Valencia, November 2011 Meeting

NEXT COLLABORATION

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1 Meeting Venue

IFIC, Paterna, 31st October 2011, 4th November 2011

2 TDR

This meeting will be devoted to the discussions that must lead to NEXT TDR.

The Workshop will run Monday to Wednesday. Meetings will run from 9 to 12:30 (with 1/2 hour coffee break) and from 15:30 to 18:00 with 1/2 hour CB. Additional, ad-hoc meetings can be run at lunch time and/or after 6.

The CM will run on thursday and friday. It is quite likely that we will need to use also friday afternoon to cover all the relevant issues. Please, plan accordingly.

There will be an IB on thursday evening, after the end of sessions and before CM dinner that will be in restaurant la Forqueta at 9:00 pm. Those of you who intend to go to the dinner, please send e-mail to Jose Perez so that we can make reservations.

This document presents the list of topics and ideas to be discussed at the workshop and the CM. The specific talks to be presented at the CM will be assigned during the workshop and an agenda with the talks will be circulated shortly before the CM.

Tuesday 1st of November is holly day, but IFIC will be open and we will bring in coffee and sandwiches.

I hope that most of you can attend the full workshop, in addition to the CM. This is a crucial meeting, since we will need to complete the TDR shortly after.

3 Sessions

1. Monday, October 31st. Sensors, electronics & DAQ

2. Tuesday, November 1st. Detector & Shielding Design

3. Wednesday, November 2nd. Prototipes & Software.
4. Thursday, November 3rd. CM
5. Friday, November 4th. CM

4 Monday, October 31st: Sensors, electronics & DAQ

4.1 SiPM Sensors

1. Choice of Pixel
   - Pixel for NEXT1 (S10362-11-025P): 1mm^2, 25μ pitch. Choice for NEXT100 (default: same).
   - Curve of light as a function of energy for pixels in NEXT1.
   - Dark current at ambient temperature: How does it affect energy measurement?
   - Cooling SiPMs to reduce dark current?
2. Characterization of SiPMs
   - Measurements on individual SiPMs before mounting on DB?
   - Organizing data base (I&V curves, gain) for SiPMs
3. R&D on improved SiPMs (sensitive to UV light)
   - Summary of results at IFIC
   - Shall we continue this R&D? If so, who?

4.2 Coating of DB

1. Coating procedure
   - Assuming 64 pixel DB and 10 000 SiPMs must coat about 160 DB

- Probably can be done at ICMOL, following same protocol than NEXT1 DB.
- Securing of resources and organization of coating calendar.
- Human resources. Distribution of work. Building a team to run shifts on coating.
- Characterization and storing of coated DBs.
- Which tests to be run in individual DBs? Which information to be stored in DB?
- Where do we store 160 DBs?
- Stability tests (re-measurements after "n" months in store and/or gas)

4.3 NEXT-1 SiPM Plane Status

1. Daughter boards
   - Cuflon as material of choice. Rpurity measurements of Cuflon.
   - Pitch & Pixels per DB. NEXT1 choices: 1 cm, 16 pixels, default for NEXT100: 1 cm, 64 pixels.
   - HV: one line (temperature controlled) per DB?
   - Production on DB: Time line and distribution of work.
2. Mother Board
   - Next-1 is a single PCB. Single PCB for NEXT-100?
   - Design of NEXT-1 MB: Design of NEXT-100 MB?
   - Production of MB: Time line and distribution of work.

4.4 FE Electronics for SiPMs

1. FE electronics for NEXT1
   - Description of FE electronics for NEXT1.

- Status of FE electronics (production) for NEXT1.
- Taking signals out in NEXT1. Implemented solutions.

2. FE electronics for NEXT-100. Baseline design

   - Design of FE electronics for NEXT-100.
   - Power and heat removal
   - Digitization and Optical links for carrying signals out.
   - Feedthroughs for optical fibers.
   - Shielding (and cooling?) of FE electronics
   - Radioactive budget: What rpurity measurements are needed?
   - Production of FE electronics: Time line and distribution of work.

3. FE electronics for NEXT-100. Backup design

   - Is it worth to keep NEXT1 electronics as backup solution?
   - Feedthroughs for 10,000 SiPMs?

4.5 DAQ and slow control for SiPMs

1. DAQ for NEXT1

   - Description of DAQ for NEXT1 SiPM plane.
   - Which parameters must be controlled/monitored? (e.g, temperature)

2. DAQ and Slow Control for NEXT100 SiPM plane

   - How do we extrapolate NEXT1 to NEXT100 DAQ?
   - Architecture (in terms of FECS, etc).
   - Parameters to control/monitor and slow controls
   - Time line and distribution of work

4.6 NEXT-1 PMTs

1. Calibration & Performance of NEXT-LBNL PMTs
2. Calibration & Performance of NEXT-1-IFIC PMTs
3. Hamamatsu R11410-10 for NEXT-100
    - Organization of studies with the 3 PMTs on stock (LBNL + IFIC)
    - Status of order (55 PMTs).
    - Design of base.
    - DC/AC for coupling the signal?
    - Design of radiopure bases
4. Characterization of PMTs for NEXT-100 plane
    - Protocol of tests to be done in individual PMTs.
    - Time line and distribution of work.
5. Radioactive Budget
    - PMTs: How do we measure at LSC? Asking samples to Hamamatsu.
    - Bases.
    - PMT cans

5 Monday, November 1st: Detector & Shielding Design

5.1 Platform and Shield

1. Design
    - Clarify any element still pending in the design.
    - Dimensions, interfaces (gas, electricity, etc.)

- Lead versus copper shells
- Review of cost.
- Stage scenario: start building platform and lead castle asap, delay copper shield until funds available.
- Is design capable to accommodate staging?

