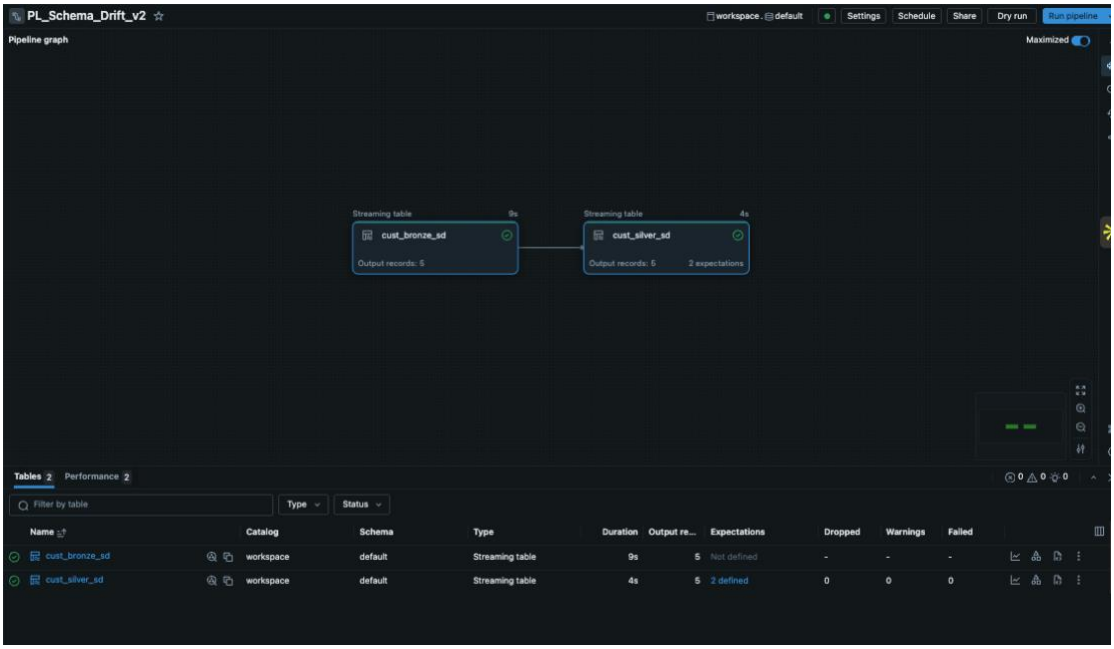
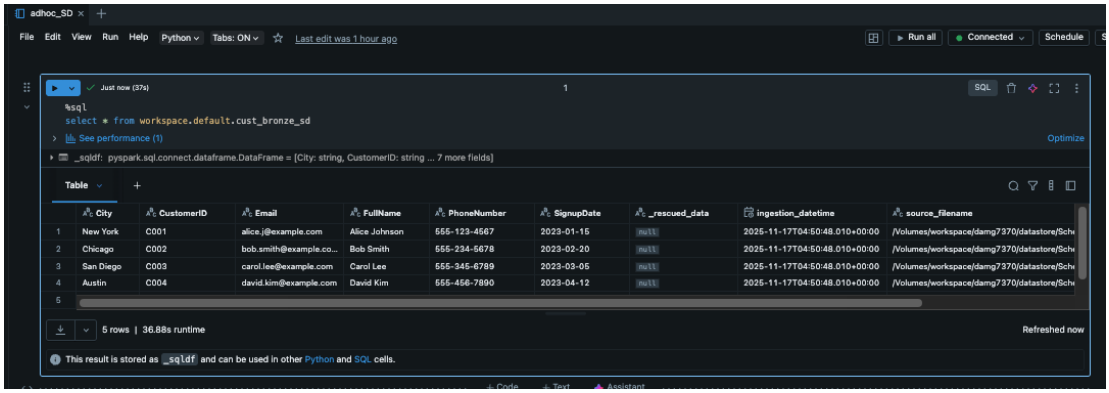
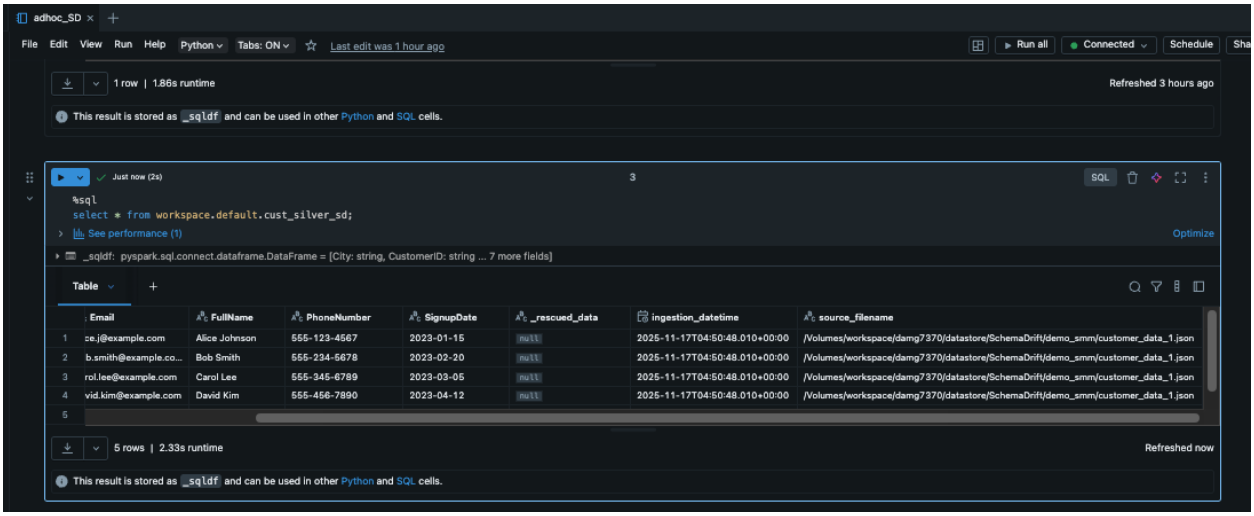
Schema Drift Replication Group 11

