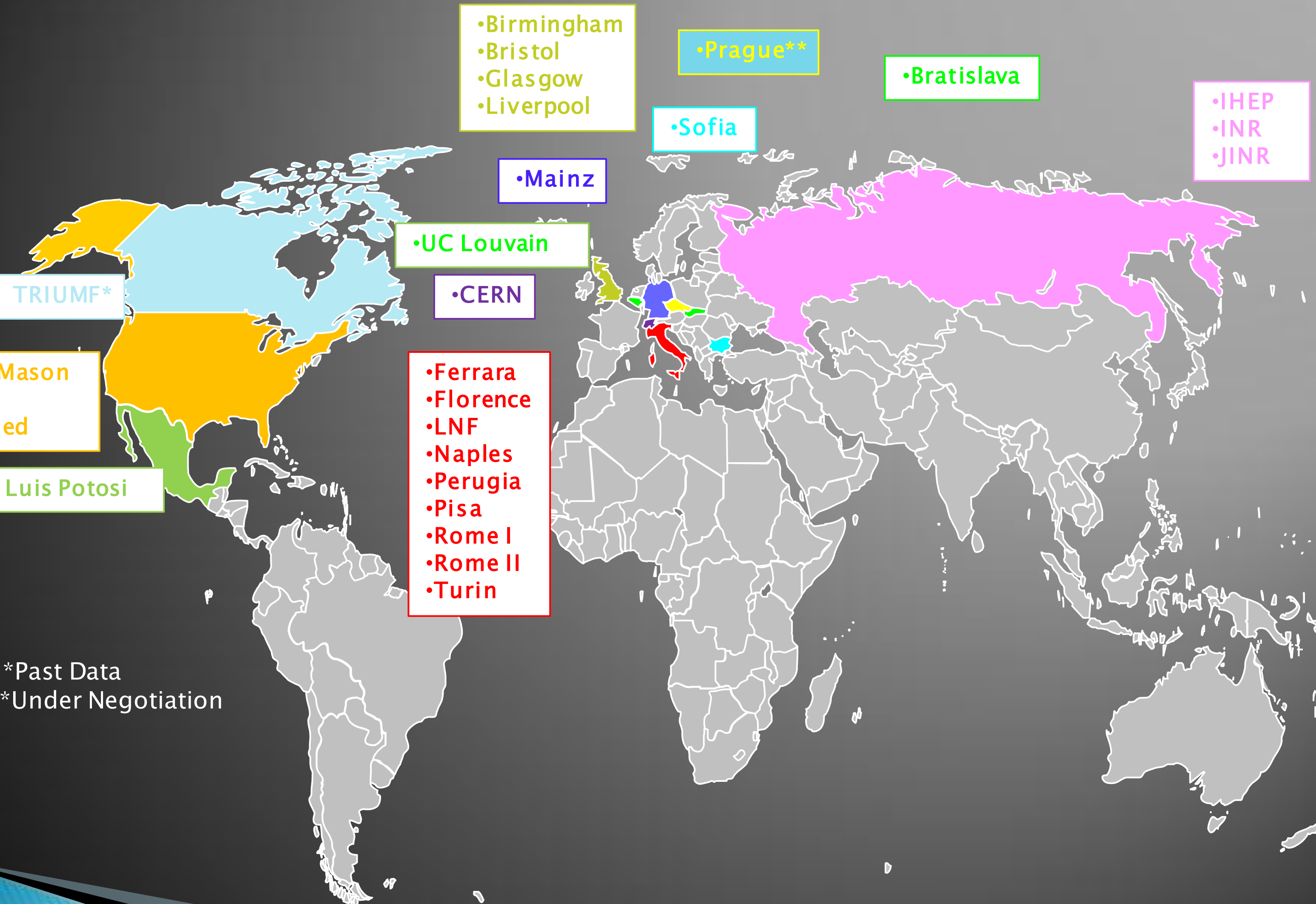
2012NA62 Status Report to the CERN SPSC

Augusto Ceccucci for the NA62 Collaboration

CERN, April 3, 2012

CERN-SPSC-2012-011
(SPSC-M-778)

The NA62 Collaboration



Flavour Physics Overview

- MEG @ PSI: **$BR(\mu^+ \to e^+ \gamma) < 2.4 \times 10^{-12}$ 90% CL**
- Direct CP-Violation in Charm (LHCb, CDF)

  ΔA_{CP} (LHCb)= $(-0.82 \pm 0.21 \pm 0.11)\%$

  ΔA_{CP} (CDF)= $(-0.62 \pm 0.21 \pm 0.10)\%$
- Decisive progress on $B^0_s \to \mu^+ \mu^-$: (SM~3.2×10^{-9})

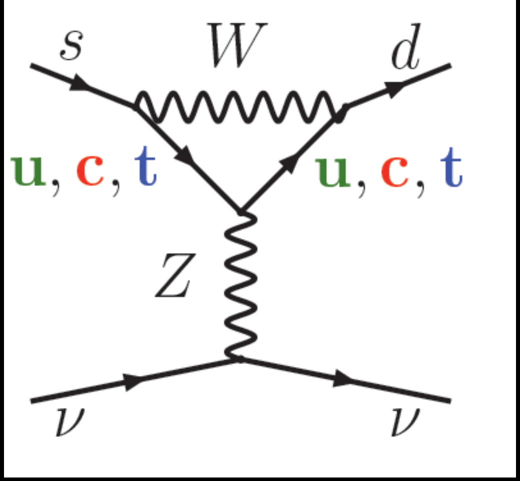
  CMS: $BR(B^0_s \to \mu^+ \mu^-) < 7.7 \times 10^{-9}$ 95% CL

  LHCb: $BR(B^0_s \to \mu^+ \mu^-) < 4.5\times 10^{-9}$ 95% CL
- Kaon Rare decays: KOTO@JPARC, NA62@SPS
- Future
  - Stopped kaon redux? ORKA@FNAL
  - Super Flavour Factories (Italy, Japan)
  - Muon programme planned at FNAL

Rare K Decays

Decay	Branching Ratio ($\times 10^{10}$)	
	Theory (SM)	Experiment
$K^+ \to \pi^+ \nu\bar{\nu}(\gamma)$	0.85 ± 0.07 [1]	$1.73^{+1.15}_{-1.05}$ [2]
$K^0_L \to \pi^0 \nu\bar{\nu}$	0.27 ± 0.04 [3]	< 260 (90% CL) [4]

[1] J.Brod, M.Gorbahn, PRD78, arXiv:0805.4119
[2] AGS-E787/E949 PRL101, arXiv:0808.2459
[3] M. Gorbahn, arXiv:0909.2221
[4] KEK-E391a, arXiv:0911.4789v1



- Must bridge the existing gap between theory and experiment
- A measurement of BR($K^+ \to \pi^+ \nu \nu$) determines V_{td} without input from Lattice QCD
- The strong suppression of the SM component ($<10^{-10}$) offers good sensitivity to NP

Minimal list of key (*or better classes of*) observables

γ from tree ($B \to DK$, ...)	(S)LHCb
$\lvert V_{ub} \rvert$ from semi-leptonic B decays	SuperB's
$B_{s,d} \to l^+ l^-$	(S)LHCb
CPV in B_s mixing	(S)LHCb
$B \to K^{(*)} l^+ l^-, \nu\nu$	(S)LHCb , SuperB's
$B \to \tau\nu, \mu\nu$	SuperB's
$K \to \pi\nu\nu$	Kaon beams (NA62,...)
CPV in charm	(S)LHCb , SuperB's
LFV in charged leptons	Muon beams, (S)LHCb, SuperB's

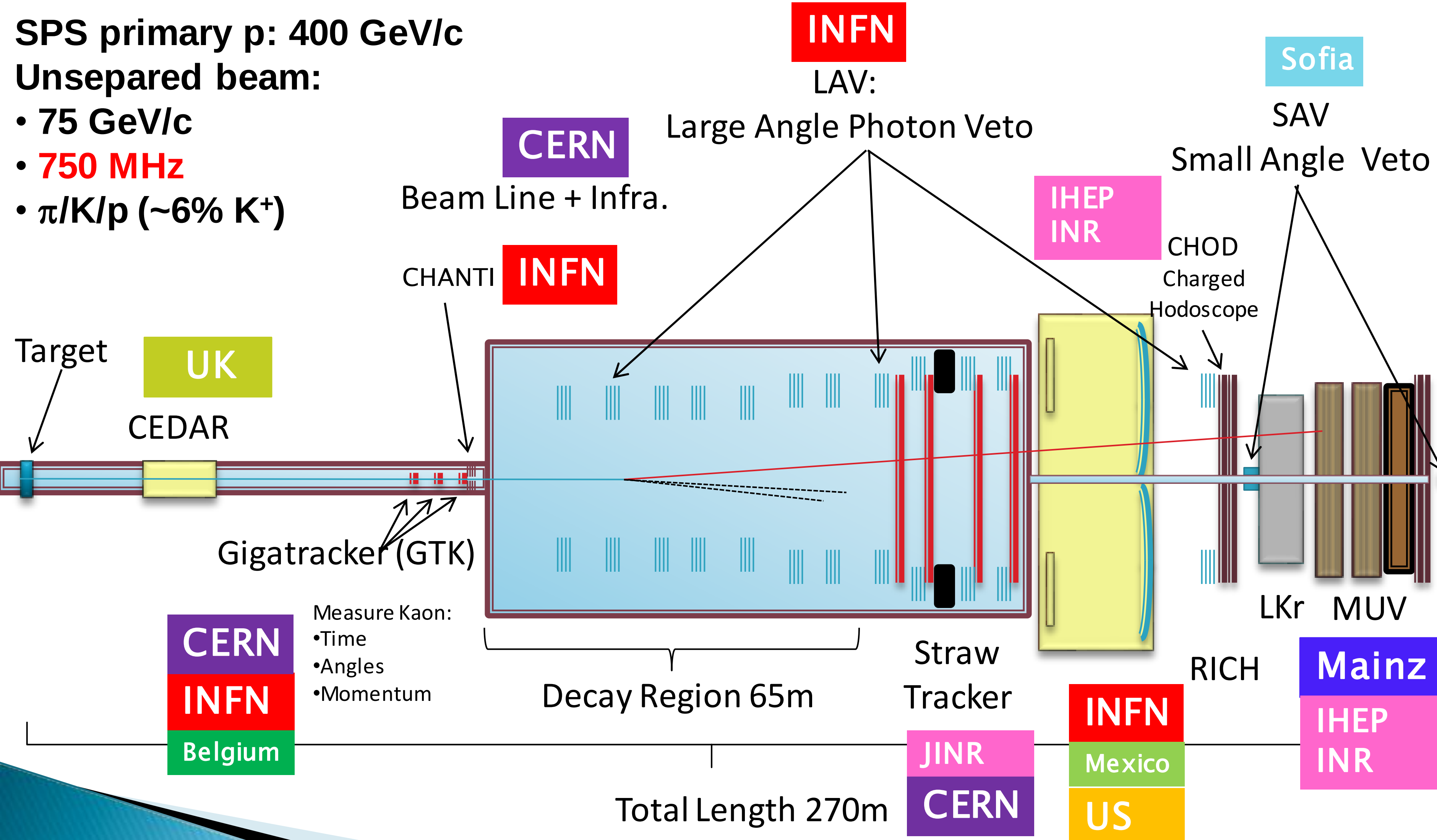
Gino Isidori

NA62 Main Detectors

- CEDAR
  - It positively identifies the kaons before they enter the decay region. It must tag approx. **50 MHz of Kaons** and be as thin as possible. It must time-stamp the K^+ with an RMS of better than 100 ps in order to improve the association of the the parent K^+ with the daughter π^+
- Gigatracker (GTK)
  - Silicon Pixel tracker to measure direction and momentum on event-by-event basis. The beam rate is almost **one GHz** (hence the detector name…). It must be very thin to avoid too many inelastic interactions…Excellent time resolution is required to time stamp each track **(< 200 ps / hit)**
- Photon Vetoes + LKr Calorimeter
  - A large system of detectors surrounding the decay tank to suppress the π^0 background by about **8 orders of magnitude**
- Straw Tracker
  - Reconstructs the decay charged particles. To reduce the multiple scattering, this large acceptance spectrometer is housed in the vacuum tank. The overall thickness of the 16 tracking views amounts to **less than 1% X_0**
- RICH
  - Pion / Muon identification up to 35 GeV/c is achieved by means of a Ring Imaging Cherenkov Counter (RICH). It also provides the time reference to correlate the pion to the correct incoming kaon track **(100 ps or better)**
- Muon Vetoes
  - To suppress the muons at the trigger and analysis level. They consist of hadron calorimeters made of iron and plastic scintillator and a fast veto plane

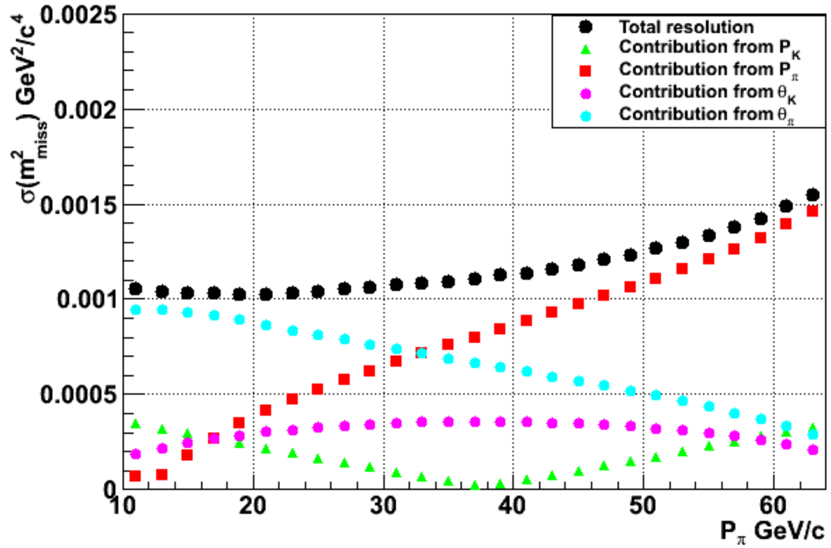
NA62 Beam & Detectors

SPS primary p: 400 GeV/c
Unseparated beam:
- **75 GeV/c**
- **750 MHz**
- **π/K/p (~6% K⁺)**



Preparation for the $K^+ \to \pi^+ \nu \bar{\nu}$ Analysis

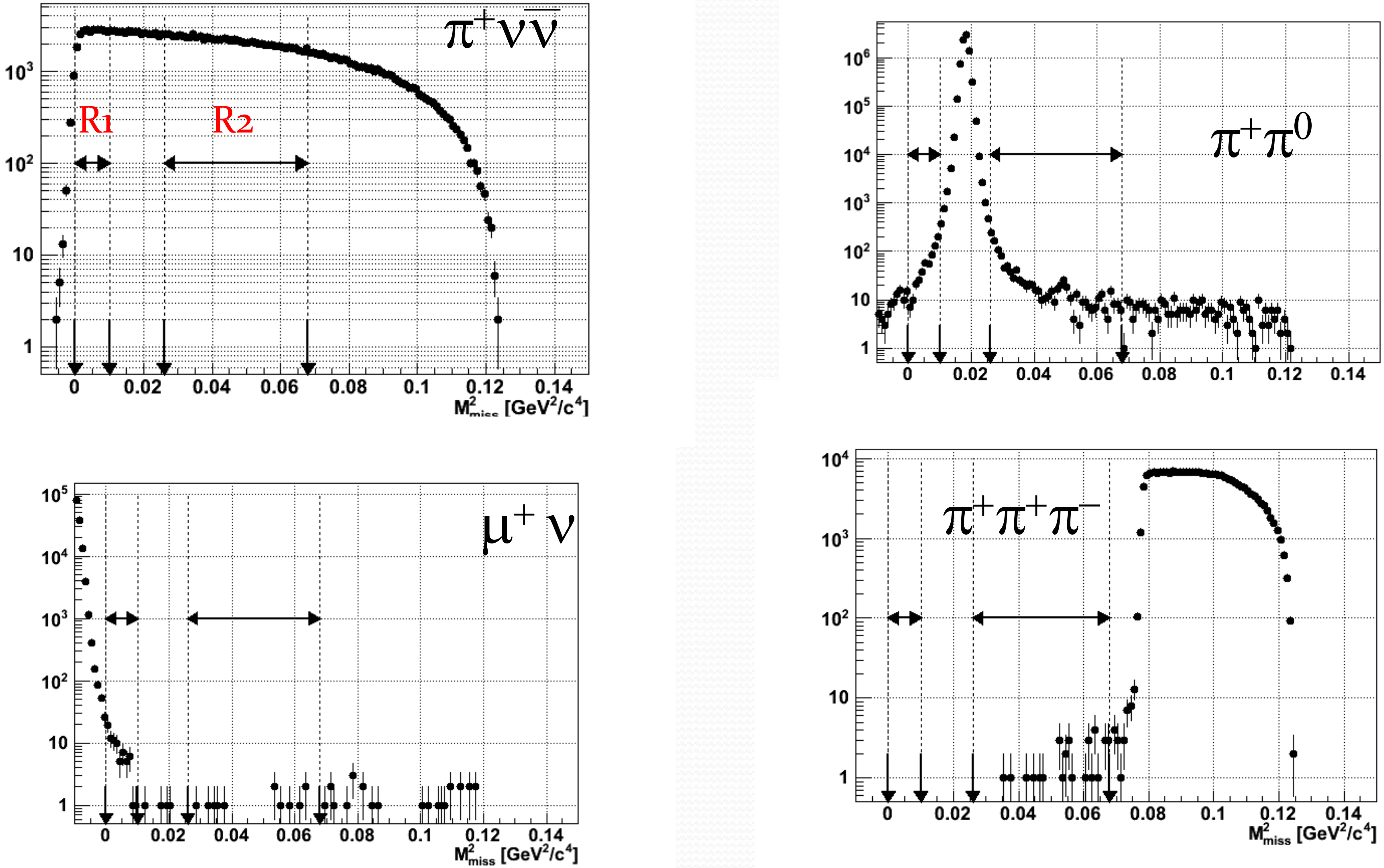
1. Kinematic rejection
2. Charged particle rejection
3. Photon rejection
4. π/μ separation and μ suppression



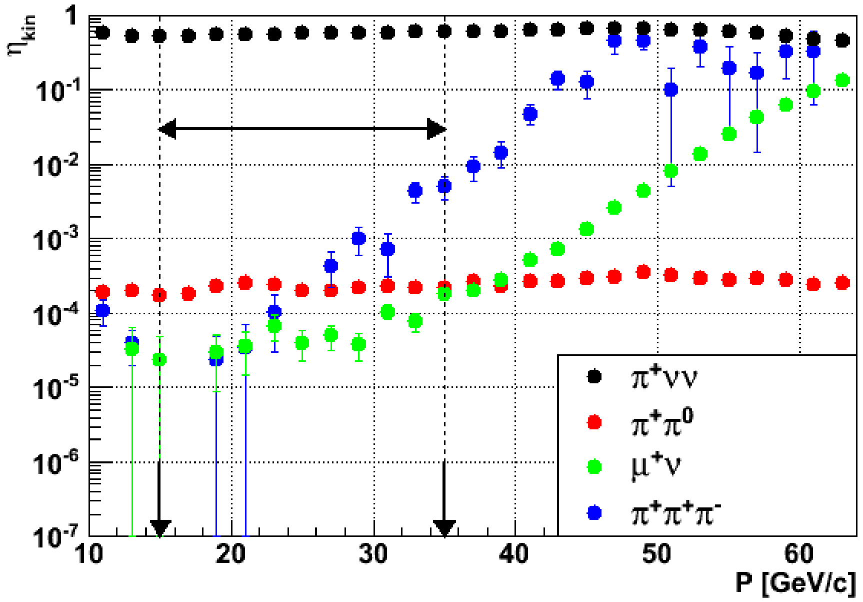
Missing Mass Resolution

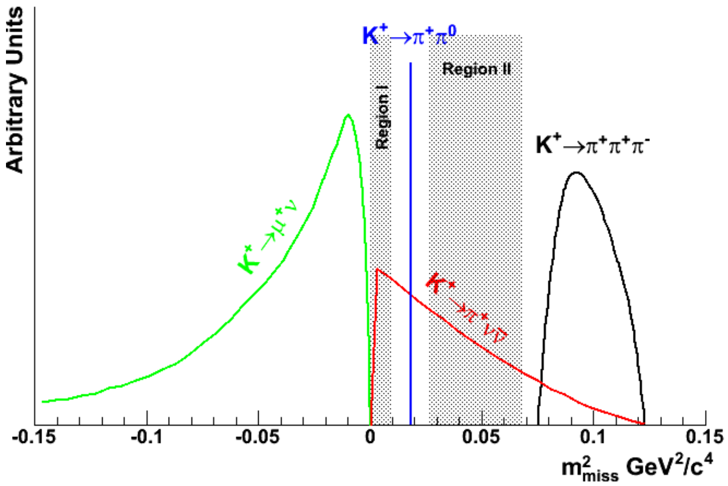
General Theme: Maintain a good signal/background ratio preserving the signal acceptance as much as possible

