2011 NA62 Status Report to the CERN SPSC

Abstract

NA62 will study the rare decay $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ at the CERN SPS. We report here progress on the construction and the preparations for the experiment since November 2010. The implications of the postponed LHC shutdown are presented. We report the final (published) result on the 40 % of the data collected 2007-2008 to study Lepton Universality and the work towards the completion of the full sample analysis.

1 Introduction

The study of Flavour Changing Neutral Currents (FCNC) in charged leptons and quark decays is a privileged road to complement the high energy searches for new physics. A strong world-wide programme is underway. At the LHC, the LHCb experiment has started to accumulate B decays and it has shown results already competitive with those published by CDF and D0 at the Tevatron with just 1% of the integrated luminosity [1]. At PSI the MEG experiment [2] is searching for the forbidden decay $\mu^+ \rightarrow e^+ \gamma$ while at CERN-SPS and J-PARC rare kaon decays will be studied. High luminosity projects are proposed in Japan and Italy to extend the reach of the experiments performed at the e^+e^- factories. In addition, the scientific strategy of Fermilab is shifting from the high energy to the high intensity frontier (Project X) where a suite of experiments is envisaged to study not only neutrino oscillations but also to push the sensitivity of rare processes and notably the frontier of $\mu \rightarrow e$ conversion. Of this broad program, NA62 will be the only experiment to employ a high momentum kaon beam. The study of the reaction

$$K^+ \rightarrow \pi^+ \nu \bar{\nu} \tag{1}$$

is particularly exciting because of the robustness and precision of the Standard Model (SM) prediction [3], and the huge opportunity for improvement on the experimental side [4]. The determination of the CKM parameter V_{td} from reaction (1) without input from lattice QCD is an important objective in the current framework and a very strong motivation for a timely construction of NA62.

About six months have passed since the most recent NA62 SPSC review. Significant progress towards construction of the sub-systems is reported. The analysis of the 2007 - 2008 data to measure the $R_K = \Gamma(K_{e2})/\Gamma(K_{\mu2})$ has continued and a result based on a 40% sample has been published.

2 Analysis of the 2007 data sample

The main goal of the NA62 physics programme based on the 2007 data sample is the measurement of the helicity suppressed ratio of the kaon leptonic decay rates $R_K = \Gamma(K_{e2})/\Gamma(K_{\mu2})$ to a precision of 0.4%, which is a factor of 3 improvement over the earlier measurements [5]. The SM expectation for R_K is both strongly suppressed and known to excellent precision due to the cancellation of the hadronic uncertainties: $R_K^{\mathrm{SM}} = (2.477 \pm 0.001) \times 10^{-5}$ [6], which makes R_K highly sensitive to non-SM physics. In particular, enhancement of R_K by $\mathcal{O}(1\%)$ is possible in the MSSM [7, 8], which represents a unique probe into mixing in the right-handed slepton sector [9]. On the other hand, R_K is
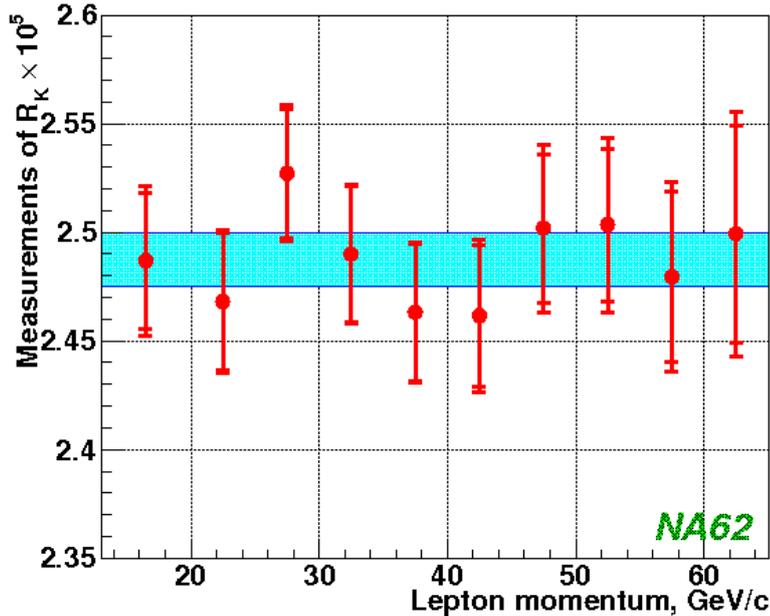
Figure 1: Measurements of R_K in lepton momentum bins with their uncorrelated statistical uncertainties and the partially correlated total uncertainties. The average R_K and its total uncertainty are indicated by a band.

sensitive to the neutrino mixing parameters within the SM extensions involving a fourth generation [10].

The first stage of the analysis consisted of a measurement of R_K based on a 40% partial data sample with the most favourable background conditions. This effort has been completed during the period from November 2010 till March 2011. The evaluation of the remaining systematic errors has been accomplished, and the final result, which represents the most precise R_K measurement to date, has been announced and published [11]: $R_K = (2.487 \pm 0.013) \times 10^{-5}$. The measurements of R_K in bins of lepton track momentum are presented in Figure 1. The result is consistent with the KLOE measurement [5] and the SM expectation. The experimental accuracy is still an order of magnitude behind the SM accuracy, which motivates further precision measurements of R_K.

At the same time, significant progress has been made towards the completion of the analysis of the remaining part of the 2007 data sample. The procedure of halo background estimation using control data samples has been optimized. Reprocessing of a dedicated control data sample collected in 2008 has been set up and is expected to be completed soon. This will allow the systematic uncertainties due to the halo subtraction to be further reduced. The Monte Carlo productions required for the analysis have been completed. A combined fit procedure accounting for correlations of the systematic uncertainties between track momentum bins and data taking periods has been developed. The full 2007 data sample contains 146 k reconstructed K_{e2} candidates with an averaged background contamination of 11%, collected under various experimental conditions. The total experimental uncertainty on R_K achieved with this sample is expected to be $\delta R_K = 0.010 \times 10^{-5}$, which meets the proposal goal.

A measurement of the structure-dependent radiative $K^+ \rightarrow e^+ \nu \gamma$ decay is steadily progressing, with the sources of background and event mis-reconstruction being identified.

In addition, the sensitivity to a sterile neutrino in the mass range of $50 - 350$ MeV/c^2, as suggested by [12], will be evaluated.

3 Beam Line and Infrastructure for the $K^+ \to \pi^+ \nu \bar{\nu}$ experiment

3.1 Beam Line and Vacuum System

Since the last report (mid November 2010) a detailed plan has been established for the installation of the K12 beam line up to the entrance of the big vacuum tank; it foresees to complete the installation by October 2011. The drawings for the construction items are well advanced and the ordering procedure has started for most items. Studies for the new T10-target cooling system are under way. The vacuum layout has been fully defined for the beam line and for the big vacuum tank (500 m^3). A solution with industrial cryo-pumps is now the baseline; to reinforce the expertise in this particular field collaboration with the CERN vacuum group TE-VSC has been agreed. The complex vacuum layout and integration downstream of the LKr calorimeter is in an advanced state of design. The beam dump design has been completed and the formalities for the call for tender are being launched. A geotechnical survey of the land downstream of ECN3 has been made and ground samples up to 30 m depth have been taken. Unfortunately, the quality of the ground at depths below -20 m is such that more complicated techniques than foreseen will have to be used. Nevertheless, it is still expected that the work can be finished early September.

3.2 Work in the Experimental Area

The MNP33 magnet is ready in its new position, the cooling system has been connected and power cables are in the process of being connected. First power tests are foreseen very soon. The cleaning of the vacuum tank modules (Blue Tubes) with dry CO_2 ice has been completed and the installation of these modules at their final positions has started. In parallel the definition of the infrastructure is progressing. The construction of ventilation doors with local overpressure zones at the access points from the control rooms to the ECN3 cavern will start soon. The modifications to the ventilation system in the ECN3+TCC8 cavern are still under discussion to find the most cost effective solution.

