

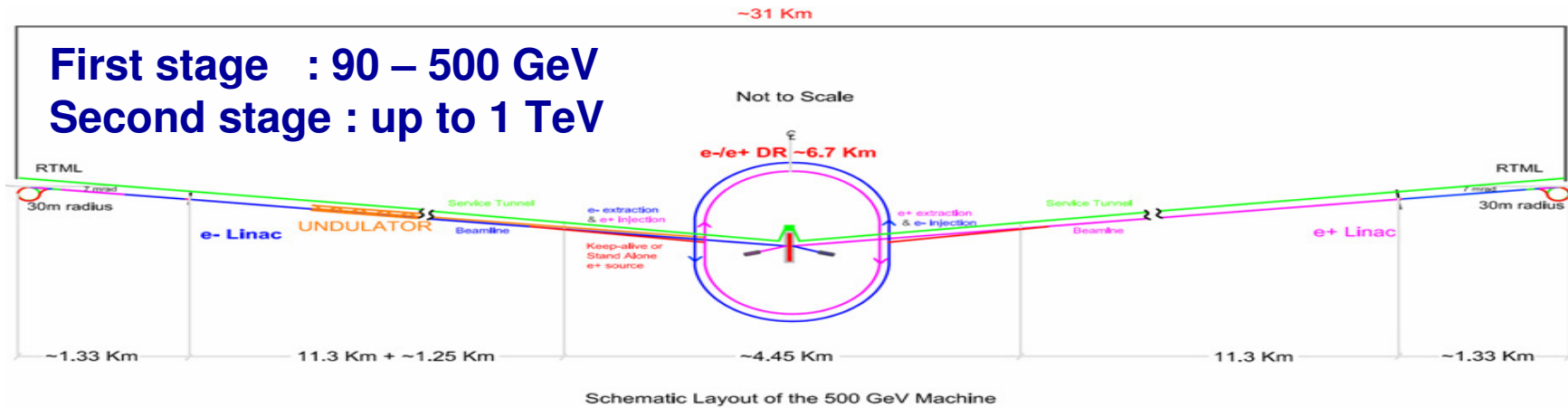
FENOMENE RARE IN FIZICA PARTICULELOR LA ENERGII INALTE

ID_ 806 Contract 253/01.10.2007

Obiective

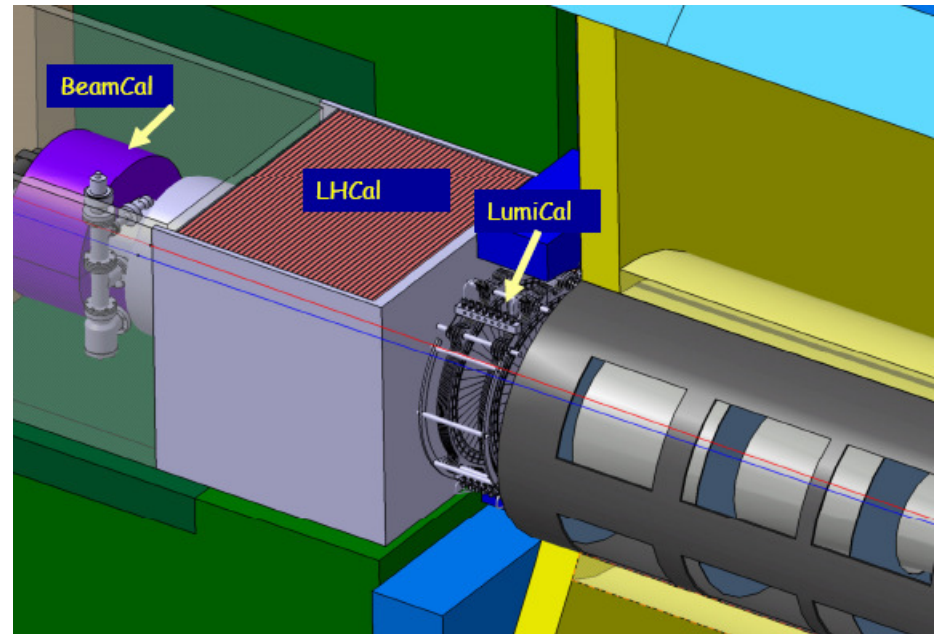
- Participare in studii R&D pentru calorimetrele din zona ILC foarte inainte si simulari de fizica
- Realizarea de studii R&D pentru proiectul NA48/3 (NA62)
- Participare in analiza primelor date colectate cu detectorul LHCb
- Studiile implica cantitati mari de date simulate si putere de procesare si stocare
- Pregatirea platformei de lucru in vederea analizei datelor (simulate si reale din cadrul proiectelor si experimentelor). Introducerea cluster-ului de computere existent in circuitul de Grid si obtinerea inregistrarii ca 'site'

