Explosively Driven Gas Gun for Fragment Impact Test

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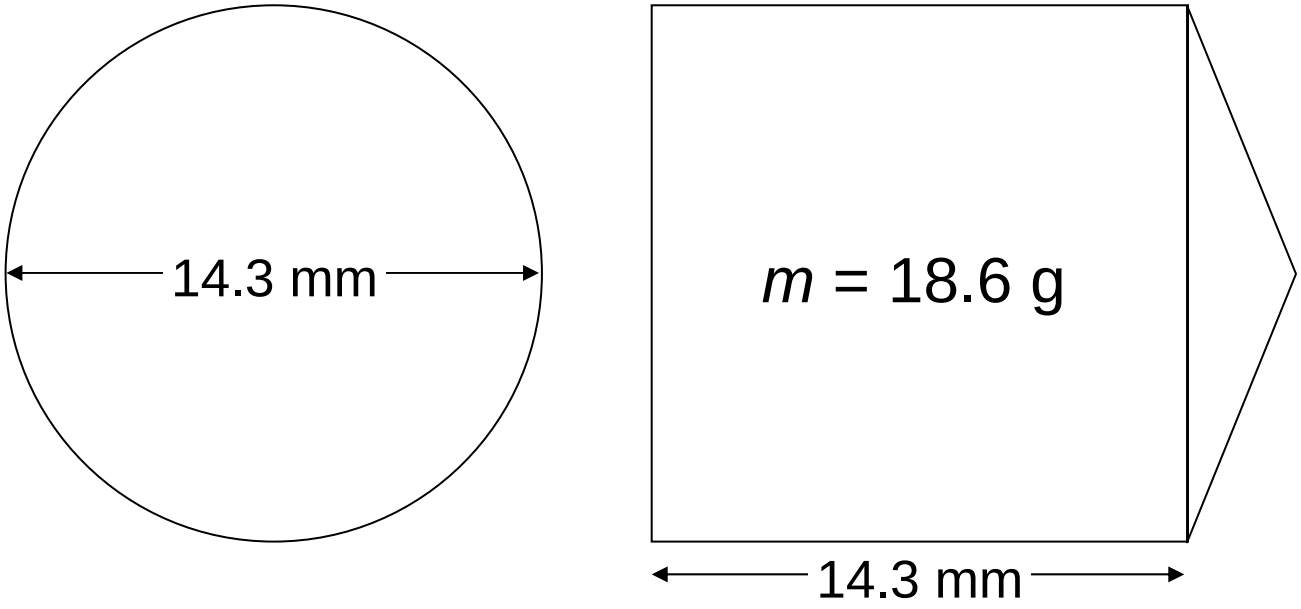
Fragment Impact Test

- NATO STANAG 4496

2530 ± 90 m/s



Conventional Launch Methods

- Gun systems
  - Powder guns
  - 2-stage light gas guns
- Explosively launched
  - EFPs
  - Explosive fragment projectors

International Launchers

- US
  - NASWCWD, China Lake — FRAGMAT
  - NSWC Dahlgren Division — FRAGMAT-type, 60 mm
  - NSWC White Oak — 25.4 mm 2SLGG
  - ARC — FRAGMAT-type
  - EMRTC — 57 mm
  - NTS & DRI — 40 mm
  - LLNL — 2SLGG
- Sweden, SDRC — FRAGMAT-type
- South Africa, Denel — Frag. proj.
- France, CEG, CAEPE — 60, 90, 98 mm
- UK, QinetiQ — 40 mm
- Australia, DSTO — 2SLGG
- Spain, LQCA — 50 mm
- Canada — -