Hrishi Pal
Seamus McAvoy
Atharva Gadgil

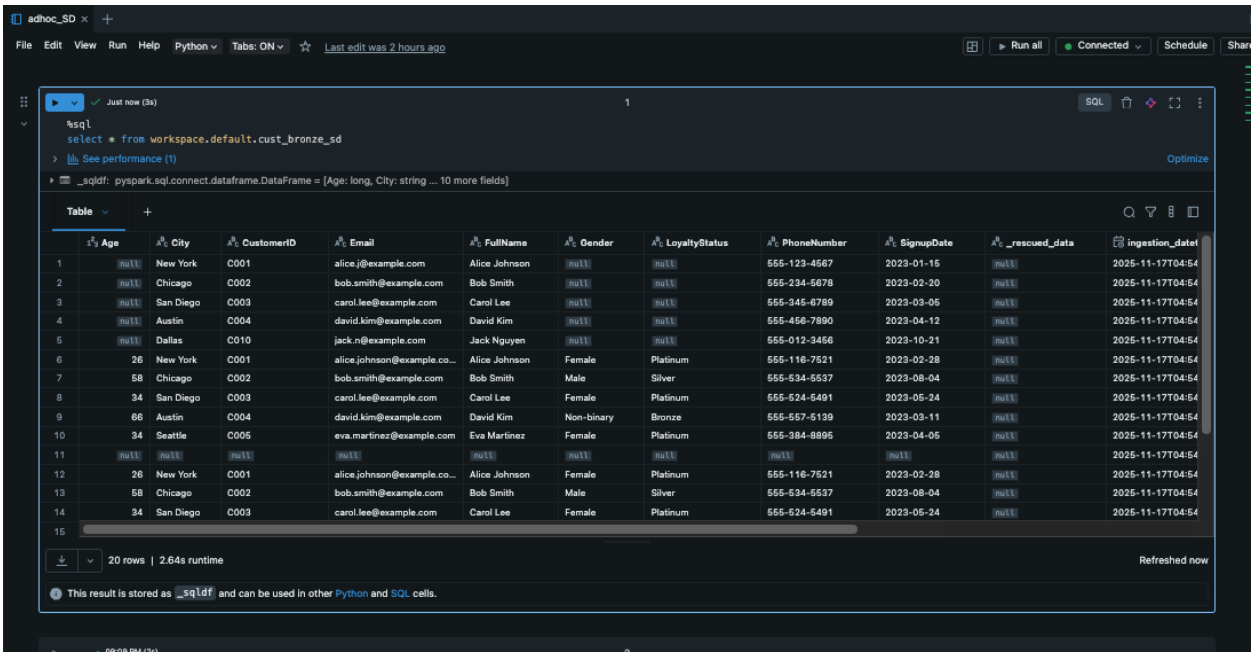
Plain Implementation



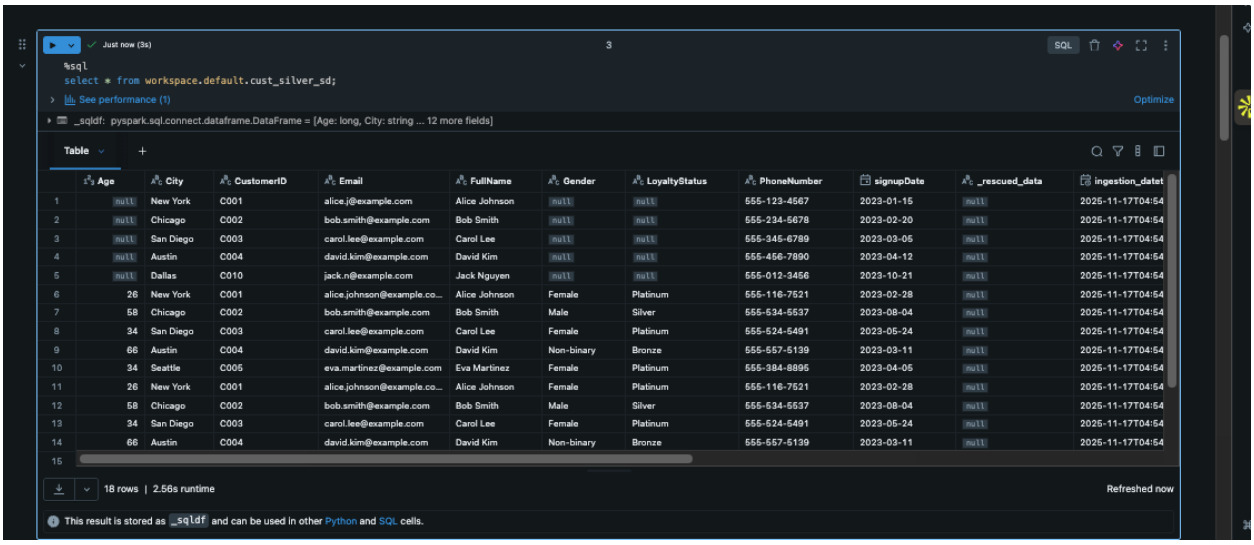




Customer_Data_2.json-



DataType Handling



```
%sql
select * from workspace.default.cust_silver_sd;
```

See performance (1) — Optimize

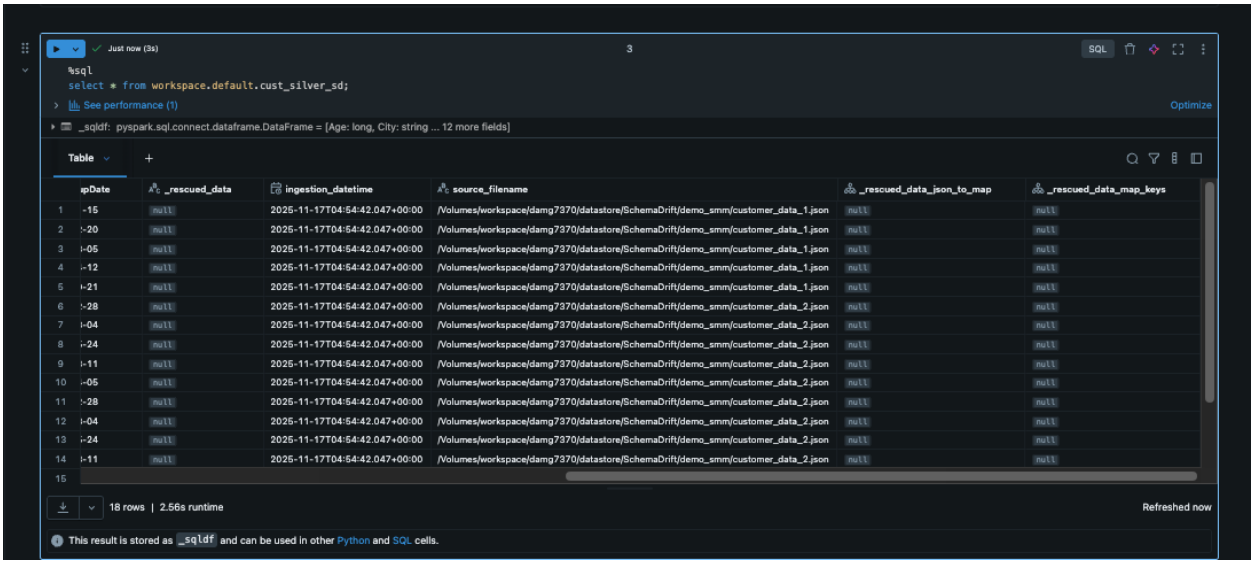
_sqldf: pyspark.sql.connect.dataframe.DataFrame = [Age: long, City: string ... 12 more fields]

Table

	Age	City	CustomerID	Email	FullName	Gender	LoyaltyStatus	PhoneNumber	signupDate	_rescued_data	ingestion_datet
1	null	New York	C001	alice.j@example.com	Alice Johnson	null	null	555-123-4567	2023-01-15	null	2025-11-17T04:54
2	null	Chicago	C002	bob.smith@example.com	Bob Smith	null	null	555-234-5678	2023-02-20	null	2025-11-17T04:54
3	null	San Diego	C003	carol.lee@example.com	Carol Lee	null	null	555-345-6789	2023-03-05	null	2025-11-17T04:54
4	null	Austin	C004	david.kim@example.com	David Kim	null	null	555-456-7890	2023-04-12	null	2025-11-17T04:54
5	null	Dallas	C010	jack.n@example.com	Jack Nguyen	null	null	555-012-3456	2023-10-21	null	2025-11-17T04:54
6	26	New York	C001	alice.johnson@example.co...	Alice Johnson	Female	Platinum	555-116-7521	2023-02-28	null	2025-11-17T04:54
7	58	Chicago	C002	bob.smith@example.com	Bob Smith	Male	Silver	555-534-5537	2023-08-04	null	2025-11-17T04:54
8	34	San Diego	C003	carol.lee@example.com	Carol Lee	Female	Platinum	555-524-5491	2023-05-24	null	2025-11-17T04:54
9	66	Austin	C004	david.kim@example.com	David Kim	Non-binary	Bronze	555-557-5139	2023-03-11	null	2025-11-17T04:54
10	34	Seattle	C005	eva.martinez@example.com	Eva Martinez	Female	Platinum	555-384-8895	2023-04-05	null	2025-11-17T04:54
11	26	New York	C001	alice.johnson@example.co...	Alice Johnson	Female	Platinum	555-116-7521	2023-02-28	null	2025-11-17T04:54
12	58	Chicago	C002	bob.smith@example.com	Bob Smith	Male	Silver	555-534-5537	2023-08-04	null	2025-11-17T04:54
13	34	San Diego	C003	carol.lee@example.com	Carol Lee	Female	Platinum	555-524-5491	2023-05-24	null	2025-11-17T04:54
14	66	Austin	C004	david.kim@example.com	David Kim	Non-binary	Bronze	555-557-5139	2023-03-11	null	2025-11-17T04:54
15											

18 rows | 2.56s runtime — Refreshed now

This result is stored as `_sqldf` and can be used in other Python and SQL cells.



```
%sql
select * from workspace.default.cust_silver_sd;
```

