



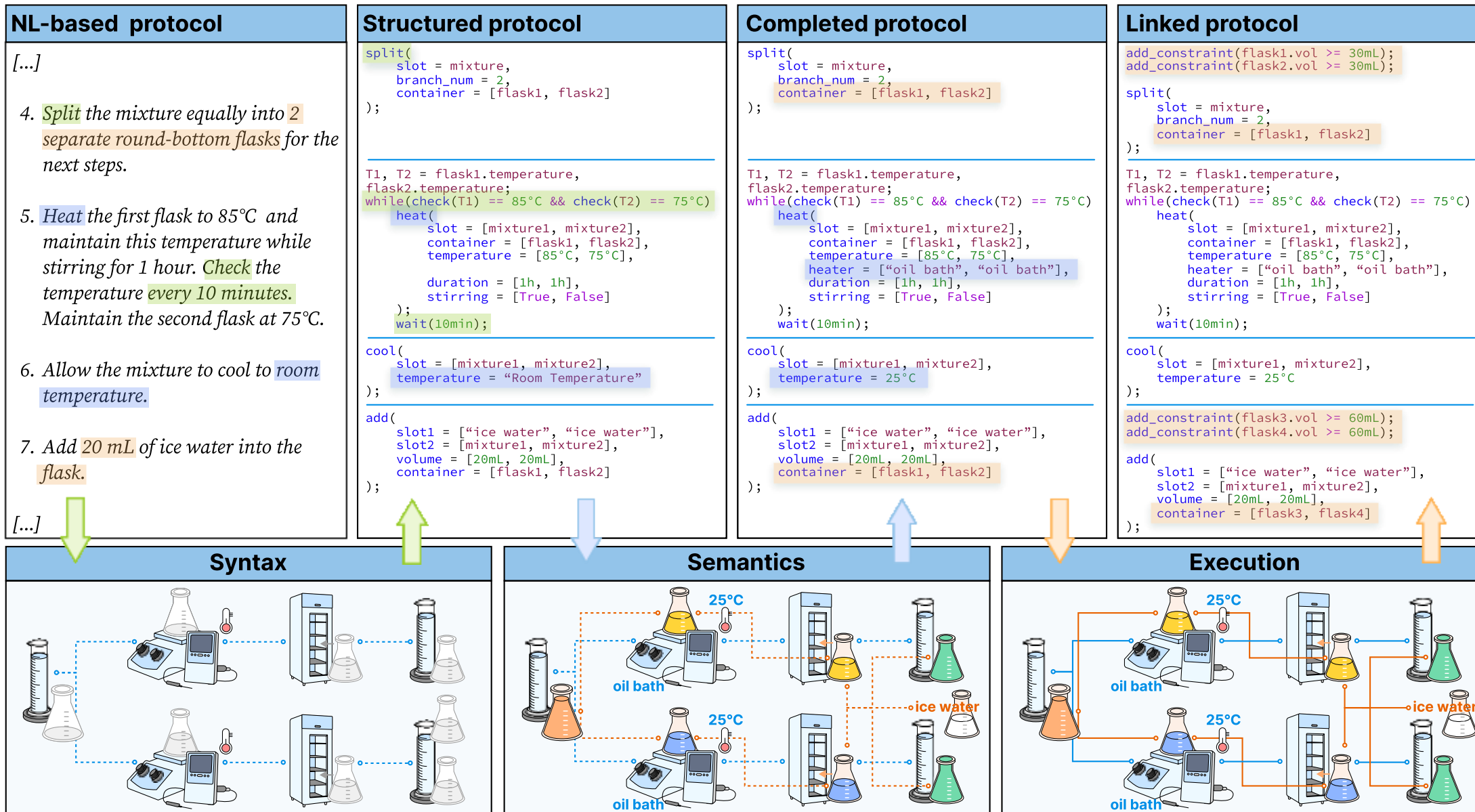
北京大學
PEKING UNIVERSITY



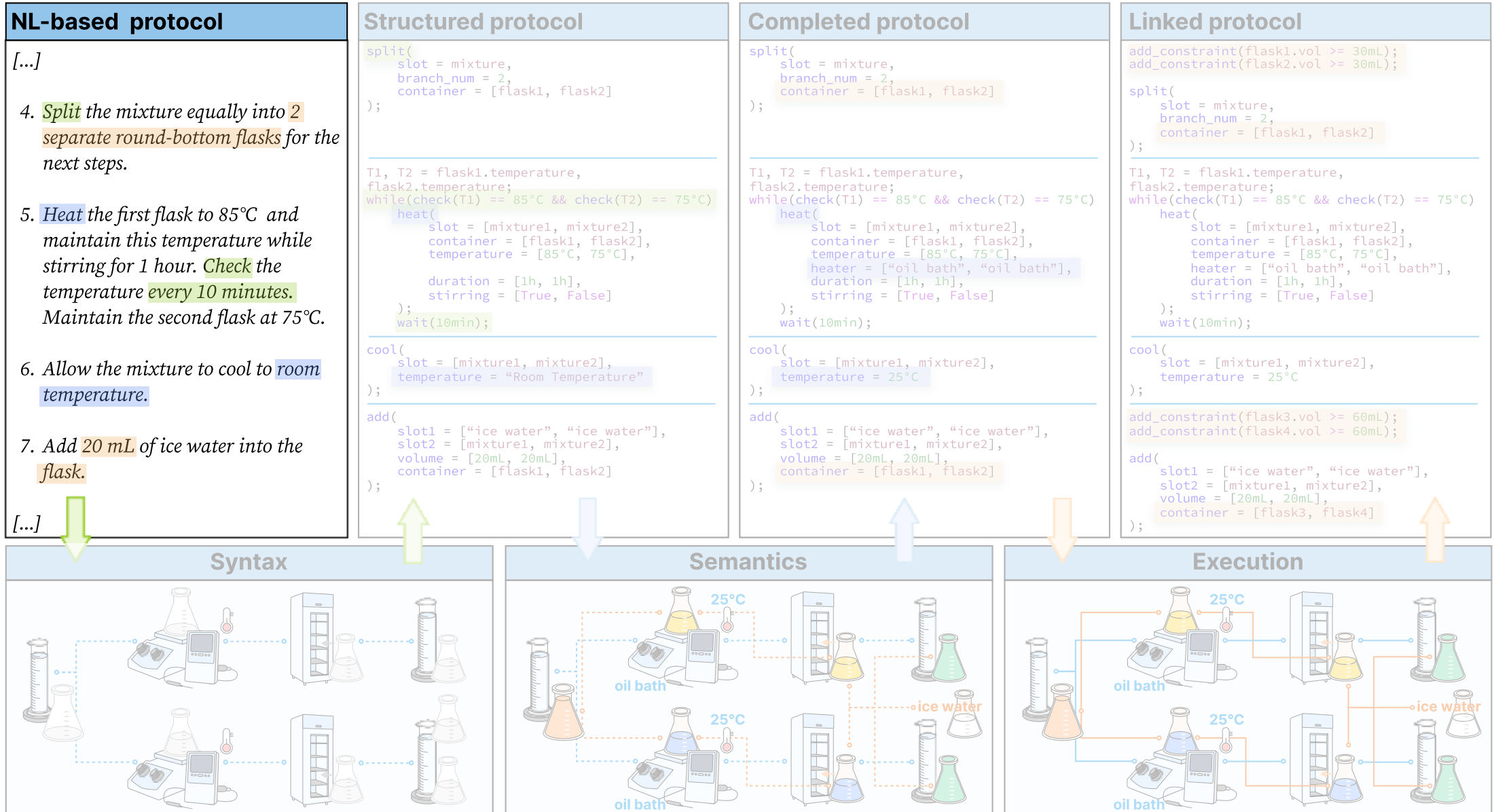
Expert-level protocol translation for self-driving labs

Yu-Zhe Shi, Fanxu Meng, Haofei Hou, Zhangqian Bi, Qiao Xu, Lecheng Ruan, Qining Wang
Department of Advanced Manufacturing and Robotics, College of Engineering, Peking University

