

# Writing Grid Scripts in CGT

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# Geometry Preparation

## STEP 1: Obtain surface representation

**CGT Tool:** `cad2srf` (CAPRI Library required)

Input: CAD, Output: Surface Triangulation

## STEP 2: Obtain seam curves

### • Aircraft

- Leading and trailing edges
- wing/body junction
- tail/body junction

### • Rocket

- Axisymmetric body definition
- protuberance junctions
- Sharp features

**CGT Tool:** `cad2srf`

Input: CAD; Output: Curves

**CGT Tool:** `seamcr`, `lsect`

Input: Structured patches; Output: Curves

**CGT Tool:** `seamcrt`

Input: Surface Triangulation; Output: Curves

**CGT Scriptlib Tools:** `CreateSeamCur`

Input: Structured patches, Triangulation; Output: Curves

## Option 2: DIY

**CGT Scriptlib Tools:**

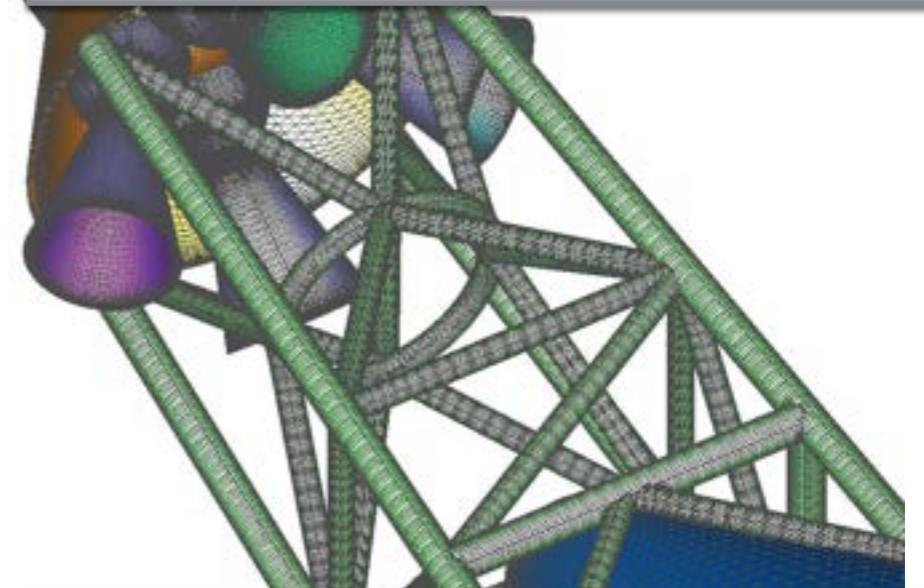
`CreateLine`, `CreateCurve`,  
`CreateAirfoilComponent`,  
`CreateParsecFoil`,  
`CreateCylGrids`,  
`CreateFrustumGrids`

## Option 3: Commercial Tools

`Ansa`, `PointWise`, `Star-CCM+`,  
etc...

