Sample Content for Estimated Cash Flow Preparation Lite – P&C
SAP Profitability and Performance Management
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PUBLIC

Sample Content for Estimated Cash Flow Preparation Lite – Property and Casualty

Processes and Functions Supporting Sample Business Scenarios

Typographic Conventions

Type Style	Description
Example	Words or characters quoted from the screen. These include field names, screen titles, pushbuttons labels, menu names, menu paths, and menu options.
	Textual cross-references to other documents.
Example	Emphasized words or expressions.
EXAMPLE	Technical names of system objects. These include report names, program names, transaction codes, table names, and key concepts of a programming language when they are surrounded by body text (for example, SELECT and INCLUDE).
`Example`	Output on the screen. This includes file and directory names and their paths, messages, names of variables and parameters, source text, and names of installation, upgrade, and database tools.
`Example`	Exact user entry. These are words or characters that you enter in the system exactly as they appear in the documentation.
`<Example>`	Variable user entry. Angle brackets indicate that you replace these words and characters with appropriate entries to make entries in the system.
`EXAMPLE`	Keys on the keyboard, for example, `F2` or `ENTER`.

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1 Introduction and Basics

1.1 About this Guide

This guide provides documentation about the sample content for *Estimated Cash Flow Preparation (ECP) Lite – Property and Casualty*, which can be installed on top of SAP Profitability and Performance Management. This sample content describes a project accelerator, ideas and best practices for a model that calculates GAAP-neutral *Best Estimate Cash Flows (BECF)* for P&C business, which are required for Subledger accounting. In addition, the sample content presents a possible calculation model for the *Exposure Period Split (EPS),* which has a central role in several GAAPs.

This document elaborates on the high-level solution overview of concrete implementations of developed sample content and existing functions of SAP Profitability and Performance Management and their practical usage.

Target Audience

- Business experts
- Solution consultants
- Presales teams

Considerations

It is essential that you familiarize yourself with the content of the corresponding guides and documents related to this topic before beginning with this example. For more information about the available guides and documents, see Related Documentation.

1.2 Constraints

This guide does not provide information about the installation of the sample content. For this purpose, see Related Documentation .

For information about integration with other systems, roles, users and authorization concepts, and for configuration information, see Related Documentation.

Interaction with other SAP applications, for example, SAP ERP, Source Data, Results Data, and BPC is described in the Administration Guide.

1.3 Related Documentation

The following table lists related documents.

Topic	Guide/Tool/Title	Links
• Installation and planning of your system landscape • Activities to keep the system running • Information about how to ensure the required security for your SAP landscape	Administration Guide	Administration Guide
• Operation of SAP NetWeaver	Technical Operations for SAP NetWeaver	https://help.sap.com/viewer/p/SAP_NETWEAVER_701
• Application Help	Detailed Application help for SAP Profitability and Performance Management	SAP Profitability and Performance Management
• SAP HANA Administration Guide	Administration guide for SAP S/4HANA; supported SDA databases	https://help.sap.com/viewer/product/SAP_HANA_PLATFORM/
• SAP Notes		https://launchpad.support.sap.com/

2 Business Background

The insurance and reinsurance industries are currently in the wake of changes. On the one hand, new technologies are emerging, allowing the industries, which rely heavily on massive amounts of data, to store more data and at the same time execute performance-intensive operations on this data. On the other hand, both regulatory and management requirements towards insurance accounting are increasing, for example, with the release of IFRS 17 for insurance contracts or the upcoming LDTI changes for US GAAP.

The *Estimated Cash Flow Preparation Lite – P&C* sample content harnesses this new technology to help insurance companies fulfill the new requirements by bridging the gap between the actuarial department and the technical accounting subledger, bringing these two worlds closer together. It is fully integrated with SAP S/4HANA Financial Products Subledger, allowing a smooth handover from the actuarial world to the world of finance.

Built on SAP S4/HANA, SAP Profitability and Performance Management is a next generation digital performance management solution that provides breakthrough real-time business data aggregation capabilities for SAP and non-SAP systems, a high-speed finance and risk calculation engine, and comprehensive simulation and scenario management.

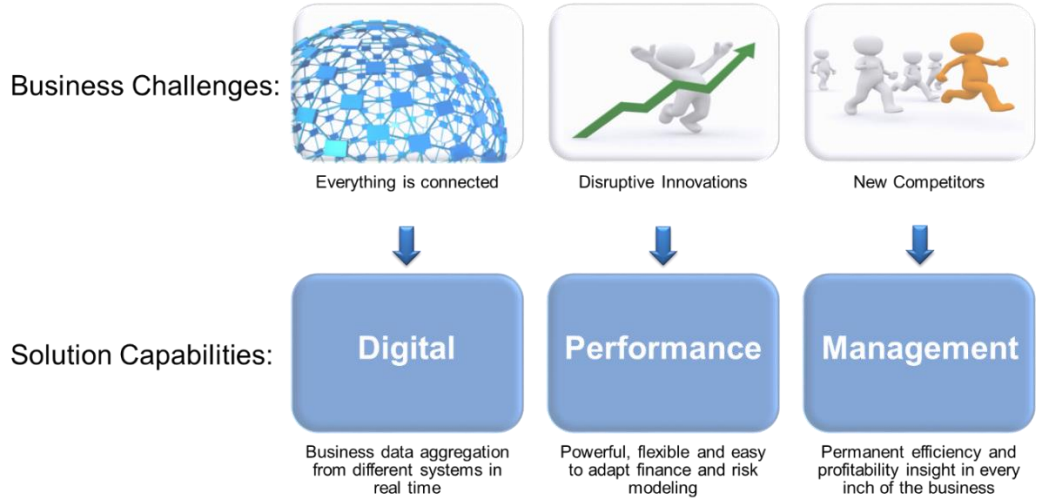


Figure 1: Digital Imperative

3 Estimated Cash Flow Preparation Lite – P&C in Detail

The purpose of the *Estimated Cash Flow Preparation Lite – P&C* sample content is to produce best estimate cash flows and patterns based on assumptions and data provided by actuaries. The intent is to remain GAAP-neutral as far as possible during this processing step, with the target to provide a GAAP-neutral cash flow projection as well as a GAAP-neutral exposure-based pattern that is ready to be processed through the subledger accounting processing steps. Where GAAP specifics are required (for example, GAAP-specific earning or amortization patterns), these can also be created and stored.

The *Estimated Cash Flow Preparation Lite – P&C* sample content consists of the following major parts:

- The first part is the Model Assignment process which gathers the input from actuarial source systems to create a set of key entries (Actuarial Granularity – ACG).
- This set of entries is then used in the second part of the *Estimated Cash Flow Preparation Lite – P&C* sample content, which is triggered by the *ACG*. In this part, the system performs *Best Estimate Cash Flow* (BECF) calculation to create cash flows.
- The third part is the *Exposure Period Split* (EPS) calculation. The EPS results are stored in a separate results data area.

The ACG consumes different kinds of input tables. The following is an overview of all the input tables:

Table Name	View Name	Description
/BA1/HKAPD	/1BC/BI<client><RDA>_____S_SCT_PFD	Actuarial Portfolio Definition
/BA1/HKANA	/1BC/BI<client><RDA>_____S_ANAN	Analytical Attributes
/BA1/HKULT	/1BC/BI<client><RDA>_____S_ULTM	Ultimates
/BA1/HKPAT	/1BC/BI<client><RDA>_____S_FP	Factor Pattern
/BA1/HKRPE	/1BC/BI<client><RDA>_____S_RPE	Exposure Development Pattern
/BA1/HKRPS	/1BC/BI<client><RDA>_____S_RPS	Seasonality Pattern
/BA1/HKLSR	/1BC/BI<client><RDA>_____S_LSR	Loss Ratio
/BA1/HKLFP	/1BC/BI<client><RDA>_____S_LFP	Lag Factor Pattern
/BA1/F2_BT_FLAT	/1BC/EIBT_<client>_FLAT	Business Transaction
/BA1/HKACG	/1BC/BI<client><RDA>_____S_ACG	Actuarial Granularity
/BA1/HKRIC	/1BC/BI<client><RDA>_____S_BECF	Best Estimate Cash Flow
/BA1/F4_FXRATE_F	/1BC/DAMD<client>_BA1_F4_FXRATE_F	Forward Exchange Rates

3.1 Model Assignment

The *Model Assignment* process is used by the Insurance/Reinsurance business process. The *Actuarial Granularity* reflects the most granular business split for which actuarial processes need to model different data objects for a specific business segment. It therefore constitutes the most granular level at which *Best Estimate Cash Flows* are to be produced by the *Estimated Cash Flow Preparation*. In other words, it constitutes the most granular process container. The *Model Assignment* process establishes a link between business/portfolio master data, patterns (*Factor Pattern*, *Lag Factor Pattern*), and *Loss Events* where applicable.

3.1.1 Process Triggers and Other Input

The *Model Assignment* process is triggered by *Calculation and Valuation Process Manager (CVPM)* when it detects that new objects are created, or existing objects are updated in the system.

CVPM observes changes in the storage areas of various objects (*Actuarial Granularity, Actuarial Portfolio Definition* , *Analytical Attributes, Lag Factor Pattern, Factor Pattern, Loss Ratio, Risk Pattern Exposure, Risk Pattern Seasonality, Loss Event, Ultimate Values, Business Transaction, Period-End Processing*). Once a change has occurred, *CVPM* creates a worklist of objects of that type. Subsequently the system runs the necessary CVPM step sequence (for example, for Actuarial Portfolio Definition or Factor Pattern) using a transaction that calls either Model Assignment with a certain trigger type (for example, APD or ANAT) or Estimated Cash Flow Preparation.

Figure 2: CVPM Worklist Structure

The *Model Assignment* process consumes the worklist data created by CVPM and sources the matched data from the FRDP objects (*Analytical Attributes, Factor Pattern, Ultimate Values, Lag Factor Pattern, Risk Pattern Exposure, Seasonality Pattern, Business Transaction, Loss Ratio, Forward Exchange Rates, Best Estimate Cash Flow* and existing *Actuarial Granularity* entries) to obtain additional key information about the objects in the worklist. On top of every sourcing function there is an View function added in order to facilitate partitioning and improve performance.

