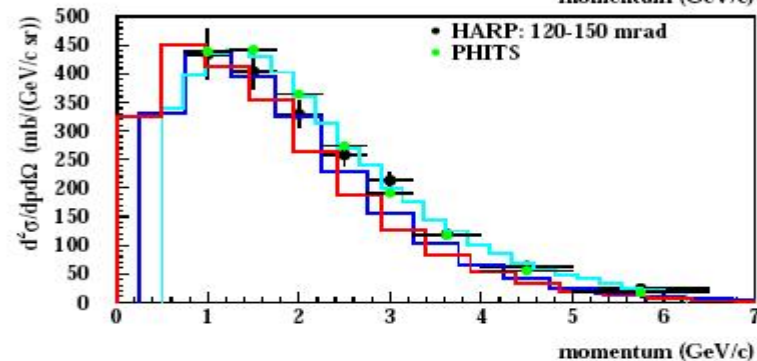# Hadronic Benchmarks and Verification Data Repository
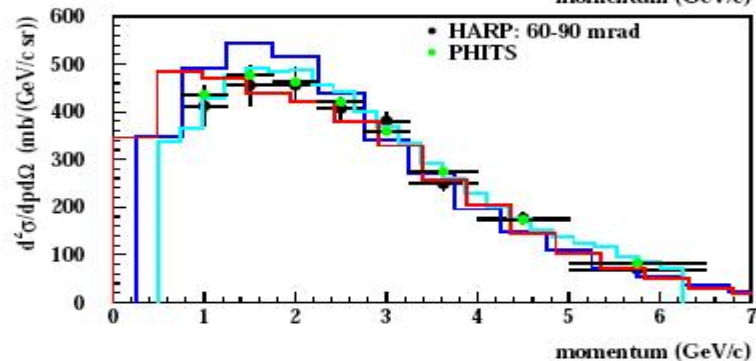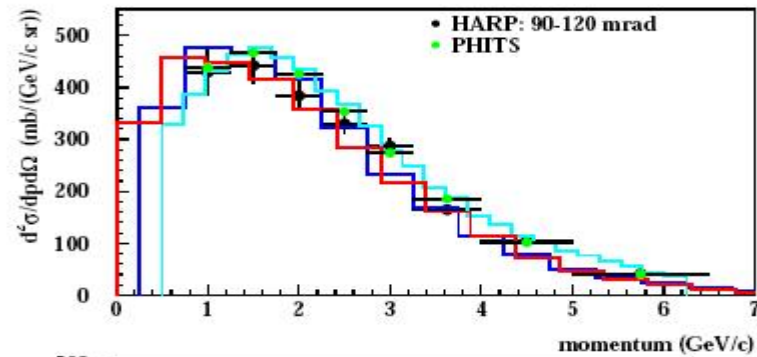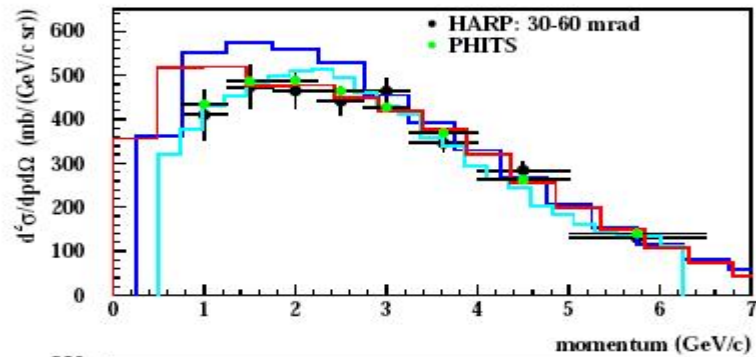
Dennis Wright
Geant4 Workshop and Users Conference
Lisbon, Portugal
10 October 2006

Grand Validation Benchmarks from HSSW

- 7 validation tests

  - covered wide energy range

  - head-to-head comparison of (5-6) simulation codes for each test

  - data sets agreed upon beforehand

  - voluntary participation

- Due to short time scale, not all tasks could be completed

Task 1: HARP (12.9 GeV/c p on Al)

