

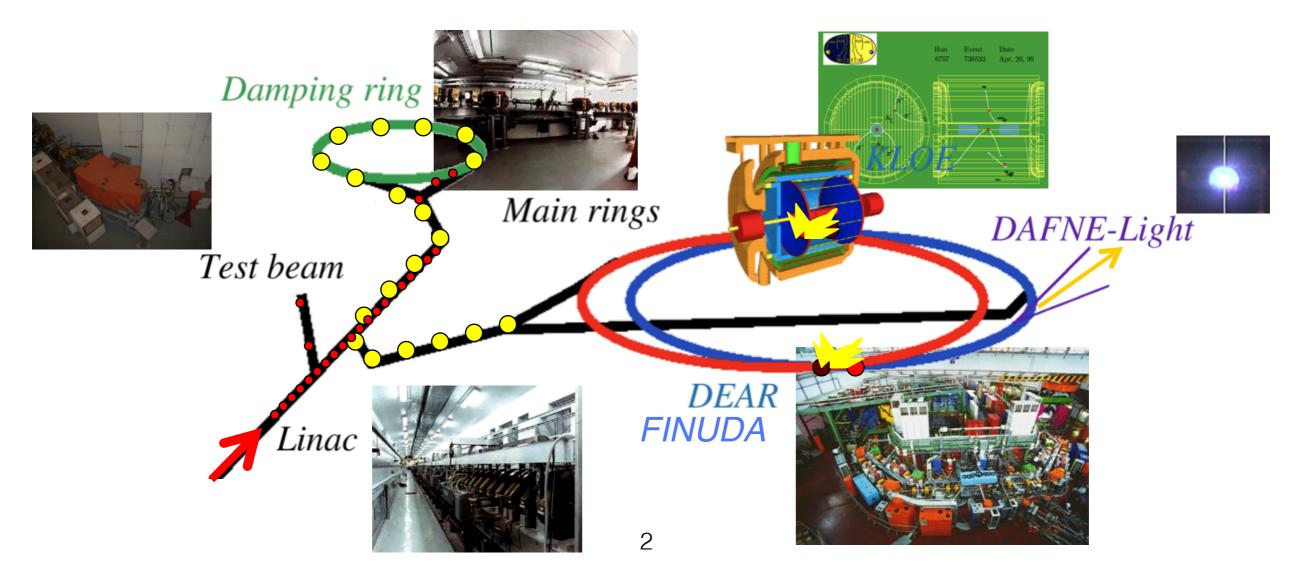
Task 8.2.2

Test beam infrastructure in Frascati LNF, Ferrara & Perugia INFN structure and University of Bergen



DAFNE accelerator Complex

The BTF (Beam Test Facility) is part of the DAFNE accelerator complex, a particles factory devoted to the production of Φ mesons and the study of K decay through the HEP and Nuclear Detectors KLOE, FINUDA and SIDDHARTA. Four synchrotron light beamlines are also available (Soft X, UV, Infrared, XUV).

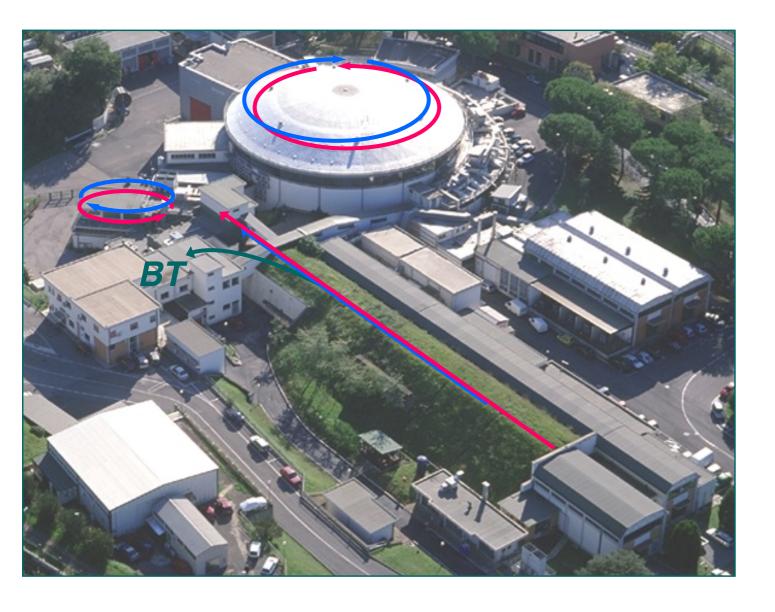


Beam Test Facility(BTF) Infrastructure



The Frascati Beam Test Facility infrastructure is a beam extraction line optimized to produce electrons, positrons, photons and neutrons mainly for HEP detector calibration purpose. The quality of the beam, energy and intensity is also of interest for experiments (~ 20% of the users) studying the electromagnetic interaction with matter









The **BTF** is a e⁻/e⁺ test-beam facility in the Frascati DAΦNE collider complex

high current Linac:

- $1 500 \text{ mA e}^- 100 \text{ mA e}^+,$
- 1 10 ns pulses, at least 10⁷ particles

Need to attenuate the primary beam:

Single particle regime is ideal for detector testing purposes

- Allows to tune the beam intensity
- Allows to tune the beam energy

BTF layout 1800 Entries 300 250 1e-200 **2e** 150 3e 100 50 12.5 Entries **BTF** DHSTB02 10 WCM⁻ $1.7 X_0$ $2.0 \, X_0$ $2.3 X_{0}$ SLTB04 Spectrum@target SLTB03 DHSTS01 momentum selection LINAC DHSTB101 tunnel ▶ to accumulator from Linac DHSTP001 SLTB01 SLTB02

