

13th meeting of the WG Radio Monte CarLow

H. Czyz/G. Venanzoni



ECT* Trento, 11-12 April 2013

<http://www.Inf.infn.it/wg/sighad/>

Thursday 11 April

Introduction: H. Czyz/G. Venanzoni - (09:00-09:30)

Radiative Corrections and MC generators I - (09:30-10:30)

time	[id] title	presenter
09:30	[31] $e+e^- \rightarrow$ hadrons below 2 GeV	Dr. EIDELMAN, Simon
10:00	[32] Two-loop electroweak corrections to high-energy wide-angle Bhabha scattering	PENIN, A.

Radiative Corrections and MC generators II - (11:00-12:30)

time	[id] title	presenter
11:00	[33] Hadron form factors in $p\bar{p} \rightarrow e+e^-$ annihilation: the role of radiative corrections	TOMASI, E.
11:30	[34] FSR corrections to the process $e^+e^- \rightarrow \bar{p} p \gamma$: modelling and the implementation into the event generator PHOKHARA	CZYZ, H.
12:00	[35] The Why's and How's of covariance matrices in the KLOE ISR analyses	MUELLER, S.

Gamma Gamma physics, FSR and Transition Form Factors I - (14:30-16:00)

time	[id] title	presenter
14:30	[36] Time like TFF using ISR	KUPSC, A.
15:00	[37] Estimated calculation of the hadronic light-by-light contribution to the $(g-2)$ of the muon	MASJUAN, Pere
15:30	[38] Analysis of eta and eta-prime transition form factors within Padé approximants	SANCHEZ PUERTAS, P.

Gamma Gamma physics, FSR and Transition Form Factors II - (16:30-20:30)

time	[id] title	presenter
16:30	[39] gamma-gamma talk on BES-III	REDMER, C.
17:00	[40] gamma-gamma sum rules and their implication on the hadronic LbL contribution to $(g-2)$	PAUK, V.
17:30	[41] White book on meson TFF	A. KUPSC/S. EIDELMAN
19:00	Collaboration dinner	

Friday 12 April 2013

Hadronic VP, g_{μ}^{--2} and $\Delta\alpha$ - (09:00-11:00)

time	[id] title	presenter
09:00	[42] Analytical calculation of a_{μ} from $\pi^+\pi^{--}$ hadronic state, including RC to $\sigma_B(s)$ and RC to the kernel in point-like approximation for pion	KURAEV, E.
09:30	[43] Muon g_{μ}^{--2} and QCD sum rules	SPIESBERGER, H.
10:00	[44] Colloquium: The role of σ_{hadronic} for the future of the precision determinations of the muon g_{μ}^{--2} and the running α_{em}	JEGERLEHNER, F.

tau physics - (11:30-12:30)

time	[id] title	presenter
11:30	[46] Are isospin corrections in $\tau^+\tau^0$ decays understood?	ROIG, Pablo
12:00	[47] Comparison of Resonance Chiral Lagrangian Currents to Experimental Data for $\tau^+\tau^-\pi^-\pi^+\nu_{\tau}$	SHEKHOVTSOVA, Olga

Discussion on RadioMotecarlow effort on a HAD evaluation - (12:30-13:30)

- Presenters: G.VENANZONI/S. EIDELMAN/T.TEUBNER

Continuation of the discussion/other talks? - (14:30-15:30)

Usual propaganda:

The paper "Quest for precision in hadronic cross sections at low energy: Monte Carlo tools vs. experimental data" has been published on the **Eur. Phys. J. C. Volume 66, Issue 3 (2010), Page 585**

Remember to quote the paper.

The European Physical Journal

volume 66 · numbers 3–4 · april · 2010

EPJ C

Recognized by European Physical Society

Particles and Fields

0970707-010

Measurements of R , the ratio of cross sections of hadronic to muonic final states in e^+e^- annihilation, in the energy range just above the open charm threshold.
From S. Actis et al.: Quest for precision in hadronic cross sections at low energy: Monte Carlo tools vs. experimental data