See performance (1) — Optimize

_sqldf: pyspark.sql.connect.dataframe.DataFrame = [Age: long, City: string ... 12 more fields]

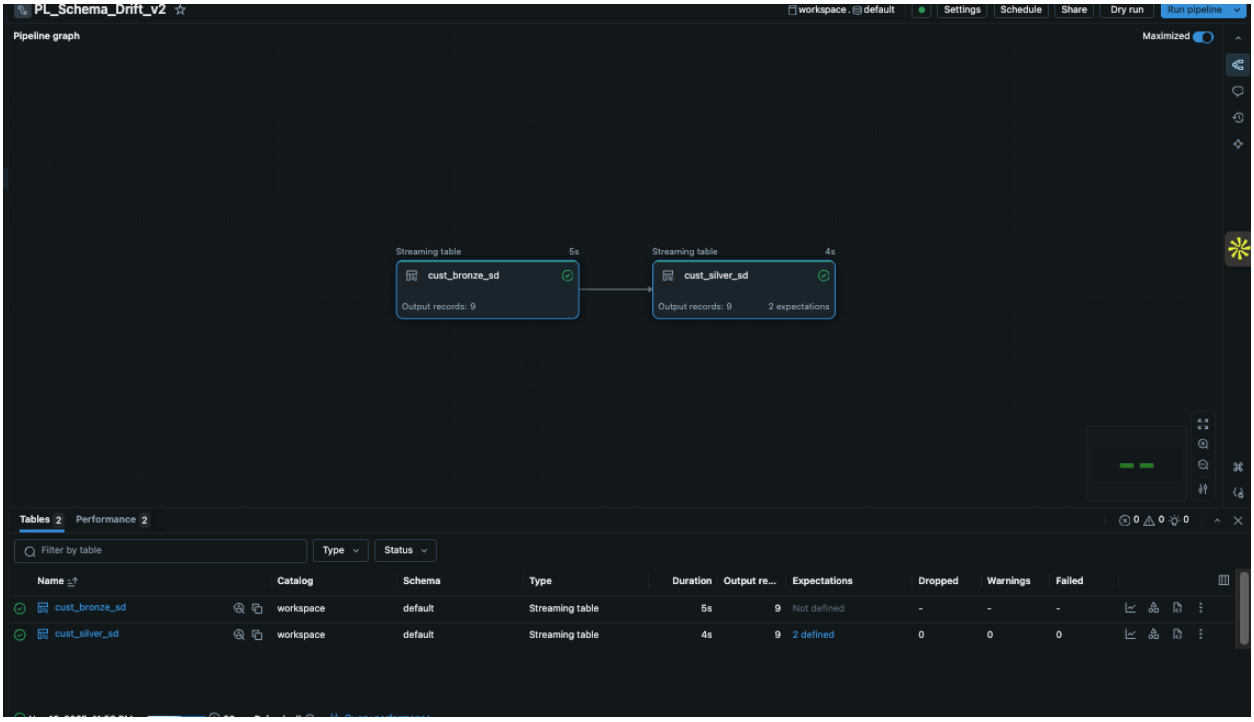
Table

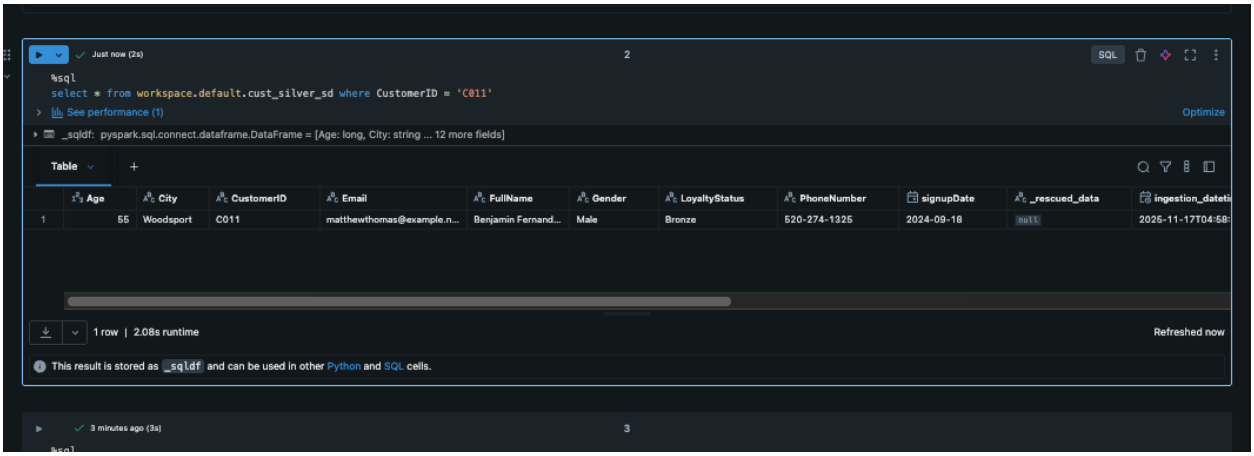
	ipDate	_rescued_data	ingestion_datetime	source_filename	_rescued_data_json_to_map	_rescued_data_map_keys
1	-15	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_1.json	null	null
2	-20	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_1.json	null	null
3	-05	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_1.json	null	null
4	-12	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_1.json	null	null
5	-21	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_1.json	null	null
6	-28	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
7	-04	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
8	-24	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
9	-11	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
10	-05	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
11	-28	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
12	-04	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
13	-24	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
14	-11	null	2025-11-17T04:54:42.047+00:00	/Volumes/workspace/damg7370/datastore/SchemaDrift/demo_smm/customer_data_2.json	null	null
15						

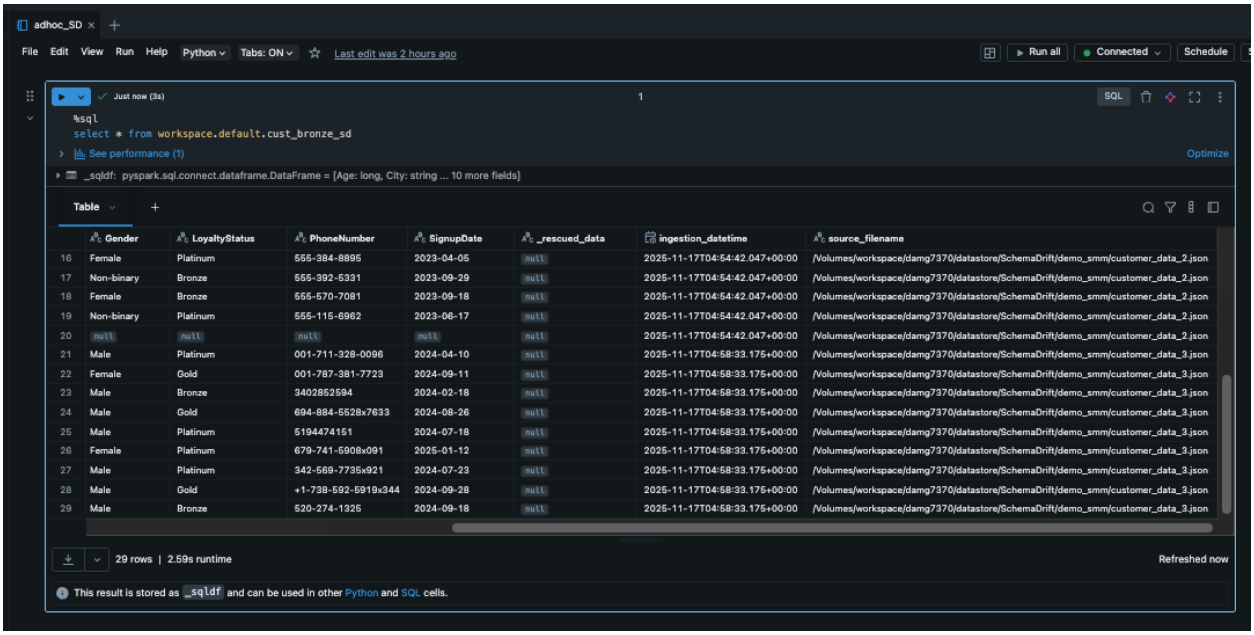
18 rows | 2.56s runtime — Refreshed now

This result is stored as `_sqldf` and can be used in other Python and SQL cells.

