

Survivability

GVSETS

GROUND VEHICLE SYSTEMS ENGINEERING & TECHNOLOGY SYMPOSIUM
& ADVANCED PLANNING BRIEFING FOR INDUSTRY



NDIA
Michigan

HISTORICAL TRENDS AND PARAMETER RELATIONSHIPS IN THE DESIGN OF ARMORED FIGHTING VEHICLES

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OPSEC #4375



Tank (T)

Survivability



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Armored Car (AC)

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Assault Gun (AG)

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Tank Destroyer (TD)

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Self-Propelled Gun (SPG)

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Self-Propelled Anti-Aircraft Gun (SPAAG)

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Armored Personnel Carrier (APC)

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Armored Personnel Carrier (APC)

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Infantry Fighting Vehicle (IFV)

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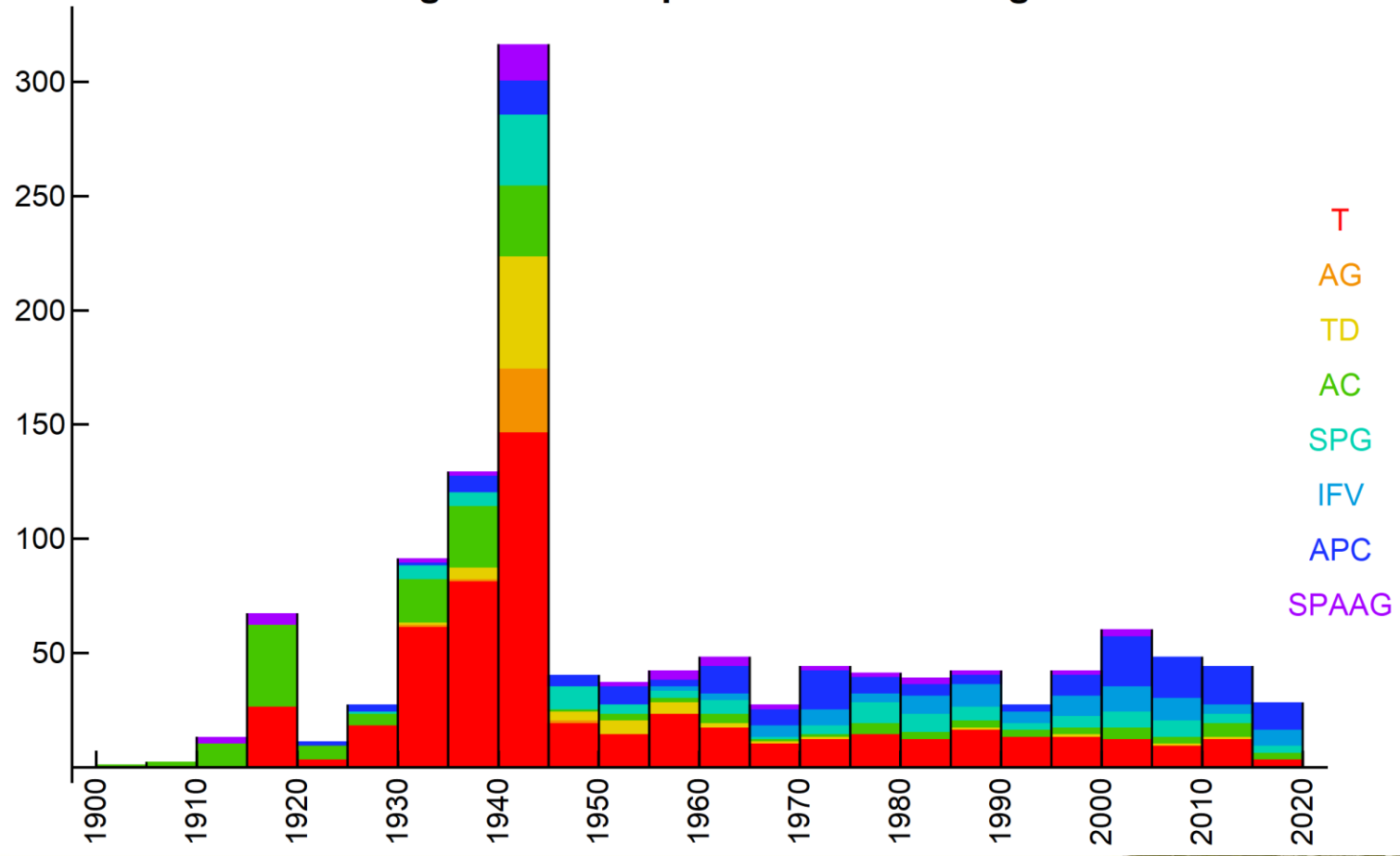


Historical Record of AFV Development

Survivability



Histogram: Development of New Designs



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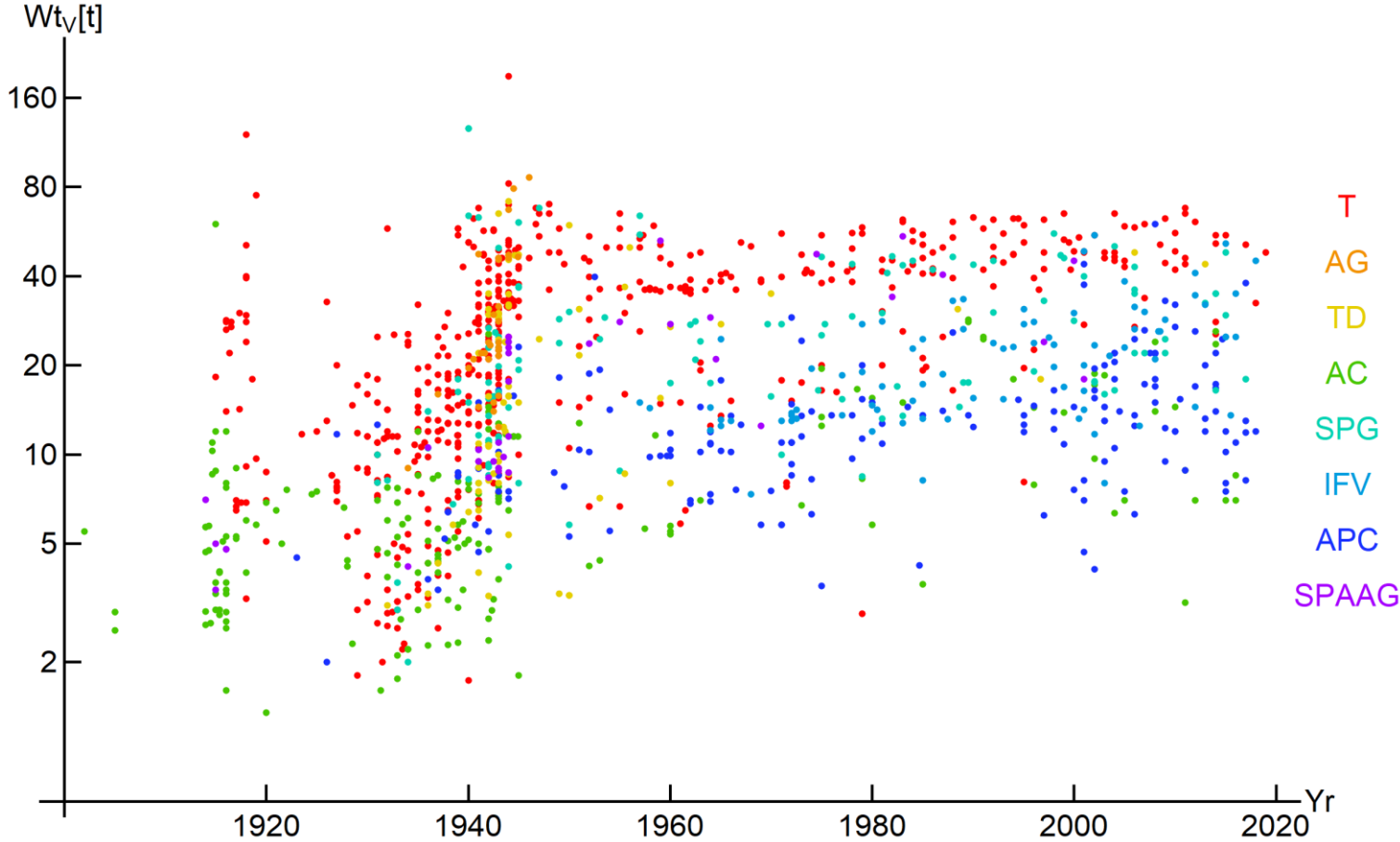
GROUND VEHICLE SYSTEMS ENGINEERING & TECHNOLOGY SYMPOSIUM
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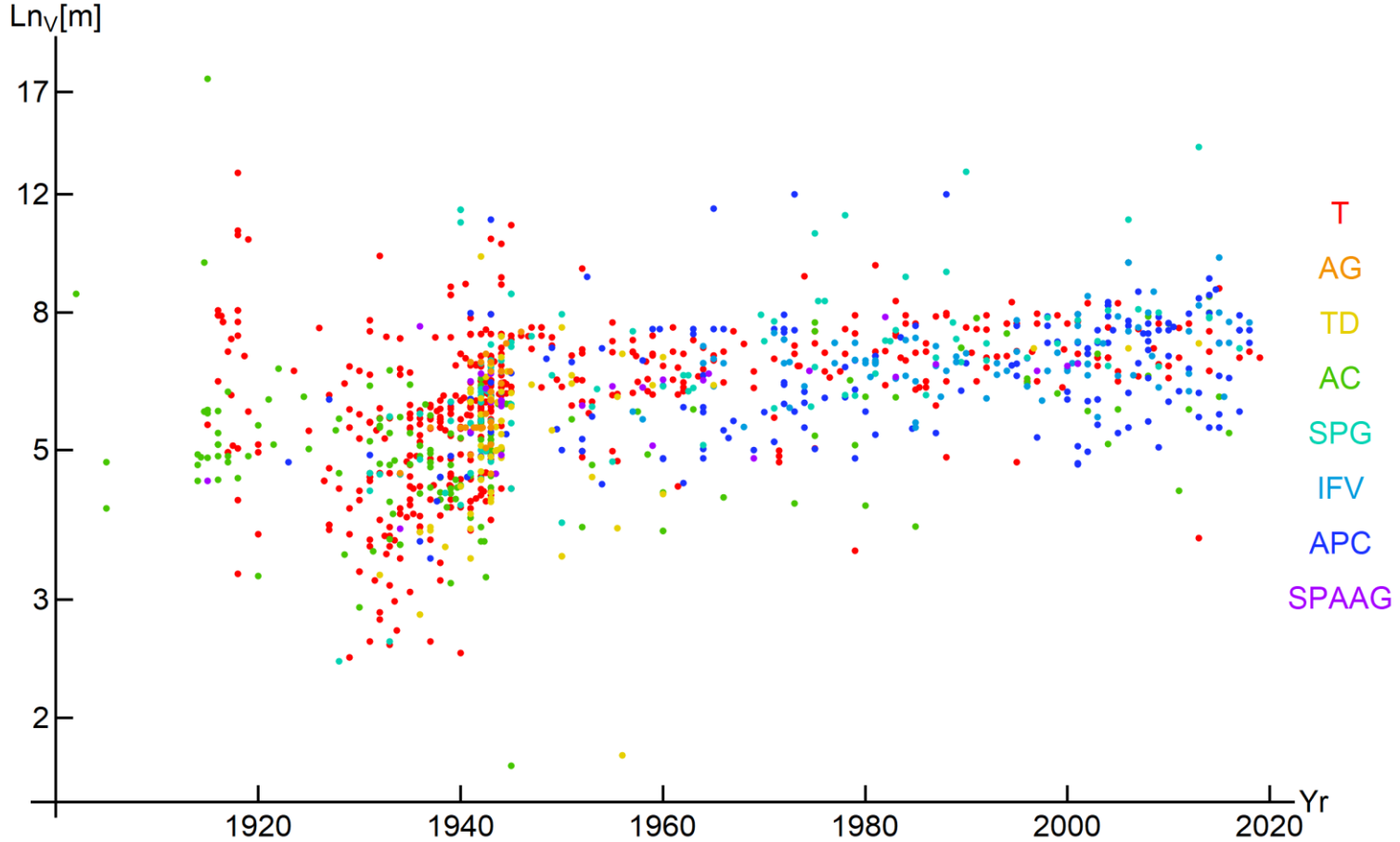