DHTB\u00e4001

TARGET⁻

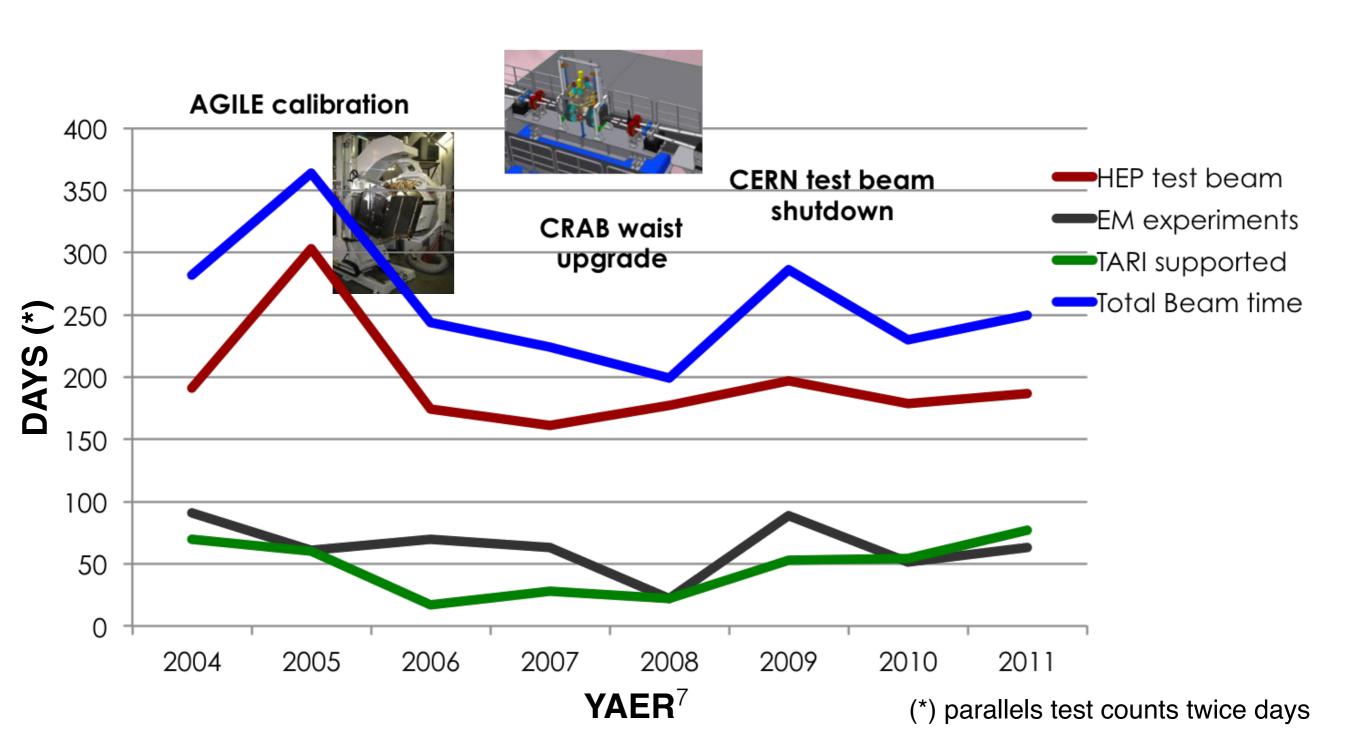
Facility beam line summary parameters



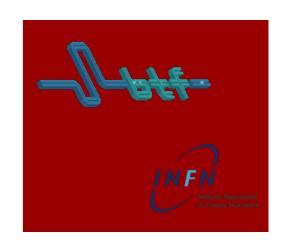
Operation mode	e ⁺ / e ⁻ beam	γ beam	Neutrons beam		
Energy range [MeV]	25-500 25-750(*)	100-500 100 -750 (*)	10 ⁻⁹ → 200		
Bunch Rate [Hz]	User triggered (*) 1 → 24 49 (*)				
Bunch length [nsec]	10 1 or 10 (*)				
Multiplicity [#/bunch]	1 → 1 → 1	4 10 ⁵ (@1.5m) n/s/cm ²			
Duty cycle [%]	~8 ~96	~40% ~96%(*)			
Spot size (Ϭ _x • Ϭ _y) [mm]	~ 2x2 ~5.5x5.5	>20	N.D.		
Divergence [mrad]	~ 1 — 1.7	>15	N.D		
Energy spread	1.00%	7.00%	N.D.		



Beam Test Facility operations



Beam Test Facility @ Europe



The Facility is since 2004 part of the **Transnational** Access to Research Infrastructures (TARI) in the Integrating Activity of "Strongly Interacting Matter", HadronPhysics2



and of the Advancing European detector development (AIDA) for the Improvement and coordination of **EU Test Beam lines**



Advancing European detector development

The AIDA project addresses infrastructures required for detector development for future particle physics experiments. In line with the European strategy for particle physics, AIDA targets user communities preparing experiments at a number of key potential future accelerators: SLHC (luminosity-upgraded LHC), future Linear Colliders (ILC and CLIC), future acceleratordriven neutrino facilities or future B-physics facilities (e.g. Super-B).

The infrastructures covered by the AIDA project are key facilities required for an efficient development of the future experiments, such as: test beam infrastructures (at CERN and DESY), specialised equipment irradiation facilities (ir

CALICE 1m³ semi digital hadronic calorimeter, now in beam tests at CERN

several European countries), common software tools, common microelectronics tools and engineering coordination offices. The project, coordinated by CERN, involves more than 80 institutes and laboratories from 23 countries as beneficiaries or associate partners. Read

European funding to access test facilities

European researchers from outside the AIDA project can benefit from dedicated Transnational Access funding to access AIDA test beams and irradiation facilities. Read

LATEST NEWS

23 Jan: Registration now open for AIDA industry event, student tutorial and annual meeting

More news >>

UPCOMING EVENTS

26-27 Mar: AIDA - Academia meets Industry: Solid-State Position Sensitive Detectors, DESY - REGISTER NOW

27 Mar: AIDA Student tutorial Solid State Detectors, DESY REGISTER NOW

28-30 Mar: AIDA 1st Annual Meeting, DESY - REGISTER NOW

More events >>

QUICK LINKS

FAQs for project members

Publication Database (CDS)

