

# Scintillator for MINERVA



Presented by

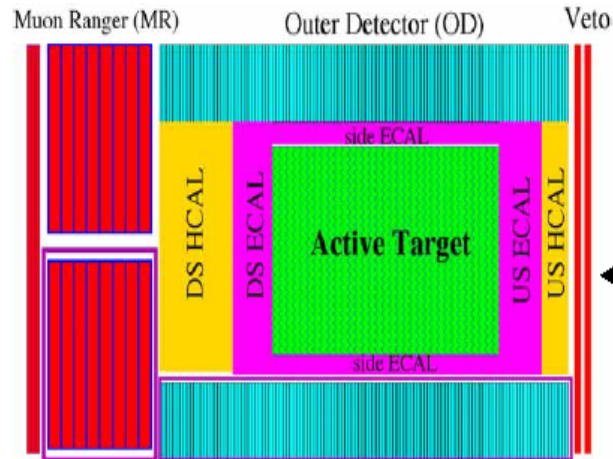
Victor Rykalin



## Outline

- MINERVA (current status)
- NICADD participation
- Plans

# MINERVA

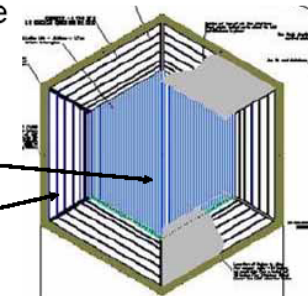


- Planes of strips are hexagonal
  - inner detector: active scintillator strip tracker
  - outer detector: frame, HCAL, spectrometer
  - XUXV planes → module

- atom of construction and installation

Inner, fully-active strip detector

Outer Detector magnetized sampling calorimeter



- Must reconstruct exclusive final states
  - high granularity for charged tracking, particle ID, low momentum thresholds,
    - e.g.  $\nu_{\mu} n \rightarrow \mu p$
- But also must contain
  - electromagnetic showers ( $\pi^0$ ,  $e^{\pm}$ )
  - high momentum hadrons ( $\pi^{\pm}$ ,  $p$ , etc.)
  - $\mu^{\pm}$  from CC (enough to measure momentum)
- Nuclear targets (high A, Fe of interest for MINOS)

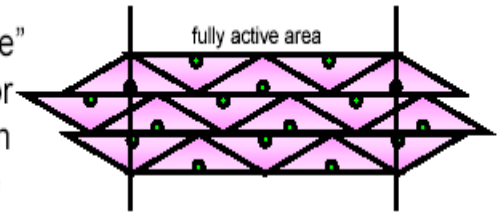
# What does MINERVA need ?

Isosceles triangle **3.3cm base, 1.7cm height.**

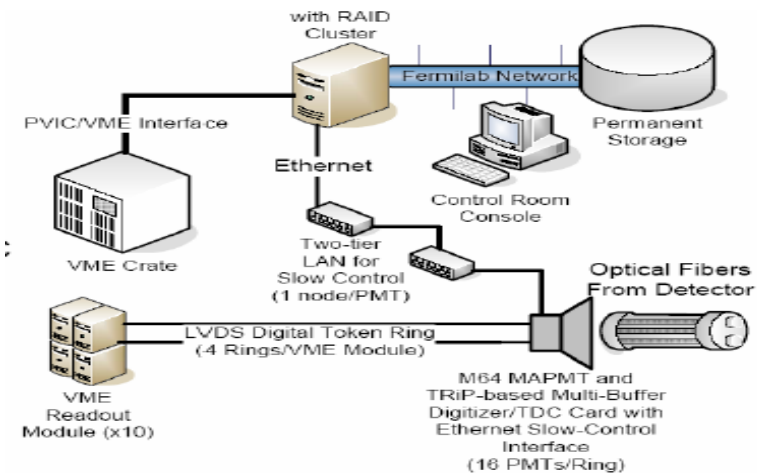
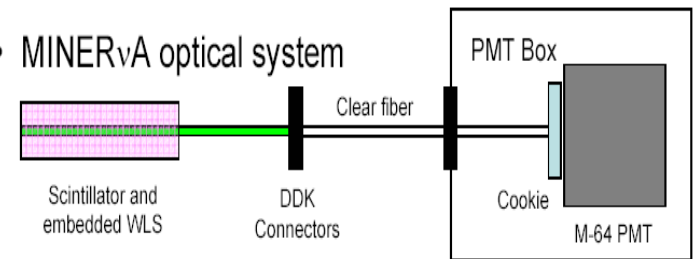
AND