History: Weight



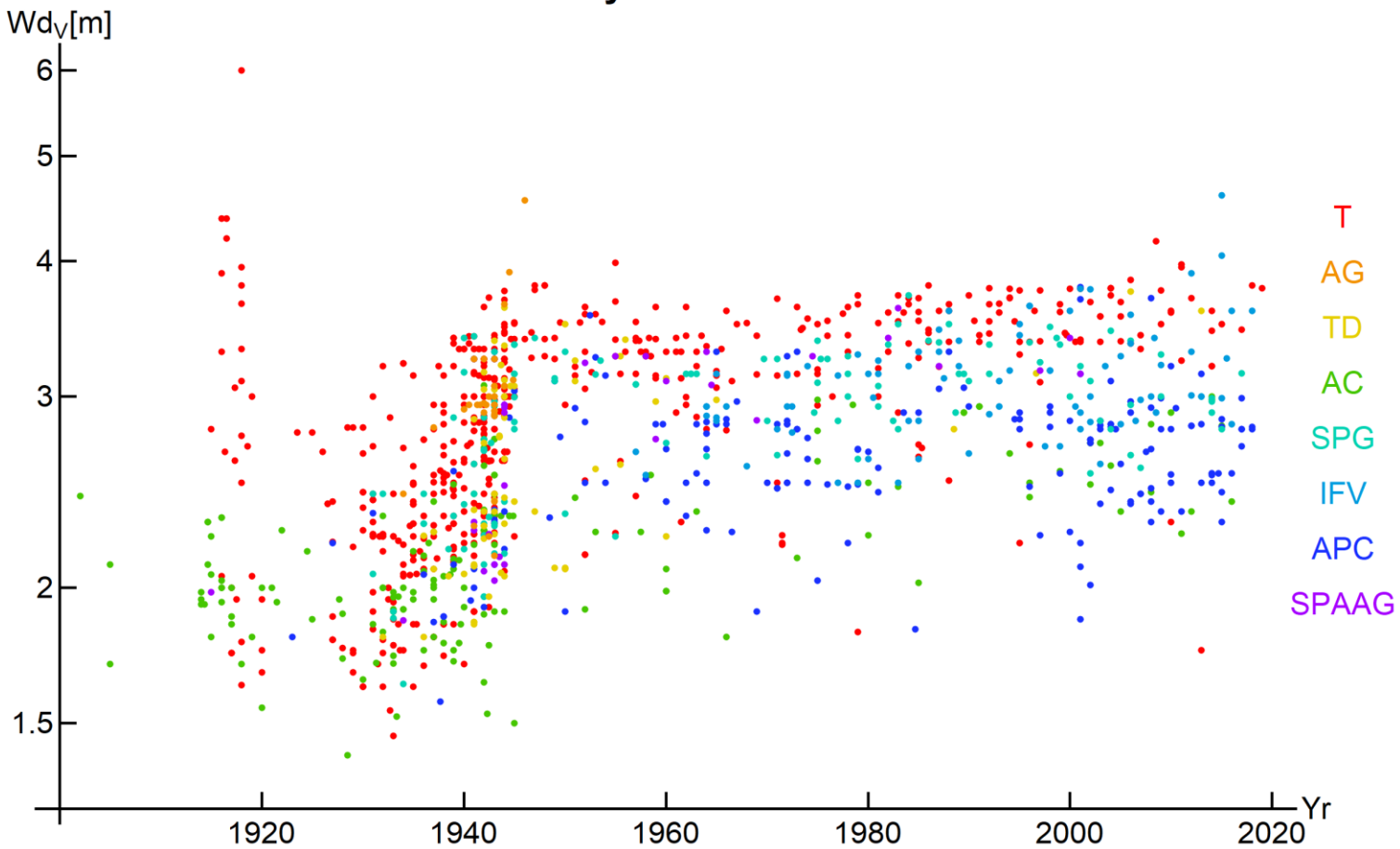


History: Hull Length



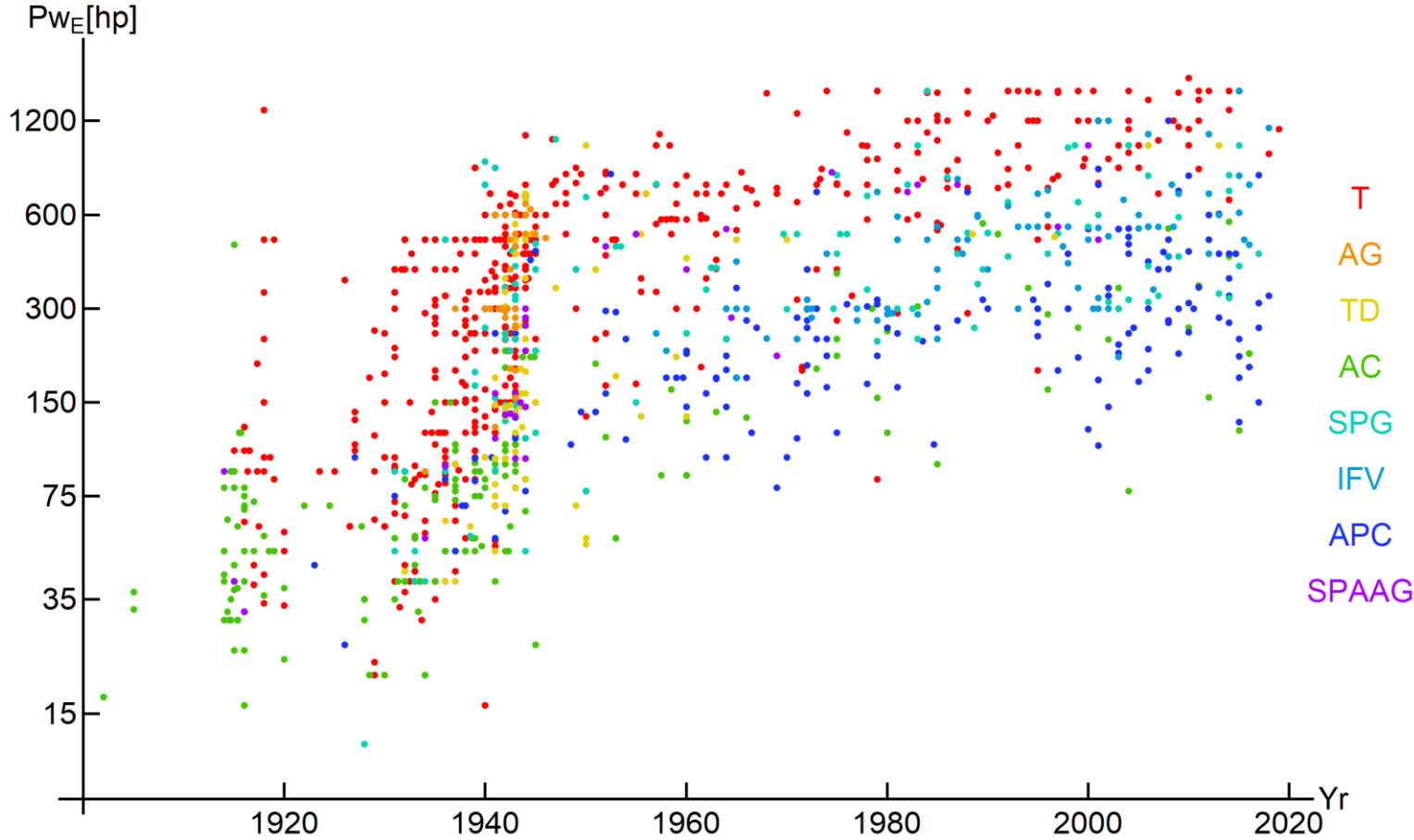


History: Hull Width



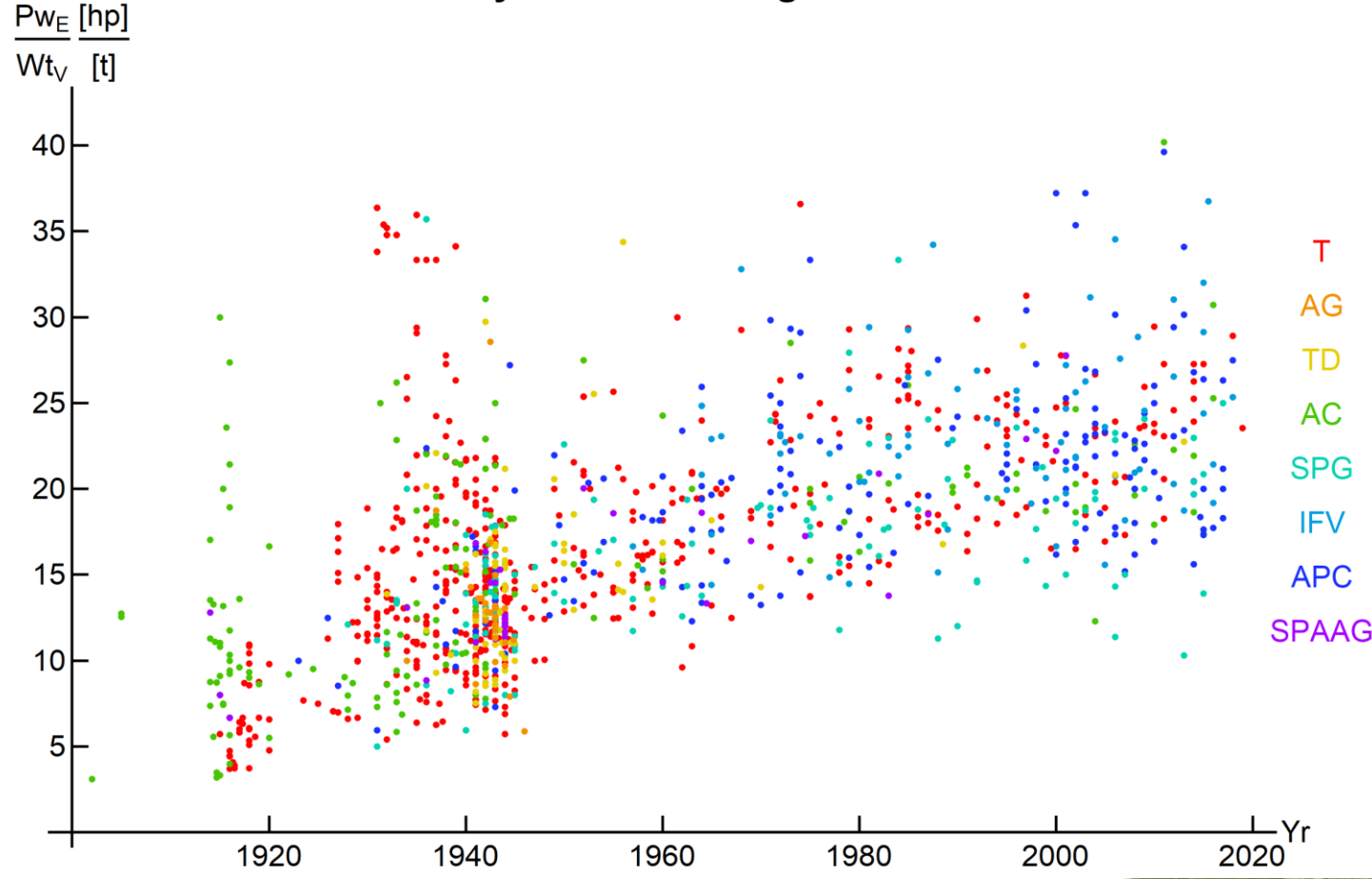


History: Engine Power



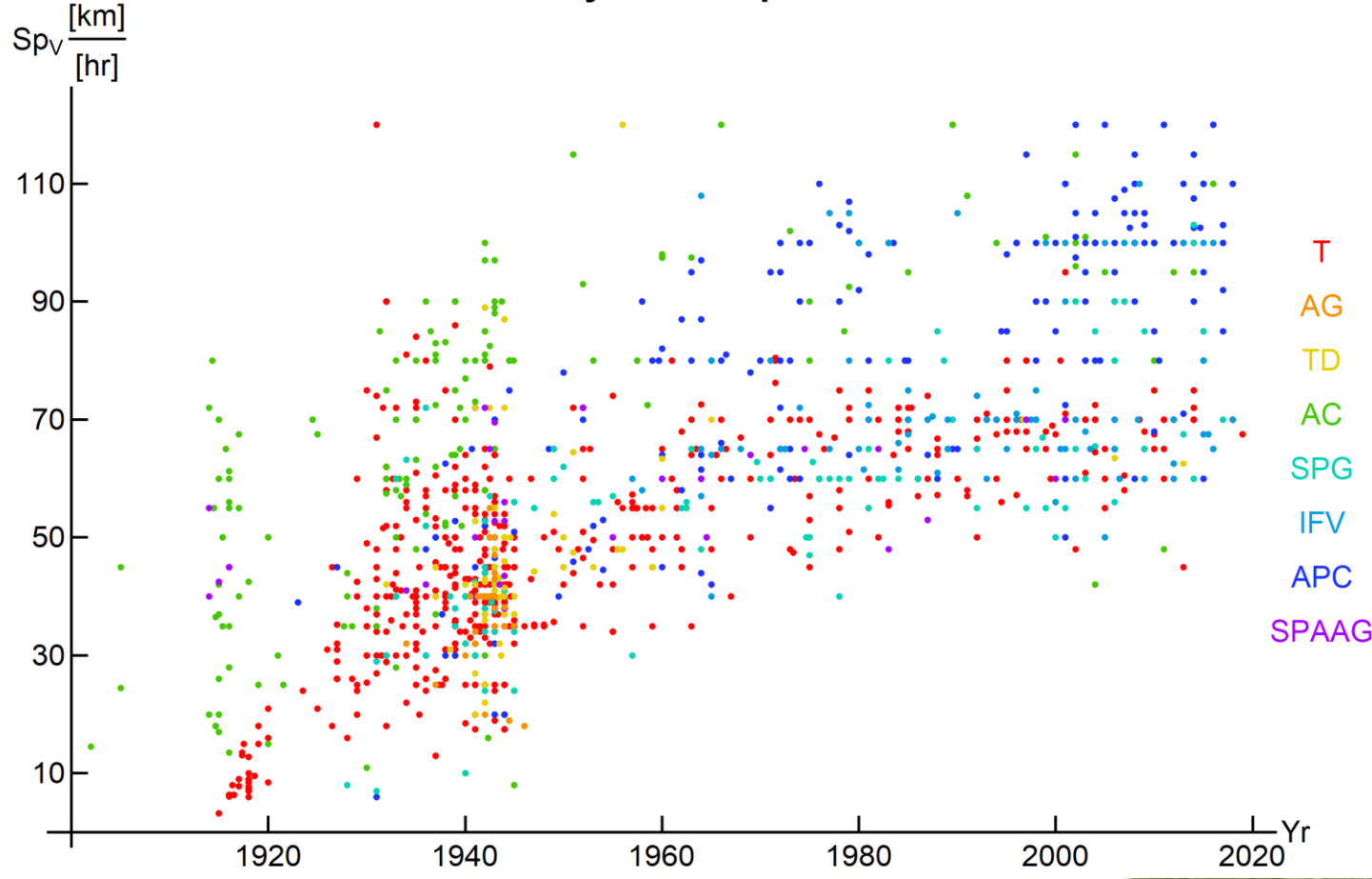