ILC – International e+e- Linear Collider



FCAL Collaboration R&D for the Very Forward Region of the ILC

1. BeamCal
2. LumiCal
3. GamCal
4. Pair Monitor



BeamCal

Scopul detectorului:

- Detectie eficienta a electronilor de mare energie la unghiuri polare foarte mici – important pentru identificare de particule
- Protejarea detectorului intern de retroimprastierea perechilor de beamstrahlung
- Distributia spatiala a depunerilor de energie contine informatii despre ciocnire
- Folosirea unui algoritm rapid pentru extragerea parametrilor fasciculului pentru imbunatatirea parametrilor acceleratorului
- BeamCal va fi lovit de o cantitate mare de perechi e+e- produse de fotonii de beamstrahlung

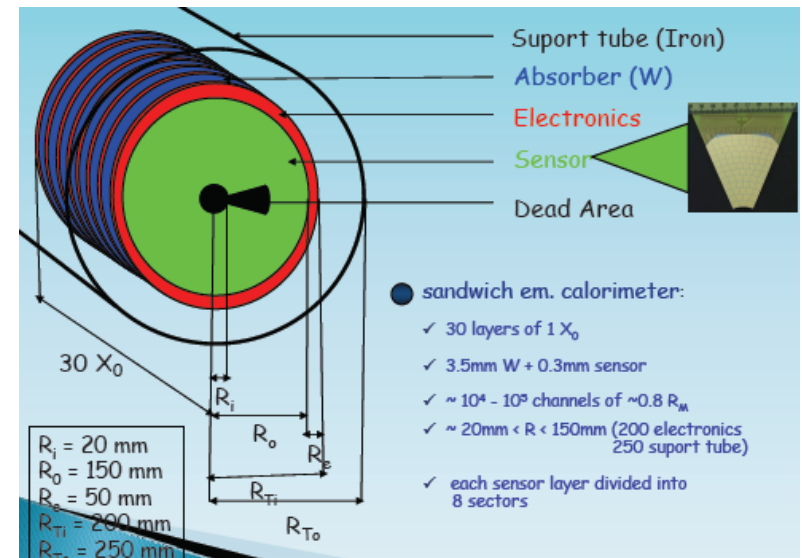
Studiile de simulare :

- investigarea fondului electromagnetic , in senzori si electronica

- dezvoltarea shower-ului electromagnetic in BeamCal
- distributia energiei depuse de perechile e+e- in fiecare strat de senzor si in dispozitivele electronice
- determinarea dozelor de radiatie in fiecare senzor si dispozitivele electronice
- investigarea fluctuatiilor fondului e+e- de la bunch la bunch, pt o statistica de 40 BX (determinarea energiei medii depuse in fiecare celula a senzorului si abaterea standard de la medie)

▪ - investigarea fondului hadronic (neutroni), in senzori si electronica

- distributia numarului de neutroni in planul senzorului
- determinarea fluxului de neutroni in straturile de senzor (in fiecare ring al senzorului)
- determinarea fluentelor de neutroni in dispozitivele electronice



BeamCal-design

Rezultate continute in:

Publicatii:

- **“Expected electromagnetic and neutron doses for the BeamCal at ILC”**

Acceptata (2009) pentru publicare in **Romanian Journal of Physics**

- **“ILC Reference Design Report Volume 4 – Detectors”.**

FERMILAB-APC, Dec 2007. e-Print: [arXiv:0712.2356](https://arxiv.org/abs/0712.2356) [physics.ins-det];

cernrep/2007-006_v4, 211p, 2007 http://doc.cern.ch/yellowrep/2007/2007-006_v4/2007-006_v4.pdf

- **“International Large Detector Letter of Intent ILC-LoI”, 2009**

<http://www.ilcild.org/documents/ild-letter-of-intent/LOI.pdf/view>

validata de juriul experti international IDAG (**International Detector Advisory Group**)

Prezentari:

