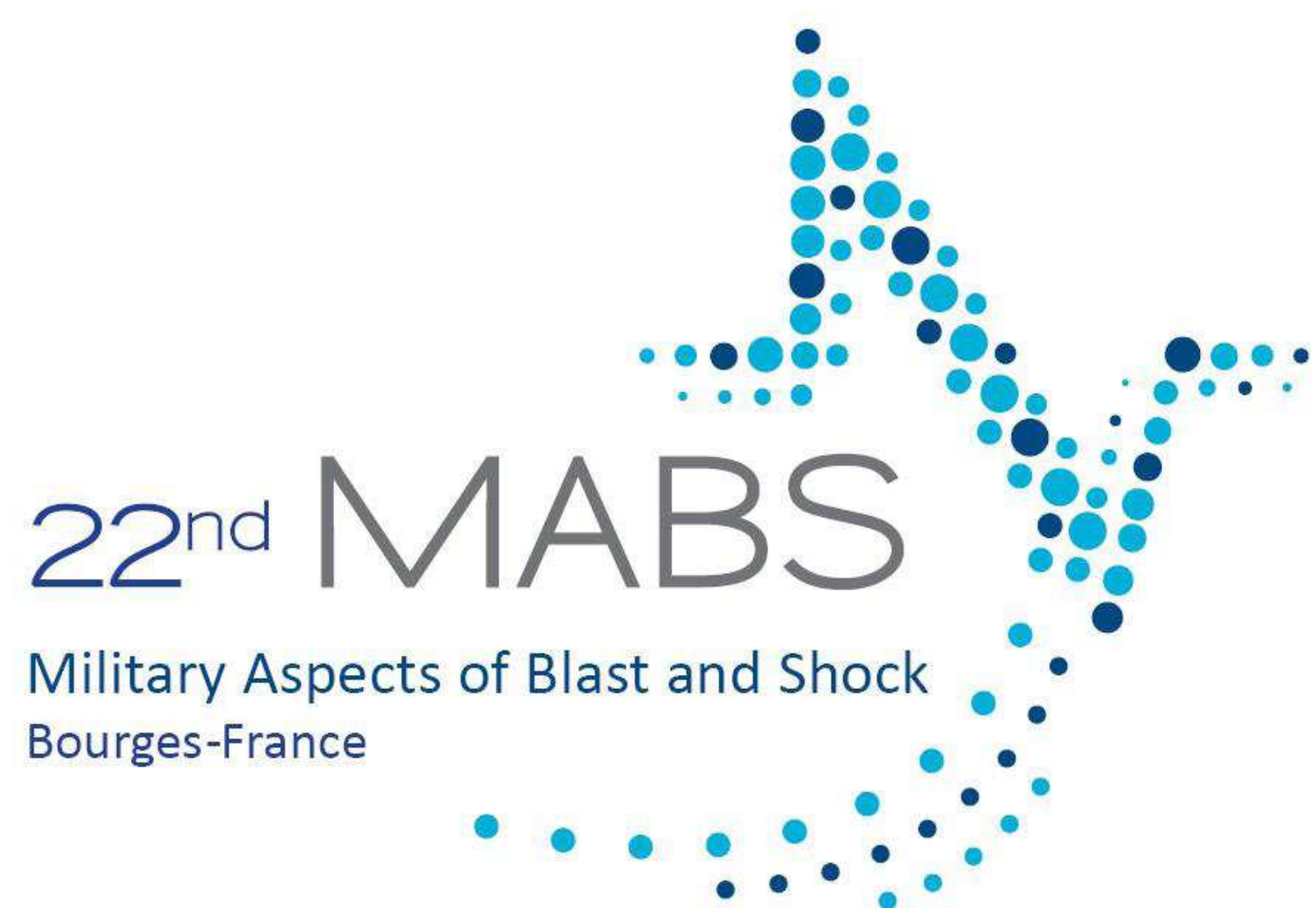


« NUMERICAL AND EXPERIMENTAL STUDY OF
BLAST WAVES SHAPE IN TUNNELS »

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PRISME - F2ME / DMS - BOURGES