History: Power to Weight Ratio



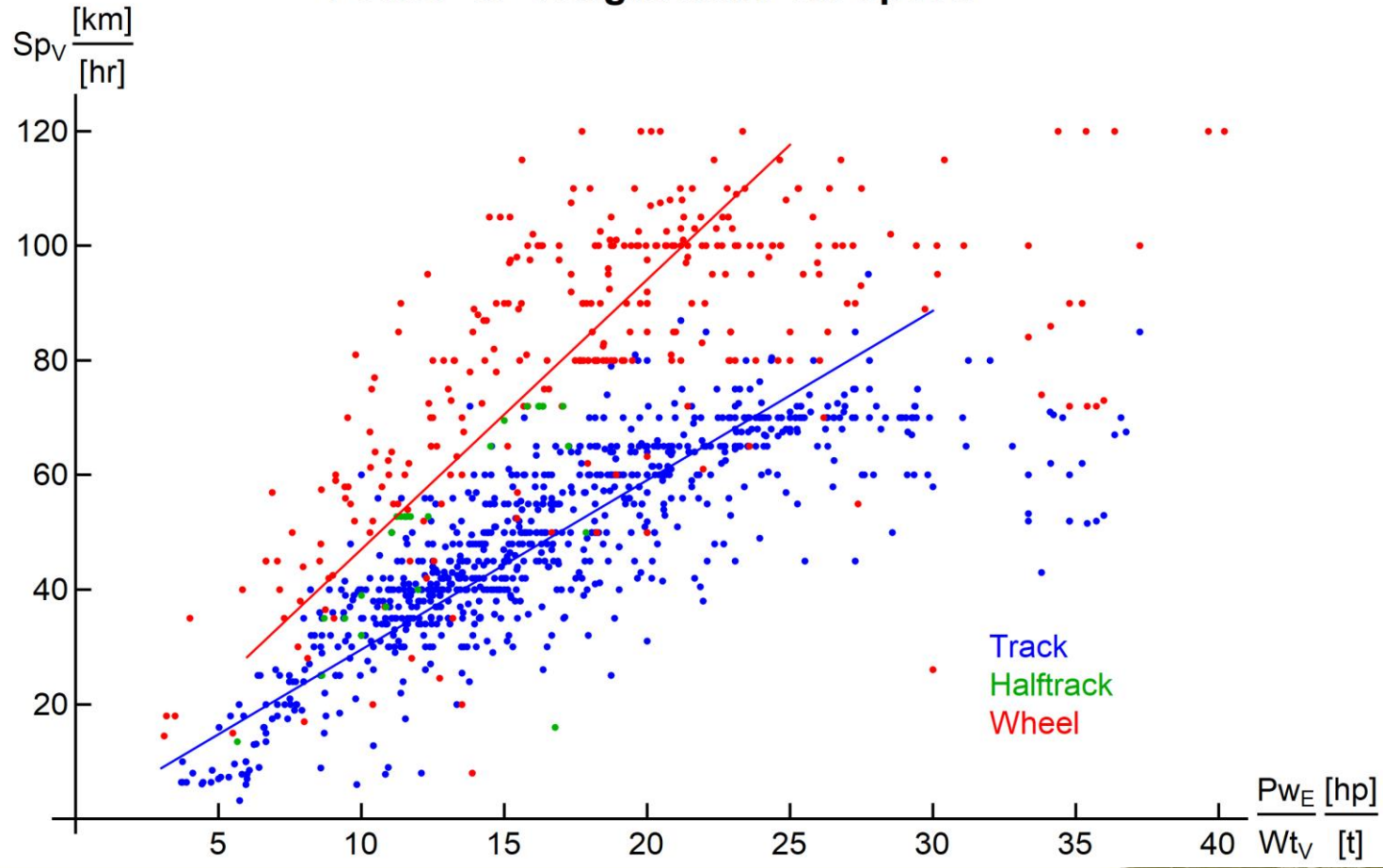


History: Road Speed





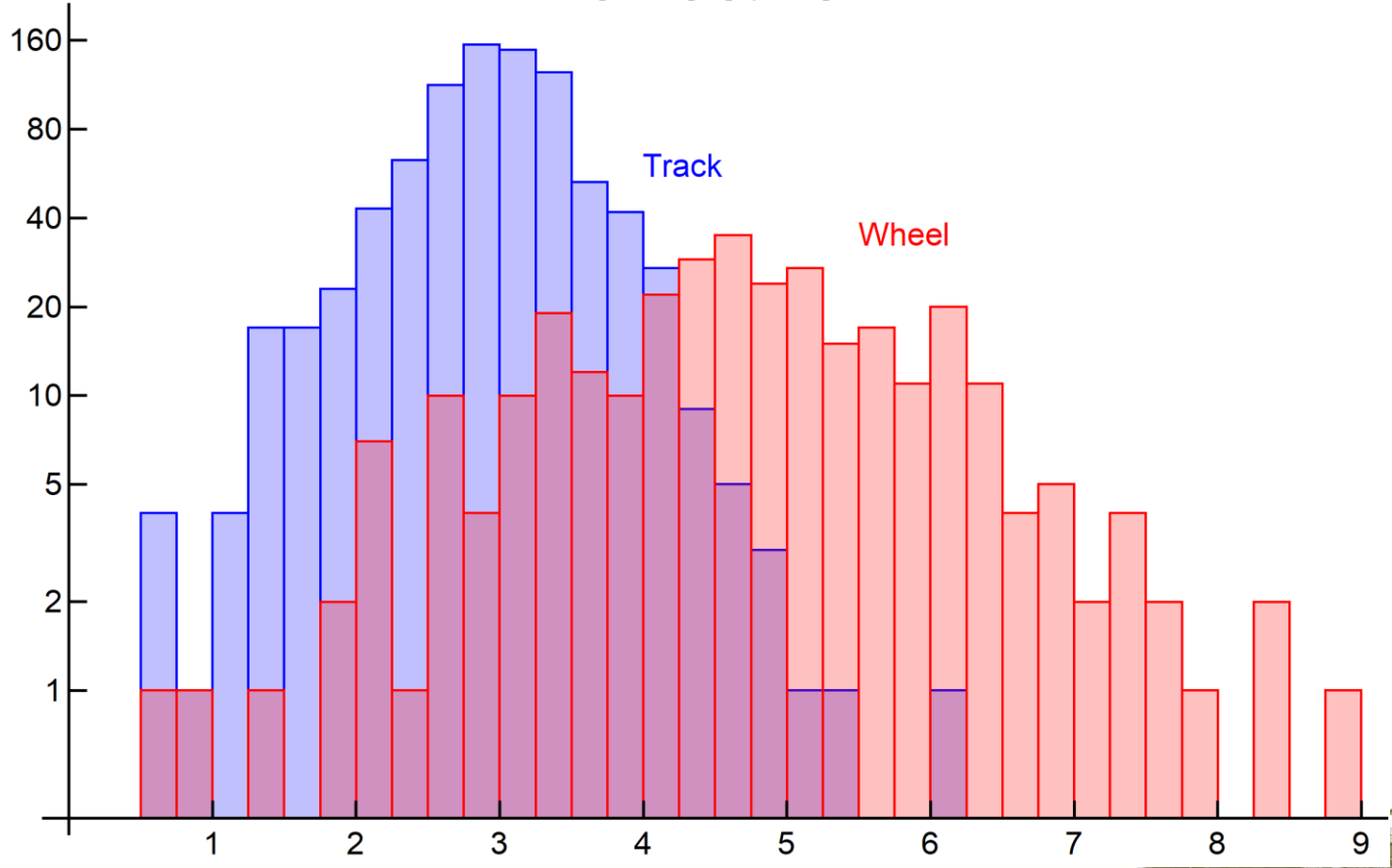
Power-to-Weight Ratio vs. Speed





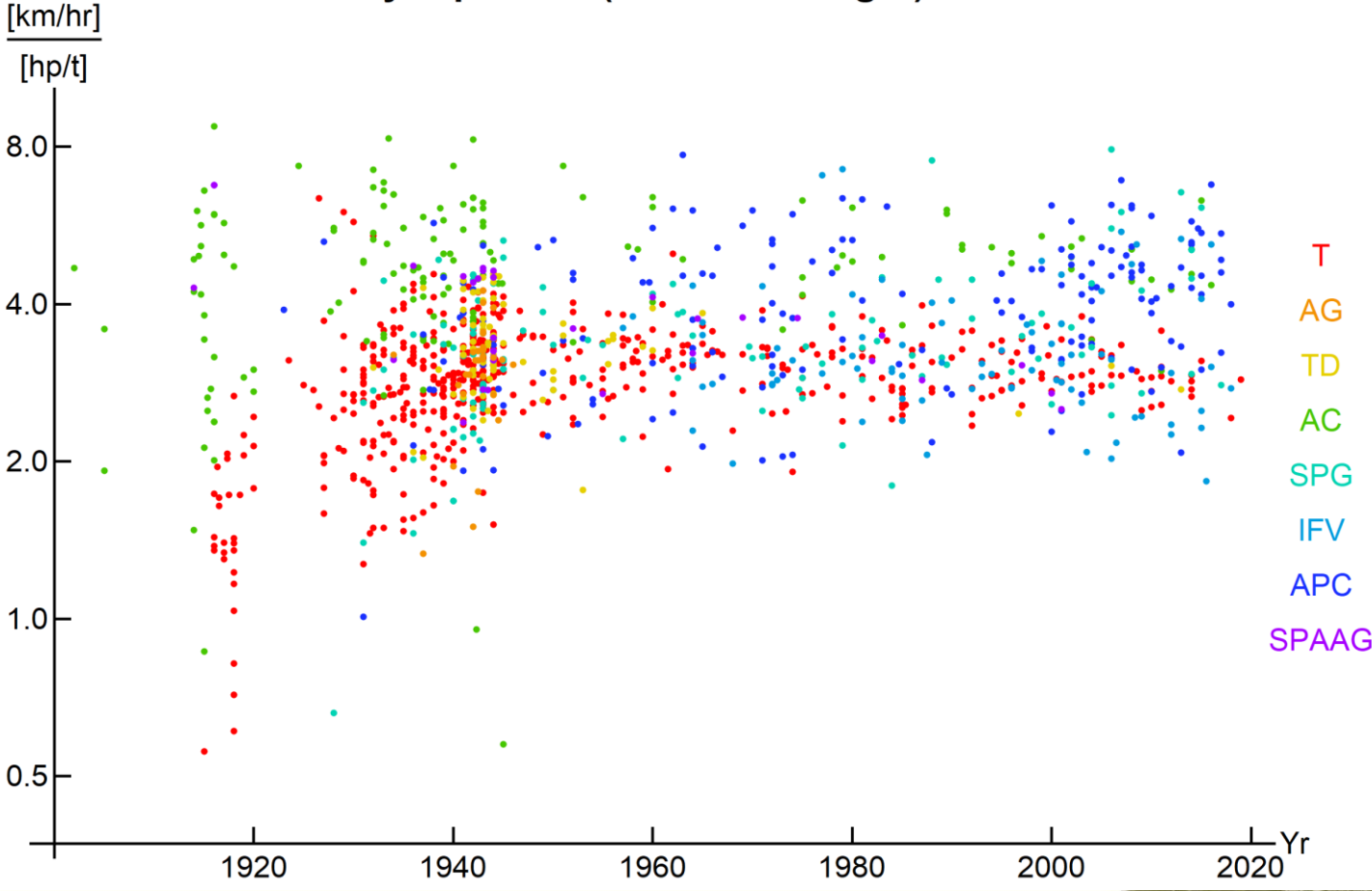
Histogram: Speed to (Power to Weight) Ratio

[km/hr] / [hp/ton]