## Option 4: Open Software

`Ogen`



# Configuration or Component?

## Configuration:

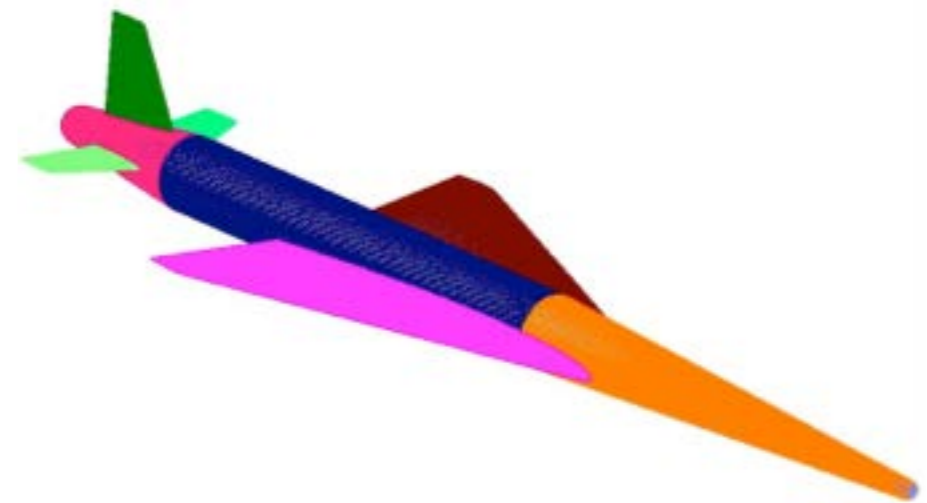
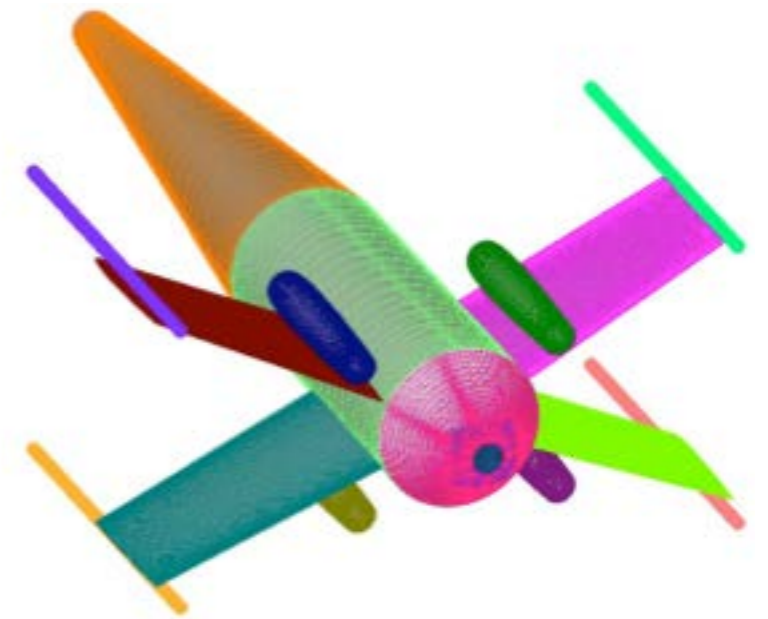
- Grid-centric
- Written for static geometries
- Rules must be followed
  - Set root names
  - Define input variables, defaults
  - Surface files: \*.srf
  - Volume files: \*.vol
  - Each file contains 1 grid
- Framework provided
- Short main script
  - BuildSurf
  - BuildVol
  - BuildPeg5i
- Peg5, X-rays supported

## Component:

- Component-centric
- Written for repeated components and moving-body cases
- Rules must be developed by each user
  - Best practice:
    - Define input variables
    - Flexible filenames: \*.sur, \*.vol, \*.cut, \*.xry
    - Each file contains multiple grids for a component
- Framework contained in a main script
- Longer main script
  - Contains all calls for surface, volume, and connectivity according to user's choice.
- Supports X-rays (Overflow)
  - Basic support for Peg5, and c3p.

# Surface Mesh Generation

- Curve Manipulation
- TFI grids
- Hyperbolically marched grids
  - Collar grids
- Assure proper surface coverage