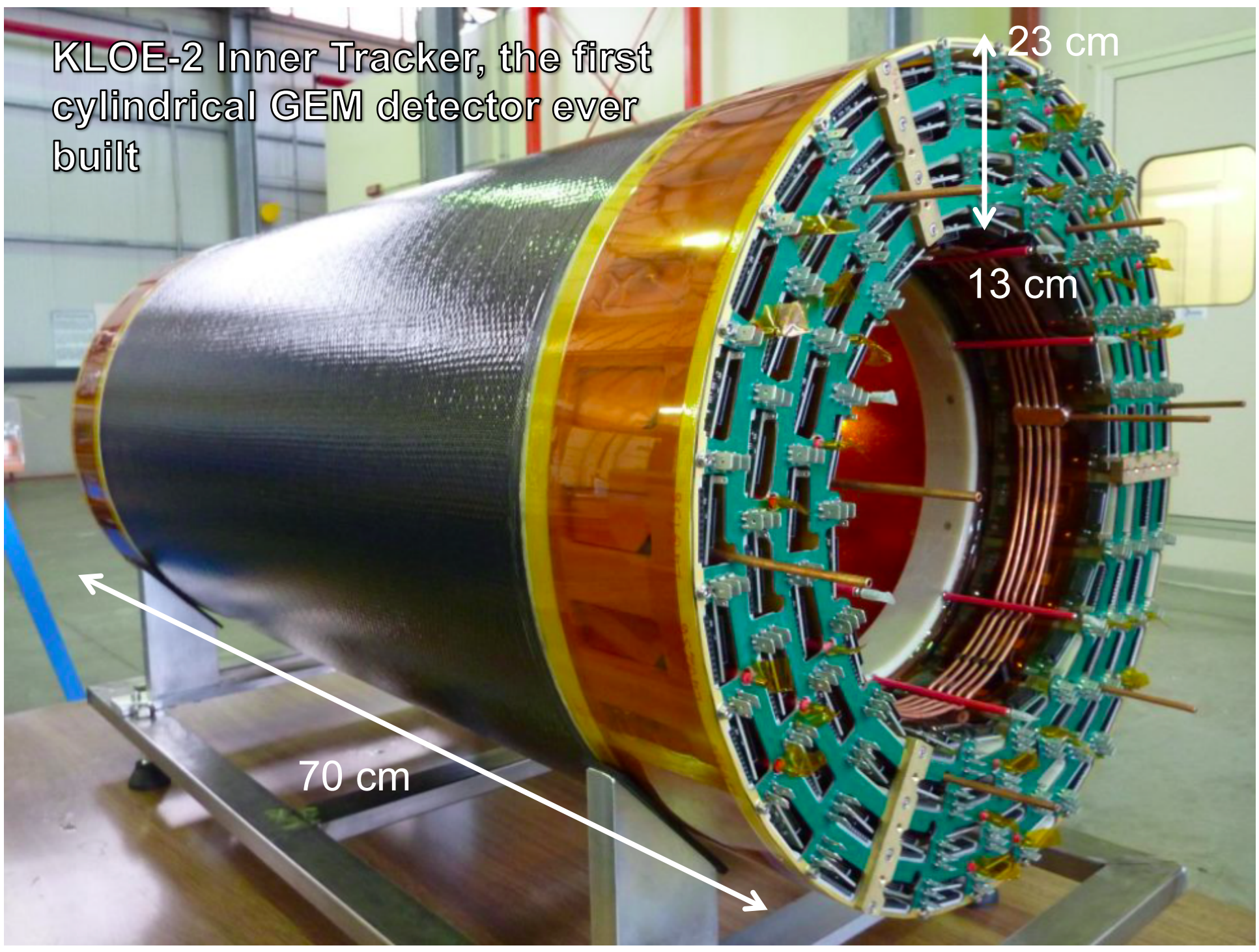
Società Italiana di Fisica

Springer

e⁺e⁻ current activities

- Great session on Wednesday with impressive results from BESIII (and much more to come)
- First measurements (published) on multihadron xsect from VEPP-2000 (see Simon talk)
- DAFNE stopped in Dec 2012 for about 6 months to insert the new upgrades (Inner Tracker, and QCAL) and undertake DAFNE consolidation. Real data taking expected for this Summer.
- Still KLOE, BaBar and Belle can give important results on hadronic cross sections, $\gamma\gamma$, and flavour physics.

KLOE-2 Inner Tracker, the first cylindrical GEM detector ever built



70 cm

23 cm

13 cm

New g-2 experiment at FNAL (E989) received CD0 in Sep 2012

Feature

Second muon experiment receives Mission Need approval from DOE



This rendering shows the location of the proposed Muon Campus at Fermilab. The arrow points to the proposed site of the planned Muon g-2 experiment. [Click to enlarge.](#) Image: Muon Department/FESS

Fermilab's plans for creating a Muon Campus with top-notch Intensity Frontier experiments have received a big boost. The Department of Energy has granted Mission Need approval to the Muon g-2 project, one of two experiments proposed for the new Muon Campus. The other proposed experiment, Mu2e, is a step ahead and already received the next level of DOE approval, known as Critical Decision 1.

"We now are officially on DOE's roadmap," said Lee Roberts, professor at Boston University and co-spokesperson for the roughly 100 scientists collaborating on the Muon g-2 (pronounced gee minus two) experiment. "This should make it easier to increase the size of our collaboration and foster international participation. Potential collaborators supported by the National Science Foundation or foreign funding agencies will be happy to see that we now have DOE's official Mission Need approval."

At present, the Muon g-2 collaboration includes scientists from institutions in China, Germany, Italy, Japan, the Netherlands and Russia as well as 16 institutions in the United States. Physicists from several institutions in the United Kingdom are in the process of joining the collaboration.

Fermilab E989 Experiment (July 12):



Argonne
Boston University
Brookhaven
CUNY Queens
Cornell
Fermilab
Illinois
James Madison
Kentucky
Massachusetts
Michigan
Muons Inc.
Northwestern
NIU?
Regis
Virginia
Washington



Shanghai



Frascati
Rome



UK Consortium?