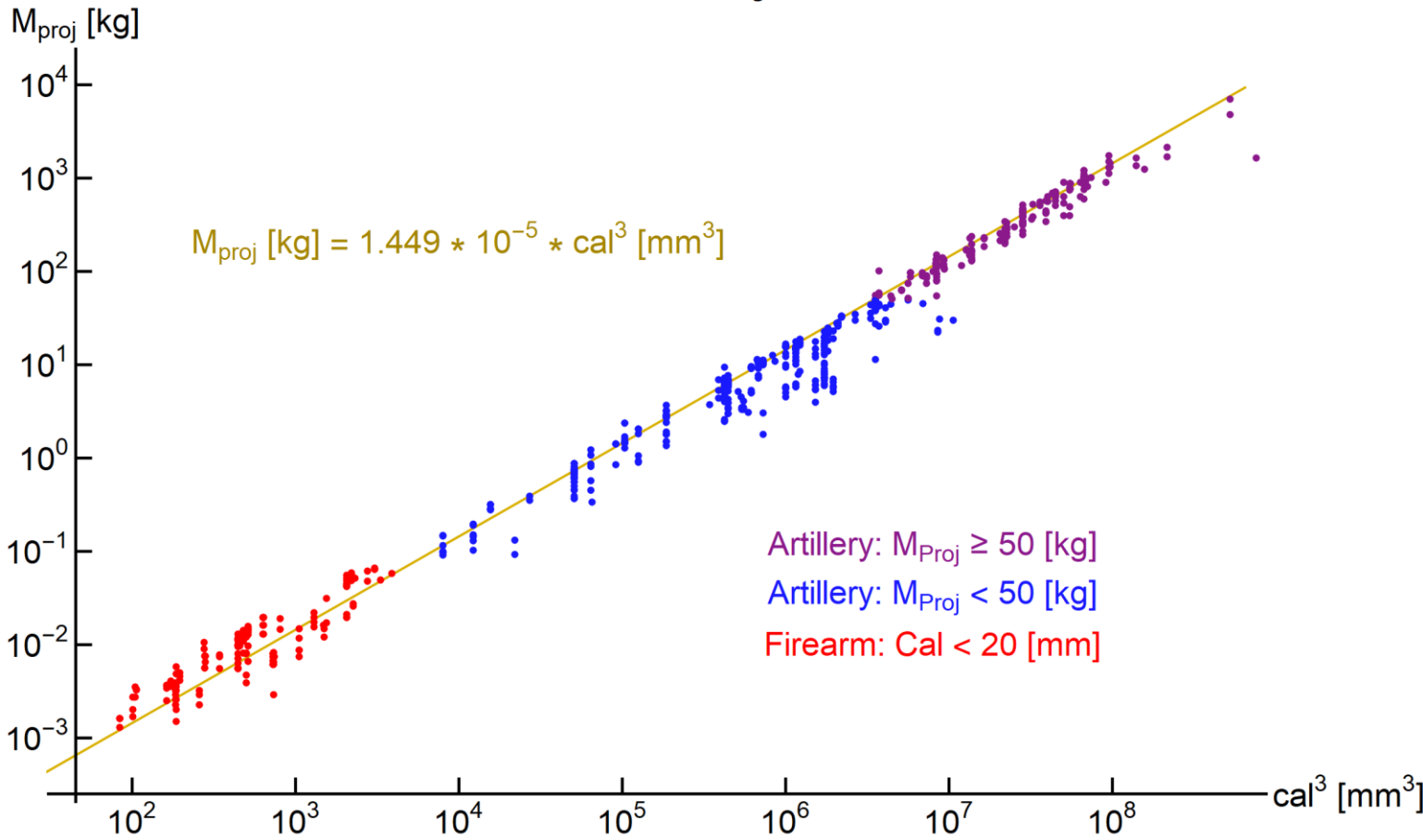


History: Speed to (Power to Weight) Ratio



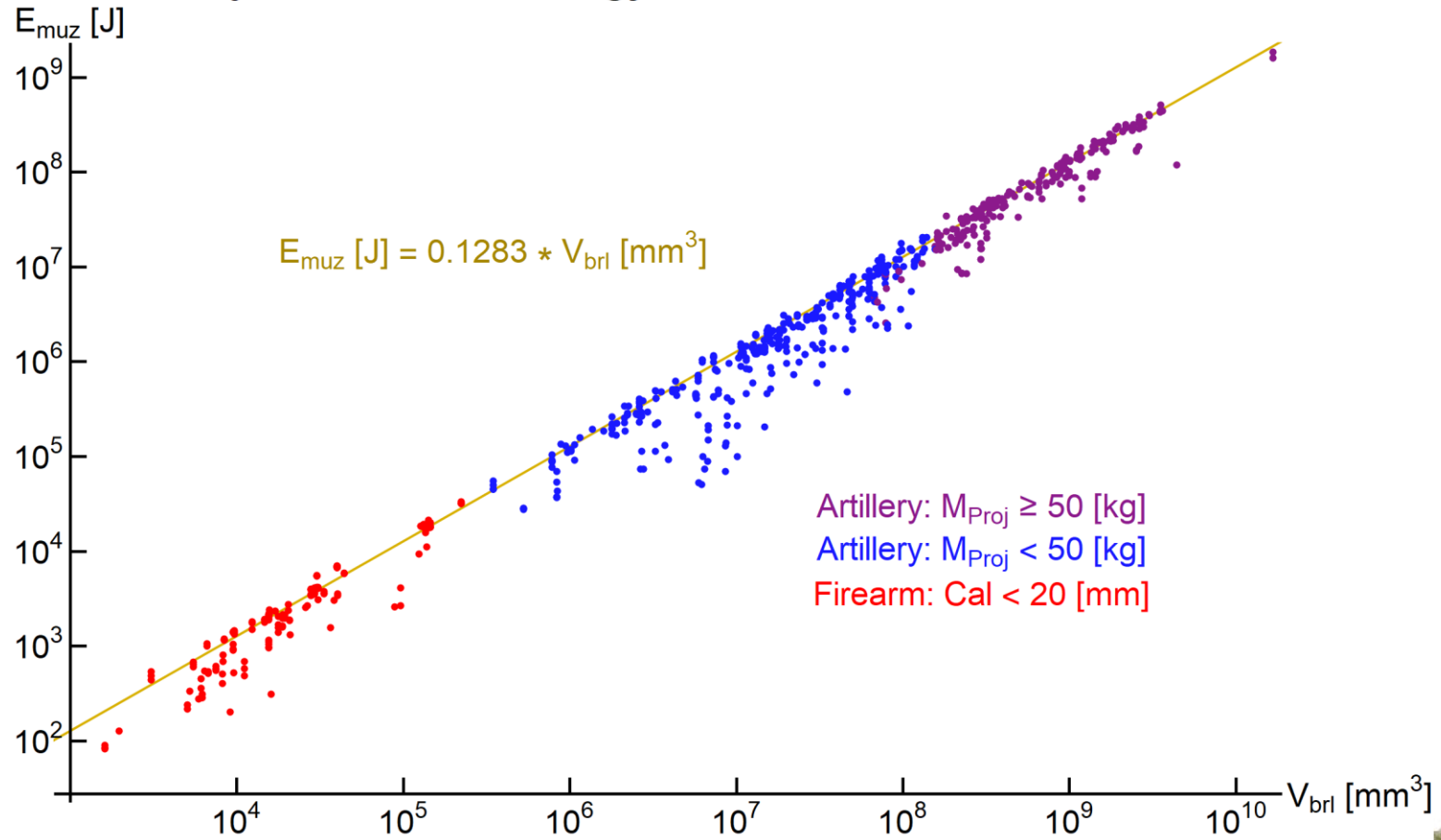


Caliber Cubed vs. Projectile Mass





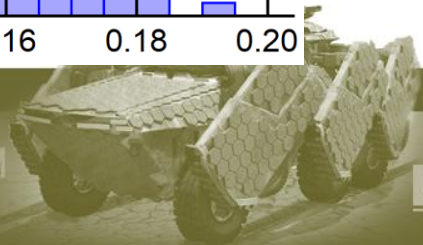
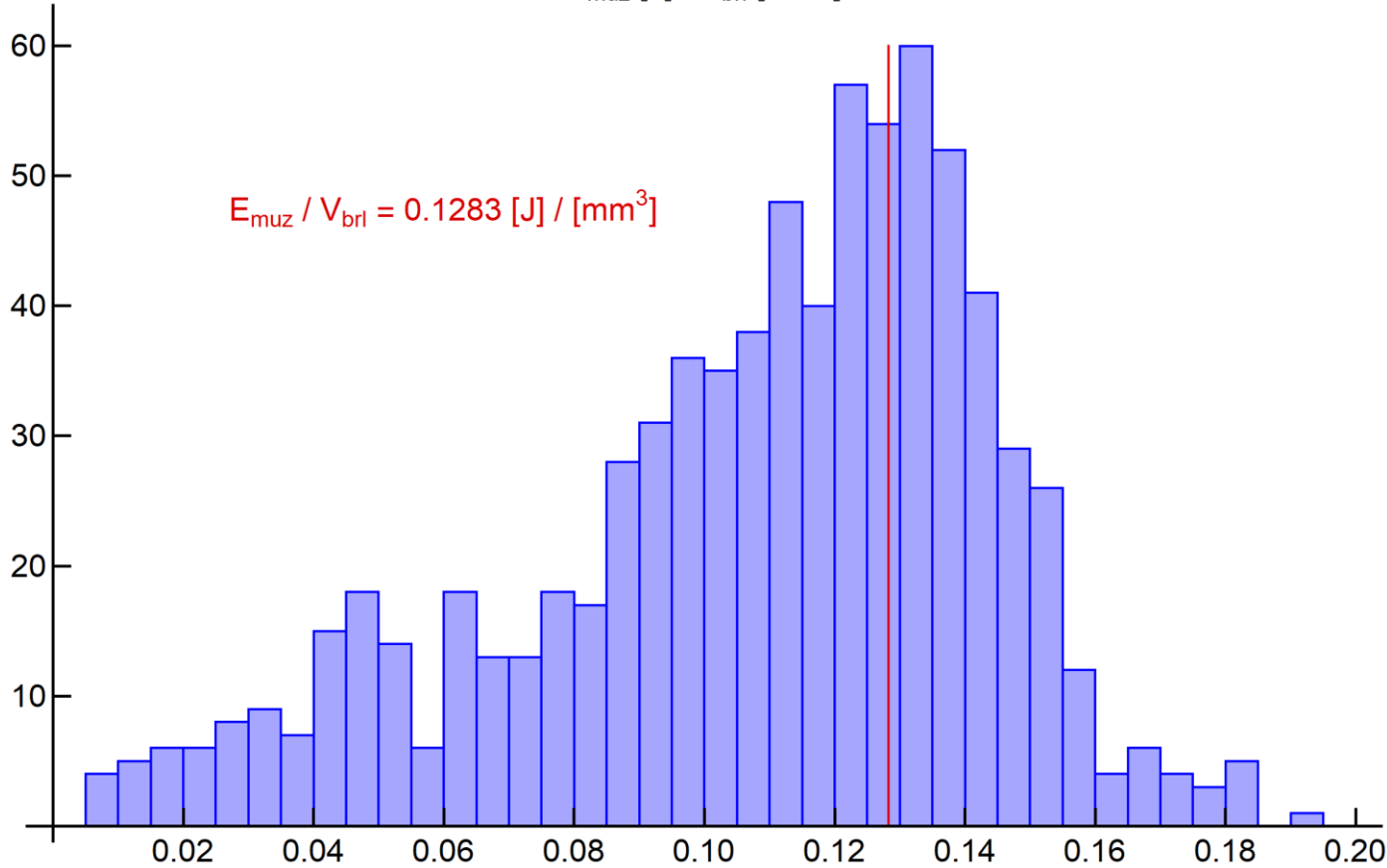
Projectile Muzzle Energy vs. Internal Barrel Volume





