“Physicist Resource Survey” - conclusion

Two pronged attack:

Survey of experiments’

“needs”

Survey of NSF/DOE grants

under constant effort instruction

Outline:

brief reminder of project

update of activities and data since May

new results

conclusions

About 1 year ago, a task force was formed by HEPAP to investigate

- *the projected "needs" of experiments and*
- *"plans" for all US HEP groups*

  "Does the field have the manpower to carry out the experiments to which the U.S. program is committed until the end of the decade?"

A survey was conducted among two communities:

- *18 experiments selected by the committee*
- *194 DOE and NSF PI's…nearly 100% response*

To the experiments:

- *evaluate their **needs** in operations (carefully defined) and analysis (carefully defined) from 2004-2009 in faculty/staff, post docs, students*

  treating 2004 as a census year, breaking out foreign and US

To the PI's

- *evaluate their **plans** for faculty, Research Assoc., Post docs, graduate students for all projects from 2004-2009*

  under a severe, constant effort boundary condition

Committee:

- *Joel Butler, Sekhar Chivukula, Glen Crawford, Howard Gordon, Young-Kee Kim, Usha Mallik, John Womersley, Bill Molzon. Chairs: Jim Whitmore and Chip Brock*

August/September 2004:

- *Committee jointly prepared*

  letters of introduction and instructions plus spreadsheets, including examples

- *They were sent to:*

  All NSF experimental EPP grant PI's, including CESR

  All DOE HEP grant PI's, including FNAL, BNL, SLAC, ANL, LBL, MITLNS

  Spokespersons (SP) of the selected 18 experiments

September through April:

- *reminding, cadjoling, begging, threatening PI's and spokespeople to respond*

  Eventually, nearly 100% of PI's responded in a useful way

  All experiments replied

At last HEPAP meeting:

- *presented Experiment responses*
- *integrals of PI responses*

Data

- *added 1 missing university and 1 missing lab reports*
- *added the PI information for comparison*
- *hand-checked automated process…no errors*

Subsequent discussions centered on the Tevatron experiments

- *Previews with CDF/DØ in near-parallel fashion, with consent of comm.*

  Brock attended the DØ Institutional Board meeting at Vancouver on 6/14

  - *showed experiment plus DØ-only PI results*

  Brock prepared parallel talk delivered by Kim to CDF Executive Board on 6/23

  - *showed experiment plus CDF-only PI results*

  Both institutional representative groups were sent a questionnaire as followup to their groups' survey results

- *FNAL Aspen PAC*

  Whitmore attended and presented same information to PAC

- *Committee has met electronically for second time to discuss results and fashion its conclusions*

PI response from universities and laboratories

physicists: DAQ…*updated*

This was completed for:

- 194 groups
- 81 NSF supported
- 136 DOE supported
  - *a number with both sources*
- 53 projects with ≥ 2 PI's responding
- 603 group-projects
  - ⇒ *~3 projects per group*

Including, for 2004:

- 717 total faculty
- 340 research scientists
- 547 PD
- 712 GS

by resource (faculty, RS, PS, GS) and by project (experiment)

note:

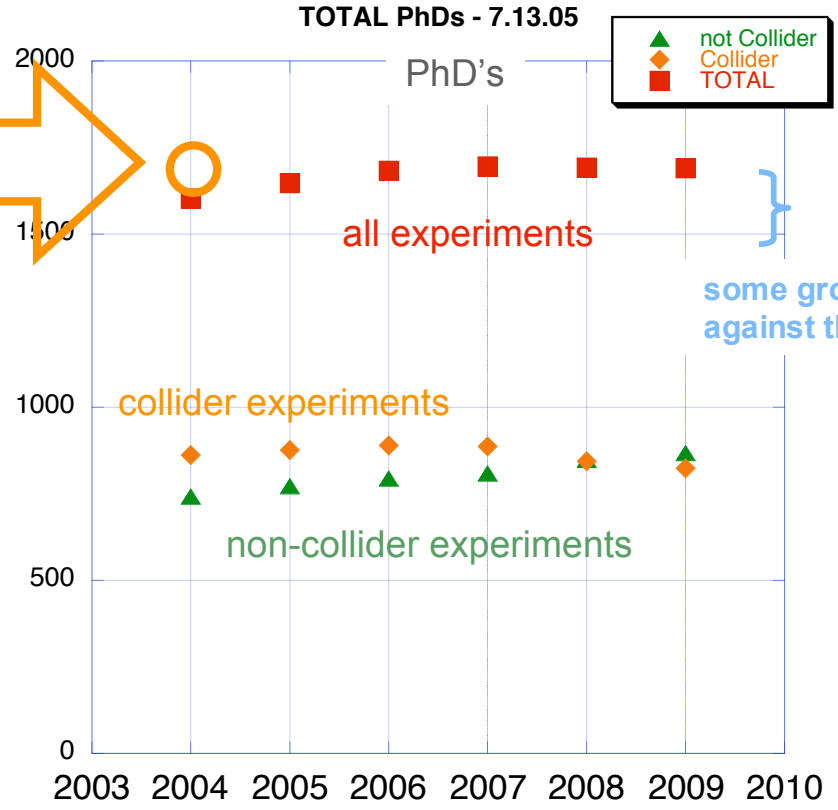
- *what's different:*
  - **Hand checking done for CDF and DØ spreadsheets**
  - **SLAC scientific staff included**

1	Institution:						
	Contact Person:						
	Funding agency(ies)						
	Projects working on between now (FY2004) and FY2009 (A, B, ...):						
	A						
	B						
	C						
	D						

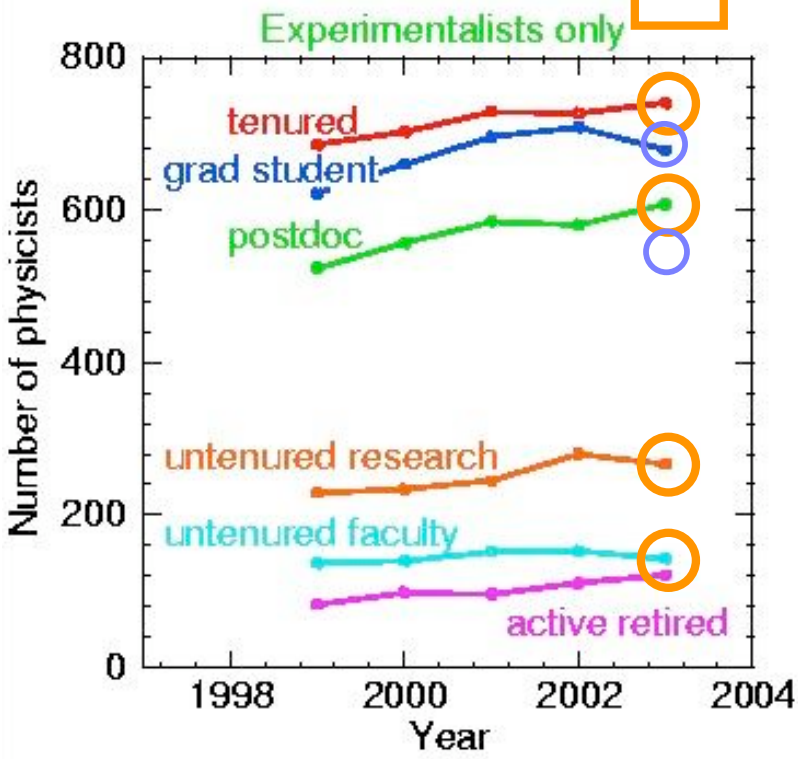
2	Numbers of current personnel in each category	Funded in FY04 from base	Funded in FY04 from off-base	Type of person
	Faculty			
	Research scientists			
	Postdocs			
	Graduate Students			
	Others (identify type of person)			

