G-2 Update

G. Venanzoni
INFN/LNF

Riunione con i referee 7 Maggio 2014

Outline

- Stato dell'esperimento;
- Reminder sul sistema di Calibrazione
- Riassunto attivita' Italiana
- Stato della partecipazione Italiana
- Conclusioni

E989 Milestones, last 12 months

- June to July 2013
  - Storage Ring relocated from BNL to Fermilab (see photos)
- July 2013
  - NSF Major Research Instrumentation award made to support Detectors, Electronics, DA
- September 2013
  - INFN approves 1st year funding of calibration system
  - DOE CD-1 review of experiment and budget
- November 2013
  - Detector group test beam run at SLAC
  - UK groups awarded funding for g-2
- December 2013
  - CD-1 approved at $46.3 M TPC (excluding NSF and International)
- April 2014
  - MC-1 building beneficial occupancy for g-2

E989 Collaboration: 38 Institutes; >150 Members

- Domestic Universities
  - Boston
  - Cornell
  - Illinois
  - James Madison
  - Massachusetts
  - Mississippi
  - Kentucky
  - Michigan
  - Michigan State
  - Mississippi
  - Northern Illinois University
  - Northwestern
  - Regis
  - Virginia
  - Washington
  - York College
- National Labs
  - Argonne
  - Brookhaven
  - Fermilab
- Consultants
  - Muons, Inc.

Italy
- Frascati,
- Roma 2,
- Udine
- Naples
- Trieste

China:
- Shanghai

The Netherlands:
- Groningen

Germany:
- Dresden

Japan:
- Osaka

Russia:
- Dubna
- PNPI
- Novosibirsk

England

University College London
Liverpool
Oxford
Rutherford Lab

Korea

KAIST

FTE Committed

Survey of Collaboration for P5

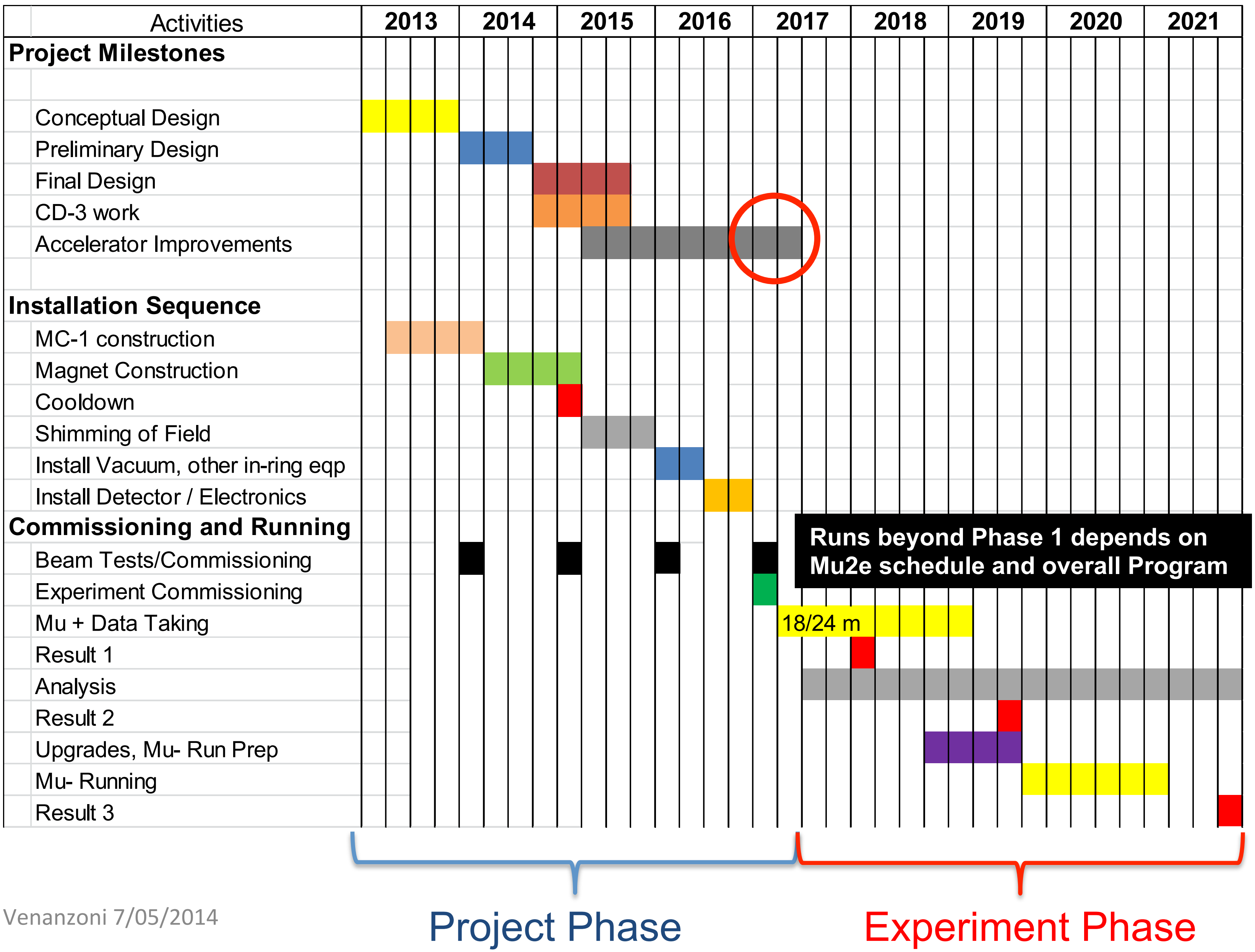
Construction	Runnning	Analysis
2014 - 2016	2017-2018	2019 - 2022
91	80	68

Almost doubled from the LoI to FNAL (2009)

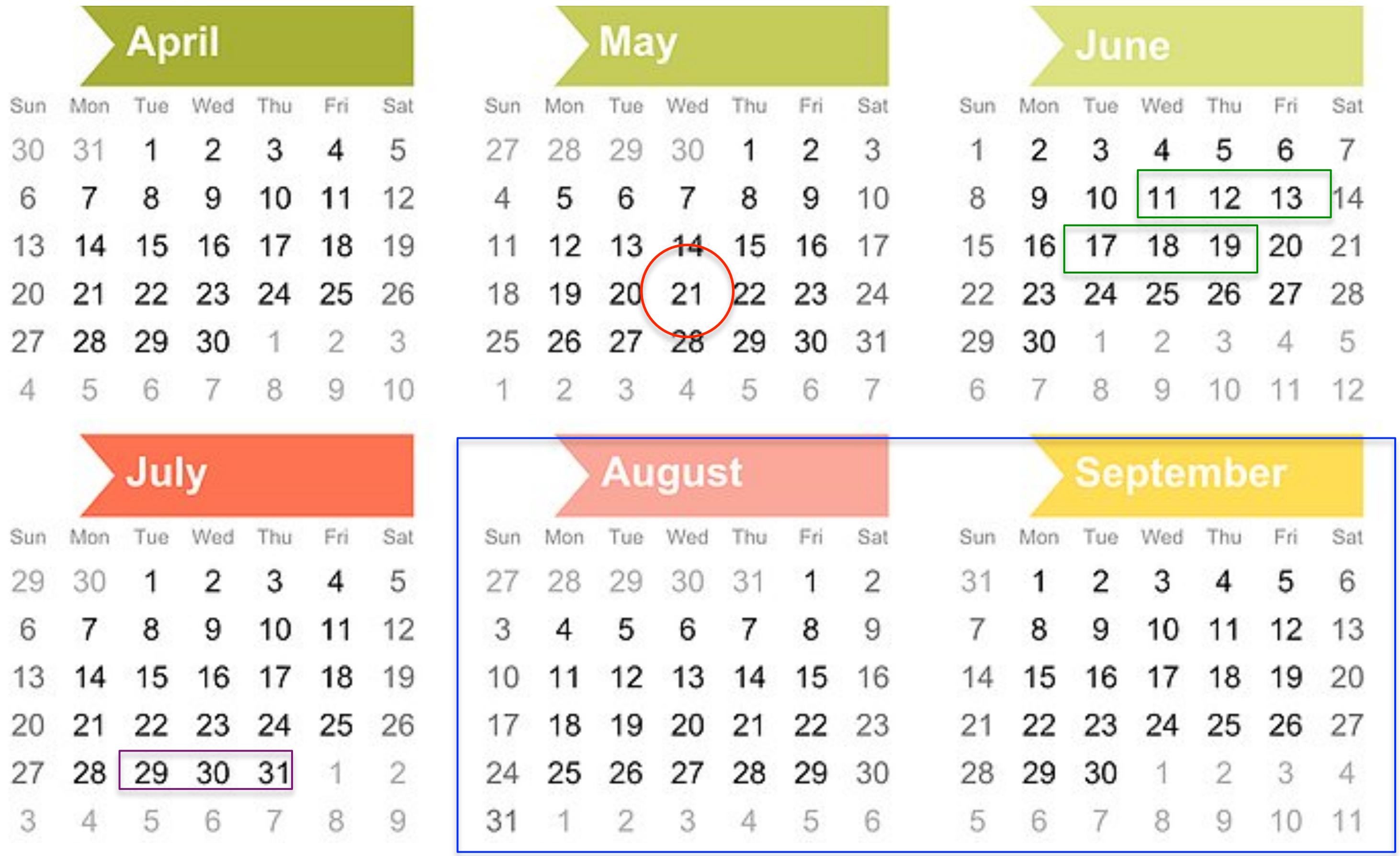
Technical Progress and Near-Term Plans

- Collaboration
  - Ring reassembly work in progress
  - Director's review, June 2014
  - CD-2 review July 2014.
  - Straw tracker group starts second test beam run April 2014
- Calorimeter Team Activities
  - PbF2 crystals ordered from SICCAS
  - Next-generation Hamamatsu SiPMs received and in tests
  - Bias control system designed
  - Digitizer prototypes built; Upgrade to 800 MSPS made
  - DAQ tests for timing and analysis throughput successful
  - Test Beam at SLAC July 2014
- Calibration Specific Activities
  - New simulations confirm the essential gain monitoring stability benchmarks of 0.04% over 700 μs for T method
  - Italian team design meeting all specs so far
  - More details on other slides

Timeline (fiscal year)



CD2/3 Doe Review on 29-31 July



Date to Post Documents

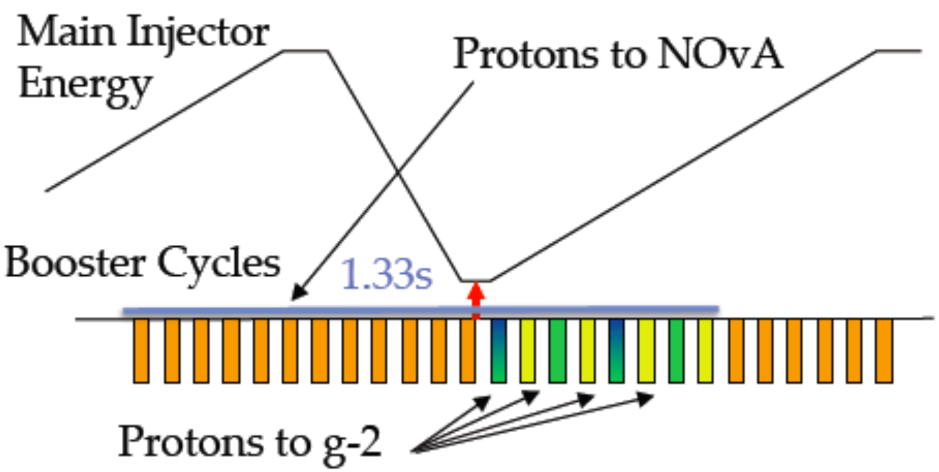
Two week window for 3 day Director's review