Dresden



KEK
Osaka



KVI



Dubna
Novosibirsk
PNPI

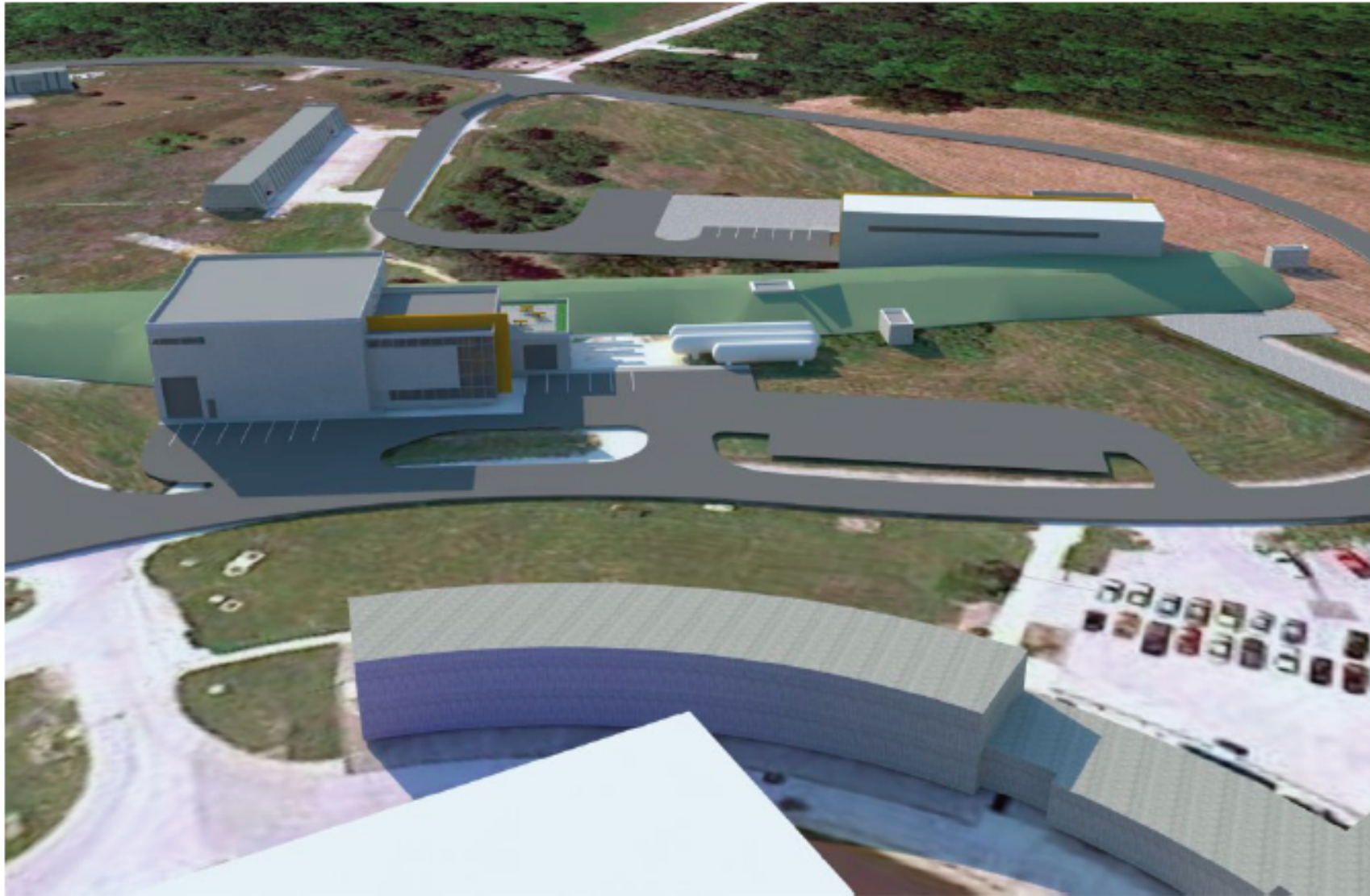
>100 Collaborators,
~30 Institutions

“Collaboration has attained critical mass...have to put all this expertise to good use by matching tasks onto interests and capabilities”

C. Polly, Project Manager, June 12

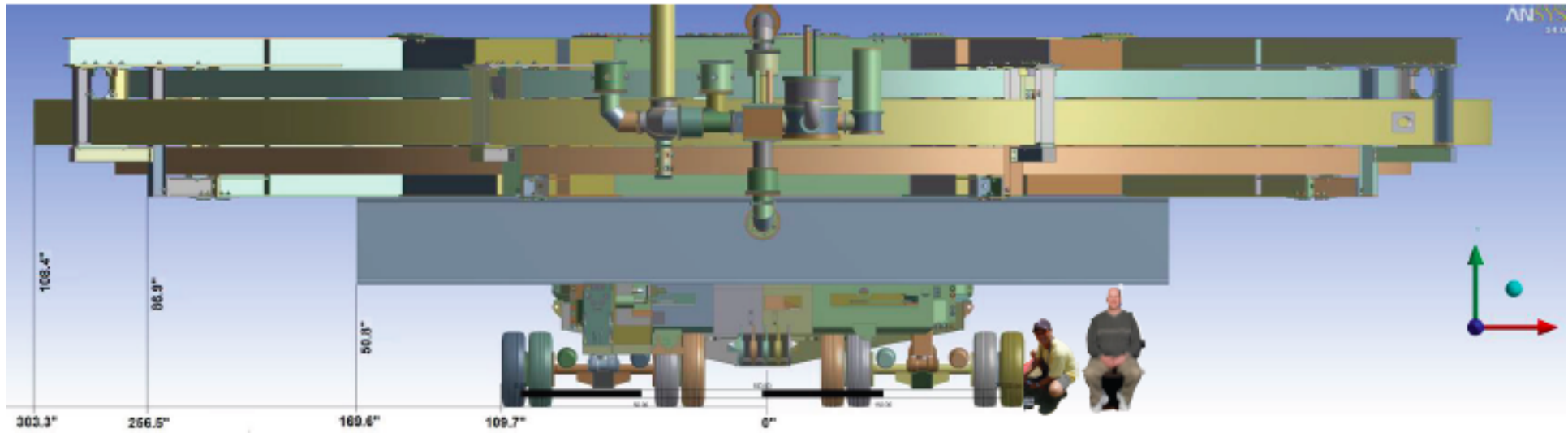


MC-1 building progress





Major events last collab meeting



	2012					2013					2014					2015				
	J	F	M	A	M	J	F	M	A	M	J	F	M	A	M	J	F	M	A	M
MC-1 Bldg planning																				
MC-1 Construction																				
Disassemble BNL ring/beam																				
Shipping window (barge)																				
Reassemble ring/upgrades																				
Cryo plant construction																				
Field shimming																				
Detector construction																				
Accelerator modifications																				

Shipping of the ring to FNAL expected by this year (probably in June)

CD1 expected by this year (CDR expected by May)

Data Taking expected in 2016/17

Important discussions:

- “White book on TFF” (A.Kupsc/S.Eidelman) on Thursday afternoon
- “WG effort on evaluation of hadronic contribution to a_μ ” (G.Venanzoni/S.Eidelman/T.Teubner) on Friday morning

