

## ISG-X Summary

SLAC/FNAL/BNL/LBNL/LLNL +

高エネルギー加速器研究機構

# Conventional Facilities – Linac

**RD for R1/R2 is not an excuse for lack of vigilance on cost.**

**US – based development of warm/cold comparative design has shown need for aggressive cost evaluation – *especially in linac subsystems.***

# Linac – Heat removal – “Mechanical”

*in a recent estimate:*

Mechanical costs are 13K\$/m

15% of the linac total

1.3 x tunnel construction cost; 44% of total civil cost

(electrical cost 1/3 of mechanical)

Costs per meter:

12.7K mech

3.5K electrical

73.8 RF source

26.2 RF girder

This cost is driven up by difficult requirements

*ISG X – Collaboration meeting*

Marc Ross/SLAC

# Cost Drivers

- the primary cooling (“canal”) water
- structure cooling system
- klystron/modulator/magnet cooling system

Each of these is about 1/3 in the above estimate (40/30/30)

- Primary CW cost driver – long piping from the canal / high flow
- Structure – high flow/ SLED/structure stabilization specification / SLED segmentation
- Klystron – total capacity
- mismatch between high  $\Delta T$  klystron / low  $\Delta T$  structure systems

# List of adopted changes:

1. Increase in accelerator structure  $\Delta T$  (from 1.5 to 7 degC)
2. Reduction in cooling capacity for klystrons – does not allow for unlimited operation without drive for all klystrons
3. Increase in structure operating temperature from 28 to 33 degC
4. Better match between CW / KCS/ACS heat exchangers (reduced CW flow)
5. Reduced use of multi-kilometer piping from canal
6. Reduction in ‘drift’ section infrastructure

*The above result in >50% savings – only two of the changes are ‘technical’ redesign, all other are changes in requirements*