# Curve Manipulation

**STEP 1: Identify curves that can be concatenated**

**CGT Tool:** `grided`

Input: Curves, Grids; Output: Curves, Grids

**CGT Scriptlib Tools:** `ConcatGrids`,  
`ConcatGrids2`, `ConcatGridsn`,  
`AutoConcateGrids`

Input: Curves, Grids; Output: Curves, Grids

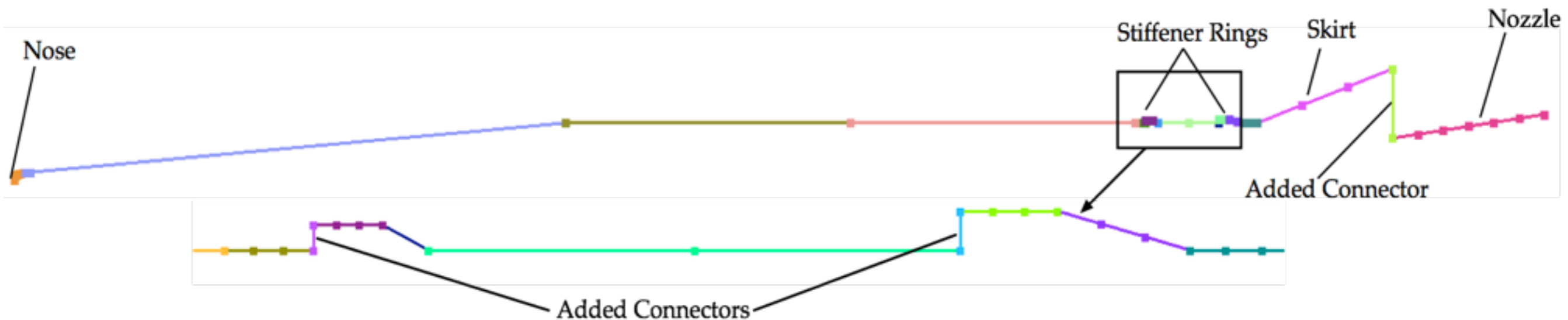
**STEP 2: Identify curves that need to be split**

**CGT Tool:** `grided`

Input: Curves, Grids; Output: Curves, Grids

**CGT Scriptlib Tools:** `ExtractSubs`,  
`ExtractGrids`, `GedSplitJkl`, `GedSplitXyz`

Input: Curves, Grids; Output: Curves, Grids



# Curve Manipulation (cont.)

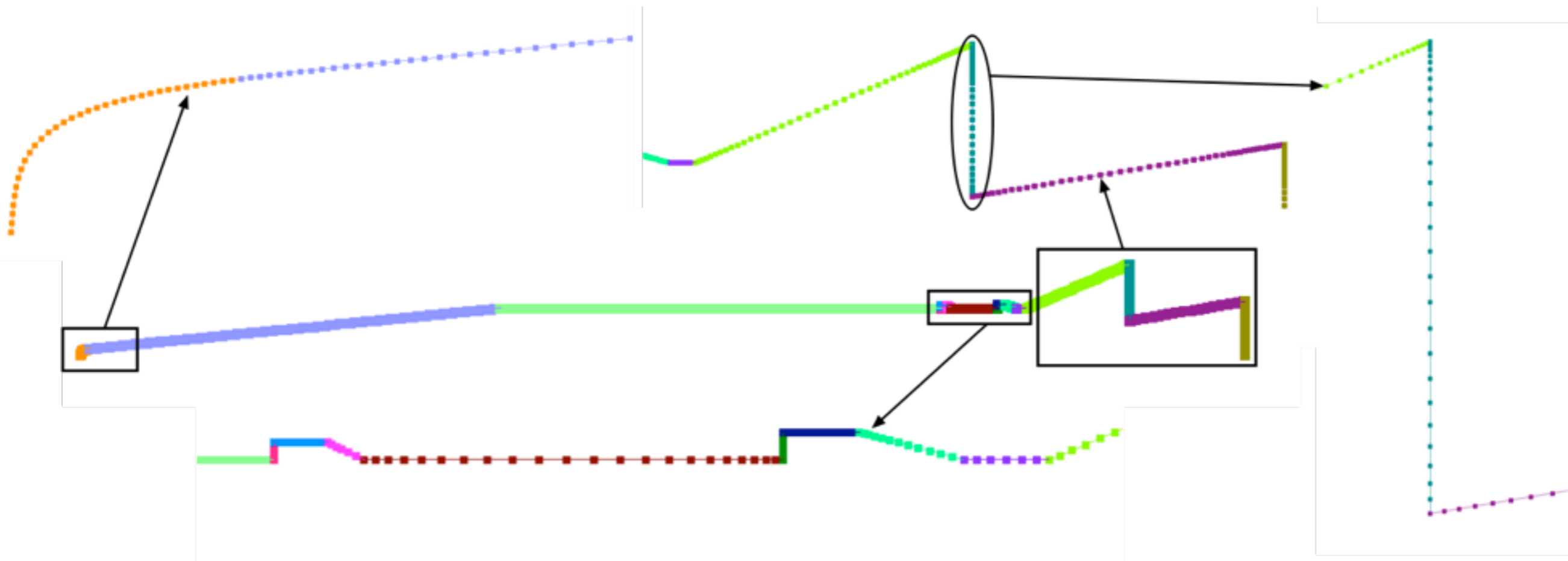
## STEP 3: Redistribute

**CGT Tool:** `srap`

Input: Curves, Grids; Output: Curves, Grids

**CGT Scriptlib Tools:** `SrapRedist`

Input: Curves, Grids; Output: Curves, Grids



# TFI Patches

## STEP 1: Identify TFI patch curves

- **Aircraft**

- LE, TE, Root, Tip

- **Rocket**

- Portions of protuberances

**CGT Tool: OVERGRID**

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool: CombineGrids**

Input: Curves, Grids in **multiple** files; Output:  
Curves, Grids in **one** file