TASK 1

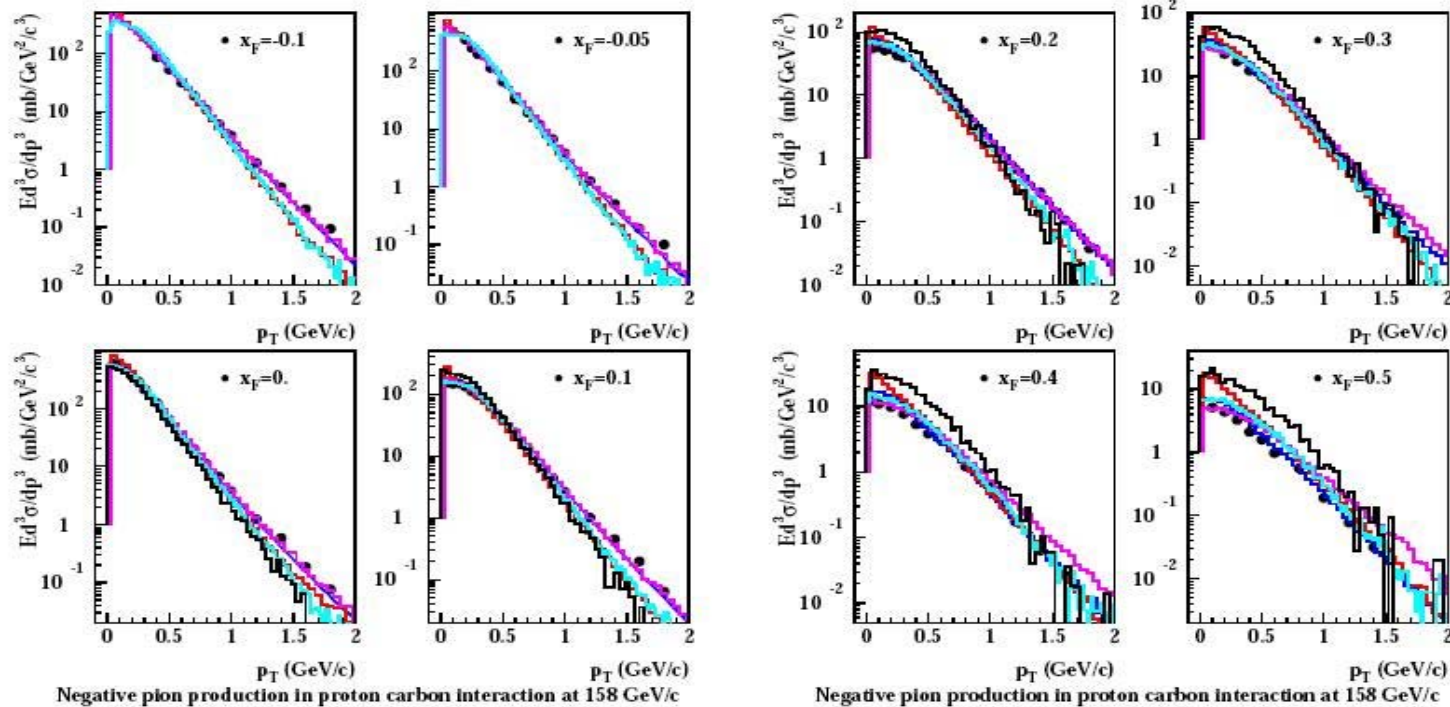π^+ production in proton aluminum interaction at 12.9 GeV/c

Black symbols - HARP data, green symbols - PHITS, red line - LAQGSM, cyan line - FLUKA, blue line - MARS

