Loan Matching 2.0

Implementation Details

26 May 2022

Last updated: 6 Oct 2022

Objective & Scope

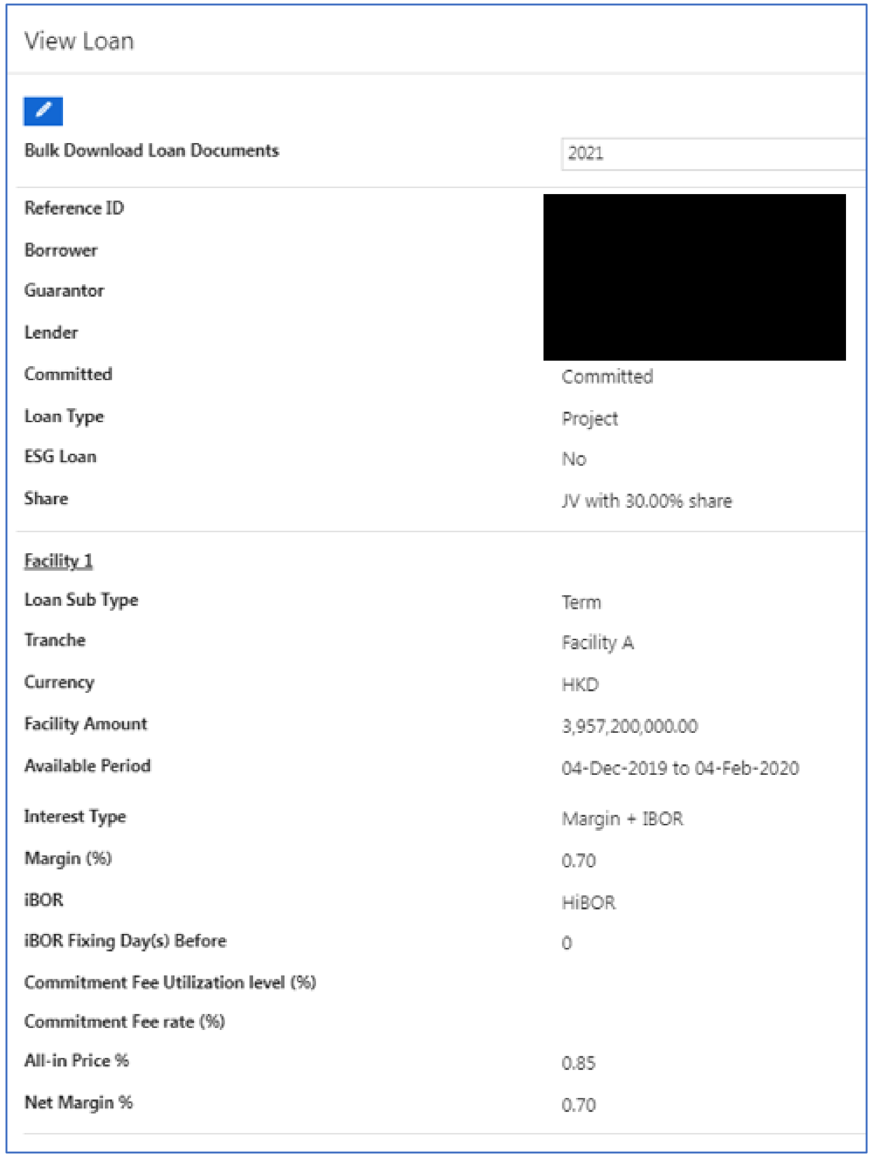
Objective

- To visualize the back-to-back support of loan facilities on development project (DP) funding needs

Scope

- DP expense breakdown:
  - Land cost 60% <- covered by Corporate Term Loan & Revolver Loan [Focus of this exercise]
  - Land cost 40% <- covered by Bridging loan (revolver) then Project Loan Tranche A
  - Construction cost 70% <- covered by Project Loan Tranche B
  - Construction cost 30% <- covered by DP (Development Project) cash

Data Source: Loan Profile in Banking & Treasury System (BTS) (Sample)

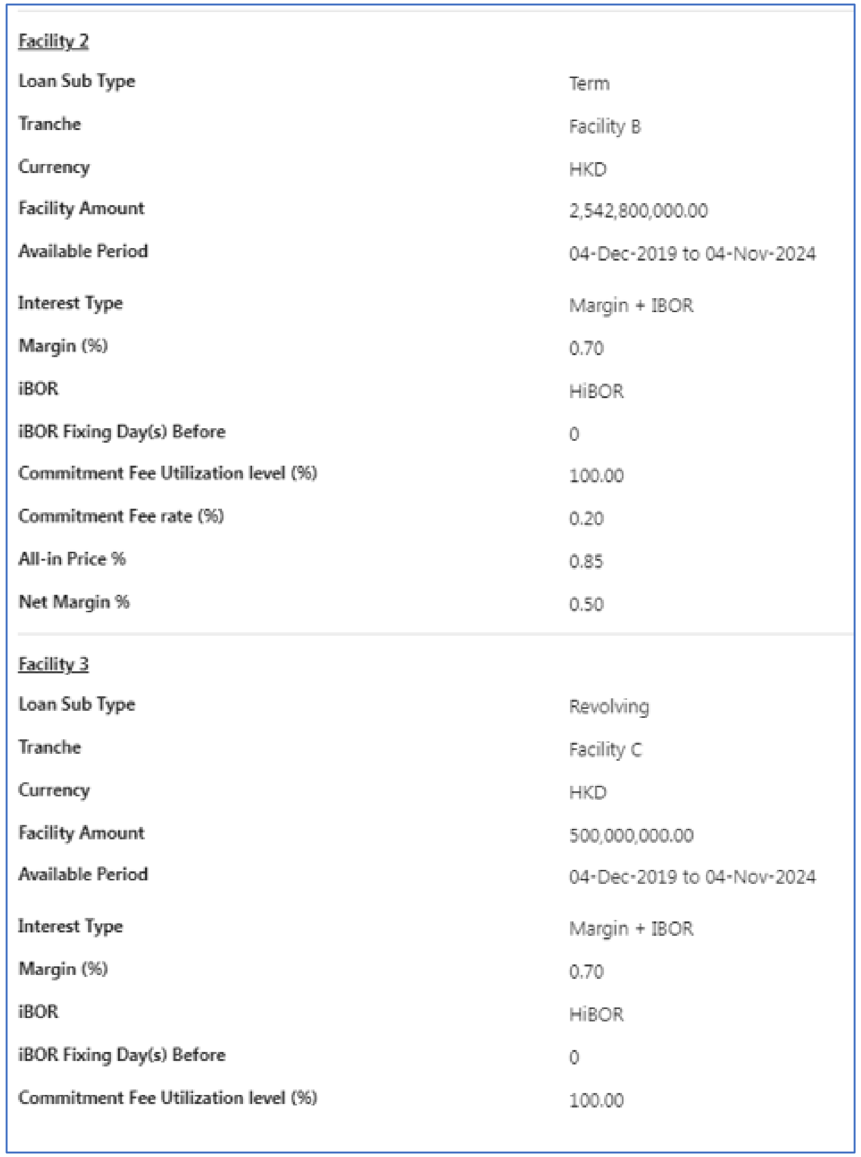


View Loan

Bulk Download Loan Documents	2021
Reference ID	[redacted]
Borrower	
Guarantor	
Lender	
Committed	Committed
Loan Type	Project
ESG Loan	No
Share	JV with 30.00% share

Facility 1

Loan Sub Type	Term
Tranche	Facility A
Currency	HKD
Facility Amount	3,957,200,000.00
Available Period	04-Dec-2019 to 04-Feb-2020
Interest Type	Margin + IBOR
Margin (%)	0.70
iBOR	HiBOR
iBOR Fixing Day(s) Before	0
Commitment Fee Utilization level (%)	
Commitment Fee rate (%)	
All-in Price %	0.85
Net Margin %	0.70

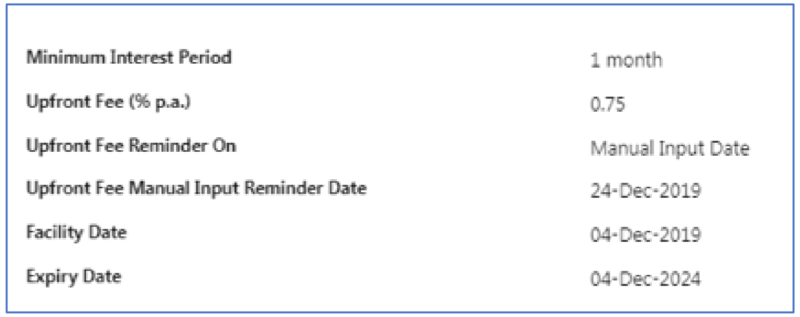


Facility 2

Loan Sub Type	Term
Tranche	Facility B
Currency	HKD
Facility Amount	2,542,800,000.00
Available Period	04-Dec-2019 to 04-Nov-2024
Interest Type	Margin + IBOR
Margin (%)	0.70
iBOR	HiBOR
iBOR Fixing Day(s) Before	0
Commitment Fee Utilization level (%)	100.00
Commitment Fee rate (%)	0.20
All-in Price %	0.85
Net Margin %	0.50

Facility 3

Loan Sub Type	Revolving
Tranche	Facility C
Currency	HKD
Facility Amount	500,000,000.00
Available Period	04-Dec-2019 to 04-Nov-2024
Interest Type	Margin + IBOR
Margin (%)	0.70
iBOR	HiBOR
iBOR Fixing Day(s) Before	0
Commitment Fee Utilization level (%)	100.00



Minimum Interest Period	1 month
Upfront Fee (% p.a.)	0.75
Upfront Fee Reminder On	Manual Input Date
Upfront Fee Manual Input Reminder Date	24-Dec-2019
Facility Date	04-Dec-2019
Expiry Date	04-Dec-2024