3.3 Detector Integration and Survey

Integration studies of the beam elements and the detectors are well advanced and the models are being used for installation and interface studies, for example in the Muon and Straw sectors. The beam line axis has been fixed and traced on the floor in TCC8 and ECN3 up to the MNP33 spectrometer magnet.

4 NA62 Schedule

Following the revised LHC planning (long shut-down in 2013), we have re-optimized our detector schedule focusing on an extended Technical Run in autumn 2012 (from Sept. to Nov.) using the new kaon beam with a reasonably complete detector. In this new

System	2011												2012											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Beam					███	███	███	███	███	███	███													
CEDAR													███	███										
GTK																				Proto				
Vacuum Sys.						Proto.Test										███	███	███	███					
LAV				3,4+5			1,2						6,7+8							11, 9+10				
STRAW																				1,3,5 + 7				
RICH														Vessel										
LKR																	Proto.							
SAV													███	███	███	███								
MUV																	3, 2 + 1							
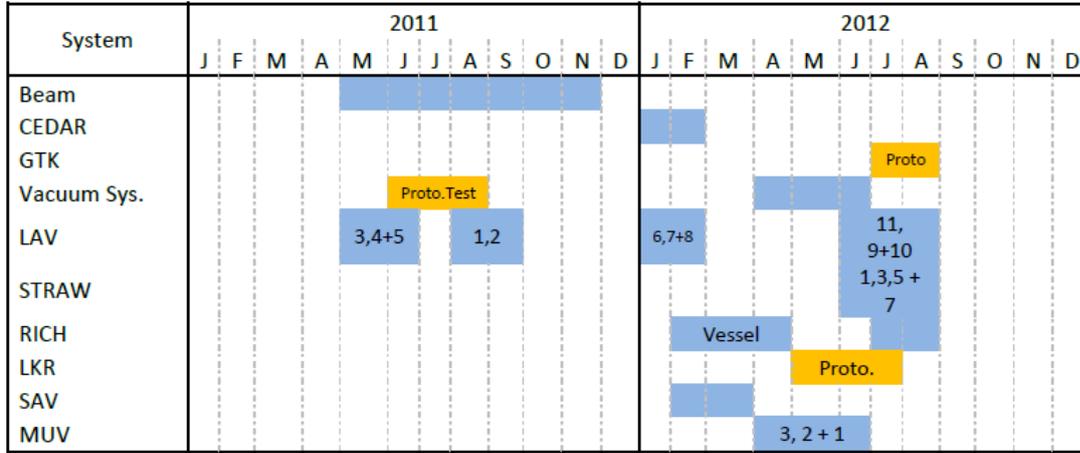
Figure 2: Installation schedule for a Technical Run starting in September 2012. Installation periods are indicated in blue, the numbers designate the module of the sub-detectors, prototype installations in yellow.

context a Synchronization Run in November 2011 no longer appears essential, and we will decide whether to abandon it or not during the next NA62 Plenary Session (to be held on April 7). Our main priority concentrates on the Technical Run in autumn 2012, for which we plan to install the following systems (see Figure 2):

- Beam line: full system will be installed in 2011.

- Beam Dump: completion expected in 2011.

- Vacuum tank and vacuum system: full system should be available; some pumping units could be staged (depending on number of installed Straw modules).

- CEDAR: full system should be available.

- GTK: the final pixel detectors will not yet be available; possibility to use prototype sensors in the Technical Run.

- LAV: plan to install 10 (or 9) LAV modules. LAV12 will not be ready. If LAV10 is not ready we would install the empty vessel to complete the vacuum tank.

- STRAW: possibility to complete 3 or 4 (out of 8) chamber modules. Chambers 1, 2 and 4 could be equipped with one (instead of two) modules each. The missing modules will be replaced by empty module frames.

4

#	Sub-System	Milestone	Date	Result
1	STRAW	Freeze Chamber + Straw Design	01/09/2010	Successfully Completed
2	GTK	GTK Read-out Cip Choice	30/09/2010	Successfully Completed
3	LAV	LAV 1,2,3,4 + 5 Ready	16/02/2011	expect completion by 08/04/11
4	RICH	Design for Mirror Supports and Wall Completed	30/06/2011	
5	STRAW	Module 1 Ready	06/07/2011	
6	GTK	Freeze Sensor + Chip Design	30/09/2011	
7	LAV	LAV 6 -8 Ready	30/10/2011	
8	STRAW	Readout Design Completed+Tested	16/12/11	
9	TDAQ	TEL62 board ready for final production	31/01/12	
10	STRAW	Four Modules Ready	15/06/2012	
11	RICH	Vessel installation ready	30/04/2012	
12	Installation	Preliminary Vacuum Tube Closing	30/09/2012	
13	LAV	LAV 8,9,10 + 11 Ready	31/10/2012	
14	RICH	Mirror and PM Installation complete	02/12/2012	
15	ECN3	Final Vacuum Tube closing	15/03/2013	

Figure 3: Full list of NA62 milestones.

- RICH: plan to install the RICH vessel in Spring 2012, including the central beam pipe.

- LKR: the calorimeter will still be read out by the existing electronics (CPD/SLM) but prototypes of the final electronics (CREAM) will be tested.

- CHOD: use the existing NA48 CHOD with prototype read-out.

- MUV: full system.

Following the recommendations from the last SPSC meeting we have added a milestone for the TDAQ system, i.e.

- "TEL62 board ready for final production", date due 31/01/2012.

We are experiencing a two-months delay for the completion of Milestone #3 (see Table 1) "LAV modules 1,2,3,4 and 5 ready". Four modules were delivered to CERN, and the fifth one is still being assembled in Frascati; we expect the assembly to be completed beginning of April 2011.

5 CEDAR

Since November 2010, the CEDAR group has continued to progress in the test and design of several aspects of the layout. Following the general mechanical design presented in

November last year, progress has been made in the specifications of the various components. In particular, a design of the light-guides has been developed, based on that done for the NA62 RICH detector. Further, to ensure maximum light collection on the PMTs, it has been decided that the rigid, light-weight structure hosting the PMTs will be curved, rather than flat, to allow for a projective geometry (see figure). As a consequence, the signal will be extracted from PMTs via flexible PCBs, while the high voltage will be distributed via cables and pin connectors (see figure). Progress has also been made on the electronics, where a custom designed pre-amplifier has been tested, built with components more radiation-hard than the ones adopted by the RICH group, and it has been found to perform similarly. The full readout chain has then been built in the laboratory using a blue LED as a light source, and its performance tests in terms of time resolution and rate capability are in progress. Finally, a full simulation of an ellipsoidal mirror (with 3 unequal axes), and of the light guides has been implemented, and a systematic study is in progress in order to identify the best parameters to give a uniform light distribution on the PMTs and a sustainable rate. Preliminary results show that a uniform light spot can be achieved. Plans for the remainder of 2011 include:

- Necessity to identify the CEDAR detector to be used for NA62. We remind that the NA62 CEDAR has to be of the "West" type to have the required performances with Hydrogen gas.

- Test beam in October 2011 of the chosen CEDAR before modification, to verify performances and gain practice with the device and its alignment.

- Build a prototype of the mechanics, covering one optical port which will be fully equipped with photo-detectors and a prototype of the readout chain. This test will allow us to verify the procedure for assembly of the mechanical structure and its compatibility with the photo-detectors and readout chain.

- Expose the electronics to a radiation environment similar to the one foreseen for our beam line. Test the single-event-upset for TEL62 in a muon beam. Test radiation hardness of pre-amplifiers (and possibly NINOs) with a neutron beam in the UK.