Kinematic Selection: Cuts on M^2_{miss}



Acceptances after Kinematic Selection



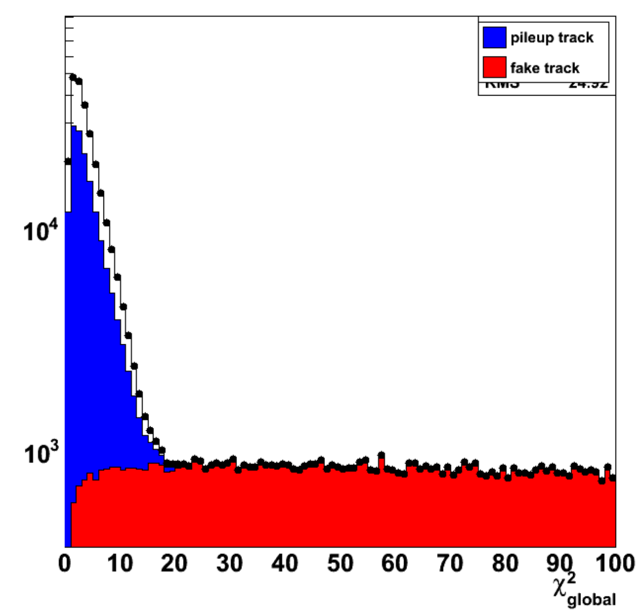


Channel	M^2_{miss} cut	Overall acceptance
$\pi^+\nu\bar{\nu}$	~0.57	~0.147
$\pi^+\pi^0$	(2.2 ± 0.5) x 10^{-4}	(4.4 ± 1.0) x 10^{-5}
$\mu^+\nu_\mu$	(0.7 ± 0.1) x 10^{-4}	(1.0 ± 0.1) x 10^{-5}
$\pi^+\pi^+\pi^-$	(1.4 ± 0.2) x 10^{-4}	(6.9 ± 2.0) x 10^{-7}

Beam Pileup and GTK reconstruction

- Pileup simulation: Rate=750 MHz in GTK
  - Average tracks in GTK per event: 2.5 (1 K, 1.5 pileup)
- All possible GTK hit combinations considered
  - Real tracks: GTK hits from the same track (Pileup tracks, Kaon tracks).
  - Fake tracks: GTK hits from different beam tracks.
- Before selection cuts:
  - Average reconstructed track per event: 27
  - Fraction of: Kaons 3.6%, Pileup 5.3%, Fake 91%

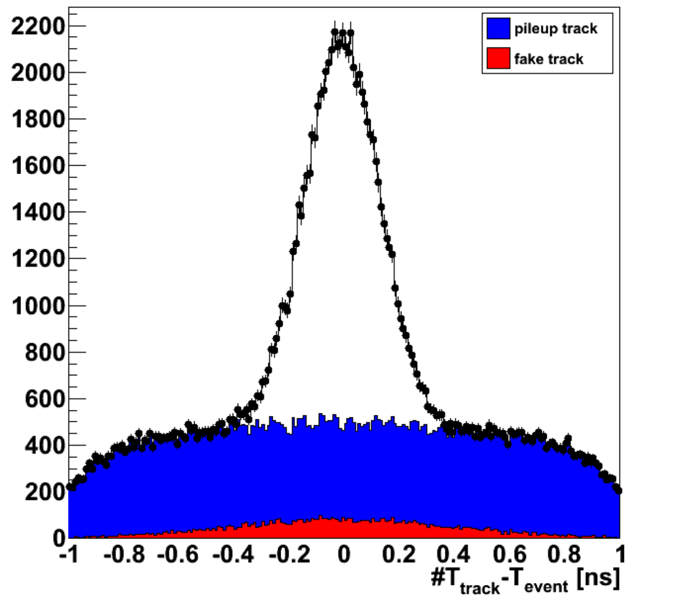
- Real Track Recognition:
- Discriminant variable: global χ^2
- Track recognition: global $\chi^2 < 20$.
- After track recognition:
  - Average reconstructed track per event: 2.6
  - Fraction of: Kaons 38% , Pileup 56%, Fake 6.1%.



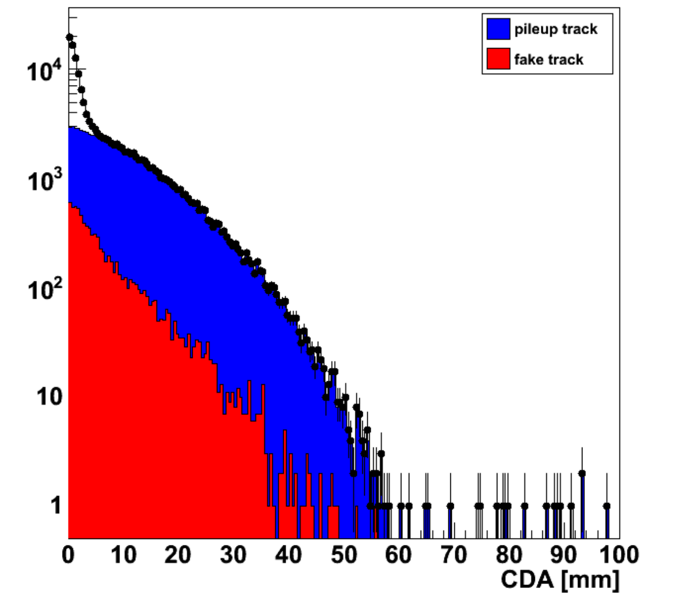
Beam Pileup and Kaon-ID

- Inputs for Kaon track identification: $\Delta T = T_{track} - T_{event}$, CDA.

ΔT for all the tracks



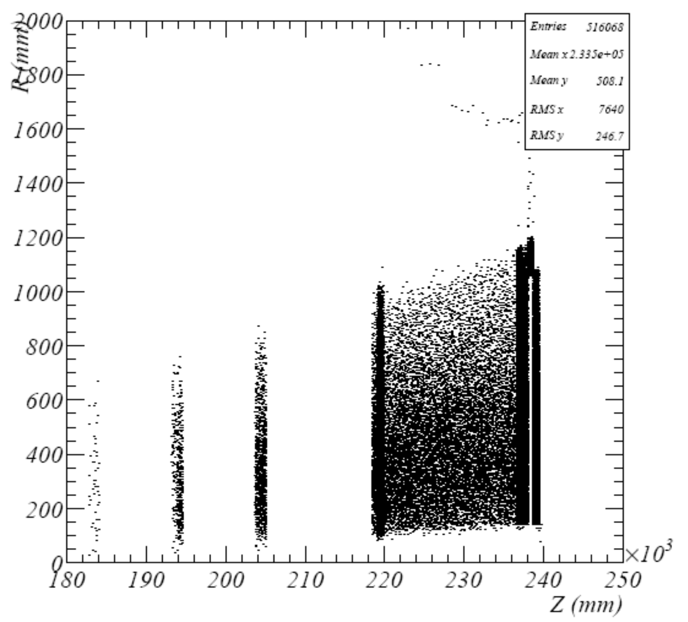
CDA for all the tracks



- Results after Kaon - ID:
  - Fraction of: Kaons 99.4%, Pileup 0.6%, Fake <0.1%

Photons in the Forward Region

- Evaluate the effect of the material in front of the LKr on the photon rejection inefficiency (straw chambers and RICH).
- Reminder: the LKr intrinsic inefficiency was evaluated on data (NA48 in 2007) .



- Probability of γ interaction: 20%
  - Most part of the interactions are simple photon conversions (e^+e^- pairs detected as well in the LKr).
- Probability of γ nuclear interaction: 10^{-3}
- Multiplicity cuts in LAV9,10,11,12 and in the detectors downstream to the RICH applied.

Energy	< 1 GeV	1 – 5.5 GeV	5.5 – 7.5 GeV	7.5 – 10 GeV	>10 GeV
LKr Inefficiency	1	10^{-3}	10^{-4}	5×10^{-5}	8×10^{-6}
Effect of the material	-	$(2.1\pm0.5)\times10^{-4}$	$(1.4\pm0.5)\times10^{-4}$	$(5\pm2)\times10^{-5}$	$(3.7\pm1.6)\times10^{-6}$

$K^+ \rightarrow \pi^+ \nu\bar{\nu}$: Analysis Summary & Plans

- During the past year Several effects have been studied

1. Kinematic rejection
   - Effect of the non gaussian tails
   - Beam pileup
2. Multi-charged particle background
   - Use of the veto detectors
   - Spot and cure possible flaws of the layout
3. Photon veto:
   - Effect of the detector material on the photon detection efficiency
4. Muon-ID using the calorimeters.

The most important backgrounds are in line with our expectations and the signal acceptance is kept at abut 10%.

- In 2012 the reparation to the $K^+ \rightarrow \pi^+ \nu\nu$ will continue.

1. Better definition of the multiplcity cuts.
2. Effect of the material on the detection of the photons in the LAVs. Study of the possibility to measure the photon detection inefficiency using data (as it has been done for the LKr).
3. Further progress in the muon identification using the calorimeters.
4. Assessment of background level from:
   - $K^+ \rightarrow \pi^+\pi^0(\gamma)$
   - $K^+ \rightarrow \pi^+\pi^+\pi^-$
   - $K^+ \rightarrow \mu^+\nu(\gamma)$
   - $K^+ \rightarrow \pi^+\pi^-e^+(\mu^+)\nu$
   - Beam induced background

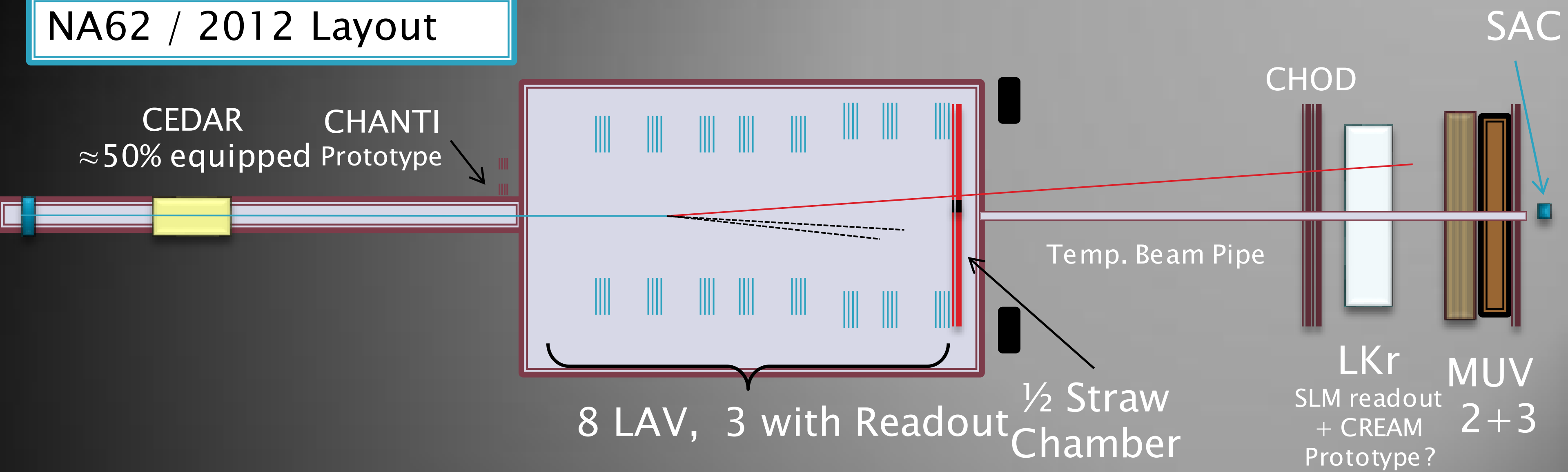
Beam Line & Infrastructure

- A very significant achievement was the completion of the new beam dump
- The beam line is being installed
- The tendering process for the vacuum system is in progress
- The surface building is being refurbished
- **The contribution of the EN/MEF team is invaluable**

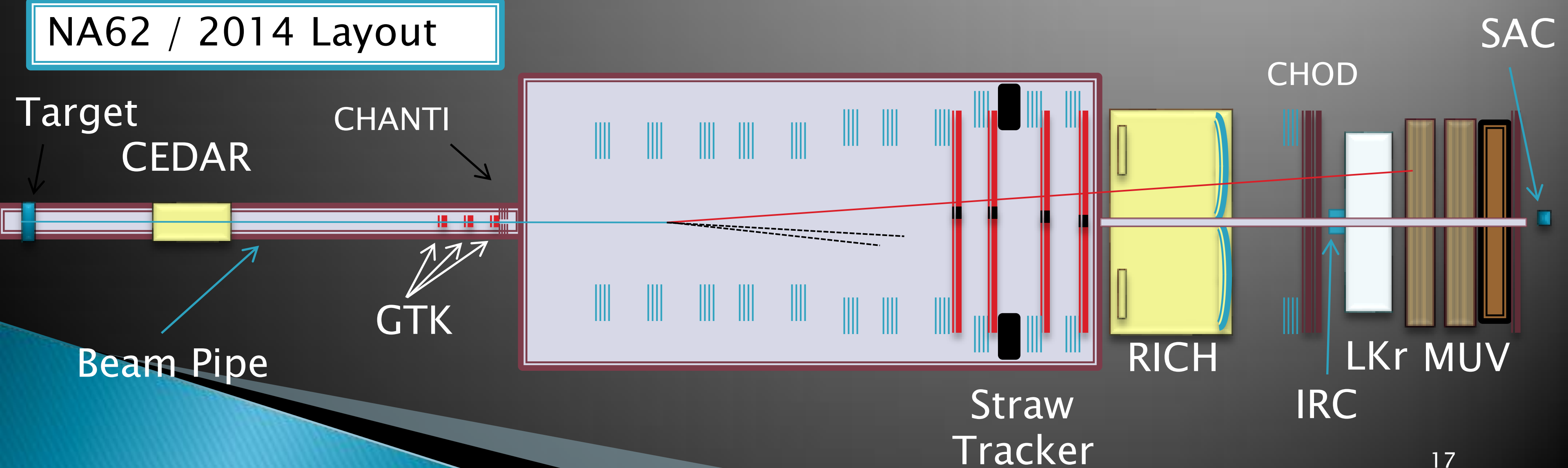
Detector Installation in ECN3

NA62 Detector

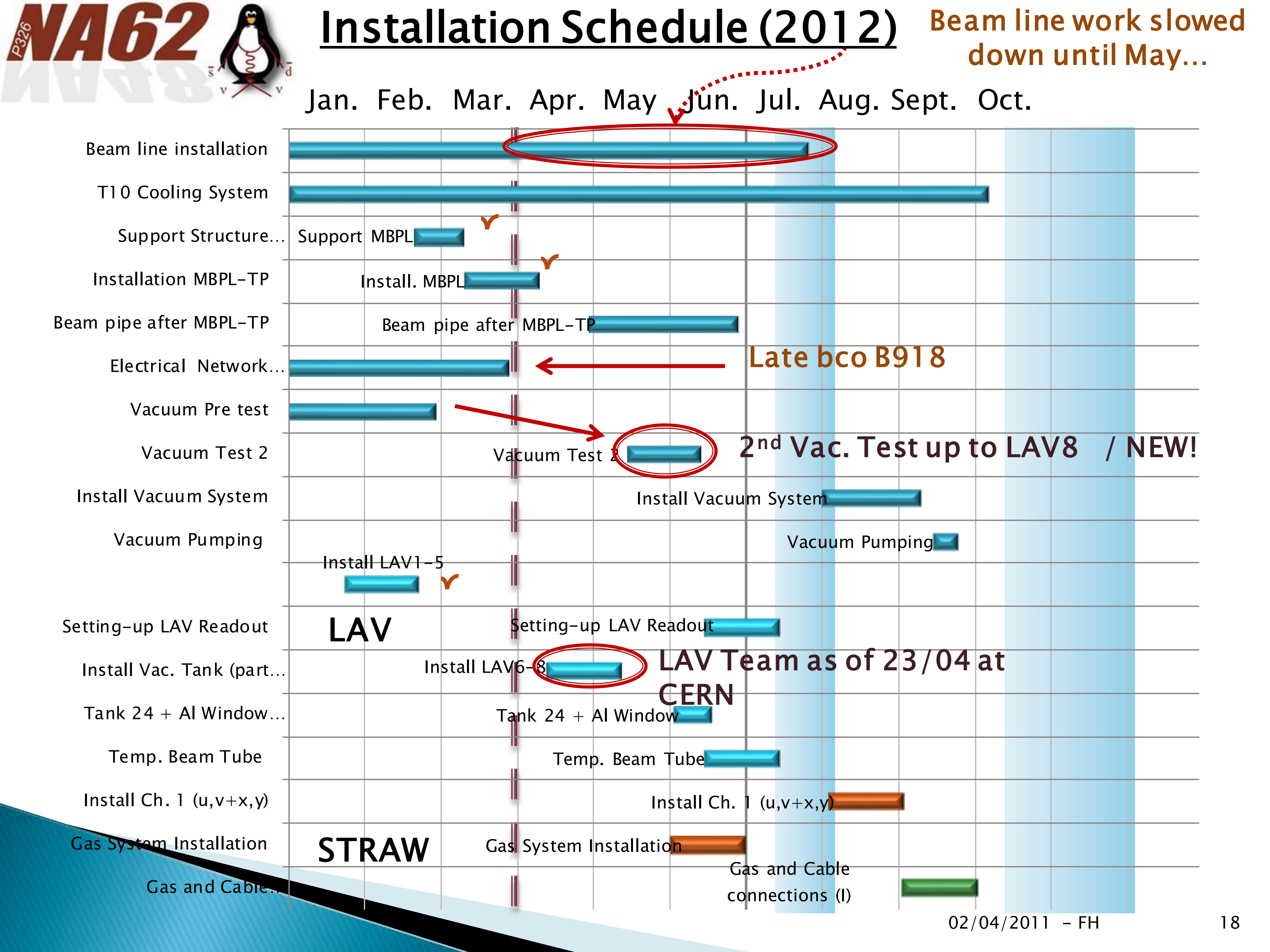
NA62 / 2012 Layout



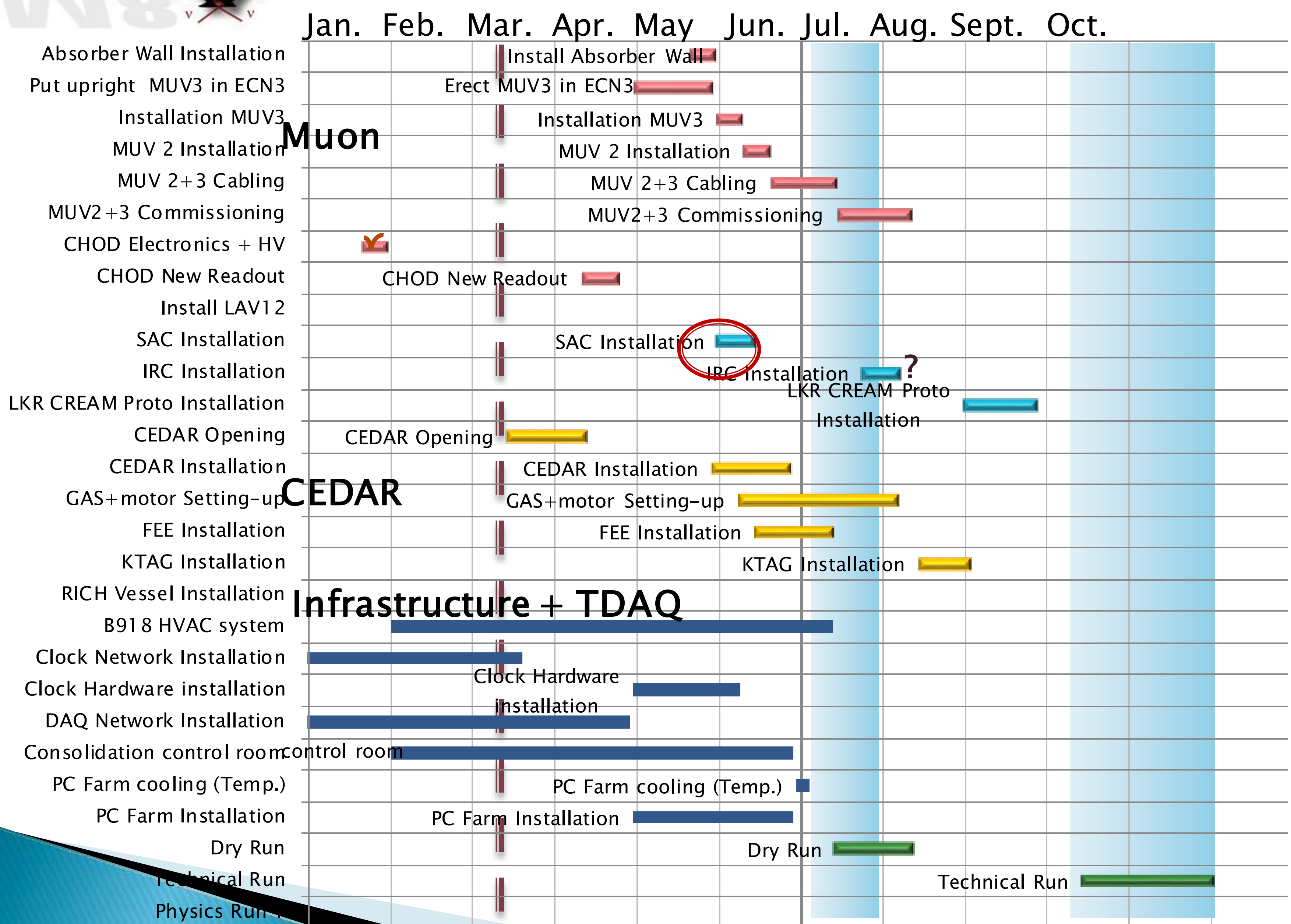
NA62 / 2014 Layout



Installation Schedule (2012)



