HINS R&D: a possible Project X Front End

Fermilab

Beam Line Elements:

- 19 Conventional RT Cavities
- 29 SC Spoke Cavities and 3 Cryomodules
- 42 SC Focusing Solenoids

RF Power Elements:

- one 325 MHz Klystron/Modulator
- one 400 kW RFQ FVM
- 19 ~20 kW FVM/Fast Tuning for RT Section
- 29 ~20-120 kW FVM/Fast Tuning for SC Section
- Power Supplies, quench protection, beam diagnostic,..

W (MeV) 0.050 2.5 10 30 60

ANL-FNAL Collaboration on R&D

Fermilab

- **HINS R&D Phase: Proof of innovative approach to high intensity beam acceleration !**
  - **2007-2011/12 R&D period**
  - **Prove, Develop & Bui ld Front-End in Meson Bldg. at 325 MHz (0-60 MeV) since much of the technical complexity is in the FE Mechanical/RF Systems**
    - **Demonstrate for the first time Amplitude/Phase Modulator (FVM) Technology and RF Power Scheme with H^-**
    - **Demonstrate for the first time RT-SC Transition at 10 MeV for High Intensity**
    - **Acquire capability to test/operate SC Spoke Cavities at FNAL**
    - **Demonstrate for the first time beam loading and pulsed operation of Spoke Cavities**
    - **Demonstrate Axis-Symmetric focusing and Beam Chopping**
    - **Demonstrate for the first time the ability to drive multiple RT and SC Sections with a single klystron**

ANL-FNAL

  - **Retain conceptual design compatibility between HINS and ILC**
    - **β=1 R&D is necessary in the event of an 8 GeV Linac phase**
- **Project X Linac Phase:**
  - **"Post-2011/12"period**

HINS@ ANL-FNAL: Past & Present Activities

Fermilab

- **In FY06 and FY07, some level of funding for the HINS program has allowed a limited-scope collaboration between ANL and FNAL for activities related to the design and development of the technology.**
- **FY06**
  - **350 k$ Beam Analysis and Design**
  - **350k$ Single Spoke Resonators design and US Industry Develop.**
- **FY07**
  - **150 k$ Beam Analysis and Design**
    - **+ additional support for a Guest Scientist (S. Aseev)**
  - **50k$ Single Spoke Resonator Processing (US Prototypes)**
- **FY08 Proposal (still to be discussed with ANL Management)**
  - **150 k$ Beam Analysis and Design**
    - **+ additional support to a Guest Scientist (S. Aseev)**
  - **50k$ Single Spoke Resonators Processing (India Prototypes)**

HINS Mid-Term Future Activities

Fermilab

- **FY09 & FY10 "Hopes"**
  - **Strengthen ANL-FNAL Collaboration on HINS/AEBL**
  - **?? k$ Processing of ~20 Single Spoke Resonators for HINS**
  - **?? k$ Large Scale Production (& Industrialization) of SCSR in US**

1M$ Question:

Will (how/when) HINS and Project X converge ?

- **Final decision on advanced (i.e. HINS-like) or conventional (SNS-like) Front End for the Linac portion of Project X will (*should*) be the subject of an engineering, cost, risk and benefit analysis by the Management team in the early stages of an approved Project X**
  - **Project X Accelerator workshop at FNAL (Nov 12-13 2007) has maintained the endorsement (already expressed by FNAL AAC Review) of the HINS R&D innovative effort.**
- **HINS as novel FE technique will likely continue to completion of 60 MeV FE through ~FY11-FY12**
  - **Funding for ANL-FNAL Collaboration**
  - **Fertile ground for development of ideas (SC to 10 MeV, solenoidal focusing) and technology (Spoke resonators, AEBL-Project X alignment, …)**
  - **Cavities processing and (possibly) testing, possible focusing magnets from FNAL for AEBL,..**

Project X/AEBL (post ~2011-2012)

Fermilab

- **If HINS technology chosen for Project X FE**
  - **Interest on major "sub-project" expressed by ANL at Project X workshop:**
    - **TSR**
      - **66 cavities**
      - **11 or 22 cryomodules**
    - **Spoke Cavities Processing**
    - **Participation in commissioning of 60 MeV Linac**
    - **Beam Dynamics Performance validation on 60 MeV Linac**
  - **Alignment of cavities development for Project X and AEBL**