Mostenirea Profesorului Hulubei,

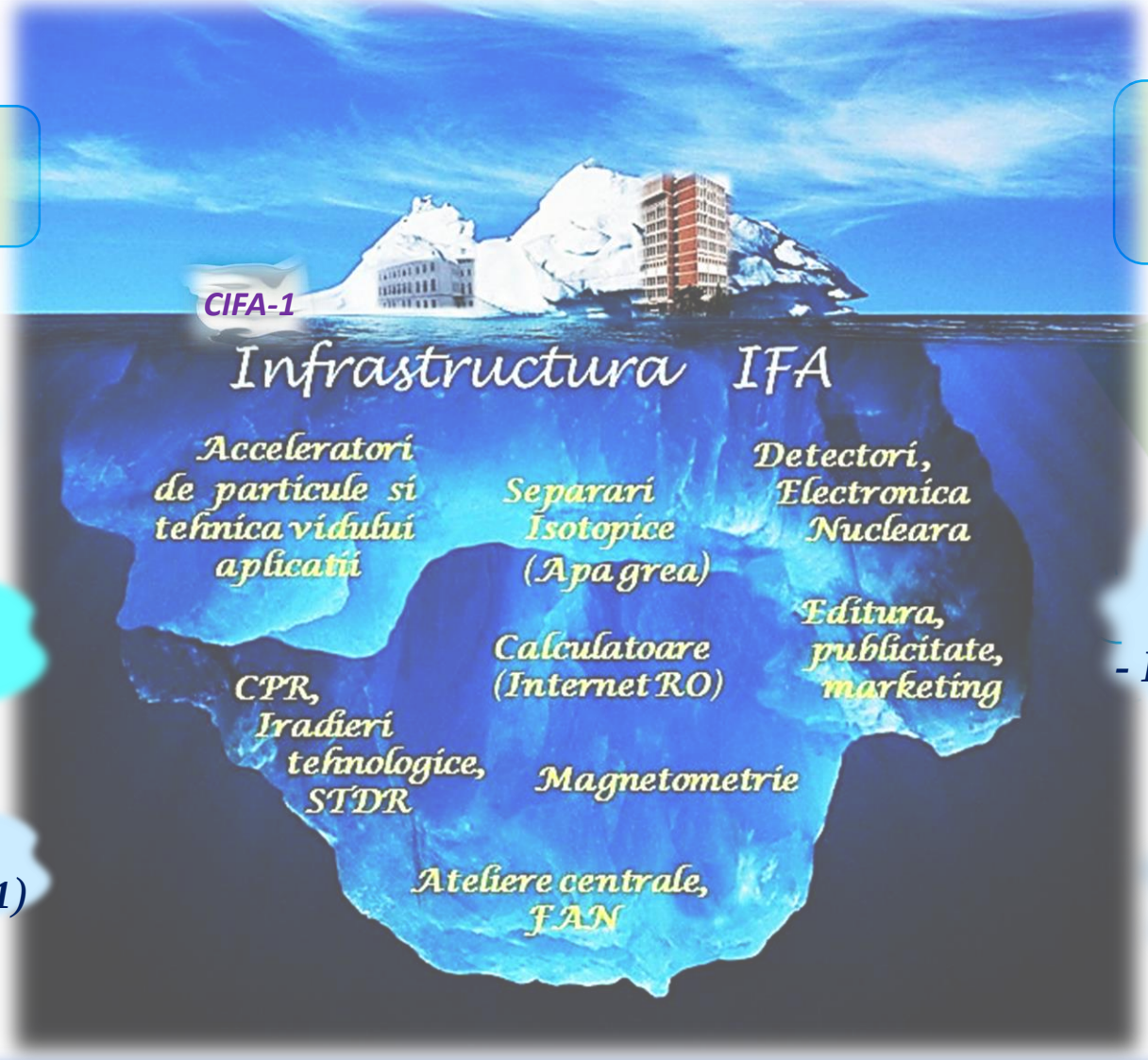
Nu numai că IFA a luat fiinţă la iniţiativa domniei sale, institutul pe care şi l-a dorit…”să fie un institut de fizică pentru românii mei…” dar dumnealui a reuşit să atragă alături de Dânsul, la conducerea ei, cele mai remarcabile valori intelectuale din domeniu.

Alaturi de dansul au fost Şerban Ţiţeica şi Ion Agârbiceanu urmați mai apoi de Ioan Ursu şi secondați la conducerea sectorului tehnic de oameni de același calibru, prin Tudor Tănăsescu, urmat de Florin Ciorăscu.

IFA - digitization - evolution - lived history - [GP]

Computers, networks, informatics

Experimental physics, detectors, infrastructure accelerators, astrophysics



The first Romanian computers + ...

First ADCs –
Analog ⇔ Digital Converters

The computing networks
(local; international)

DAQs
- **MCAs**
- **List Mode DAQ**

- **PA-Aligator**
  - computer control
- **CERN contrib.**

IFIN-GRID
(DFCTI;DFH; RO-02/07/11)
(Dr. M. A. Dulea)

Large international collaborations:
CERN, GSI, FAIR, IUCN etc.

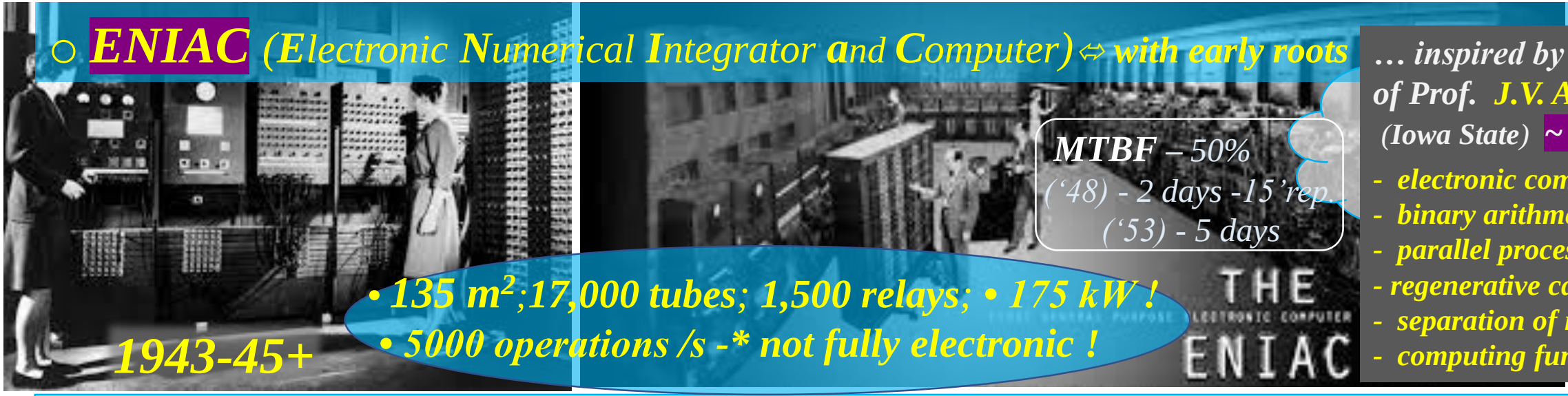
Diaspora

Diaspora

Digitalization, Cyber Physical Systems, AI, IoT…

***IFA** a fost un **izvor, un loc de cult al stiintei**, un spatiu in care se respira stiinta si tehnica de tot felul si nu este de mirare ca IFA a fost si **“virful de lance”** al **“digitalizarii” Romaniei,** de la **calculatoare** si pina **la informatica,** in sens larg.*

***Un sir lung de “pionieri” au cladit si consolidat**, dealungul timpului, aceasta imagine deosebita a IFA-ei.*



○ **ENIAC** (*Electronic Numerical Integrator and Computer*) ⇔ **with early roots**

… *inspired by the work of Prof. J.V. Atanasoff (Iowa State)* **~ 1937 /38**

- *electronic computation,*
- *binary arithmetic,*
- *parallel processing,*
- *regenerative cap. memory*
- *separation of memory,*
- *computing functions.*