Two week window for 2 day DOE Review

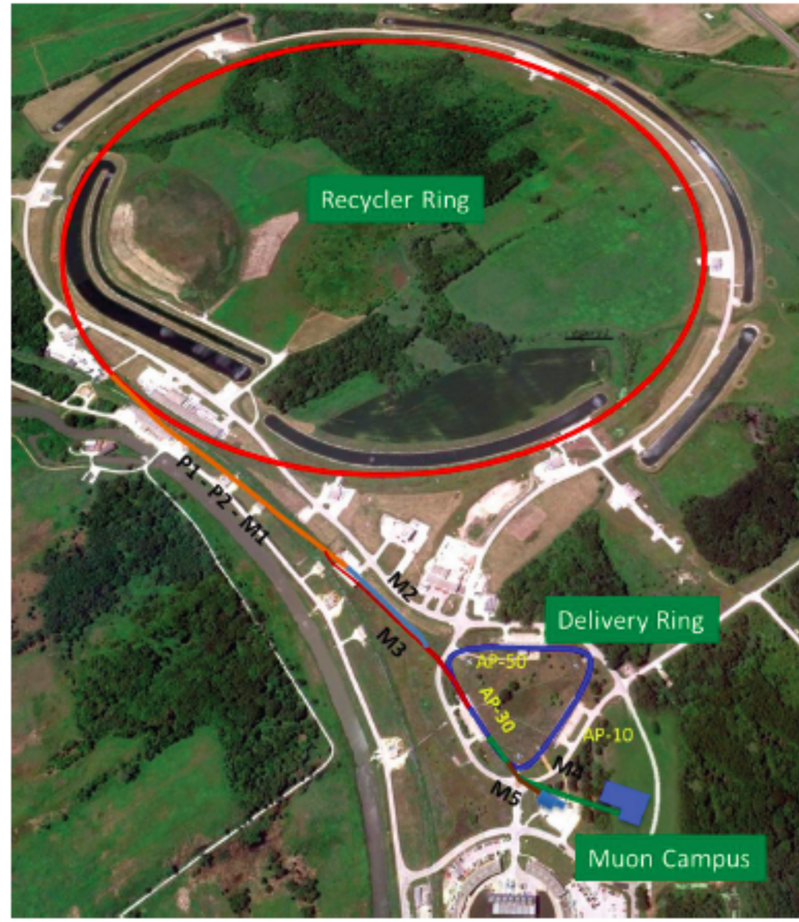
Last 10 weeks of fiscal year

Convert Anti-Proton Source to Custom Muon Source

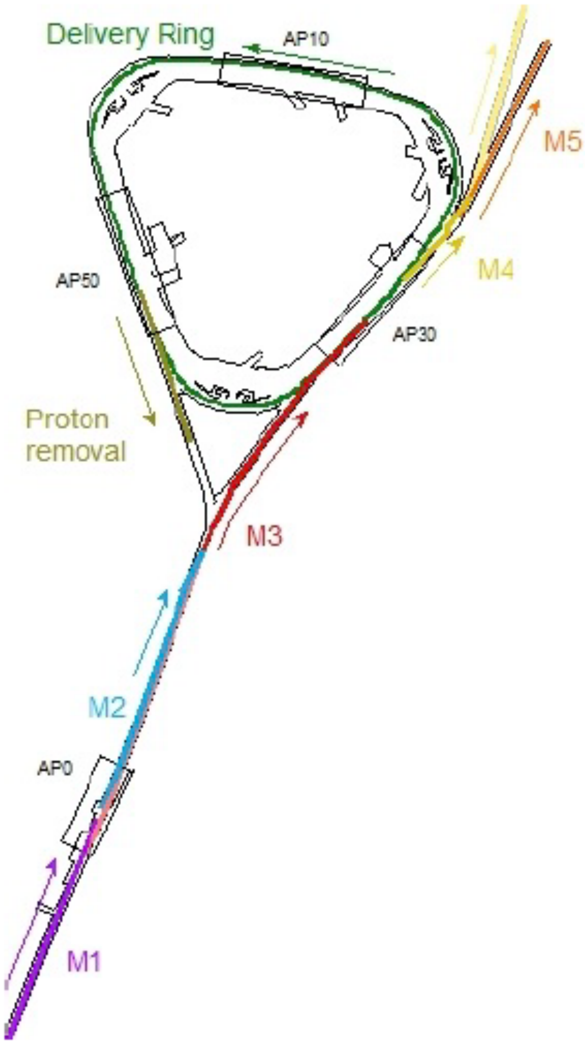
- **share bunches**



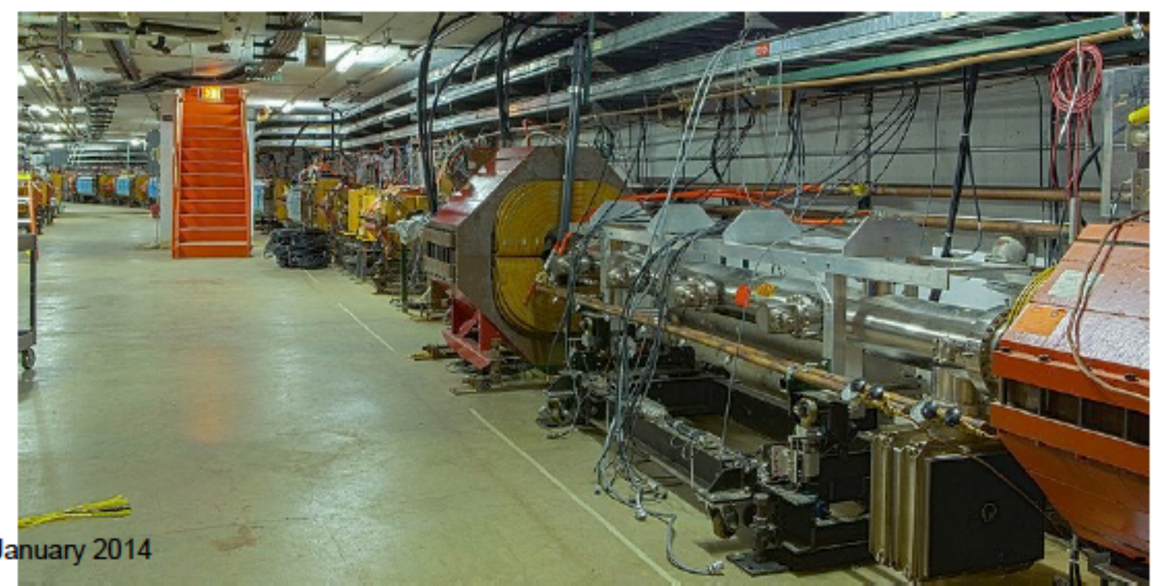
- **> 6x more muons than BNL**
  - 0.4, for reduced π yield
  - 1.8, smaller β in FODO
  - 2, longer decay L
  - 3, forward decay
  - 1.33, π dp/p
  - 2, open inflector/ kicker



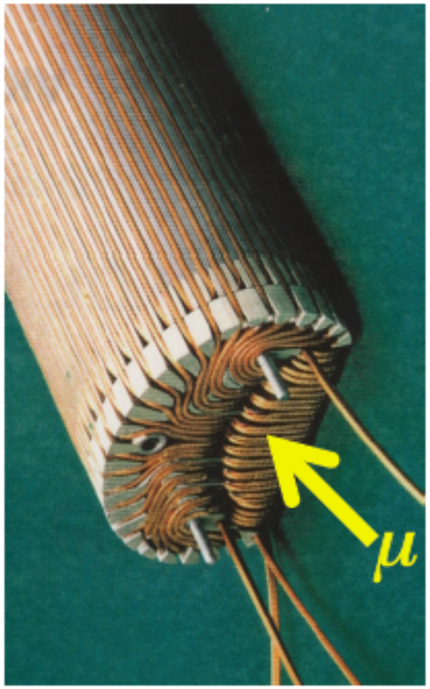
Beamlines

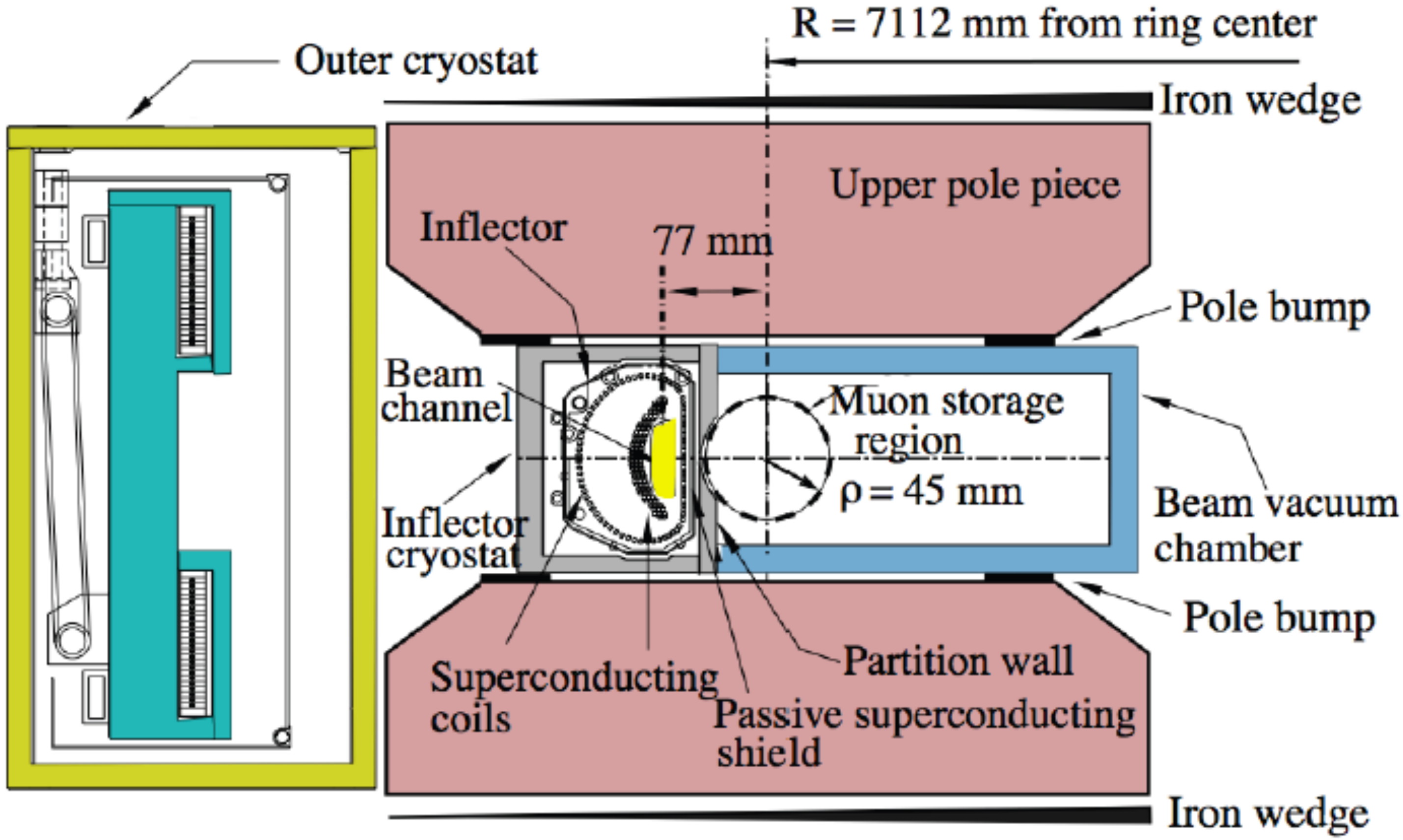


- Re-use existing Antiproton-source infrastructure
- Modify final focus on target for 8-GeV primary beam (M1)
- Improve acceptance / decay-muon capture in secondary lines (M2/M3)
- Reconfiguration of extraction region (D30 straight) and extraction from Delivery Ring
- New external beamline to g-2 storage ring (M4/M5)



New Superconducting Inflector to replace E821



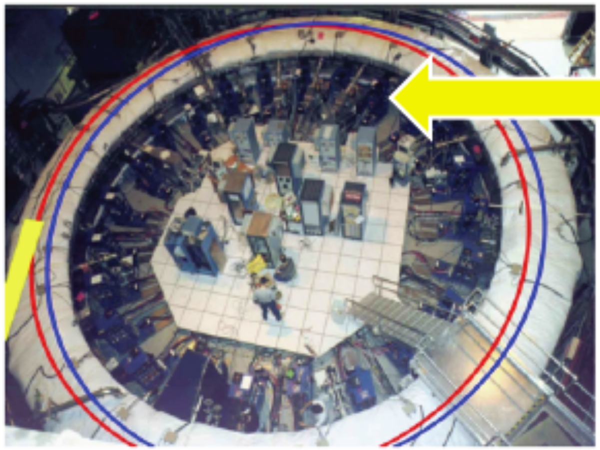


Goal: New inflector with no material over the beam and wider aperture

New Inflector Task Force (Boston, BNL, Cornell, Fermilab, KAIST, RAL)