AIDA meetings (Indico)

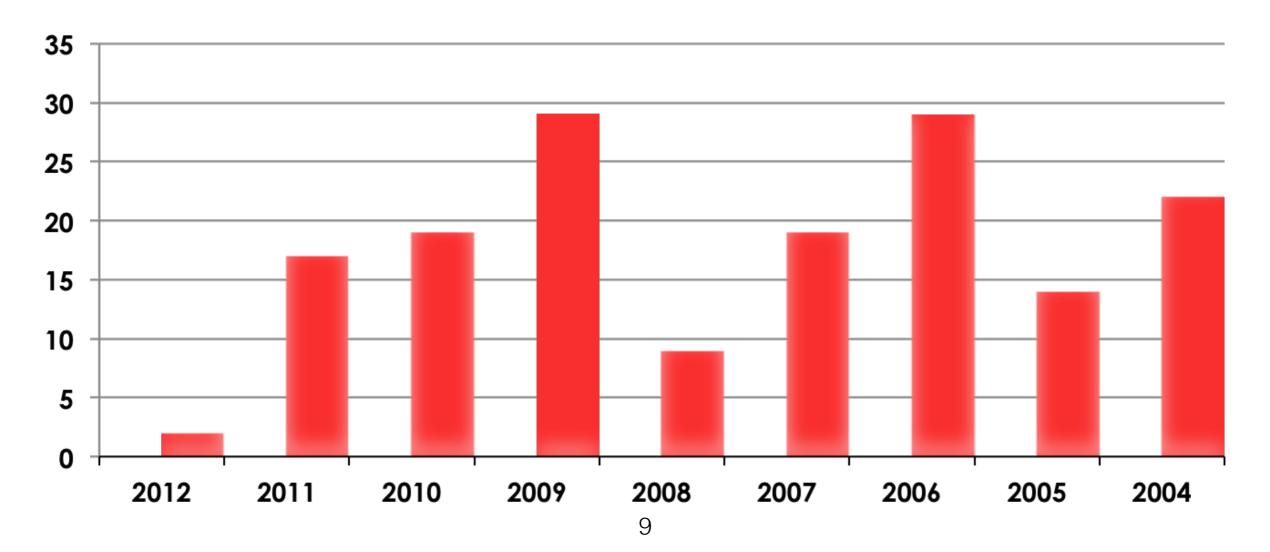
Intranet in



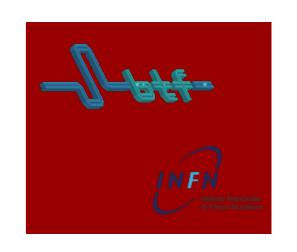


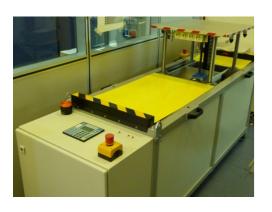
Scientific productivity: citations

It's not easy to **track all publication**, many users do not cite the facility, someone cite in the wrong way. A simple search on *google scholar* of the keywords **BTF+INFN** show an average of **18 publications per years**.



Conclusions @ KICK-OFF MEETING (February 2011)

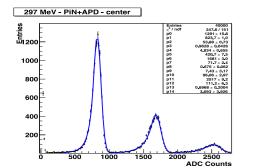




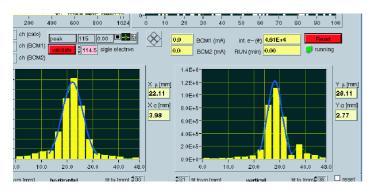
- design and put in operation a remotely controlled trolley for detector test
 - installation foreseen in march 2011



- equip the BTF with a GEM chambers for monitoring with a resolution of about 100 μm
 - very good result obtained; high resolution device is under development

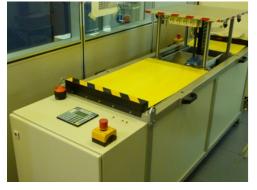


- equip the BTF with LYSO calorimeter as monitor the beam energy
 - preliminary test done. More measurements, electronic tests, etc are foreseen in 2011
- muti purpose DAQ system
 - continuously under implementation adding new board & drivers. Photon tagging & data tag and synchronization is in progress

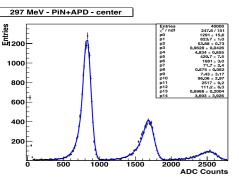




Status @ 20 May 2011







200 400 600 800 1024 0 10 20 30 40 50 60 70 80 90 100

ch (salo)
peak 115 0.00 0 00 BCIM1 (mA) int.e-(*) 4.51E+4
peak 115 0.00 0 BCIM1 (mA) int.e-(*) 4.51E+

- design and put in operation a remotely controlled trolley for detector test
 - done
- equip the BTF with a GEM chambers for monitoring with a resolution of about 100 μm
 - high resolution device is under development: neutron efficiency and rejection under test with new prototype
- equip the BTF with LYSO calorimeter as monitor the beam energy
 - Second test done in May, father measurements foreseen in Sep.
- muti purpose DAQ system
 - in progress: DAQ data ROOT interface complete and available for users.