6 Gigatracker (GTK)

We present a brief status report on the following items: 1) Sensor production and bump-bonding, 2) ASIC development, 3) Front-end cooling; 4) Mechanical integration, 5) Off-detector read-out electronics, 6)Test -beam data analysis. We focus mainly on the progress made during the last six months and on the expected developments in 2011.

6.1 Sensor production and bump-bonding

- The production of p-in-n sensor wafers has been completed in summer 2010 at FBK (Trento, Italy). The bump-bonded prototype assemblies were successfully tested in the lab and in a dedicated test-beam during summer-autumn 2010.

- In November 2010 FBK started the design of n-in-p wafers based on the existing layout: the production will start in the coming weeks and is expected to be completed before July 2011. Bump-bonding to prototype read-out chips and testing for a complete assembly validation (including irradiation) will follow.

- The existing p-in-n bump-bonded assemblies have been tested up to 400-500 V bias voltage in the laboratory test setup: further increase of voltage on individual assemblies in the test-beam lead to a non-functioning of the chip. Visual inspections indicate that the most likely cause is a discharge that occurred between the sensor and the chip due to the high electric field. A work plan is being discussed with IZM for the deposition of an insulating layer in the sensor corner regions to increase the stability at higher bias voltage (up to 700 V).

- Bump-bonding of 100 μm thin chips to full-size sensor has to be demonstrated. Since the final GTK read-out chip (0.13 μm CMOS IBM processing) will not be available before the end of 2011, feasibility studies will be carried out using dummy wafers. Processing of 10 dummy sensor wafers (200 μm thick) has been completed in February 2011 at FBK. A basic layout of the final read-out chip is now available in a gds file (approximate overall dimensions, top metal and passivation of pixels and bonding pads) and will be used to produce dummy read-out chip wafers.

- Irradiation of p-in-n bump-bonded assemblies will be performed this year. The modification of the read-out PCB to insert a removable daughter card housing the assembly is almost complete. This characterization will be crucial to study sensor and chip behavior at different exposures.

- A Call for Tender for the final assembly production (i.e. large sensor bump-bonded to 10 thinned read-out chips) will be launched this year, after the definition of a detailed process description and process development steps.

6.2   Full size ASIC development

- The ASIC general system architecture has been defined.

- Threshold DACs have been designed and integrated in the modified discriminator in the pixel cell. The full pixel matrix was built up. The global biasing structure using DACs and the distribution network have been designed.

- The TDC-DLL has been modified to reduce power consumption and re-qualified via simulation. The TDC structure (DLL; fine registers; hitArbiters) have been placed and routed in the 300 μm column. Post layout verification is underway to validate that block.

- The next steps before submission are the design of the end-of-column standard cell logic, the design of the read-out logic and the integration of these building blocks with the pixel matrix.

- In parallel hit separation studies with the laser setup have been conducted to verify the behavior of the demonstrator ASIC with respect to particles arriving in the same pixel within short time periods (hit separation studies). The results confirm the correct behavior of the front-end electronics. Furthermore, laser pulses were used to understand the silicon signal development for charge releases on different positions within the pixel cell. For the demonstrator, a radiation campaign is planned to verify the total dose effects on the assembly.

- In parallel, the test infrastructure for the ASIC will be built up. As soon as the ASIC pin assignment is frozen, test cards for the single ASIC will be designed and produced.

6.3   Cooling

The Working Group is investigating two techniques for the cooling of the front-end electronics: a) gas cooling, where low temperature nitrogen gas is flushed through the detector; b) micro-channel cooling based on a thin silicon micro-channel cooling plate circulating liquid C_6F_{14}. We present here a brief summary of the status.

- a) Gas cooling

  Following the results coming from the tests, the effort has focused on the reduction of the temperature gradient; the injection of the nitrogen has been split by wings distributing the flow more uniformly on the detector. The test results (12/2010) give a reduction of the temperature gradient of 50% (from 18 C to 9 C). Simulations optimizing the channels are ongoing and the first results have been achieved. After the simulation results, a test aiming to verify the effective temperature distribution is planned (04-05/2011). The temperature on the detector can be set from +5 C to -30 C depending on the nitrogen flow rate. A vibration test investigating resonances coming from the flow has been done: the results show that the detector is stable and no vibrations occur. A test checking the stability of the wire bonds under the nitrogen flow is planned (04/2011). The design of the nitrogen supply system is under way.

- b) Micro-channel cooling

  Since November 2010:

  The test stand has been improved. New temperature sensors have been installed in the fluid line. The heater power is now monitored in the DAQ. The first Si-Si bonded wafers were tested. Conclusions from this test were a revision of the channel design and the production process. Wafers with the new design are currently under production at EPFL. Further tests on the stability of the Si-Pyrex bonding have been performed. The Pyrex cover was thinned to 200 μm. The results exceed the predictions from numeric simulations and are promising for even thinner Pyrex covers.

  In 2011:

  The programme to test the Si-Pyrex structural resistance is going on. Pyrex with thicknesses down to 50 μm will be tested. Si-Si bonded wafers with the improved manifold and corresponding design will be ready for thermo-hydraulic tests by the end of March 2011. The tests on Si-Si bonding will continue together with CSEM (Neuchatel). Once the production process has been validated the full production cycle will be outsourced to CSEM. A test programme of the integration between cooling plate, sensor and readout chips has been started and will cover the following issues: choice of the bonding material, the handling of objects and the design of the mechanical supports.

6.4   Mechanical Integration

The electro-mechanical integration has been optimized for ease of production, also allowing better access to the module once installed. The drawings of the GTK vessel have been ported to the CAD tool, Catia. The plan for the next months is to simulate the signal integrity of critical lines of up to 3.2Gb/s on the GTK carrier board. The next step will be to realize a PCB holding the final GTK assembly, taking into account the simulation results and allowing integration studies with dummy structures and prototypes.

6.5   Off-detector Read out Electronics

The off-detector electronics must receive the data pushed by the on-detector GTK ASICs, save it on temporary buffers for the L0 trigger latency time, select the GTK data matching the L0 trigger request and send packets of events to the sub-detector PCs; the diagram recalls the architecture of an off-detector card, which can be dubbed GTK-RO card for short.

   The baseline design foresees that one GTK-RO will be linked to one GTK ASIC and will be built as a modular unit. It is not yet decided whether this unit will be laid out as a stand-alone 6U VME card or as a daughter card of a larger board conforming to the ATCA standard.

   The development is proceeding as follows:

1. Testing the critical parts of the FPGA design on a development kit (DE4) from Terasic. The kit is based on an FPGA of the same Stratix IV GX type as the GTK-RO card (which will mount, for budget reasons, a smaller size device with respect to that featured by the DE4 evaluation board). The FPGA interfaces tested so far are:

   - the input transceiver: a small 4 channel transceiver block has been instantiated in the FPGA and electrically tested at 3.2 Gbps through a loopback daughter card installed on one of the HSMC connectors of the Terasic DE4 evaluation board.

   - the DDR2 memory: a single instance of DDR2 SDRAM interface has been tested with one of the 2 200 pin SODIMM modules (64 bit) featured by DE4 evaluation board. The instantiation of a second interface and the testing of both are being currently carried out, with the objective of estimating resources required in total and seeing that they can be provided by the target FPGA.

   - the Ethernet ports: four instances of Ethernet links implementing a custom protocol have been implemented on a second DE4 evaluation board and are being used to test the data rate which can be sustained by the GTK-RO when its outputs are connected (through a switch) to a host PC equipped with 2 10GbE network cards. The purpose of this exercise is to determine the resources required in a Stratix IV GX FPGA and thus allow the proper target FPGA for the GTK-RO cards to be chosen.

2. Drawing the schematic diagram of the GTK-RO card, with the FPGA and its ancillary devices, the power regulators and the I/O ports.