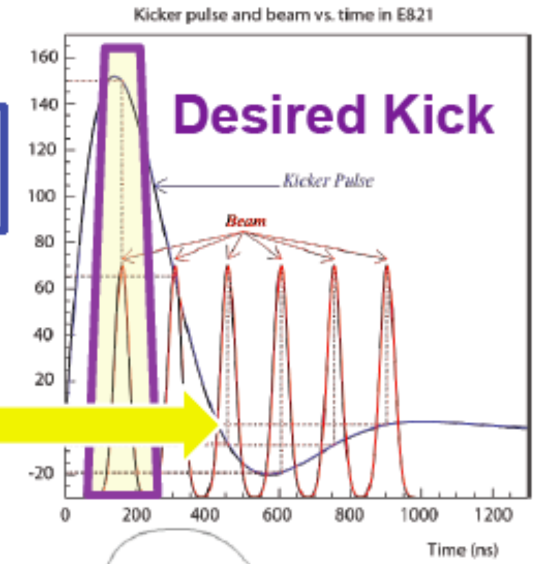
Victoria Bayliss, Tom Bradshaw, Nathan Froemming, Thomas Gadfort, Carol Johnstone, Vladimir Kashikhin, William Morse, Hogan Nguyen, Brett Parker, Chris Polly, Lee Roberts, David Rubin, Yannis Semertzidis, Vladimir Tishchenko, Alexander Zlobin

Improved muon Storage Fraction (Kicker, Quads and Inflector Upgrades)

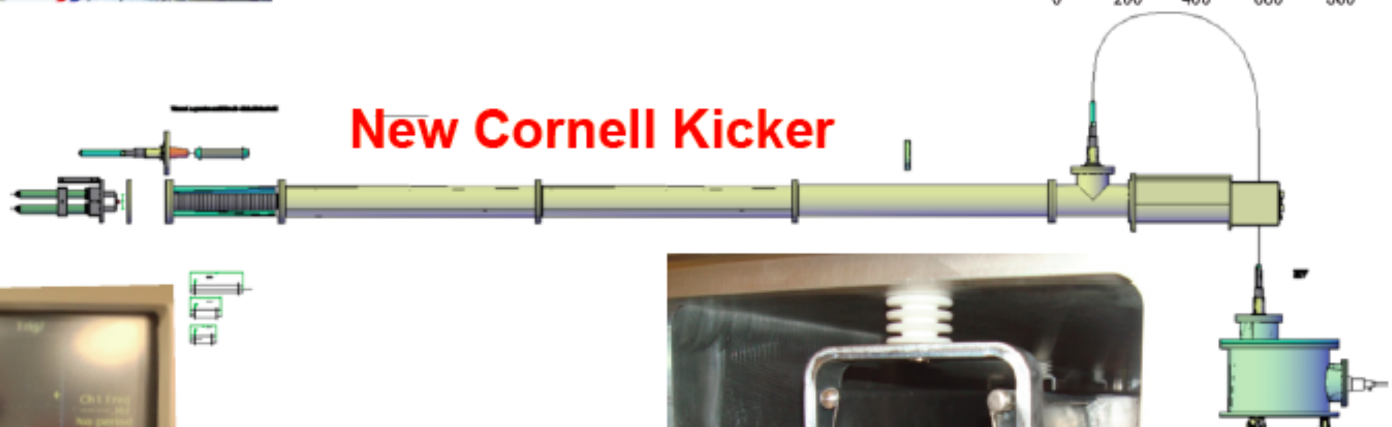


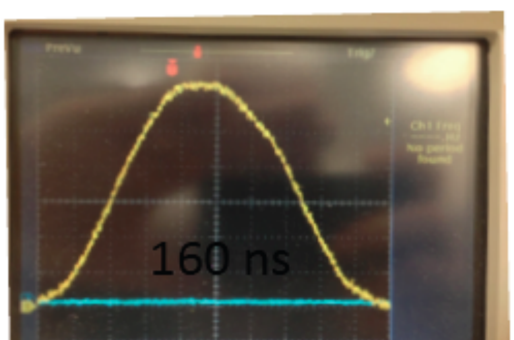
Kicker needed to put Muons onto a Stable Orbit

Old kick was too long, and not strong enough



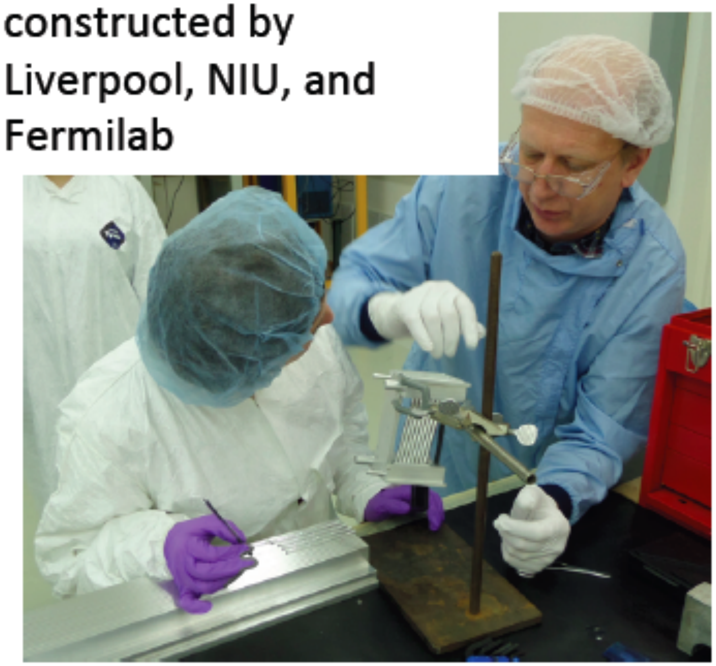
New Cornell Kicker

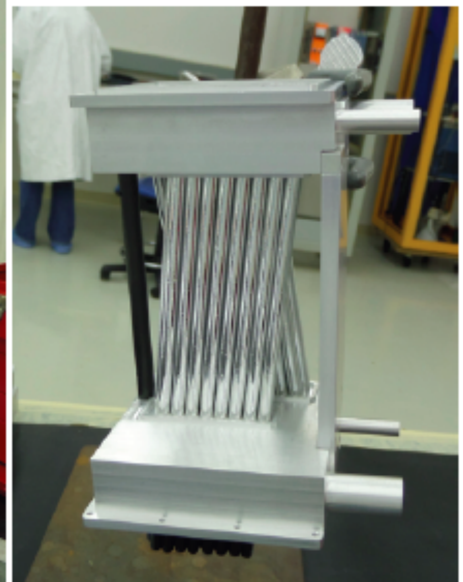




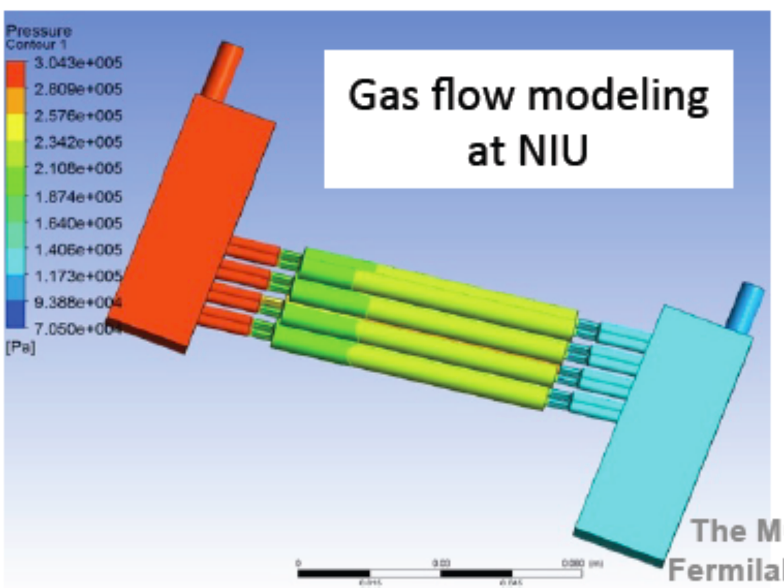
Tracker Hardware

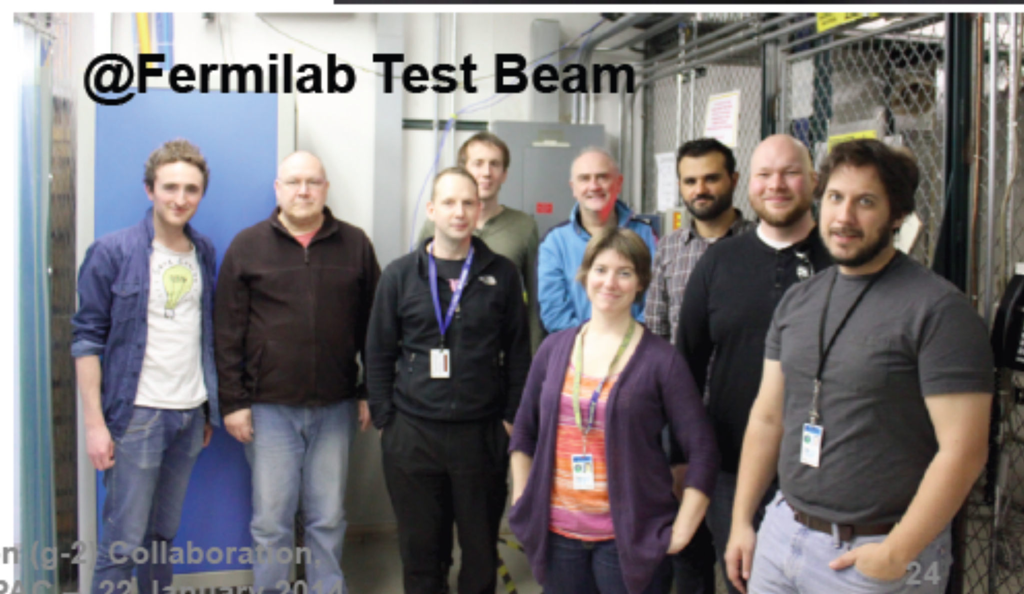
32 channel prototype constructed by Liverpool, NIU, and Fermilab





