Meson Detector Building Plans for PX and SRF

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SRF Management Meeting

May 13, 2010

Project X Topics Suggested by Bob K

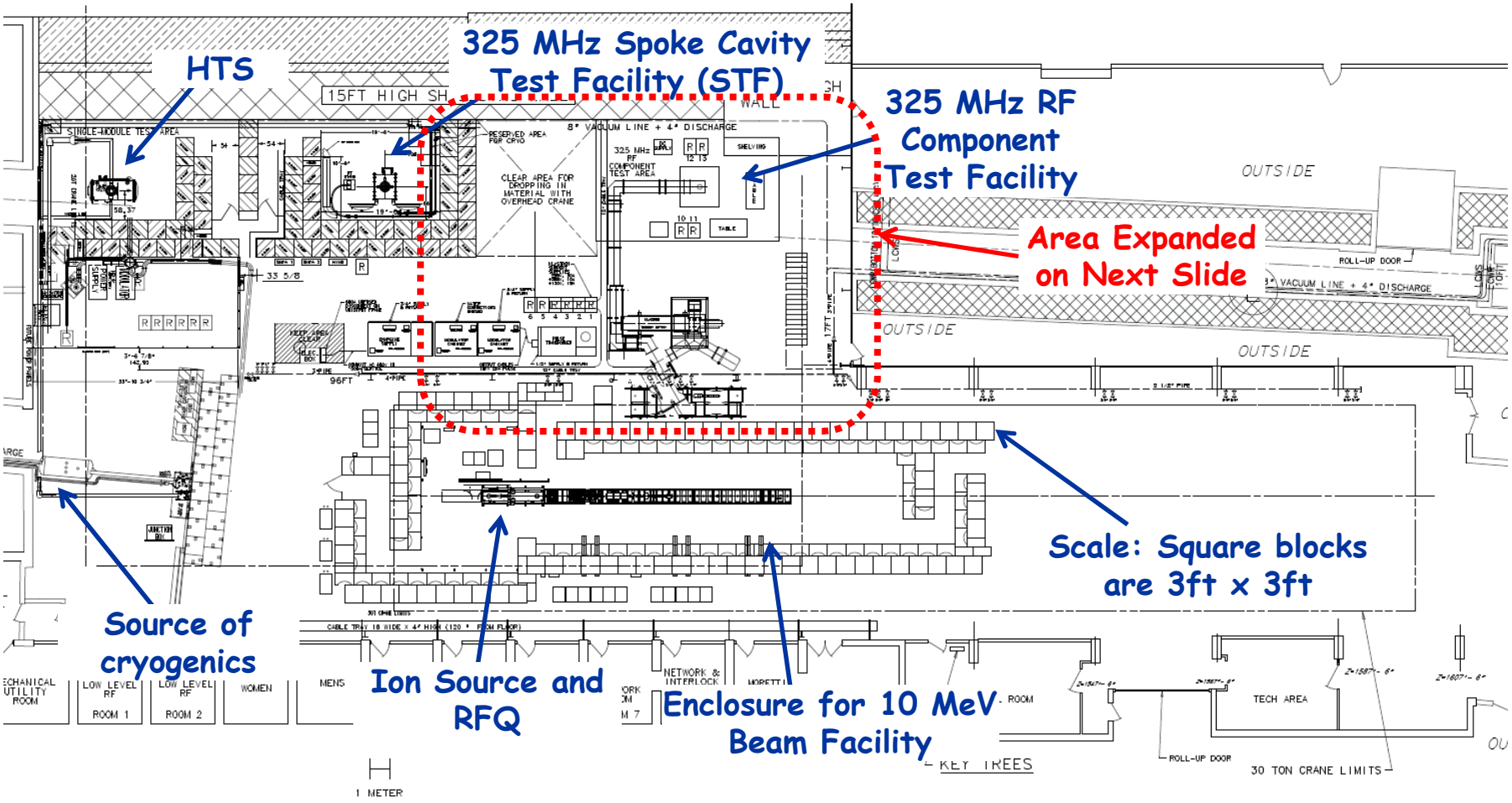
- 1) Assumed elements of the facility (HTS, STF, HTS-2, HINS beam test fac, SSR0 test CM)
- 2) proposed floor layout
- 3) cryo tasks and issues
- 4) RF tasks and issues
- 5) strawman schedule (include a strawman MicroSoft Project Schedule & milestones)
- 6) funding needs to support strawman schedule
- 7) MDB labor issues in support of strawman schedule
- 8) unknowns, choices, required decisions, etc

