Critical items for a LCTPC read-out technology choice

- Several aspects are important, but not critical because all three technologies - pads, micromegas and pixels - can meet them:
  - Minimize power consumption produced by detector and electronics
  - Sufficient cooling (little material, use e.g. CO2 cooling)
  - Thin detector (radiation length)
  - Sufficient z resolution and absence of deformations in z < 0.3 mm
  - dE/dx resolution of 5% or better
  - Stable detector operation with T2K gas
- For these items it is hard to argue that because of the better z or dE/dx resolution for the pixels, one should choose a particular technology. The reason is that “it is nice to have” (so a plus) but not a physics requirement.

Critical items for a LCTPC read-out technology choice

- Critical items are in my opinion the requirements in the bending plane of the detector. So the momentum resolution and the control of the resolution and systematics in the bending plane along the track and over the module. This means control over the mechanics of the module, electric fields (including E cross B) over the module.
- In order to match the tracking performance this implies a flatness of the residuals over the module (read-out plane) in the xy transverse plane of 10-20 microns.
  - Currently none of the three technologies has demonstrated this
  - For the pixels we put in considerable effort to reach very high precision mechanical mounting (10-20 microns) of the quad and 8-quad module.
  - The mechanical precision of large micromegas modules and flatness of the surface achieved for the pads is easily 100 microns or worse. This means in my opinion - based on the pixel mechanics - that systematical deformations could be a factor 5 worse than what is required.

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- The way to resolve this is to measure in a test beam with a silicon telescope the deformations over a module.
  - It is important to study these without and with B field; to get also a measurement of ExB deformations.
  - In my opinion one should not correct deformations out; in the construction of the module, they should be kept less than 10-20 microns in the bending plane. Regions where this is not reached should be removed. Only alignment corrections (shift and rotation) should be allowed.
    - If one does start to correct for deformations then corrections should be understood and constant in time; e.g. not depend on varying quantities such as temperature, background rates etc. Corrections larger that 100-200 microns should not be allowed (and these regions removed), because one needs to control them at the 10-20 microns level (factor 10).
  - These results should drive decisions on an optimal module size and technology choice.