Histogram: Gun Energy Efficiency

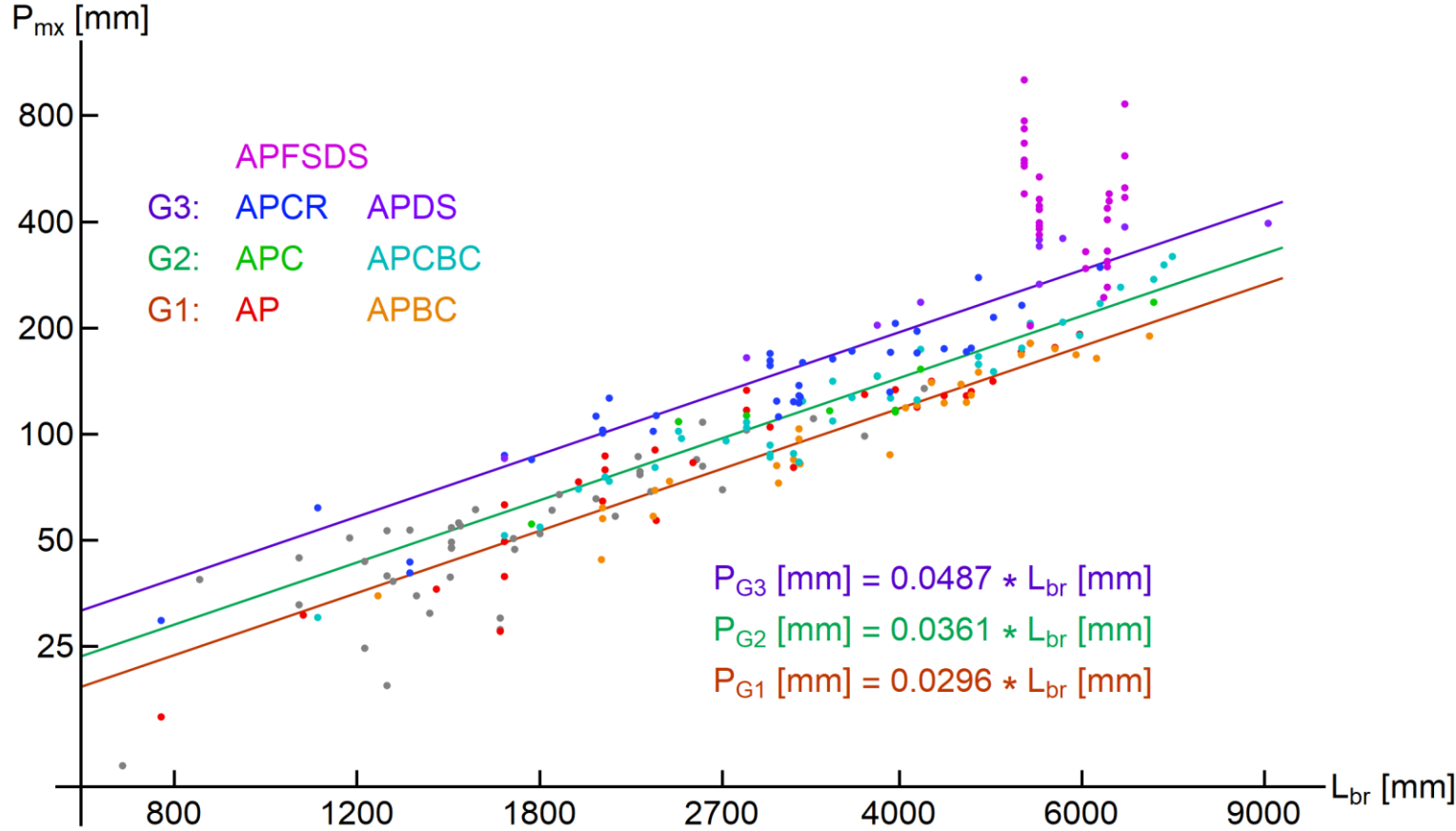
$$E_{\text{muz}} [\text{J}] / V_{\text{brl}} [\text{mm}^3]$$