HARP Comparison

- Vladimir Ivantchencko is tuning some parameters in LEP models

- Need to develop separate model for this energy range

- Probably cannot have public comparison of data until at least an alpha version is ready
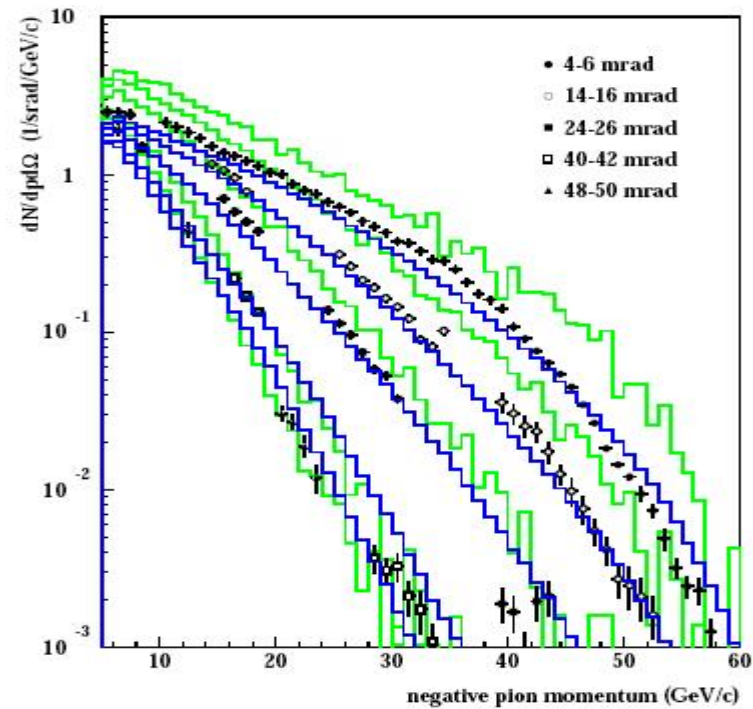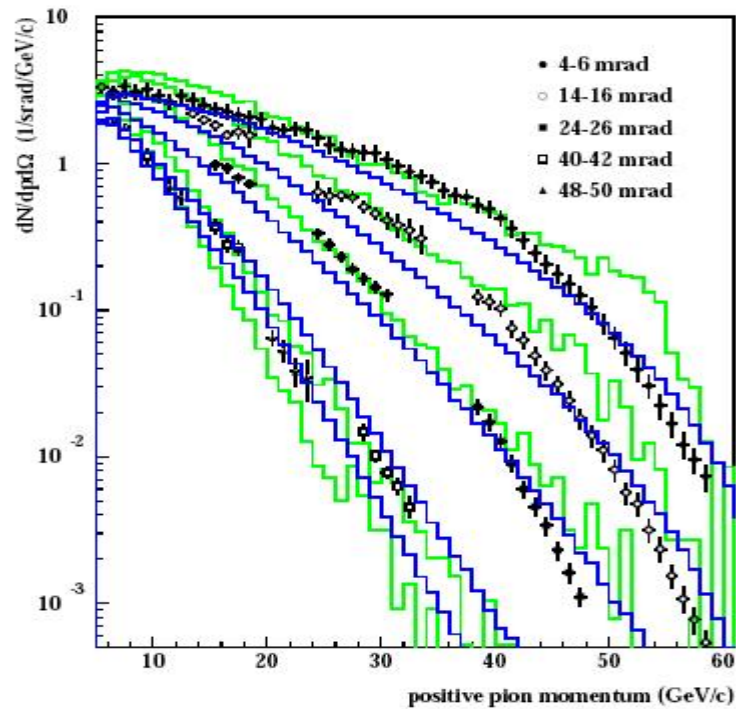
Task2a: NA49 (158 GeV/c p on C)

TASK 2A

Negative pion production in proton carbon interaction at 158 GeV/c

Black symbols - NA49 data, red line - LAQGSM, blue line - MARS, black line - G4,
magenta line -DPMJET

