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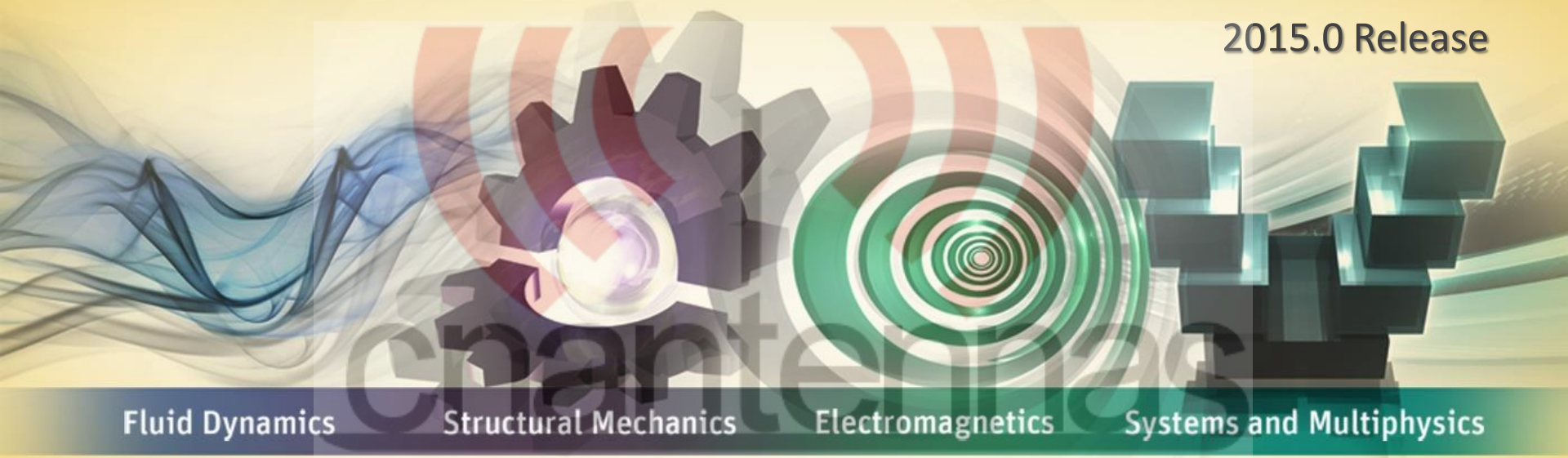
Workshop 11-1: Independent Study



ANSYS HFSS for Antenna Design

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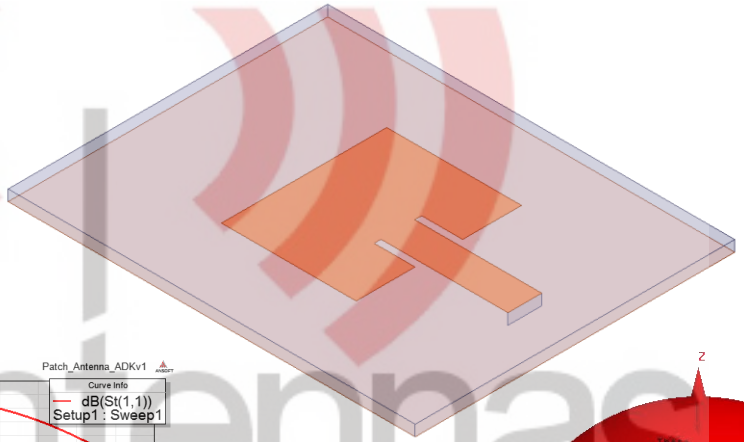
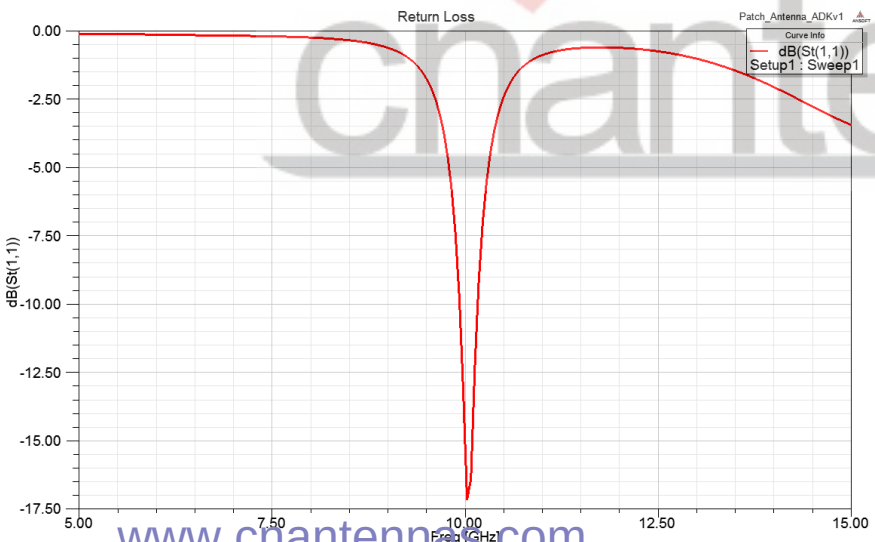
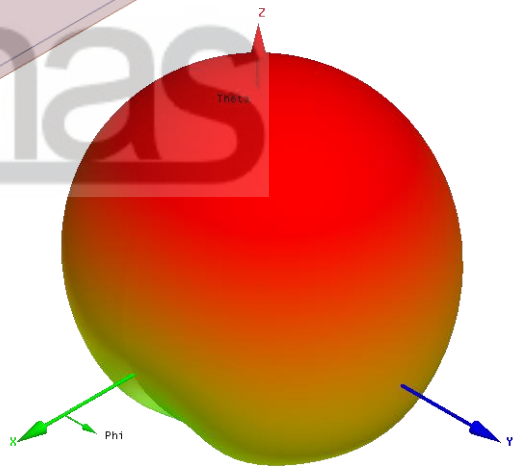
Rectangular Patch Antenna