3	Estimated number of FTE personnel working on each project in each category in each year (only from base funding):						
	Faculty	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0
	Research Scientists	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0
	Postdocs	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0
	Graduate students	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0

Ph.D totals from the PI's: does it make sense?...*updated*



from the pdg census:



note:

- *what's different:*
  SLAC scientific staff included

http://hepfolk.lbl.gov/census/summary/2003/2003allgraphs.html

PI & experiment-"needs" comparisons

Counting faculty seems to be a tricky business

- *Their time-fractions are inherently complicated and time-dependent*
- *We used % of Research Fraction - "RF"*

  this allowed for a variety of comparisons and easy checking that the constant-effort rule was followed…since it sums to a name

  But: RF overcounts FTE
- *Experiments use FTE*

  for postdocs and graduate students, essentially FTE = RF

  Standard in experiments is a 50% efficiency factor for faculty time

  For laboratory scientific staff, RF considerably higher than 50%
- *A scaling: use an estimated FTE ("ESTFTE") for faculty counting*

  "ESTFTE" = 0.5*(university professor RF)+(laboratory scientific staff RF)

Plots will indicate either "FTE" or "ESTFTE" where appropriate

Correlations:

- *PD and GS counting totally correlated to faculty involvement*

  e.g., a 20% faculty person implies at least 1 student and/or 1 postdoc

  while…a 0% FTE faculty person–implies zero

For running experiments

- *estimation of need*

  is relatively straightforward for operating the experiments

  - *estimate ±10% on operations uncertainties*

  is considerably less so for analyzing the experiments

  - *same people do both, sometimes at different times during their involvement*
  - *analysis intensity follows the integrated luminosity jumps*

For future experiments

- *estimate is of something other than "need"*

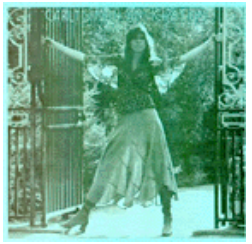
  reported as consisting of basically a mixture of

  - *real effort now ongoing in construction (like operations in running exp), again ±10%?*
  - *plus a census of what groups intend to do in the future*

The point:

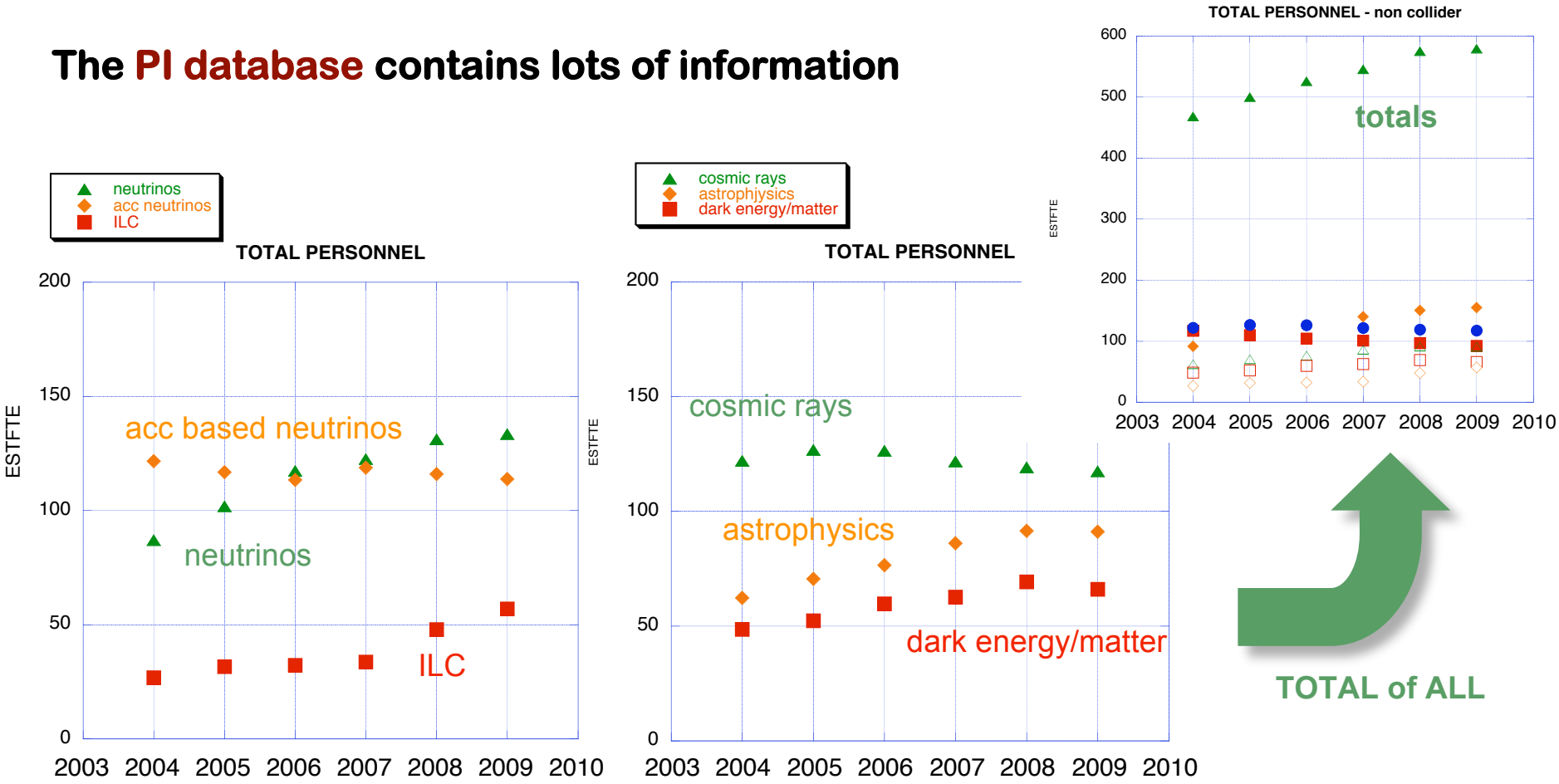
- *I'm trying to be sure that I do not use the word "need" for the LHC experiments*

  What's reported I'll call "Anticipation" in what follows



all non-collider future and current programs reported by PI's

The PI database contains lots of information



"neutrinos," such as: AMANDA, Double Chooz, IceCube, K2K, KamLand, SNO, SuperK, others…