Installation Schedule (2012)

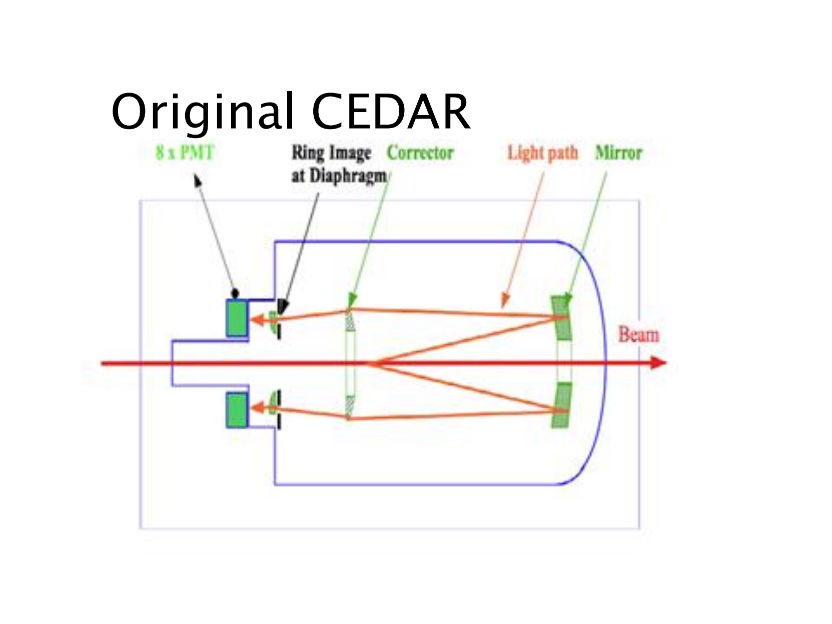


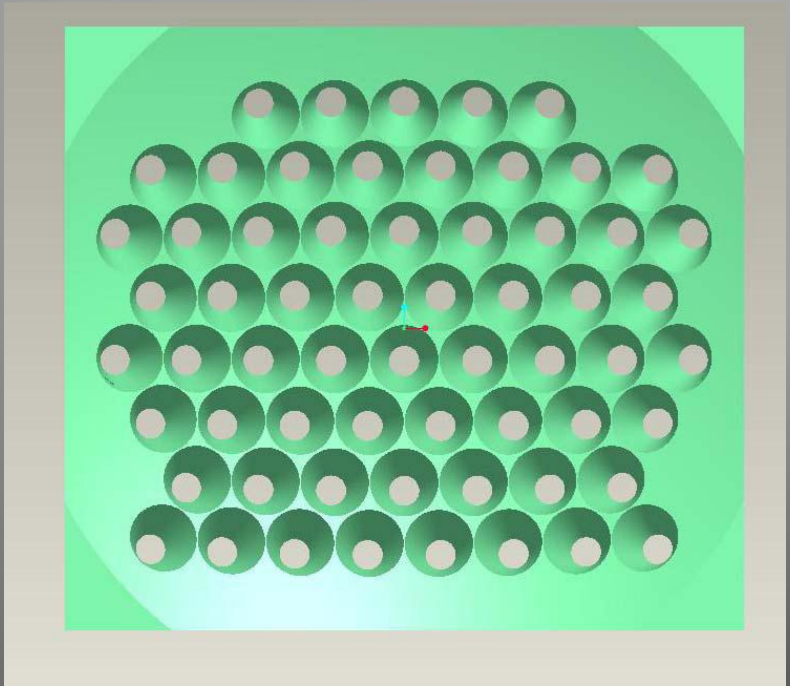
Milestones

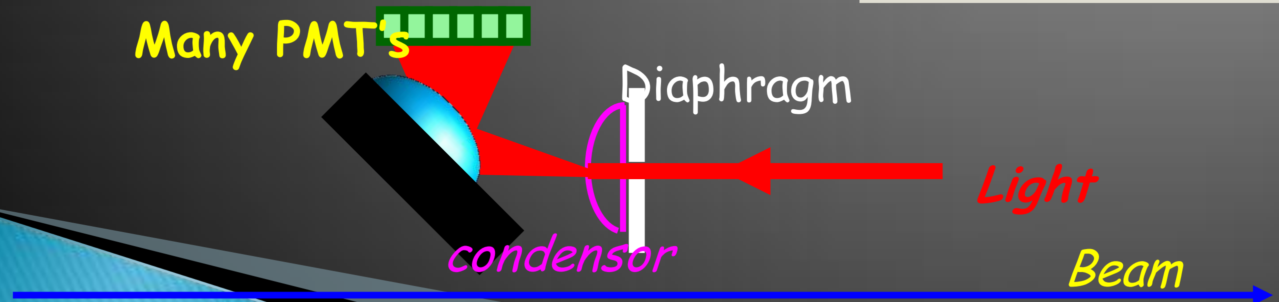
#	Sub-System	Milestone	Date	Result	Comments
1	STRAW	Freeze Chamber + Straw Design	01/09/2010	√	
2	GTK	GTK Read-out Cip Choice	30/09/2010	√	
3	LAV	LAV 1,2,3,4 + 5 Ready	16/02/2011	√	Successfully completed the 08/04/11
4	RICH	Design for Mirror Supports and Wall Completed	30/06/2011	partially √	Work was interrupted because of manpower problems. New Engineer started only in Dec. 2011. Expect Sept. 2012
5	STRAW	Module 1 Ready	30/11/2011	partially √	Straws are all installed (excellent quality!) Wiring and HV test continue til June
6	GTK	Freeze Sensor + Chip Design	30/06/2012	ongoing	The design of the blocks is mostly terminated. Layout and optimization is ongoing
7	LAV	LAV 6 -8 Ready	30/04/2012	√	completed by end of April
8	STRAW	Readout Design Completed+Tested	16/12/11	ongoing	First version of FE cover under test. Prototype of SRB exist. There is steady progress, but slower then hoped last year. Expect validation of RO for TR.
9	TDAQ	TEL62 board ready for final production	31/01/12	√	Completed. The pre-series of TEL62 boards was launched. Firmware under development.
10	STRAW	Two Modules Ready	15/06/2012	-	Due to the delay on Module 1 and the work for TR we expect the completion of Module not before end 2012.
11	RICH	Vessel installation ready	30/04/2013	-	Tender documents will be ready in May 2012 Order expected before Summer holidays
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	02/12/2013	-	
15	ECN3	Final Vacuum Tube closing	15/03/2014	-	

CEDAR

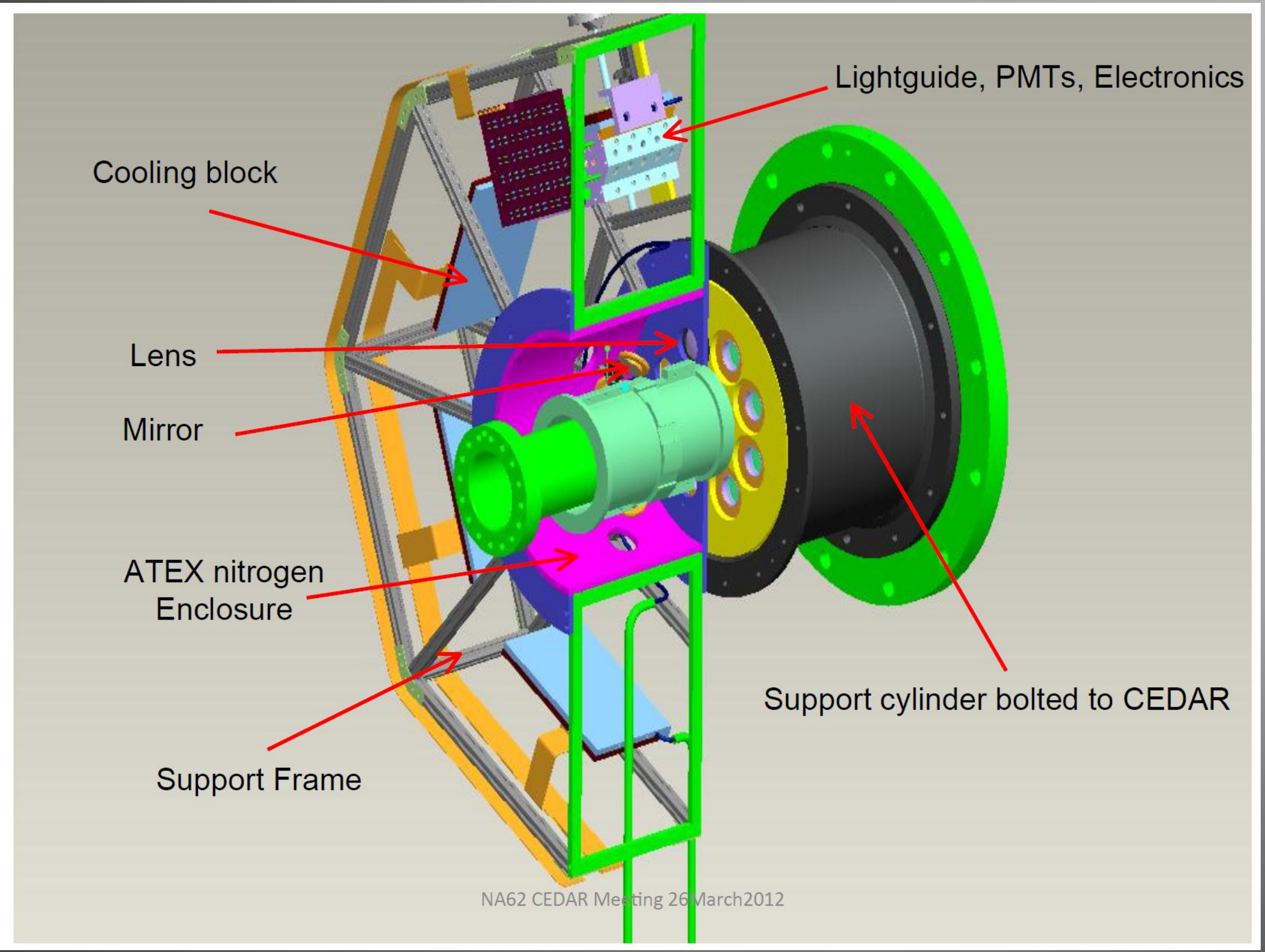
With 50 MHz kaon rate one must spread the photon rate on many photo-detectors (PMs)







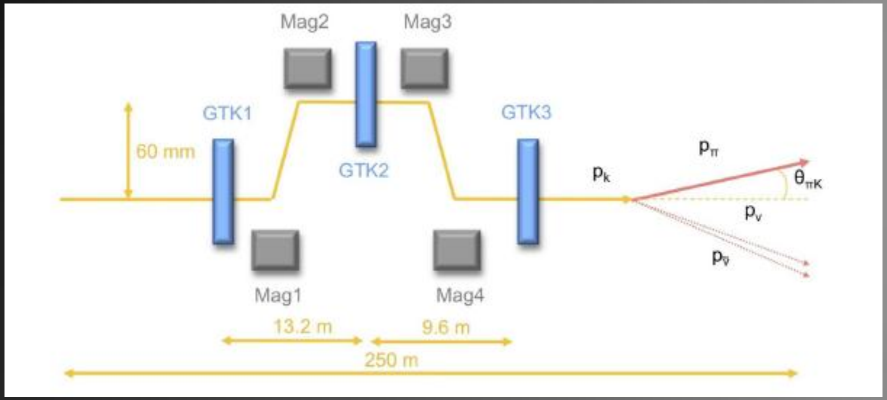
KTAG



In the 2012 technical run (TR) the full KTAG enclosure will be available. The light guides, electronics and cooling plates will be installed for four out of eight light spots. Each light spot will be read out by 32 instead of 64 photomultipliers (PMs).

Aluminum light-guide (prototype) obtained by electric discharge machining in Liverpool

Gigatracker (GTK)



To measure the beam particles

- direction (σ_{RMS} ~16 μrad)
- momentum (σ_{RMS} ~ 0.15 GeV/c, σ_{RMS}/p ~ 0.2%)
- track time (σ_{RMS}~ 200 ps / station -> ~ 150 ps / track)

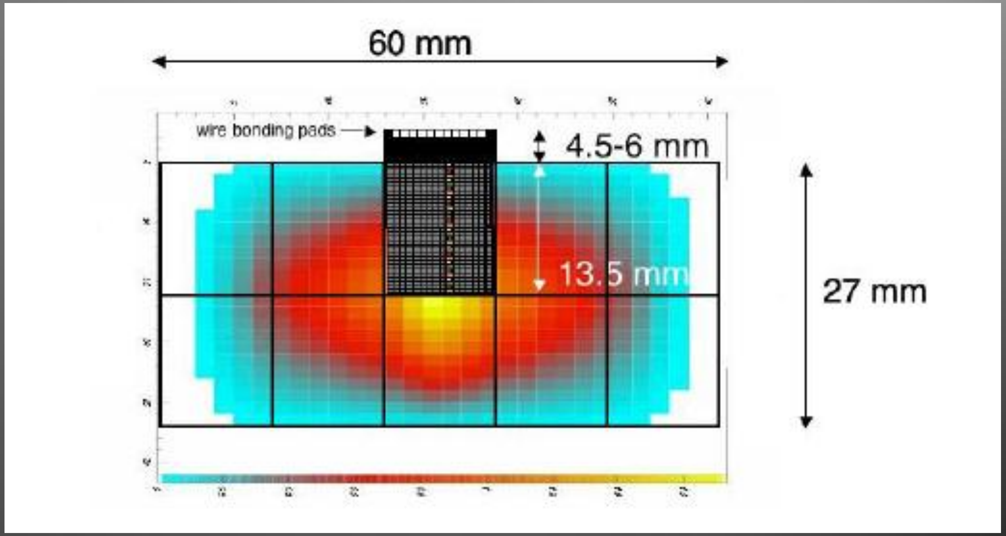
Three stations

200 μm Si sensor

300 x 300 μm² pixel

Stations mounted inside the vacuum tube

Dimensions of the stations to match the beam shape



Main progresses since last SPSC review meeting in Apr. 2011

- *Assemblies*. p-in-n and n-in-p sensors have been produced at FBK (Trento, Italy) and ready to be used. Thinning down to 100 μm has been achieved. To be solved: surface discharge between chip and sensor at voltages above 450-500 V.

- *Cooling.* The Micro-channel technology has been chosen as baseline solution (Dec. 2011). With a ceramic mock-up the performances of the solution have been established. The temperature uniformity over the detector is about 7 ^{0}C. The jigs for assembling are under construction.

- *ASIC design*. The design of the blocks is mostly terminated. Layout and optimization is ongoing. The 3.2 Gb/s serializer has been designed: layout and verification are underway.

- *GTK carrier*. A prototype board has been produced and used to evaluate signal transmission in a realistic environment : namely 3.2 GHz over 25 cm length. Investigation on optical components to transmit high-frequency signals has been done.

- *Mechanics.* Design of the vacuum tank and GTK carrier integration has been finalized and it is ready for the production of the three stations.

- *Off Detector R/O electronics.* A prototype of the GTK-RO card is under test in Ferrara: basic functionalities have been proven to work.

Plans for the next 12 months

- *Assemblies.*

Evaluate r/o chip thinning (to less than 100 um) and bump-bonding procedure using dummy components. Launch Call for Tender for production of final bump-bonded assemblies

- *Cooling.*

Produce prototypes according to the baseline solution: 150 μm thickness, two-inlet and two-outlet pipe and appropriate geometry.
Produce prototypes according to the "frame" option and compare with the performance of the baseline solution

- *ASIC design*.

Complete layout and verification. Submission of the engineering run and initiate the electrical and laser test.

GTK carrier.
Start the design of the carrier board. Acquire HV and LV power supplies and install infra-structures (optical fibers, cabling).

- *Mechanics.*

Mechanical production of GTK1 and GTK2 stations and mounting them on the beamline.
Finalization of GTK3/CHANTI design and production in the second half of 2012. Installation expected for 2013

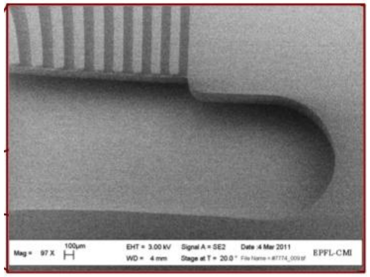
- *Off Detector R/O electronics.*

Launch the full production of the GTK-RO modules and have all the element of the DAQ system up to the DAQ PCs properly operating.

GTK: Micro-Channel Cooling

Cross section of the cooling plate

Channels = 200 x 70 μm
Wall thickness = 200 μm
Cover thickness = 30 μm



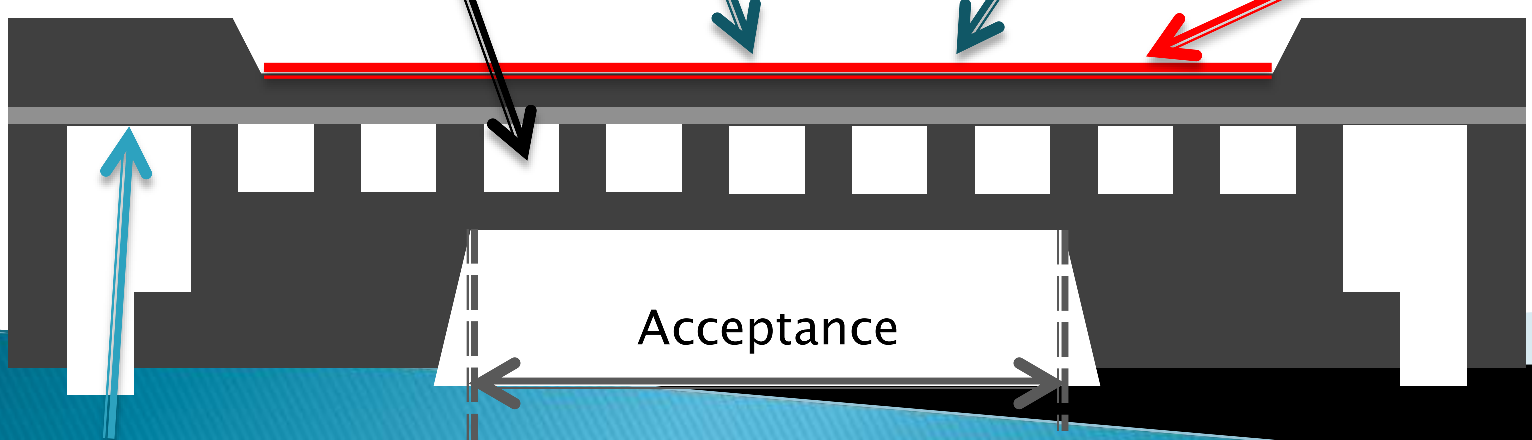
Operating temperature -25 C

30 + 30 μm Silicon = 0.0064 % X_0
(above and below channels)

30 + 30 + 70 μm Silicon = 0.0139 % X_0
(between channels)