- **Independent exercise**
  - Given a defined geometry you are asked to setup, analyze and view results for a rectangular patch antenna
  - This type of exercise is a representative example of what would likely be asked of you when using HFSS at your job site
  - The instructor will be available to assist in project setup, there is no step by step instructional guide for this example





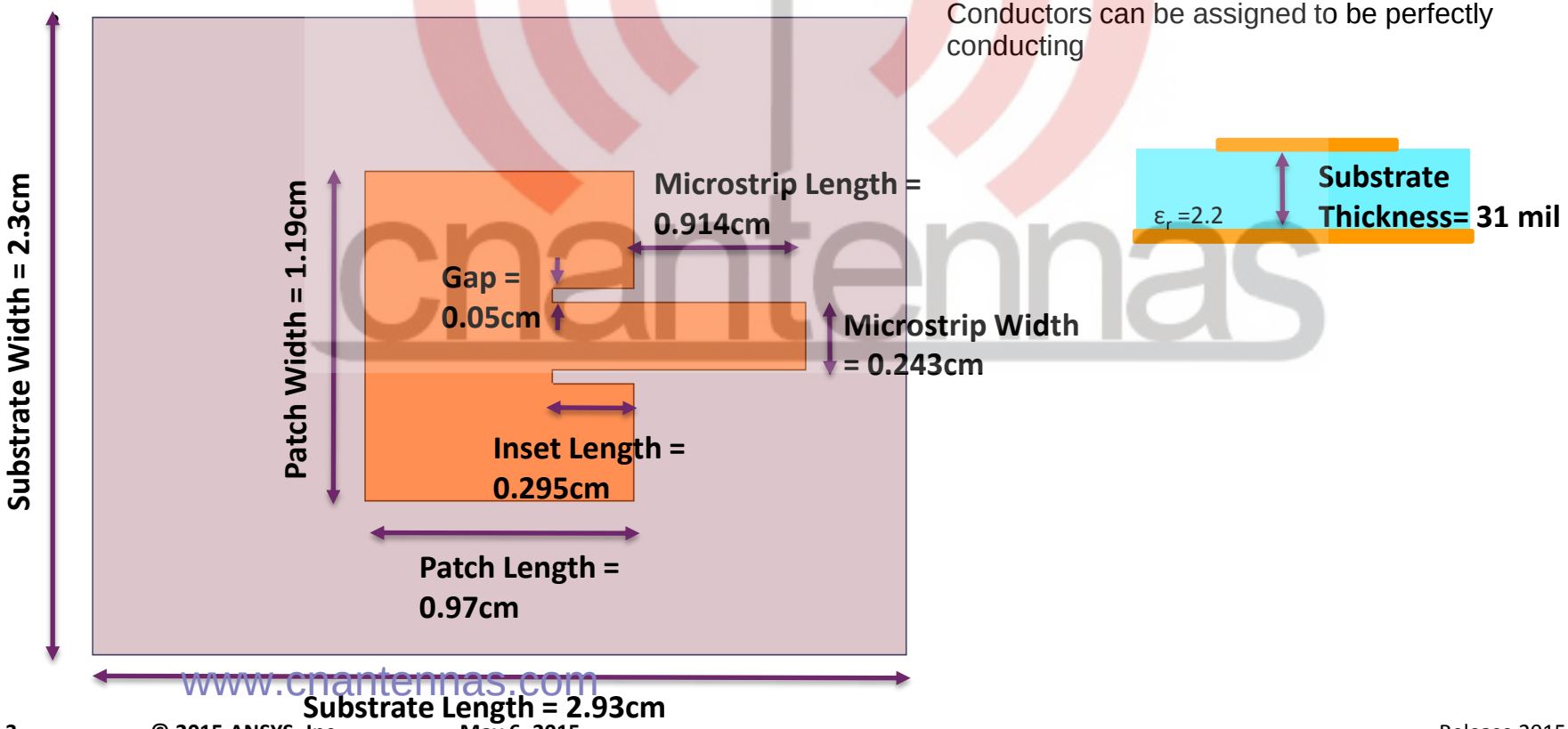


Rectangular Patch Antenna Problem Definition

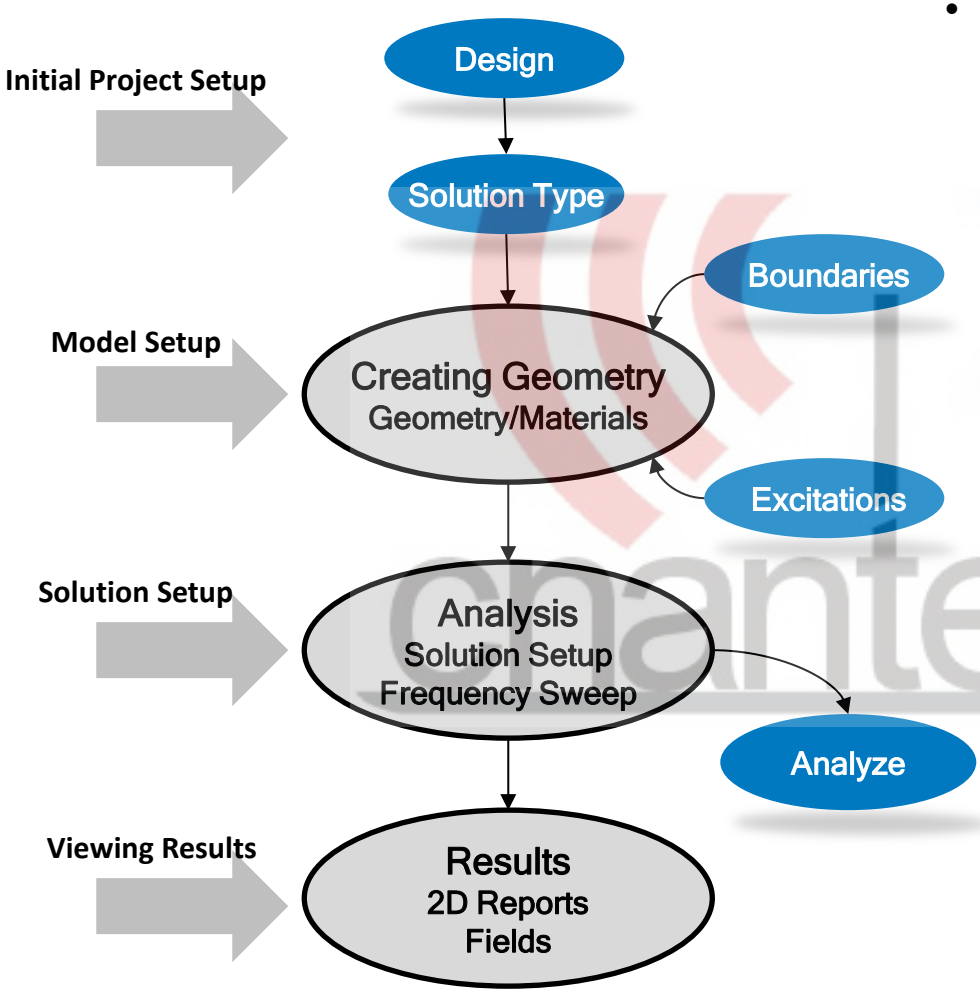
- **Microstrip Patch Antenna**
- Analyze geometry from 5GHz to 15 GHz
  - Antenna is resonant around 10 GHz
  - 50 ohm Port Impedance
- Outputs
  - Return loss plot in rectangular format