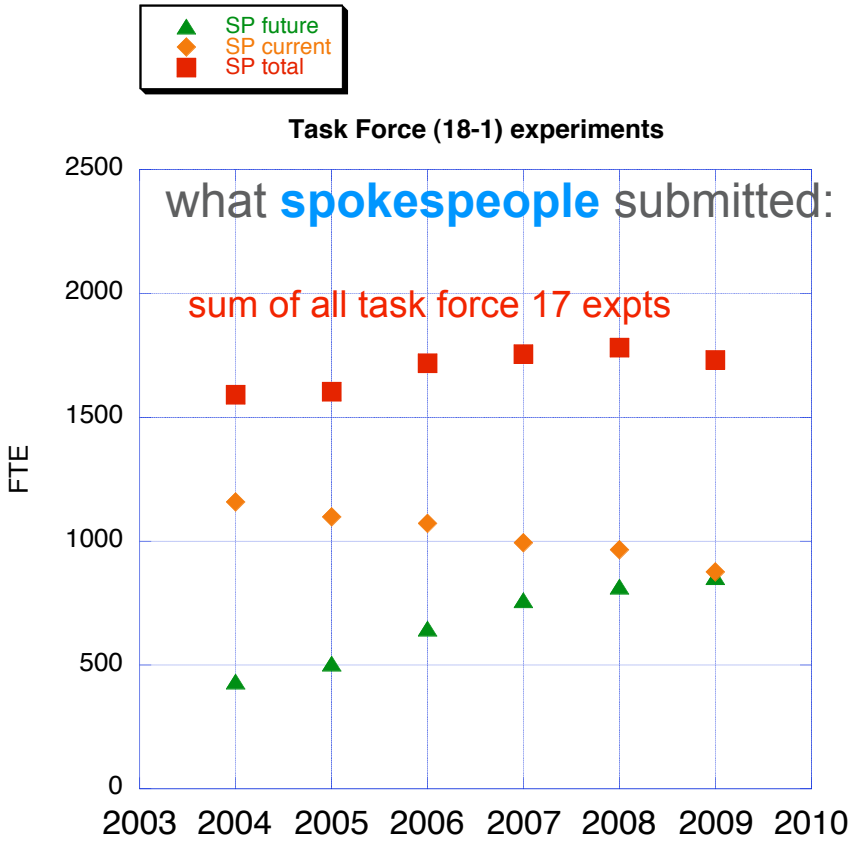
"accelerator based neutrinos," such as: MiniBooNE, MINOS, NOvA, T2K, Minerva, NuTeV

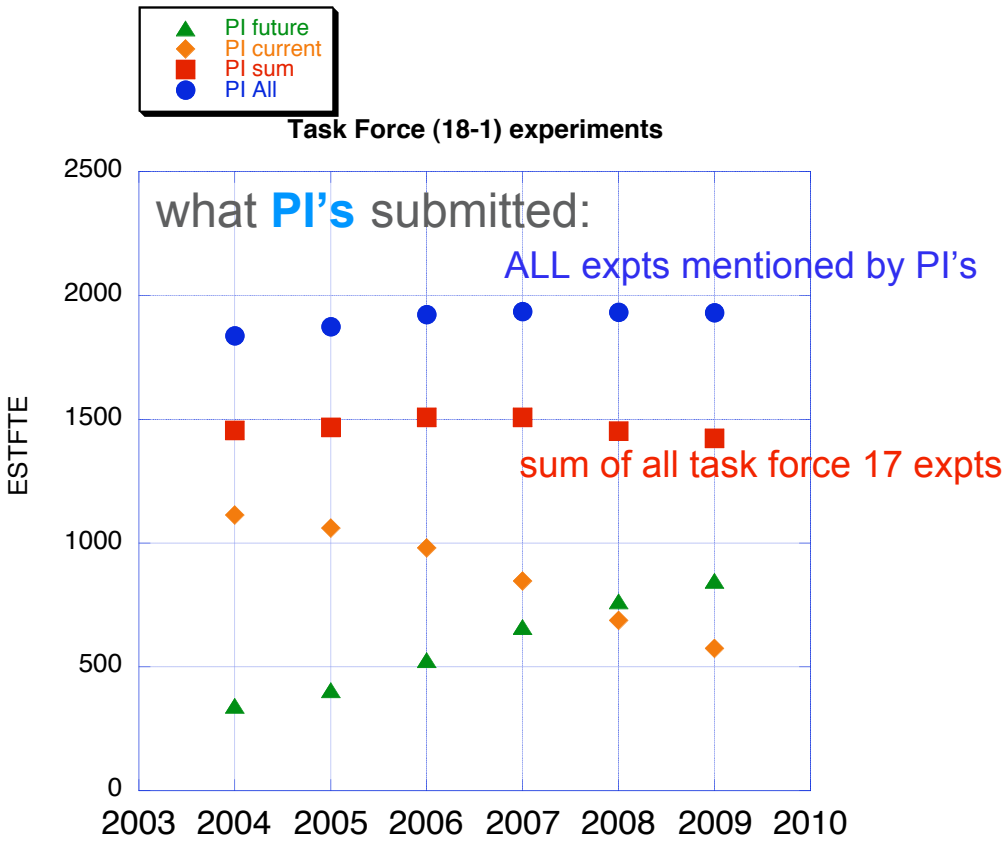
"cosmic rays," such as: Auger, CACTUS, CHICOS, CREAM, CROP, FLASH, HiRes, Milagro, STACEE, VERITAS

"astrophysics," such as: CMB, GLAST, LIGO, SDSS, SNAP

"dark energy/dark matter," such as: CAST, CDMS, COUP, DES, DRIFT, eBubble, LSST, UNO, SuperCDMS, XENON, ZEPLIN II

The entire survey of 17 experiments, Spokespersons and PI's





KEY:

current: DØ, CDF, BaBar, Minos, CLEO, MiniBooNE, SUPER K, STACEE, LIGO, AUGER, MINERvA

