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Proposal for testing HWR cryomodule with a beam (PXIE-10MeV)

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acknowledging discussions with A. Saini, C. Baffes, P. Derwent, V. Lebedev and radiation estimate by A. Leveling

PIP-II technical meeting

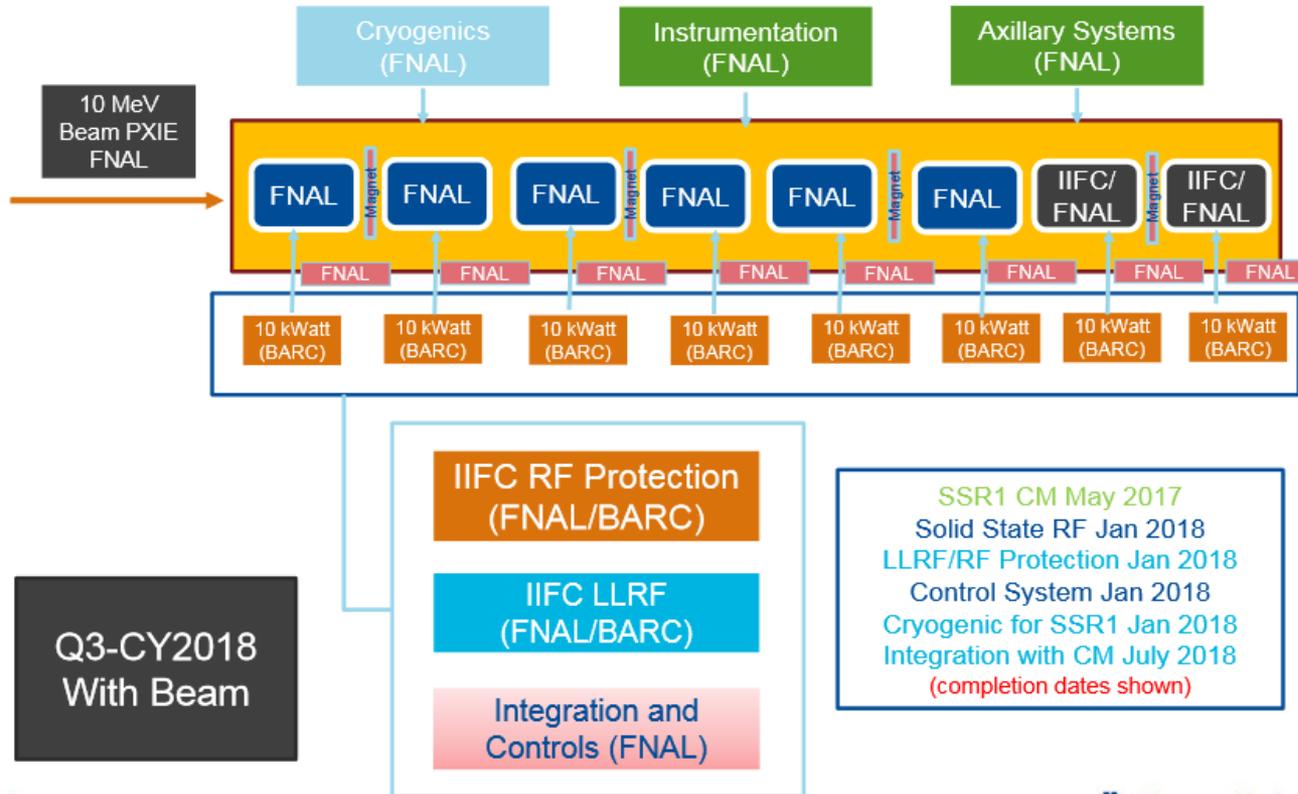
September 8, 2015

Present plan

- Install HWR and SSR1 simultaneously and pass the beam through both at once
 - Finish installation in Q4 FY18
 - The plan depends on the level of budgeting and collaboration with IIFC
- Technically driven schedule for both cryomodules may be faster; might be ready in Q4 FY17.
 - Delaying factors:
 - Money
 - Schedule of the cryo distribution system
 - Agreed upon schedule for SSR1 RF delivery by IIFC