3. Choosing the key components, besides the FPGA, for the different blocks of the GTK-RO using specific evaluation boards, when needed, to explore implementation details and measure performances.

4. The schematic layout should be ready at the end of March and by then the dimensions of the boards and its conforming standard should be decided.

5. The goal is to have a working small-scale system by the end of 2011, in order to launch the production in early 2012.

6.6 Test-beam Data Analysis

The demonstrator bump-bonded assemblies were characterized in a dedicated test-beam in September 2010. During the test beam in T9 (PS East Hall) a low rate 10 GeV/c hadron beam (mainly π^+ and p) traversed consecutive GTK assemblies installed on precisely aligned mechanical supports and scintillators with very good timing resolution (45 ps for the coincidence of the fast detectors, 195 ps for the coincidence of S1 and S2). The assemblies were continuously operated at 300 V bias voltage for three weeks and both the assemblies and the DAQ showed very stable performance.

Since November 2010 the analysis code has been completely re-written in order to be incorporated in the existing NA62 Software Framework. A track event has been defined by a software trigger (coincidence of S1 and S2) and all the raw hits recorded in a 100 ns time window around the trigger are passed to the reconstruction. The time-walk correction is calibrated using the fast scintillators data, which provide the reference time with the smallest uncertainty. At present the tails of the Time over Threshold (ToT) distribution for GTK hits are cut, reducing the useful statistics by 5-10%. In addition, consecutive hits from pixels in a given 5-pixel group are rejected, as the absolute delay of these hits is different. Due to this cut more than 20% of the data was rejected. The final analysis will take into account all the events in the ToT tails and will try to apply corrections for the different delays inside the 5-pixel groups.

The time resolution of all the GTK pixels has been measured using the fast and slow (S1 and S2) scintillators as references, and the result can be seen in Figure 4. On the same plot is also shown the time resolution extracted using GTK information only, by taking the time difference between corresponding pixels in GTK1 and GTK2. From this plot it is clear that the three methods give consistent results within 10-20 ps (the far away points are due to pixel threshold spread, an effect that is shown averaged by the green triangles). The dependence of the GTK time resolution on the bias voltage has been investigated as well, by modifying the bias applied to the sensor. A clear trend is visible in Figure 5, indicating that an over-bias of at least 300 V is mandatory to achieve the target time resolution. The test-beam analysis is being documented and soon a paper will be submitted to peer-review journals.

7 Straw Tracker

The Straw Tracker is intended to measure the momentum and the direction of charged tracks originating from kaon decays. Recent progress involves:

- Final straw material validation including metallization (Hostaphan RNK2600).
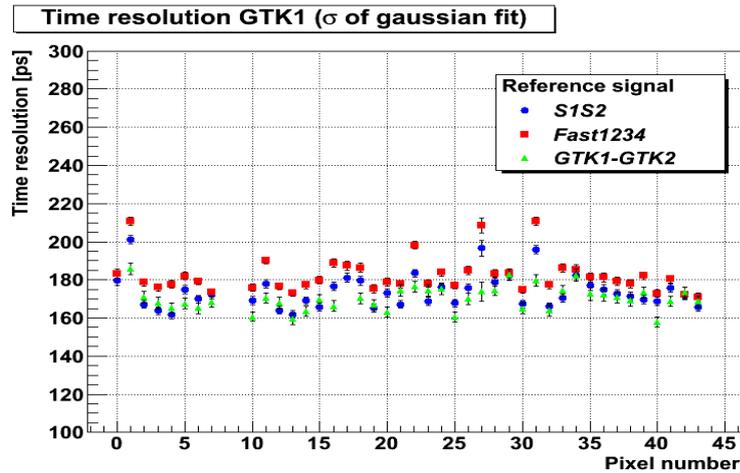
Figure 4: Time resolution for all the 45 pixels of GTK1

- The manufacturing of straws in large quantities.

- Validation of the straw manufacturing process and the quality control procedure (see Figure 6).

- Design and procurement of the module 0 frame (1/8 of the detector i.e. 896 straws) shown in Figure 7.

The plans for the remainder of 2011 include:

- From the experience gained with the 64-straw prototype, assemble and test the "module 0", which should fulfil the requirements to be used in the NA62 experiment. This is also a final check of the design and the various components before launching the procurement of the components for the remaining seven modules.

- Continue cosmic-rays tests of the 64-straw prototype using an independent tracker based on 4 Micromegas modules [1]. The aim is to verify the final resolution numbers and to test the FPGA-based TDC read-out (until now we have used the TELL1 board). Detector operation will also be tuned.

- Final beam test with 64-straw prototype and final front-end (with FPGA as TDC on the cover). The previous solution with the TEL62 board is kept as back-up until the new solution is validated.

- Prepare and start the production of the remaining modules.

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[1]Each module gives one coordinate.
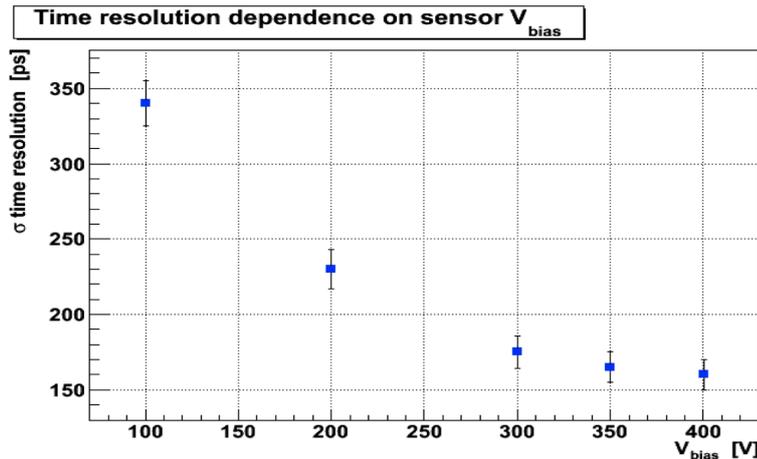
Figure 5: GTK prototype time resolution dependence on the sensor bias voltage.

