VLHC

CRYOGENICS & BEAM SCREEN WORKING GROUP

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Thomas Jefferson National Accelerator Facility Operated by the Southern Universities Research Association for the U.S. Depart. Of Energy

BEAM SCREEN

- 1.9 K system is easy. Regeneration interval >> year.
- Both 4.5 **and 20** K high field magnets require beam screen. R&D is required. LHC requires solutions for both their 4.5 & 300 K magnets. Two VLHC options exist:

  1. Physical absorption: a) shield is required

     b) absorber (e.g., metal sponge) is required

     c) regeneration 20 K, tri-monthly

  2. Chemical absorption: a) finite life

     b) regeneration 600 K, annual

CRYOGENIC PARAMETERS & ISSUES

- Sensible heat vs. latent heat systems
  - e.g., Nb_3Sn magnet operating between 4.5 & 5.0 K vs. 4.5 & 5.5 K
  - Trade off between: Short sample

    Complexity

    Cooling passages and cryostat sizes
- String length and / or re-cooler spacing

<u>??? Temperature requirements for injection</u>

RELIABILITY AND MAINTENANCE

- Integrated Design
  - You can't get there with separate working groups on magnets and cryogenics.
  - Trade-off's required between efficiency and availability
  - Require up front itemization of all off design modes
- Scaling LHC is not an option; a simple magnet cryogenic system is required
  (LHC tunnel cryogenics has more than 1 valve per magnet average
- Vendor Issues
  1. We must maintain core competency within the government lab community
  2. We require smart procurements / full time resident inspectors
  3. We must be prepared to deal with costs and time required for vendor development
- **Capital vs. life cycle costs (5, 10, or 20 yr. ????)**

REQUIRED R&D; PRIORITIZED

NON VLHC FUNDED R&D

- Screw compressor efficiency (> half of total inefficiency)
  - Use multi stage systems with pressure ratios of ~3 not 6 to 8
  - Use more efficient stages
  - **** **Buy and try** ****
  - Option: Use IHEM funding
  - **$$$$ Has three-year pay back ???**
- HTS power leads; ongoing LHC & Fermi effort (FY94 W.G.)

WILL HAPPEN ANYWAY

- Short sample vs. dT optimizations for Nb_3Sn (FY94 W.G.)

REQUIRED R&D; PRIORITIZED (cont'd.)

R&D THAT SHOULD BE FUNDED BY VLHC

1. Flow instabilities
   - Density wave instabilities
     - Major issue if density is varying by factor 3 or more
     - Can be stabilized by inlet pressure drops (costs efficiency)
   - Numeric simulations are deeded

2. Beam screens
   - Start at when LHC effort stops

3. Cycle and efficiencies for sensible heat vs. latent heat systems