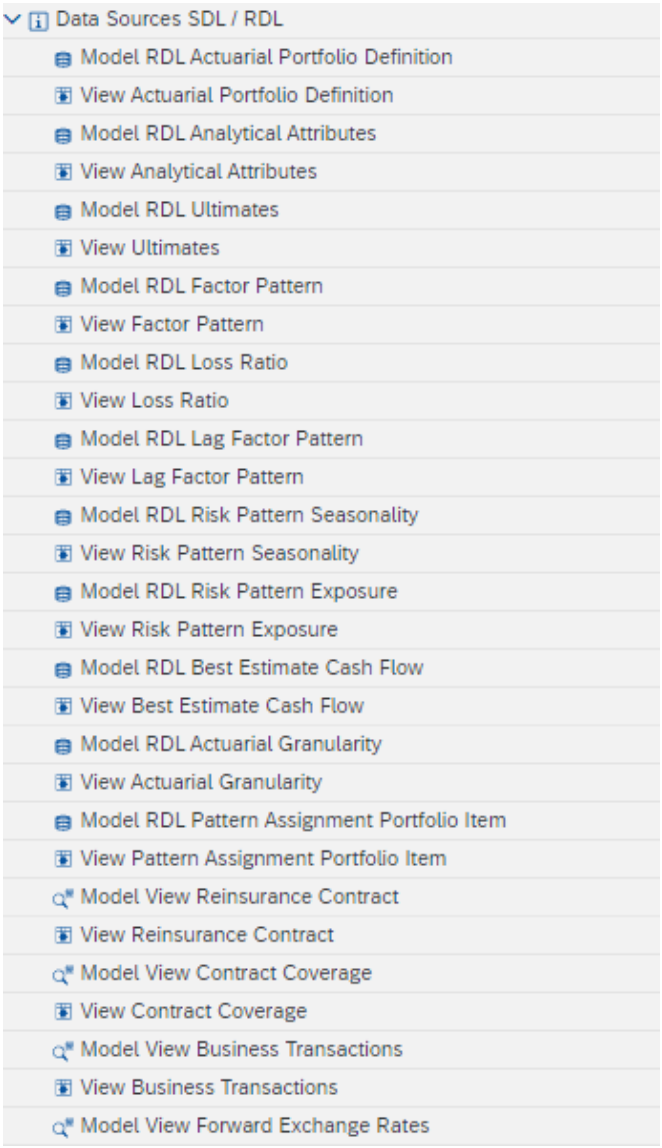


Figure 3: Input View Structure

3.1.2 Assignment Methods

The *Model Assignment* process looks up *Actuarial Granularity* entries that match the triggers in the worklist and updates them if they exist. If an *Actuarial Granularity* entry does not exist, the *Inception* function creates a complete assignment with all the related objects. It also creates *Actuarial Granularity* entries with references to *Portfolio*, *Analytical Attributes*, *Ultimate Values*, *Factor Patterns*, *Risk Pattern Exposure*, *Risk Pattern Seasonality, Loss Ratio* and *Lag Factor Pattern(s)*.

The final functions of the *Model Assignment* process determine the *Version*, *Expectation Change,* and the *Reference Date for Redistribution*.

3.1.3 Define Actuarial Granularity

In the *ECP Lite (P&C)* content, all data is processed at actuarial portfolio level. To do so, you set the Contract Category field (BA1_C55CONTCT) to “4” and enter the name of the respective portfolio in the *Contract ID* field (BA1_C55CONTID).

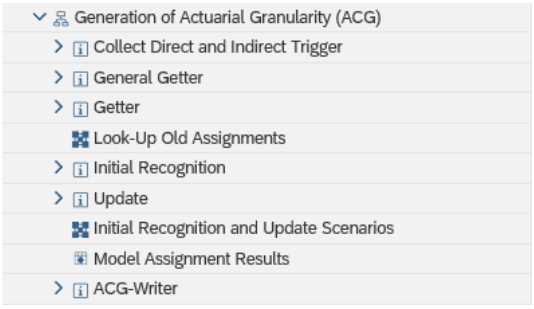


Figure 4: Implementation of Model Assignment

The *Generation of Actuarial Granularity (ACG)* Calculation Unit consists of the following integral parts:

- The sections under *Collect Direct and Indirect Triggers, General Getter* and *Specific Getter* collect data, join all the different data sources, and determine whether an *Initial Recognition (Inception)* or *Update* scenario takes place.
- The *Initial Recognition* scenario/function creates a new *ACG* entry for a specific portfolio and assigns all mandatory triggers.
- The *Update* function checks whether an entry in a given *ACG* already exists. If so, it checks whether the new data is more recent than the existing data. It only updates the specific pattern of the trigger. If the conditions are met, it cancels the existing entries and writes them back in the correct order.
- *The Model Assignment Results function* is the final step before the data is written to the *FRDP* table. It determines the *Expectation Change*, *Version* number and other important fields.

An example for better understanding:

1. On January 1, 2019, the actuarial department has created a new portfolio. They need to upload the data into the system and create the following input tables:
    - Actuarial Portfolio
    - Analytical Attributes
    - Factor Pattern
    - Ultimate
    - Loss Ratio
    - Lag Factor Pattern
2. On February 15, 2019, the actuarial department notices that the factor pattern for the created ACG entry is outdated. They update the input data and load it into the system.

To simplify the process, the created entry is filtered to display the portfolio ID, business date, version number, reference entity and reference business date.

- The portfolio determines the master data.
- The business date is the creation date of this P&C insurance portfolio.
- The version number enables the ACG entry to be sorted chronologically.
- The reference entity separates the input (Actuarial Portfolio Definition = APD, Analytical Attribute = ANAT, Factor Pattern = FPAT, Ultimate = ULT, Loss Ratio = LSR, Lag Factor Pattern = LFP).
- The reference business date represents the business date for this specific input.

These two events will be treated in the following way by the system:

1. Due to the creation of a new portfolio, initial recognition takes place. All the necessary input data is retrieved and merged to create a new ACG entry with version 1.

Portfolio ID	Bus. Date	Ver. Number	Ref. Entity	Ref. Bus. Date
A	2019-01-01	1	APD	2019-01-01
A	2019-01-01	1	ANAT	2019-01-01
A	2019-01-01	1	FPAT	2019-01-01
A	2019-01-01	1	ULT	2019-01-01
A	2019-01-01	1	LFP	2019-01-01
A	2019-01-01	1	LSR	2019-01-01

2. The ACG notices the old ACG entry and collects the data from it. It then updates the FPAT entry with the newly created data and writes the new business date. It is important that it writes version number 2 and that the reference business date is only changed for the updated data.

Portfolio ID	Bus. Date	Ver. Number	Ref. Entity	Ref. Bus. Date
A	2019-02-15	2	APD	2019-01-01
A	2019-02-15	2	ANAT	2019-01-01
A	2019-02-15	2	FPAT	2019-02-15
A	2019-02-15	2	ULT	2019-01-01
A	2019-02-15	2	LFP	2019-01-01
A	2019-02-15	2	LSR	2019-01-01

3.1.4 Expectation Change Category Determination

The *Expectation Change* field, which is derived in the *Model Assignment* process, defines which action is performed on the cash flow. The following change reasons are possible:

- *Inception*
- *Contract Modification*
- *Experience Variance: Model-Driven*
- *Experience Variance: Contract-Based*

- *Assumption Change: Underwriting Risks*
- *Termination*

Accounting Changes	Expectation Change Categories	Description
100	10	Inception
500	30	Contract Modification
505	50	Experience Variance: Model-Driven
506	55	Experience Variance: Contract-Based
600	60	Assumption Change: Underwriting Risks
800	90	Termination

- The *Expectation Change* is set to “10” if inception occurs. This signifies that a new portfolio (with *Version* 1) is created.
- *Contract Modification* indicates a change in the master data.
- The *Experience Variance: Model-Driven* scenario appears only when an update of the trigger *Period-End Processing (PEP)* is executed.
- The *Experience Variance: Contract-Based* scenario indicates a change in information relating to the portfolio (for example, an *Actual* is entered into the system). Therefore, a new *ACG* is created.
- *Assumption Change: Underwriting Risks* determines that an ultimate, a factor pattern, a lag factor pattern, loss ratio or a risk pattern is updated.
- *Termination* represents the end of a portfolio. It is triggered by either updating the respective portfolio with its status set to “Inactive” or by updating the relevant *Ultimate values* with the *Termination indicator* set. After this, no further update will be executed on the respective *ACG*. However, if the object that caused the termination (*Portfolio* or *Ultimate Values*) is updated again with an active status or without the *Termination* indicator respectively, the system updates the relevant *ACGs* again.

3.1.5 Versioning Concept

The *Version Number* field is defined in the *Model Assignment* process. It keeps the ACG entries of one assigned portfolio in a chronological order. Every ACG run creates its own version number. The created version number depends on the following key fields of the ACG table: *Portfolio ID*, *Coverage*, *Cost or Revenue Element* and *Loss Event*.

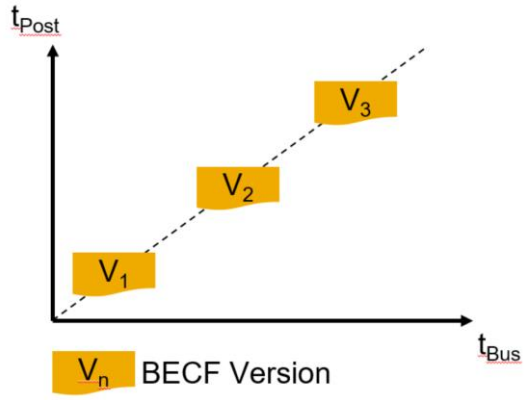


Figure 5: Versioning Concept

The first version created is always an initial recognition scenario and each further version number is triggered when one of the entities of the ACG is updated. Therefore, it is possible that one portfolio has multiple versions.

3.2 BECF Calculation

The *Best Estimate Cash Flows* are calculated in the *Estimated Cash Flow Preparation (ECP)* process. The creation process is divided into the following functional modules (calculation units):

- *Derive Incurred Amounts*
- *Convert Life Cycle*
- *Acknowledge Actuals*
- *Split into Exposure Periods*
- *Account for Passage of Time*

The versioning of the cash flows is carried out by the *Model Assignment* process and stored in the *ACG* as well as the target *Result Data Areas* (*BECF*, *EPS* and *Expectation Change Assignments*). The *ECP* process therefore creates a new cash flow for each version of an *Actuarial Granularity* that is written to the *ACG Result Data Area*, even if this means that the resulting cash flow might be identical to the previous version.

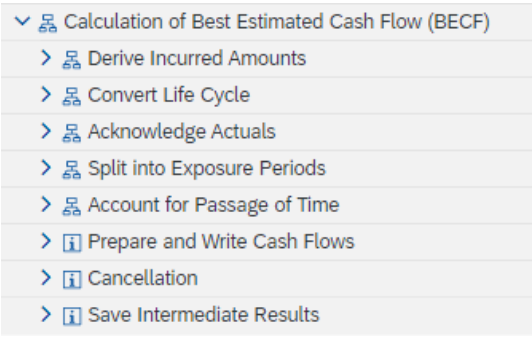


Figure 6: ECP Process Structure

3.2.1 Derive Incurred Amounts

3.2.1.1 Interpolation

The *BECF* is calculated using the input from actuarial tools that provide patterns to *Financial Products Subledger*. A pattern is a series of time points with an amount that represents a balance or a movement, valid for a point in time defined relative to a starting point. However, the time series that come from the actuarial systems do not necessarily match the points in time required for accounting processes.

To ensure the cash flow is fit for purpose, the *Interpolation* function does the following:

- Determination of the *Cash Flow Start Date*

  The start dates defined in the patterns received from the actuarial systems are to be understood as the earliest meaningful start date but do not necessarily match the start date of the respective portfolio. The *Interpolation* function resolves this by moving the start date of the cash flow to the latest of either the portfolio start date, the pattern start date, or the tranche start and tranche end date.

- Determination of the *Incurred Date*

  The patterns received from the actuarial systems contain only timing information that is relative to a starting point. To enable them to be used in the subledger, the *Interpolation* function transforms the relative timing information into absolute dates based on the periodicity set in the *ECP* configuration.