8 RICH

The RICH detector is needed to suppress the μ^+ contamination in the π^+ sample by a factor of at least 100 between 15 and 35 GeV/c momentum, to measure the pion crossing time with a resolution of about 100 ps and to produce the L0 trigger for a charged track. The detector will consist of a 17 m long tank, filled with neon gas at atmospheric pressure, with a mosaic of 20 spherical mirror with 17 m focal length, placed at the downstream end, and 2000 photomultipliers placed at the upstream end. The RICH vessel construction drawings are in progress. The RICH will consist of a vacuum proof vessel, made of construction steel, subdivided into 4 sections of decreasing diameter between 3.9 m (upstream end) and 3.2 m (downstream). The vessel is expected to be installed in Spring, 2012. An aluminum beam pipe will span the length of the RICH to keep undecayed beam particles in vacuum in order to avoid interactions. The dimension of the beam pipe is under careful study to satisfy requirements of stiffness and transparency to gamma. An aluminum honeycomb wall will be placed in front of the downstream end-cap of the vessel to support the mirror mosaic; this wall, 50 mm thick and divided into two halves, was carefully studied to be stiff enough for the 400 kg load of the mirror mosaic but at the same time as transparent as possible to gammas to be seen from the downstream LKr calorimeter. The mirror mosaic will be made with 18 spherical mirrors of hexagonal shape (350 mm side) and 2 of semi-hexagonal shape to be put close to the beam pipe; all the mirrors have already been manufactured and will be aluminized at CERN in the coming months. The mirror system installation is foreseen for summer 2012. A mirror alignment system, based on piezo-motor actuators is under development. Pure neon gas will be injected into the vessel after vacuum has been established inside; a system of gas purification and recirculation is also considered as a backup solution. The photomultipliers will be placed onto two disks 780 mm in diameter each, closing off two cylinders protruding from a trumpet shaped flange connecting the largest section of the vessel with the upstream vacuum tank. Each disk will be made in two parts, both
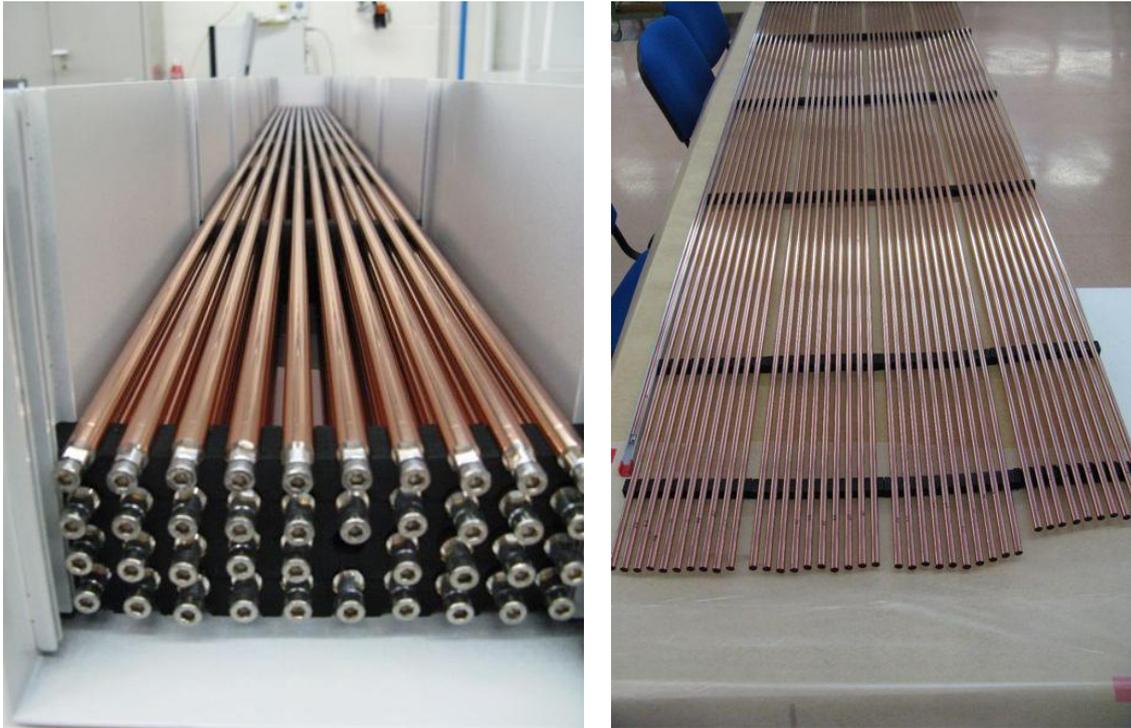
Figure 6: Straws under pressure (left) and a batch of straws waiting to be equipped with temporary end pieces and pressurized.

in aluminum: the inner part, 23 mm thick, separates neon from air by means of 12.7 mm wide, 1 mm thick quartz windows and collects the incoming light with a Winston cone; the outer part holds the photomultipliers. Executive drawings of all these disks are under preparation; these disks will be machined in the mechanical workshop of the University of Firenze during 2011 and later shipped to CERN for the glueing of the quartz windows and Mylar foils used to increase the reflectivity of each Winston cone. About 2000 Hamamatsu R7400-U03 photomultipliers have been bought and delivered and are now under test; HV dividers will be ordered from Hamamatsu in the coming weeks to be available by Spring, 2012; all the required HV power supplies have been already purchased and are available. The photomultiplier readout electronics will be custom made: an executive design is under development and production will be completed by mid 2012; the readout electronics, based on the NINO ASIC, has been extensively checked in two test beam runs with a RICH prototype and a new version is needed only to provide the proper channel multiplicity required by the NA62 DAQ system. We remind the reader that a full-length RICH prototype was built to demonstrate the feasibility of the RICH project and was tested in 2007 with 96 PMTs and in 2009 with 414 PMTs: the results of the 2007 and 2009 prototypes test beams have been published in [13] and [14] respectively.

Figure 7: The Straw module 0 frame in the transport trolley.

9 Photon Vetoes

The Large Angle Veto (LAV) is to be composed of 12 stations situated between 120 and 240 m from the target along the beam axis. The first eleven stations are part of the vacuum decay tube, while the last one is located outside the vacuum tank. The LAV stations have a diameter going from 2 to 3 m. The basic building blocks of these detectors are lead glass crystals with attached photomultipliers (PMT) from the former OPAL electromagnetic calorimeter. Four blocks (lead glass crystals + PMT's) are mounted on a common support structure forming an azimuthal segment. Inside the vacuum tube the azimuthal segments are assembled forming a complete ring of lead glass blocks. Each LAV stations is made up of 4 or 5 rings, which are staggered in azimuth to provide complete hermeticity of at least three blocks in the longitudinal direction.

9.1 Recent Achievements

During the past few months work has continued on the four LAV stations with the smaller diameter A2-A5. A1 was already assembled in 2009. Currently, the A2 and A3 stations have already been assembled and A2 has been tested in the T9 beam at CERN last summer. The test has been performed using the final layout and the final front-end electronics prototype. The front end electronics is based on the Time over Threshold (ToT) and will allow us to have a time resolution of about 1 ns and an energy resolution of the order of 10%. In addition to the results already presented in the previous status
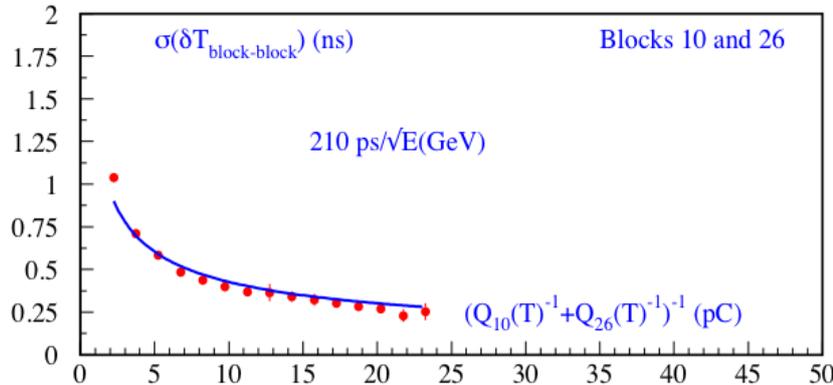
Figure 8: LAV time resolution from the difference of the two most upstream blocks of A2 after slewing correction.

report, we emphasize here the time resolution achieved as reported in Figure 8.

Concerning the intermediate diameter stations (A6-A8), the construction has started and the A6 vessel is expected to be delivered to LNF by the end of May 2011.

The production of the front-end electronics has started. Work on the simulation and the reconstruction software has steadily continued.

Besides the steady progress on the module assembly, we have experienced some problems on Modules A2 and A3 where some crystals have been damaged (fissures) after exposure to too important temperature gradients. The temperature sensitivity is caused by strain forces between the crystal and the steel flange, which are glued together. This problem was already observed in OPAL and is intrinsically related to the assembly. In order to avoid risks in the future, we will store all LAV modules after delivery to CERN in the underground area, which has good temperature stability. We have also added permanent temperature monitoring on all modules.

9.2 Plans for the remainder of 2011

Modules A4 and A5 will be delivered to CERN shortly. The replacement of the broken crystals in A2 and A3 isforeseen during the forthcoming months: for A3 the repair will be done at CERN, while A2 will be shipped back to Frascati with the returning transport of the next delivery to CERN. Later during 2011, we plan to construct and test 3 intermediate diameter vessel A6-A8 and one of the largest diameter, A11. These will be shipped to CERN and installed on the NA62 line. By the time end of the year, seven vessels will be installed.