- **Doses and bunch by bunch fluctuations in BeamCal at the ILC**, E. Teodorescu

<http://www-zeuthen.desy.de/ILC/fcal/>:

[FCAL Collaboration Meeting](#), 29-30 June, 2009, DESY-Zeuthen, Germany

- **Energy spectra and particle distributions in BeamCal at the ILC**, E. Teodorescu

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[FCAL Collaboration Workshop](#), 6-7 May , 2008, Krakow, POLAND

- **FCAL Report**, W. Lohmann

<http://ilcagenda.linearcollider.org/contributionDisplay.py?contribId=129&sessionId=22&confId=2628>

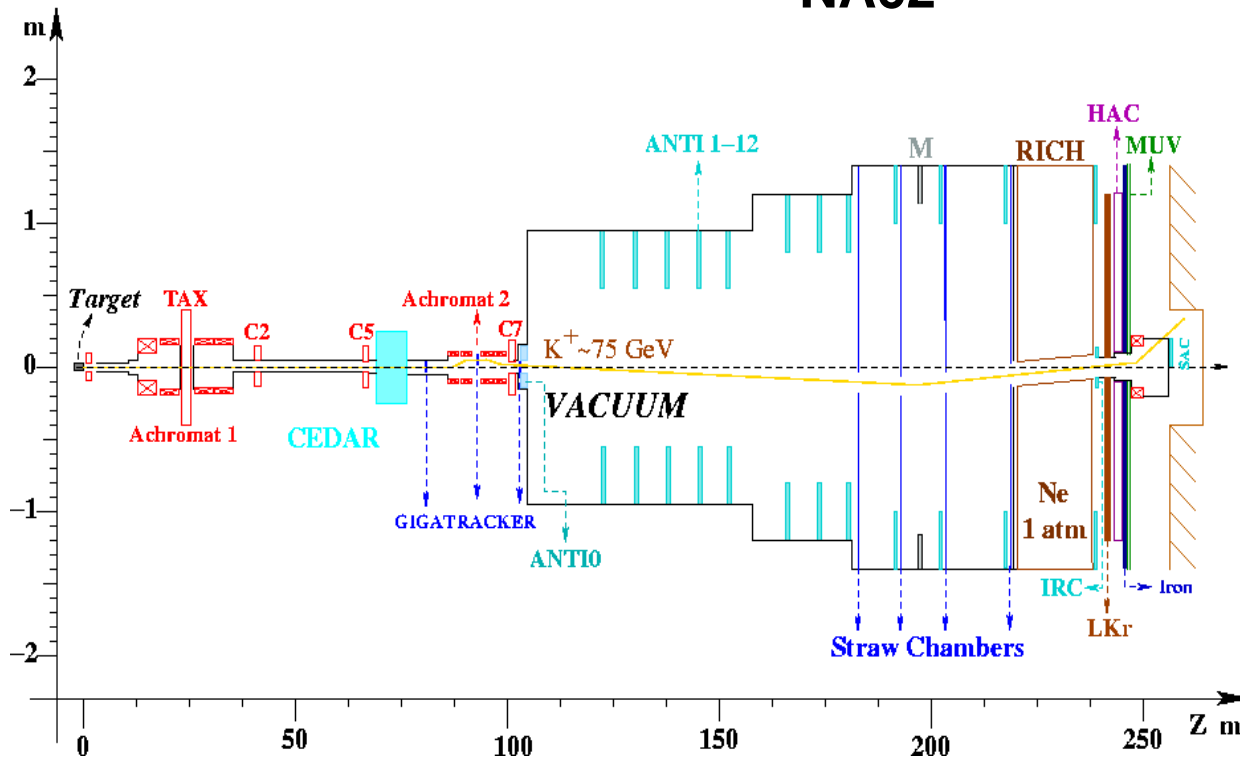
LCWS08 and ILC Workshop, Chicago 2008

Lucrare masterat:

- **“Simulations of Electromagnetic and Hadronic Background in BeamCal at the ILC”, 2008 E.**

Teodorescu

NA62



Instalatia NA62 :

- **CEDAR** – contori Cherenkov diferentiali -> indentificarea K^+
- **RICH** –separarea pionilor de muoni
- **GIGA TRACKER** – determinarea traiectoriei fasciculului inainte de a intra in regiunea de dezintegrare
- **ANTI-vetouri fotonice** ce inconjoara tancul de dezintegrare
- **SPECTROMETER** – determinarea directiei si impulsului pionului rezultat din dezintegrarea kaonului