Colloquium

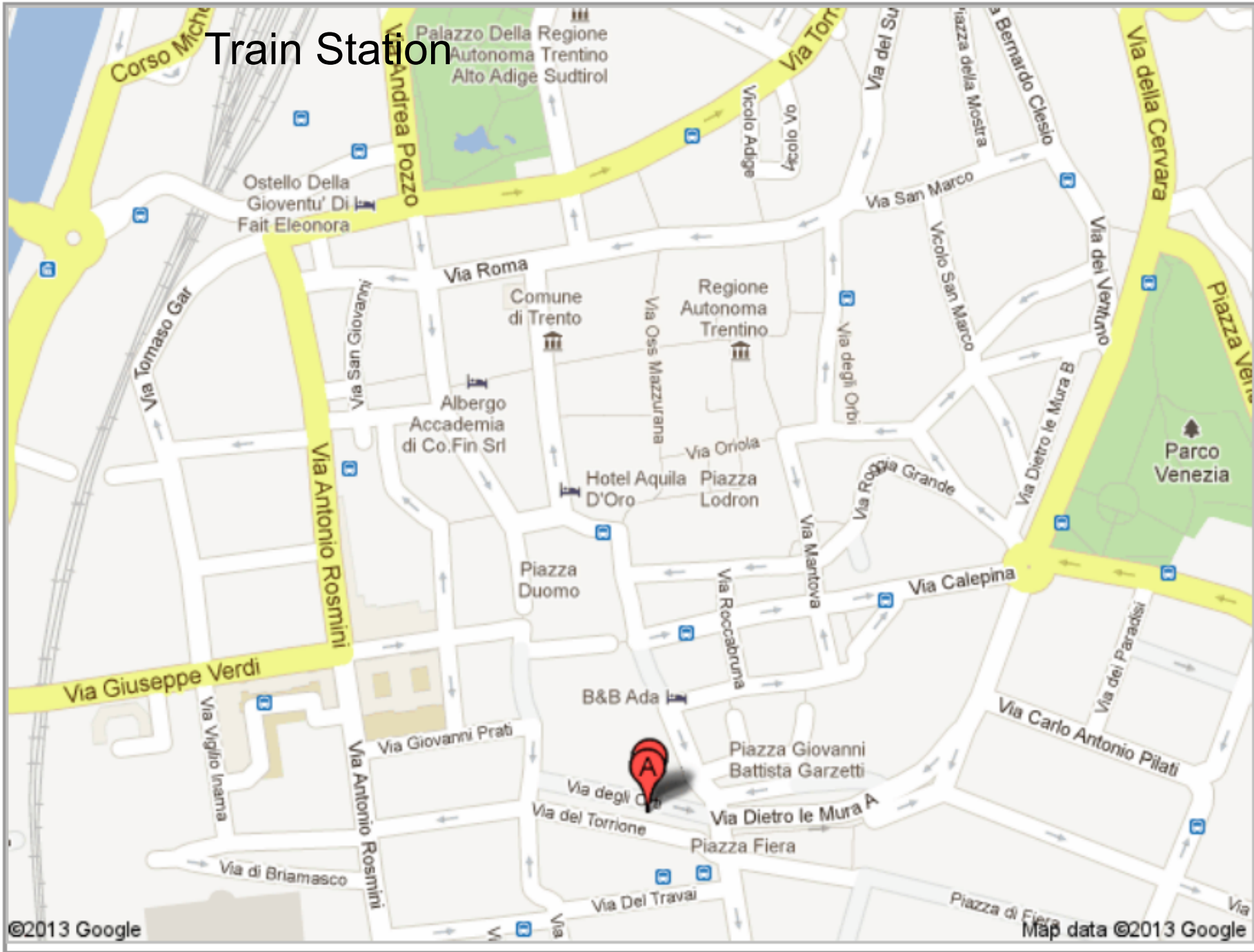
Friday, 12 April 10:00 - 11:00

The role of σ_{hadronic} for the future of the precision determinations of the muon $g-2$ and the running α_{em}

Fred Jegerlehner

At 8.00 pm we will have the dinner
at the Restaurant ”Orso Grigio”
Via degli Orti, 19, Trento

Train Station



Next meeting

It will be done as satellite of PHIPSI13 Conference (Rome).

<http://www.roma1.infn.it/hipsi13/index.html>



It will be done in Frascati (or Rome) on 13/14 Sept (Fri/Sat)
If it will be done in Frascati participants don't have to change hotel (they can stay in Rome) and take the local train (20') to reach Frascati.

More information soon

Have a nice meeting and many thanks to the director of ECT*, Prof. Wolfram Weise, for hosting this workshop and to the ECT* secretary, Dr. Ines Campo, for her valuable help with the organization of this meeting!!!

spare



Schedule for Director's Reviews



May June 2013

19	20	21	22	23	24	25
• Possible Dir Rev • Review of Intensity Frontier Research	• Possible Dir Rev • Review of Intensity Frontier Research	• Possible Dir Rev • Review of Intensity Frontier Research	• Possible Dir Rev • Review of Intensity Frontier Research	• Possible Dir Rev • Review of Intensity Frontier Research		
26	27	28	29	30	31	1
Memorial Day			John F. Kennedy's • Possible Dir Rev	• Possible Dir Rev	• Possible Dir Rev	
2	3	4	5	6	7	8
• Possible Dir Rev	• Possible Dir Rev • Fermilab Away PAC Mtg	• Possible Dir Rev • Fermilab Away PAC Mtg	• Possible Dir Rev • Fermilab Away PAC Mtg	• Possible Dir Rev • Fermilab Away PAC Mtg	• Possible Dir Rev • Fermilab Away PAC Mtg	• Fermilab Away PAC Mtg

- Looks like May 29-31 is only possibility in this range
- Other dates we can infer from this
 - May 6: All docs due to PM office for final review (BoE, CDR, RLS, etc.) **32 days!**
 - May 13: Final documents submitted to reviewers
 - May 22: Practice talks
 - June 24-28 or Jul 8-12: Earliest two possible weeks to schedule Lehman Review