In parallel half of the front-end electronics will be produced, tested and installed. The mechanics an the tools relating to A9, A10 and A12 will be finalized and the tendering

procedure will be started. We will also progress on the frontend and readout part, starting to test the complete chain, final crates final frontend board and final TEL62 to be ready before the end of the year.

10 SAC and IRC

The SAC and the IRC, the forward veto detectors, are planned to be "Shashlyk" type electromagnetic calorimeters. The main efforts were concentrated to construct the IRC (Inner Ring Calorimeter). The producer of the mechanics and the lead plates was chosen and was asked to provide feedback on the preliminary engineering design. Since the lead plates have approximately 30 cm diameter it was decided to produce them from a 97% lead 3% antimony alloy. A producer for the Pb-alloy sheets was found and they are expected to be ready by mid-April. Afterwards the manufacturing of the mechanics and holes drilling in the lead plates will take approximately two months. A detailed simulation of the geometry of the SAC and IRC was performed taking lead and scintillator plates and the WLS fibres into account. This allowed the final geometry of the IRC to be fixed and to assure that there was no need to put the whole detector inside a vacuum tube. An eccentric cylinder design with the beam pipe passing through was adopted. The IRC will be split longitudinally into two parts with holes misaligned in order to assure the best photon detection efficiency. Due to the final dimensions of the IRC, the already built SAC prototype could perhaps be used as final detector. The necessary modifications are the change of the WLS fibres and the PMTs while the existing prototype fulfils the requirements for geometrical coverage. The design of the support structure for the SAC inside the vacuum tube has started. A table providing movement in all directions together with rotation about the vertical axis is foreseen. One of the key issues for the small angle vetoes is the high rate leading to a high probability of event overlap, which is caused mainly by muons from the decay of beam particles. They leave a small amount of energy but are localized in a few channels. This fact pushes the requirements for the timing properties of the electronics to the limits. A twelve bit GHz ADC-based solution could be envisaged but needs to be designed and tested.

11 Liquid Krypton Calorimeter (LKr)

11.1 Consolidation of the existing LKr readout

In the previous report, we described the work done to test the SLM (Smart Link Modules) system at full rate. For a run in 2012 and also for full commissioning by the end of 2011, we have written a first version of an automatic mechanism for running all the instances of the readout programme and we are starting the definition and implementation of a merger programme to put together all the fragments coming from the SLM PCs. This will run in the prototype NA62 Event builder farm and data will eventually go in the standard event building mechanism foreseen for 2012. On the hardware side, the design of the TALK (Trigger Adapter for Liquid Krypton) has been completed and the PCB production has been launched. It is expected to have the prototype board ready by early June. The main function of this board is to interface the new NA62 clock and trigger distribution system with the old mechanism in use by the LKr readout. Moreover, production of a set of refurbished power supplies has been assigned to the firm Wiener and it is expected

to have 10 of these available in late summer 2011. These power supplies will replace the old Fastbus ones, which were subject to frequent failures.

11.2   Tendering for the final NA62 LKr readout

A specification document, fully describing the characteristics and the operating modes of the CREAM (Calorimeter REAdout Module) has been prepared and will be sent to a number of preselected firms with good experience in the field of fast digitizers. It is expected to have the final financial approval by September 2011. The schedule then foresees to have 5 prototypes ready by June 2012 and to deliver the final units, after a thorough test of the prototype, starting in March 2013. The installation of the system will be completed during 2013.

11.3   Software

The code for a complete GEANT4 simulation of the calorimeter has been finished and is being used by several people. We have started the work on the reconstruction, to integrate the NA48 algorithm in the NA62 software framework and to improve its efficiency, for use of the LKr calorimeter as a veto. Porting of additional NA48 tools, like energy and time calibration and digital filter pulse reconstruction, will start soon.

11.4   Cryogenics and vacuum

The calorimeter beam pipe is equipped on its inlet and outlet with custom-made guillotine valves separating it from the rest of the beam pipe. It is important to note that the vacuum inside the calorimeter is not only the vacuum for the beam, but at the same time the insulation vacuum for the krypton, therefore it has to be maintained permanently. The material of the downstream guillotine valve is uncritical for the physics - because it sits in the shadow of the calorimeter- and we have therefore decided to replace the custom made valve by an industrial gate with better tightness.

   A detailed plan for this delicate replacement has been prepared and at the same time we foresee to remove same small remnants inside the tube, which are left inside from the 1999 DCH incident.

11.5   DCS

In collaboration with EN/ICE, we have started the migration of the calorimeter DCS to the NA62 PVSS-based control system. This activity is described in the DCS section of this report.

12   Muon Veto (MUV)

12.1   MUV1

For the MUV1 detector, the first scintillators with the final dimensions have been produced at IHEP, Protvino, and are currently being tested in Mainz. The first measurements indicate that they seem to fulfill the requirements needed for the MUV1 detector.

After some improvements of the production process, mainly for slight adjustments of the dimensions, the mass production of the MUV1 scintillators is now starting. The production facility at IHEP is able to produce 12–24 scintillators per day, the production of a total of about 1200 scintillators (including spares) is foreseen to be finished by early Summer, 2011.

After shipping to Mainz, the scintillators will be equipped with WLS fibers, tested, and assembled into the MUV1. Most of the facilities for this work have already been constructed. The assembly of the MUV1 is estimated to take about one year until Spring, 2012. Immediately afterwards, the MUV1 detector will be shipped to CERN and installed in NA62.

In parallel to the MUV1 construction, read-out and trigger electronics of all MUV detectors will be built. It is foreseen to use the already existing electronics from the LAV system, with minor modifications and adjustments for the muon veto system.

12.2 MUV2

The MUV2 detector is the existing front module of the NA48 hadron calorimeter. For use in NA62, only the existing PMTs have to be tested and to be selected. This will be done in 2011.

12.3 MUV3

For the MUV3 detector, the final design and dimensions were fixed at the end of 2010 (see Fig. 9). All drawings exist and the manufacturing of the mechanics is currently underway at IHEP. They are foreseen to be finished by summer 2011.

The 260 scintillating tiles will also be manufactured at IHEP, however, with a different method than the MUV1 scintillators: Instead of melting scintillating granulate in pre-assembled forms, the tiles of dimension $22 \times 22 \times 5$ cm^3 are cut from large blocks of scintillators. As the polishing procedure is relatively elaborate, the MUV3 tiles are expected to be finished about the end of 2011.

After production, the single pieces of the MUV3 will be shipped from Protvino to CERN, where the final assembly will take place.

13 Trigger and DAQ

With the completion of the **Technical Design** the overall architecture of the TDAQ system and part of the interface to the computing system were finalized.

Concerning common infrastructure, the construction of the required **clock and trigger distribution** modules was started in Birmingham and at CERN; prototypes have been built and tested, and the production of all the required modules is now ongoing. The Birmingham group coordinating this activity is now collecting the information from sub-detector groups concerning crate locations and clock distribution trees, in order to make a common order for fibres and splitters, so that the clock **network** can be installed later this year according to the technical installation plan.