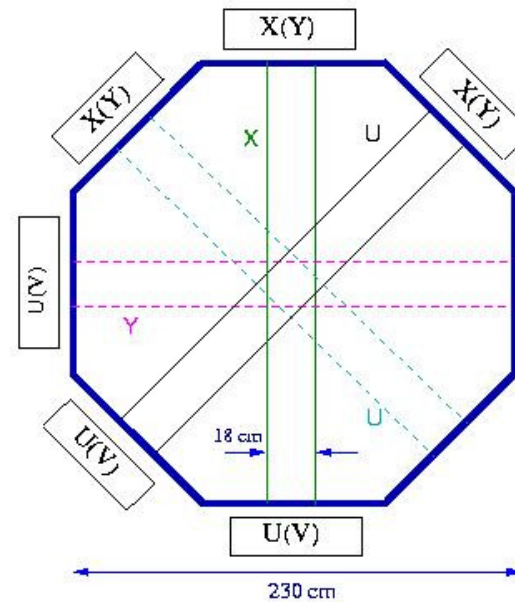
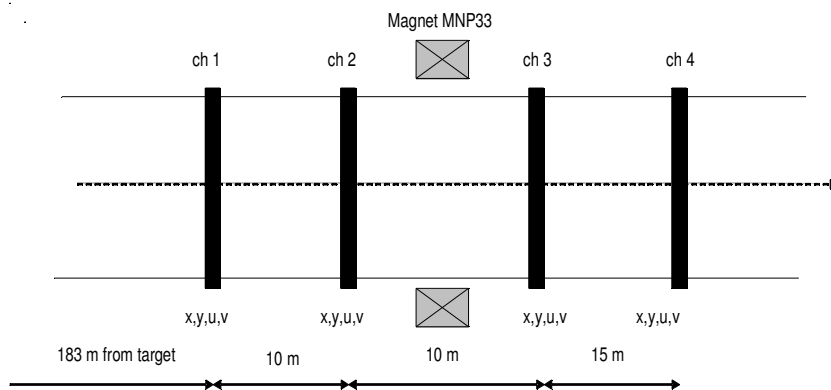
Experimentul in pregatire NA62 intentioneaza sa masoare dezintegrarea ultra-rara $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ la acceleratorul SPS CERN prin colectarea unui exemplar larg (80-100) de dezintegrari cu fond mic (semnal/fond, S/B, ≈ 10), folosind dezintegrarile in zbor a $75\text{GeV}/c$ K^+ . Scopul principal urmarit consta in masurarea raportului de ramificare si a elementului de matrice CKM, V_{td} care este putin cunoscut, cu precizie de $\approx 5\%$.

Masuratori precise ale $\text{Br}(K \rightarrow \pi \nu \bar{\nu})$ ofera o cale independenta de determinare a triunghiului de unitaritate si oportunitatea de a realiza un test precis al MS si a cauta efecte pentru o noua fizica (NP)

Straw tracker

Straw tracker \Leftrightarrow 4 camere straw tubes, fiecare camera avand 4 vederi - pentru detectia si masurarea directiei si impulsului produsilor de dezintegrare incarcati

- 'straw tracker' trebuie sa opereze in vid ($\approx 10^{-7}$ mbar)



Responsabilitate: Dubna si CERN

Participam alaturi de grupul Dubna

Implicare in

program de reconstructie (atat pentru date simulate cat si pentru date reale):

- familiarizarea cu codul de reconstructie a tracku-rilor particulelor de interes
- actualizarea geometriei detectorului (trecerea de la 6 camere straw si 2 magneti la 4 camere si 1 magnet)
- obtinerea si compararea rezultatelor noului setup cu rezultatele furnizate de setup-ul anterior
- In continuare se urmareste folosirea codului de simulare al intregului setup al experimentului si compararea rezultatelor obtinute cu rezultatele furnizate de codul specific straw-tuburilor

Proiectul ***Measurement of the rare decay $K^+ \rightarrow \pi^+ \nu \nu$ at the CERN SPS (NA62)*** propus de IUCN/ pentru anii 2010-2014, unde **grupul nostru** (C. Coca, L. Dumitru, M. Orlandea si E. Teodorescu) **este co-autor**, a fost prezentat la 31st meeting “PAC (Programme Advisory Committee) for Particle Physics”, 10-11 iunie 2009, IUCN-Dubna. **PAC** a recomandat aprobarea participarii (in continuare) in proiectul NA62/CERN de importanta stiintifica deosebita. http://www.jinr.ru/img_sections/PAC/PP/31/31-PAC-PP-Recom-eng.pdf

