Outer Barrel: Pigtails & Production Flow

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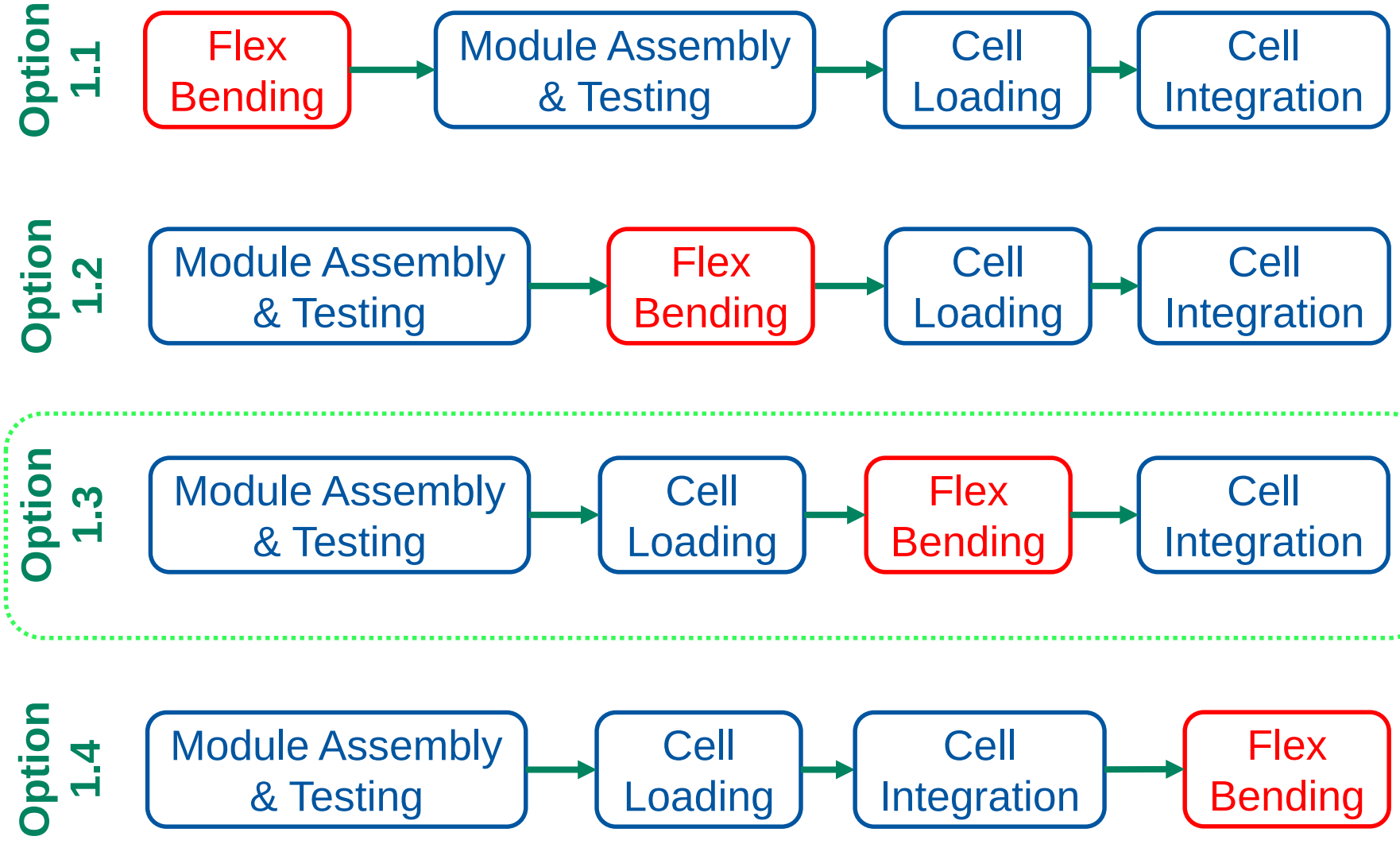
Option 1: Flex Including Pigtails (*a la* Demonstrator)



Two different OB module types from the very beginning!