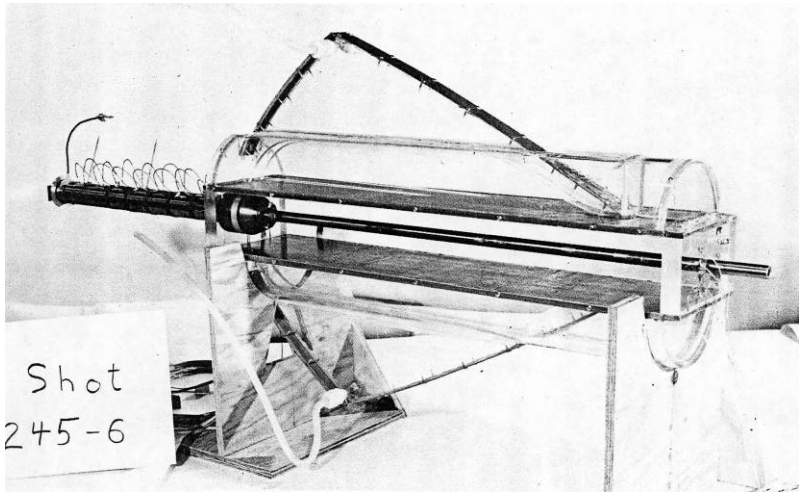
Objective

Since light gas guns and powder guns require important capital investment (unjustified in Canada)

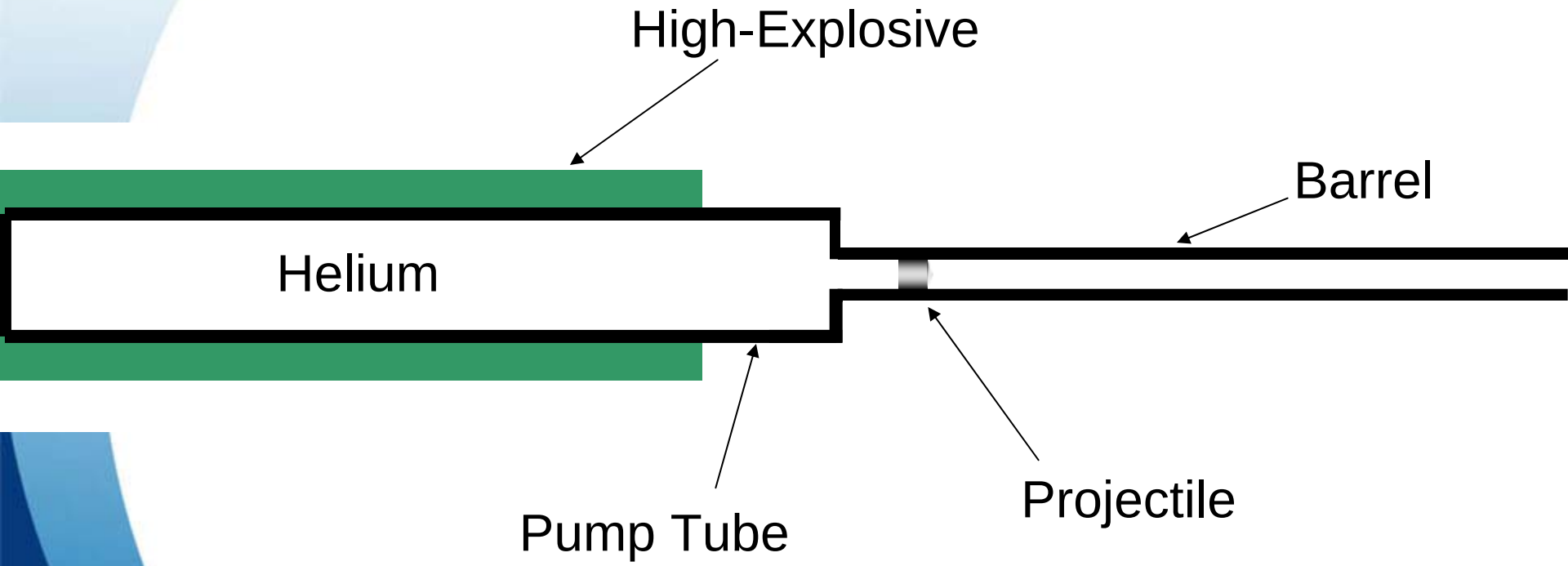
- Develop hybrid launcher
  - Disposable
  - Inexpensive
  - Variable velocity
  - Produces no yaw