I will address some, but not all, of these topics

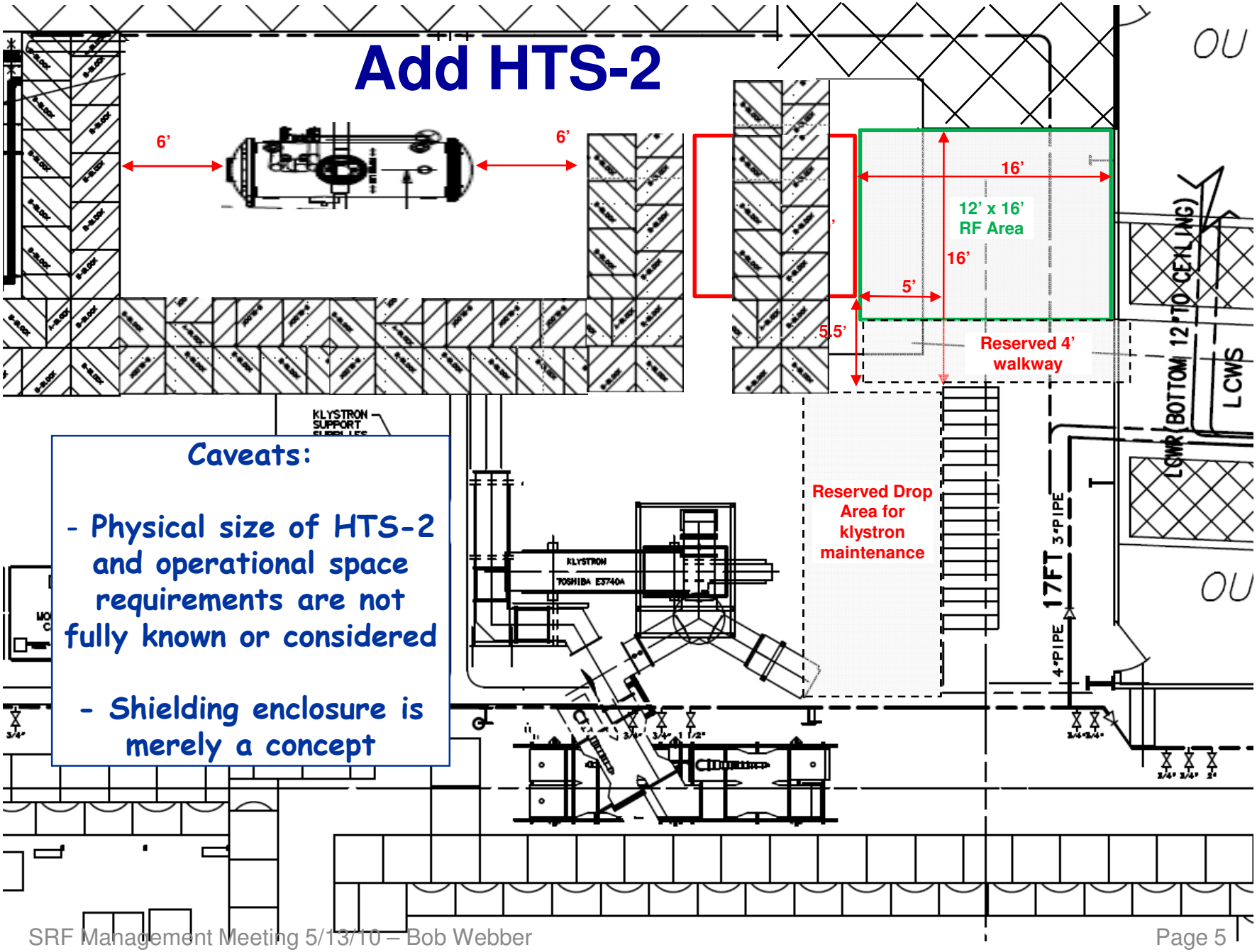
Elements of the MDB Facility

- Existing ILCTA Horizontal Test Stand (HTS) for testing dressed 1.3 and 3.9 GHz elliptical cavities
- Spoke Horizontal Test Stand (STF) for testing dressed 325 MHz superconducting spoke cavities
- HTS-2 --- Two-cavity version of HTS (HTS-2) for testing 1.3 GHz and 650 MHz elliptical cavities
- 325 MHz RF Component Test Facility
- Low-energy ~10 MeV proton/H- beam facility for:
  - Superconducting solenoid magnet field, alignment, optical characterization
  - Chopper testing
  - Beam instrumentation development and testing
  - Beam through short SSR cryomodule (~3 cavities/ 4 solenoids)