Loan Matching Program Implementation

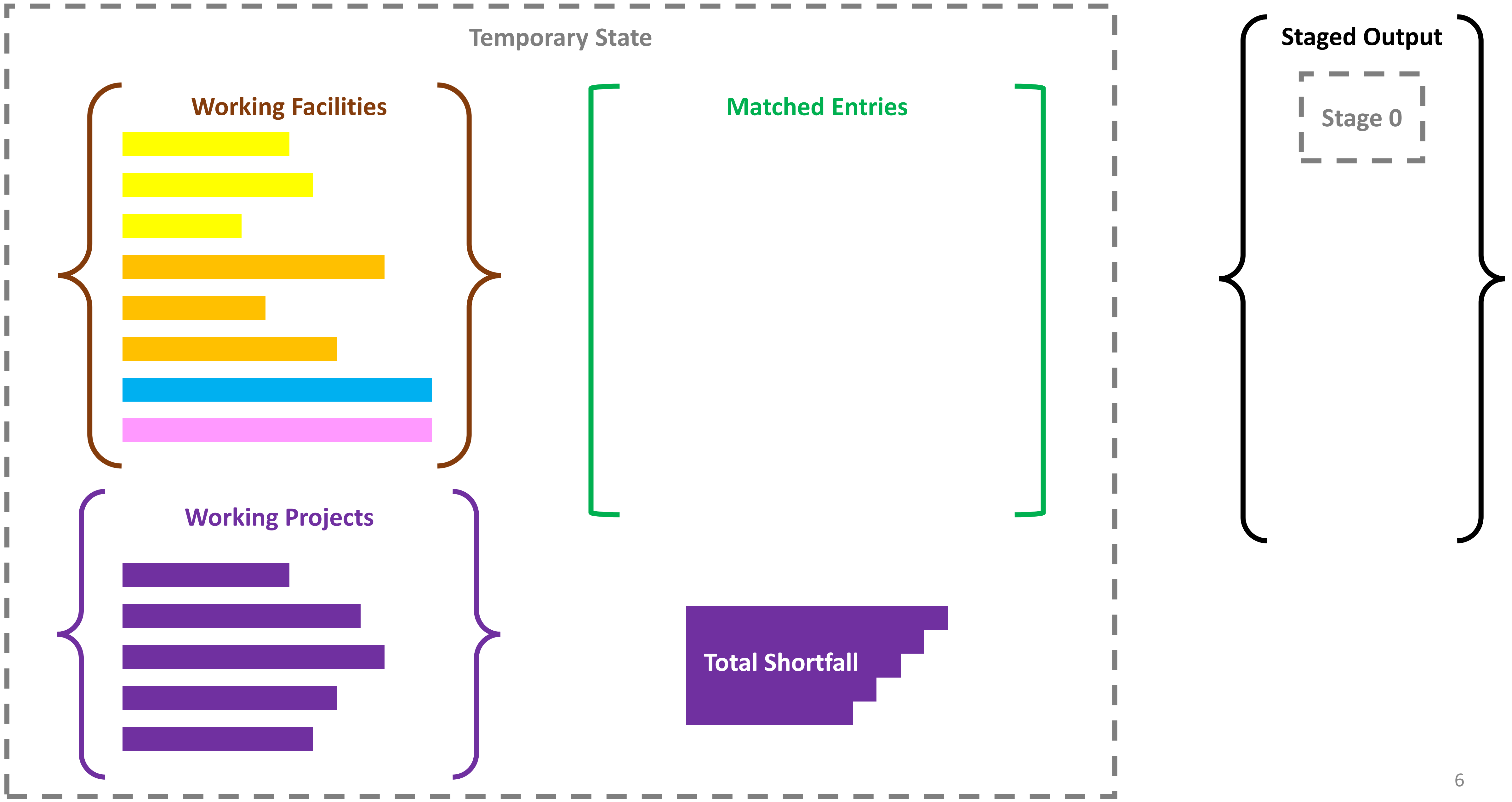
1. Built on Python frameworks: Flask -> Dash -> Plotly
    - Flask: Python web application framework, for kicking start multiple Dash dashboard
    - Dash
        - Set the layout of a dashboard webpage (a user interface with buttons and input box)
        - Define callback functions receiving instruction from users, do computation, and generate output (text/ Plotly chart) to be seen on dashboard
    - Plotly: Data visualization in charts/ tables

2. In a dashboard (dashboard_xx.py):
    - A Loan Matching object
        - Store all information, including loan facility info, project info, matching parameters, working data, and staged output data
        - Methods for running the matching logics and updating the working data/ staged output data [More on this in the next page]
        - Initialized with default config (YAML) when the dashboard instance (webpage) is started and saved on webpage
    - Dash layout
    - Dash callbacks
        - Read latest Loan Matching object on webpage
        - If the matching parameters changed (by modifying the values on dashboard), then re-run matching (call methods in Loan Matching object to update data in Loan Matching object), and change in chart
        - If only to change the display of visualization (i.e., no change in the matching parameters), then no need to re-run matching, the change in chart take place immediately
        - Save the updated Loan Matching object on webpage

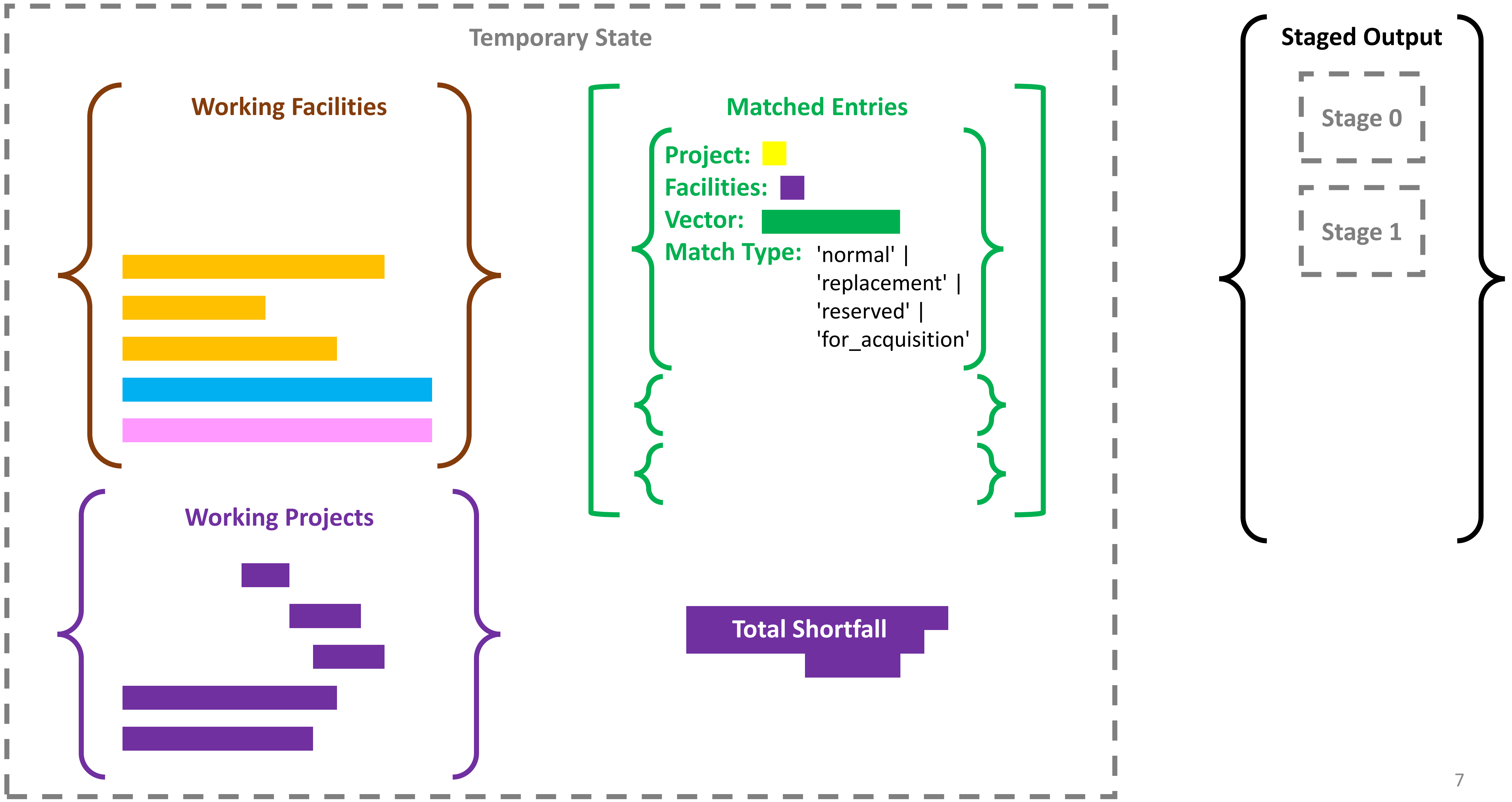
Loan Matching Program Implementation – Folder Structure

`./`	
`├ app/`	Flask application folder
`│ ├ dash/`	Dash application folder
`│ │ ├ data/`	
`│ │ │ ├ input/`	
`│ │ │ │ ├ backup/`	A backup copy is saved when a data file is uploaded
`│ │ │ │ ├ project_data.xlsx`	
`│ │ │ │ ├ bts_data.xlsx`	
`│ │ │ │ ├ project_data_template.xlsx`	
`│ │ │ │ └ bts_data_template.xlsx`	
`│ │ │ └ output/`	
`│ │ ├ __init__.py`	
`│ │ ├ routes.py`	Dash routing
`│ │ ├ utils.py`	Self-defined helper functions
`│ │ ├ loan_matching.py`	LoanMatching class
`│ │ ├ dashboard_xx.py`	Dashboards – Dash layout and callbacks are defined here
`│ │ ├ dash_config_xx.yaml`	Config info/ default values for Dash dashboard
`│ │ └ upload_file.py`	Data file upload/ management function built with Dash
`│ ├ templates/`	HTML templates (with Jinja syntax)
`│ ├ assets/`	Static asset (favicon only) for Dash app
`│ ├ static/`	Static asset, incl. CSS and favicon for Flask app
`│ ├ __init__.py`	Function for creating Flask app that kick starts Dash apps
`│ └ routes.py`	Routing to index page
`├ venv/`	Python virtual environment
`├ requirements.txt`	Python requirements
`├ start.bat`	Batch file to activate Python environment and start the app
`└ wsgi.py`	Start the Flask app