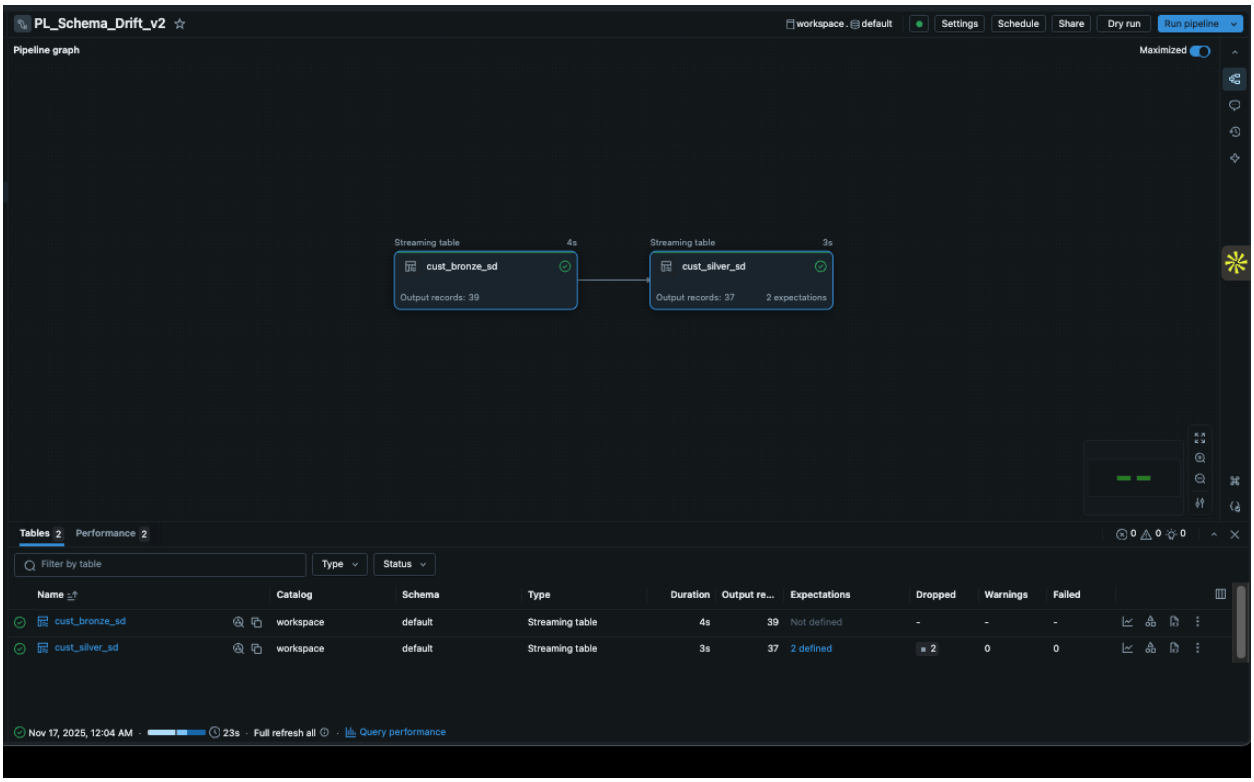
Customer_Data_3.json-

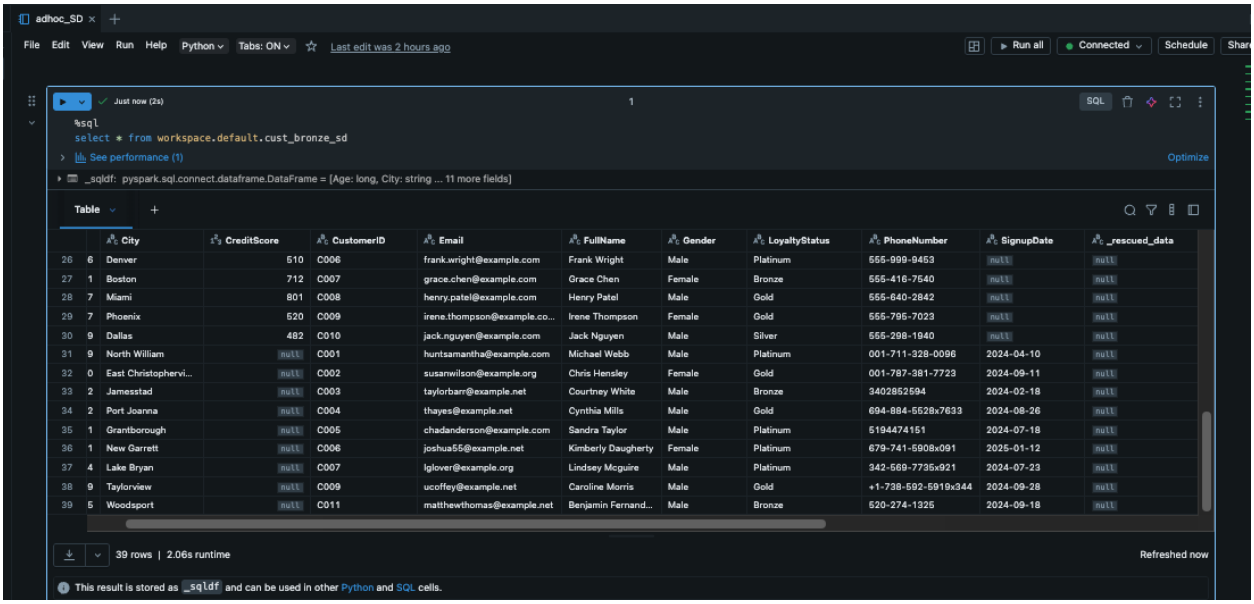




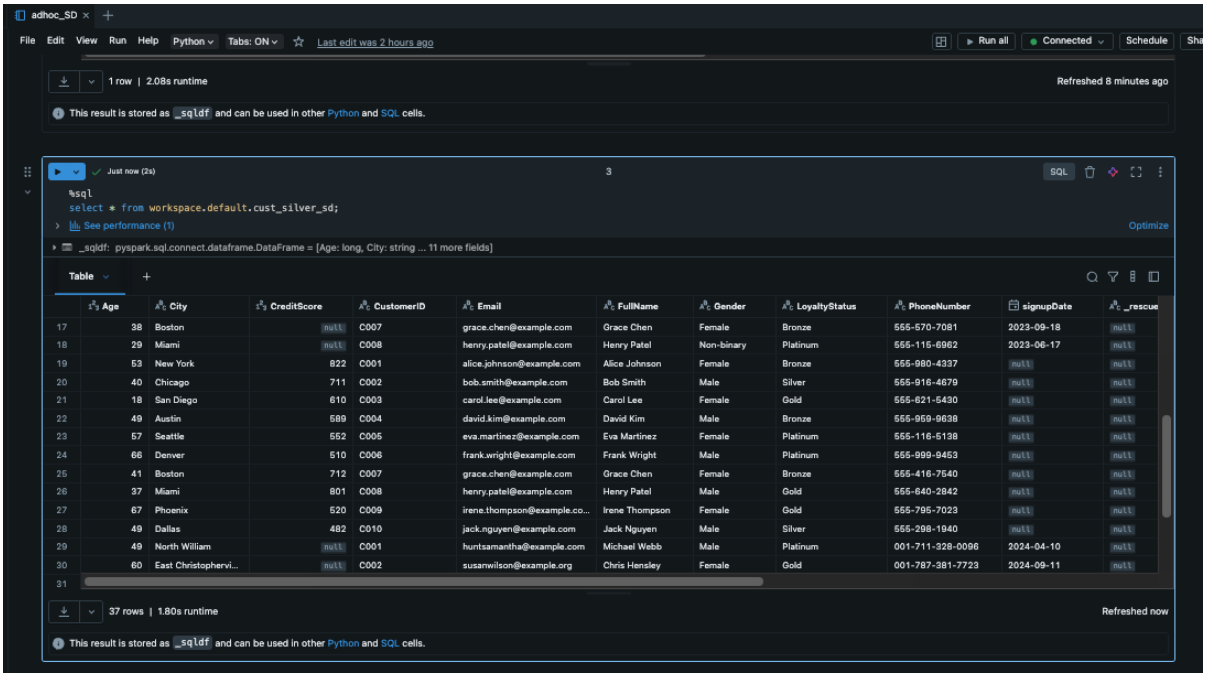


Missing CreditSore logic fix-

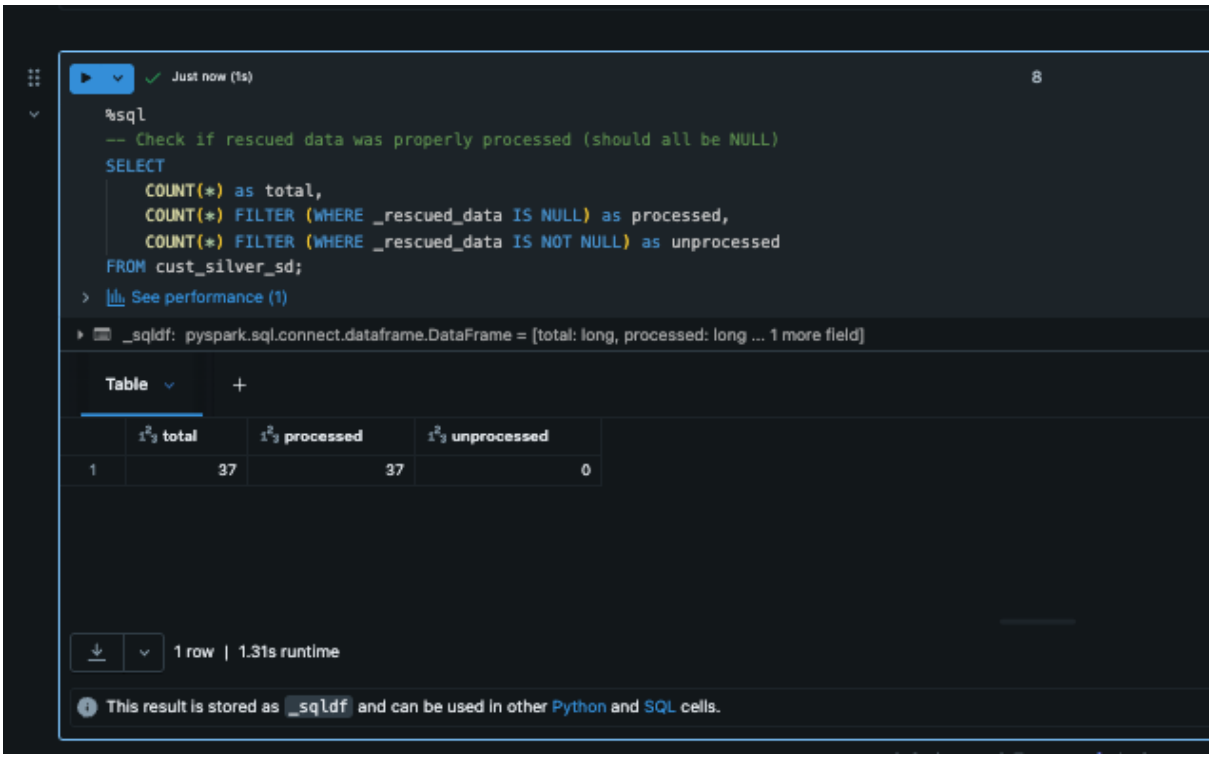


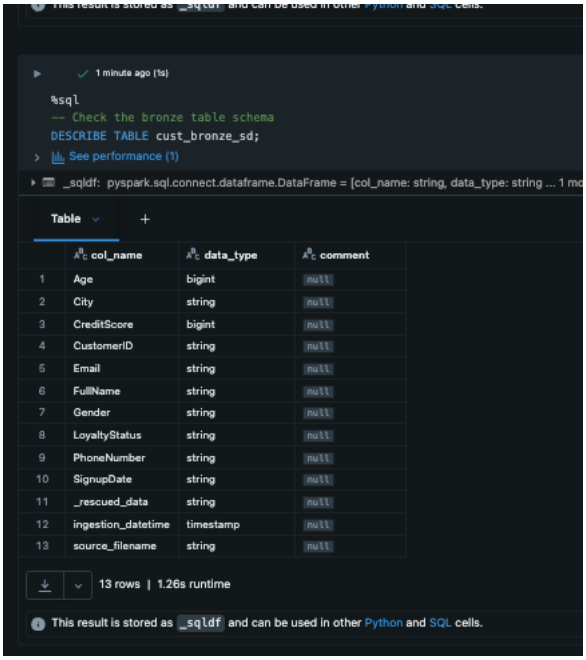


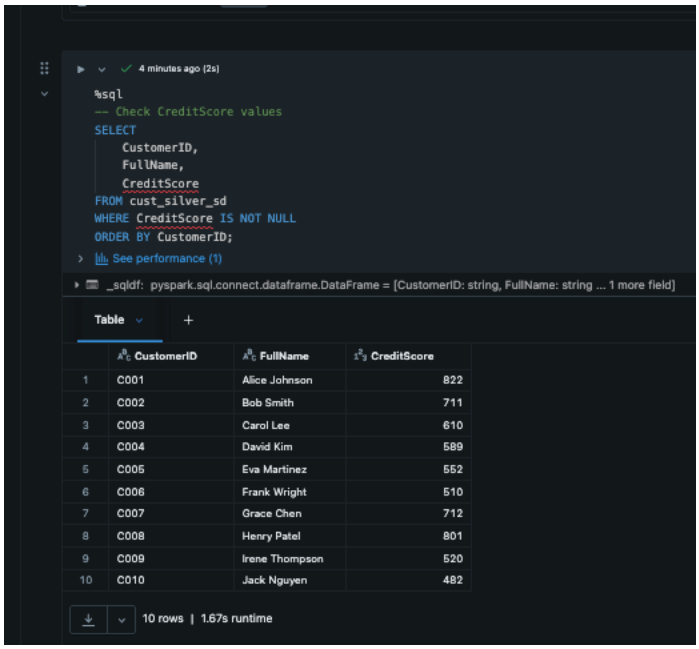
	City	CreditScore	CustomerID	Email	FullName	Gender	LoyaltyStatus	PhoneNumber	SignupDate	_rescued_data
26	6 Denver	510	C006	frank.wright@example.com	Frank Wright	Male	Platinum	555-999-9453	null	null
27	1 Boston	712	C007	grace.chen@example.com	Grace Chen	Female	Bronze	555-416-7540	null	null
28	7 Miami	801	C008	henry.patel@example.com	Henry Patel	Male	Gold	555-640-2842	null	null
29	7 Phoenix	520	C009	irene.thompson@example.co...	Irene Thompson	Female	Gold	555-795-7023	null	null
30	9 Dallas	482	C010	jack.nguyen@example.com	Jack Nguyen	Male	Silver	555-298-1940	null	null