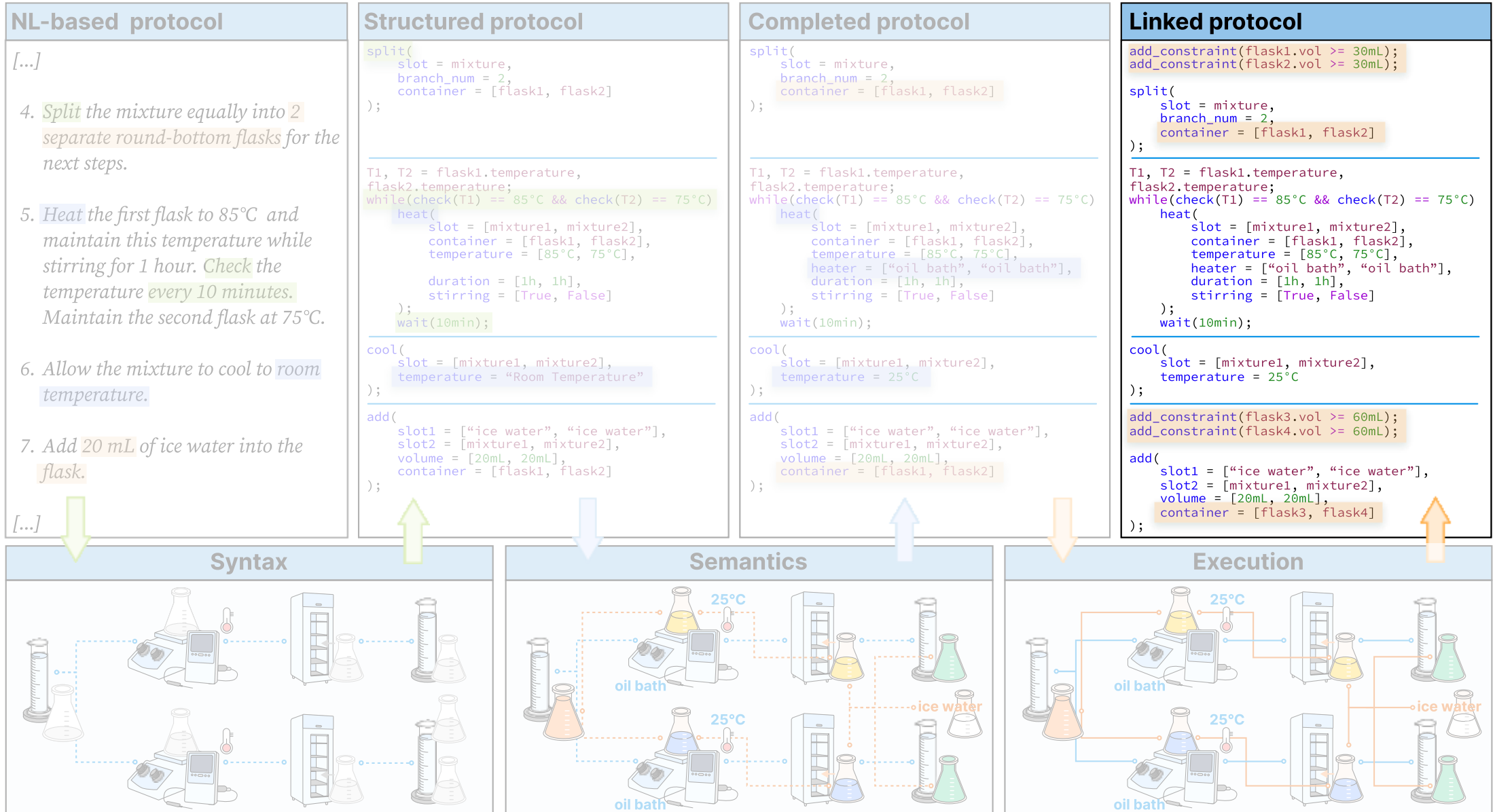
The protocol translation problem



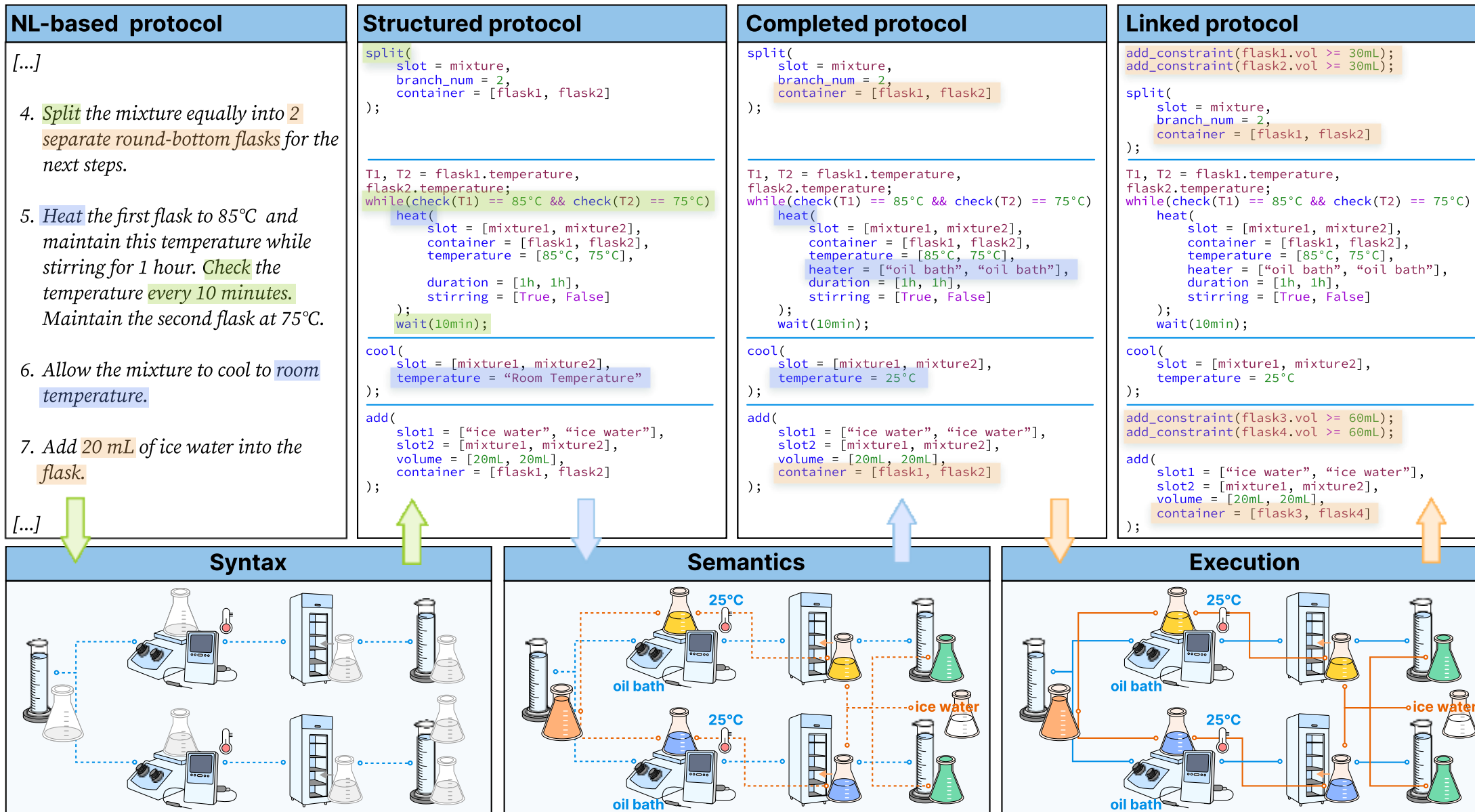
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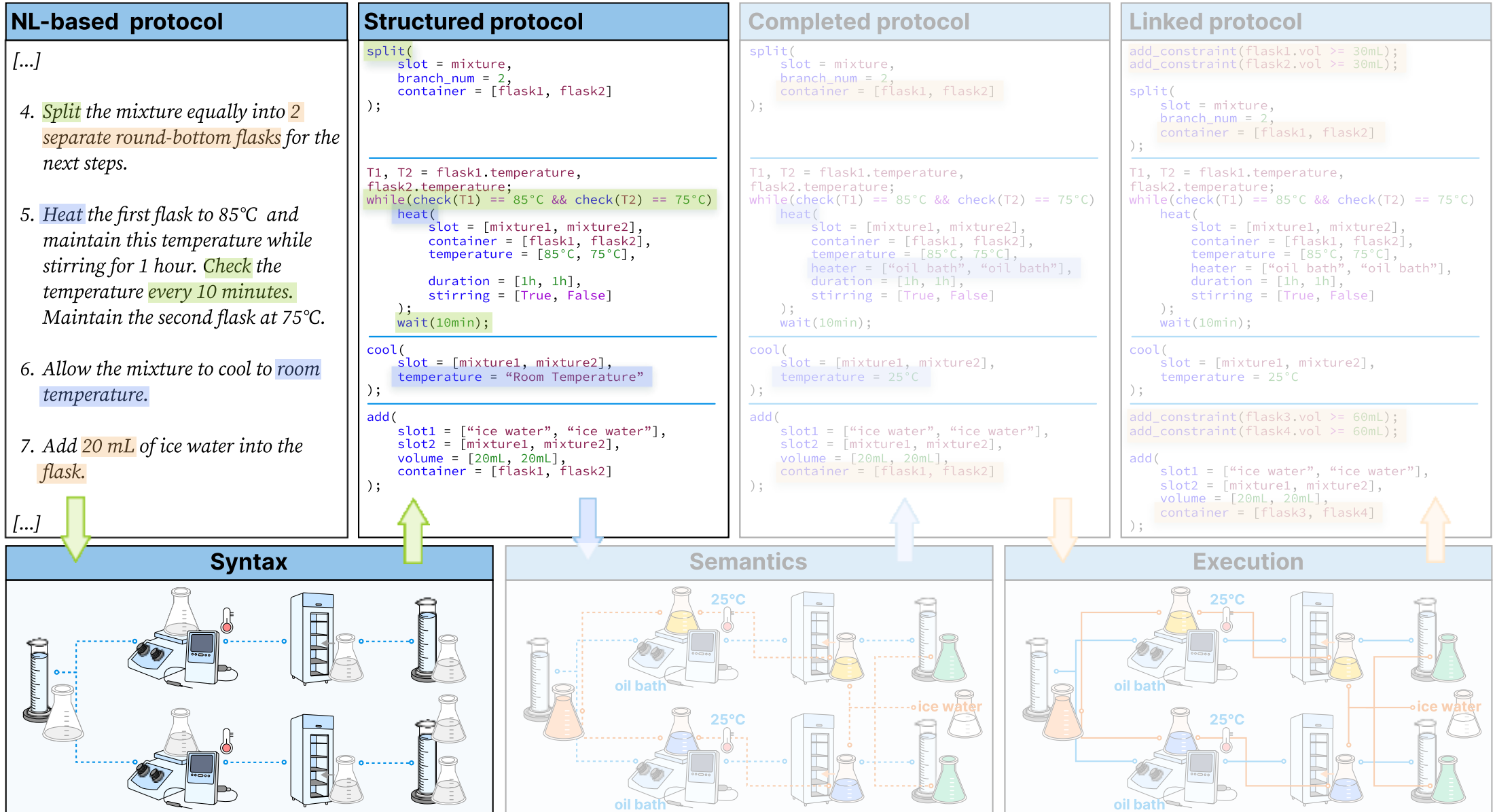
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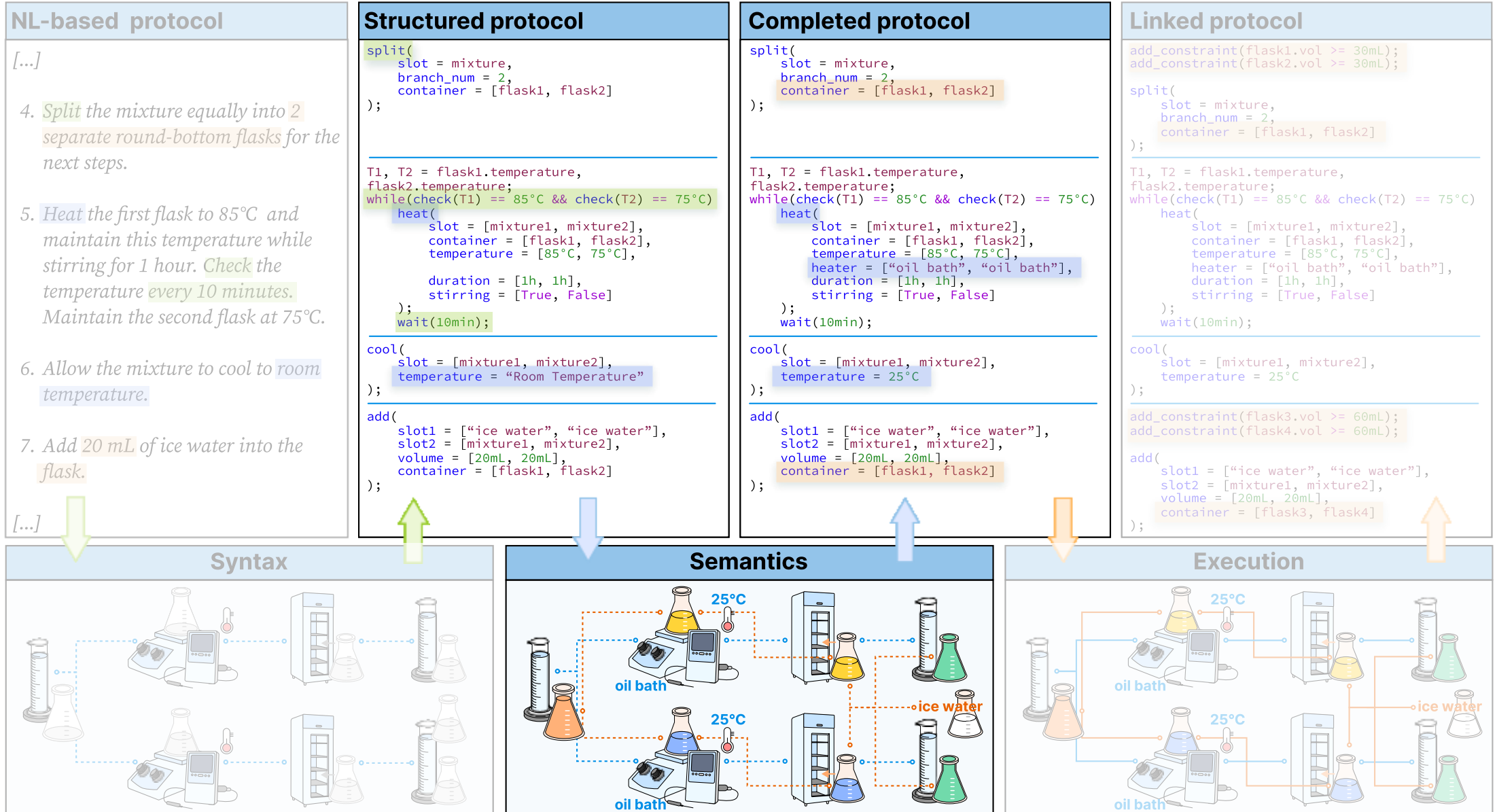