- Right triangle **1.65cm base, 1.7cm height.**
- ~ **6:5 ratio** of isosceles and right triangles.
- ~ **11000 isosceles and 9000 right triangles.**
- Isosceles triangles are **1.21 - 2.42 m.**
- The right triangles are **1.24 - 2.05 m.**
- The total volume of scintillator ~ **6.87E6 cc ~ 7000 kg**

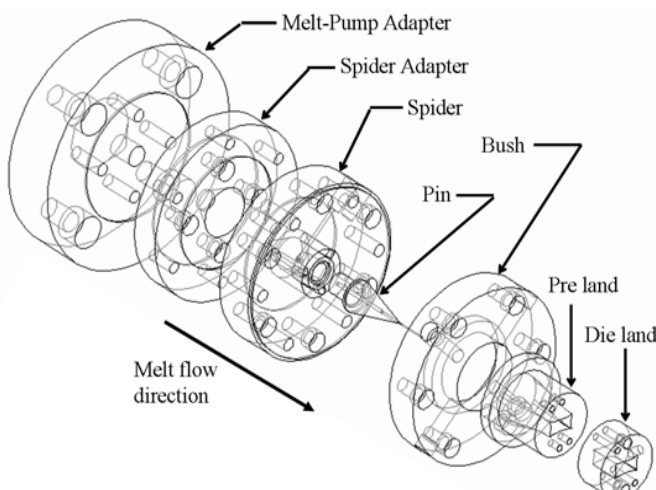
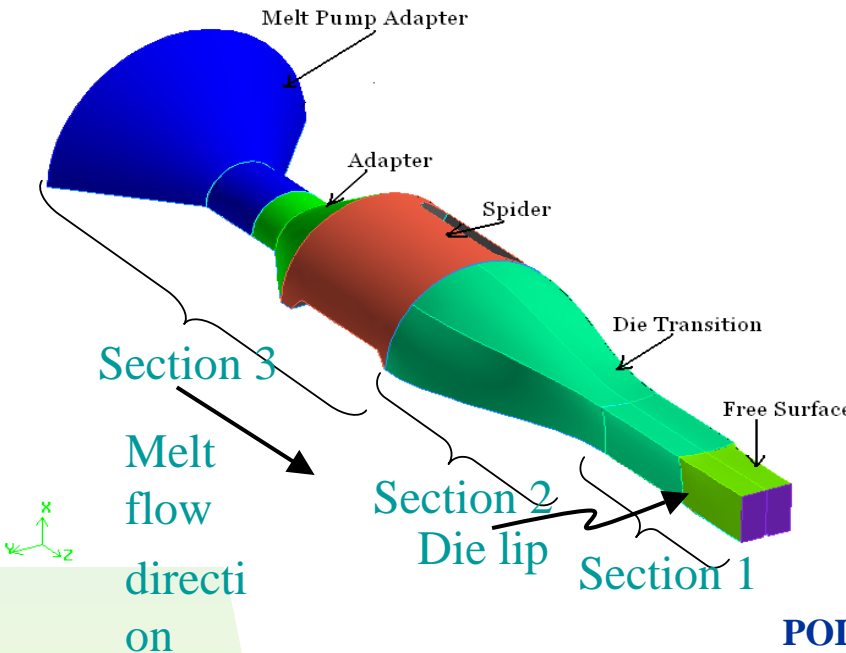
“Vertical slice”  
test detector  
construction  
(Hampton)