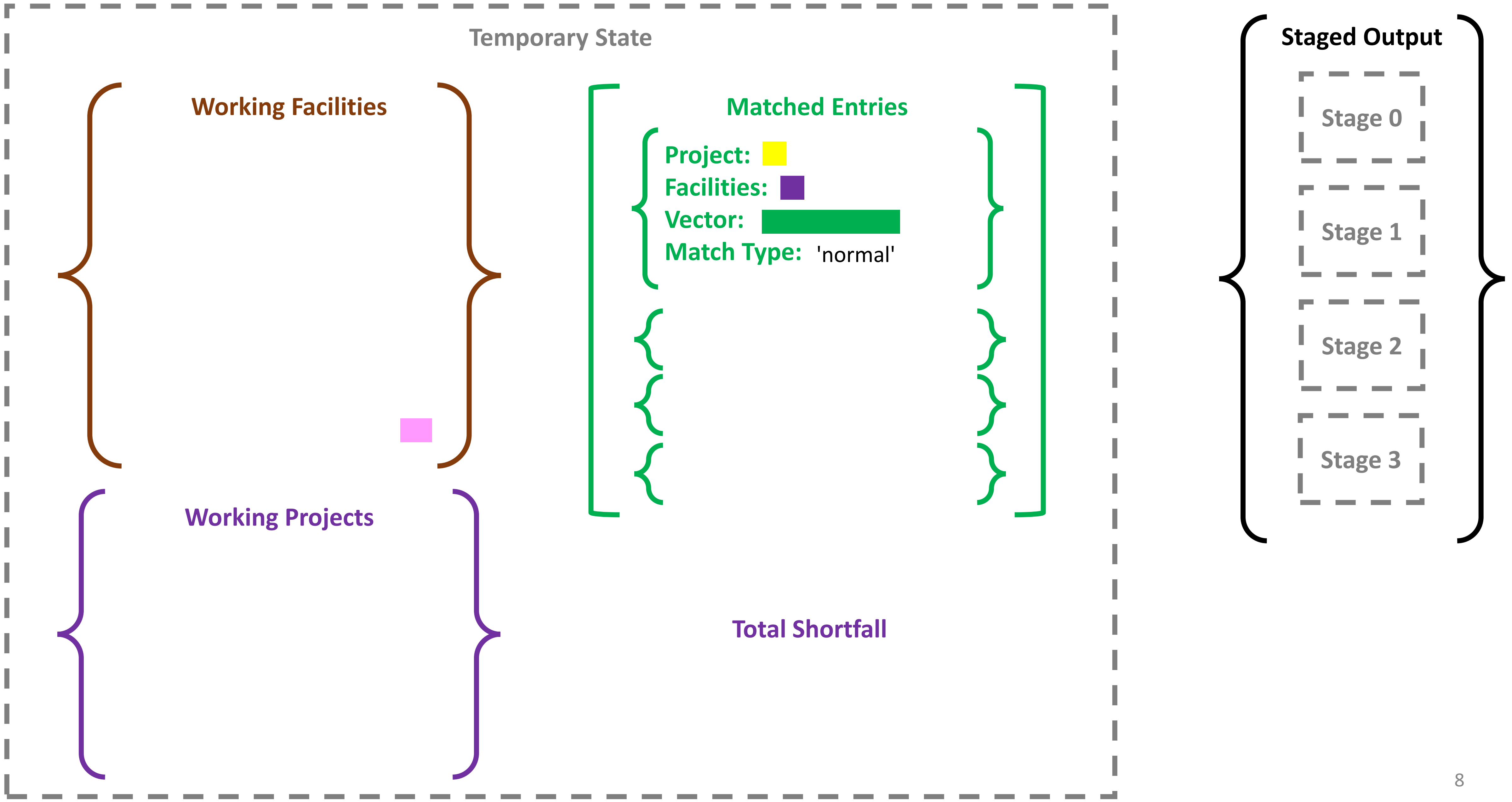
Loan Matching Program Implementation – working data and staged output (1)



Loan Matching Program Implementation – working data and staged output (2)



Loan Matching Program Implementation – working data and staged output (3)



Matching Schemes

• Stage 0:	Initial
• Stage 0a:	Manual matching
• Stage 0b:	Set aside Committed Revolver
• Stage 1:	Match Term Loan
• Stage 2:	Match Term Loan + Committed Revolver
• Stage 2a:	Match Term Loan + Committed Revolver + Uncommitted Revolver Replacement
• Stage 3:	Match Term Loan + Committed Revolver + Uncommitted Revolver Replacement + Equity

- Scheme 1 = Stages 0 + 1 + 2 + 3
- Scheme 2 = Stages 0 + 1 + 2 + 2a + 3 (dashboard 01d)
- Scheme 3 = Stages 0 + 0b + 1 + 2 + 2a + 3 (dashboard 04)
- Scheme 4 = Stages 0 + 0a + 0b + 1 + 2 + 2a + 3 (dashboard 05)

Matching Logic – Standard Solo-then-JV Matching for Stages 1, 2 & 3

Parameters in consideration

Parameters	Description	Value defined in		
		Raw data file	**YAML config file**	**Dashboard**
Project				
Amount	Loan Requirement (in HK$B) = Land cost (x JV Share) x 60%	Loan Requirement		
Start Date	Day Zero OR Project start date, whenever is later	Project Start Date		
End Date	Project End Date	Project End Date		
Loan/ Equity				
Amount	Loan Facilities Amount (in HK$B) (for Stages 1 and 2) / Equity amount (in HK$B) (for Stage 3)	Loan Facility Amount	Default Equity Amount	Equity Amount
Start Date	Day Zero OR Loan Facility Available Period From, whenever is later; Take Day Zero for Equity	Loan Facility Available Period From	Default Day Zero	
End Date	Target Prepayment Date = Loan Expiry Date – Target Prepayment Period (TPP); Take Max Date for Equity	Loan Expiry Date		TPP