Present MDB Layout



Add HTS-2



Caveats:

- Physical size of HTS-2 and operational space requirements are not fully known or considered

- Shielding enclosure is merely a concept

RF Needs – 1300 and 3900 MHz

- 3900 MHz
  - ~80 kW pulsed (RF1-3900P80) (existing for HTS)
- 1300 MHz
  - ~300 kW pulsed (RF2-1300P300) (existing for HTS, shared with HTS-2)
  - ~30 kW CW (RF3-1300CW30) (Pasquinelli TV transmitter; coming soon, must retune drivers and buy 1300 IOT, shared between HTS and HTS-2)
  - ~1 MW pulsed (1.3 ms at 5 Hz) (RF4-1300P1000) (new system from ??)*
  - ~100 kW pulsed (3 ms pulse at 40 Hz) (RF5-1300P100) (new system from??)*

    - *from Andy Hocker HTS-2 document
    - Can RF2-1300P250 or RF4-1300P1000 be made to serve purpose of RF5-1300P100?

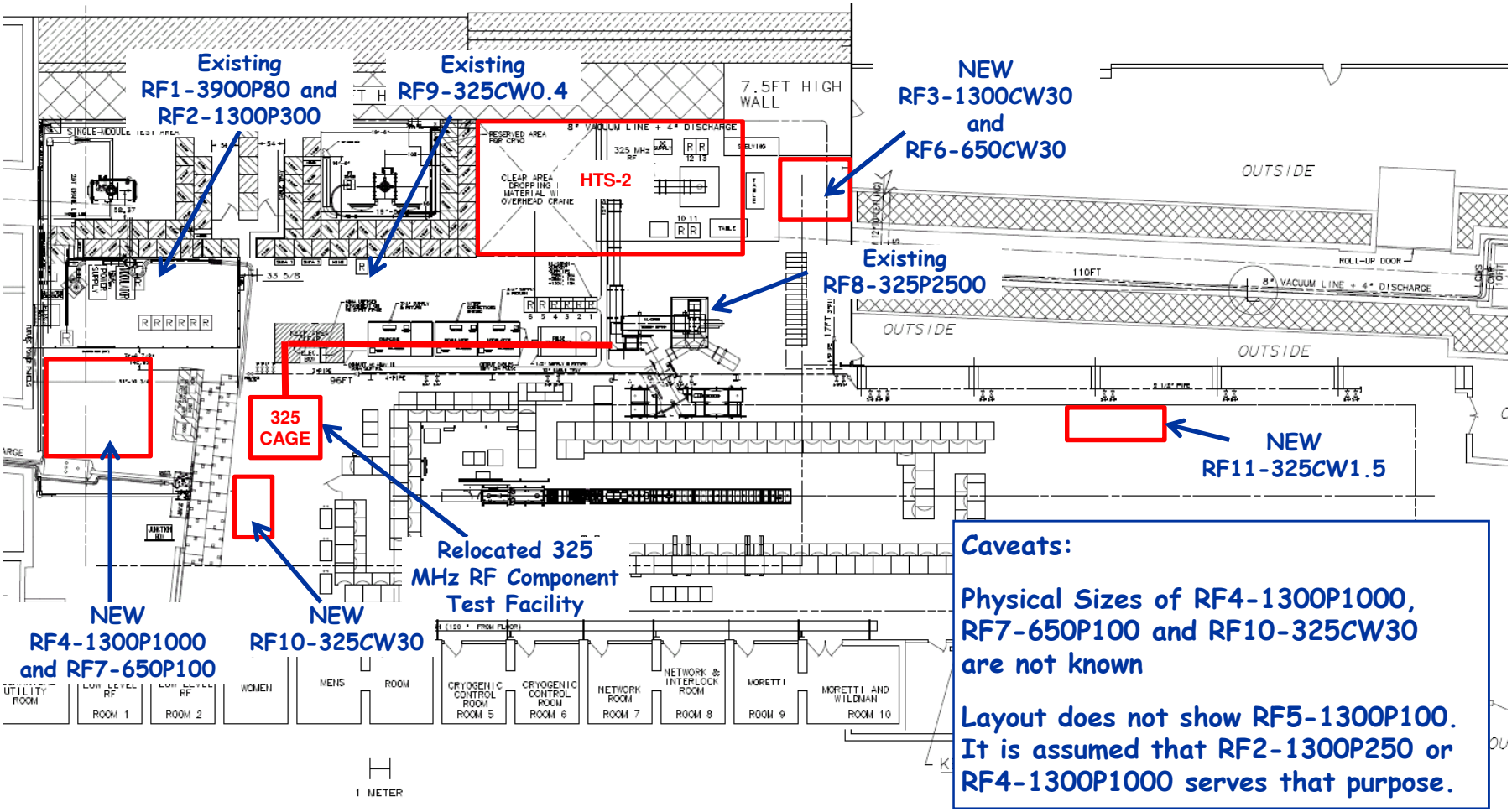
RF Needs – 650 MHz

- ~10-30 kW CW for PX cavity testing (RF6-650CW30) (Pasquinelli TV transmitter; coming soon)*
- ~100 kW pulsed 650 MHz (10 ms at 10 Hz) (RF7-650P100) for PX cavity/coupler testing (new system from ??)*
  - *from Andy Hocker HTS-2 document

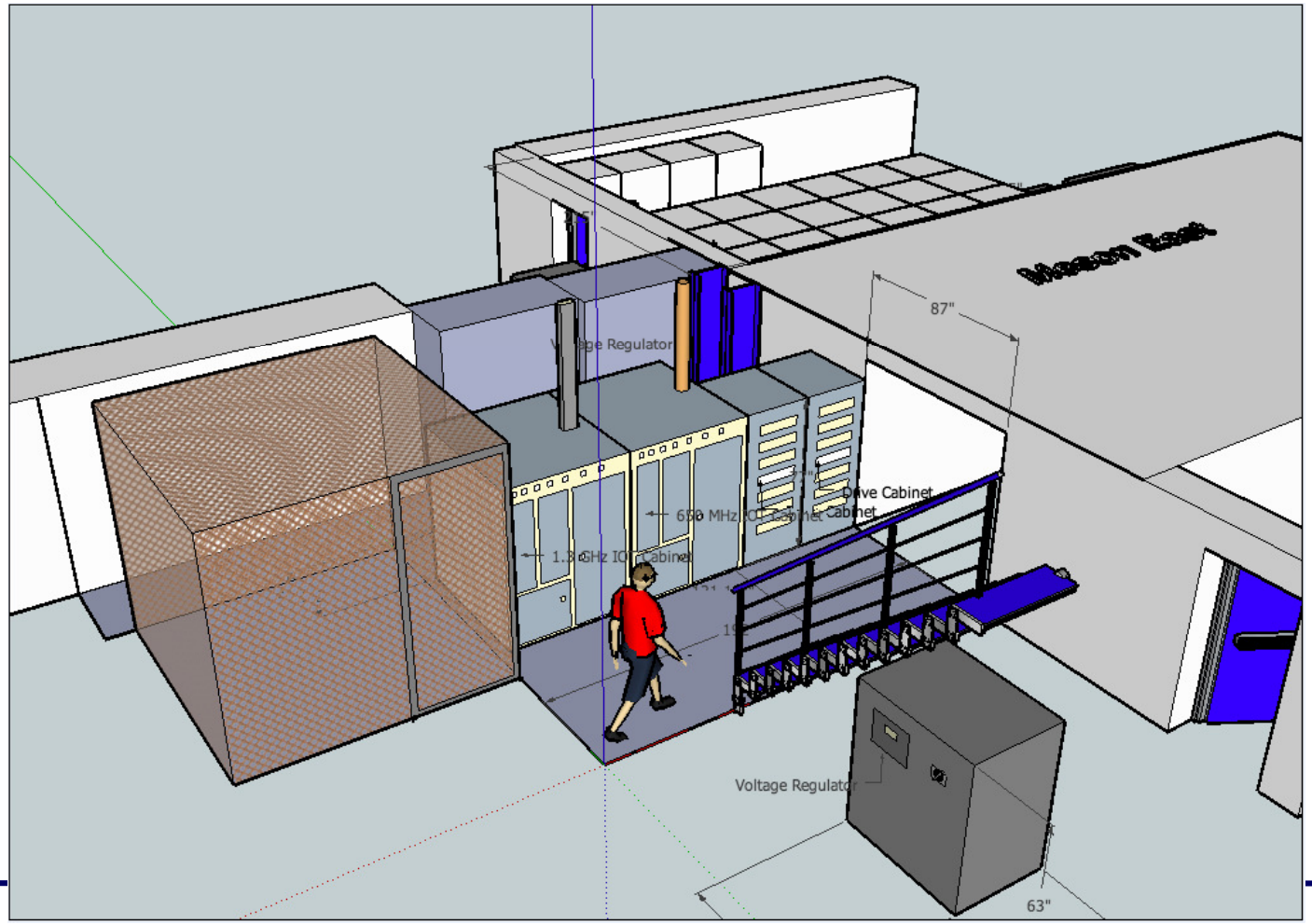
RF Needs – 325 MHz

- ~2500 kW pulsed (RF8-325P2500) for operating HINS beam facility (existing for HINS)
- ~200-400 W CW (RF9-325CW0.4) for "VTS-like" (i.e. high Q_{ext}) testing of spoke cavities in STF (existing for HINS)
- ~10-30 kW CW (RF10-325CW30) for CW testing of spoke cavities in STF (new system from ??)
- Three or four ~1.5 kW CW systems for beam tests of short spoke cavity cryomodule (RF11-325CW1.5)