future: Atlas, CMS, SNAP, MECO, KOPIO, VERITAS

"PI All" is for all experiments included in PI survey: the 17 plus all others

Total Personnel:
CLEOc and BaBar SP and PI projections

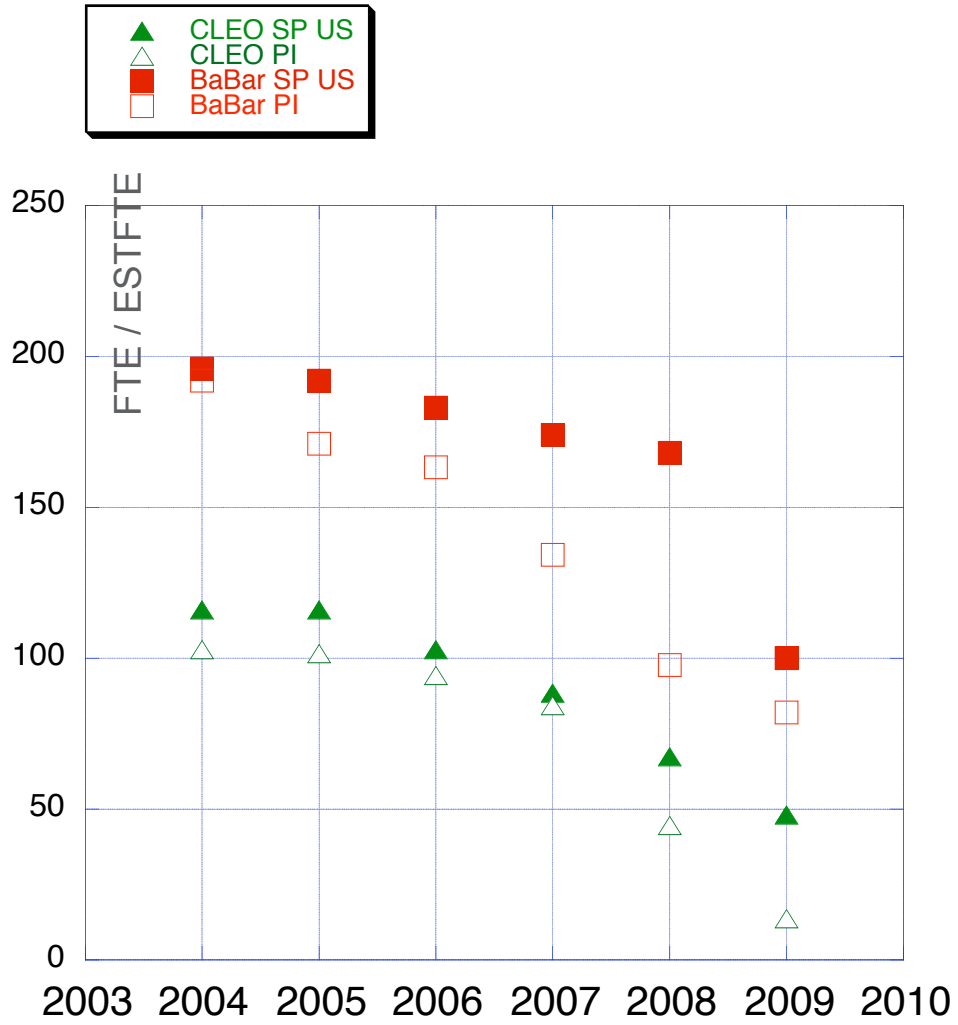
In what follows:

- *All Experiment plots are Operations plus Analysis*
- *All Experiment plots are US personnel only*

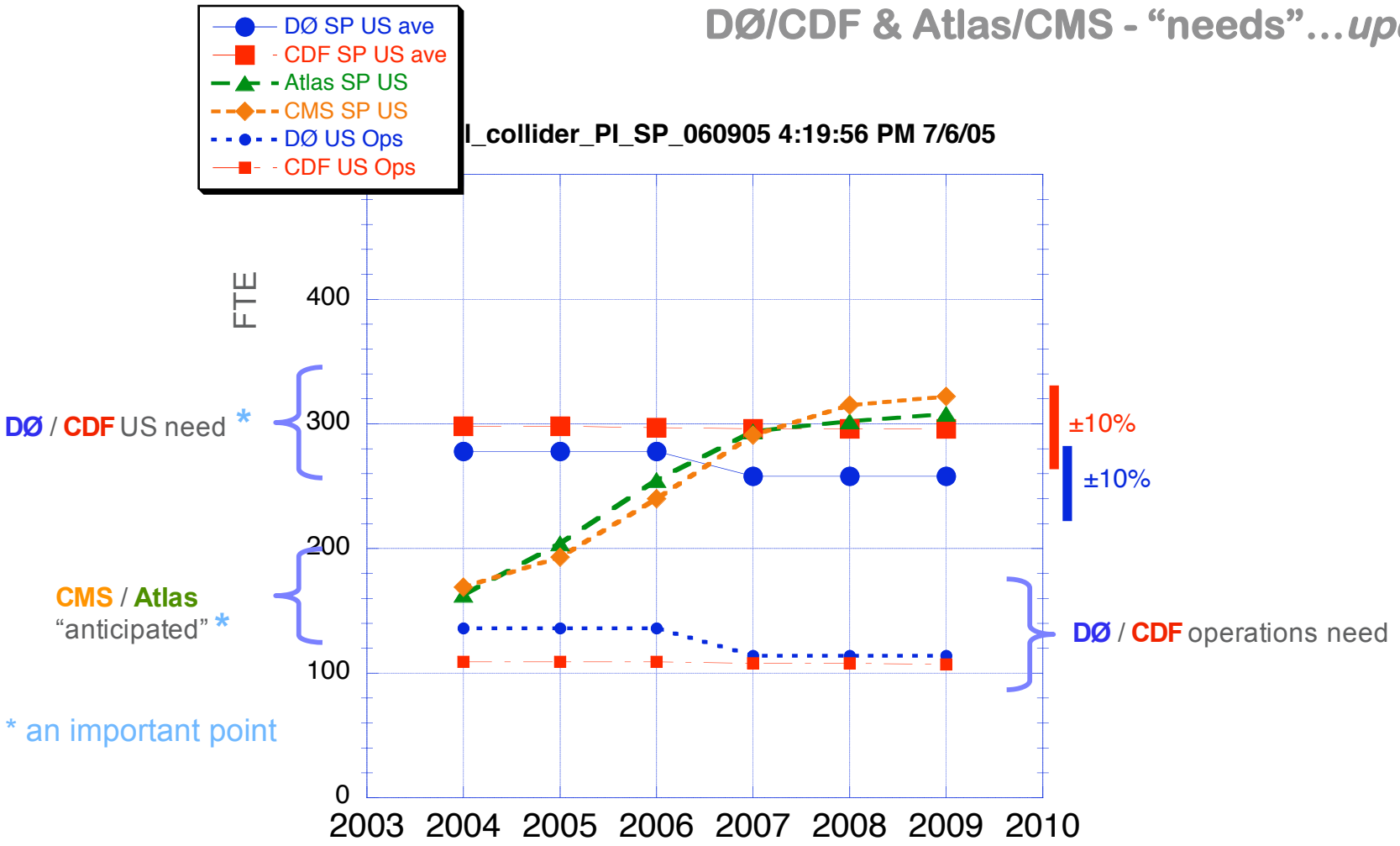
  scaled from the 2004 fraction
- *Uncertainties:*