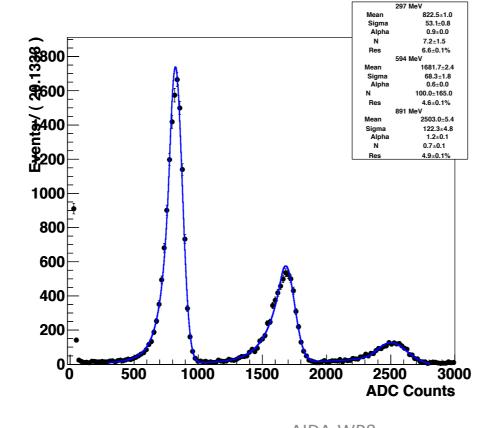


LYSO calorimeter to study the dependence of the beam energy and resolution on the beam operating parameters

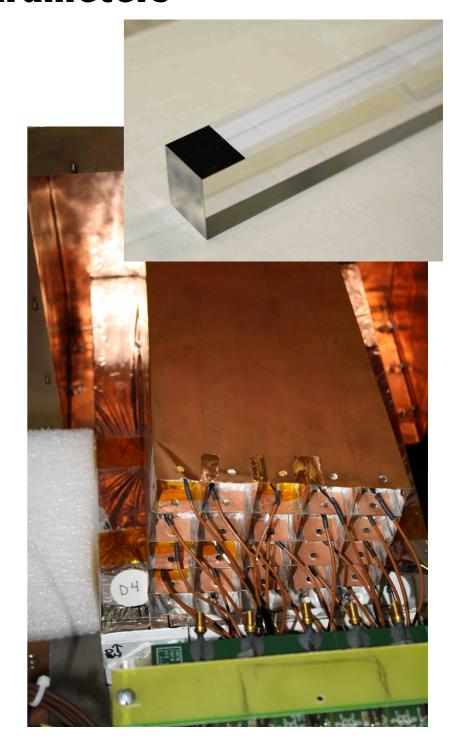
Prototype mechanical structure has been designed and built Front-end electronics has been designed and developed

25 Crystals in the matrix tested at the BTF facility in 2011.



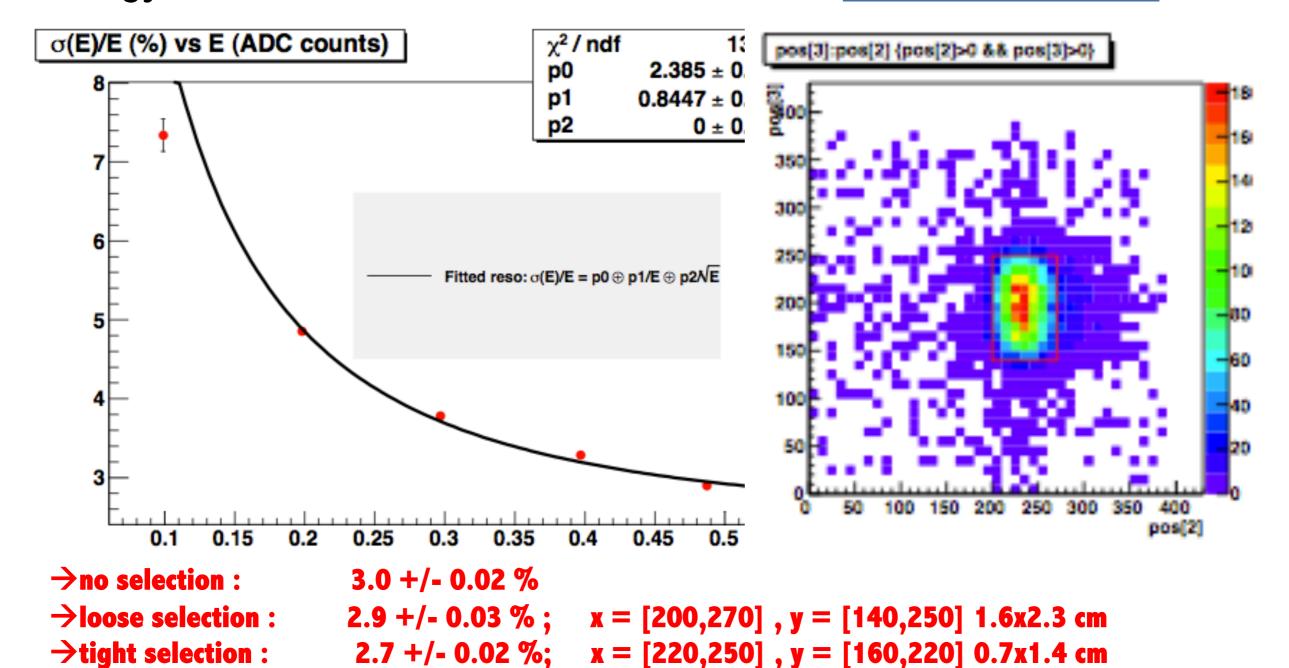


AIDA-WP8



Energy resolution fit — Silicon Selction

Silicon Selection Effects



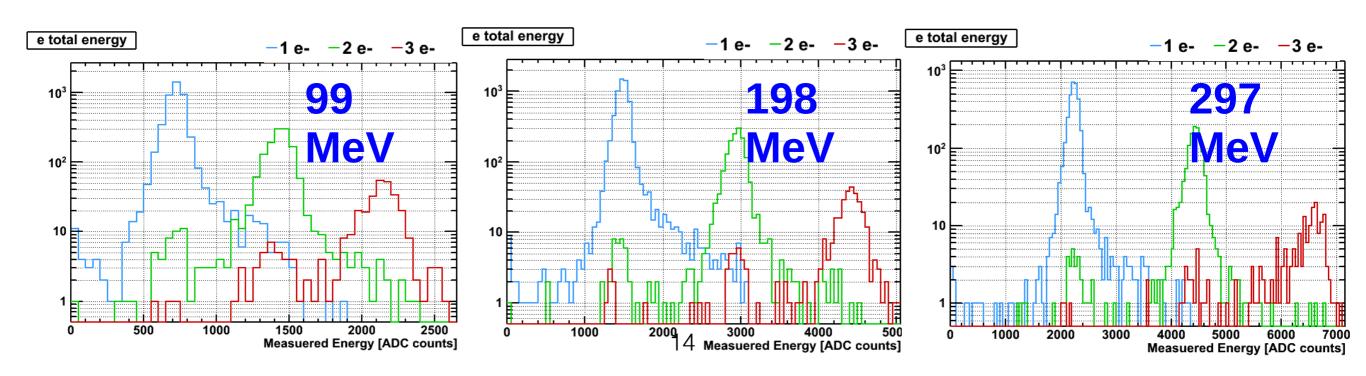
Another Test Beam is ongoing this week with optimized LY uniformization (roughening of the crystal surface)

