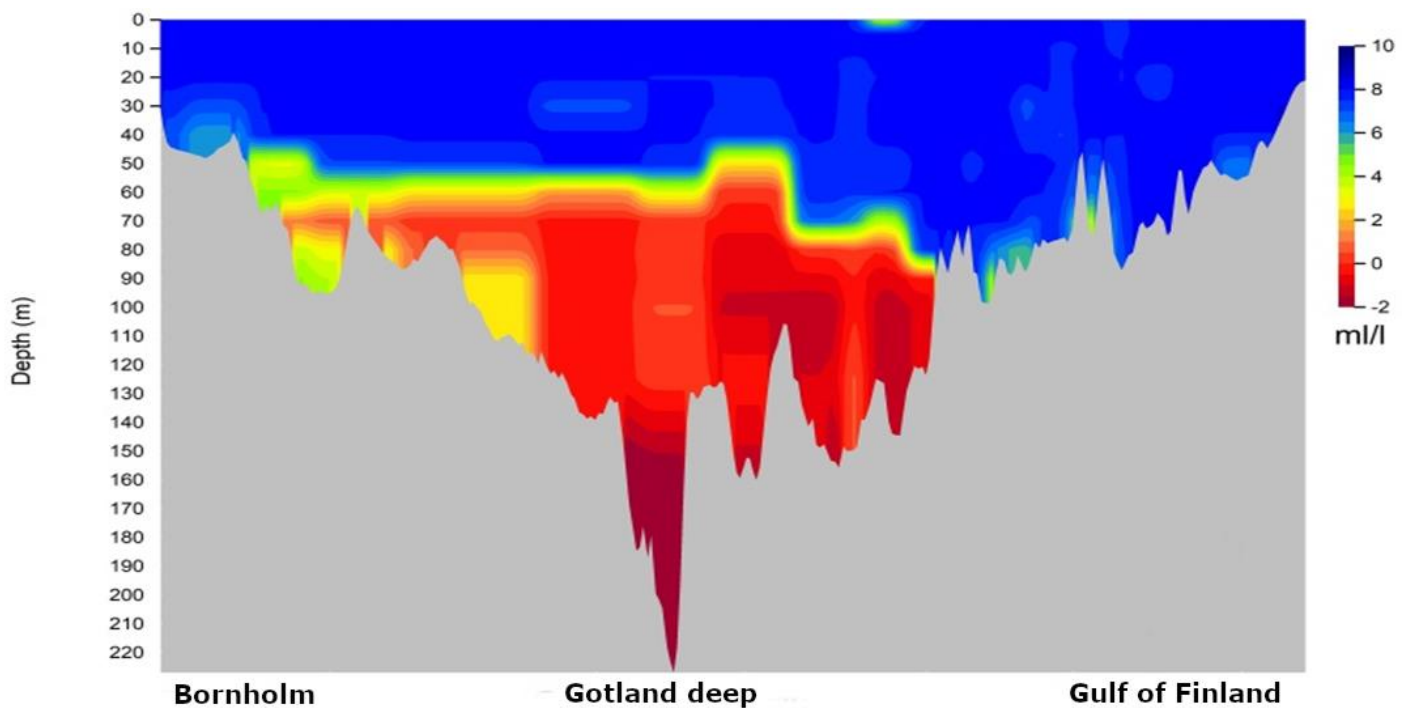


Fig. 2. A cross section of oxygen stratification along a transect between and Bornholm and Gulf of Finland. Data outside Gulf of Finland is based on Combine 1 leg 2 data (separate cruise report) and includes also data generated by the Swedish meteorological and hydrological institute (SMHI).

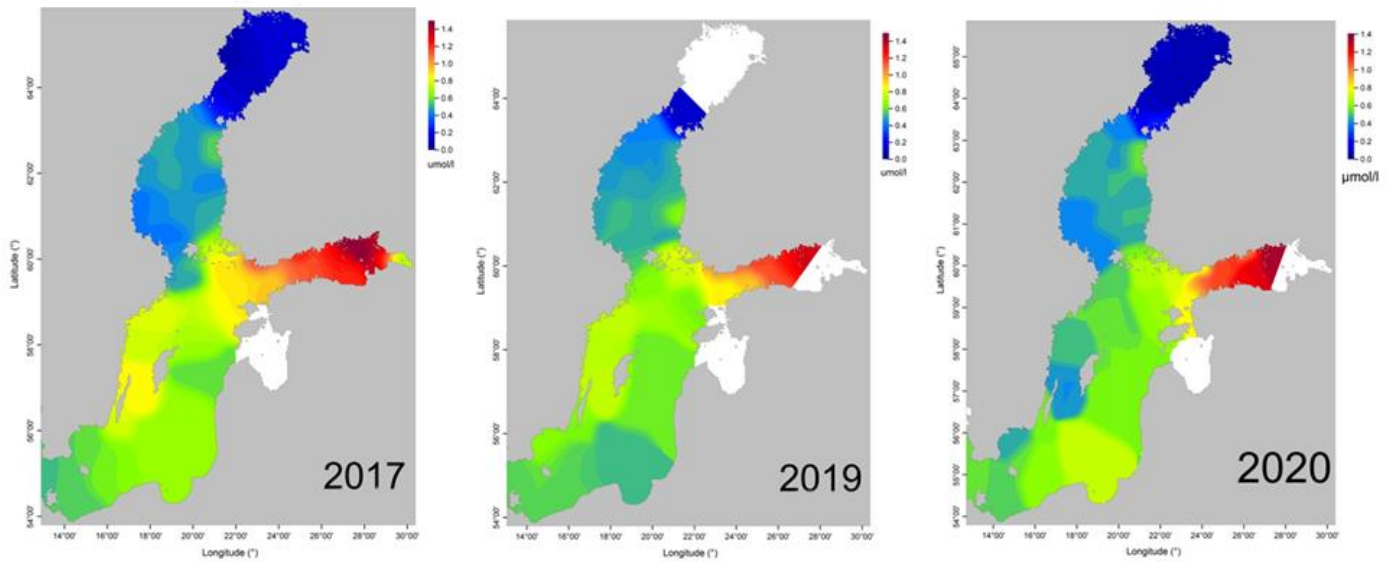


Fig. 3. Interpolated phosphate concentrations (μM) at 1 m depth during winters 2017, 2018 and 2020.

Oil in the uppermost water column

The concentrations of dissolved and dispersed oil at 1 m depth were analysed onboard and fell all below the $1.0 \mu\text{g l}^{-1}$ threshold value set by the Intergovernmental Oceanographic Commission. Additionally 10 replicate samples taken from a 30-litre water sampler (station JML) were analysed for quality control purposes.

SCIENTIFIC STAFF

Chief scientist:

Kankaanpää Harri T.

Participants:

Räike Antti
Hyvärinen Susanna
Kinnunen Tanja
Varmanen Pia
Rosendahl Kirsi
Lastumäki Ilkka
Riikonen Jere
Hedberg Henrik
Partanen Manu
Jalli Heini
Hietala Riikka
Kosloff Pekka

Master: Olli Keintola

Departure from Helsinki on Tuesday January 21, 2020 at 10:06 local time

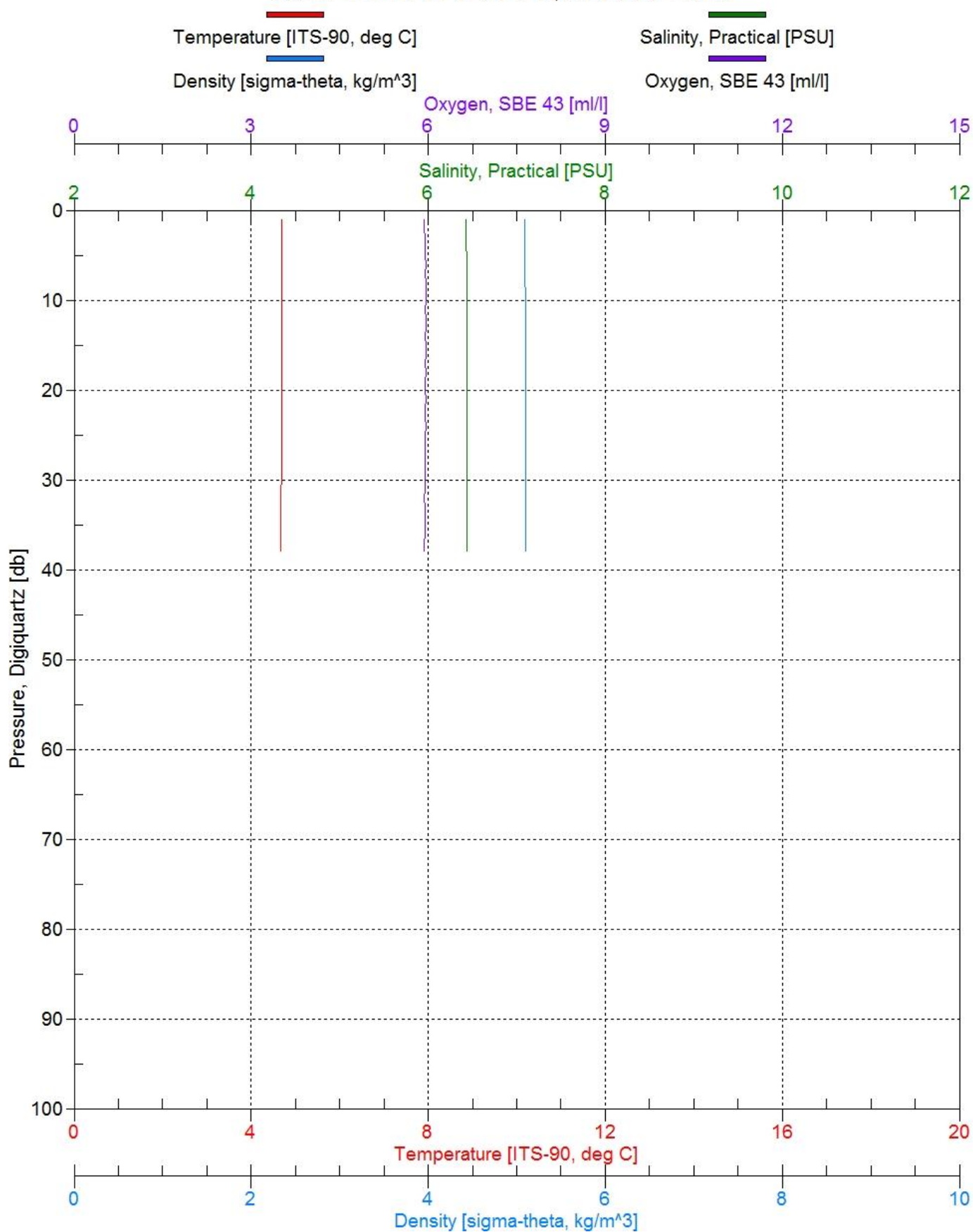
Arrival to Hanko on Friday January 24, 2020 at 10:05 local time

**LIST OF STATIONS (all coordinates are given in WGS-84 in degrees.minutes.minute
desimals)**

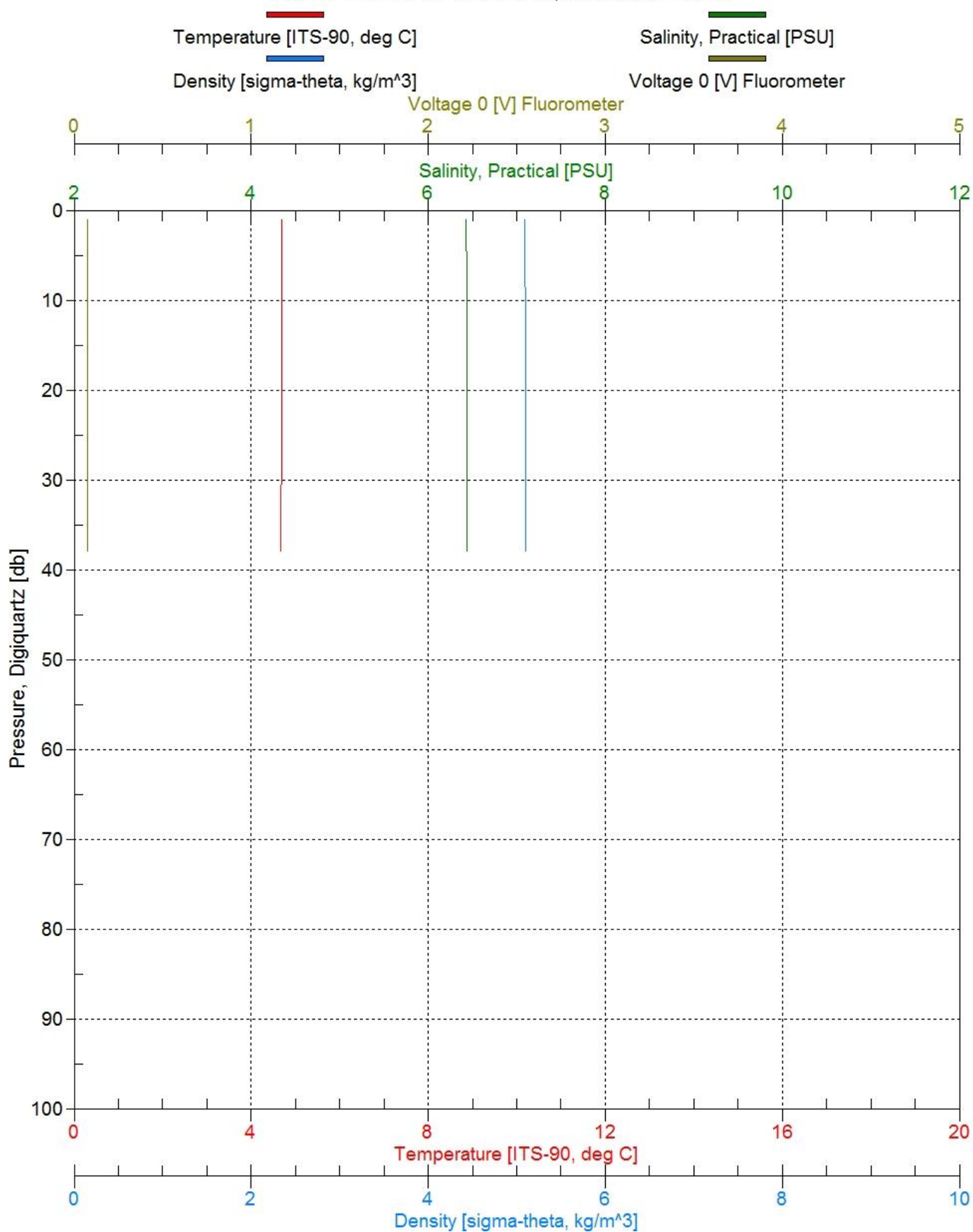
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01 0007	LL6A	N59.5501	E025.0181	73.00	20200122	1122
01 0008	LL7	N59.5079	E024.5027	102.00	20200122	1351
01 0009	GF1	N59.4230	E024.4092	83.00	20200122	1631
01 0010	LL9	N59.4201	E024.0181	66.00	20200122	2140
01 0011	XII3	N59.5201	E023.5881	24.00	20200123	0054
01 0012	JML	N59.3491	E023.3761	81.00	20200123	0434
01 0013	JML_LAATU	N59.3491	E023.3761	81.00	20200123	0627
01 0014	JONTKA	N59.3188	E023.2939	121.00	20200123	1311
01 0015	JONTKA_LAA	N59.3188	E023.2939	121.00	20200123	1505
01 0016	F62	N59.2001	E023.1581	96.00	20200123	1844
01 0017	LL12	N59.2901	E022.5381	82.00	20200123	2303
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Appendix 1. CTD profiles generated during the cruise.