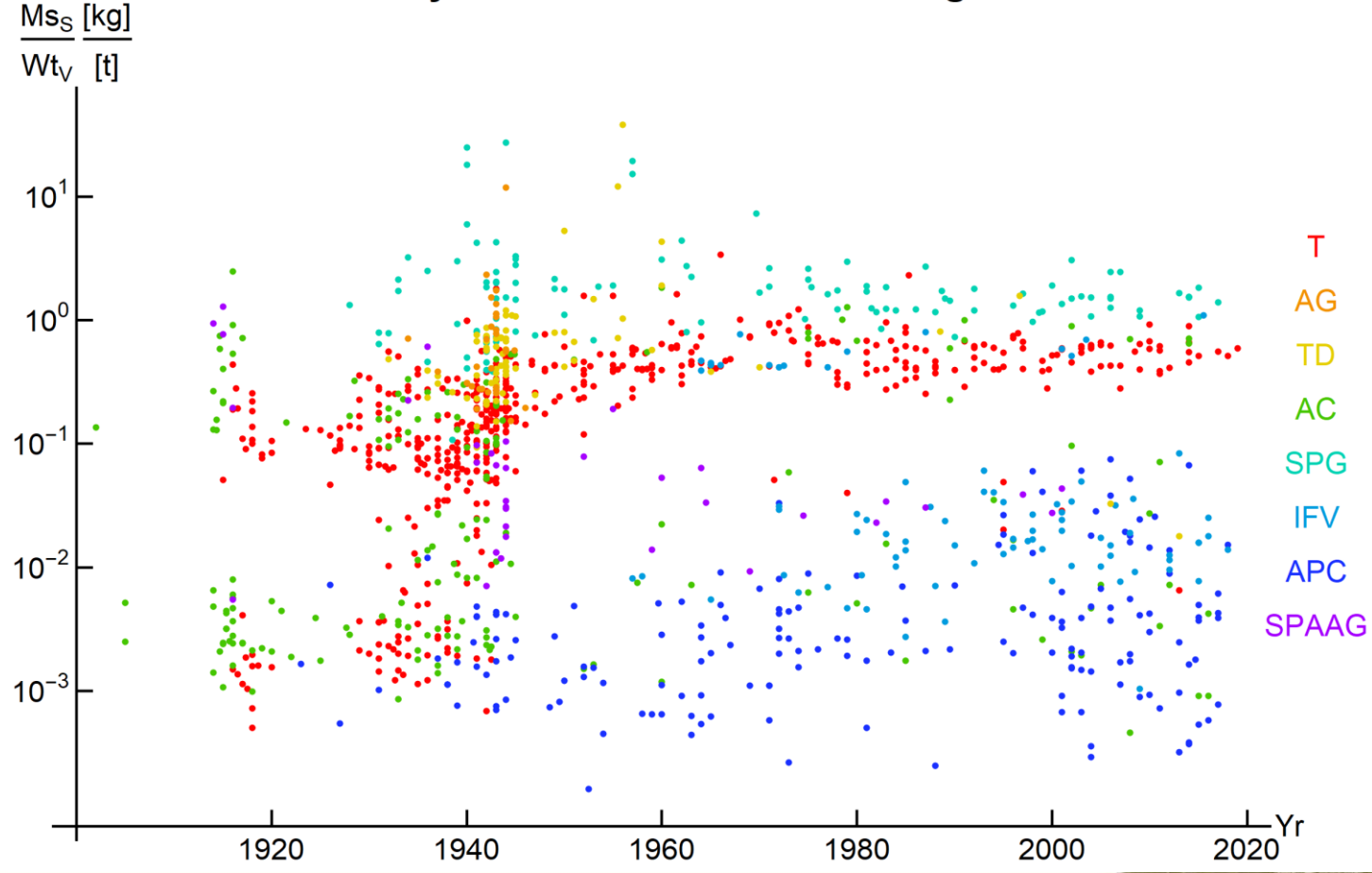
Max RHA Penetration vs. Barrel Length

Range = 0 & Incident Angle = 90°



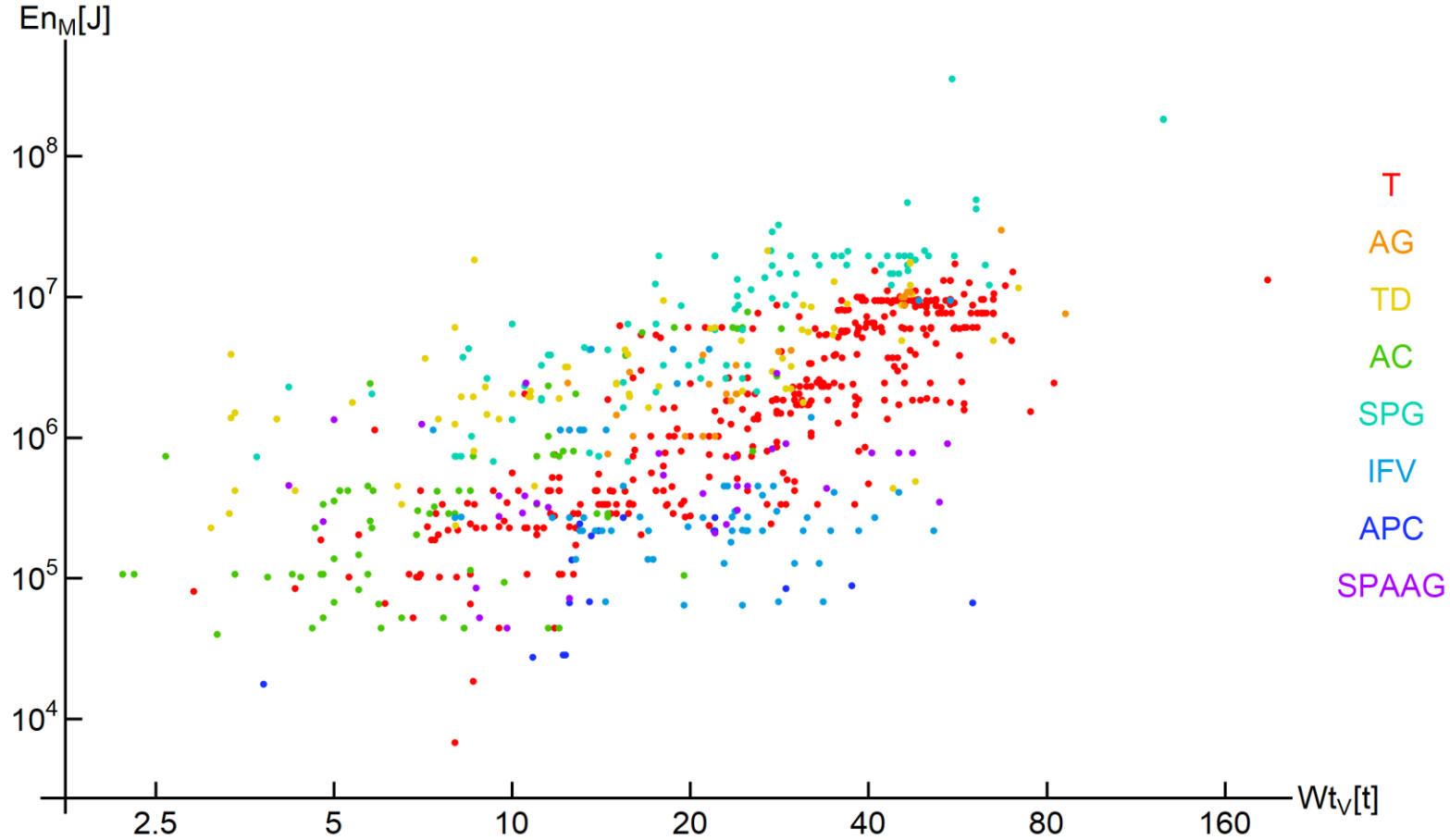


History: Salvo Mass to Vehicle Weight





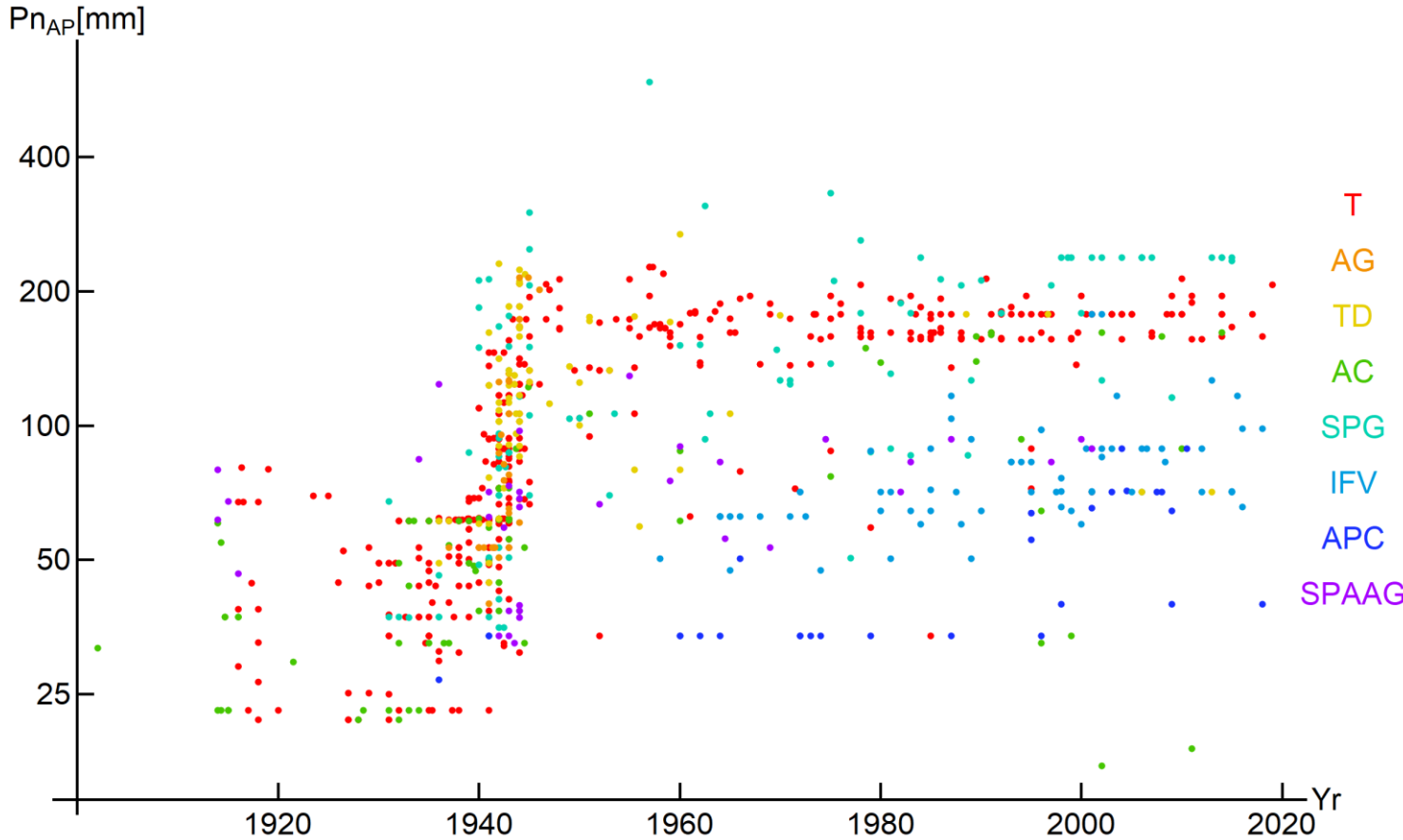
Salvo Muzzle Energy vs. Vehicle Weight





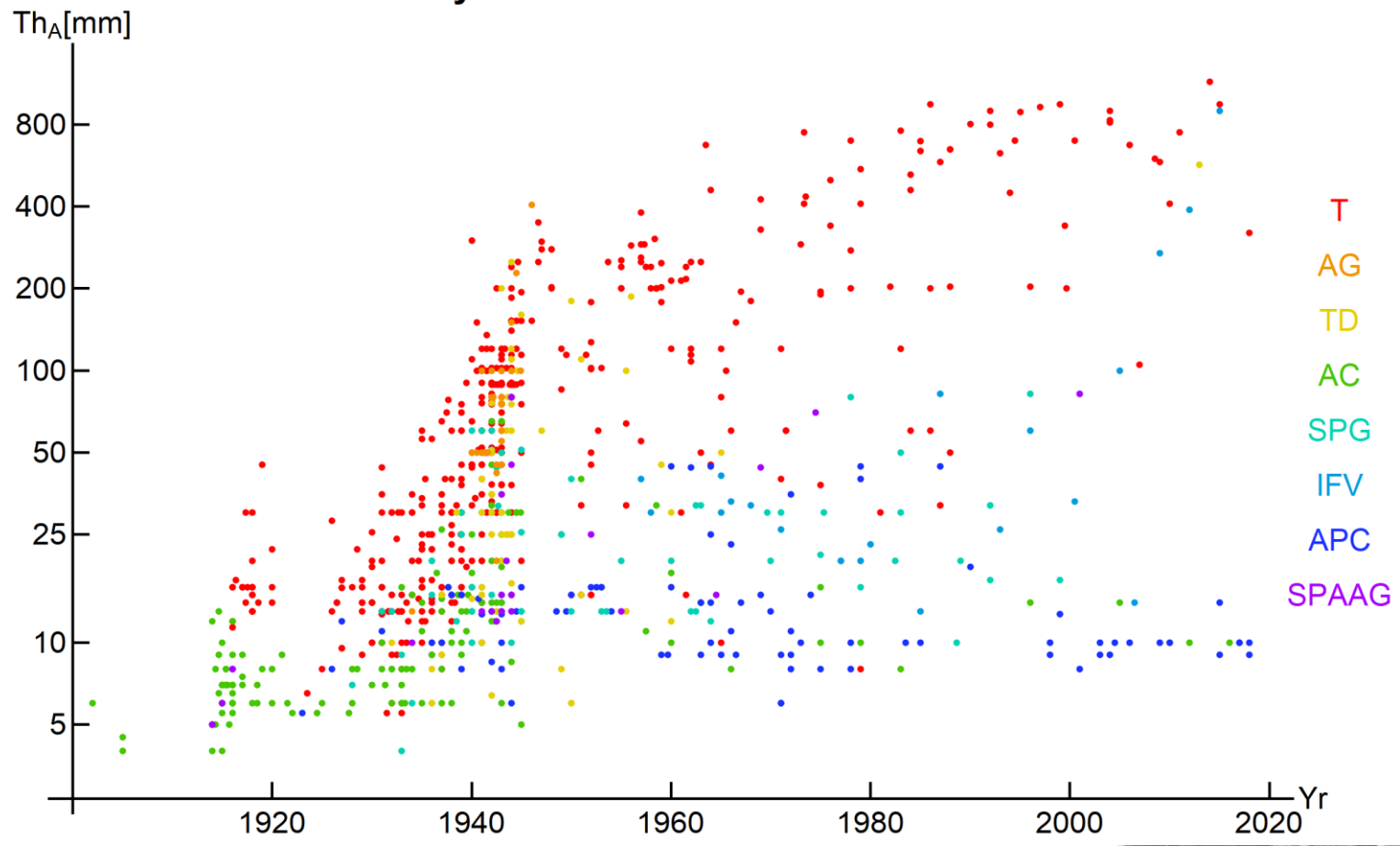
History: Max Armor Penetration

Standard AP Ammunition



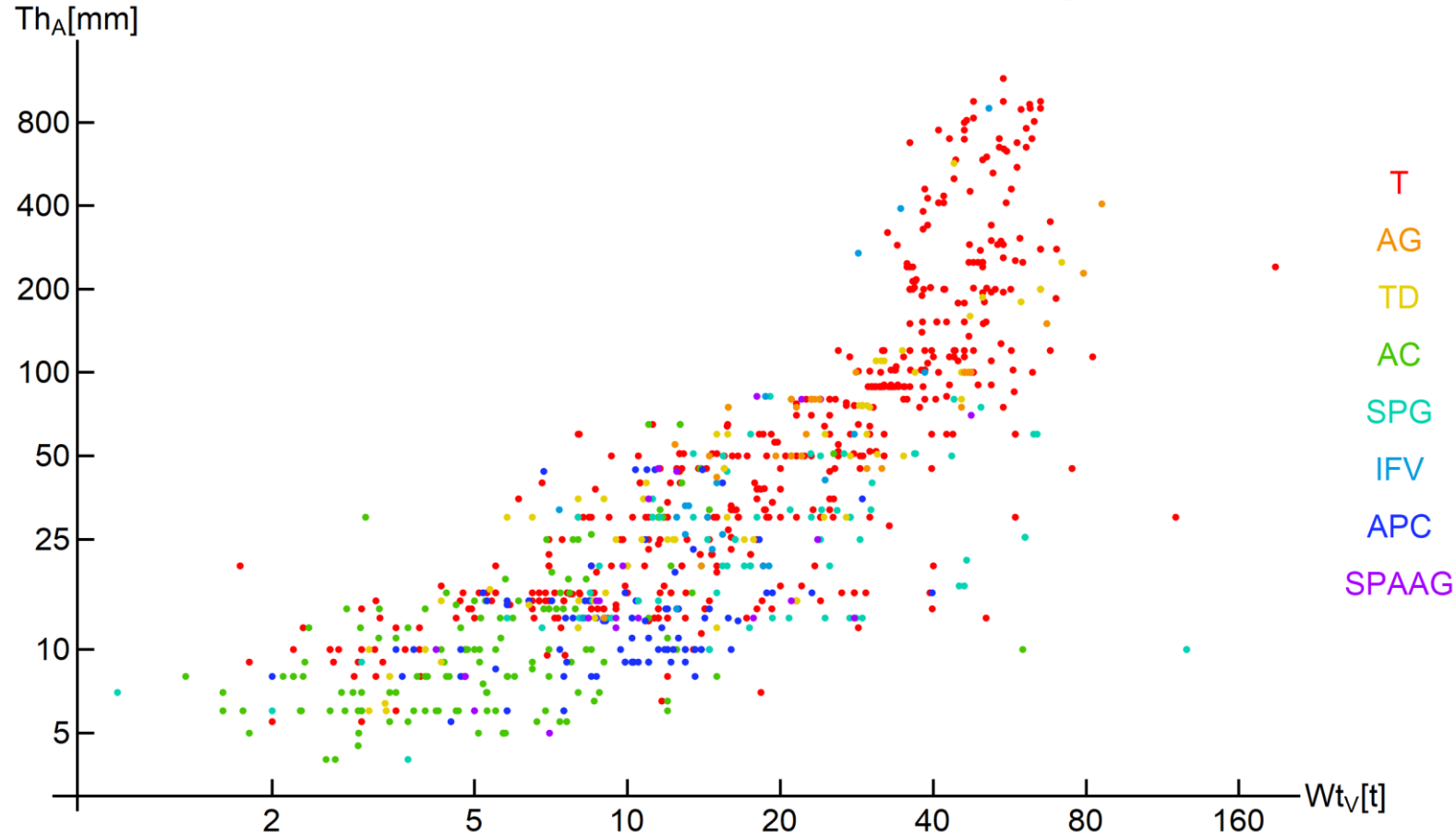


History: Maximum Armor Thickness