70 μm C6F14 = 0.0037 % X_0

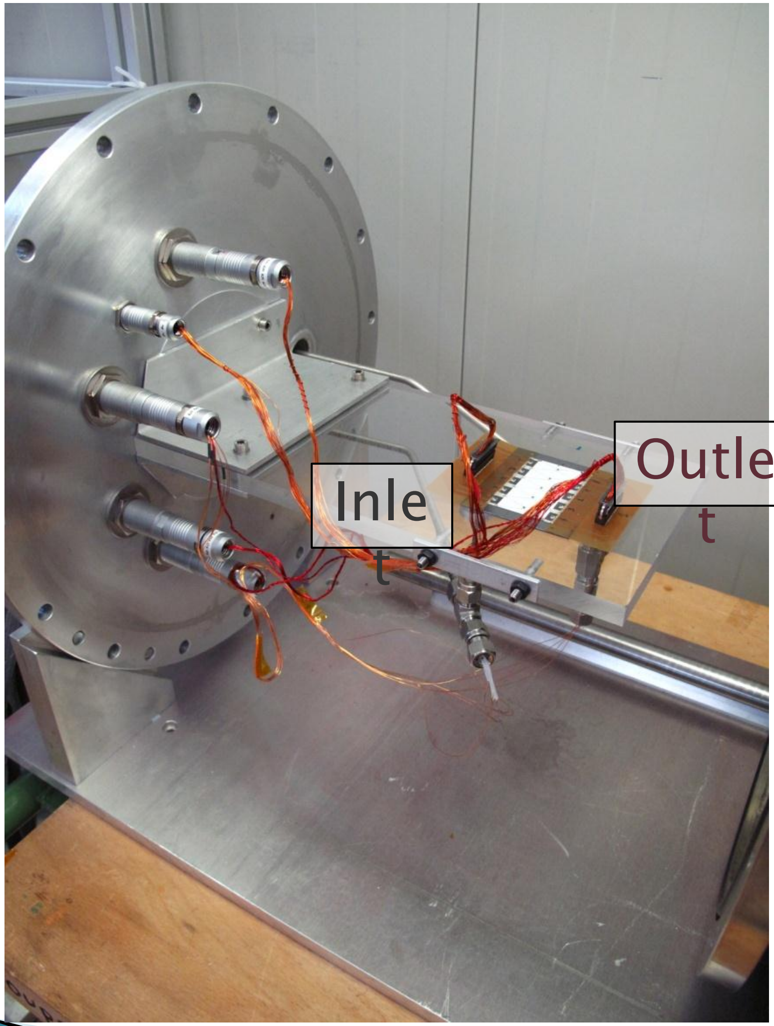
30 μm epoxy = 0.0008 % X_0

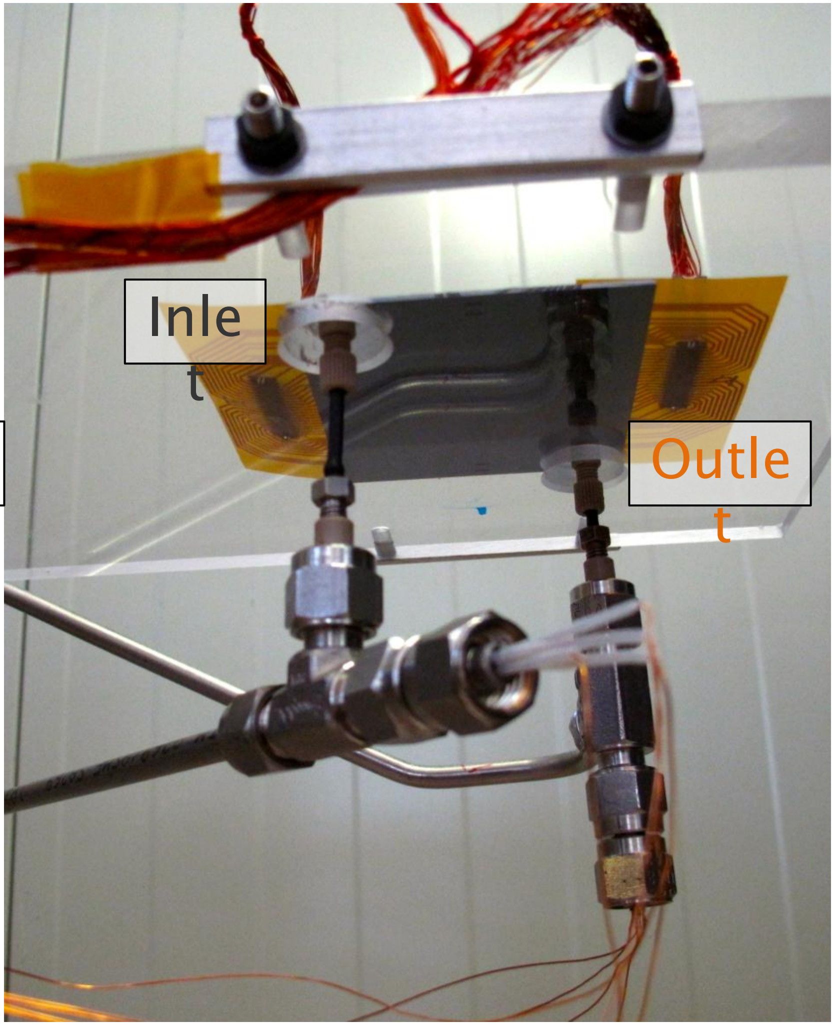


10 μm Pyrex = 0.0008 % X_0
(removed in final production)

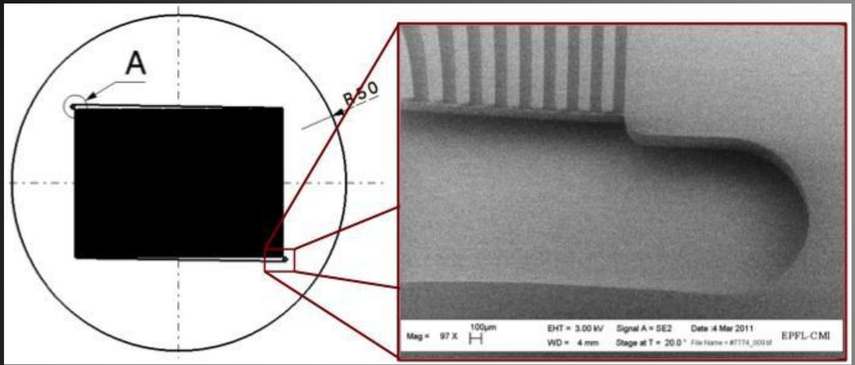
Total material budget in the acceptance area = 0.013 X_0%
(min 0.011% – Max 0.015%)

