



# Infrastructure Review - W.B.S. 1.1.7

## Water Systems

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- Water Systems
  - Upstream LCW for Extraction and Pre-Target Magnets & P.S.
  - Downstream LCW for cooling the MINOS Near Detector Coil, Power supply and Electronics Racks.
  - Downstream RAW for cooling the Absorber .
  - Decay Pipe Cooling for cooling the decay pipe.
  - Horn RAW (RadioActive Water), for cooling the Horns. (2 systems)
  - Target RAW for cooling the target, horn protection baffles.
- Vacuum Systems
  - Extraction and Primary Beam, Hadron Decay Pipe
- Gas Systems
  - Primary Beam Instrumentation
  - Secondary Beam Instrumentation



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## Absorber Cooling RAW System

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- Absorber RAW System has pumps, heat exchanger located in the absorber access tunnel. Intermediate loop has the pumps, heat exchangers and filters located in the MINOS service building.
- Heat Exchangers sized for 200 kW, actual heat load is approximately 130kW. Will use a welded plate and frame HX between RAW and intermediate loop, a S&T between intermediate loop and the pond water.
- Both RAW and Intermediate loop pumps are 60 gpm pumps, 65 feet TDH, 3 HP. Pump not spec not yet written. Will include a hot stand-by unit for both RAW and Intermediate loop pumps.
- Provides cooling to remove the beam energy deposited in the absorber along the vacuum decay pipe.
- ~ 90 gallons of water in the absorber and piping, more in expansion tank, heat exchangers and manifolds.
- Heat rejected to MINOS pond water.
- Activation of water ...see Kamran's Talk.



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## Absorber Cooling RAW System

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- Status of the Absorber Cooling RAW System:
  - Piping layout drawings have been started by Ron Williams
  - Piping to be installed in the Service Building and Outfitting Contract.
  - Skid Design not started for either the RAW or the Intermediate loop skid.
  - Instrumentation List Complete
    - Best scheme to read in to/out of ACNET not yet settled.
    - Will use one PID loop to control temperature for the intermediate loop, no direct temperature control on the RAW loop.
    - Will have a few pump interlocks



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## Decay Pipe Cooling RAW System

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- Decay Pipe RAW System has pumps, heat exchanger located in the absorber access tunnel @ d.s. end and heat exchanger, filter, DI bottle in the underground mechanical support room at u.s. end.
- Heat Exchanger sized for 200 kW, actual heat load is approximately 130 to 150kW. Will use a welded plate and frame HX.
- 50 gpm pump, 325 feet TDH, 7.5 HP. Pump not spec not yet written. Will include a hot stand-by unit.
- Provides cooling to remove the beam energy deposited in the shielding along the vacuum decay pipe.
- ~ 1250 gallons of water in the piping, more in expansion tank, heat exchangers.
- Heat rejected to MINOS chilled water (same water used for de-humidification in the underground spaces) at downstream end and to the intermediate loop of CUB water at the upstream end (also used for de-humidification in the underground spaces).
- Activation of water is not severe. Should not have to change this water during the life of the experiment.



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## Decay Pipe Cooling RAW System

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- Status of the Decay Pipe Cooling System:
  - Piping layout drawings prepared in PPD by Tom Sperry (U.S.) and Ron Williams (D.S.)
    - Connections between individual tubes and the manifold are in an accessible area.
  - Piping to be installed in the Service Building and Outfitting Contract.
  - Skid Design not started.
  - Equipment Purchase Requisitions and specifications not prepared.
  - Changing from 1” nominal copper lines to ¾” nominal polyethylene coated copper lines to prevent galvanic corrosion between the copper and the low carbon steel decay pipe.
    - The decay pipe is less noble, therefore it would corrode, possibly causing a vacuum leak.
  - Instrumentation List Complete
    - Best scheme to read in to/out of ACNET not yet settled.
    - No temperature control
    - Will have a few pump interlocks



