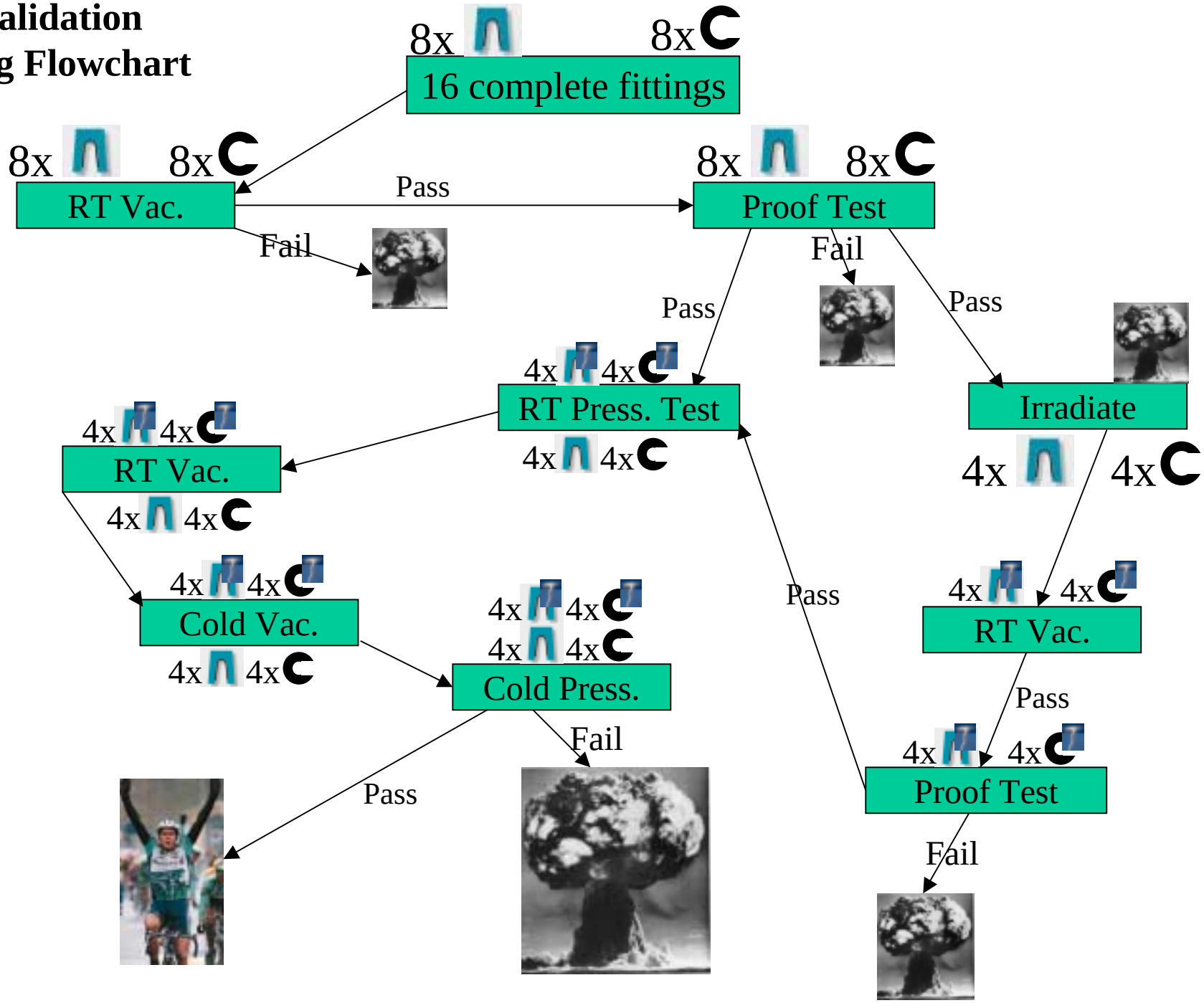
Seal Validation Testing Flowchart



Testing Regimen - Seals

- Variseals (4)  and C-rings (4)  : Un-irradiated
  - RT He Vacuum Check
  - RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)
  - RT Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges)
  - RT He Vacuum Check
  - Cold He Vacuum Check (in freezer at –20 Celsius)
  - Cold Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges, -20 Celsius)
- Variseals (4)  and C-rings (4)  : *Irradiated* 
  - RT He Vacuum Check
  - RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)
  - ***Irradiate to 50 Mrad at LLNL (in containment vessel filled with C_3F_8)*** 
  - *RT He Vacuum Check* 
  - *RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)* 
  - *RT Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges)* 
  - *RT He Vacuum Check* 
  - *Cold He Vacuum Check (in freezer at –20 Celsius)* 
  - *Cold Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges, -20 Celsius)* 

Testing Regimen – Glue Joints

- Glue Joints (4) – No Seals [2 w/o and 2 w/ adhesion promoter]
  - RT He Vacuum Check
  - RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)
  - ***Irradiate to 50 Mrad at LLNL (in containment vessel filled with C_3F_8)***
  - *RT He Vacuum Check*
  - *RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)*
  - *RT Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges)*
  - *RT He Vacuum Check*
  - *Cold He Vacuum Check (in freezer at –20 Celsius)*
  - *Cold Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges, -20 Celsius)*
  - *Thermally cycle (5 full cycles – warm/cold/warm)*
  - *RT He Vacuum Check*
  - *Cold He Vacuum Check (in freezer at –20 Celsius)*
  - *Cold Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges, -20 Celsius)*

Testing Regimen – Brazed Joints

- Brazed Joints (4) – “Dumbell” fittings with 2 Seals – seals in place for entire process
  - RT He Vacuum Check
  - RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)
  - ***Irradiate to 50 Mrad at LLNL (in containment vessel filled with C_3F_8)***
  - *RT He Vacuum Check*
  - *RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)*
  - *RT Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges)*
  - *RT He Vacuum Check*
  - *Cold He Vacuum Check (in freezer at –20 Celsius)*
  - *Cold Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges, -20 Celsius)*

Testing Regimen – E-beam Joints

- E-beam Joints (4 if possible) – “Dumbell” fittings with 2 Seals – seals in place for entire process
  - RT He Vacuum Check
  - RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)
  - ***Irradiate to 50 Mrad at LLNL (in containment vessel filled with C_3F_8)***
  - *RT He Vacuum Check*
  - *RT Proof Test (at 8 bar absolute internal pressure, 1 hour duration)*
  - *RT Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges)*
  - *RT He Vacuum Check*
  - *Cold He Vacuum Check (in freezer at –20 Celsius)*
  - *Cold Pressure Decay Test (at 10 psi internal pressure, with diff. Gauges, -20 Celsius)*

Things to Remember

- Assembly
  - All joints should be assembled by hand to a “visually acceptable” level of clamping (clamps appear even, joint looks closed, etc.)
  - Sample should be clearly marked in a way that will not be damaged by C_3F_8 immersion
  - Joint assembly should be leak checked (first test) and clamps manipulated until leak checking is satisfactory (better than 1e-7 Torr-L/Sec)
  - After this point, the joint should not be disassembled or manipulated until after the **completion of all tests**
- Irradiation
  - Samples should be immersed in liquid C_3F_8 while still mated, but not internally pressurized
  - RT Vac tests and proof tests should be completed before and after irradiation as validation that the seal is still intact (otherwise time may be wasted on useless testing)