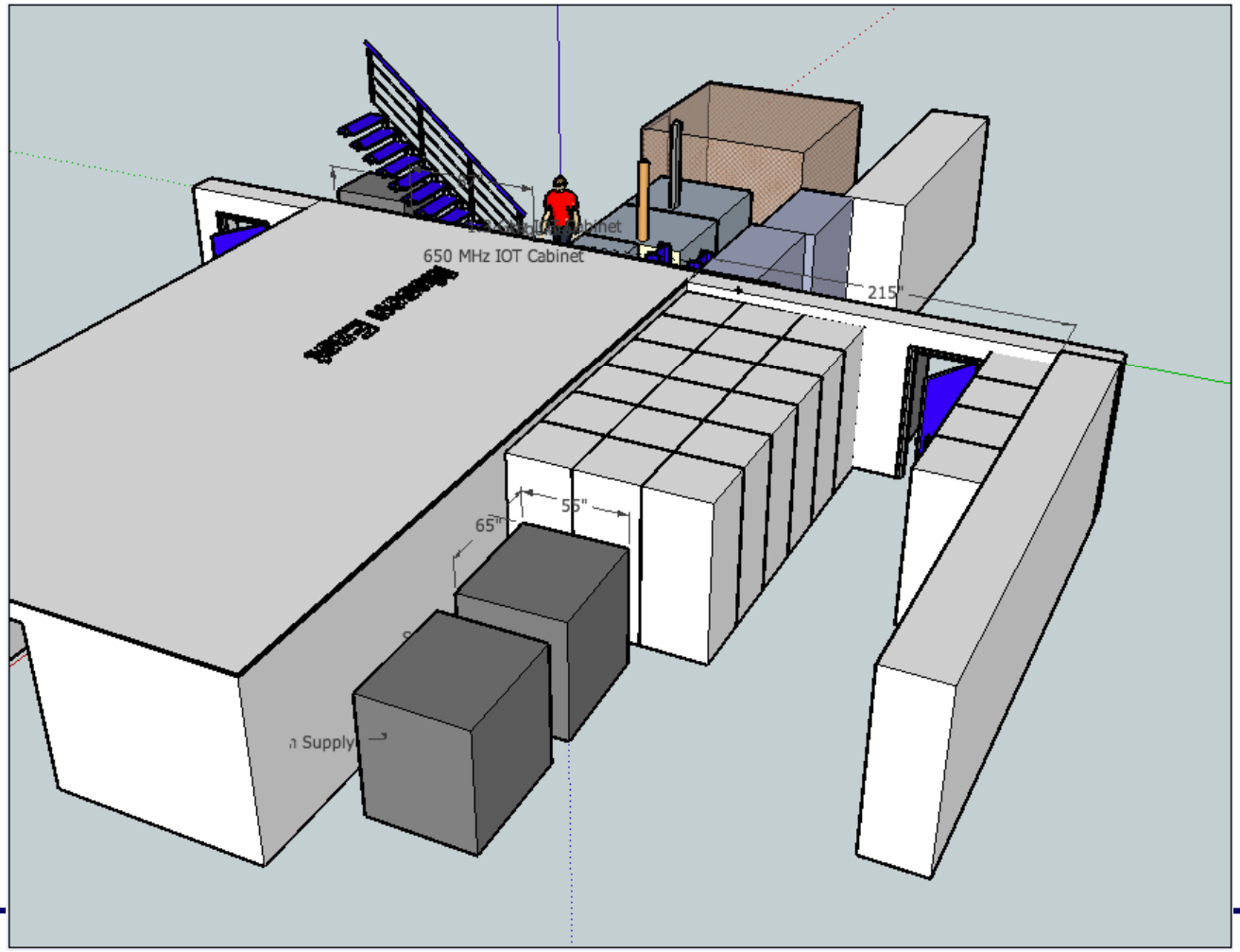
?Complete? Layout



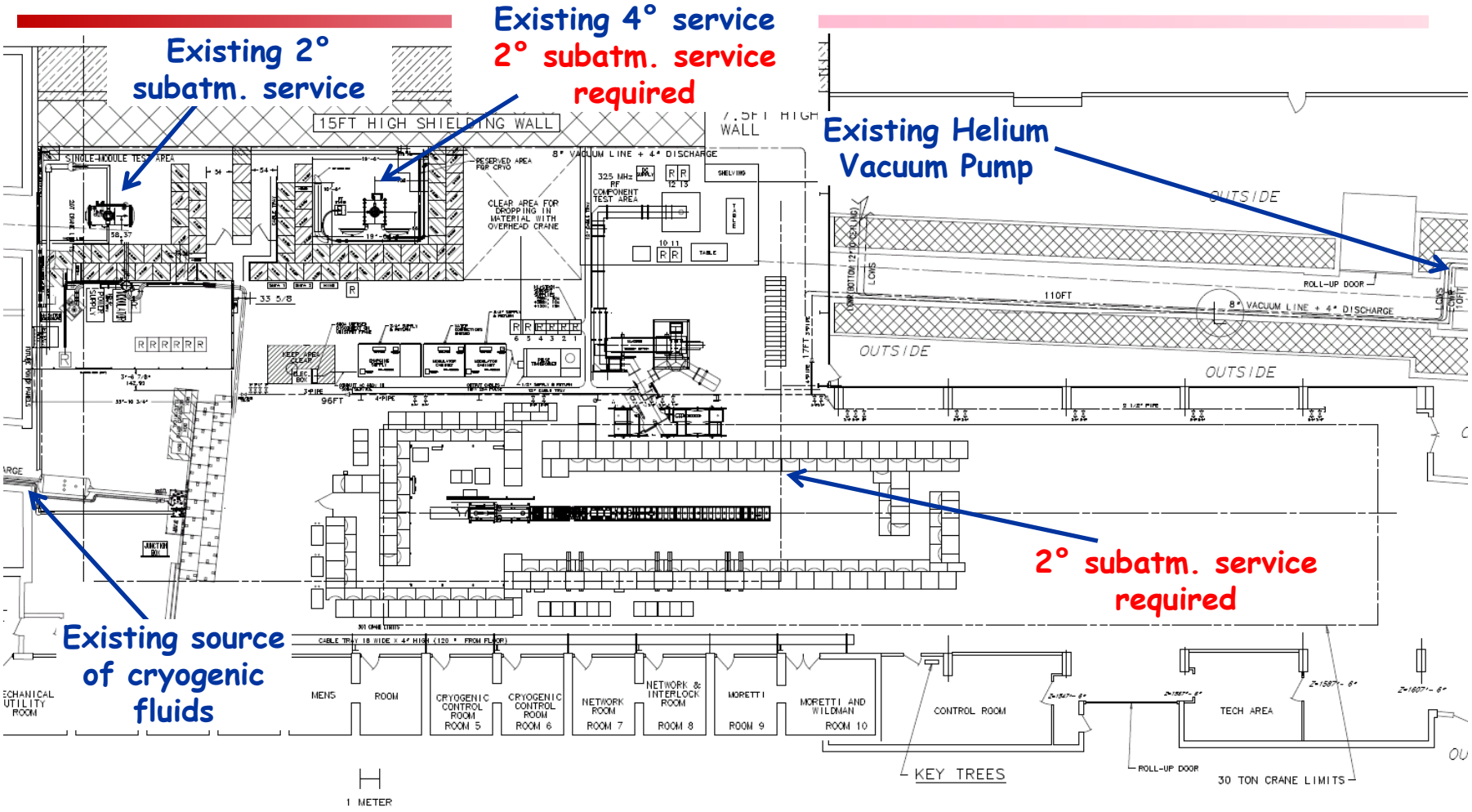
Pasquinelli TV Transmitter RF System Layout in MDB



Pasquinelli TV Transmitter RF System Layout in MDB



MDB Cryo


Existing 2° subatm. service
Existing 4° service
2° subatm. service required
Existing Helium Vacuum Pump
2° subatm. service required
Existing source of cryogenic fluids
15FT HIGH SHIELDING WALL
SINGLE-MODULE TEST AREA
RESERVED AREA FOR CRYO
8" VACUUM LINE + 4" DISCHARGE
CLEAR AREA FOR DROPPING IN MATERIAL WITH OVERHEAD CRANE
325 MHz RF COMPONENT TEST AREA
OUTSIDE
110FT
ROLL-UP DOOR
96FT
MENS ROOM
CRYOGENIC CONTROL ROOM ROOM 5
CRYOGENIC CONTROL ROOM ROOM 6
NETWORK ROOM ROOM 7
NETWORK & INTERLOCK ROOM ROOM 8
MORETTI ROOM 9
MORETTI AND WILDMAN ROOM 10
CONTROL ROOM
TECH AREA
KEY TREES
ROLL-UP DOOR
30 TON CRANE LIMITS
1 METER