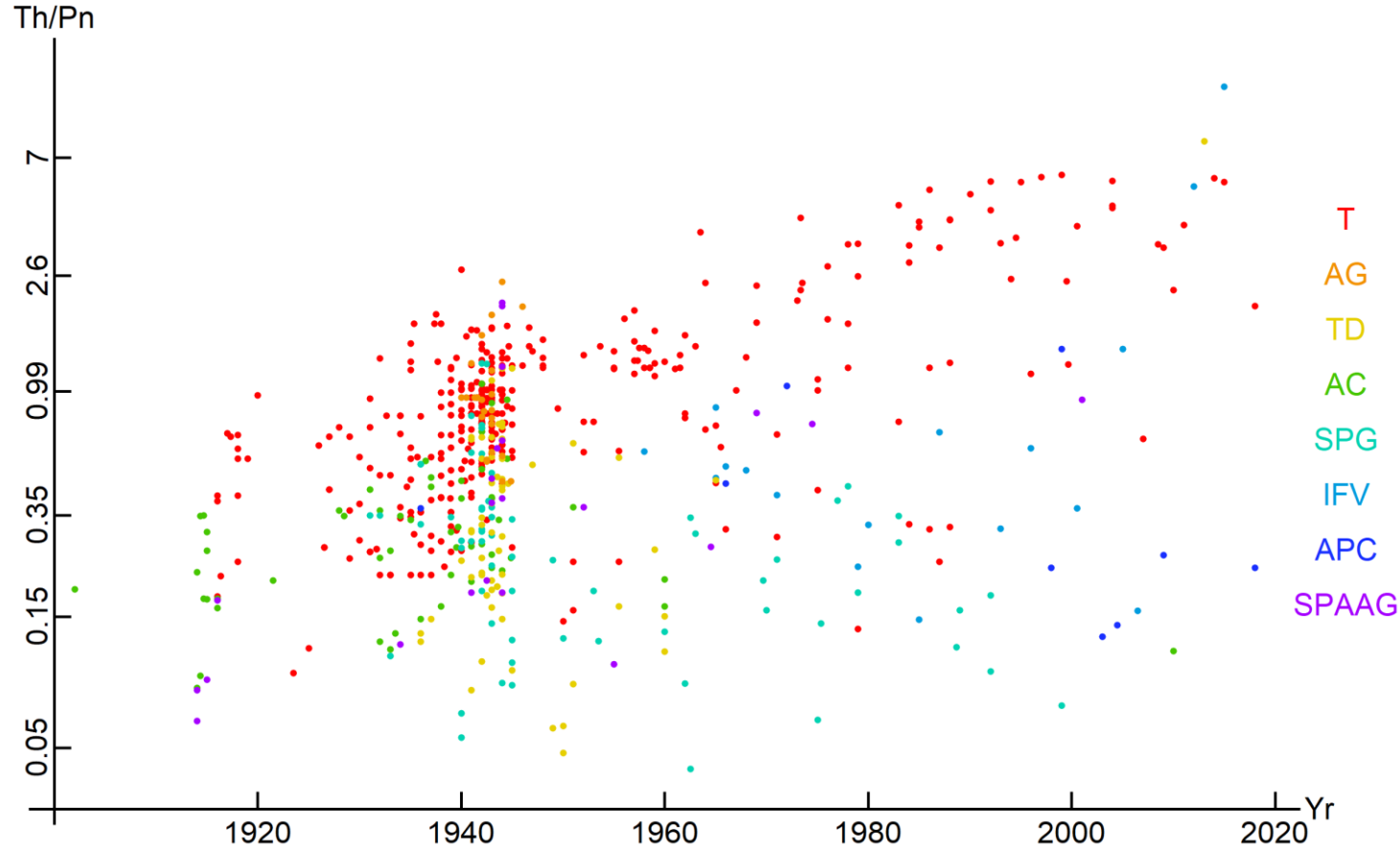
Maximum Armor Thickness vs. Vehicle Weight





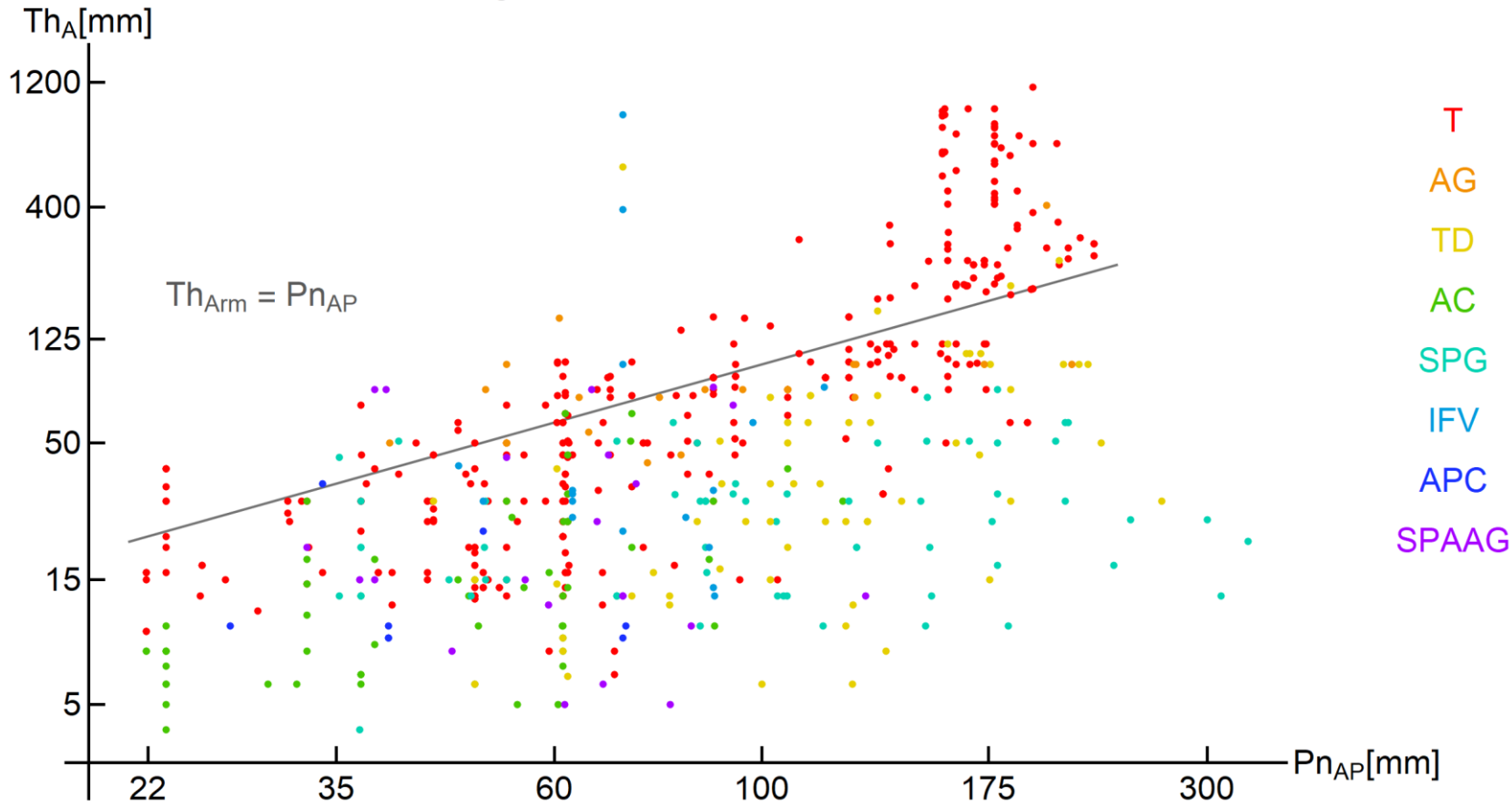
History: Armor Thickness to Armor Penetration

Standard AP Ammunition





Armor Thickness vs. Armor Penetration Standard AP Ammunition





- Dynamic active suspensions
 - Reduced vibration
 - Higher sustainable speed
- Efficient drivetrains for tracked vehicles
 - Improved mobility-power efficiency





- Stronger materials for gun chambers and barrels
 - Smaller / lighter guns capable of higher muzzle energy
 - Longer fatigue life and better lifetime accuracy
- Larger main guns for Tanks and SPGs
 - Heavier general purpose HE ammunition
 - More energetic APFSDS rounds
- Resilient APFSDS ammunition
 - Response to KE-effective ERA and APS





- Solutions to reduce weight and increase RHAe value
 - Lightweight high-strength ceramics / composites
- Improved protection for vehicle sides / rear / top
 - KE-effective ERA and APS