AIDA-WP8

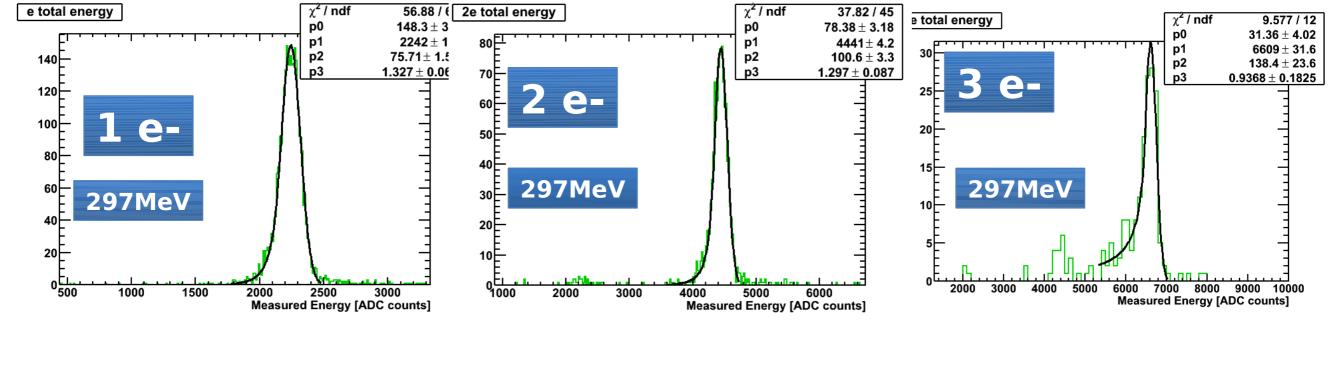
 \rightarrow very tight selection : 2.6 +/- 0.003 %; x = [220,240], y = [180,220] 0.5x0.9 cm

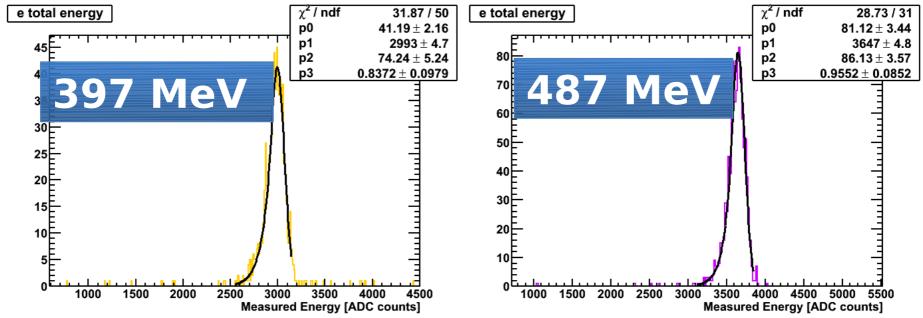
LOW MULTIPLICITY ANALYSIS

E _{meas`} Beam	99	198	297	397	487	594	891
99	99x1	99x2	99x3				
198		198x1		198x2		198x3	
297			297x1			297x2	297x3
397				397x1			
487					487x1		