31	9 North William	null	C001	huntsamantha@example.com	Michael Webb	Male	Platinum	001-711-328-0096	2024-04-10	null
32	0 East Christophervi...	null	C002	susanwilson@example.org	Chris Hensley	Female	Gold	001-787-381-7723	2024-09-11	null
33	2 Jamesstad	null	C003	taylorbarr@example.net	Courtney White	Male	Bronze	3402852594	2024-02-18	null
34	2 Port Joanna	null	C004	thayes@example.net	Cynthia Mills	Male	Gold	694-884-5528x7633	2024-08-26	null
35	1 Grantborough	null	C005	chadanderson@example.com	Sandra Taylor	Male	Platinum	5194474151	2024-07-18	null
36	1 New Garrett	null	C006	joshua55@example.net	Kimberly Daugherty	Female	Platinum	679-741-5908x091	2025-01-12	null
37	4 Lake Bryan	null	C007	lglover@example.org	Lindsey Mcguire	Male	Platinum	342-569-7736x921	2024-07-23	null
38	9 Taylorview	null	C009	ucoffey@example.net	Caroline Morris	Male	Gold	+1-738-592-5919x344	2024-09-28	null
39	5 Woodsport	null	C011	matthewthomas@example.net	Benjamin Fernand...	Male	Bronze	520-274-1325	2024-09-18	null