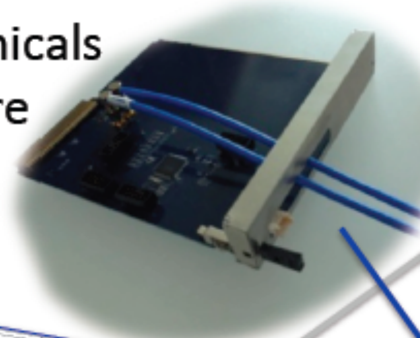
Electronics from Boston

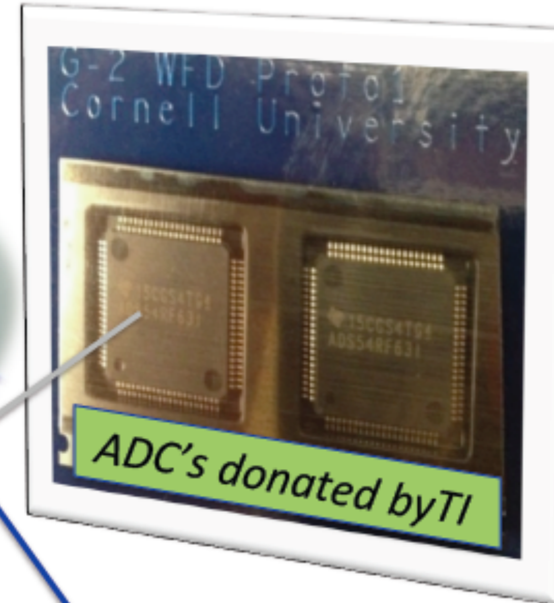




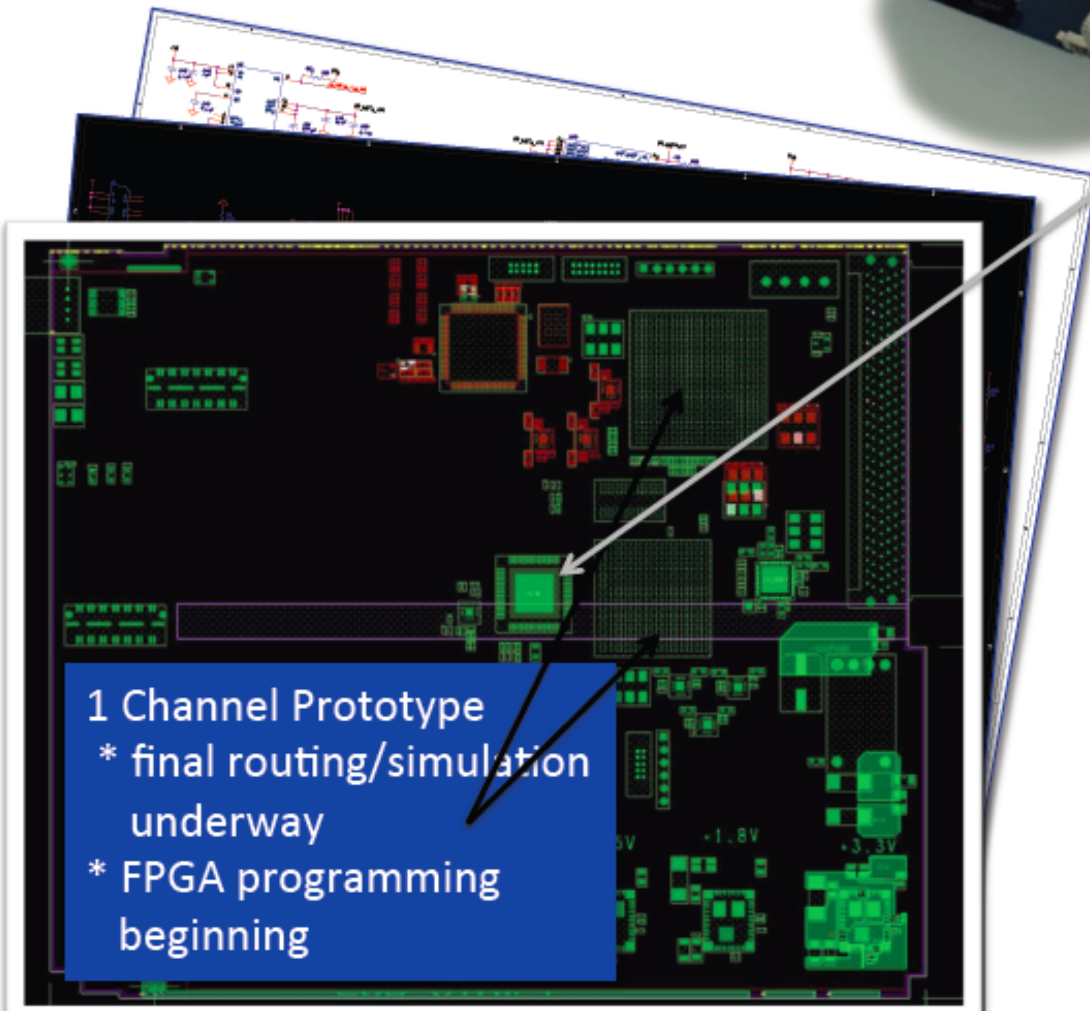
Wave Form Digitizer Highlights

Proto1 board complete
* clock distributions studies
* check mechanicals
* MMC firmware

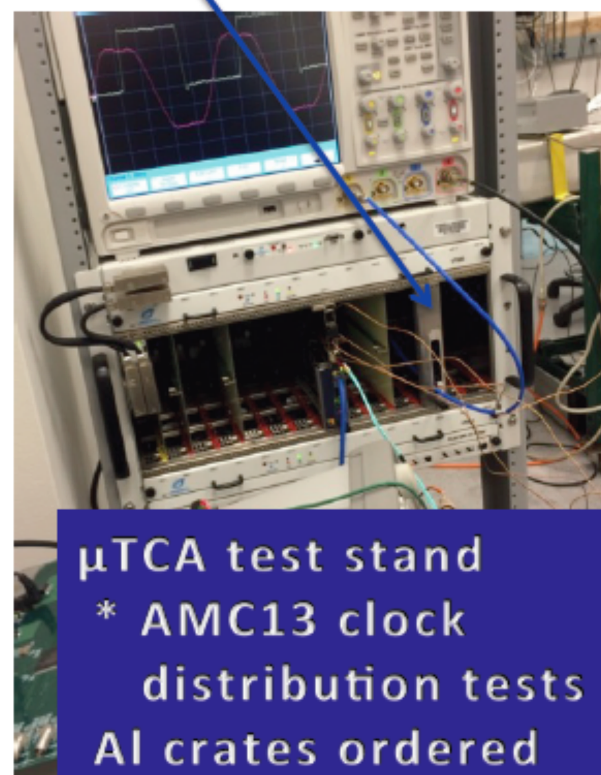




ADC's donated byTI



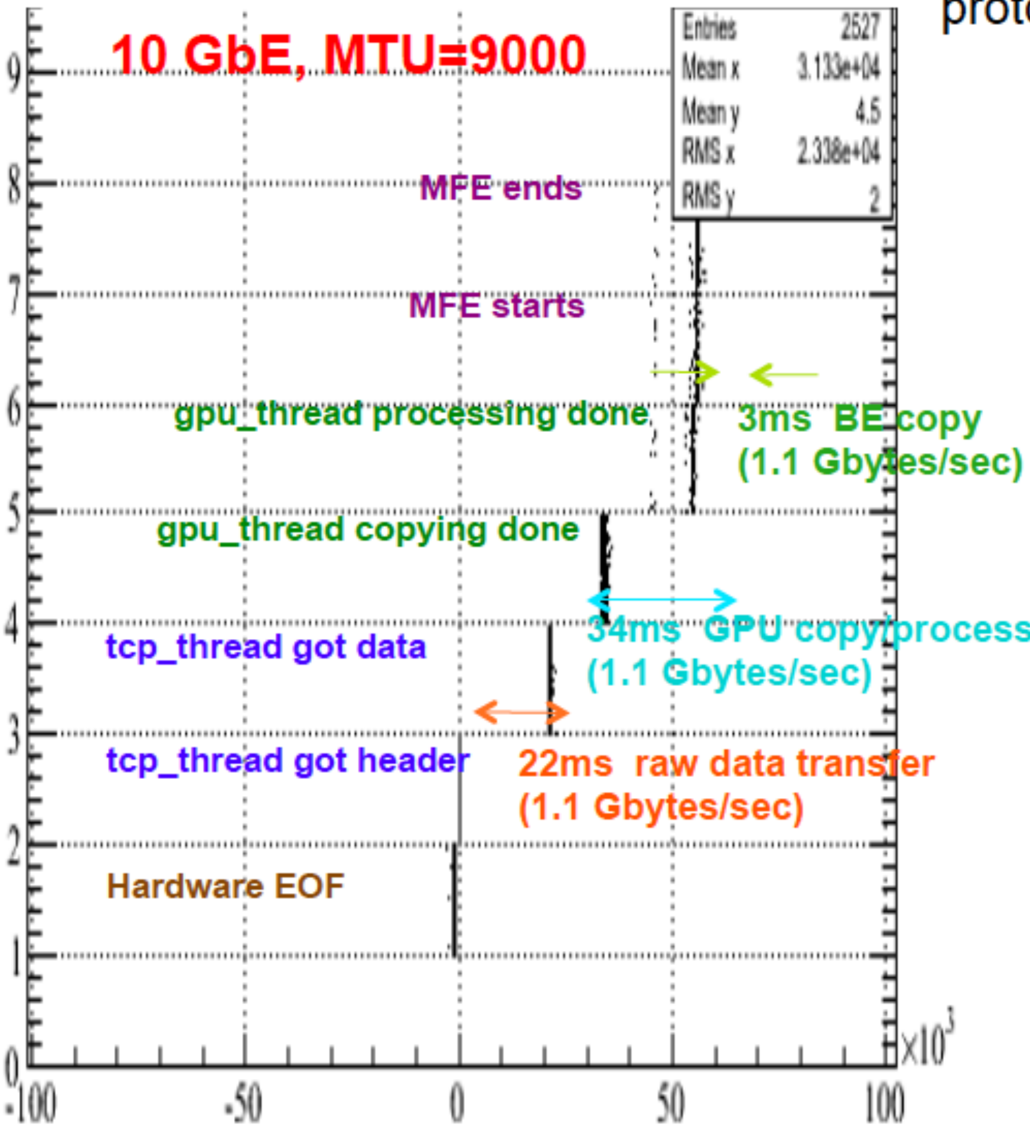
1 Channel Prototype
* final routing/simulation underway
* FPGA programming beginning



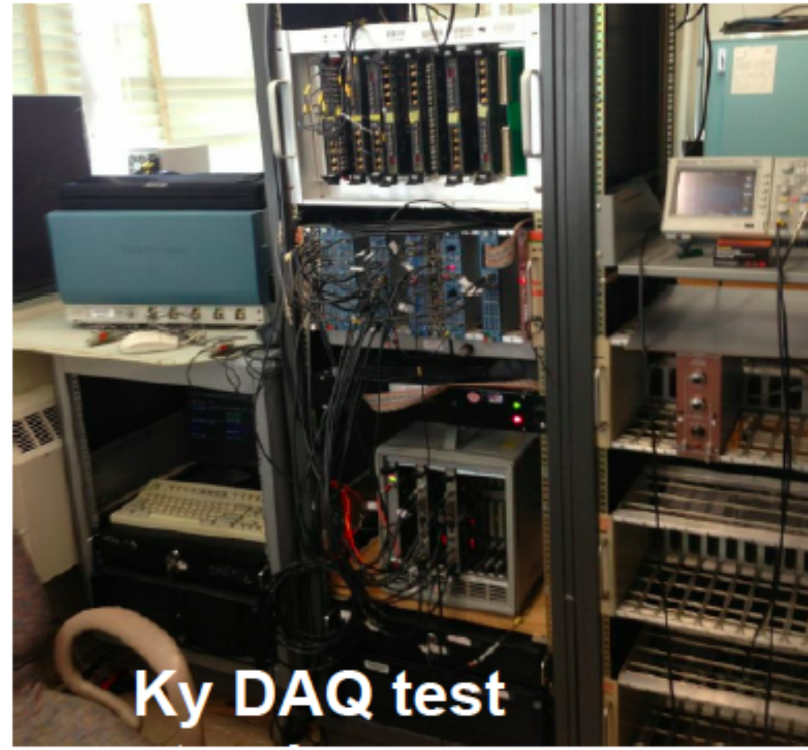
µTCA test stand
* AMC13 clock distribution tests

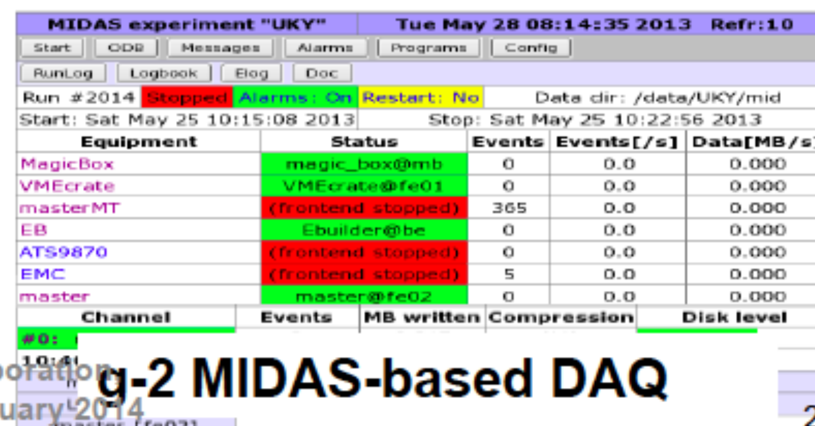
Al crates ordered

Calo readout timing tests



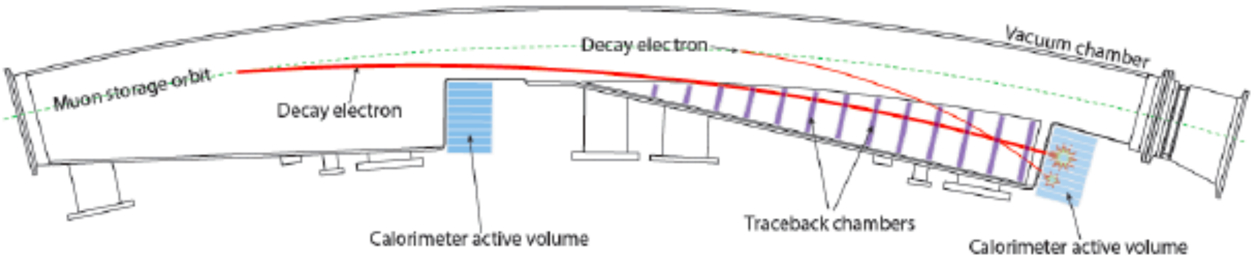
KY DAQ test stand: 10 GbE readout and GPU-based processing of emulator data, + prototype control synchronization system.