3.2.1.1.1 Date Determination

Some parameters have been created and implemented in the *BECF Calculation* for the date determination. The `DEFAUL_` process has been set up at the calculation unit level with the following parameters:

- *Period Type* (**I_PERIOD_TYPE**) determines the periodicity of the incurred dates (6=Monthly; 7=Yearly; 11=Quarterly). In the Estimated Cash Flow Preparation Lite – P&C content this parameter is set to 6 for the default process.
- *Date Determinant* (**I_DATE_DET**) sets the day of month (in case of quarterly or yearly periodicity, the month will be the last of every period):
  - **1 = Beginning of Period**: The *Incurred Dates* are always set to the first day of the month.
  - **2 = End of Period**: The *Incurred Dates* are always set to the last day of the month.
  - **3 = Middle of Period**: The *Incurred Dates* are always set to the middle of the month depending on the length of the respective month.
  - **4 = Actual Date**: The *Incurred Dates* are set to the same day of the respective period as the *Start Date*. For example, if the *Start Date* is January 12, all *Incurred Dates* in the following period are set to the 12th of the respective period.

- **5 = Day of period**: The *Incurred Date* is always *Day of Month* that has to be specified into the **I_DAY_OF_MONTH** parameter, or the last day of the month if the specified date does not exist in the respective month.

  In the Estimated Cash Flow Preparation Lite – P&C content this parameter is set to 5 for the default process.

- *Day of Month* (**I_DAY_OF_MONTH**) is used only if the *Date Determinant* parameter has been set to 5. For the DEFAUL_ process this parameter is set to 25.

- *Day Count Convention* (**I_DAY_COUNT_CONV**) defines how the portion of a year is determined between two calendar dates. In the Estimated Cash Flow Preparation Lite – P&C content this parameter is set to 5 for the default process. The following methods are available:

  - **0 = US (NASD) 30/360**
  - **1 = Actual/Actual**
  - **2 = Actual/360**
  - **3 = Actual/365**
  - **4 = European 30/360**
  - **5 = German 30/360**

Not all dates are achievable, but several combinations can be made to customize the results. For example, with a start date of 2018-01-16 and a quarterly period type, a new start date of 2018-03-25 (as well as every other date in this month, since as already mentioned the month will always be the last of the period) can be derived by setting *Date Determinant*=5 (*Day of Period*) and *Day of Month*=25. But it cannot be set to February or to a specific date in January (only 1, 15, 16, 31 would be possible). Once the time grid of the incurred cash flow is derived, the *Interpolation* function uses linear interpolation to calculate the incurred amounts at the end of the respective period.

In the following sections the different *Interpolation* functions are explained and their rules are described:

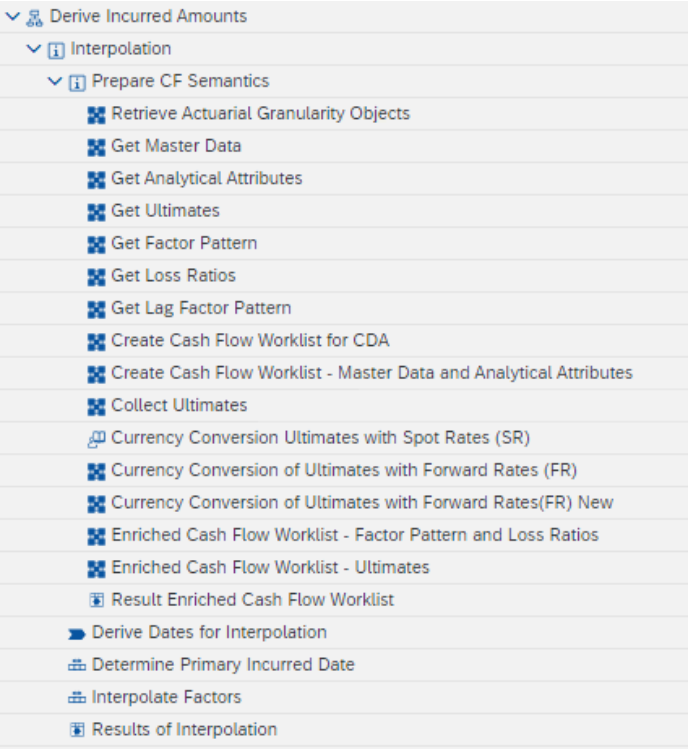


Figure 7: Technical Implementation of Interpolation

3.2.1.2 Non-Life Annuities (Double Trigger)

For P&C there are two fundamentally different risk dimensions relating to claims:

- **Primary Risks** define how claims come into force (for example, mortality risk, disability risk, accident risk, injury risk, unemployment risk).
- **Secondary Risks** define the uncertainties about the size of the payments and for how long they are going to be made (for example, longevity risk, inflation risk, investment risks).

This means that claim payments may be made as lump sum cash flows or in several annuities (non-life annuity cash flows).

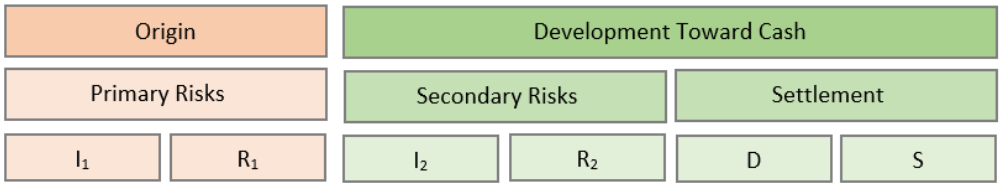


Figure 8: Life Cycle Dates

In the sample content, the dates are represented by the following fields:

- I_1 = *Primary Incurred Date*
- I_2 = *(Secondary) Incurred Date*
- R_1 = *Primary Reported Date*
- R_2 = *(Secondary) Reported Date*

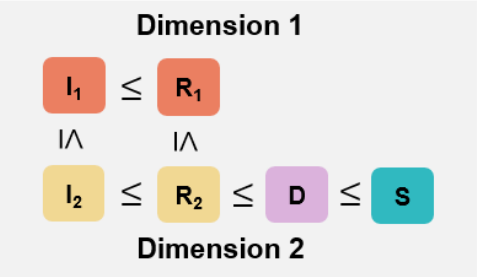


Figure 9: Non-Life Annuity Date Conditions

The *Interpolation* function determines a *Primary Incurred Date* as well as a *(Secondary) Incurred Date* for lump sum and for non-life annuity products:

- For lump sum products, the pattern *Start Date* is determined using the incoming start date/portfolio start date from actuarial source systems.
- For non-life annuity products, due to the boundary conditions shown in the diagram above, the date is determined on top of the start date/portfolio start date by adding the period values for *Primary Incurred Date* to the delivered periods (in other words, I_2 needs to be calculated based on I_1).

Example

I_1 is determined using the relative timing information delivered using the distribution pattern:

- *Pattern Start Date* (PSD)
- *Primary Period End Number* (PPEN)
- *Primary Calculation Frequency Code* (PCFC)

Pattern Start Date	Primary Dev Period	Primary Calendar Frequency Code	Primary Incurred date	Secondary Dev Period	Secondary Calendar Frequency Code	Factor (P&C)
01.01.2018	1	quarterly	01.04.2018	1	monthly	0,25
01.01.2018	2	quarterly	01.07.2018	1	monthly	0,25
01.01.2018	3	quarterly	01.10.2018	1	monthly	0,25
01.01.2018	4	quarterly	01.01.2019	1	monthly	0,25

Figure 10: I1 Assignment (Example)[1]

[1] The Primary Incurred Date is calculated by multiplying the Primary Period End Number with the number of months per period determined by Primary Calculation Frequency Code and adding this result to the month of the Pattern Start Date. In Figure 10 patterns are delivered on quarterly basis, so the first period date for example is calculated by multiplying 1 with 3 (1 quarter has 3 months) and adding this number to the month of the Pattern Start Date.
The day is always based on the PSD (no adjustment). For example, if the PSD is the 16th of the month, the corresponding I1 dates will also start on the 16th.

Pattern Start Date	Primary Dev Period	Primary Calendar Frequency	Primary Incurred date	Secondary Dev Period	Secondary Calendar Frequency	Secondary Incurred date	Factor (P&C)
01.01.2018	1	quarterly	01.04.2018	1	monthly	25.05.2018	0,0833333
01.01.2018	1	quarterly	01.04.2018	2	monthly	25.06.2018	0,0833333
01.01.2018	1	quarterly	01.04.2018	3	monthly	25.07.2018	0,0833333
01.01.2018	2	quarterly	01.07.2018	1	monthly	25.08.2018	0,0833333
01.01.2018	2	quarterly	01.07.2018	2	monthly	25.09.2018	0,0833333
01.01.2018	2	quarterly	01.07.2018	3	monthly	25.10.2018	0,0833333
01.01.2018	3	quarterly	01.10.2018	1	monthly	25.11.2018	0,0833333

Figure 11: I2 Assignment (Example)[2]

3.2.1.2.1 Prepare CF Semantics

All the functions under *Prepare CF Semantics* are required to create the *BECFs*, on which all further *ECP* functions are based.

- The *Retrieve Actuarial Granularity Objects* function retrieves the relevant *ACG* entries from the *CVPM* worklist for the current run and joins them to the corresponding *ACG* entries read from the *RDL*. These items contain all key information to create the *BECF* afterwards.
- The functions *Get Master Data* and *Get Analytical Attributes* assign all information from the portfolio as well as the *Analytical Attributes* to the *ACG* entries. *Create Cash Flow Worklist – Master Data and Analytical Attributes* combines information from the previous two functions.
- In addition, *Get Lag Factor Pattern* determines period values using data from Lag Factor Pattern RDL, which is the preparation of the second *HoldBack Date*. The *Get Loss Ratio* function assigns the loss ratio to the ACG entries.
- The *Collect Ultimates* function retrieves all the required ultimates using the key information from the ACG entries and *Get Ultimates* and *Get Factor Pattern* functions. The *Currency Conversion Ultimates with Spot Rates (SR)* function provides the currency conversion for all ultimate values considered in the past having a different currency than the settlement currency of the portfolio. Furthermore, the function *Currency Conversion of Ultimates with Forward Rates (FR)* retrieves the forward exchange rates for ultimate estimates considered in the future and converts the amounts.
- After reading the key date, the pattern information from actuarial source systems is assigned to the portfolio in *Enrich Cash Flow Worklist – Factor Pattern and Loss Ratios.*
- The *Create Cash Flow Worklist for CDA* function retrieves the change reason information from the different source data depending on the change reason values.

[2] General Interpolation Process

The day is always adjusted (by combining the parameters as explained above) to the 25th of the month (agreement). Distribution of the given factor: In Q1 the given (quarterly) factor is 0.25, this value must be split over three months within the same quarter. Hence the factor for each secondary incurred period is 0.083333.

- The *Result Enriched Cash Flow Worklist* function limits the list of fields to enhance performance of the following *ECP* process.

3.2.1.2.2 Derive Dates for Interpolation

The derivation rule used in the *Derive Dates for Interpolation* function determines the ultimates' cash flow *Start Dates*. The system writes the results to the *Results* field in the *Action* box (`ECP_PAT_STR_DATE_SHIFT`).

Based on the start dates determined in this step, the *Determine Primary Incurred Date* function calculates the primary incurred date, as well as the minimum primary incurred date according to the selected calendar frequency code.

3.2.1.2.3 Interpolation Functions

Since pattern information that comes from actuarial source data can have different periodicity values (for example, daily, monthly, and yearly), the *Interpolation* function is expected to create a pattern structure based on a consistent periodicity for all pattern items within one partition.

The structure adopts the day count convention that is defined in each of the rule types (RT).

> Note:
> The day count convention settings need to be consistent for all rule types. The day count conventions German30/360 and ACTUAL/ACTUAL are available. German30/360 means that every month is considered to have 30 days and one year consists of 360 days.

