



Fermi National Accelerator Laboratory

EXTRUDED SCINTILLATOR R&D FOR MINERVA

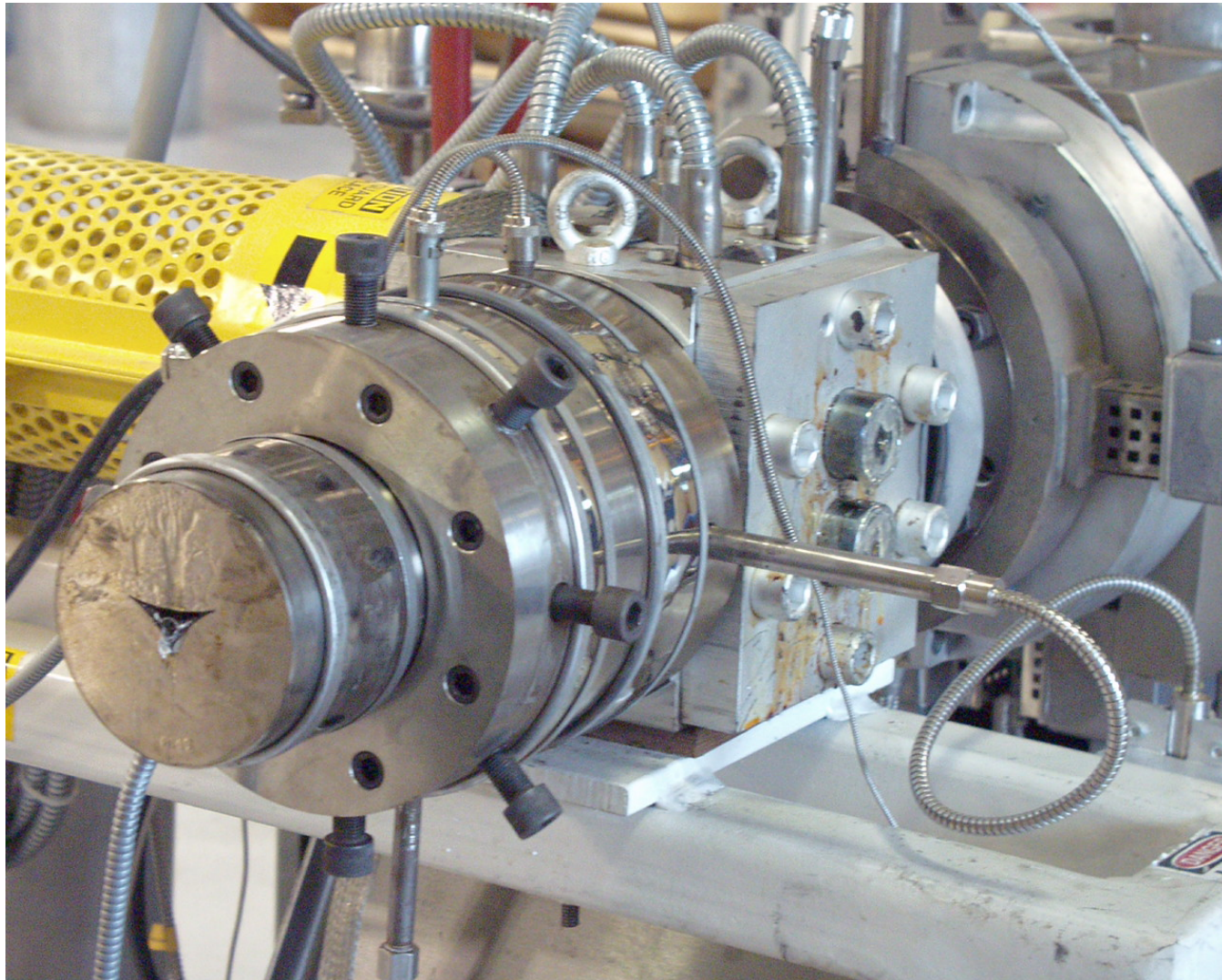
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Minerva Collaboration Meeting
July 29-30, 2005



FNAL/NICADD EXTRUSION FACILITY





PROGRESS FROM FEBRUARY MEETING

- A few R&D runs in June
 - GOAL: Check feeder performance
 - Addressed feeding fluctuations caused by pellet refills
- Back to the die maker in July
 - Widen triangle base corners (by 6 mils)
 - GOAL: Better shape (bottom corners)
 - Continue with extrusion rates of 75 kg/h
 - Reasonable triangular shape and hole
 - INPUT: Hole size?