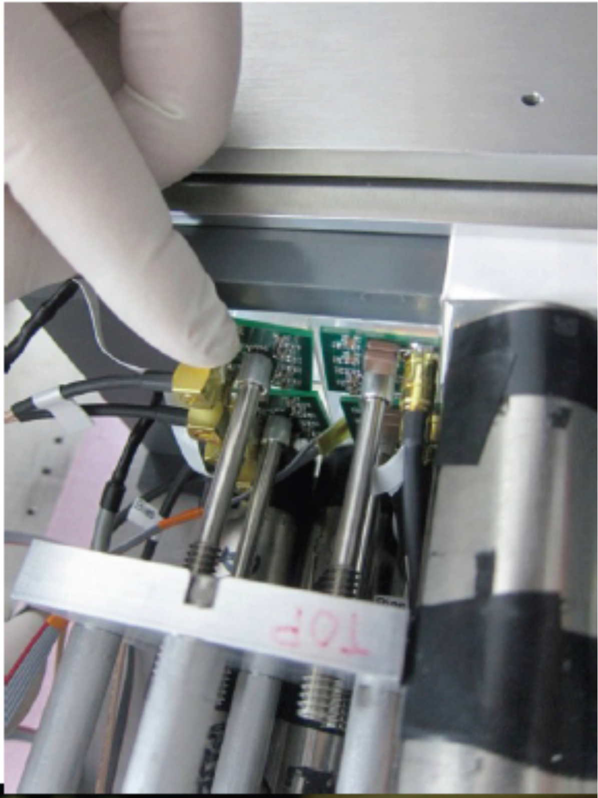




g-2 MIDAS-based DAQ

Reduced Precession Systematics:
All new detectors, electronics & DAQ

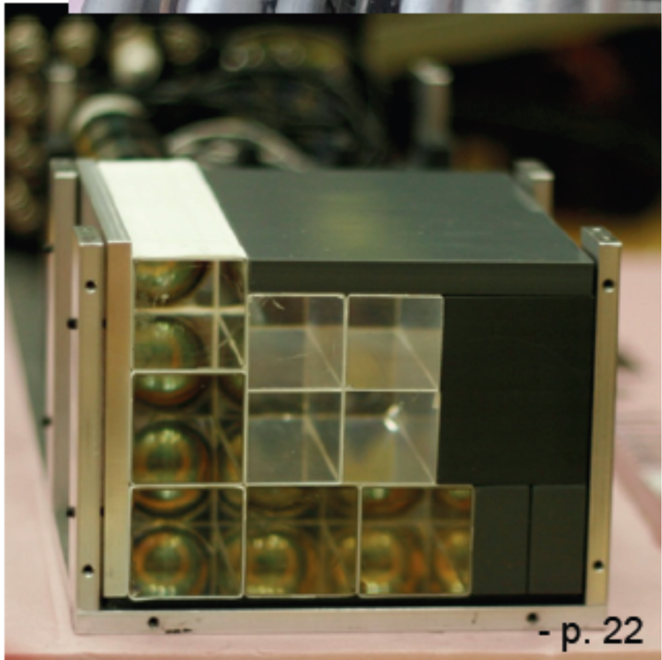




At the SLAC test beam

Single particle beam 2.0 - 4.5 GeV
9 crystals, 5 PMTs, 4 SiPMs

Good energy resolution ~1 pe/MeV.
Excellent energy linearity.
Good timing resolution.
SiPM proved good for photon readout.
SiPM response better than 2 nsec.
In-situ gain calibration by laser
PbF2 crystal purchase in progress



Proposed Preparation Schedule in SEATTLE

- June 2 - 6 :   **Crystal and SiPM preparations**
  - Transmission measurements for each crystals, wrap, assemble housing
  - SiPMs and boards tested in stand-alone setup at CENPA or Muon Lab
- June 9 – 13: **Installation of SiPMs with Bias and Crystals**
  - SiPMs mounted to crystals; tested with a standard light source setup
  - Mount units inside mechanical housing.
  - **UVa Group at Seattle**; install and debug Bias and it's control. Cable and mount to SiPMs.
- June 16 – 19 **(or just before CD2 review);** **Calibration Installation**
  - **Italian team in Seattle**. Setup laser, distribution, monitoring; test it locally (train locals);
  - Attaches front plate to housing and does pe calibration exercises.
  - arrives and is used together with local readout electronics to practice pulsing the detectors. Italian groups here.
- June 23 – 27: **Digitizer Installation / Software Coordination**
  - **Cornell group arrives** with digitizers and does basic setup (trains locals).
  - **Kentucky group arrives** and works on MIDAS readout of Digitizers
  - UW group continues to test stand-alone installation and perform calibrations
- June 30 – July 3 (short). **System Tests Continue on WFDs, DAQ, Detectors**
  - By now need enough on-site experts to keep system running. Who will be here then?
- July 7 – 11. **Reserved for any slippage; Pack up at end of week**
- July 14th: **Drive equipment to SLAC (full day); others fly**

- **RUN: July 17 to 28TH (morning); Packup on 28th, return to Seattle**

@SLAC

- July 15-17: Daytime Installation
  - If area "open", anyone can enter; Once secured, limited to 4 – 6 using key system
  - Schedule Safety Class in here (2 h); ***required***
- July 17 – 28: Two Shifts; Split Group accordingly with 4 h overlap;
  - Beam is 9 pm to 9 am (nominally)
  - Access to area 9 am to 9 pm will not cost our beam time
  - We must divide into two groups:
    1. Those that must "get it going" (hardware, online DAQ);
    2. Those that can start analyzing the data and organizing the output and results and suggesting next running steps and daytime calibrations
    3. 8 AM report is given each day (Hertzog) at Control Room
- July 27th overnight is last beam shift, ending Monday morning, the 28th;
- July 28th Packup; begin return trip…

MC-1 Reality vs Concept

In parallel with the g-2/Mu2e work

Fiscal Year	2012	2013	2014	2015	2016	2017	Total
MC-1 Building GPP	0.5	7.5	1.0				9.0
Beamline Enclosure GPP		0.4	3.7	5.6			9.7
MC Infrastructure GPP			0.5	0.5			1.0
(feeder if needed)						1.1	1.1
Cryo AIP		1.1	5.1	1.3	0.8	1.4	9.7
Recycler RF AIP		0.4	1.0	3.8	3.4		8.6
Beam Transport AIP		0.2	2.5	3.7	0.3		6.6
Delivery Ring AIP		0.1	1.9	3.3	4.3		9.5
Muon Campus TPC	0.5	9.6	15.6	18.2	8.8	2.5	55.2

needed only for Mu2e

- Muon Campus Goals in CY14
    - Finish MC-1 building
    - Complete most of the work for g-2 portion of cryo plant
    - Begin tunnel construction
    - Start work on the accelerator construction AIPs

Attivita' Italiana (ultimi 12 mesi)

- Maggio 2013: Contributo al CDR con la scrittura del paragrafo sul sistema di calibrazione. Proposta di un sistema baseline (con due stadi di distribuzione) ed uno alternativo ("Pisa Frame")
- Giugno 2013: Presentazione del Sistema di Calibrazione Laser all'Independent Design Review di FNAL per il CD1;
- Luglio 2013: Presentazione alla CSN1 per l'apertura di Sigla GMINUS2;
- Settembre 2013: Approvazione per il 2014; Ottenimento di un finanziamento di ~100kE per attivita'di R&D Calibrazione 2014.
- Novembre 2013: primi ordini concordati con i referee INFN;
- Gennaio-Maggio 2014: test in laboratorio e sviluppo prototipi; evoluzione della proposta; scrittura capitolo calibrazione per il TDR

ω_a Systematic Requirements

E821 Error	Size [ppm]	Plan for the E989 $g-2$ Experiment	Goal [ppm]
Gain changes	0.12	Better laser calibration; low-energy threshold; temperature stability; segmentation to lower rates; no hadronic flash	0.02
Lost muons	0.09	Running at higher n-value to reduce losses; less scattering due to material at injection; muons reconstructed by calorimeters; tracking simulation	0.02
Pileup	0.08	Low-energy samples recorded; calorimeter segmentation; Cherenkov; improved analysis techniques; straw trackers cross-calibrate pileup efficiency	0.04
CBO	0.07	Higher n-value; straw trackers determine parameters	0.03
E-Field/Pitch	0.06	Straw trackers reconstruct muon distribution; better collimator alignment; tracking simulation; better kick	0.03
Diff. Decay	0.05[1]	better kicker; tracking simulation; apply correction	0.02
Total	0.20		0.07

Needs a 0.04% control of gain fluctuations ([0-700 μs])

Requirements for short-term (0-700 μs) stability for E989

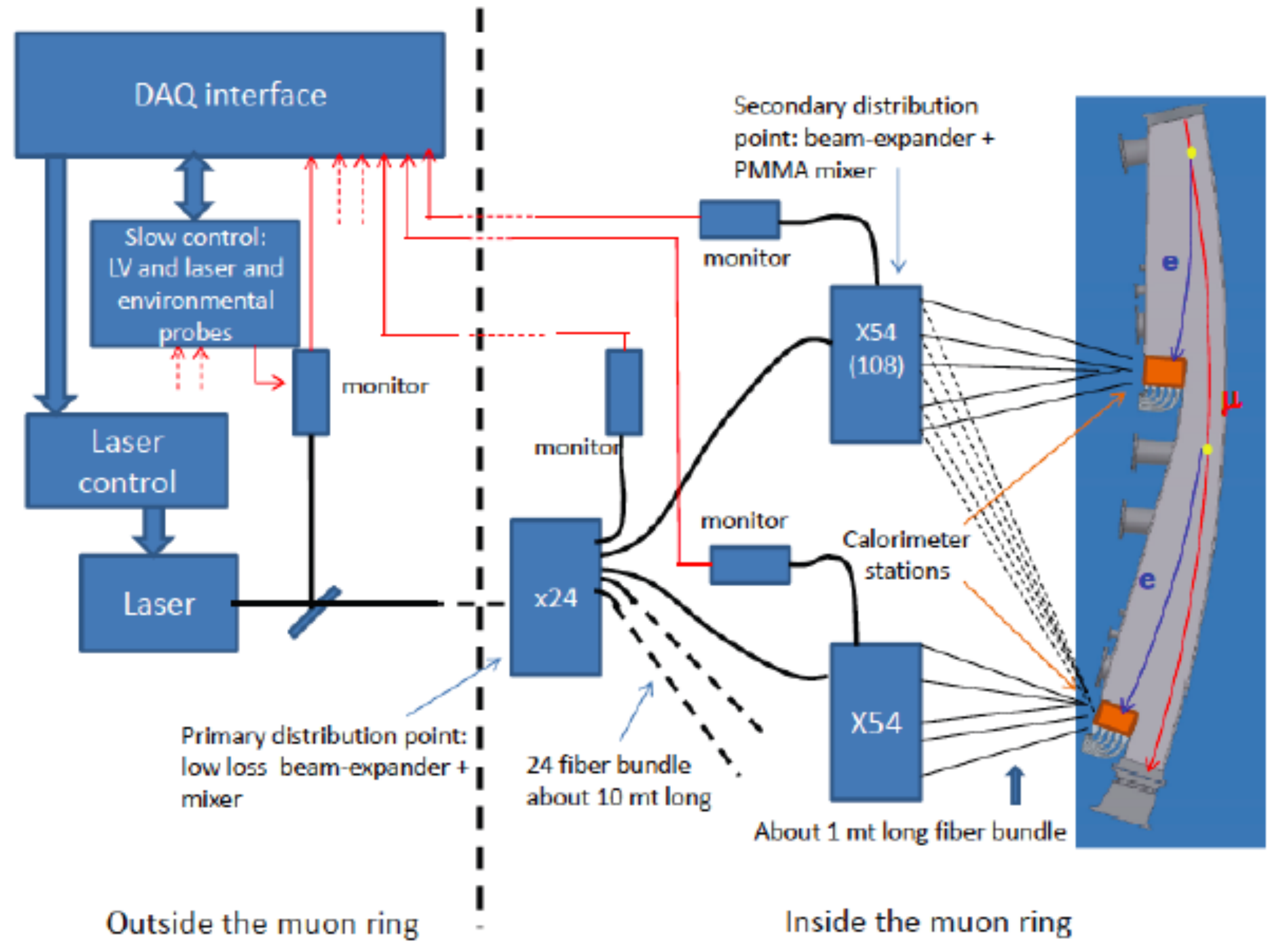
- A rule of thumb: **$\Delta G/G$ ~0.2% → $\Delta\omega_a/\omega_a$~0.1 ppm**
- In E821:
  - $\Delta G/G$ ~0.1-0.2% → ~0.1 ppm