The Large Hadron Collider beauty experiment for precise measurements of CP violation and rare decays

LHCb este un experiment dedicat fizicii particulelor beauty la LHC. LHC-ul este considerat o sursa foarte bogata in particule beauty din intreg spectrul (B^\pm , B^0 , B_s , B_c si barioni-b)

LHC va intra in functiune spre sfarsitul lunii noiembrie

Activitatile R&D legate de proiectul LHCb (incepand cu 1996) au fost continute in alte proiecte anterioare

In cadrul proiectului IDEI s-a prevazut participarea, in special, la analiza primelor date luate la LHC (2009-2010)

Realizari

- **“The LHCb Detector at the LHC”** (A. Augusto Alves jr, .., C.Coca, D.D Dumitru, D.T. Dumitru, .., M. Orlandea,.. R. Petrescu, T.Preda...A.Rosca, .. V.I. Rusu, et al, **JINST 3 S08005, 2008** <http://iop.org/EJ/Jinst/>
(Journal of Instrumentation **JINST**, impact factor pe primi 3 ani de **0.333** ; Journal nou, din 2006)

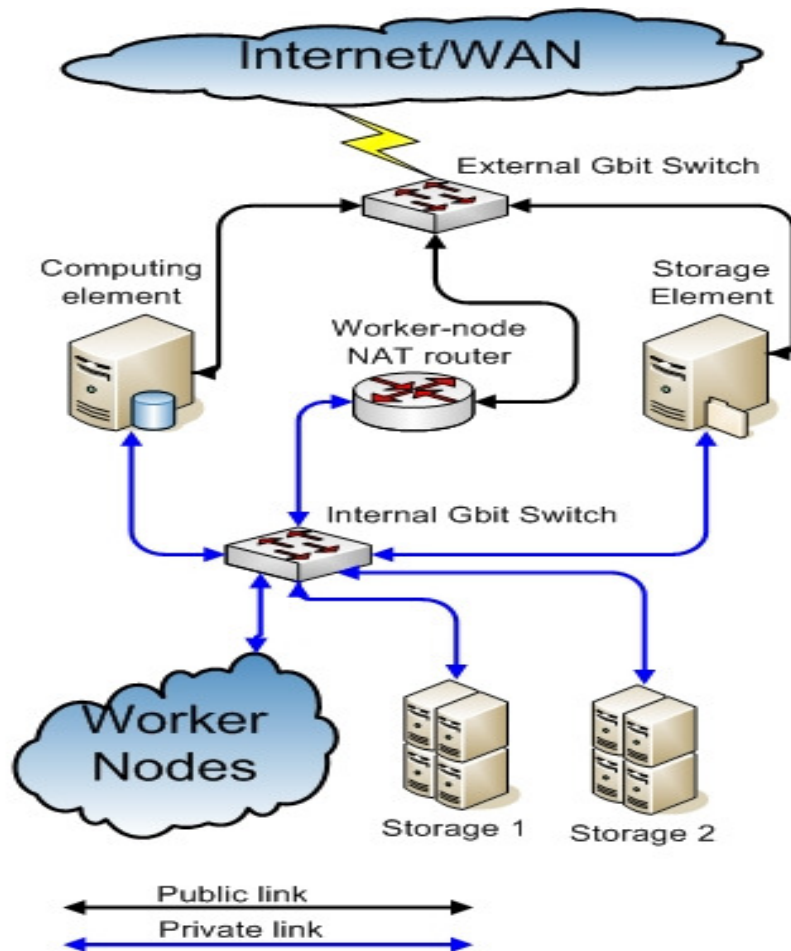
- **“The LHCb Hadronic Calorimeter”**

(Yuri Guz for LHCb collaboration/. ..C.Coca,..M. Orlandea et al.), presented at *XIII Intern. Conf. on Calorimetry in High Energy Physics (CALOR 2008)*, Pavia, Italy, May 26th -30th, 2008; published in **Journal of Physics: Conference Series 160 (2009) 012054**

