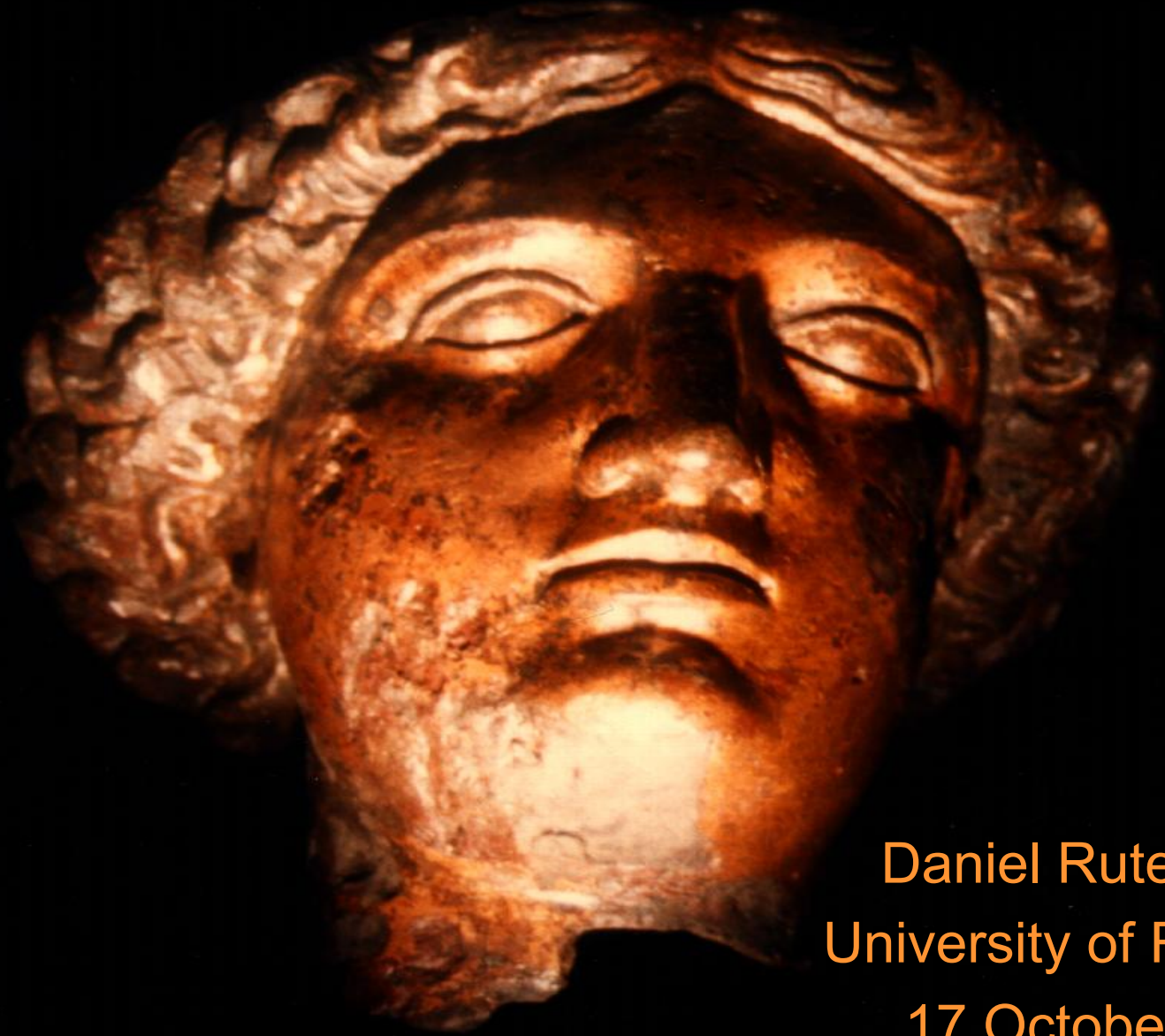# Computing and Common Processing

Daniel Ruterbories

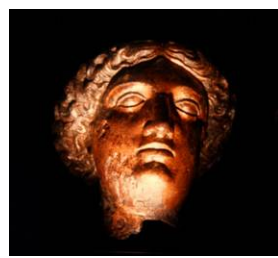University of Rochester

17 October 2016

Charge Questions

- Question 1(D): The model for data processing and analysis including the budget and effort required