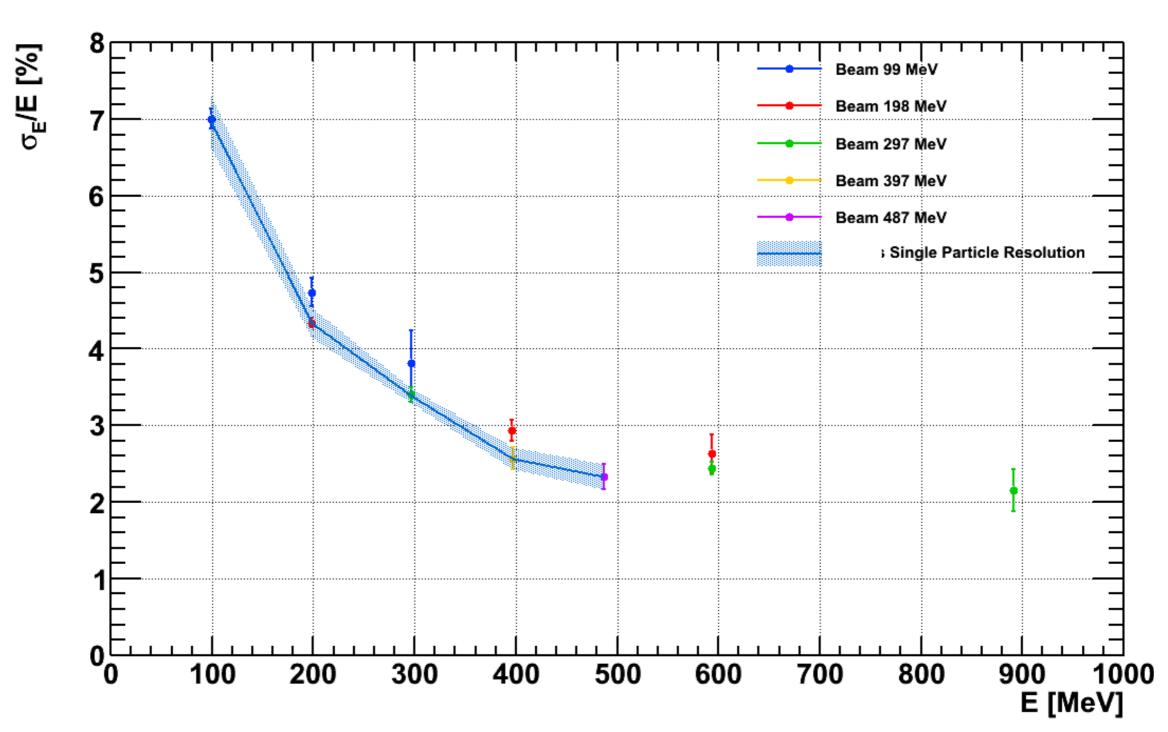


TYPICAL ENERGY FIT

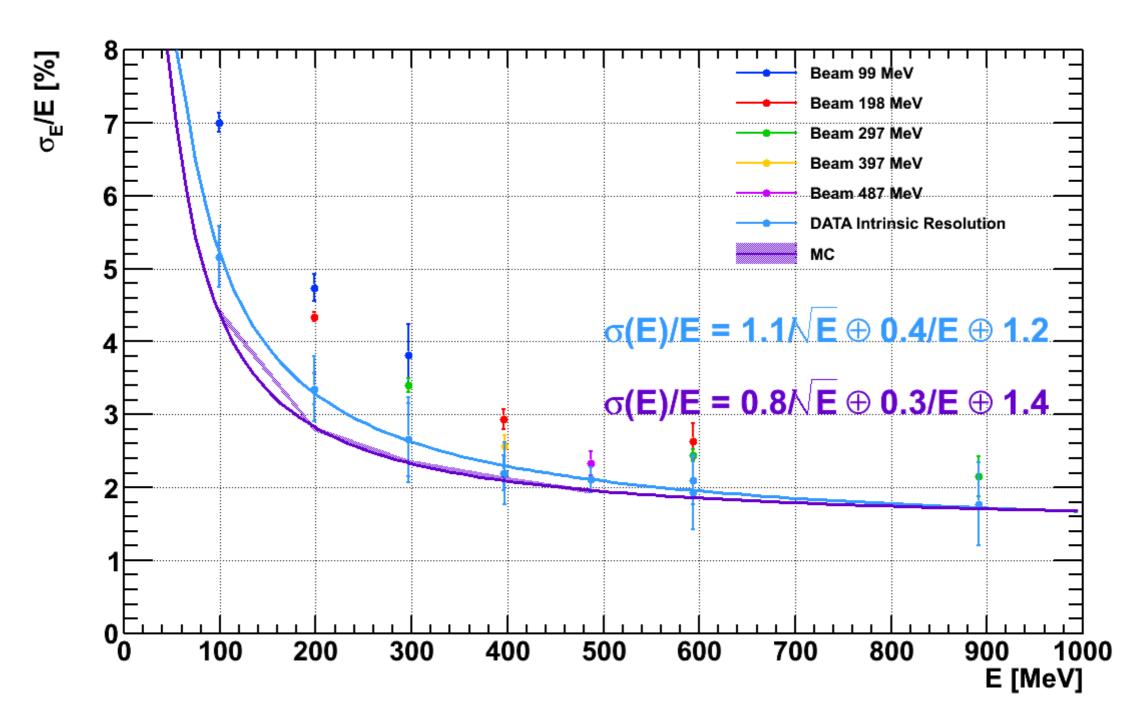




Multi Particle Resolution vs Energy

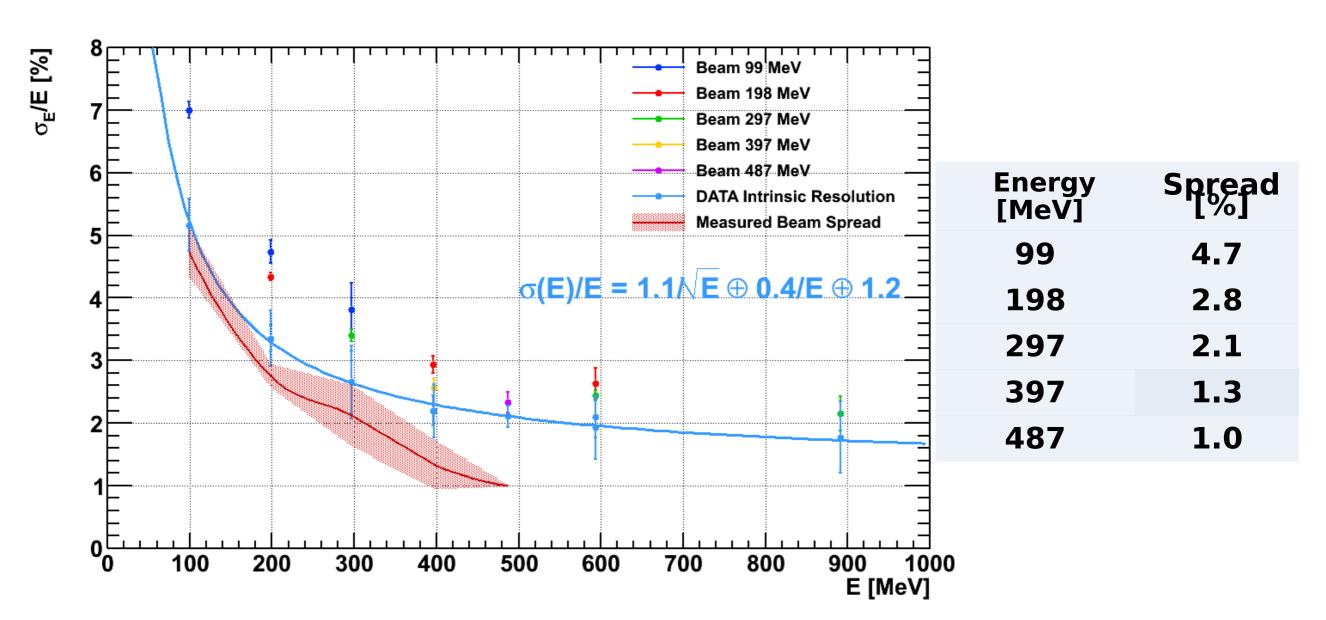


Exp. Data vs MC comparison



- Subtracted DATA-MC agreement within errors, MC resolution is systematically better than DATA
- MC with proper beam spread under production