Present plan for SSR1

System Test of SSR1 CM and RF Power with Beam



Shekhar Mishra, Integrated PIP-II R&D Plan

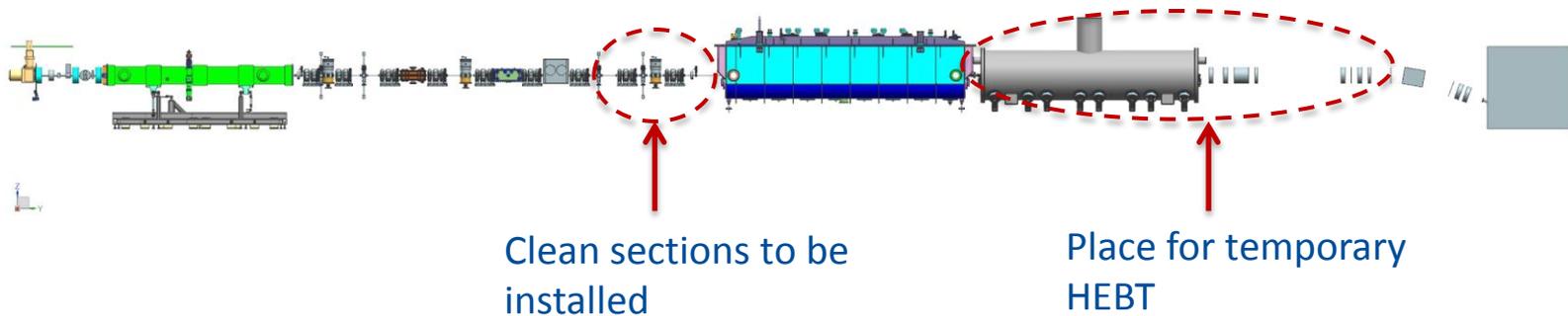
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PXIE-10?

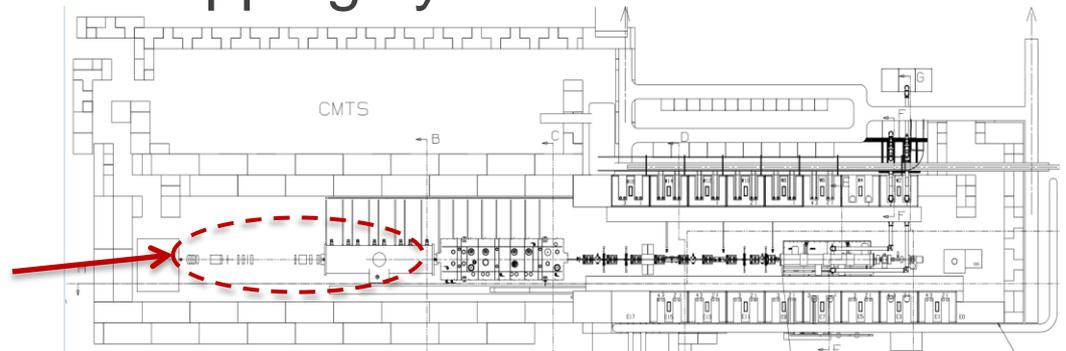
- Suppose the budget exceeds the present estimations or SSR1 is delayed by unforeseen circumstances. Does it make sense to install initially only HWR?
 - With a complete cave and a temporary HEBT (tHEBT)
- By Q4 FY17, we expect to have full-length MEBT
 - No chopping system
 - Should be fully prepared for injection of a into HWR
 - Pulses formed in LEBT



PXIE-10: possible scenario

- Duration 3-6 months to minimize interference with SSR1
 - After installing the complete cave, MEBT parts, and tHEBT
- Research program
 - HWR RF commissioning
 - Passing a pulsed beam through HWR
 - Characterize the beam using the tHEBT
 - Output beam parameters; beam loss in HWR; etc. (Arun's report)
 - Understand vacuum transitions from warm to SRF parts; MPS
- Meanwhile, build the MEBT chopping system

Place for
temporary HEBT



PXIE-10: pro and contra

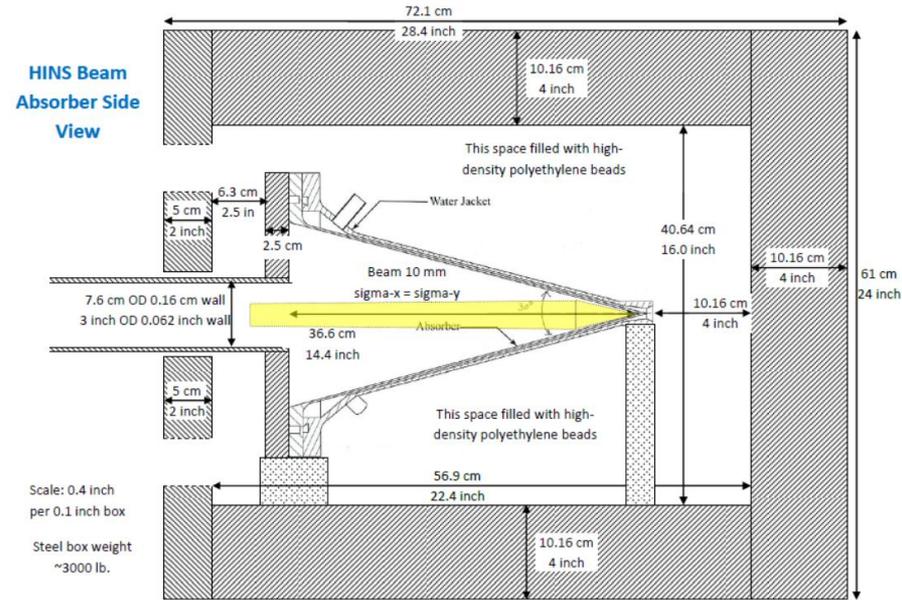
- Possible pros:
 - Speeding up overall
 - More effective use of operational personnel
 - Characterization of beam parameters and losses inside CM is simpler for a shorter configuration
 - Can use insertion devices
 - Separate commissioning of two CM can lower overall risk
 - Can correct found or created problems in HWR
- Contras:
 - Not clear whether the HWR cryo distribution system can be ready by Q4 FY17 even in technically-driven schedule
 - Additional cost of temporary HEFT