Matching Logic – Standard Solo-then-JV Matching for Stages 1, 2 & 3

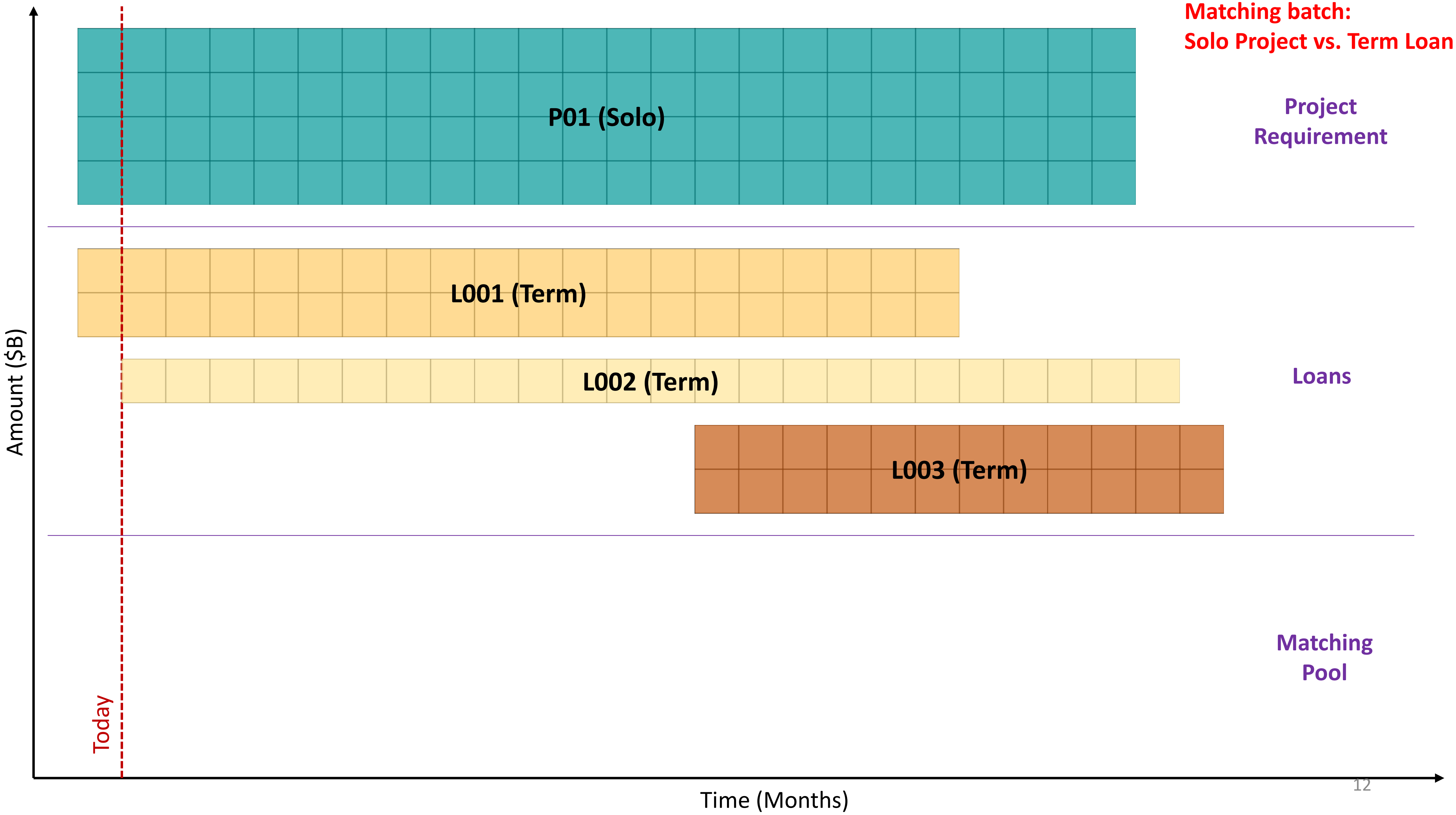
Algorithm

1. Consider Term Loan, Committed Revolver and Equity in Stages 1, 2 and 3 respectively

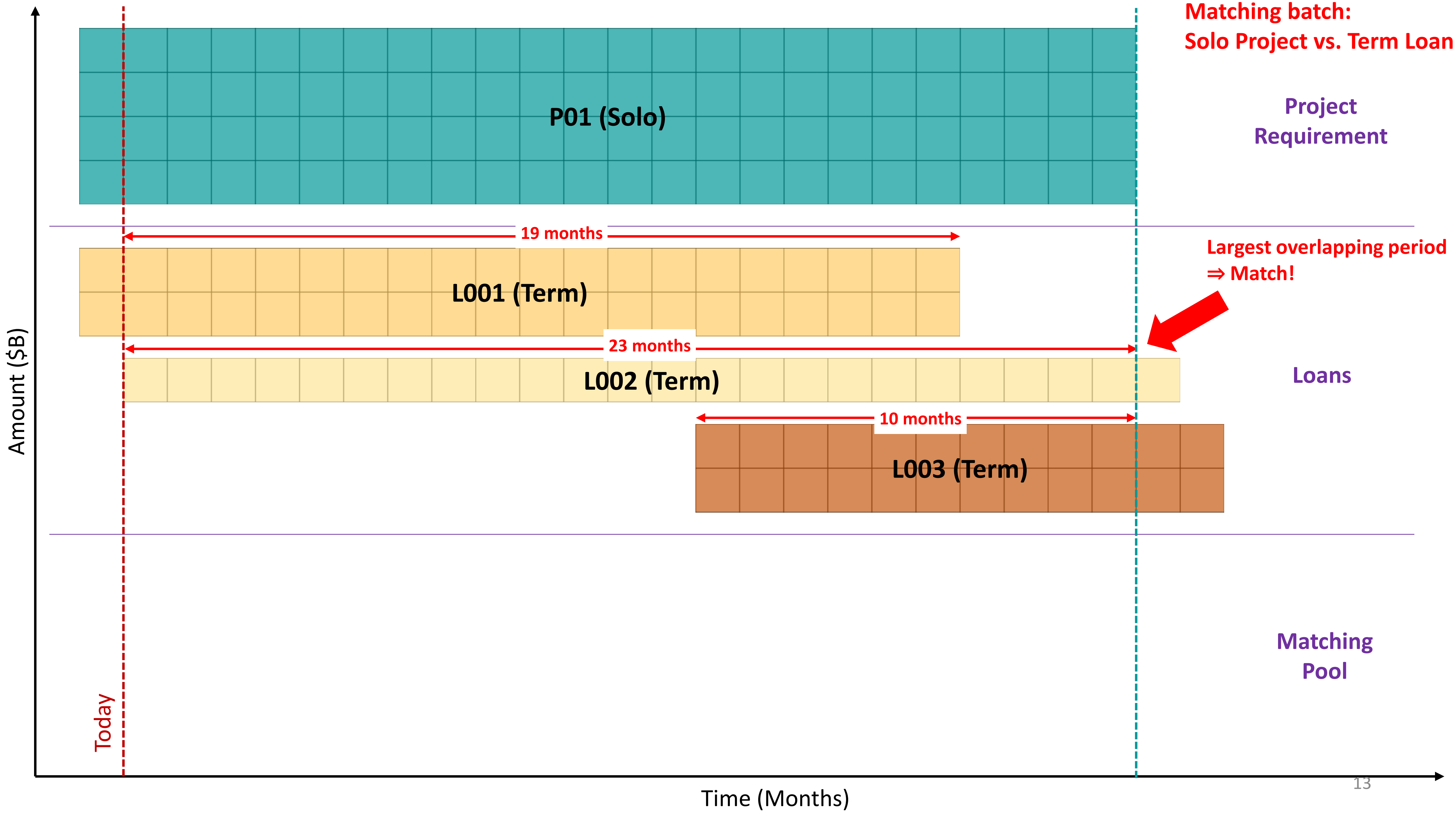
2. In each Stage,
   1st matching batch = loan facilities vs. Solo projects,
   2nd matching batch = loan facilities vs. JV projects

3. For each matching batch:
   i. Match with **largest "overlapping period"**
   ii. Iterate until no more matching can be done

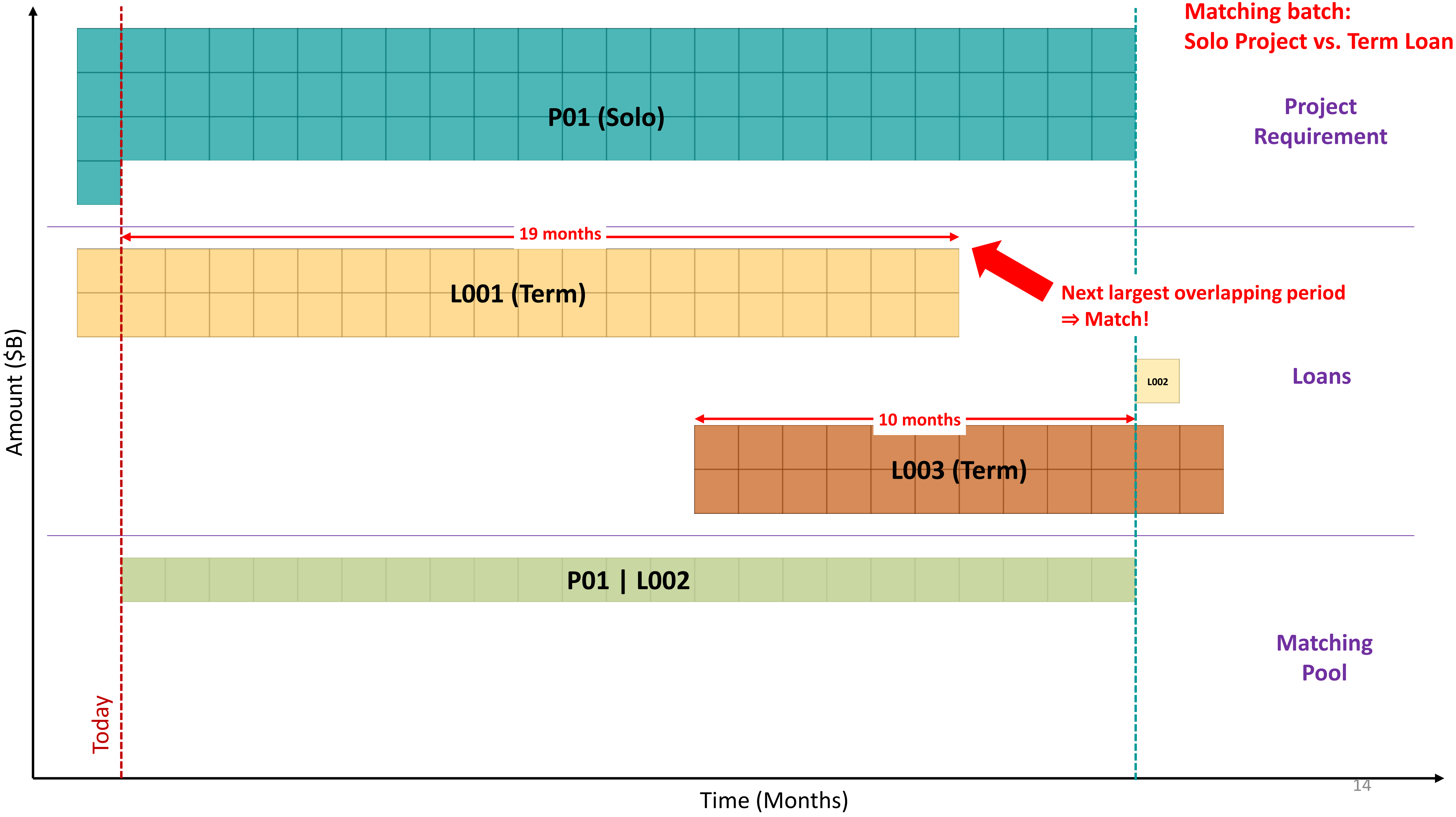
Matching batch:
Solo Project vs. Term Loan



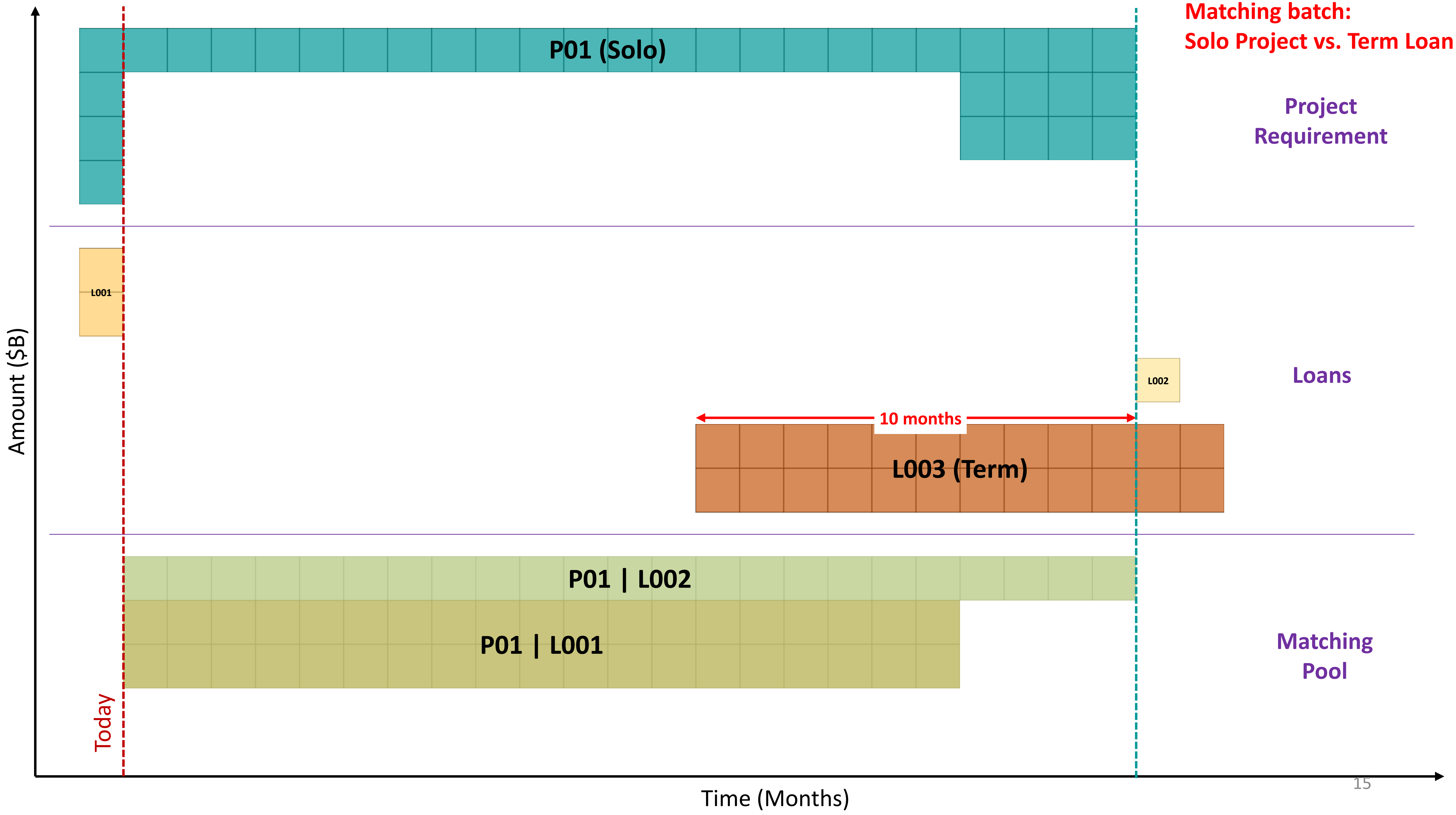
Matching batch: Solo Project vs. Term Loan