Btf Beam Energy Spread



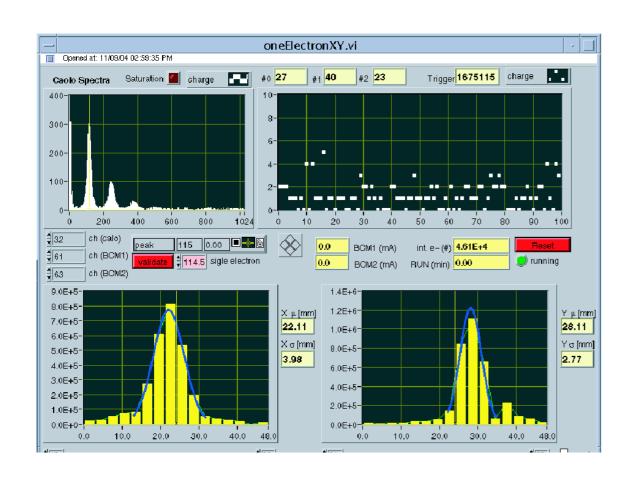
But this method needs further measurement to be validate:

- energy loss due to beam divergence calorimeter/cells border effects
- energy loss in the Silicon Tracker
- statistics

LYSO calorimeter

- During 2011/2012 the measure of energy beam quality has been setup and we understand how to proceed
- A **cross calibration** of the calorimeter is foreseen for October 2012 at the Maintz photon beam.
- In the mean time the UIB is setting up a crystal calorimeter in order to measure the component in 100keV range
- A simulation of the full calorimeter matrix is in progress. Is expected to be completed in 2013
- In the second half of 2013 the final measurements is expected to complete the milestone.

DAQ & full simulation



The BTF DAQ is developed in labVIEW and partially integrated in DAFNE control system

The purpose of the task is to integrate all the device avaliable for users, beam diagnostics and DAFNE controls in a common DAQ system able to acquire most of the users equipment and/or share machine data for experiments

A full **simulation**, **optics** layout etc, are continuously upgrading in order to take in to account the beam line development

DAQ and software development

- GEAN4/GEANT4 BEAM LINE of the full BTF extraction line.
- Development and optimization of the DAQ for:
 - GEM tracker
 - Neutrons detectors
 - Silicon tracking chamber (photon tagging)
- Refurbishing of the BTF DAQ System in !CHAOS framework



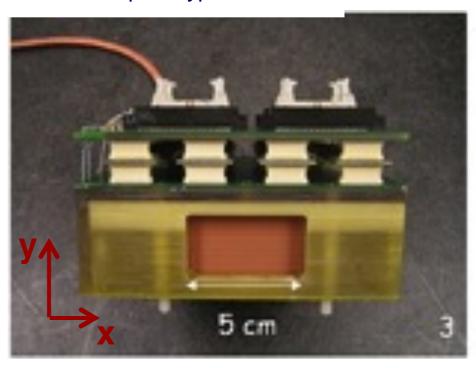
a new SidC topology with the following futures:

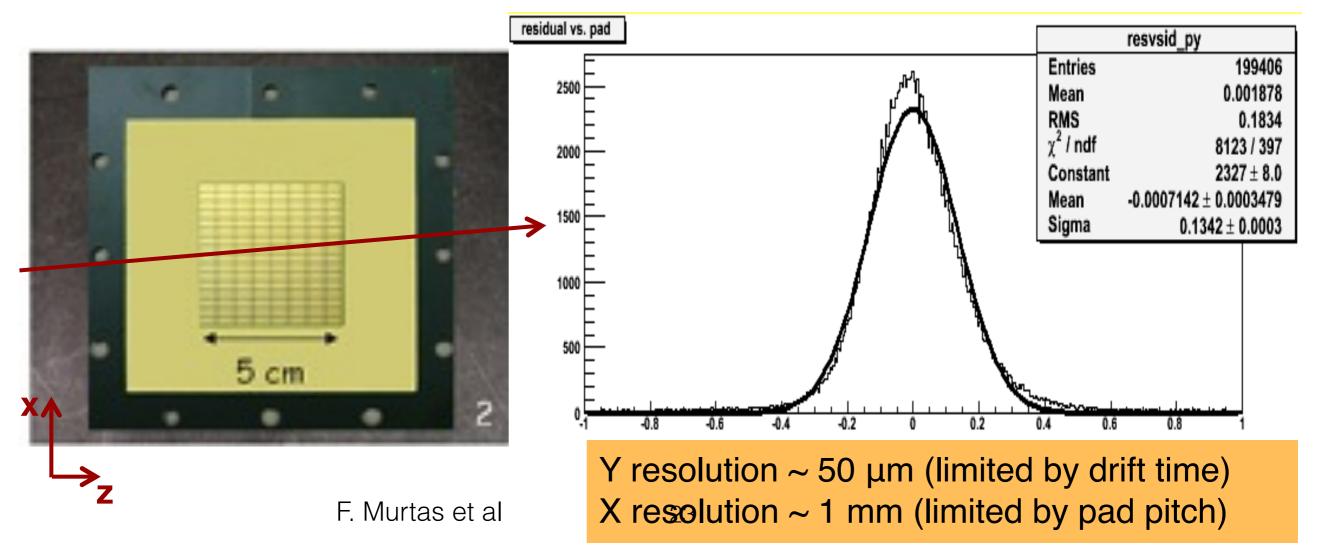
- redundancy of all its parts; intrinsic scalability; no point of failure; hardware (device to be controlled) hot-integration and auto configuration
- integration in the SidC structure (library) of triggered DAQ operation mode
- based on a distributed object caching for real-time data access (Live Database)
- based on **no relational** database-oriented archiving data (History Database)
- abstraction of the structural components of the control to reduce dependence on the particular HW and SW, allowing for an extreme adaptability
- compatibility with commercial standard and custom components and any future developments