Option 1: Flex Including Pigtails (*a la* Demonstrator)

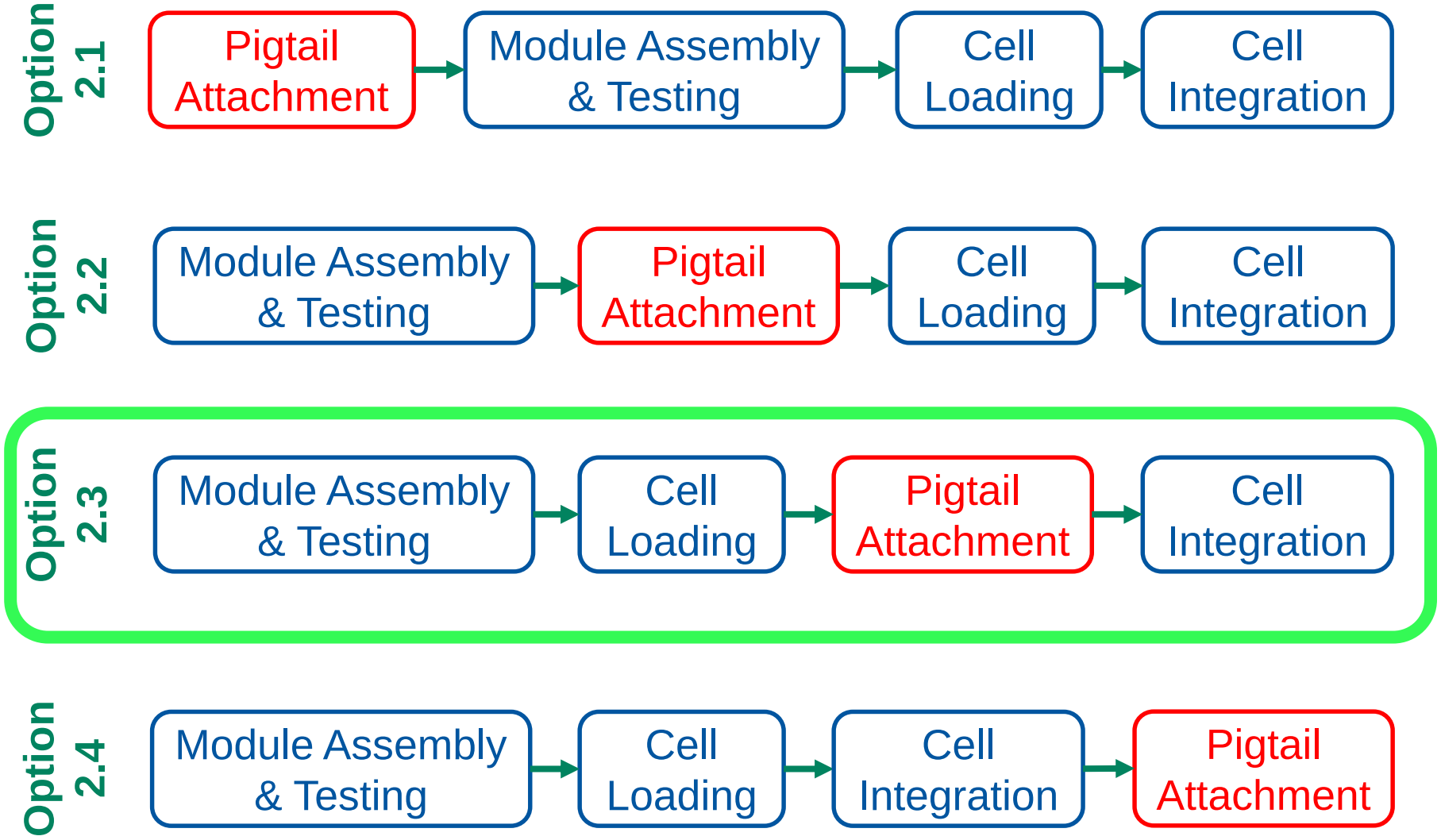
Flex Concept	Pigtail installation/bending	Comments	
1. Flex with pigtails	1.1 Bending before module assembly	+ Simpler flex design + Easier to meet power specifications - 2 different flexes for OB flat and inclined sections from the beginning (NO flexibility)	+ Compatible with hot forming of pigtails - Module assembly extremely difficult with bent pigtail - 3D geometry makes handling, testing, shipment very difficult - Cell loading difficult with bent pigtail

	1.2 Bending before cell loading		- NOT Compatible with hot forming of pigtails
			  - Difficult to guarantee envelope in flat section
			  - Pigtail geometry to change with time
			- Complex and risky bending process for flat section
			- Cell loading difficult with bent pigtail