S. Striganov

5

NA49 Comparison

- Due to lack of time not all comparisons were made

- We should be able to do most comparisons in this task
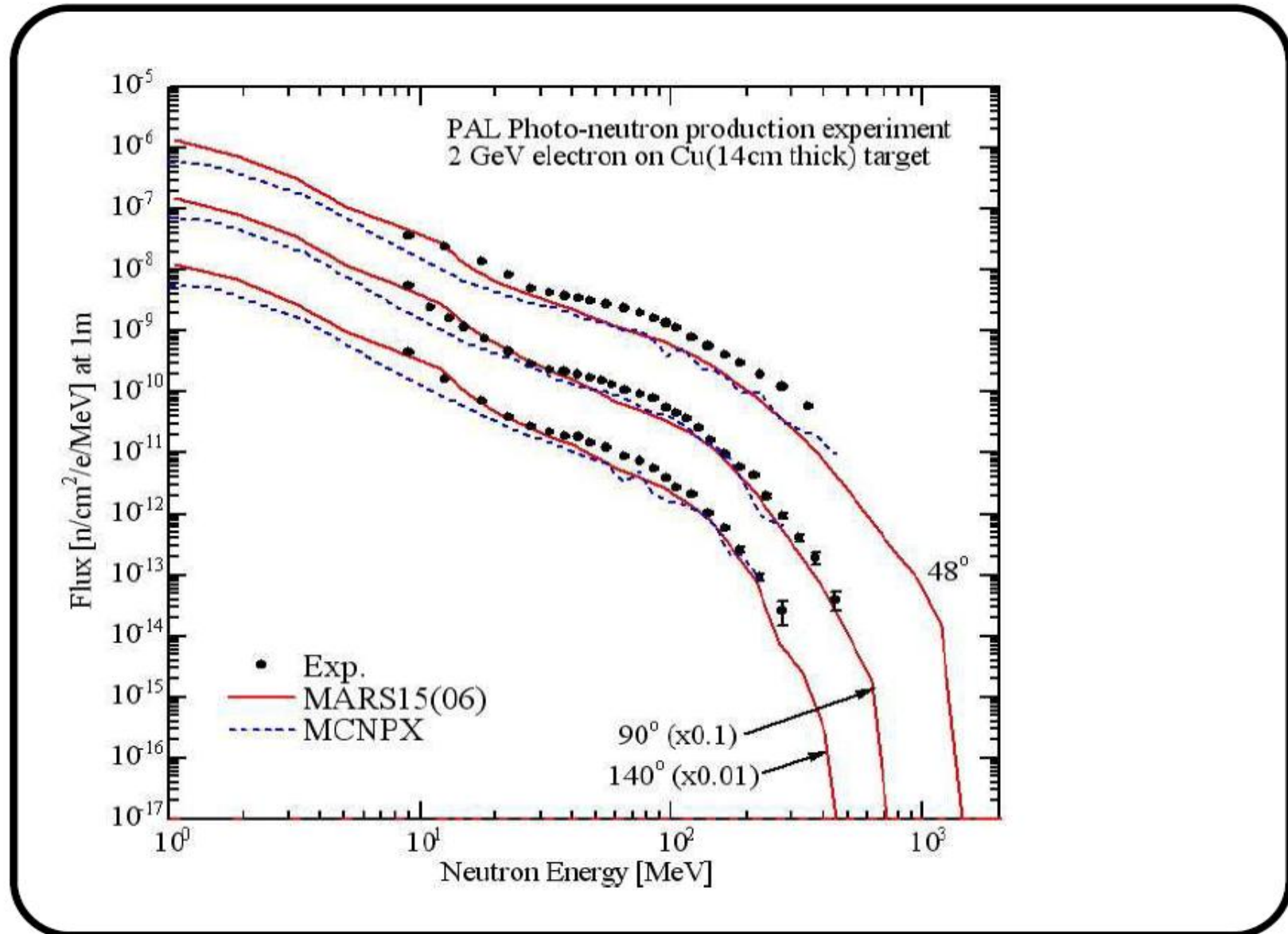
Task 3: 67 GeV/c p on Al

67 GeV/c Comparison

- Not done due to lack of time

- Will be done shortly – test is set up

Task 4: PAL (2 GeV e on Cu)