The user can configure a monthly, quarterly, or yearly pattern output structure. In addition to the creation of the missing pattern items, the *Interpolation* function also calculates the missing pattern values.

The functionality comprises the following rule types:

- *Term Conversion*
- *Term Target*
- *Term Selection*
- *Term To Date*
- *Value Conversion*
- *Formula*

These rule types work in sequence, starting with the rule type *Formula.*

Implementation Structure:

1. *Formula*
2. *Value Conversion* > `MOVTOBAL` *Values of Movement* items become balanced values (running total)
3. *Term Target*

4. *Value Conversion* > `BALTOMOV`
5. *Term Selection*
6. *Term to Date*

Detailed description of the rule types:

- The rule type (RT) *Formula* is used twice to convert the terms with different periodicity delivered by the source systems into a common basis of days, taking into account the day count convention set up in the rule type. First the *Development Period End (DPE)* values (based on days) are determined followed by the determination of *Development Period Start* values derived by *DPE*.
- RT *Value Conversion* either converts delta values (movements) into cumulative values (balances), also known as a running total (`MOVTOBAL`), or the other way around where the delta values are computed from a series of cumulative values (`BALTOMOV`). The key field for this is *Pattern Key Figure Type,* which determines whether the *CF Item* is a delta or balance type. In the implementation, the first *Value Conversion* is used to convert delta values into balanced values because the mathematical interpolation of the pattern values can be ensured on a balanced basis only. The second *Value Conversion* converts the balanced values of the pattern items originally imported into movement/delta items because the function must ensure the original pattern key figure type.
- RT *Term Target* creates a pattern structure according to the “period type” setting and the day count convention set in the UI.

  Note:

  In preparation for the second *Value Conversion*, all pattern items originally delivered are still part of the result. In addition, it fills the missing pattern values of the newly created pattern items with the interpolated values.
- RT *Term Selection* filters the results from the second RT *Value Conversion* for all period-end items according to the *Period Type* settings (monthly, quarterly or yearly) and according to the day count convention chosen. This rule type also computes a period to value and unit for each CF item that is needed in the RT *Term To Date* afterwards.
- RT *Term to Date* determines the incurred dates for each CF item by taking into account the *Period Type*, the *Start Date* of the pattern and the *Period Number* provided by the RT *Term Selection*.

The rule type sequence described above is used in Estimated Cash Flow Preparation Lite - P&C to interpolate factors.

Figure 12: Technical Implementation of Interpolation

Results of Interpolation is used to reduce the number of fields to those needed by the functions that follow, and thereby improve system.

The purpose of the *Interpolation* process is to ensure that the calculated cash flows are available in the required periodicity. This is done by using the factor pattern input. The actuarial source data might not match the points in time required for the accounting processes, in which case it has to be interpolated in order to convert the cash flows into the desired target periodicity and calculate missing patterns items.

As shown in the graphical example below, in the input only some pattern information is given, represented by the blue bars. The *Interpolation* process uses linear interpolation, and hence calculates the missing values, which are represented by the green bars.

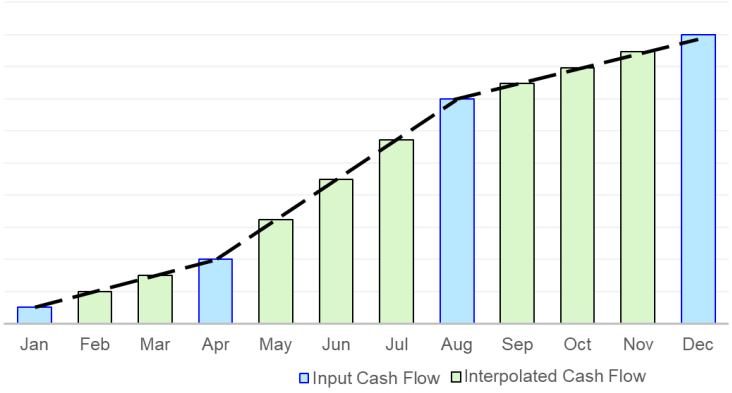


Figure 13: Pattern Linear Interpolation

The input pattern can be delivered in different periodicities (daily, monthly, quarterly, or yearly). In addition, it can be made in in the following items:

- Movement items: The given percentage values represent delta values, which show the movement since the last time point to the current time point.
- Balance items: The given values represent cumulative values, which show the accumulated value from the start of the pattern to the current time point.

The following example shows a factor pattern of the type movement with monthly output periodicity and the *Pattern Start Date* on January 1.

In the factor pattern input, information about five periods is given with the time frames between the period ends not being the same. The period end values are 1, 4, 6, 9, and 12. In case of movement pattern, the given factor values are delta values, showing the change in value since the last period.

Portfolio ID	Cost or Revenue Element	Pattern KF Type	Pattern Start Date	Period Type	Period To	Factor
PORTF_A	Premium	MOV	01.01.21	Month	1	0.1
PORTF_A	Premium	MOV	01.01.21	Month	4	0.3
PORTF_A	Premium	MOV	01.01.21	Month	6	0.3
PORTF_A	Premium	MOV	01.01.21	Month	9	0.1
PORTF_A	Premium	MOV	01.01.21	Month	12	0.2

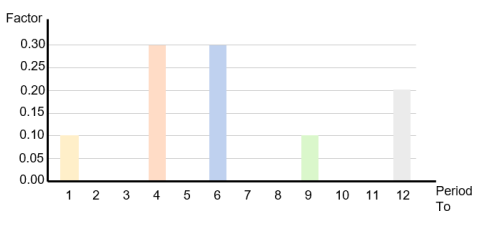


Figure 14: Movement Type of Factor Pattern Before Interpolation

The *Interpolation* process distributes the factors, obtaining an equal distribution for each month by splitting up the given values. For example, the value of 0.3, which was given with period end 4, is distributed equally across period 2, 3, and 4. Also the other input patterns are split up, so that all missing periods are assigned a factor value.

Portfolio ID	Cost or Revenue Element	Pattern KF Type	Pattern Start Date	Period Type	Period To	Factor
PORTF_A	Premium	MOV	01.01.21	Month	1	**0.100**
PORTF_A	Premium	MOV	01.01.21	Month	2	**0.100**
PORTF_A	Premium	MOV	01.01.21	Month	3	**0.100**
PORTF_A	Premium	MOV	01.01.21	Month	4	**0.100**
PORTF_A	Premium	MOV	01.01.21	Month	5	**0.150**
PORTF_A	Premium	MOV	01.01.21	Month	6	**0.150**
PORTF_A	Premium	MOV	01.01.21	Month	7	**0.033**
PORTF_A	Premium	MOV	01.01.21	Month	8	**0.033**
PORTF_A	Premium	MOV	01.01.21	Month	9	**0.033**
PORTF_A	Premium	MOV	01.01.21	Month	10	**0.067**
PORTF_A	Premium	MOV	01.01.21	Month	11	**0.067**
PORTF_A	Premium	MOV	01.01.21	Month	12	**0.067**

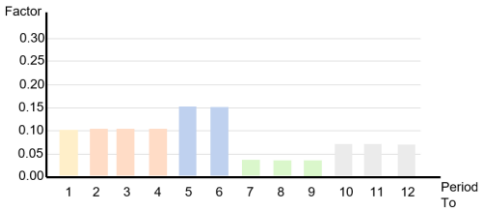


Figure 15: Movement Type of Factor Pattern After Interpolation

After the factor pattern has been interpolated, the correct *Incurred Date* is being calculated. To calculate the *Incurred Date*, among others, the following information has to be provided:

- Pattern Start Date
- Parameters[3]
  - `I_PERIOD_TYPE`
  - `I_DATE_DET`
  - `I_DAY_OF_MONTH` (not mandatory)
- Specified period end value of the pattern item

Since our periodicity is monthly and our start date is January 1, the first *Incurred Date* is January 31. The same logic applies to the other periods which leads to the incurred dates shown in the following figure:

Portfolio ID	Cost or Revenue Element	Pattern KF Type	Pattern Start Date	Period Type	Period To	Factor	Incurred Date
PORTF_A	Premium	MOV	01.01.2021	Month	1	0.100	**31.01.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	2	0.100	**28.02.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	3	0.100	**31.03.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	4	0.100	**30.04.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	5	0.150	**31.05.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	6	0.150	**30.06.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	7	0.033	**31.07.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	8	0.033	**31.08.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	9	0.033	**30.09.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	10	0.067	**31.10.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	11	0.067	**30.11.2021**
PORTF_A	Premium	MOV	01.01.2021	Month	12	0.067	**31.12.2021**

[3] For more information about parameters potential values and their influence on dates determination, see "Date Determination" part

Figure 16: Incurred Date Calculation

3.2.1.3 Scaling

After the *Interpolation* process has derived the time grid of the incurred cash flow and aligned its timing information to the respective portfolio, the *Scaling* process calculates the incurred amounts based on the volume information of the respective portfolio.

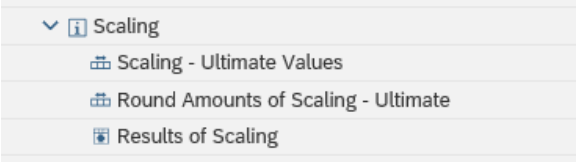


Figure 17: Technical Implementation of Scaling

For P&C business the actuarial systems provide a time series of factors that add up to 100% per *Cost or Revenue Element*, as well as the respective *Ultimate Value*, which represents the overall amount that is expected to be incurred over the life of a portfolio for a given *Cost or Revenue Element*. In this case, the *Scaling* process distributes the *Ultimate Value* over time by multiplying it with the respective factors (*Scaling - Ultimate Values*). For claims, the ultimate value is multiplied by the percentage value of the factor pattern as well as the loss ratio. However, for all other *Cost or Revenue Elements*, it is only multiplied by the factor pattern.

3.2.2 Convert Life Cycle

Financial Product Subledger concept introduces the life cycle concept, which documents the transition of an amount through its five life cycle stages: Ultimate, Incurred, Reported, Due and Settled. The life cycle concept in *ECP Lite (P&C)*, however, is implemented using only three life cycle stages, namely Ultimate, Incurred and Settled. To support this concept, *ECP Lite (P&C)* enriches the input received from the actuarial systems with the respective life cycle information.

While the transition from *Ultimate* to *Incurred* is already taken care of when the incurred cash flow is created in *Interpolation* and the *Scaling* of *ECP Lite (P&C)*, the *Life Cycle Conversion* performs the shift from an incurred amount to become settled.

The transition between these two life cycle stages is done using the *Period-Independent* approach, where lag factor patterns are applied to the respective dates and amounts.

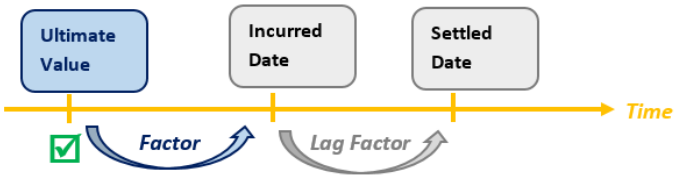


Figure 18: Period Independent Life Cycle Approach

3.2.2.1 Currency Conversion

This function converts the currencies of amounts for both estimated cash flow items and actuals. The conversion uses spot rates for estimates that occur in the past and actuals. The business dates are used to determine the correct spot rates for actuals, and the calculated *Incurred Dates* are used for estimates. The currency conversion function is implemented three times within *ECP Lite (P&C)*.