***MTBF** – 50% ('48) - 2 days -15' rep.. ('53) - 5 days*

1943-45+

- ***135 m²;17,000 tubes; 1,500 relays; • 175 kW !***
- ***5000 operations /s -* not fully electronic !***

Physicist J. Mauchly & Eng. J. Presper, Moore School of Electrical Eng. de la ***Pennsylvania Univ.***

- *a government-funded project to build an all-electronic computer under contract to the army…*

work began in early 1943 – 1946 (after the war…)

➢ ***On the occasion of the patent, the court ruled in favour of Prof. J.V. Atanasoff*** *… (but only in 1973…)*

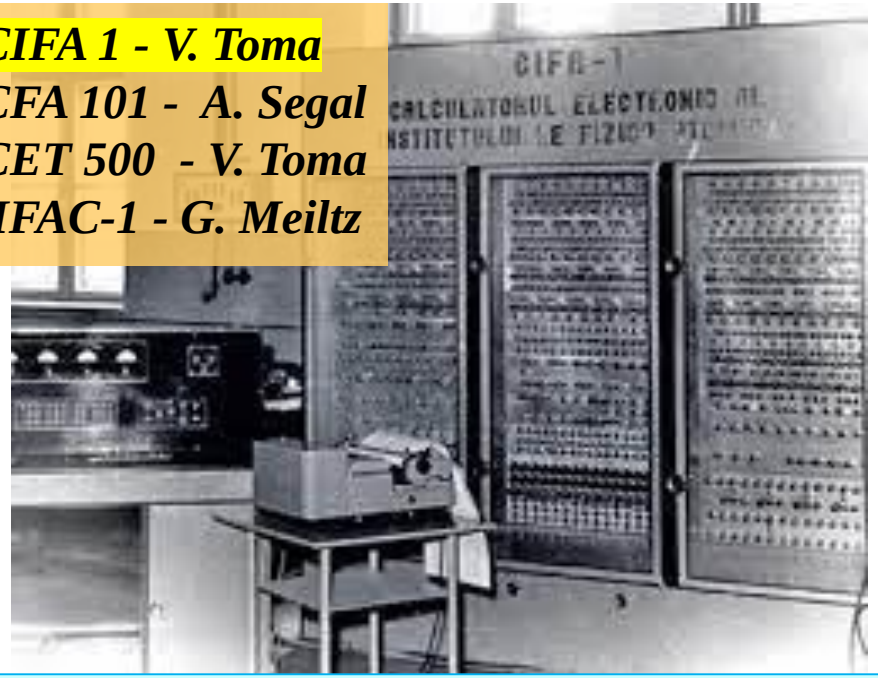
- ***it was just a moral, belated recognition. (J.V. Atanasoff & Dr. Berry, Iowa State … ABC continued until 1942)***

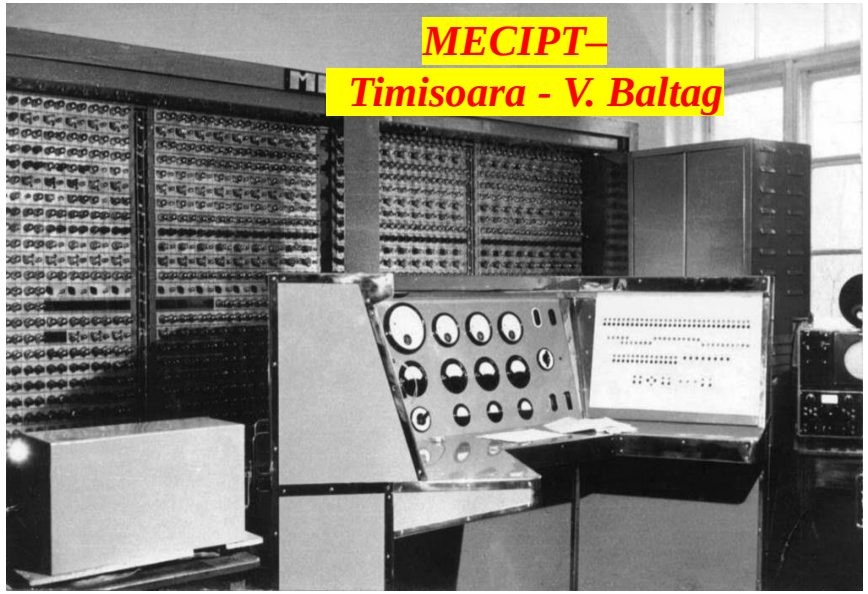
1973 - Federal court…putting the invention of the electronic digital computer in the….public domain

- ***1945- Collosus (UK); Z3 (DE)- distroyed in Berlin-'43 …from 1950 -52 all over the world:*** - ***SEAC*** si ***SVAC, Whirlwind, (USA), Z4*** si ***ERMETH (Germany*** si ***Switzerland); Pilot ACE (GB); BESM-1 (USSR)***

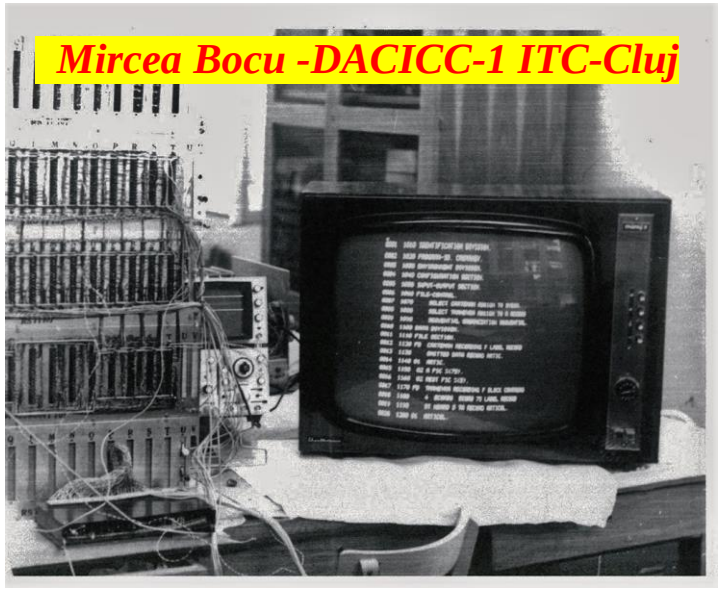
- ***Commercial computer*** : - **1951** ***UNIVAC (Remington Rand; GE); Ferranti Mark 1 (Manchester); CDC*** *(S. Cray);* ***DEC; IBM*** in **1952**, series **IBM-701** ⇔ Series ***IBM-650, (large series ~2000 pcs.)***

CIFA 1 - V. Toma
CFA 101 - A. Segal
CET 500 - V. Toma
IFAC-1 - G. Meiltz





MECIPT–
Timisoara - V. Baltag



Mircea Bocu -DACICC-1 ITC-Cluj

- At ***the initiative*** of ***Prof. T. Tanasescu*** *and with his* ***direct participation****, in the years* ***1953 - 1956***

- ***The first Romanian computer CIFA1*** (with electronic tubes) (coordinator ***V. Toma***) – **1956**

- A handful of hardworking people (V. Toma, A. Segal, V. Hurduc, Nicu Boca, A. Stoicescu, O. Cărbunaru, V. Manu-Iosifescu, etc.) made Acad. Horia Hulubei announce, at Romanian Academy, 2-6 July 1956,

the commissioning of the first Romanian computer CIFA 1!*.... the "**golden egg hen**" of the 50's @ IFA.*

- ***CIFA101*** computer (***A. Segal*** coordinator) (also with tubes, but ***with superior performance*** CIFA1)
- ***CET-500*** computer (with transistors, coordinator ***V. Toma***) - **1964**
- ***IFAC-1*** computer ***with transistors and clearly superior performance*** (coordinator ***G. Meiltz***) - **1967**

First publication*: (**T. Tănăsescu si V. Toma**, "A Bukaresti Fizikai Intezet Elektronikus Szamologepe", **Budapest, 1956***

*from **CIFA-1** to **IFAC-1***

How much human effort, how much truly pioneering technological research, to achieve performance:

CIFA1 • ***2000 additions / subtractions /s; 500 multiples /s*** in fixed point;

• ***memory on the drum*** - CrNi cylinder - organized in 512 addresses x 31 bits, i.e., approx. 2kB

• ***comparing this performance with those of the IBM-650*** computer from the 60's, it would have been ***in a global performance ratio of 1: 4!*** (comparing memory volume and computational speed).