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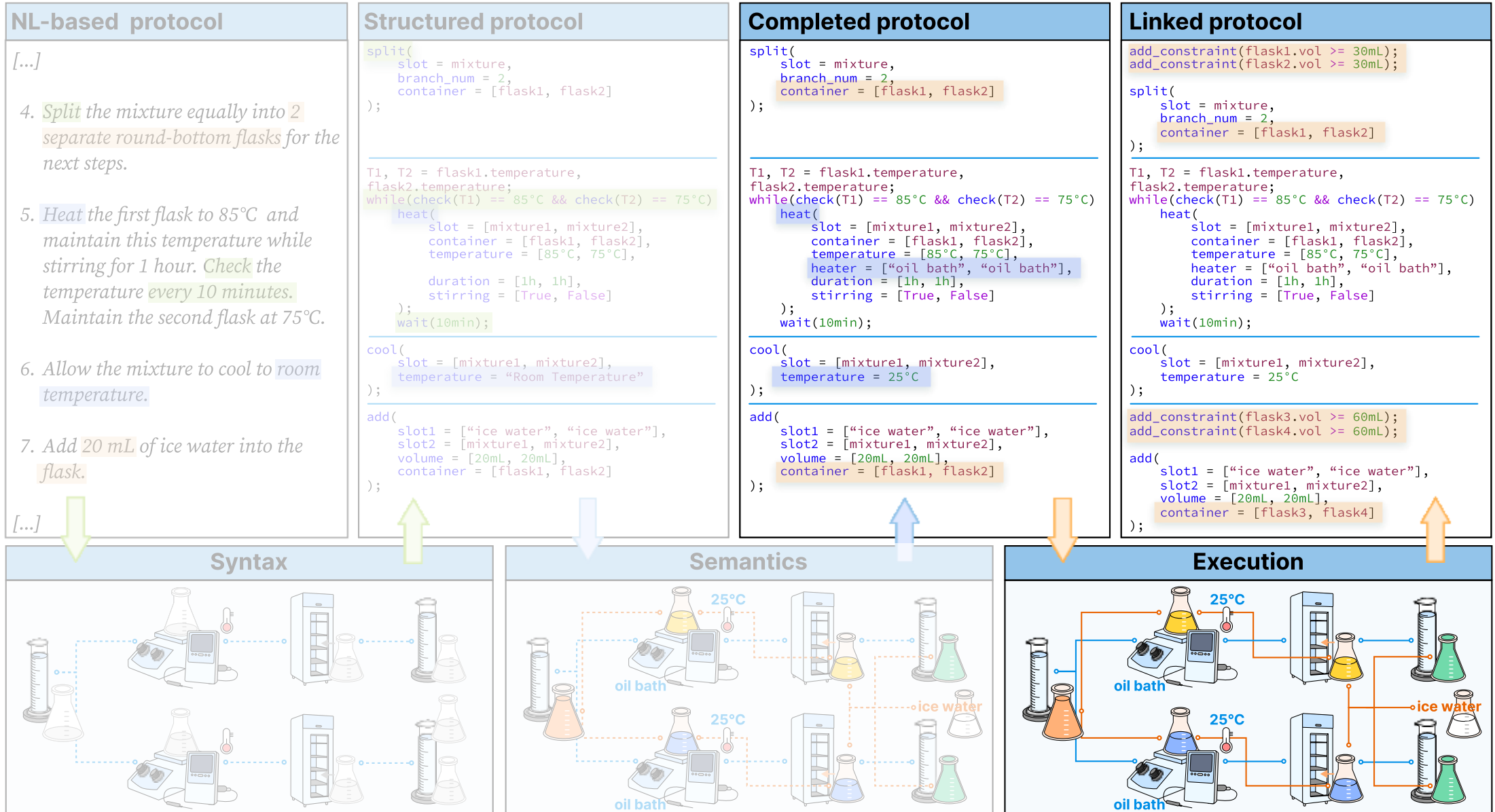
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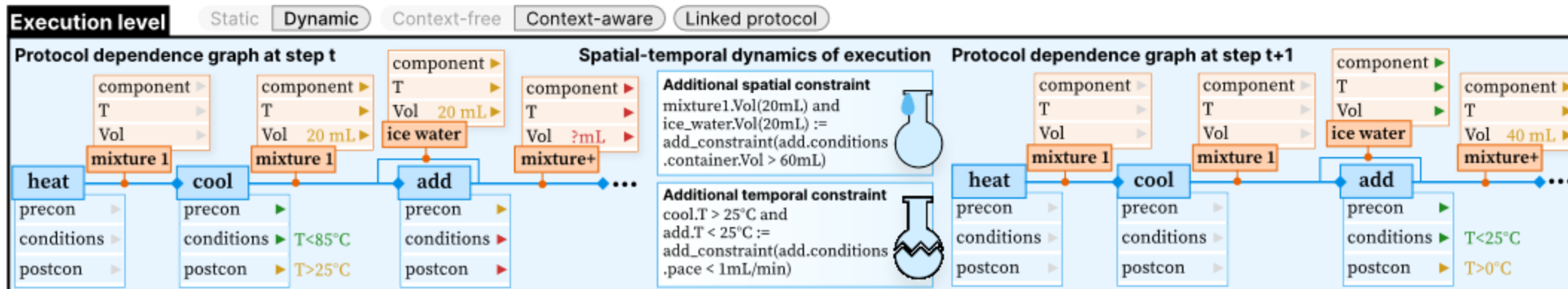
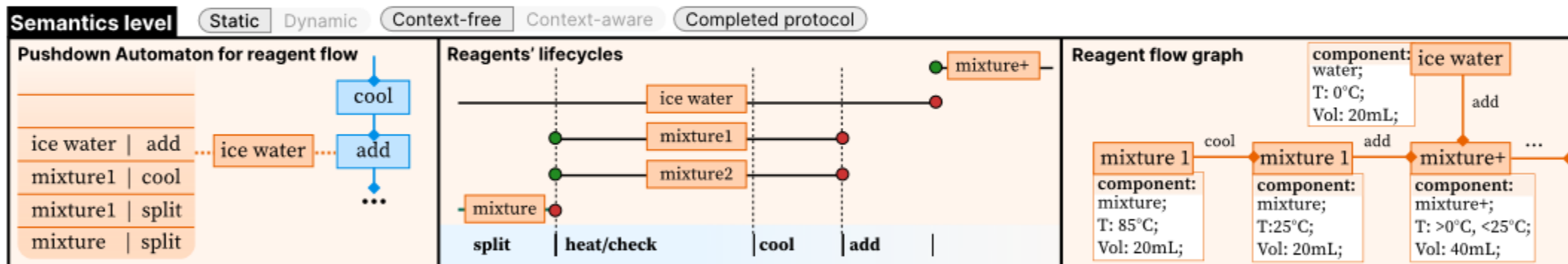
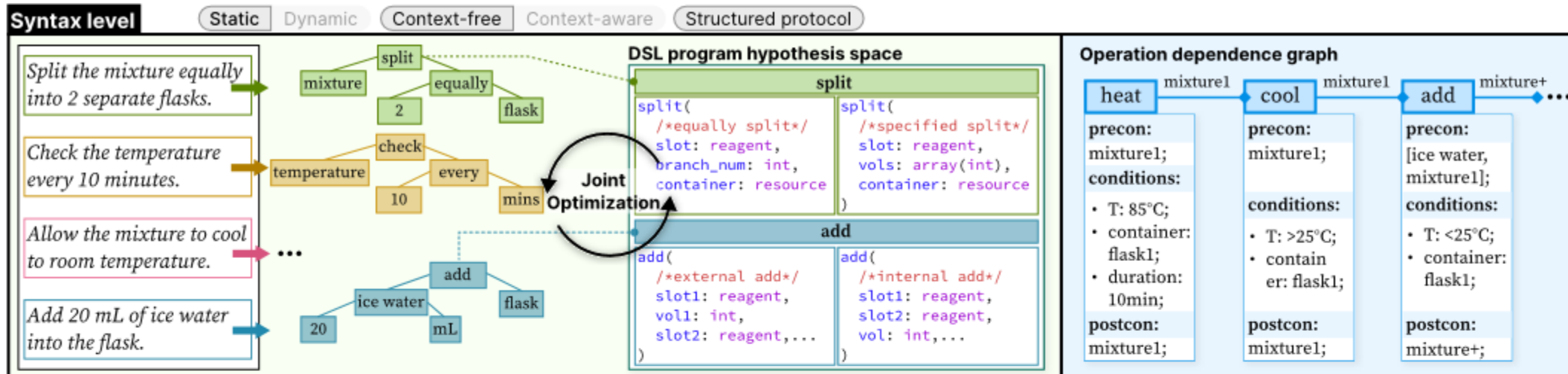
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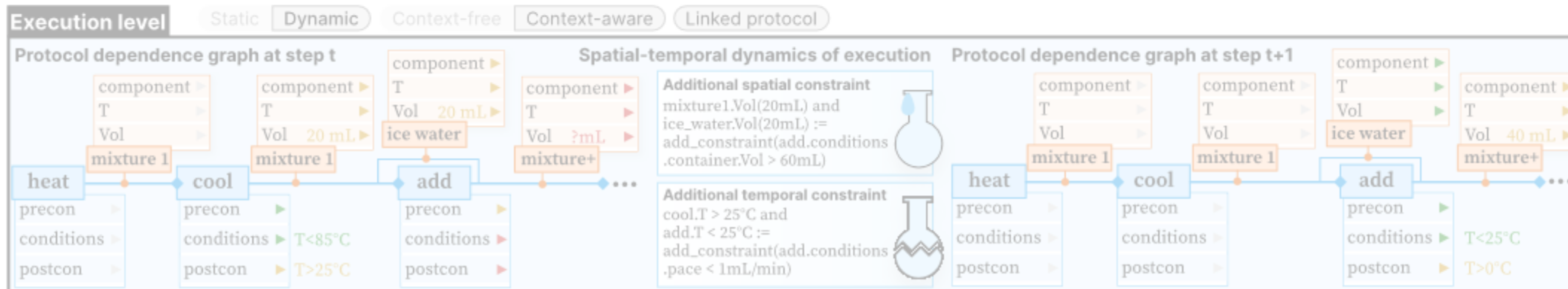