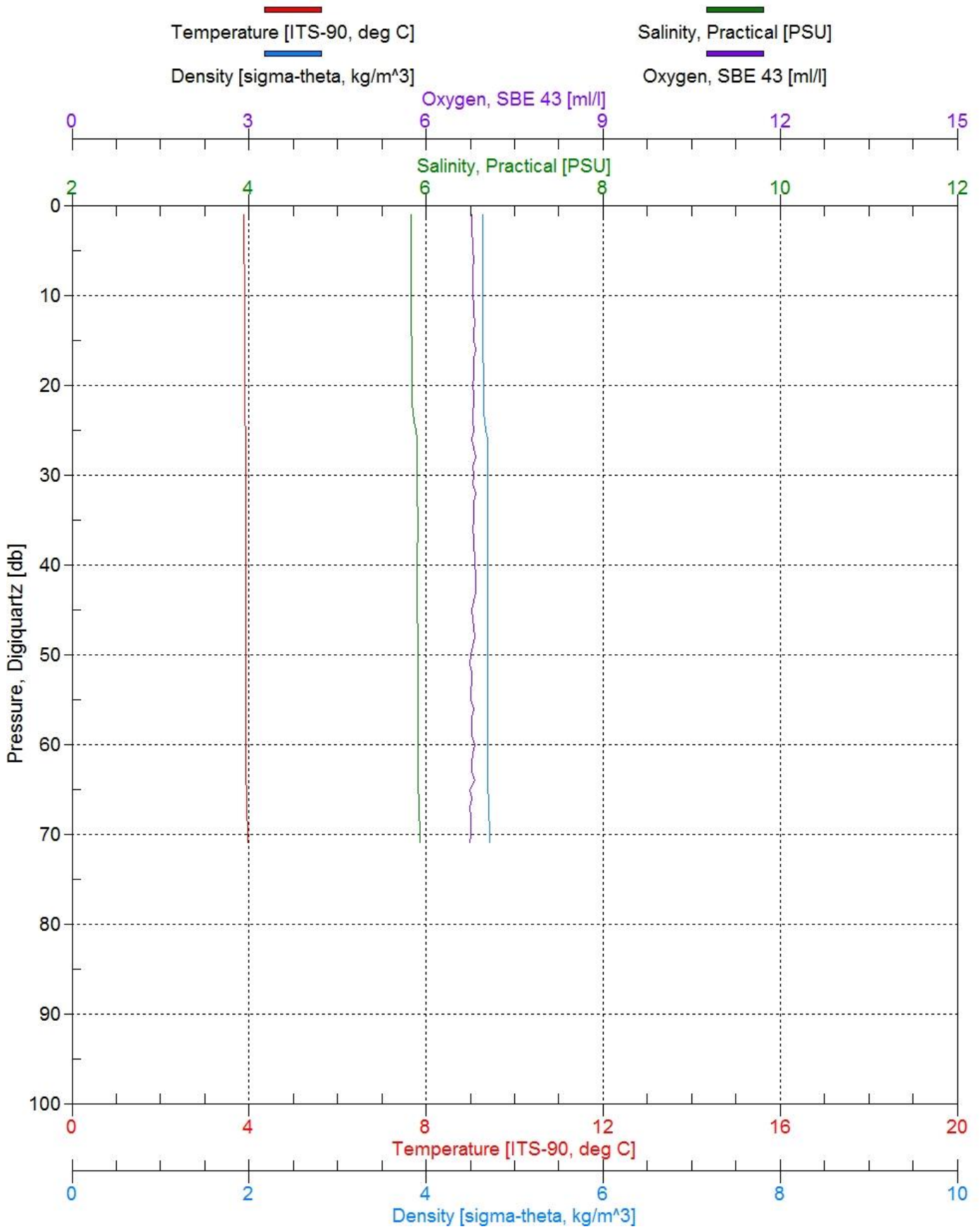
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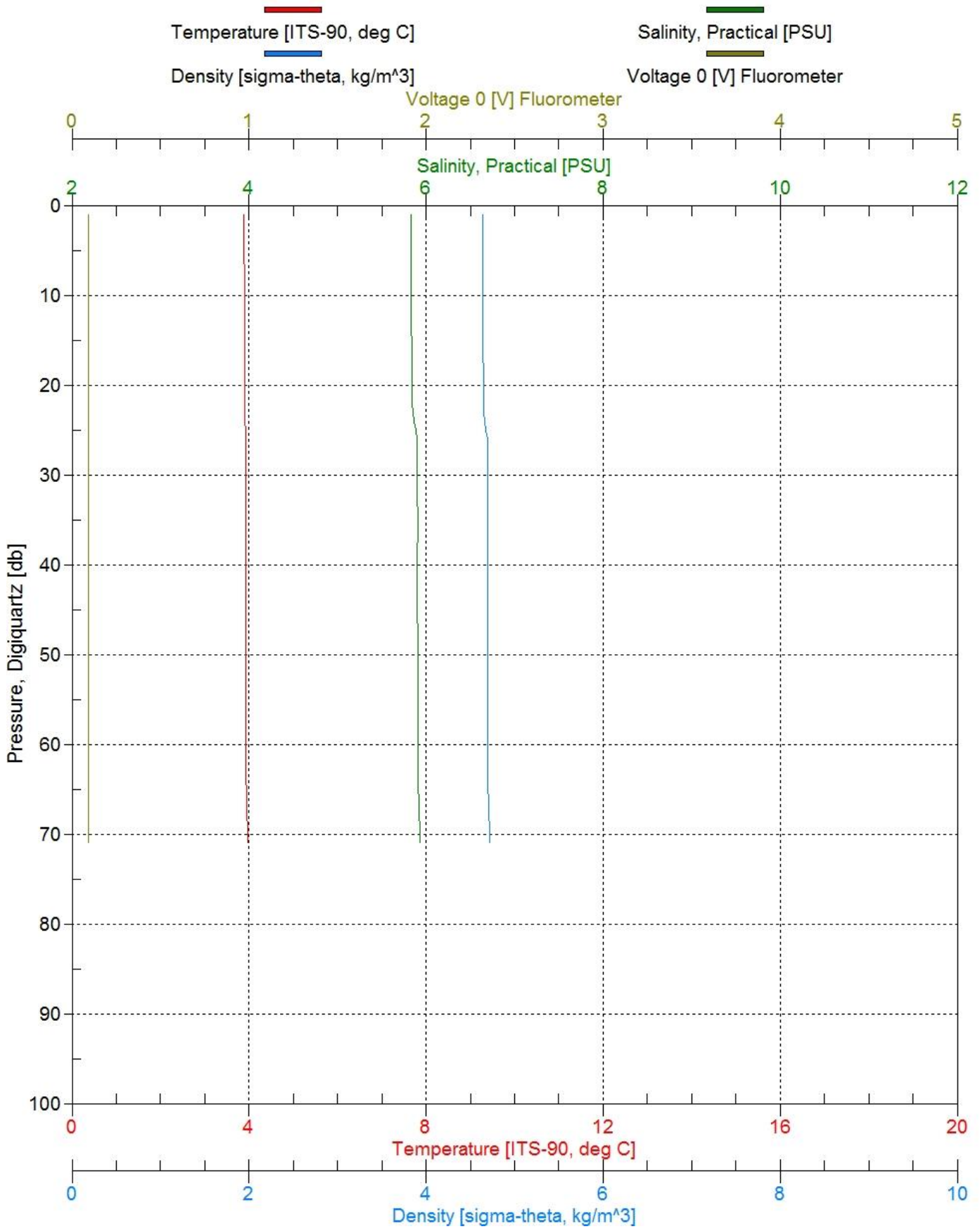
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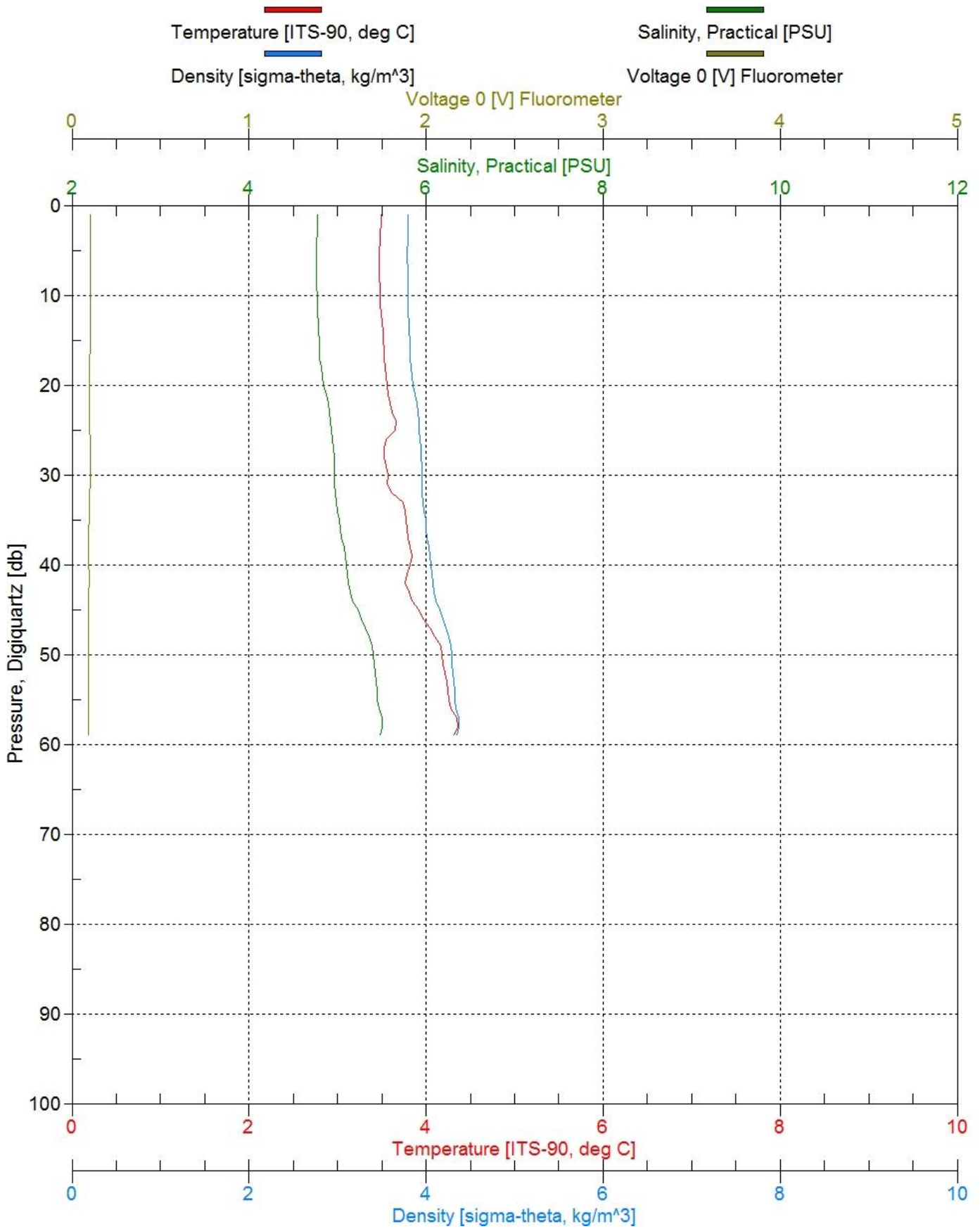
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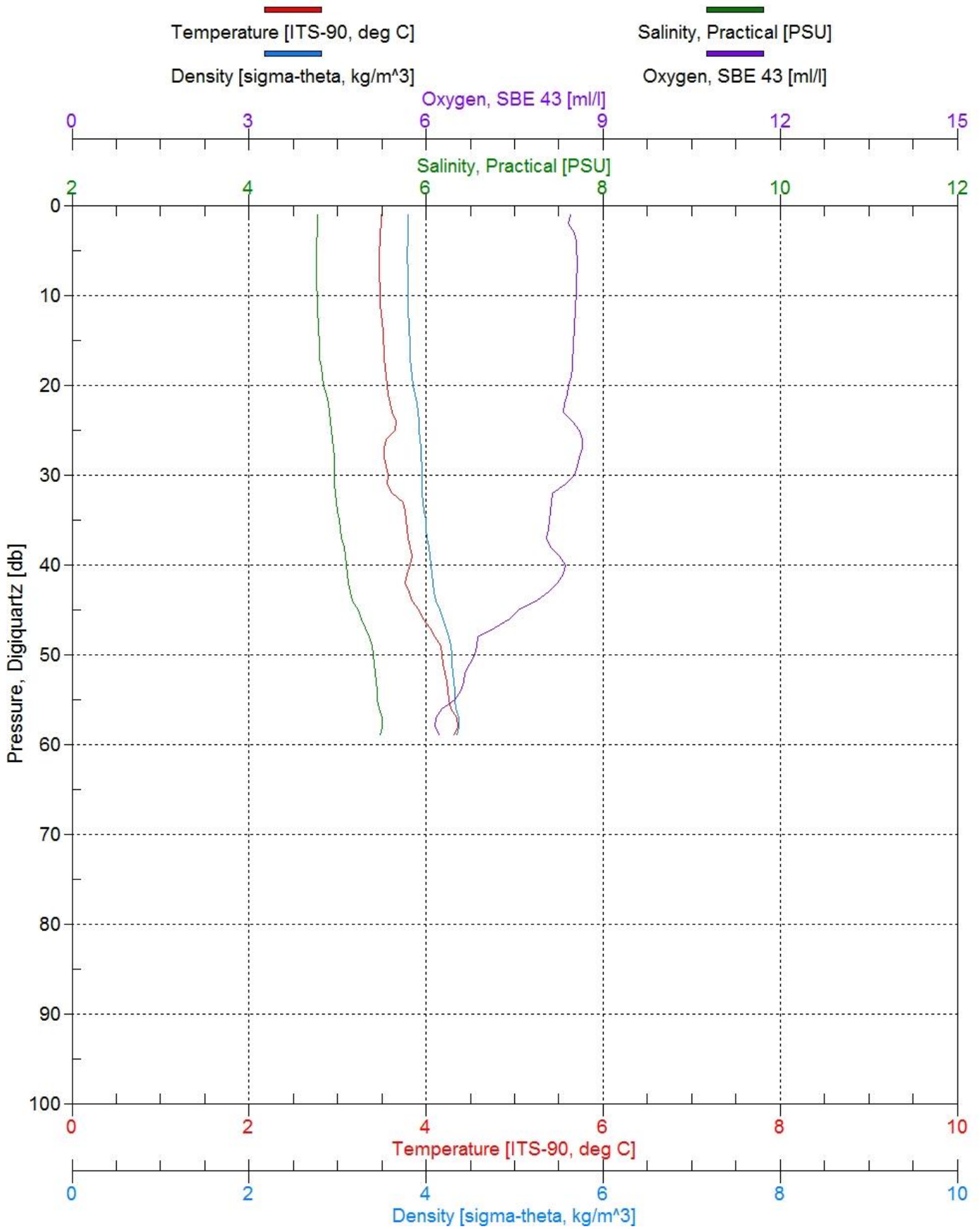
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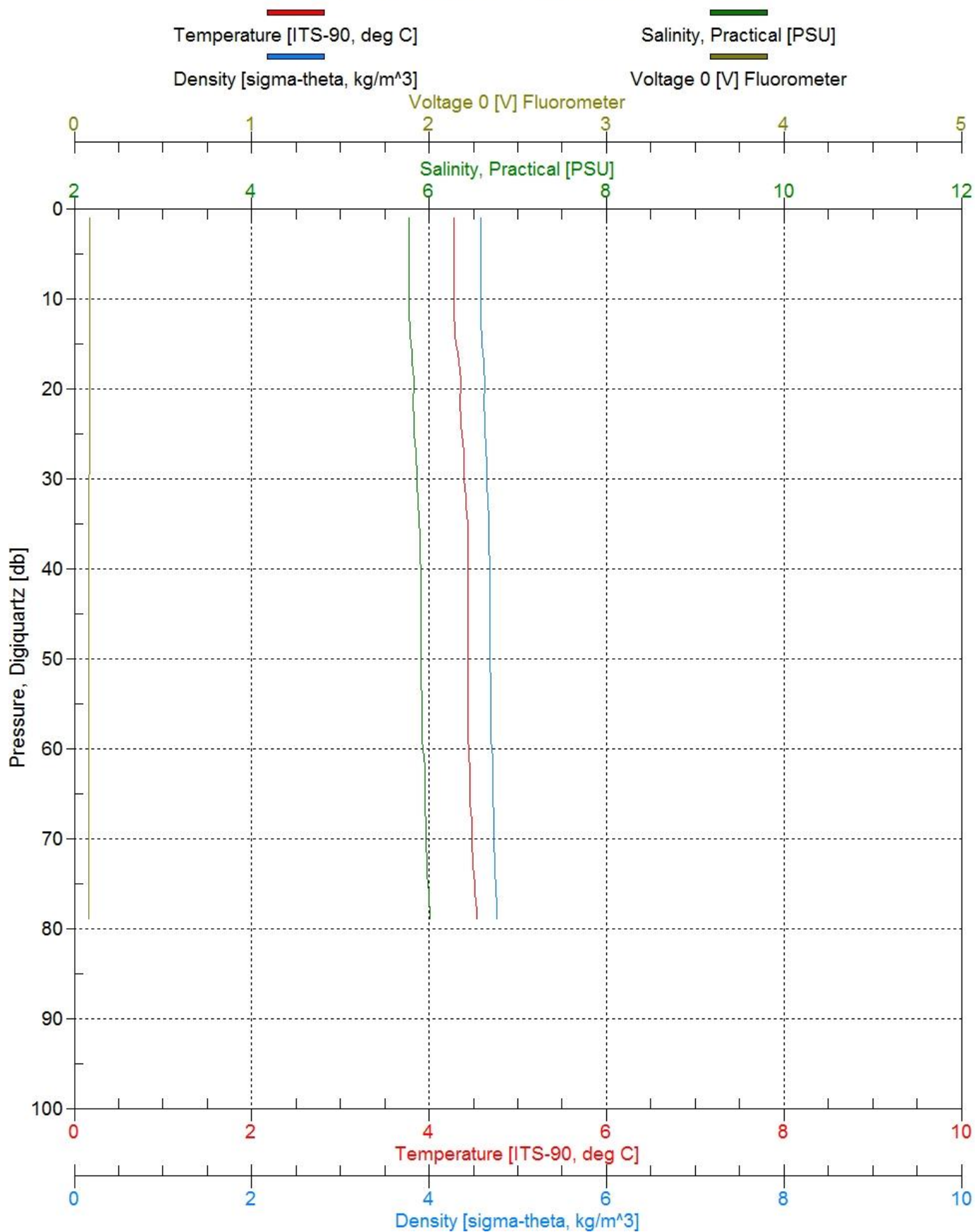