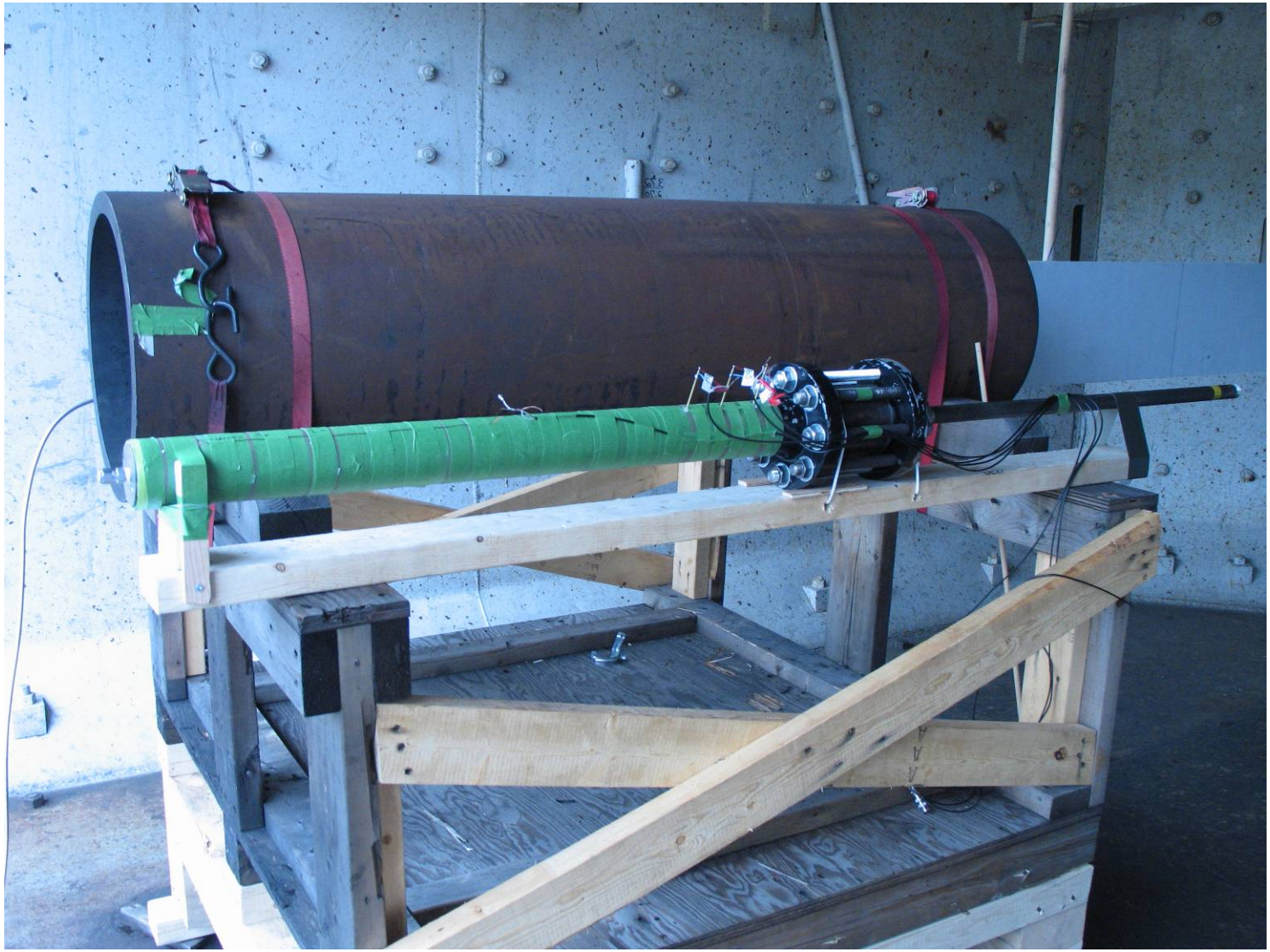
Physics International Co.