- **Simulari Monte Carlo utilizand site-ul RO-15-NIPNE (continuare)**

Pregatirea platformei de lucru, local si conectarea la retea de tip Grid

- dezvoltari aduse cluster-ului de computere al grupului, achizitionat anterior, si incadrarea acestuia in retea de Grid cu dezvoltarea infrastructurii de GRID specifica
- pe cluster-ul nostru, *RO-15-NIPNE*, s-au instalat si ruleaza uneltele software specifice pentru doua Organizatii Virtuale (VO): LHCb si ILC



Hardware resources of RO-15-NIPNE *Network Topology*

Computing system
Full Gigbit links

Two segments for security reasons:

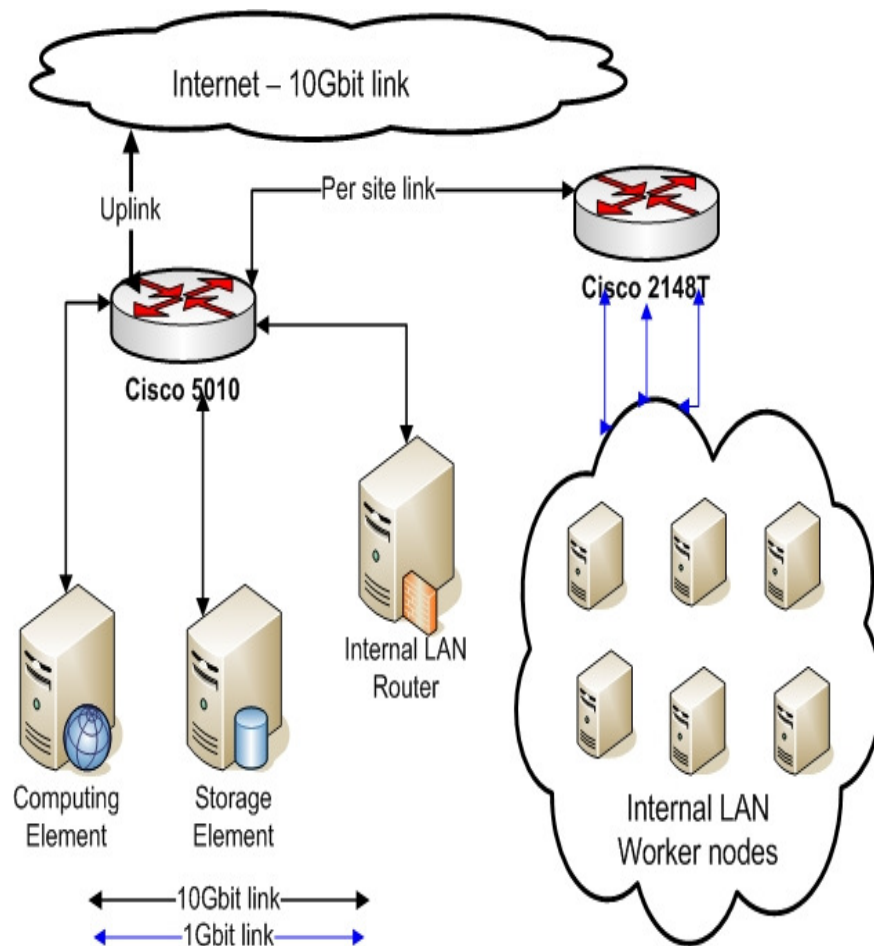
- *Private segment:*
worker-nodes and storage
- *Public segment:*
router, CE, SE

Hardware resources of RO-15-NIPNE



- 2 x Rack 44 U
- 20 Systems - dual xeon
3 GHz (single core), 4 Gb RAM, 300 Gb Hdd
- 5 Systems – dual xeon 2 GHz (quad core), 16 Gb RAM, 200 Gb HDD
- 2 Storage systems dual xeon
3 GHz, 4 Gb RAM, 12,8 Tb HDD
- 2 x Switch 24ports Gigabit
- Ups 2 x 5000 VA, 2000 VA
- Link Gigabit
- Cold system 36000 BTU