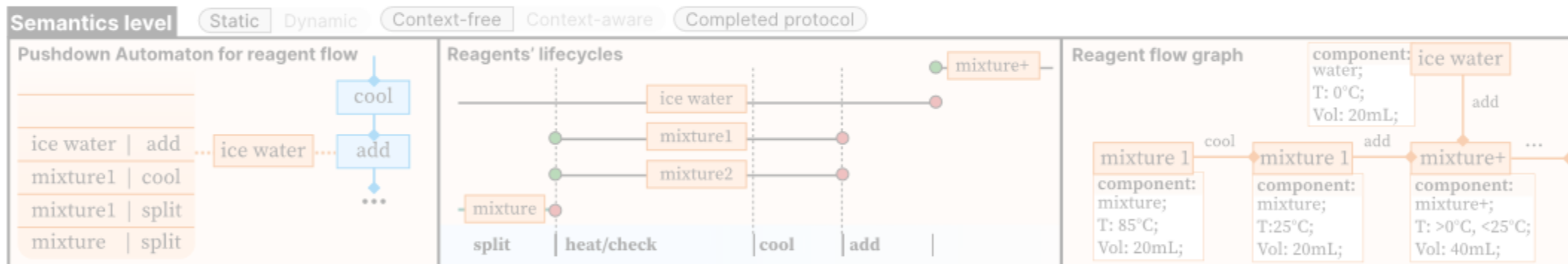
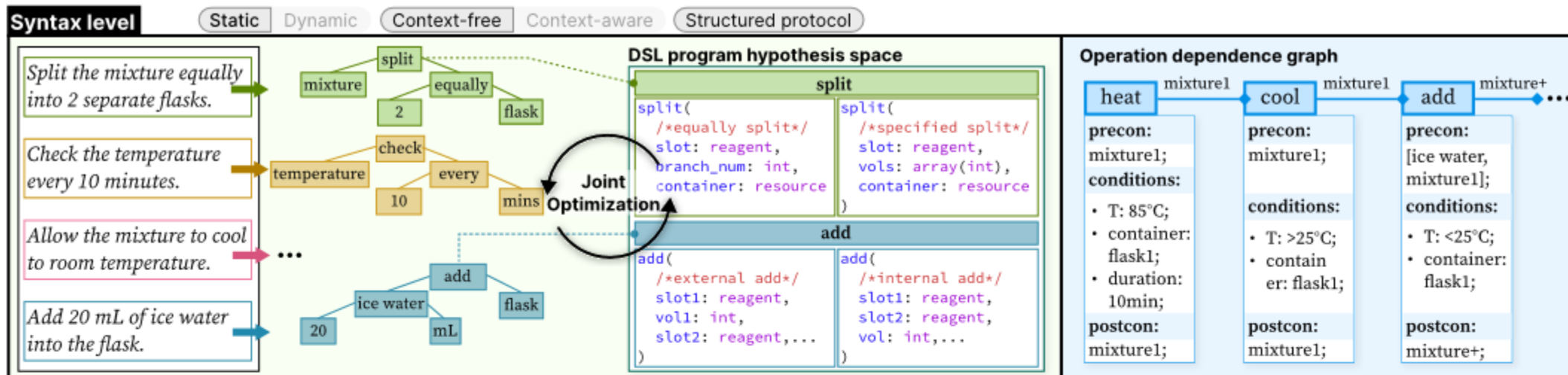
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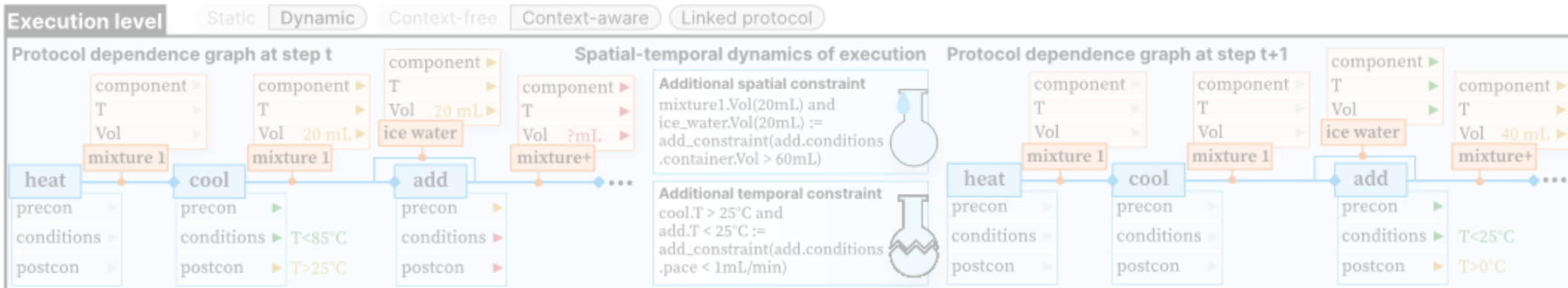
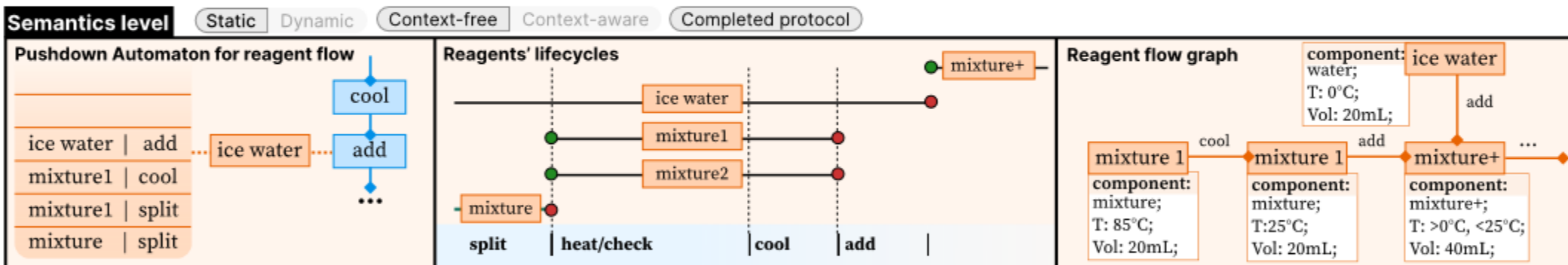
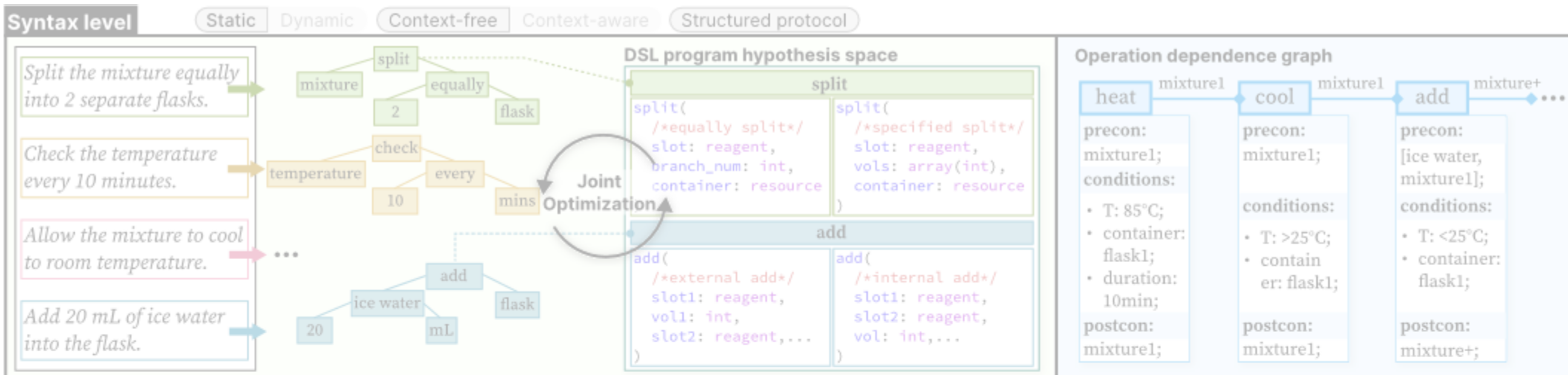
Translator building protocol dependence graphs