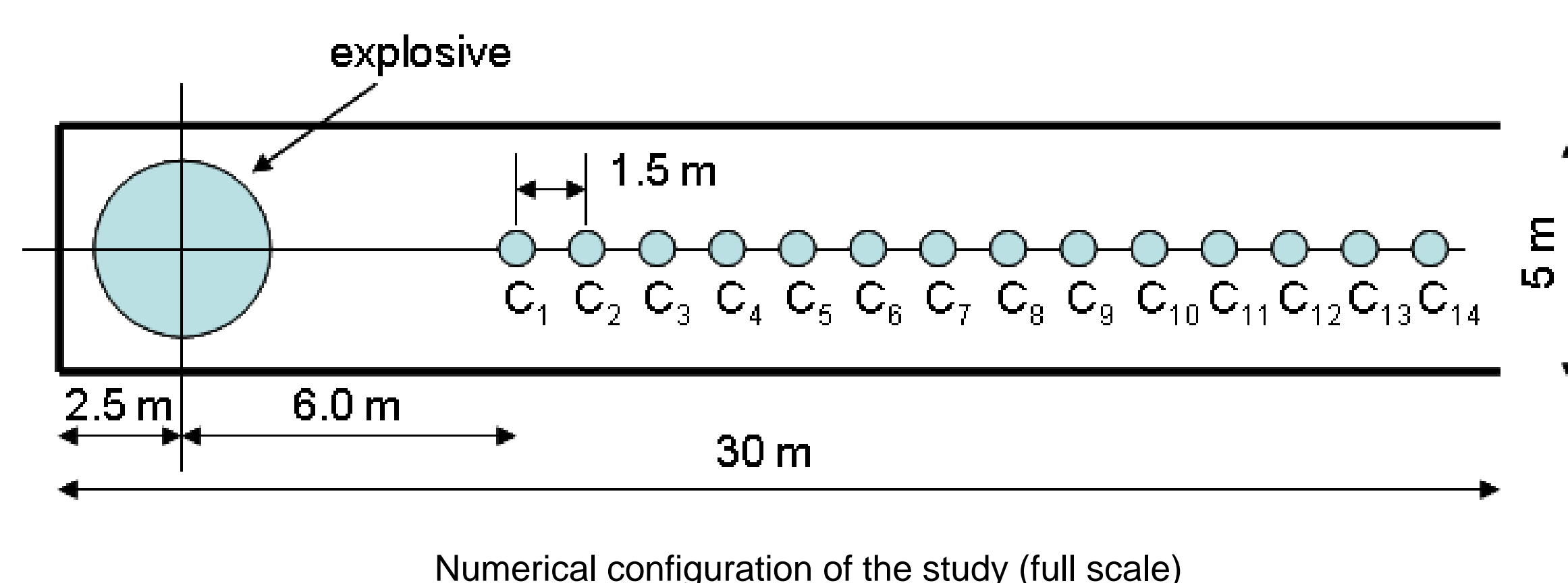


When an explosion occurs in a tunnel, the study of the blast wave quickly becomes complicated, due to the multiple propagation patterns of the blast wave (Incident wave, regular and Mach reflections) and to the geometrical conditions. Considering this problem, two patterns can be revealed. Near the explosive, one can see the well known free-field pressure wave. This overpressure, during its propagation, after multiple reflections on the tunnel's walls, can behave like a one-dimensional wave.

The aim of this paper is to determine the position of this transition zone along the tunnel with reduced-scale experiment and hence to validate the dedicated law established in a previous work. Both numerical and experimental methods are presented. Previous experimental works have been done on this topic, based on a real scale. In this present study, the experiments are realized in the laboratory using a 1/30th scaled model, simulating T.N.T. detonations ranging from 0.1 kg to 12 kg in a tunnel of 25 square meter cross section and 30 meters in length. The experiment on scaled models allows us to realize many inexpensive experiments; an accurate profile of the overpressure can be determined along the tunnel. The transition zone between the free-field and the one-dimensional decay law is presented using non-dimensional parameters and is also compared with the numerical simulation.