CD1 expected by this year (CDR expected by May)

We need up to CD3 to have the project really approved

Precision target of new experiment at
FNAL $1.6 \cdot 10^{-10}$ (respect to $6.3 \cdot 10^{-10}$ E821)

Accuracy of SM calculation $\sim 5 \cdot 10^{-10}$

$$a_{\mu}^{\text{exp}} - a_{\mu}^{\text{theo,SM}} = (27.7 \pm 8.4)10^{-10} \quad (3.3\sigma)$$

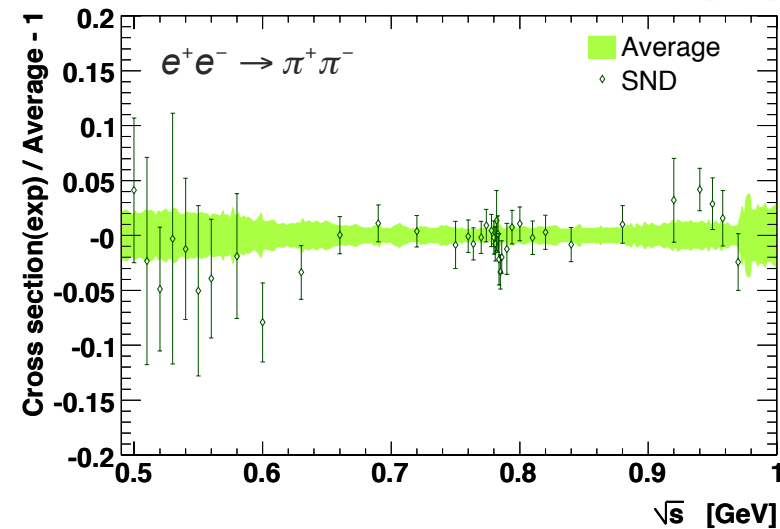
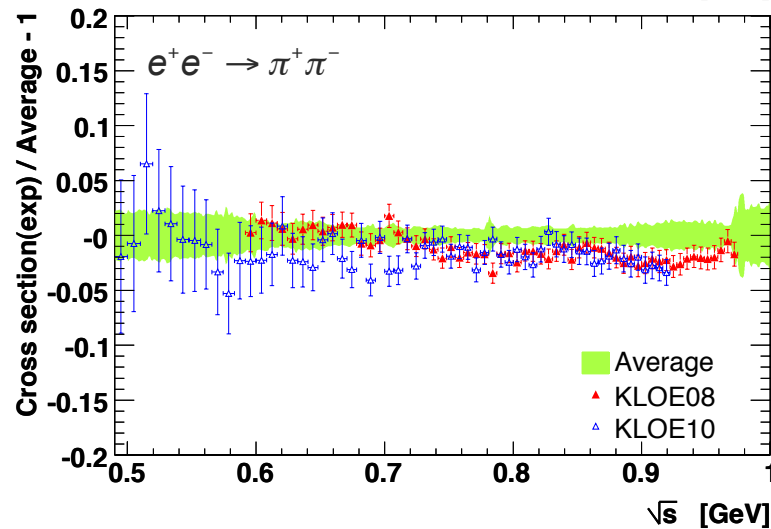
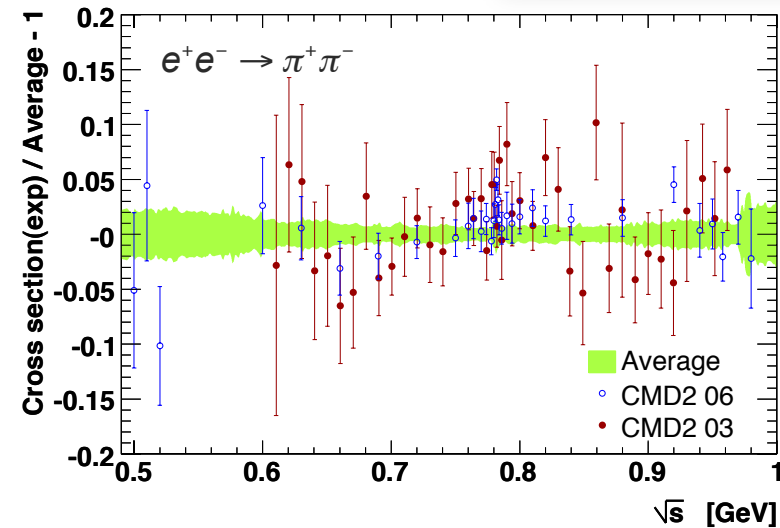
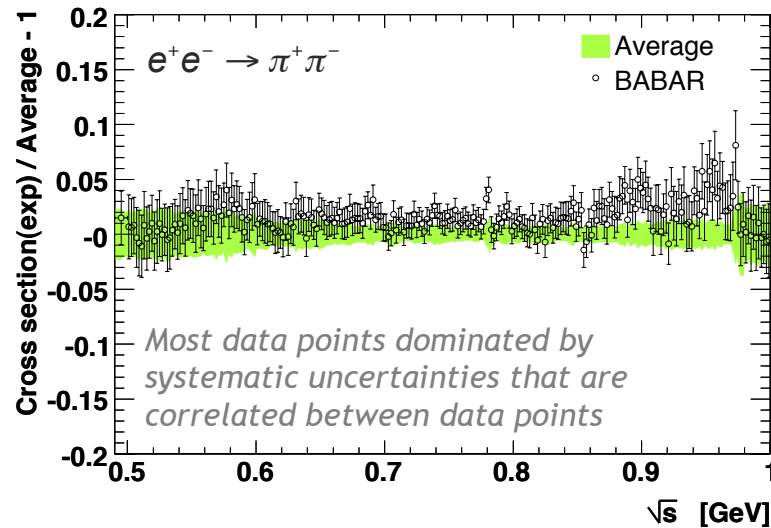
$$8.4 = \sim 5_{\text{HLO}} \oplus \sim 3_{\text{HLbL}} \oplus 6_{\text{BNL}}$$

$$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ ? & ? & ? & 1.6_{\text{NEW G-2}} \end{array}$$

How much can theoretical error improve?