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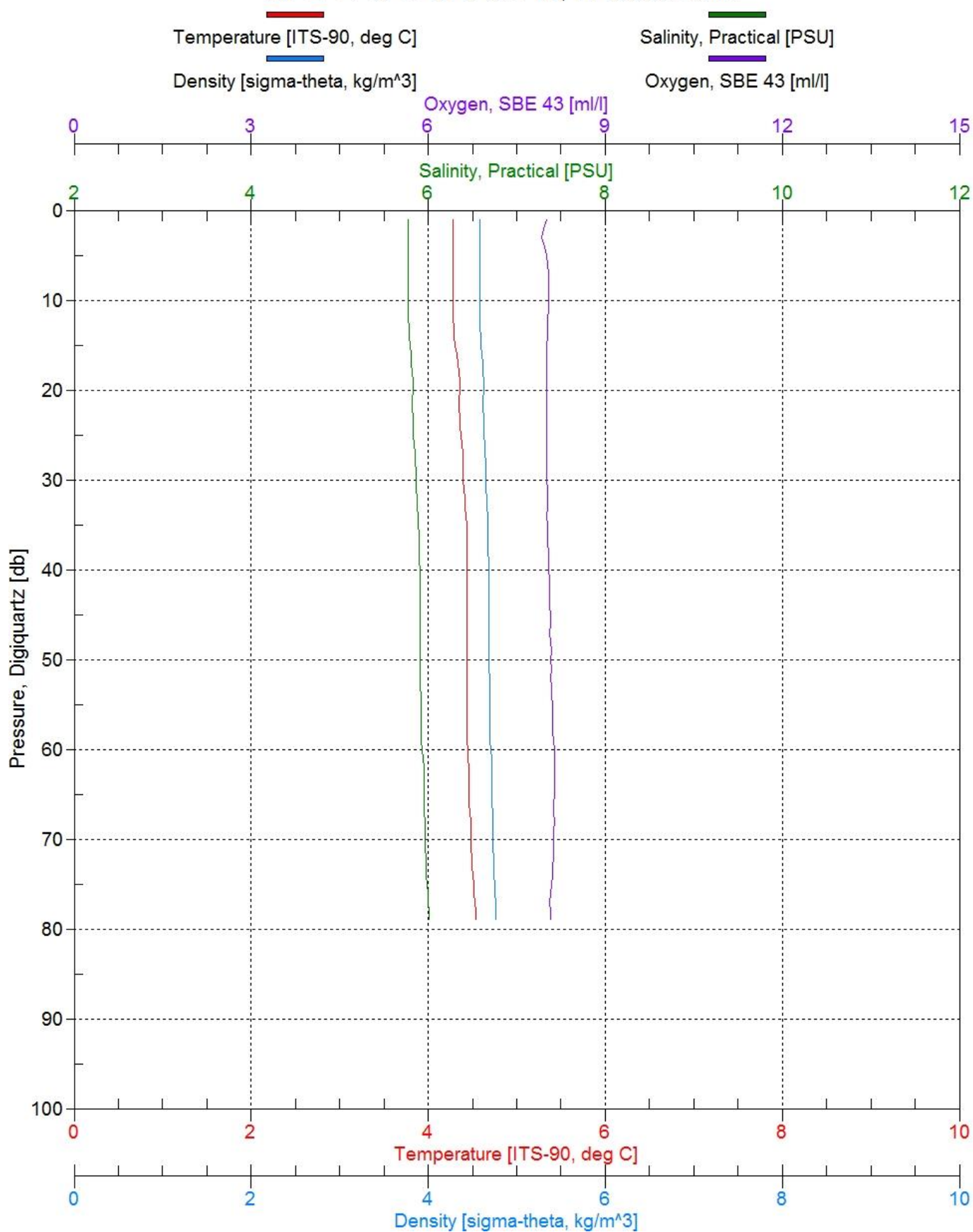
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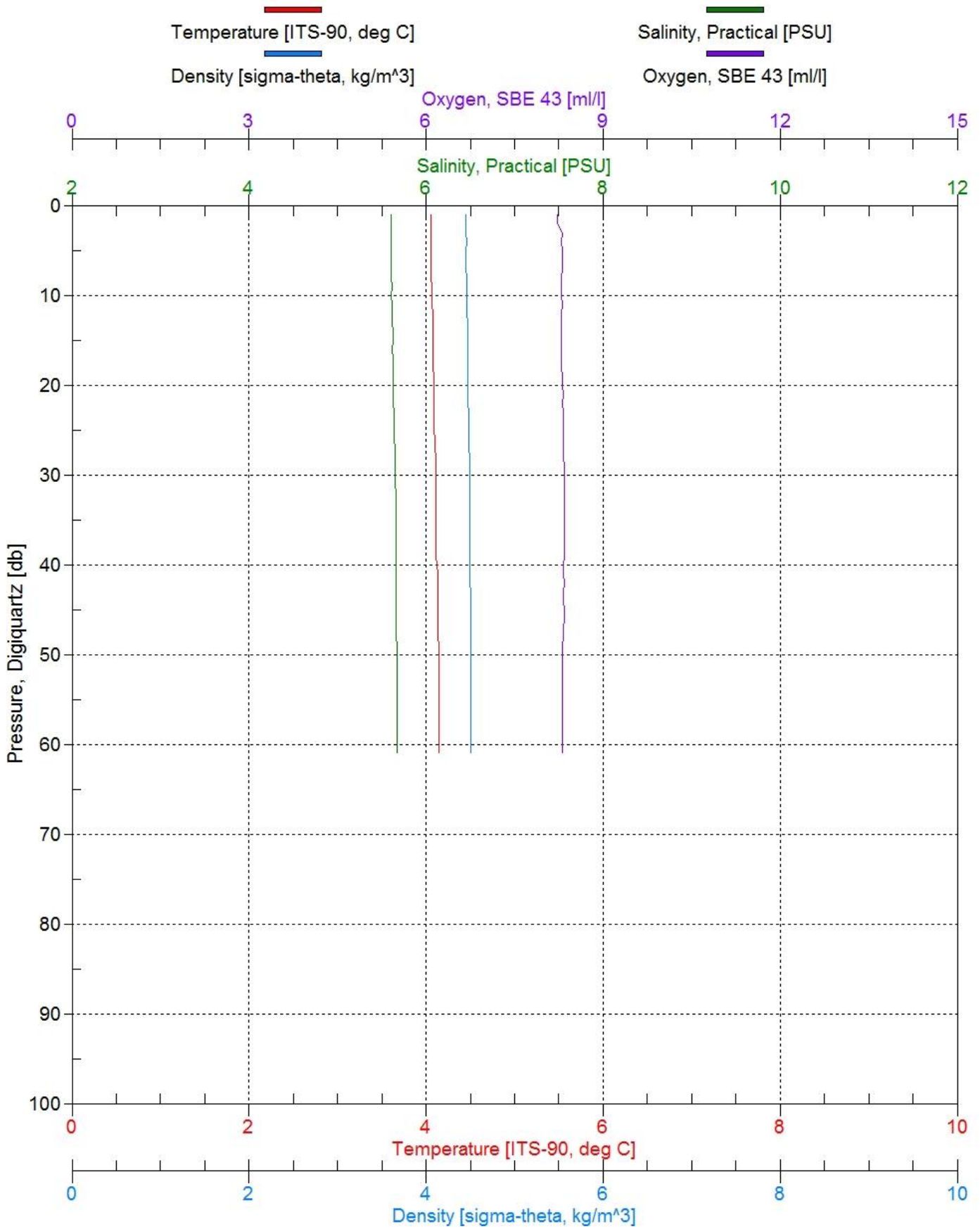
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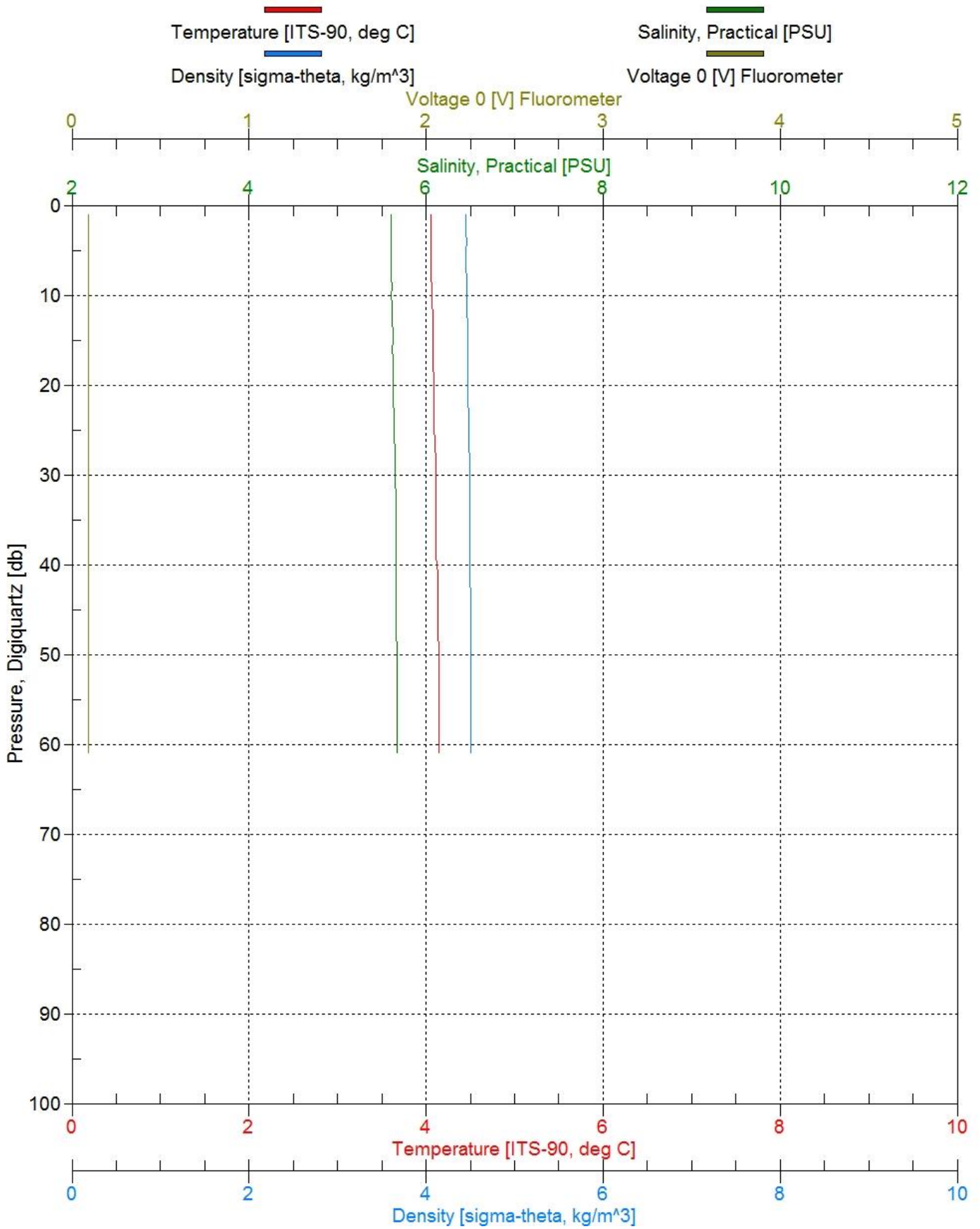
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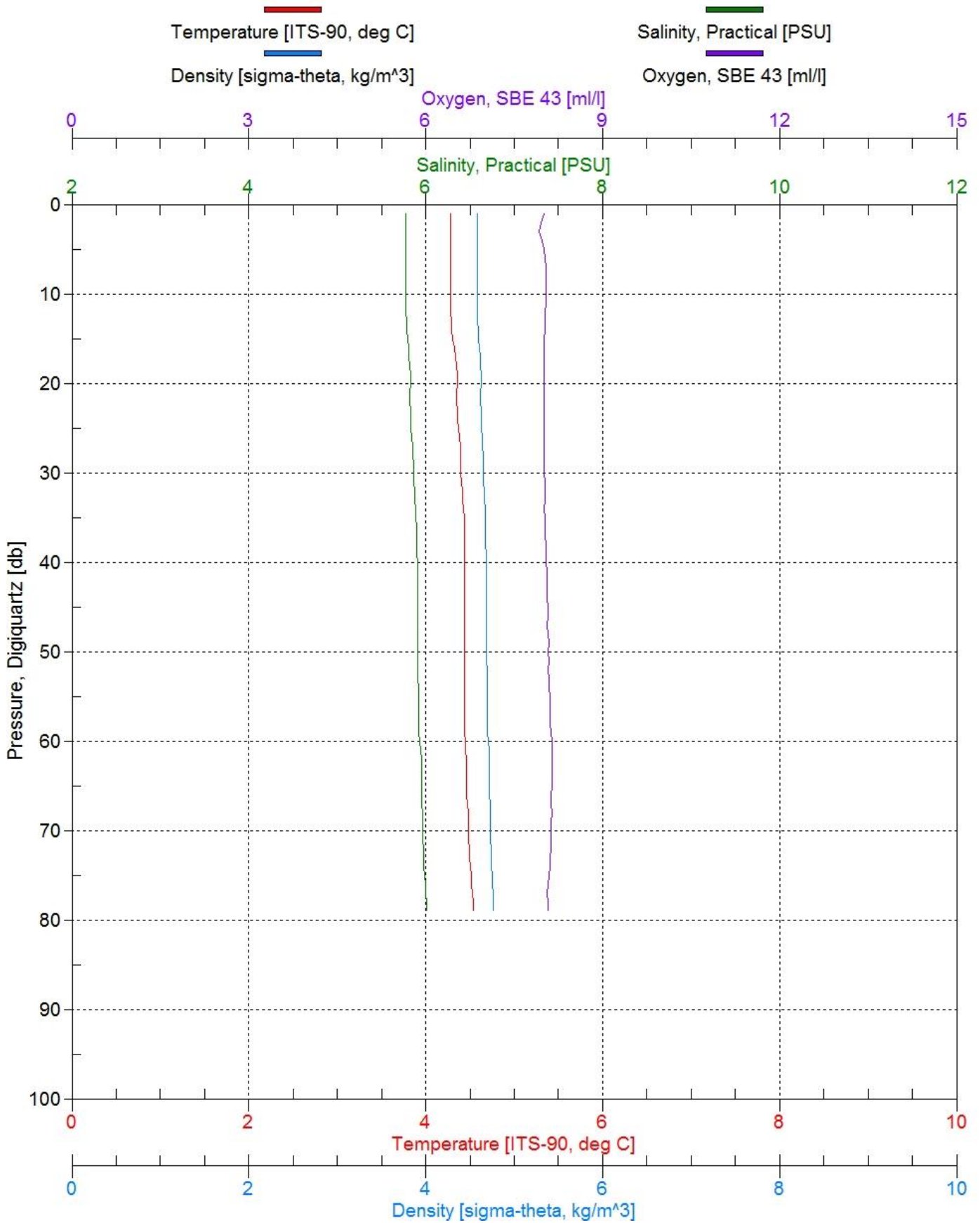
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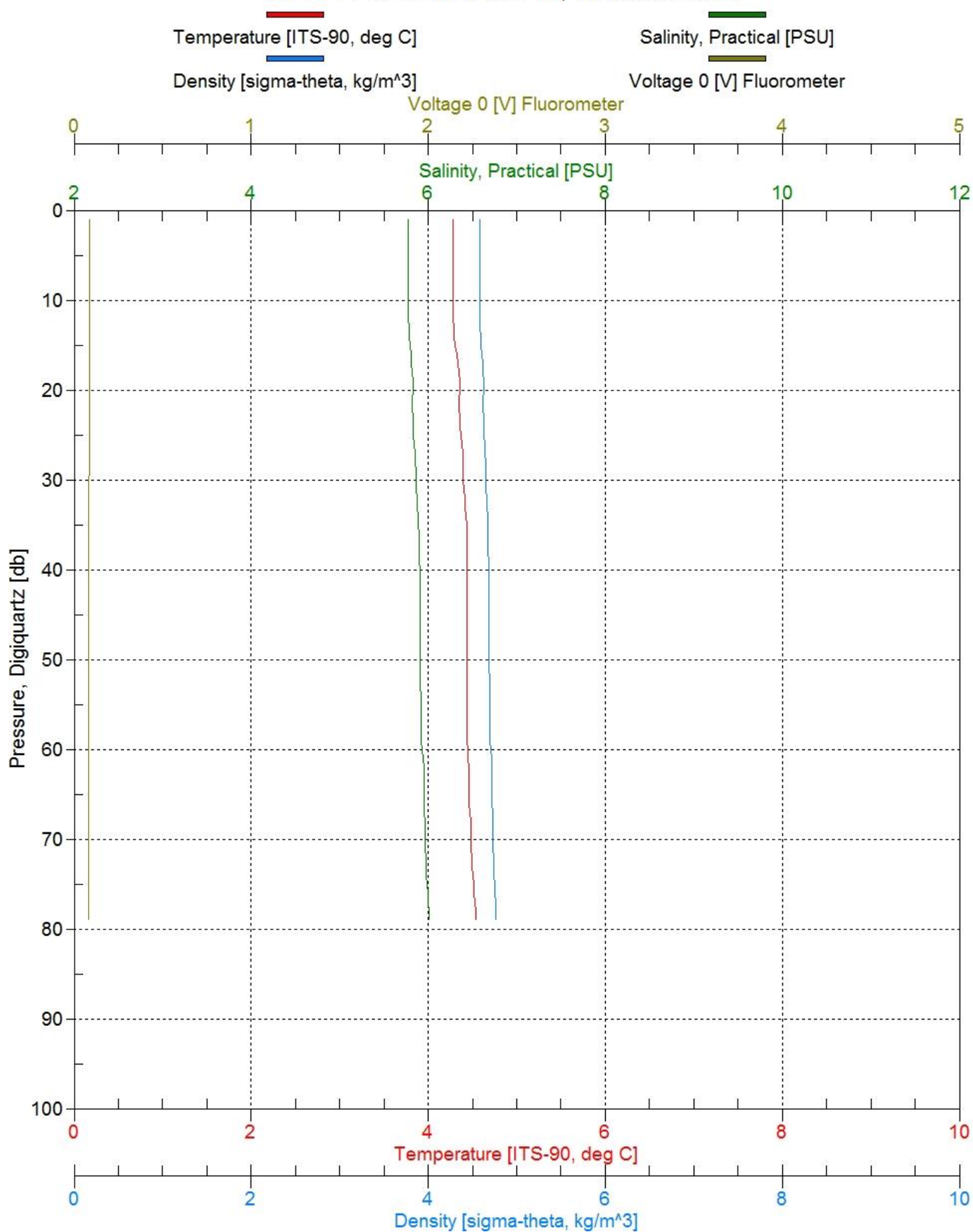