• MINERVA optical system



# Die simulations at NIU ME



**POLYFLOW** package software  
Finite-element code

Predict three-dimensional free surfaces

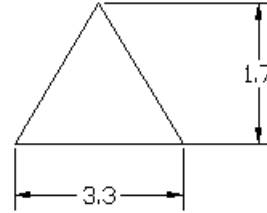
Inverse extrusion capability

Evolution procedure

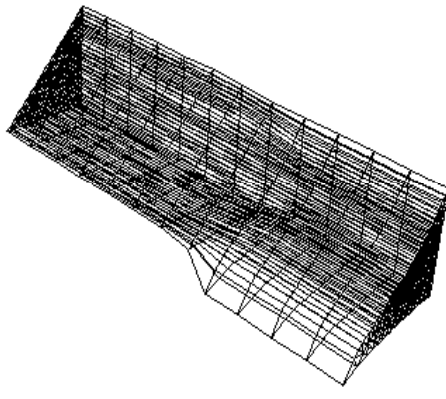


# Triangle die simulation (isothermal case)

isosceles triangle (two sides are same)



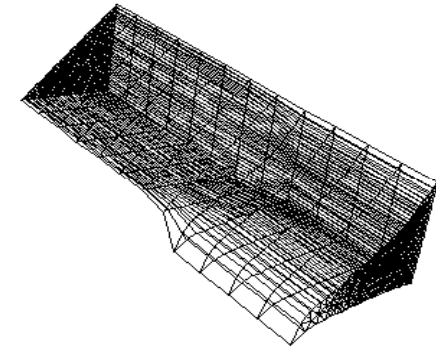
Case 1: Mesh Size 8064 Elements



POLYFLOW Grid Time Index: 1 Mar 05, 2004 FLOWIT/Post 1.2