- ***A big step forward was made by the team formed by G. Meiltz*** *(with* ***O. Cărbunar*** *and* ***S. Constantinescu****),* ***who made in the years 1967-1968 the IFAC-1 computer, with Romanian transistors, with***

  • ***with 1 million operations /s, with 38-bit word (30 mantissa; ~ 10 decimal digits - and 8 exponent bits).***

  • ***microprogramming of arithmetic operations with diodes, compared to IBM using compared to*** IBM using CROS- (read-only storage capacitor) and TROS- (read-only storage transformer),

  • ***ferrite core memory***, made in France, with 4096 addresses and ~ ***3-4 μs*** access time (complete electronics crafted at the Computing Center).

Although the gap was considerably narrowed, but for the ever-increasing needs of peripheral computing power, in 1972 an IBM 370/135 computer was purchased, which operated until 1991.

- Meanwhile, in 1986, a **CORAL** computer was hosted (like the PDP of the DEC), and in 1988, the ***VAX*** computer (DEC) was purchased.

The evolution of computer networks in IFA, Magurele platform

Architecture and constant implementation over ~ 30 years Şerban Constantinescu

(only for the UNDP & TCP / IP project Nelu Mihai)

previously a network of 4 computers and interactivity was provided only by 80 serial connections (48 + 16 + 16)

1988-90, 2x VAX UNDP Labtam, computer networks, via Ethernet connections ~ 10 Mbps

8 linii

[FAN] CORAL

8 linii

FAN

Inceputul timid … cu *6 terminale grafice utilizatori interactivi*

The first Ethernet network - TCP / IP

SO-UNIX, AT&T license, Ethernet connections used the TCP / IP protocol, still used today

LHC – CERN
⇔ GRID
>> 100 Gbps

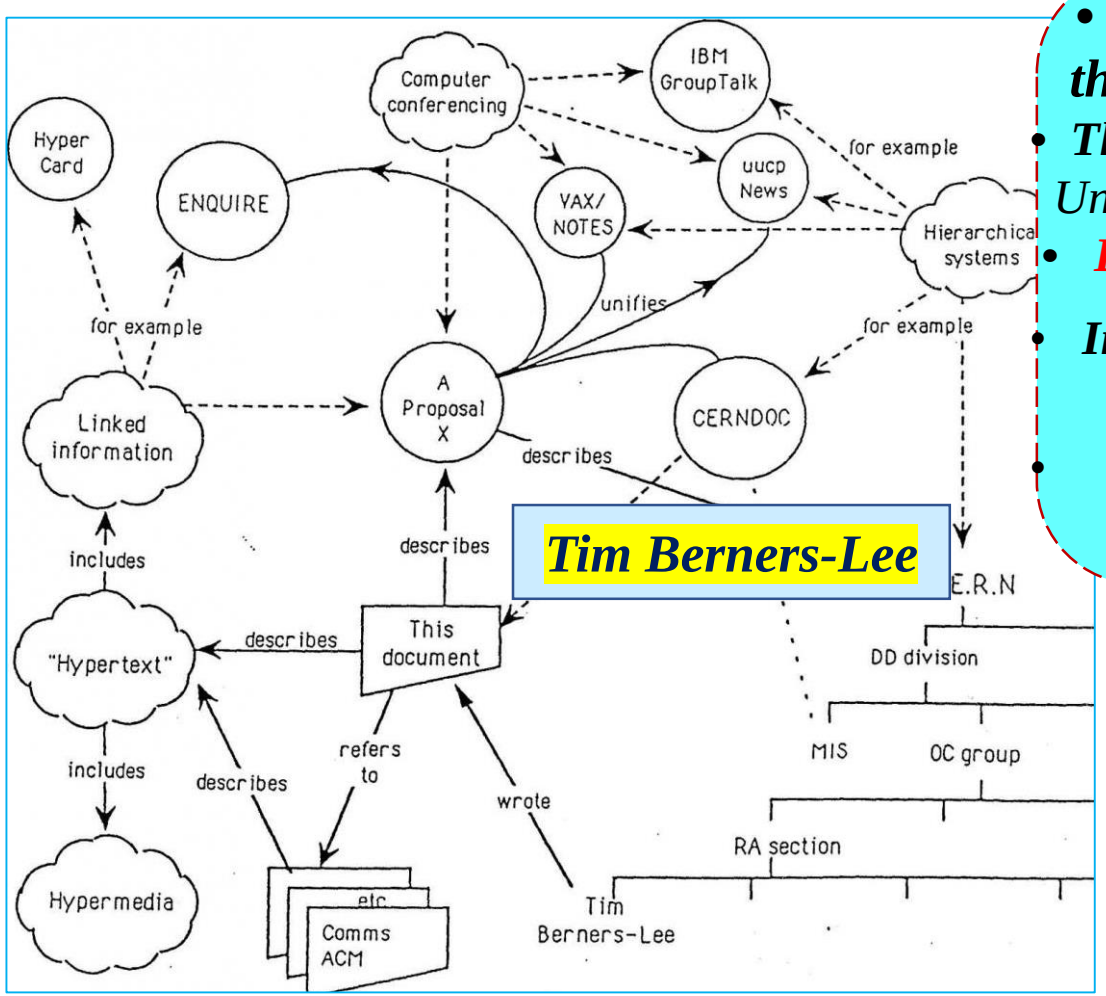
Internet 91-92

Cristea P., Pascovici Gh., Popovici N., *Romanian Academic Network, Present Status and Future Developments, International Networking Conference,* Kobe, Japan, Proceedings of INET'92…

Carnegie Mellon Foundation donation - Harry Barnes Jr. and Steve Ruth (George Mason Univ.)

- *telephone connections with ICI and UPB - successively started with BITNET; then the Internet • with speed 4800 bps then always increased ..*

In 2000 - 1GBps and hundreds of networked PCs…



- ***1991-92 Romania's accession to the Internet – the first step - IFA & UPB - Proc. INET'92, Kobe, Japan, 1992***
- ***The support of the*** *former* ***Amb. Harry Barnes Jr, Steve Ruth*** *(G. Mason Univ.) and the* ***Carnegie Mellon Foundation*** *for equipment support* **.**
- ***Development implementation architect Serban Constantinescu***
- ***Infrastructure equipment - Exit from our isolation****; Magurele – telephone lines; - optical fiber; - computing equipment…*
- ***The surprise of the many opponents - contestants…***