## STEP 2: Create TFI patches

- **Aircraft**

- Top of wing, Bottom of wing
- Portions of other parts

- **Rocket**

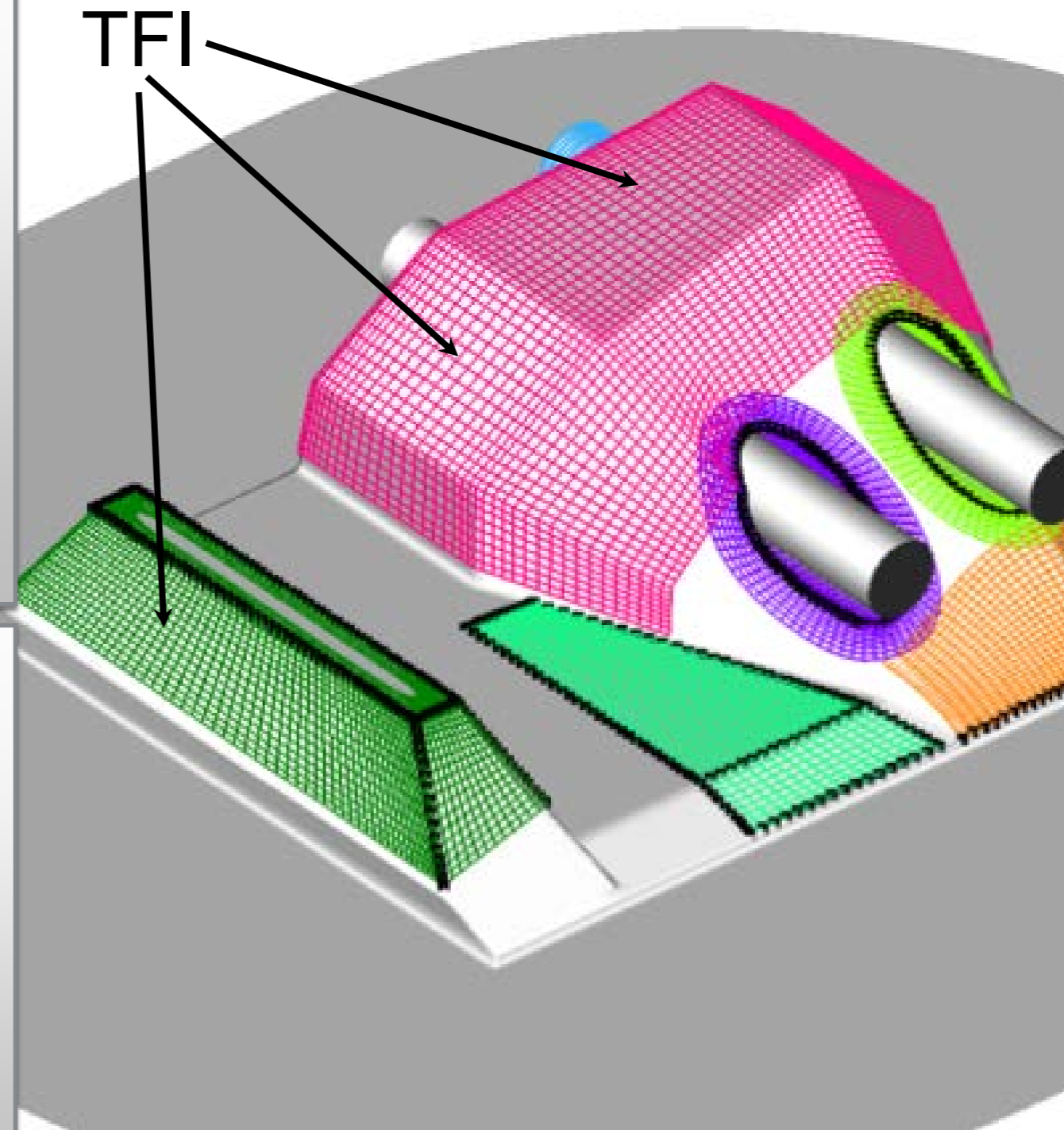
- Portions of protuberances

**CGT Tool: surgrd**

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool: GenTFI**

Input: Ref. Surface, Curves; Output: Grid



# Collar Grids

## STEP 1: Identify Starting curves

- **Aircraft**