Extensive discussions with sub-detector groups led to the identification of two slightly different versions of a **common crate**, both for readout boards and front-end electronics, suitable to most systems; the choice of manufacturer was made in accordance to CERN, and the required hardware was adopted as a standard CERN item; as a counterpart
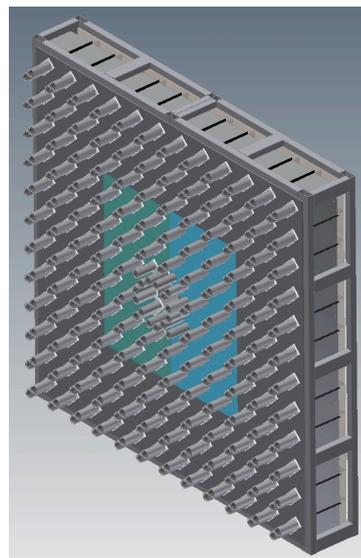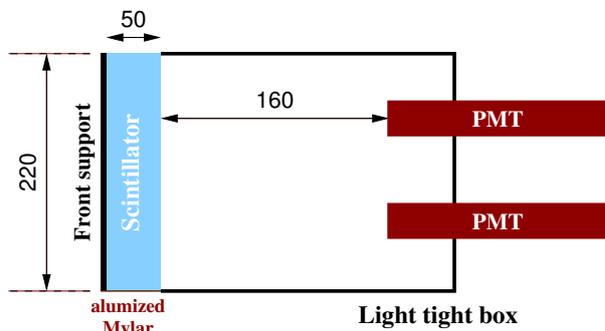
Figure 9: Design of the MUV3 detector. Left: Layout of a single module. Right: Full view of the MUV3.

of the more expensive common solution chosen, it is expected that significant software and maintenance support from CERN will be available. Crate prototypes were ordered and are expected to be tested in Spring, 2011 for validation with NA62 hardware (e.g. TEL62).

The **common TDC-based TDAQ system** will be used by several sub-detectors and involves two main components: TDC daughter cards (TDCB) and TEL62 mother boards, both developed in Pisa. This system will be used at least for the CEDAR, CHANTI, RICH, CHOD, LAV, MUV systems, with the TEL62 mother board being also used for the LKr L0 trigger, Straws and IRC/SAC readout and LKr readout central trigger interface.

Concerning the **TDC board**, a PCB layout mistake resulted in the need for an unforeseen new iteration, with no functional difference with respect to the available prototypes. No significant problems were identified so far on the card. After a long and troublesome history, the final (commercial) solution for signal cables has been identified, and prototypes are now available. Prototypes of the final TDC cards are in production and should be available in Spring, 2011: they will be extensively tested for performance, and distributed to the sub-detector groups for validation with their own sub-detector hardware; it is expected that TDCB tests will be performed at least in Pisa, CERN, Perugia and Birmingham. A long-running test system is being developed in Pisa. About 15 TDC boards will be produced in 2011, for which components are already available.

The **TEL62 board** is a major upgrade of the LHCb TELL1 board. The design was made in Pisa, discussed within the collaboration and described in an internal note (NA62-10-06). The board shares some components with the original TELL1, but uses much more powerful and modern devices, resulting in more than 4 times the computational power and more than 20 times the buffer memory than the original, plus several other improvements in terms of connectivity. The PCB layout was done at CERN (by the team which did it for the TELL1), and prototypes are now in production, expected for end of March 2011. After extensive testing, up to 10 boards will be built in 2011, for which components are already available, and distributed to sub-detector groups. Besides

prototype debugging, the main issue here will be the manpower for the **development of the final firmware:** while the Pisa group is expected to play a leading role, significant involvement from all sub-detector groups using the board will be mandatory in order to be able to keep the schedule; some staging is foreseen, with basic functionality being developed first and additions (such as inter-board communication for trigger primitive generation in detectors with more than 512 channels) being postponed. All of the **critical components** were bought for the total needs of NA62 excluding the Straws system, for which a decision on the final DAQ system is not yet available.

Some TELL1 boards are available to start building up the expertise on the system in sub-detector groups, while waiting for the TEL62 (identical for what concerns external connectivity and slow control). One concern is the behaviour of the (non rad-hard) electronics in the (not extreme) **radiation** environment of NA62, mostly for the CEDAR; radiation estimates are available, and the Birmingham group will make functional tests with existing hardware in a comparable radiation environment this year.

Another system using extensively TEL62 boards is the new **LKr L0 trigger system** developed in Roma Tor Vergata: three new daughter cards are required for this, for inter-board communication and optical data collection; two of them have been built and are being tested, the last one will be ready later this year. Extensive link tests and small-scale integration is going to be performed at the beginning of 2012. Waiting for the LKr readout system to be available for sending data, a mock-up test environment will have to be set up in the coming months. Simulation work is furthermore needed to better assess the capabilities of the algorithm to be implemented in FPGAs.

The design of the **central L0 trigger processor** (L0TP) has always been the least advanced project, but some progress was made since the last quarter of 2010, also thanks to the involvement of new collaborators from Ferrara, with expertise in real-time systems. Tests on hardware/software systems were made in order to test the simplest PC-based solution for this single device. The performance tests performed so far were positive, and so far no show-stoppers were found for this approach. Much more work is required to implement a demonstrator system with the required functionality in terms of processing and time synchronization. A PC-based L0TP would need a network interface board, for which commercial solutions will be evaluated in the coming months, and a TTC custom hardware synchronization board, to be designed and built, on which some group in the collaboration expressed interest. Discussions on how to implement a reduced-functionality L0TP for an early technical run was started, and at least two solutions were proposed which would not need additional hardware development, but some significant firmware effort.

Discussions on the **online system** (e.g. run control and interface with the computing system) were started, and resulted in a specification document (NA62-11-2), whose purpose is also to facilitate the possible involvement of support groups from CERN. Existing software tools used in LHC experiments were identified as suitable to NA62 needs, and real implementation work should start in the coming months. The development of common high-performance network data-handling front-end software was started in Pisa, which could be used by all systems. We do not discuss here the sub-detector specific front-end systems, which differ also for detectors using the common TDC-based TDAQ system, except to recall that significant progress was made for the LAV system, which is now quite well defined as the RICH, and waiting for the final engineering.

We now mention specific sub-detectors with different DAQ systems. The **Giga-tracker** custom system is steadily progressing towards a demonstrator DAQ system fully

in line with the specifications. The **Straw** system is pursuing the design of a proposed cheaper custom TDC-based DAQ, still keeping the common TDC-based system as a fallback solution (final decision between the two is expected in January 2012). The situation is not yet completely clear for **small-angle vetoes** (SAC/IRC) system, which assumed a FADC readout based on custom 1GHz FADC TEL62 daughter-cards, but is now also considering the common TDC-based readout. The specification document for the new **LKr readout system** (CREAM) was written at CERN and discussed within the collaboration; the project is now almost ready for the tender, which will include design and production. First prototypes are expected in about one year from now. A multi-purpose TEL62 daughter card has been designed which would allow interfacing the existing readout system to the new trigger infrastructure, before the new system is available; this is currently being manufactured and could be part of an early L0TP replacement.

During the past months significant progress was made in the design of the **fast muon veto plane** (MUV3), which is essential for the L0 trigger; the detector is now designed, and the details of its implementation and TDAQ interface need to be smoothed out.

A campaign of **simulations** for the trigger was restarted, now using the full NA62 GEANT4-based Monte Carlo program, in which features for easing a fast trigger simulation are being added. The results for L0 rates do confirm earlier estimates based on toy MC, and are being refined by implementing more realistic computations and cuts. Some activity on **higher level triggers** was started with a dedicated meeting in which sub-detector groups presented ideas for online processing. Significant work is needed here to time prototype algorithms and estimate the computing power required in the online farm.

A R&D program is going on at Pisa and CERN for replacing part of the L0 trigger primitive generation system with an innovative **GPU-based processing system**, with great advantages in terms of flexibility and scalability. Extensive results on online algorithms for RICH ring-finding were found to be encouraging in this respect; more work is required to assess the total latency involved with the network transmission and data handling in the host PC.