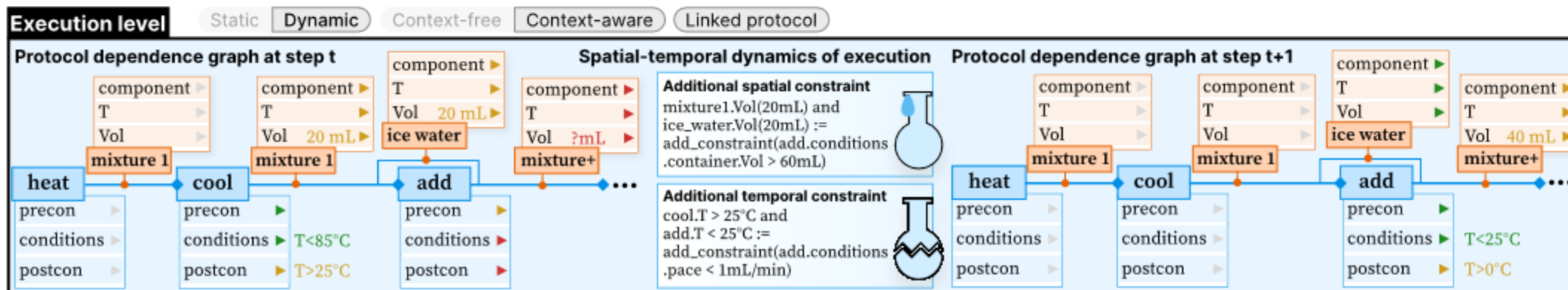
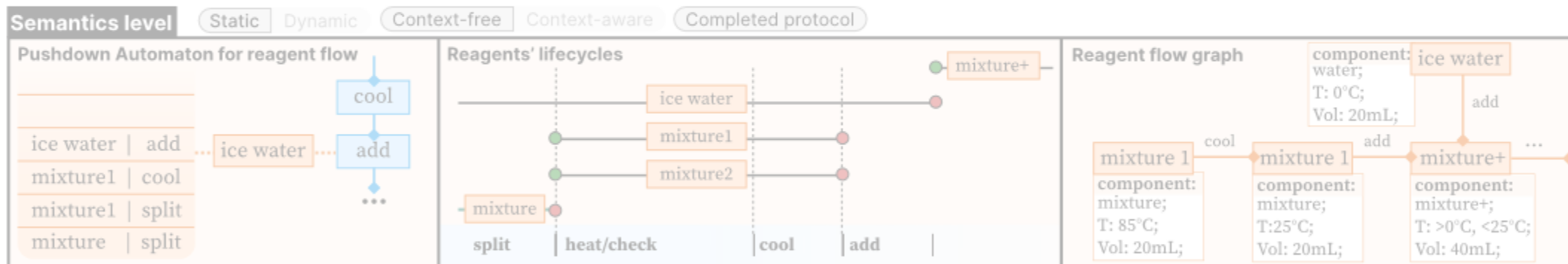
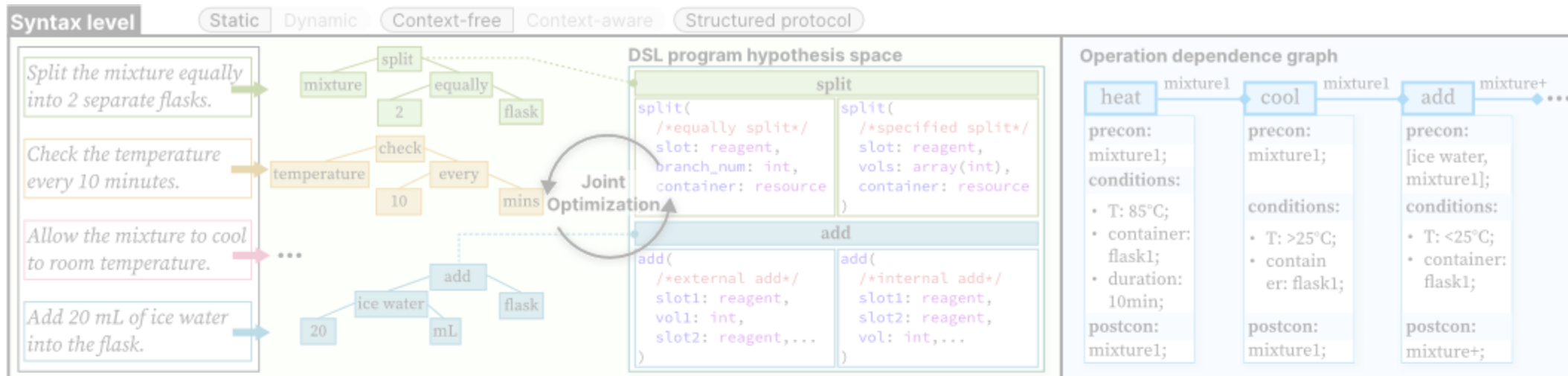
Translator building protocol dependence graphs