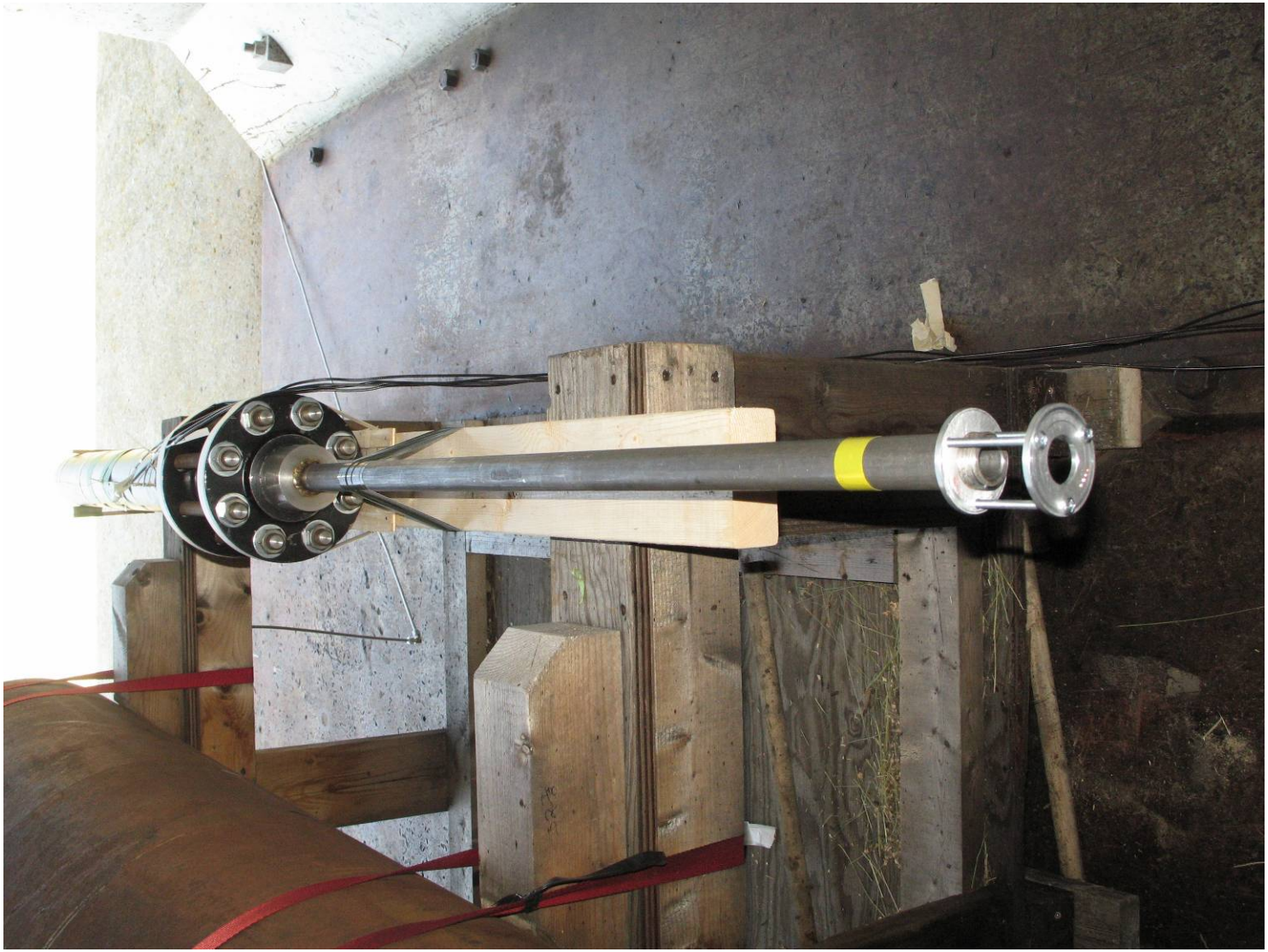
- Developed a 2-stage launcher (1960's)
- Micrometeoroid impact studies
- Funded by NASA for Apollo
- 2 g → 14 km/s, kg's → 4 km/s