	Age	City	CreditScore	CustomerID	Email	FullName	Gender	LoyaltyStatus	PhoneNumber	signupDate	_rescue
17	38	Boston	null	C007	grace.chen@example.com	Grace Chen	Female	Bronze	555-570-7081	2023-09-18	null
18	29	Miami	null	C008	henry.patel@example.com	Henry Patel	Non-binary	Platinum	555-115-6962	2023-06-17	null
19	53	New York	822	C001	alice.johnson@example.com	Alice Johnson	Female	Bronze	555-980-4337	null	null
20	40	Chicago	711	C002	bob.smith@example.com	Bob Smith	Male	Silver	555-916-4679	null	null
21	18	San Diego	610	C003	carol.lee@example.com	Carol Lee	Female	Gold	555-621-5430	null	null
22	49	Austin	589	C004	david.kim@example.com	David Kim	Male	Bronze	555-959-9638	null	null
23	57	Seattle	552	C005	eva.martinez@example.com	Eva Martinez	Female	Platinum	555-116-5138	null	null
24	66	Denver	510	C006	frank.wright@example.com	Frank Wright	Male	Platinum	555-999-9453	null	null
25	41	Boston	712	C007	grace.chen@example.com	Grace Chen	Female	Bronze	555-416-7540	null	null
26	37	Miami	801	C008	henry.patel@example.com	Henry Patel	Male	Gold	555-640-2842	null	null
27	67	Phoenix	520	C009	irene.thompson@example.co...	Irene Thompson	Female	Gold	555-795-7023	null	null
28	49	Dallas	482	C010	jack.nguyen@example.com	Jack Nguyen	Male	Silver	555-298-1940	null	null
29	49	North William	null	C001	huntsamantha@example.com	Michael Webb	Male	Platinum	001-711-328-0096	2024-04-10	null
30	60	East Christophervi...	null	C002	susanwilson@example.org	Chris Hensley	Female	Gold	001-787-381-7723	2024-09-11	null
31											


Just now (1s)
%sql
-- Check if rescued data was properly processed (should all be NULL)
SELECT
COUNT(*) as total,
COUNT(*) FILTER (WHERE _rescued_data IS NULL) as processed,
COUNT(*) FILTER (WHERE _rescued_data IS NOT NULL) as unprocessed
FROM cust_silver_sd;
See performance (1)
_sqldf: pyspark.sql.connect.dataframe.DataFrame = [total: long, processed: long ... 1 more field]
Table
total
processed
unprocessed
1
37
37
0
1 row | 1.31s runtime
This result is stored as _sqldf and can be used in other Python and SQL cells.


1 minute ago (1s)
%sql
-- Check the bronze table schema
DESCRIBE TABLE cust_bronze_sd;
See performance (1)
Table
col_name
data_type
comment
1 Age bigint null
2 City string null
3 CreditScore bigint null
4 CustomerID string null
5 Email string null
6 FullName string null
7 Gender string null
8 LoyaltyStatus string null
9 PhoneNumber string null
10 SignupDate string null
11 _rescued_data string null
12 ingestion_datetime timestamp null
13 source_filename string null
13 rows | 1.26s runtime
This result is stored as _sqldf and can be used in other Python and SQL cells.



The process__rescue_data_new_fields() function had a critical bug

new_keys = [row["rescued_key"] for row in df_keys.collect()] if not df.isStreaming else []

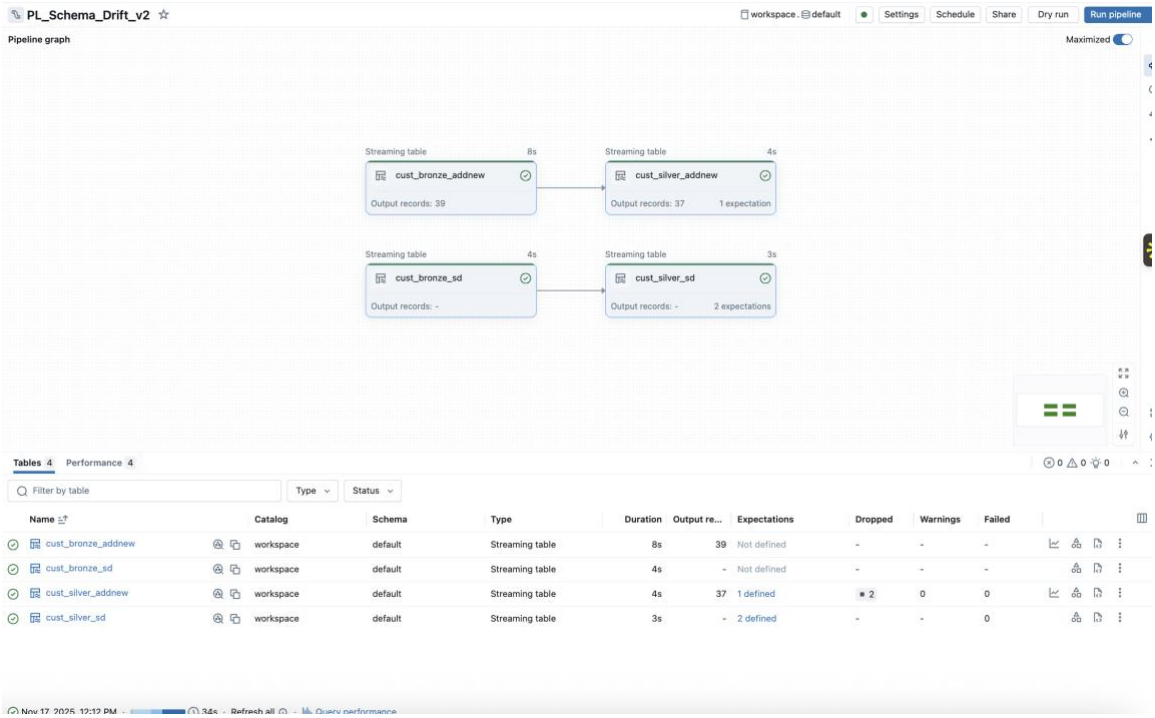
- Delta Live Tables (DLT) uses **streaming DataFrames** for real-time processing
- When df.isStreaming evaluates to True, the function returns an **empty list** []
- An empty list means **no new columns are extracted** from _rescued_data
- The .collect() operation cannot be used on streaming DataFrames because they represent unbounded, continuous data