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## Horn 1 Cooling RAW System

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- Horn 1 RAW System has pumps, heat exchanger, filter, DI bottle in the underground mechanical support room at u.s. end.
- Heat Exchanger sized for 150 kW, actual heat load is approximately 30kW. Will use a welded plate and frame HX.
- 115 gpm pump, 61 feet TDH, 5 HP. (This needs to be re-checked) Pump not spec not yet written. Will include a hot stand-by unit.
- Provides cooling to remove the beam energy and  $I^2R$  deposited in horn 1.
- ~150 gallons of water in the piping, more in expansion tank, heat exchangers.
- Heat rejected to the intermediate loop of CUB water at the upstream end (also used for de-humidification in the underground spaces).
- Activation of water is severe. Will change annually but will also exceed the recommended concentrations.



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## Horn 1 Cooling RAW System

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- Status of Horn 1 Cooling Raw System:
  - Piping layout drawings completed between the skid and the top of the modules. Will layout final connections as the module design is signed off.
  - Piping to be installed in the Service Building and Outfitting Contract.
  - Skid Design has started by Don Friend in PPD.
  - Instrumentation List Complete
    - Best scheme to read in to/out of ACNET not yet settled.
    - No temperature control is used
    - Will have a few pump interlocks



## Infrastructure Review - W.B.S. 1.1.7 Horn 2 Cooling RAW System

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- Horn 2 RAW System has pumps, heat exchanger, filter, DI bottle in the underground mechanical support room at u.s. end.
- Heat Exchanger sized for 50 kW, actual heat load is approximately 10kW. Will use a welded plate and frame HX.
- 115 gpm pump, 61 feet TDH, 5 HP. Pump not spec not yet written. Will include a hot stand-by unit.
- Provides cooling to remove the beam energy and  $I^2R$  deposited in horn 2.
- ~100 gallons of water in the piping, more in expansion tank, heat exchangers.
- Heat rejected to the intermediate loop of CUB water at the upstream end (also used for de-humidification in the underground spaces).
- Activation of water is severe. Will change annually but will also exceed the recommended concentrations.



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## Horn 2 Cooling RAW System

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- Status of Horn 2 Cooling RAW System:
  - Piping layout drawings completed just as in horn 1.
  - Piping to be installed in the Service Building and Outfitting Contract.
  - Skid Design has been started by Don Friend in PPD.
  - Instrumentation List Complete
    - Best scheme to read in to/out of ACNET not yet settled.
    - No temperature control is used
    - Will have a few pump interlocks



## Infrastructure Review - W.B.S. 1.1.7 Target Cooling RAW System

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- Target RAW System has pumps, heat exchanger, filter, DI bottle in the underground mechanical support room at u.s. end.
- Heat Exchanger sized for 20 kW, actual heat load is approximately 10kW. Will use a welded plate and frame HX.
- 15 gpm pump, 58 feet TDH, 1 HP. Pump not spec not yet written. Will include a hot stand-by unit.
- Provides cooling to remove the beam energy and  $I^2R$  deposited in the target. Baffle is currently air cooled but if water cooling is found to be needed, this system will provide it.
- ~50 gallons of water in the piping, more in expansion tank, heat exchangers.
- Heat rejected to the U.S. LCW system.
- Activation of water is unknown as it has not yet been calculated.



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## Target Cooling RAW System

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- Status of the Target and Baffle RAW System:
  - Piping layout drawings completed between the skid and the top of the target module. Routing through the module will be laid out once engineering on the target module commences.
  - Piping to be installed in the Service Building and Outfitting Contract.
  - Skid Design has not started.
  - There remains some difference of opinion as to if the beam baffle is, or is not, water cooled. This has a negligible affect on the cost.
  - Instrumentation List Complete
    - Best scheme to read in to/out of ACNET not yet settled.
    - No temperature control is used
    - Will have a few pump interlocks