  - Wing/Body junction
  - Tail/Body junction
- **Rocket**
  - Protuberances/Stack junction

**CGT Tool: OVERGRID**

## STEP 2: Create collar grids

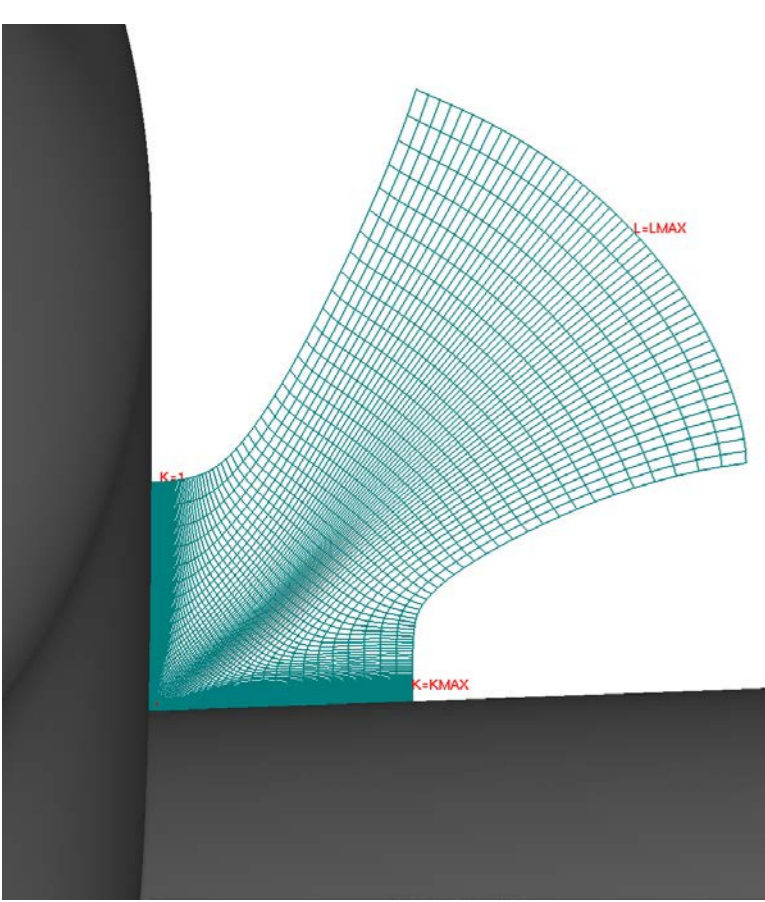
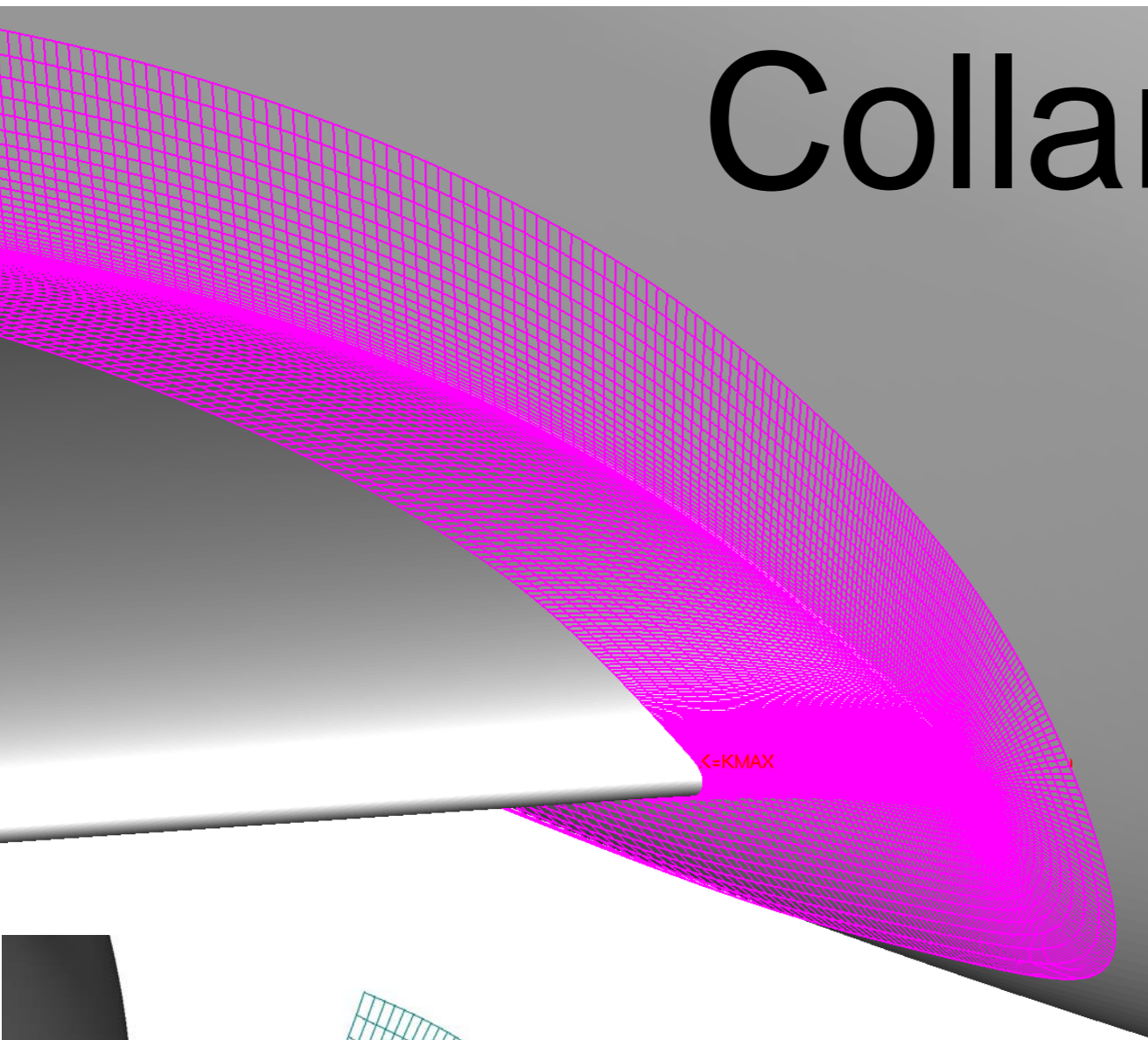
- **Identify Starting curves**
- **Aircraft**
  - Wing/Body junction
  - Tail/Body junction
- **Rocket**
  - Protuberances/Stack junction