- Question 1(E): SCD and collaboration resources

- Question 4: Are there robust plans for data processing and data analysis? Have adequate resources from the collaboration been identified for data analysis to meet the set goals?
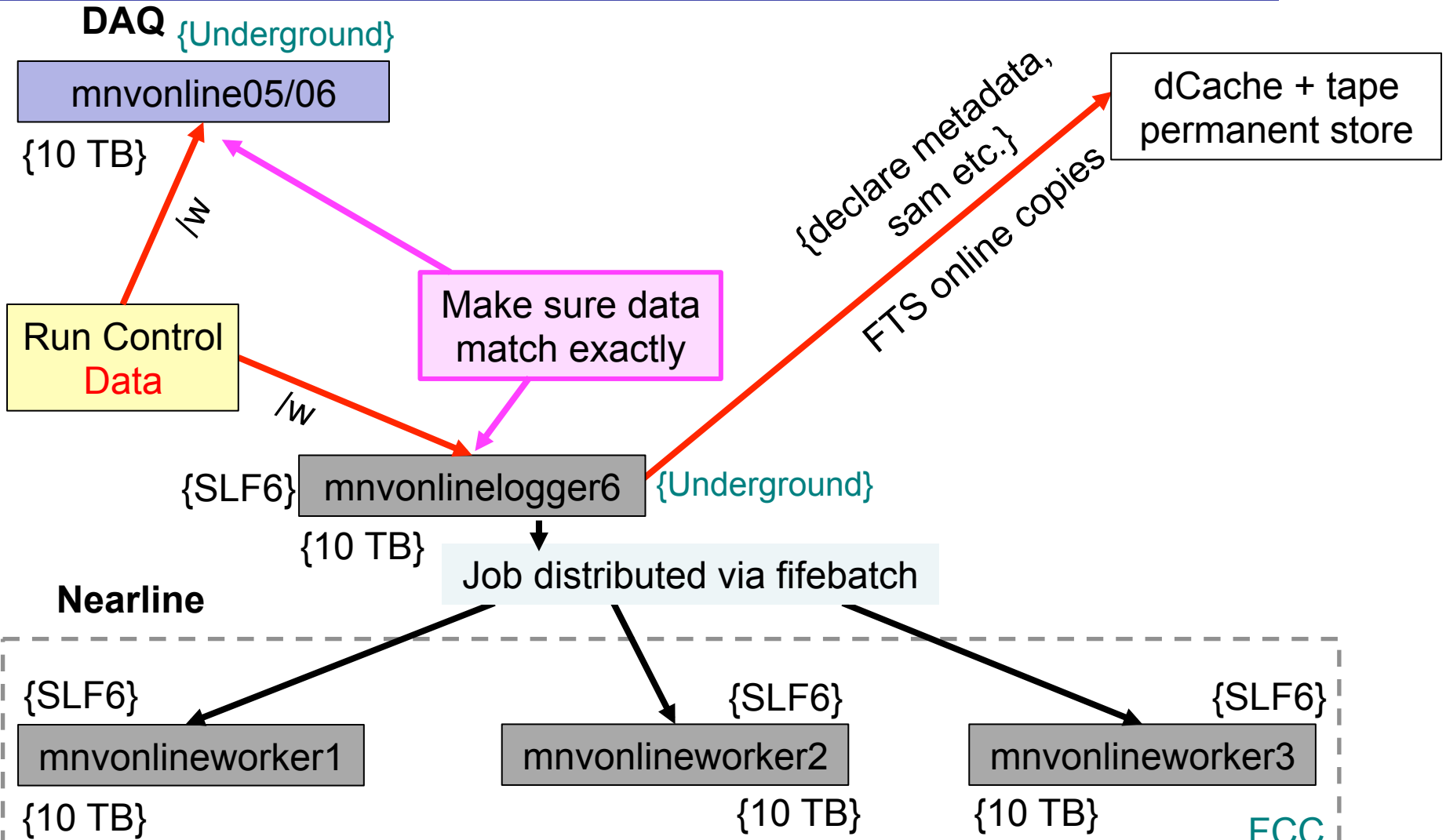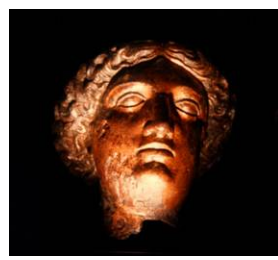
Outline