The first conversion functions are in the *Prepare CF Semantics* process in *Derive Incurred Amounts*. Both functions convert the ultimate values either using spot rates or forward exchange rates.

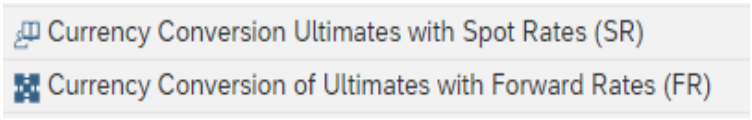


Figure 19: Currency Conversion Before Interpolation

- The *Currency Conversion Ultimates with Spot Rates (SR)* function converts ultimate values that are considered in the past or that have a date equal to the current date. The conversion therefore first identifies the affected items and uses spot rates. The pattern start date should be used as reference date. If this date is not available, the portfolio start date is used instead.
- The *Currency Conversion of Ultimates with Forward Rates (FR)* function converts all cash flow items considered in the future. First, it identifies the affected ultimate values and then applies forward exchange rates for the conversion.

The second set of conversion functions comes right after the Interpolation function. There the actuals will be converted.

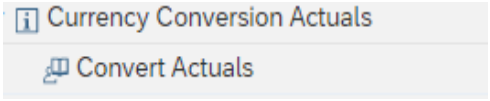


Figure 20: Currency Conversion After Interpolation

- The *Convert Actuals* function retrieves all actuals and converts them using their business dates to apply the correct spot rates.

The third set of conversion functions comes right before the BECF is written to the Result Data component and contains sub functions that convert cash flow items from settlement currency into the expected payment currency (EXP) at header level as well as into the actual payment currency (ACT). The functions ending with “(SR)” and “(FR)” work in a similar way as the functions in the first two sets of conversion functions.

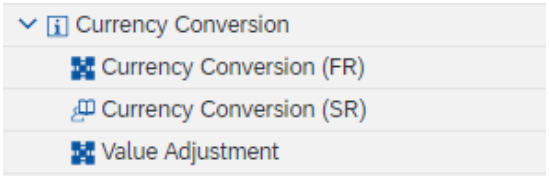


Figure 21: Currency Conversion Before the Writing of BECF Results

- The *Currency Conversion (FR)* function retrieves the forward rates needed to convert the cash flow items of BECF using the *Enriched Cash Flow Worklist – Ultimates* function as input. All amounts with an incurred date greater than the current date are converted in this function.
- The *Currency Conversion (SR)* function converts all cash flow items (including estimates and actuals) where the incurred date is prior to or equal to the current date. Spot rates are used for the conversion.
- The *Value Adjustment* function gathers the results of both currency conversion functions installed prior to it. It provides a rounding function for actuals that have been split in order to ensure that the total sum of the cash flow after the split is the same as the amount of the incoming actual.

3.2.2.2 Data Preparation: Cash Flow Stream

The purpose of this part is to fetch information about the Actuals (BTs) and enrich it to be used it in the Currency Conversion.

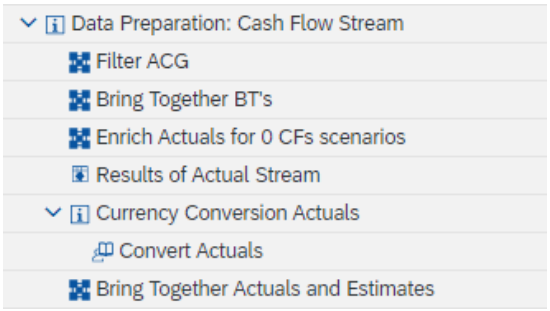


Figure 22: Data Preparation for Currency Conversion and Life Cycle Conversion

The following functions are used:

- The *Filter ACG* function retrieves all the business transactions that match the key of *Portfolio ID*, *Loss Event ID*, *Cost or Revenue Element* and have a business date that is earlier than (or equal to) the *Last Acknowledgement Date*[4] in the corresponding *ACG* entry. It also sets the `ECP_CF_IND` indicator for *Settled Actuals* to '04' based on the transaction type.

  The *Bring Together BT's* function also makes use of the *cut-off date*, which was introduced to avoid retaining business transactions that are not needed for current process or future processing. The function *Get BT with MEC* only keeps business transactions with a *business date* later than the *cut-off date*, which can be beneficial for performance reasons. Note that the cut-off date field does not necessarily need to be filled.
- The *Enrich Actuals for 0 CFs scenarios* function prepares the cash flows resulting from the actuals with information that indicates that those actuals refer to *Ultimates* that have a value of 0.

[4] The *Last Acknowledgement Date* represents the date on which the actuals were acknowledged the last time. This means that whenever an actual comes into the system, the *Last Acknowledgement Date* is set to the *Key Date* in the *Model Assignment* process.

- The *Results of Actual Stream* function deletes fields, which are not necessarily needed in the following process.
- The *Bring Together Actuals and Estimates* function is a Union All between *Results of Scaling* and *Convert Actuals* with some field mappings.

3.2.2.3 Period-Independent Approach

The period-independent approach to *Life Cycle Conversion* relies on *Lag Factor Patterns*, which provide information about when parts of a given amount transition to the subsequent life cycle stage.

Example of a *Lag Factor Pattern* for the transition from the incurred to the settled life cycle stage:

Type	Lag (in months)	Factor
Incurred to Settled	0	0.2
Incurred to Settled	1	0.5
Incurred to Settled	2	0.3

The period-independent *Life Cycle Conversion* splits the amounts according to the *Lag Factor Pattern* and determines the respective life cycle dates. This provides the same options as it does for the creation of the incurred cash flow:

- **Beginning of Period**: The dates are always set to the first day of the period.
- **End of Period**: The dates are always set to the last day of the period.
- **Middle of Period**: The dates are always set to the middle of the period.
- **Day of Period**: Only applicable if the period is month. The dates are always specified days of the month or the last day of the month if the specified date does not exist in the respective month.
- **Actual Date**: The dates are set to the same day of the respective period as the *Date* field. For example, if the value of the *Date* field is January 12, all *Life Cycle Date fields* are set to the 12th of the respective period. If the period is not month, the last month of the period is used.

Although ECP Lite (P&C) only uses the *Incurred Date* and the *Settled Date*, the *Reported Date* (Primary and Secondary) and the *Due Date* still have to be set, since they are part of the Model RDL, to which the results will be written in the end. Therefore, all of the dates mentioned are set to the *Incurred Date* in the *Life Cycle Conversion* in *ECP Lite (P&C)*.

Pattern Start Date	(Secondary) Incurred Date	Primary Reported Date	(Secondary) Reported Date	Due Date	Calendar Frequency	Ultimate Amount	Incurred Amount	Lag	Factor	Settled Date	Settled Amount
2018-01-01	2018-05-25	2018-05-25	2018-05-25	2018-05-25	monthly	25,000.00	10,000.00	0	0.2	2018-05-25	2,000.00
2018-01-01	2018-05-25	2018-05-25	2018-05-25	2018-05-25	monthly	25,000.00	10,000.00	1	0.5	2018-06-25	5,000.00
2018-01-01	2018-05-25	2018-05-25	2018-05-25	2018-05-25	monthly	25,000.00	10,000.00	2	0.3	2018-07-26	3,000.00

2018-01-01	2018-06-25	2018-06-25	2018-06-25	2018-06-25	monthly	25,000.00	15,000.00	0	0.2	2018-06-25	3,000.00
2018-01-01	2018-06-25	2018-06-25	2018-06-25	2018-06-25	monthly	25,000.00	15,000.00	1	0.5	2018-07-25	7,500.00
2018-01-01	2018-06-25	2018-06-25	2018-06-25	2018-06-25	monthly	25,000.00	15,000.00	2	0.3	2018-08-25	4,500.00

3.2.2.3.1 Implementation of Period-Independent Life Cycle Conversion

All cash flows (estimates and actuals) pass through this sequence of functions. The lag factors are joined to the cash flows and are then life cycled.

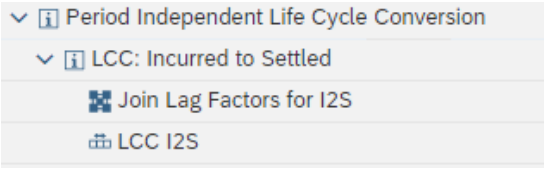


Figure 23: Technical Implementation of Period-Independent LCC

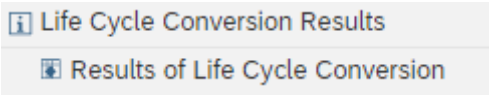


Figure 24: Technical Implementation LCC Results

The period-independent approach is performed by the following functions:

- The *Join Lag Factors for I2S* function joins the lag factors for *Incurred to Settled* with the estimates (in other words, ECP_CF_IND=01) of the cash flow stream that come from the *Data Preparation: Cash Flow Stream* section (the *Bring Together Actuals and Estimates* function). It then also joins the actuals (in other words, ECP_CF_IND=04) from the *Bring Together Actuals and Estimates* function. The *LCC I2S* function converts the cash flows to determine the *Settled Date* and the *Settled Amount*.
- The *Results of Life Cycle Conversion* function reduces the number of fields from the *LCC I2S* function by deleting unnecessary fields. It also performs the mapping of the *Incurred Date* to the *Reported Date* (Primary and Secondary) and the *Due Date*.

3.2.3 Acknowledge Actuals (Regime Calculations)

Although the *Best Estimate Cash Flows* ultimately only reflect estimates, it is important to also consider the actuals, which are delivered to SAP S/4 HANA *Financial Products Subledger* via *Business Transactions*. Since the actuals are delivered directly to SAP S/4 HANA *Financial Products Subledger* for documentation, *ECP Lite (P&C)* needs to make sure that the actuals are no longer part of the estimates to avoid double recognition in the *subledger*. Within *ECP Lite (P&C)* this task is handled by the *Regime Calculations* process.

In order to correctly deduct the actuals from the estimates, the life cycle stage of the actuals first needs to be clear. This can be determined based on the *Transaction Type* and the *Posting Date*. The *Posting Date* of an incoming premium payment, for example, represents the “settled” life cycle stage. Based

on the respective life cycle date, the actuals are sorted into the estimated cash flows that were calculated in prior functions.

The relevant life cycle stage for the acknowledgement is the incurred time. Therefore, as a next step the *Regime Calculations* process needs to determine the *Incurred Date* in case it has not been delivered. This is done by matching the actuals with the estimates.

The cash flows are matched using the following criteria:

- Period type
- Match basis
- Dates

The system first checks if there is a match in the same period ("same period match"; depending on the period type parameter). If there is no match of the actuals and the estimates within the same period, it moves on to the past period ("past period match"). This means that the system checks if there is an estimate in the past of the actual, which can be matched. If this is not the case either, future period match is done, i.e. it is checked if there is an estimate in the future to be matched with the actual.

The Match Basis configuration ensures that only the necessary match logic can be executed (i.e. if a match is found in the same period, the past period match as well as the future period match will not be performed anymore). This further improves the performance of the function. The *Primary Reported Date*, *Secondary Reported Date* and *Due Date* are set as optional, since *ECP Lite (P&C)* does not intend to differentiate between the *Incurred, Reported* and *Due Dates*. Hence, the system only needs to apply the match logic based on the *Settled Date* alone.