**CGT Tool: surgrd**

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool: GenHypSurGrids**

Input: Ref. Surface, Curves; Output: Grid





# Concatenate, Break-up Grids

**STEP 1: Identify grids that can be concatenated, or need to be split**

**CGT Tool:** OVERGRID

**STEP 2: Concatenate grids**

**CGT Tool:** grided

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool:** ConcatGrids,  
ConcatGrids2, ConcatGridsn,  
AutoConcateGrids

Input: Ref. Surface, Curves; Output: Grid

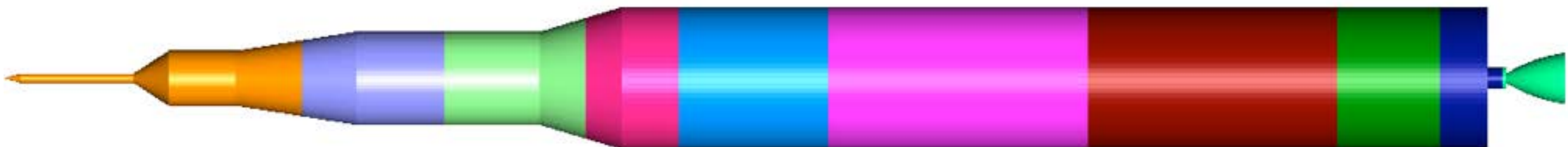
**STEP 3: Split grids**

**CGT Tool:** grided

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool:**  
ExtractGrids, GedSplitJkl, GedSplitXyz,  
ExtractSubs, SplitToNGrids