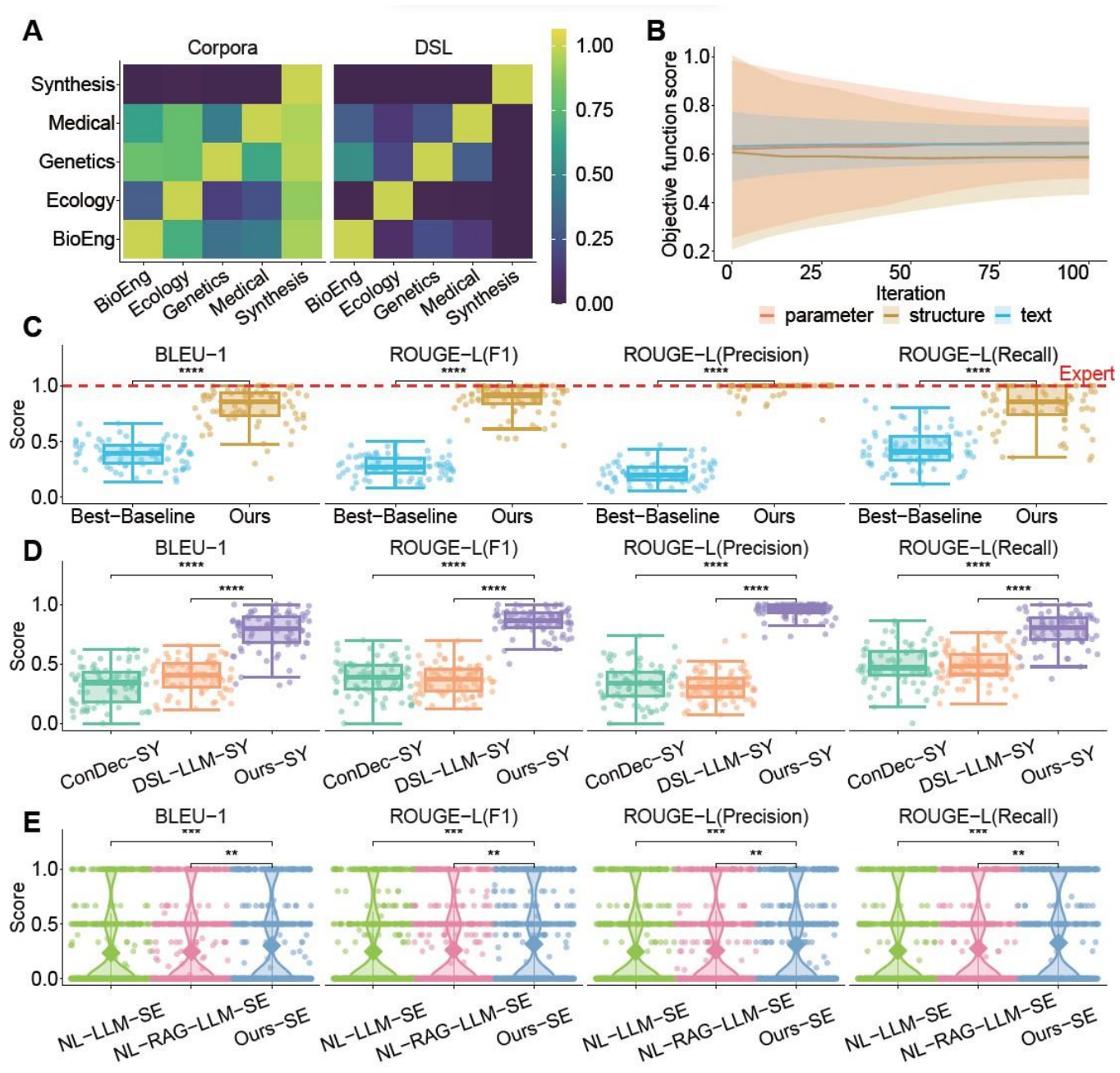
Translator building protocol dependence graphs