- **Substrate -**
- **Rogers RT/duroid 5880 ™**
  - ε_r =2.2 (available in the HFSS material library)
  - Thickness = 31 mil
- **Use infinitely thin 2D sheet objects for ground and antenna metallization**

  Conductors can be assigned to be perfectly conducting

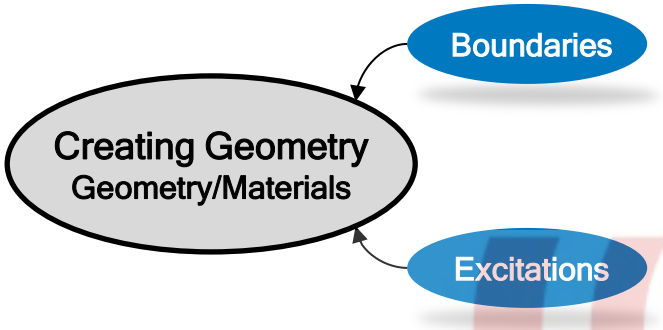


Independent Exercise: Project Tips

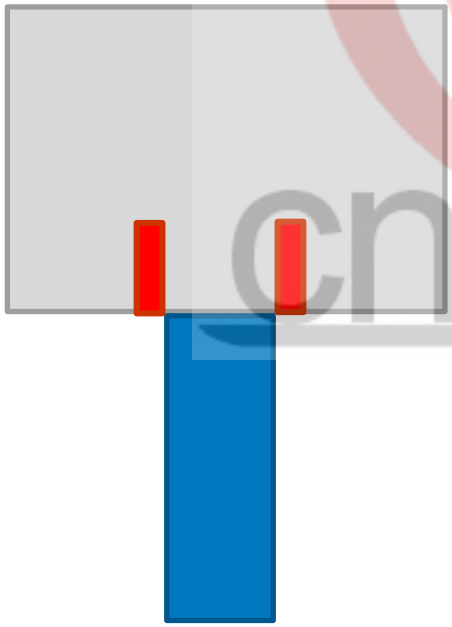


- **Remember to use this flow as a guide for setting up the project**
  - Review dipole example to help with each individual step
  - Should the solution type be Driven Model or Driven Terminal?
  - Can it be either?
  - Use design variables to simplify geometry creation
  - Consider sketching out geometry on paper first
  - Decide how the geometry will be drawn in relation to a coordinate system
  - This is a resonant antenna, how should we choose the solution frequency?

Independent Exercise: Geometry Hints



- **Geometry**
  - Create a substrate using the draw box command
  - Drawing the patch can be as simple as drawing a few rectangles
  - Boolean operations can be used to subtract/unite objects
  - Do we need to define any other geometry for boundary conditions and excitations?
- **Boundaries**
  - How can the rectangular sheet objects representing the patch be turned into conductors?
  - How does HFSS deal with radiating fields?
- **Excitations**
  - How will this problem be excited?
  - Lumped port or wave port



Challenge Exercise

- **Now that you have simulated the antenna with the provided dimensions, re-design the antenna to be resonant at 12GHz.**
  - Create antenna radiation pattern plots
    - 3D Gain Plot at 12 GHz
      - Have you considered the antenna polarization?
    - 2D Gain Plot at 12 GHz (phi=0 deg and phi 90 deg)
    - 2D Gain Plot at 11 GHz (phi=0 deg and phi 90 deg)
  - Create a plot showing the return loss from 10 GHz to 14 GHz
  - What is this antenna's radiation efficiency?

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