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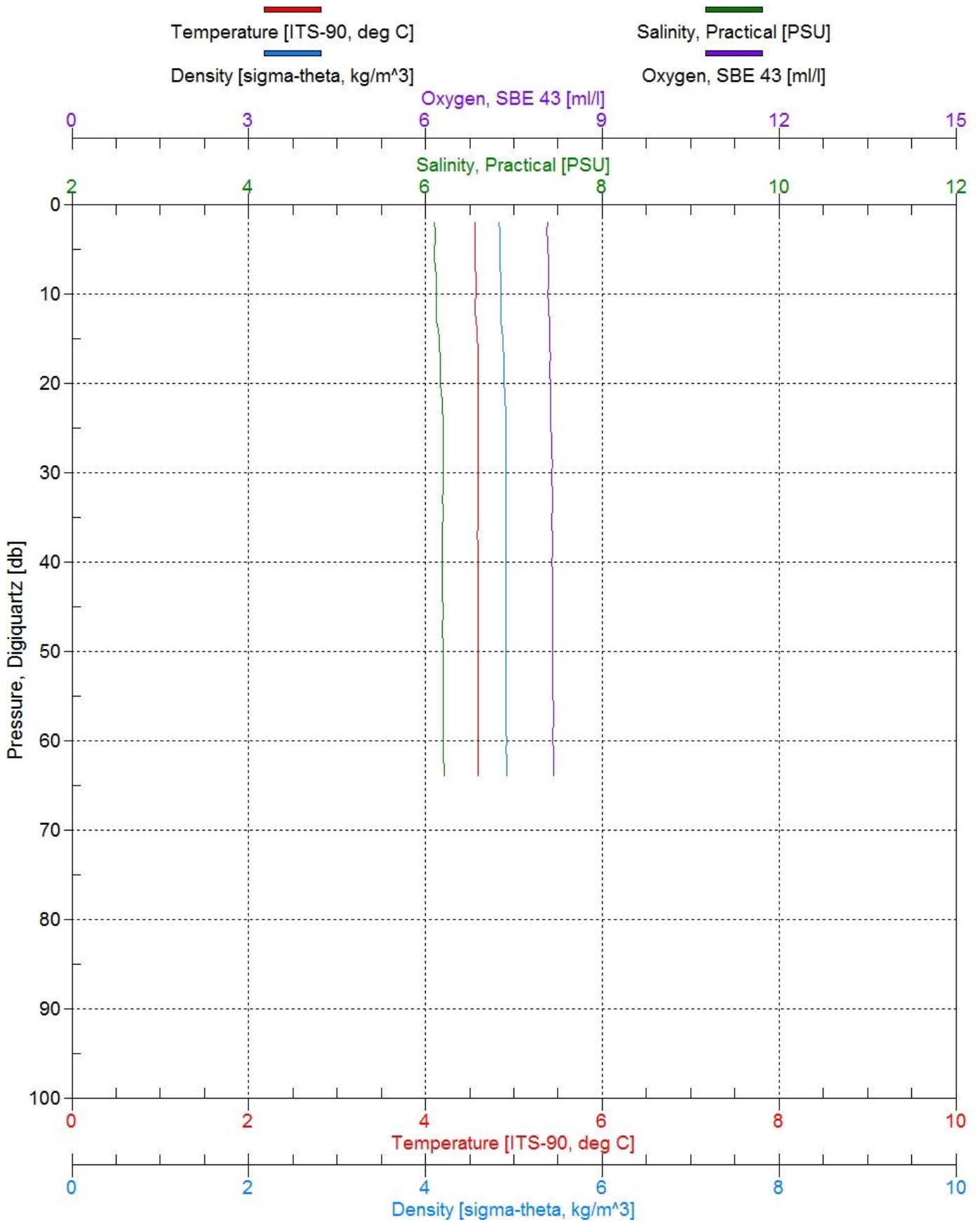
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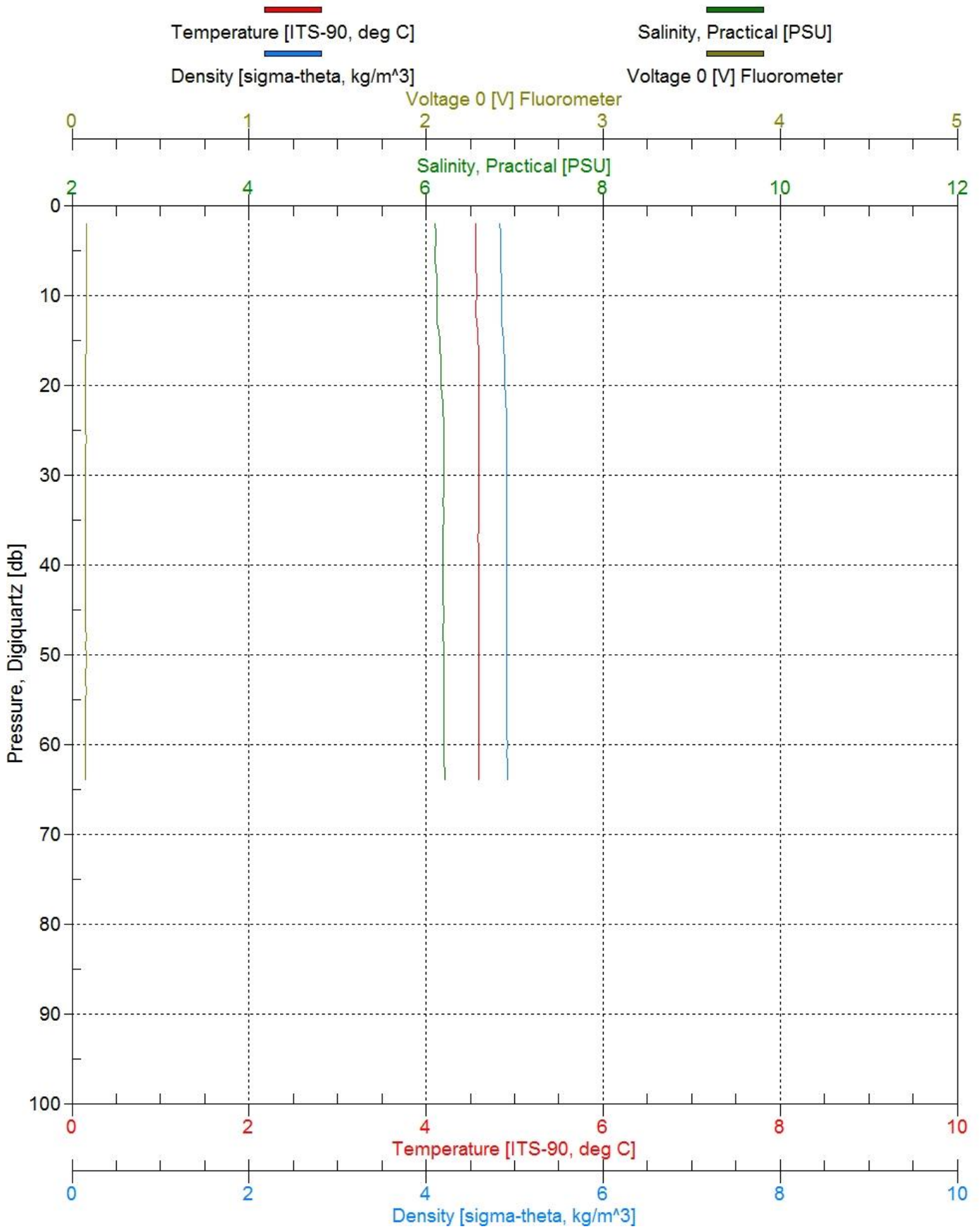
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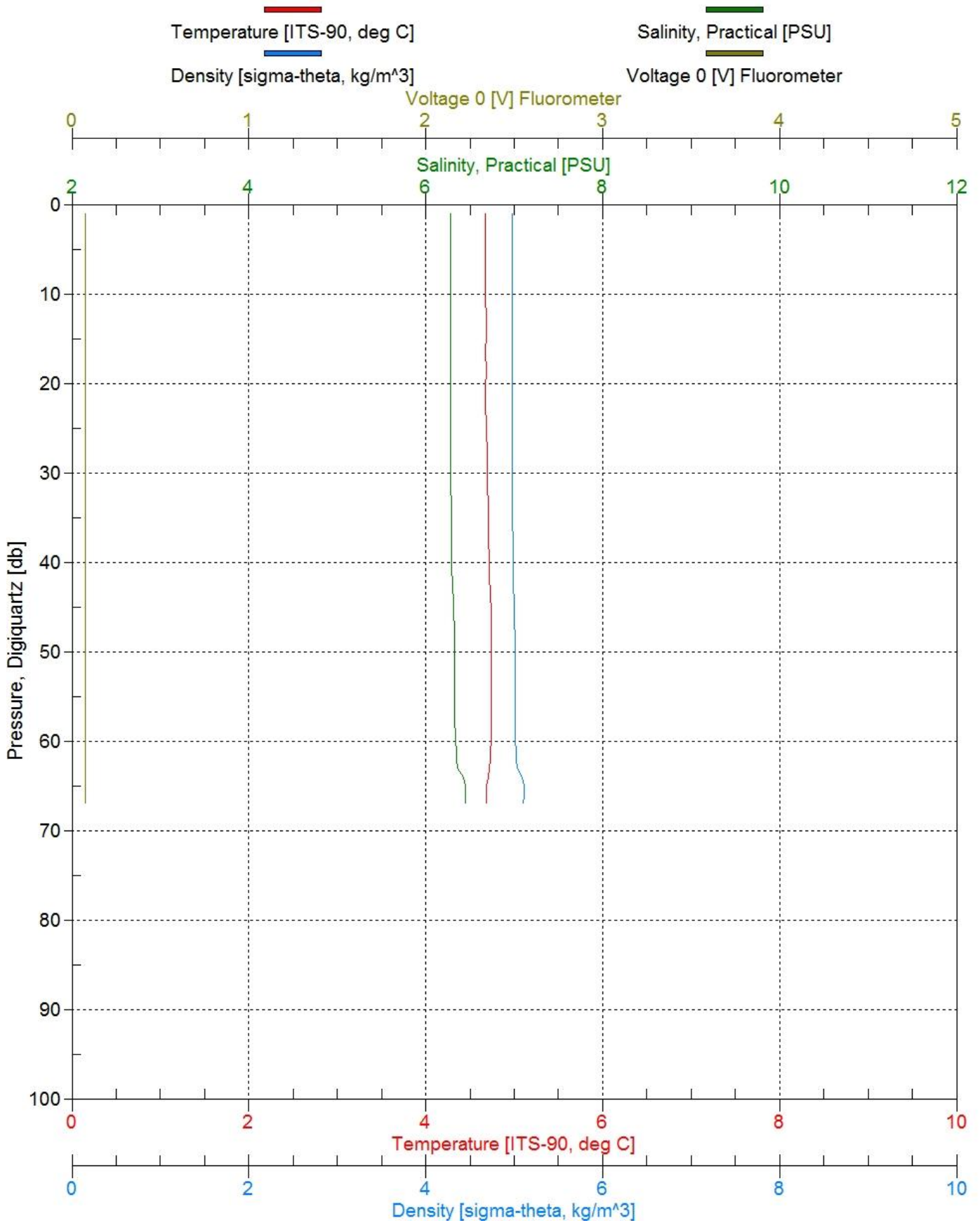
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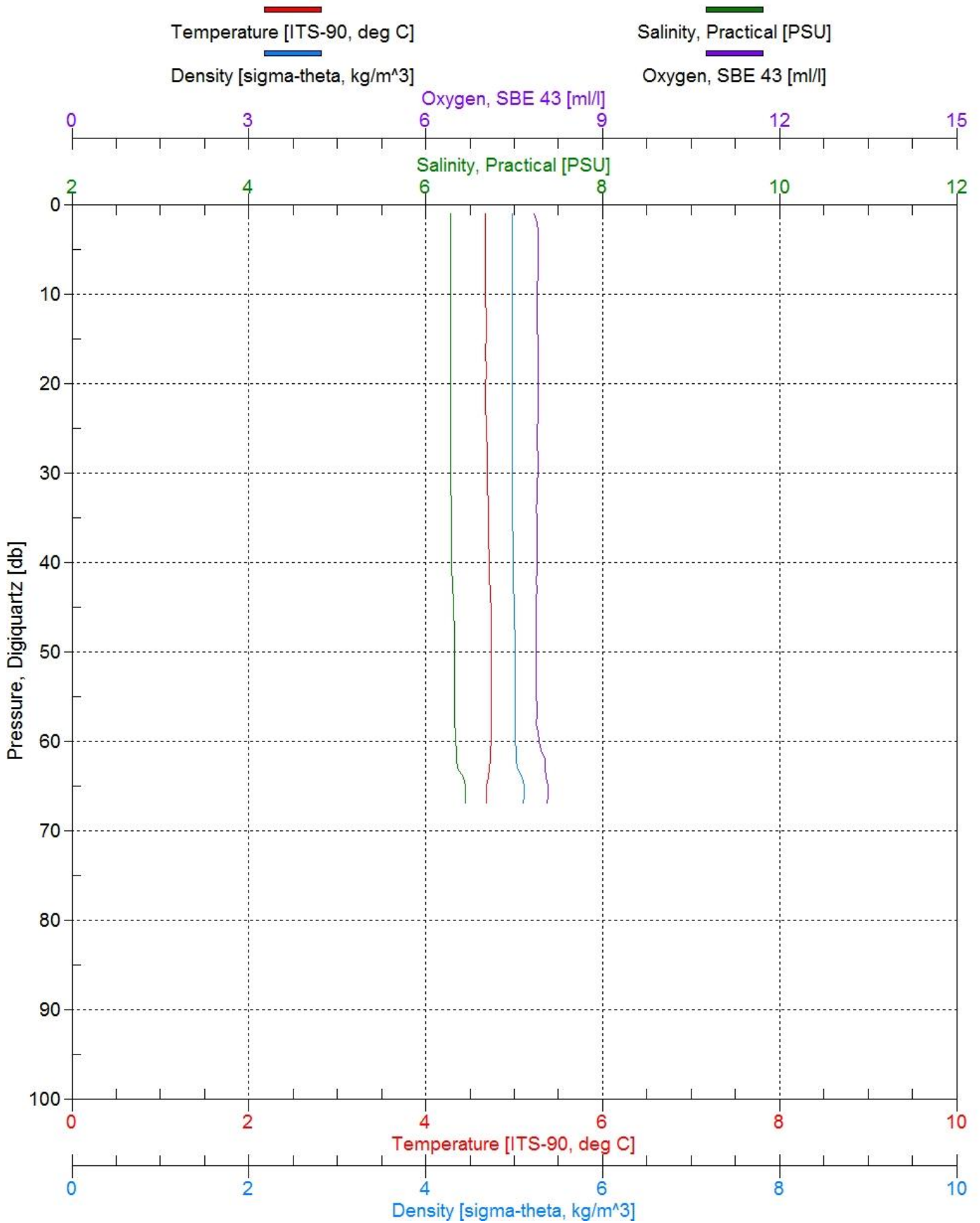
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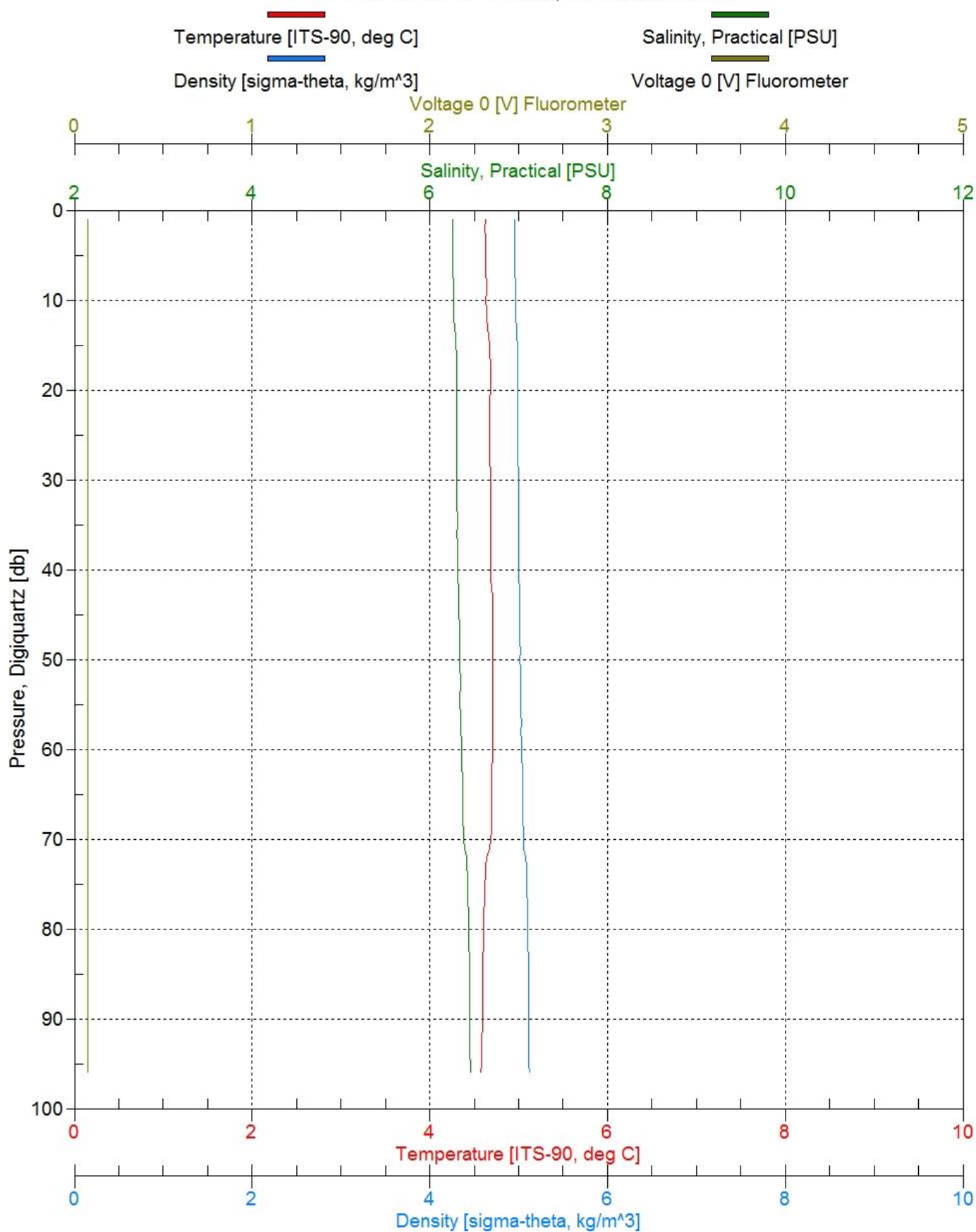