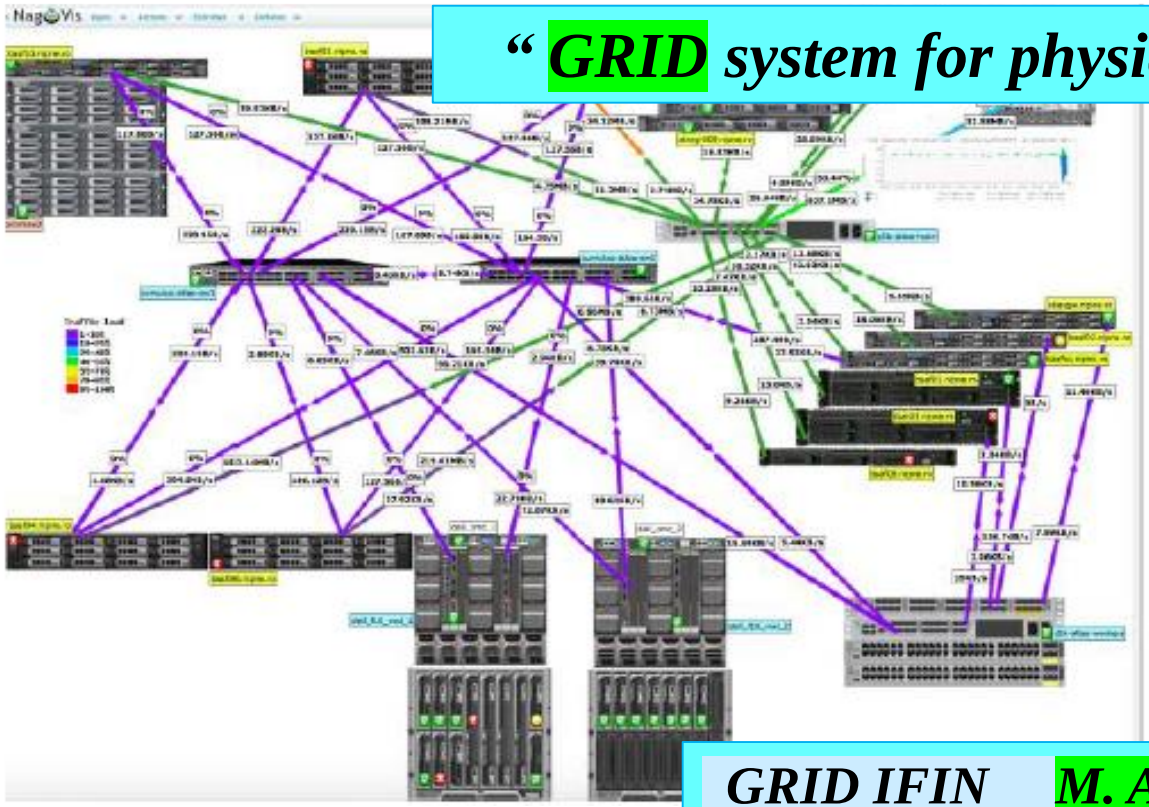
RO Senate, IFIN etc

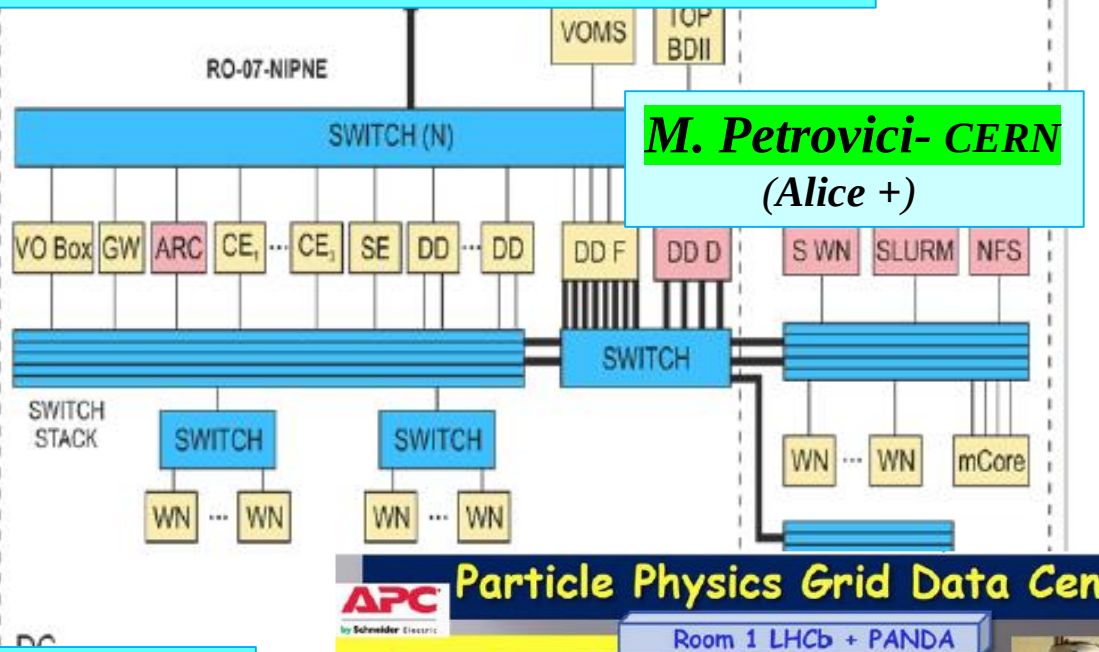
World Wide Web *born at CERN in* ***March 1989…***
Tim Berners-Lee ***wrote a proposal to develop a radical new way of linking and sharing information****: the* ***www.***

In 1990 a useful visit to CERN G.P. and A. Dorobantu …

CERN teams up with Leaders in Information Technology to build giant ***Data Grid***

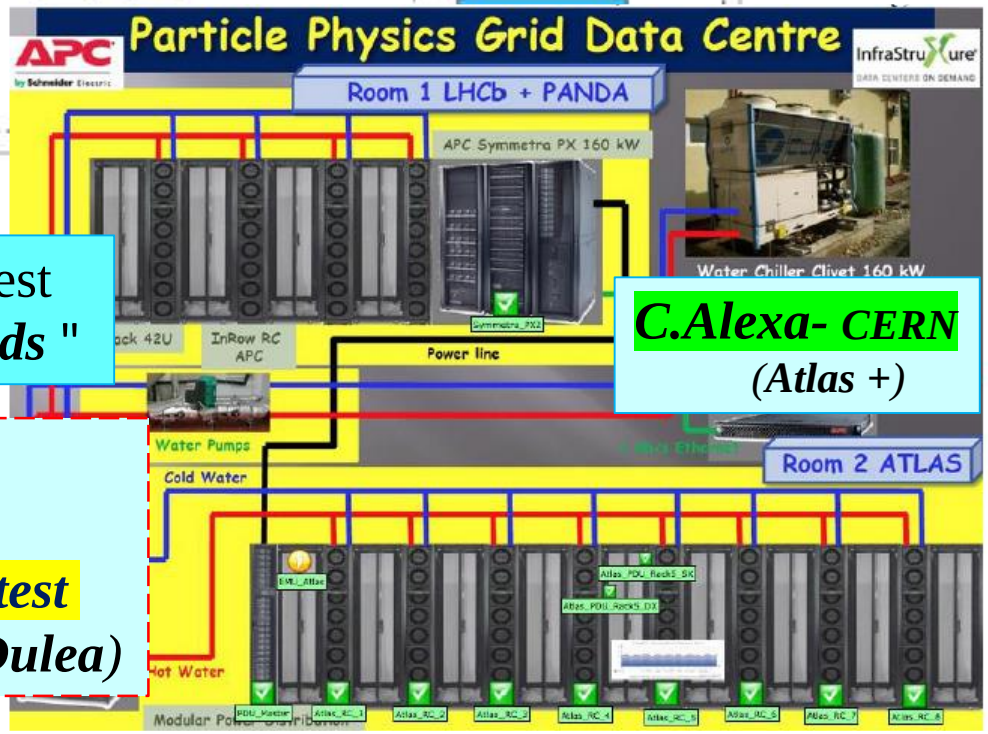
“ GRID system for physics research and related fields ”





M. Petrovici- CERN
(Alice +)

GRID IFIN ***M. A. Dulea***



C.Alexa- CERN
(Atlas +)

Report (2019) on IT installations of national interest
“GRID system for physics research and related fields "

