Since the last collaboration meeting, the ND280 detector project has undergone a huge transition:

- January 2009: most efforts focussed at home institutions
- July 2009: most detector elements now at JPARC (or soon to arrive) with preparation, testing, and installation underway

This presentation will show the tremendous progress made possible by the hard work of many people

- it is not possible to give credit to each person/group in a summary like this... the collaboration thanks you all
Overview

- ND280 facility and magnet
- INGRID on axis detector
- Off-axis detector:
  - SMRD
  - P0D
  - FGD
  - TPC
  - ECAL
- Watch list
ND280 facility then

- From January 2009:
ND280 facility now

- All 3 buildings completed
  - NA has the control room (office area) and a large working area being used to prepare the FGD and TPC detectors
  - NMU is primarily used to house gas supply and mixing systems
NM progress

- Basket stand installation
NM progress

- Basket access (mezzanine and stairs)
NM progress

- Basket installed
NM progress

- Stages installed
ND280 facility issues

- NA – basic services were not included (crane and HVAC)
  - gantry & manual hoists brought in
  - temporary HVAC system installed (contract to January 2010)
  - both done at the expense to the groups using the facility

- NM – “cost saving” decisions are having consequences
  - concrete walls were not sealed
  - lower cost HVAC system without dehumidify function
Salt ingress in combination with humid air could pose a corrosion risk to equipment in the NM experimental areas

- a corrosometer has just been deployed on B1 level to evaluate the severity

Mold is a concern in stairwells and elevator waiting areas
ND280 facility issues

- **Humidity**
  - gaining experience with NM-HVAC and summer weather
  - low heat load in NM at this time - condenser coil not as active
  - add curtains to isolate SS level
  - installed recycled dehumidifiers
NM - humidity

- data, so far, is not conclusive

- dehumidifiers installed
- curtains installed

- outside humidity
- outside dewpoint
ND280 facility issues

- problems accessing part of JPARC network from offsite
  - being addressed by expert group (Ken, Renee, Geoff)
- long term storage
  - Scott Oser will work to put together a space request, with help from Roy and convenors
- desk space shortage at ND280
  - used and new furniture moved into counting room
- garbage collection saga
  - appears to be sorted out now – still a fee for removal of wooden crates
Magnet services installed since last meeting:

- power converter
- coil current leads
- magnet water pipes from B1 to 1F
- cooling pipes to power supply
Installed (cont.)

- Magnet control and safety system – instrumentation tested
- Field mapping device – ready to operate
Magnet

- Magnet services installation in progress:
  - cooling plant
  - cabling to magnet, power converter, cooling plant
  - water connection to magnet and cooling plant
Magnet

Schedule slippage since last meeting:

- Delay imposed on tendering cooling plant installation in order to sort out funding
- First energizing was to be June 22, now planned for Aug 17
- All detector installation in basket moved back accordingly
INGRID
First module assembled Feb 2009

Installed in May 2009
- Commissioned with cosmics
  - first look in agreement with simulation

- Tracking plane efficiency $99.5 \pm 0.6 \%$
Beam event search during beam commissioning...

Neutrino event (interaction within module)

Expected $\sim 0.2$ events

No event in time with beam found...

Neutrino event (interaction in the wall)

Expected $\sim 0.4$ events
Remaining 6 H-modules assembly completed on July 2
- currently being tested with cosmics

installation underway and will be completed July 18

V module assembly to be completed on August 8 and installation by mid August

Will be ready for future beam commissioning runs

work done in the LINAC building
SMRD

- Assembly work started in March in LINAC building
  - assembly and instrumentation now complete
- Installation proceeding very well
  - yokes were well aligned
Installation sequence

1) 

2) 

3) 

4)
Optical contact problem

- Tests and inspections discovered that ~5% of counters had fibre retracted by 0.1 – 0.3 mm
  - Light yield reduced by 10-30%
- Appears that mechanical shock to some boxes cause endcap to slightly delaminate from scintillator
  - Decided to screw endcap to scintillator for all counters, including those already installed
Installation nearing completion...