2. Seismic study
   - Final study should be available for LSC forwarding
3. TDR
   - A TDR on platform + shielding + seismic study must be written and promptly submitted to LSC.
   - Approval of platform + shielding will happen before risk assessment study. Design must be agreed with LSC so that construction starts as soon as possible.

5.2 Chamber

1. Vessel Design
   - Complete constructive design of steel vessel.
   - Dimensions & interfaces.
   - Copper shielding. Copper type (low radioactivity, low oxygen, etc.).
   - Review of cost.
   - Stage scenario: Run with steel vessel (and lead without copper) for initial phase of depleted run, add copper as soon as funds available.
   - Is design capable to accommodate staging?
   - Construction time line
2. PMT cans

- Final design available?
- Prototypes? Time line?
- PMT service plate

3. SiPM service plate
    - Final design available?
    - Time line?

5.3 Field Cage, Grids, Light Tube and HV

1. Field Cage
    - Final design available?
    - Buffer region? FC to chamber, anode buffer?
    - Cathode voltage? Charge walking in dielectrics.
    - 3M + TTX light tube? fixing to copper rings.
    - radioactivity budget
    - Cost and time line.
2. HV
    - Final design available?
    - Prototypes? Time line?
    - Horizontal? Vertical? Maximum HV for cathode and anode?
    - radioactivity budget
    - Cost and time line.
3. Grids
    - Final design available?
    - Maximum voltage?
    - Deflection effects?

6 Tuesday, November 2nd: Prototypes & Software

6.1 LBNL prototype: results & prospects

1. Resolution studies
   - "Final" results on Cs-137 analysis.
   - Factors that contribute to resolution in NEXT-LBNL
   - Paper
   - Other isotopes: extrapolation curve to high energy (studies with more than one energy point)
2. Tracking studies
   - SiPM plane?
3. Experience with N2
   - Do we need/want a hot getter?

6.2 IFIC prototype: results & prospects

1. Resolution studies
   - Summary of results from Run-I (summer)
   - Status of Run-II
   - Program of studies: Isotopes to be used.
   - Procedure: calibration and corrections.
   - X rays as a must for final corrections.
2. Tracking studies
   - Slicing + baricenter as basic approach
   - Improving the baricenter approach

- Tracking.
- Fiducialize the event

3. Experience with Run-II
   - Operating conditions, etc.

6.3 UNIZAR prototype: results & prospects

1. Resolution studies
   - Resolution results with old/new MM?
2. Tracking studies
   - Tracking with MM
3. Gas mixtures
   - Results on gas mixtures?

6.4 Montecarlo

1. Full and Fast MC
   - Availability of Full and Fast MC. Run time. Issues.
2. Efficiency studies
   - Understanding S1 efficiency
   - Can we improve peak finder?
   - reconstruction efficiency?
3. Resolution studies
   - Quantify the factors that contribute to resolution.
   - Estimate residual corrections. How close to intrinsic can we get?

   item Tracking studies

- Demonstrate tracking (slicing + xy + voxel +...) in MC
- Understand improvements to baricenter
- Quantify corrections associated to tracking.

6.5 NEXT background model

1. Full and Fast MC
   - Availability of Full and Fast MC. Run time. Issues.
2. Efficiency studies
   - Understanding S1 efficiency
   - Can we improve peak finder?
   - reconstruction efficiency?
3. Resolution studies
   - Quantify the factors that contribute to resolution.
   - Estimate residual corrections. How close to intrinsic can we get?

   item Tracking studies
   - Demonstrate tracking (slicing + xy + voxel +...) in MC
   - Understand improvements to baricenter
   - Quantify corrections associated to tracking.

6.6 Software

1. Constructing Model
   - List of elements to be introduced in detailed version of the MC
2. Implementing Model
   - Writing every element in the MC.

3. Running to count realistic bkgnd in NEXT

    - Run data, with external bkgnd (gammas from Canfranc) and with internal bkgnd (NEXT model) to find out the number of Bi-214 and Tl-209 interactions per year.
    - Produce a map of interactions (x,y,z,E) to be used as input for fast simulations.

4. Time line and share of work

7 Thursday, November 3d: General Meeting

7.1 Summary talks

- Tracking plane

    1. SiPMs, characterization (+ studies of enhanced SiPMs).
    2. SiPMs, Design of DB, design of MB, construction strategy.
    3. SiPMs, Coating of DB. Procedure, resources and strategy.
    4. NEXT-1 FE electronics for SiPM.
    5. NEXT-100 FE electronics for SiPM.
    6. NEXT-100 Service plate, optical FTs, and DAQ

- Energy plane

    1. PMTs, characterization and mode of operation.
    2. PMT cans. Design, production, coating.
    3. Plumbing, FTs, and DAQ.

- Platform, Shielding and Seismic study

    1. Design of platform and shielding.
    2. Seismic study.

- Chamber design
    1. Vessel design and copper shield
    2. Field cage, HV and grids.
- Gas system
    1. Gas system design. Solved problems and pending issues.
    2. Construction and time line

8 Friday, November 4th: General Meeting

8.1 Summary talks

- Prototypes
    1. Status and results from LBNL prototype
    2. Status and results from IFIC prototype
    3. Status and results from UNIZAR prototype
- Monte Carlo
    1. Status and program for Monte Carlo studies
    2. Fast Monte Carlo
    3. Implementation of Background Model in MC
    4. MC "background event" library production
- Radiopurity
    1. Results of Ti measurements.
    2. Radiopurity campaign organization.
- Software
    1. Status of FMWK. Releases.

- TDR
    1. TDR chapters.
    2. TDR executive report.
- Time Line
    1. Time line for NEXT-100 construction
    2. Costing the detector and sharing of responsibilities.