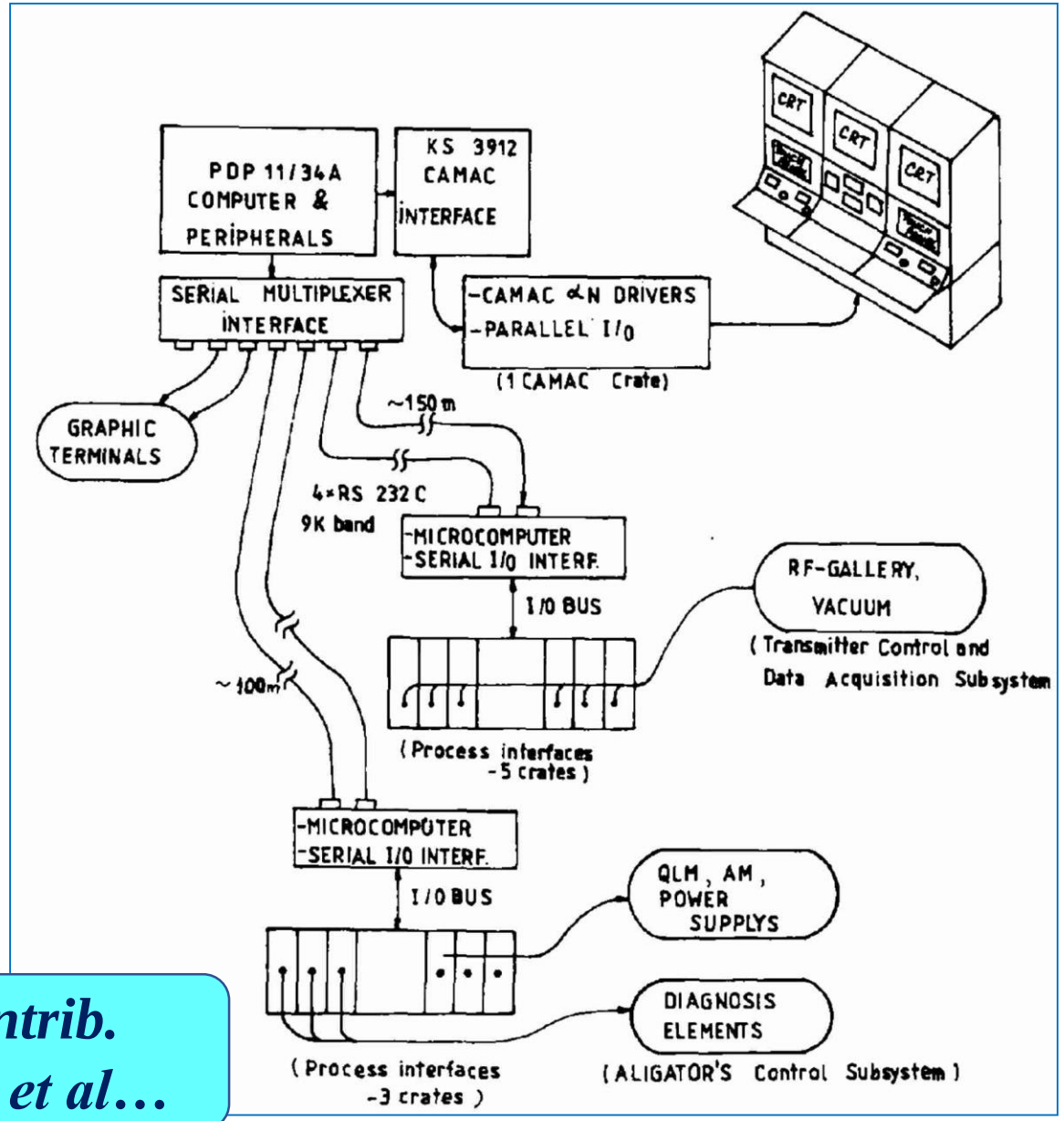
- ***over 9,000 processing cores (CPU cores) and a disk storage capacity of 7 Peta-Bytes…***
- ***IFIN Grid the distributed infrastructure with greatest concentration of resources at national level -M. A. Dulea)***

"Cyber Physical System" – Integration of Physical & Computational Elements

μC-Control of the Post-Acceleration installation ALIGATOR (1979 - 82)

- Complex system, in terms of number of parameters and spatial distribution of controlled sub-assemblies
- Fully controlled -22 RF stations as well as
- many beam transport and beam diagnosis devices (dipoles, magnetic quadrupoles, vacuum subsistem, electrostatic scanning, logarithmic electrometers, pulsing etc.)

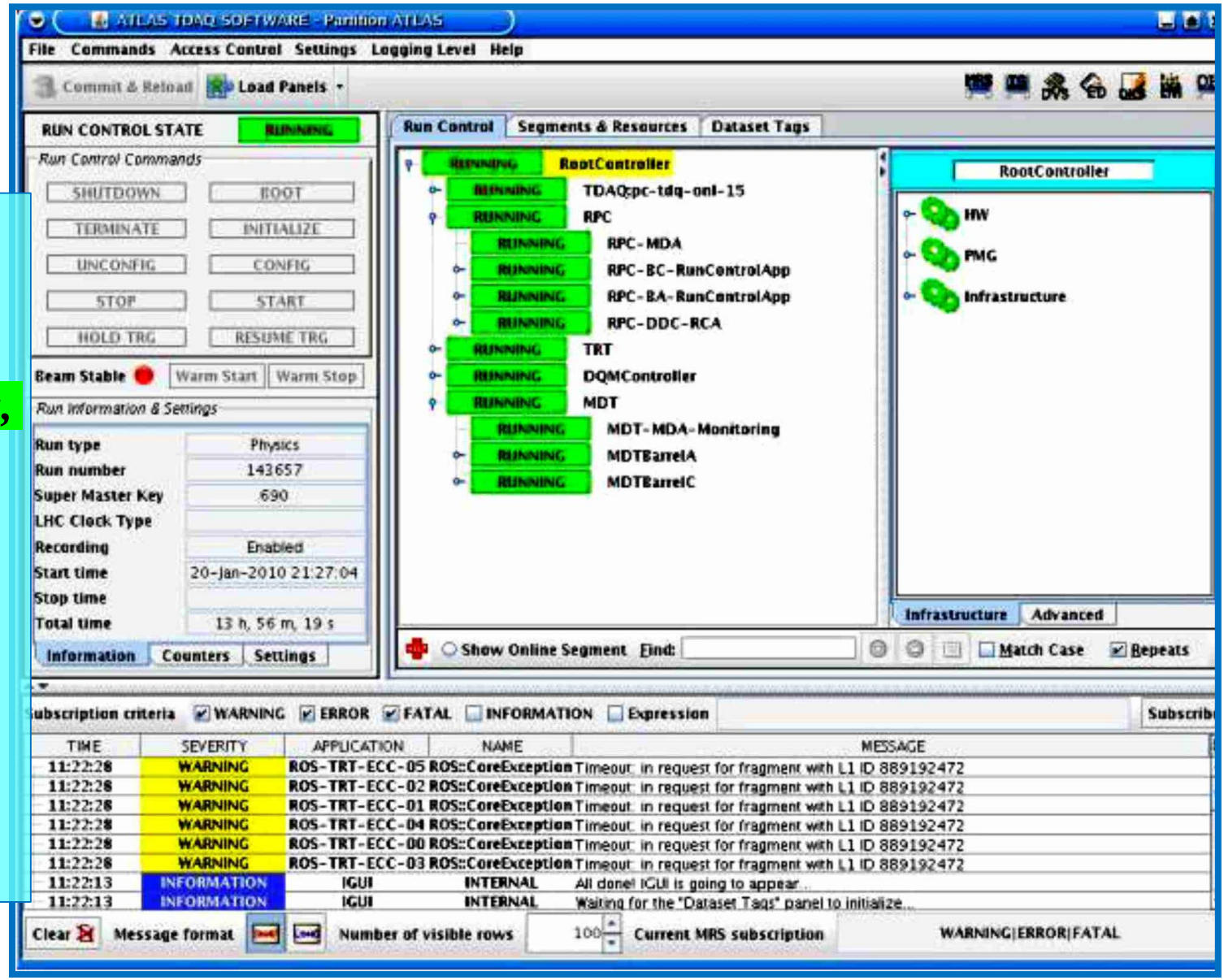
- Two computing subsystems were designed based on Intel 8080A2 process microcomputers, distributed in the installation and fast serialized with the PDP11 / 34A minicomputer (G. Pascovici, M. Duma)
- The team: V. Catanescu, R, Ruscu, L.Pascovici si D. Moisa
  - Brought many openings in the development of μP-systems