[F. Gray, PhD Thesis]

- For E989:
  - $\Delta\omega_a/\omega_a$~0.02 ppm →$\Delta G/G$ ~0.04% (statistical + systematic)

    → **Very demanding request for the calibration system!**
- Possible Strategy (for the laser system):
  1. Initial goal of 0.1% → $\Delta\omega_a/\omega_a$~0.05 ppm
     - →Total syst. error on ω_a would be 0.17 ppm instead of 0.16 (<10% increase)
     - →Cross check with the endpoint method (the laser system not affected by pile-up)
  2. Reach the goal of 0.04% →$\Delta\omega_a/\omega_a$~0.02 ppm

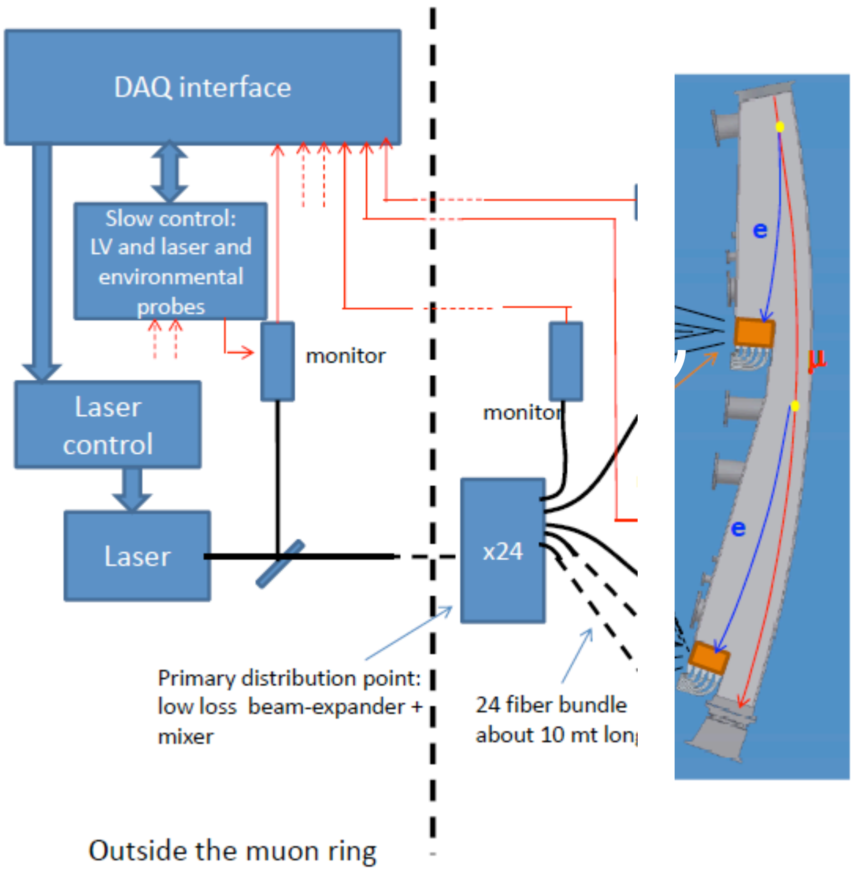
Baseline design
Calorimeter calibration system:



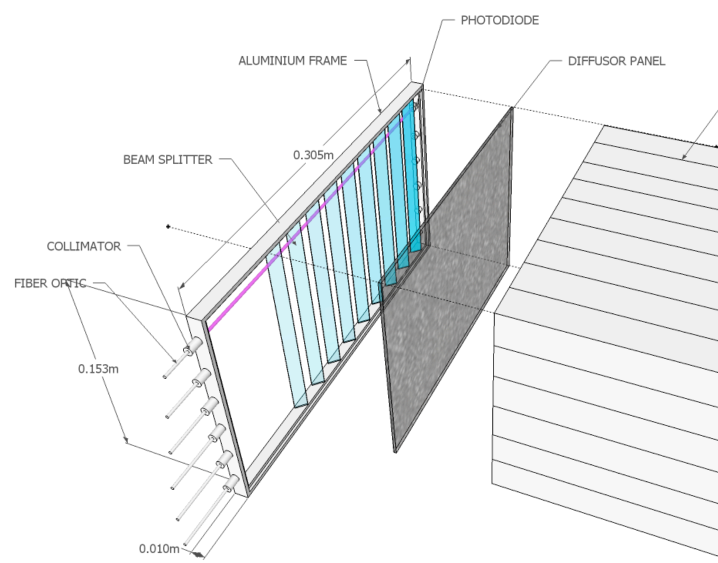
Graziano Venanzoni, WBS 476.04.02.06 Calibration System, Muon g-2 Independent Design Review, June 5-7, 2013

Due punti di distribuzione: 1 primario +[8-24] secondari. 1300 fibre. Per ogni punto di distribuzione un monitoring

Sistema di Calibrazione: Soluzione alternativa ("Pisa Frame")



- Soluzione piu' semplice
- Monitoring anche per singola fila di cristalli
- Il costo dipende fortemente dal monitoring scelto (6 fotodiodi x modulo, 6x24=150 in totale)
- Stabilita' meccanica e temporale?

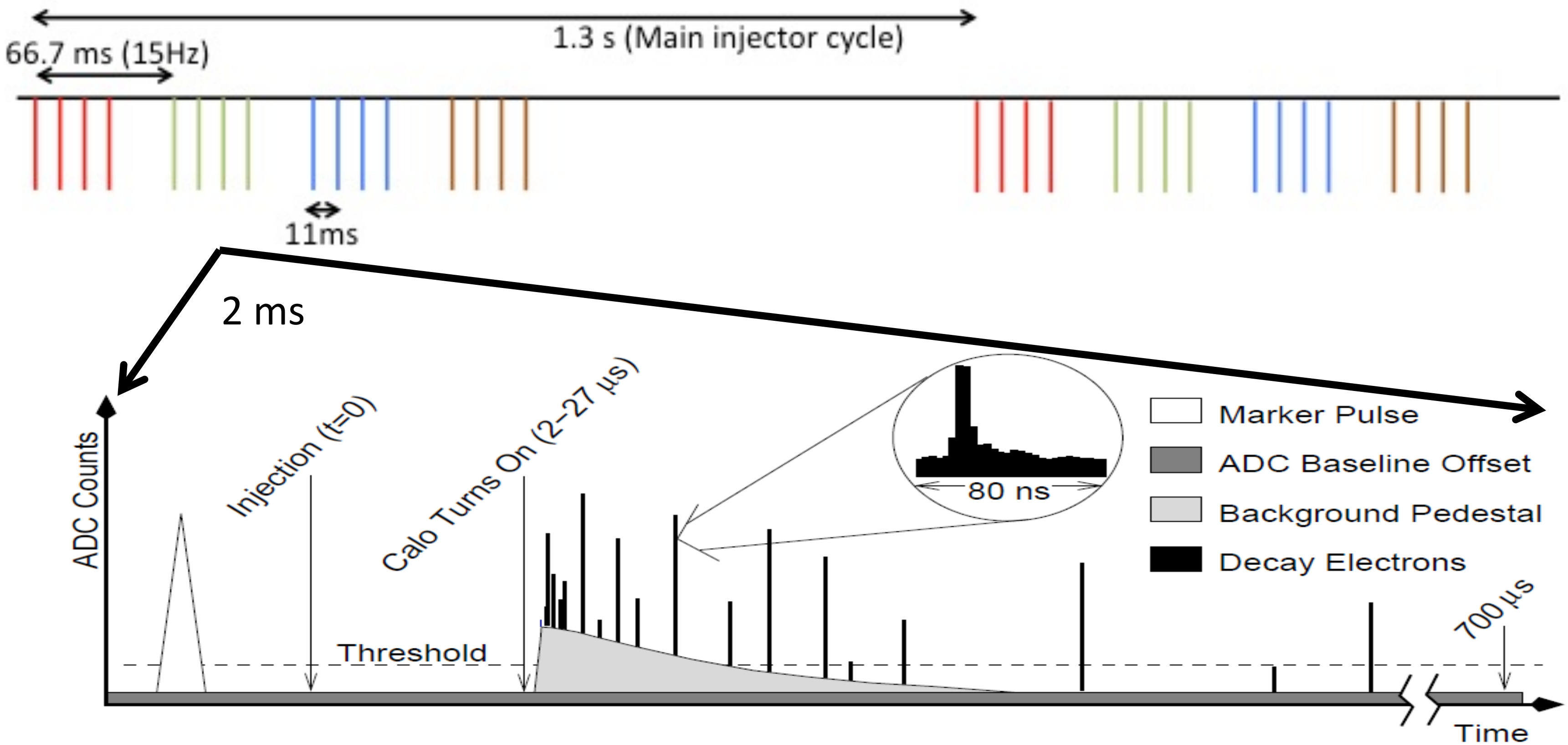


- Unico Punto di distribuzione primario con sole 150 fibre (invece di 1300), grazie ad un diverso routing delle fibre ai cristalli ("Pisa frame"). ~130 monitoring

- Le due soluzioni hanno caratteristiche e criticita' diverse. Anche come componentistica possono richiedere soluzioni diverse

- Per il momento su suggerimento dei referee ci siamo concentrati sul disegno "baseline"

Statistical Goal



700μs

To reach **0.04%** statistical uncertainty per point (1600 events/point)

- Let's assume 9 points per fill (1 every 80 **μ**s, 12.5 kHz laser repetition rate)
- By moving the offset by 5 **μ**s after a fill → 16 fills to have a single event calibration cycle (i.e. one point every 5 **μ**s), i.e. 1.3 s (1/2 hour to have full calibration cycle (1600 events every 5 **μ**s).

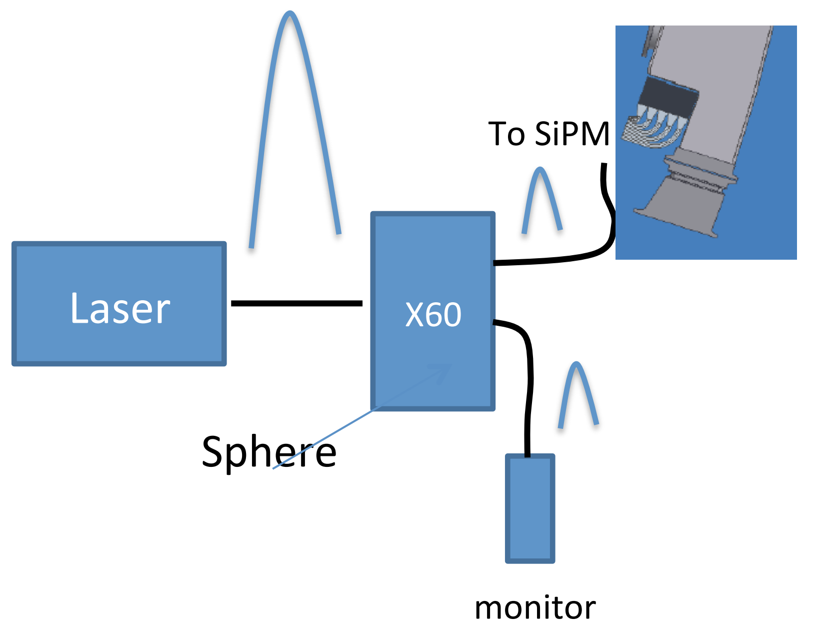
30' calibration runs with ~10 kHz laser frequency → sampling of G(t) in 140 points between 0 and 700μs

Systematics: requests

- Monitoring and its electronics stable at 10^{-4}
- Laser source and distribution system stable at ~10^{-3}

– What matters is **the SiPM/monitoring** signal ratio:

- With a performing monitoring all the effects of beam pointing, source fluctuation, etc…, cancel in the ratio;
- loss of uniformity (in time) and local effects (temperature gradients, mechanical stress) could modify the ratio



→ **Stable, redundant and self-calibrating monitoring system**

Laser characteristics:

- Wavelength λ:[350-450], 400 nm as reference
- Energy pulse equivalent to 2 GeV (assuming *up to* 2p.e./MeV):

$$E_{pulse}^{TOT} = \frac{24 \times 54 \times E_{pulse}^{crystal}}{T} = \frac{24 \times 54 \times 0.01 pJ}{T} = \frac{13 pJ}{T}$$

