



# Staging

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## What is Staging?

- There is a very large range of opinions. Here are two extremes
  - e.g. All spares or backup equipment moves to operations
  - or Start with 2 low emittance, polarized guns (not yet developed), no DR's, 2 linacs of 150GeV in different layout.
- I will not consider either extreme but we do need a working definition.



## My Definition

- Staged energy, luminosity or related parameters on an e<sup>+</sup>/e<sup>-</sup> machine which is a subset of the base design
- **AND**
- The upgrade path to the base machine or beyond must be realistic in terms of time down for physics??
- **Still rather vague!**



## Staging Energy

- This is part of design philosophy (beyond 500 GeV ) but we have to be clearer as to what is IN and OUT of design and costs.
- When we consider Energy staging should we take an example of 300-500->700 GeV with continuing construction of components and maybe CF&S.
- This approach is the best match to a new International Facility that has stable yearly funding, like CERN, which bridges construction, operations and upgrades.



# Staging Energy Issues

- The most “attractive” approach to energy staging is to do everything in the center and expand outwards.
- **BUT** there are issues
- The turnaround, ....what does it cost to duplicate?
- Compressor(s).....Could we compress before transport and turn?
- Where is the E+ source?
- Can we standardize linac quads (presently there are 3 strengths in every third cryostat) to operate over a larger range?
- Construction during operation?



## Staging the present CDR design

- Build the CDR CF&S
- Install only first  $\frac{1}{2}$  linacs after the compressors with E+ source at midpoint
- Install second half of linacs during downtimes of first 2 to 3 years of operation.
- Continue civil construction outwards??
- If questions on previous slide get positive answers then one would re-optimize this scenario.
- There are many other options with only  $\frac{1}{2}$  the power sources and cryostats that have to be looked at but my opinion is they cost more!