Experimental set-up



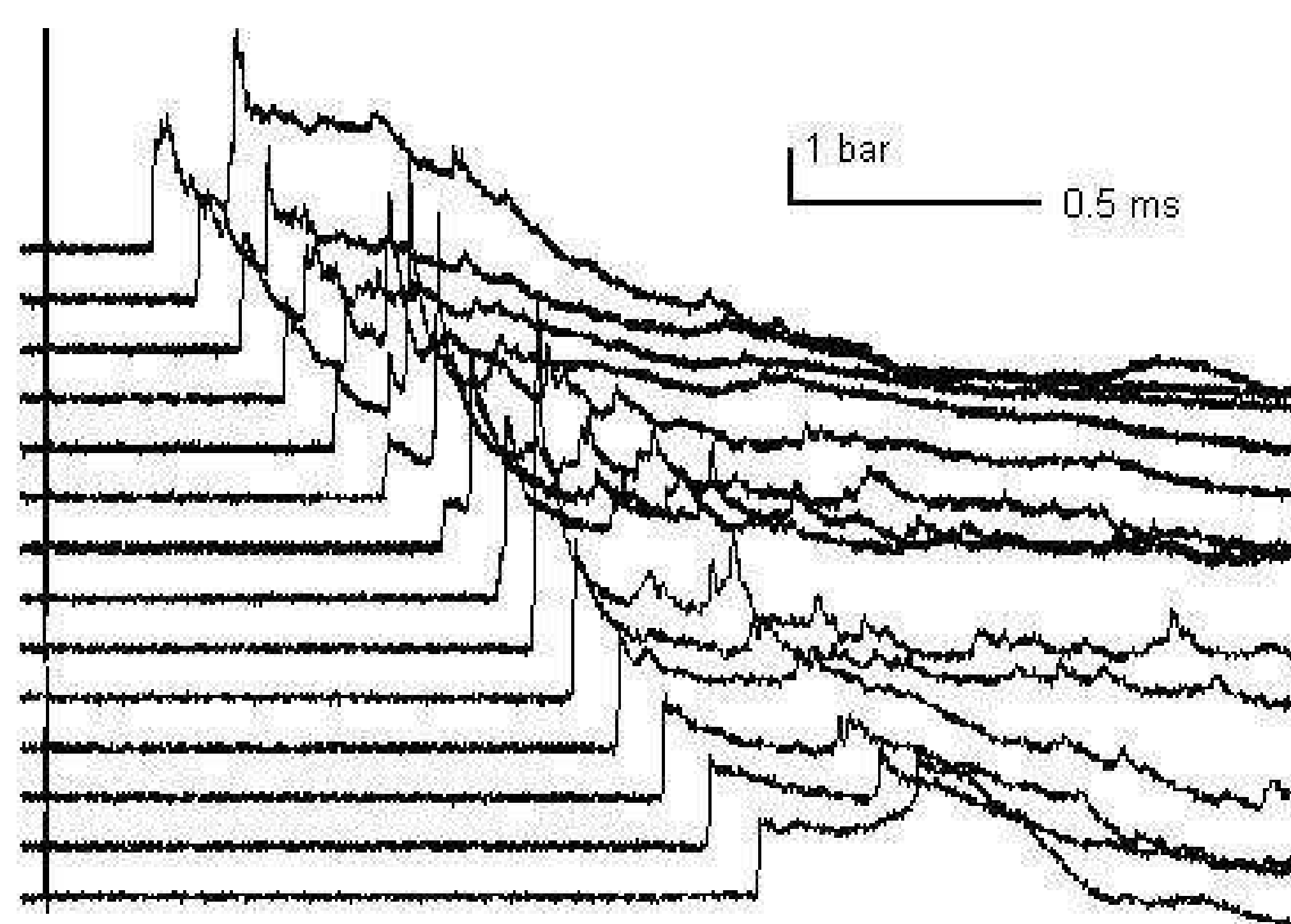
Soap bubble filled of gaseous mixture

Bubble radius (mm)	R=25	R=36	R=50	R=70
Mass of T.N.T. (g) - scale 1/30 th -	0.0198	0.059	0.158	0.433
Mass of T.N.T. (kg) - full scale -	0.535	1.593	4.266	11.691