Project X

Cryo Tasks and Issues

(slide from Klebaner, PX-Docdb #440)

Upgrade Plan

- Convert STC for 1.8 K operation
  - Seals for subatmospheric operation, J-T heat exchanger, instrumentation, etc.
- Modify STC cryogenic distribution system (AD/Cryo)
- New Spoke CMTS *(read as short spoke cryomodule)* distribution system (AD/Cryo)
  - Cryogenic transfer line, warm headers, vacuum pumping line, interface boxes, controls, ODH systems, etc
- Possible Horizontal Test Cryostat repair (relief system, 5 K shield)
- Cryogenic distribution for other devices (SC solenoids, etc.) *(TBD)*

Project X

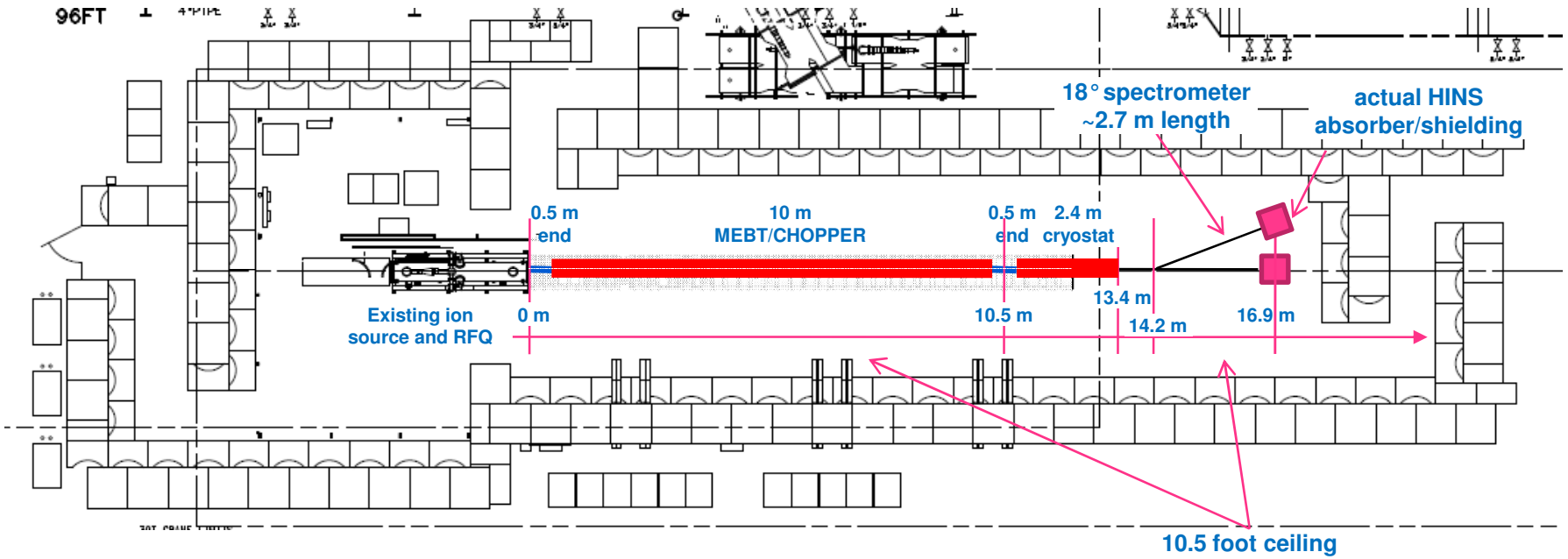
Cryo Tasks and Issues

(slide from Klebaner, PX-Docdb #440)

Summary

- MDB cryogenic system has capacity to support simultaneous operation of HTS, STC and Spoke CMTS *(11 cavity / 6 solenoid)* at 1.8 K
- STC and associated distribution system requires modification to operate with superfluid helium
- Additional applications (SC solenoids, etc) will require capacity upgrade ($$$, reduced already low reliability)
- Required modifications (STC) or new systems (CMTS, etc.) are man power limited

Layout for 3-Cavity SSR0 Cryostat



Strawman Milestone Schedule – HTS-2 Shielding Enclosure

(added after original presentation)