Future upgrades of RO-15-NIPNE



New resources

10Gbit network link on CE, SE, Router and LAN

VLAN-aggregated structure on Cisco 5010

Worker nodes and storage pool on full Gbit network

– Storage system will support an additional 6TB from 12.5 actual capacity

– 14 systems (8 core) in 2010

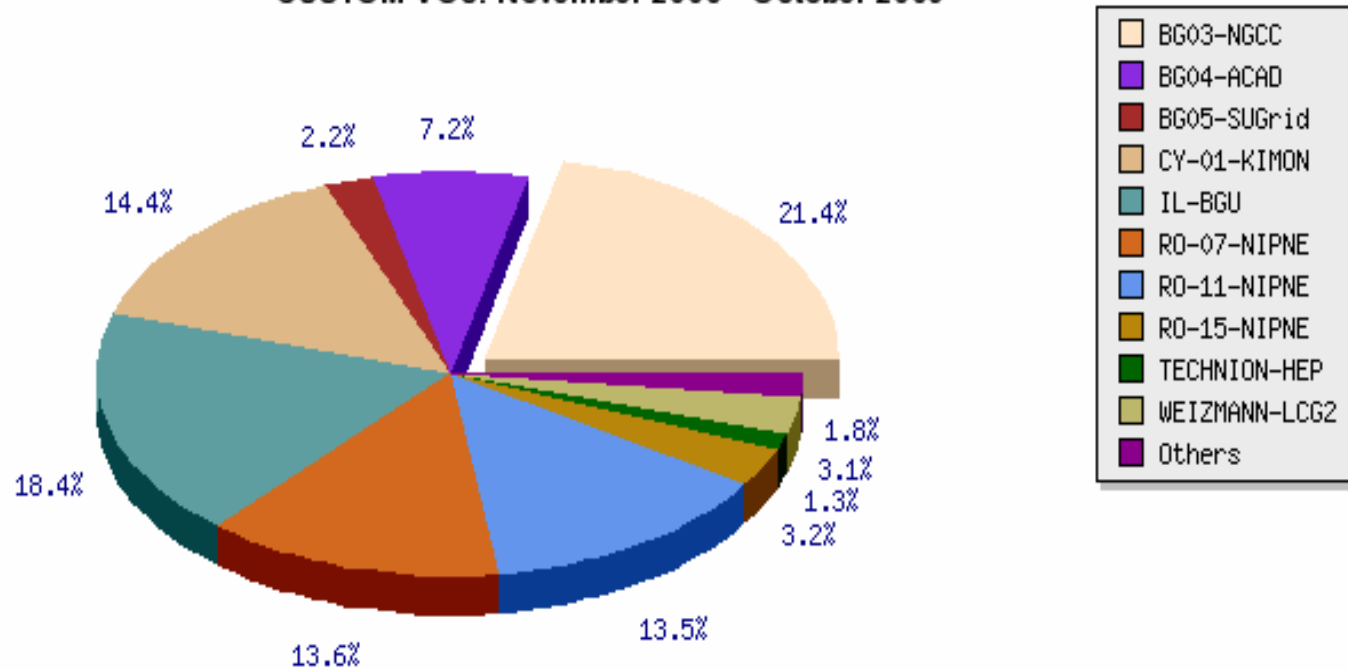
– Additional back-up batteries for the Symmetra system

Software

- Linux installed: SLC4 64bit version on each system, the gLite 3.1 package installed
- Storage backend uses Gentoo Linux
- Supported VOs: LHCb, ILC
- Grid installation of the LHCb platform: DaVinci, Gauss, Brunel, DIRAC
- Grid installation of the ILC platform:
VO-ilc-ilcsoft-v01-06-sl4 , LCIO, Marlin, Mokka

SouthEasternEurope Normalised CPU time per SITE

CUSTOM VOs. November 2008 - October 2009



Timpul CPU normalat per SITE pentru VO LHCb
Contributia Ro-15-NIPNE, Iunie – Septembrie 2009

Sumar

Publicatii:

- “A Distributed Computing System dedicated to High Energy Physics Experiments”

(C.Coca, M.Orlandea, A.Rosca, M. Stanescu-Bellu)

presented at “*IASK International Conference*” 3-6 December, 2007, Porto; published in “**Proceedings of the IASK International Conference -E- Activity and Leading Technologies 2007**”, ISBN: 978-972-99397-5-4, pag 323-327

- “ILC Reference Design Report Volume 4 – Detectors”.

Gerald Aarons, Toshinori Abe,.....Cornelia Coca,...Marius Ciprian Orlandea, ...Eliza Teodorescu, Akio Terashima,..et al., (Ties Behnke, Chris Damerell, John Jaros, Akiya Miyamoto (eds.)).