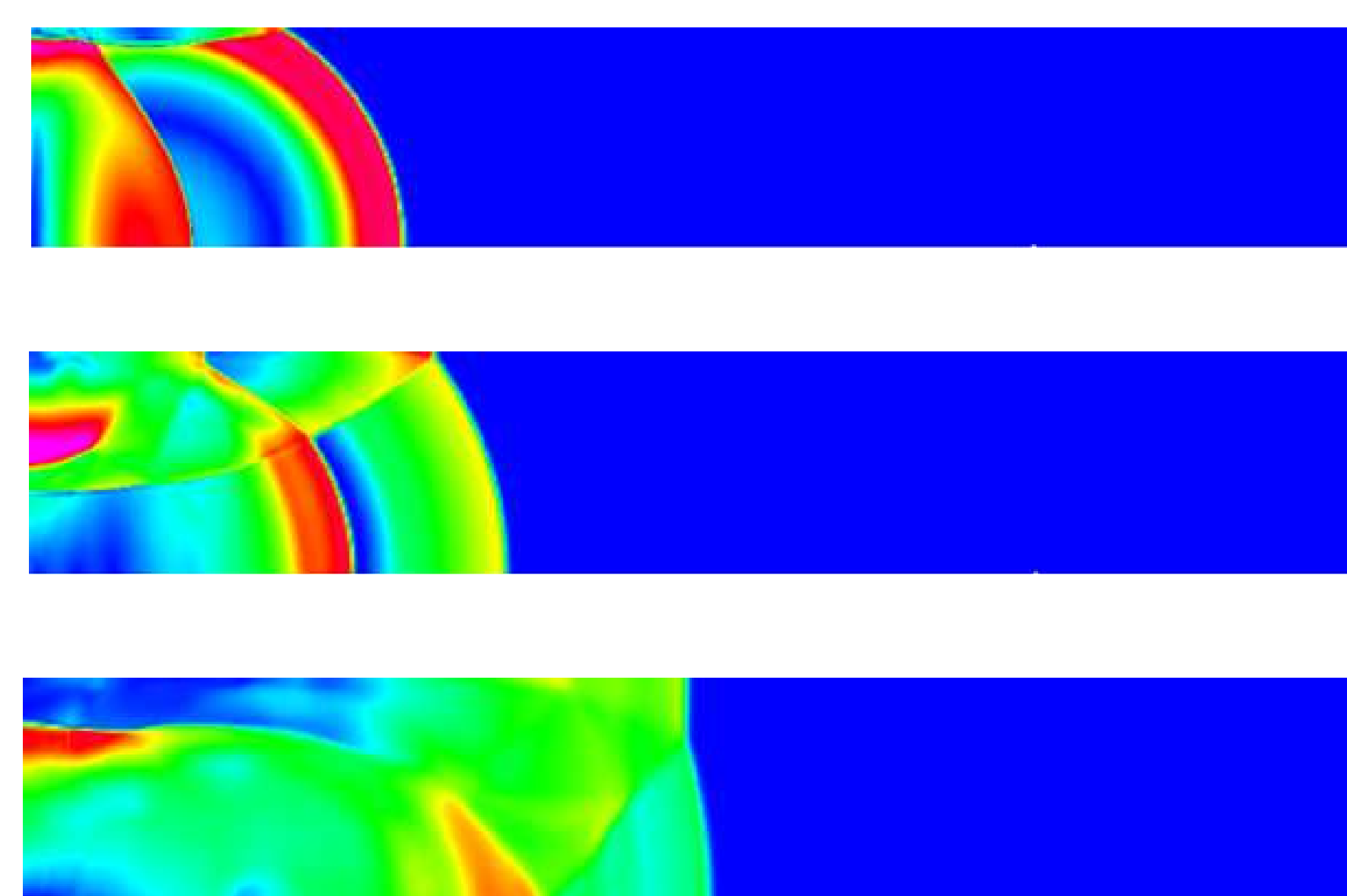
Quantities of explosive

Mass (kg)	Equivalent spherical diameter d (cm)	Ratio size α
0.535	8.7	1.73
1.593	12.4	2.49
4.266	17.3	3.46
11.691	24.2	4.84