- Schedule reference – delivery of HTS-2 cryostat January 2013 per "Integrated SRF Plan" dated February 2010
- Schedule objective – enclosure ready to receive cryostat January 2013

- HTS-2 Shielding Enclosure Milestone Schedule
  - Complete conceptual design with preliminary shielding assessment, sensible labyrinth layout, maximum cryostat dimensions, cryogenic delivery system footprint, consideration of necessary wall penetrations, etc. to discover any showstoppers – September 2010 (while we're thinking about it)
  - Detailed enclosure design including RF power transmission and control elements and cryogenic delivery system components to be located within the enclosure – January 2012 thru February 2012
  - Begin procurement of cave construction materials – February 2012
  - Begin 325 MHz RF Component Test Facility re-location – March 2012
  - Begin HTS-2 Enclosure construction – June 2012
  - MDB cryo shutdown for installation of delivery systems to HTS-2 and to low-energy beam facility destinations – October 2012
  - HTS-2 Enclosure ready to receive cryostat – January 2013

Strawman Milestone Schedule – RF Systems (added after original presentation)

- Review by RF engineers of general overall concept laid out in this presentation – September 2010 (while we're thinking about it)
- ~30 kW CW (RF3-1300CW30) – Install June 2010 at TV frequency; modify for 1300 MHz in time to support HTS-2 commissioning early 2013
- ~10-30 kW CW for PX cavity testing (RF6-650CW30) – Install June 2010 at TV frequency; modify for 650 MHz in time to support HTS-2 commissioning early 2013
- ~1 MW pulsed (1.3 ms at 5 Hz) (RF4-1300P1000) – Design, build and commission to support ILC cavity testing needs in 2010
- ~10-30 kW CW (RF10-325CW30) for CW testing of spoke cavities – Procure, install and commission in time to support SW spoke cavity testing November 2011
- ~100 kW pulsed 650 MHz (10 ms at 10 Hz) (RF7-650P100) – Procure, install and commission in time to support HTS-2 commissioning early 2013
- Three or four ~1.5 kW CW systems for short spoke cavity cryomodule (RF11-325CW1.5) – Procure, install and commission in time to support short cryomodule testing December 2013

Strawman Milestone Schedule – Cryogenics (1 of 2) (added after original presentation)

- Dewar/solenoid interface for single solenoid cryostat operation
  - Schedule objective (Nagaitsev) – demonstrate solenoid beam axis alignment to 0.5 mm rms by Oct 2011
  - Complete design of dewar/solenoid interface – September 2010
  - Procure/fabricate components – October 2010 thru March 2011
  - Install and commission – May 2011
- Cryostat and cryo delivery system mods for STF operation at 1.8°K
  - Schedule objective (Webber) – first 1.8°K STF RF test of jacketed SSR1 completed in November 2011
  - Designs complete – November 2010
  - Procurement/fabrications complete – July 2011
  - Installation complete including two week HTS cryo downtime – September 2011

Strawman Milestone Schedule – Cryogenics (2 of 2) (added after original presentation)

- Cryogenic delivery system for HTS-2
  - Schedule objective (reference HTS-2 enclosure schedule) – Installation of delivery systems to HTS-2 – October 2012
  - Complete design, procurement and testing in preparation for October 2012 installation
  - First cool-down of HTS-2 cryostat – February 2013
- Cryogenic delivery system for Beam Facility
  - Schedule objectives –
    - Single cryo shutdown affecting HTS and STF for installation of both HTS-2 and Beam Facility cryo delivery systems – October 2012
    - Support completion of short cryomodule test with beam by September 2014 (reference Beam Facility schedule)
  - Complete design, procurement and testing in preparation of at least the upstream cryo delivery components for the beam facility – for October 2012 installation
  - Complete design, procurement, testing, and installation of any remaining cryo delivery components for the beam facility for installation – by April 2014

Strawman Milestone Schedule – Beam Facility

(added after original presentation)

- Complete “Six-Cavity Test” (Webber) – June 2011
- Demonstrate that solenoid beam axis can be aligned to 0.5 mm rms (Nagaitsev/Webber) – by Oct 2011
- Select bunch frequency (162.5 or 325) by demonstrating a broad-band chopper (Nagaitsev/Webber) – by July 2013 (CD2)
- Complete test of SSR0 “short” cryomodule (3/4 cavities, 4/5 solenoids + correctors, BPMs) (prototype for a “long” cryomodule) with beam and broad-band chopper (Nagaitsev/Webber) – by Sept 2014
- Ongoing development of instrumentation, optics, couplers, LLRF

Summary

- Lots of work to get done…including developing manpower and M&S estimates