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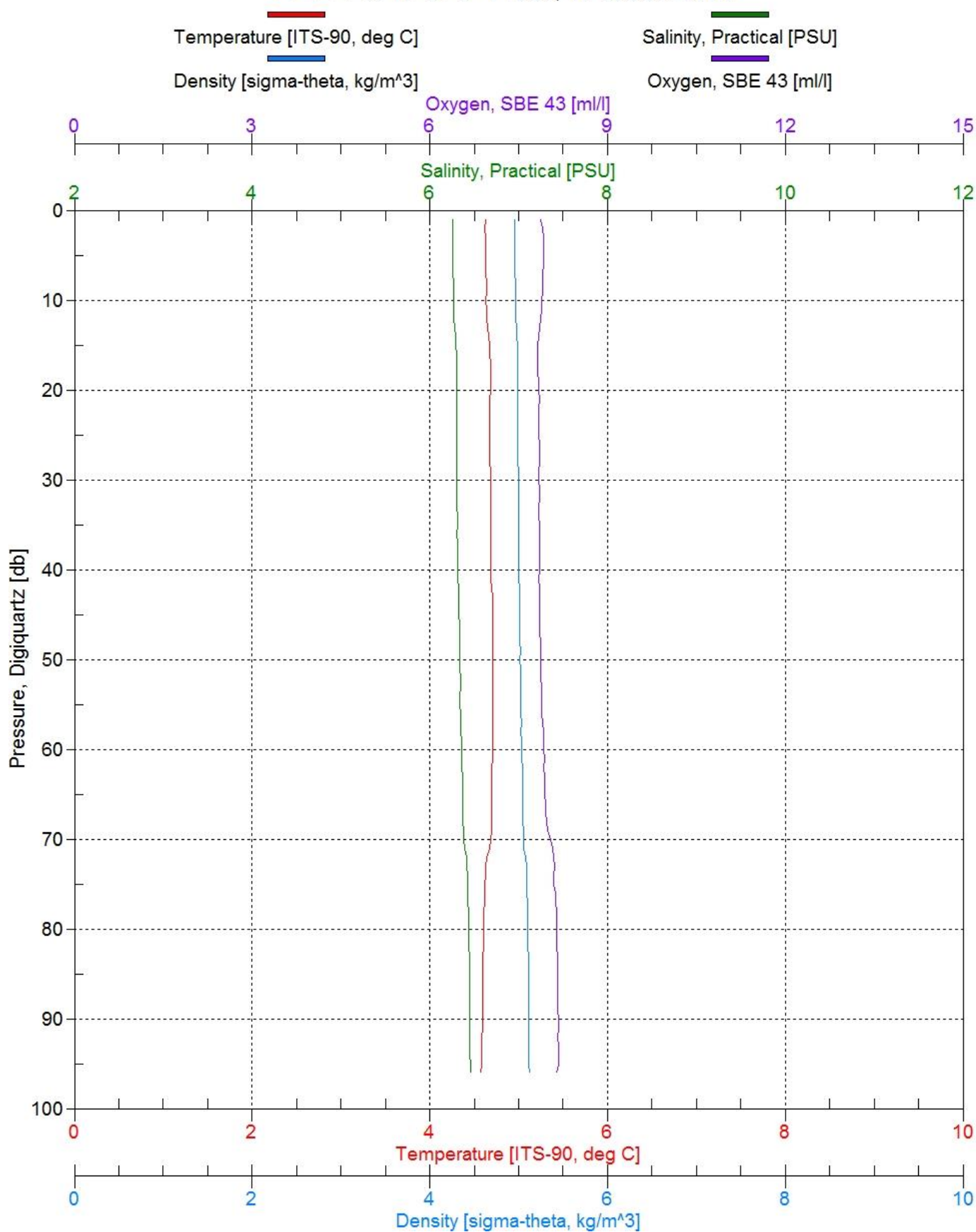
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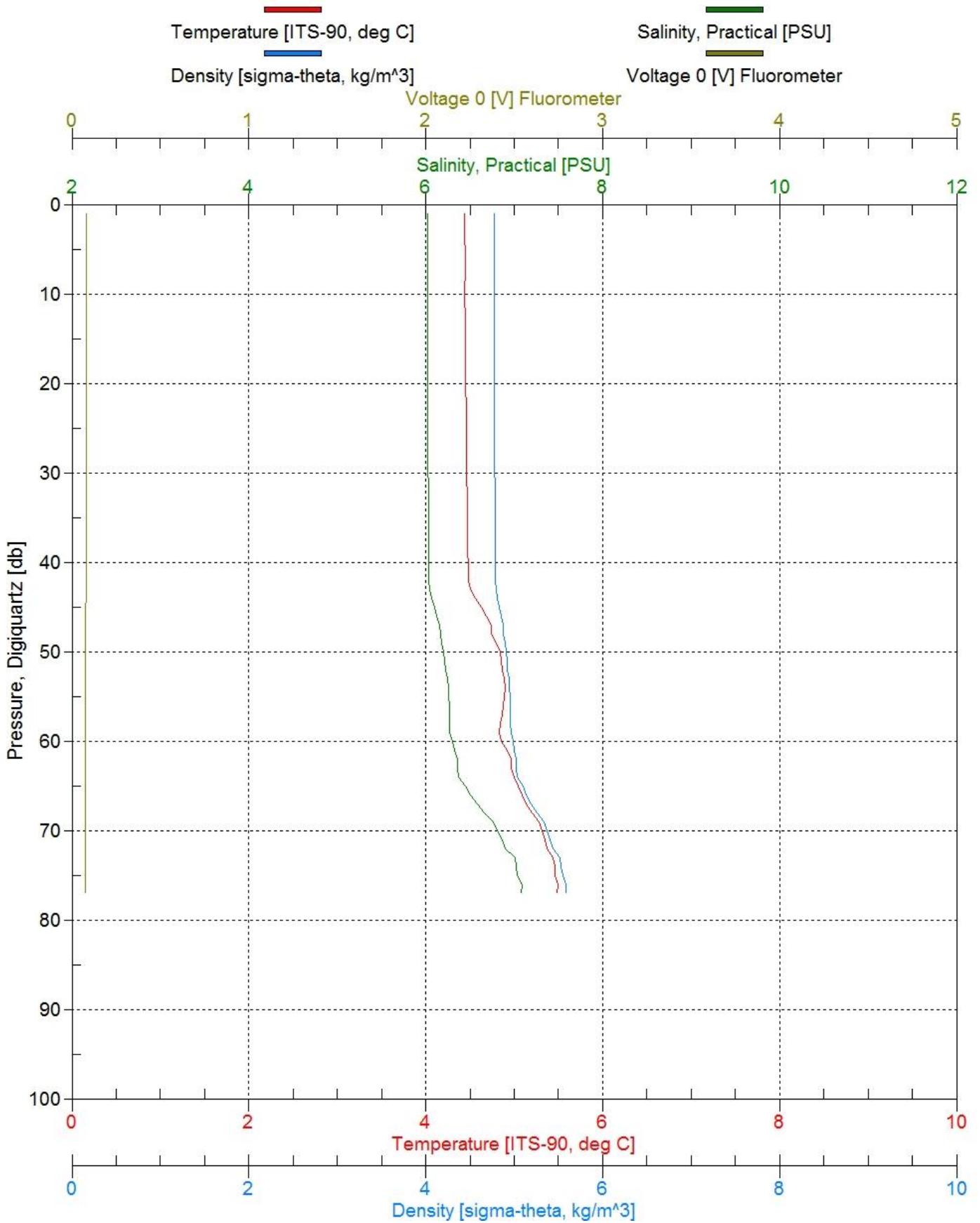
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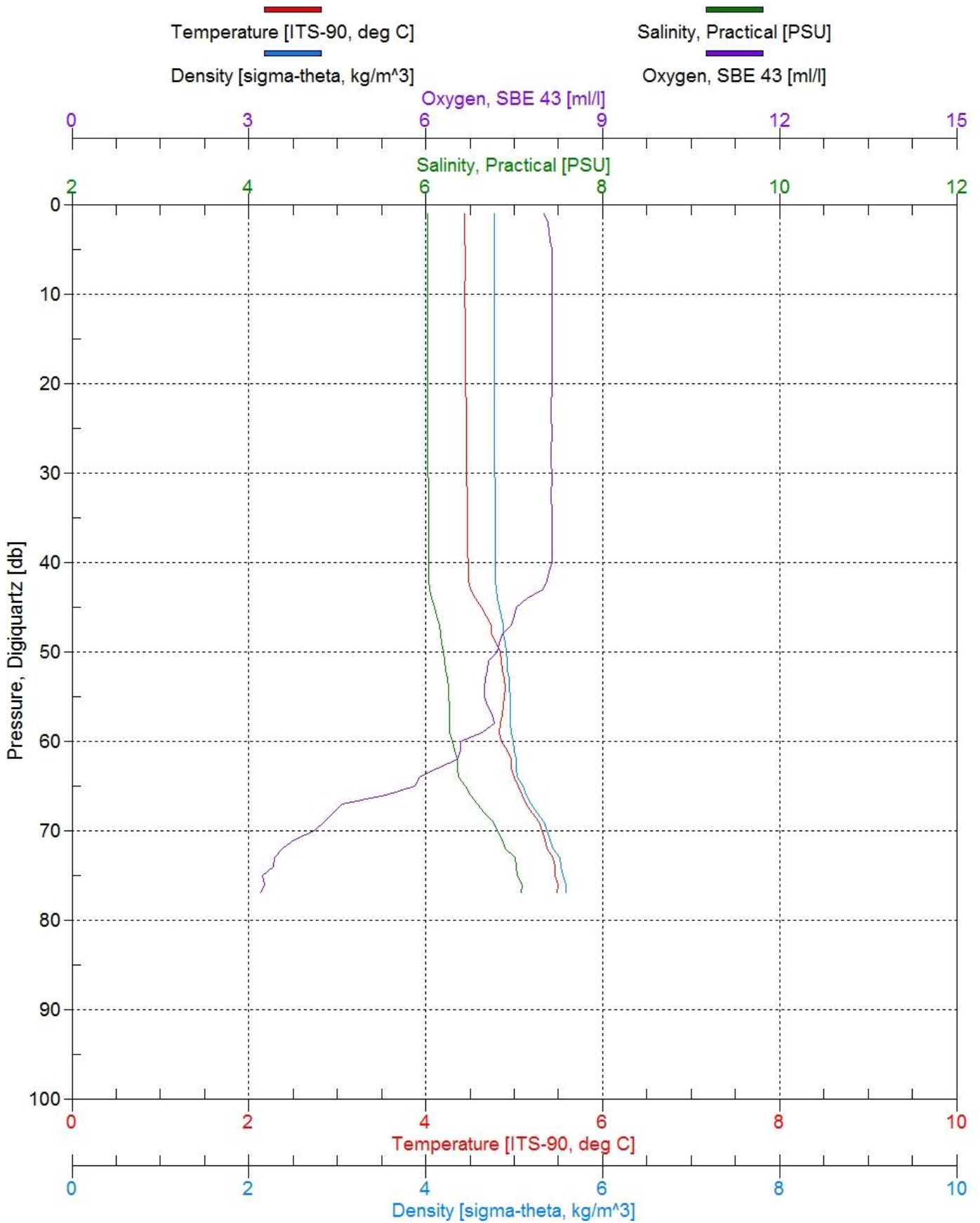
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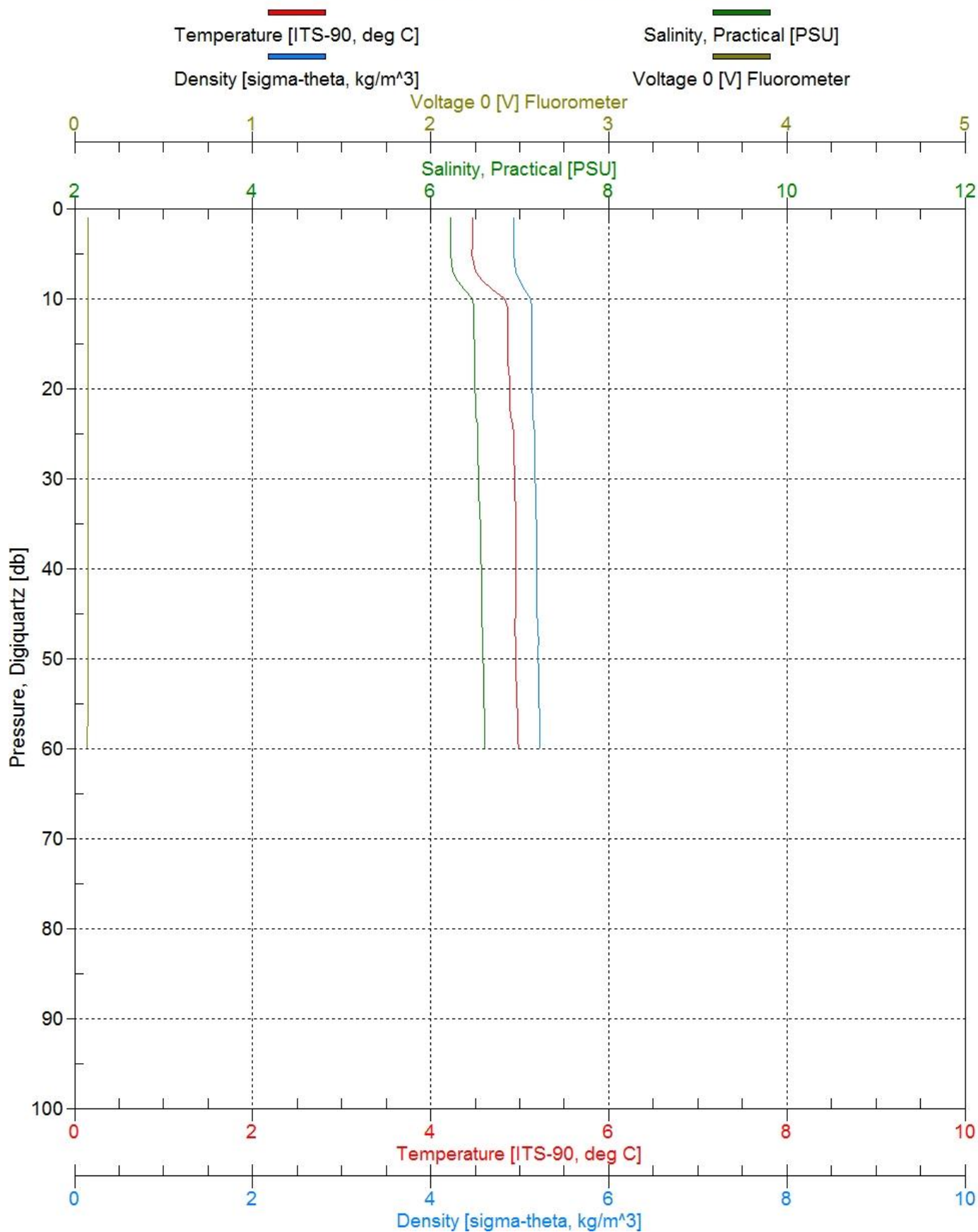
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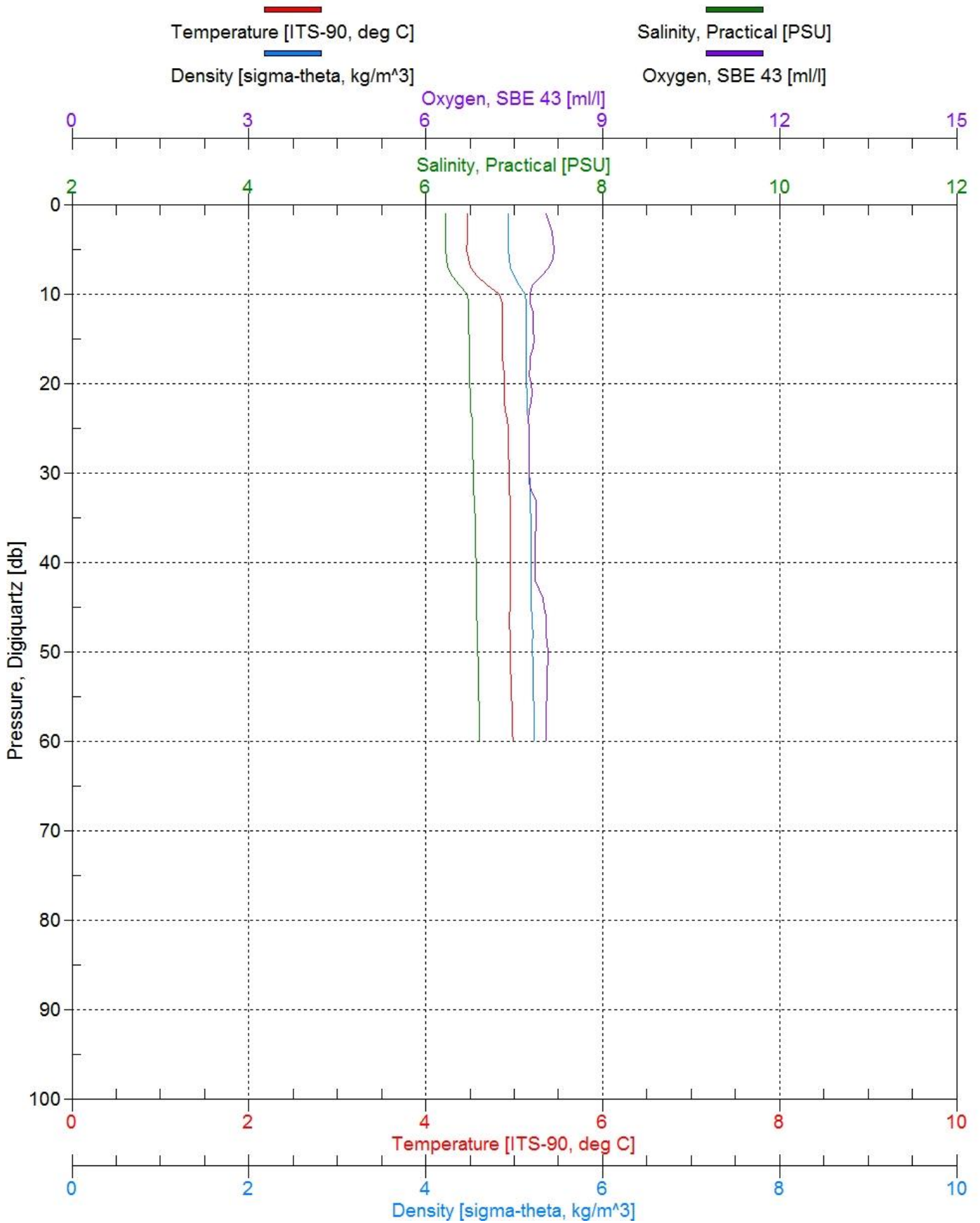