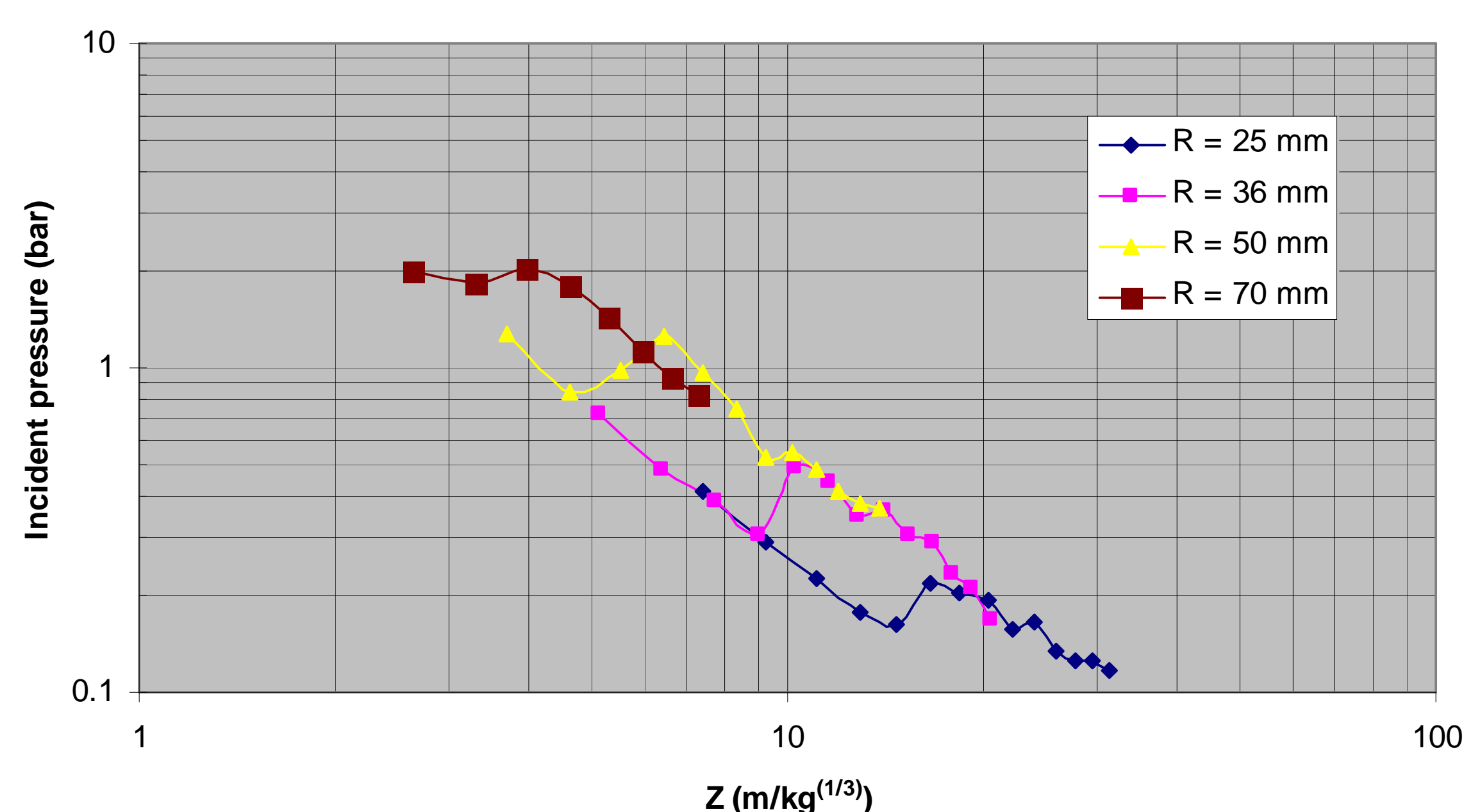
Parameters of the explosive charges at full scale