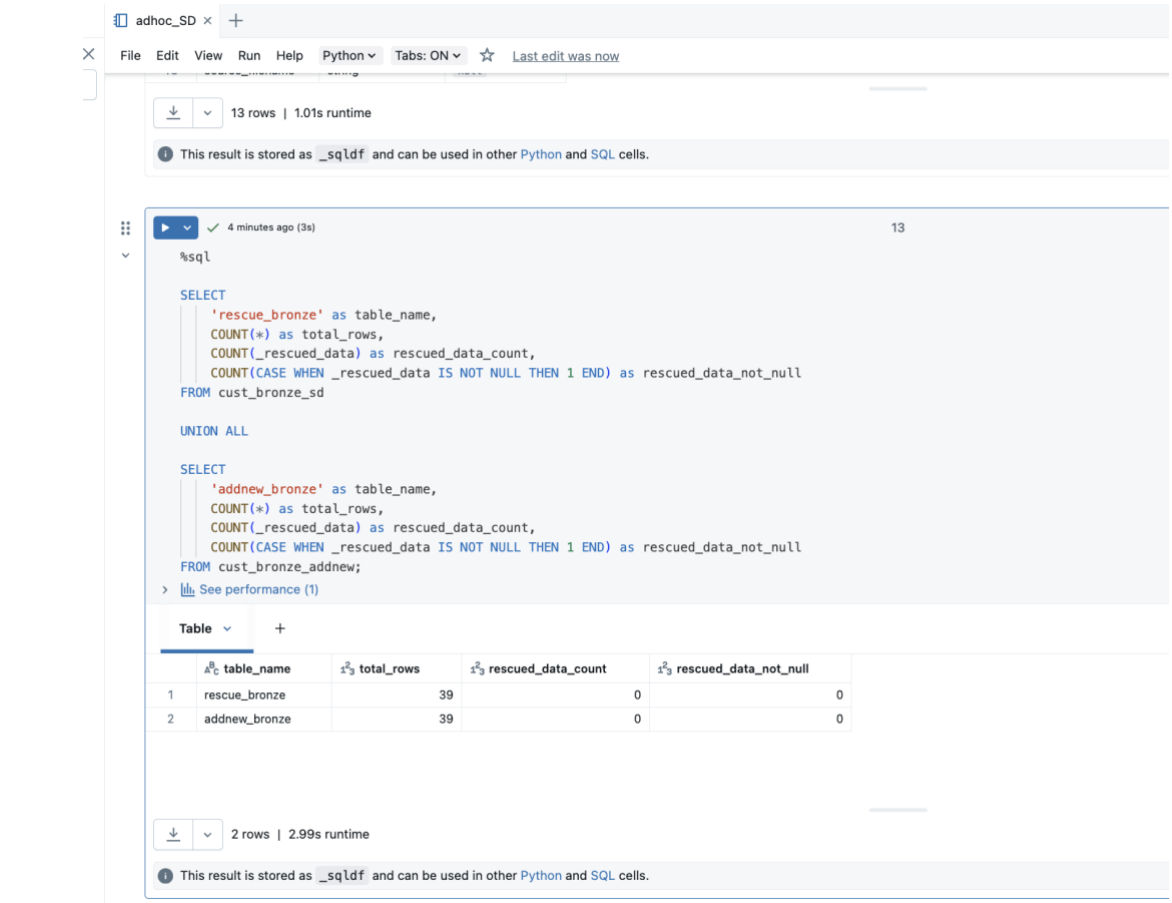
The fix –

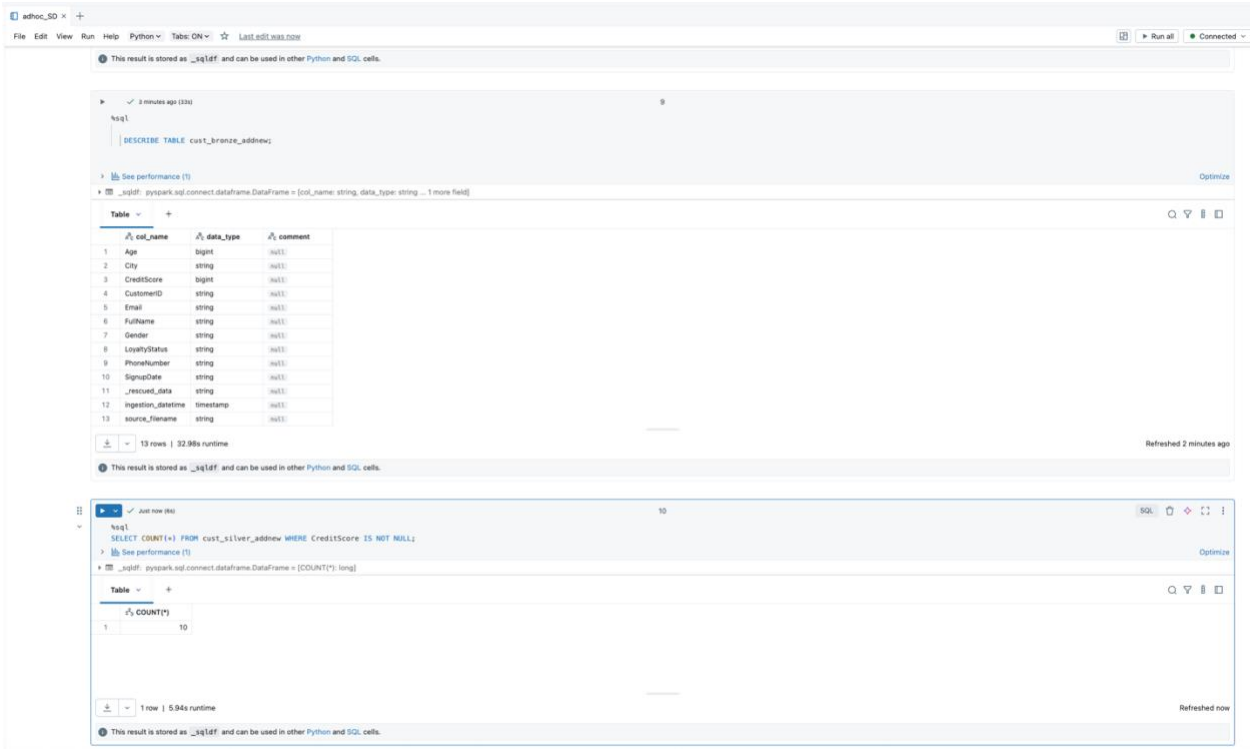
```
# Function to handle adding NEW FIELDS
def process__rescue_data_new_fields(df):

#Add all fields from _rescued_data to key map
df = df.withColumn(
"_rescued_data_json_to_map",
from_json(
col("_rescued_data"),
MapType(StringType(), StringType())
)
)
```

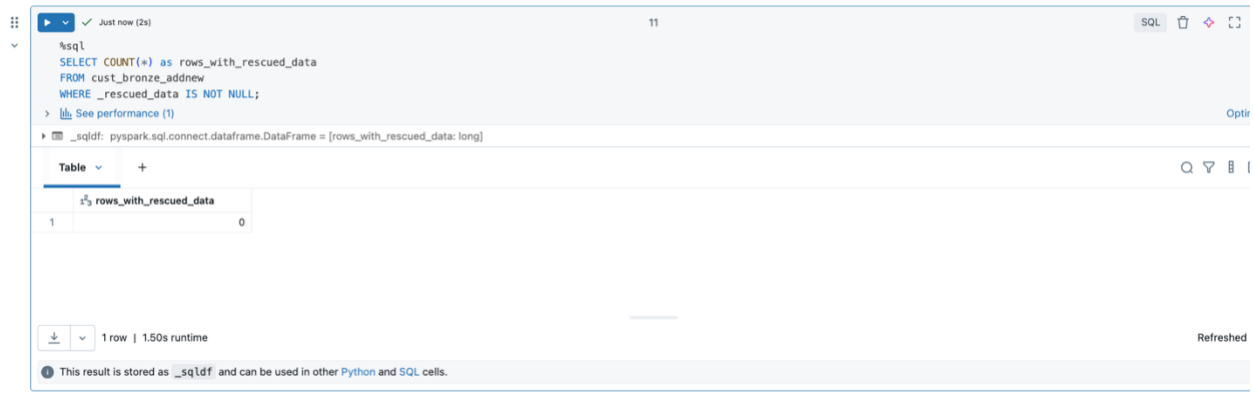
```
# Extract all keys from _rescued_data_map_keys
df = df.withColumn("_rescued_data_map_keys", map_keys(col("_rescued_data_json_to_map")))

# Get all keys in all rows as a new DataFrame
df_keys = df.select(
explode(
map_keys(col("_rescued_data_json_to_map"))
).alias("rescued_key")
).distinct()

# Collect keys as a list (only if df is not streaming)
# If streaming, you must provide the list of possible keys another way
# FIX:
new_keys = [row["rescued_key"] for row in df_keys.collect()] if not df.isStreaming else ["Age", "Gender",
"LoyaltyStatus", "CreditScore"]

# FIx
existing_columns = set(df.columns)

# Add new columns for each key
for key in new_keys:
# FIX:
if key != "_file_path" and key not in existing_columns:
df = df.withColumn(
key,
# FIX:
when(
col("_rescued_data_json_to_map").isNotNull(),
col("_rescued_data_json_to_map").getItem(key)
).otherwise(lit(None)).cast(StringType())
)

#***Ehnancement can be done by adding additional logic
#***  to exclude columns that are already in dataframe(Substract those columns)
#***  to infer datatype for new columns and use infered datatype instead of static stringtype
#***  additionally check if each column exists and dataframe has rows on each transformation and raise exception
before using it

# FIX
df = df.drop("_rescued_data_json_to_map", "_rescued_data_map_keys")

return df
```