Situation of Two-pion channel

Davier et al., EPJ C 71, 1515 (2011)

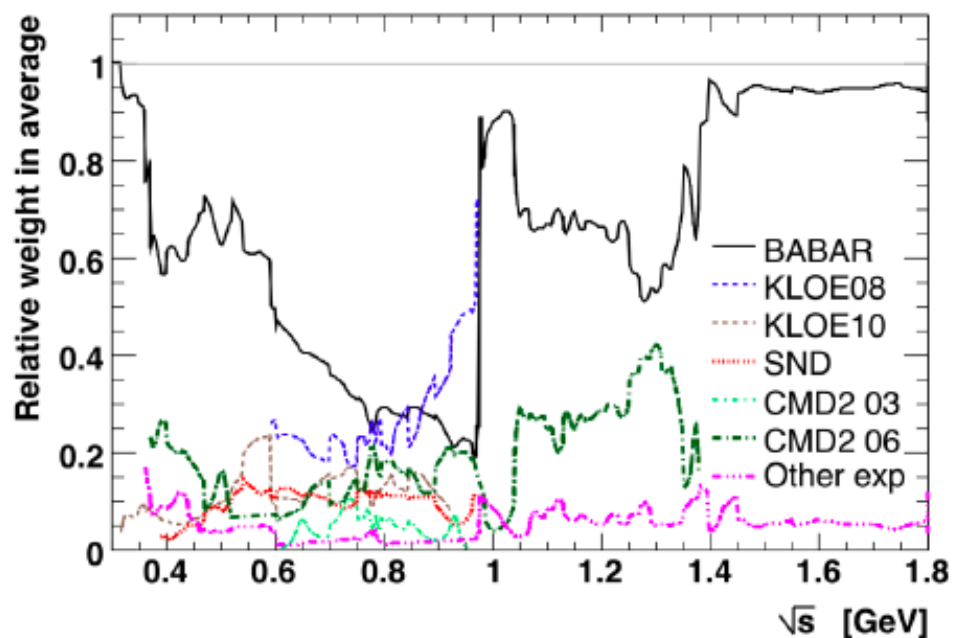


Agreement not excellent amongst all the data.

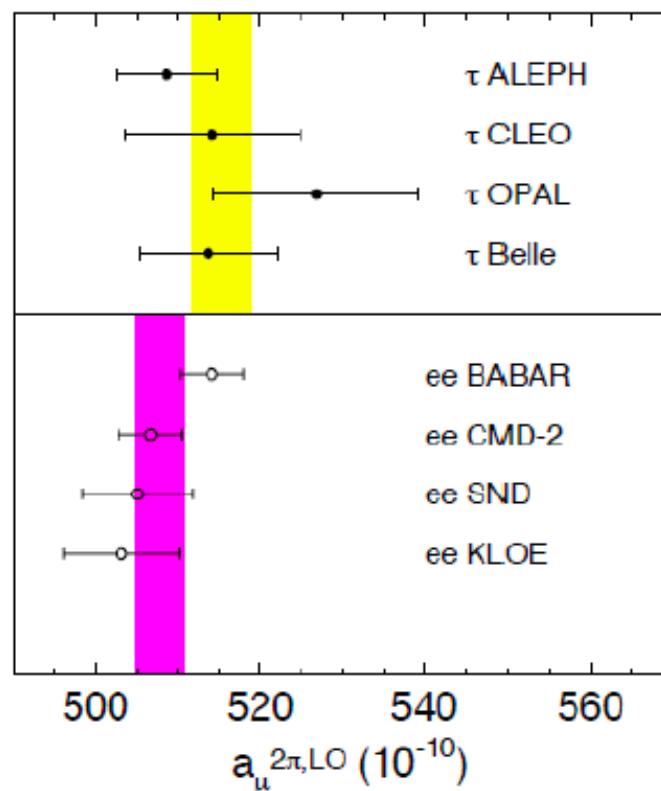
Impact of BABAR data for $g-2: \pi^+\pi^-$

Weights of different experiments in combining their results (DHMZ 2009-2010)

BABAR dominates everywhere, except between 0.8 and 0.93 GeV where KLOE is the most precise



