



# **ILD** integration - Update on inner structure -Matthieu Joré – October the 18th jore@lal.in2p3.fr In2p3







- Brief reminder
  - The ILD inner region
  - Goals of these calculations
- Calculations
  - Input data
  - Boundary conditions
  - Results
- Conclusions



### ILD inner region









- Critical region of the ILD detector
- No mechanical studies performed
- The goals were to make rough calculations in order to
  - Check feasibility
  - Check the mechanical behavior
  - Estimate material budget for improving the simulation model
- Dimensions of the tube :
  - Rout : 329 (TPC Rin-1mm)
  - Lenght : 4700mm
- Criterias :
  - Max displacement around 0.1mm(?)
  - As thin as possible







- Components to be supported :
  - Vertex : 300g supported on FTD3
  - FTD : 500g / disks
  - SIT : estimated at 5Kg supported on FTD3
  - Beam pipe : ab. 15Kg with wires
  - Cables : ab. 15Kg supported with FTD disks (ab. 1Kg/disks)
- Material : Carbone fiber / epoxy composite :
  - Young modulus : 50GPa
  - Density : 1750Kg/m3
  - First assumed to be isotropic
    - Realistic with the pure traction/compression loading (flexure of the tube)





## Weight estimation





Details on weight calculation (semi tube model) :

P1 = P\_VTX/2+P\_SIT/2+cables +BP/2\*30% = 0,15+2,5+3+2 ≈ 8Kg P2 = FTD+cables/FTD = 0,5 + 1 = 1,5Kg P3 = BP/2\*70% = 5Kg

Total weight to be supported  $\approx$  30Kg



FEA model







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• Stress









#### • Natural frequencies:



**MDI Integration @ CERN** 

#### M. Joré – Updates on inner region support





- Rough estimation seems fine :
  - Max displacement of about 0,1mm
  - First resonant frequency at 90Hz
  - Thickness of tube could be 1mm of CFRP (P≈20Kg)
  - 0,33% X0
    - → Could be implemented in the simulation
- But effort is needed to produce a more detailed design, needed for DBD 2012 :
  - Reduce X0?
  - Improve simulation with real composite properties
    - Who could perform this because I'm not expert on CFRP structure?
  - How to split the tube?
  - Connection pieces (more material)
  - Connection to TPC (more material)
  - Design of BP wire supporting system
  - Add holes for assembly (use of temporary support)