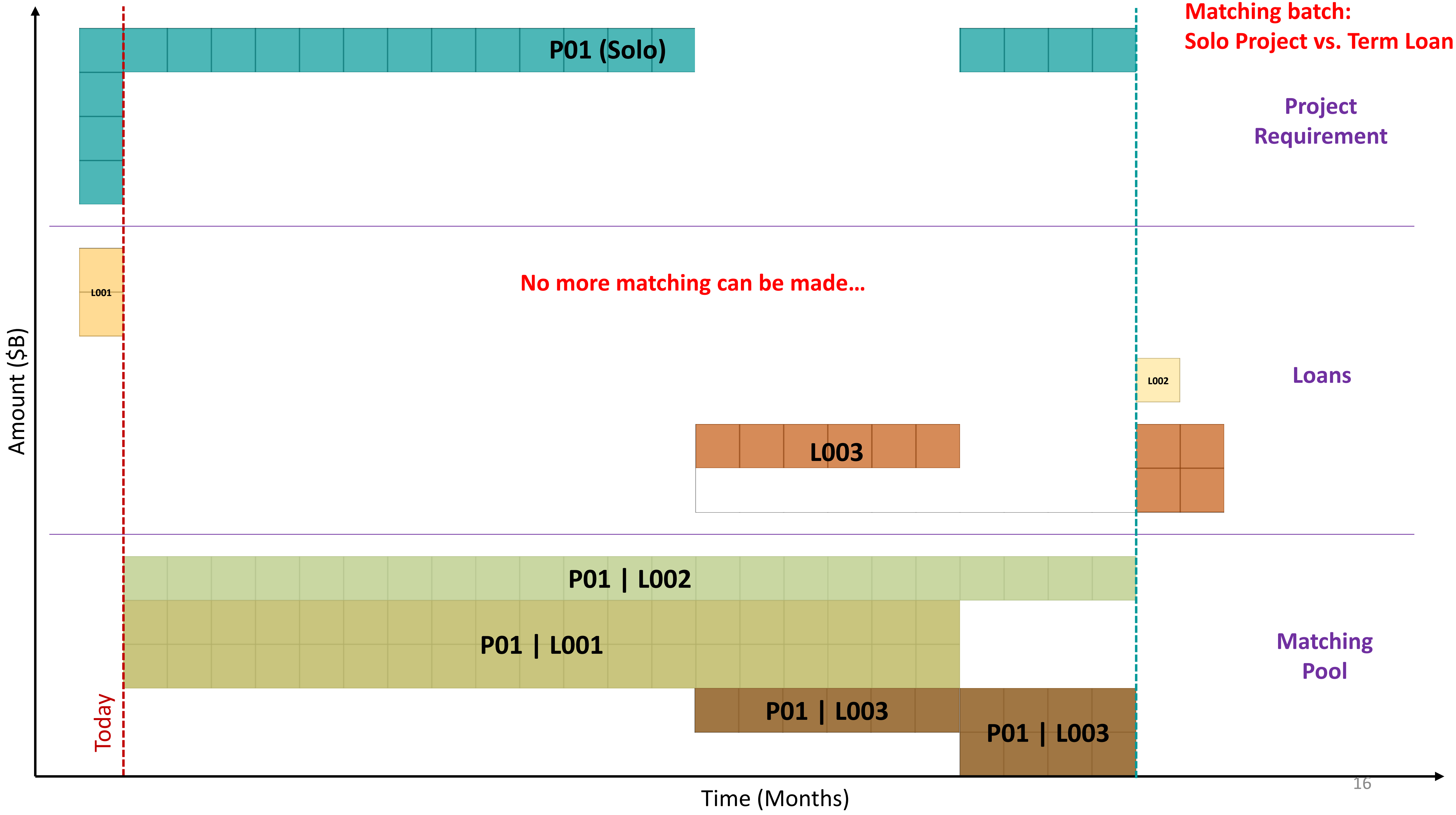
Matching batch: Solo Project vs. Term Loan



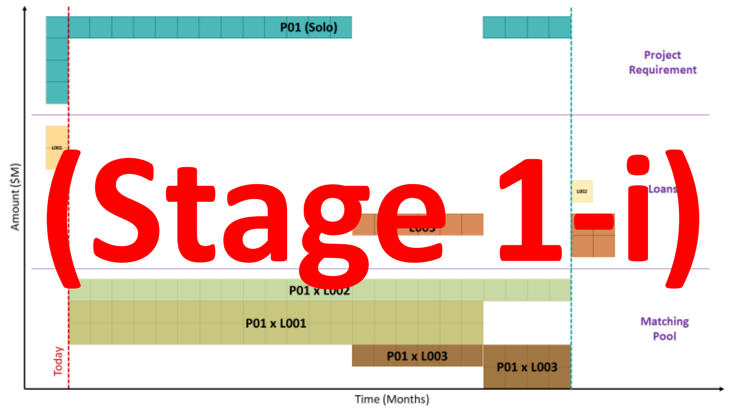
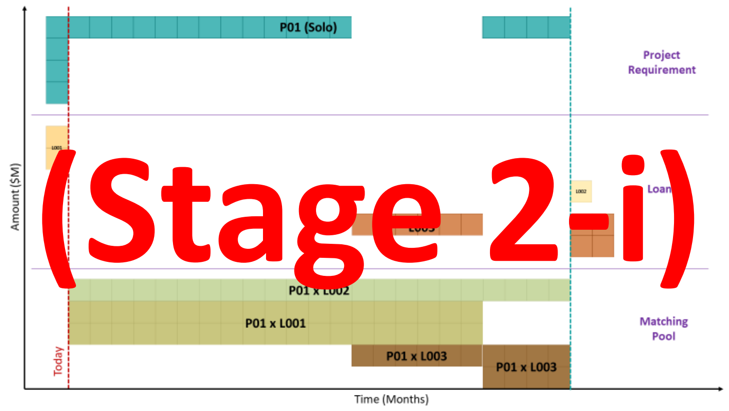
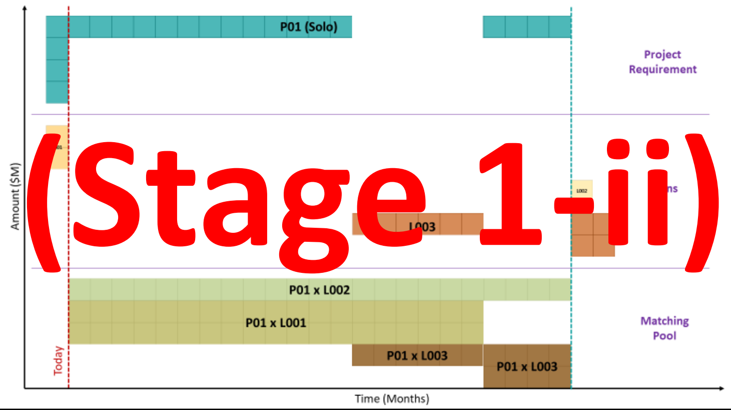
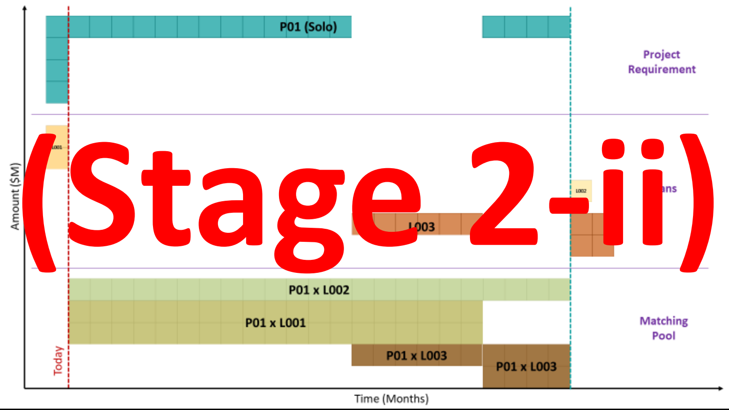
Matching batch: Solo Project vs. Term Loan