Primary Incured Date	Secondary Incurred Date	Primary Reported Date	Secondary Reported Date	Due Date	Settled Date
2018-05-25	2018-05-25	2018-05-25	2018-05-25	2018-05-25	2018-05-25
2018-05-25	2018-05-25	2018-05-25	2018-05-25	2018-05-25	2018-06-25
2018-05-25	2018-05-25	2018-05-25	2018-05-25	2018-05-25	2018-07-25
2018-06-25	2018-06-25	2018-06-25	2018-06-25	2018-06-25	2018-06-25
2018-06-25	2018-06-25	2018-06-25	2018-06-25	2018-06-25	2018-07-25
2018-06-25	2018-06-25	2018-06-25	2018-06-25	2018-06-25	2018-08-25
					2018-08-01

Figure 13: Determination of the Missing Prior Dates (R, D, S) for P&C, Applying the Match&Enrich Logic[5]

In the example above, the *Primary Incurred Date* is inferred based on the estimates that are in the same settled period as the actual (*Match&Enrich* logic; same period match). If the delivered date (i.e. the *Settled Date*) is prior to all the estimates' I_1 dates, the system assigns the same as the delivered date (all other dates follow the same approach).

After the matching was done, the actuals are split to the matched estimates, the actuals are enriched with the corresponding dates and in the end the *Settled Amount* for the actuals is calculated. This is done by using the following formula:

[5] Green lines represent estimates, blue lines represent actuals.

$$Settled\ Amount = Actual\ Amount * \frac{Matched\ Estimate\ Amount}{Sum\ of\ Matched\ Estimates}$$

Once the actuals have been assigned an *Incurred Date*, split and enriched, acknowledgement can take place. Since the treatment of actuals can be different depending on how reliable the information is at the time of the calculation, the *Regime Calculation* function must determine the cash flow regime that each individual actual is in. In the *ECP Lite (P&C)* sample content, the following cash flow regimes are considered:

- Estimated Future
- Follow Estimates
- Follow Actuals

In each of the regimes, the impact of the actuals on the *Best Estimate Cash Flow* is different. The regime that a cash flow item or actual is considered to be in is based on its *Incurred Date*, the key date of the cash flow and the respective *HoldBack Date* for a given portfolio.

Acknowledgement of Actuals (AoA) has been implemented in accordance with the following rules:

- R_1 to be filled with R_2, i.e. R_1 to be filled with I_2, since R_2 is filled with I_2.
- I_1 has to be derived with the same logic explained above (I_1 <= I_2; cardinality between I_1 and I_2 is 1:n). In case of single trigger cash flows, $I_1 = I_2$ and $R_1 = R_2$.

I_1	I_2	R_1	R_2	D	S
Interpolation	Interpolation	I_2	I_2	I_2	Life Cycle Conversion
I_1 matched record	I_2 matched record	R_1 matched record	R_2 matched record	D matched record	Input Data Settled BT

3.2.3.1 Regime Determination

The regime is determined for each individual cash flow item, irrespective of whether it is an estimate or an actual. This is done based on the *Incurred Date* and its position relative to the regime boundaries.

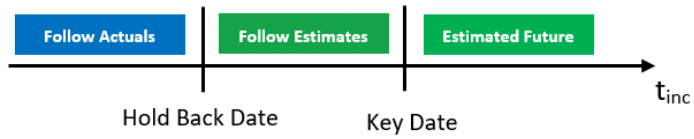


Figure 14: Acknowledgement of Actuals Regimes

All the relative boundary information is readily available, as it is delivered to *Financial Products Subledger* from source systems (*HoldBack Date*) or determined during *Model Assignment* (*Key Date* of the cash flow).

3.2.3.2 Follow Actuals

The first cash flow regime is the *Follow Actuals Regime*, in which estimates originating from the actuarial model are no longer considered to be valid and only the future impact of actuals.

Incurred	Reported	Due	Settled	Amount
~~2017-02-01~~	~~2017-02-01~~	~~2017-02-01~~	~~2017-02-01~~	~~30.00 €~~
~~2017-02-01~~	~~2017-02-01~~	~~2017-02-01~~	~~2017-03-01~~	~~20.00 €~~
~~2017-02-01~~	~~2017-02-01~~	~~2017-02-01~~	~~2017-04-01~~	~~30.00 €~~
2017-02-01	2017-02-01	2017-02-01	2017-04-05	60.00 €
~~2017-02-01~~	~~2017-02-01~~	~~2017-02-01~~	~~2017-05-01~~	~~20.00 €~~
~~2017-03-01~~	~~2017-03-01~~	~~2017-03-01~~	~~2017-03-01~~	~~30.00 €~~
~~2017-03-01~~	~~2017-03-01~~	~~2017-03-01~~	~~2017-04-01~~	~~20.00 €~~
2017-03-01	2017-03-01	2017-03-01	2017-04-05	40.00 €
~~2017-03-01~~	~~2017-03-01~~	~~2017-03-01~~	~~2017-05-01~~	~~30.00 €~~
~~2017-03-01~~	~~2017-03-01~~	~~2017-03-01~~	~~2017-06-01~~	~~20.00 €~~
~~2017-04-01~~	~~2017-04-01~~	~~2017-04-01~~	~~2017-04-01~~	~~30.00 €~~
2017-04-01	2017-04-01	2017-04-01	2017-04-05	60.00 €
~~2017-04-01~~	~~2017-04-01~~	~~2017-04-01~~	~~2017-05-01~~	~~20.00 €~~
~~2017-04-01~~	~~2017-04-01~~	~~2017-04-01~~	~~2017-06-01~~	~~30.00 €~~
~~2017-04-01~~	~~2017-04-01~~	~~2017-04-01~~	~~2017-07-01~~	~~20.00 €~~

Figure 15: Follow Actuals Logic

3.2.3.3 Follow Estimates

Actuals with an *Incurred Date* that is later than the *HoldBack Date* and that is earlier than or the same as the *Key Date* of the respective cash flow version are assigned to the *Follow Estimates Regime*. During this cash flow regime, the aim is to keep the estimated ultimate as well as the distribution of the ultimate over the incurred time in line with the model. To do so, the impact of actuals is countered equally by creating estimate adjustments that carry the same life cycle information (*Incurred* and *Settled Date*) and the inverted amount of the actual cash flow item they are based on.

Incurred	Reported	Due	Settled	Amount
2017-04-01	2017-04-01	2017-04-01	2017-05-01	20.00 €
2017-04-01	2017-04-01	2017-04-01	2017-06-01	30.00 €
2017-04-01	2017-04-01	2017-04-01	2017-07-01	20.00 €
2017-07-01	2017-07-01	2017-07-01	2017-07-01	90.00 €
2017-07-01	2017-07-01	2017-07-01	2017-08-01	60.00 €
2017-07-01	2017-07-01	2017-07-01	2017-09-01	90.00 €
2017-07-01	2017-07-01	2017-07-01	2017-10-01	60.00 €
2017-10-01	2017-10-01	2017-10-01	2017-10-01	90.00 €
2017-10-01	2017-10-01	2017-10-01	2017-11-01	60.00 €
2017-10-01	2017-10-01	2017-10-01	2017-11-21	40.00 €
2017-10-01	2017-10-01	2017-10-01	2017-11-21	- 40.00 €
2017-10-01	2017-10-01	2017-10-01	2017-12-01	90.00 €
2017-10-01	2017-10-01	2017-10-01	2017-12-04	80.00 €
2017-10-01	2017-10-01	2017-10-01	2017-12-04	- 80.00 €
2017-10-01	2017-10-01	2017-10-01	2018-01-01	60.00 €

Figure 16: Follow Estimates Adjustments

3.2.3.4 Estimated Future

The *Estimated Future Regime* is determined for all cash flow items with an *Incurred Date* that is later than the key date to the respective cash flow version. As actuals are only considered up until the key date, the *Estimated Future Regime* does not include any impact from actuals and therefore only consists of estimates.

3.2.3.5 Implementation of Regime Calculations

The following functions calculate cash flows based on their regimes:

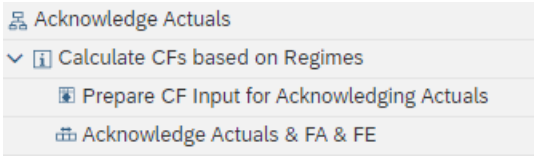


Figure 17: Technical Implementation of Regime Calculations

- The *Prepare CF Input for Acknowledging Actuals* function prepares the input for the Acknowledgement of Actuals function as required. The cash flow regime is initiated, and estimates are marked with a flag to distinguish them from actuals.
- The *Acknowledge Actuals & FA & FE* function has six rules:

  The first three rules perform the past, same and future period match while the others determine the regime of each cash flow and conduct the regime calculation for Follow Actuals and Follow Estimates.

  1. *Acknowledge Actuals*:
     - Determines the missing life cycle dates for actuals.
     - Matches the actuals based on the period type to the estimates based on the Settled Date and based on the match basis (Same Period/ Past Period/ Future Period Match).
     - Proportionally splits the amount (`CF_SETTLED_AMOUNT`) in each actual CF based on the amount in each of the matching estimates.
     - Takes the missing dates for the actuals from the matched estimates.
     - The full CF is then prepared by bringing together all the estimates and actuals into one stream.
     - Regime Determination (`ECP_CF_REGIME`): based on the *Incurred Date* in the CF, the regime is determined for each CF (estimate and actual):
       - Estimated Future ('04')
         Incurred Date > *Key Date* and *Incurred Date* > *HoldBack Date*
       - Follow Estimates ('03')
         Incurred Date <= *Key Date* and *Incurred Date* > *HoldBack Date*
       - Follow Actuals ('01')
         Incurred Date <= *HoldBack Date*
  2. *CF Regime: Follow Actuals:*
     - Only actual CFs are retained in this regime.
     - Estimates are not available in this regime.
  3. *CF Regime: Follow Estimates:*
     - For every actual that is considered in this regime, a corresponding negative estimate is created.
     - The original estimates are retained as they are.

3.2.4 Split into Exposure Periods

Based on the incurred cash flows, the *Exposure Period Split* aligns the premiums and commissions with the risk exposure of the portfolio, providing the information as to which part of an expected premium payment covers claims of a certain period. Since this information is required for subsequent process steps and provides valuable information for *Financial Products Subledger* and for reporting, *ECP Lite (P&C)* stores the results of the *Exposure Period Split* in a separate results data area.

There are the following methods to perform the *Exposure Period Split*:

- Firstly, there is the general EPS approach, in which risk profiles are applied to the exposure periods in order to distribute the premiums and commissions. This is the default approach. In this approach the *model-based Risk Profile Matrix (RPM)* is calculated based on the following inputs:
    - The duration of the underlying portfolio from the *Incurred Factor Pattern*.
    - *Risk Development Pattern*: This pattern describes how the underwriting risk develops over time relative to the life cycle of the portfolio.
    - *Seasonality Pattern*: This pattern represents the risk distribution over the course of one year. This approach is mainly used to calculate risks related to weather conditions or policyholder behavior at certain times of the year (for example, to determine the exposure for insurance portfolios covering flood or windstorm claims that tend to naturally occur in certain seasons).
- Secondly, the EPS without Risk Profiles approach distributes the premiums and commissions equally across all exposure periods (i.e. in this case there are no risk profiles considered).
- The last approach is referred to as the “Simplified Approach”, which is used for all other *Cost or Revenue elements* (other than premiums and commissions). Here the amounts are adapted from the AoA cash flow stream and the *Exposure Dates* are set to the *Incurred Dates*.