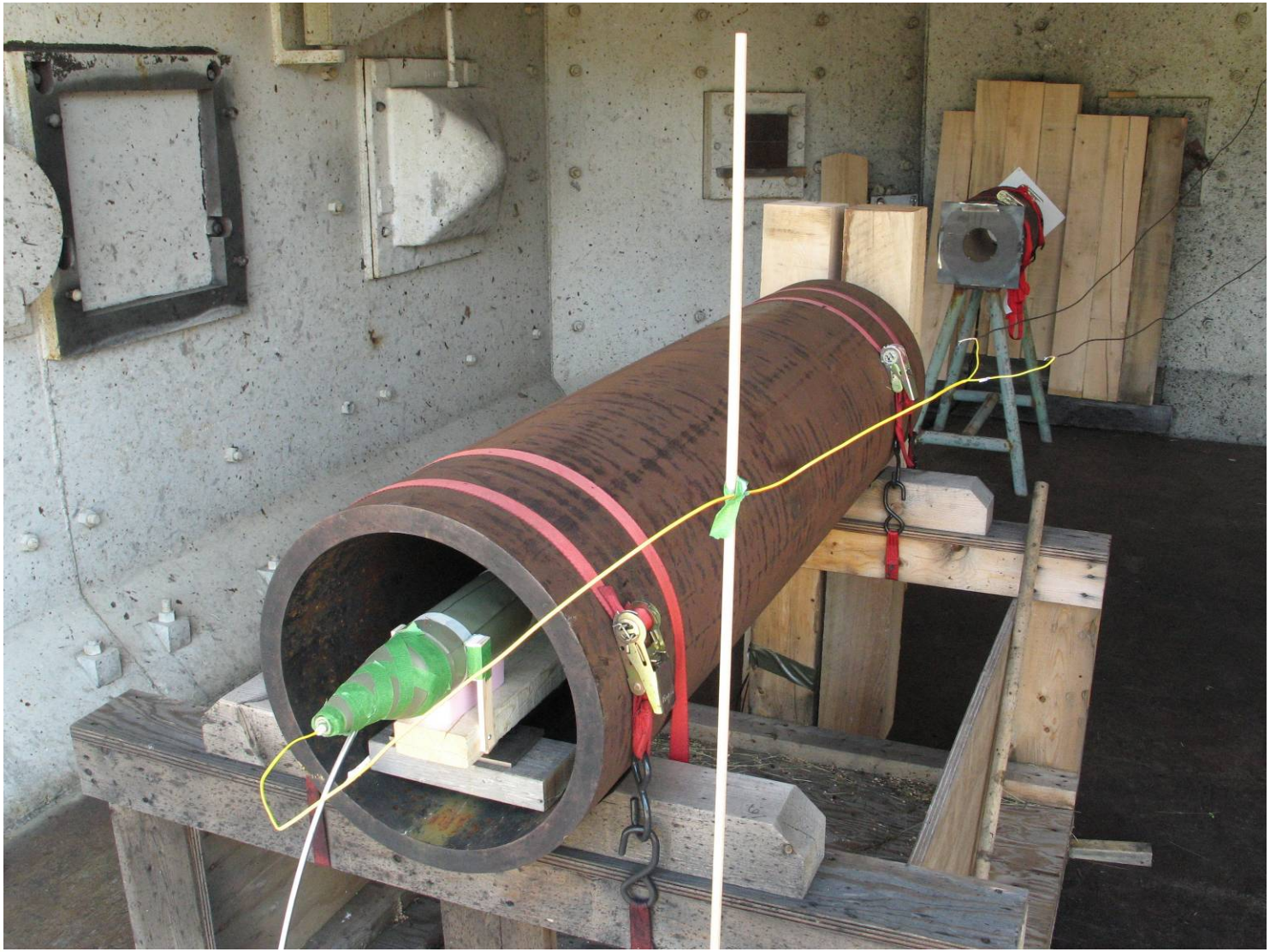


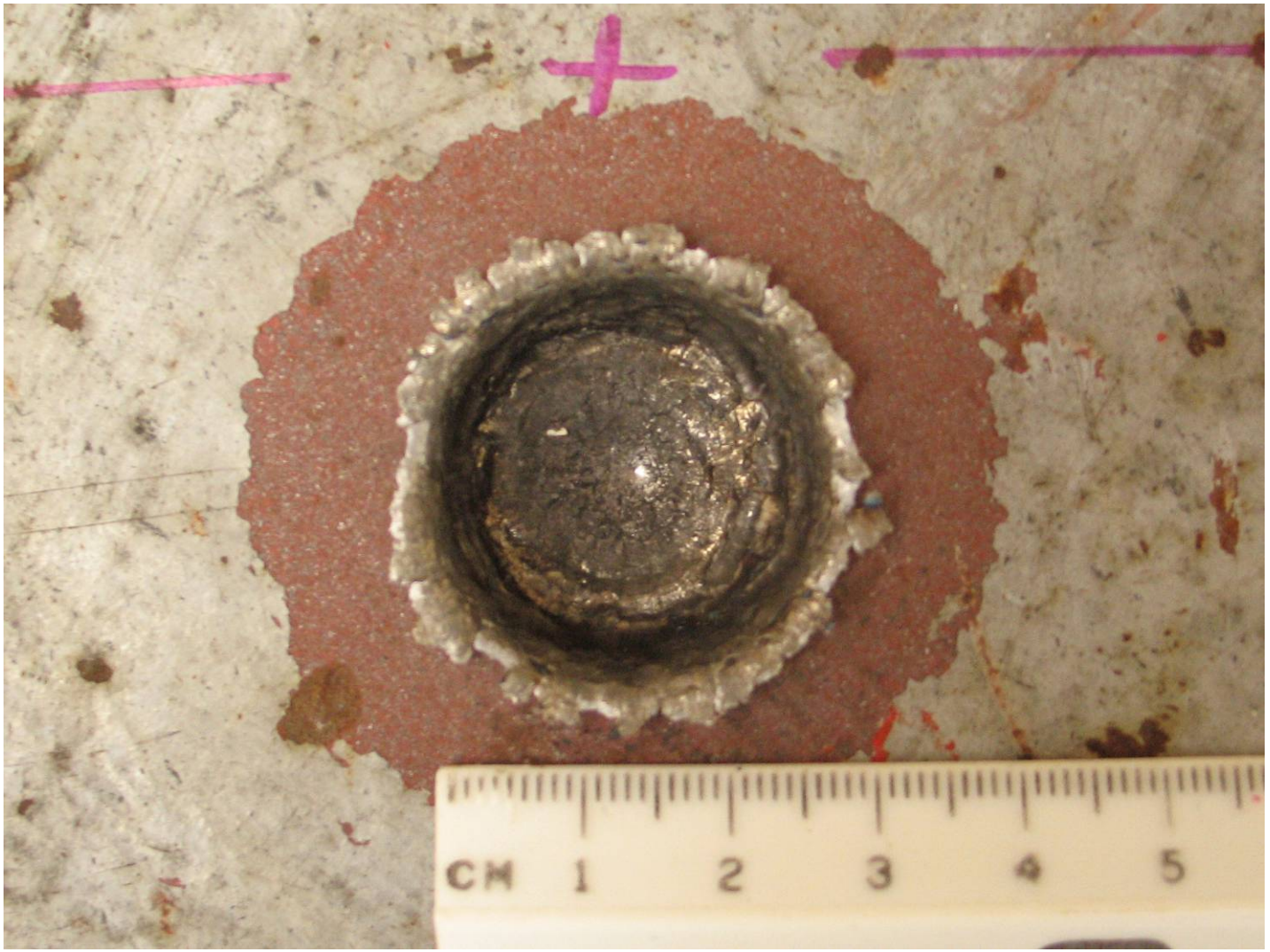
Explosively Driven Gas Gun