CERN contrib.
- M. Caprini et al…

contribution to CERN …

- *The group from Bucharest*
  (M. Caprini, E. Bădescu et al)
  contributed to the development of components for the exchange of information and messages, for reporting errors, for the general command of the experiment through a GUI (graphical user interface), for verifying the correct functioning, for assigning user roles.
- *Message Reporting System, Information Service, Integrated Graphical User Interface, Access Manager Roles Manager, Electronic Logbook, Diagnosis and Verification System.*



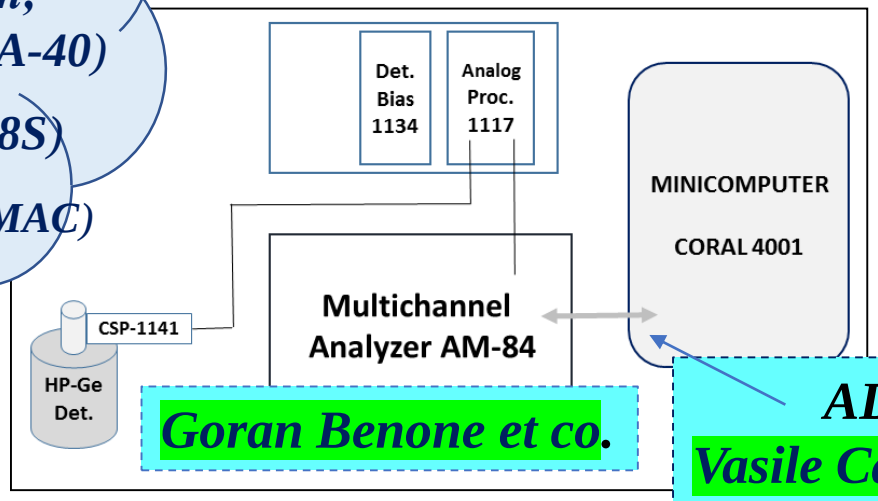
… "Cyber Physical Systems", IoT…

The rather long road from single MCAs to modern DAQ in Experimental Physics

… at the beginning, the first competitive Multichannel Analysers

- **A. Segal - 64 ch.**
- Intertechnique 200 ch; 400 ch. (SA-40)
- ND 50/50 (4K +PDP-8S)
- Ortec 4k-8k (NIM, CAMAC)

Un alt sir lung de "pionieri" care au cautat si gasit solutii….



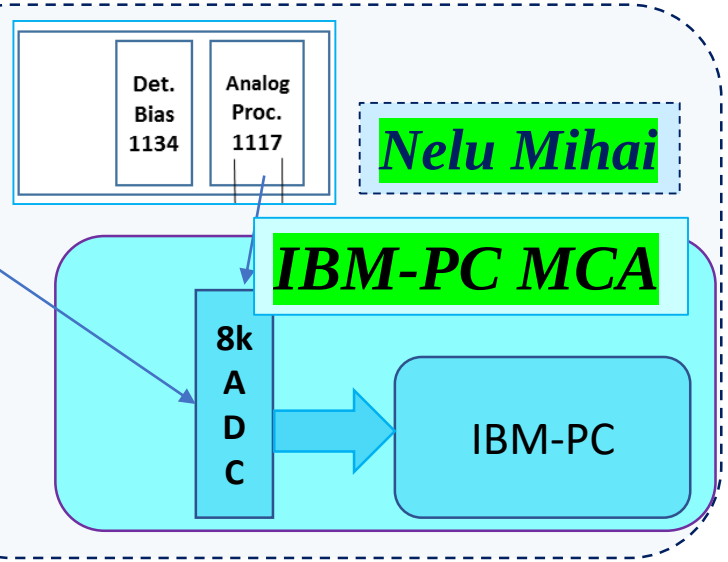
Goran Benone et co.

ADC, Vasile Catanescu

E. Katz, B. Goran, M Caprini, I. Bals et co.

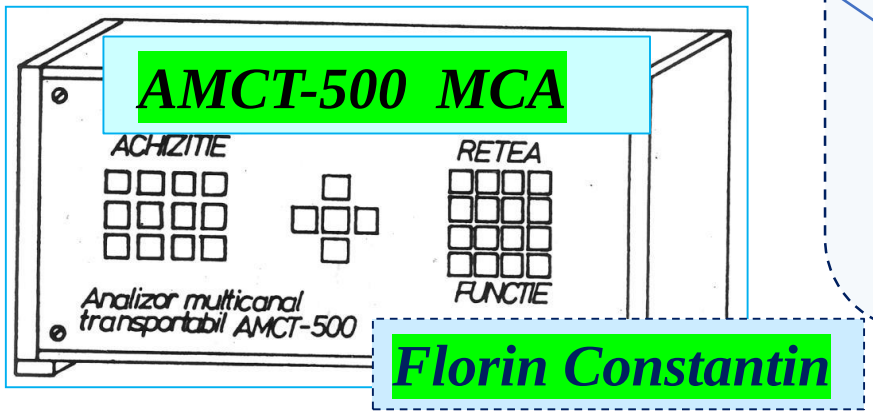
CAMAC R&D

- *Modules (CPUs, I/O),*
- *DAQ Systems (VVR, Suprav. Baraje)*



Nelu Mihai

IBM-PC MCA



AMCT-500 MCA

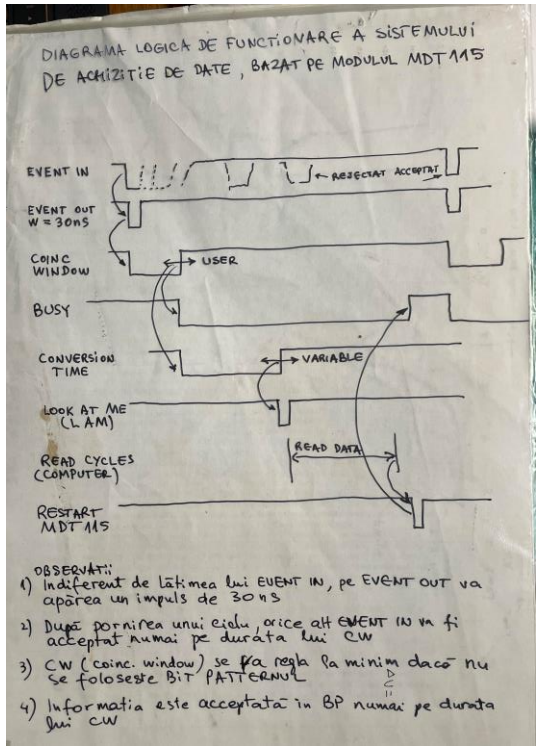
Florin Constantin

The rather long road from single MCAs to modern DAQ in Experimental Physics

special contribution of
Moisa Dorin Tudor - hardware
MDT 4 & MDT-115
and **M. Duma** - software

The first real step towards "List Mode" DAQ…

- Laben - dedicated memory 1MB
  - List Mode
  - Increment
- MDT 115 with 4 mode of operation:
  - without BT (Bit Pattern)
  - with BT, synchronized with LAM
  - with BT no LAM ⇔ MB
  - List Mode- Data – BT



LABEN

- **HSM (1 MB) Derand.**

(Laben + GP)

