

AGATA@LNL

IT & DAQ Infrastructures

AGATA Week – Sept 18, 2019
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INFN-LNL IT Department

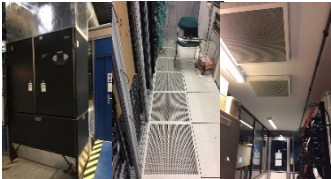
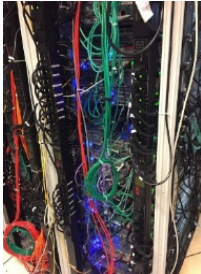

- ▶ AGATA Computing Requirements for the LNL Campaign
- ▶ LNL Data Centres
 - VAX Room
 - GRID Room
 - New Data Centre
- ▶ Network and Security Issues for all AGATA sub-systems
- ▶ AGATA and Complementary Detectors: DAQ, Run Control and Monitoring

AGATA@GANIL: DAQ infrastructure

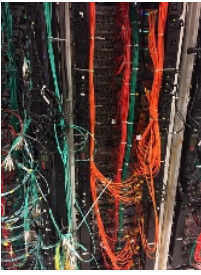

~45 capsules - 1π

- ▶ **Computing Room (7 racks)**
 - ATCA crates + GTS Tree (3 racks)
 - 2U servers with LINCO2/GGP cards (2 racks)
 - Ceph storage + data flow + services (2 racks)
 - Measured power consumption of about 17kW
- ▶ 60 meters long point to point optical fibers from the experimental hall (digitizers) to the computing room (ATCA crates and 2U GGP servers)



Computing Room

CEPH storage/
 DCOD data flow
 /services

2U servers –
 LINCO2 / GGP

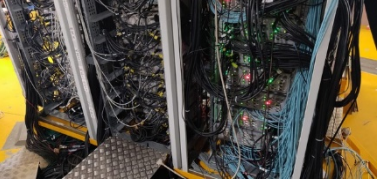
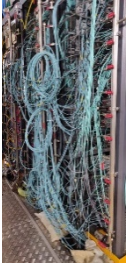
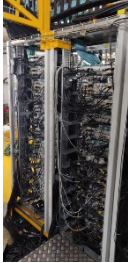



ATCA crates

Optical
Fibers

Experimental hall

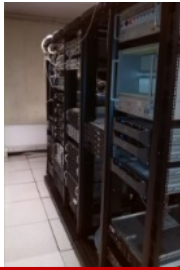
- ▶ Digitizers – 3 racks
- ▶ LV, HV – 3 racks

AGATA@LNL: Computing Requirements

- ▶ **First installation** at LNL of the AGATA DAQ will be similar to the configuration in use today at Ganil. But:
 - **More capsules to readout (up to 60)**
 - **Still point to point optical fibers (phase0 and phase1 electronics) to install**
 - **Computing Room Requirements: 8 racks, about 20-25kW of power consumption**
 - ATCA crates, 2U servers with GGP and LINCO2 cards, Ceph storage, data flow and general services CPUs
 - Experimental Hall: ~7 racks
 - Digitizers, HV, LV, ...
 - Control Room: same location as previous LNL campaign (Agata Demonstrator)
- ▶ **During LNL campaign AGATA array will evolve increasing in size (up to 90 capsules – 2π)**
- ▶ **The electronics and the DAQ will evolve adopting new technologies**
- ▶ DAQ/IT infrastructure must support both **initial** and **future** requirements:
 - New “Ethernet based” phase 2 electronics (Digitizers++) will gradually replace “older” electronics
 - ATCA crates will gradually disappear
 - Point to point optical fibers will not be necessary anymore
 - 2 unit servers will be replaced by “standard” (1U or 0.5U) servers with 10Gb Ethernet cards
 - ...
- ▶ Space requirements should not change during the LNL campaign, power consumption could increase (more CPUs, more complex PSA algorithms, machine learning, GPUs...)
- ▶ Considering up to 90 capsules we have estimated the following needs:
 - **8 racks , 50kW max power consumption, 10000Kg weight**