  certainly ±10% for Ops

  certainly larger for Analysis



Total Personnel:
DØ/CDF & Atlas/CMS - "needs"…*updated*



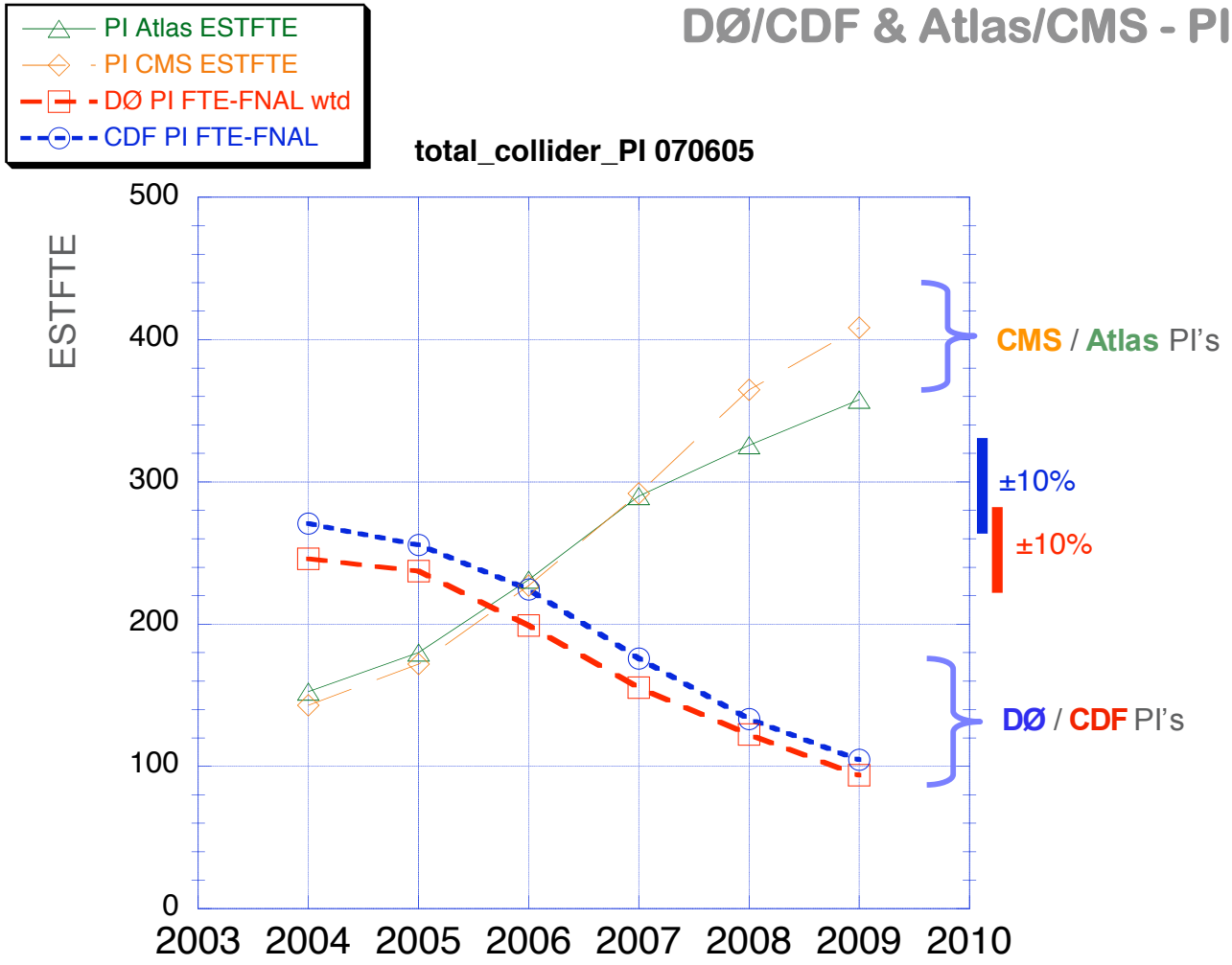
note:

- *what's different:*

  added the separate Operations "need" for CDF and DØ…an accurate need calculation

  - *the difference is the estimate of analysis "need"*

Total Personnel:
DØ/CDF & Atlas/CMS - PI projections

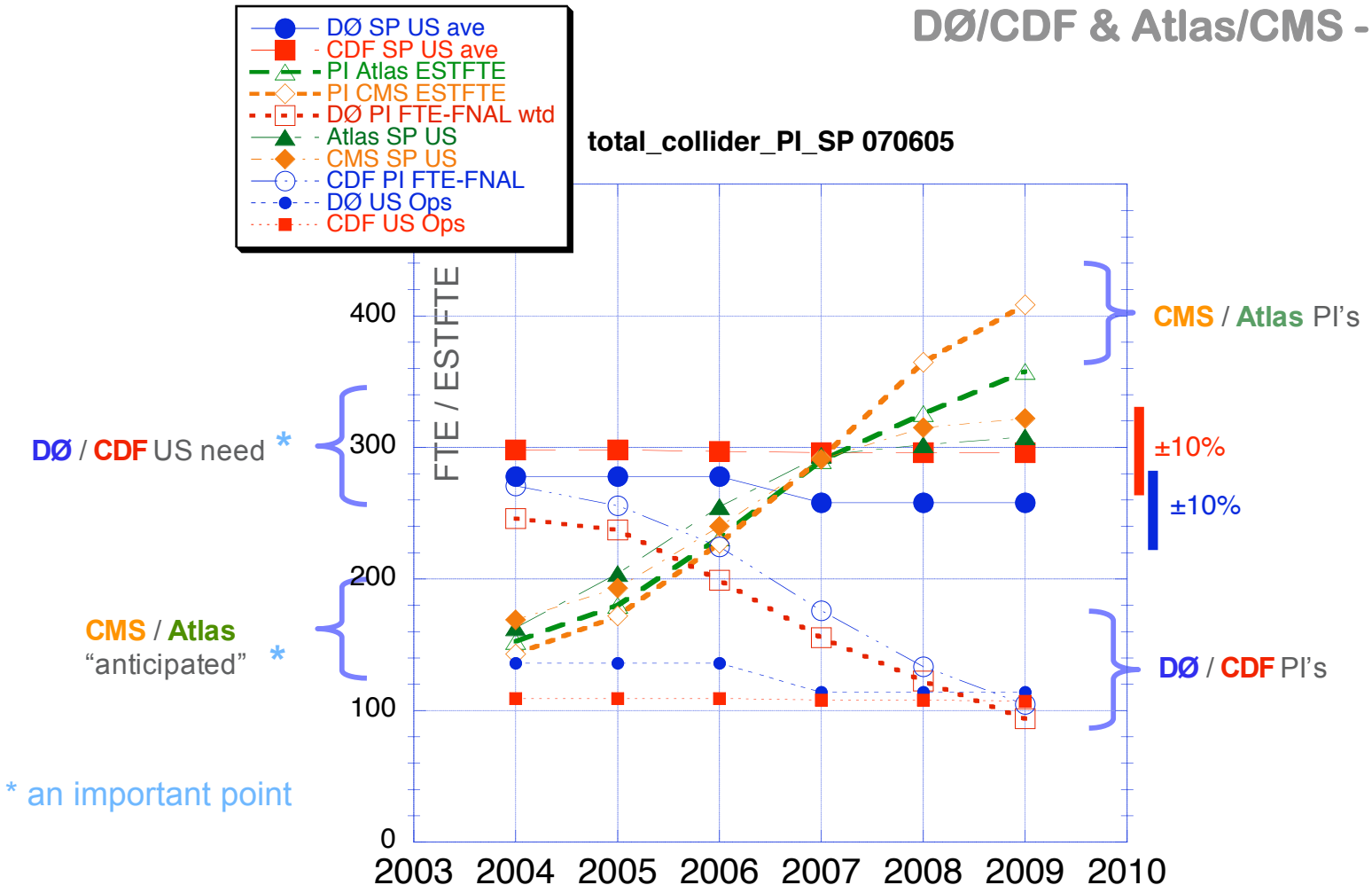


note:

- *what's different:*

  PI's survey included in ESTFTE

Total Personnel:
DØ/CDF & Atlas/CMS - all together



PI's in colliders…pretty much go to LHC

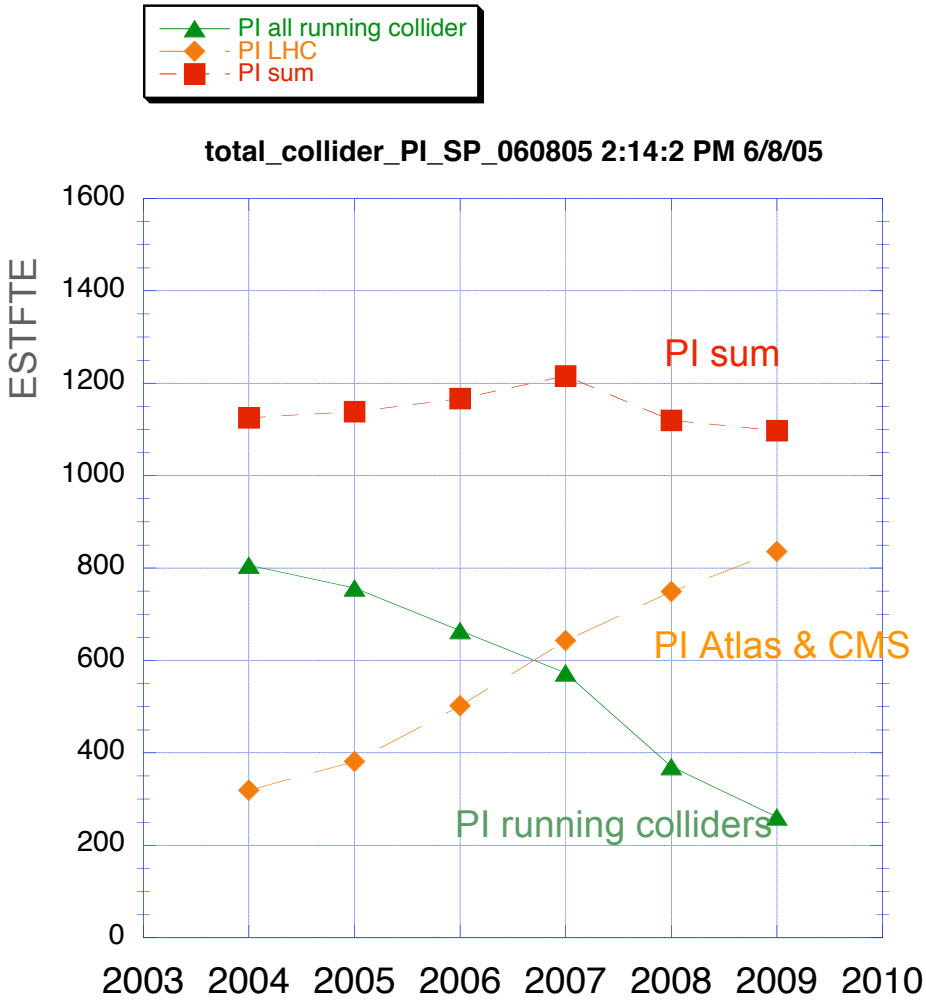
***green*: DØ+CDF+BaBar+CLEOc**

***orange*: US ATLAS + US CMS**

***red*: sum**

observe:

- *within this sub-community, the PI's followed the constant-effort rules*
- *BaBar and CLEOc groups' migration to LHC is significant*



Collider Spokespeople's "needs/anticipations"

***green*: DØ+CDF+BaBar+CLEOc**

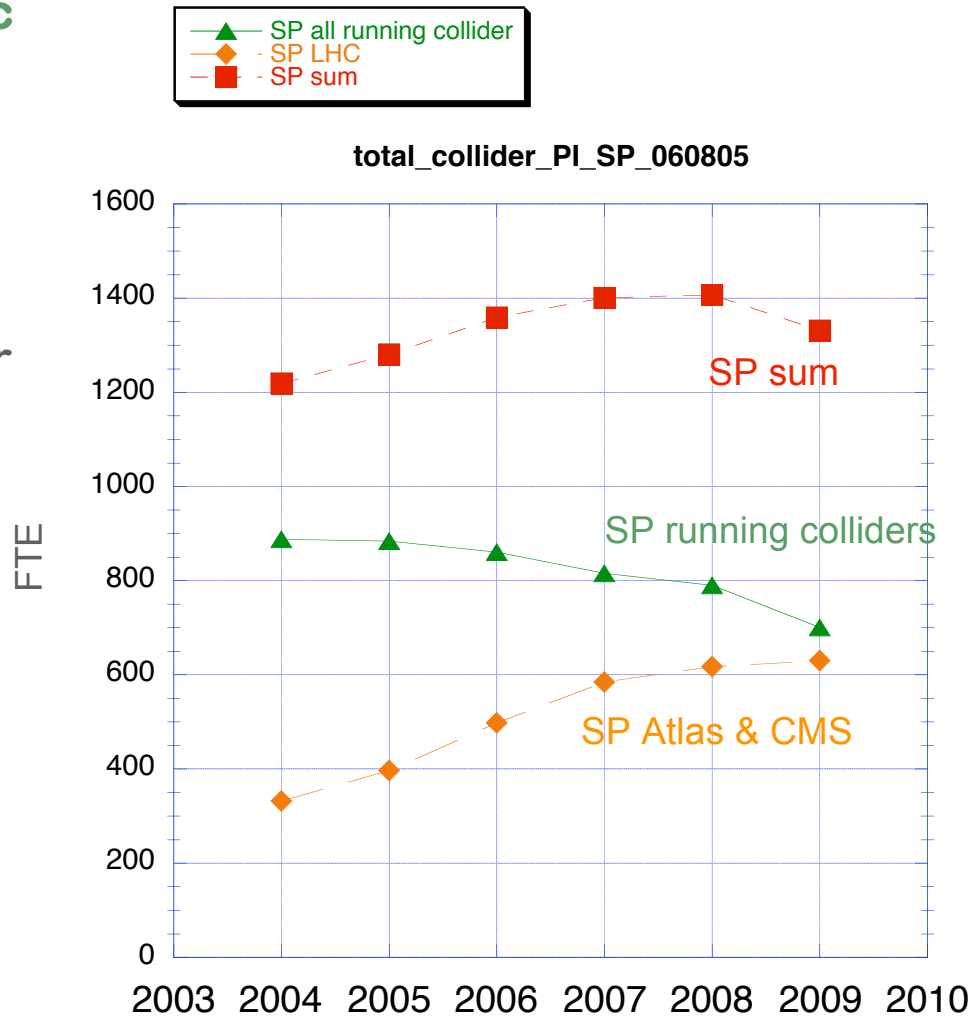
***orange*: US ATLAS + US CMS**

***red*: sum**

observe?