Finally, an **early dry run** focusing on testing the overall infrastructure and connectivity between the prototypes of different systems was discussed within the collaboration. Some basic TDAQ tests do not require beam and might be scheduled early next year, well in advance of any test run with beam particles. Only a few detectors need to be involved for this purpose, and since positive triggering in any early run cannot rely on the RICH, the use of the existing NA48 charged hodoscope was considered. The hardware can be made functional again, but the detector as it is cannot provide precise timing at the L0 trigger level unless light-propagation and slewing corrections are performed online. One realistic possibility for this requires boosting the R&D work on GPUs to implement a small scale real-life system which might work at the reduced L0 trigger rate foreseen for an early run. For the ultimate NA62 high rate environment, a new suitable charged hodoscope will most likely be needed: it would also simplify the L0 trigger, because a simple RICH-based L0 trigger requires the implementation of inter-board communication from the beginning.

14   Detector Control System

The main activities of the DCS group were concentrated on further collection of User Requirements, hardware choice and procurement, and development of prototypes and small control systems. In December 2010 the group held a first extended meeting with participation of representatives from the sub-detectors. During the meeting the requirements of sub-detectors were presented and discussed. The meeting also established a framework for DCS activities, including a model of collaboration, sharing of contributions and available resources. It was decided to hold such meetings regularly. The CAN bus together with the Ethernet will be the main control bus of the experiment. It will be used for control of ISEG power supplies, WIENER crates and low voltage power supplies, and the ELMB's. The CAN bus cable structure was elaborated by the group and adopted by the collaboration Technical Coordination team. A few detector teams (LAV, CEDAR and MUV) are considering the ISEG power supply as a candidate for the base unit of their high voltage systems. The group made a detailed assessment of this purchase, including consideration of long term hardware and software support. A framework of the procurement and support was established with PH/ESE and EN/ICE sections. Significant efforts were made in the design of Final State Machine model of the future system. The development is nearly completed and will be presented at the next extended DCS meeting. Important progress has been achieved in rejuvenating the control system of power supplies for the LKr electromagnetic calorimeter. For the low voltage system it was decided to use the ELMB integrated into a custom board. This solution allows to reuse of existing cables and patch panels. A preliminary schematic layout of the board was worked out. Now the board is under development and production in the TE/MPE group. The digital IO signals will be treated by Siemens PLC. The PLC, IO cards and auxiliary equipment have been procured. Corresponding software is close to finalization. The existing control of the high voltage system is based on custom-made electronics, running on a VME processor programme. A prototype application has been worked out and tested, allowing the existing hardware to be reused, but applying modern DIM technology. Development of the PVSS component, including the main functionalities of the future system, is well advanced and will be finished soon. Responding to the request of the Large Angle Veto team, the group developed a new control system for storagr of the LAV modules. The system monitors the temperature of the area and LAV modules, stores this information in the ORACLE data base and sends an alert SMS in case of abnormal temperatures. The group plans to deploy control solutions in the experiment progressively. As the first stage, the LKr power supply vertical slice application will be implemented and tested soon (end of Spring - beginning of Summer, 2011). The second important milestone will be to be able to test all functionalities for a few sub-detectors together.

15   New Simulation and Reconstruction Software

We have developed a software infrastructure, for simulation and reconstruction/analysis, taking into account the somewhat special needs and limitations given by the nature of the experiment. We are currently finalizing the implementation of the geometry of the sub-detectors according to the up to date knowledge of the future hardware: it is a GEANT4 based application, modularized in slices of the beamline, exploiting the longitudinal development of the layout to avoid technical complications and subdivide the work among

many groups (corresponding to the hardware developers) in a simple way. The output of the simulation has been conceived to be independent from any time dependent feature, to avoid the time consuming regeneration of MC samples; once the geometry and physics list will be finalized, this approach should allow to save CPU time. For what concerns the reconstruction, if follows the same logic of subdivision as the simulation, and it is fully based on ROOT, as it is the storage on disk of MC samples. Actually the reconstruction is contained in a more complex package, which provides also intermediate steps of elaboration; since it is important to have both simulated and actual data passing through the same algorithms, it was necessary to divide the processing in steps that might be the same for data and MC from a level equivalent to raw data decoding on. To fulfil this requirement, which is related to the independence of the MC samples from time varying conditions, it has been decided to have a digitization step, taking MC output and emulating the readout electronics, which produces the same output as the raw data decoding, which just puts binary data from readout in a more friendly format. At this level all miscalibrations and noises are added to the simulated hits, which become in principle equivalent to true data, even though there is link to the original simulated information. Given the ratio between the branching fraction of the aimed signal and it's backgrounds, simulating them is not straightforward, because, besides the CPU time needed to have such amount of MC events, the result would rely too much on the quality of the simulation in reproducing tails; for this reason in all the studies that have been done a factorization approach has been used. This leads to the need to be able to perform event overlay both for MC and data; currently this feature is being implemented for MC samples, but with a scheme which should work in the future also for data. For simulated events, the overlay is performed just before the digitization step, merging hit collections from several MC samples with the appropriate timing. There is also a trigger simulation step, still under development, which intervenes between the digitization and the reconstruction, which exploits and emulates the choice of having the trigger of the experiment completely based on digital information. The reconstruction algorithms have not been completed yet, as the digitization ones; nevertheless, the modularity of the architecture allows to use the same software both for simulating and analysing test beam data, providing a good tool for understanding the detectors and improving the software itself on the base of true data.

15.1 Activities for the Next 12 Months

In the next 12 months we would like to finalize the simulation, digitization and reconstruction according to the best understanding that we will have (a few more test beam periods are foreseen). The whole system will need an interface to a conditions database, which will be based on the LCG tool CORAL, for which we will profit from the experience of the currently running experiments to avoid the known issues related to databases in general, and in particular to their off-site availability. Some analysis will be done on MC data samples, to be ready to simulate the conditions of the currently expected run in 2012 and compare with the data that will be collected, for tuning both the simulation and the reconstruction.

16 Publications

Since the last NA62(NA48) SPSC review in November 2010, the collaboration has contributed to the scientific production with the following publications:

- NA62 Collaboration

    1. Test of Lepton Flavour Universality in $K^+ \to l^+\nu$ Decays accepted by Phys. Lett. B, on line March,2011 as doi:10.1016/j.physletb.2011.02.064

- NA48/2 Collaboration

    1. New measurement of the $K^\pm \to \pi^\pm\mu^+\mu^-$ decay Phys. Lett. B 697 (2011)107, on line February 2011

    2. Precise tests of low energy QCD from Ke4 decay properties Eur. Phys. J. C 70 (2010)635, on line November 2010

- NA48/1 Collaboration

    1. Precision measurement of the ratio $\mathrm{BR}(K_S \to \pi^+\pi^-e^+e^-)/\mathrm{BR}(K_L \to \pi^+\pi^-\pi_D^0)$ Phys. Lett. B 694 (2011)301, on line January 2011

16.1 Conferences

The collaboration is actively contributing to International Conferences and topical Workshops with NA62 Detector contributions, recently published results and new preliminary results from NA48/2 data analysis.

1. IEEE 2010, Knoxville, USA, Nov 2010: 3 talks and 2 posters

2. DISCRETE 2010, Roma, Italy, Dec 2010: 1 invited review talk, 2 NA62 talks, 1 NA48 talk

3. WIN 2011,Cape Town, South Africa, Feb 2011: 2 NA62 talks, 1 NA48 talk

4. Lake Louise Winter Institute 2011, Lake Louise, Canada, Feb 2011: 1 NA62 talk

5. 25th Rencontres De Physique De La Vallée D'Aoste, La Thuile, Italy, Mar 2011: 1 NA48/NA62 talk

6. 46th Rencontres de Moriond EW 2011 ,La Thuile, Italy, Mar 2011: 1 NA48/NA62 talk

7. 46th Rencontres de Moriond QCD 2011 ,La Thuile, Italy, Mar 2011: 1 NA48 talk

More contributions are planned in future 2011 Conferences.

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