LNL Computing Rooms



VAX Room

- ▶ 30 square meters – **close to AGATA**
- ▶ Traditional (old) environmental cooling
- ▶ **5 standard racks**
- ▶ 3 «network» racks
- ▶ Up to 20kW electrical power
- ▶ It hosts main LNL network hardware (router, firewall, ...), a few LNL network services infrastructure and local DAQ CPUs
- ▶ **Only 2 free racks (initially dedicated to Galileo)**
- ▶ Power and cooling infrastructure is being renewed (still for only 20kW max)
- ▶ *AGATA Demonstrator@LNL: 2 racks for 2U LINCO servers and «pizza box» CPUs*
- ▶ First Option considered: **Upgrade the VAX Data Centre to support AGATA requirements: more racks, more electrical power, more cooling, ...**



GRID data centre

- ▶ 70 square meters – **150m away from AGATA**
- ▶ “Hot Aisle” water cooling technology with in-row APC coolers
- ▶ **22 APC racks, 11 in-row coolers**
- ▶ 1 network rack
- ▶ Up to 120kW power
- ▶ About 250 server, 7 PB storage for several LNL and INFN activities
- ▶ Tier2, cloudVeneto, IT services, SPES controls, Galileo DAQ storage, INFN Business Continuity project, ecc.)
- ▶ **All the racks are almost full**
- ▶ **Power consumption about 110kW: close to the limit**
- ▶ *AGATA Demonstrator@LNL: 1 rack for storage and data servers*

LNL Technical Department

«Feasibility study to move the GRID Data Centre to a new location» – Q1 2018

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2. STATO DI PROGETTO

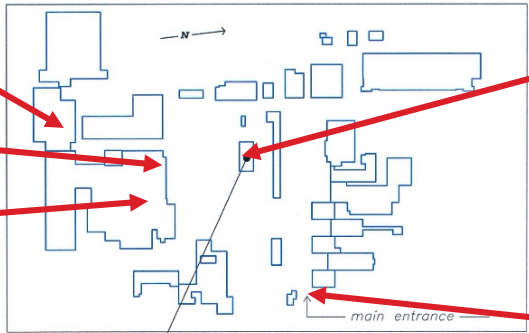
2.1 Descrizione degli ambienti

Lo stato di progetto prevede lo spostamento del data center e degli uffici del Servizio Tecnologie Informatiche in un unico edificio, ora adibito a soli uffici:

GRID Data Centre

AGATA

VAX Data Centre



**Existing Building:
New Data Centre**

Main Entrance

**Agata apparatus
and new data
centre distance:
100m > d > 60m**

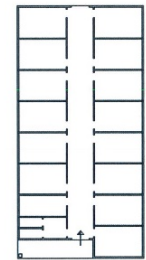


Figura 4 - Attuale layout dell'edificio oggetto dello studio di fattibilità

La riorganizzazione di questo edificio prevede di destinarne metà a data center e l'altra metà a uffici, come da seguente schema:

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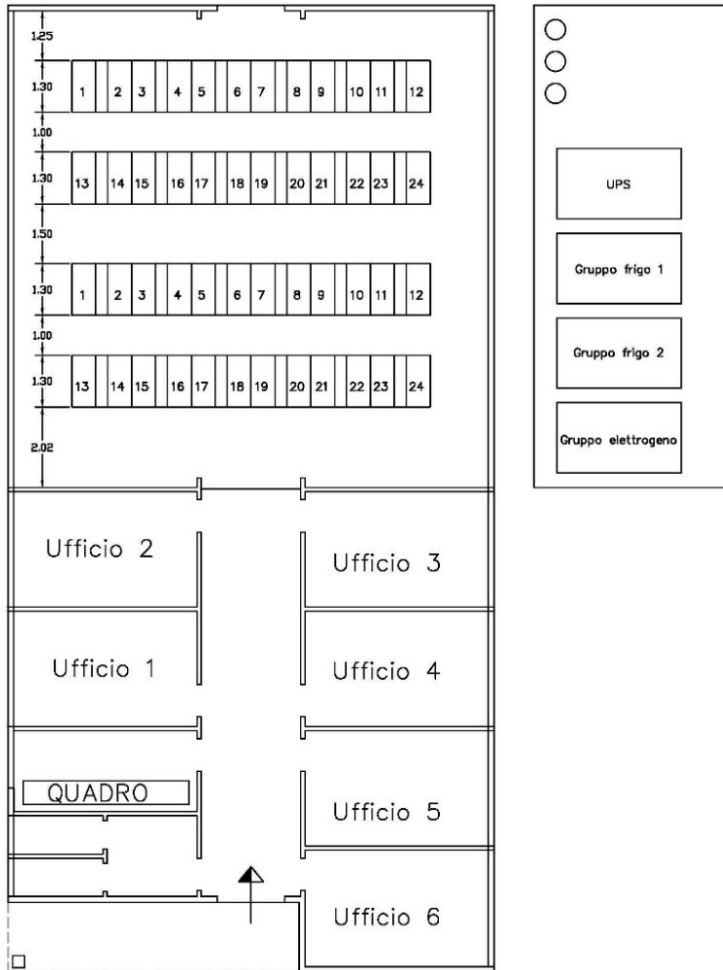
ISTITUTO NAZIONALE DI FISICA NUCLEARE
 Laboratori Nazionali di Legnaro

SERVIZIO GESTIONE IMPIANTI E SICUREZZE

Studio di fattibilità – Spostamento data center e uffici del Servizio Tecnologie Informatiche

Redattore	Verifica	Approvazione
Michele Galassi <i>Michele Galassi</i> Firma	Roberto Spagnolo <i>Roberto Spagnolo</i> Firma	Nello Stronati <i>Nello Stronati</i> Firma



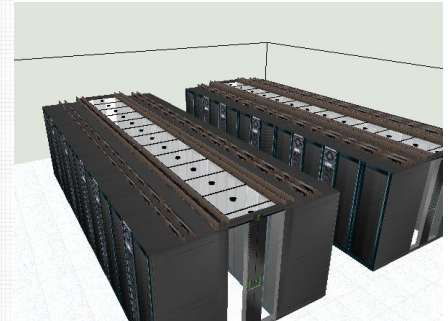
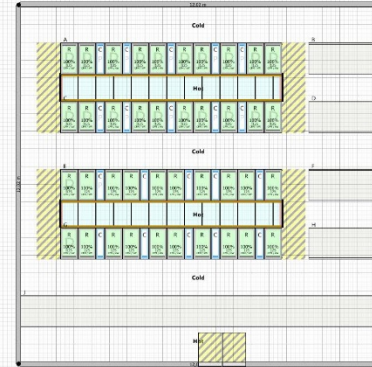


- ▶ **Goal: Building a new Data Centre that replaces the “old” GRID Room, providing more space and power for any future LNL IT needs**
- ▶ 144 square meters (12m x 12m) – half building
- ▶ 48 racks in total, two “hot aisle” groups of 24 racks each
 - In-row water cooling
- ▶ Refrigerating units, UPS, and diesel generator located outside the building
- ▶ Modular approach for future growth
- ▶ 24 racks (1 hot aisle) dedicated to the equipment now hosted in the GRID room
- ▶ 24 racks (second hot aisle) for expandability
- ▶ Maximum power consumption of about 10kW per rack
- ▶ Cost estimation (optimistic!?) of 240 kEuro plus taxes for:
 - Building adaptation and refurbishment
 - N.2 250kW refrigerating units
 - 200 kVA modular UPS system
 - 600 kVA diesel generator
- ▶ *The cost estimation did not include:*
 - *The project done by an external company*
 - *All the infrastructure for the second hot aisle (needed for AGATA)*

New Data Centre: very very preliminary rack design

Work just started

- ▶ **Preliminary tentative rack design by APC/Schneider-Electric for a 12x12 room**
 - 40 racks
 - 2 “hot aisles” with in-row coolers
 - Some space left around the racks for other equipment (if needed)



- ▶ The feasibility study by LNL technical department is the starting point to project and build a new data centre.
- ▶ More detailed **layout** and **cost evaluation** is ongoing
- ▶ Important decision still to be taken:
 - Increase the size of the room? Dedicate all the building to Data Centre?
 - What PUE we would like to have?
- ▶ Next step: **detailed project by an external company with experience in data centre projects and “green” technologies**
 - Company contract by the end of the year!?