PAL Photo-neutron production experiment
2 GeV electron on Cu(14cm thick) target
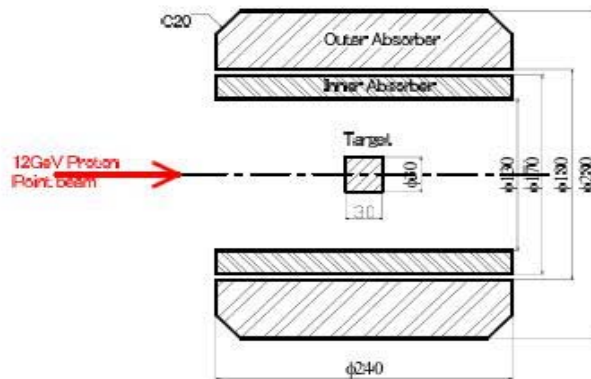
- Exp.
- MARS15(06)
- MCNPX

48°

90° (x0.1)
140° (x0.01)

PAL Comparison

- Task done by Ilya Agapov
  - results not in agreed format so not included in competition
  - also an excess of ~10 MeV neutrons we still do not understand

- Repeat this task

Task 5: Total Energy in a Cu Absorber

Energy in Absorber Comparison
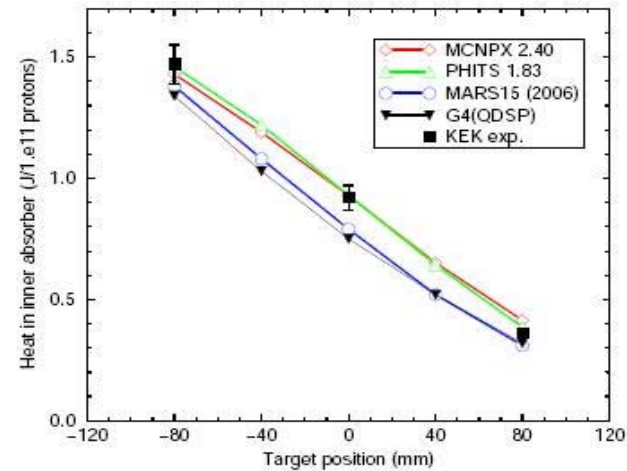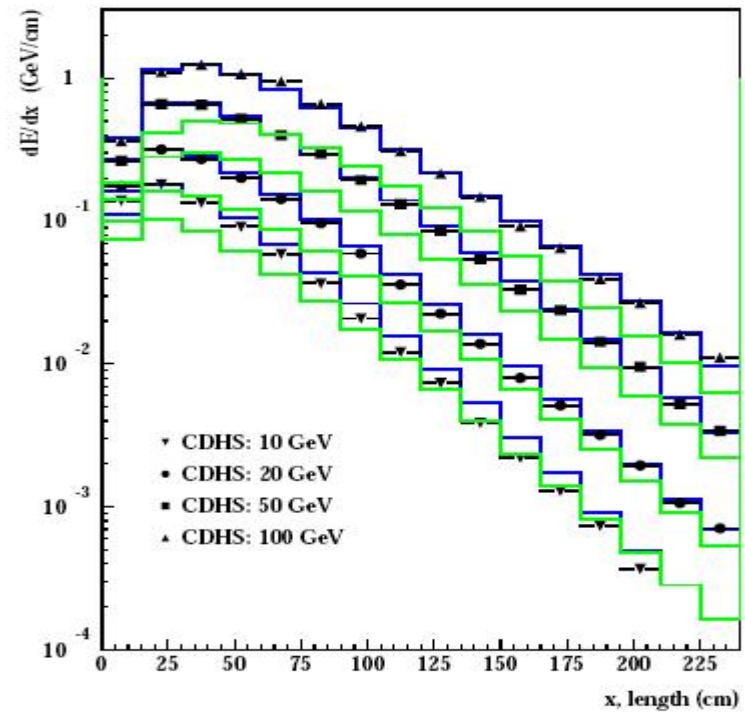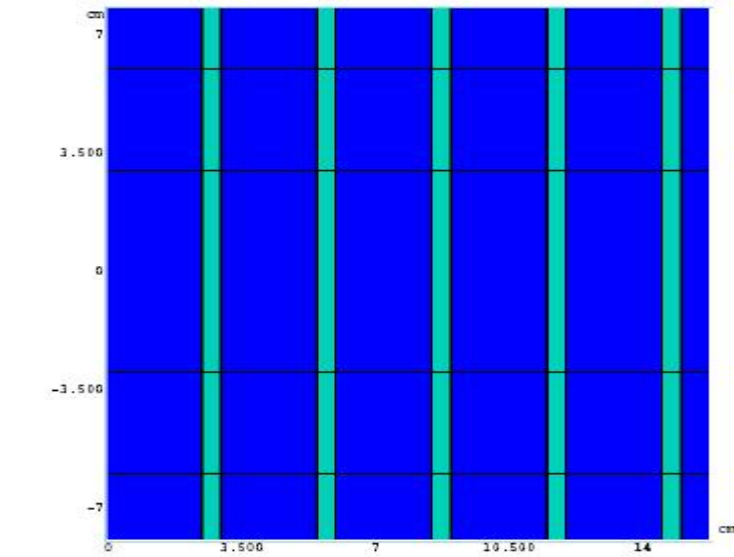
- Some small problem here?
  - 18% difference from data at $z_{targ} = 0$
  - Mars in agreement with Geant4
  - MCNPX and PHITS show excellent agreement