- Models for online/nearline analysis
- Models for offline data analysis
- SCD and collaboration resources
- What resources are necessary to execute the data analysis plan
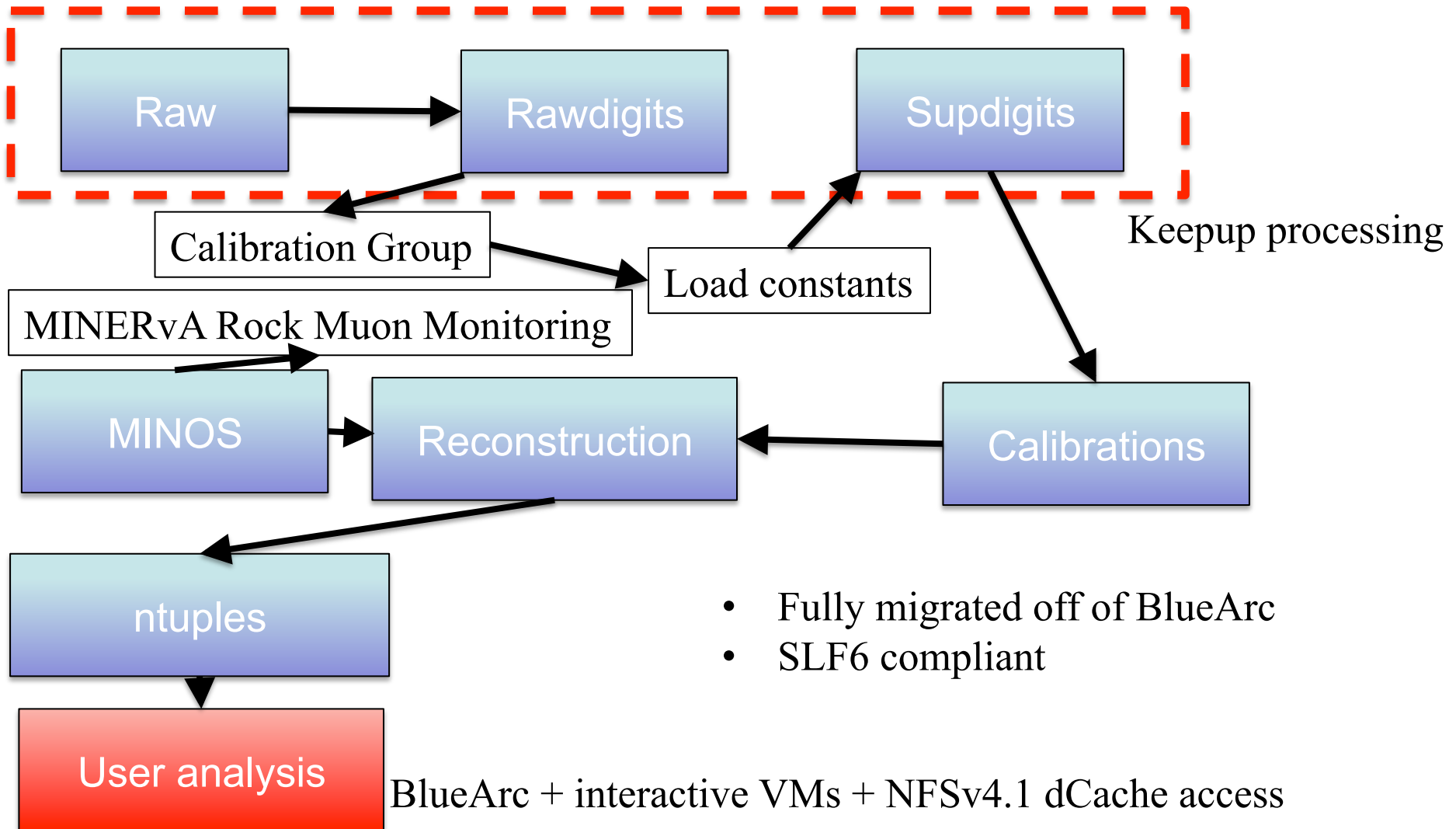
Charge Question

