

## WP2 The process of selecting the

## technical solutions in the year ahead

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- a) Assume CL-FEL design reflects a 10-years ahead user facility.
  - this impacts the risk level below
- b) Has to guarantee low-risk implementation and high reliability.
- c) Afford medium-risk technological R&D
  - e.g., S-band vs. C-band vs. X-band Gun
- d) Afford low-risk physics
  - e.g., e-current shaping vs. optics control, optical FEL shaping vs. short ebunches, CHIC-type undulators vs. SASE, etc.
- e) Let us start with minimum wavelength for SX and HX
  - Wavelength tuneability, multi-color and multi-pulses will be discussed later.





- A. Receive Users' wishes list
- B. Identify injector beam, main linac and undulator parameters (ranges) from semi-analytical models
  - *Selection/Discard among multiple options is in place already at this stage*
- C. Discard high risk technical solutions at any level
  - e.g., X-band Gun, kHz rep. rate, compressor geometry, SCU vs. CMU,...?
- D. Do 1-D S2E runs with most standard/ready-to-use technical solutions in mind
  - This is to identify physical show-stopper and major conflicts with FEL specs
- E. Define target beam & machine parameters
  - *e-beam: norm. emittance, duration, peak current, energy spread*
  - Linac acc. gradient, compression scheme, undulator period-K ranges



## **Technical Choice**

Compare Injectors (e.g., S- vs. C-band)

 *i*) normalized emittance; *ii*) peak current.

 Compare Compression Schemes (e.g., w or w/o VB)

 *i*) projected emittance; *ii*) peak current.

 Compare Undulators (e.g., SCU vs. CMU vs. IVU)

 *i*) peak power at saturation; *ii*) length





- 1. Revise Users' wish list and re-define self-consistent FEL specs
  - If fundamental wishes are not met, re-design to meet them at the expense of cost, compactness, risk...
- 2. Wavelength tuneability
  - Assume e-beam energy changes in step (e.g., 3 energy levels).
  - *Fine/continuous wavelength tuning rely on undulators gap/phase at given e-beam energy.*
  - *Minimum e-beam energy has to be*  $\geq$  *energy at second compressor.*
- 3. Multi-color, multi-pulses, polarization
  - Simulate few representative cases with given set up.
  - *Identify further optimization steps.*
  - *Identify further technological revisions.*