FERMILAB-APC, Dec 2007. e-Print: **arXiv:0712.2356** [physics.ins-det];

cernrep/2007-006_v4, 211p, 2007 http://doc.cern.ch/yellowrep/2007/2007-006_v4/2007-006_v4.pdf

-“The LHCb Detector at the LHC” (A. Augusto Alves jr, ..., C.Coca, D.D Dumitru, D.T Dumitru, ..,M. Orlandea,..

R. Petrescu, T.Preda...A.Rosca, .. V.I Rusu, et al, **JINST 3 S08005, 2008** <http://iop.org/EJ/Jinst/>

(Journal of Instrumentation **JINST**, impact factor pe primi 3 ani 0.333 Journal nou, din 2006, cu arie larga)

- “The LHCb Hadronic Calorimeter”

(Yuri Guz for LHCb/Hcal collaboration. ...C.Coca,...M. Orlandea et al.), presented at XIII Intern. Conf. on Calorimetry in High Energy Physics (**CALOR 2008**), Pavia, Italy, May 26th -30th, 2008; published in **Journal of Physics: Conference Series 160 (2009) 012054**

-“Expected electromagnetic and neutron doses for the BeamCal at ILD”

Cornelia Coca¹, Wolfgang Lohmann², Marius Orlandea¹, Andrey Saproinov³ and Eliza Teodorescu¹

1- IFIN-HH, Bucharest, Romania, 2– DESY Zeuthen, Germany, 3- JINR, Dubna, Rusia

Acceptata (**2009**)pentru publicare in **Romanian Journal of Physics**

-“High-Performance Computing System for high energy physics”.

M.Orlandea, C.Coca, L.Dumitru, E.Teodorescu

Acceptata(**2009**) pentru publicare in **Romanian Journal of Physics**

- “International Large Detector Letter of Intent ILD-Lol”, 2009

<http://www.ilcild.org/documents/ild-letter-of-intent/LOI.pdf/view>, validata de juriul experti international **IDAG**

Prezentari:

- **Energy spectra and particle distributions in BeamCal at the ILC**, (E. Teodorescu)

<http://www-zeuthen.desy.de/ILC/fcal/>; [FCAL Collaboration Workshop](#), 6-7 May , 2008, Krakow, POLAND

- **FCAL Report** (W. Lohmann)

<http://ilcagenda.linearcollider.org/contributionDisplay.py?contribId=129&sessionId=22&confId=2628>

[LCWS08 and ILC08 Workshop](#), Chicago 2008

- **Doses and bunch by bunch fluctuations in BeamCal at the ILC**, (E. Teodorescu)

<http://www-zeuthen.desy.de/ILC/fcal/>:

[FCAL Collaboration Meeting](#), 29-30 June , 2009, DESY-Zeuthen, Germany

- **“High Performance Computing system for High Energy Physics” (RO-15- NIPNE)**, (L. Dumitru)

FCAL Collaboration Meeting CERN, Oct 2009

<http://indico.cern.ch/getFile.py/access?contribId=23&resId=1&materialId=slides&confId=64383>

<http://www-zeuthen.desy.de/ILC/fcal/>

Lucrare masterat:

- **“Simulations of Electromagnetic and Hadronic Background in BeamCal at the ILC”, 2008** (E. Teodorescu)

Criteria de performanta 2009

Criteria de performanta	Numar prevazut	Numar Realizat
Articole acceptate (reviste ISI)	1	2
Articole acceptate (baze de date)	3	2

Rezultate deosebite

- Aportul adus la studii de optimizare a unuia dintre detectorii FCAL: BeamCal
- Intrarea in productie a site-ului RO-15-NIPNE

Aceste contributii permit accesul la programul:

FP7 application

- Infrastructure to allow ‘Physics studies’ after 2012
- Cracow (2x), DESY, Tel Aviv from (EUDET)
- + VINCA and IFIN-HH

Structura grupului , implicarea tinerilor

Dr. COCA Cornelia	director proiect
Drd. ORLANDEA Marius	cercetator stiintific
Drd. TEODORESCU Eliza	asistent cercetare
Ms. DUMITRU Laurentiu	licentiat 2008/st.&teh.inform BUC si Southern Denmark
Dr. PETRASCU Horia	CS3 (partial implicat)
Dr. ROSCA Aura	faza de inceput

- Cercetatorii in formare (E. Teodorescu, L. Dumitru) , sunt platiti integral din contract
- Prioritate in stagiile de lucru in strainatate (E. Teodorescu, L. Dumitru)