- Question 1(D): The model for data processing and analysis including the budget and effort required

- Question 1(E): SCD and collaboration resources

Nearline Current Data Flow Structure

DAQ {Underground}

mnvonline05/06 — scp → minervagpvm02 — nfs mount r/w → /minerva/data2 BlueArc

{10 TB}

/w

{email expert about failures}

Run Control Data

Make sure data match exactly

/w

{SLF5} mnvonlinelogger4 {Underground}

{10 TB}

Nearline

Job distributed via condor

{declare metadata, sam etc.}

keepup via FTS cronjob on minervagpvm01

tape permanent store

{SLF5}   {SLF5}   {SLF5}   {SLF5}

mnvnearline01   mnvnearline02   mnvnearline03   mnvnearline04

{4 TB}   {4 TB}   {4 TB}   {4 TB}   FCC

Future Nearline

DAQ {Underground}

mnvonline05/06

{10 TB}

Run Control
Data

/w

/w

Make sure data
match exactly

{declare metadata, sam etc.}

FTS online copies

dCache + tape
permanent store

{SLF6} mnvonlinelogger6 {Underground}

{10 TB}

Job distributed via fifebatch

Nearline

{SLF6}

mnvonlineworker1

{10 TB}

{SLF6}

mnvonlineworker2

{10 TB}

{SLF6}

mnvonlineworker3

{10 TB}

FCC

MINERvA Data Model

Keepup processing

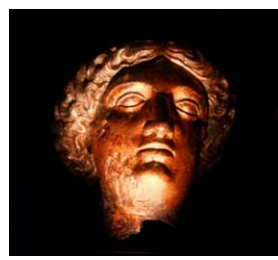- Fully migrated off of BlueArc
- SLF6 compliant