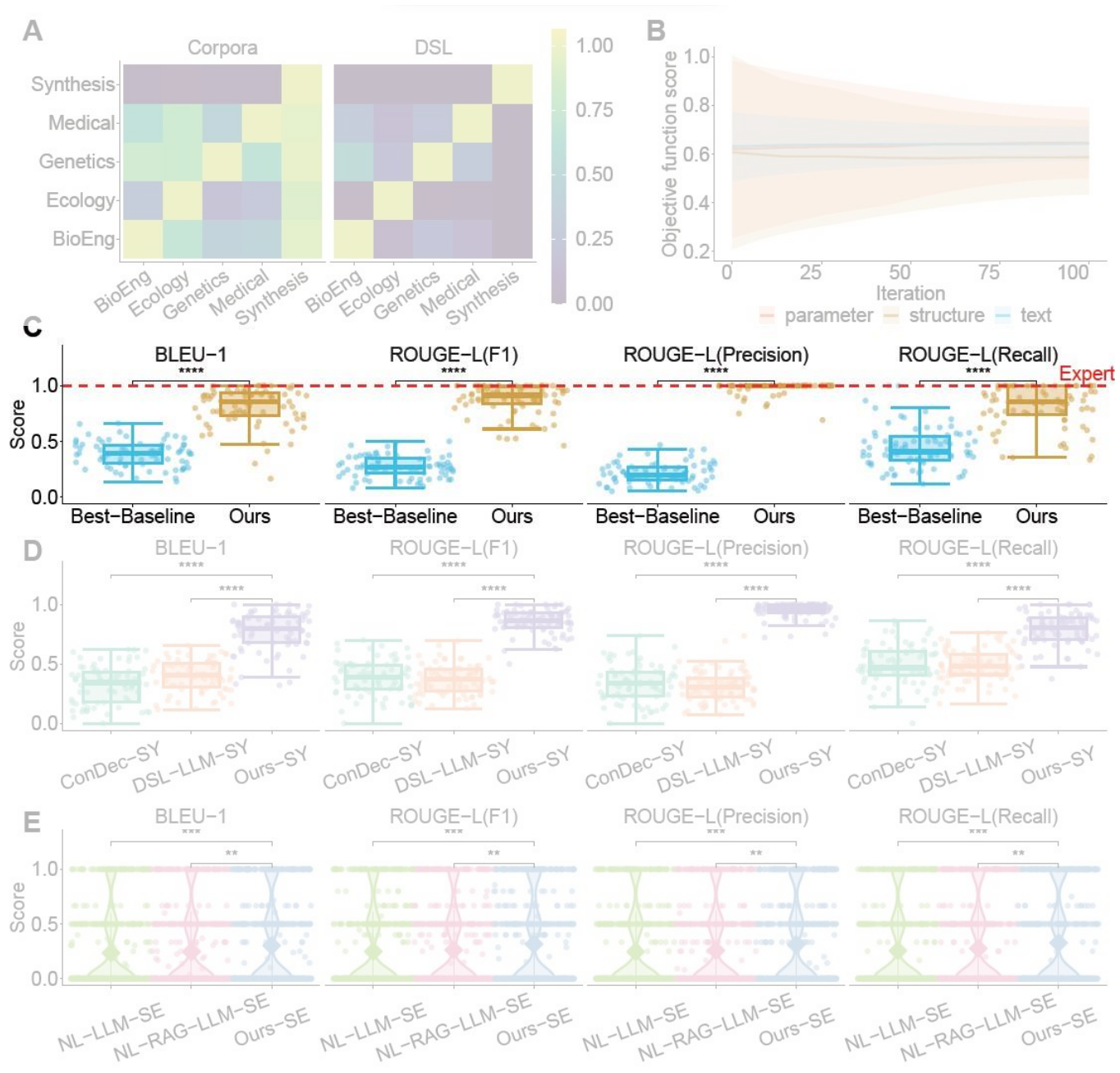
Translator building protocol dependence graphs