Pr. AT-IAEA

CAMAC

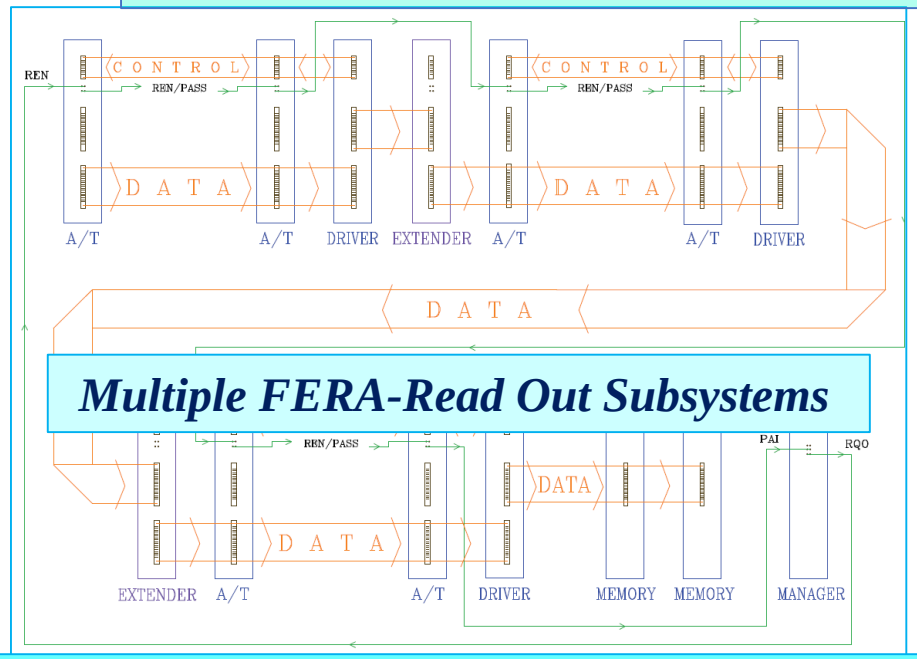
CC

Modif. GP

PDP 11/34 Interf.

LeCroy (Teledyne) - FERA Read Out System

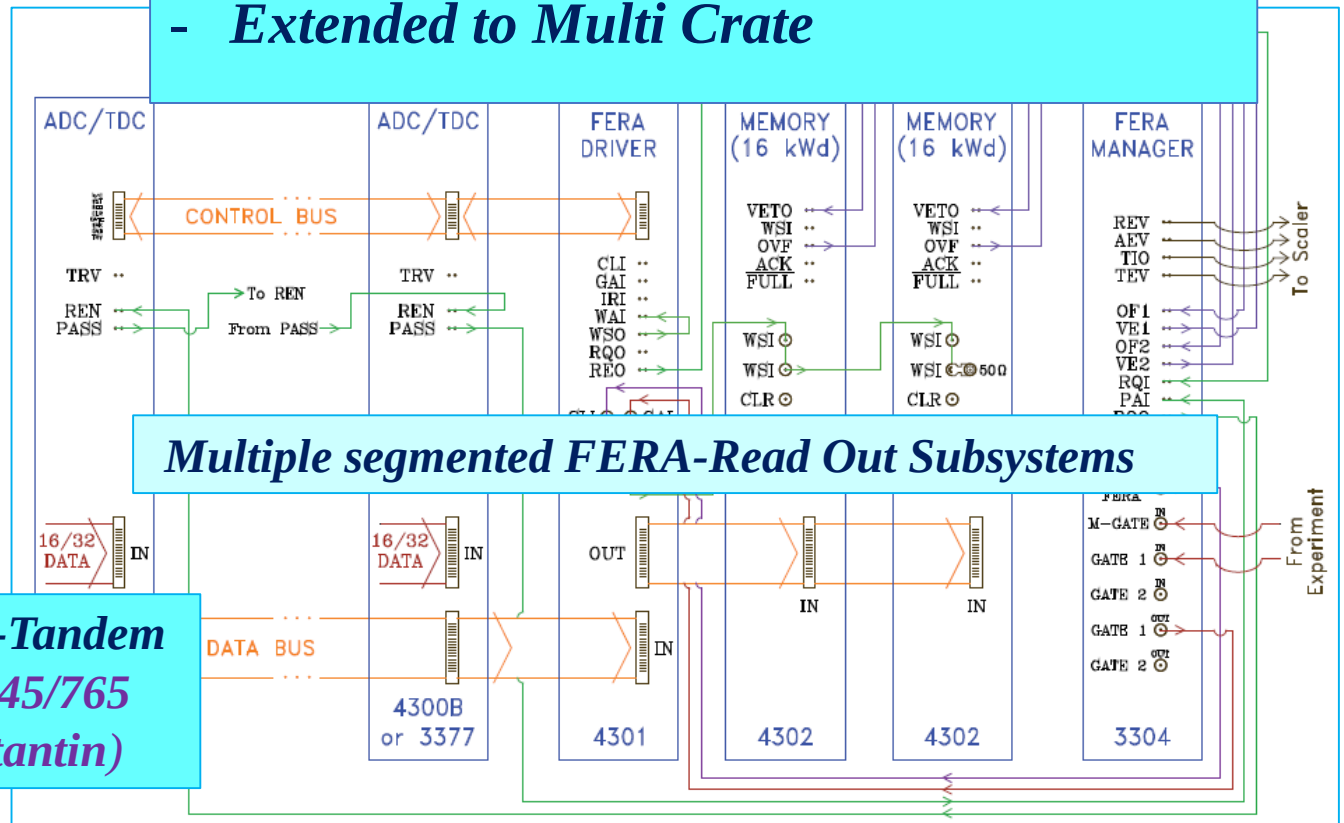
- *Tandem DAQ FERA Read-Out*
  - *N. Marginean, G. Suliman*
    - *GASP – comp. data format*
    - *K-max based DAQ*



Multiple FERA-Read Out Subsystems

- *DAQ bazat pe FERA ReadOut implementat la DFN-Tandem*
  dar si o aplicatie specifica micro-controller PIC 16C745/765
  (C. Cirstea, S. Buda, F. Constantin)

- *Extended ECL (10 MHz) fast data bus and fast control & REN/PASS logic ...*
- *FERA Driver (4301)*
- *HSM (4302)*
- *4x ADC (Ortec 413) and TDC*
- *Extended to Multi Crate*

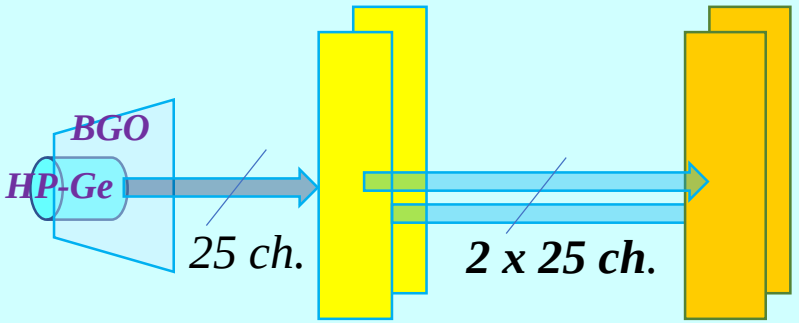


Multiple segmented FERA-Read Out Subsystems

Tandem IFIN-HH - DAQ

FEE - Mesytec
MSCF-F-C
(Low & High Gain)

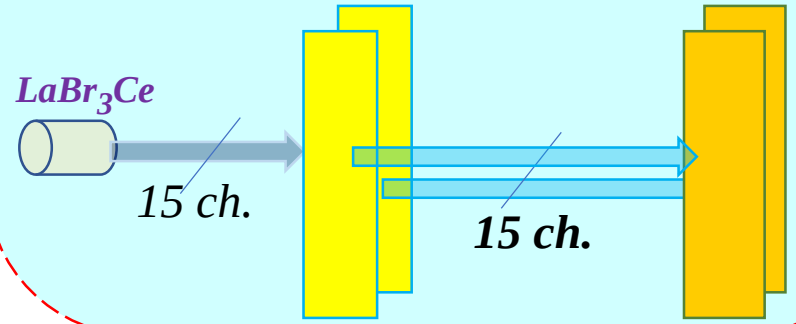
Mesytec
MADC-32
MTDC-32



Multiplicity logic

(Mesytec **MSCF16**-F and **CFD**$_i$)

