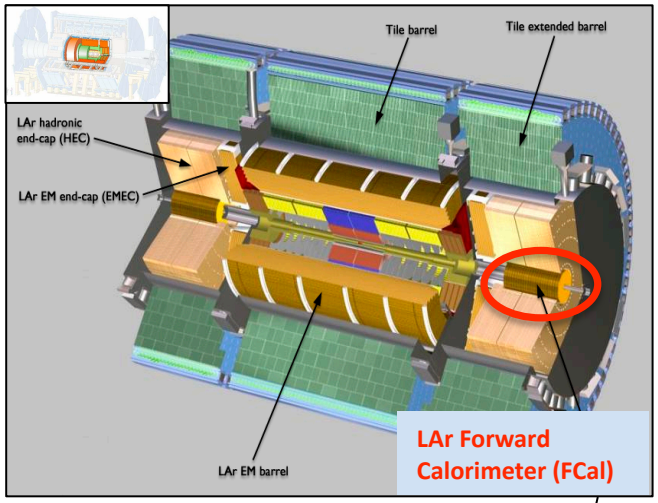
Upgrade Plans for ATLAS Forward Calorimetry for the HL-LHC

Margret Fincke-Keeler (Univ of Victoria, Canada), on behalf of the ATLAS Liquid Argon Calorimeter Group



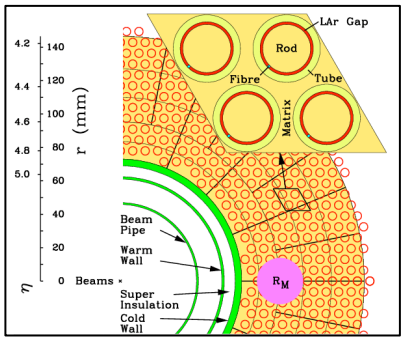
Expected for HL-LHC Phase-2 upgrade (~2002)

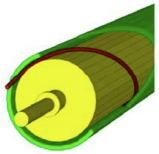
√ s=14 TeV, **L=5x10^{34} cm^{-2}s^{-1},** luminosity levelling

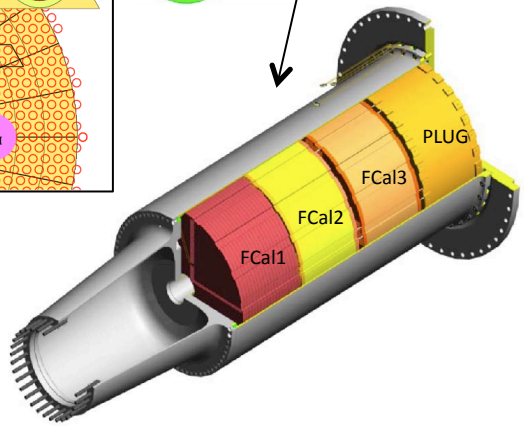
The existing ATLAS Forward Calorimeter (FCal) and motivation for a possible upgrade

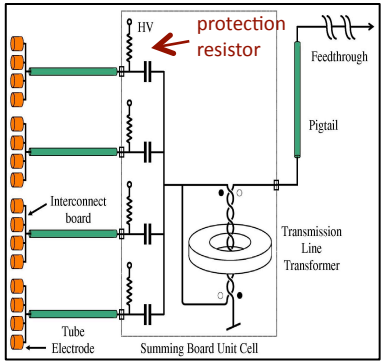
- LAr/Cu (FCal1); LAr/W (FCal2,FCal3) ; (eta ~ 3-5)
- Concentric rod and tube electrodes embedded in Cu/W absorber matrix

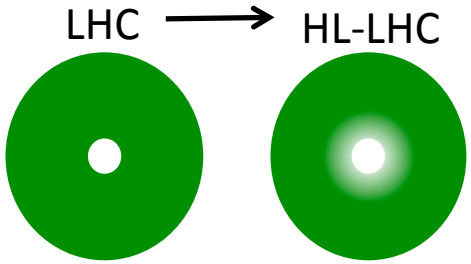
- Degradation of FCal signal (particularly FCal1) at high eta at HL-LHC luminosities
  - Positive ion buildup in the LAr gap
  - Large ionization current leads to large HV drop across protection resistors; adequate HV cannot be maintained across LAr gap
  - → lack of hermeticity leads to an increase in fake missing E_T
  - → performance of FCal will vary with instantaneous luminosity
- Risk of Argon boiling at inner radius due to beam heating











Qualitative illustration of the expected degradation of FCal1 in r/phi with luminosity increasing from LHC to HL-LHC

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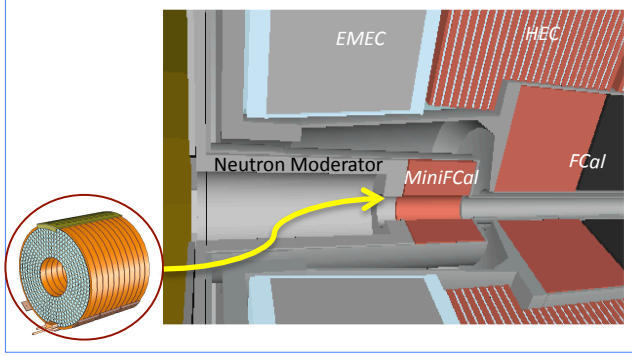
Possible Options and Practical Considerations

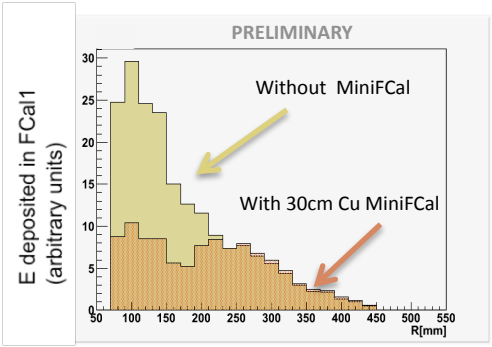
FCal Replacement (sFCal)

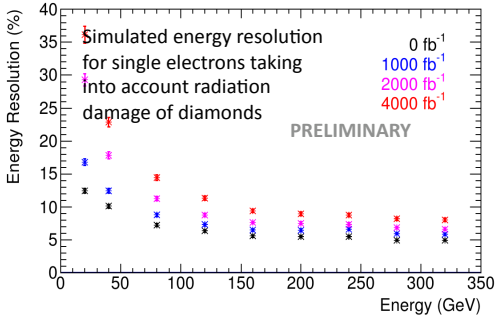
- Similar design as the existing FCal, but with a smaller LAr gap to prevent ion buildup
- Install cooling loops to prevent boiling of argon.
- New HV protection resistors with lower resistance to prevent HV sag across LAr gap.
- Installation is complicated and requires at least partial opening of the ATLAS endcap cryostat.
- A small prototype has been built and proven to work without degradation in a high luminosity testbeam at Protvino.

A (warm) MiniFCal based on pCVD Diamond Detectors

- A new calorimeter module (MiniFCal) to be placed into an existing recess of the cryostat in front of the FCal.
- Installation would be comparatively easy and fast.
- Simulations have explored a baseline design of Cu absorber plates and pCVD diamond wafers as the active material , taking into account results from the beam tests and predictions of the expected neutron flux.







The ATLAS Collaboration continues to work towards a decision for a High Luminosity Upgrade