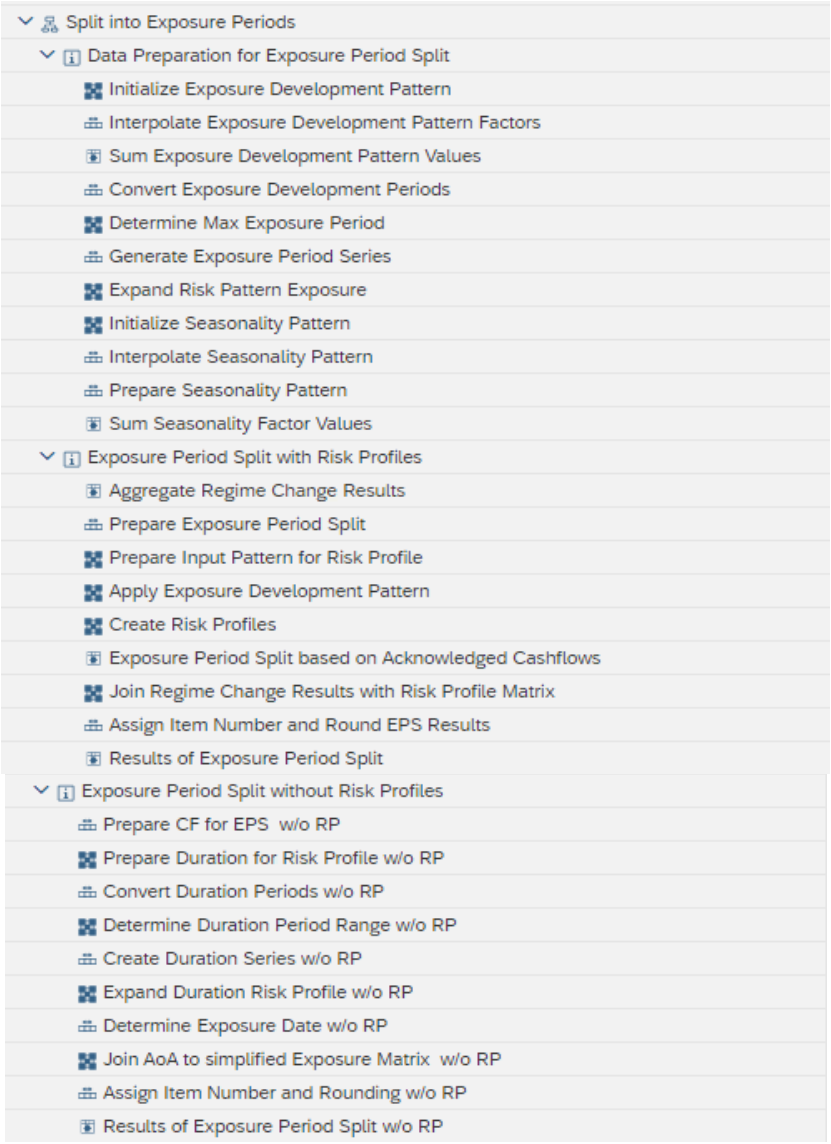


Figure 18: Technical Implementation of Exposure Period Split

3.2.4.1 Data Preparation for Exposure Period Split

The following functions are used to prepare data needed to determine the risk profiles for Exposure Period Split calculation for P&C line of business:

- The *Initialize Exposure Development Pattern* function collects the input data of the exposure development pattern for the current run.
- The function *Interpolate Exposure Development Pattern Factors* ensures that the Exposure Development Pattern calculates the missing factor values based on the given input periodicity.
- The functions *Sum Exposure Development Pattern Values* and *Convert Exposure Development Periods* adjust the Exposure Period boundaries by converting them into the desired output periodicity.

- The *Determine Max Exposure Period* function detects the maximum exposure period that allows you to generate a discrete time series of exposure periods with a monthly step size in the *Generate Exposure Period Series* function.
- The *Expand Risk Pattern Exposure* function expands the risk pattern by joining the newly generated exposure period series and performs value adjustment for the exposure factor value.
- The *Initialize Seasonality Pattern* function collects the input data of seasonality pattern for the current run.
- The *Interpolate Seasonality Pattern* function calculates the missing seasonality factor values.
- The *Prepare Seasonality Pattern* function prepares the seasonality pattern, so that it is ready to be used in the Exposure Period Split.
- The *Sum Seasonality Factor Values* function calculates the sum of the seasonality factor values per period, depending on the required output periodicity.

3.2.4.2 Exposure Period Split

The following functions are used to calculate the Exposure Period Split based on risk profiles for P&C line of business:

- For this *EPS* process, the cash flow stream coming from the *Regime Calculations (RC)* function is grouped based on incurred period in the *Aggregate Regime Change Results* function.
- The *Prepare Exposure Period Split* function then computes development period split factors required in case the portfolio does not start at the beginning of the month but later. The function also determines a calculation type for each set of cash flow data (per partition) and converts the Duration value into the required output periodicity.
- The *Prepare Input Pattern for Risk Profile* function splits each incurred period of a cash flow item into exposure periods by using the value of the *Duration* field.
- The *Apply Exposure Development Pattern* function assigns the *Exposure Development Pattern* to the corresponding cash flows.
- The *Create Risk Profiles* function applies the *Seasonality Pattern,* if given, to the cash flow. In addition, it computes the risk profile factors for each cash flow item per incurred period.
- The *Exposure Period Split based on Acknowledged Cash Flows* view function aggregates the exposure periods of the same month per incurred period to create the final *EPS* matrix.
- The *Join Regime Change Results with Risk Profile Matrix* function assigns the RPM to the cash flows from *RC,* where the *Incurred Date* of RPM is equal to the *Incurred Date* of the *RC* CF item. On top it computes the risk profile amounts by multiplying the aggregated settlement amounts with the risk profile factors.
- The *Assign Item Number and Round EPS Results* function rounds the amounts of the cash flow and assigns an item number to each cash flow item.

- Finally, the *Results of Exposure Period Split* view function adds several values to the final cash flow (for example, EPS category flag '010') and reduces the number of fields to provide only the fields required.

Since exposure and seasonality patterns are not needed in IFRS 17, a partially parallel, simplified approach has been implemented, the Exposure Period Split without Risk Profiles.

3.2.4.3 Exposure Period Split without Risk Profiles

The following functions are used to calculate the Exposure Period Split based on an evenly distributed risk profile structure over the time of exposure periods for P&C line of business:

- The *Prepare CF for EPS w/o RP* function computes development period split factors required in case the portfolio does not start at the beginning of the month but later. The function also determines a calculation type for each set of cash flow data (per partition) and converts the duration value into the required output periodicity.
- The *Prepare Duration for Risk Profile w/o RP* function adjusts the duration value and splits the cash flow items into two periods in case that portfolio start is not the first day of the month.
- The *Convert Duration Periods w/o RP* function adjusts the duration periods and determines the exposure development split factor.
- The *Determine Duration Period Range w/o RP* function detects the maximum duration period in order to be able to generate a discrete time series of duration periods with a monthly step size in the *Create Duration Series w/o RP* function.
- The *Expand Duration Risk Profile w/o RP* function expands the seasonality pattern by joining the newly generated duration period series. Hence, this function extends the pattern in accordance with the number of adjusted duration periods to represent the distribution into exposure periods.
- The *Determine Exposure Date w/o RP* function assigns an exposure date to each cash flow item.
- The *Join AoA to simplified Exposure Matrix w/o RP* function aggregates the results of the risk profile matrix calculation and joins them to the results of Acknowledge Actuals. In addition, it computes the final risk profile amounts.
- The *Assign Item Number and Rounding w/o RP* function rounds the amounts of the cash flow and assigns an item number to each cash flow item.
- The *Results of Exposure Period Split w/o RP* function adds several values to the final cash flow (e.g. EPS category flag '020') and restricts the number of fields to provide only the fields required.

3.2.5 Account for Passage of Time (Redistribution)

The *Redistribution* process takes care of the passage of time by redistributing the differences between the estimates (based on actuarial assumptions) and the actuals, into future periods. This method

follows the assumption that even though the actuarial assumptions did not match the actuals, the underlying amounts have been incurred but are delayed with regards to reporting. Based on this assumption, the *Redistribution* process only adjusts the settled life cycle, leaving the incurred life cycle as it was estimated by the actuaries.

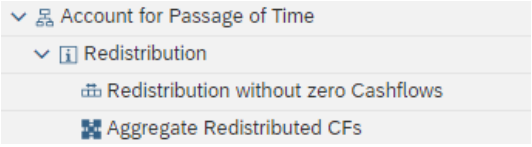


Figure31: Technical Implementation of Account for Passage of Time

The *Redistribution* process provides the following two methods: *Single Deferral (Snow Plough)* and *Spread Deferral (Snow Cannon)*. Since the *Spread Deferral* method requires estimates in future periods to be available, the *Single Deferral* method acts as a fallback option if *Spread Deferral* is the preferred method and there are no future estimates available.

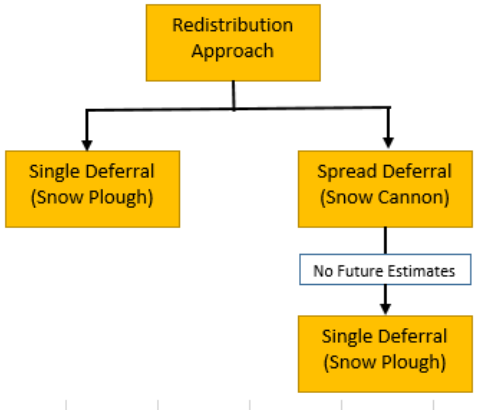
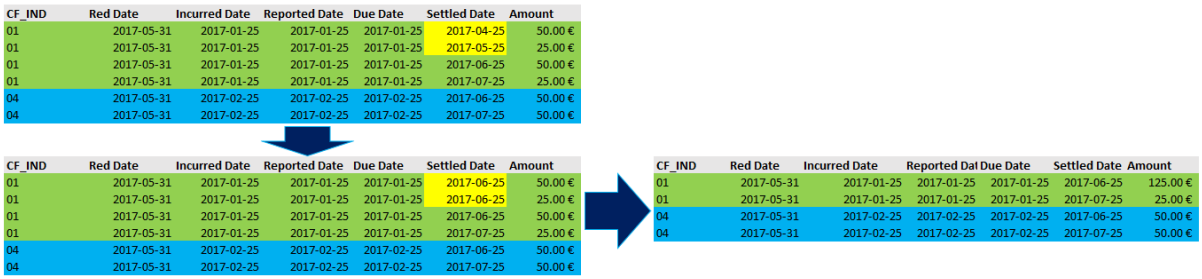


Figure 32: Redistribution Decision Tree

The *Redistribution with Zero Cash Flow* function redistributes all records prior to the redistribution date. A record is prior to this date if the *Settled Date* of an estimate is no later than the last day of the period of the redistribution date.
Due to the value adjustment, zero cash flows must be processed separately. At the end of the process, the results are aggregated.

3.2.5.1 Single Deferral (Snow Plough)

Instead of using future estimates, the deferral process redistributes remaining estimates to the earliest possible future period. This method applies when *Single Deferral* is specified as the preferred method. It also applies when *Spread Deferral* is specified as the preferred method but there are no future estimates available to distribute the remaining estimates to.