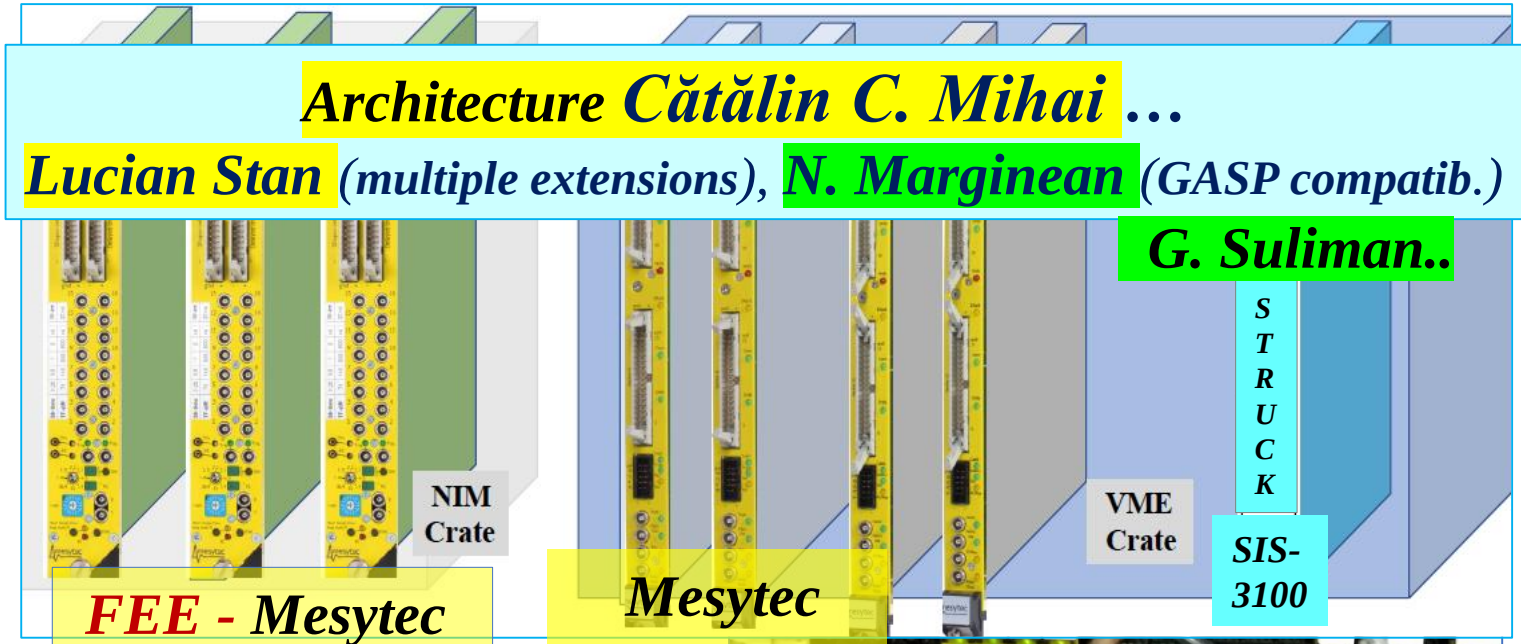
- **Global trigger** (⊕**BGO**)
- **HP-Ge trigger - (M_j)**



Architecture Cătălin C. Mihai …

Lucian Stan (multiple extensions), **N. Marginean** (GASP compatib.)

G. Suliman..



FEE - Mesytec
MSCF-F-C
(Low & High Gain)

Mesytec
MADC-32
MTDC-32

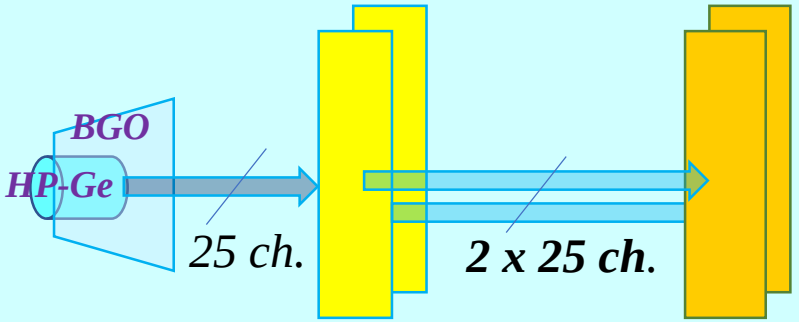
Struck SIS 3100
SIS 1100-CM
(SIS 1100-Opt)

PCI system

Tandem IFIN-HH - DAQ

FEE - Mesytec
MSCF-F-C
(Low & High Gain)

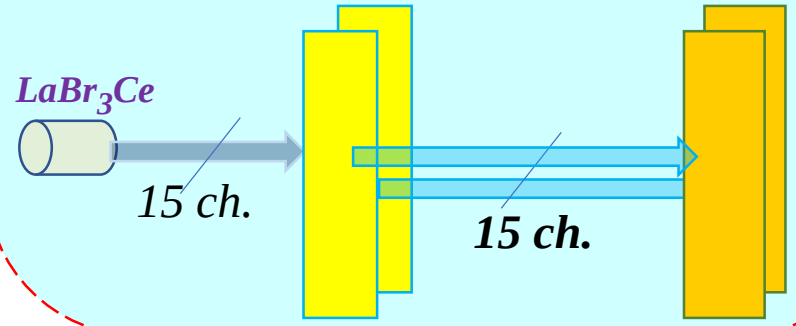
Mesytec
MADC-32
MTDC-32



Multiplicity logic

(Mesytec MSCF16-F and CFD_i)

- **Global trigger ($\oplus$BGO)**
- **HP-Ge trigger - (M_j)**



Main specifications

- *Fast timing (CFD + MTDC multi hit)*
- *Up to 128 channels*
- *Global trigger rate ~ 20 kcps; · VME transfer rate ~ 80 MBps (opt. ~200 MBps with 2eVME)*
- ***Parameters**: 5 for HPGe: (Energy H & L, Time /125ps/ch;65kch/, BGO_Energy, BGO_Time) and 2 for Aux-Det. (LaBr3Ce, Solar Cells): E & T / 4ps/ch; 65 kch /*

Struck SIS 3100
SIS 1100-CM
(SIS 1100-Opt)

PCI system

***Diaspora - researchers** who grew up as researchers in the structure of IFA, then continued…*

- *R&D, private invest. & management*
- *academical R&D & teaching*

Nelu Mihai

- *1992 the VRTXmc microkernel was implemented in over 1 Billion embedded systems in 1995-2005; then at NASA (Hubble Space Telescope), one of the most widespread RTOPs*
- *Open Programmable Networks, then SDN (Software Defined Network) and SDN (CPlane Networks) based operating system*
- *pioneered hyper distributed cloud computing (HDCC)*
- *IoT (micro-inverters, DC optimizers, robotic trackers) - Solar Internet for the next generation of Smart Grid*
- *included in the 'top 500 companies' (Forbes)*

Dan C. Marinescu

- *1984-2001 he was a professor of computer science at Purdue University, Indiana ; since*
- *2001, provost professor of computer science at the University of Central Florida, Orlando*
- *Over 220 articles, academic books, reference:*
- *Approaching Quantum Computing*, **D.C. Marinescu, G.M. Marinescu,** 2004
- *Classical and Quantum Information*, **D.C. Marinescu, G.M. Marinescu,** 2012
- *Cloud Computing, Theory & Practice*, **D.C. Marinescu**, 2017, 3rd ed. 2020
- *Process Coordination and Ubiquitous Computing* (co-editor), 2020

…IFA a fost un izvor, un loc de cult al stiintei, un spatiu in care se respira stiinta si tehnica de tot felul si nu este de mirare ca IFA a fost si "virful de lance" al "digitalizarii" României, de la calculatoare si pina la informatica, in sens larg.

… un sir lung de adevarati "pionieri" care au cladit si consolidat, dealungul timpului, aceasta imagine, atmosfera deosebita a IFA-ei

si mi-a facut mare placere sa îi pot aminti aici…