CO-EXTRUDER

- For a 1.25 in. single screw pedestal co-extruder:
 - Killion-Davis-Standard
 - Crompton-Davis-Standard (\$49,760 +)
 - **American Kuhne (\$41,920, 8-10 wk delivery)**
 - **PURCHASE ORDER PLACED**
 - **Delivery September 30, 2005**
- Die
 - **PURCHASE ORDER PLACED**
 - Ball/socket die for co-extruder + transfer line (\$2,500)
 - Co-extrusion adapter for current and future dies (\$4,500)

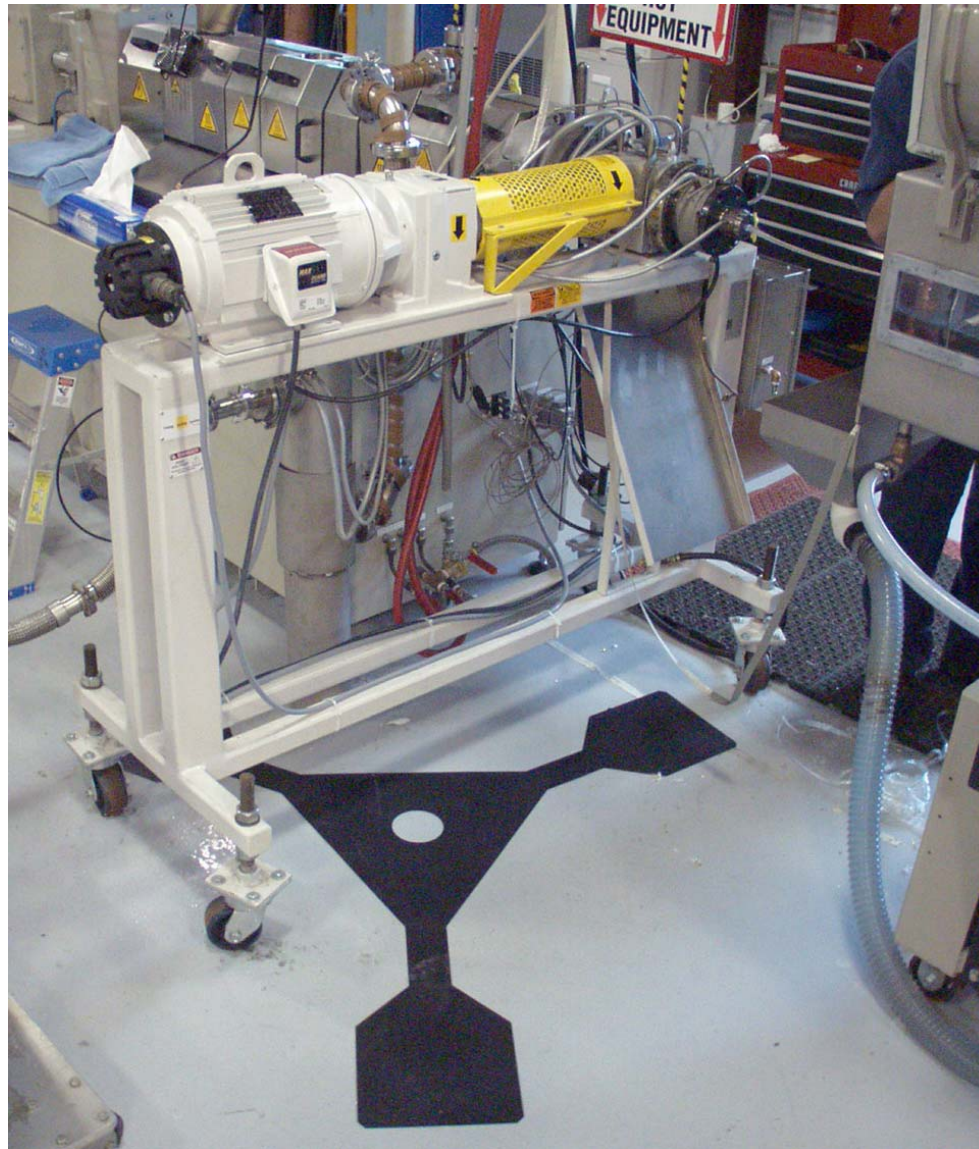


CO-EXTRUDER



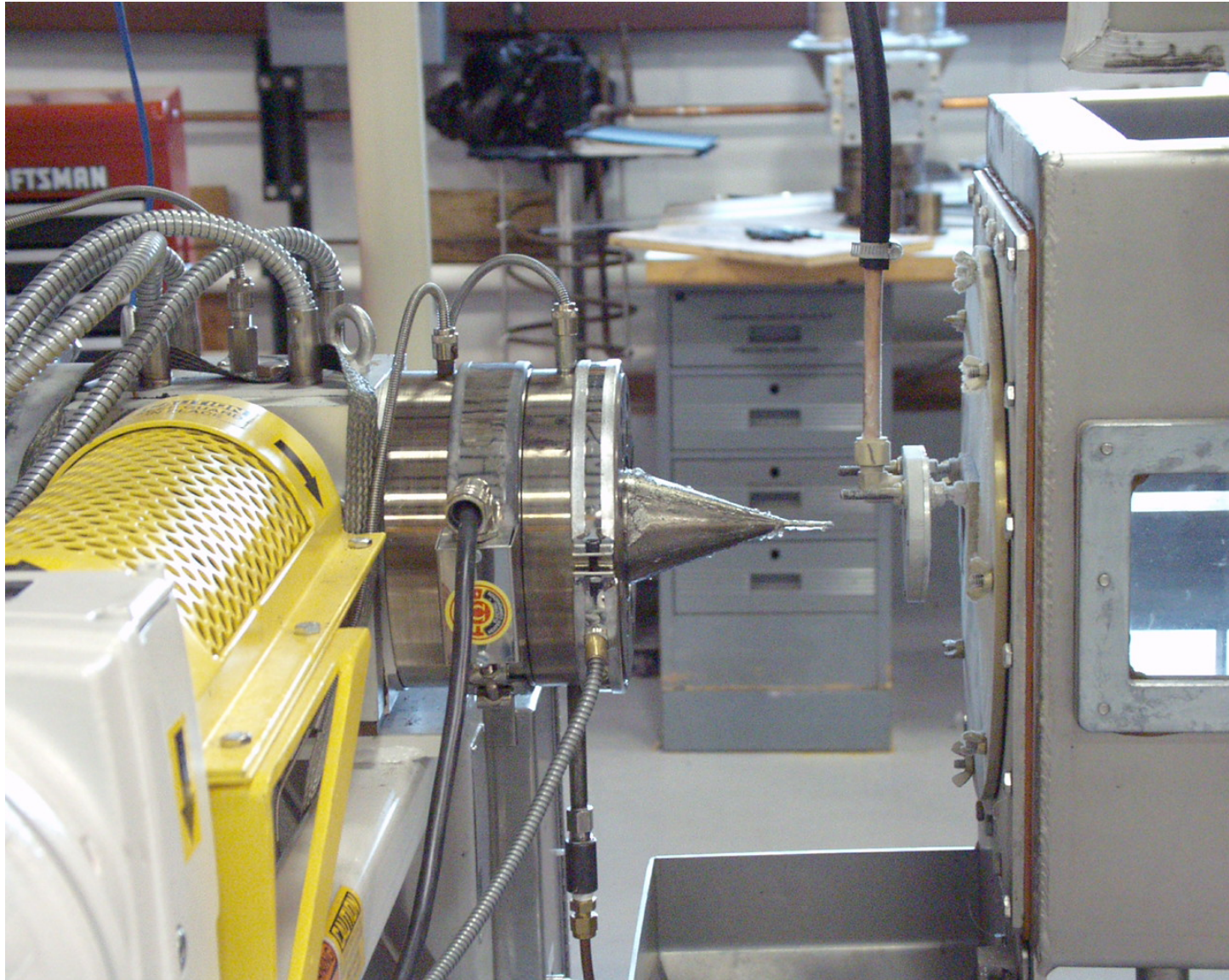


FNAL/NICADD EXTRUSION FACILITY





FNAL/NICADD EXTRUSION FACILITY





NEXT STEP

- Electrical installation
 - Minimal – 2 days
 - Material ordered (early July)
- Co-extruder installation
 - 1 month – **October 2005**
 - Hook-up machine (hopefully plug-and-play)
 - Run triangle die with capstocking
 - Titanium dioxide needed – rest available



COST UPDATE – CO-EXTRUDER INSTALLATION

	Estimated Materials Cost (\$)	Comments
OD Die and sizing tooling	\$10,000.00	To develop square strip
Titanium dioxide concentrate (250 lbs @ \$3/lb)	\$750.00	NEEDED 9/30/05 - To test co-extruder
	SUBTOTAL \$10,750.00	
	16.1% FNAL Indirect charges \$1,730.75	
	TOTAL \$12,480.75	

- Do we purchase all TiO₂ at once (1,000 lbs)?
- Do we purchase the next die now FY05?
- Do we keep cost for 2 more die sets in the project cost as “contingency”? At least for one. To cover calibrator maintenance or spare.