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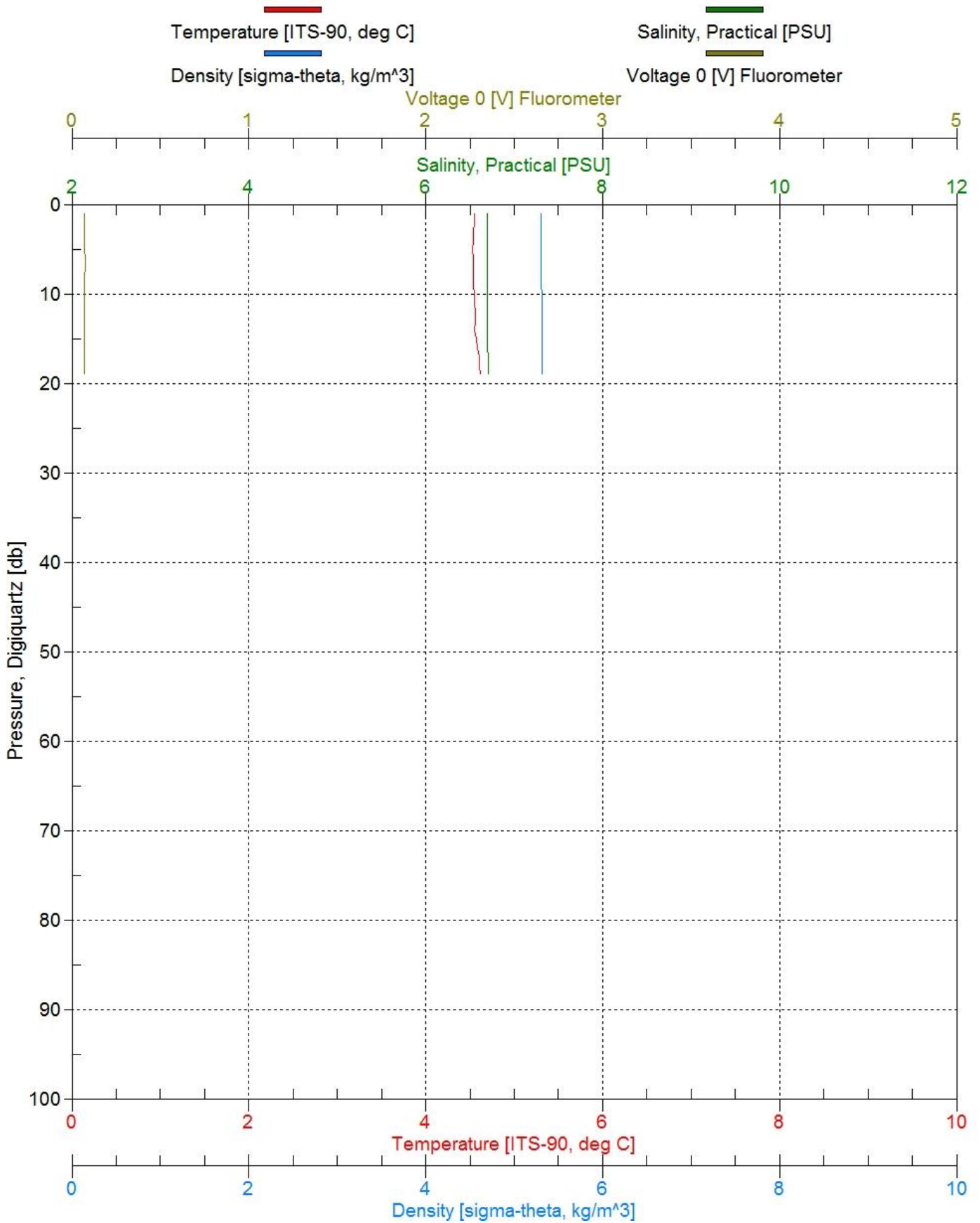
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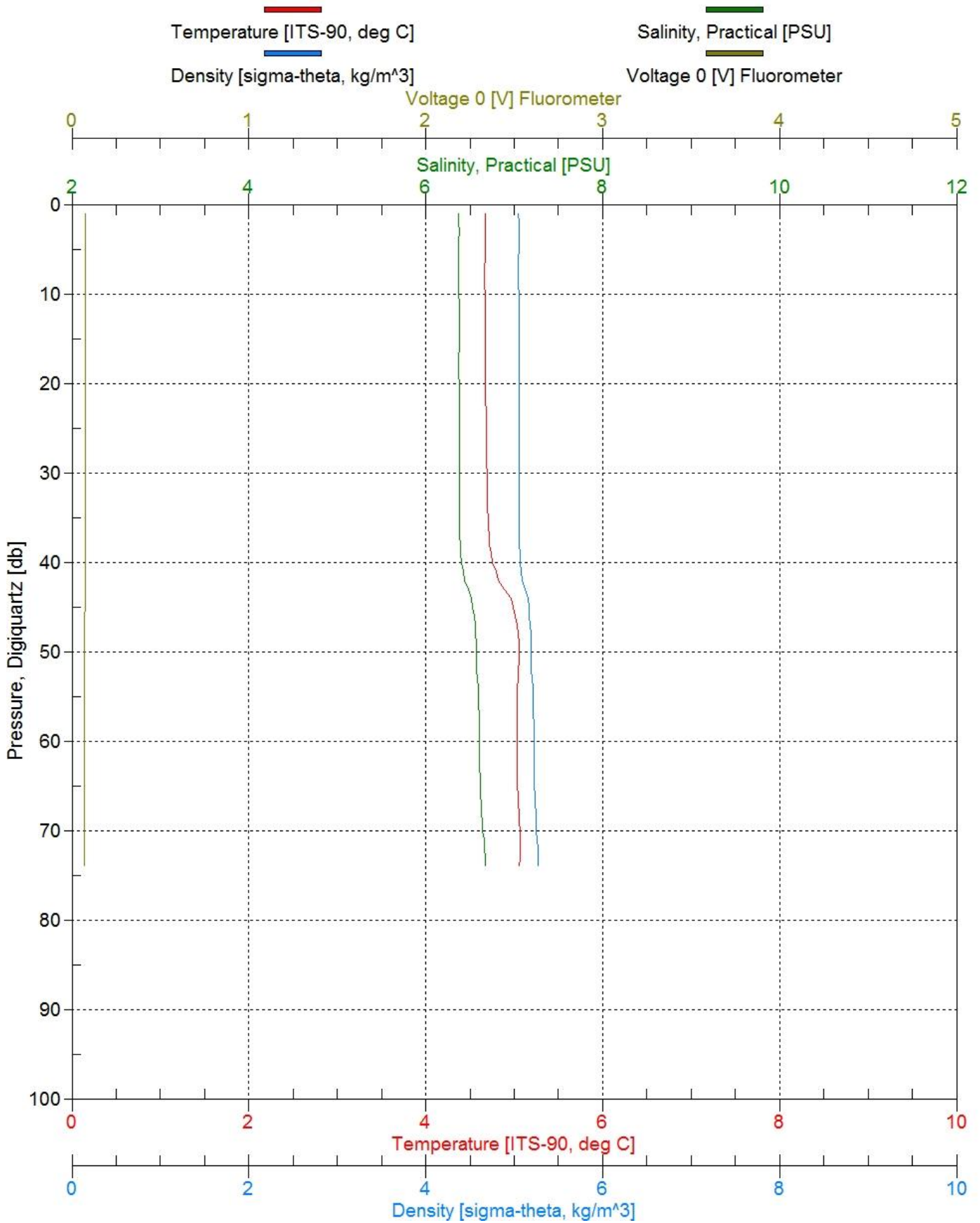
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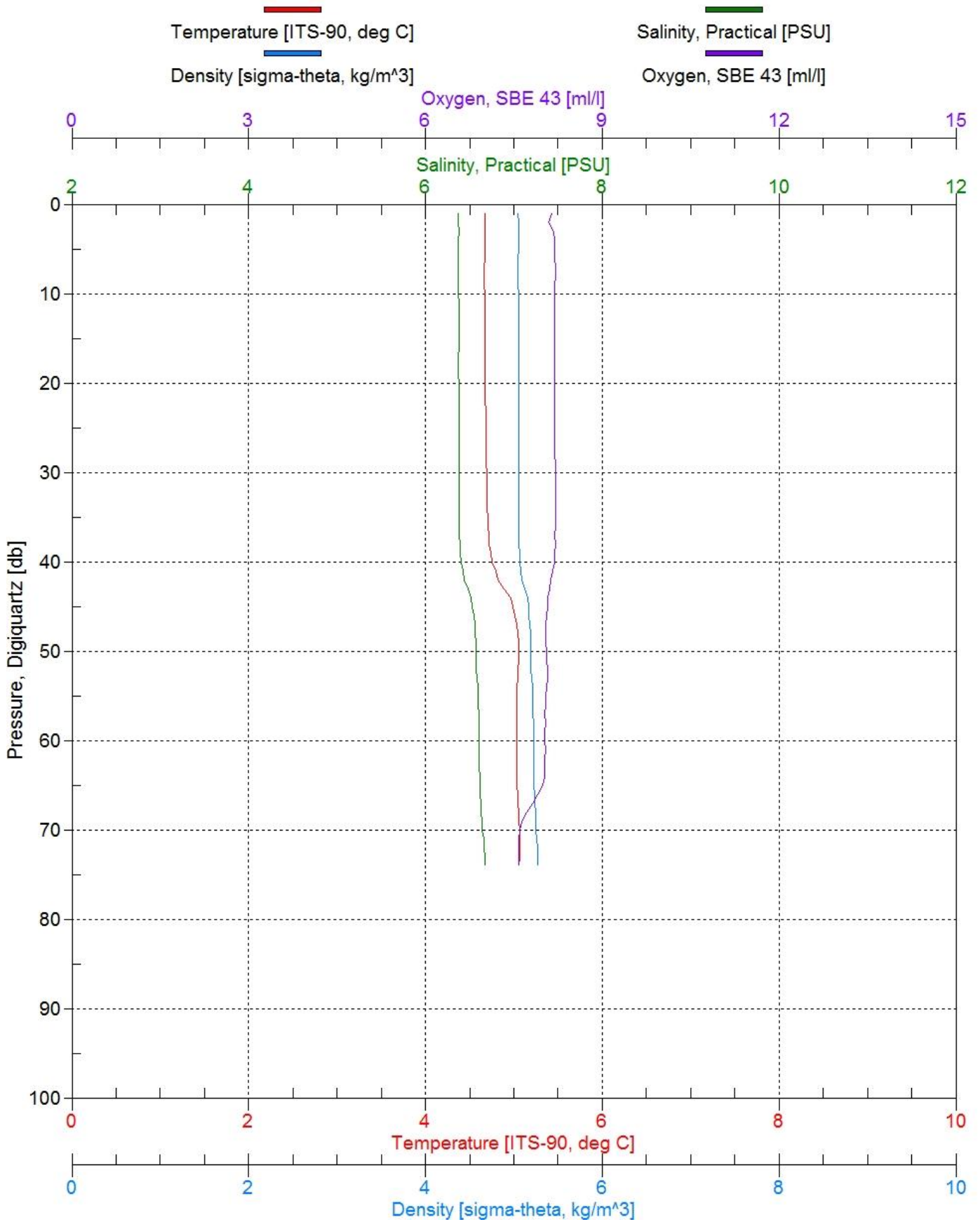
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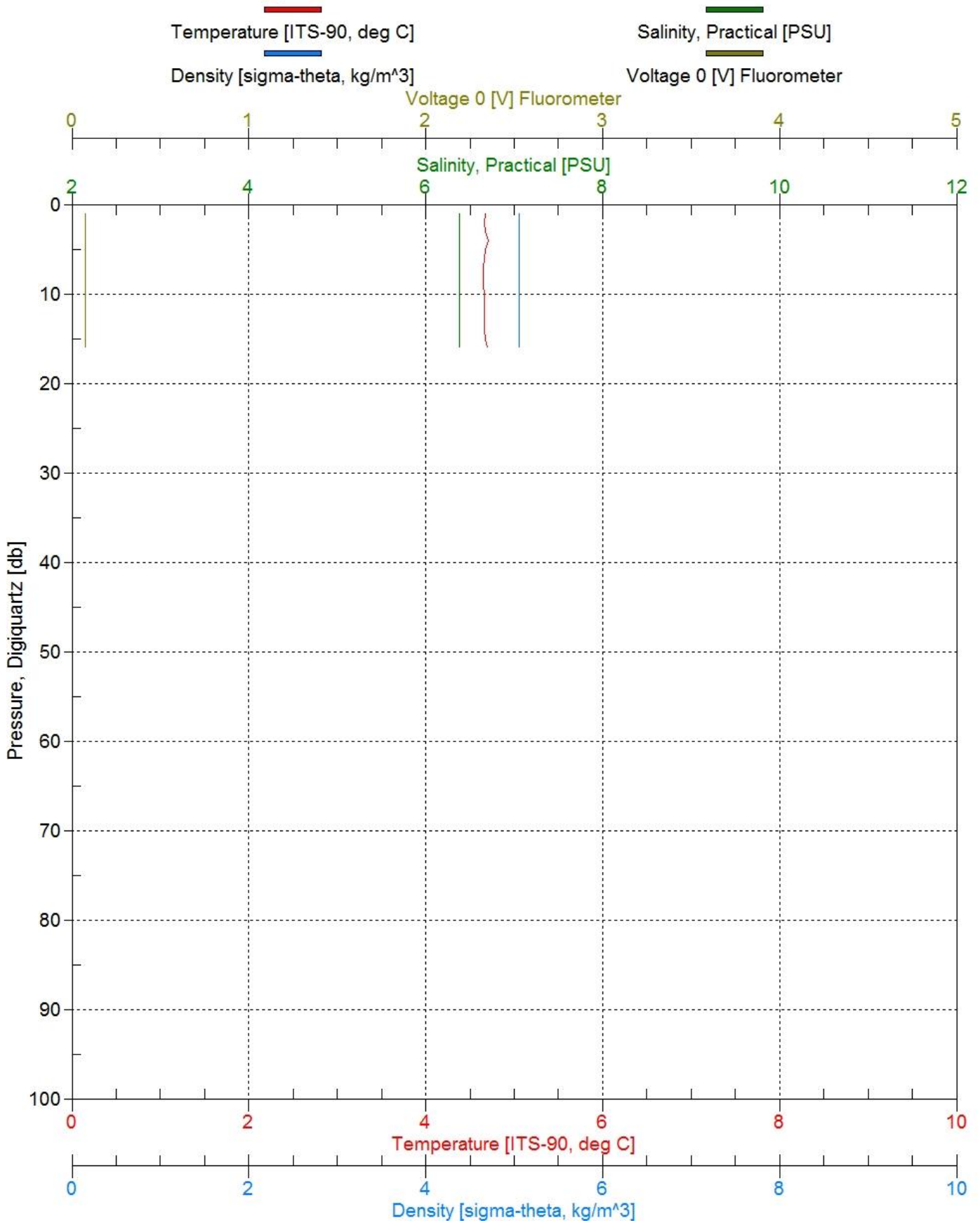
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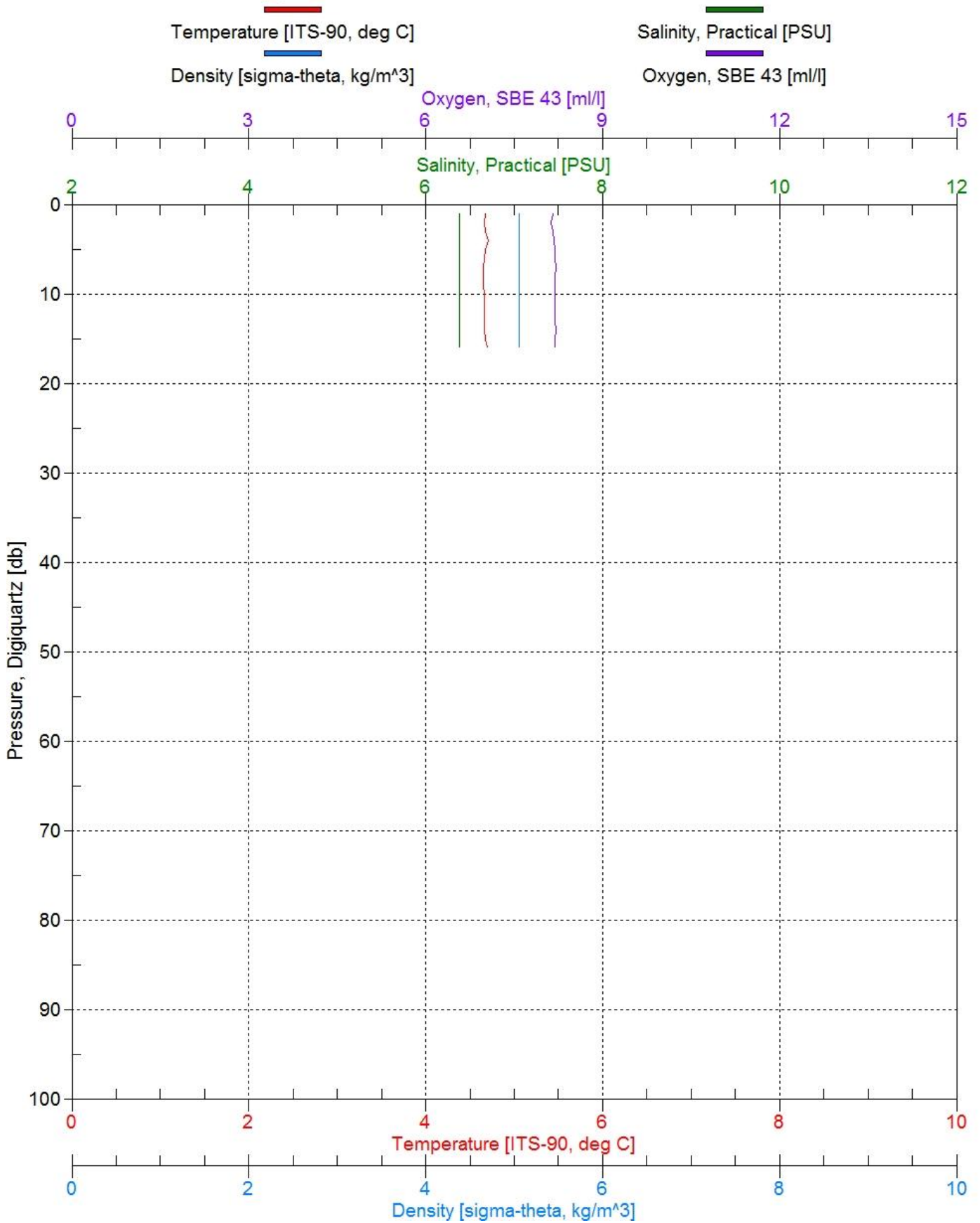