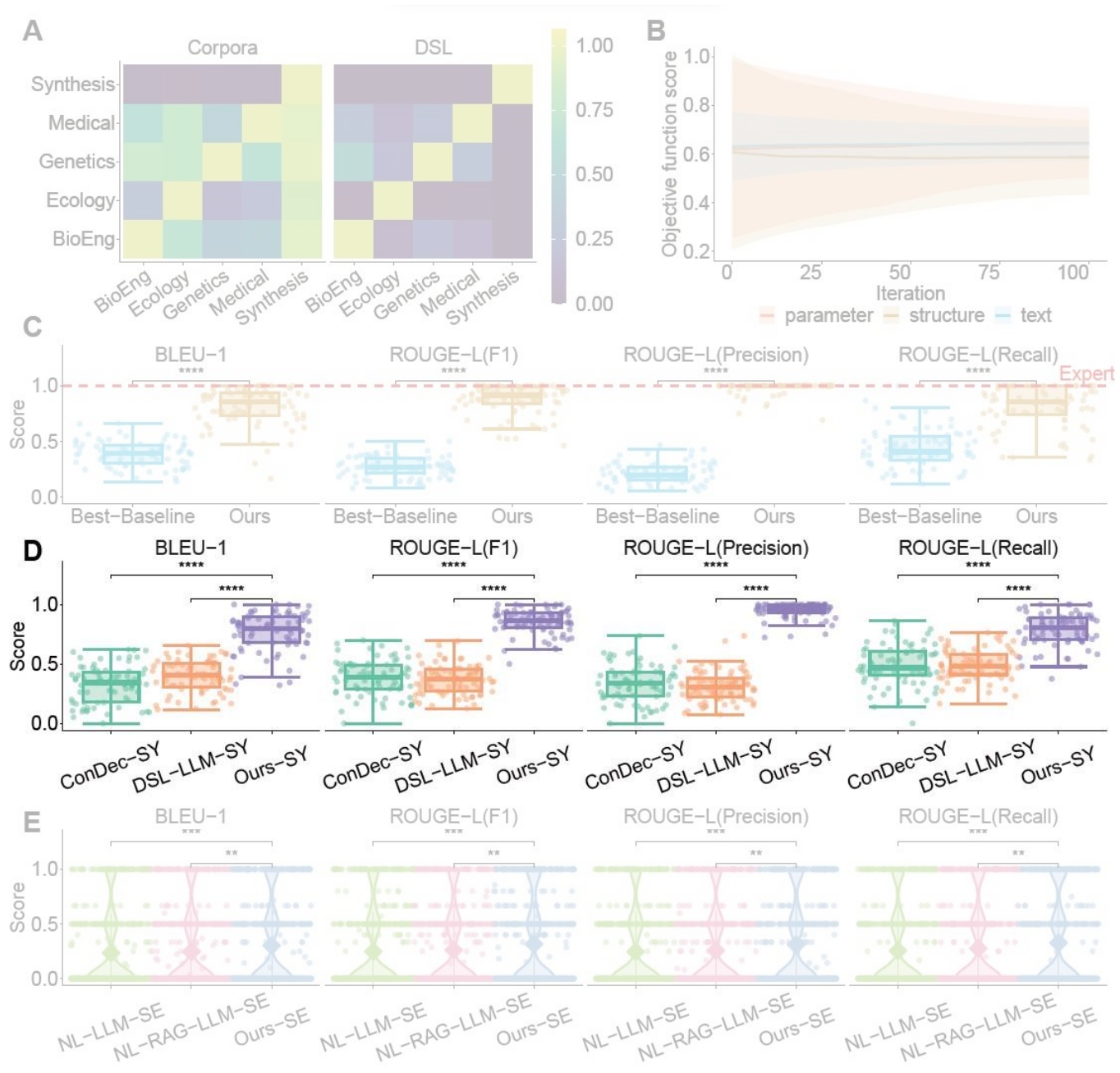
Quantitative results



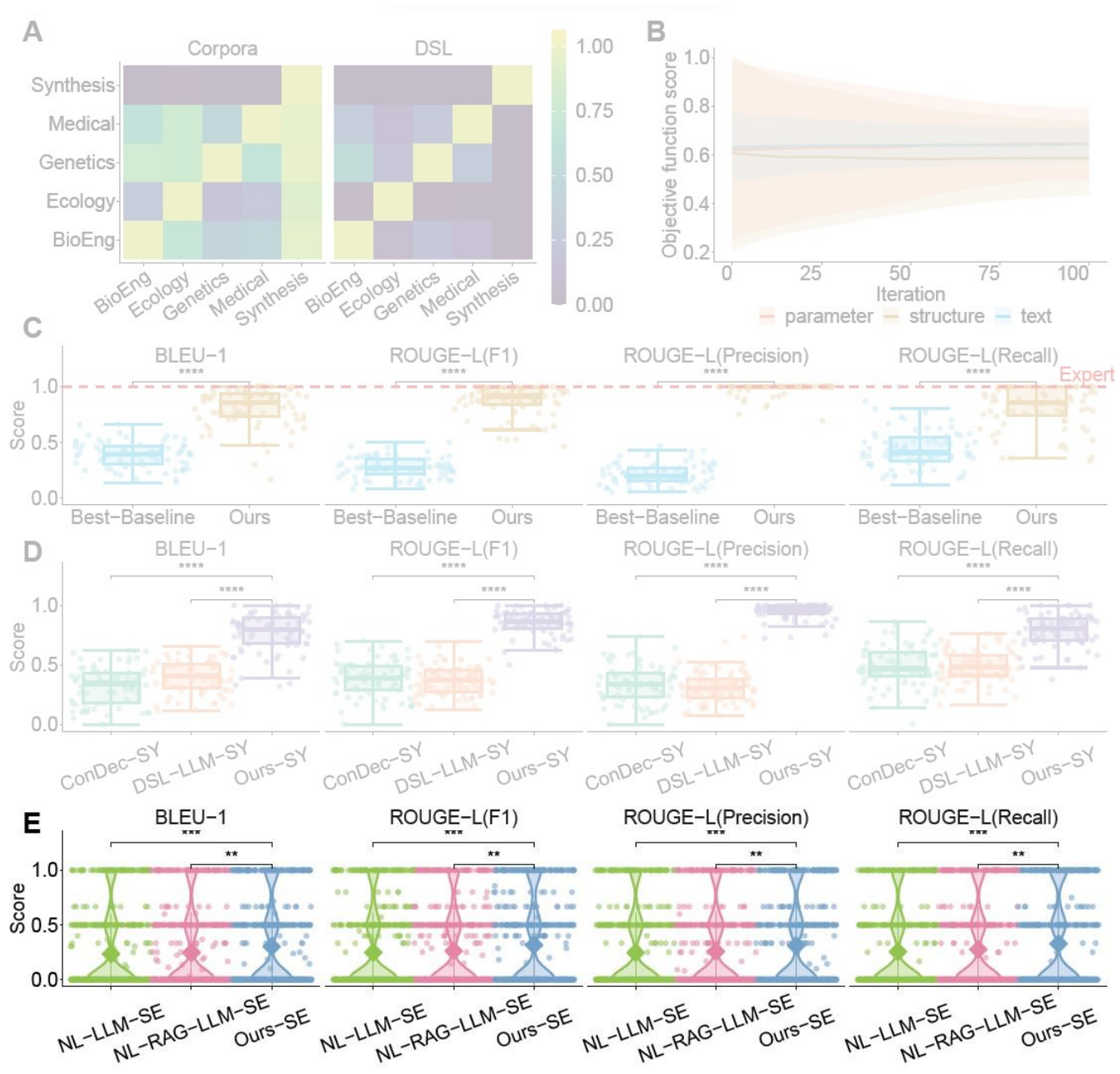
Quantitative results



Quantitative results

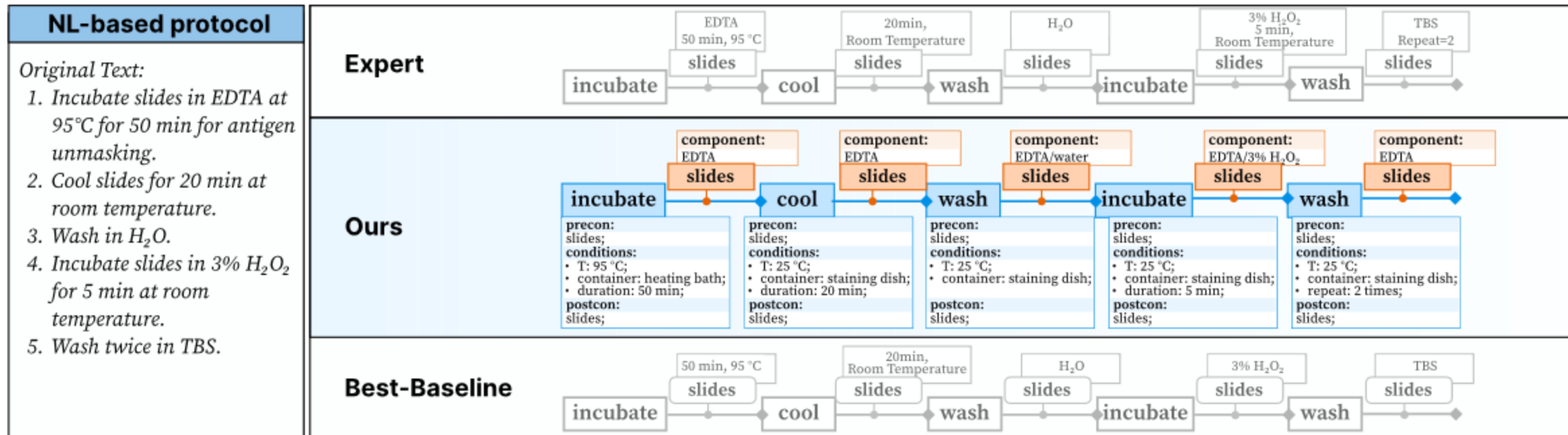


Quantitative results



Qualitative results

A



B

| Syntax | |
|---|--|
| <p><i>Original Text:</i> Transfer the remaining cell lysate (480 µL) to a scintillation vial .</p> | |
| <p>Groutruth: action: transfer, output: 3H-Penciclovir reagent: cell lysate volume: 480 µL container: scintillation vial</p> | <p>Ours: action: transfer output: 3H-Penciclovir reagent: cell lysate volume: 480 µL container: scintillation vial</p> |
| <p>DSL-LLM-SY: action: transfer container: scintillation vial output: radiolabeled cells volume: 5 mL</p> | <p>ConDec-SY: action: transfer concentration: scintillation container: scintillation vial output: reagent: Cytoscint fluid volume: 5 mL</p> |

C

| Semantics | |
|---|--|
| <p><i>Original Text:</i></p> <ol style="list-style-type: none"> 1. Stain the slides with DAPI nucleic acid stain (for 30 seconds). 2. Wash three times with PBS (in slide-beakers) applying gentle shaking. | |
| <p>Groutruth: stain(reagent = [slides, DAPI nucleic acid stain]); wash(reagent = [PBS] time = [three times])</p> | <p>Ours: stain(reagent = [slides, DAPI nucleic acid stain] time = [30 seconds]); wash(reagent = [PBS] time = [three times] container = [slide-beakers])</p> |
| <p>NL-LLM-SE: stain(reagent = [slides]); time = [5 min] wash(reagent = [PBS] container = [...] time = [three times])</p> | <p>NL-LLM-SE: stain(reagent = [DAPI nucleic acid stain]); time = [1 min] wash(reagent = [PBS] time = [three times])</p> |

Takeaways

We study the **problem** of translating protocols aimed to guide humans to those suitable for machine execution.

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Our translator has the potential to **democratize** scientific discovery.

Thank you!