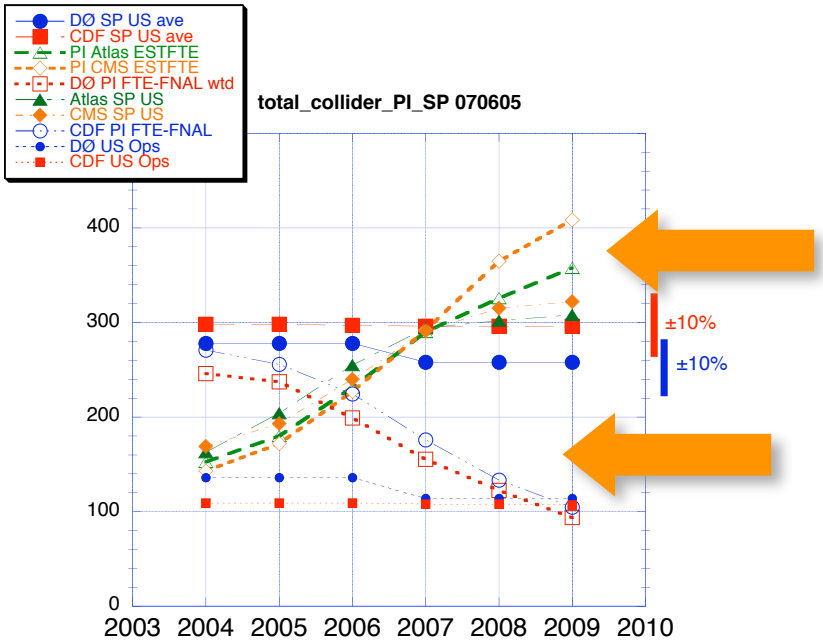
- *"needs/anticipations" appear to rise in the 07-08 period*

  is this the case?



the tevatron situation
appears to present special challenges

therefore, there was a special follow-up in June



focusing on the Tevatron situation

outyears are the result of huge extrapolation from 2005

Observations:

- *An apparent correlation among ~80 independent DØ/CDF PI's*
- *A signficant PI fall-off, especially > 2006*
- *The difficulty in defining "needs" by the experiments*
- *The almost certain…um…uncertainty in predicting ≥08 - unclamped beyond '04*

NOTE:

- *This is all theoretical - **nothing has happened yet.***
- ***It suggests a potential problem to be investigated.***

Are these the real "needs" of the experiments?

Are these the real "plans" of the PI's?

"Constant Effort" rule was very difficult to contend with for PI's

DØ IB + CDF EB reps received a questionnaire that included the following questions for anonymous reply:

1. *Do these results surprise and/or concern you?*
2. *Would you have liked to have kept a greater presence in DØ or CDF during the 2006-9 period than your response suggested?*
3. *If you would have, what led to your decision to respond with a significant reduction in plans for CDF or DØ?*
4. *What factors influenced your projection to 2007?*
5. *What would you have needed to believe about your particular circumstances in order for you to have responded with a greater presence in DØ or CDF?*
6. *Should CDF and DØ collaborations just live with this apparent plan or should the tevatron community promote a managed transition? **Do you have a sense of what would constitute a managed transition?***
7. *Would these apparent results - especially #C and #D- have led you to have responded differently if you had known beforehand?*

   (“#C and #D” refer to the PI projections: more-LHC than anticipated & fall off in tevatron plans)

I tried a draft of questions out on a few DØ people…one reported back:

“One positive thing that I come away with is a greater sense of duty to DZero. I can't now assume that other groups will keep DZero running as we shift to CMS.”

Questionnaire - about half of DØ and CDF institutions responded by 7/1

Emphasized by all: Outstanding physics will come from the Tevatron

- *Redirection of physicist resources can compromise the physics*
- *Premature migration would prevent PD and GS from experience necessary for LHC analysis*

Two issues dominated any shift from Tevatron to LHC

- *Physics: some needing to participate in LHC on Day 1*
- *Some reported implicit and/or explicit directives from agencies to shift from Tevatron to LHC*

  60% say "physics"; 45% say "pressure" (including 9% who say both)

The constant effort constraint:

- *was a reason for an apparent coherent response away from Tevatron*

  65% said that, with incrementally more resources, they could devote additional students or postdocs to the Tevatron program

Small groups have a special problem

- *Essentially a binary, either-or decision*

Essentially all were in favor of a "managed" transition. Some suggested:

- *specific ideas for streamlining of operations, analysis, code changes*
- *more inclusion of Lab technical people into traditionally physicist roles*
- *prioritizing of physics goals*
- *the need for close coordination among stakeholders leading to a strategy*

  and assurance that those who conformed would not suffer funding loss

Conclusions

Reminder: These responses were made in the framework of:

A constant level of effort from the PI's

They were done in the context of time-dependent uncertainties:

1. *Potential for exciting physics results*
2. *Uncertainty in the LHC schedule*
3. *The uncertainty of Tevatron and B-factory luminosity future performance*

The "3 uncertainties" for the following…

Summary/Conclusions from this exercise

- **The committee concludes that maximizing the physics return from the Tevatron and BaBar while simultaneously preparing for an active US role in Atlas and CMS may tax physicist resources of the US HEP community.**
  - *especially factoring in the other efforts planned and underway in neutrino physics, astrophysics, cosmology, and cosmic ray physics.*
- **With respect to the Tevatron and LHC, the next 2 years will be crucial in terms of understanding the evolution of the "3 uncertainties" of the previous slide, but the field cannot wait to see whether this will prove to be the case.**
- **Although we cannot be sure that additional resources will be required, navigating this transition will require an unprecedented, active coordination among a) the running collider experiments (primarily, BaBar, DØ, and CDF), b) their lab managements, c) US Atlas and US CMS, and d) the agencies in order to ensure it does not become a real problem**
  - *The Tevatron presents special challenges: There might be a serious problem at the Tevatron beginning within 1-2 years for those groups trying to evolve to LHC while simultaneously maintaining sufficient strength in CDF and DØ. (For BaBar, this situation appears to be less severe at this point.)*
  - *A focused effort on helping to maintain the Tevatron & B-factory efforts of a small number of specialized groups/personnel may be required in order to alleviate potential problems…if necessary, a few-year supplement to University Program budget could be required*
- **This coordination should start immediately and conclusions be reached in a matter of a few months in order that plans can be formulated and remedies negotiated very soon.**

personal opinon

my personal opinion: we'll get through this, but only with a significant effort

- **Far better to uncover a potential problem now and fix it, than when too late**

- **We've done all that can be done with average FTE-counting**

  In fact: all FTE's are **not** *the same…time to differentiate*

  Job 1: **Stakeholders start to identify named individuals and groups matched to specific systems and roles. Also identify important senior physicists trying to split their efforts, but finding it difficult because of resources. Now. It will be hard.**

  The burden is on the experiments and the labs to identify critical groups' needs

  Job 2: **Iterate to a solution among expts, lab managements, and funding agencies**

  The responsibility is with the agencies to make particular groups capable of doing both

  Do this all in a few months.

- **Perceptions have driven a significant part of this survey**

☞ *NSF & DOE need to learn to encourage research at the Tevatron*

  I don't sense that this comes through as much as it should

  This situation is a great one-time opportunity to change those perceptions

- **Next Big Machines seem to dominate the agencies**

  Data-in-hand deserves better attention, especially given the enormous physicist and financial investment

personal opinon

An All Star Effort

We're in the discovery business

…which happens in two ways:

"Home runs" – of course – LHC is the Big Bat

and will pay off in discovery physics for decades

"Small Ball" - strategic play: bunts, hit and run, base stealing

historically, careful, precision measurements have often led to significant surprises

- **But: careful, precise measurements only come with experience & long effort**

  Fermilab and SLAC are

  The Careful, Precise Measuring Places

  for quite a while yet

  So, they are an integral part of the discovery business

- **A well-designed, balanced program realistically nourishes both methods**

We're done.