	1.3 Bending after cell loading but before cell integration (Demonstrator approach)		+ Cell loading is simpler
			- NOT Compatible with hot forming of pigtails
			  - Difficult to guarantee envelope
			  - Pigtail geometry to change with time
			- Complex and risky bending process for flat section

	1.4 Bending after cell integration		- NOT Compatible with hot forming of pigtails
			  - Difficult to guarantee envelope
			  - Pigtail geometry to change with time
			- Complex and risky bending process for flat section (risky for multiple modules)

Option 2: Flex with Power & Data Connectors

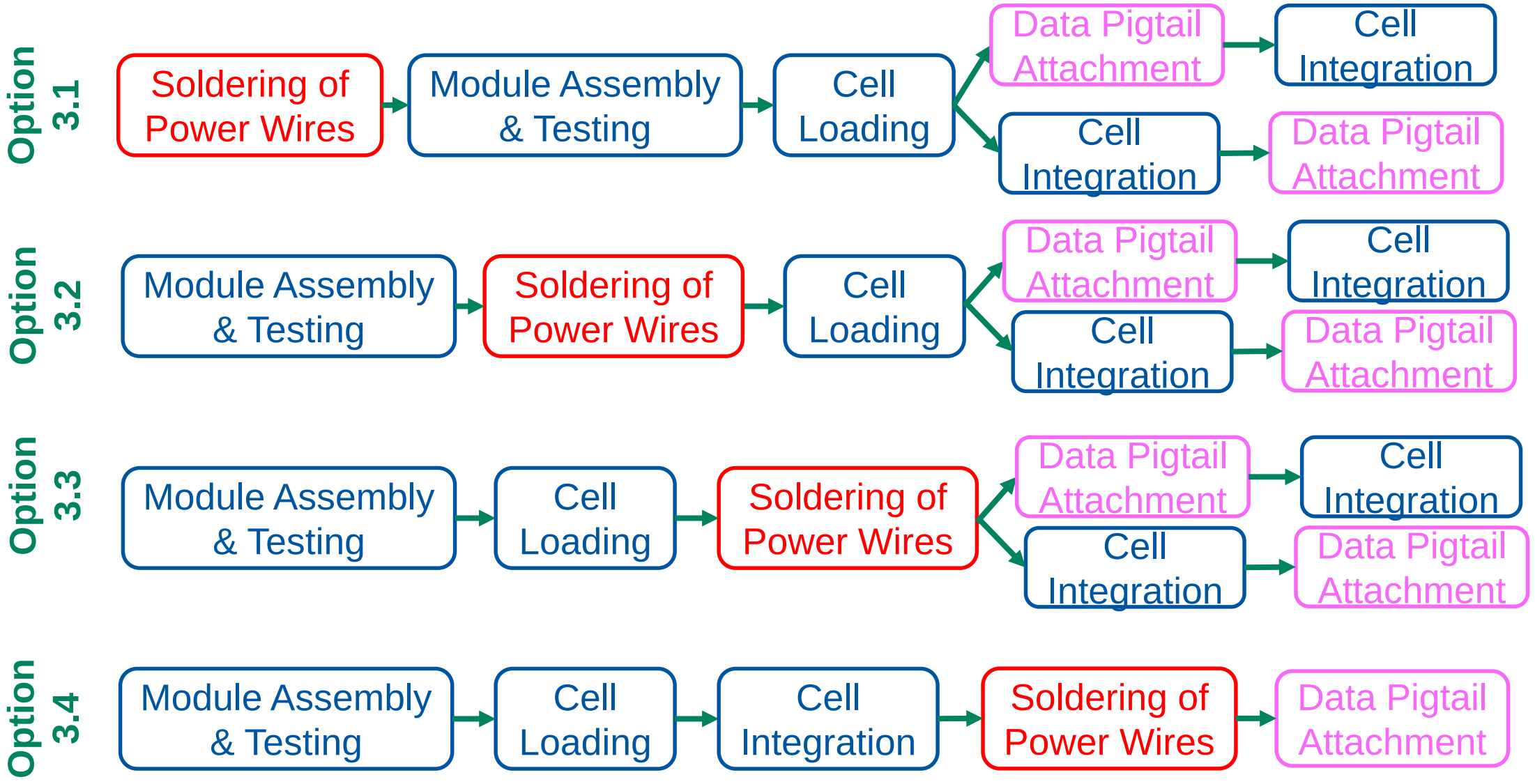


Assuming that the pigtails are bent BEFORE the connection. Otherwise the situation reverts back to Option 1 (with the added advantage that a single flex design could be used for flat and inclined sections)