Ceramic Heater Integration

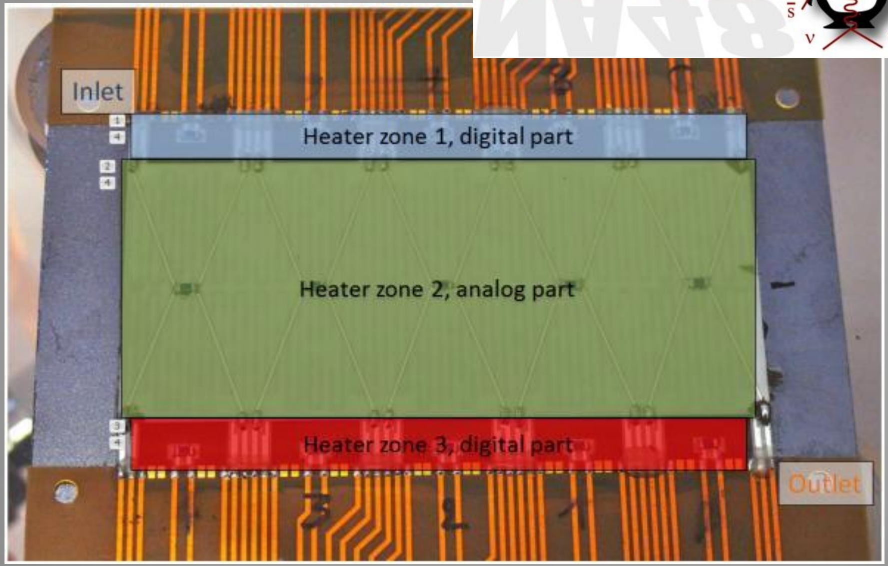


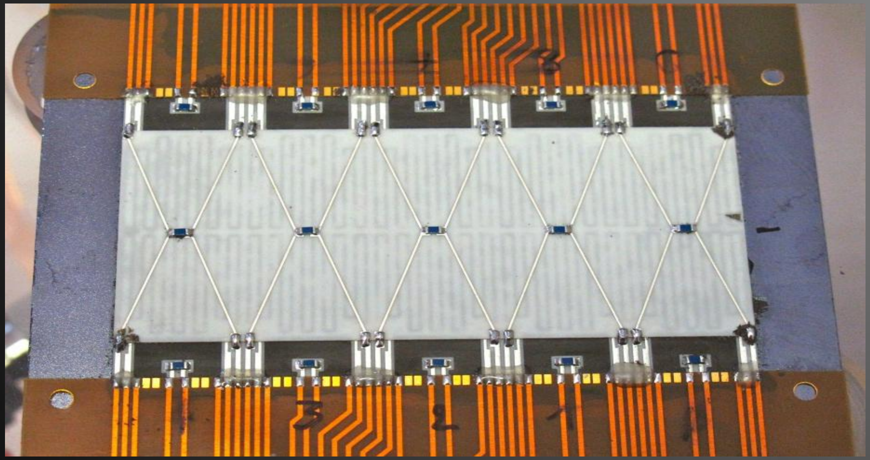


GTK cooling

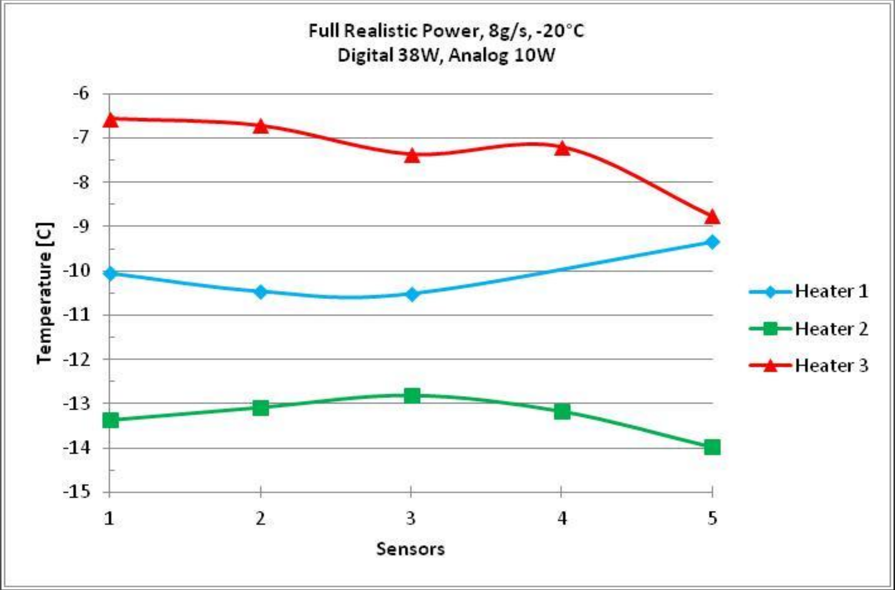


micro-channel cooling

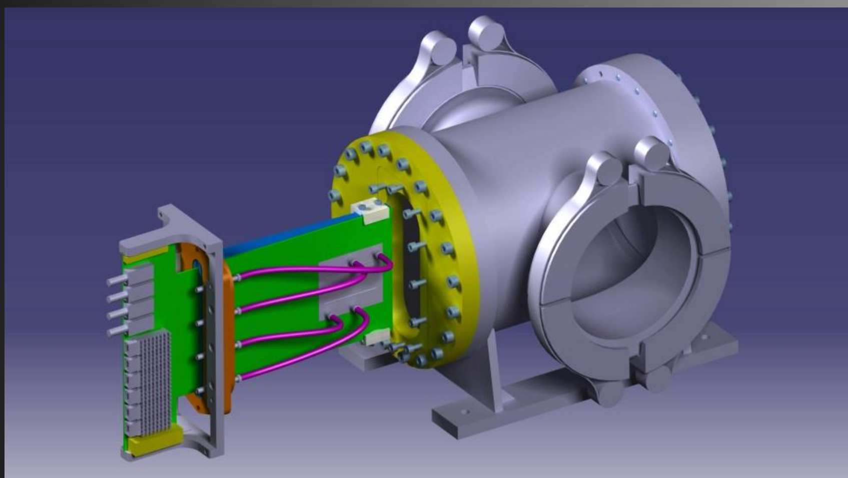




Ceramic heater to
simulate chip dissipation



GTK: Mechanics & Read Out

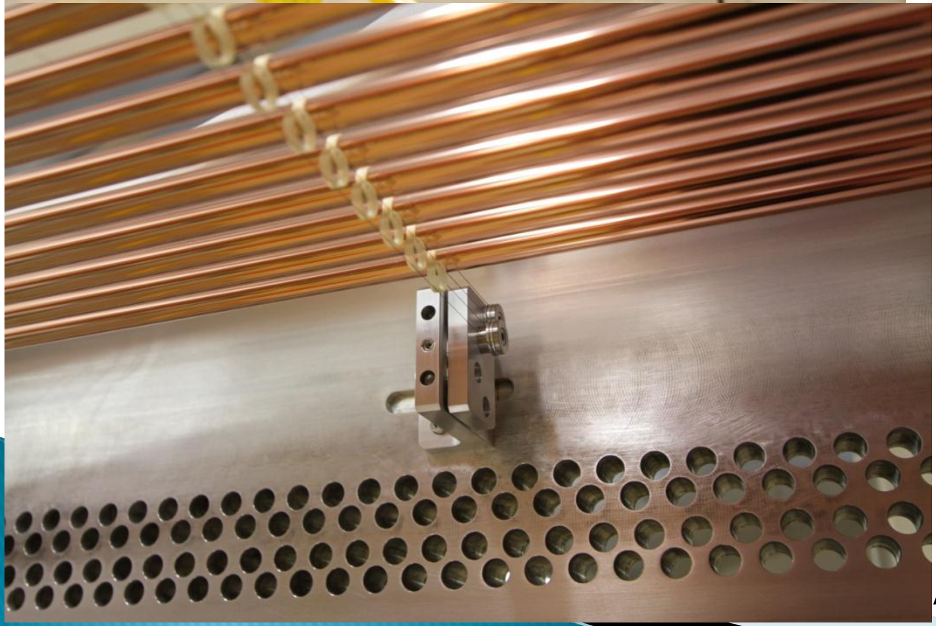


Mechanical Integration

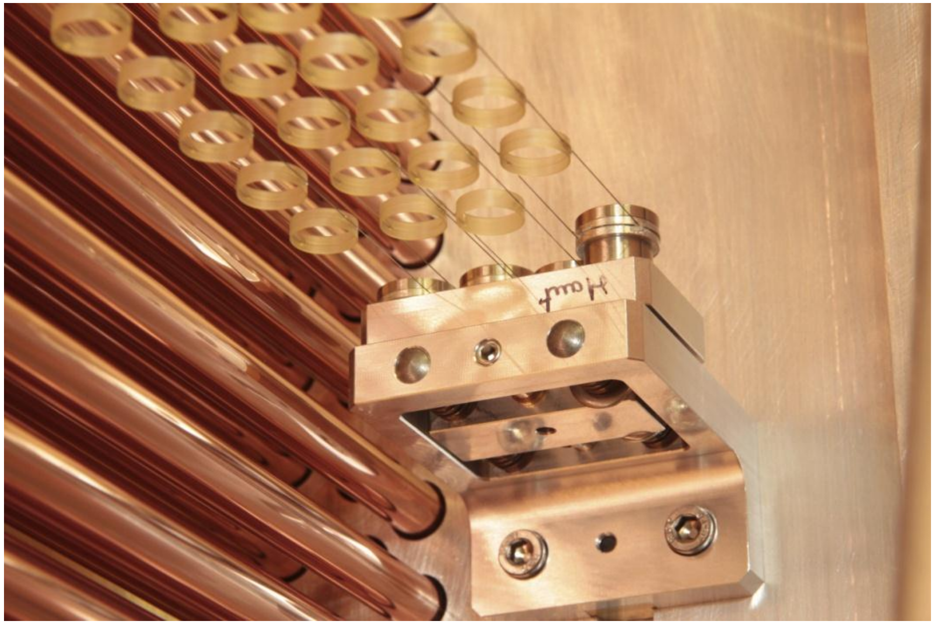
GTK-RO motherboard prototype

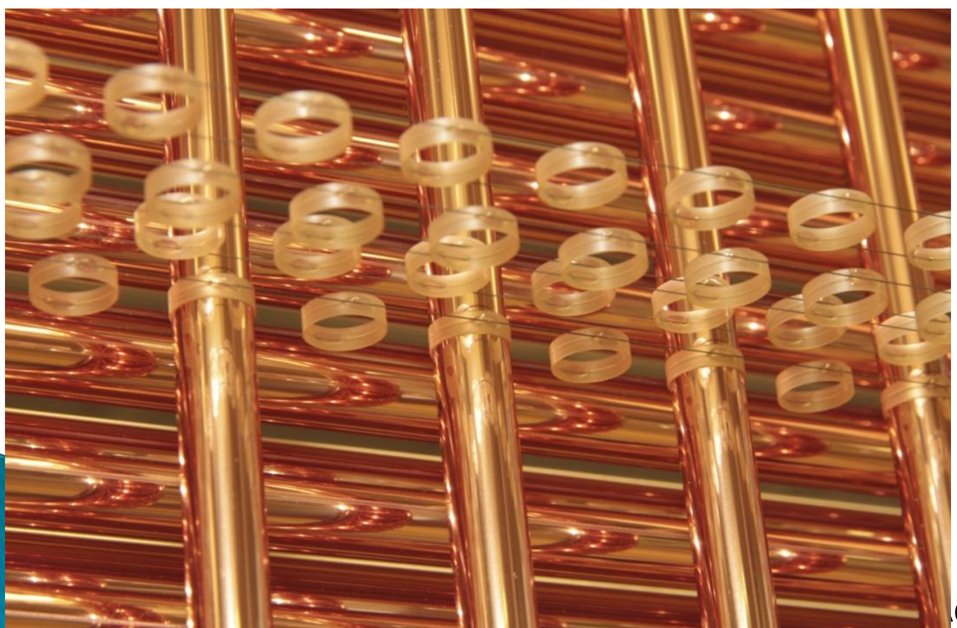
Straw Tracker

Module assembly –straw insertion

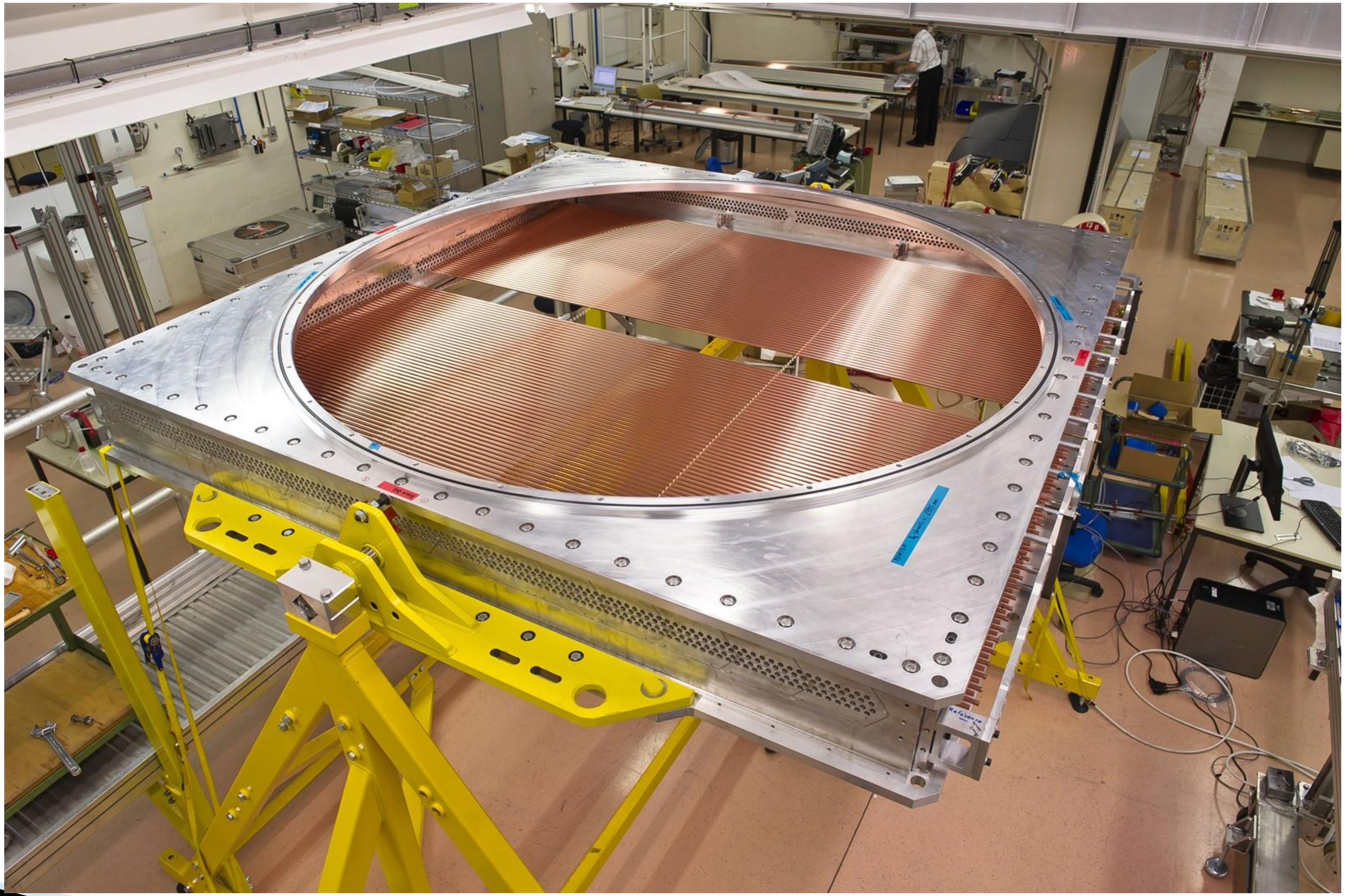


Spacers



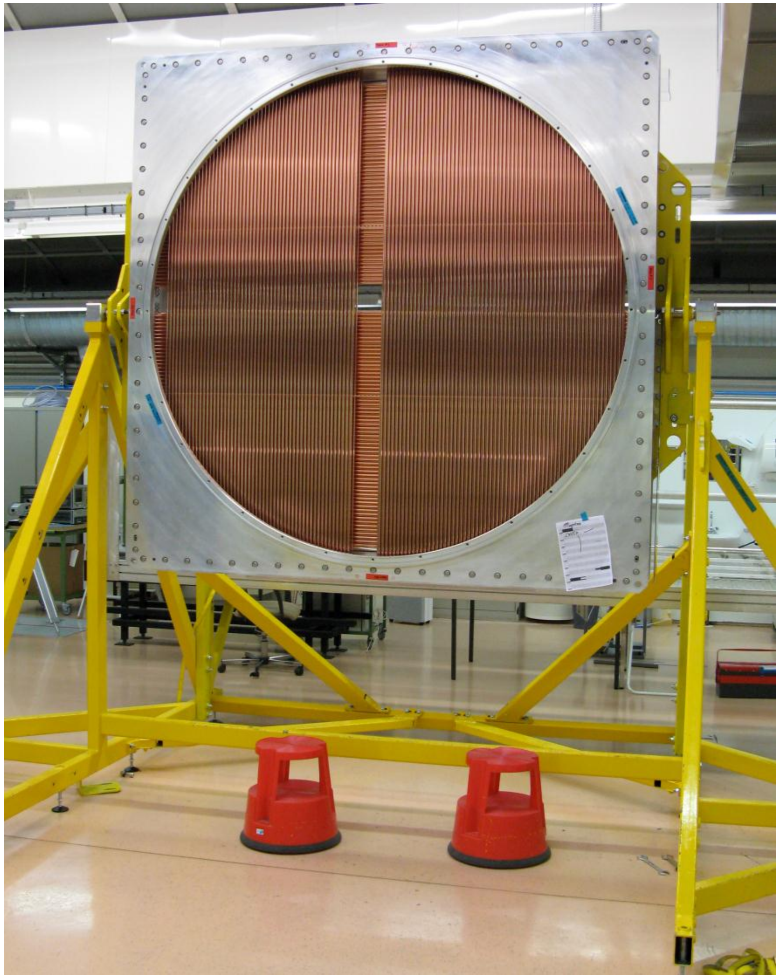


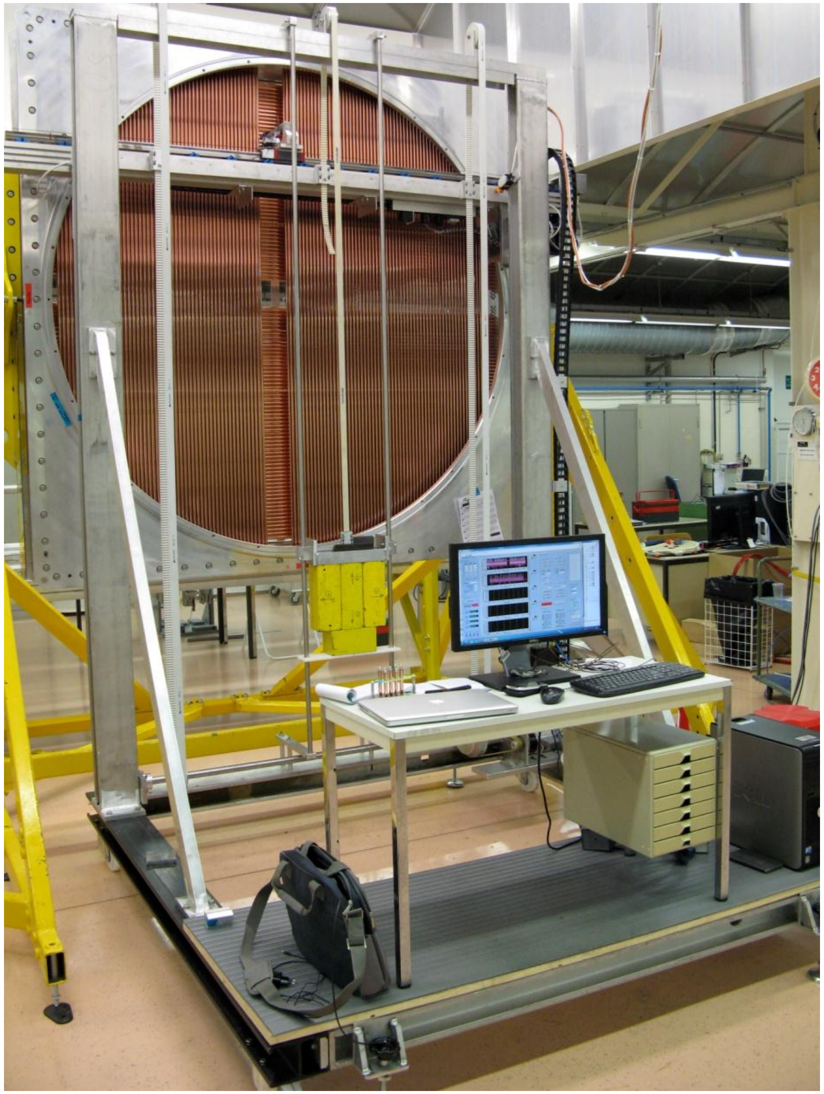
Straw Module 1



Straw Module 1

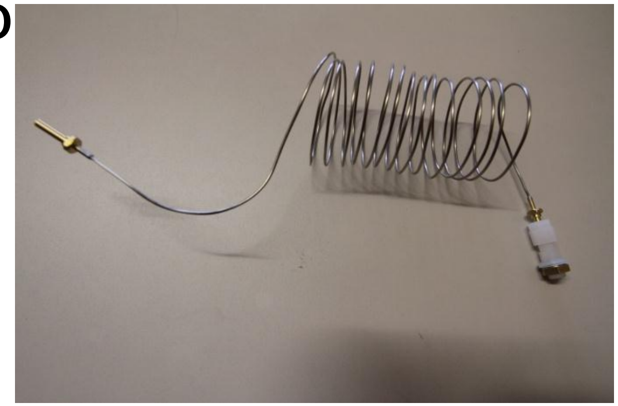
896 straws



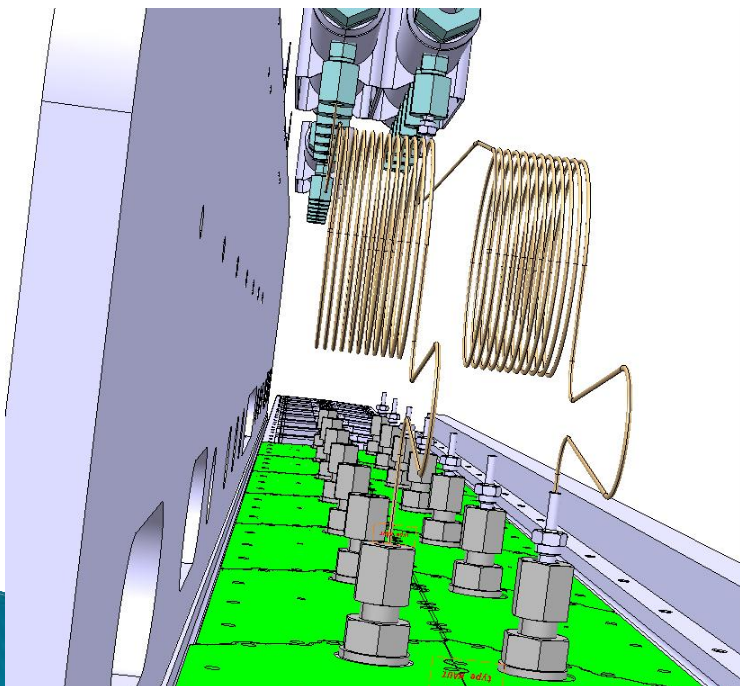


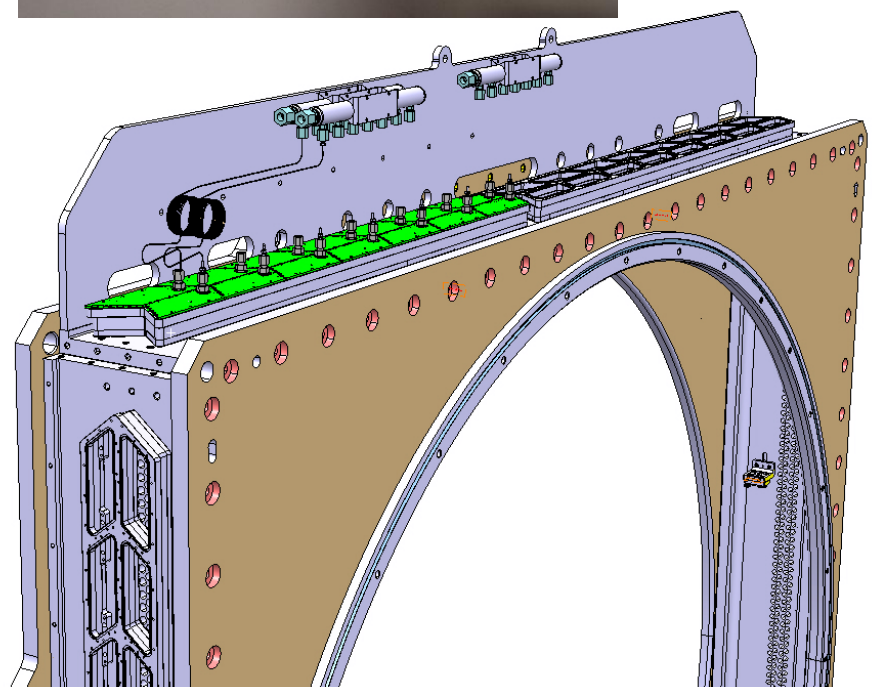
Gas connections

- Manifolds and connectors to covers supplied by SERTO
- Connectors are validated in terms of aging
- Dismountable support plate

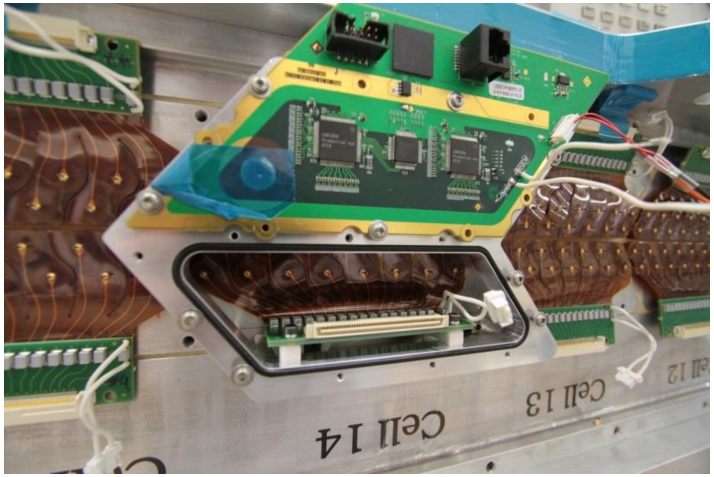


dp=500 mbar

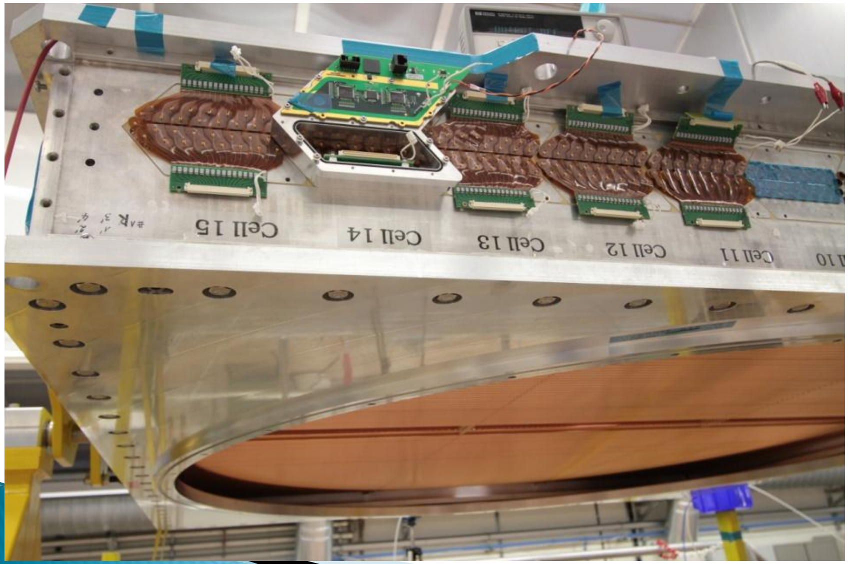


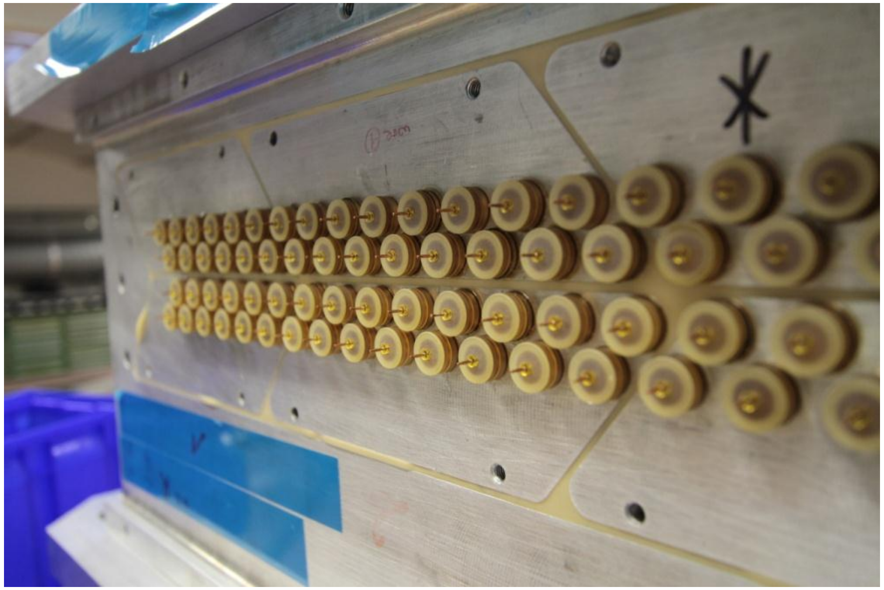


Module 1 wiring and testing



- ~30% wired and tested HV





Module 2 & 3

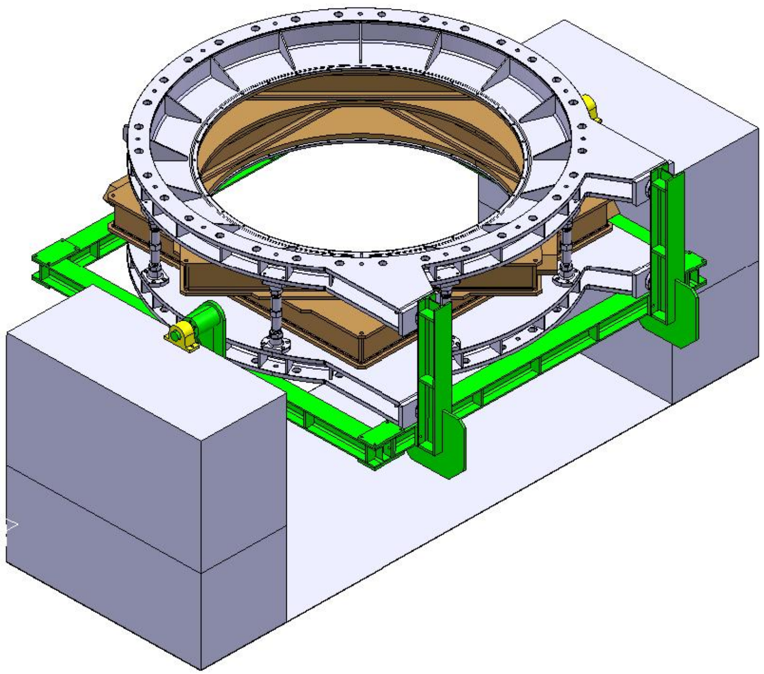
- Module 2
  - Leak testing started

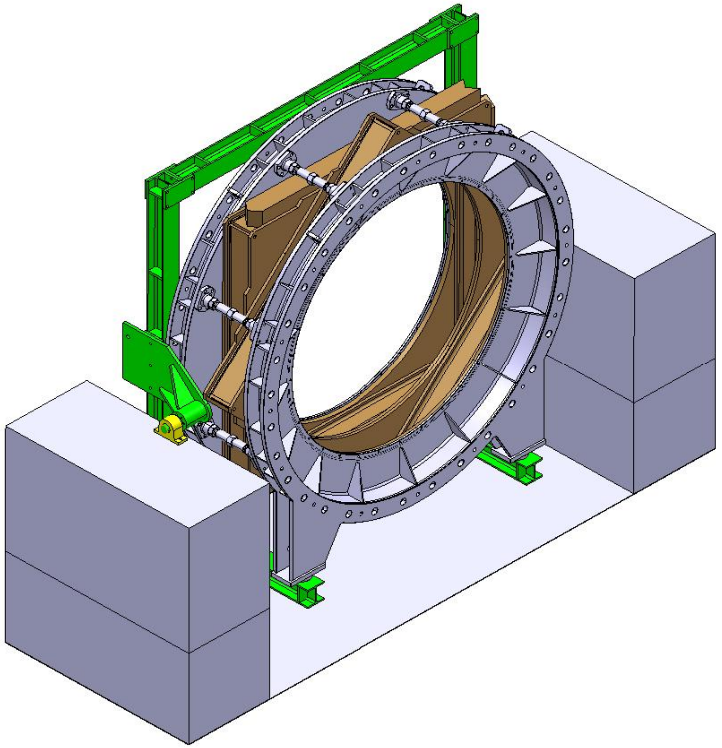
- Module 3 (Dubna)
  - Unpacking, sealing , leak test

Straw Stacking tooling

- Ordered and ready beginning of June

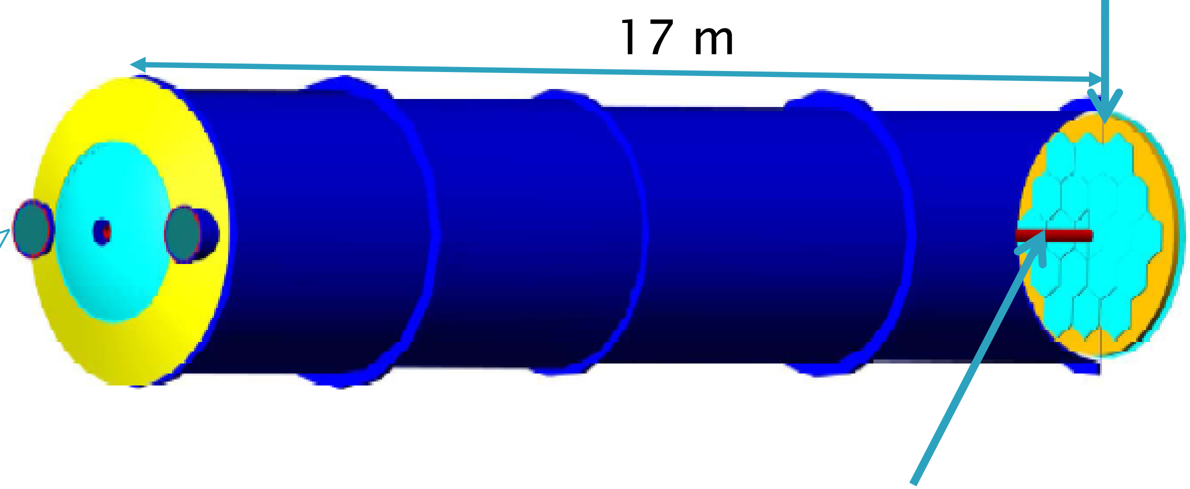
F. Garnier P-A Giudici.