CM 1 2 3 4 5

High-Speed Video

V = 1200 m/s

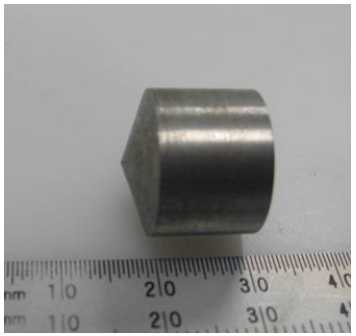
42,000 fps

1 μs shutter

Experimental Results

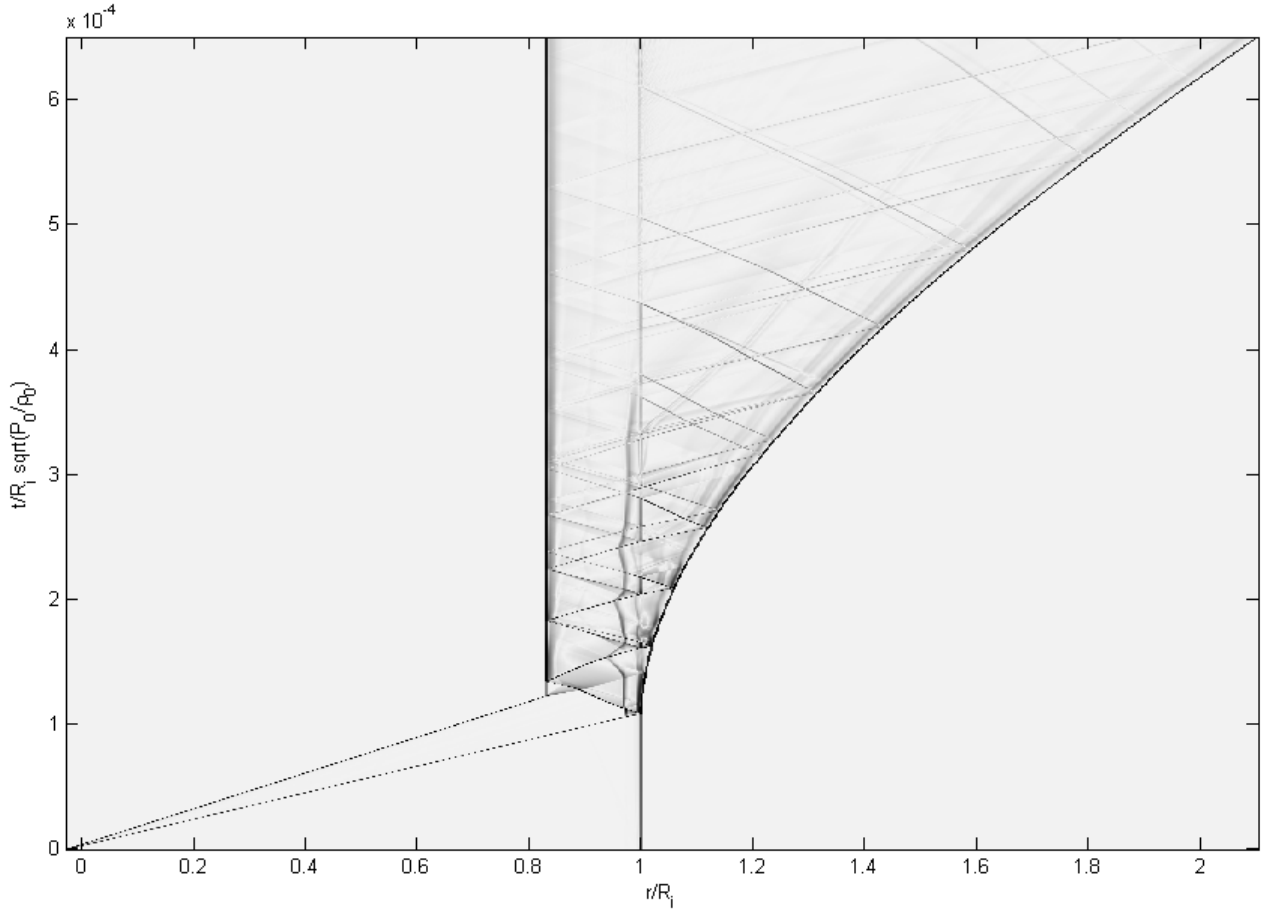
- Fragment comparable to STANAG 4496
- 15 g (18.6), 15.9 mm (14.3), Bridgman cup