Option 2: Flex with Power & Data Connectors

Flex Concept	Pigtail installation/bending	Comments	
2. Flex with Power and Data connectors	2.1 Bent Pigtails attached before module assembly	+ Common flex possible for OB flat and inclined sections - More complex flex design - Difficult to select power connector to meet power specifications	+ Compatible with hot forming of pigtails + No need for temporary pigtails for testing - Module assembly extremely difficult with bent pigtail - Module type defined from the beginning - 3D geometry makes handling, testing, shipment very difficult - Cell loading difficult with bent pigtail
	2.2 Bent Pigtails attached after module testing but before cell loading		+ Compatible with hot forming of pigtails - Cell loading difficult with bent pigtail - Module type defined early on - Need to use temporary pigtails for previous tests
	2.3 Bent Pigtails attached after cell loading but before cell integration		+ Compatible with hot forming of pigtails + Module type defined late in the process (added flexibility) + Still relatively feasible to secure tab for power connector (e.g. B25) - Need to use temporary pigtails for previous testing steps
	2.4 Bent Pigtails attached after cell integration		+ Compatible with hot forming of pigtails + Module type defined at the very end (added flexibility) - Need to use temporary pigtails for previous testing steps - More difficult and risky to secure tab for power connector (e.g. B25)

Option 3: Flex with Data Connector + Soldering Pads for Power Wires

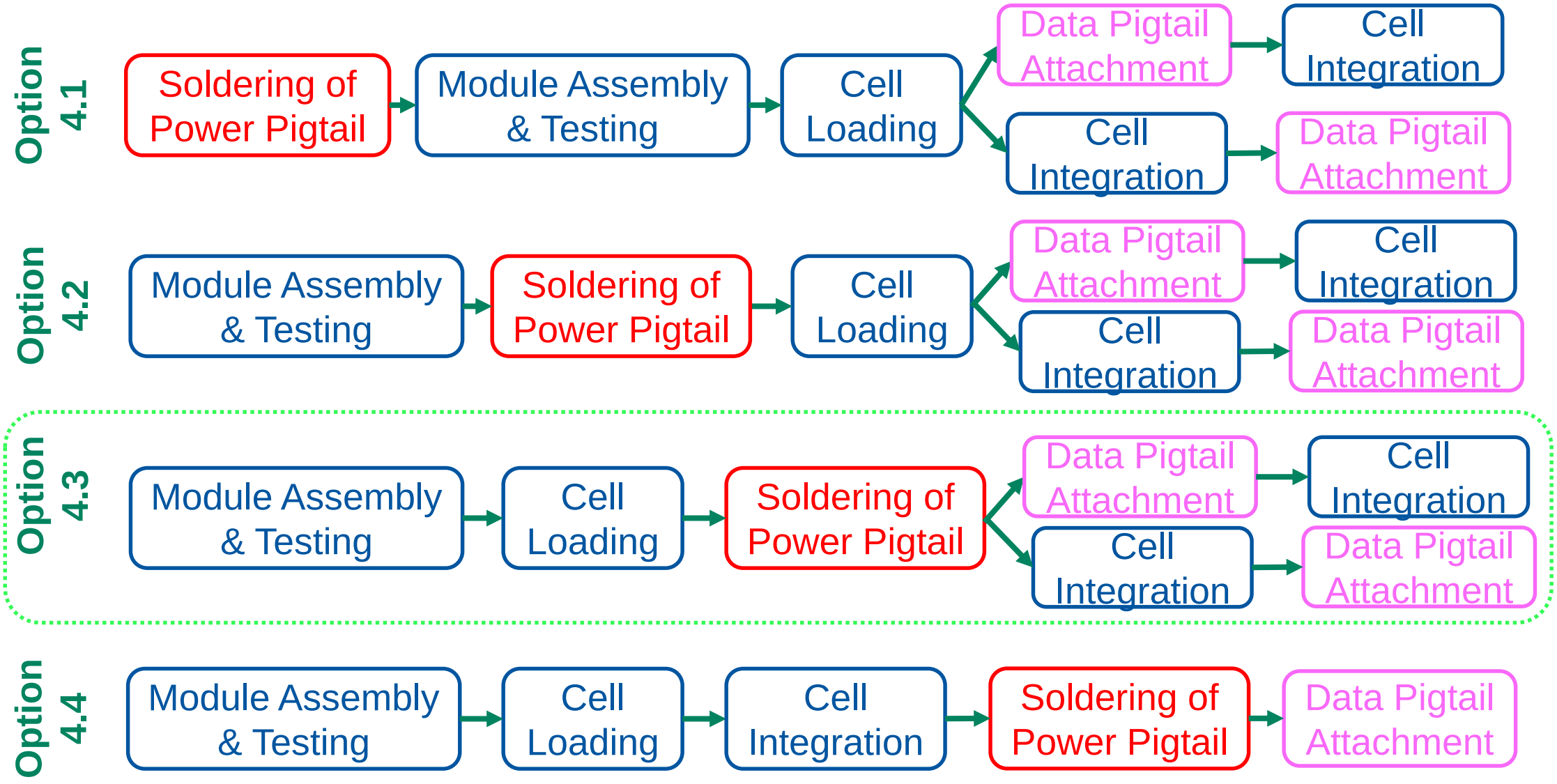


Assuming that the data pigtail is bent BEFORE the connection and installed AFTER cell loading (otherwise the situation reverts back to Option 2)

Option 3: Flex with Data Connector + Soldering Pads for Power Wires

Flex Concept	Pigtail installation/bending	Comments	
3. Flex with Data connector and Soldered Power Wires	3.1 Power wires soldered before module assembly	+ Common flex possible for OB flat and inclined sections - Difficult to manage soldered connection, including mechanical reliability and strain reliefs - Very difficult to control wire envelope in flat section - Difficult to make common OB/EC flex (wires exist in opposite sides of module)	+ Easier and safer to perform the soldering step - Module assembly, handling & shipment more difficult - Unclear how to shape wires (not particularly flexible) - Module defined from the beginning - Cell loading more difficult with wires in place - Temporary data pigtails needed
	3.2 Power wires soldered after module assembly but before cell loading		+ Easier for module assembly (wires soldered before testing or temporary powering solution required). - Risky soldering step (on top of module) - Unclear how to shape wires (not particularly flexible) - Module defined from the beginning - Cell loading more difficult with wires in place - Temporary data pigtails needed