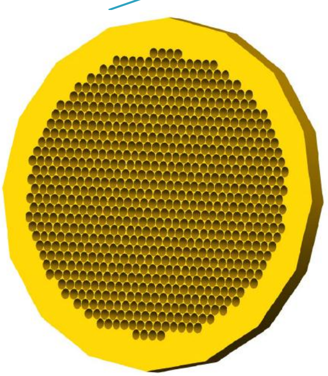




RICH

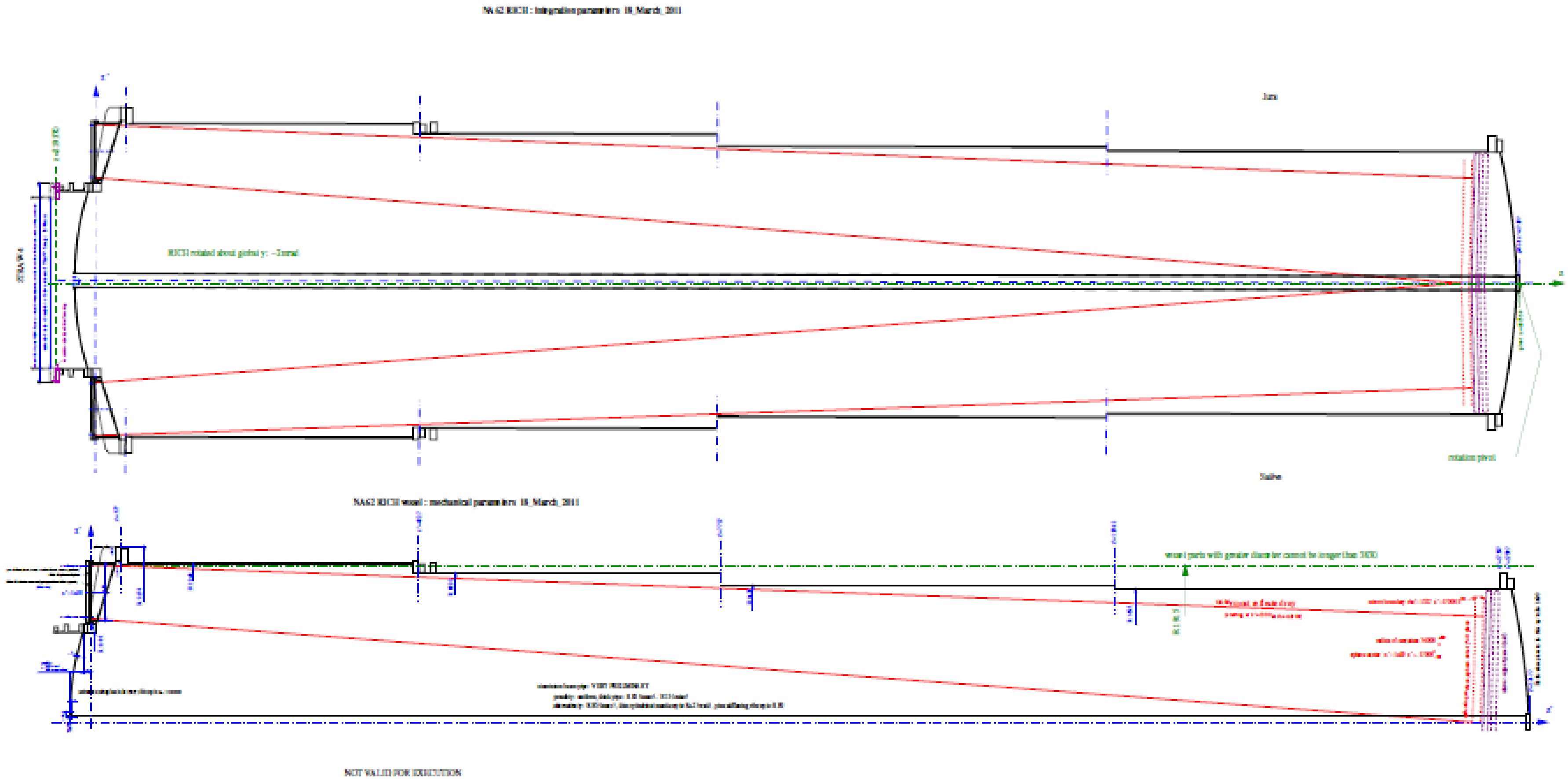
- Separate pions from muons <1% level between 15 and 35 GeV/c
- Track time at 100 ps level
- Partecipate in the L0 trigger





- Neon as Cherenkov radiator
- mosaic of mirrors (17 m focal length)
- two spots with PM (1000 PM per spot)
- beam pipe passing through

Vacuum proof RICH vessel

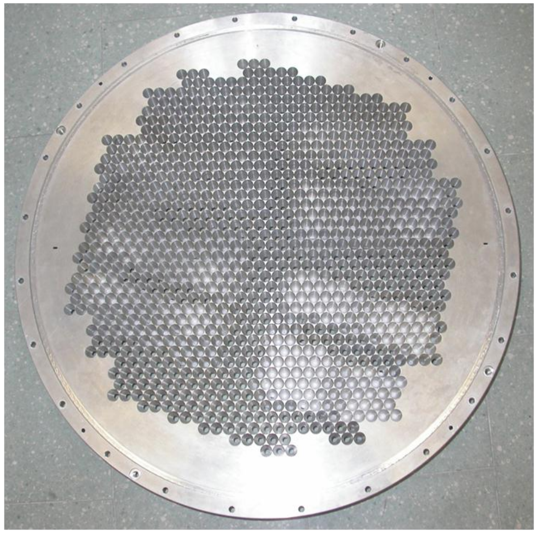


Simplified gas system:implified: inject pure Neon into an evacuated vessel

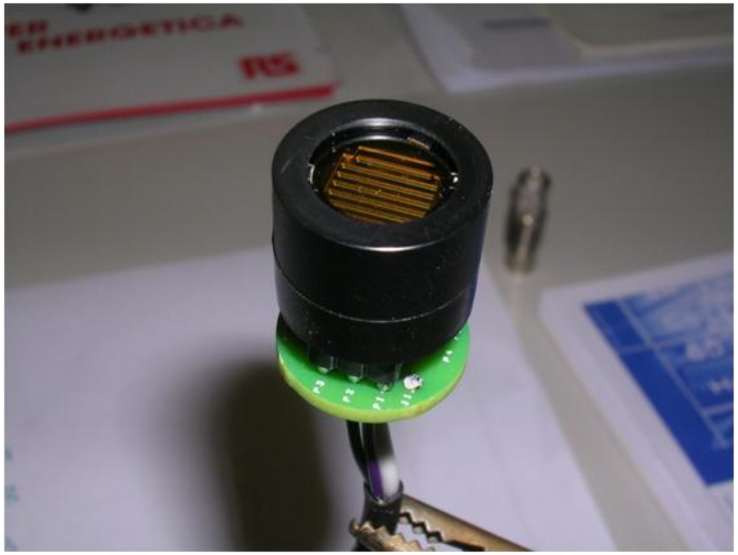
The order to the manufacturer should be submitted before the summer

Photomultipliers

- >2000 PM already available
- Custom made HV divider to be produced in the coming months



One of the two aluminum disk separating the Neon gas from the PMs

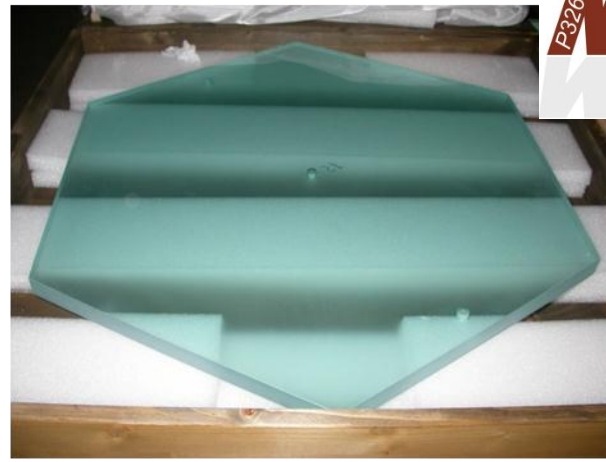


A PM (Hamamatsu R7400-U03) with a prototype HV-divider without the insulating case.

A HV distribution board: for each HV channel (SHV connectors, at the bottom of the figure) four PM are supplied (small black connectors at the top); each board supplies 32 PMs.

Mirrors

- All mirrors at CERN (18 hex + 2 semi-hex)
- Coating to be done at CERN
- Optical quality tests already done



One of the hexagonal mirrors before aluminization.

Mirror support system with a “dummy” mirror:

- hung at the center
- aligned with micrometric piezo.motors

One of the semi-hexagonal mirrors before aluminization

Large Angle Vetoes (LAV)

Installation status

5 LAV installed on the blue tube, the installation lasted 3 weeks
The installation procedures worked perfectly
the same procedure will be used for A6-A8 installation in April

Status of LNF construction

A8 now completed, shipped to CERN on April 12th

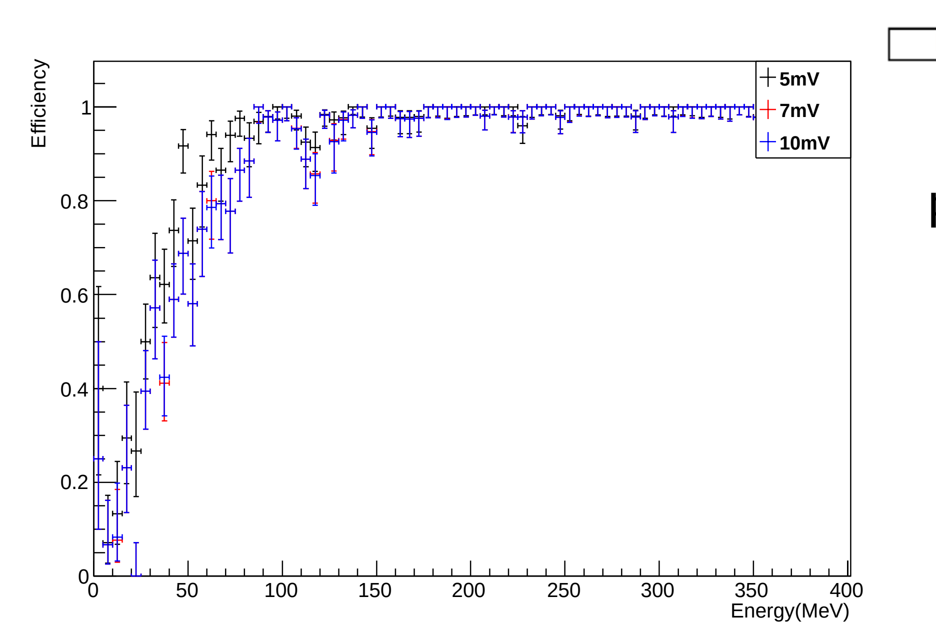
On track for A11 delivery in mid/end-June

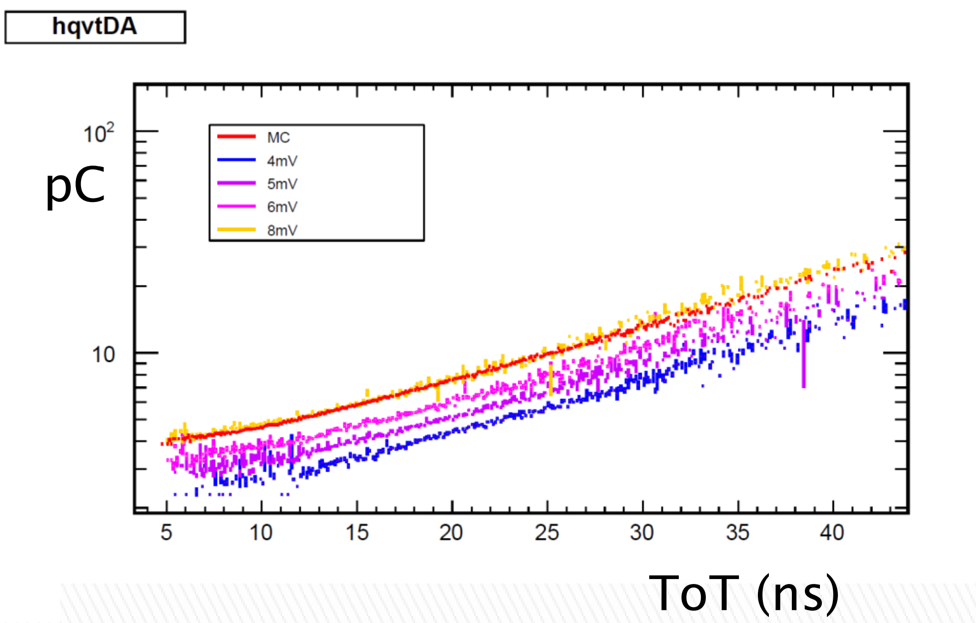
A9-A10 stainless steel vessel: material procurement started

Start planning the A12 design taking into account the CHOD and IRC installation

Progress on LAV simulation

In case of undetected photons by LAV, the other γ from π^0 decay has enough energy to be detected very efficiently by LKr& SAC





LAV inefficiency ε~ 0.3%

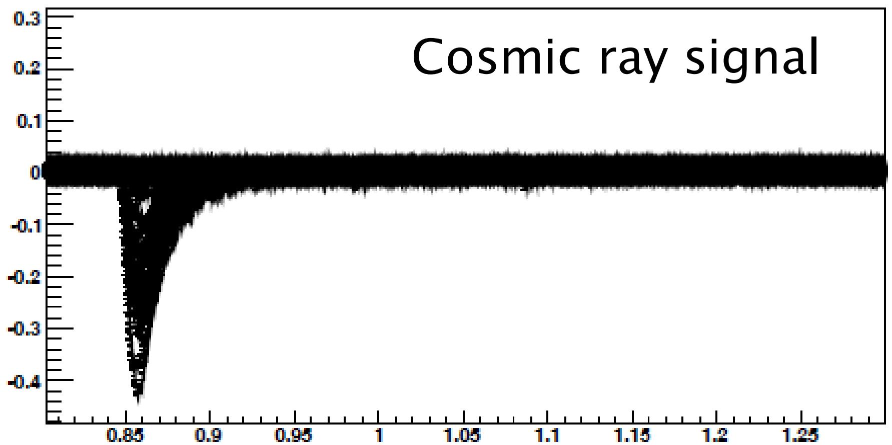
Data MC Comparison

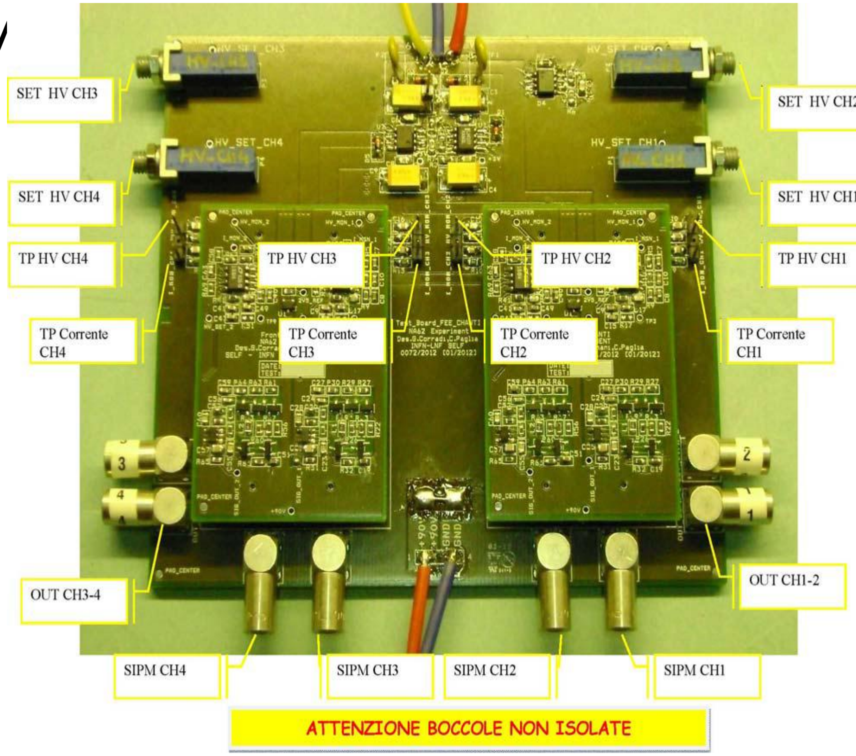
CHANTI

CHANTI first station completed
second station bars test started

FEE: Re-use LAV ToT boards in a two level scheme

CHANTI boards: Set Vbias , FAST amplification, Read single ch current (nA) , read temp probes. First prototype ready

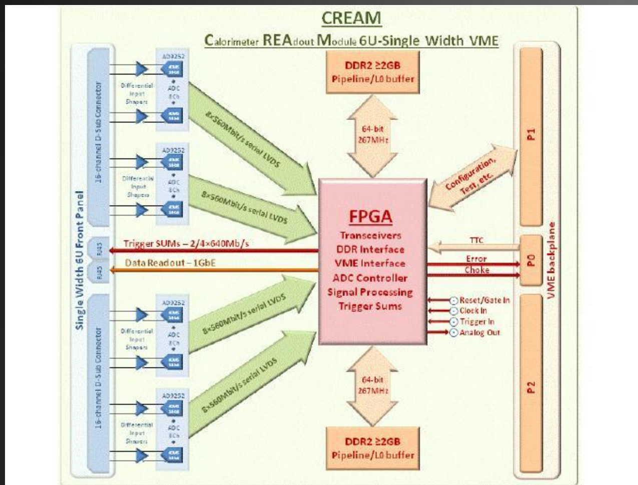




IRC

- Mechanical elements ready
- Lead plates for both sectors produced and tested
  - Alone plate by plate
  - Assembled in a module – all fiber holes are passable with rod with diameter 1.4mm

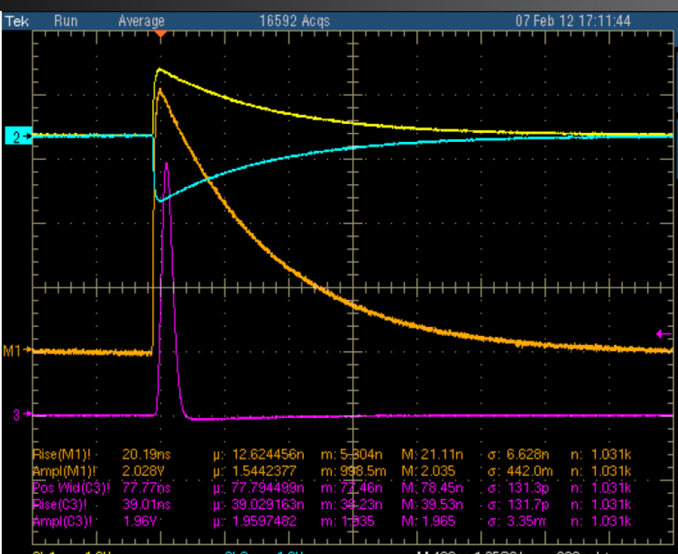
Status of the new LKR readout



Tender assigned to CAEN in September 2011

5 prototypes by July 2012

Supply	Delivery date
Batch N1 – 5 prototype modules - shall be delivered to CERN	July 1, 2012
Batch N2 – 10 Pre-series modules - shall be delivered to CERN	January 1, 2013
Batch N3 – Detailed documentation and firmware documentation - shall be delivered to CERN	January 1, 2013
Batch N4 – 220 series production modules - shall be delivered to CERN	April 1, 2013
Batch N5 – 220 series production modules - shall be delivered to CERN	July 1, 2013

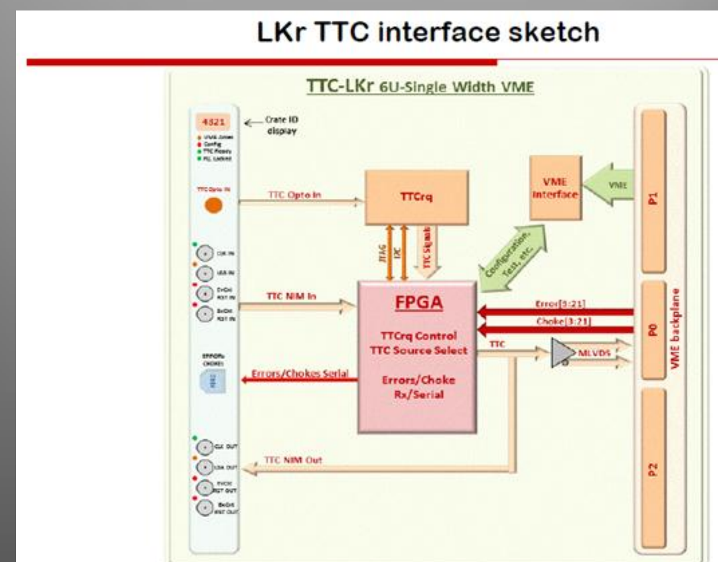


Caen started working on a prototype shaper

FPGA type defined

DDR3 firmware ready

Readout protocol details to be worked out



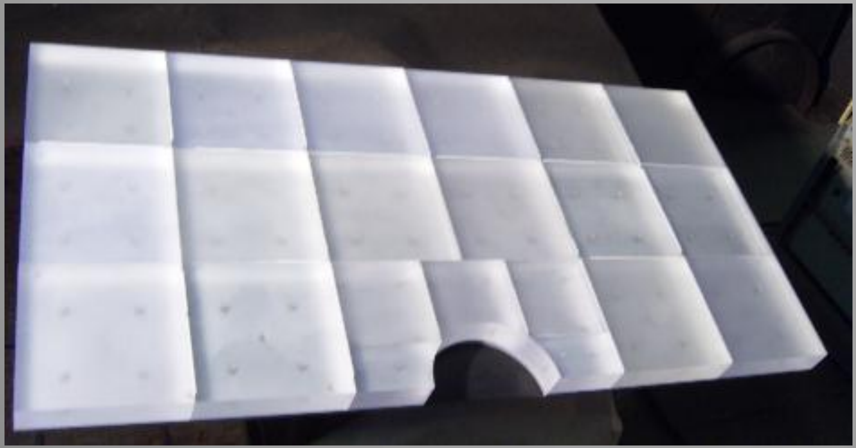
Trigger interface card (1 per crate) being developed at CERN

MUV1&2 Status and Plans

- Progress since Apr 2011:
  - **MUV1 scintillator mass production almost done.**
  - All tools and benches available in Mainz for **mass processing and testing of all 1056 scintillators.**
    (polishing, groove milling, fiber gluing, testing, wrapping, etc.)
  - All **MUV2 & MUV3 PMTs thoroughly tested and calibrated.**
- Plans for 2012:
  - **MUV1 construction in Mainz → Apr-Dec '12**
  - **MUV2 reinstallation, cabling & commissioning → Spring '12**
    ➜ participation in dry & technical run 2012.

MUV3 Status and Plans

- Progress since Apr 2011:
  - Full scintillator production at Protvino.
  - Frame produced (Pisa) and assembled at CERN.
  - MUV3 detector assembled and first tests with cosmics done.
- Plan for 2012:
  - Cabling & commissioning.
  - Participation in technical runs.