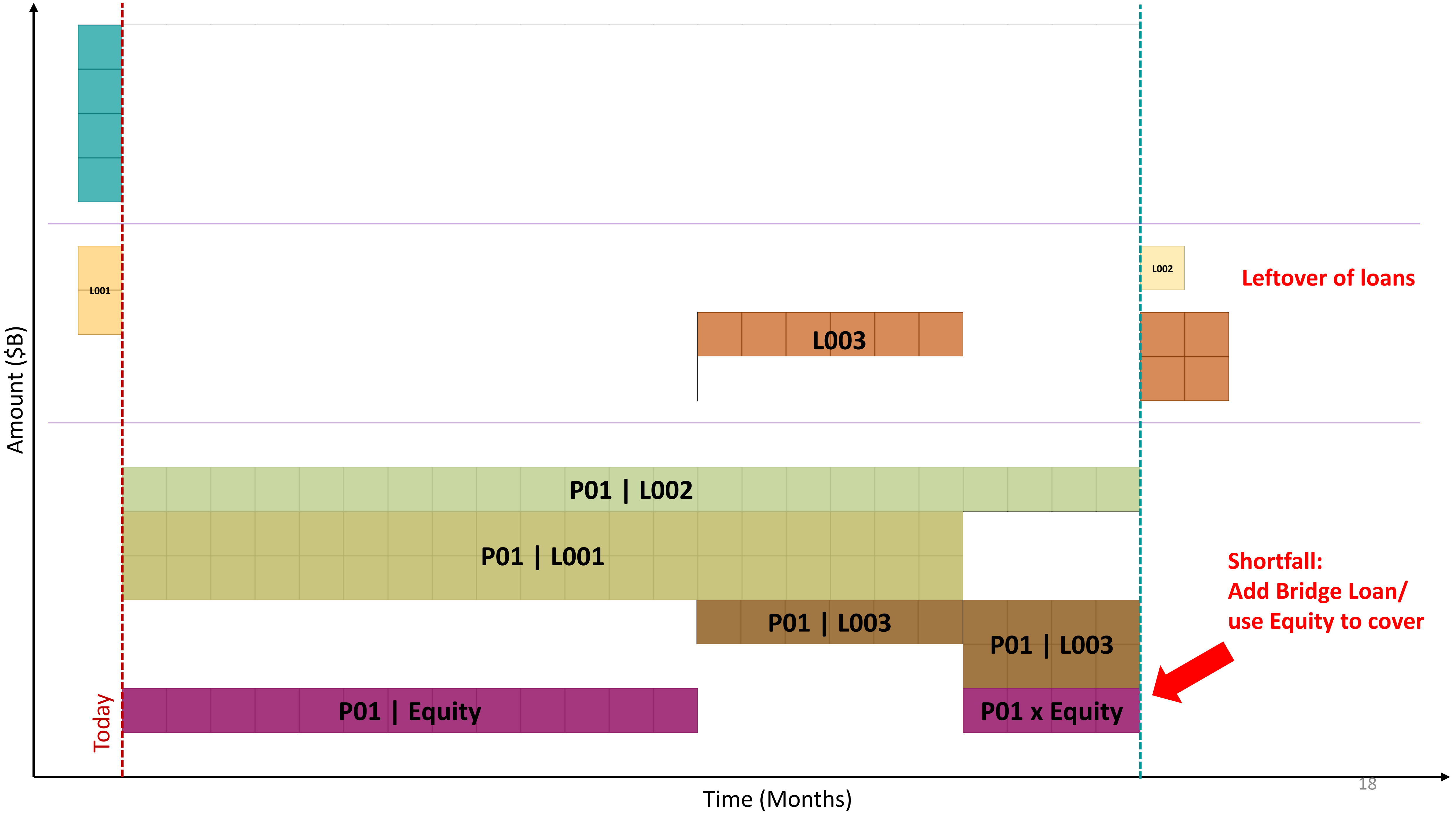


Matching batch:
Solo Project vs. Term Loan



Repeat for other matching groups: Stage 1 (Term) → Stage 2 (Revolver) → Stage 3 (Equity)

	Term Loans	Revolvers
Solo Projects	 (Stage 1-i)	 (Stage 2-i)
JV Projects	 (Stage 1-ii)	 (Stage 2-ii)


Amount ($B)
Time (Months)
Today
L001
L002
L003
Leftover of loans
P01 | L002
P01 | L001
P01 | L003
P01 | L003
P01 | Equity
P01 x Equity
Shortfall:
Add Bridge Loan/
use Equity to cover

Matching Logic – Manual Matching for Stages 0a

Parameters in consideration

Parameters	Description	Value defined in		
		Raw data file	YAML config file	Dashboard
Manual Matching Input String	String pattern: [Project abbrev.] | [Loan facility ID] ; [Project abbrev.] | [Loan facility ID] ; … Character "|" and ";" are critical; Leading and trailing space are acceptable.;			Manual Matching Input String

Algorithm

1. Based on the string input in Dashboard, match the project and loan facilities in sequence,
   e.g., "WCH6|565;LP12|618", match WCH6 with loan facility #565 first, then match LP12 with loan facility #618

2. The concept of "overlapping" applies

Matching Logic – Set aside Committed Revolver for Stages 0b

Parameters in consideration (1)

Parameters	Description	Value defined in		
		Raw data file	**YAML config file**	**Dashboard**
Committed Revolver				
Amount	Loan Facilities Amount (in HK$B)	Loan Facility Amount		
Start Date	Day Zero OR Loan Facility Available Period From, whenever is later	Loan Facility Available Period From	Default Day Zero	
End Date	Target Prepayment Date = Loan Expiry Date – Target Prepayment Period (TPP)	Loan Expiry Date		TPP
Net Margin	Net margin (in %)	Loan Facility Net margin		

Matching Logic – Set aside Committed Revolver for Stages 0b

Parameters in consideration (2)

Parameters	Description	Value defined in		
		Raw data file	YAML config file	Dashboard
Configurable Parameters				
Revolver Ceiling	Revolver ceiling amount (in HK$B) = max. amount of committed revolver in total to set aside		Default Revolver Ceiling	Revolver Ceiling
Revolver Ceiling For	Whether set aside committed revolver for loan matching or acquisition		Default Revolver Ceiling For	Revolver Ceiling For
Revolver To Stay	Criteria for being set aside (to stay) – by highest/ lowest … • Loan facility amount (in HK$B) (pick the maximum if some amount is already matched in Stage 0a) • Loan facility period = End date – Start date + 1 • Net margin • Area = Amount x Period • Cost = Net margin x Area		Default Revolver To Stay	Revolver To Stay

Matching Logic – Set aside Committed Revolver for Stages 0b

Algorithm

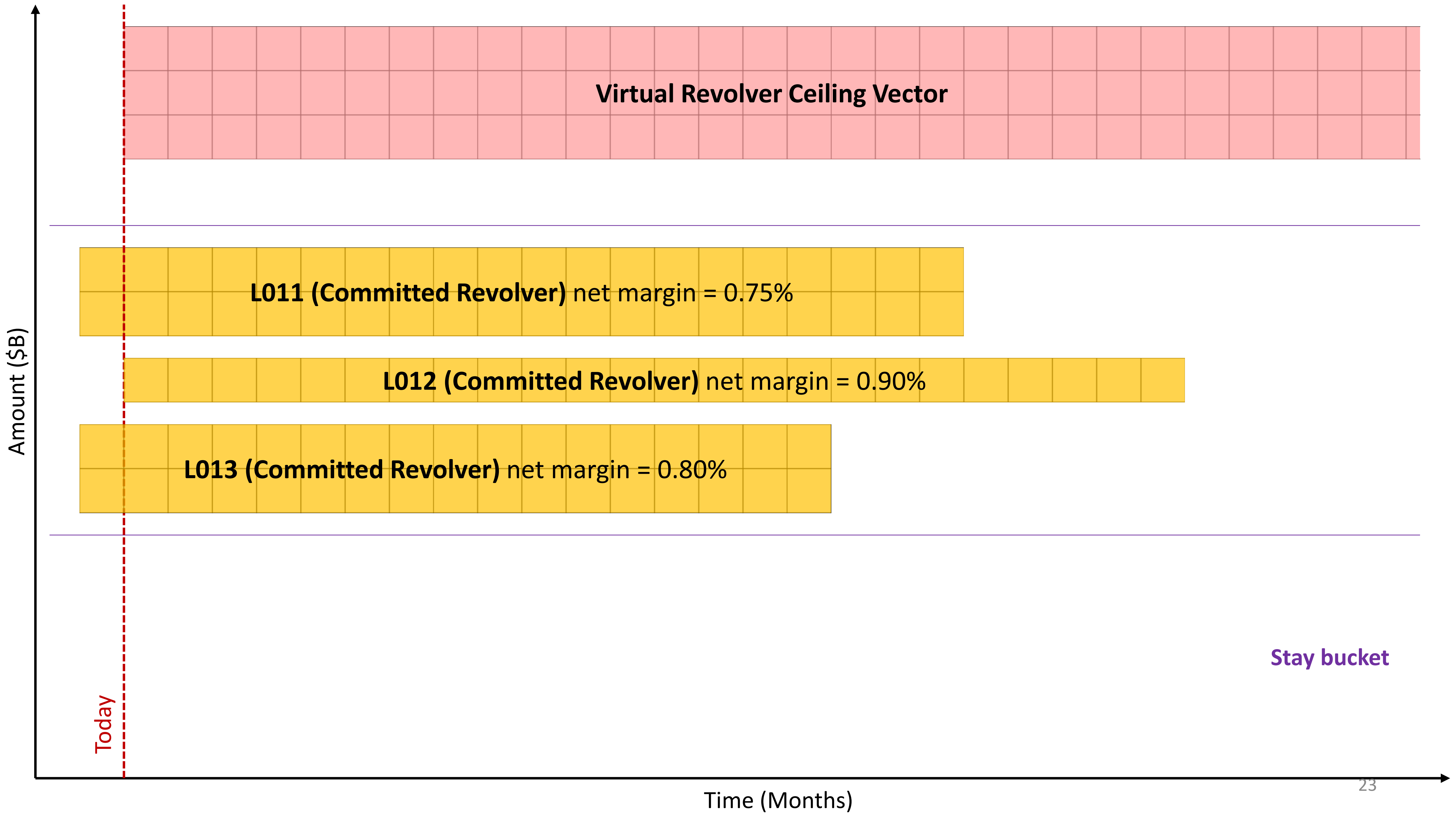
1. Identify the 3 parameters (**Revolver Ceiling**, **Revolver Ceiling For**, **Revolver To Stay**) specified in Dashboard, e.g., "Set aside max. HK$**5.0**B revolver with **highest net margin** for **loan matching**.", it means to allocate at most $5.0B revolver facilities with highest net margin for loan matching, the exceeded amount of any date will be allocated out of loan matching pool, that is, for acquisition.