Input: Ref. Surface, Curves; Output: Grid



# Assure Complete Surface Coverage

**STEP 1: Identify gaps, improper overlaps**  
**CGT Tool: OVERGRID**

**STEP 2: Identify/Create Curves**  
**CGT Tool: seamcr, seamcrt**  
Input: Ref. Surface; Output: Curves  
**CGT ScriptLib Tool: CreateSeamCurs**  
Input: Ref. Surface, Curves; Output: Grid

**STEP 3: Fill gaps**

- **TFI**
- **Hperbolic surface marching**  
**CGT Tool: surgrd**  
Input: Ref. Surface, Curves; Output: Grid  
**CGT ScriptLib Tool: GenTFI, GenHypSurGrids**  
Input: Ref. Surface, Curves; Output: Grid

# Volume Mesh Generation

## Option 1: Interactively

**CGT Tool:** hypgen

Input: Surface grid; Output: Volume grid

## Option 2: Configuration scripts

**CGT Scriptbin Tool:** BuildVols

Input: Surface grid; Output: Volume grid

## Option 3: Component scripts

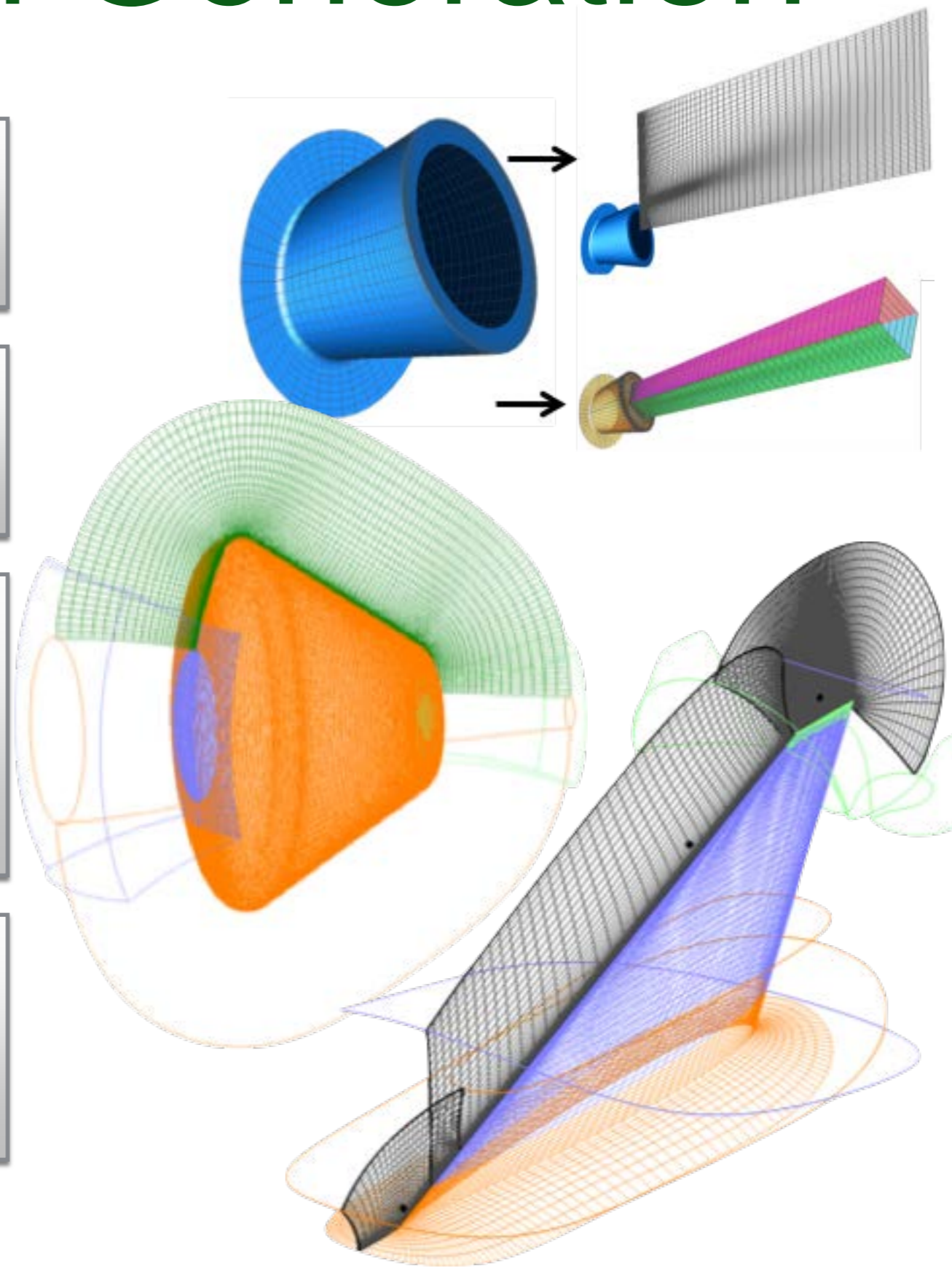
**CGT Scriptlib Tool:** GenHypVolGrids,  
GenUniformBox, GenStretchedBox,  
CreateCore, BuildGeneralPlumeGrids, ...