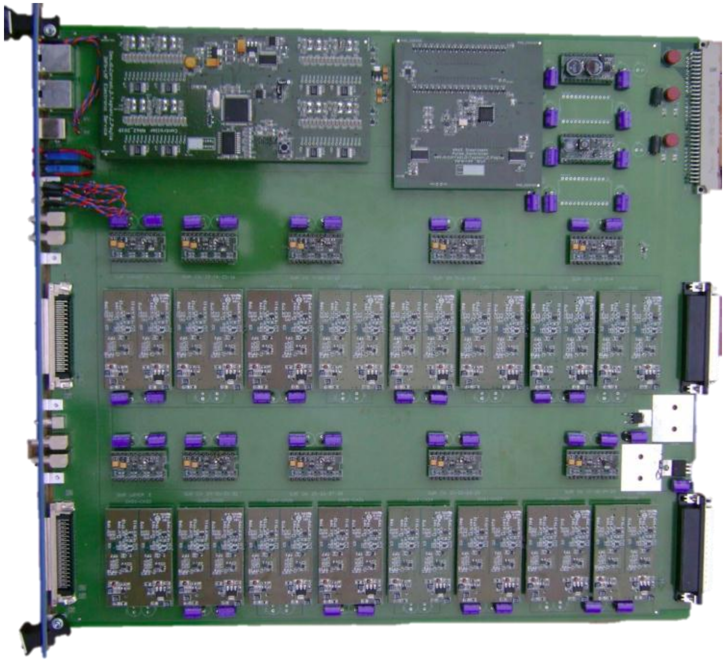


TDAQ

Overview of 2012 runs TDAQ

	# channels (in 2012)	FEE	R/O
CEDAR	128	CEDAR board	TDCB+TEL62
CHANTI	46	Chanti board + LAV FEE	TDCB+TEL62
LAV	480	LAV FEE	TDCB+TEL62
STRAW	~1800	Cover Board + SRB	TEL62
CHOD	128	LAV FEE	TDCB+TEL62
LKR	~5000	CPD+SLM	PCs
MUV2	88	LAV FEE	TDCB+TEL62
MUV3	296	CFD+TRAM	TDCB+TEL62
IRC/SAC	8	LAV FEE	TDCB+TEL62

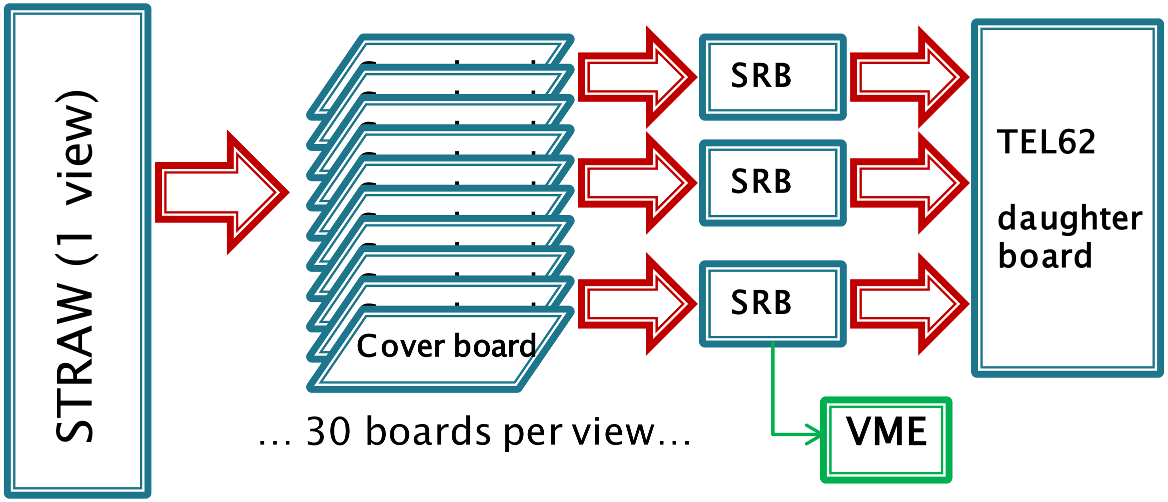
LAV FEE board

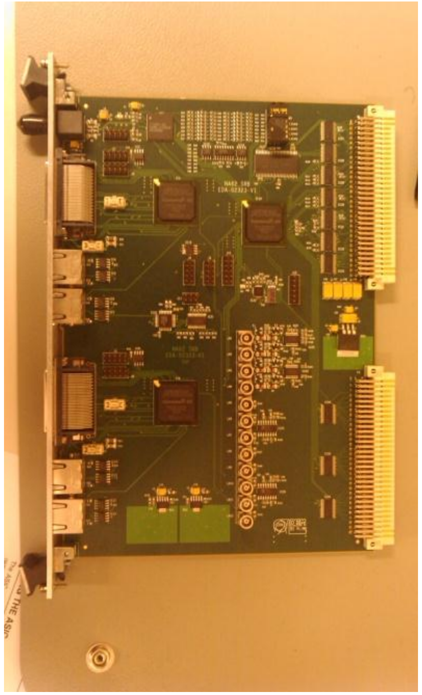


Detector	LAVFEE
CHANTI	2
LAV	15
CHOD	4
MUV2	9
SAC/IRC	1

- ToT (Time Over Threshold) with large dynamic range
- Double threshold
  - Redundant front end
  - Slewing correction
- Control PC, pulser and signal sum
- 9U board with mezzanines
  - 32 input, 64 output
- 31 boards in production
  - Ready and tested for the end of May

Straw readout

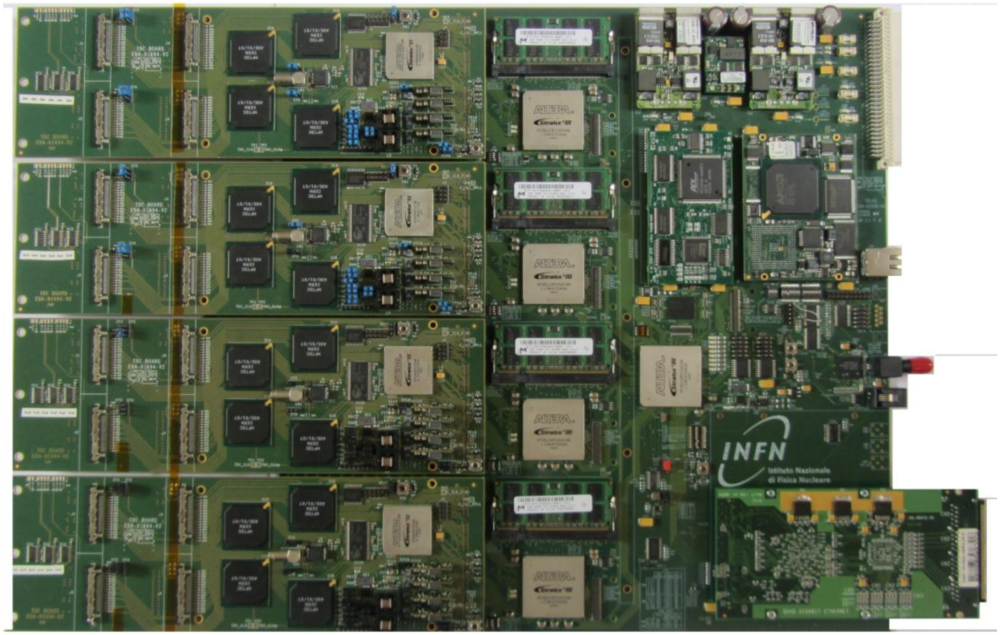




- Cover board and SRB (Straw Readout Board) prototypes are ready:
  - Cover board final production in June
  - SRB final prototype will be ready in June with a simplified version of the firmware.
  - TEL62 daughter board prototype ready in October
- In the Technical Run the readout will be done using VME (fall back solution), in case the daughter board will not be ready.

TEL62 for the 2012 runs

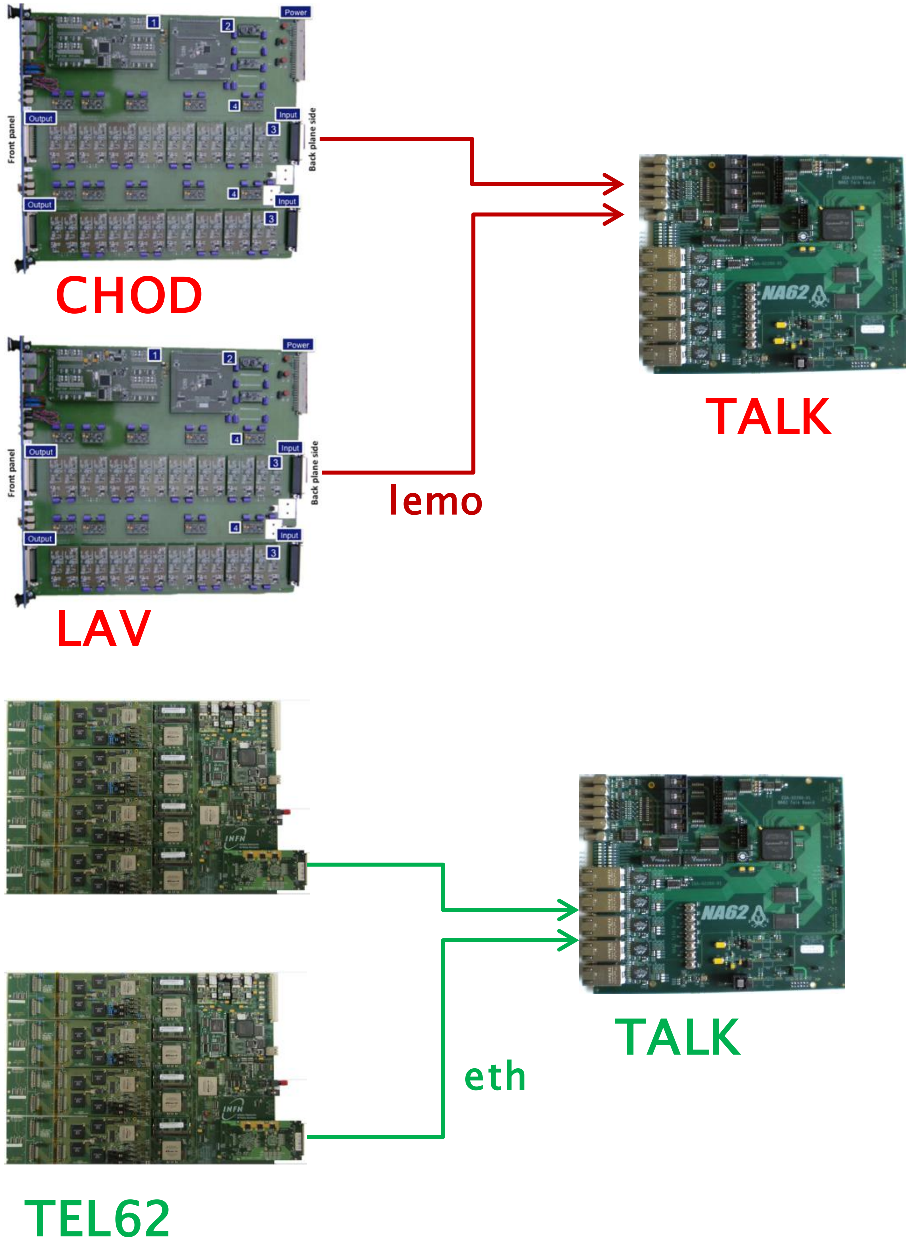
Detector	TEL62
CEDAR	1
CHANTI	1
LAV	3
STRAW	1
CHOD	1
LKR/L0	3
MUV2	1
MUV3	1
SAC/IRC	1



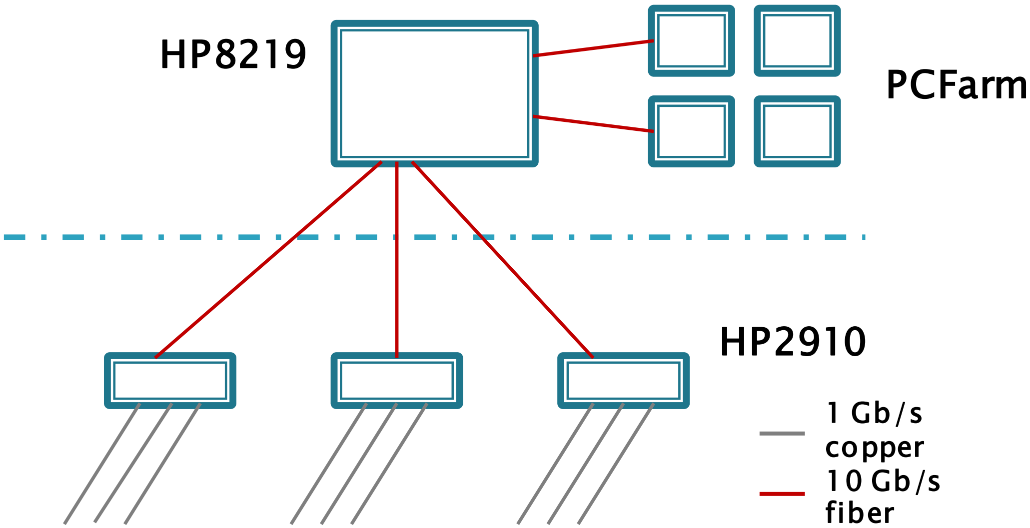
- The TEL62 is a main board to digitize (using daughter boards), buffer data and to build trigger primitives.
- It's an evolution of the LHCb TELL1 board.
- 13 boards in production: will be ready at the end of April.
- Special crates ordered will arrive after Easter.

Triggering with TALK board

- Two ways:
  - With LEMO.
  - Using the primitives produced inside the TEL62.
- The use of the asynchronous primitives is the baseline solution. This depends on the specific firmware inside the TEL62.
- The fall back solution will be done using the signals coming directly from the FEE boards.



PCFarm & Network

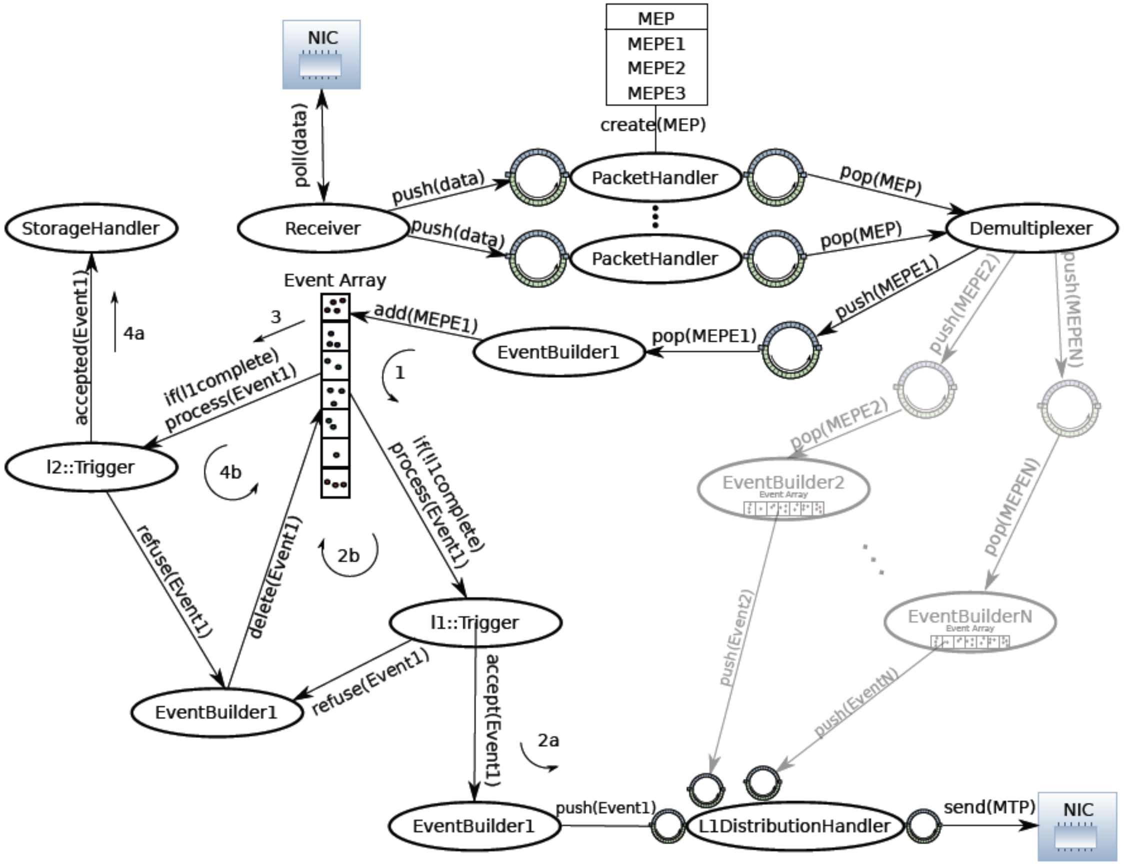


HP2910

HP8212

- 7 x HP2910 already bought.
- HP8212 ordered with 3 “8x10Gb/s” modules and 1 “24x1 Gb/s” module (middle of May).
- Six 12 cores PCs foreseen for this year (to partially test the switches):
  - 2 already available.
  - 4 to be buy soon.
- 10 Racks with cooling door ordered (end of April).

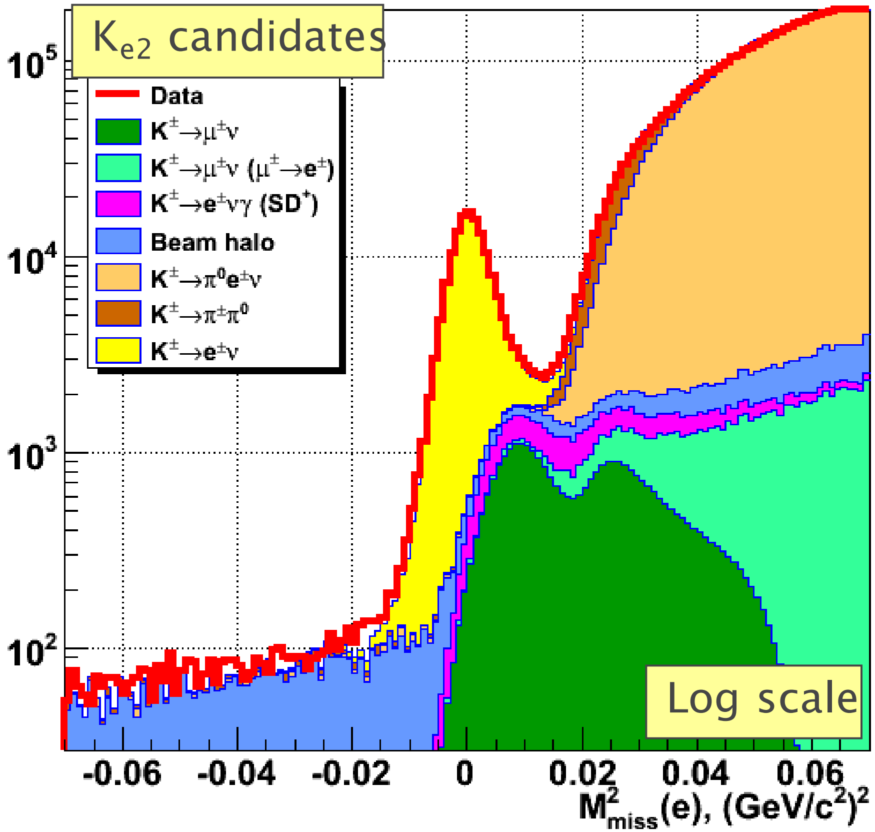
Readout software & Run Control

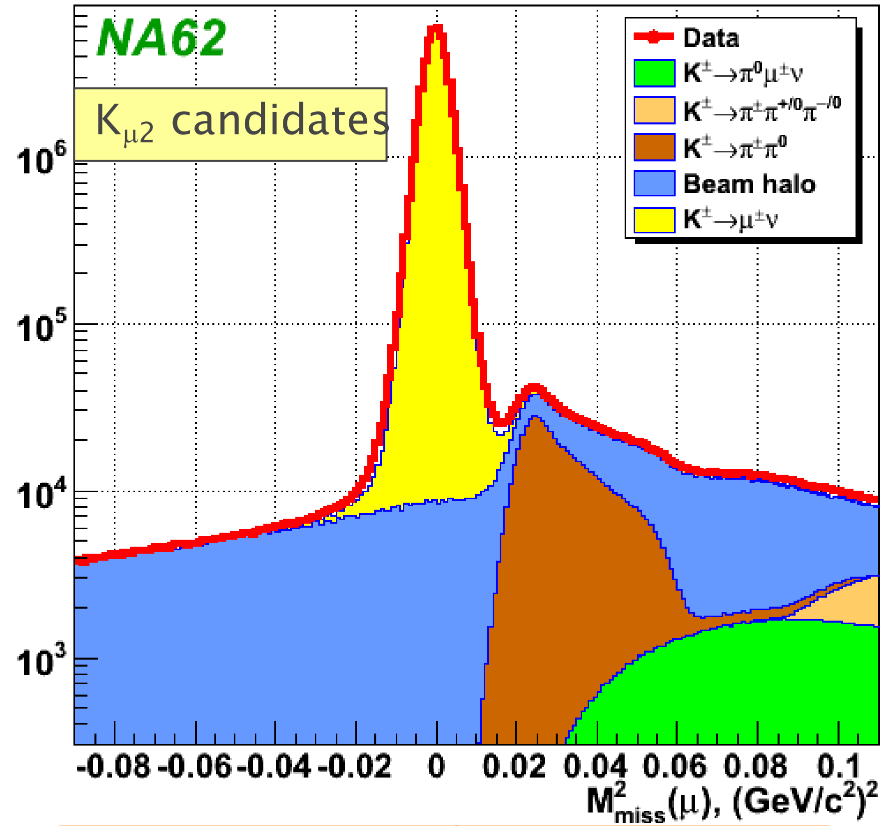


- Readout software almost ready: prototype at the end of April.
- Run Control program in preparation in collaboration with the EN/ICE group: base on PVSS, SMI++ and DIM.