Case 2: Mesh Size 11160 Element

Mesh plot

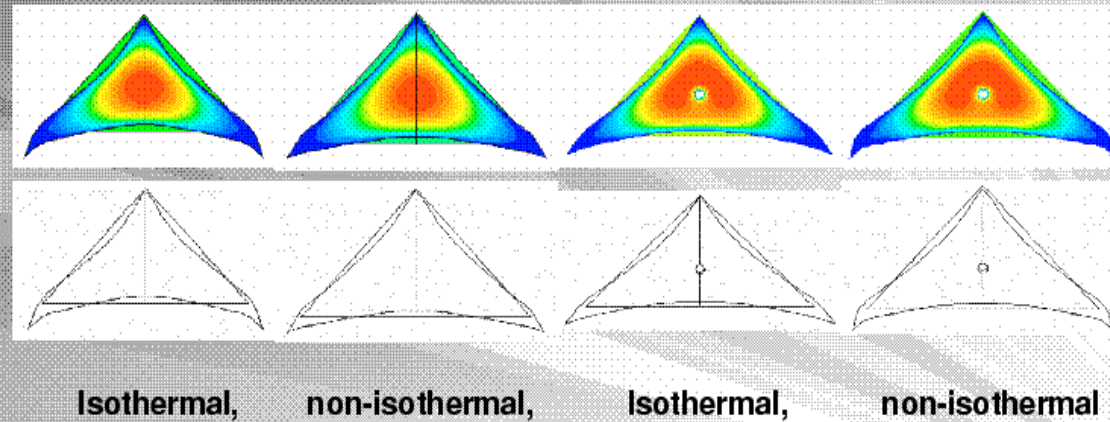


POLYFLOW Grid Time Index: 1 Mar 05, 2004 FLOWIT/Post 1.2



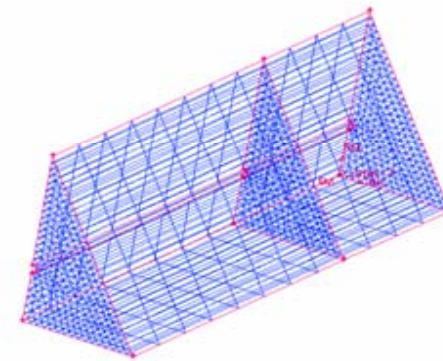
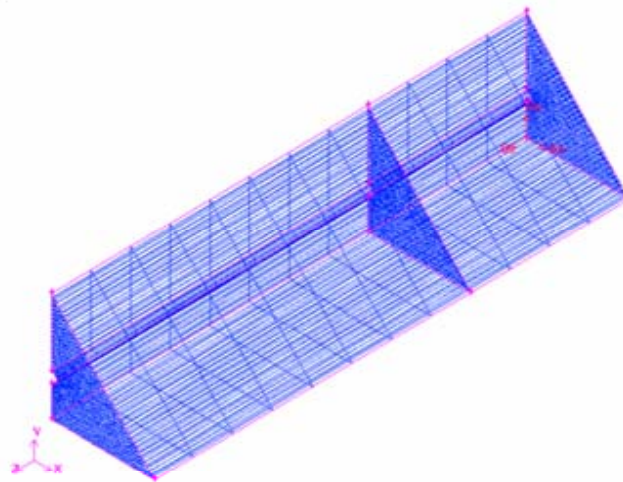
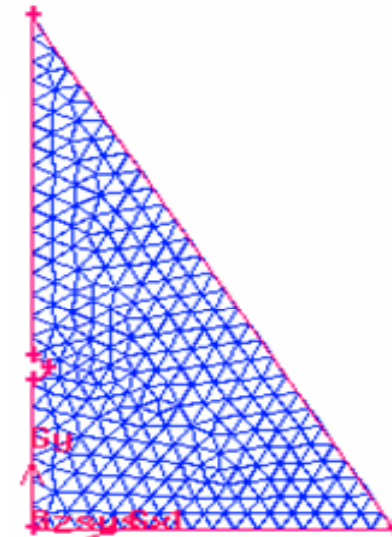
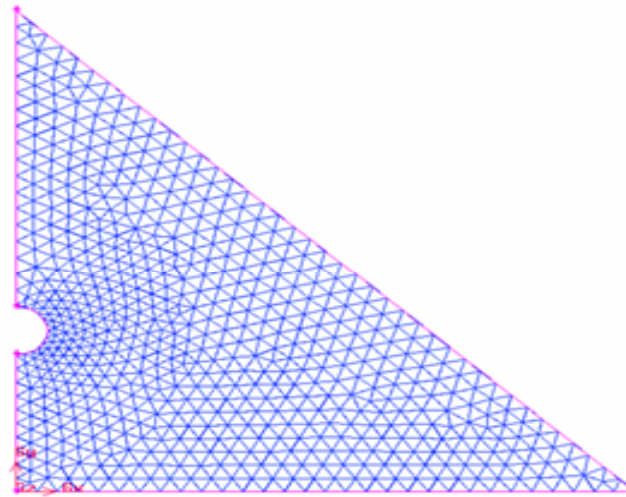
## Comparison no hole / with hole

Front Views without and with a 1.4 mm Hole





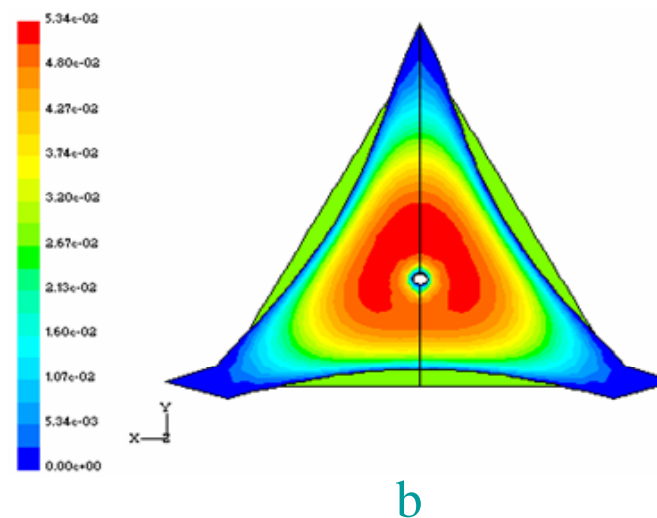
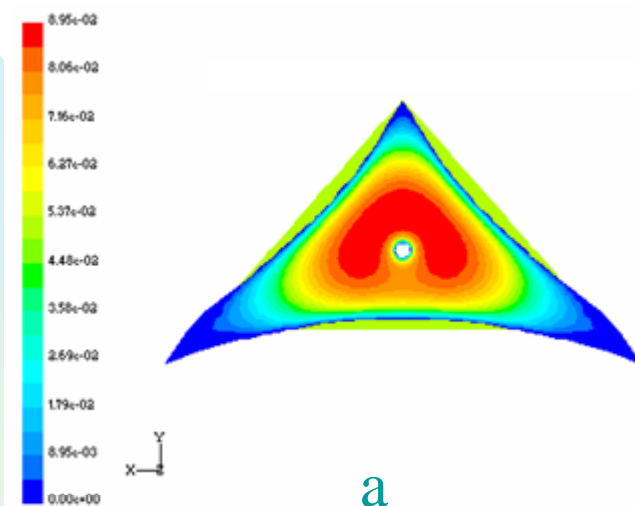
# Equilateral case, (12120 elements mesh).