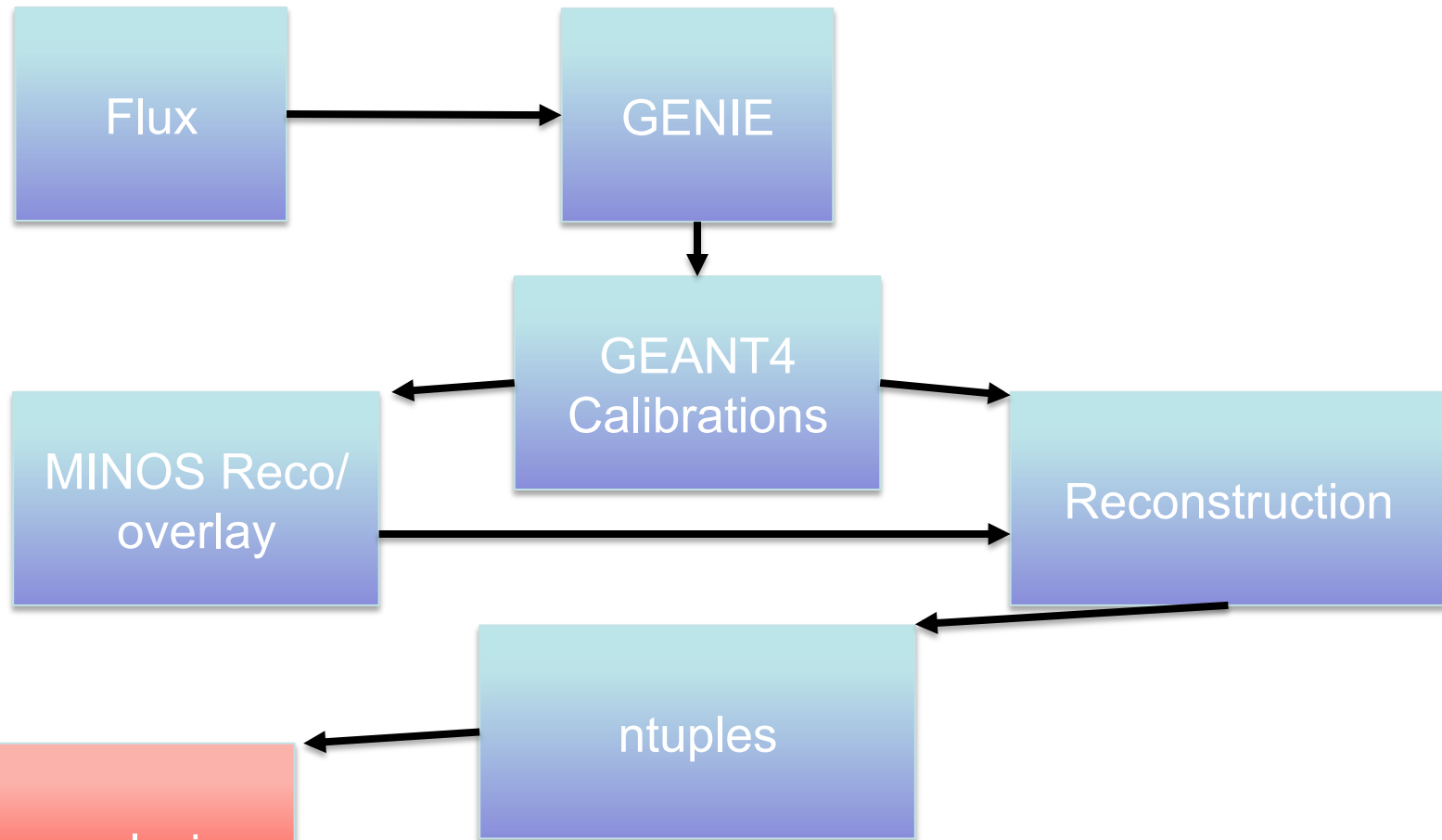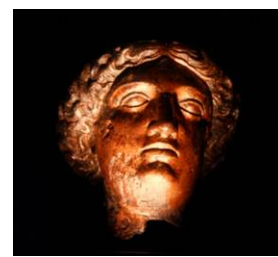BlueArc + interactive VMs + NFSv4.1 dCache access

MINOS Data Model

- Used to be MINOS collaborators who managed and ran jobs – expertise has been transferred to MINERvAfs
- Physical machines are currently SLF5
  - Tested this process on SLF6
- Migration off BlueArc nearly fully tested