- Assuming T= 10^{-3} → E^{TOT}_{pulse} ~ 10nJ (conservative estimate)
- Pulse width ~ns
- Repetition Rate O(10 KHz) (but also in other modes)

The **"light transmission factor" T** includes light looses along the optical path: filters, diffusive elements, fiber coupling, light routing to calorimeter

For the Test Beam at Slac we will have 25 channels (E^{TOT}_{pulse} ~ 50pJ)

Ricerca candidati Laser (λ=405 nm)

Company	Model no.	Pulse width [ps]	Energy/ pulse [pJ]	Nominal Avg Power [mW@kHz]	Avg Power @10kHz rep (constant energy/pulse) [mW]	No. photons/ pulse	Notes	Distributor	Price (incl VAT) [EUR]	Delivery (wks)
PicoQuant	LDH-P-C-405 (high-P)	300	50	2@4000	0,0005	1,02E+08	Including PDL 200-B driver	Crisel Instruments	11056	4-8
PicoQuant	LDH-P-C-405B (high-P)	300	75	3@4000	0,00075	1,53E+08	Including PDL 200-B driver	Crisel Instruments	12276	4-8
PicoQuant	LDH-P-C-405M (high-P)	300	500	20@4000	0,005	1,02E+09	Including PDL 200-B driver (multimode output, poor beam quality)	Crisel Instruments	13496	8
Alphalas	PICOPOWER-LD-405-10k	1000	50	0.0005@10	0,0005	1,02E+08	Including driver	Alphalas	5661	4
Advanced Laser Diode Systems	Pilas PiL040X	45	13	0.00013@10	0,00013	2,65E+07	Including driver EIG2000DX	Advanced Laser Diode Systems	10760	5-6
Advanced Laser Diode Systems	Pilas PiL040X +PiL040SPS	45	35	0.00035@10	0,00035	7,13E+07	Including driver EIG2000DX and high power option PiL040SPS	Advanced Laser Diode Systems	11492	5-6

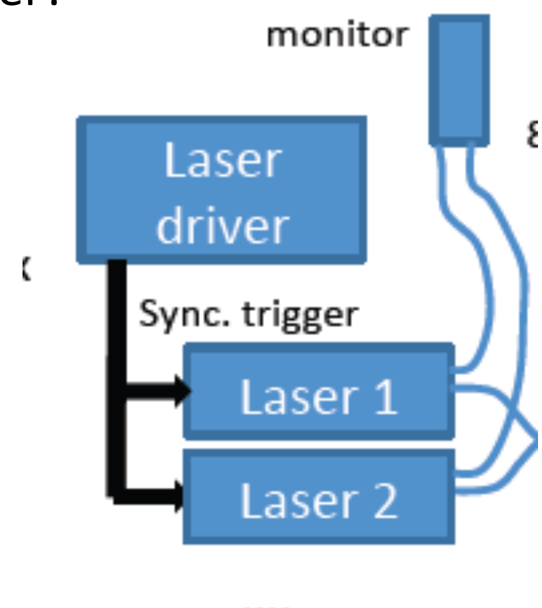
Picoquant is OK

T= $2*10^{-4}$= Trasmission efficiency on fiber for a bundle of 60 fibers 1mm ∅ connected to 2'' Sphere (details in Ferrari's presentation)

E^{TOT}_{pulse} ~ 0.01pJ/T = 0.01pJ/($2*10^{-4}$)=50 pJ

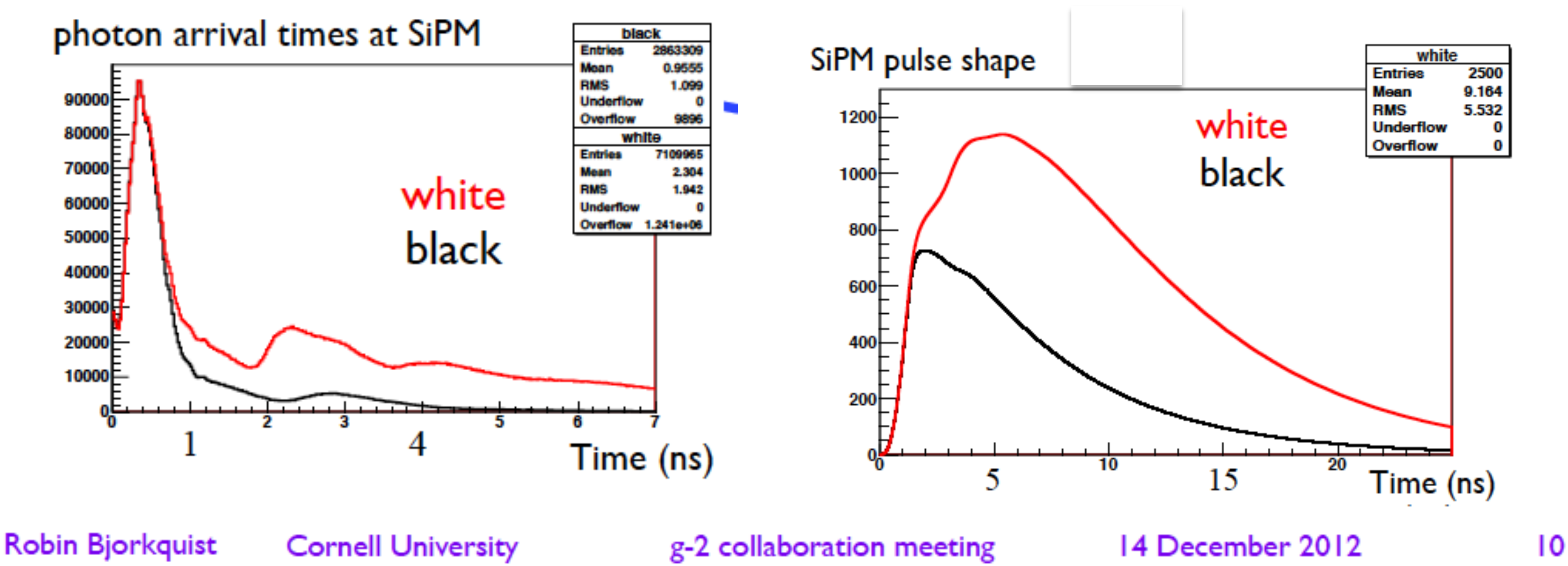
- Laser source:
  - for the Test Beam:
    - PicoQuant LDH-P-C-405M, λ=405nm, ΔT=300ps, E_{pulse}=500 pJ
  - For the final solution:
    - E~ 10 nJ (but possibly lower with an optimized distribution system)
    - Multilaser solution instead of a high power laser?

Katana HP



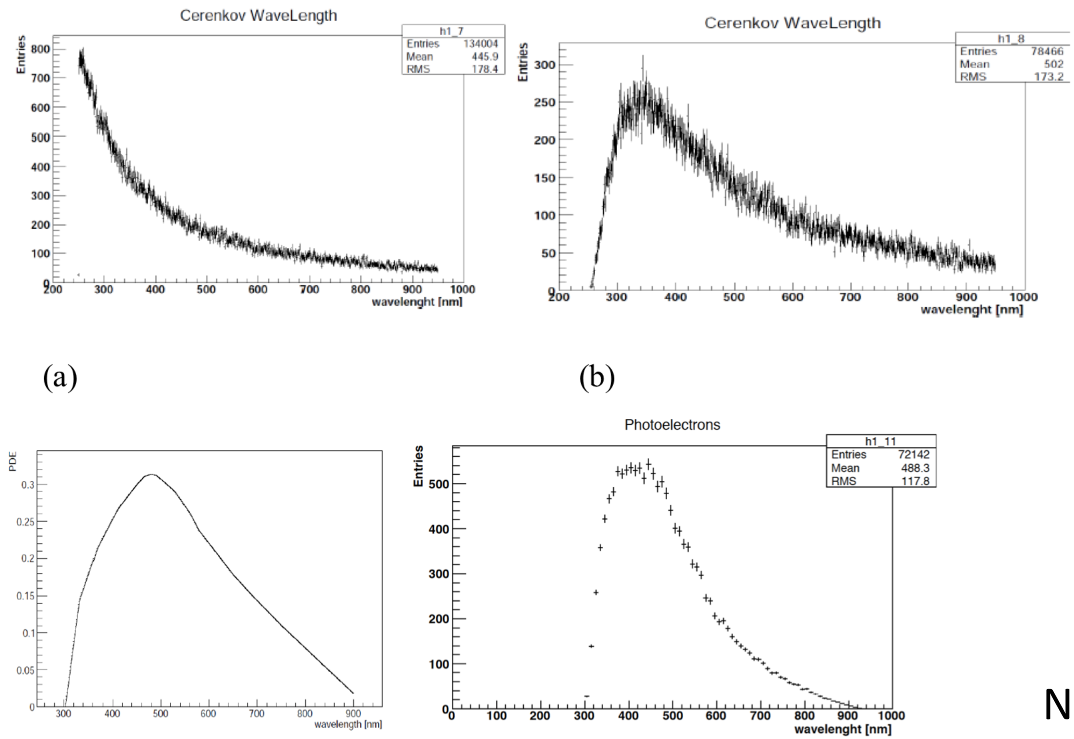
Caratteristiche temporali segnale laser

- Segnale largo ~ns per riprodurre il segnale dei fotoni in arrivo ai SiPM (che viene allargato dal SiPM)



Ci si aspetta che le caratteristiche temporali del segnale laser vengano modificate dal sistema di distribuzione (sfere, ecc…)

Prime simulazioni (A. Anastasi)



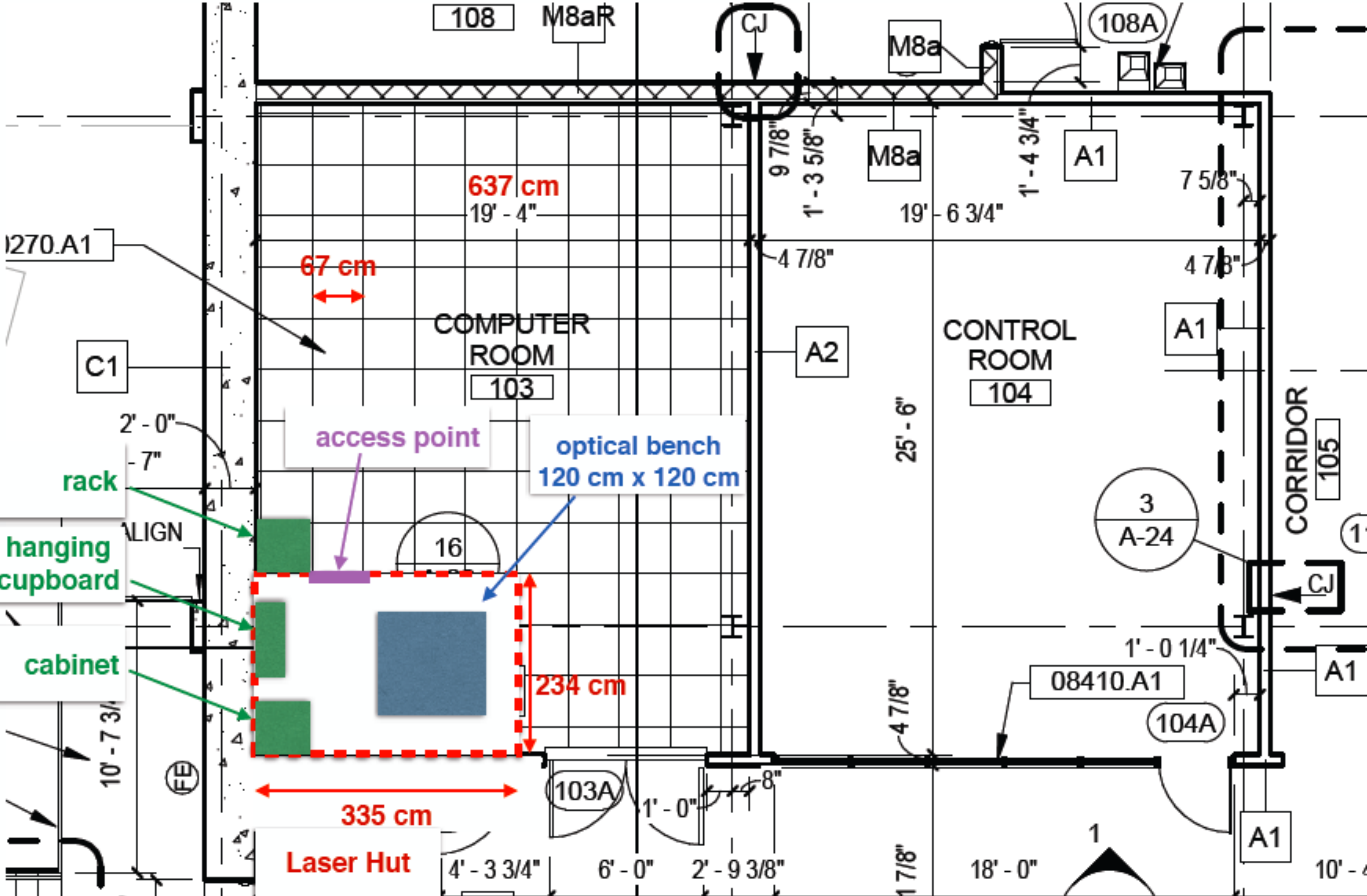
(a) (b)