Integral from threshold to 1.8 GeV

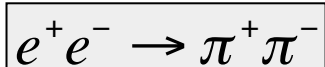
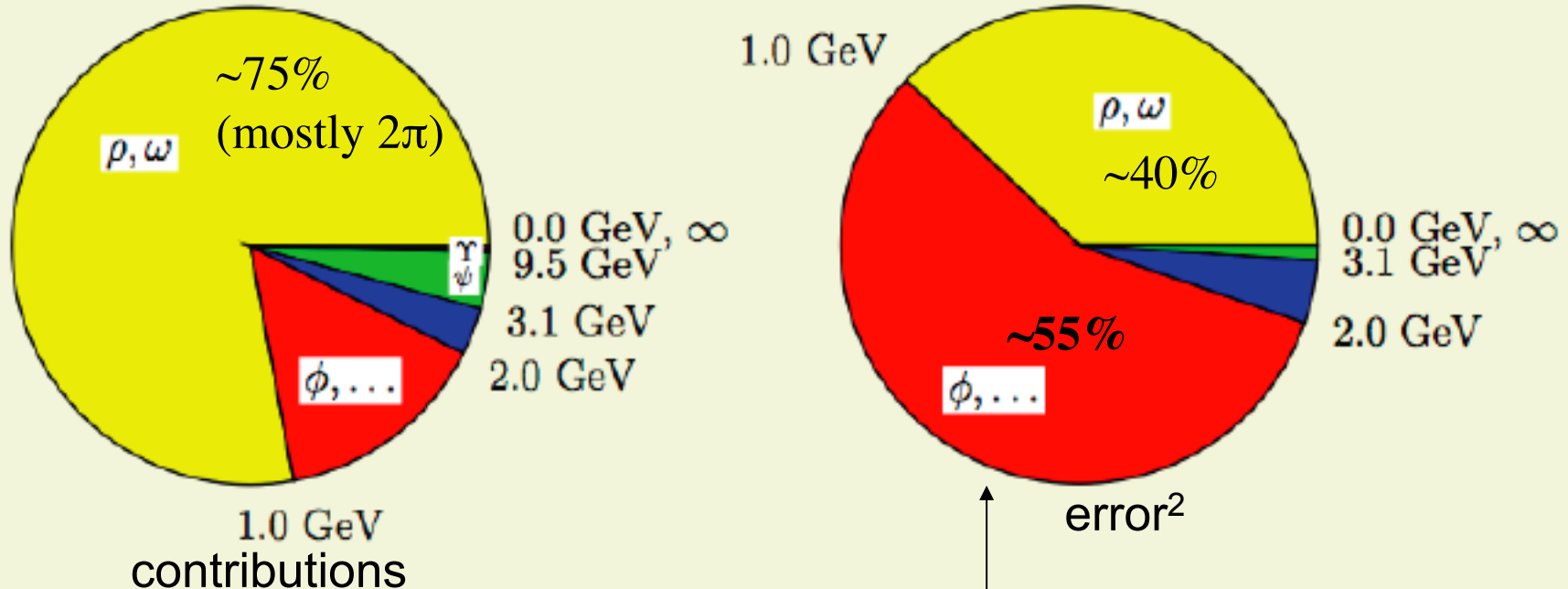


BABAR most precise (with CMD-2)
reduces tension between e^+e^- and τ

Error budget on a_{μ}^{HLO}

$$\delta a_{\mu}^{\text{HLO}} = 5.3 = 3.3(\sqrt{s} < 1 \text{ GeV}) \oplus \mathbf{3.9}(1 < \sqrt{s} < 2 \text{ GeV}) \oplus 1.2(\sqrt{s} > 2 \text{ GeV})$$

F. Jegerlehner, Talk at PHIPSI08



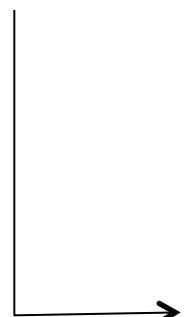
in the range $< 1 \text{ GeV}$
contributes to 70% !

But

Very important also the
region 1-2 GeV !!!

$\delta\sigma_{\text{HAD}} \sim 0.4\% \sqrt{s} < 1\text{GeV}$ (instead of 0.7% as now)

$\delta\sigma_{\text{HAD}} \sim 2\%$ $1 < \sqrt{s} < 2\text{GeV}$ (instead of 6% as now)



$\delta a_{\mu}^{\text{HLO}} = 2.6$ (instead of ~ 5 as now)

Possible with Direct scan at VEP2000 and
ISR at DAFNE, BEPCII and B-factories

What about HLbL ?

- As today $\delta a_{\mu}^{\text{LbL}} = [2.5-4]10^{-10}$
- How to improve? $\gamma\gamma$ physics can help? YES!

On the possibility to measure the $\pi^0 \rightarrow \gamma\gamma$ decay width and the $\gamma^*\gamma \rightarrow \pi^0$ transition form factor with the KLOE-2 experiment

D. Babusci¹, H. Czyż², F. Gonnella^{3,4}, S. Ivashyn^{a,5}, M. Mascolo^{3,4},
R. Messi^{3,4}, D. Moricciani^{b,4}, A. Nyffeler⁶, G. Venanzoni¹ and KLOE-2
Collaboration*

the purpose of this letter. The estimates are performed to demonstrate, within several approaches, an improvement of uncertainty, which will be possible when the KLOE-2 data appear. Discussion of the validity of these approaches as well as the form factor modeling is beyond the scope of this letter.

Eur.Phys.J. C72 (2012) 1917

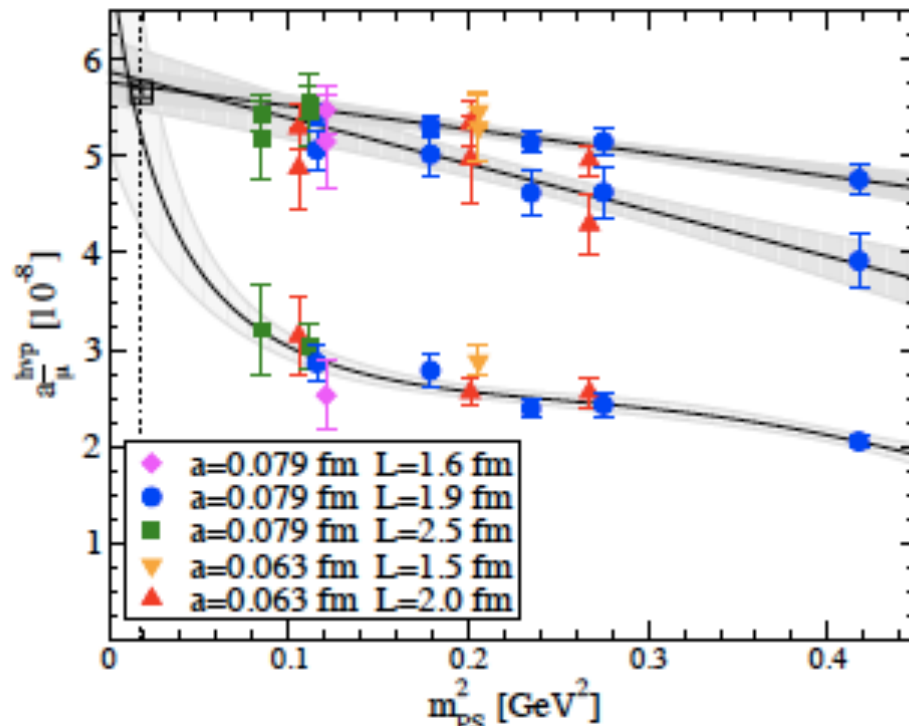
$\gamma\gamma$ physics is done at B-factories.