GEM-TPC Traker

GEM TPC cross section beam Triple GEM structure 8 samples for each readout

GEM TPC prototype





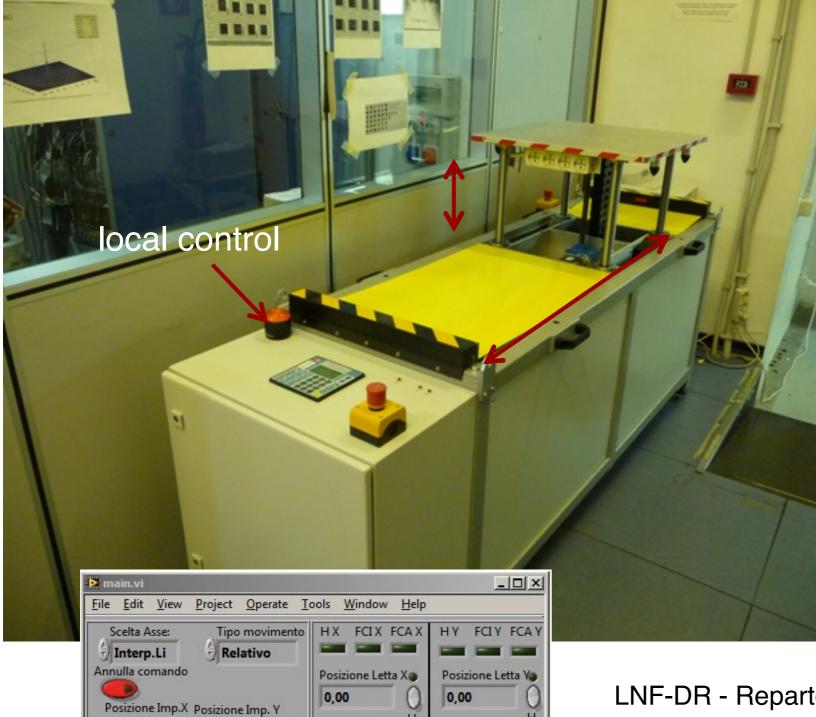
Activity report for a TPC GEM tracker

- A prototype for a 3D track system has been developed in Frascati Laboratory. It consists of a **compact TPC with 4 cm drift**, and a **triple GEM** structure as readout system.
- The tracker system has been tested at BTF in various condition of particles multiplicity, from single up to thousand electrons per bunch, and at CNAO with continuous **proton** beams. A resolution of **80 microns** for a single particle has been **checked correlating data of a medipix** telescope.
- A test beam has been done on November at CERN using a Lead Ion beam.
- Final system of TPC GEM readout with a data acquisition card based on FPGA and powered with the HVGEM module will be ready in April. The test of two profile chamber prototypes is foreseen for the end of the 2012

Remote trolley

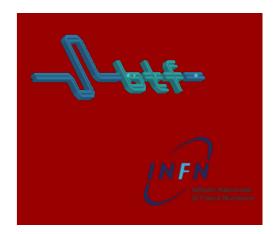
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STOP

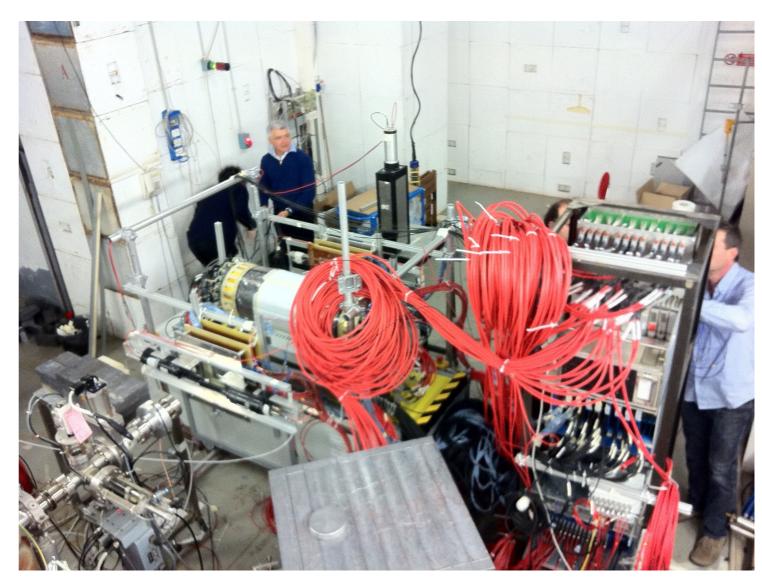
LNF - Div.Ricerca - Rep. Automatismi & Controlli



LNF-DR - Reparto Automatismi e Controlli: Ubaldo Denni, M. Antonietta Frani, Giuseppe Papalino

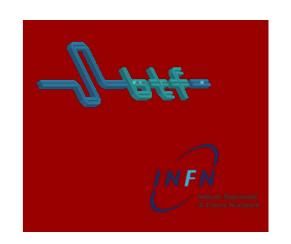
Remote trolley

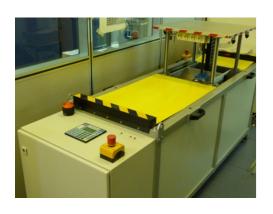
Trolley parameters				
disposable area	600x600 mm			
min height	915 mm			
max height	1250 mm			
horiz. excursion	1000 mm			
max load	200 Kg			
accuracy	< 1 mm2			

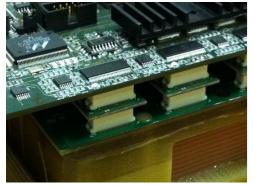


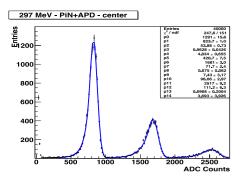
KLOE inner tracker (GEM foil cilindric) test beam on the BTF remote controlled trolley 26

Task 8.2.2 mileston status @ 28 Mar 2012









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- remote trolley
 - done
- equip the BTF with a GEM chambers for monitoring with a resolution of about 100 μm
 - in progress: HVGEM module will be ready in April. The test of two profile chamber prototypes is foreseen for the end of the 2012
- equip the BTF with LYSO calorimeter as monitor the beam energy
 - in progress: new measurement started on the 25/3. A cross calibration of LYSO is foreseen at Maintz in October.
- muti purpose **DAQ** system
 - in progress: we are working on the integration on new diagnostics and the porting under !CHAOS freimwork