(c) (d)

Np.e.˜1.6/MeV

Figura 1: (a) spettro in lunghezza d'onda dei fotoni Cerenkov emessi da un e- di 2 GeV; (b) spettro dei fotoni che arrivano sulla faccia del SiPM; (c) PDE del SiPM; (d) spettro dei p.e. . La figura e'ottenuta da una simulazione con Geant di A. Anastasi

Laser Hut in the Control Room



Test Fatti e Risultati ottenuti (ultimi 6 mesi)

- **Sorgente Laser:**
  - Definite le richieste di intensita' x il TB (50 pJ/impulso), basata sui test con la sfera. Per la soluzione finale ˜10 nJ (conservativa). Simulazione -> Larghezza di impulso~ns (possibilmente meno), λ=405 nm (simulazione)
  - Acquistati due Laser: Picoquant (testina) da 500pJ/pulse per il TB di SLAC; Alphalas (completo) 50 pJ/pulse x prove di stabilita' laser in tecnica eterodina, test 1x4 fiber splitter. Si attende l'arrivo.
  - Misurata una sensibilita' a variazioni di parametri nella catena di lettura diodo-amplificatore dello 0.5 % su 30 minuti e dello 0.6 % su di diverse ore (con tecnica eterodina)
- **Sistema di distribuzione:**
  - Caratterizzata la sfera in intensita', allargamento temporale, uniformita', stabilita'.
  - Prime misure con sistema alternativo: Beam Expander+Mixer
  - Acquisto fiber splitter 1x4

Test Fatti e Risultati ottenuti (ultimi 6 mesi)

- **Sistema di Monitoring:**
  - Definito un primo prototipo (senza amplificazione Pin Diodes) autocalibrante
  - 0.2% accuratezza statistica singolo evento
  - 0.1% stabilita' temporale su piu' di un giorno
- **Elettronica di controllo:**
  - Primi test Virtex con generazioni di segnali a 10 kHz.
  - Studio sistema alternativo CUSTOM
  - Scelta Baseline: VIRTEX
- **Elettronica di Monitoring:**
  - Sviluppo soluzione Baseline "Charge integrator". Front End e Layout completato; Scheda in montaggio. Previsione di uso al TB di SLAC
  - Sviluppo soluzione "Backup" commerciale (CREMAT). Prototipo realizzato
- **Simulazione:**
  - Primi risultati su segnale Cerenkov con e- da 2 GeV con GEANT

In aggiunta preparazione al Test Beam, di cui riportera' Giovanni P.

Partecipazione Italiana e FTE (2014)

- **LNF (2 FTE):**
  - **G. Venanzoni 70% (RN,RL)**
  - **D. Babusci 40%**
  - **R. Cimino 30%**
  - **S. Dabagov 30%**
  - **D. Hampai 30%**
- **TS/UD (2 FTE):**
  - **G. Cantatore 50% (RL)**
  - **M. Karuza 50%**
  - **D. Cauz 40 %**
  - **G. Pauletta 20%**
  - **L. Santi 40%**
- **Na (0.6 FTE):**
  - **S. Catalanotti 20%**
  - **M. Iacovacci 20%**
  - **S. Mastroianni 20%**
- **RM2 (0.4 FTE):**
  - **G. Di Sciascio 20%**
  - **D. Moricciani 20%**
- Interesse anche da parte di PISA e Dipartimento di Ingegneria, Univ Cassino

TOT 5 FTE, 15 persone

<FTE> ~0.3

Grande potenzialita' di crescita nei prossimi anni

Partecipazione Italiana e FTE (2014 Effettiva)

- **LNF (4.5 FTE):**
  - G. Venanzoni 70% (RN,RL)
  - D. Babusci 40%
  - R. Cimino 30%
  - S. Dabagov 30%
  - D. Hampai 30%
  - C. Ferrari (INO) 50%
  - A. Fioretti (INO) 50%
  - C. Gabbanini (INO) 50%
  - A. Anastasi (PhD) 100%

- **RM2 (0.4 FTE):**
  - G. Di Sciascio 20%
  - D. Moricciani 20%

In rosso le persone gia'associate su GMINUS2

- **TS/UD (3 FTE):**
  - G. Cantatore 50% (RL)
  - M. Karuza 50%
  - D. Cauz 80 %
  - G. Pauletta 40%
  - L. Santi 80%

← Transizione Mu2e→ G-2

- **Na (1.6 FTE):**
  - S. Catalanotti 20%
  - M. Iacovacci 20%
  - S. Mastroianni 20%
  - R. Di Stefano 100%

TOT 9.5 FTE, 20 persone

<FTE> ~0.5

Anagrafica sostanzialmente raddoppiata

Partecipazione Italiana e FTE (Previsione 2015)

- **LNF (4.3 FTE):**
  - **G. Venanzoni 70% (RN,RL)**
  - **D. Babusci 40%**
  - **S. Dabagov 30%**
  - **D. Hampai 40%**
  - **C. Ferrari (INO) 50%**
  - **A. Fioretti (INO) 50%**
  - **C. Gabbanini (INO) 50%**
  - **A. Anastasi (PhD) 100%**

- **TS/UD (3 FTE):**
  - **G. Cantatore 50% (RL)**
  - **M. Karuza 50%**
  - **D. Cauz 80 %**
  - **G. Pauletta 40%**
  - **L. Santi 80%**

- **Na (2.0 FTE):**
  - **M. Iacovacci 40%**
  - **S. Mastroianni 40%**
  - **S. Catalanotti 20%**
  - **R. Di Stefano 100%**

- **RM2 (0.4 FTE):**
  - **G. Di Sciascio 40%**
  - **D. Moricciani 30%**

TOT 10 FTE, 19 persone

<FTE> ~0.5

Conclusioni

- G-2 sta marciando molto bene verso le varie fasi di approvazione; a breve il CD2; Collaborazione molto forte; previsione data taking ~2017
- Partecipazione Italiana molto importante e sentita in G-2; ruolo critico del sistema di Calibrazione per il raggiungimento del goal sistematico; partecipazione alle fasi decisionali dell'esperimento (Institutional Board e meeting dedicati)
- Attivita' Italiana negli ultimi 12 mesi molto consistente, con progressi tecnici sul fronte della Calibrazione: test in laboratorio, sviluppo prototipi, simulazione; discussione alloggiamento laser e spazi nel nuovo buiilding; uffici.
- Gruppo Italiano de facto raddoppiato (rispetto a quanto dichiarato nel 2013): 20 persone ~10 FTE, <FTE>~0.5; Si prevede un consolidamento per il 2015.

Huge progress since our last PAC presentation

- The E989 Collaboration is now very strong, with a large international component that is making major contributions
- Ring Move almost finished
- Building almost finished
- Prototype detectors being tested in beams at SLAC and Fermilab
- Ring reassembly to begin by March 2014.
- We are working toward CD-2 review in May-June timeframe.

Conclusione della presentazione di Lee Roberts (spoke) al Comitato Scientifico di FNAL, 22 Gennaio 2014

SPARES

Programma di Lavoro sintetico

- 2014:
  - TB a SLAC; continuazione test in laboratorio e ottimizzazione prototipi (distributore, monitoring)
  - Completamento scheda di elettronica e di controllo laser
  - Lavoro sul “Disegno alternativo” (Pisa frame)?
- 2015:
  - Completamento test per l’ottimizzazione del disegno
  - Congelamento del disegno
  - Inizio acquisti per il sistema completo
- 2016:
  - Conclusione acquisti
  - Assemblaggio e commissioning a FNAL

Agenda della riunione

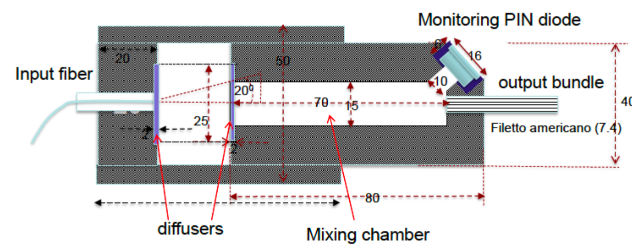
- Stato di g-2, partecipazione italiana e reminder calibrazione - G. Venanzoni (30')
- Misure noise photodiode - G. Cantantore/M. Karuza (30')
- Test prototipo sistema di monitoring - G. Pauletta/D. Cauz (30')
- Misura della sfera diffusiva e distributore alternativo - C. Ferrari (30')
- Elettronica controllo laser; elettronica di monitoring - M. Iacovacci (30’)
- Test Beam SLAC - G. Pauletta (20')
- Simulazione - A. Anastasi (20') (TBC)
- Richieste aggiuntive - G.Venanzoni (20') (TBC)
- AoB

Evoluzione della proposta (dal 2012)

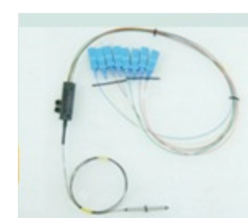
- Settembre 2012: CD0 ricevuto
- Luglio 2013: Ring arrivato a FNAL
- Settembre 2013: CD1 review (CDR (>100 firmatari)) :
- Dicembre 2013: CD1 ricevuto
- CD2/CD3 review with DOE in Luglio 2014; TDR atteso per la fine di Maggio
- Presa dati (attesa) fine 2016/inizio 2017

- Distribution system
  - Diffusive Sphere:
    - 2” Solution studied in details: Low transmission ($2x10^{-4}$ with 1mm fibers), time response˜few ns, high uniformity and stability
    - Possible solution for the TB
    - 1” possible solution for the the secondary distribution point of the final design (to be studied)

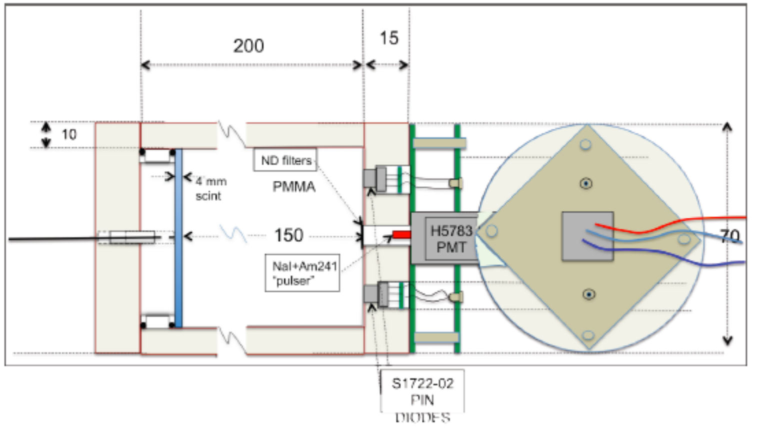
  - Beam shaper+mixer:
    - First prototype tested: higher transmission (10^{-2}), time response<1ns, low uniformity and stability
    - Possible solution for the secondary distribution point (to be studied)
    - Need additional R&D.
    - Not guaranteed for the TB.



  - Fiber splitting:
    - Commercial solution. Possible Up to 1x32. FBT technology
    - Insertion loss<15dB; Uniformity < 3 dB. Stability?
    - Possible solution for the primary distribution point (to be studied)
    - 1x4 purchased for test



- Monitoring:
  - One Monitoring with 3 Pin Diodes (or 2Pin Diodes 1 PMT) for each Calorimeter Station
  - Each Signal will be sent to a dedicated board (charge amplifier) and possibly also to WFD



– Laser Control and Monitoring Boards, and the interface with the DAQ and Slow Control