It will also be done at KEDR, KLOE-2 and BESIII with dedicated detectors, in a region where data are scarce

Also $e^+e^- \rightarrow PS\gamma$ (A. Kupsc)

Of course other approaches are possible

- A new 2-3% **lattice** result for the lowest-order hadronic (u,d quarks only) contribution:



Prospects for HLBL?

Experimental value:

$$a_{\mu, N_f=2}^{\text{hvp,exp}} = 5.66(05)10^{-8}$$

$$a_{\mu, N_f=2}^{\text{hvp,new}} = 5.66(11)10^{-8} \leftarrow \textit{Excellent agreement}$$

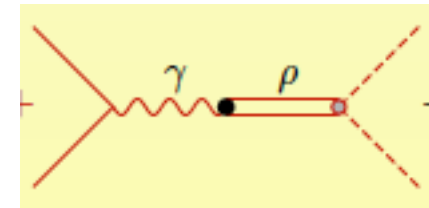
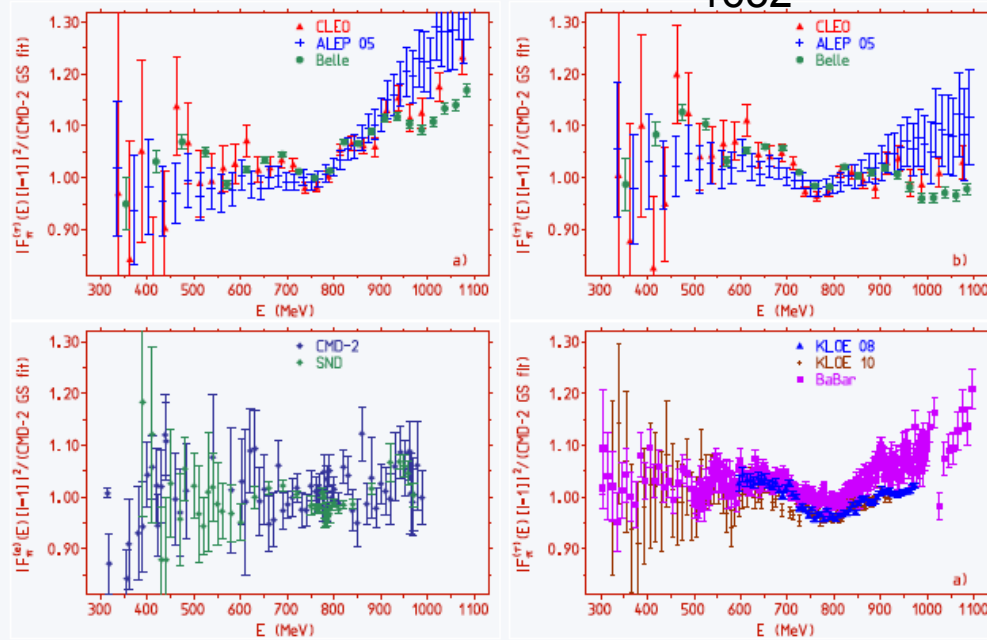
-Other ideas?

In both cases experimental and theoretical activities are essential!

Still a lot of work for our WG!

Jegerlehner and Szafron claim that the e^+e^- vs τ is solved if an additional correction (ρ - γ mix.) is included

F. Jegerlehner and R. Szafron, Eur. Phys. J. C71 (2011) 1632



$|F_\pi(E)|^2$ in units of e^+e^- $|=1$ (CMD-2 GS fit): a) τ data uncorrected for $\rho - \gamma$ mixing, and b) after correcting for mixing. Lower panel: e^+e^- energy scan data [left] and e^+e^- radiative return data [right]

τ decays		
Belle		25.24 ± 0.39
CLEO		25.44 ± 0.44
ALEPH		25.49 ± 0.13
DELPHI		25.31 ± 0.24
L3		24.62 ± 0.61
OPAL		25.46 ± 0.34
τ average		25.42 ± 0.10
$e^+e^- + \text{CVC}$		
CMD2 03		25.65 ± 0.29
CMD2 06		25.56 ± 0.31
SND 06		25.52 ± 0.36
KLOE 08		25.26 ± 0.29
e^+e^- average		25.40 ± 0.28
KLOE 10		25.18 ± 0.34
BABAR 09		25.77 ± 0.28
PDG average		25.51 ± 0.09

$B(\tau \rightarrow \pi\pi^0\nu_\tau)$ 24 25 26 27 %

$$a_\mu^{\text{had,LO}}[e, \tau] = 690.96(1.06)(4.63) \times 10^{-10} \quad (e + \tau) \quad \text{JS 11}$$

$$a_\mu^{\text{had,LO}}[e^+e^-] = (692.3 \pm 4.2_{ee+\text{QCD}}) \times 10^{-10}$$

$$a_\mu^{\text{had,LO}}[\tau] = (701.5 \pm 3.5_\tau \pm 1.9_{\text{SU}(2)} \pm 2.4_{ee+\text{QCD}}) \times 10^{-10}$$

DHMZ 11

How to improve the critical mass:
can we access to European funds
(especially for travelling and
positions)?

Can we have time to discuss this?

It seems we are too small to apply for a network