Temporary HEBT

- By that time, all PXIE warm magnets (BARC) are on hands
 - HEBT and spare/prototype MEBT magnets available
- The HEBT may include
 - 2 or 3 doublets with dipole correctors (re-usable in final HEBT)
 - Slit-slit emittance scanner (later to be installed permanently in MEBT)
 - Time-of-Flight monitor and Fast Faraday Cup used for MEBT commissioning
 - Laser diagnostics, wire scanners (for final HEBT)
 - “SNS/HINS” 16 kW beam dump
 - Additional M&S cost is minor
- Pulse mode only
 - Duty factor is determined by radiation from the dump

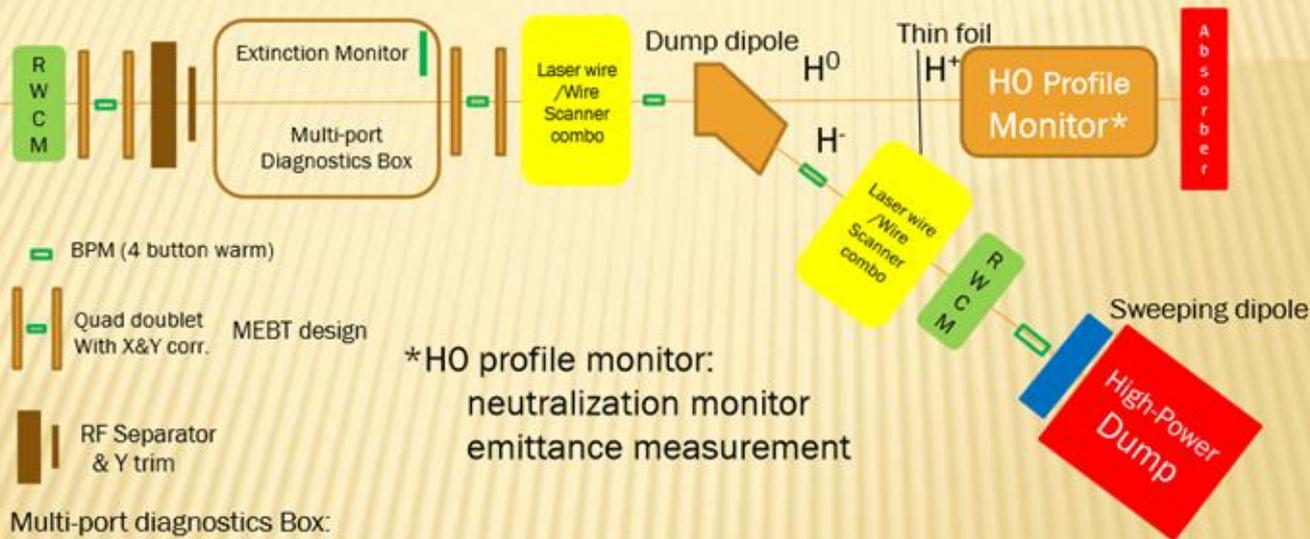
Possible pulse duration

- Assumptions
 - pulsed 5 mA beam at 60Hz
 - Fully constructed cave
- From analytical estimations by Tony Leveling
 - HINS/SNS dump with no shielding: pulse duration is ~0.2 ms
 - With a steel box filled by polyethelene beads: ~0.9 ms
 - MARS simulations capabilities at ~10 Mev are coming
- Pulse duration is adequate for most of necessary measurements



Final HEBT and dump are prepared in parallel

CURRENT DIAGNOSTIC LINE CONCEPT



Multi-port diagnostics Box:

- emittance slit/detector
- wire scanner (are these needed here if dedicated system exists?)
- laser wire (are these needed here if dedicated system exists?)
- halo monitor
- longitudinal bunch shape monitor
- future "unknown" diagnostics

PX Fall Collaboration Meeting

DEJ

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tHEBT can NOT perform the program foreseen for final HEBT. Can include parts of HEBT if ready .

From D. Johnson report at 2012 collaboration meeting

Possible actions

- If PXIE-10 is considered as a plausible option, we need to
 - Direct possible “unexpected” PXIE money to
 - PXIE cryo distribution system
 - HWR CM
 - 162.5 MHz RF amplifiers
 - Optimize the overall PXIE plan
 - Look more carefully at possible radiation levels and associated problems
 - Need additional thoughts, simulations, and discussions about measurements at PXIE-10