	3.3 Power wires soldered after cell loading but before cell integration		+ Easier for module assembly and cell loading + Module type defined late in the process (added flexibility) - Risky soldering step (on top of module) - Unclear how to shape wires (not particularly flexible) - Need to use temporary pigtails for previous testing steps
	3.4 Power wires soldered after cell integration		+ Easier for module assembly and cell loading + Module type defined at the very end (added flexibility) - Very risky soldering step (on top and next to modules) - Unclear how to shape wires (not particularly flexible) - Need to use temporary pigtails for previous testing steps

Option 4: Flex with Data Connector + Soldering Pads for Power Pigtail



Assuming that the Power and Data pigtails are bent BEFORE the attachment (otherwise, revert back to Option 1)

Option 4: Flex with Data Connector + Soldering Pads for Power Wires

Flex Concept	Pigtail installation/bending	Comments	
4. Flex with Data connector and Soldered Power Pigtail	3.1 Power pigtail soldered before module assembly	+ Common flex possible for OB flat and inclined sections + Easier to control envelope IF the Power pigtail is preformed before soldering - Difficult to manage soldered connection, including mechanical reliability and strain reliefs	+ Easier and safer to perform the soldering step - Module assembly extremely difficult with bent pigtail - 3D geometry makes handling, testing, shipment very difficult - Cell loading difficult with bent pigtail - Temporary data pigtails needed - Module type defined from the beginning
	3.2 Power pigtail soldered after module assembly but before cell loading		+ Easier for module assembly (power pigtail soldered before testing or temporary powering solution required) - Risky soldering step (on top of module) - 3D geometry makes handling, testing, shipment very difficult - Cell loading difficult with bent pigtail in place - Temporary data pigtails needed - Module type defined relatively early
	3.3 Power pigtail soldered after cell loading but before cell integration		+ Easier for module assembly and cell loading + Module type defined late in the process (added flexibility) - Risky soldering step (on top of module) - Need to use temporary pigtails for previous testing steps
	3.4 Power pigtail soldered after cell integration		+ Easier for module assembly and cell loading + Module type defined at the very end (added flexibility) - Very risky soldering step (on top and next to modules) - Need to use temporary pigtails for previous testing steps

Questions?