SCHEDULE – R&D, PROTOTYPE

- R&D = die tuning
- November + December 2005 – ID die tuning
- January + February 2005 – OD die tuning

- My concerns:
 - 1 - module prototype – when ?
 - VST – when ?
 - Anything else needed ?



COST UPDATE – R&D, PROTOTYPE

- 1 ID plane → 128 strips
- 1 ID module → 4 planes → 512 strips for ID
- 1 OD plane → 48 strips
- 1 OD module → 4 planes → 192 strips
- 1 strip (3.3x0.85x200 cc) → 561 cc → 583 g
- 1 ID + OD module → ~ 410 kg

- **ASSUME 1-MODULE → 500 kg (1,100 lbs)**
- **Is this what it is needed?**
- **Anything else for assembly tests?**



COST UPDATE – R&D, PROTOTYPE

	Estimated Materials Cost (\$)	Comments
<i>ID</i>		
Polystyrene pellets (2 gaylords @ 1,632 lbs/gld. @ \$1.15/lb)	\$3,753.60	To prepare triangular strip
Dopants (35 bottles @ \$155/ ea)	\$5,425.00	To prepare triangular strip
Liquid nitrogen (3 dewars @ \$126/ea)	\$378.00	To dry and purge polystyrene
	SUBTOTAL	
	\$9,556.60	
	16.1% FNAL Indirect charges	
	\$1,538.61	
	TOTAL	
	\$11,095.21	
<i>OD</i>		
Polystyrene pellets (3 gaylords @ 1,632 lbs/gld. @ \$1.15/lb)	\$5,630.40	To prepare square strip
Dopants (50 bottles @ \$155/ ea)	\$7,750.00	To prepare square strip
Liquid nitrogen (4 dewars @ \$126/ea)	\$504.00	To dry and purge polystyrene
	SUBTOTAL	
	\$13,884.40	
	16.1% FNAL Indirect charges	
	\$2,235.39	
	TOTAL	
	\$16,119.79	
<i>Prepare 1-module</i>		
Polystyrene pellets (1 gaylords @ 1,632 lbs/gld. @ \$1.15/lb)	\$1,876.80	To prepare prototype
Dopants (12 bottles @ \$155/ ea)	\$1,860.00	To prepare prototype
Liquid nitrogen (1 dewars @ \$126/ea)	\$126.00	To dry and purge polystyrene
	SUBTOTAL	
	\$3,862.80	
	16.1% FNAL Indirect charges	
	\$621.91	
	TOTAL	
	\$4,484.71	



COST UPDATE - PRODUCTION

- TOTAL scintillator volume:
 - 2.23E7 cc = 23,192 kg (51,130 lbs)
- Add 5% fabrication scrap and 5% assembly scrap - 56,370 lbs (35 gaylords of pellets)
- Add amount needed for capstocking: 3 gaylords of pellets
- TOTAL PS needed: 38 gaylords
- NEED INPUT:
 - ID vs OD ratio
 - What institution places order → indirect charges



COST UPDATE - PRODUCTION

		Estimated Materials Cost (\$)	Revised M&S 7/26/05	Estimated contingency	Revised M&S w/ contingency 7/26/05
Scintillator strips					
Dow Styron 663 W (62,016 lbs @ \$1.10/lb) (1)	40%	\$68,217.60	\$68,217.60	\$95,504.64	\$95,504.64
Dopants (600 units @ \$135/ea) (2)	40%	\$81,000.00	\$81,000.00	\$113,400.00	\$113,400.00
Nitrogen gas (25 LN ₂ dewars @ \$126/ea) (3)	20%	\$3,150.00	\$3,150.00	\$3,780.00	\$3,780.00
TiO ₂ capstocking (1000 lbs @ \$2.10/lb) (4)	40%	\$2,100.00	\$2,100.00	\$2,940.00	\$2,940.00
Die and sizing tooling (2 different sets) (5)	20%	\$20,000.00		\$24,000.00	
Miscellaneous					
Machine shop (6)	20%	\$200.00	\$500.00	\$240.00	\$600.00
Consumables (jars, tubing, labels, UV lamp,...) (8)	20%	\$5,000.00	\$5,000.00	\$6,000.00	\$6,000.00
	5%				
SCINTILLATOR CONSUMABLES SUBTOTAL			\$159,967.60		\$222,224.64
16.1% Indirect Charges			\$25,754.78		\$35,778.17
SCINTILLATOR CONSUMABLES TOTAL			\$185,722.38		\$258,002.81
DIE SUBTOTAL			\$20,000.00		\$24,000.00
16.1% Indirect Charges			\$3,220.00		\$3,864.00
DIE TOTAL			\$23,220.00		\$27,864.00