Expect to be completed by end of July
Electronics installation

Status: (as of July 7)

- all 128 TFBs mounted on to yokes; cabling (mini-coax, cat5e) in progress
- all 4 RMMs and 32 trigger fan-in cards mounted on to yokes
- power distribution system (primary, secondary panels and cables) mounted on yokes and in process of being commissioned
- UK electronics experts in Tokai; start of SMRD electronics/DAQ commissioning this week

- environment (humidity, salt ingress, air quality) in ND280 pit is very serious concern for functionality of detector

DAQ commissioning about to start
- watch for problems due to environment
POD

- P0D modules arrived at JPARC in late April
- Large group on site for checkout (10-12)
  - cosmics, light injection, water target fill tests
  - small numbers of boards and MPPCs needed to be replaced
Cosmic Ray runs with upstream ECAL

- Cosmic ray setup currently using the upstream ECAL.
- 7 layer X&Y tracking planes, 1820 detector channels, 1856 electronics channels (36 not used)
- Currently no zero suppression in data

EVENT DISPLAY of Cosmic ray track in x and y bar position versus z position.

See P0D pre-meeting talk by Trung
Cosmics results:

- residuals
- pedestal drift ~ 0.01 PE/hr
- Light injection system working for all readout channels
- Unusual intensity pattern not yet understood

![Graph showing ADC (pulse height) vs Fiber Number](image)

Zigzag pattern was seen at SBU. It is not understood, but appears to be a feature of LED light distribution on the fibers. Was seen in SBU scanner setup, but not at CSU prototype.

Simple LED pulser designed to have light intensity distribution that slowly varies from fiber to fiber over a factor of ~3.

S. Dytman June, 2009
**Water Bag Fill Test of 2 Water Target SP0D’s at LINAC**

1st WTSP0D bracing (no exposed water bag)

Set up of 900 gallon tank & rack to fill 1st WTSP0D. Note 2nd WTSP0D on right has exposed water bag

1st Water Bag
Fill test
Done
May 27

Pump tank

Horizontal water tank, in pit will be vertical.

2nd WTSP0D, Foam pad placed on exposed water bag

2x8” wood planks braced against foam pad

2nd Water Bag
Fill test
Done
June 2

Attaching level/pressure sensor cables to readout
Water Tank and Pump Rack installation in PIT (6/29)

Pump Rack installed below FGD stand

900 gal. water storage tank in stand with drip pan

Water hoses between pump rack and basket

Remarks; U.Wash. stand with drip pan arrived just in time for pit installation

Photos by Norm
On schedule for installation into basket at end of September

Would like to be ready for any further beam commissioning in October...
FGD

- FGD #1 arrived safely on June 19
- all channels tested in horizontal orientation
  - 5 MPPC replaced (probably connection problem)
  - 1 backplane replaced
FGD

- FGD#1 tilted to vertical
- electronics to arrive next week – install and operate until FGD installation in basket in October
FGD

- **FGD#2 water panel tests:**
  - Polycarbonate water panels are 2.5cm thick, hold 70kg of water each.
  - All water panels were leak-checked at TRIUMF, then again after arrival in Tokai. All have passed all checks, including tests with vacuum pump and water fill test.
  - Water capacities measured to <1%.
  - Negative pressure water circulation system for target water will arrive and be installed starting next week.
FGD

- **FGD#2**
  - arrives next week
  - unpack, restack, electronics test, tilt to vertical by end of July

- **Light pulser board**
  - earlier prototype had problems
  - improved layout – new prototype being fabricated
  - production board installation expected only in November
Backend electronics (common with TPC) to be done with fallback solution (ML405 evaluation kit)
2 crates will each hold 6 + 1 spare DCC

- successfully operated with 6 DCCs at TRIUMF in May
- need longer term tests to assess reliability
  - DCC upgrade may be considered
TPC