- ▶ All AGATA equipments / subsystems have networking requirements
 - Equipment in the **experimental hall** (Digitizers, HV, LV, ...)
 - Equipment in the **Computing Room (AGATA DAQ / electronics / storage)**
 - **Control Room** PCs
 - **Complementary detectors** installations
 - ...
- ▶ For each sub-system it is important to identify, discuss and define in detail:
 - Networking Functional Requirements
 - Performance needed
 - Network configuration
 - CyberSecurity issues
 - Who are the IT administrators
 - Access from the LNL «general purpose» network and from outside sites for:
 - Administration, support, operation, monitoring, ...
 - Outbound connections to copy data (GRID access) or import data
- ▶ We need to plan and setup a **secure** but **functional** and satisfying **networking infrastructure, compliant with EU, Italian, INFN laws and regulations**
 - Documentation is very important (wiki!?)
 - Working Group to collect and analyse all the requirements?

Complementary detectors: DAQ operation and monitoring

- ▶ LNL DAQs (**Prisma**, **GALILEO**, Pisolo, ...) use **XDAQ**, a C++ software framework developed at CERN by the LHC **CMS** experiment TriDAS group
- ▶ A generic XDAQ RU (readout unit) provides the mechanisms to integrate several different readout mechanisms into the data flow
- ▶ XDAQ was adopted for **Prisma** VME readout during the AGATA Demonstrator@LNL (2009-2011):
 - Prisma data were then merged with AGATA data by Narval software
- ▶ Prisma VME readout is going to be replaced by using GGPs or CAEN Digitizers (R&D in progress), using the XDAQ generic RU, and needs to be integrated in Agata data flow
- ▶ Galileo DAQ is fully based on XDAQ and experience to readout and integrate several complementary detectors was done
- ▶ The idea is to use XDAQ for the LNL complementary detectors

See tomorrow Alain Goasduff presentation

Issue / Question:

- ▶ Overall Integrated Run Control and Monitoring for AGATA + complementary detectors
 - DCOD based?
 - GALILEO XDAQ based?
 - Ganil RC?

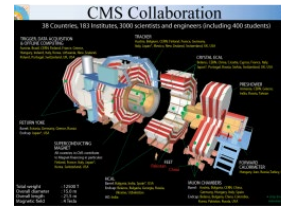
- ▶ AGATA DAQ requirements cannot be easily satisfied by the present LNL computing infrastructures
- ▶ A **new Data Centre**, replacing the present GRID data centre, will provide a new important multidisciplinary infrastructure for the laboratory, and is going to satisfy the AGATA requirements for the LNL campaign
- ▶ Building «in time» the new data centre is a «nice» challenge
 - Work just started
 - For the detailed project a commercial company, with the proper expertise with data center «green» solutions, will be identified (this year)
- ▶ The upgrade of the VAX room is still a backup (not easier) option
- ▶ **Networking** requirements and cybersecurity issues must be evaluated for any sub-system or equipment related to the AGATA apparatus
 - Working group?
- ▶ Complementary detectors readout in XDAQ to be integrated with the AGATA main data flow
 - Who will provide the «global» Run Control and overall monitoring software?