## Velocity plot, front view



Front views of the Die lip and the Constant sections (Velocity plot) of (a) isosceles and (b) equilateral dies (mirrored for viewing)



## Current status

- 1. Without hole and with hole triangle die profiles were simulated (Isosceles and Equilateral cases)**
- 2. Different mesh size was used**
- 3. Non-isothermal and isothermal case were simulated**

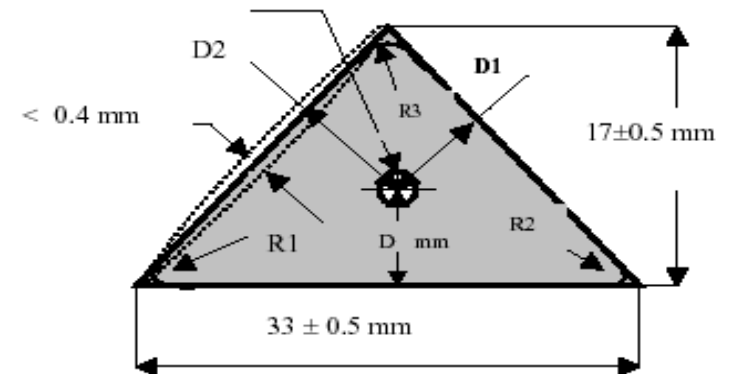
## Summary and recommendations

- The simulation on the triangle die profiles was performed
- Both cases outcome looks odd
- We recommend to continue the simulation with some corrections within one month( have to be discussed with simulation team).
- If we should keep up with a schedule the money issue should be clarified in order to proceed with **outside vendor !**

# Specs for MINERVA

## MINERVA TRIANGLE PROFILE

Hole, centered , diameter of  $1.4+0.2-0$  mm



We assume some rounding for the corners:

$R1, R2 = < 1$  mm

$R3 = < 1.2$  mm

We assume small rounding for the Edges:

$D, D1, D2 = 7 \pm 0.2$  mm

# Outside vendor quotation !



## Quotation

*Extrusion Tooling & Technology, Inc.*

*1000 Rand Rd. - Unit 210 Wauconda, IL 60084-3104 847-526-1606 fax 847-526-7443 solutions@ETTInc.com*

Date: July 6, 2004

Chuck Serritella  
Fermi National Accelerator Lab  
Particle Physics Division, Lab 6  
Batavia, IL 60510  
USA

Quote Number: 04-8237  
(Please place this number on Purchase Order)  
Quoted by: Wes Scott,  
President

Thank you for the opportunity to quote the following tools:

Description	Price
2" Tubing Head, complete with Extruder Adaptor, Heaters and Pin & Bushing Set for Minerva Triangle Profile .....	USD \$ 5,980.00
6" long Bronze Sizing Sleeve .....	USD \$ 900.00

Delivery: 2 to 3 weeks, (from finalization of details)

Terms: Net 30 Days

F.O.B. Wauconda, Illinois

- Price, terms and delivery times are valid for 30 days; price is net of shipping and handling charges and is payable in US Funds. Quotation valid only to above addressee company; not transferrable without permission from ETTI.

- Delivery times are stated for all items except heaters. (ETTI purchases heaters from outside sources and cannot guarantee their delivery times.)

- Documentation is not covered.

- Above tools are not developed. Development charges are as follows:

Development performed at our location: \$85.00 per hour, \$85.00 minimum charge; in addition material and freight; weekend and holidays at \$1,900.00 per day, \$1,900.00 minimum.

Development performed at your location, in the continental United States only: is available and customized to your needs. Please call to discuss.