CF_IND	Red Date	Incurred Date	Reported Date	Due Date	Settled Date	Amount
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-04-25	50.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-05-25	25.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-06-25	50.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-07-25	25.00 €
04	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-06-25	50.00 €
04	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-07-25	50.00 €

CF_IND	Red Date	Incurred Date	Reported Date	Due Date	Settled Date	Amount
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-06-25	50.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-06-25	25.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-06-25	50.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-07-25	25.00 €
04	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-06-25	50.00 €
04	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-07-25	50.00 €

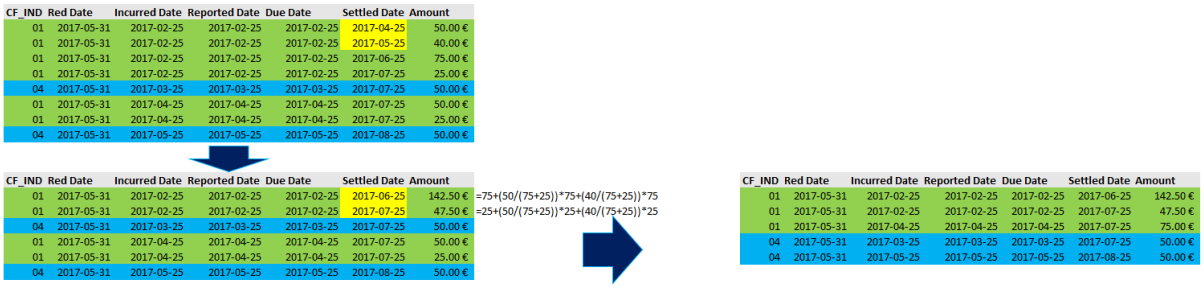
CF_IND	Red Date	Incurred Date	Reported Dat	Due Date	Settled Date	Amount
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-06-25	125.00 €
01	2017-05-31	2017-01-25	2017-01-25	2017-01-25	2017-07-25	25.00 €
04	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-06-25	50.00 €
04	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-07-25	50.00 €

Figure 33: Snow Plough Example

When the *Snow Plough* method is used and the record is prior to the redistribution date, the *Value Date* (i.e. the Settled Date) field is set to the period after the redistribution date. If no aggregation happens, all dates defined in cleanup fields are set to initial.

3.2.5.2 Spread Deferral (Snow Cannon)

This method distributes the remaining estimates to future estimates with an incurred date in the same period as the remaining estimates. For the distribution of the remaining estimates, the *Redistribution* process uses the amounts of the future estimates as a distribution key.



CF_IND	Red Date	Incurred Date	Reported Date	Due Date	Settled Date	Amount
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-04-25	50.00 €
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-05-25	40.00 €
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-06-25	75.00 €
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-07-25	25.00 €
04	2017-05-31	2017-03-25	2017-03-25	2017-03-25	2017-07-25	50.00 €
01	2017-05-31	2017-04-25	2017-04-25	2017-04-25	2017-07-25	50.00 €
01	2017-05-31	2017-04-25	2017-04-25	2017-04-25	2017-07-25	25.00 €
04	2017-05-31	2017-05-25	2017-05-25	2017-05-25	2017-08-25	50.00 €

CF_IND	Red Date	Incurred Date	Reported Date	Due Date	Settled Date	Amount	
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-06-25	142.50 €	=75+(50/(75+25))*75+(40/(75+25))*75
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-07-25	47.50 €	=25+(50/(75+25))*25+(40/(75+25))*25
04	2017-05-31	2017-03-25	2017-03-25	2017-03-25	2017-07-25	50.00 €	
01	2017-05-31	2017-04-25	2017-04-25	2017-04-25	2017-07-25	50.00 €	
01	2017-05-31	2017-04-25	2017-04-25	2017-04-25	2017-07-25	25.00 €	
04	2017-05-31	2017-05-25	2017-05-25	2017-05-25	2017-08-25	50.00 €	

CF_IND	Red Date	Incurred Date	Reported Date	Due Date	Settled Date	Amount
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-06-25	142.50 €
01	2017-05-31	2017-02-25	2017-02-25	2017-02-25	2017-07-25	47.50 €
01	2017-05-31	2017-04-25	2017-04-25	2017-04-25	2017-07-25	75.00 €
04	2017-05-31	2017-03-25	2017-03-25	2017-03-25	2017-07-25	50.00 €
04	2017-05-31	2017-05-25	2017-05-25	2017-05-25	2017-08-25	50.00 €

Figure 19: Snow Cannon Example

When the *Snow Cannon* method is used and the record is prior to the redistribution date, the amount of the record is allocated proportionally to the other records with the same entries in the granularity fields. If there are none, the *Snow Plough* method is used as a fallback option.

3.2.6 Prepare and Write Cash Flows

In this section, the actuals are filtered out and the estimated amounts are aggregated based on common values for the relevant characteristics.

The *Prepare CFs: Clear out Actuals* function clears the actual date information in the cash flows arising from actuals.

The *Get ACGs to produce the Zero Cash Flows* function sets a flag for only those ACGs where the sum of the estimates is 0. These 0 estimates are then joined with the remaining ACG entries in the *Get ACGs with Termination Ind. To produce the Zero CFs* function.

The *Join Results of Zero CFs and Prep. ECP* function then brings together all CFs arising out of ACGs that have non-zero values, i.e. the results of the *Prepare CFs: Clear out Actuals* function, and 0 CFs arising out of ACGs that produce only 0 values, i.e. *Get ACGs with Termination Ind. To produce the Zero CFs* function.

The *Currency Conversion* section was already described earlier in this document (see section “Currency Conversion” in “Convert Life Cycle”).

The *Results of Estimated Cash Flow Preparation* function collects the converted BECF entries and decreases the number of fields by deleting fields, which are not necessary.

The *Bring Together Cancellation and BECF Cash Flows* function combines the BECF results with the cancellation cash flows.

Once all cash flows are ready to be written, the storage of the results in the corresponding Result Data Layer tables can take place.

The *All Results for Exposure Period Split* function collects the result data from the following functions before it passes them to the writer function: *Results of EPS*, *Results of EPS IFRS* and *Terminated CF items*.

The *Store Results of Exposure Period Split* function determines the Result Data Area and Result Type, to which the *Write Results of Exposure Period Split* function should write the EPS results.

The *Store Results of Cash Flows* function determines the Result Data Area and Result Type, to which the *Write Results of Cash Flows* function should write the BECF results.

The *Store Change Driver Results of Cash Flows* function determines the Result Data Area and Result Type, to which the *Write Change Driver Results of Cash Flows* function should write the Expectation Change results.

The *Trigger Writing of Results from BECF, EPS, CHD* function joins all of the above-mentioned Writer functions.

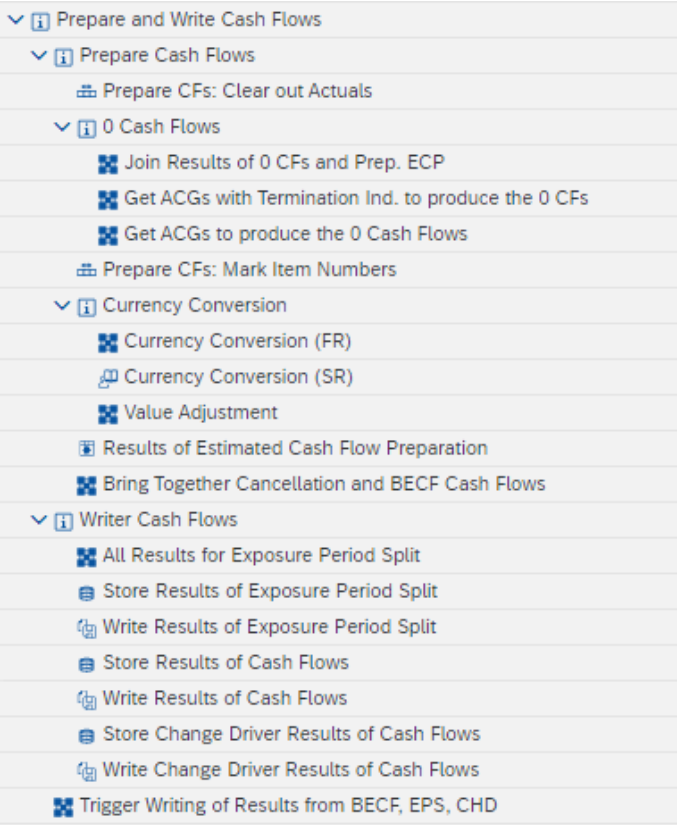


Figure 20: Technical Implementation of Prepare and Write Cash Flows

3.2.7 Cancellation

There are two possible *Cancellation* scenarios:

1. *Update* with *Key Date* < Old *ACG Key Date* (a model change occurs that affects previous *ACG* entries): All entries with a higher Key Date are cancelled. A new entry is written and all old entries with a higher key date are written again. To keep the sequence stable for the *Capture* process step, subsequent *ACGs* are updated with a new *version* number.
2. A specific entry is cancelled by the user: The *Model Assignment* function cancels the specific *BECF version* and all the subsequent versions. To keep the sequence stable for the *Capture* process step, subsequent *ACGs* are updated with a new *version* number.

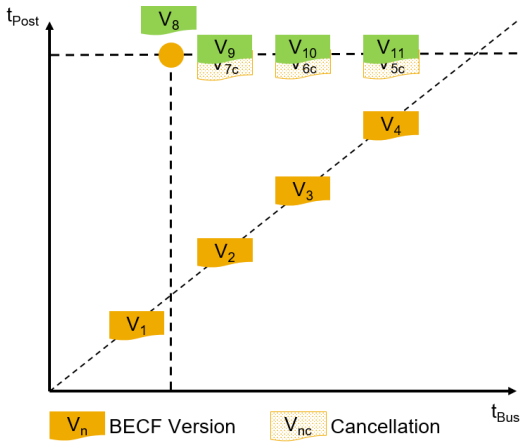


Figure 21: Cancellation Scenario 1

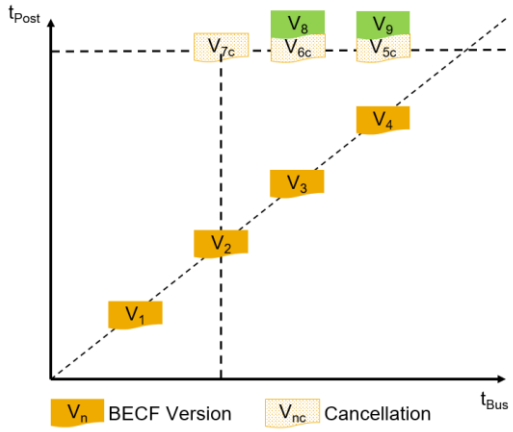


Figure 22: Cancellation Scenario 2

In the *Actuarial Granularity Objects – Aggregated* function, the *ACG* objects with a *Cancellation Indicator* (flag) are retrieved and aggregated.

Then, in the *Join Cancellation Ind. with BECF* function, the corresponding *BECFs* are retrieved from the *RDL* to be cancelled. The results of *Cancellation* are retrieved in the *Bring Together Cancellation and BECF Cash Flows* function, before the newly calculated *BECFs* are written to *RDL*.

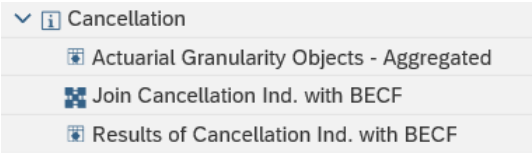


Figure 38: Cancellation Implementation Functions

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