- 2 TPCs are completed
  - TPC0 – arrived in JPARC in June
  - TPC1 – running in test beam at TRIUMF
- TPC2 is under construction
  - hope to complete before start of run
- MM module production
  - gone very well – very good uniformity as verified by test bench
  - completed by end of August
- Front end electronics
  - gone very well – manufacturing issues now resolved
  - production to be completed by September
- Backend electronics
  - use fallback solution (ML405)
  - plan to ship 18 DCCs at end of September – no contingency
TPC assembly
readout of full endplate at TRIUMF - cosmics
TPC gas system

Gas Handling System

Challenge:
Supply 30 l/min Ar: 2% iC₂H₆: 3% CF₄
Maintain pressure to 0.1 mbar

- Purity (O₂<10ppm, CO₂<100ppm, H₂O<100ppm)
- Fail safe features

Gap CO₂ system in red
Detector mixed gas in blue

Gas supply room

Mixing rack

Buffer + recirculation

Gas purity analysis

Safety monitoring

SS level (under detector)

Detector level

ND280 construction status report July 10, 2009
TPC gas system

Rack on detector level to show flow I/O of detector and measure \( dP = P_{\text{detector}} - P_{\text{gap}} \)

Racks for below detector

- Recirculation Pump
- Gap CO2 Distribution
- TPC gas Distribution
- PLC

Racks for gas mixing building

- Buffer Tank
- Mixing
- Purifiers
- Monitor Chambers
- Analyzers
- PLC

EPICS control system
tests underway

Testing nearly complete – send to JPARC later this month
TPC gas system

Gas pipe installation nearly complete:
- underground to ground level
  - done
- supply room manifold systems
  - nearly done
- mixing room
  - nearly done
TPC

- TPC 0 now in cleanroom in NA
- Overpressure test confirms inner box intact
ECAL

- Downstream ECAL in CERN testbeam: May and June

- Preliminary layer efficiency for mip: 98.3%
- Reconstruct angle of incidence with 3-5 degree resolution for incident angles up to 75 degrees
Beam Test Statistics

No problems and more PS cycles than expected: accumulated 3 x (stats applied for)

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1.0 GeV electron

3.0 GeV pion
ECAL

- Barrel and P0D ECALs
  - 12 more modules

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**Full ECAL build - procurements**

- **Scintillator bars**: 16,500 bars (40km) required, 12,400 in the UK, 5,000 prepared and QA'd
- **WLS fibres**: 5,035 delivered and QA'd
- **Lead sheets**: half delivered + primed, half on order
- **MPPCs**: 22,000 (all) delivered, 18,000 QA'd and prepared, completion imminent, on schedule
- **TFBs, BEBs**: production and QA completed
- **Carbon fibre module skins**: delivered
- **Bulkheads**: in construction, 2 first modules ready
- **Cables, pipes, busbars, etc**: ordered / delivered
ECAL

- Work is shared amongst 5 sites
Main scheduling issues

- FNAL bar production lost 2 months (15/03-15/05) with extrusion problems
- Reasonable quality, ~8% rejection
- Fibre preparation at FNAL not so fast, other priorities, sparse communication
- Overall good but variable quality, 17 of 5,000 rejected
- Still possible track to install 2 Barrel and 1 POD-ECAL modules for first data in December assuming no further problem (aggressive schedule)
Major milestones

- **DS-ECAL:**
  - At Tokai: 26 August 09
  - Installation: 13 October 09

- **Barrel ECAL:**
  - Side module at Tokai: 5 November 09
  - Installation: 8 December 09
  - Top module at Tokai: 8 December 09

- **POD-ECAL:**
  - Side module at Tokai: 13 November 09
  - Installation: 1 December 09
  - Top module at Tokai: 21 December 09

- **Full ECAL installed: by October 10**
Summary of issues to be concerned about:

- NM: humidity, salt, and mold
- SMRD: adversely affected by environment?
- FGD and TPC: backend electronics
- TPC: 3\textsuperscript{rd} TPC schedule
- ECAL: bar and fibres from FNAL
Summary

- Tremendous progress has been made since the last collaboration meeting
  - very nice to see the international partners working well together, under the coordination of Captain Preece
  - this bodes well for the future, as we will be working even more closely to bring all the detector systems together for first beam in less than 6 months