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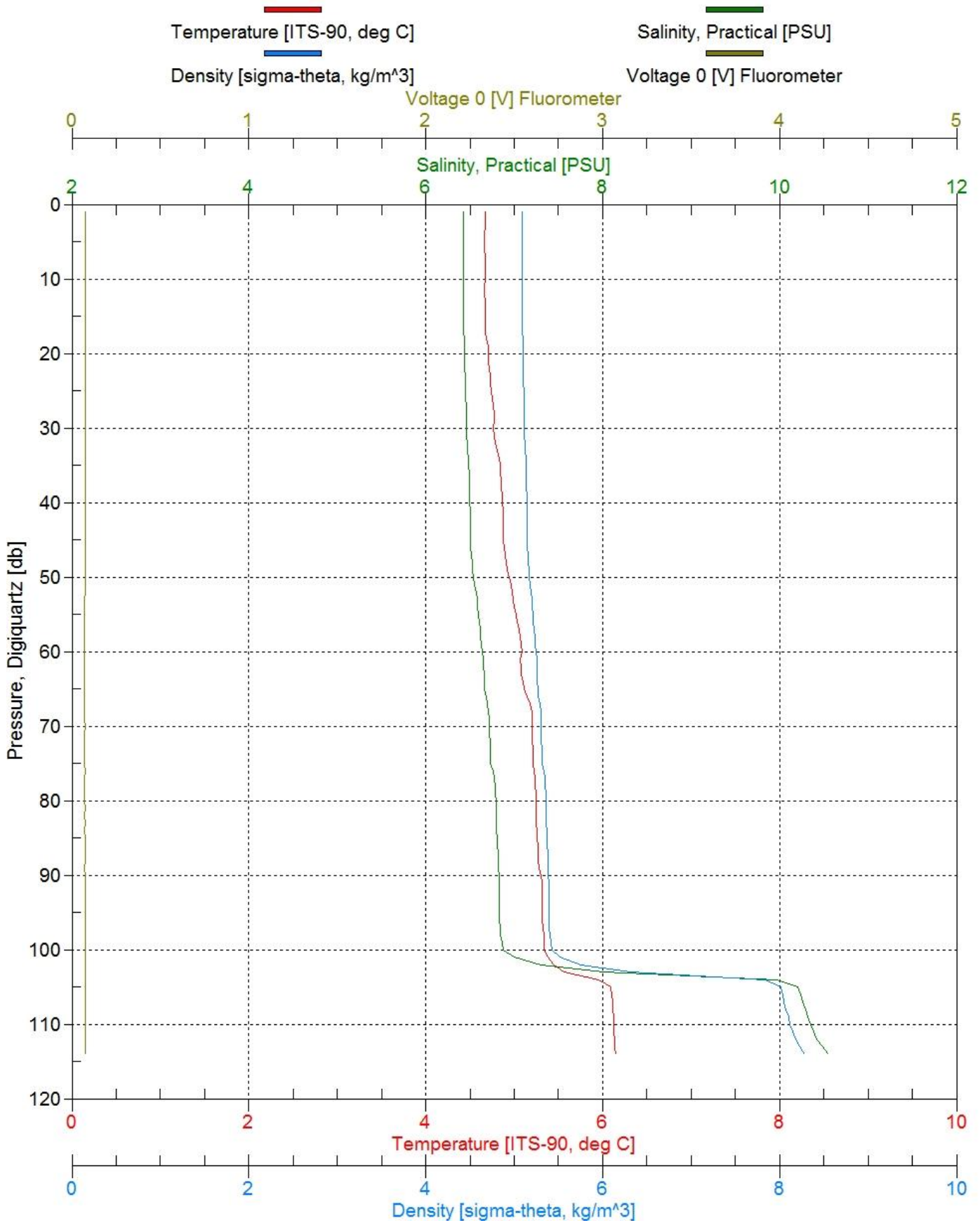
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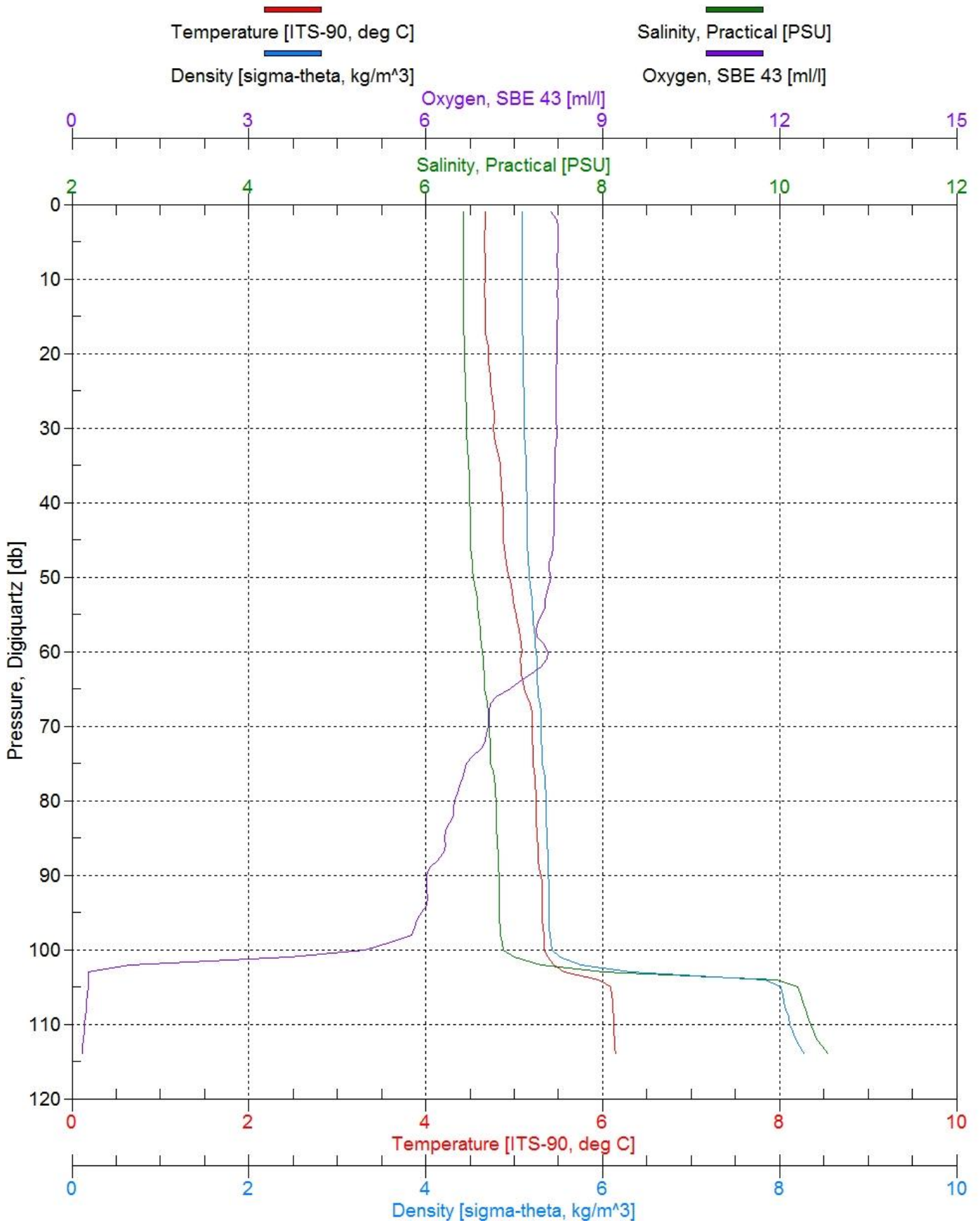
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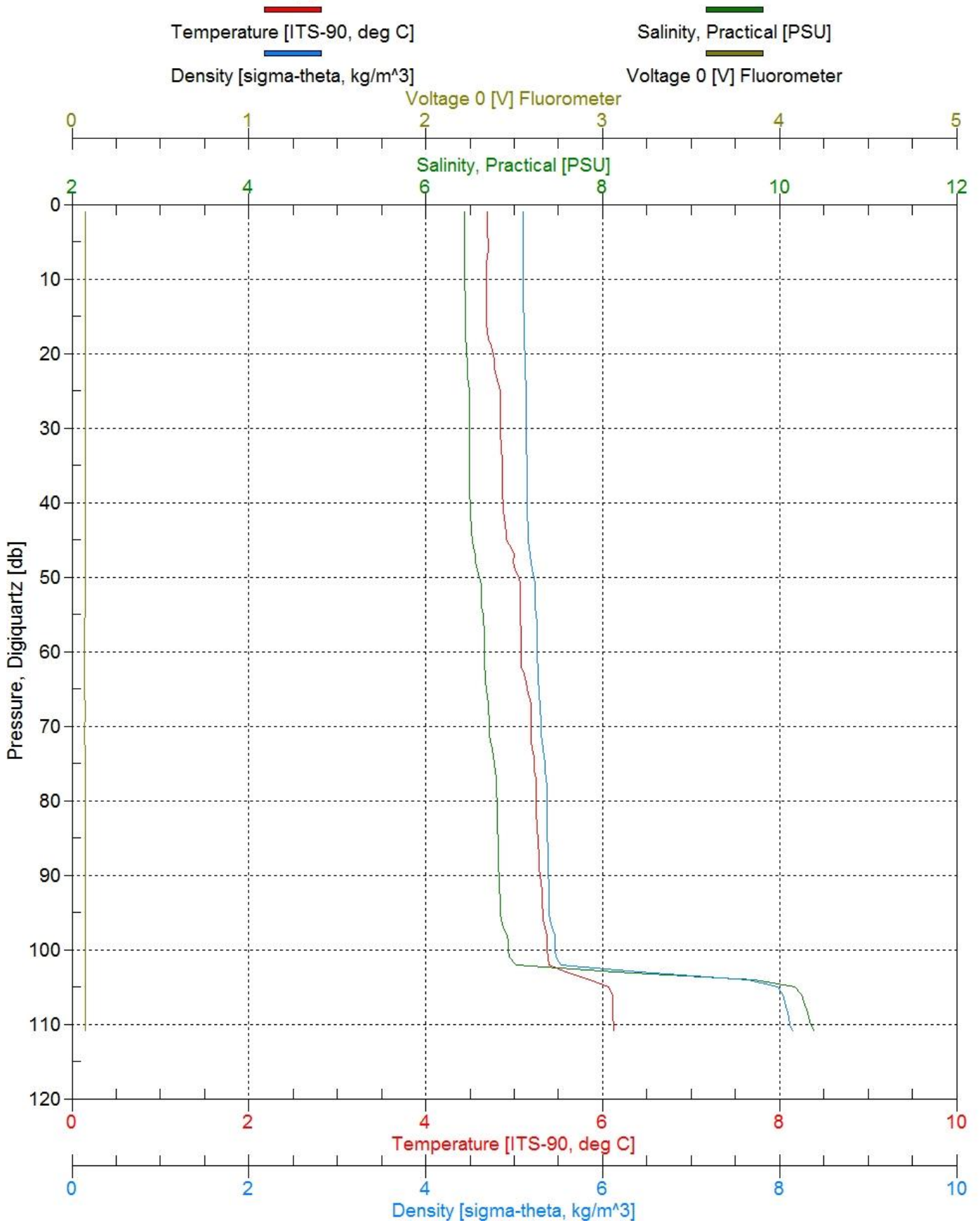
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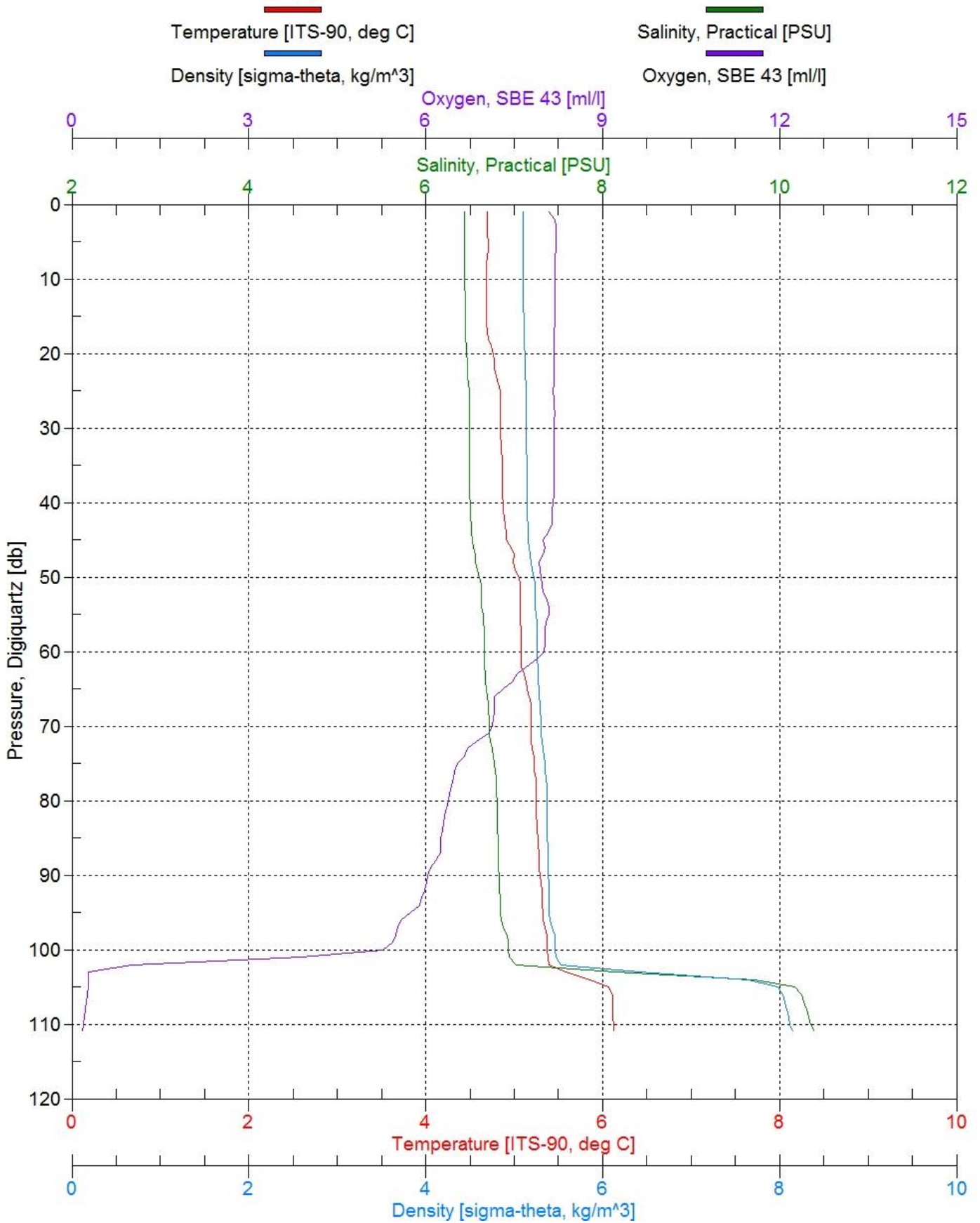
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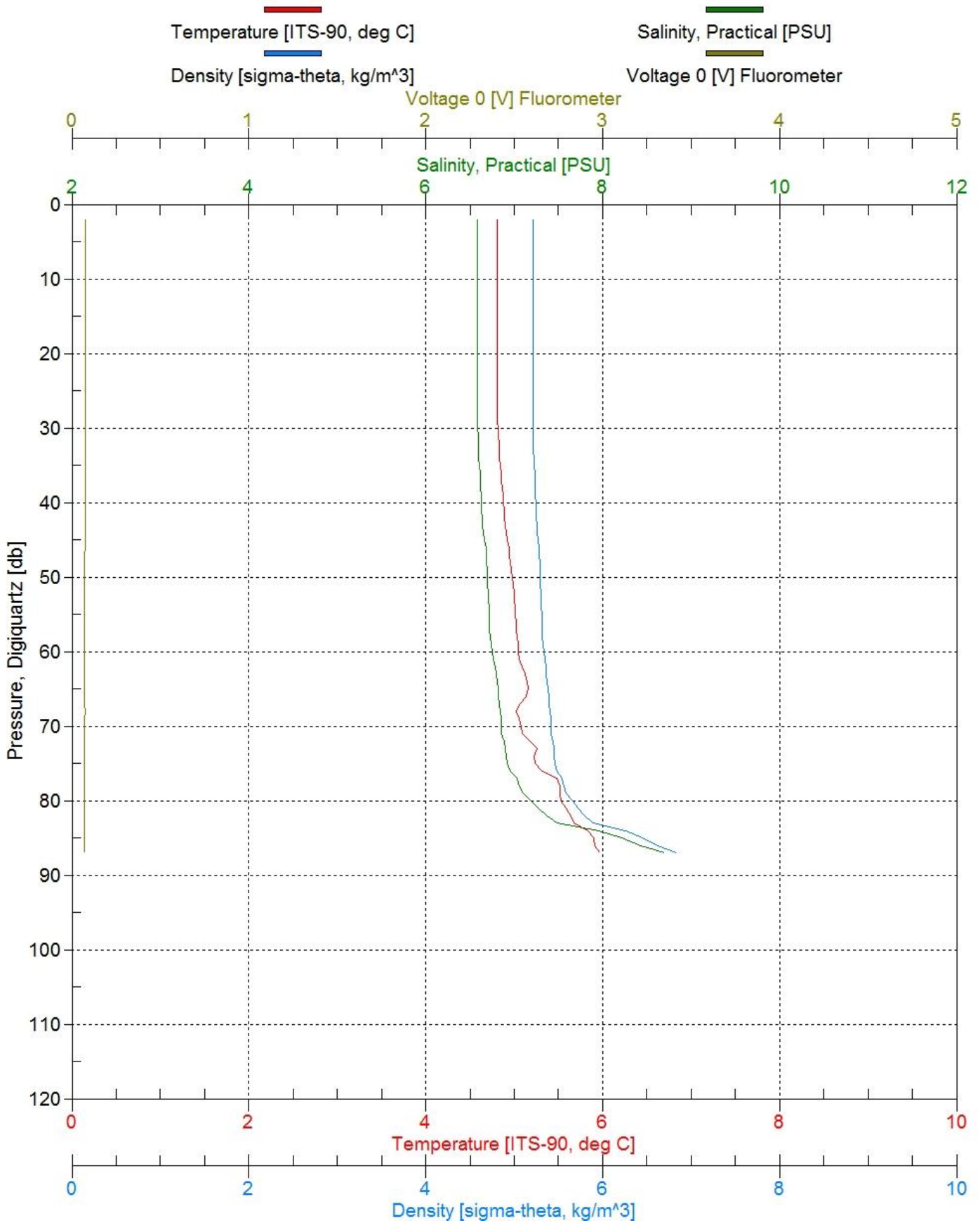