Thanks
Q&A

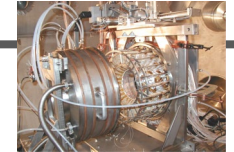


Sistemi di acquisizione dati

- Presa dati 2019: **Prisma, Pisolo, Exotic e Galileo** ai LNL, **Drift Tube di CMS** al CERN (con INFN PD)



- Nuove richieste di supporto: **GARFIELD** in collaborazione con INFN Fi



▶ **Galileo: Prima presa dati a LNL: luglio 2015**

- DAQ basato su **CMS XDAQ** framework
- 9 server per acquisizione dati, 5 server per servizi, 1 storage (3 box da 48TB l'uno), 2 cpu su crate vme, 5 desktop
- Rete: connessione a 20 gigabit tra server di frontend in sala2 e server di backend (build e storage) in sala GRID



▶ **Attività anno 2019**

- Supporto alle prese dati degli esperimenti
- **Pisolo: Upgrade DAQ**
 - nuovo HW PCIe e porting software a XDAQ13
- **Galileo:**
 - Porting software RU e filtri su CentOS7/XDAQ14: test con fascio ongoing
 - installazione e gestione pc per test rivelatori
 - sviluppo e test software per miglioramento prestazioni
- **R&D per readout con nuovi digitizers CAEN**
 - Interesse per Prisma e altri ancillari AGATA

▶ **AGATA a LNL (2007-2011)**

- Computing: **2 rack in sala VAX** (rack elettronica esterni)
- Integrazione rete e sicurezza LNL
- Contributo sviluppo DAQ ("DAQ Box")
- Integrazione DAQ di Prisma
- Sviluppo Run Control (CMS RCMS) per campagna LNL
- Partecipazione sviluppo DAQ Box
- Control room
- Supporto DAQ

▶ **AGATA a LNL (2021 →)**

- **Computing: 8 rack, 50kW di Potenza (Sala VAX!?)**
- Integrazione rete e sicurezza LNL
- **Upgrade e Integrazione DAQ di Prisma e ancillari**
- **Run Control (non si userà quello di Ganil): sviluppi software necessari**
- DAQ ("DAQ Box") gestita dalla collaborazione (Orsay)
- Control room
- Supporto installazione DAQ e primo intervento



Reti e Sicurezza Informatica

- ▶ **Misure Minime di Sicurezza Informatica per le PA (entro 31/12/2017)** - Agid
 - Normativa **obbligatoria** per le PA: definisce in modo dettagliato le misure minime di sicurezza da adottare
 - **INFN**: distinzione tra macchine **GA (gestionali- amministrative)** e **TS (tecnico-scientifiche)**
- ▶ **GDPR (General Data Protection Regulation)** – dal **25/05/2018**
 - Regolamento europeo relative al **Trattamento dei dati personali**
 - Nominato dall'INFN il **DPO (Data Protection Officer)**: dpo@infn.it
 - **Le Misure Minime AgID costituiscono la base per l'applicazione del GDPR**

Attività CCR in corso

- ▶ Revisione del «Disciplinare»
- ▶ Documenti «Norme d'Uso per sistemi TS»
- ▶ Corso/Tutorial online sulla sicurezza informatica

Rete Locale (LAN) in continua evoluzione

- ▶ Modifiche nelle modalità di gestione e accesso alla rete e ai servizi dettate da «best practice» e «**normative di legge**»
- ▶ Create **zone GA (Gestionali-Amministrative)** per i servizi di **Amministrazione, Direzione, Fondi Esterni** e **STI** (mail server, ...)
 - Applicazione **restrittiva** delle Misure Minime Agid
 - Rete dedicata e isolata, **PC completamente gestiti da STI**
- ▶ **Zone TS (Tecnico-Scientifiche)**
 - Servizi, Impianti, Esperimenti, ... ma anche desktop e laptop personali
 - Applicazione meno restrittiva delle misure Agid
 - **PC e server gestiti dagli utenti (amministratori)**

Responsabilità degli utenti

- ▶ Rispettare il «**Disciplinare per l'utilizzo delle Risorse Informatiche**»
 - Accettato e firmato per presa visione da tutti
- ▶ Collegare in rete solo risorse registrate e autorizzate
- ▶ Amministrare correttamente le risorse informatiche
 - Utilizzo di **password** non banali e «private», utilizzo di **software con regolari licenze**, utilizzo **antivirus, backup** dei dati rilevanti, ...
- ▶ Porre attenzione nell'utilizzo corretto dei servizi utilizzati (es: mail di phishing) e ad eventuali dati personali e/o sensibili