- Trial 1
  - 3 layers of Detasheet
  - 1200 m/s

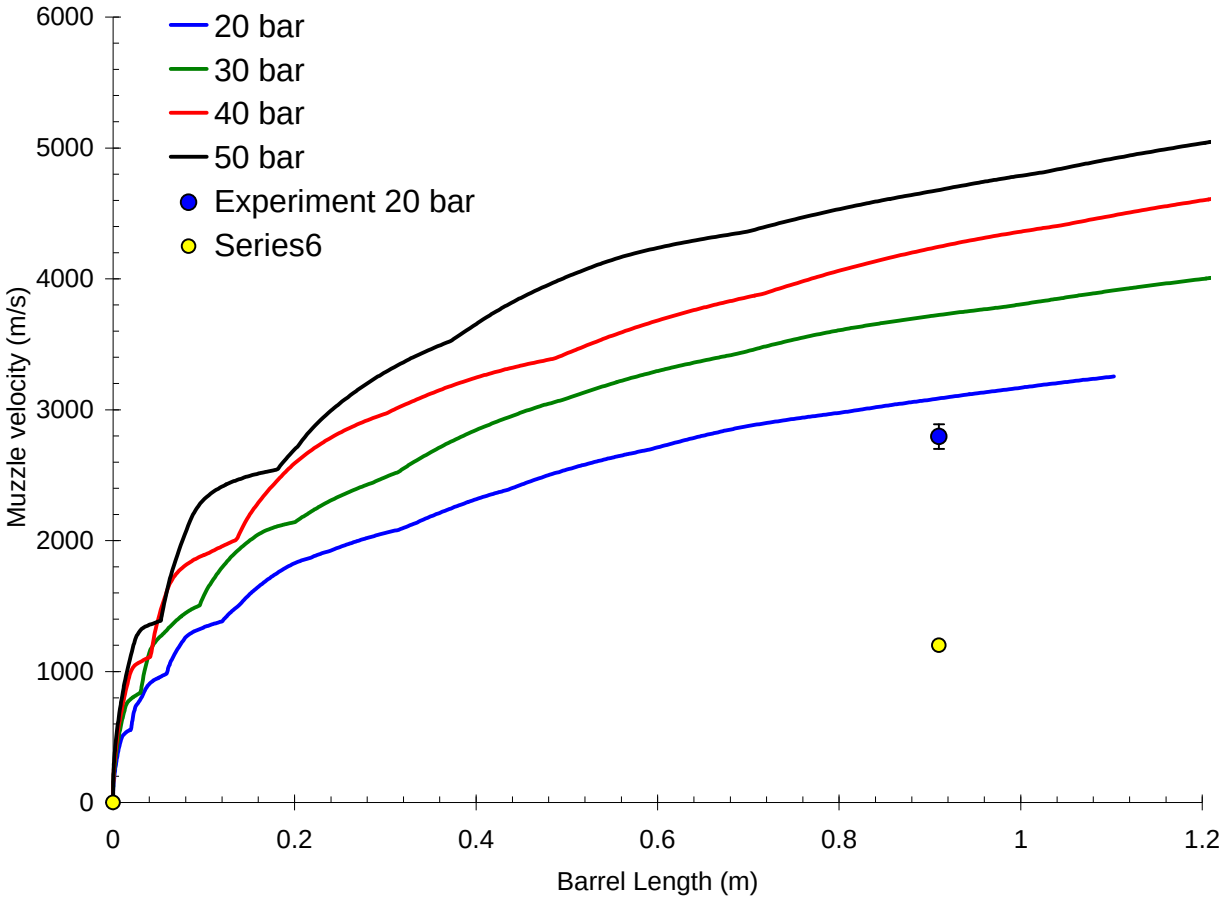


- Trial 2
  - 4 layers of Detasheet
  - 2700 – 2900 m/s

Euler Calculation



Euler Calculations



Conclusions

- Appears possible to launch a projectile (15 g) to 2.5 km/s
- Low cost (< $1000)
- Velocity can be controlled by He fill pressure

- Can give small countries, such as Canada, access to Fragment Impact Testing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