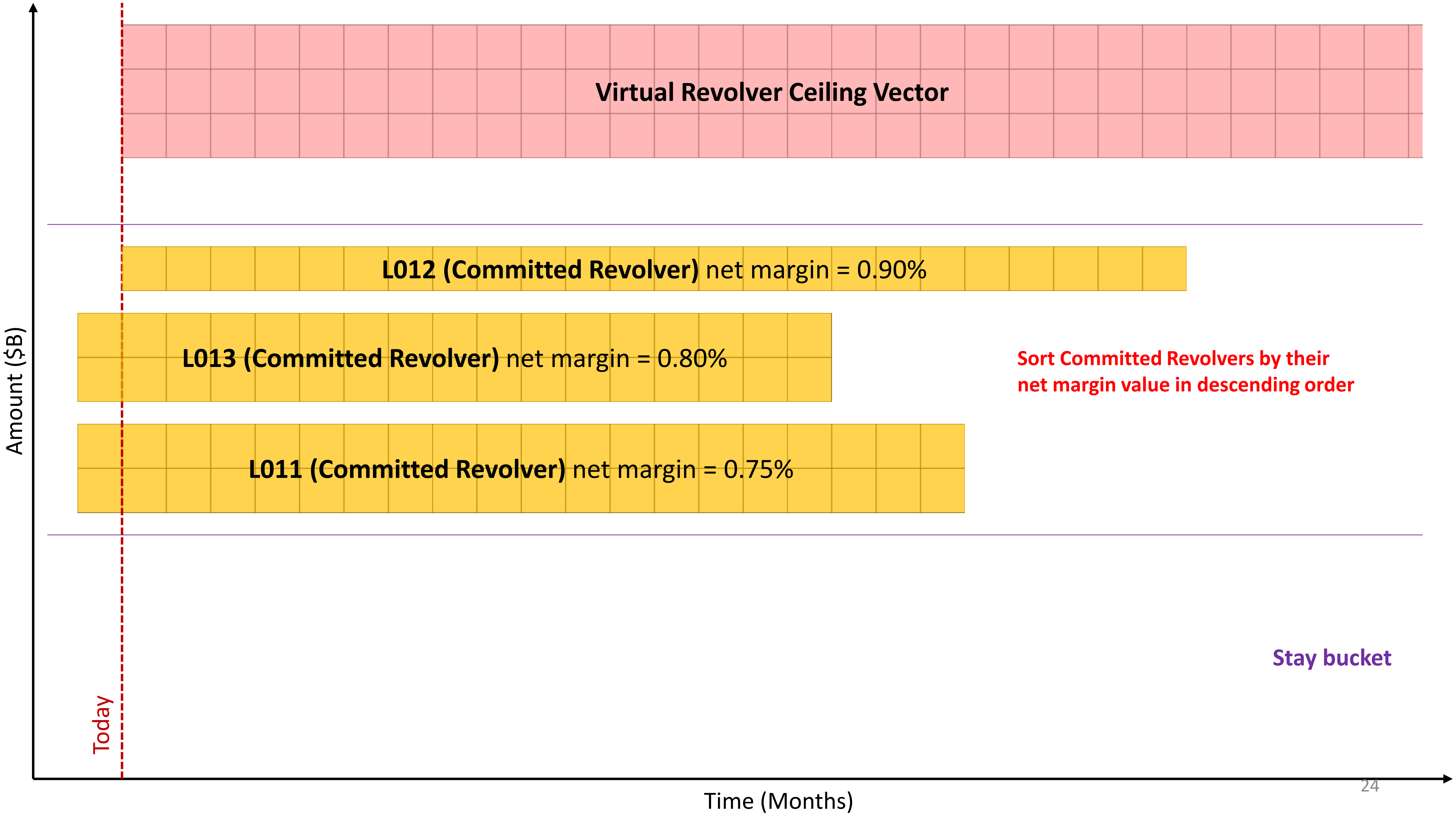
2. Generate a vector based on **Revolver Ceiling**, with amount = ceiling value and period from Day Zero to Max Date

3. Sort the Committed Revolvers as a **queue** based on **Revolver To Stay**, e.g., for "highest net margin", we sort the Committed Revolvers by their net margin values in descending order.

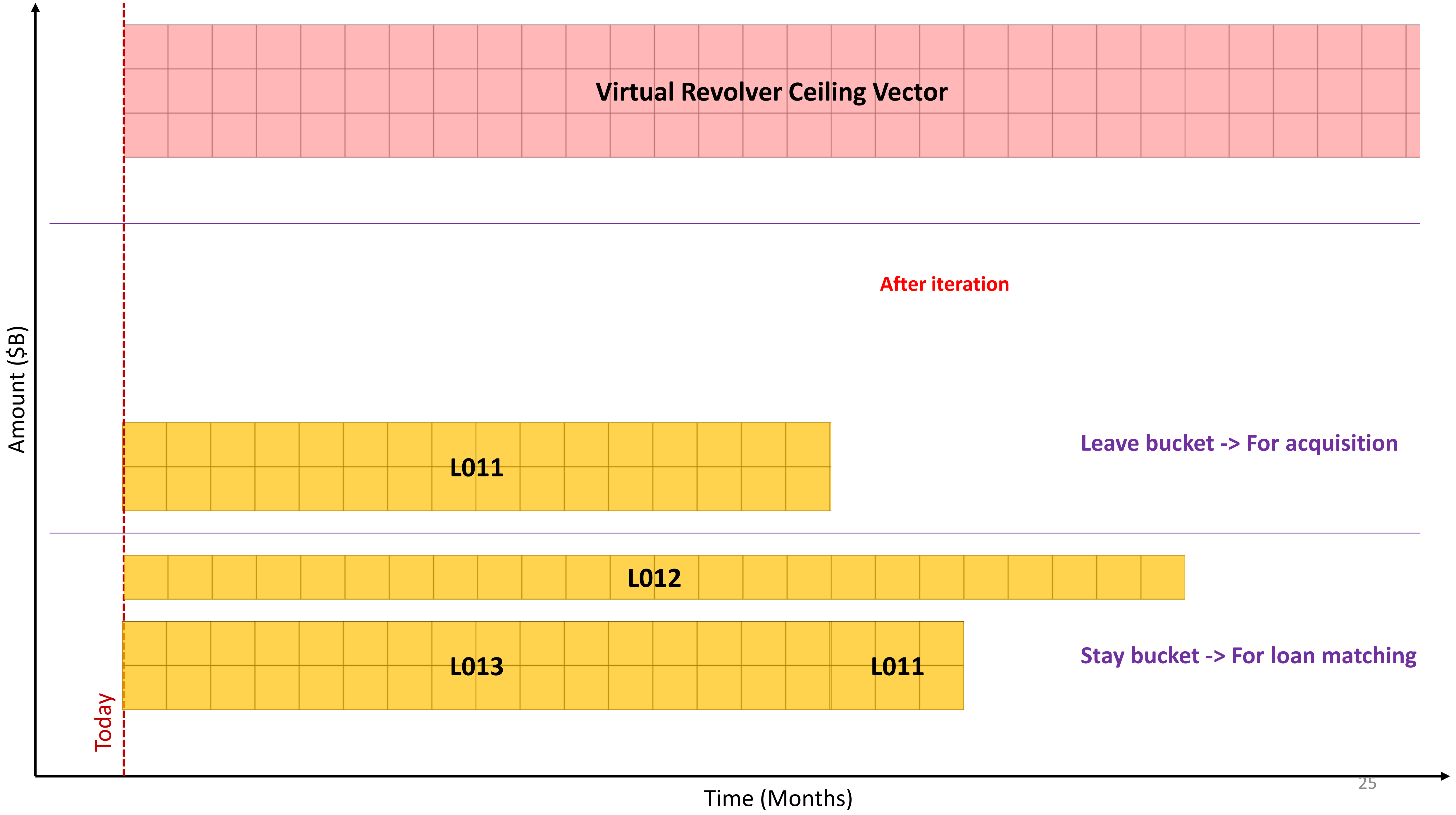
4. Check overlapping between **Revolver Ceiling vector** and the items in **Committed Revolver queue**, place the overlapping vectors into "stay bucket" and discount the **Revolver Ceiling vector**, iterate until no more overlapping can be found, put the rest vectors into "leave bucket"

5. Vectors in "stay bucket" will be used for the purpose specified in **Revolver Ceiling For**, while the vectors in "leave bucket" will be used for the purpose otherwise.