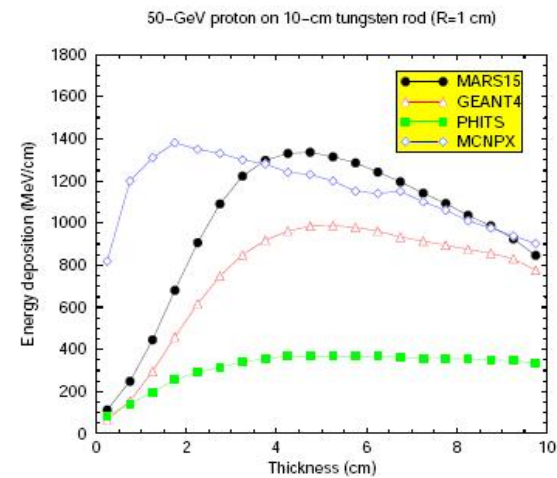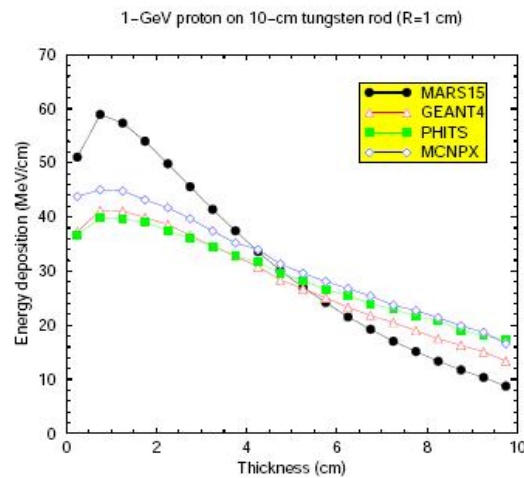# Task 6: Iron-Scintillator Calorimeter

TASK 6

Black symbols - CDHS data, green line - PHITS, blue line - MARS

Task6: Calorimeter

- We should do this, too

- MARS does a good job

Task 7: Energy Deposited in W Rod

TASK 7

1–GeV proton on 10–cm tungsten rod (R=1 cm)

50–GeV proton on 10–cm tungsten rod (R=1 cm)

Notes: (1) No electromagnetic shower transport above 1 GeV in PHITS and MCNPX.

(2) MARS15 results from an unofficial developer version.

✿ Fermilab

S. Striganov

Task7: Energy in W Rod

- Geant4 comes out in the middle (reasonable)
  - no codes in agreement with any other

Grand Validation Benchmarks from HSSW

- Agreed to make benchmark competition a regular exercise

  – next one in ~18 months

- We should think about proposing benchmarks of our own

Verification Data Repository

- HSSW competition provided some new data sets

  – mostly thick target data

  – some calorimeter data

- New data repository page added to Geant4 web page

  – above data sets will be added to it

  – please add your favorites