MC Generation Model

Flux → GENIE

GENIE → GEANT4 Calibrations

GEANT4 Calibrations → MINOS Reco/overlay

GEANT4 Calibrations → Reconstruction

MINOS Reco/overlay → Reconstruction

Reconstruction → ntuples

ntuples → User analysis

BlueArc + interactive VMs+ NFSv4.1 dCache access

Computing and collaboration resources

- MINERvA Collaboration Resources
  - Computing Infrastructure [1.0 FTE]
    - Daniel Ruterbories (Lead)   U. Rochester   Postdoc
    - Philip Rodrigues   U. Mississippi   Professor
  - Production [0.7 FTE]
    - Dipak Rimal (Lead)   U. Florida   Postdoc
    - Tejin Cai   U. Rochester   Graduate Student
  - Software Release [0.5 FTE]
    - Trung Le (Lead)   Tufts   Postdoc
  - Keepup MINERvA [0.25 FTE]
    - Anushree Ghosh (Lead)   USM   Postdoc
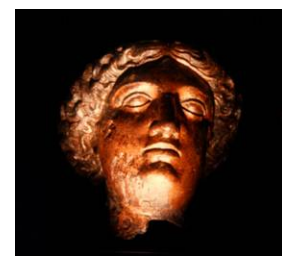   - Heidi Schellman   Oregon State U.   Professor
  - Keepup MINOS [0.2 FTE]
    - Dipak Rimal (Lead) to be handed off   U. Florida   Postdoc
 - MINOS data quality / validation [0.2 FTE]
    - TBD who maintains scripts but not evaluate the plots.

# Computing and collaboration resources

- SCD Resources
  - Liaison for efficient communication – Gabe Perdue
  - Grid and Cloud computing
  - Scientific Collaboration Tools
  - Scientific Computing System
  - Scientific Data Management
  - Scientific Data Storage and Access
  - Scientific Databases
  - Scientific Software
  - Simulation Software

Computing and collaboration resources
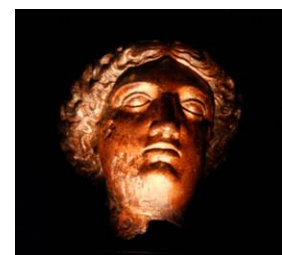
- Core CD Resources
  - Authentication and Directory
  - Central Web Hosting
  - Database Hosting
  - Desktop Services
  - Fermilab (Data Center) Facilities
  - Network Services
  - Networked Storage Hosting
  - Service Desk

Budget - media
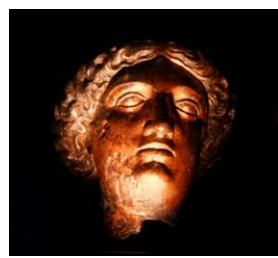
Media Type - Tape	TB written in the past year	Adjusted TB*	Cost
tape raw binary	16	18.67	$560
tape supp / cal digits	15.5	18.08	$543
tape reco	23.2	27.07	$812
tape simulation	418.3	488.02	$14,641
Media Type - Disk	**Total TB allocated (private) / in-use (public)**		
persistent dCache	193		$5,629.17
raw data write dCache	132		$3,850.00
read/write pools dCache	470		$13,708.33
public scratch dCache	76		$2,216.67
Total media cost			**$41,959.17**

EOP Table 2

Tape adjusted to 14 month period.
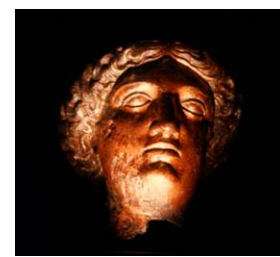Disk is actual usage or private allocation

Budget – CPU Time

Marginal cost of computing	1 year CPU hours (millions)	CPU Hours**	Cost
data processing	3.9	4.55	$45,500
simulation processing	11.7	13.65	$136,500

** Adjusted to 14 months

EOP Table 2

Budget – SCD Personnel and total

Computing Labor	Neutrino Experiments (total FTE)	MINERvA (total FTE)	Neutrino Experiments (Incremental)	MINERvA (Incremental)
Software Development and Support	17.92	0.93	6.72	0.64
Operations	16.73	2.5	4	0.55
Facilities	22.4	2.45	4.5	0.53
Total	57.05	5.88	15.22	1.72

Total computing and media cost	$223,959
SCD Support Services (5.88 FTE-year, 14 month period)*	$1,715,000
Incremental Support Services (1.72 FTE-year, 14 month period	$501,667
Grand total (incremental)	**$725,625**

*** FTE estimate based off of DOE operations review, from service desk tickets. Source M. Votava, A. Lyon, S. Fuess
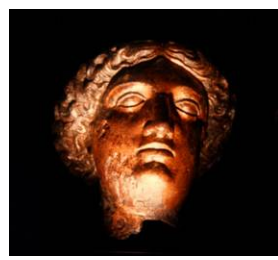
EOP Table 2

Charge Question

- Question 4: Are there robust plans for data processing and data analysis? Have adequate resources from the collaboration been identified for data analysis to meet the set goals?