Input: Surface grid; Output: Volume grid

## Option 4: Higher-level component scripts

**CGT Scriptlib Tool:** BuildAxisymGrids

Input: Axisym. curve or Surface grid; Output:  
Volume grid with caps



# Connectivity

**Step 1: Write connectivity inputs to file**

**Option 1: Manual**

**Option 2: Configuration scripts**

**CGT Scriptbin Tool: BuildPeg5i**

Input: Volume grid; Output: Grid Connectivity

**Option 3: Component scripts**

**CGT Scriptlib Tool: AddCutterID, SetCutterCutee, WriteOvr2InpFile**

Output: OVERFLOW input

**Step 2: Create x-rays**

**DCF/OVERFLOW only**

**CGT Scriptlib Tool: CreateXrayMap**

Input: Cutter, Output: X-ray

**Step 3: Run connectivity code**

**Option 1: Manual**

**Tools: DCF/OVERFLOW, Pegasus5, etc.**

Input: Volume grid; Output: Connectivity

**Option 2: Component scripts**

**CGT Scriptlib Tool: RunConnectivityCode**

Input: Volume grid; Output: Connectivity

**Step 4: Remove orphans**

**CGT Tool: OVERGRID**

Diagnose Module

# Boundary Conditions

## Step 1: Setup BCs

Option 1: Manual

Option 2: Configuration scripts

**CGT Scriptbin Tool:** WriteOvfi

Output: Grid BC file

Option 3: Component scripts

**CGT Scriptlib Tool:** AddGridNames,  
AddBCInfo, WriteBCInfo

Output: Component BC file

## Step 2: Process and write Overflow input file

Option 1: Manual

Option 2: Configuration scripts

**CGT Scriptbin Tool:** BuildOveri

Input: Grid BC files; Output: Overflow inputs

Option 3: Component scripts

**CGT Scriptlib Tool:** ProcessBCInfo,  
WriteOvr2InpFile

Input: Component BC files; Output:  
OVERFLOW input

# FOMOCO Inputs

## Step 1: Setup integration surfaces

Option 1: Manual

### Option 2: Configuration scripts

**CGT Scriptbin Tool:** WriteOvfi

Output: Grid BC file

### Option 3: Component scripts

**CGT Scriptlib Tool:**

AddFomocoSubset,  
AddFomocoMegaComp,  
WriteFomoInfo

Output: Component Fomo file

## Step 2: Process and write FOMOCO input file

Option 1: Manual

### Option 2: Configuration scripts

**CGT Scriptbin Tool:** BuildOveri

Input: Grid BC files; Output: Overflow inputs

### Option 3: Component scripts

**CGT Scriptlib Tool:**

ProcessFomoInfo, WriteOvr2InpFile

Input: Component Fomo files; Output:  
OVERFLOW input