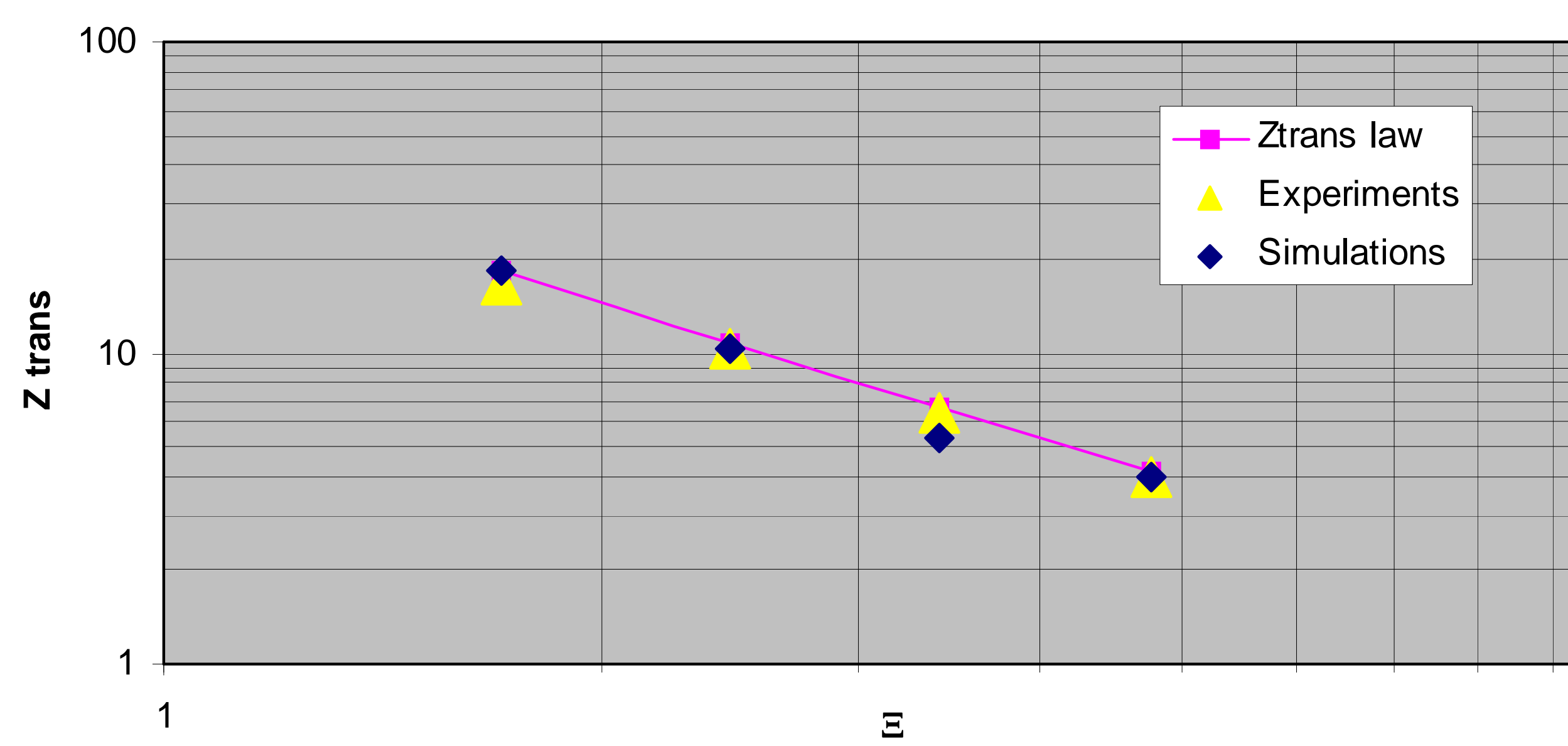
Experimental incident pressure versus time along the tunnel (C₁ to C₁₄) - Radius R = 70 mm



iso Mach at different times (t = 10, 20 and 30 ms)
- Full scale simulation -



Incident pressure versus time along the tunnel



Ztrans law zone of transition : $Z_{tr} = \frac{0.0509}{(\alpha/100)^{12.8}}$