Again, thanks to:

- *Glen Crawford, who has functioned beyond just committee membership*
- *The other members of the committee: Usha Malik, Bill Molzon, Joel Butler, Howard Gordon, Young-Kee Kim, John Womersley, and Sekhar Chivukula*
- *Brenda Wenzlik for keeping it sane at MSU*
- *The staffs at DOE and NSF who helped with encouragement to people to complete the surveys*

  Joe Dehmer for space to work at NSF

  Ramona Winkelbauer at NSF for her technical help
- *The 200 or so PI's who felt it their duty to respond*
- *The 18 experimental managements which did the arduous bottoms-up analysis of their "needs"*

Summary/Conclusions from this exercise

- **The committee concludes that maximizing the physics return from the Tevatron and BaBar while simultaneously preparing for an active US role in Atlas and CMS may tax physicist resources of the US HEP community.**
  - *Including the other efforts planned and underway in neutrino physics, astrophysics, cosmology, and cosmic ray physics.*
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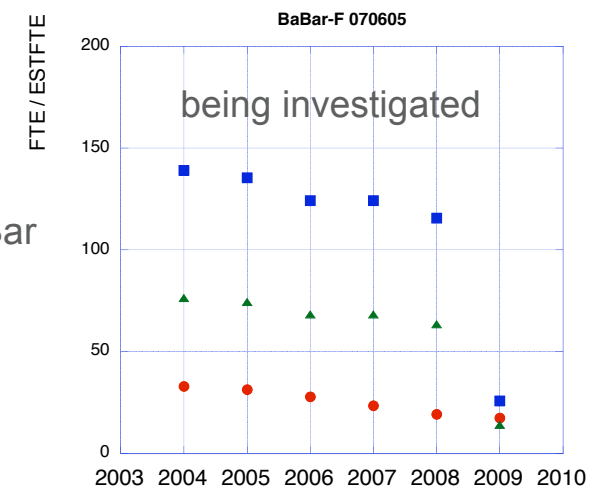
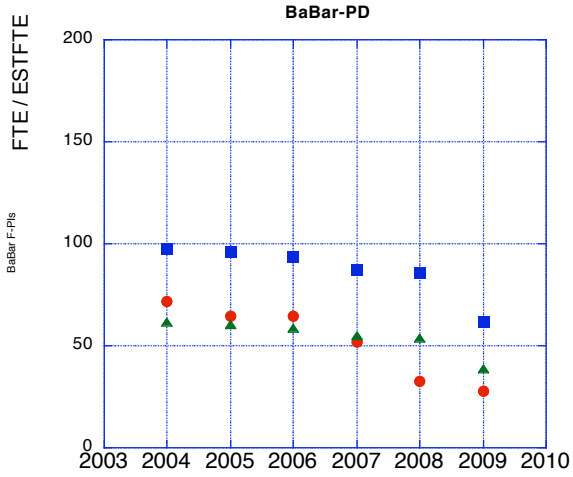
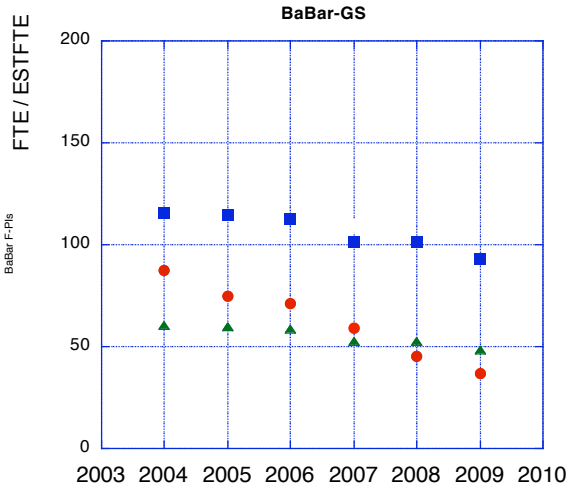
BaBar, CLEO: total PI responses compared with Experiment Needs

■ total SP reported ▲ scaled to US-based SP ● US-based PI

BaBar

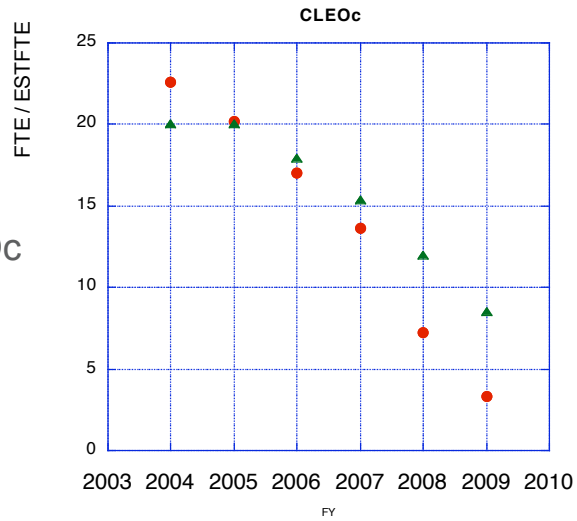


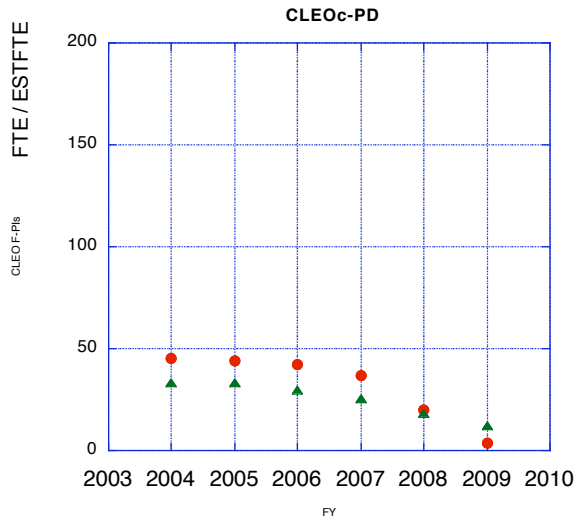


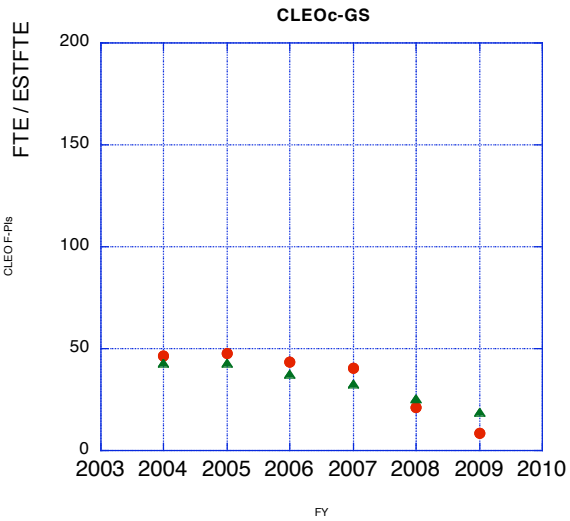


faculty/staff post docs graduate students

CLEOc







CDF, DØ: total PI responses compared with Experiment Needs