Virtual Revolver Ceiling Vector
L011 (Committed Revolver) net margin = 0.75%
L012 (Committed Revolver) net margin = 0.90%
L013 (Committed Revolver) net margin = 0.80%
Stay bucket
Today
Amount ($B)
Time (Months)



Virtual Revolver Ceiling Vector
L012 (Committed Revolver) net margin = 0.90%
L013 (Committed Revolver) net margin = 0.80%
L011 (Committed Revolver) net margin = 0.75%
Sort Committed Revolvers by their net margin value in descending order
Stay bucket
Today
Amount ($B)
Time (Months)


Virtual Revolver Ceiling Vector
After iteration
L011
Leave bucket -> For acquisition
L012
L013
L011
Stay bucket -> For loan matching
Today
Amount ($B)
Time (Months)

Matching Logic – Uncommitted Revolver (UC) Replacement for Stages 2a

Parameters in consideration (1)

Parameters	Description	Value defined in		
		Raw data file	YAML config file	Dashboard
Matched Entries – Project | Committed Revolver (generated from earlier Stages)				
Vector	Matched amount (in HK$B) by date			
Net margin	Net margin of Committed Revolver	Net margin		
Uncommitted Revolver (UC)				
Amount	Loan Facilities Amount (in HK$B)	Loan Facility Amount		
Start Date	Day Zero OR Loan Facility Available Period From, whenever is later; Take Day Zero for evergreen UC	Loan Facility Available Period From	Default Day Zero	
End Date	Target Prepayment Date = Loan Expiry Date – Target Prepayment Period (TPP); Take Max Date for evergreen UC	Loan Expiry Date		TPP
Net Margin	Net margin (in %)	Loan Facility Net margin		

Matching Logic – Uncommitted Revolver (UC) Replacement for Stages 2a

Parameters in consideration (2)

Parameters	Description	Value defined in		
		Raw data file	YAML config file	Dashboard
Configurable Parameters				
UC Evergreen	Whether the UC is assumed without expiry date		Default UC Evergreen	UC Evergreen
UC Full Cover	Whether the UC vector need to "fully cover" the Matched Project | Committed Revolver Entry's vector (i.e., the amount of UC > amount of matched entry in every date), in order to do the replacement		Default UC Full Cover	UC Full Cover
UC Check Saving By Area	Whether to check saving area x net margin difference OR by net margin difference only; Saving area = amount x overlapping period; Net margin difference = UC's net margin – Committed Revolver's net margin		Default UC Check Saving By Area	UC Check Saving By Area

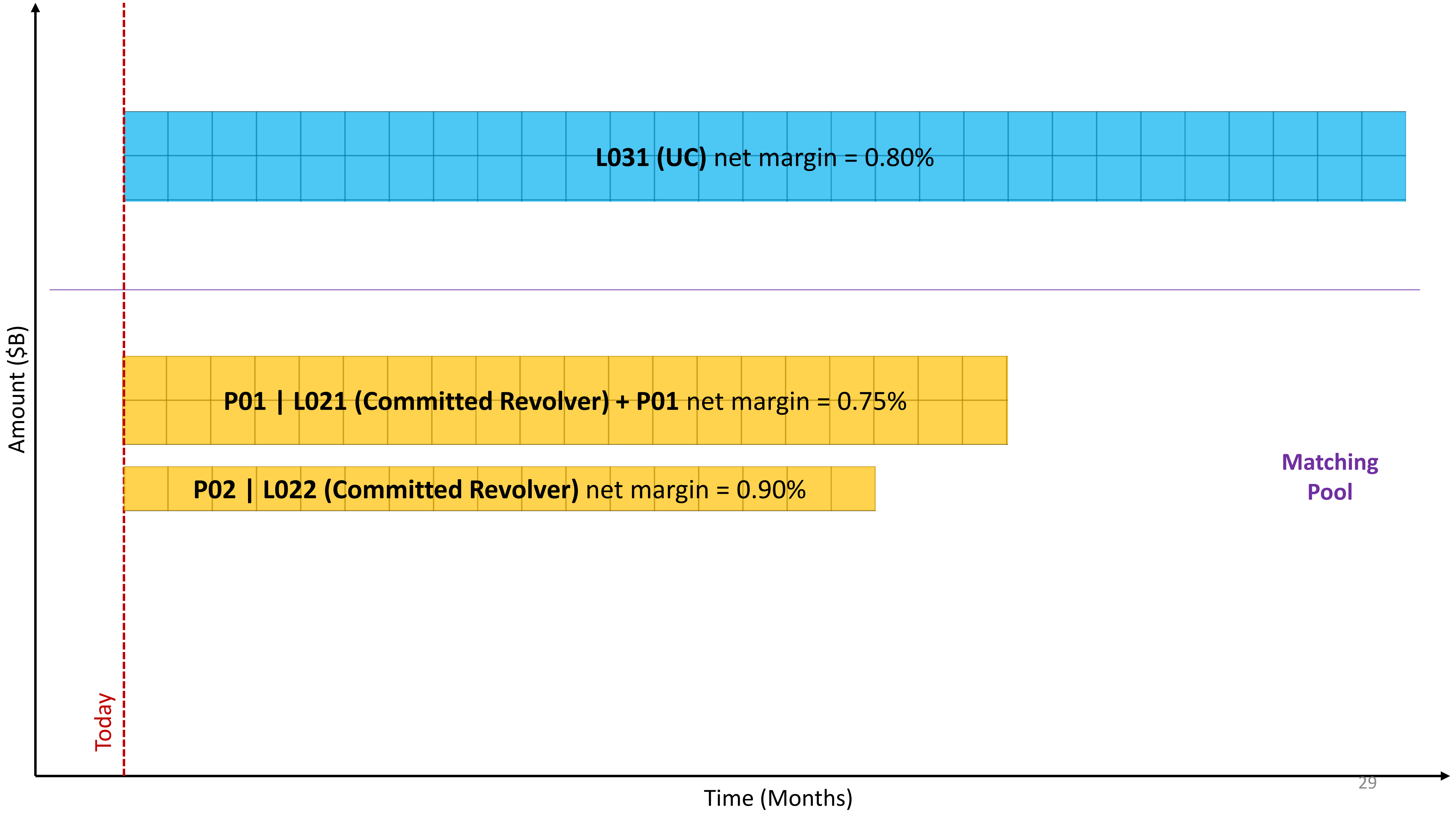
Matching Logic – Uncommitted Revolver (UC) Replacement for Stages 2a

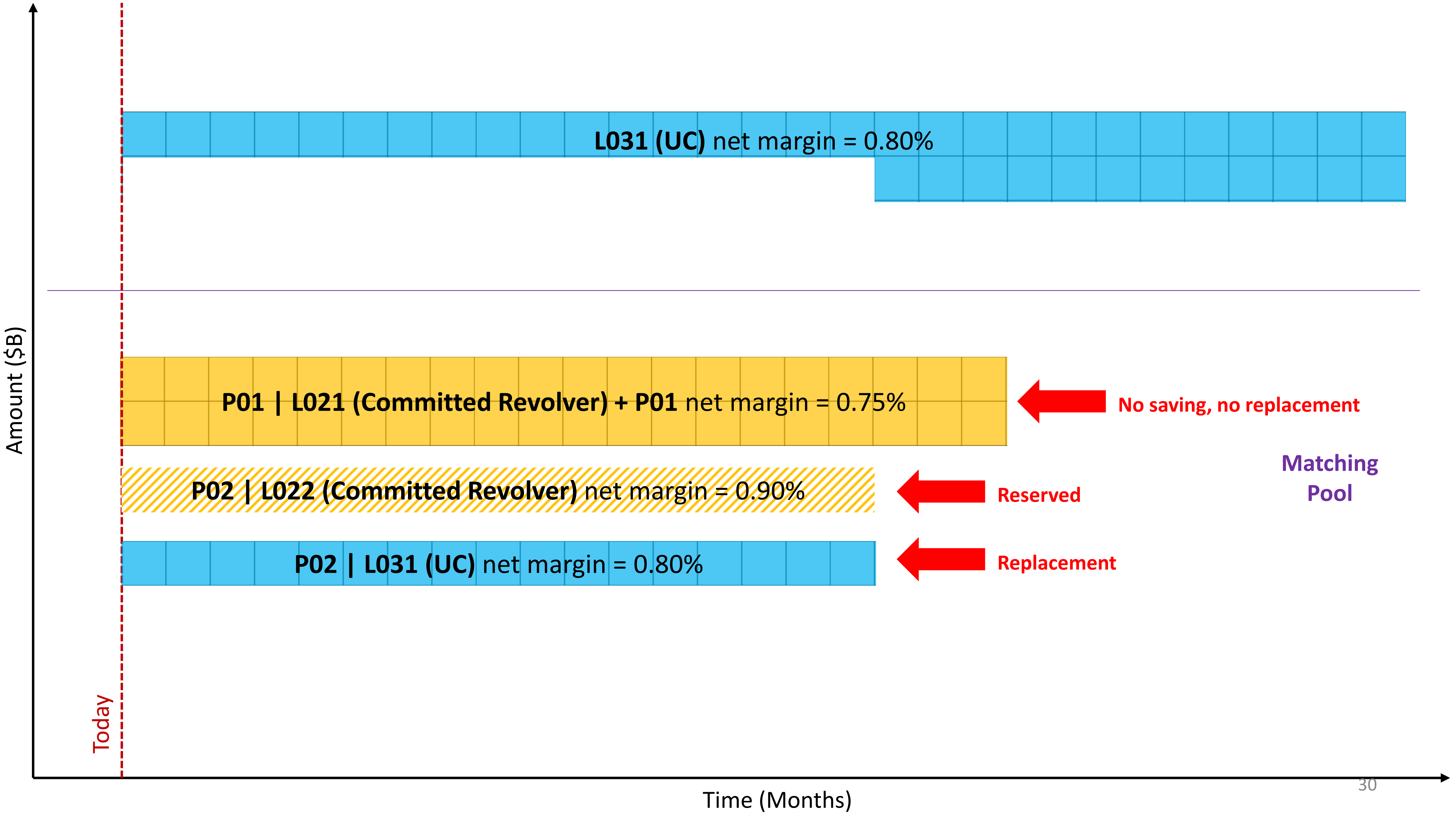
Algorithm

1. UC can replace a Matched Project | Committed Revolver Entry if the following criteria are met:
   - There is saving considering net margin/ net margin x area
   - If UC fully covers the Matched Entry's vector (only if UC Full Cover is True)

2. Pick the replacement with largest saving first, iterate until no more replacement can be made

3. The UC replacement entry – in forms of Project | UC – will be added into the Matched Entries pool, marked as "matched"; while the Project | Committed Revolver Entry being replaced will be marked as "reserved"


L031 (UC) net margin = 0.80%
P01 | L021 (Committed Revolver) + P01 net margin = 0.75%
P02 | L022 (Committed Revolver) net margin = 0.90%
Matching Pool
Today
Amount ($B)
Time (Months)


L031 (UC) net margin = 0.80%
P01 | L021 (Committed Revolver) + P01 net margin = 0.75%
No saving, no replacement
P02 | L022 (Committed Revolver) net margin = 0.90%
Reserved
Matching Pool
P02 | L031 (UC) net margin = 0.80%
Replacement
Today
Amount ($B)
Time (Months)