Computing Plan

- To meet the analysis goals we need the following processing campaigns per year
  - 1-2 small 1x data POT MC samples
  - 1 large 10x data POT MC sample
- In addition continued processing for data monitoring and calibrations
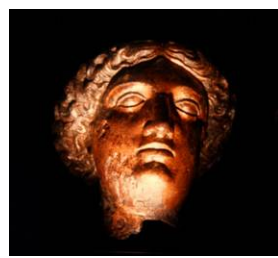
Computing Resource Usage

- ## 1 full processing @ 10E20 POT (10x data stat.)
  - ### Disk space usage is 1.5PB
    - 750TB is direct input into user analysis (reco files)
    - Remaining files typically reside on tape only
  - ### CPU Usage is 6M CPU-hours
    - This is JUST processing time
    - Efficiency corrected is 7.5M CPU-hours (80% efficiency)

- ## Small passes
  - ### Disk Space usage 150TB
  - ### CPU Usage efficiency corrected 750k CPU hours

CPU Time Allocation

- We are given a quota of 1800 "slots"
  - Equivalent to ~16M CPU hours
- CPU time -> real time is 175 days
- Add overhead for book keeping and resubmissions 25%
  - Catalogue, transfer, audit files
- Allocation left for users:
  - 7M CPU Hours
- Historically users are ~60% of our usage, but in the ME era they will not process the full dataset every time as was typically done in LE

CPU Time Allocation

- MINERvA production is 1 technical step and a testing phase away from being OSG enabled
  - Plan is to push production, when possible, to OSG
  - Timeline is end of year
- Bottom line – MINERvA can fit within the allocated time on GPGrid completely, **but** will be OSG enabled.

Disk Space
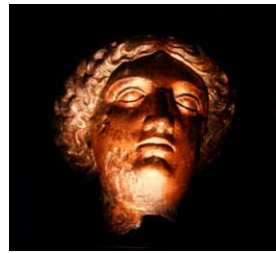
- Currently have 2 large storage solutions for users
  - 240 TB BlueArc (local access only), 200 TB dCache
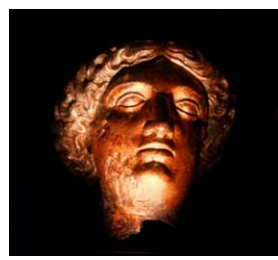- Plan is to reduce BlueArc space, utilizing dCache more.

Databases
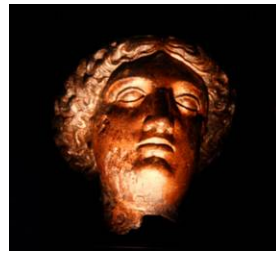
- Conditions database – no foreseeable issue
- MINOS replica database – static in size, just need it up
- MINOS data – no foreseeable issue in growth

Interactive Machines

- Currently have 5 at our disposal
- With longer processing times and many active analyses we may need to explore the possibility of a few more

Conclusions

- Through the yearly reviews and regular communication SCD understands our computing needs and helps us meet our scientific goals
    - Spokespersons and the head of SCD
    - Offline coordinator and SCD experts
    - Collaboration and our SCD Liason – Gabe Perdue
- MINERvA is always consulting with SCD about new products and ways to adopt them
- With MINERvA adding OSG capability we will continue our contribution to the local effort in understanding techniques that benefit the lab's experiments.