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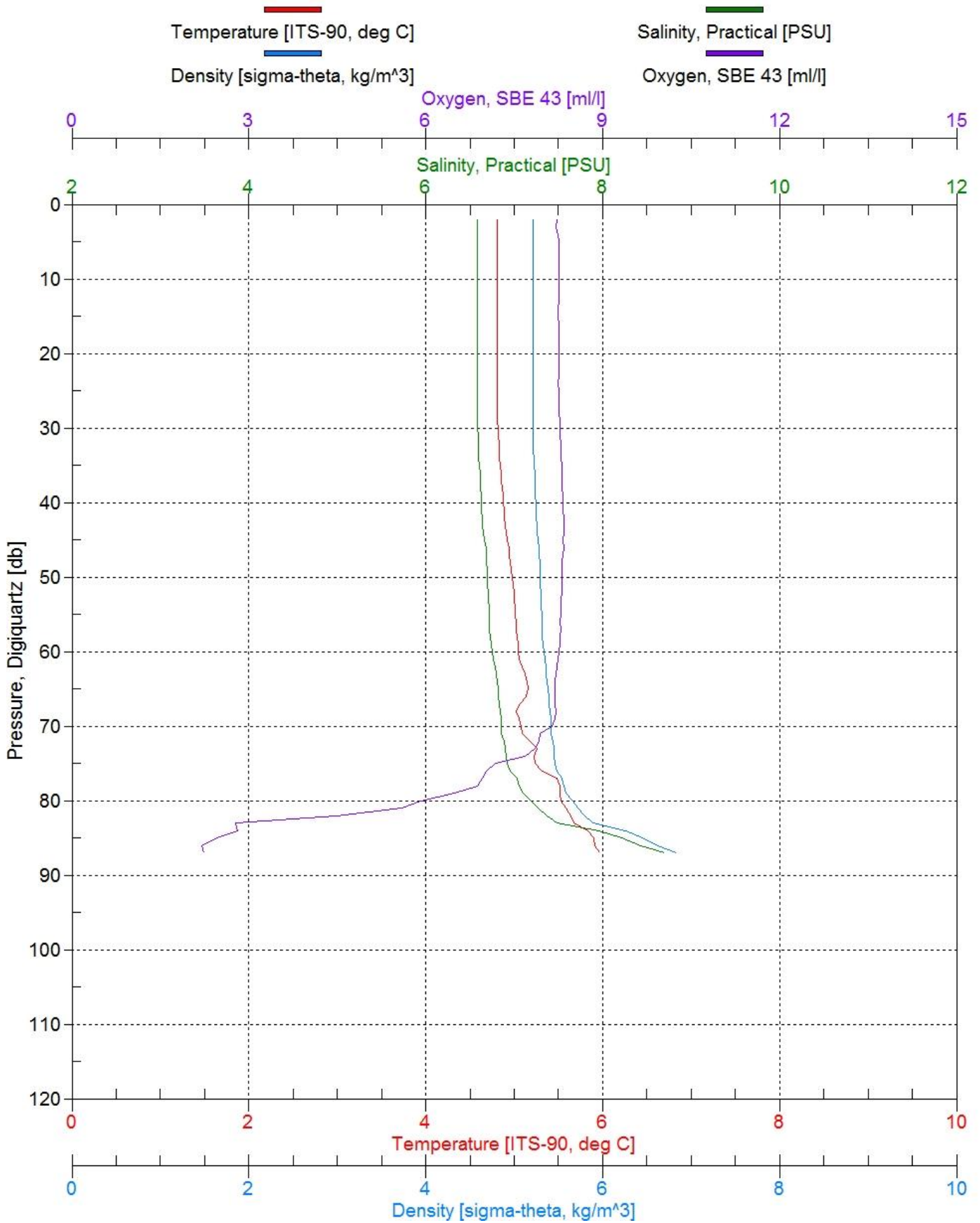
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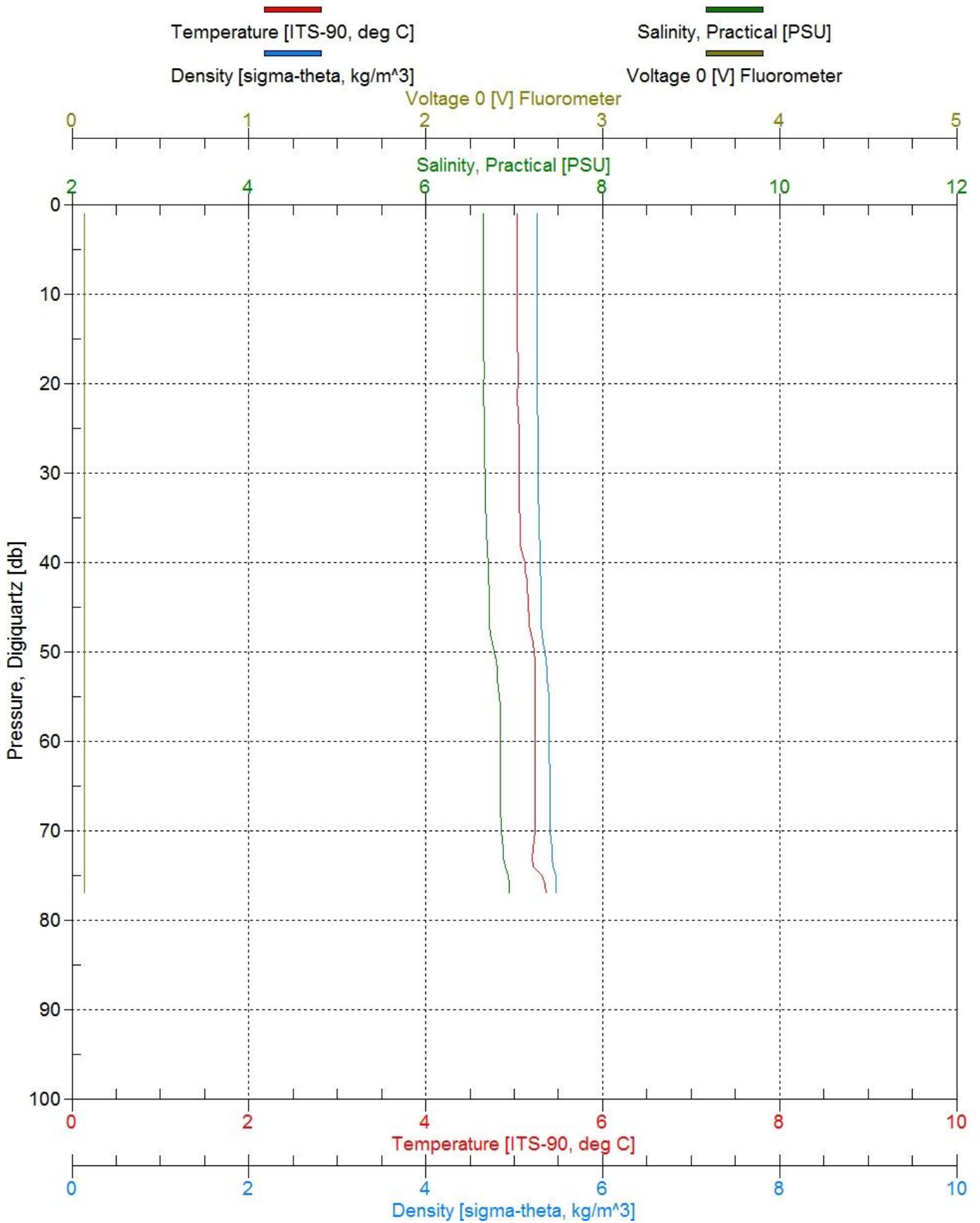
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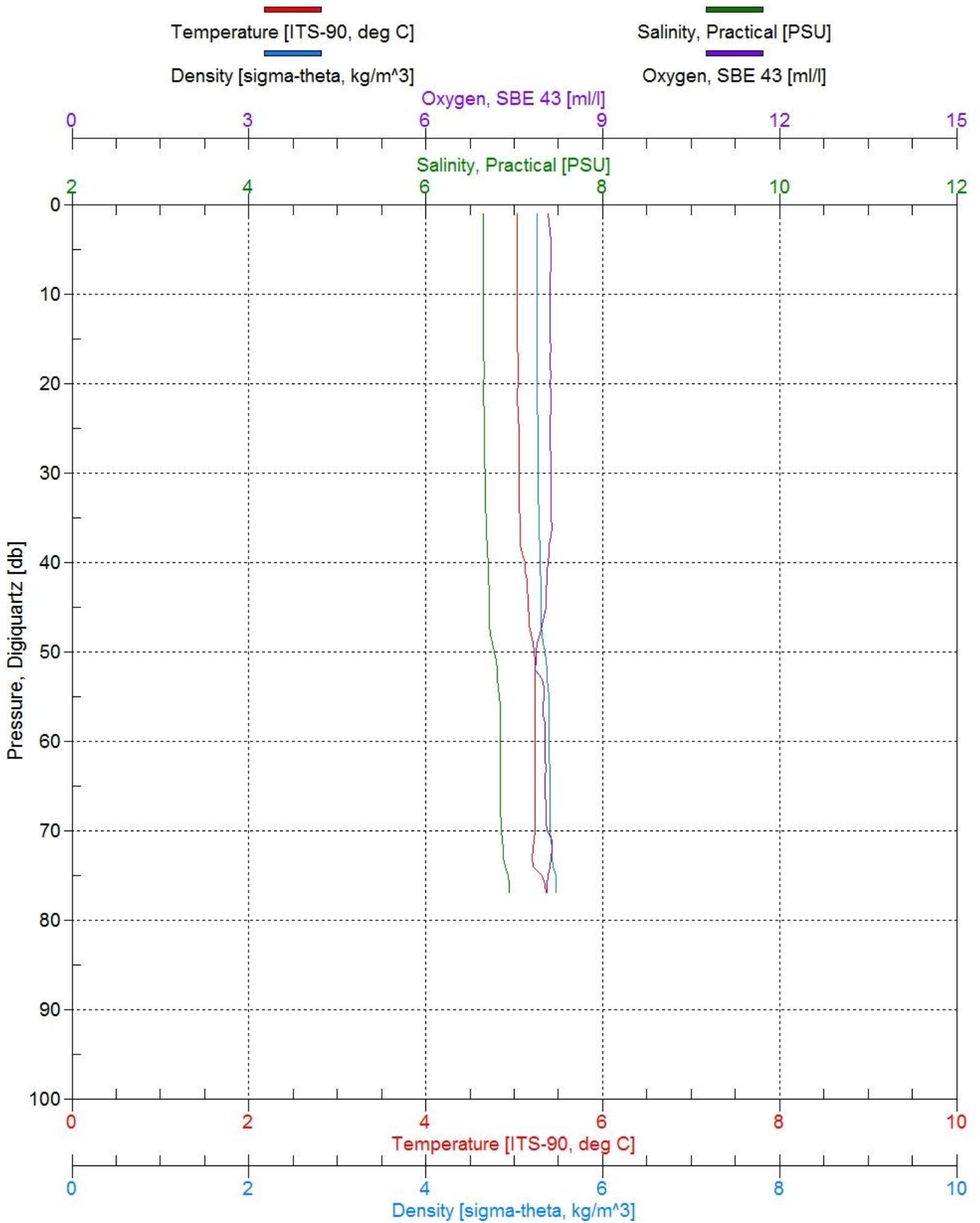
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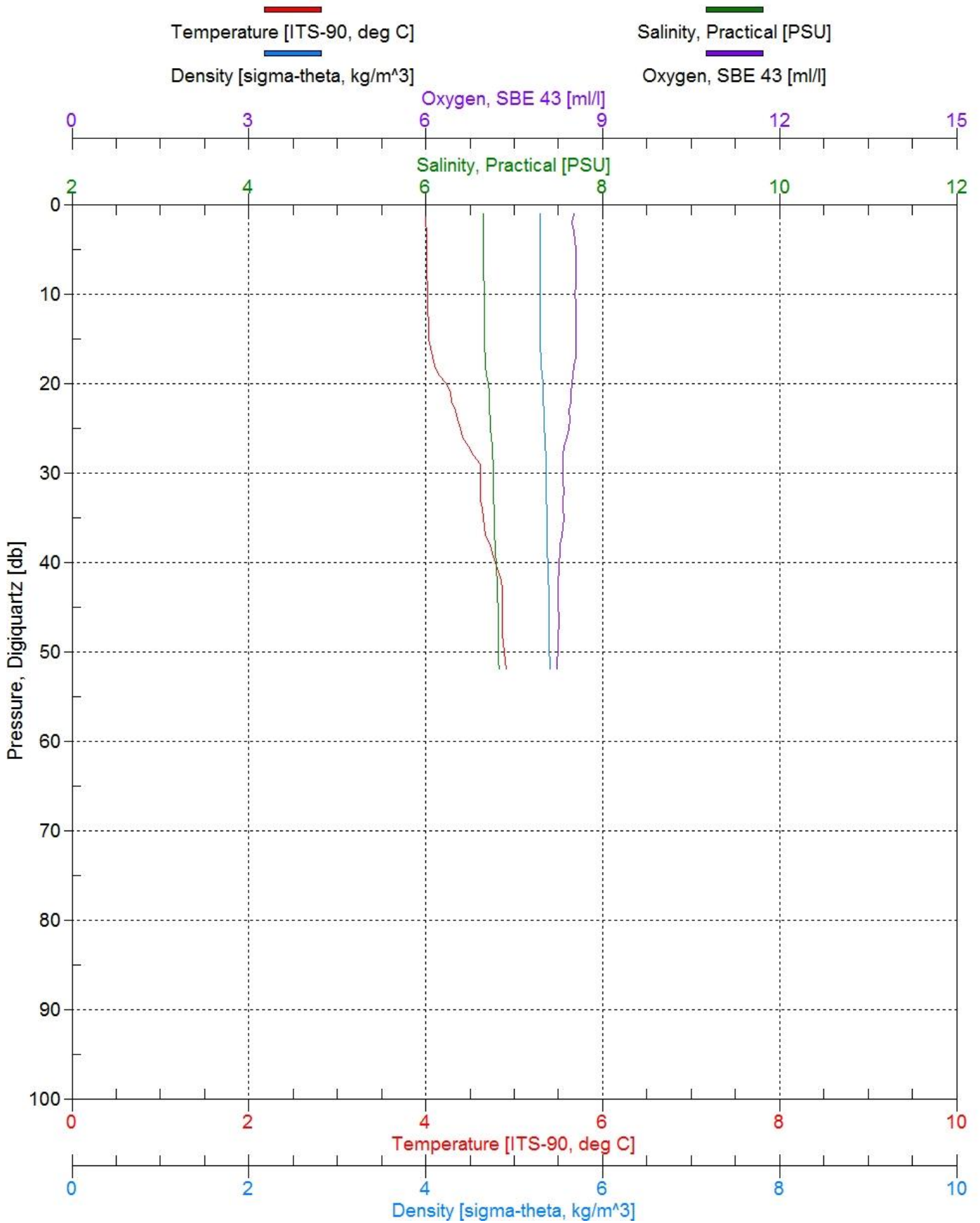
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