Final $R_K = K_{e2}/K_{\mu 2}$ measurement

K_{e2} and $K_{\mu 2}$ samples





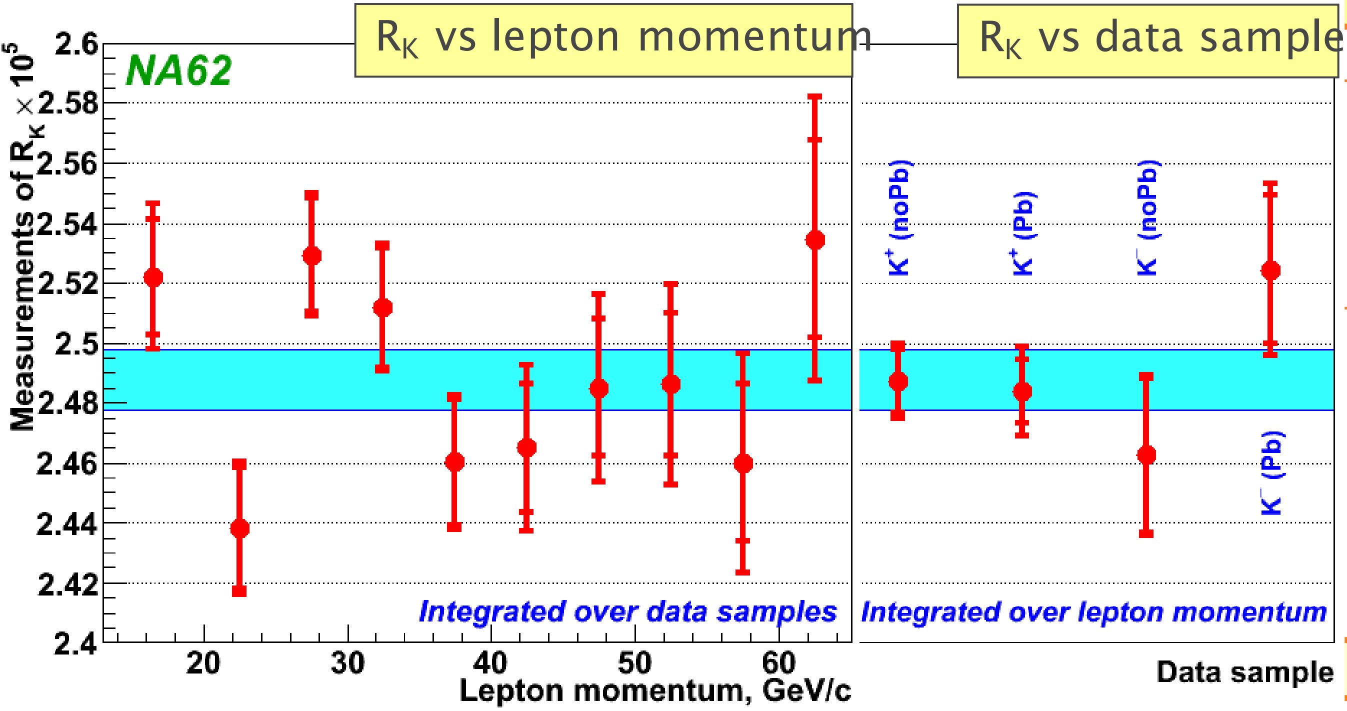
145,958 $K^{\pm}\to e^{\pm}\nu$ candidates.
Electron ID efficiency: (99.28±0.05)%.

Background source	B/(S+B)
$K_{\mu 2}$	(5.64±0.20)%
$K_{\mu 2}$ ($\mu\to e$)	(0.26±0.03)%
$K_{e2\gamma}$ (SD^{+})	(2.60±0.11)%
$K_{e3(D)}$	(0.18±0.09)%
$K_{2\pi(D)}$	(0.12±0.06)%
Wrong sign K	(0.04±0.02)%
Muon halo	(2.11±0.09)%
Total	(10.95±0.27)%

The result (full NA62 data set)

$$R_K = (2.488 \pm 0.007_{stat} \pm 0.007_{syst}) \times 10^{-5}$$
$$= (2.488 \pm 0.010) \times 10^{-5}$$

Fit over 40 measurements (4 data samples $\times$ 10 momentum bins) including correlations: $\chi^2/ndf=47/39$.



Uncertainty source	$\delta R_K \times 10^5$
Statistical	0.007
$K_{\mu 2}$ background	0.004
$K^\pm \to e^\pm \nu\gamma$ (SD$^+$)	0.002
$K^\pm \to \pi^0 e^\pm \nu$, $K^\pm \to \pi^\pm \pi^0$	0.003
Beam halo background	0.002
Thickness of spectrom.	0.003
Acceptance correction	0.002
DCH alignment	0.001
Electron identification	0.001
1TRK trigger efficiency	0.001
LKr readout efficiency	0.001
Total uncertainty	0.010

Partial (40%) data set: PLB 698 (2011) 105.
Full data set: paper to be submitted in April/May 2012.

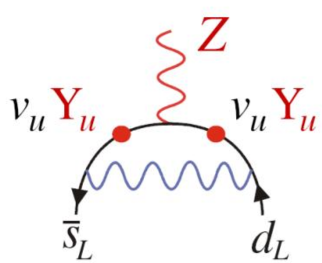
Summary

- Preparations towards the dry and technical run are progressing well
- We will collect important commissioning data (from a sub-set of detectors) before LS1
- NA62 construction is in full swing, the schedule remains tight
- The duration of the injector's shutdown should be as short as possible
- The collaboration wishes to acknowledge the invaluable support provided by CERN and thanks in particular the Support and Technical teams from the PH, EN and TE Departments
- NA62 plans to actively participate to the European Strategy update process

Spares

Kaon Rare Decays and NP

C. The Z penguin (and its associated W box)

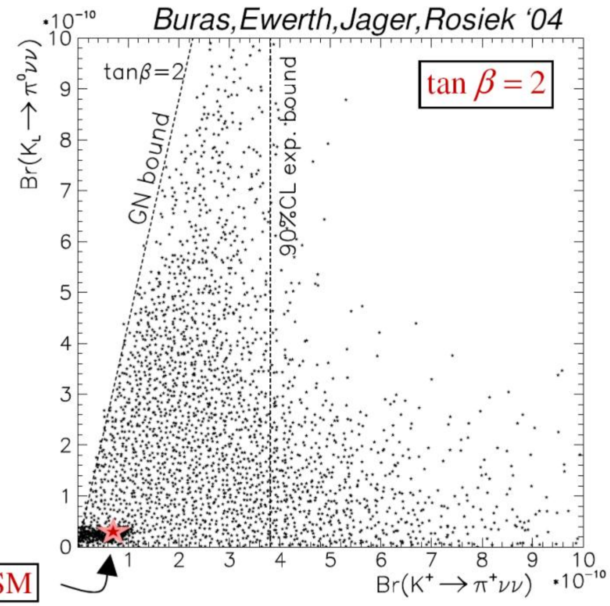


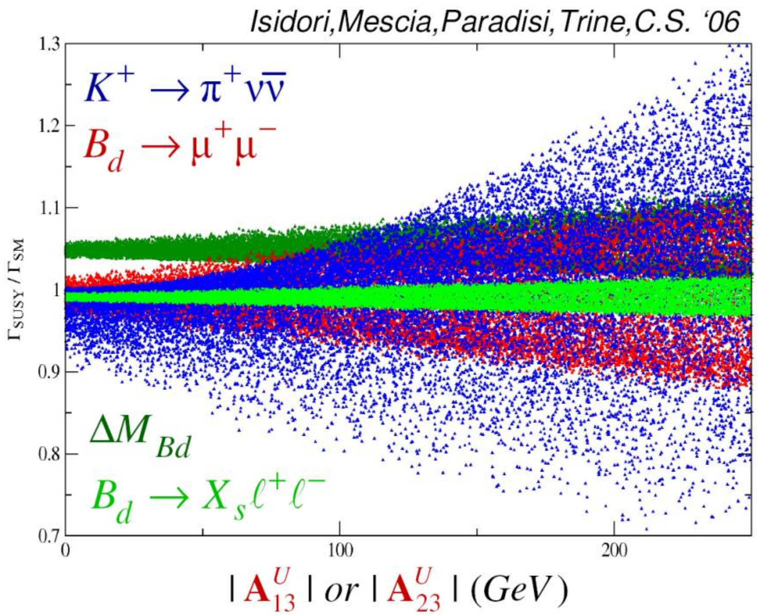
- $SU(2)_L$ breaking: $SM : v_u^2 Y_u^{*32} Y_u^{31} \sim m_t^2 V_{ts}^* V_{td}$

$$MSSM : v_u^2 A_{\tilde{u}}^{*32} A_{\tilde{u}}^{31} \sim m_t^2 \times O(1)\ ?$$

$$MFV : v_u^2 A_{\tilde{u}}^{*32} A_{\tilde{u}}^{31} \sim m_t^2 V_{ts}^* V_{td} \left| A_0 a_2^* - \cot \beta \mu \right|^2 .$$

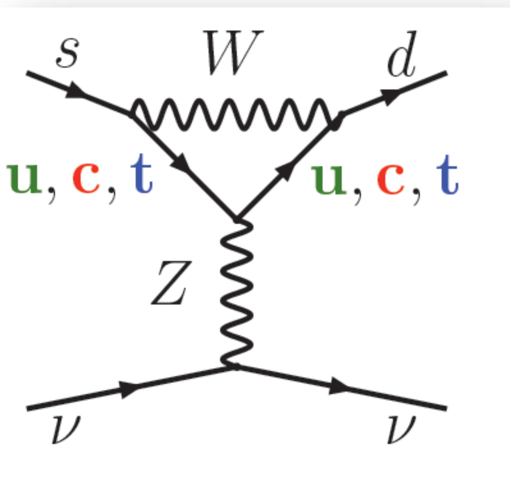
- Relatively slow decoupling (w.r.t. boxes or tree).





(courtesy by Christopher Smith)

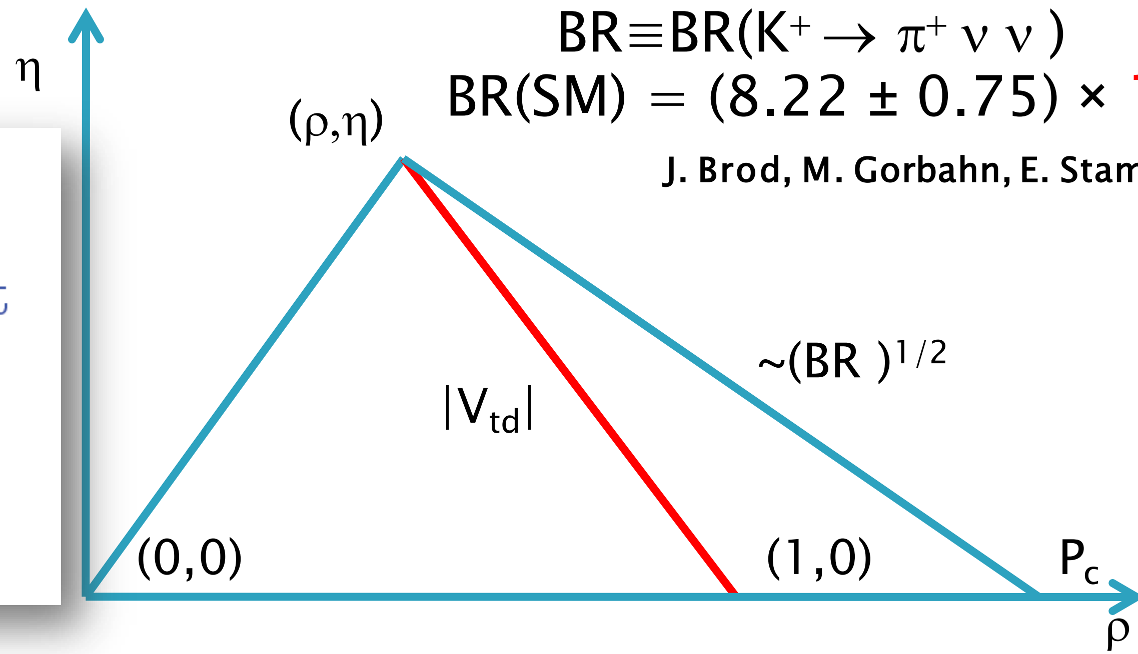
$K^+ \to \pi^+ \nu \bar{\nu}$ in SM



$BR \equiv BR(K^+ \to \pi^+ \nu \nu)$

$BR(SM) = (8.22 \pm 0.75) \times 10^{-11}$

J. Brod, M. Gorbahn, E. Stamou

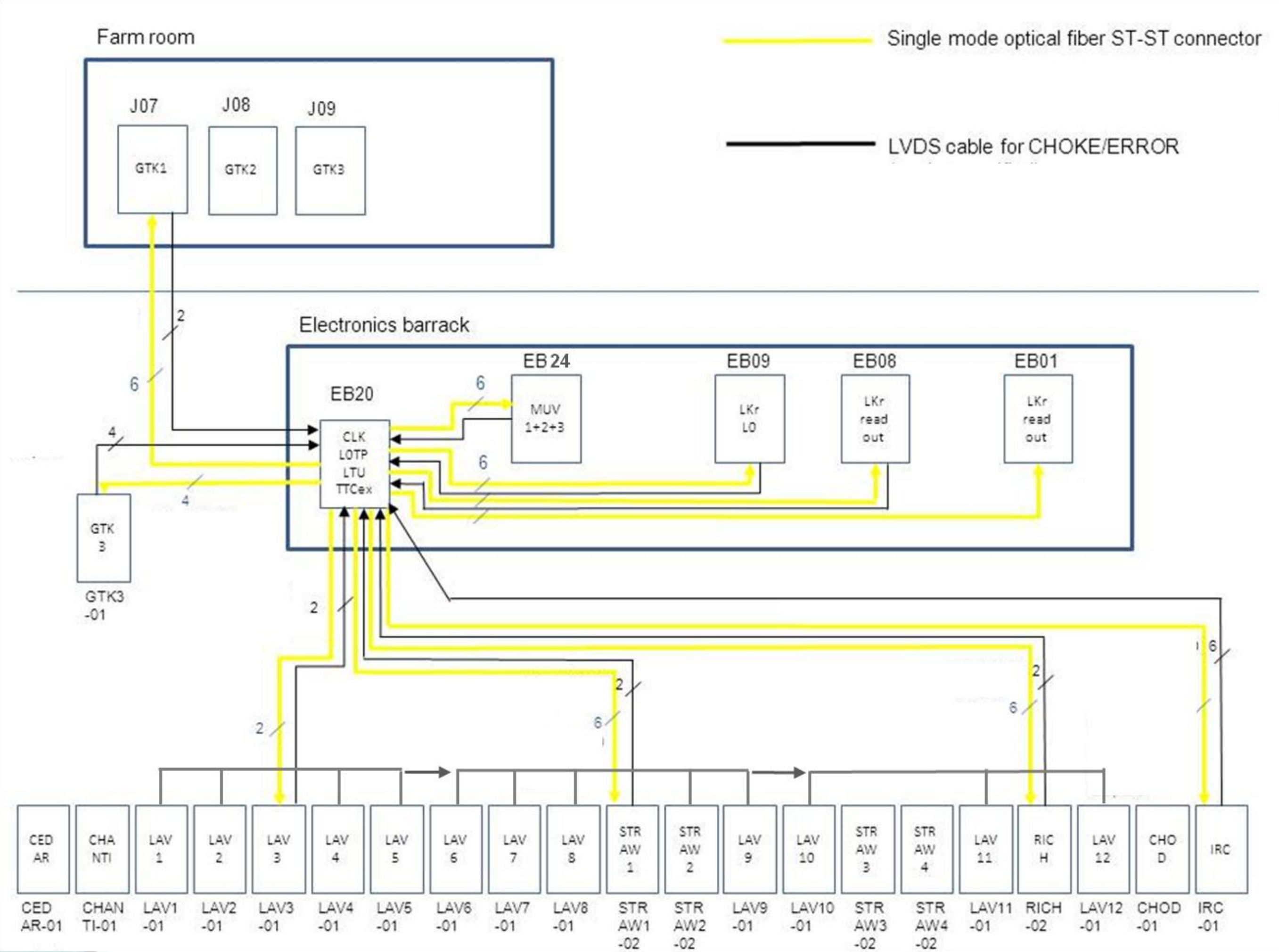


$$\delta\, |V_{td}| \,/\, |V_{td}| \approx 0.4\, \delta P_c / P_c \oplus 0.7\, \delta BR / BR \oplus \delta\, |V_{cb}| \,/\, |V_{cb}|$$

~2 % (mostly $\delta\, m_c$) 62 % BNL 3 %

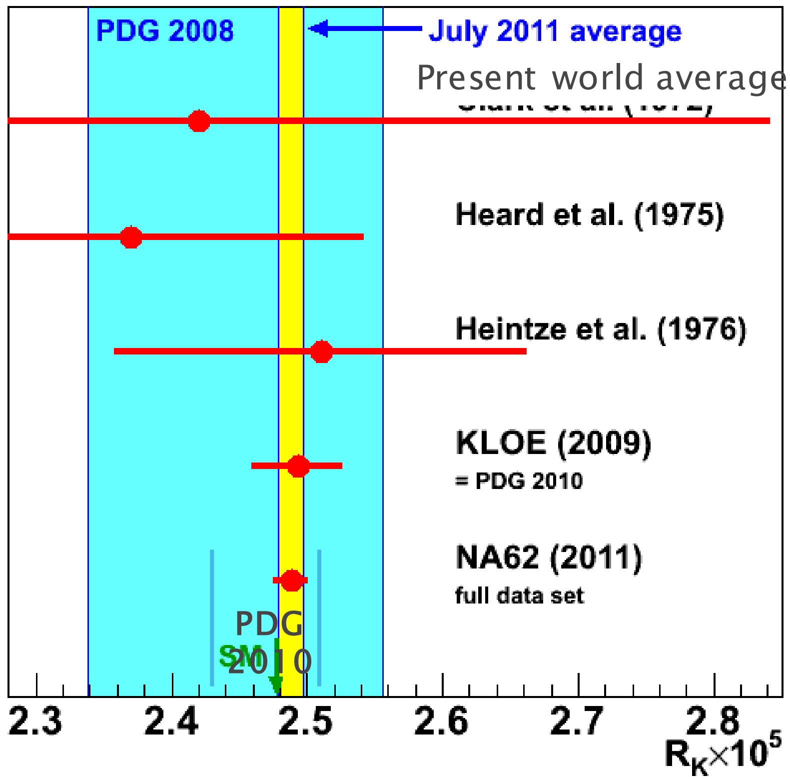
7% aim of NA62 (2y)

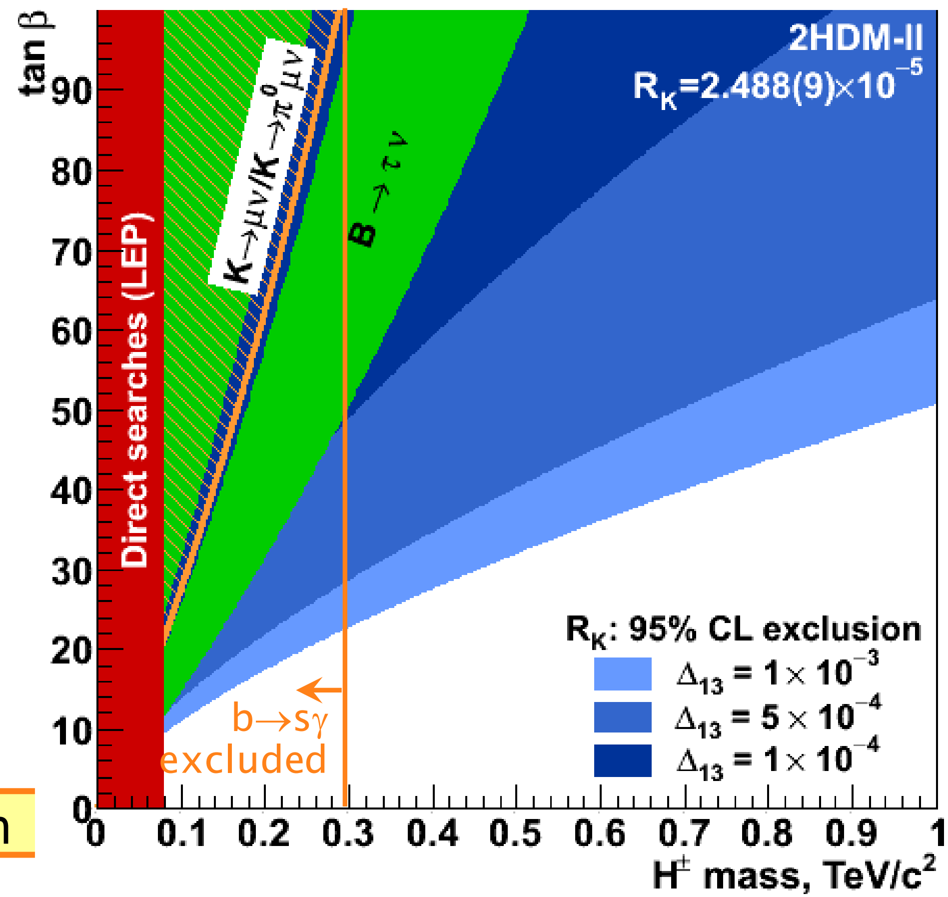
Clock & Trigger distribution



- The fibers for clock & trigger distribution will be installed this week.
- The copper cables for choke/error will be installed after the fibers.
- A board to make the control signals “local OR” (CHEF – CHoke and Error Fan in) has been designed and will be ready in June.

R_K world average





World average	$\delta R_K \times 10^5$	Precision
PDG 2008	2.447±0.109	4.5%
Now	2.488±0.009	0.4%

Other limits on 2HDM-II:
PRD 82 (2010) 073012.

SM with 4 generations:
JHEP 1007 (2010) 006.

Trigger partition: LTU & TTCex

- The L0TP will communicate trigger decision through TTC system.
- The trigger partition for each detector is composed by LTU+TTCex and optical splitters.
- The LTU+TTCex for 2012 runs has been already produced and distributed to the sub-detectors groups.
- The firmware and the control software are complete.