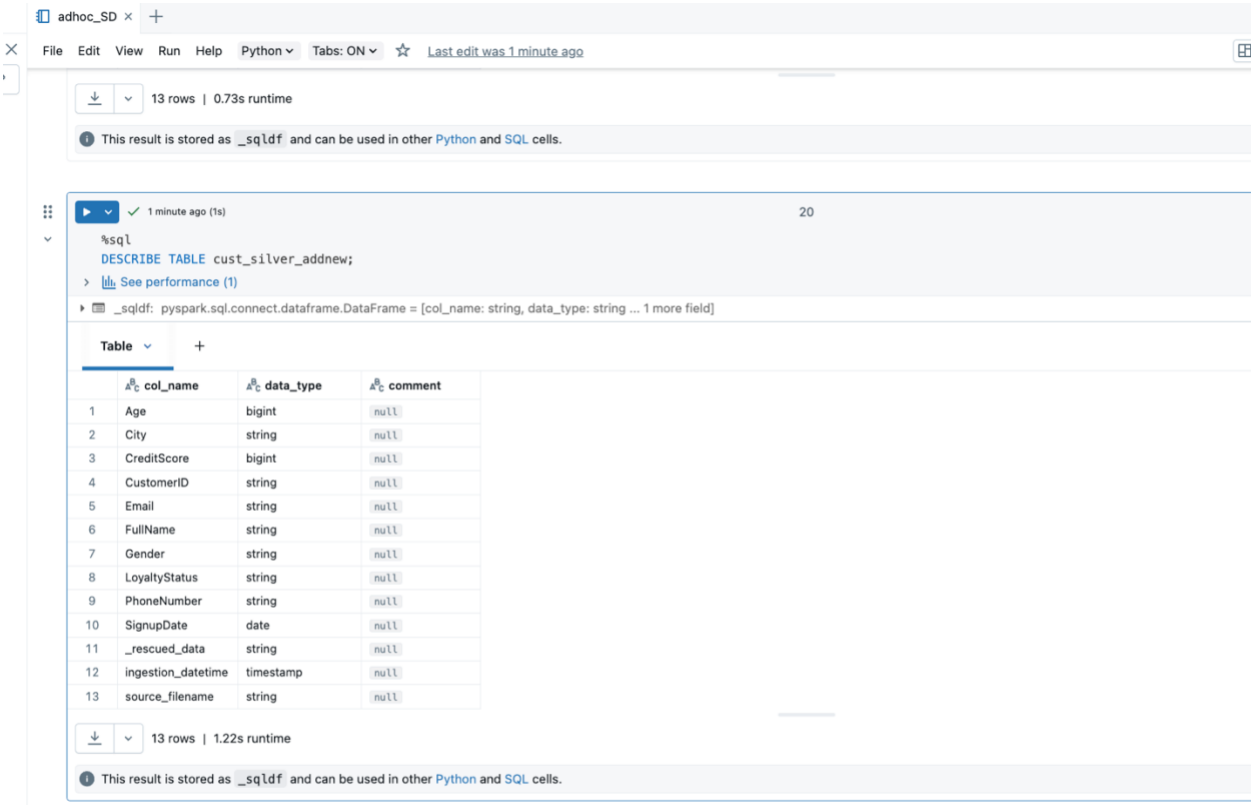
addNewColumn-




adhoc_SD
File Edit View Run Help Python Tabs: ON Last edit was now
13 rows | 1.01s runtime
This result is stored as _sqldf and can be used in other Python and SQL cells.
4 minutes ago (3s)
13
%sql
SELECT
'rescue_bronze' as table_name,
COUNT(*) as total_rows,
COUNT(_rescued_data) as rescued_data_count,
COUNT(CASE WHEN _rescued_data IS NOT NULL THEN 1 END) as rescued_data_not_null
FROM cust_bronze_sd
UNION ALL
SELECT
'addnew_bronze' as table_name,
COUNT(*) as total_rows,
COUNT(_rescued_data) as rescued_data_count,
COUNT(CASE WHEN _rescued_data IS NOT NULL THEN 1 END) as rescued_data_not_null
FROM cust_bronze_addnew;
See performance (1)
Table
table_name total_rows rescued_data_count rescued_data_not_null
1 rescue_bronze 39 0 0
2 addnew_bronze 39 0 0
2 rows | 2.99s runtime
This result is stored as _sqldf and can be used in other Python and SQL cells.


adhoc_SD
%sql
DESCRIBE TABLE cust_bronze_addnew;
Table
col_name data_type comment
13 rows | 32.98s runtime
Refreshed 2 minutes ago
%sql
SELECT COUNT(*) FROM cust_silver_addnew WHERE CreditScore IS NOT NULL;
Table
COUNT(*)
10
1 row | 5.94s runtime
Refreshed now


Just now (2s)
11
SQL
%sql
SELECT COUNT(*) as rows_with_rescued_data
FROM cust_bronze_addnew
WHERE _rescued_data IS NOT NULL;
See performance (1)
_sqldf: pyspark.sql.connect.dataframe.DataFrame = [rows_with_rescued_data: long]
Table
rows_with_rescued_data
1
0
1 row | 1.50s runtime
Refreshed
This result is stored as _sqldf and can be used in other Python and SQL cells.


adhoc_SD
File Edit View Run Help Python Tabs: ON Last edit was 1 minute ago
13 rows | 0.73s runtime
This result is stored as _sqldf and can be used in other Python and SQL cells.
1 minute ago (1s)
20
%sql
DESCRIBE TABLE cust_silver_addnew;
See performance (1)
_sqldf: pyspark.sql.connect.dataframe.DataFrame = [col_name: string, data_type: string ... 1 more field]
Table
col_name
data_type
comment
1 Age bigint null
2 City string null
3 CreditScore bigint null
4 CustomerID string null
5 Email string null
6 FullName string null
7 Gender string null
8 LoyaltyStatus string null
9 PhoneNumber string null
10 SignupDate date null
11 _rescued_data string null
12 ingestion_datetime timestamp null
13 source_filename string null
13 rows | 1.22s runtime
This result is stored as _sqldf and can be used in other Python and SQL cells.
+ Code + Text Assistant
[Shift+Enter] to run and move to next cell
[Cmd+Shift+P] to open the command palette
[Esc H] to see all keyboard shortcuts

1. Code Complexity

Rescue Mode:

- Required many lines of code across two helper functions
- Complex JSON parsing and extraction logic needed
- Manual handling of each new field

AddNewColumns Mode:

- Required less lines of code
- Simple datatype conversion logic
- Automatic handling of new fields

Inference: AddNewColumns mode achieves **95% code reduction**, making it significantly easier to maintain and less prone to bugs.

2. Data Quality Control

Rescue Mode:

- Expectation "_rescued_data IS NULL" enforces data quality
- Schema changes can be reviewed before incorporation
- Provides audit trail of schema evolution

AddNewColumns Mode:

- No manual review step for new fields
- Immediate acceptance of all incoming fields
- Less control over what becomes part of the schema

Inference: Rescue mode prioritizes stringent governance, whereas addNewColumns emphasizes agility over control.

Conclusion

Both schema evolution modes effectively manage dynamic schemas, yet they adhere to distinct organizational philosophies.

- **Rescue mode** = "Control first, automate second" → Best for structured, governed environments
- **AddNewColumns mode** = "Automate first, control when needed" → Best for agile, exploratory environments

The 95% reduction in code complexity achieved with the addNewColumns mode underscores its effectiveness in minimizing the development and maintenance burden for use cases that do not necessitate stringent schema governance. This automatic approach ensures the preservation of data quality while simultaneously reducing the overall workload.